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March 3, 2026

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

BOLTON NORTH HILL OPTION 1 LANDS

TOWN OF CALEDON REGION OF PEEL

PREPARED FOR:

BOLTON NORTH HILL LANDOWNERS GROUP

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
211 YONGE STREET, SUITE 600
TORONTO, ON M5B 1M4

MARCH 2026

CFCA FILE NO. 708-3446

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CROZIER

Revision Number	Date	Comments
Rev.0	December 17, 2021	Issued for 1st Submission
Rev.1	February 18, 2025	Issued for 2nd Submission
Rev.2	March 3, 2025	Issued for 3rd Submission

EXECUTIVE SUMMARY

C.F. Crozier & Associates Inc. has prepared this Functional Servicing and Stormwater Management Report to support the development of the Bolton North Hill area, as part of the Secondary Plan Approval. Specifically, Option 1 Lands and a 4.64 ha development parcel within the Option 2 Lands, referred to as the Site, which are part of six (6) parcels of development areas around the existing community of Bolton (Options 1 to 6). All of the Bolton North Hill Landowners Group, including what is traditionally referred to as the Option 1 Lands and the Cold Creek development at the southern end of the Option 2 Lands, has been indicated as a Phase 1 priority development area per the Town of Caledon Official Plan Amendment to address Growth Management and Phasing.

We have explored the municipal servicing opportunities and constraints for the Site and have summarized our findings and conclusions herein. Relevant standards from the Town of Caledon, Region of Peel, and Toronto and Region Conservation Authority have been applied to develop a functional servicing and stormwater management strategy. This report reviews water servicing, sanitary servicing, grading, pre- and post-development drainage conditions, stormwater management, water balance and low impact development, and natural heritage.

The proposed servicing strategies have been prepared with careful consideration of the Town and Region's overarching principles. The proposed strategies demonstrate the feasibility of servicing the Site by presenting technically correct and economically feasible solutions that use and improve existing infrastructure. These strategies also provide services to existing populations that are under-served and services population into the future beyond the Bolton Residential Expansion Settlement areas.

A Subwatershed Study (SWS) is also being prepared in parallel with this report (under separate cover). The stormwater management strategy developed herein will inform the completion of the SWS and will ultimately be the overarching document for directing more detailed stormwater management designs for the Site.

Water Servicing

R.J. Burnside & Associates Inc. was retained by the Bolton North Hill Landowners Group to develop a water servicing strategy for the Option 1, 2, and 3 Lands, which has most recently been summarized in a Technical Memorandum dated July 14, 2025.

Our proposed water servicing strategy for the Option 1 and 2 Lands is consistent with the proposed R.J. Burnside strategy, which also provides water servicing for the Option 3 Lands to the southwest of the Site. In accordance with their memo, ultimate development of the Option 1 and 2 Lands will require the addition of Pressure Zone 7, accompanied by a new Zone 7 booster pumping station at King Street and Coleraine Drive. Water storage is proposed in the form of two elevated tanks to provide flow equalization and meet the required fire and emergency demands. One of the proposed elevated tanks is located in the northeast corner of the Option 1 Lands, adjacent to Regional Road 50.

Sanitary Servicing

Region of Peel is currently undertaking an Environmental Assessment (EA) to determine the preferred sanitary servicing alignment for the Option 1 and 2 lands. The current strategy is for these developments to discharge to a trunk sewer in Humber Station Road. Gravity trunk sewers in Regional Road 50 and Emil Kolb Parkway will direct flows to a sewage pump station within the Humber River Valley on Emil Kolb Parkway, which will pump flows south along Emil Kolb Parkway with discharge to a gravity sewer in King Street and ultimately to the trunk sewer in Humber Station Road. Option 2 will be serviced by a proposed forcemain or gravity sewer, dependant on the outcome of an EA, in Columbia Way which will convey flows west to Regional Road 50. The sanitary servicing solution is subject to refinement as the EA and detailed design by the Region is progressed.

Proposed Grading & Roads

A preliminary grading design was prepared to support the servicing and stormwater management strategies. The roadway elevations were constrained by the invert elevations of the normal water level of the stormwater management ponds and made considerations of the water and sanitary servicing.

The Site was graded to match post-development drainage conditions to the pre-development drainage divides. Sloping or retaining walls were minimized by setting boundary grades to be within a tolerance of the existing elevations at the property lines. This is particularly evident where the Site borders natural heritage features to be cognizant of restrictions for construction within or adjacent to these protected areas. Given the restrictions for construction within or adjacent to natural heritage features, particular attention was paid to setting boundary grades in areas where the Site borders these protected areas.

Drainage Conditions

Existing drainage patterns will be preserved as much as possible under the proposed development conditions, with topography generally sloping southwards toward the tributaries of the Main Humber River. The drainage divide between sub-basin 10 of the Main Humber River (which requires quantity control) and main areas of the Main Humber River Watershed (which do not require a prescribed level of quantity control based on Humber River watershed criteria), will be generally maintained by the proposed grading and servicing concept. Minor and major system flows from most of the development area will be directed to one of eleven (11) proposed stormwater management ponds. Stormwater management ponds have been located at natural topographic low-points and provide an appropriate outlet to the adjacent watercourse or ditch in accordance with the pre-development drainage conditions. Residential lot or park grading adjacent to Environmental Policy Areas will aim to discharge clean stormwater runoff from landscaped areas to the natural features to promote water balance.

Regional Road 50 and Emil Kolb Parkway have several existing features to allow for conveyance of overland flows through the right-of-ways. These features, consisting of culverts and bridges, will be maintained with no proposed upgrades. Additionally, we have not proposed any crossings of natural features to the existing road networks or within the proposed road network.

Floodplain Analysis

The floodplain analysis for the Site includes a headwater drainage feature assessment, mapping of the existing floodplain, and an evaluation of the post-development floodplain. Within the Toronto and Region Conservation Authority, the Regulatory Floodplain is based on the greater of the Regional storm (Hurricane Hazel) and the 100-year event. Based on the results of the analysis, there will be modifications required to some of the tributaries in order to safely convey external runoff either through or around the proposed development.

Stormwater Management

Runoff from the Site will be directed to on-site stormwater management (SWM) wet ponds designed to provide quantity, quality, and erosion control. A total of eleven (11) end-of-pipe stormwater management wet pond facilities are proposed to treat runoff from post-development drainage areas within the Main Humber River Watershed. A total of three (3) stormwater management ponds are proposed within sub-basin 10 of the Humber River Watershed and therefore require unitary flow controls for events up to the 100-year storm event. A total of eight (8) ponds will be located within an area of the Main Humber watershed that does not require quantity control per TRCA criteria, therefore these ponds shall provide quality and erosion controls at a minimum. While quantity controls are not prescribed for areas draining to the Main Humber River, a downstream analysis was completed within this report to analyse any downstream impacts resulting from the development. In cases where there are downstream increases in downstream peak flows resulting in an increased risk of flooding, additional quantity controls may be necessitated by the on-site SWM facilities. The remaining three (3) SWM ponds are located within sub-basin 10 of the Humber River, which will be designed to provide quantity control as well as quality and erosion control. The Subwatershed Study (being prepared under separate cover in parallel with this report) will ultimately be the overarching document for directing more detailed stormwater management criteria for the Site.

Outfall elevations for the SWM pond facilities were set at or above the 25-year water level of the receiving watercourse. The 25-Year water surface elevations are summarized in Section 8.3. Design of the SWM pond facilities adheres to the requirements of the Town of Caledon.

Water Balance and Low Impact Development

A site-wide water balance assessment and feature-based water balance assessment will be completed for the Site as part of the Hydrogeological Report being prepared by Crozier under separate cover.

According to mapping from the Toronto and Region Conservation Authority, the Site is located within a Significant Groundwater Recharge Area and a High Groundwater Recharge Area (Stormwater Management Criteria, 2012). Due to these vulnerable areas, the Site is required to maintain pre-development groundwater recharge rates and appropriate distribution, ensuring the protection of related hydrologic and ecologic functions.

Low Impact Development (LID) methods can be implemented on-site to mitigate water balance on-site and/or to wetland. Potential LID methods explored in this report include green roofs, roof downspout disconnection, infiltration galleries, rainwater harvesting, bioretention, vegetated filter strips, permeable pavement, and enhanced grass swales. Further implementation strategies will be explored at the Draft Plan stage.

Secondary Plan Natural Heritage Study Report

Dillon Consulting Ltd. has prepared a Secondary Plan Natural Heritage Study Report under separate cover, dated February 2026.

Conclusions & Recommendations

The conclusions and recommendations for servicing the Site are preliminary in nature based on the level of detail derived from the Concept Plan (Bousfields Inc., February 11, 2026). Servicing and stormwater management solutions are expected to be refined as further planning applications progress and through correspondence with the Town of Caledon, Region of Peel, Toronto and Region Conservation Authority, and any other applicable reviewing agency. Drawings, figures, and appendices have been prepared in support of this report.

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1.0 Introduction

1.1 Study Purpose

C.F. Crozier & Associates Inc. (Crozier) was retained by Bolton North Hill Landowners Group to prepare a Functional Servicing and Stormwater Management Report in support of a Local Official Plan Amendment (LOPA) for the Bolton North Hill Secondary Plan Option 1 Lands (the Site) in the Town of Caledon, Region of Peel. The Site consists of 167.52 ha of developable land and is located generally north of the intersection of Regional Road 50 and Columbia Way.

This report will demonstrate how the Site can be developed in accordance with the Town of Caledon and Region of Peel guidelines from a functional sanitary and water servicing and preliminary stormwater management perspective. Functional water servicing for the Site has been developed based on a Technical Memorandum by R.J Burnside & Associates Inc. dated July 14, 2025 and will be discussed in this report.

The proposed servicing strategies included in this report have been prepared with careful consideration of the Town and Region's overarching principles. The proposed strategies demonstrate the feasibility of servicing these expansion lands by presenting technically correct and economically feasible solutions that use and improve existing infrastructure. These strategies also provide services to existing populations that are under-served and services population into the future beyond the Bolton Residential Expansion Settlement areas.

The goal of the servicing strategy presented herein is to develop the most feasible solution for the entire Site. Per drawing C701 – Landownership Map, there are several landowner holdouts within the Site. Should current landowners wish to progress the development of their properties, there are feasible interim servicing solutions available. Given that the Option 2 Lands and landowner holdouts are not anticipated to be developed concurrently with Option 1 Lands, interim phases are anticipated to rely on existing servicing infrastructure. A preliminary interim servicing strategy has been developed (see drawing C708) to depict a viable servicing solution should the landowner holdouts remain.

All of the Bolton North Hill Landowners Group, including what is traditionally referred to as the Option 1 Lands and the Cold Creek development at the southern end of the Option 2 Lands, has been indicated as a Phase 1 priority development area per the Town of Caledon Official Plan Amendment to address Growth Management and Phasing.

1.2 Study Area

Option 1 Lands are approximately 163 ha and are generally located north of the intersection of Regional Road 50 and Columbia Way and north and south of Emil Kolb Parkway (east of the Humber River). One member of the Bolton North Hill Landowner Group owns land within the Option 2 Lands, which are approximately 4.6 ha and bound by Columbia Way to the south and Mount Hope Road to the west. This Report also addresses servicing and stormwater management for this parcel.

Both Option 1 and 2 Lands are located within the Main Humber River Watershed, and there is a minor watershed divide bisecting Option 1 Lands that directs flows east/west.

According to the Concept Plan by Bousfields Inc. dated February 11, 2026, the elements envisioned for the proposed development include:

- 1288 Single Units
- 1029 Townhouses/Back-to-Back Townhouse Units
- 1419 Medium/High Density Units
- 659 Mixed Use Units
- School, Parks, Woodlot and Open Spaces
- Stormwater Management Pond Blocks

The Concept Plan, outlining the proposed development and land ownership boundaries is provided in Appendix A.

1.3 Concept Plan

The Concept Plan (Bousfields Inc., February 11, 2026) has been reviewed by the Bolton North Hill Landowners Group and conforms to the development proposals set forth by each landowner, along with the requests of external stakeholders such as the public and catholic school boards, Town of Caledon, and Region of Peel. The functional design is based on this plan and unit/population counts have been derived accordingly.

A number of major structural elements define the Bolton North Hill development, including:

- A logical hierarchy of collector and local roads that provide:
    - Internal movement in a manner that is supportive of vehicular and pedestrian modes of transportation; and
    - Connectivity to the existing collector roads (Mount Hope Road, Columbia Way, Regional Road 50, Emil Kolb Parkway, and Duffy's Lane).
- Key features of the above transportation hierarchy include:
    - Extension of the roundabout at the intersection of Regional Road 50 and Emil Kolb Parkway; and
    - Bisecting local collectors that provide internal connectivity to parks and shared spaces.
- Open Space blocks that allow for the protection of Natural Heritage features such as woodlots, wetlands, and floodplains.
- Mixed-use development including commercial, institutional, and residential.
- Mix of residential densities that focus on affordable housing solutions with apartments, back-to-back townhomes, townhomes, and single residential lots.

- Park space and integrated stormwater management blocks that provide trail connectivity through the development.

- Separate public and catholic school board space.

1.4 Background Studies & Previous Reports

A previous version of this Report was submitted to support the Secondary Plan application in February 2025. Since then, we have received comments from agencies and the development landscape within the Bolton area has evolved. Previous studies include:

1. **Without Prejudice Servicing Feasibility Report, Proposed ROPA 30 for Bolton Residential Expansion Study (September 2020):** This report provided a servicing strategy to demonstrate feasible sanitary and water servicing for Options ½ lands north of Columbia Way. This report was prepared as input to the Bolton Residential Expansion Study in preparation for the 2020 Local Planning Appeal Tribunal.

2. **Servicing Strategy for a 30 ha Portion of Option ½ Settlement Lands (October 2020):** This supplementary memo was prepared to facilitate consensus among landowners other than those of Option1/2 lands, in an effort to reach a settlement agreement as part of the Local Planning Appeal Tribunal. This memo also describes high level water and sanitary servicing strategies for approximately 30 ha of Option1/2 lands.

3. **Servicing Strategy & Cost for Option 1 & Option 3 Settlement Lands (November 2020):** This supplementary memo was prepared to clarify servicing strategies for Option 1 and Option 3 lands as part of the settlement agreement reached in the Local Planning Appeal Tribunal. This memo provided additional context for high level water and sanitary servicing strategies for approximately 60 ha of Option 3 in addition to the Option 1 settlement area.

4. **"Technical Memorandum – Zone 7 Demands", R.J. Burnside & Associates Inc. (July 2025):** This updated memo provides water system hydraulic and hydraulic transient analyses of proposed upgrades to the Regional Municipality of Peel's existing Bolton Pressure Zone 6 and future Bolton Pressure Zone 7.

5. **"Hydraulics Technical Memorandum No. 1 – System Curve and Hydraulic Analysis", HydraTek (June 2025):** This memo provides a proposed strategy for providing water servicing to the Option 1, 2, and 3 Lands. The memo reviews various development horizons and discusses the feasibility of providing water servicing to support this variety of development expansion areas

6. **Option 1 & 2 Sanitary Servicing Capacity and Hydraulic Grade Line Analysis (June 2021):** This memo was prepared to analyze the feasibility and sequencing of interim and ultimate sanitary servicing opportunities and constraints for Option 1/2 lands over various planning horizons in 2031, 2051 and beyond 2051.

7. **Option 1 & 2 Lands Secondary Plan Natural Heritage Study Report (Dillon, February 2026):** This report was prepared to assess potential impacts to the Natural Heritage Features within the Study Area to help inform the Bolton North Hill Secondary Plan.

This report has been completed in accordance with the guidelines, standards, and policies of the Town of Caledon, Region of Peel, and Toronto and Region Conservation Authority with consideration for various provincial-level initiatives. The relevant background studies and reports include:

- "2020 Water and Wastewater Master Plan for the Lake-Based Systems", Region of Peel & GM BluePlan, June 2020, herein "2020 Master Plan"
- "Provincial Policy Statement", May 2020, herein "2020 PPS"
- "A Place to Grow: Growth plan for the Greater Golden Horseshoe", August 2020, herein "2020 Growth Plan"
- "Bolton Residential Expansion Regional Official Plan Amendment Discussion Paper", The Planning Partnership (TPP), April 2016
- "Bolton Residential Expansion. Analysis in support of the Regional Official Plan Amendment", Region of Peel, June 2016
- "Development Standards Manual", Town of Caledon, 2019
- "Stormwater Management Criteria", Toronto and Conservation Authority, August 2012
- "Development Charges Background Study", Region of Peel, December 2020
- "Bolton Residential Expansion Study. Infrastructure Report", GM BluePlan, June 2014
- "Bolton Residential Expansion Study. Recommendations: Selection of Expansion Area", June 2013
- "North Bolton Elevated Tank/Reservoir and Feedermain – Schedule C Class EA Study", AECOM, October 2011
- "Bolton Urban Community Water and Wastewater Analysis", AECOM, March 2010
- "Region of Peel Watermain Design Criteria", June 2010
- "Region of Peel Sanitary Sewer Design Criteria", July 2009 (modified March 2017)

1.5 Subwatershed Study

A Subwatershed Study (SWS) will be conducted concurrently with the Local Official Plan Amendment application and the design for the Site will ultimately need to conform to the criteria established in the Subwatershed Study. It is expected that the SWS results will impact primarily the extended detention times and onsite retention volumes because of the erosion assessment. Reach delineation and rapid geomorphic assessments (on participating lands) were completed by GeoMorphix Ltd. in the spring of 2024. Results of this rapid field reconnaissance indicated that multiple reaches are sensitive to erosions, thereby requiring further analysis in support of an appropriate stormwater management strategy for the site. Detailed geomorphic field assessments will be completed and erosion thresholds calculated for erosion-sensitive reaches as part of the subwatershed study.

The number and location of LIDs required will also be established as part of the water balance and feature specific water balance modeling required for the SWS.

It is understood that a flood vulnerable area is present downstream of the subject Bolton North Hill lands, located in the vicinity of Highway 50 and King Street, referred to as the Bolton Flood Vulnerable Cluster on TRCA mapping. Additional analysis will be completed through the subwatershed study to assess any potential increases in flood elevation downstream of the site (with particular attention to this flood vulnerable area) as a result of the proposed development. Mitigation measures to prevent increases in downstream flood elevations will be assessed through the subwatershed study and will inform whether more stringent stormwater management controls are needed for the Bolton North Hill development.

Stormwater management ponds shown on the Concept Plan (Bousfields Inc., February 11, 2026) were located at low points across the site with outlets to receiving tributaries, similar to existing conditions. The following report outlines the required quality, erosion, and quantity (where required) volumes for each facility, which are subject to continued refinement based on the progression of the Local Subwatershed Study by Crozier (under separate cover). The locations of the SWM facility outlets, the required quality and required quantity volumes are not expected to change significantly based on the results of the SWS.

1.6 Study Team

Members of the Bolton North Hill study team involved in the preparation of the Functional Servicing and Stormwater Management Report documents and their respective disciplines are listed below.

Bousfields Inc.	Urban Planning Land Use Design	Planning Justification Report
Arcadis (formerly IBI Group)	Planning and Urban Design	Fiscal Impact Study
C.F. Crozier & Associates Inc.	Municipal Design / Water Resources	Functional Servicing and Stormwater Management Report
	Transportation Engineering	Traffic Impact Study
Dillon Consulting Ltd.	Land Development Municipal Design	Secondary Plan Natural Heritage Study

The Region of Peel is currently undertaking a Municipal Class Environmental Assessment (EA) for water and wastewater servicing to determine the preferred servicing strategy for the Option 1 and 2 lands. The external servicing strategy has been developed in consultation with the Region of Peel and several other consultants representing the private and public sector. The servicing strategy to be adopted in future detailed design to support development will need to align with the work undertaken by all consultants.

R.J. Burnside & Associates Inc.	Water Distribution	On behalf of Option 3 lands
Urbantech Consultants	Wastewater Conveyance	On behalf of Option 3 lands
Ainley	Water and Wastewater Municipal Class EA	On behalf of Region of Peel
CIMA	Water and Wastewater Municipal Class EA	On behalf of Region of Peel

2.0 Water Servicing

2.1 Background

R.J. Burnside was retained by the Bolton North Hill Landowners Group in cooperation/ coordination with the Option 3 Landowners Group to complete an analysis on the existing water distribution system in the Bolton Residential Expansion Study (BRES) lands. The goal of this analysis was to provide a proposed water servicing strategy for the full build-out scenario of the Option 1, 2, and 3 Lands. The latest conclusions of their Technical Memorandum (July 14, 2025) with respect to Option 1 and 2 Lands are summarized below and Appendix A contains R.J. Burnside's Technical Memorandum from July 14, 2025.

2.2 Pressure Zone 7

According to the Bolton Residential Expansion Study (Region of Peel, September 24, 2020), the development of Option 1 and 2 Lands will require a new pressure zone to facilitate water servicing. The Site is outside of the range of elevations associated with the water distribution infrastructure for Pressure Zone 6 (214.5 m – 259.1 m), as stated in the Water and Wastewater Master Plan (Region of Peel, 2020). Therefore, ultimate development of Option 1 and 2 Lands will require the addition of Pressure Zone 7 (PZ7), accompanied by a new Zone 7 booster pumping station at King Street and Coleraine Drive.

Storage is proposed in the form of two elevated tanks to provide flow equalization and to meet the required fire and emergency demands. One of the proposed elevated tanks is in the northeast corner of Option 1 Lands, adjacent to Regional Road 50. The serviceable elevation of PZ7 ranges from 243.4 m to 289.6 m as stated in the Water and Wastewater Master Plan (Region of Peel, 2020).

2.3 Interim Water Servicing Strategy

R.J. Burnside and HydraTek have updated their analysis on the water servicing for both the interim and ultimate development scenarios. HydraTek's Hydraulics Technical Memorandum No. 1 (June 2025) uses hydraulic modelling analysis to propose that the Macville Booster Pump Station (BPS) can service an interim population of 2,960 persons within the Option 1 Lands. This memo provides analysis for the Macville BPS and characterization for PZ7 under existing, interim, and ultimate conditions. The model demonstrated that in the interim period, Bolton PZ7 will operate as a closed pressure system with a supply HGL of 327.7m and system pressures controlled by the Macville BPS.

Interim servicing will be maintained until development within the Option 1/2 Lands exceeds approximately 2,960 persons. Beyond this threshold, additional water storage will be required to satisfy flow equalization, fire protection, and emergency supply requirements. At that stage, floating storage is proposed in the form of two elevated tanks (ETs). One elevated tank is proposed within the Option 1 Lands, with its final location to be confirmed through the ongoing Environmental Assessment.

2.4 Ultimate Water Servicing Strategy

The full build-out modelling presented in HydraTek's Hydraulics Technical Memorandum No. 1 demonstrates that the ultimate PZ 7 servicing solution can accommodate full build-out conditions. The ultimate servicing strategy includes two ETs located within Option 1 and Option 3 Lands, a 600 mm diameter feedermain along Emil Kolb Parkway to Regional Road 50, and a 400mm along Regional Road 50 and Columbia Way. This infrastructure is sufficient to service the full PZ7 build-out, subject to confirmation of elevated tank sizing and final locations through the ongoing Environmental Assessment.

Under the ultimate build-out scenario, a looped watermain system is proposed to interconnect the Option 1, 2, & 3 Lands, providing system redundancy and operational reliability. The elevated tank proposed within the Option 1 Lands is currently anticipated to be located on landowner property outside of the development limits within the Oak Ridges Moraine (ORM). The Ontario Regulation 140/02 policy of the ORM allows for infrastructure within its limits but not development. Internally, water servicing is proposed to provide the necessary domestic and fire demands. A looped system will be maintained, and all Region of Peel standards will be adhered to for the design of the watermains and appurtenances.

The proposed Macville Booster PS will ultimately work in conjunction with the elevated water tanks that will provide water supply for the entire Pressure Zone 7. This design is being undertaken in consultation with the Region, as it is proposed on Region owned- lands and will be assumed by the Region for operation and maintenance. Alongside the detailed design, R.J. Burnside and HydraTek is updating their analysis on the water servicing for both the interim and ultimate development scenarios.

Further details of the full build-out water servicing strategy can be seen on Drawing C709 – Preliminary Water Distribution Plan. The water servicing strategy for the Option 1 lands will need to respect the findings of any updated analysis conducted by R.J. Burnside and/or the Region of Peel.

3.0 Sanitary Servicing

3.1 Existing Sanitary Servicing

The existing sanitary servicing infrastructure for lake-based systems within the Region of Peel is described in detail in the Water and Wastewater Master Plan (Region of Peel, 2020). Volume 3 and Volume 4 of this Master Plan discuss existing water and sanitary infrastructure in the Region, including an examination of the capacity of Bolton's existing sanitary infrastructure. The Master Plan is expected to be updated in 2025 (Volume 5); the servicing strategy moving forward from that point will need to respect the approach and conclusions set forth by the Region.

Bolton is predominantly serviced by two sanitary trunk sewers: a 900 mm diameter trunk sewer on Albion-Vaughan Road in the east end and a 525 mm diameter trunk sewer on Coleraine Drive in the west end. These two trunk sewers merge outside of the southern limits of Bolton at the intersection of Coleraine Drive and Regional Road 50. The wastewater then continues flowing south in a sanitary sewer along Regional Road 50 to the McVean Sewage Pumping Station, and ultimately for treatment at the G.E. Booth Wastewater Treatment Plant.

The 525 mm diameter sanitary trunk sewer on Coleraine Drive was installed in 1983, expanding to approximately 800 m north of George Bolton Parkway. This sanitary sewer was then extended 400 m further north at 600 mm diameter in 1989, then terminated at 375 mm diameter at King Street West in 1999.

The 900 mm diameter Albion-Vaughan (AV) trunk sewer as it exists today was completed in early 2015 and currently terminates north of the railway corridor on Albion Vaughan Road. The Region of Peel's capital works program included completing this trunk sewer by the spring of 2021 to terminate at the northern most extent of Nunnville Road, which also involves the decommissioning of the existing Albion Vaughan and Harvestview Sewage Pumping Stations along a similar timeline. The AV trunk sewer has an approximate full flow capacity of 1,000 L/s.

3.2 Design Sanitary Flow

The Water and Wastewater Master Plan, Volume 4 (Region of Peel, 2020) was referenced to calculate the sanitary design flows for the Site. Dry weather unit sewage flows of 290 L/capita/day and 270 L/capita/day were used for residential and employment populations, respectively. Population yields (derived from the unit count of the Concept Plan), an infiltration flow of 0.26 L/s/ha, and a peaking factor were applied to the unit sewage flow to obtain the total estimated design sanitary flow. Table 1 summarizes the results and Appendix B2 contains detailed calculations.

Table 1: Estimated Sanitary Design Flows

Land Parcel	Development Area (ha)	Average Daily Flow (L/s)	Average Peaking Factor	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Sanitary Flow (L/s)*
Option 1	150.4	105.1	3.6	171.8	39.1	274.2
Option 2	4.64	3.2	4.00	6.46	1.2	9.95

*30% contingency factor has been applied to address potential scope changes

Therefore, the proposed development of Option 1 and 2 Lands will generate a total of 284.2 L/s in sanitary discharge.

3.3 Proposed Sanitary Servicing

The external servicing strategy has been developed in consideration of the Region's advancing Water and Wastewater Municipal Class EA Crozier continues to work closely with the Region and its consultants through monthly coordination meetings to ensure alignment of the Bolton North Hill servicing strategy with Regional objectives.

The preferred approach remains unchanged from the previous edition of this report and for all new developments north of Columbia Way, which is to discharge into a proposed sanitary system on Highway 50 and Emil Kolb Parkway. Flows are then pumped via twin 450 mm diameter forcemains to a 525 mm diameter trunk sewer flowing west via gravity on King Street, and ultimately to a 1200 mm diameter trunk sewer flowing south on Humber Station Road.

The trunk sewer on Humber Station Road is being designed to convey flows from all the currently proposed development and future Whitebelt Lands development in the north and west ends of Bolton. The analysis, design, and construction for the furthest downstream portion of this sewer (between Mayfield Rd and Healey Rd) is being undertaken by the Region and its consultants, with Urbantech responsible for the upstream portion north of Healey Rd, including the trunk sewer on King St.

Internal Sanitary Servicing Strategy

The internal servicing strategy aims to convey flows via gravity to trunk sewer connections on Regional Road 50 and Emil Kolb Parkway. While there are significant negative elevation changes from these connection points to the outer edges of development, we understand the Region is proposing the trunk sewer to be deep enough such that no sewage pumping stations will be necessary within the Subject Lands.

All proposed sanitary sewers will be Polyvinyl chloride (PVC) pipes. PVC was chosen over reinforced concrete to reduce the infiltration into the sanitary sewer system. Additionally, unless otherwise stated all sanitary sewers are proposed to be 250 mm diameter with minimum slope to provide self-cleansing velocity, in accordance with the Region of Peel standards.

Interim Sanitary Servicing Strategy

An interim servicing strategy has also been provided for the 4.3 ha parcel in the Option 2 Lands, since it is likely that they would develop well ahead of the timeline for the remaining Option 2 Lands. The upgrades necessary within the existing system south of Columbia Way to accommodate the development are minor and may be proven unnecessary through more detailed modelling. For this solution, the Option 2 Lands would discharge into the existing sanitary sewer on Mount Hope Road south of Columbia Way and eventually discharge to the Bolton Sanitary Pumping Station south of King Street East, where flows would then be pumped via a forcemain into the existing AV trunk sewer.

Table 2 below breaks down the flows from the drainage area being sent to the existing sanitary sewer system south of Columbia Way during the interim condition. A total of 7.0 L/s of sanitary flows from the proposed development will be sent to the existing system south of Columbia Way.

Table 2: Sanitary Flows to the Existing System (Interim Condition)

Drainage Area Number	Area (ha)	Average Daily Flow (L/s)	Peaking Factor	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Sanitary Flow (L/s)
8	4.64	2.8	4.0	6.46	1.2	7.7

Sanitary flows from Drainage Area 8 will be connected to the existing system at Columbia Way and Mount Hope Drive via a 250 mm diameter gravity sewer at 0.5% grade.

Ultimate Sanitary Servicing Strategy

Table 3 below breaks down the flows from each drainage area being sent to Emil Kolb Parkway, and detailed calculations are provided in Appendix B2.

Table 3: Sanitary Flows to Emil Kolb Parkway (Ultimate Condition)

Drainage Area Number	Area (ha)	Average Daily Flow (L/s)	Peaking Factor	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Sanitary Flow (L/s)*
1	41.0	23.6	3.35	43.50	10.7	70.41
2	16.4	9.7	3.66	19.89	4.3	31.4
3	16.2	8.6	3.72	16.33	4.2	27.09
4	22.0	13.30	3.54	26.97	5.7	42.50
5	14.7	10.0	3.60	22.52	3.8	34.25
6	15.4	9.0	3.68	18.48	4.0	29.23
7	24.7	13.0	3.59	23.83	6.4	39.33
8	4.64	2.8	4.00	6.46	1.2	9.95

*30% contingency factor has been applied to address potential scope changes

It should be noted that the design for the Emil Kolb Parkway trunk sewer is to be completed by the Region.

3.4 Proposed Sewage Pumping Station

We understand the Region's preferred approach is to provide one (1) sewage pumping station (SPS) within the Humber River Valley along Emil Kolb Parkway that will service the development of the Option 1 and 2 lands. Crozier has been working collaboratively with the Region to share and review preliminary design information. The ultimate design will be undertaken by the Region based on the results of the Municipal Class EA.

Table 4 shows the total tributary flows to the SPS.

Table 4: Sewage Pumping Station (SPS) Summary

Lands	Area (ha)	Cumulative Area (ha)	Population	Cumulative Population	Dry Weather Flow (L/s)	Peaking Factor	Infiltration & Inflow (L/s)	Total Flow (L/s)
Option 1	150.4	150.4	14415	14415	49.1	2.8	38.9	274.2*
Option 2 (BNHLG)	4.64	155.0	483	14898	50.6	2.8	40.1	180.5
Option 2 (Remaining Whitebelt)	117.7	272.7	8077	22975	77.7	2.6	70.6	271.7
Rounding Out Area C	7.5	280.2	538	23513	79.5	2.6	72.5	277.5
Columbia Square	3.3	283.5	2247	25760	87.0	2.5	73.4	294.4

*30% contingency factor has been applied to address potential scope changes

4.0 Proposed Grading & Roads

4.1 Grading Constraints & Objectives

The following constraints were taken into consideration in preparing the grading plan for the Site:

- The existing elevations of Emil Kolb Parkway, Regional Road 50, and Columbia Way.
- The existing elevations at the property lines of all land parcels.
- Matching the existing drainage patterns within the Site in the post-development condition, and keeping overland flows sent to the Humber River tributaries as close to existing as possible.
- Sending overland flows to the proposed Stormwater Management Pond locations.
- Conveying external flows through or around the Site as necessary.
- Minimum and maximum road slopes per the Town of Caledon standards.

Further to the above constraints, proposed grading for the Site adheres to the following objectives:

- Optimize cut and fill operations and achieve a balanced site.
    - Prevent / minimize the need for retaining walls.
    - Special consideration for the preservation of existing ground elevations in the vicinity of natural features.
- Maintain required cover for municipal infrastructure and utilities including reducing the need for pump stations to convey sanitary flows.
- Accommodate the future lot grading, based on preliminary concepts in accordance with the Town standards.
- Utilize the opportunity for walkout lot types where parcels border areas outside of the development limit.
- Maximize the reuse of topsoil within the Site to limit hauling operations.

4.2 Preliminary Grading Design

The preliminary grading design for the Site is shown on Drawing C704 – General Grading. The grading plans include proposed road centerline elevation and slopes, existing surface contours and the direction of overland flow routes. The following sections outline critical elements of the grading design.

Compatibility with Environmental Policy Areas

As mentioned in the above constraints, proposed elevations adjacent to Environmental Policy Areas will match existing as close as possible to minimize impact to these sensitive areas. Grading adjacent to natural heritage features considers natural heritage buffers/constraints, erosion setbacks, and external overland flow. As the Concept Plan and design progress we will continue to monitor the grading impacts in these areas and minimize the need for retaining walls, sloping, etc.

Lot or park grading adjacent to Environmental Policy Areas will aim to discharge clean stormwater runoff from landscaped areas to the natural features to promote water balance.

Road Centerline Gradients

The preliminary grading design conforms to the Town of Caledon design standard of maintaining a minimum and maximum asphalt gradient of 0.5% and 6.0%, respectively in most areas.

Stormwater Management Ponds

In some instances, the proposed stormwater management ponds (SWMPs) create boundary conditions that the road centerline elevations must adhere to for each drainage area. This occurs where the permanent pool elevations for the SWMPs were fixed based on the respective receiving outlet elevations, which are set at 0.10 m above the 25-year flood elevation of each tributary. These permanent pool elevations then set the road centerline elevation required to facilitate minor and major flow conveyance to the SWMPs.

Grading of roads, lots, and SWMP Blocks considers a buffer required to match proposed or existing boundary elevations. Ponds have been sized such that no retaining walls are required to facilitate grading.

Overland and Emergency Flow Routes

The roads have been graded to ensure positive drainage of major system flows towards the SWMPs within each drainage area. The major system drainage is directed overland to the SWMPs and will operate in the event of a minor system blockage or when the minor system capacity is exceeded (above the 10-year storm event). Each SWMP includes an overland flow path to direct major flow from the roadways into the ponds and an emergency spillway that will operate in the event of an outlet blockage or in the event of a large storm exceeding the pond design capacity. Emergency spillways will be sized for the Regulatory event (larger of the 100-year uncontrolled flow or the Regional uncontrolled flow).

Other Drainage Considerations

If road grading cannot accommodate the conveyance of overland flow to the SWMP, localized capture of the 100-year storm will be contemplated. This will be further determined at detailed design based on road grading and stormwater management requirements for capturing and treating flows.

There are small areas identified across the Site that propose uncontrolled runoff directed to adjacent Environmental Policy Areas. The typical location is split or walkout lots that back onto undevelopable land where the rear-yard drainage cannot be captured. The drainage from these areas is considered inherently 'clean' runoff. At this time, uncontrolled flows from developable areas have been eliminated but are subject to change based on constraints encountered at detailed design. Uncontrolled drainage has been accounted for in the sizing of the SWMPs.

4.3 Earthworks Analysis

An earthworks analysis was performed based on the preliminary grading plan for the Site to determine the locations within the Site that require cut or fill and derive a net earthworks requirement. Matching the pre-development drainage divides helps to match proposed and existing elevations closely across the site, however, the natural topography is quite undulated, and areas of large cut and fill have still resulted.

Drawing C705 – Preliminary Earthworks Map illustrates the cut and fill areas for the Site with colour coded banding and Table 5 below for the resultant volumes.

Table 5: Earthworks Volumes

Land Area	Cut (m3)	Fill (m3)	Net (m3)
Option 1 Lands	1,424,000	1,121,000	303,000 (CUT)
Option 2 Lands	37,000	1,100	35,900 (CUT)

The earthworks were calculated with an average topsoil depth and pre-grade across the entire Site. In absence of a geotechnical report for the Site, the stripped topsoil depth was assumed to be 0.3 m, which is consistent with historically agricultural lands across southern Ontario. The pre-grade depth was assumed to be 0.8 m, which is a weighted average of the typical pre-grade for parks (0.3 m), roads/institutional/commercial (0.6 m), single residential lots (0.8 m), townhomes (1.0 m), and apartments (2.0 m).

At this stage, the earthworks analysis was completed to understand which areas of the Site could be refined in subsequent revisions so that cut and fill and the resultant net volume (import or export) is minimized. As the development is advanced, the proposed grading will be further refined to achieve balance where possible. It is not feasible that each parcel of land will balance, and therefore collaboration between the landowners will likely be required to share cuts and fills.

In preparing subsequent development staging/phasing plans, the cut and fill areas will be further analyzed to coordinate the earthworks program between individual owners.

5.0 Drainage Conditions

5.1 Existing Drainage Conditions

The Site is located within the regulation limits of Toronto and Region Conservation Authority (TRCA) and discharges directly to the Main Humber River and Cold Creek subwatersheds. A network of small tributaries, ditches, culverts, and bridges convey runoff from the Site to the larger watercourses downstream.

A hydrologic model (Visual OTTHYMO v.6.2) was received from TRCA for the Main Humber River and Cold Creek. It is noted that subcatchment boundaries received from TRCA have been further refined by Crozier based on the detailed topographic data obtained from the Land Information Ontario Dataset by the Ministry of Natural Resources and Forestry and existing drainage features (ditches, culverts, bridges, etc.) to clarify existing drainage flow paths, boundaries, and outlets. The existing hydrologic and hydraulic modeling was obtained for the purposes of assessing the Floodplain. Refer to Section 8.0 for further details regarding the floodplain modeling.

Both Option 1 and 2 Lands are located within the Main Humber River Subwatershed. There is a minor watershed divide bisecting Option 1 Lands that directs surface flows east/west towards the Main Humber River tributaries. From this drainage divide, surface flows from both internal and external lands generally drain south to tributaries of the Main Humber River. Lands east of this drainage divide are within Sub Basin 10 of the Humber River and are subject to unit flow controls per TRCA criteira. Option 2 Lands are located north of the intersection at Mount Hope Road and Columbia Way and drain north towards Cold Creek, a tributary of the Main Humber River.

A total of five (5) nearby tributaries of the Main Humber River (labelled as Tributaries 'A-E') are located downstream of the site and receive surface water runoff from both the Option 1 and external lands. One tributary of Cold Creek (labelled as Tributary 'F') is located downstream of the site and receives runoff from the Option 2 lands. To model the existing drainage conditions to each of the minor receiving tributaries, the Humber River catchments have been further discretized into a total of six (6) drainage areas which comprise of both the Option 1 and 2 lands as well as external areas draining to the subject minor tributaries.

Existing drainage, both internal and external to Option 1 Lands, generally flows south towards one of the five (5) nearby tributaries of the Main Humber River (labelled as Tributaries 'A-E'). Option 2 Lands are located northeast of the intersection at Mount Hope Road and Columbia Way and have been delineated as one (1) internal drainage area. Drainage from the Option 2 Lands generally drains north towards Cold Creek, a tributary of the Main Humber River.

Drawing C703 – Pre-Development Storm Drainage Plan illustrates the existing drainage patterns within the Site and surrounding area.

Existing land use within the subject lands is primarily agricultural, with some commercial, forest, meadow, rural residential and wetlands present. Due to these lands being primarily agricultural, there is no storm sewer infrastructure on-site (except for existing storm sewer infrastructure along road right-of-ways). As such, surface runoff from the subject site drains via overland flow towards the receiving tributaries under existing conditions.

Since the Humber River hydrology model received from TRCA is a calibrated model used for regulation, the drainage parameters (including time to peak values, CN* values, initial abstraction values, etc.) have remain unchanged from the original model received. As such, only the catchment areas have been updated based on the local refinement of catchments described above.

According to the Ontario Soil Survey mapping for Peel County, there are mainly four soil types present on Site: King Clay Loam, Bottom Land, Monoghan Clay Loam and Pontypool Sandy Loam. King Clay Loam is the dominant soil type found across the majority of the Site. Figure SOIL-1 (provided in Appendix E – Figures) illustrates the predominant soil types across the Site and surrounding area.

Existing land use on Site is primarily agricultural, with some commercial, forest, meadow, rural residential and wetlands present. Refer to Figure LAND-1, provided in Appendix E – Figures, which depicts the existing land use conditions.

Table 6 below provides a summary of the existing drainage catchments and catchment areas used for modeling. Refer to Appendix C2 for a detailed summary of the calculated hydrologic parameters.

Table 6: Pre-Development Catchments – Draining towards Site

Catchment ID	**Drainage Area** (ha)	**Initial Abstraction, IA** (mm)	**Modified Curve Number, CN*** (2-5yr)	**Time to Peak** (2-5yr) (hours)	**Modified Curve Number, CN*** (10-500yr)	**Time to Peak** (10-500yr) (hours
TRIB A	37.79	10	69	3.69	90	2.46
TRIB B	36.99	10	69	3.69	90	2.46
TRIB C	109.13	10	70	4.04	92	2.69
TRIB D	168.1810	70	4.04	92	2.69	
TRIB E	151.92	10	71	4.2	89	2.1
TRIB COLD	67.64	10	70	1.78	88	0.89
Total	**571.66**	**-**	**-**	**-**	**-**	**-**

The catchments listed in Table 6 represent those that contribute drainage towards the Site and receiving minor tributaries of the Humber River and Cold Creek.

5.2 Proposed Drainage Conditions

Existing drainage patterns will be preserved as much as possible under the proposed development conditions, with topography generally sloping southwards toward the tributaries of the West Humber River. The drainage divide between sub-basin 10 of the Main Humber River and areas of the Main Humber River Watershed will be generally maintained by the proposed grading and servicing concept. Minor and major system flows will be directed to the SWM facilities via storm sewers and road grading.

The Option 1 lands have been discretized into a total of twelve (12) internal drainage catchments under post-development conditions. The Option 2 lands have been delineated as a single drainage catchment. Proposed land uses were assigned based on the Concept Plan (Bousfields, February 11, 2026), comprising of low to high density residential, commercial, schools, parks, open space, and stormwater management ponds. Per the concept plan land uses, percent impervious values for each catchment were calculated using the area-weighted method and values from Table 2-2 of the 2018 Humber River Hydrology Update (Civica, April 2018). For the purposes of the stormwater management analysis, mixed-use, commercial, and/or high-density land use areas proposed on the Concept Plan were assigned TIMP and XIMP values of 70% and 60% respectively, consistent with medium-density (townhouses). In the event that these areas will be developed at a higher density, on-site controls will be implemented at Draft Plan stage to reduce peak flows to be equivalent to the runoff associated with a 70% TIMP value. Detailed percent impervious value calculations and Table 2-2 are provided in Appendix C2.

Refer to Drawing C706 – Preliminary Post-Development Storm Drainage Plan, depicting the proposed drainage boundaries and conceptual SWM pond locations. A summary of the proposed Site drainage areas, composite runoff coefficients, and corresponding percent impervious values are provided in Table 7 below.

Table 7: Post-Development Drainage Area Summary

Catchment ID	**Drainage Area (ha)**	**Total Impervious** (%)	**Directly Connected Impervious** (%)	**Receiving Tributary**
201	8.50	58%	48%	Tributary A
202	7.34	55%	46%	Tributary B
203	8.71	62%	52%	Tributary B
204	18.33	61%	52%	Tributary C
205	17.71	68%	59%	Tributary D
206	5.83	63%	53%	Tributary C
207	17.86	64%	57%	Tributary D
208	34.45	68%	58%	Tributary D
209A	22.25	62%	53%	Tributary E
209B	1.33	60%	50%	Tributary E
210	17.67	62%	52%	Tributary E
212	3.51	10%	0%	Tributary E
213	5.03	70%	60%	Tributary F (Cold Creek)
Total Site	**168.52**	**-**	**-**	**-**

Changes to the quantity and quality of stormwater runoff resulting from the proposed development will be mitigated by a comprehensive stormwater management (SWM) strategy. This strategy includes a total of eleven (11) SWM wet pond facilities to provide stormwater management for the Site, including quantity, quality and erosion control of post-development runoff.

External Drainage

Runoff from external areas, which previously drained through the Option 1 lands under existing conditions will not be altered by the proposed development. Positive drainage for these external catchments will be maintained by the proposed grading and servicing concept to route these flows through or around the development area.

Flows from external drainage area EXT3 and the western portion of external drainage area EXT4 will be captured into a storm pipe, conveyed through the Site and will outlet to the upper reaches of Tributary C. Flows from the 1.87 ha woodlot area, external drainage area EXT5, and the eastern portion of external drainage area EXT4 will be captured into a storm sewer pipe, conveyed through the Site and will outlet to the existing concrete culvert at Emil Kolb Parkway (adjacent to the outlet for SWM Pond 3). These storm sewer pipes were sized to convey the 100-year storm event. Flows from extreme storm events that exceed the conveyance pipe capacity (i.e., storm events greater than the 100-year storm) will drain overland through the Site via the proposed road network and overland flow paths.

The remaining external drainage areas will be conveyed by swales around the proposed development. Runoff from these areas will be directed to the adjacent tributaries, thereby maintaining existing drainage patterns/outlets. Table 8 below provides a summary of the external catchment areas draining through and in the vicinity of the Site.

Table 8: Post-Development Drainage Area Summary (External)

Catchment ID	Drainage Area (ha)	Receiving Tributary
EXT1	28.75	Tributary A
EXT2	25.18	Tributary B
EXT3A	36.40	Tributary C
EXT3B	47.61	Tributary C
EXT4	97.24	Tributary D
EXT5	108.20	Tributary E
EXT6	62.60	Tributary F (Cold Creek)
Total External	**405.97**	**-**

Minor System Drainage

Storm sewers internal to the development will be designed to convey post-development minor system flows to the stormwater management ponds. The Town of Caledon (Development Standards Manual, 2019) requires that storm sewers without foundation drains be designed to convey the 5-year storm event at a minimum. For systems where foundation drains will be connected to the storm sewers, the Town requires the system to be designed to accommodate a 10-year storm event. To be conservative at this stage in the development, the storm sewers for the Site were designed to convey the 10-year storm peak flows, which is required when foundation drains are used.

Sizing of these storm sewers was completed using the Rational Method and using the Town's standard Intensity-Duration-Frequency Rainfall Curves (Town Standard Drawing No. 103). Refer to Appendix C1 for the storm sewer design sheet.

Major System Drainage

Major system stormwater runoff that exceeds the capacity of the storm sewers will drain overland via the proposed road right-of-ways (ROWs) to the respective stormwater management ponds. Per development standards, overland flows shall be contained within the ROWs and shall not cross private property. Depths of flooding permitted on streets and at intersections for all classes of road during the 100-year design storm event are as follows:

- The product of depth of water (m) at the gutter times the velocity of flow (m/s) shall not exceed 0.65 m^2/s.
- The depth of water should not exceed 0.30m

6.0 Stormwater Management

6.1 Stormwater Design Criteria & Targets

Stormwater management design for the Site is governed by criteria set out in the following documents:

- Development Standards Manual (Town of Caledon, 2019)
- Stormwater Management Criteria (Toronto and Region Conservation Authority (TRCA), 2012)
- Stormwater Management Planning and Design Manual (Ministry of Environment, (MOE), 2003)

A Subwatershed Study (being prepared under separate cover) will ultimately be the overarching document for directing more detailed stormwater management criteria for the Site.

The applicable stormwater management criteria are summarized below.

Quality Control

The Development Standards Manual (Town of Caledon, 2019) states that all new developments must adhere to the quality control requirements in the Stormwater Management and Planning & Design Manual (MOE, 2003). Additionally, all new stormwater management facilities shall be designed to meet Enhanced (Level 1) protection per the MOE SWMPD manual, requiring 80% removal of Total Suspended Solids (TSS) from 90% of the total annual runoff volume.

Erosion Control

The Development Standards Manual (Town of Caledon, 2019) and MOE SWMPD manual (MOECC, 2003) requires that developments with proposed stormwater management ponds must provide extended detention control of the runoff volume generated from a 4-hour, 25 mm storm event over a period of 48 hours.

Since the Site is considered greenfield development, a detailed erosion analysis based on a geomorphic assessment will need to be completed to determine if more stringent erosion controls are required to mitigate erosion within the receiving tributaries.

Quantity Control

The Site is located within the Humber River Watershed, therefore post-development flow rates must be controlled to the prescribed TRCA unit flow rates for the Humber River. TRCA Stormwater Management Criteria (2012) states that the main branches of the Lower, Main, East, West and Upper Humber River watershed do not require any quantity control measures. Lands that do not discharge to these main branches are required to adhere to the quantity control flow rates for the Humber River Watershed.

Most of the Site drains to the main branch of the West Humber River, therefore quantity controls are not required for these areas. However, the runoff from these areas is conveyed to the West Humber River through small tributaries. The impacts of releasing uncontrolled flows to these tributaries must be evaluated to determine the level of quantity control required. Refer to Section X.X for downstream analysis results.

Areas of the Site located within sub-basin 10 (generally located east of Highway 50) of the Humber River watershed must be designed to meet targets calculated using the Humber River Unit Flow Relationships for sub-basin 10. The Unit Flow Relationship Equations for the 2 through 100-year storm events within sub-basin 10 (Stormwater Management Criteria, TRCA 2012) are presented in Table 9 below.

Table 9: Humber River Watershed - Sub-Basin 10 Unit Flow Relationships

Return Period	Equation C: Sub-Basin 10
2-Year	Q = 3.142 - 0.233 * ln(A)
5-Year	Q = 5.557 - 0.427 * ln(A)
10-Year	Q = 7.443 - 0.578 * ln(A)
25-Year	Q = 9.838 - 0.757 * ln(A)
50-Year	Q = 11.920 - 0.921 * ln(A)
100-Year	Q = 14.140 - 1.096 * ln(A)

In accordance with Table 3-1 of the Stormwater Management Criteria (TRCA, 2012) calculation of return period peak flows within the Humber River Watershed shall be based on the 6-hour and 12-hour AES storm distributions. The storms used by TRCA for the Humber River model include the 6-hour, 12-hour, and 24-hour AES storm distributions and have therefore been used for this analysis.

Flood Control

As the Bolton North Hill Lands are upstream of a flood vulnerable area additional modeling is required to assess the impact of the development on dowsream land owners. Modeling has been completed for the 350 year, 500 year and regional storm to identify if additional quantity control is required to mitigate downstream impacts. Please refer to Section XX for details of this analysis.

Water Balance

Based on TRCA mapping, the Site is located within a Significant Groundwater Recharge Area and a High Groundwater Recharge Area (Stormwater Management Criteria, TRCA 2012). Due to these vulnerable areas, the Site will be required to maintain pre-development groundwater recharge rates and appropriate distribution, ensuring the protection of related hydrologic and ecologic functions. Further analysis of the water balance requirements will be conducted following the completion of a hydrogeological report.

6.2 Stormwater Management Strategy

The proposed grading and servicing strategy for the Site will generally maintain existing drainage patterns as well as the sub-watershed divide between the two sub-basins of the Humber River Watershed; sub-basin 10, which is subject to prescribed water quantity and quality controls, and a sub-basin that does not require quantity control.

Runoff from most of the development lands will be directed to on-site stormwater management (SWM) wet ponds designed to provide quantity, quality, and erosion control. A total of eleven (11) end-of-pipe stormwater management wet pond facilities are proposed to treat runoff from post-development drainage areas as illustrated on Drawing C706 – Preliminary Post-Development Storm Drainage Plan.

A total of eight (8) ponds will be located within an area of the Main Humber River Watershed, which does not require prescribed quantity controls per TRCA criteria. Although the Main Humber does not require quantity control, runoff from these ponds is conveyed through small drainage features to the Main Humber. These small drainage features will be evaluated as part of the Local Subwatershed Study to determine if they can safely convey uncontrolled flows from the development. The ponds located within the Main Humber Watershed are therefore designed to provide post to pre quantity control as well as quality and erosion control, providing conservative pond block sizing for this FSR. The remaining three (3) SWM ponds are located within sub-basin 10 of the Humber River which requires quantity control to meet unit flow rates specific to this subbasin and have been designed accordingly to provide quantity control as well as quality and erosion control.

Conceptual locations for the SWM wet pond facilities are shown on Drawing C706 – Preliminary Post-Development Storm Drainage Plan and have been selected according to the following:

- Located within natural low points, to minimize earthworks and maintain existing drainage patterns.
- Proximity to an outlet, such as an existing receiving tributary, ditch, or storm sewer (there are no existing storm sewers in the vicinity of the Subject Lands, however they may be proposed if urbanization of the existing arterial roads is considered).
- Minimize storm sewer infrastructure size and avoid potential service crossing conflicts (should storm sewers be proposed as a receiver).
- Optimize land use by maximizing developable tableland and serviceable areas.

In addition to the parameters listed above, options to expand SWM ponds into adjacent Greenbelt areas can be explored throughout further refinement of the design in order to maximize the developable area. The Greenbelt Plan 2017 identifies where urbanization should be limited in order to provide permanent protection to the agricultural land base and the ecological and hydrological features and functions occurring on the landscape within the Greater Golden Horseshoe. Existing, expanded, and new infrastructure is permitted within the Greenbelt Plan Area provided it serves significant growth and economic development expected in southern Ontario beyond the Greenbelt (Planning Act, Section 4.3.1.1 (b)). Stormwater management infrastructure is permitted within the Greenbelt Plan Area, however SWM facilities are prohibited in key natural heritage features, key hydrologic features, and their associated vegetation protection zones (Planning Act, Section 4.2.3.3).

Of note, SWM ponds 2/3 are two hydraulically connected wet pond cells, which will function as one stormwater management facility, which outlets to Tributary B. SWM pond 8 will include a flow splitter outlet to maintain flows to both Tributaries C and D under post-development conditions.

SWM Pond Grading & Design Considerations

This report outlines the preliminary quantity, quality and erosion control storage volumes required by each of the conceptual stormwater management ponds. Stormwater management criteria will be refined through the completion of the Local Subwatershed Study by Crozier (under separate cover). Block sizing for each of these stormwater management facilities will be quantified through progression of the Tertiary Plan and landowner's individual Draft Plans.

Each of the stormwater management (SWM) ponds shall be designed with consideration for grading, public safety, future maintenance access, and safe conveyance of emergency flows. A summary of the criteria to be taken into consideration for design of the stormwater management ponds is as follows:

- Site grading to provide safe overland conveyance of flows into the stormwater management facilities.
- Ponds graded with maximum side slopes of 4:1 from the bottom of the pond to 0.5 m below the normal water level.
- Maximum side slopes of 7:1 applied above the 4:1 sloping to the top of pond berm/ access road, with maximum 4:1 sloping from the top of berm to match into the pond block perimeter grades outside the pond.
- Permanent pool volume sized to achieve an Enhanced Level of quality protection with a depth of 1.5 m in the forebay and the main cell.
- Permanent pool elevation above the 25-year water level of the receiving watercourse.
- Extended detention storage and drawdown of the 25-mm rainfall event over a minimum period of 48 hours, at a maximum depth of 1.0 m per MECP guidelines.
- Active storage ponds located within sub-Basin 10, sized according to TRCA Unitary Flow Rate criteria for the Humber River Watershed (sub-Basin 10) with a maximum active storage depth of 2.0 m.
- A minimum 0.30 m of freeboard provided above the maximum (100-year) water level to the top of pond berm.
- Emergency spillways sized to convey the unattenuated Regulatory storm event runoff, which is defined as the greater of the Regional or 100-year unattenuated flow.
- A 5.0 m wide maintenance access road located with maximum longitudinal slopes of 8.0% and a maximum cross-fall slope of 2.0%. The maintenance access road will facilitate access to the inlet structure, forebay, and outlet structure for maintenance.

Site-Specific Stormwater Management Considerations

The stormwater management strategy for the Bolton North Hill development relies mainly on communal stormwater management ponds to meet quantity (if needed), quality, and erosion control requirements. As noted within **Section 5.2**, the Mixed-use, commercial and/or high-density blocks have been modelled with a percent impervious value consistent with medium-density (townhouse) development for the purposes of this report and communal SWM pond sizing. In the event that these areas will be developed at a higher density than 70% imperviousness, on-site stormwater management controls shall be explored to mitigate increased peak flows directed to the downstream communal ponds.

6.3 Quality Control

As mentioned in Section 6.1, all new developments (including all new stormwater management facilities) are required to provide Enhanced (Level 1) Protection (80% removal of TSS) on an annual loading basis. This quality control criteria will be achieved by the permanent pool of each of the proposed stormwater management (SWM) wet pond facilities.

Permanent pool volumes required to achieve Enhanced (Level 1) Protection were calculated based on the drainage area and associated imperviousness (calculated per the Concept Plan) tributary to each pond, in accordance with Table 3.2 of the Planning and Design Manual (Ministry of Environment, Conservation and Parks (MECP), 2003). Detailed permanent pool volume sizing calculations are provided in Appendix C2 and the results are summarized in Table 10 below.

Table 10: SWM Pond Permanent Pool Volume Summary

SWM Facility	Contributing Drainage Area (ha)	Percent Impervious of Drainage Area (%)	Required Permanent Pool Volume[1] (m^3)
1	7.34	55%	1,101
2/3	8.71	62%	1,455
4	18.33	61%	3,020
5	17.71	68%	3,202
6	23.59	62%	3,942
7	34.45	68%	6,228
8	23.69	63%	4,015
9	17.67	62%	2,952
10	8.50	58%	1,338
11	5.03	70%	931

[1] Required storage volumes interpolated from Table 3.2 of SWM Planning and Design Manual (MECP, 2003) are based on upstream impervious area, less 40 m^3/ha required for extended detention.

Each of the proposed SWM ponds will be graded to provide sufficient volume to meet or exceed the permanent pool volume required to achieve Enhanced Protection quality criteria, as shown in Table 10 above.

Permanent pool water levels within each of the proposed SWM pond facilities will be set based on the 25-year water level of the receiving tributary. Per TRCA criteria, the elevation between SWM pond outfalls and the receiving channel shall be minimized, by placing the outfall as low down on the slope as possible, while still above the 25-year floodline. From these outfall elevations, an outlet pipe slope was assumed to establish the minimum permanent pool water level within each pond; the pipe slope varies between ponds and was iterated so that the top of pond matches the minimum grade in the pond block. SWM ponds within catchments 203 and 207 outlet to an existing culvert or roadside ditch. Outfall inverts for these SWM pond facilities were based on the ditch or culvert invert.

Forebay Sizing

At the Draft Plan stage, forebays within each of the SWM wet ponds will be designed to achieve required dispersion and settling lengths in accordance with water quality sizing objectives in Section 4.6.2. of the SWM Planning and Design Manual (MECP, 2003). Forebay berms will be used to achieve these criteria as well as to meet a minimum forebay length to width ratio of 2:1, as recommended by the MECP.

6.4 Erosion Control

At a minimum, a 40 m^3/ha erosion control volume is required (MECP, 2003). Per Town and TRCA criteria, erosion controls for each SWM wet pond are required to provide extended detention and drawdown of a 25 mm rainfall event over a minimum 48-hour period.

A VO model was prepared for the post-development drainage conditions using the 25 mm 4-hour Chicago design storm to determine the resulting runoff volumes directed to each stormwater management facility. Detailed output from the VO model is provided in Appendix C3**.** Erosion control volume requirements are summarized in Table 11 below.

Table 11: Erosion Control Volume Requirements

SWM Facility	Contributing Drainage Area (ha)	Percent Impervious of Drainage Area (%)	Required MECP Erosion Control Volume[1] (m^3)	Required 25mm Event Erosion Control Volume[2] (m^3)
1	7.34	55%	294	1,021
2/3	8.71	62%	348	1,313
4	18.33	61%	733	2,749
5	17.71	68%	709	2,883
6	23.59	62%	943	3,574
7	34.45	68%	1,378	5,573
8	23.69	63%	948	3,702
9	17.67	62%	707	2,664
10	8.50	58%	340	1,278
11	5.03	70%	201	832

[1] MECP Erosion Control Volume required is 40 m^3/ha, obtained from the MOE SWM Planning and Design Manual (2003)
[2] 25mm Event Erosion Control Volume obtained from the Visual Otthymo model

6.5 Downstream Analysis

The majority of the proposed development area is located within the Main Humber watershed, which does not require quantity controls as prescribed within TRCA Stormwater Management Criteria (2012). Since runoff from the proposed development is conveyed through small drainage features to the Main Humber, a downstream analysis has been completed to assess the impact of increased runoff to these smaller features. Additionally, there is a Flood Vulnerable Area (FVA) currently identified in the downtown area of Bolton. As such, the downstream analysis also examined any potential increases in peak flows and flood risk associated with the main Humber River and this associated Flood Vulnerable Area.

The Subwatershed study being prepared under separate cover will also include a downstream analysis of the smaller drainage features downstream of the site as well as the Flood Vulnerable Area. Results presented in the Subwatershed Study will ultimately be the overarching document for directing more detailed stormwater management criteria for the Site.

The Humber River hydrology model was run for both the existing and proposed (uncontrolled) development conditions. Peak flow rates resulting from each model were then compared at specified flow nodes to understand the impact of the development on peak flow conditions within the downstream tributaries and Main Humber River. A comparison of peak flows is summarized in Table 12 below.

Table 12: Downstream Analysis – Comparison of Peak Flows

StFlow Node (NHYD #)	Design Storm Event	Existing Condition Peak Flow (m^3/s)	Proposed (Uncontrolled) Condition Peak Flow (m^3/s)	Difference (%)
1682	2-Year 6-Hour AES	4.71	4.70	0%
	5-Year 6-Hour AES	9.12	9.11	0%
	10-Year 6-Hour AES	15.74	15.49	-2%
	25-Year 6-Hour AES	22.55	22.26	-1%
	50-Year 6-Hour AES	29.55	29.55	0%
	100-Year 6-Hour AES	37.40	37.39	0%
	350-Year 12-Hour AES	88.22	88.11	0%
	500-Year 12-Hour AES	98.70	98.56	0%
	Hurricane Hazel	431.31	430.47	0%

1471	2-Year 6-Hour AES	4.77	5.29	11%
	5-Year 6-Hour AES	9.31	9.24	-1%
	10-Year 6-Hour AES	19.48	18.11	-7%
	25-Year 6-Hour AES	27.39	25.61	-7%
	50-Year 6-Hour AES	34.60	32.60	-6%
	100-Year 6-Hour AES	42.84	40.57	-5%
	350-Year 12-Hour AES	89.69	89.16	-1%
	500-Year 12-Hour AES	100.69	99.85	-1%
	Hurricane Hazel	441.94	435.94	-1%
2048	2-Year 6-Hour AES	7.05	8.98	27%
	5-Year 6-Hour AES	9.78	12.80	31%
	10-Year 6-Hour AES	20.26	18.99	-6%
	25-Year 6-Hour AES	28.28	26.65	-6%
	50-Year 6-Hour AES	35.90	33.89	-6%
	100-Year 6-Hour AES	44.20	41.95	-5%
	350-Year 12-Hour AES	90.83	90.13	-1%
	500-Year 12-Hour AES	101.78	100.81	-1%
	Hurricane Hazel	442.31	437.97	-1%
2043	2-Year 6-Hour AES	16.51	17.50	6%
	5-Year 6-Hour AES	23.44	25.08	7%
	10-Year 6-Hour AES	35.32	37.39	6%
	25-Year 6-Hour AES	43.29	45.93	6%
	50-Year 6-Hour AES	50.17	53.29	6%
	100-Year 6-Hour AES	56.49	60.04	6%
	350-Year 12-Hour AES	90.84	90.16	-1%
	500-Year 12-Hour AES	101.48	100.75	-1%
	Hurricane Hazel	439.81	436.00	-1%

2128	2-Year 6-Hour AES	5.82	7.80	34%
	5-Year 6-Hour AES	8.19	11.14	36%
	10-Year 6-Hour AES	12.21	15.74	29%
	25-Year 6-Hour AES	15.05	19.57	30%
	50-Year 6-Hour AES	17.66	22.87	29%
	100-Year 6-Hour AES	19.95	25.84	30%
	350-Year 12-Hour AES	17.05	22.00	29%
	500-Year 12-Hour AES	18.09	23.38	29%
	Hurricane Hazel	22.36	26.91	20%
7520	2-Year 6-Hour AES	3.10	4.26	37%
	5-Year 6-Hour AES	4.44	6.33	43%
	10-Year 6-Hour AES	7.86	10.38	32%
	25-Year 6-Hour AES	10.00	13.37	34%
	50-Year 6-Hour AES	11.79	15.80	34%
	100-Year 6-Hour AES	13.44	17.85	33%
	350-Year 12-Hour AES	15.88	20.18	27%
	500-Year 12-Hour AES	16.96	21.58	27%
	Hurricane Hazel	24.63	28.65	16%
894	2-Year 6-Hour AES	0.51	0.50	-2%
	5-Year 6-Hour AES	0.99	0.97	-1%
	10-Year 6-Hour AES	5.73	5.67	-1%
	25-Year 6-Hour AES	8.38	8.33	-1%
	50-Year 6-Hour AES	10.96	10.90	-1%
	100-Year 6-Hour AES	14.22	14.18	0%
	350-Year 12-Hour AES	32.83	32.77	0%
	500-Year 12-Hour AES	37.33	37.27	0%
	Hurricane Hazel	157.38	157.16	0%

1850	2-Year 6-Hour AES	3.34	4.55	36%
	5-Year 6-Hour AES	4.93	6.81	38%
	10-Year 6-Hour AES	22.01	21.75	-1%
	25-Year 6-Hour AES	30.77	30.35	-1%
	50-Year 6-Hour AES	38.40	37.86	-1%
	100-Year 6-Hour AES	46.62	45.97	-1%
	350-Year 12-Hour AES	87.25	86.44	-1%
	500-Year 12-Hour AES	96.47	95.58	-1%
	Hurricane Hazel	311.36	309.43	-1%
1794	2-Year 6-Hour AES	17.38	19.60	13%
	5-Year 6-Hour AES	25.20	29.12	16%
	10-Year 6-Hour AES	43.08	47.93	11%
	25-Year 6-Hour AES	56.54	60.43	7%
	50-Year 6-Hour AES	71.12	70.37	-1%
	100-Year 6-Hour AES	88.05	85.05	-3%
	350-Year 12-Hour AES	168.53	164.83	-2%
	500-Year 12-Hour AES	186.93	182.74	-2%
	Hurricane Hazel	690.00	681.76	-1%

As can be seen from the table above, peak flows increases are generally observed as a result of the development. Within the Main Humber peak flows during the smaller 2-5 -year storm events present the largest change in peak flows, whereas the larger storms show decreases in peak flows. During the Regional (Hurricane Hazel) storm event, only a 1% increase in peak flow rates is observed through the main reach of the Humber River.

The portion of the development area located within sub-basin 10 which outlets to Tributary E and Cold Creek, is required to meet prescribed unit flow rates per TRCA criteria for events up to and including the 100-year design storm event. Results of the downstream analysis showed significant increases in peak flows during the 350 yr, 500yr and Regional (Hurricane Hazel) storm event, therefore peak flow controls for these larger storm events will be implemented for SWM ponds which outlet to Tributary E and Cold Creek. It was also noted that for Tributary E and Cold Creek the unit flow rates for the 2 and 5 year storm did not fully control the peak flows to pre-development levels. Due to the erosive potential of the downstream reaches a more conservative control target has been established for these facilities. These target flow rates will be reassessed based on the results of the downstream erosion assessment.

6.6 Quantity Control

SWM Pond Quantity Control Criteria Summary

Based on the prescribed TRCA unit flow rates (where applicable) and the results of the downstream analysis presented in Section 6.5, Table 13 summarizes the quantity control criteria applicable to each individual SWM facility.

Table 13: SWM Facility Quantity Control Requirement Summary

SWM Facility	Humber River Sub-basin	Receiving Tributary	Design Storm Control Required	Flood Control Required
1	Main Humber	Tributary B	2 – 5 year and 100 year Post to Pre	350 year, 500 year and Regional Post to Pre
2/3	Main Humber	Tributary B	2 – 5 year and 100 year Post to Pre	350 year, 500 year and Regional Post to Pre
4	Main Humber	Tributary C	2 – 5 year and 100 year Post to Pre	No
5	Main Humber	Tributary D	2 – 5 year and 100 year Post to Pre	350 year, 500 year and Regional Post to Pre
6	Sub-basin 10	Tributary E	Unitary Flow Controls[1]	350 year, 500 year, Hazel
7	Main Humber	Tributary D	2 – 5 year and 100 year Post to Pre	350 year, 500 year and Regional Post to Pre
8	Main Humber	Tributary C/D	2 – 5 year and 100 year Post to Pre	350 year, 500 year and Regional Post to Pre
9	Sub-basin 10	Tributary E	Unitary Flow Controls[1]	350 year, 500 year, Hazel
10	Main Humber	Tributary A	2-5 year post to pre.	No
11	Sub-basin 10	Tributary F (Cold Creek)	Unitary Flow Controls[1]	350 year, 500 year, Hazel

Note 1 - Unitary Flow Controls for 2-5 year adjusted per table 14 below, controls for the 10-100 year) per TRCA criteria (sub-basin 10)

The Subwatershed study being prepared under separate cover will ultimately be the overarching document for directing more detailed stormwater management criteria for the Site.

Sub-Basin 10 SWM Ponds

As previously noted, the eastern portion of the development is located within sub-basin 10 of the Humber River Watershed, where control of post-development peak flows is required to meet the Unit Flow Relationships for the Humber River (sub-basin 10), as previously identified in Table 9 of this report. See Table 14 below for the target flows to each pond based on pre-development areas to the pond outlets.

Table 14: Target Flows for SWM Ponds in Sub-Basin 10

Storm Event	SWMP 6		SWMP 9		SWMP 11	
	Pre-Dev. Area to Pond (ha)	Target Flow Rate (m^3/s)	Pre-Dev. Area to Pond (ha)	Target Flow Rate (m^3/s)	Pre-Dev. Area to Pond (ha)	Target Flow Rate (m^3/s)
2-Year	22.95	23.9	16.13	16.7	5.03	10.9
5-Year		52.2		37.1		21.5
10-Year		129.3		94.1		32.7
25-Year		171.4		124.7		43.3
50-Year		207.3		151.0		52.5
100-Year		245.7		178.9		62.2
500-Year		-		-		-
350-Year		-		-		-
Regional		2.125		0.910		-

A VO model was prepared for the post-development drainage conditions using the 6-hour, 12-hour, and 24-hour AES design storms. Target flow rates for each pond were calculated using the Unit Flow Relationships for sub-basin 10 based on the total drainage area contributing to each pond. Target flows were then coded into VO as a route reservoir command to determine the resultant active storage volumes required. Detailed Humber River target flow calculations are provided in Appendix C2 and Visual Otthymo model outputs for the SWM Pond Designs are provided in Appendix C3.

Results of the modeling determined that the 12-hour and 24-hour AES storms produced the larger volume requirements compared to the 6-hour AES storm. As such, ponds shall be sized to meet the larger volume requirement for the ponds to achieve Unit Flow criteria under both 6-hour, 12-hour, and 24-hour AES events for all storms up to and including the 100-year event.

Since SWM ponds 6 and 9 both outlet to Tributary E, quantity control of the Regional (Hurricane Hazel) storm event will also be provided to mitigate increases in peak flows downstream. As such, a sizing exercise has also been completed in VO to determine the required volume to mitigate increases in peak flows associated with the Regional storm event.

Tables 15, 16, and 17 summarize the resultant active storage volumes for each SWM pond facility located within sub-basin 10 of the Humber River Watershed.

Table 15: SWM Pond 6 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow[1] Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	22.92	62%	23.9	6,300
5-Year			52.2	8,000
10-Year			129.3	9,300
25-Year			171.4	10,900
50-Year			207.3	12,100
100-Year			245.7	13,300
350-Year			-	-
500-Year			-	-
Regional			1.215	24,500

[1] Target flow rates calculated based on contributing area to SWM pond and Unit Flow Rate Equations for Sub-Basin 10 of the Humber River Watershed (TRCA, 2012).

Table 16: SWM Pond 9 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow[1] Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	17.67	62%	16.7	4,800
5-Year			37.1	6,100
10-Year			94.1	7,000
25-Year			124.7	8,200
50-Year			151.0	9,100
100-Year			178.9	10,100
350-Year			-	-
500-Year			-	-
Regional			910.0	18,100

[1] Target flow rates calculated based on contributing area to SWM pond and Unit Flow Rate Equations for Sub-Basin 10 of the Humber River Watershed (TRCA, 2012).

Table 17: SWM Pond 11 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow[1] Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	5.03	70%	10.9	1,400
5-Year			21.5	1,800
10-Year			32.7	2,100
25-Year			43.3	2,400
50-Year			52.5	2,650
100-Year			62.2	2,900

[1] Target flow rates calculated based on contributing area to SWM pond and Unit Flow Rate Equations for Sub-Basin 10 of the Humber River Watershed (TRCA, 2012).

Main Humber River SWM Ponds

Target flows for the SWM facilities within the Main Humber River watershed were coded into VO as route reservoir commands to determine the resultant active storage volumes required. Detailed Humber River target flow calculations are provided in Appendix C2 and Visual Otthymo model outputs for the SWM Pond Designs are provided in Appendix C3.

Results of the modeling determined that, overall, the 24-hour AES storm produced the larger volume requirement compared to the 12-hour and 6-hour AES storm. As such, ponds shall be sized to meet the larger volume requirement for the ponds to achieve quantity control under both 6-hour and 12- and 24-hour AES events for all storms up to and including the 100-year event. Tables 18-24 summarize the resultant active storage volumes for each SWM pond facility discharging to the Main Humber River. Table 25 summarizes the total active storage required for each SWM pond facility.

Table 18: SWM Pond 1 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	7.34	55%	0.005	2,010
5-Year			0.012	2,700
10-Year			-	-
25-Year			-	-
50-Year			-	-
100-Year			0.149	3,550
350-Year	-	-	0.213	4,490
500-Year	-	-	0.227	4,730
Hazel	-	-	0.405	7,060

Table 19: SWM Pond 2/3 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	8.71	62%	0.007	2,600
5-Year			0.015	3,400
10-Year			-	-
25-Year			-	-
50-Year			-	-
100-Year			0.169	4,440
350-Year	-	-	0.251	5,580
500-Year	-	-	0.269	5,870
Hazel	-	-	0.482	8,500

Table 20: SWM Pond 4 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	18.33	61%	0.020	5,300
5-Year			0.042	7,000
10-Year			-	-
25-Year			-	-
50-Year			-	-
100-Year			-	-

Table 21: SWM Pond 5 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	17.71	68%	0.019	5,500
5-Year			0.041	7,000
10-Year			-	-
25-Year			-	-
50-Year			-	-
100-Year			0.506	8,840
350-Year	-	-	0.715	10,680
500-Year	-	-	0.766	11,190
Hazel	-	-	1.321	13,277

Table 22: SWM Pond 7 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	34.45	68%	0.038	10,500
5-Year			0.080	13,500
10-Year			-	-
25-Year			-	-
50-Year			-	-
100-Year			0.979	17,150
Hazel	-	-	2.567	25,640

Table 23: SWM Pond 8 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	23.69	63%	0.026	7,000
5-Year			0.055	9,000
10-Year			-	-
25-Year			-	-
50-Year			-	-
100-Year			0.677	11,470
Hazel	-	-	1.361	18,319

Table 24: SWM Pond 10 Active Storage Volume Summary

Storm Event	Post-Development Contributing Area (ha)	Percent Imperviousness (%)	Target Flow Rate (m^3/s)	Required Active Storage Volume (m^3)
2-Year	8.50	58%	0.010	2,500
5-Year			0.021	3,300
10-Year			-	-
25-Year			-	-
50-Year			-	-
100-Year			-	-

Table 25: SWM Total Active Storage Volume Summary

SWM Pond Location	Total Active Storage Volume (m^3)
SWM Pond 1	10,603
SWM Pond 2/3	12,953
SWM Pond 4	6,829
SWM Pond 5	22,111
SWM Pond 6	13,300
SWM Pond 7	42,786
SWM Pond 8	24,745
SWM Pond 9	10,100
SWM Pond 10	3,300
SWM Pond 11	2,900

Stormwater Facility Outfalls

The Stormwater Management Criteria (TRCA, 2012) outlines criteria required for stormwater management outfalls to reduce the risk of erosion to the outfall structures, channels, and receiving watercourse and floodplain. The outfall criteria are listed as follows:

- Hard structure outfalls (i.e., headwalls or anything made of concrete) are required to be located outside of the 100-year erosion limit, unless not technically feasible.
- Outfalls should not impact the flood levels.
- Avoid backwater conditions in outfalls, unless explicitly accounted for in the design.
- Minimize elevation between the outfall and receiving channel, placing it as low down on the slope as possible, while still above the 25-year floodline.
- Plunge pools are to be designed at the outfall outlet, unless it can be demonstrated that it is not required to dissipate flow energy, or a plunge pool cannot reasonably be constructed due to topographic constraints.
- Outfalls that are set-back 10 m to 20 m from the channel require a flow spreader and/or a plunge pool design, where feasible.

Several outfall pipes are likely to require steep slopes due to the deep valleys where the receiving watercourses are located. For the outfall pipes with steep slopes, opportunities to reduce slopes, such as incorporating drop structures or cascades will be evaluated at the detailed design stage.

7.0 Water Balance & Low Impact Development

7.1 Site Water Balance and Wetland Feature-Based Water Balance

A water balance assessment and feature based water balance assessment will be completed for the Site as part of the Hydrogeological Report being prepared by Crozier under separate cover. Well drilling took place during October and November 2021 and the results of the monitoring program will be provided in the Hydrogeological Report Submission.

7.2 Low Impact Development

Per TRCA mapping, the Site is located within a Significant Groundwater Recharge Area and a High Groundwater Recharge Area (Stormwater Management Criteria, TRCA 2012). Due to these vulnerable areas, the Site will be required to maintain pre-development groundwater recharge rates and appropriate distribution, ensuring the protection of related hydrologic and ecologic functions.

Low Impact Development (LID) methods can be implemented on-site to mitigate water balance within the Subject Lands and/or to a wetland. Detailed infiltration facility sizing, including in-situ percolation tests and drawdown calculations for each facility, will be completed as part of the Draft Plan stage.

A list of potential LID options, including the SWM criteria which can be achieved via each LID option, is presented in Table 26 below for consideration.

Table 26: LID Options Feasibility Summary

LID Type	Location	Stormwater Management Benefits					
		Un-Lined System			Lined System		
		Water Balance Via Infiltration	Water Quality	Stream Erosion Control	Water Balance Via Infiltration	Water Quality	Stream Erosion Control
Infiltration Gallery (Trenches, Chambers, & Soakaway)	Low & Med-Density Residential (Rear-Yard)	☑	☑	☑	☒	☒	☑
	Mixed-Use Blocks						
	High-Density Blocks						
	Boulevard						
	Park Blocks						
	Pond Blocks						
	LID Blocks						
	Greenbelt Areas						
Bioretention	Mixed-Use Blocks	☑	☑	☑	☒	☑	☑
	High-Density Blocks						
	Boulevards						
	Park Blocks						
	Pond Blocks						
	LID Blocks						
	Greenbelt Areas						

LID Type	Location	Stormwater Management Benefits					
		Un-Lined System			Lined System		
		Water Balance Via Infiltration	Water Quality	Stream Erosion Control	Water Balance Via Infiltration	Water Quality	Stream Erosion Control
Enhanced Grass Swales	Low & Med-Density Residential	☑	☑	☑	☒	☑	☑
	Mixed-Use Blocks						
	High-Density Blocks						
	Boulevard						
	Park Blocks						
	Pond Blocks						
	LID Blocks						
	Greenbelt Areas						
Disconnected Downspouts	Residential lots	☑	☒	☑	N/A	N/A	N/A
Green Roofs	Mixed-Use Blocks	☒	☑	☑	N/A	N/A	N/A
	High-Density Blocks						
	Schools						
Permeable Pavements	Residential Driveways	☑	☑	☑	☒	☑	☒
	Local Roads						
	Mixed-Use Blocks						
	High-Density Blocks						
	Schools						
	SWM Pond Access Roads						

Tree Pits / Planters	Boulevards	☑	☑	☑	☒	☑	☑
	Park Blocks						
	Mixed-Use Blocks						
	High-Density Blocks						
	Schools						
Rainwater Harvesting	Residential lots (Rain Barrels)	☑ (via irrigation)	☑	☑	N/A	N/A	N/A
	Mixed-Use Blocks (Rainwater Cistern)						
	High-Density Blocks (Rainwater Cistern)						
Additional Depth Topsoil	Residential lots	☑	☑	☑	N/A	N/A	N/A
	Boulevards						
	Parks						
Pocket Wetlands	Mixed-Use Blocks	☒	☑	☑	☒	☑	☑
	High-Density Blocks						
	Parks						
	Boulevards						
	Greenbelt Areas						

Note that further investigation of these LID options, including understanding the feasibility of their implementation and in-situ soil and groundwater conditions, will be conducted at the Draft Plan stage once the results of the hydrogeological study are available.

8.0 Floodplain Analysis

8.1 Headwater Drainage Feature Assessment

The Site is situated within the headwaters of the Main Humber River Watershed. A headwater drainage feature assessment specific to the Site has been prepared under separate cover as the Option 1/2 Lands Secondary Plan Natural Heritage Study Report (Dillon, December 2024).

According to the Natural Heritage Study, there are no headwater drainage features within the Site which are protected or require conservation. Therefore, none of the headwater drainage features are maintained within the Site and no floodplain mapping is required or provided for these features within the Site boundary. Conveyance of external drainage discharging to the Site under existing conditions will be achieved by routing the flow through sewers. Additional information regarding the conveyance of external drainage is described in more detail in Section 5.2.

8.2 Hydraulic Modelling

Existing hydraulic (HEC-RAS) models for the Main Humber River and Cold Creek were provided by the Toronto and Region Conservation Authority (TRCA). The received models include:

- Engineered HEC-RAS model for the Main Humber River and the associated TRCA floodplain Map Sheet Hum_77, Hum_81 and Hum_82
- Estimated HEC-RAS model titled Middle Main for tributaries of the Main Humber River Watershed
- Estimated HEC-RAS model titled Cold Creek for tributaries of the Cold Creek Subwatershed
- Engineered HEC-RAS model titled Cold Creek-R2 for tributaries of Cold Creek West and Tributary E.

Updated hydraulic modelling was completed in HEC-RAS v.6.4.1. Digital copies of the HEC-RAS models are provided with this submission. The estimated models for tributaries of the Main Humber River Watershed and Cold Creek Subwatershed were revised as part of this analysis due to their proximity to the Site. The Engineered TRCA HEC RAS model received on February 4, 2026 was used to complete the floodplain analysis for Tributary E and Cold Creek West. Based on pre-consultation with the TRCA, the existing engineered hydraulic model for the Main Humber River does not require re-modelling since the associated floodplain is well outside of the Site area and does not experience any impact in terms of water surface elevation due to development.

From the TRCA estimated models, four (4) tributaries (MM_9_2 - 9.203, MM_9_2_trib - 9.204, MM_9_2 - 9.205, and Cold_10_7 - 10.7) were selected for further analysis. Upon further investigation of the Site's existing and proposed drainage conditions, three (3) new tributaries were added to the model to provide a more comprehensive analysis of the floodplain in the immediate vicinity of the Site. To simplify the review process, the naming convention of each tributary has been updated in the model to reflect the naming convention of tributaries described Section 5.0. The updated naming convention of each tributary, listed from west to east across the Site, is summarized below in Table 27.

Table 27: HEC-RAS Model River Reach Naming Convention

HEC-RAS Model	Original HEC-RAS Tributary ID	Updated HEC-RAS Tributary ID
Middle Main	X[1]	Tributary A
	X[1]	Tributary B
	MM_9_2 - 9.203	Tributary C
	MM_9_2_trib - 9.204	Tributary D
	MM_9_2 - 9.205	Tributary C + Tributary D
Cold Creek	Cold_10_7 - 10.7	Tributary E
	X[1]	Tributary F (Cold Creek)

1. "X" Refers to a new tributary that has been added to the HEC-RAS model.

Modelled cross-sections within the Site were updated to reflect topographic survey information derived from Drone Survey Canada (July 2021). Modelled cross-sections outside of the Site were updated to reflect the Digital Terrain Model (LiDAR-Derived) data obtained from the Land Information Ontario (LIO) Dataset by the Ministry of Natural Resources and Forestry (October 2023). As described in Section 8.1, floodplain mapping has only been completed outside the Site where significant headwater drainage features are located. Since there are no changes to the topography outside of the Site, the cross-section geometries are the same under both existing and proposed conditions.

Two watercourse crossings were added to the existing hydraulic model. Watercourse crossing information was obtained from as-built drawings available on the Region of Peel Public Works – Peel Asset Locator Application. At locations where as-built drawings were not available, watercourse crossings were measured manually during field visits. Watercourse crossing information is summarized in Table 28 below.

Table 28: Modelled Watercourse Crossings

Location	HECRAS Tributary ID	Material	Culvert Length (m)	Culvert Diameter (mm)	Data Source	As-Built Drawing No.
Duffy's Ln approximately 175 m north of Emil Kolb Pkwy	Tributary B	Corrugated Steel Pipe	30.4	600	Field Measurement	N/A
Emil Kolb Pkwy approximately 770 m west of HWY 50	Tributary C	Concrete Bridge with Piers	NA	NA	As-Built	55280-D

Detailed HEC-RAS model schematics, including invert elevations of the above culverts, for Middle Main and Cold Creek are provided in Appendix D1 for reference. Copies of as-built drawings are provided in Appendix D1.

HEC-RAS steady state flow data was updated using the results of the existing and proposed hydrologic models described in Section 6.0. To analyze the Regional floodplain elevations of each tributary, the following storm events were run in Visual Otthymo (v.6.2):

- 100-Year 6-hour AES Design Storm
- 100-Year 12-hour AES Design Storm
- Hurricane Hazel Design Storm

The results of the hydrologic model prove that Hurricane Hazel produces the greatest peak flows. Therefore, Hurricane Hazel was used to perform Regional analysis of the floodplain as per the TRCA's Technical Guidelines for Flood Hazard Mapping (March 2017).

In addition to the Regional event, 2-Year, 25-Year, and 100-Year design storms were also included in the hydraulic model to perform further analysis. The 6-hour AES design storm produced greater peak flow rates than the 12-hour AES design storm after running the events in the hydrologic model. Therefore, the 6-hour AES design storm was selected for further analysis to achieve the most conservative results. A summary of the design storms and method of analysis is provided below:

- 2-Year 6-hour AES: To analyze changes in erosive forces between the existing and proposed conditions models
- 25-Year 6-hour AES: To evaluate acceptable outfall elevations for proposed stormwater management facilities described in Section 6.0
- 100-Year 6-hour AES: To assess the overall changes in floodplain elevations during the 100-year event as part of standard floodplain mapping practices

Peak flow rates were input at various cross-sections of each tributary. The HEC-RAS flow change locations are defined by the upstream limits of each reach, points of confluence, watercourse crossings, and the locations proposed SWM facilities. The existing and proposed Regional flow rates, HEC-RAS flow change locations, and corresponding VO flow node are summarized below in Table 29.

Table 29: HEC-RAS Regional Flow Change Locations

Tributary ID	VO Flow Node Existing	VO Flow Node Proposed	HEC-RAS Station	Regional Flow Rate (m^3/s)	
				Existing	Proposed
A	Transposition	Transposition	1017	0.503	0.473
	7696	7717	996	2.821	2.654
B	Transposition	Transposition	1005	1.703	2.115
	7695	7728	999	2.761	3.429
C	Transposition	Transposition	2179.936	4.559	4.259
	Transposition	Transposition	1855.838	5.325	4.975
	7691	7731	993.3609	7.790	7731
D	Transposition	Transposition	1195.92	5.227	6.093
	Transposition	Transposition	1192.146	8.930	10.410
	7692	7863	886.4161	12.209	14.233
C + D	7690	93	294	0.523	0.523
E	Transposition	Transposition	4822.04	2.448	2.920
	Transposition	Transposition	4460.59	3.914	4.668
	7686	7685	3837.47	9.002	10.737
	7518	7518	10.011	303.179	300.389
R1	1682	1682	107.233	385.589	384.839
	3448	3448	106.631	384.227	383.841
	1471	1471	102.613	395.094	389.732
	Transposition	Transposition	102.398	374.948	374.948
	2048	2048	100.401	395.422	391.543
	1379	1379	11.39	639.230	630.957

1. Flow rates have been prorated based on an area-weighted calculation of each drainage area.

The above proposed flow rates represent the uncontrolled condition. The analysis assumes that the proposed SWM facilities would be under maximum capacity during the Regional event and would not provide quantity control of runoff from the Site. The 2-Year to 100-Year flow rates at each flow change location are provided in Appendix D2. Under the proposed condition, the 2-Year to 100-Year events represent the controlled condition. The analysis of design storms assumes that runoff from the Site would be controlled due to the proposed SWM facilities.

8.3 Hydraulic Model Results

WSE and velocities (left overbank, main channel, and right overbank) were generated and compared for both the existing and proposed conditions models. Tables summarizing the 2-Year, 25-Year, 100-Year WSE and velocity data are summarized in Appendix D3. Table 30 provides a summary of the Regional results at Tributary A.

Table 30: Tributary A – Regional Existing Vs. Proposed WSE and Velocity Data

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
1017	254.86	254.85	0.01	0	0	0	0.96	0.95	0.01	0	0	0
1000	253.53	253.53	0	0	0	0	0.9	0.89	0.01	0	0	0
999	252.4	252.4	0	0	0	0	0.12	0.12	0	0	0	0
998.6	252.38	252.38	0	0	0	0	0.21	0.2	0.01	0	0	0
998.4	252.34	252.34	0	0	0	0	0.34	0.33	0.01	0	0	0
998	251.93	251.93	0	0	0	0	0.85	0.83	0.02	0	0	0
997.7	249.47	249.46	0.01	0	0	0	1.29	1.28	0.01	0	0	0
997	245.8	245.79	0.01	0	0	0	1.04	1.07	-0.03	0	0	0
996.6	242.27	242.26	0.01	0	0	0	1.01	0.99	0.02	0	0	0
996	237.8	237.79	0.01	0	0	0	1.15	1.14	0.01	0	0	0
995.8	236.04	236.03	0.01	0	0	0	1.32	1.29	0.03	0	0	0
995.6	234.69	234.69	0	0	0	0	1.02	1.01	0.01	0	0	0
995	232.59	232.58	0.01	0	0	0	1.63	1.6	0.03	0	0	0
932	232	232	0	0.01	0.01	0	0.05	0.04	0.01	0.02	0.01	0.01

1. A "–" indicates that the channel component does not contain runoff at this location

Tributary A experiences minimal decrease in WSE under the proposed condition. As a result, the main channel velocities are also subject to some minor reduction. This decrease occurs because the proposed drainage patterns within the Site are different compared to the existing conditions topography. Less runoff will discharge to Tributary A and more runoff will then discharge to Tributary B. The minimal decrease in WSE and velocity at Tributary A does not pose any increase to flood risk.

Table 31 provides a summary of the Regional results at Tributary B.

Table 31: Tributary B – Regional Existing Vs. Proposed WSE and Velocity Data

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
1005	257.12	257.17	-0.05	0	0	0	1.72	1.8	-0.08	0	0	0
1004.6	255.95	256	-0.05	0	0	0	1.7	1.8	-0.1	0	0	0
1004	254.97	255.01	-0.04	0	0	0	1.58	1.67	-0.09	0	0	0
1003	251.72	251.76	-0.04	0	0	0	1.52	1.58	-0.06	0	0	0
1002	250.89	250.96	-0.07	0	0	0	0.18	0.21	-0.03	0	0	0
1001.4	250.89	250.96	-0.07	0	0	0	0.06	0.07	-0.01	0	0	0
1001	250.89	250.96	-0.07	0	0	0	0.05	0.06	-0.01	0	0	0
1000.8	250.89	250.96	-0.07	0	0	0	0.01	0.01	0	0	0	0
1000.2	250.89	250.96	-0.07	0	0	0	0.02	0.02	0	0	0	0
1000	250.89	250.96	-0.07	0	0	0	0.01	0.02	-0.01	0	0	0
999.64	0											
999	243.3	243.43	-0.13	0	0	0	2.82	3.03	-0.21	0	0	0
998	241.43	241.5	-0.07	0	0	0	2.1	2.2	-0.1	0	0	0
997.4	239.49	239.55	-0.06	0	0	0	1.78	1.89	-0.11	0	0	0
997	237.43	237.46	-0.03	0	0	0	1.47	1.54	-0.07	0	0	0
996	234.81	234.84	-0.03	0	0	0	1.43	1.51	-0.08	0	0	0
995.4	232.27	232.33	-0.06	0	0	0	1.92	2.02	-0.1	0	0	0
994.4	231.85	231.85	0	0.01	0.01	0	0.03	0.03	0	0.01	0.01	0
994	231.85	231.85	0	0	0	0	0.01	0.01	0	0	0	0

1. A "–" indicates that the channel component does not contain runoff at this location.

As mentioned in the analysis of Tributary A results, the proposed condition routes less runoff to Tributary A and more runoff to Tributary B. As a result of allocating more runoff to Tributary B, there are increases in WSE throughout the channel. The most significant increase (0.29 m) occurs immediately downstream of the crossing at Duffy's Lane. This increase in WSE can likely be attributed to the increase in flow and undersized culvert at Duffy's Lane. While the increase is considerable, it occurs for a small length of channel is located deep in a significant valley corridor. As indicated in the velocity results, water is still contained well within the banks of the main channel. Since the steep side slopes of the valley provide a narrow channel corridor, there is minimal increase to the extent of floodplain area. Downstream of Duffy's Lane, there is only significant woodland area where no future development will occur. Therefore, the downstream increase in WSE poses no threat to developable land or public safety.

According to the Ministry of Natural Resources – Technical Guide River & Stream Systems: Flooding Hazard Limit (2002), safe access and egress are defined by the following conditions:

- Depths no greater than 0.3 m.
- Velocities no greater than 1.7 m/s.
- Product depth-velocities no greater than 0.4 m^2/s.

At Duffy's Lane, the maximum depth over the road under the proposed condition is 0.28 m. The velocity and product depth-velocity are 0.67 m/s and 0.18 m^2/s, respectively. Therefore, safe access along Duffy's Lane can still be achieved given the increase in flow at Tributary B.

Table 32 provides a summary of the Regional results at Tributary C.

Table 32: Tributary C – Regional Existing Vs. Proposed WSE and Velocity Data

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
2179.936	257.07	257.06	0.01	0	0	0	0.7	0.7	0	0	0	0
2159.385	256.99	256.98	0.01	0	0	0	0.5	0.5	0	0	0	0
2097.132	256.83	256.82	0.01	0	0	0	0.58	0.57	0.01	0	0	0
2030.564	256.34	256.33	0.01	0	0	0	1.45	1.42	0.03	0	0	0
1994	256.21	256.19	0.02	0	0	0	0.34	0.33	0.01	0	0	0
1970.384	256.2	256.18	0.02	0	0	0	0.2	0.19	0.01	0	0	0
1911.614	256.2	256.18	0.02	0	0	0	0.21	0.2	0.01	0	0	0
1881.066	0											
1855.838	255.84	255.83	0.01	0	0	0	1.39	1.37	0.02	0	0	0
1813.506	254.99	254.98	0.01	0	0	0	1.15	1.12	0.03	0	0	0
1775.696	254.41	254.41	0	0	0	0	0.95	0.92	0.03	0	0	0
1726.57	253.3	253.29	0.01	0	0	0	1.37	1.35	0.02	0	0	0
1684.01	252.16	252.15	0.01	0	0	0	1.17	1.18	-0.01	0	0	0
1603.573	252	251.99	0.01	0	0	0	0.23	0.23	0	0	0	0
1539.326	251.89	251.88	0.01	0	0	0	0.71	0.7	0.01	0	0	0
1486.021	251.35	251.33	0.02	0	0	0	1.18	1.16	0.02	0	0	0
1450.067	250.78	250.77	0.01	0	0	0	1.61	1.58	0.03	0	0	0
1406.638	250.2	250.18	0.02	0	0	0	1.17	1.14	0.03	0	0	0
1338.455	249.33	249.32	0.01	0	0	0	1.58	1.55	0.03	0	0	0
1304.352	248.58	248.56	0.02	0	0	0	1.67	1.65	0.02	0	0	0
1265.187	247.93	247.89	0.04	0	0	0	1.8	1.9	-0.1	0	0	0
1206.875	246.81	246.78	0.03	0	0	0	1.76	1.76	0	0	0	0
1175.661	246.29	246.28	0.01	0	0	0	1.57	1.53	0.04	0	0	0

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
1120.613	245.37	245.35	0.02	0	0	0	1.18	1.15	0.03	0	0	0
1083.716	244.89	244.86	0.03	0	0	0	1.84	1.85	-0.01	0	0	0
1042.153	243.73	243.71	0.02	0	0	0	1.15	1.13	0.02	0	0	0
1006.177	243.16	243.14	0.02	0	0	0	1.81	1.77	0.04	0	0	0
993.3609	243.04	243.02	0.02	0	0	0	1.04	1.02	0.02	0	0	0
935.4169	242.42	242.4	0.02	0	0	0	1.9	1.9	0	0	0	0
870.5434	240.62	240.58	0.04	0	0	0	2.59	2.55	0.04	0	0	0
836.4684	239.53	239.5	0.03	0	0	0	2.57	2.53	0.04	0	0	0
799.8246	238.76	238.73	0.03	0	0	0	2.42	2.37	0.05	0	0	0
745.4448	236.54	236.51	0.03	0	0	0	2.3	2.27	0.03	0	0	0
716.4415	235.51	235.5	0.01	0	0	0	2.06	1.97	0.09	0	0	0
687.3773	235.1	235.07	0.03	0	0	0	1.64	1.67	-0.03	0	0	0
661.4518	234.27	234.24	0.03	0	0	0	2.35	2.3	0.05	0	0	0
627.6722	233.4	233.37	0.03	0	0	0	2.36	2.32	0.04	0	0	0
589.2625	232.75	232.73	0.02	0	0	0	1.35	1.32	0.03	0	0	0
540.5079	232.16	232.13	0.03	0	0	0	2.3	2.26	0.04	0	0	0
510.2238	231.19	231.17	0.02	0	0	0	2.03	1.98	0.05	0	0	0
457.5412	229.95	229.91	0.04	0	0	0	2.45	2.41	0.04	0	0	0
414.0466	229.3	229.28	0.02	0	0	0	2.25	2.18	0.07	0	0	0
374.4607	228.69	228.67	0.02	0	0	0	2.08	2.05	0.03	0	0	0
330.2584	227.84	227.8	0.04	0	0	0	1.1	1.31	-0.21	0	0	0

1. A "–" indicates that the channel component does not contain runoff at this location.

Tributary C experiences a minimal decrease in WSE and velocity throughout the channel. There are no concerns in terms of increasing the flood risk to adjacent properties and public safety.
Table 33 provides a summary of the Regional results at Tributary D.

Table 33: Tributary D – Regional Existing Vs. Proposed WSE and Velocity Data

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
1195.922	264.33	264.36	-0.03	0.56	0.61	-0.05	1.48	1.53	-0.05	0.36	0.43	-0.07
1194	263.71	263.74	-0.03	0.51	0.51	0	1.24	1.3	-0.06	0	0	0
1193.146	263.4	263.43	-0.03	0	0	0	0.52	0.55	-0.03	0.32	0.34	-0.02
1193.1	263.2	263.22	-0.02	0.98	1.04	-0.06	1.6	1.68	-0.08	0	0	0
1193.002	263.18	263.2	-0.02	0.06	0.07	-0.01	0.2	0.22	-0.02	0.07	0.07	0
1193.001	263.08	263.12	-0.04	0.78	0.73	0.05	1.6	1.48	0.12	0	0	0
1193	262.48	262.52	-0.04	0.12	0.14	-0.02	0.76	0.81	-0.05	0	0	0
1192.777	262.36	262.39	-0.03	0	0	0	0.94	0.99	-0.05	0	0	0
1192.631	262.07	262.11	-0.04	0	0	0	0.94	0.98	-0.04	0	0	0
1192.407	261.3	261.34	-0.04	0	0.14	-0.14	1.7	1.79	-0.09	0	0	0
1192.296	260.6	260.65	-0.05	0	0	0	1.96	2.03	-0.07	0	0	0
1192.146	257.43	257.49	-0.06	0	0	0	2.15	2.22	-0.07	0	0	0
1158.742	255.85	255.9	-0.05	0	0	0	1.51	1.54	-0.03	0	0	0
1117.042	255.09	255.16	-0.07	0	0	0	2.34	2.44	-0.1	0	0	0
1085.498	254.46	254.52	-0.06	0	0	0	2.23	2.31	-0.08	0	0	0
1056.979	253.48	253.5	-0.02	0	0	0	1.43	1.49	-0.06	0	0	0
1006.094	250.35	250.43	-0.08	0	0	0	2.51	2.6	-0.09	0	0	0
954.6843	248.23	248.31	-0.08	0	0	0	2.57	2.67	-0.1	0	0	0
927.8772	247.55	247.64	-0.09	0	0	0	2.74	2.83	-0.09	0	0	0
886.4161	246.94	247.05	-0.11	0	0	0	2.07	2.11	-0.04	0	0	0
830.2587	246.14	246.25	-0.11	0	0	0	2.78	2.84	-0.06	0	0	0
765.2102	245.23	245.3	-0.07	0	0	0	1.75	1.73	0.02	0	0	0
719.386	244.58	244.6	-0.02	0	0	0	1.69	1.82	-0.13	0	0	0
691.6686	244.17	244.21	-0.04	0	0	0	1.54	1.59	-0.05	0	0	0
639.0789	243.24	243.29	-0.05	0	0	0	1.89	1.95	-0.06	0	0	0
605.7167	242.58	242.62	-0.04	0	0	0	1.87	1.96	-0.09	0	0	0
552.2101	240.9	240.98	-0.08	0	0	0	1.98	1.9	0.08	0	0	0
508.8769	240.12	240.21	-0.09	0	0	0	2.45	2.48	-0.03	0	0	0
457.6058	239.16	239.2	-0.04	0	0	0	1.78	1.85	-0.07	0	0	0
393.3919	237.75	237.8	-0.05	0	0	0	2.16	2.26	-0.1	0	0	0
345.8717	237.22	237.27	-0.05	0	0	0	1.43	1.54	-0.11	0	0	0
308.4069	236.81	236.84	-0.03	0	0	0	1.76	1.84	-0.08	0	0	0
261.2717	236.03	236.11	-0.08	0	0	0	1.67	1.64	0.03	0	0	0
237.4458	235.48	235.55	-0.07	0	0	0	2.6	2.71	-0.11	0	0	0

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
197.6155	234.13	234.17	-0.04	0	0	0	1.39	1.48	-0.09	0	0	0
176.7205	233.84	233.87	-0.03	0	0	0	1.78	1.88	-0.1	0	0	0
163.5648	233.51	233.55	-0.04	0	0	0	1.85	1.92	-0.07	0	0	0
151.4771	232.33	232.42	-0.09	0	0	0	2.63	2.72	-0.09	0	0	0
140.92	231.85	231.9	-0.05	0	0	0	2.07	2.16	-0.09	0	0	0
123.28	230.94	231.01	-0.07	0	0	0	2.49	2.59	-0.1	0	0	0
89.70679	230.31	230.41	-0.1	0	0	0	2.65	2.72	-0.07	0	0	0
72.5771	229.73	229.79	-0.06	0	0	0	2.1	2.17	-0.07	0	0	0
51.16022	228.96	228.99	-0.03	0	0	0	1.57	1.63	-0.06	0	0	0
26.54893	228.21	228.25	-0.04	0	0	0	1.75	1.8	-0.05	0	0	0

1. A "–" indicates that the channel component does not contain runoff at this location.
2. An "NA" indicates that the open channel has been removed and converted to pipe flow under the proposed condition.

From cross sections 1195.992 to 1192.296, Tributary D will be converted to piped flow under the proposed condition. Therefore, the flood risk along this section does not exist. Similar to Tributary B, the maximum increase in WSE (0.14 m) occurs within a deep valley corridor. The results indicate that the water is contained within the main channel as there are no values for the left and right bank velocities. Even though there is a considerable increase in depth, the steep side slopes of the valley contain the water and prevent the floodplain area from increasing. The described increase will not pose any risk to public safety or neighbouring properties.

Table 34 provides a summary of the Regional results at Tributary C + Tributary D.

Table 34: Tributary C + Tributary D – Regional Existing Vs. Proposed WSE and Velocity Data

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
294	227.13	227.13	0	0	0	0	0.62	0.62	0	0	0	0
266.3048	225.08	225.08	0	0	0	0	1.25	1.25	0	0	0	0
236.2558	224.21	224.21	0	0	0	0	0.2	0.2	0	0	0	0
205.6305	224.21	224.21	0	0	0	0	0.11	0.11	0	0	0	0
173.8239	224.21	224.21	0	0	0	0	0.04	0.04	0	0	0	0
151.7834	224.21	224.21	0	0	0	0	0.02	0.02	0	0	0	0
116.6732	224.21	224.21	0	0	0	0	0.01	0.01	0	0	0	0
66.5837	224.21	224.21	0	0	0	0	0	0	0	0	0	0
34.76245	224.21	224.21	0	0	0	0	0	0	0	0	0	0

1. A "–" indicates that the channel component does not contain runoff at this location.

The increase to WSE and velocity at Tributary C + Tributary D is minimal and can be considered negligible (0.01 m to 0.02 m). There will be no increase in flood risk due to the proposed development.

Table 35 provides a summary of the Regional results at Tributary E.

Table 35: Tributary E – Regional Existing Vs. Proposed WSE and Velocity Data

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
4822.04	263.65	263.69	-0.04	0.09	0.2	-0.11	0.81	0.81	0	0.5	0.52	-0.02
4783.59	263.17	263.18	-0.01	0.32	0.37	-0.05	0.78	0.89	-0.11	0.46	0.52	-0.06
4731.68	262.11	262.15	-0.04	0.48	0.38	0.1	1.18	1.05	0.13	0.52	0.57	-0.05
4652.11	262.11	262.18	-0.07	0.03	0.03	0	0.09	0.09	0	0.03	0.03	0
4592.65	262.11	262.18	-0.07	0.03	0.03	0	0.08	0.09	-0.01	0.02	0.02	0
4515.64	262.08	262.15	-0.07	0	0.08	-0.08	0.67	0.67	0	0.31	0.33	-0.02
4460.59	262.07	262.13	-0.06	0.09	0.1	-0.01	0.16	0.17	-0.01	0.09	0.1	-0.01
4407.62	262.02	262.09	-0.07	0.2	0.22	-0.02	0.49	0.51	-0.02	0.22	0.23	-0.01
4354.33	261.84	261.91	-0.07	0.18	0.22	-0.04	0.63	0.67	-0.04	0.4	0.42	-0.02
4322.62	261.72	261.78	-0.06	0.22	0.25	-0.03	0.65	0.69	-0.04	0.29	0.3	-0.01
4293.51	261.53	261.59	-0.06	0.25	0.32	-0.07	0.91	0.97	-0.06	0.56	0.58	-0.02
4265.3	260.95	260.98	-0.03	0	0	0	1.52	1.62	-0.1	0.57	0.68	-0.11
4240.34	260.23	260.27	-0.04	0	0	0	0.62	0.65	-0.03	0.47	0.49	-0.02
4181.11	259.92	259.96	-0.04	0.21	0.24	-0.03	0.52	0.55	-0.03	0.38	0.4	-0.02
4121.04	259.2	259.22	-0.02	0.66	0.71	-0.05	1.37	1.44	-0.07	0.97	1.05	-0.08
4055.36	258.95	259.01	-0.06	0.06	0.06	0	0.1	0.11	-0.01	0.07	0.07	0
4004.48	258.95	259.01	-0.06	0.03	0.03	0	0.07	0.07	0	0.02	0.02	0
3947.08	258.95	259.01	-0.06	0.01	0.01	0	0.04	0.05	-0.01	0.01	0.01	0
3869.46	258.95	259.01	-0.06	0.06	0.06	0	0.1	0.11	-0.01	0.05	0.06	-0.01
3837.47	258.84	258.91	-0.07	0.68	0.69	-0.01	1.33	1.3	0.03	0.54	0.53	0.01
3758.91	258.66	258.73	-0.07	0.26	0.27	-0.01	0.37	0.39	-0.02	0.23	0.25	-0.02
3700.91	258.56	258.63	-0.07	0.37	0.41	-0.04	0.54	0.57	-0.03	0.38	0.42	-0.04
3650.13	258.39	258.45	-0.06	0.38	0.42	-0.04	0.66	0.7	-0.04	0.57	0.61	-0.04
3587.5	258.15	258.2	-0.05	0.45	0.49	-0.04	0.54	0.58	-0.04	0.48	0.51	-0.03
3530.86	257.85	257.9	-0.05	0.56	0.59	-0.03	0.74	0.79	-0.05	0.58	0.62	-0.04
3486.25	257.47	257.52	-0.05	0.39	0.39	0	0.69	0.74	-0.05	0.6	0.64	-0.04
3456.94	257.19											
3435.76	256.73	256.77	-0.04	0.69	0.74	-0.05	0.95	1.01	-0.06	0.93	0.98	-0.05
3426.56	256.48	256.52	-0.04	0.51	0.56	-0.05	0.75	0.82	-0.07	0.8	0.86	-0.06
3396.62	256.13	256.18	-0.05	0.8	0.85	-0.05	0.91	0.97	-0.06	0.78	0.84	-0.06
3377.5	255.86	255.92	-0.06	0.72	0.74	-0.02	0.7	0.73	-0.03	0.67	0.69	-0.02
3359.36	255.64	255.77	-0.13	0.77	0.67	0.1	0.84	0.76	0.08	0.77	0.69	0.08
3339.67	255.5	255.69	-0.19	0.58	0.51	0.07	0.68	0.6	0.08	0.62	0.54	0.08

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
3321.23	255.43	255.66	-0.23	0.49	0.44	0.05	0.66	0.57	0.09	0.47	0.41	0.06
3287.37	255.38	255.63	-0.25	0.3	0.28	0.02	0.46	0.44	0.02	0.41	0.39	0.02
3269.41	255.33	255.59	-0.26	0	0.14	-0.14	0.72	0.67	0.05	0	0.15	-0.15
3191.63	255.24	255.53	-0.29	0.15	0.18	-0.03	0.43	0.4	0.03	0.12	0.13	-0.01
3188.65	255.21	255.49	-0.28	0	0	0	0.75	0.79	-0.04	0	0	0

1. A "–" indicates that the channel component does not contain runoff at this location.

Tributary E experiences no impact to WSE and velocity throughout the channel. There is no flood risk at Tributary E due to the proposed development.

Table 36 provides a summary of the Regional results at Cold Creek West.

Table 36: Tributary Cold Creek West– Regional Existing Vs. Proposed WSE and Velocity Data

X Section	Water Surface Elev.			Left Bank Vel.			Main Channel Vel.			Right Bank Vel.		
	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ	Ex.	Pr.	Δ
1784.71	254.64	254.56	0.08	0	0	0	1.66	1.55	0.11	0	0	0
1752.69	253.6	253.55	0.05	0	0	0	1.42	1.26	0.16	0	0	0
1724.34	252.75	252.72	0.03	0	0	0	0.99	0.89	0.1	0	0	0
1663.99	250.42	250.34	0.08	0	0	0	1.84	1.72	0.12	0	0	0
1612.71	248.72	248.74	-0.02	0	0	0	0.87	0.9	-0.03	0	0	0
1586	247.25	247.26	-0.01	0	0	0	1.14	1.18	-0.04	0	0	0
1531	244.34	244.35	-0.01	0	0	0	1.3	1.34	-0.04	0	0	0
1458	239.52	239.53	-0.01	0	0	0	1.6	1.63	-0.03	0	0	0
1397	236.72	236.72	0	0	0	0	1.65	1.64	0.01	0	0	0
1339	234.88	234.87	0.01	0	0	0	1.02	1.02	0	0	0	0
1206	232.06	232.05	0.01	0	0	0	2.48	2.48	0	0	0	0
1205	230.83	230.83	0	0	0	0	0.4	0.39	0.01	0	0	0
1202.128 10.09.38	230.23	230.23	0	0.83	0.83	0	3.77	3.77	0	0.83	0.83	0
1202.052 10.09.37	230.2	230.2	0	0.59	0.59	0	2.51	2.51	0	0.65	0.65	0
1201.976 10.09.36	229.92	229.92	0	0.62	0.62	0	3.71	3.71	0	1	1	0
1201.9 10.09.35	229.5	229.5	0	0.91	0.91	0	4.03	4.03	0	0.79	0.79	0
1201.824 10.09.34	229.64	229.64	0	0.61	0.61	0	2.06	2.06	0	0.46	0.46	0
1201.748 10.09.33	228.93	228.93	0	1.17	1.17	0	4.61	4.61	0	0.94	0.94	0
1201.672 10.09.32	228.97	228.97	0	0.55	0.55	0	2.52	2.52	0	0.78	0.78	0
1201.596 10.09.31	228.81	228.81	0	0.77	0.77	0	2.57	2.57	0	0.82	0.82	0

1. A "–" indicates that the channel component does not contain runoff at this location.

There is generally a decrease in WSE and velocity at the beginning section of Cold Creek West. This occurs because the proposed grading sends water further downstream compared to the existing conditions. The decreases are not a concern in terms of flood risk. There is minimal increase at the mid-tributary that can be considered negligible (0.01 m to 0.02 m).

As per the TRCA's Technical Guidelines for Flood Hazard Mapping (March 2017), Regional floodplain mapping for the Hurricane Hazel event was generated for both the existing and proposed conditions. Drawings C711A to C711D depict the Regional floodplain mapping and associated 10 m development setback. As illustrated in the floodplain mapping, the property boundary and extent of development is outside of the Regulatory floodplain. A comparison of the existing and proposed conditions floodplain mapping demonstrates that there is minimal increase to floodplain area due to development.

9.0 Secondary Plan Natural Heritage Study Report

Dillon Consulting Ltd. has prepared a Secondary Plan Natural Heritage Study Report (herein referred to as the Report), dated December 2024, under separate cover. The purpose of this Report is to document the existing conditions of the natural environment within 120 m of the Site. The Report also addresses the potential limits of development, evaluates potential environmental impacts associated with development, and recommends mitigation, restoration, and enhancement measures to preserve and/or restore natural features.

The Report includes discussion on the following with respect to existing conditions:

- Designated Natural Heritage Features
- Landforms, Soils and Geology
- Aquatic Environment
- Terrestrial Environment
- Significant Wildlife Habitat
- Species at Risk

Additional studies will be required for future development proposal and particularly on lands where access was not granted for preparation of the Secondary Plan Natural Heritage Study Report.

10.0 Regional Official Plan Amendment 30 Lands

Regional Official Plan Amendment 30 "ROPA 30" identified lands at the south end of the Bolton North Hill Option 1 lands as the ROPA 30 lands, which were included within the Bolton Settlement Area. Following approval with modifications by the Minister of Municipal Affairs and housing for the Reel Region Official Plan 2022, as well as the approval of the Future Caledon Official Plan (2025), and the Town's approved Growth Management and Phasing Plan ("GMPP"), a comprehensive servicing strategy has been developed for the Bolton North Hill Lands. The servicing plan would allow any development parcel to proceed with adequate municipal servicing. Interim water servicing is being provided through the Macville Booster Pumping Station up to 2,960 people, with the ultimate water servicing strategy reliant on a new elevated tank. Sanitary servicing is being provided through new gravity trunk sewers on Highway 50 and Emil Kolb Parkway, with ultimate discharge to Humber Station Road via sewage pump station, forcemain, and gravity sewer on King St.

11.0 Conclusions & Recommendations

The proposed development of the Site can be serviced for water, sanitary and stormwater in accordance with the Town of Caledon and Region of Peel requirements and standards. A summary of our conclusions and recommendations includes:

1. Water servicing is in line with the R.J. Burnside Technical Memorandum dated May 13, 2021, which includes the creation of a new Pressure Zone 7 to service the north end of Bolton. An elevated water tank will be included within Option 1 and a 400 mm diameter feedermain is required along Emil Kolb Parkway and Regional Road 50 to service the Subject Lands. A water booster station (designed by R.J. Burnside) will be utilized for water supply prior to the construction of the elevated water tank.

2. The Region and other consulting teams are completing the design of the sanitary servicing strategy for the Subject Lands. Through consultation with these teams, we understand that sanitary servicing is designed to convey all sanitary flows from the Option 1 and Option 2 Lands west to Humber Station Road. From the Option 2 Lands to the intersection of Regional Road 50 and Emil Kolb Parkway, flows will be conveyed via a forcemain or gravity sewer depending on the outcome of the Region's Water and Wastewater Municipal Class Environmental Assessment. From Regional Road 50, flows will then discharge via a gravity sewer to a proposed sewage pumping station on Emil Kolb Parkway. Flows will then be pumped south on Emil Kolb Parkway to a gravity sewer on King Street, which will outlet to the trunk sewer on Humber Station Road.

3. Grading of the Site is constrained by existing elevations (matching drainage divides and elevations at the boundary), the normal water level in the stormwater management (SWM) facilities, and minimum cover on the gravity sanitary system. Stormwater flows in excess of the 10-year event are conveyed to the SWM facilities via overland flow path. Existing elevations on the arterial roadways (Regional Road 50, Emil Kolb, and Duffy's) will be maintained and matched at the entrances to the Site.

4. Several drainage divides exist throughout the Site, which direct flows to tributaries of the West Humber River. The drainage divide between sub-basin 10 of the West Humber River (which requires quantity controls) and areas of the West Humber River Watershed (which do not require quantity control) will be generally maintained by the proposed grading and servicing concept.

5. The floodplain analysis includes mapping of the existing floodplain and an evaluation of the post-development floodplain. The proposed development plan will require tributaries within the development area to be realigned in order to safely convey external drainage though or around the proposed development. Based on the findings of the Dillon headwater drainage feature assessment this realignment may need to include replication of the floodplain storage provided onsite and natural channel design.

6. Stormwater management facilities (wet ponds) will be implemented within each of the drainage divides to maintain outlets to the existing watersheds. A total of eight (8) ponds will be located within an area of the Main Humber watershed, which does not require typically quantity control; some of these ponds require quantity control to mitigate increases in peak flows to downstream features, as well as quality and erosion control. The remaining three (3) SWM ponds are located within sub-basin 10 of the Humber River and designed to provide quantity control as well as quality and erosion control. Outlets from the ponds will be set at or above the 25-year water level of the receiving watercourse.

7. A water balance assessment will be included in a future hydrogeological report, which will be prepared by C.F. Crozier & Associates Inc. under separate cover. Low impact development (LID) features were investigated to assist with water balance and environmentally friendly stormwater management solutions. Potential LID methods to be utilized on Site include green roofs, roof downspout disconnection, infiltration galleries, rainwater harvesting, bioretention, vegetated filter strips, permeable pavement, and enhanced grass swales.

8. A Secondary Plan Natural Heritage Study Report (the Report) was prepared by Dillon Consulting Ltd. and provided under separate cover. The Report provides a detailed background review and description of the existing terrestrial and aquatic conditions within 120 m of the Site where access was permitted.

Based on the above conclusions, we support the proposed development application of the Site from the perspective of water supply, sanitary servicing, and stormwater management.

C.F. CROZIER & ASSOCIATES INC.

Travis Gibson, P.Eng., PMP
Manager, Land Development

C.F. CROZIER & ASSOCIATES INC.

Rebecca Archer, P.Eng.
Project Engineer, Land Development

JL:RA/tc

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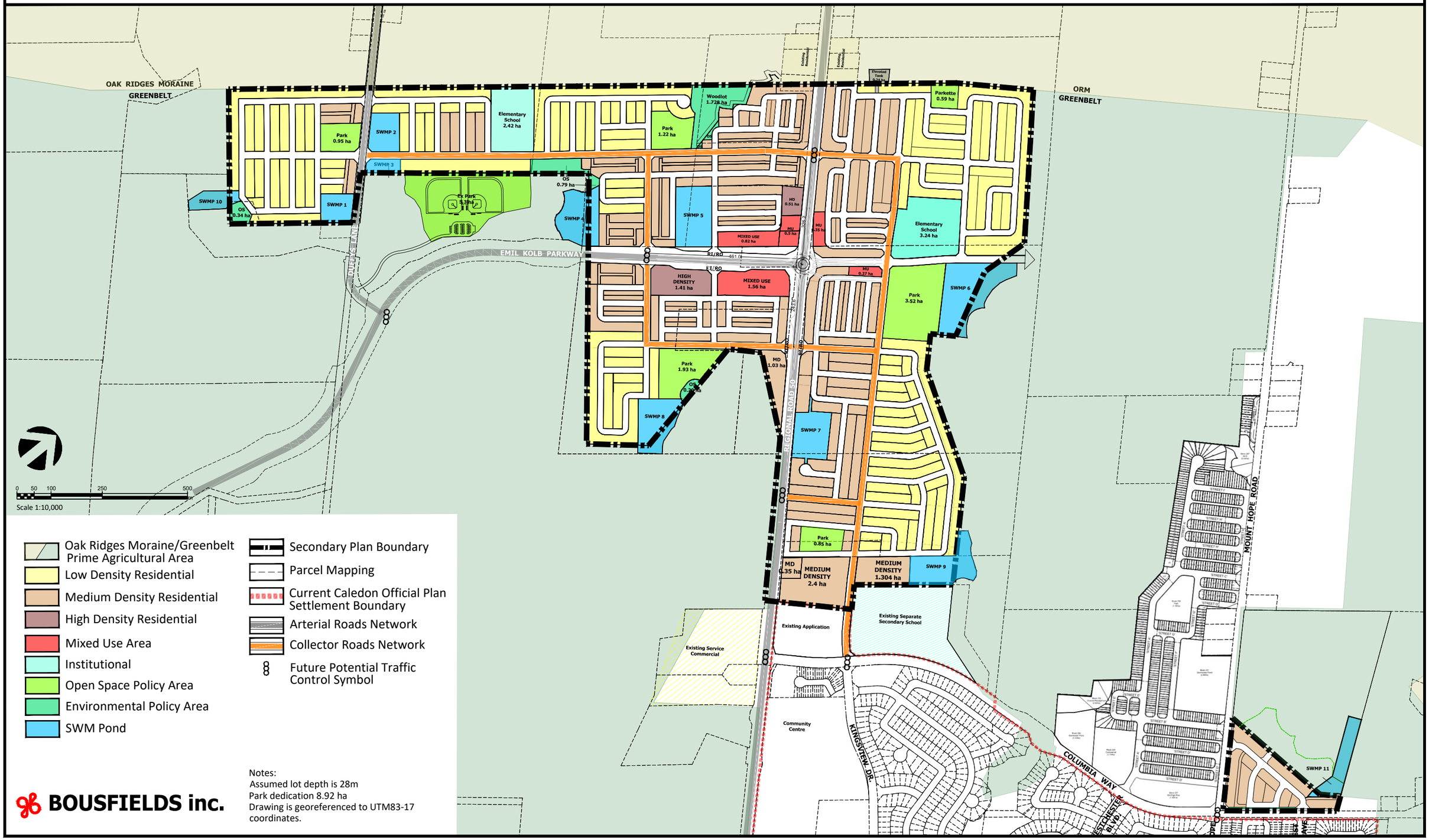
APPENDIX A

Background Documentation

Bolton North Hill Tertiary Plan

Owner's Plans Consolidation



- Oak Ridges Moraine/Greenbelt
- Prime Agricultural Area
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Mixed Use Area
- Institutional
- Open Space Policy Area
- Environmental Policy Area
- SWM Pond
- Secondary Plan Boundary
- Parcel Mapping
- Current Caledon Official Plan Settlement Boundary
- Arterial Roads Network
- Collector Roads Network
- Future Potential Traffic Control Symbol

BOUSFIELDS inc.

Notes:
Assumed lot depth is 28m
Park dedication 8.92 ha
Drawing is georeferenced to UTM83-17 coordinates.

R.J. Burnside & Associates Limited 3 Ronell Crescent Collingwood ON L9Y 4J6 CANADA
telephone (705) 446-0515 **fax** (226) 526-9660 **web** www.rjburnside.com

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Technical Memorandum – Zone 7 Demands

Date: July 14, 2025 **Project No.:** 300034976.0001

Project Name: Bolton Option 1, 2 & 3 Lands

Client Name: Option 1/2 Landowners Group and Bolton Option 3 Landowners Group

Submitted To: Ms. Miriam Polga, P.Eng., Region of Peel

Submitted By: Rhys Cavill, CET

Reviewed By: Jeff Langlois, P.Eng., MBA

1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) has been retained by the Option 1/2 Landowners and Bolton Option 3 Landowners Group to complete a preliminary hydraulic water modelling analysis of future development areas within a new pressure Zone 7 in the community of Bolton. The water distribution system in Bolton is part of the Region of Peel (Region) water distribution system.

The Town previously completed the Bolton Residential Expansion Study (BRES) to determine the best approach to meet their urban boundary expansion needs. The BRES examined six different options for expansion of the Bolton settlement area and examined how each area could be serviced.

As had been determined in the previous BRES work, the Option 1, 2, 3, and Rounding Out Area (ROA) lands are generally outside of the range of elevations associated with Pressure Zone 6 of the existing water distribution infrastructure in Bolton. The northern section of Option 4 Lands will also generally be outside of the range of elevations associated with Pressure Zone 6. As such, development of Option 1, 2, 3, 4 and ROA lands will ultimately require the development of a new Pressure Zone 7 within Bolton. The land areas to be serviced by the future Zone 7 are shown in Figure 1 attached.

Previous studies completed in support of BRES identified a new Zone 7 booster pumping station. Ultimately, floating storage is proposed in the form of an elevated tank (ET) to provide storage for flow equalization, fire demands, and emergencies. Two ETs have been ultimately proposed. The first is to be situated in the vicinity of the northwest corner of the Option 3 lands

and the second to be situated generally to the north of the Option 1 lands. The general locations of the Zone 7 ETs are shown in Figure 1.

The purpose of this technical memorandum is to outline the assumptions made to determine the demands for each of the areas to be serviced by the new Zone 7 Booster Pumping Station (BPS). A version of this memo dated September 19, 2023 was previously circulated to the Region, and the memo has been updated to reflect feedback provided by the Region in an email dated November 21, 2023. In support of the design of the Booster Pumping station, a revised version of the memo was circulated to the Region January 2, 2024. The memo has been further updated to reflect direction from the Region with regard to fire flows (increase to 250 L/s) and detailing the demand implications associated with Zone 6 Lands that may transition to Zone 7.

2.0 Demand Calculations

The demand calculations for each of the land areas examined have been enclosed.

2.1 Peaking Factor

Peaking factors have been referenced from the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010, as requested by the Region in their November 21, 2023 email. The peaking factors used in the modelling are as follows:

- Residential Maximum Day Factor (MDF): 2
- Non-Residential Maximum Day Factor (MDF): 1.4
- Peak Hour Factor (PHF): 3

2.2 Water Demand

Water Demands for the model have been calculated based on the following per capita demands:

- Residential: 280 L/cap/d
- Employment: 300 L/cap/d

These per capita demands above are referenced from the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010 as requested by the Region in their November 21, 2023 email. Previously, this estimate was based on the Region of Peel 2020 Water and Wastewater Master Plan for Lake-Based Systems.

Preliminary Block Plans for the Option 1 2031 Lands and the Option 3 Lands were prepared by Gerrard Designs and provided for modelling purposes.

To calculate the population for Option 1 2031 and Option 3 using the block plans provided, the following densities were assumed:

- Townhouse: 3.4 ppu
- Single Detached: 4.2 ppu
- Apartment: 3.1 ppu
- Employment: 50 pp/ha

The densities were referenced from the Region of Peel Linear Wastewater Standards, 2023.

Block plans were not available for the Option 2 Lands, Option 4 Lands, 2051 Rounding Out Areas and Whitebelt Lands. If block plans are available in the future, the demands can be updated to reflect the proposed unit densities.

The following population densities were assumed in the absence of a block plan:

- Residential Lands: 141 pp/ha
- Employment: 50 jobs/ha

The Residential Lands density has been referenced from the GSAI report for the Caledon Station Secondary Plan, dated May 10, 2023. This is a more conservative number compared to the 67.5 pp/ha previously used referenced from the Region of Peel's Official Plan. The density is more reflective of the block plans that have been submitted for Zone 7 thus far.

The Employment density has been referenced from the Region of Peel Linear Wastewater Standards, 2023.

It is anticipated that as development design progresses the demand will be further refined. Refer to Appendix A for the demand calculations.

2.2.1 Option 1 Lands

The calculated population yield for the 2031 Option 1 Lands and the 2051 Option 1 Lands is based on the Functional Servicing and Stormwater Management Report Bolton Option 1 & Option 2 Lands, dated December 2021, prepared by Crozier.

The total estimated population yield for the Option 1 Lands are as follows:

- Residential: 14,749 persons
- Employment: 960 jobs (including schools)

The calculated 2051 Option 1 lands demands are:

- Average Day Demand (ADD): 51.1 L/s
- Maximum Day Demand (MDD): 100.3 L/s
- Peak Hour Demand (PHD): 153.4 L/s

32.03 ha of land has been allocated for development in 2031 and an additional 146.6 ha of land has been allocated for development in 2051. The total Option 1 Land area is approximately 178.6 ha.

2.2.2 Option 2 Lands

The Option 2 Lands are entirely within the 2051 buildout scenario.

A land area for the Option 2 Lands of 95 ha has been provided by the Region of Peel as part of the ROPA 30 Lands. The Functional Servicing and Stormwater Management Report Bolton Option 1 & Option 2 Lands, dated December 2021, prepared by Crozier provided a block plan for 4.3 ha of the Option 2 Land Area. The unit count from the Crozier report was taken and the balance of the land area from the Population Allocation Plan was used.

The total estimated population yield for the Option 2 Lands are as follows:

- Residential: 13,221 persons

The calculated 2051 Option 2 Lands demands are:

- Average Day Demand (ADD): 42.8 L/s
- Maximum Day Demand (MDD): 85.7 L/s
- Peak Hour Demand (PHD): 128.5 L/s

2.2.3 Option 3 Lands

The calculated population yield for the Option 3 Lands is based on the proposed Block Plan dated May 1, 2023, prepared by Gerrard Design. This block plan includes the 2051 full build out of the Option 3 Lands. The population yields assume employment at the school commercial areas at the ground level of the mixed-use blocks, and commercial at the GO Station blocks. The estimated population yields are as follows:

- Residential: 28,736 persons
- Employment: 1,927 jobs (including schools)

The calculated 2051 Option 3 Lands demands are:

- Average Day Demand (ADD): 99.8 L/s
- Maximum Day Demand (MDD): 195.6 L/s
- Peak Hour Demand (PHD): 299.4 L/s

The total Option 3 Land area is 182.4 ha.

2.2.4 Option 4 Lands

The area of Option 4 Lands that would be brought into Zone 7 was estimated based on the existing Zone 6 pressure elevation boundary of 259.1 m. Using the existing topography within Option 4, an approximate total land area of 28 ha has been established.

The total estimated population yield for the Option 4 Lands are as follows:

- Residential: 3,948 persons

The calculated 2051 Option 4 Demands are:

- Average Day Demand (ADD): 12.8 L/s
- Maximum Day Demand (MDD): 25.6 L/s
- Peak Hour Demand (PHD): 38.4 L/s

2.2.5 Rounding Out Areas

The Zone 7 Rounding Out Area B is within the 2031 buildout scenario. The Zone 7 Rounding Out Areas A+C are within the 2051 buildout scenario.

The total estimated population yield for the Rounding Out Area B Lands (ROA B) are as follows:

- Residential: 1,199 persons

The total calculated Rounding Out Area B (2031) demands are:

- Average Day Demand (ADD): 3.9 L/s
- Maximum Day Demand (MDD): 7.8 L/s
- Peak Hour Demand (PHD): 11.7 L/s

The total estimated population yield for the Rounding Out Areas A and C Lands (ROA A & C) are as follows:

- Residential: 2,919 persons

The total calculated Rounding Out Area A & C demands are:

- Average Day Demand (ADD): 9.5 L/s
- Maximum Day Demand (MDD): 18.9 L/s
- Peak Hour Demand (PHD): 28.4 L/s

The total ROA 2051 Demands (ROA A, B & C) are:

- Average Day Demand (ADD): 13.3 L/s
- Maximum Day Demand (MDD): 26.7 L/s
- Peak Hour Demand (PHD): 40.0 L/s

2.2.6 Existing Lands

There are existing areas within Bolton Pressure Zone 6 that have ground elevations within the Pressure Zone 7 service range. As such, the development of Bolton Pressure Zone 7 will allow for these existing lands to move into the new Pressure Zone, thereby providing pressure improvements for existing residents.

The existing land area that would be brought into Pressure Zone 7 was estimated by the Region of Peel. The Region then determined a total demand for the area based on historical billing records. These values were used in a previous version of this memo; however, this version incorporates the latest projections for these lands as included in the Region's model as provided to Hydratek.

The two existing areas that are assumed to be brought online to Zone 7 are generally west of Coleraine Drive. Largely on the south side of King Street and east of Highway 50, south of Columbia Way. These are areas where the Region has reported complaints by residents of inadequate pressure from time to time. While the Region has made improvements to the system to work toward addressing these concerns, the pressure remains at the lower end of the Region's preferred operating range, primarily due to elevation.

The 2031 demands provided by the Region of Peel are:

- Average Day Demand (ADD): 24.4 L/s
- Maximum Day Demand (MDD): 38.4 L/s
- Peak Hour Demand (PHD): 50.8 L/s

The 2051 demands provided by the Region of Peel are:

- Average Day Demand (ADD): 27.1 L/s
- Maximum Day Demand (MDD): 42.4 L/s
- Peak Hour Demand (PHD): 56.3 L/s

2.2.7 Whitebelt Lands

The Whitebelt Lands represent lands having future development potential beyond the 2051 planning horizon. Using ground elevation 259.1 m as an approximation of the Pressure Zone Boundary, it is estimated that approximately 290 ha of the Whitebelt Lands will be in Pressure Zone 7.

The total estimated population yield for the Whitebelt lands are as follows:

- Residential: 40,890

The calculated Whitebelt Lands Demands are:

- Average Day Demand (ADD): 132.5 L/s
- Maximum Day Demand (MDD): 265.0 L/s
- Peak Hour Demand (PHD): 397.5 L/s

2.2.8 Total Demands

The total estimated demands considered for this exercise are summarized in Table 1 below:

Table 1: Demand Summary

Land Area	Area (ha)	Pop.	Demand (L/s)			
			ADD	MDD	PHD[1]	PHD[2]
Option 1 ROPA 30 2031	32.1	2,963	9.6	19.2	28.8	30.7
Option 3 MZO 2031	77.47	19,133	62.2	122.3	186.7	196
ROA 2031 (ROA B)	8.5	1,199	3.9	7.8	11.7	12.5
2031 Demand w/o Existing Zone 6			**75.7**	**149.3**	**227.2**	**239.2**
2031 Ex. Zone 6 Lands ***	N/A	N/A	24.4	38.4	50.8[2]	50.8
Interim - Total 2031*	**118.07**	**23,294**	**100.1**	**187.7**	**278.0**	**290.0**
Interim - Total 2031* (ML/d)			**8.6**	**16.2**	**24.0**	**25.0**
Option 1 Full Buildout 2051	178.6	15,709	51.1	100.3	153.4	160
Option 2 Full Buildout 2051	95	13,221	42.8	85.7	128.5	137
Option 3 Full Buildout 2051	182.4	30,662	99.8	195.6	299.4	313
Option 4 Zone 7 Lands 2051	28	3,948	12.8	25.6	38.4	41
ROA 2051 (ROA A, B, C)	29.2	4,117	13.3	26.7	40.0	42.7
Whitebelt - post 2051	290	40,890	132.5	265.0	397.5	424
Ultimate w/o 2051 Zone 6			**352**	**699**	**1057**	**1118**
2051 Ex. Zone 6 Lands ***	N/A	N/A	27.1	42.4	56.3[2]	56.3
Ultimate – Total 2051**	**803.2**	**108,547**	**379**	**741**	**1113**	**1174**
Ultimate - Total Demands (ML/Day)**			**32.7**	**64.1**	**96.2**	**101.4**

*Total 2031= Option 1 ROPA 30, Option 3 MZO, ROA 2031 and Existing Zone 6 Lands (Land Area and Service Population associated with Existing Zone 6 Lands to be incorporated not provided by the Region).

**Total 2051 = Option 1, 2, 3, 4 2051 Lands + ROA 2051 + Ex Zone 6 + Whitebelt.

Option 1 ROPA 30, Option 3 MZO and ROA 2031 included in Option 1 2051, Option 3 2051 Total and ROA 2051 Total.

*** Land Area and Service Population associated with Existing Zone 6 Lands to be incorporated not provided by the Region and hence not included in shown totals for area and populations.

1. Based on PHD as calculated in Appendices
2. Based on diurnal demand pattern hourly peaking factor of 1.6 from Region's InfoWater Model.

2.3 Fire Flow

A minimum requirement of 220 L/s for three hours while maintaining a minimum system operating pressure of 20 psi, was established in the Bolton Residential Expansion Study Infrastructure Report, prepared by GM BluePlan Engineering dated June 16, 2014 and was used on earlier version of this report. The minimum flow requirement was increased to 250 L/s as requested by the Region.

3.0 Booster Pumping Station Capacity

The following table outlines the interim and ultimate Zone 7 Booster Pumping Station demands based on the calculations above. It is assumed that the Booster Pumping Station will initially service Option 1 2031, Option 3 MZO, ROA B 2031 and the noted existing Zone 6 lands. The MDD demand included for the Zone 6 Lands under this scenario is 38.4 L/s. In addition to supplying ADD, MDD, and PHD to the Zone 7 lands, the interim BPS will supply fire flow under for the interim demands.

The ultimate buildout conditions will include Options 1, 2, 3, 4 2051, ROA 2051, noted existing Zone 6, and the Whitebelt Lands. Under the ultimate buildout conditions, it is assumed that both ETs will be online. The BPS will not be required to supply fire flow to Zone 7 as it will be supplied by the ETs.

Table 2 below outlines the demands associated with the interim and ultimate Zone 7 BPS configuration.

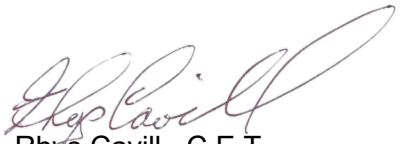
Table 2: BPS Capacity

	Serviced Areas	MDD (L/s)	MDD + Fire Flow (L/s)	PHD (L/s)
Interim	Option 1 2031, Option 3 MZO Lands, Existing Zone 6, ROA 2031	188	438	290
Ultimate	Option 1, 2, 3, 4, ROA, Existing Zone 6, Whitebelt	741	Fire flow provided by Zone 7 ET's.	Equalization provided by Zone 7 ET's.

The station is currently proposed to be constructed with the required pumps to address the demands associated with the ultimate demand of 741 L/s. Zone 7 elevated storage is required to address the ultimate or 2051 demands.

For a discussion of closed system spare firm capacity with or without the Zone PZ6/PZ7 zone realignment refer to section 7.1, Item 4, of Hydratek's, Technical Memo No. 1, System Curve and Hydraulic Analysis Macville BPS and Bolton Watermains, Region of Peel ,version 3, dated June 25, 2025. Provided under separate cover.

R.J. Burnside & Associates Limited



Jeff Langlois, P.Eng., MBA.
Project Manager
JL:tf

Rhys Cavill, C.E.T.
Senior Designer

Enclosure(s) Figure 1 – Water Infrastructure and Land Area Locations
Demand Calculations

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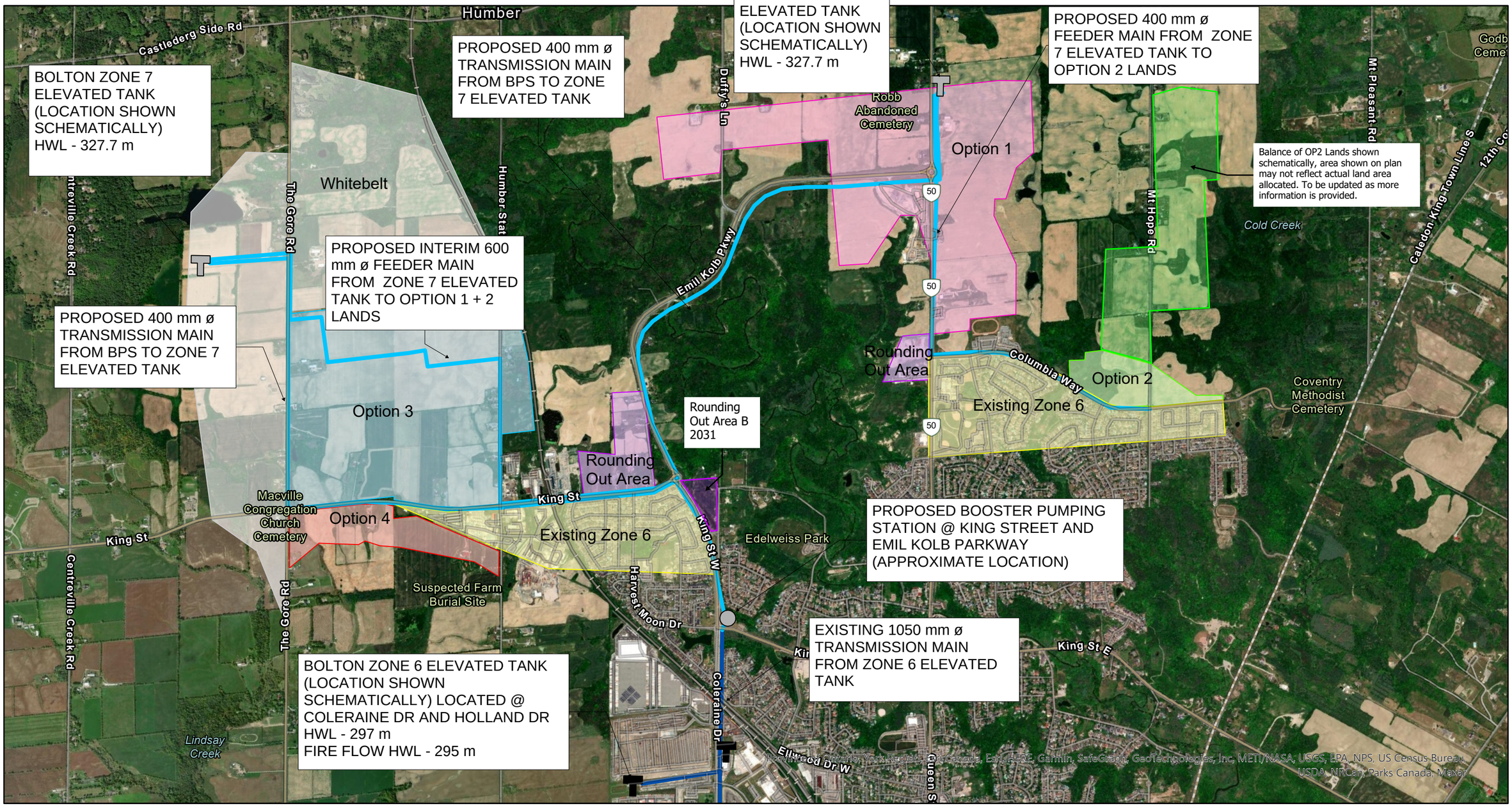

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Client

BOLTON OPTION 3 LANDOWNERS GROUP

Figure Title

BOLTON ZONE 7

WATER INFRASTRUCTURE

Drawn	Checked	Date	Figure No.
RW	JLL	2023/09/19	1
Scale: H 1:6,000		Project No.: 300034975	

File Path: C:\Users\RWalton\Documents\230510 Bolton OP3 Infowater Update\230510 Bolton OP3 Infowater Update.aprx Print Date: 2023/09/19 Time: 12:54 PM

Bolton Zone 7 Demand Summary

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

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Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (Commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023

** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023

assumptions used in absences of a development plan

Demands per Land Area

	Area (ha)	Population	Demand L/s			
			ADD	MDD	PHD	
Option 1 ROPA 30 2031	32.1	2963	9.6	19.2	28.8	
Option 1 Full Buildout 2051	178.6	15709	51.1	100.3	153.4	
Option 2 Full Buildout 2051	95	13221	42.8	85.7	128.5	
Option 3 MZO 2031	77.47	19133	62.2	122.3	186.7	
Option 3 Full Buildout 2051	182.4	30662	99.8	195.6	299.4	
Option 4 Zone 7 Lands 2051	28	3948	12.8	25.6	38.4	
ROA 2031	8.5	1199	3.9	7.8	11.7	
ROA 2051	29.2	4117	13.3	26.7	40.0	
Existing Zone 6 Lands	0	0	16.0	32.0	48.0	*demands based on Historical Billing Records from Region
Whitebelt - post 2051	290	40890	132.5	265.0	397.5	
Interim - Total 2031*	**118.07**	**23294**	**91.7**	**181.3**	**275.2**	
Ultimate - Total 2051**	**803.2**	**108547**	**368.4**	**730.9**	**1105.3**	
Ultimate 2051 MDD (ML/Day)			**31.8**	**63.1**	**95.5**	

*Total 2031 = Option 1 ROPA 30, Option 3 MZO, ROA 2031 and Existing Zone 6 Lands

**Total 2051 = Option 1, 2, 3,4 2051 Lands + ROA 2051+Ex. Zone 6 + Whitebelt

Option 1 ROPA 30,Option 3 MZO and ROA 2031 included in Option 1 2051, Option 3 2051 and ROA 2051 total

Bolton Option 1 2031 Zone 7 Demand Calculations

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

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Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023
** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023
assumptions used in absences of a development plan

Demand Allocation

2031 Buildout

				L/ha/s			L/s		
Unit Type	Total Area (ha)*	# of units*	Population	ADD	MDD	PHD	ADD	MDD	PHD
Single Detached		288	1210				3.9	7.8	11.8
Townhomes		473	1608				5.2	10.4	15.6
Apartments		37	115				0.4	0.7	1.1
Commercial	0.6		30				0.10	0.1	0.3
Total	**32.1**	**798**	**2963**	0.3	0.4	0.9	**9.6**	**19.2**	**28.8**

*From Functional Servicing and Stormwater Management Report Bolton Option 1 & Option 2 Lands, dated Dec 2021, prepared by Crozier
Appendix B3- Draiange Area Population Breakdown (OP1 ROPA 30 Lands correlate with Sanitary Drainage Area 1)

Bolton Option 1 2051 Zone 7 Demand Calculations

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

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Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023
** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023
assumptions used in absences of a development plan

Demand Allocation

Buildout Year	Unit Type	Area (ha)	# of units*	Population	L/ha/s			L/s		
					ADD	MDD	PHD	ADD	MDD	PHD
2051	Single Detached	46.04	1554	6527				**21.2**	**42.3**	**63.5**
	Townhomes	33.04	2038	6929				**22.5**	**44.9**	**67.4**
	Apartment Units	4.37	417	1293				**4.2**	**8.4**	**12.6**
	Commercial	1.4		70				**0.2**	**0.3**	**0.7**
	School (2 based on Block Plan)	4.9		890				**3.1**	**4.3**	**9.3**
Total	****	**178.6**	**4009**	**15709**	**0.3**	**0.6**	**0.9**	**51.1**	**100.3**	**153.4**

*From Functional Servicing and Stormwater Management Report Bolton Option 1 & Option 2 Lands, dated Dec 2021, prepared by Crozier for Option 1 lands - Appendix B2
**total 178.6 ha area includes non serviceable area such as: park, SWMP, Open space, Roads, Elevated Tank etc, not listed

Bolton Option 2 2051 Zone 7 Demand Calculations

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

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Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023
** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023
assumptions used in absences of a development plan

Demand Allocation

				L/ha/s			L/s		
Unit Type	Total Area (ha)	# of units*	Population	ADD	MDD	PHD	ADD	MDD	PHD
Townhomes	4.3	127	432						
Remaining Lands**	90.7	TBD	12789						
2051	**95**		**13221**	**0.5**	**0.9**	**1.4**	**42.8**	**85.7**	**128.5**

*From Functional Servicing and Stormwater Management Report Bolton Option 1 & Option 2 Lands, dated Dec 2021, prepared by Crozier for Option 1 lands
**Total Land Area of 95 ha provided by the Region of Peel referenced from their ROPA 30 Lands

Bolton Option 3 2031 MZO Approved Zone 7 Demand Calculations

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

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Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023

** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023

assumptions used in absences of a development plan

Demand Allocation

				L/ha/s			L/s		
Buildout Year	Total Area (ha)	# of units*	Population	ADD	MDD	PHD	ADD	MDD	PHD
Single Detached		146	613				2.0	4.0	6.0
Townhome		1445	4913				15.9	31.8	47.8
Apartment		4058	12580				40.8	81.5	122.3
Commercial	11.63		582				2.0	2.8	6.1
School	0.92		445				1.5	2.2	4.6
2031	**77.47**	**5649**	**19133**	**0.8**	**1.6**	**2.4**	**62.2**	**122.3**	**186.7**

*From Macville Block Concept Plan - MTSA, prepared by Gerrad Design, dated May 1, 2023

Bolton Option 3 2051 Full Buildout Zone 7 Demand Calculations

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

BURNSIDE

Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students+40 Staff. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023

** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023

assumptions used in absences of a development plan

Demand Allocation

2051 Buildout

				L/ha/s			L/s		
Unit Type	Total Area (ha)	# of units*	Population	ADD	MDD	PHD	ADD	MDD	PHD
Townhomes		2916	9914				32.1	64.3	96.4
Single Detached	23.87	807	3389				11.0	22.0	33.0
Apartments		4978	15432				50.0	100.0	150.0
Commercial	11.83		592				2.1	2.9	6.2
School (3 Schools on Block Plan)	7.54		1335				4.6	6.5	13.9
Total	**182.4**	**8701**	**30662**	**0.5**	**1.1**	**1.6**	**99.8**	**195.6**	**299.4**

*From Macville Block Plan Concept, prepared by Gerrard Design, dated May 1, 2023

Bolton Option 4 2051 Zone 7 Demand Calculations

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

BURNSIDE

Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023

** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023

assumptions used in absences of a development plan

Demand Allocation

Unit Type	Total Area (ha)*	# of units	Population	L/ha/s			L/s		
				ADD	MDD	PHD	ADD	MDD	PHD
2051	**28**	**TBD**	**3948**	**0.5**	**0.9**	**1.4**	**12.8**	**25.6**	**38.4**

*area estimated based on land area within Option 4 exceeding 259 m, based on existing ground elevation

Bolton ROA 2051 Zone 7 Demand Calculations

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

BURNSIDE

Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023

** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023

assumptions used in absences of a development plan

Demand Allocation

				L/ha/s			L/s		
Unit Type	Total Area (ha)*	# of units	Population	ADD	MDD	PHD	ADD	MDD	PHD
ROA B 2031	**8.5**	**TBD**	**1199**				**3.9**	**7.8**	**11.7**
ROA A+C 2051	**20.7**	**TBD**	**2919**				**9.5**	**18.9**	**28.4**
TOTAL 2051	**29.2**		**4117**				**13.3**	**26.7**	**40.0**

*areas from Population Allocation Plan 2031-2051 BRES, prepared by NAK dated February 2021

Bolton Existing Lands Zone 7 Demand Calculations

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

BURNSIDE

Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023

** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023

assumptions used in absences of a development plan

Demand Allocation

Unit Type	Total Area (ha)	# of units	Population	L/ha/s			L/s*		
				ADD	MDD	PHD	ADD	MDD	PHD
Total							**16.0**	**32.0**	**48.0**

*ADD and PHD provided by the Region of Peel based on preliminary delineation of pressure zone booundaries and historical billing records for the existing areas

Bolton Whitebelt Post 2051 Zone 7 Demand Calculations

Prepared by:	RW
Checked by:	JLL
Project No:	300034976
Date:	1/2/2024

BURNSIDE

Assumptions

Water Demands

Residential	Residential Per Capita Flow	280	L/person/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	2		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		
Employment	Employment Per Capita Flow	300	L/employee/day	From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Max Day Factor	1.4		From the Region of Peel Linear Infrastructure Watermain Design Criteria, 2010
	Peak Hour Factor	3		

Fire Flow

220 L/s	From Bolton Residential Expansion Study Infrastructure Report, June 16, 2014

Density

Unit Type	People Per Unit (ppu)*	People Per Hectare (pp/ha)**	
Townhomes	3.4	141	
Single Detached	4.2	141	
Large Apartment	3.1	141	
Employment (commercial)		50	Region of Peel Linear Wastewater Standards, 2023
School (pp/school)		445	Region of Peel Linear Wastewater Standards, 2023. Schools designed for 850 students. Assume Sr Public Schools

*Region of Peel Linear Wastewater Standards, 2023

** from GSAI Report for Caledon Station Secondary Plan, dated May 10, 2023

assumptions used in absences of a development plan

Demand Allocation

				L/ha/s			L/s		
Unit Type	Total Area (ha)	# of units	Population	ADD	MDD	PHD	ADD	MDD	PHD
Whitebelt	**290**	**TBD**	**40890**	**0.5**	**0.9**	**1.4**	**132.5**	**265.0**	**397.5**

HYDRAULICS TECHNICAL MEMORANDUM NO. 1 (HTM1)

Date: 25 June 2025

Revision: Version 3 (Final)

To: Jeff Langlois and Rhys Cavill (R. J. Burnside)

From: Johnathan D. Nault and Djordje Radulj (HydraTek & Associates)

Subject: System Curve and Hydraulic Analysis
Macville BPS and Bolton Watermains, Region of Peel

HydraTek File No.: 22103

1. INTRODUCTION

HydraTek & Associates (HydraTek), A Division of FP&P HydraTek Inc., has been retained by R. J. Burnside & Associates Ltd. (Burnside) on behalf of Caledon Community Partners Inc. (CCP) to undertake water system hydraulic and hydraulic transient analyses of proposed upgrades to the Regional Municipality of Peel's (Region's) existing Bolton Pressure Zone 6 (PZ6) and future Bolton Pressure Zone 7 (PZ7) water system. The proposed upgrades comprise: (i) Macville (PZ6-to-PZ7) Booster Pumping Station (BPS), (ii) the 1050 mm Emil Kolb PZ6 watermain, 900/600 mm Emil Kolb PZ7 watermain, and 600 mm King Street PZ7 watermain, and (iii) realignment of some existing PZ6 lands into the future PZ7 system to improve servicing pressures. The aforementioned upgrades, along with others, will extend the Region's water system further north from the current extent in North Bolton, thereby providing water servicing for future developments. This report, Hydraulics Technical Memorandum No. 1 (HTM1), presents the water system hydraulic analysis for detailed design. Overall, the key objectives of HTM1 are listed below:

- Confirm design flows for Macville BPS under different system states and design years;
- Develop Macville BPS system (resistance) curves to identify design points for pump sizing;
- Characterize Bolton PZ7 system pressures and fire flow capacities with the proposed the North Bolton water servicing strategy and zone realignment; and
- Provide additional recommendations for system improvements and design considerations.

2. REFERENCE INFORMATION

The following information was relied upon to complete the hydraulic analysis:

- 600 mm King Street PZ7 watermain 50% design drawings by Burnside, dated 24 February 2025.
- 900 mm Emil Kolb PZ7 watermain 50% design drawings by Burnside, dated 21 February 2025.
- Macville BPS 90% design drawings by Burnside, dated 14 February 2025.
- "Macville BPS Final Preliminary Design Report" by Burnside, dated 31 October 2024.

- System map of future water infrastructure from the Region's draft 2024 Development Charges update study, received from the Region on 11 October 2024.
- Region's InfoWater Pro extended period simulation (EPS) hydraulic model dated 26 July 2024, received from the Region on 18 September 2024.
- "New (900 mm Zone 7) Watermain on Emil Kolb Parkway in Bolton, 30% Design Report Draft" by Burnside, dated 05 June 2024.
- "New (600 mm Zone 7) Watermain on King Street in Bolton, 30% Design Report Draft" by Burnside, dated 05 June 2024.
- Initial Bolton Zone 6 and Zone 7 realignment concept presentation by the Region, received 26 April 2024.
- "Zone 7 Demands" technical memorandum by Burnside, dated 04 January 2024.
- "Bolton Water and Wastewater Feasibility Study" master report by GM BluePlan (now GEI), dated February 2023.
- "Bolton Water and Wastewater Capacity Improvements Feasibility Study" technical memorandum by GM BluePlan (now GEI), dated January 2023.

3. BACKGROUND

3.1 Existing System Description

Figure 1 presents a map of the existing Bolton water system and surrounding zones. Details of pumping stations and storage facilities that are relevant for this analysis are respectively provided in Table 1 and Table 2. The existing Bolton water system comprises three interconnected zones, which are outlined below:

- Pressure Zone 6: PZ6 is a large open pressure system that services the north end of Brampton, south end of Caledon, and most of Bolton. Water is supplied by West Brampton High Lift (PZ6) Pumping Station (HLPS), Alloa (PZ6) Low Lift Pumping Station (LLPS), East Brampton (PZ6) HLPS, North Brampton (PZ6) LLPS, and Tullamore (PZ6) HLPS. Another station, Sandhill (PZ6) PS, is planned for the future. The system presently has floating storage at Bolton West Elevated Tank (ET), Bolton East ET, and Snelgrove ET, each with a top water level (TWL) of 297 m. Snelgrove ET is soon to be replaced by the proposed Victoria Reservoir. There is also the Bolton North BPS, a small station that draws from Pressure Zone 5B (PZ5B) and supplements supply to the local PZ6 system at the northeast end of Bolton (mainly for emergencies).
- Pressure Zone 5.5: PZ5.5 is a small sub-zone within Bolton that is supplied by PZ6 through the Deer Valley Pressure Reducing Valve (PRV). The Deer Valley PRV maintains a supply HGL of 283 m.
- Pressure Zone 5B: PZ5B is an open pressure system that services part of central Bolton. Water is supplied by the Bolton South BPS fill valves, which act as an altitude valve to fill floating storage at the Bolton Standpipes (SPs) with a TWL of 273 m.

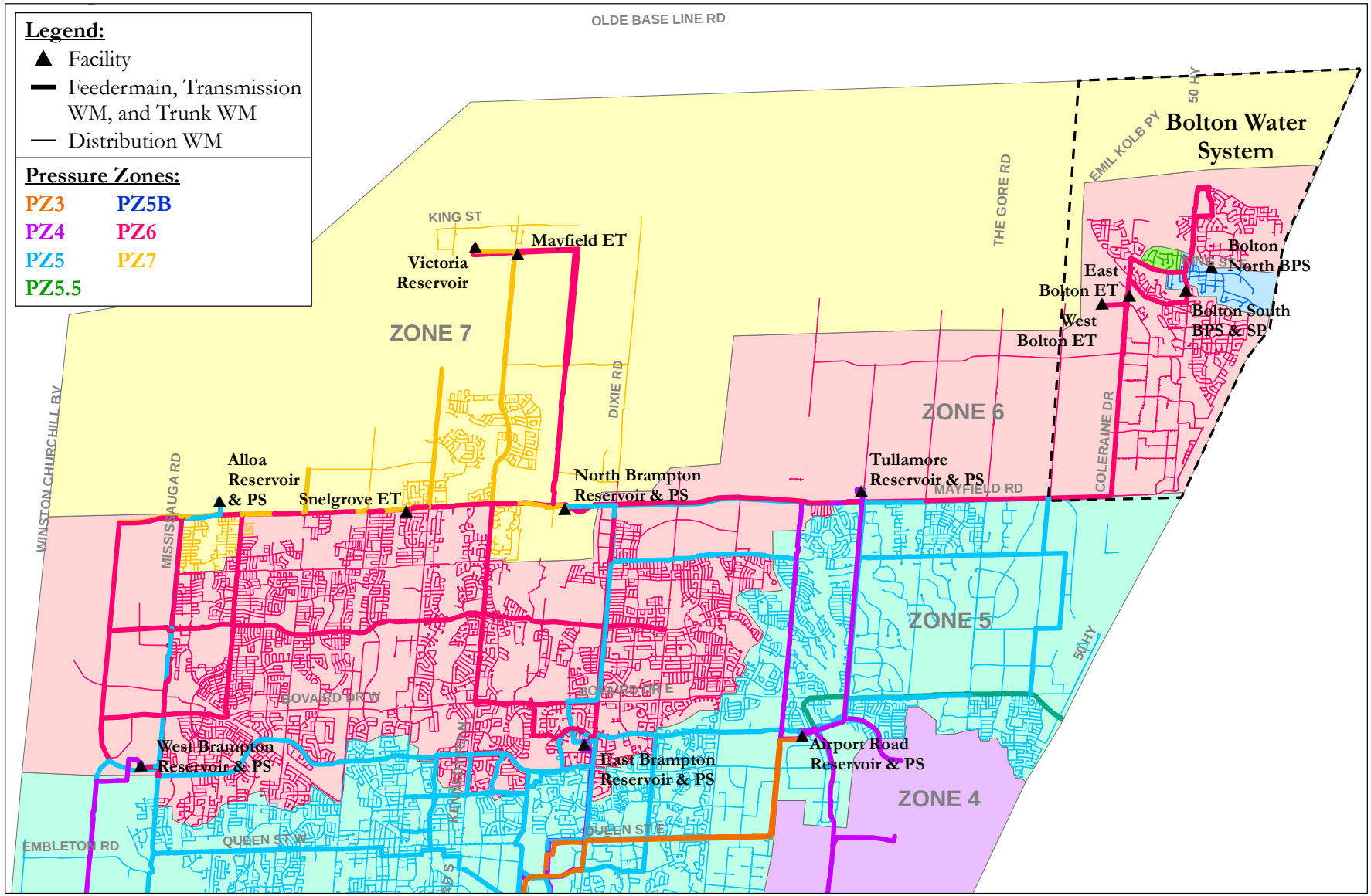

Figure 1: Background – map of existing PZ6, PZ5.5, PZ5B, and PZ7 water systems

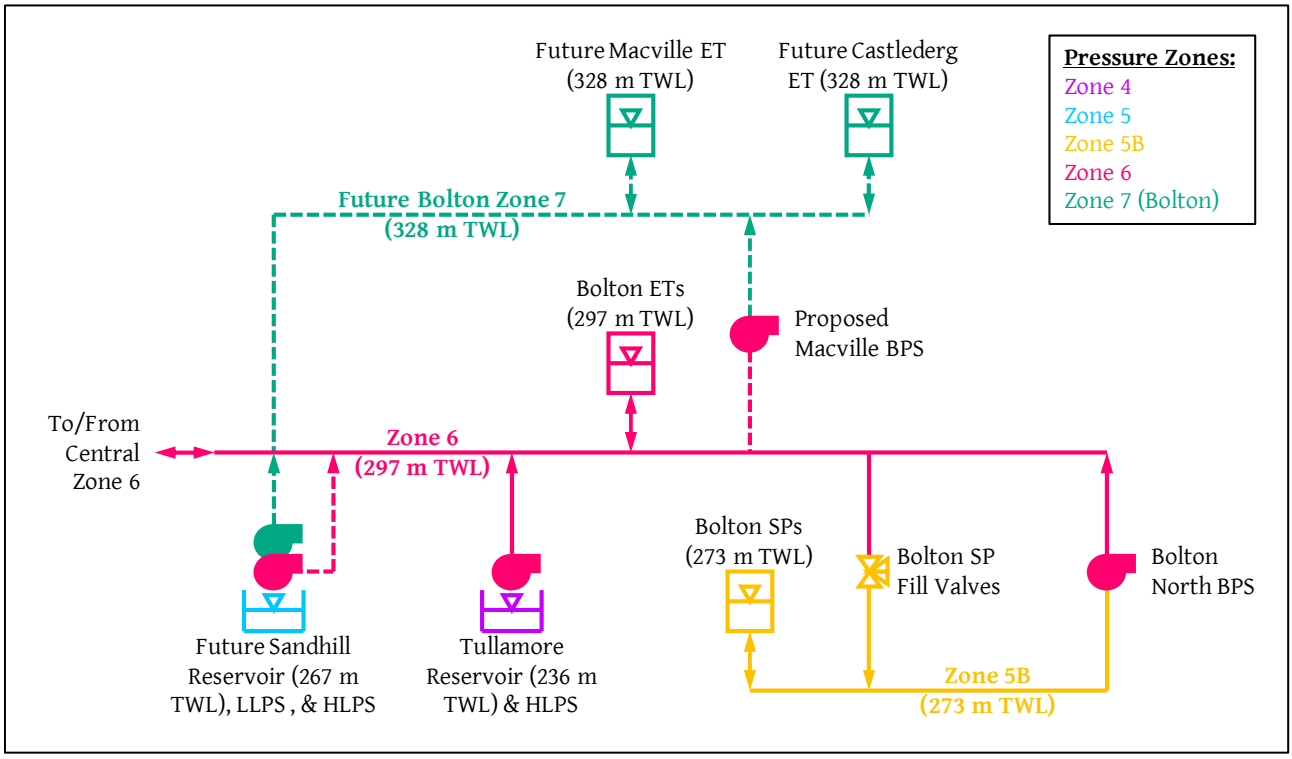

Figure 2: Background – schematic of the Region's existing PZ6 system and proposed Bolton PZ7 system

Table 1: Background – list of relevant pumping stations

Pressure Zone	Station Name	Status	Suction Supply	No. Existing Pumps	Nominal Firm Capacity (ML/d)
PZ6	Tullamore (PZ6) HLPS	Existing	Tullamore Reservoir	4	120
	Bolton South BPS	Existing	Bolton SP	-	-
	Bolton North BPS	Existing	PZ5B	3	9
	Sandhill (PZ6) PS	Future	Sandhill Reservoir	Future	Future
Bolton PZ7	Macville BPS	Proposed	PZ6	4	TBD
	Sandhill (PZ7) PS	Future	Sandhill Reservoir	Future	17.3*

* From the Region's current InfoWater Pro EPS hydraulic model.

Table 2: Background – list of relevant storage facilities

Pressure Zone	Facility Name	Status	Storage Depth (m)	Top Water Level (m)	Volume (ML)
PZ4	Tullamore Reservoir	Existing	6.0	236.2	40
PZ5	Sandhill Reservoir	Future	4.1	266.8	Future
PZ5B	Bolton SP #1	Existing	8.9	273.2	1.6
	Bolton SP #2	Existing	8.9	273.8	1.6
PZ6	West Bolton ET	Existing	13.5*	297.2	9.1
	East Bolton ET	Existing	12.0*	297.2	4.5
Bolton PZ7	Macville ET	Future	Future	327.7	Future
	Castlederg ET	Future	Future	327.7	Future

* These values represent the actual overall ET depths. Typical operating storage depths are 7.2 m for the Bolton ETs.

3.2 North Bolton Water Servicing

Presently, North Bolton water servicing extends to King St. and to Columbia Way (Figure 4). Beyond the existing water system, a number of lands are slated for development, and a water servicing feasibility study was completed by GEI in 2023 to explore different alternatives. Figure 5 illustrates the future system state with the preferred water servicing strategy, including the subject development districts. The preferred strategy comprises:

(i) the formation of a new Bolton PZ7 water system that will service the north end of Bolton and adjacent lands in the south part of Caledon;

(ii) water supply from a single new PZ7 pumping station (Macville BPS) for the interim period, including accompanying suction- and discharge-side watermains,

(iii) a local zone realignment of some high elevation PZ6 lands into Bolton PZ7 to mitigate low system pressures, and

(iv) future provision of floating storage and additional supply from another new Bolton PZ7 pumping station and/or interconnection with the Region's existing central PZ7 water system.

Central to the current hydraulic analysis are items i, ii, and iii. Bolton PZ7 is planned with a future TWL of 327.7 m, matching that of the Region's existing Central PZ7 water system. For the interim period until floating storage is provided, Bolton PZ7 will operate as a closed pressure system with a supply HGL of 327.7 m, and system pressures will be controlled by Macville BPS. For the future period, Bolton PZ7 will operate as an open system with floating storage. The Region's draft 2024 Development Charges (DC) study has identified two Bolton PZ7 storage facilities relevant to the current analysis[1]: Macville Elevated Tank (ET) to the west, and Castlederg ET to the east (Figure 5). A separate study is ongoing by others to confirm planning-level design details of these facilities, including their location and sizing. Further details are presented in the following subsections regarding Macville BPS, the proposed watermains, development lands, and other system upgrades.

3.3 Macville BPS and Proposed Watermains

Figure 5 shows the location of Macville BPS. Figure 3 illustrates a schematic of the proposed Macville BPS layout based on the 50% design drawings. Macville BPS will draw directly from PZ6 (297.2 m TWL) via the proposed 1050 mm PZ6 watermain along Emil Kolb Pkwy., and it will supply the future Bolton PZ7 (327.7 m HGL/TWL) through a proposed 900 mm PZ7 watermain along Emil Kolb Pkwy. and various other watermains. Macville BPS design details are outlined below:

- Interim design flow: 2031 peak hour demand (PHD) and 2031 maximum day demand (MDD) plus fire flow for a design fire demand of 21.6 ML/d (250 L/s).
- Buildout design flow: 2051 MDD without considering additional supply capacity from the future Sandhill PZ7 PS.
- Pumps: Four same-sized pumps will be installed. The pumps will be sized for 2051 MDD, and each pump will have a variable frequency drive (VFD) to provide pressure control under interim closed system conditions. For interim closed system conditions, design flows will be supplied by two duty pumps and two standby pumps, which meets MECP (2023) design guidelines for systems with a single supply and inadequate (or no) floating storage. For future open system conditions, design flows will be supplied by three duty pumps and one standby pump.

[1] A third Bolton PZ7 storage facility, South Albion ET, has also been identified by the Region's draft 2024 DC study. The South Albion ET is planned to be built later than the Macville ET and Castlederg ET, and the South Albion ET will be situated further west of the North Bolton water system. Accordingly, the South Albion ET is not considered in this analysis.

- Pressure control: Under interim closed system conditions, Macville BPS will provide system pressure control using a combination of pump VFDs and two relief/recirculation valves (RRVs; also called back pressure valves).
- Bypass check valve: The Macville BPS design includes a bypass check valve from the suction header (PZ6) to the discharge header (PZ7) for emergency backup supply in case pumping is lost.

The current design scope also includes a number of PZ6 and PZ7 watermains. The proposed watermains are listed below, and they are shown in Figure 6 and Figure 7 along with other future watermains:

- 1050 mm PZ6 watermain along Emil Kolb Pkwy. from the existing 1050 mm PZ6 subtransmission main at King St. W. to Macville BPS.
- 900 mm PZ7 watermain along Emil Kolb Pkwy. from Macville BPS to King St.
- 600 mm PZ7 watermain along King St. from Emil Kolb Pkwy. to west of Humber Station Rd.
- 600 mm PZ7 watermain along Emil Kolb Pkwy. from King St. to Highway 50

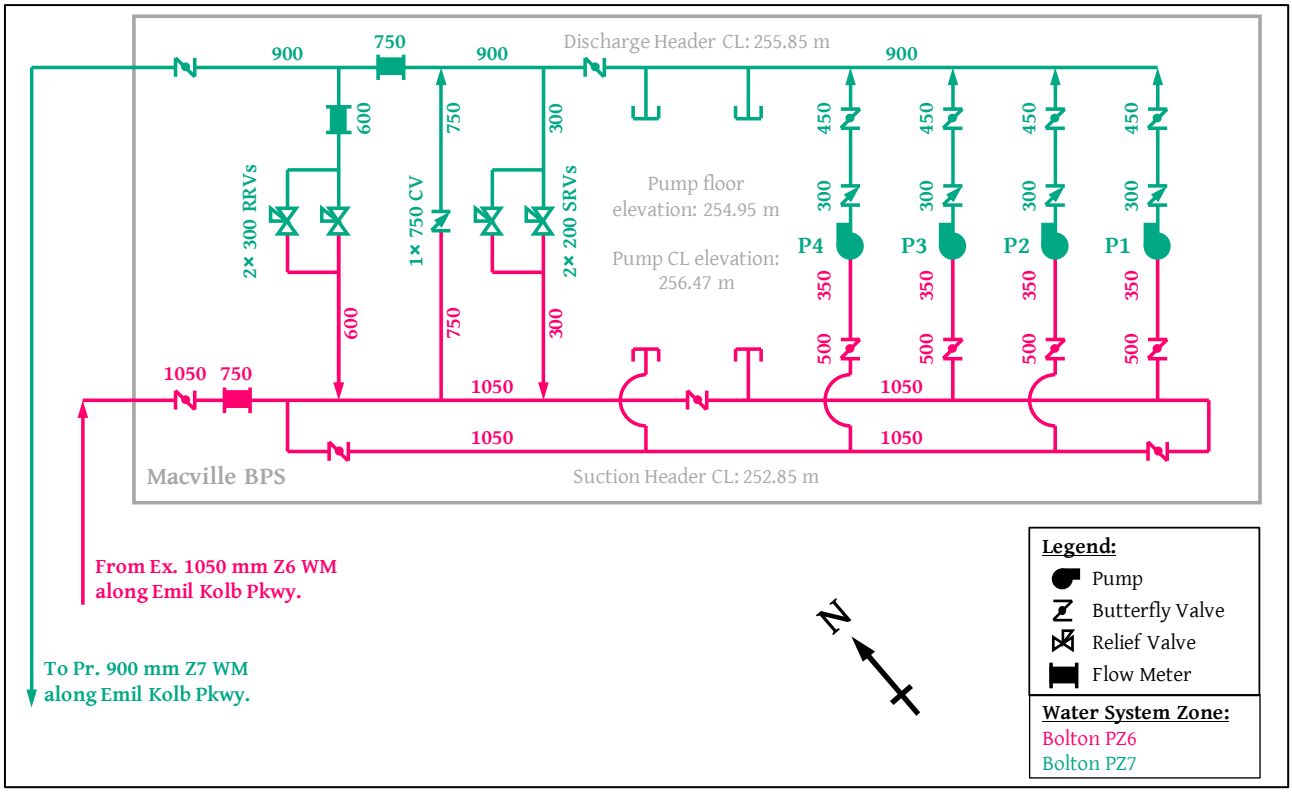

Figure 3: Background – schematic of proposed Macville BPS

3.4 Other Future System Upgrades

Table 4 presents a detailed list of proposed Bolton water system upgrades based on the Region's InfoWater model and the Region's draft 2024 DC Updates study. Figure 6 illustrates a map of the PZ6 water system upgrades, and Figure 7 shows the PZ7 water system upgrades.

4. ZONE REALIGNMENT

The Region's initial zone realignment concept was used as a starting point for the current study. It was analyzed and updated, beginning with an assessment of servicing elevations. Table 3 lists estimated servicing elevations for the existing PZ6 and future (open) PZ7 water systems. From these, Table 3 identifies an elevation of 260 m as the ideal target zone boundary to best achieve the Region's 40 to 100 psi operating pressure range. Figure 8 and Figure 9 illustrate maps of the existing and proposed future zone boundaries, respectively, which consider the target ideal elevation delineation of 260 m. Indeed, the zone realignment boundary is interrelated with the hydraulic analysis and system design. Accordingly, these were considered jointly and iteratively, and Figure 9 reflects the preferred zone boundaries. Further discussions are presented in the 'results and discussion' main section alongside the hydraulic modeling analysis.

Table 3: Zone realignment – servicing elevations

Pressure Zone	Storage Properties				System Head Loss* (m)	System Pumping Gain* (m)	Servicing Elev. (m)	
	Facility	Depth (m)	TWL (m)	Level Range*			Lower (100 psi)	Upper (40 psi)
PZ6	West and East Bolton ETs	7.2+	297.2	50-95%	4	2	229	261
PZ7	Macville ET & Castlederg ET	10.0	327.7	40-95%	4	2	259	290

* Hydraulic modeling results were used to determine suitable parameters for typical storage level ranges (minimum and maximum), system head losses (relative to minimum storage HGLs), and system pumping HGL gains (relative to maximum storage HGLs).

\+ A storage depth of 7.2 m is considered for the West and East Bolton ETs based on their typical operating depths.

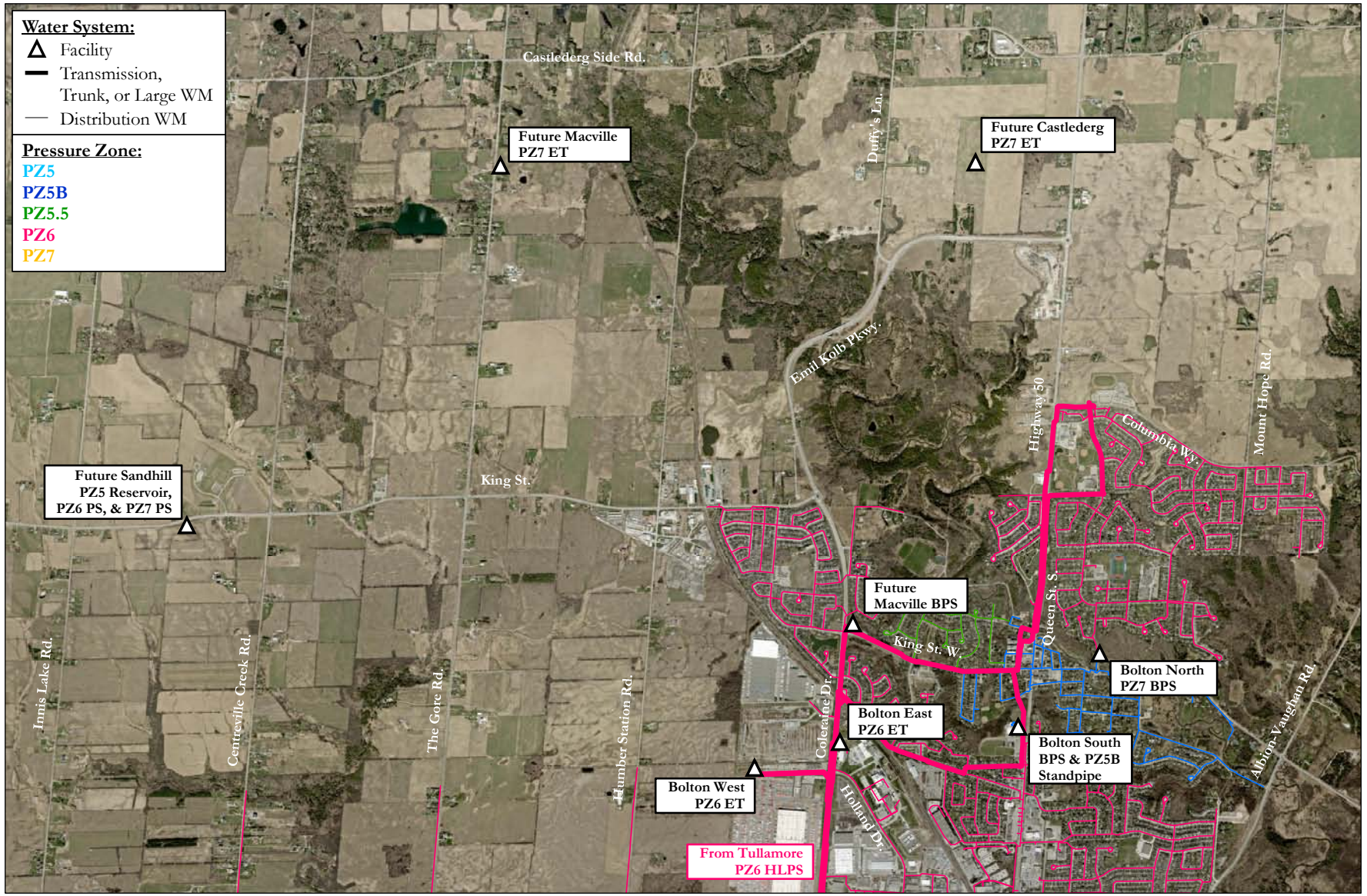

Figure 4: Background – Bolton water system with existing zone boundaries and watermains

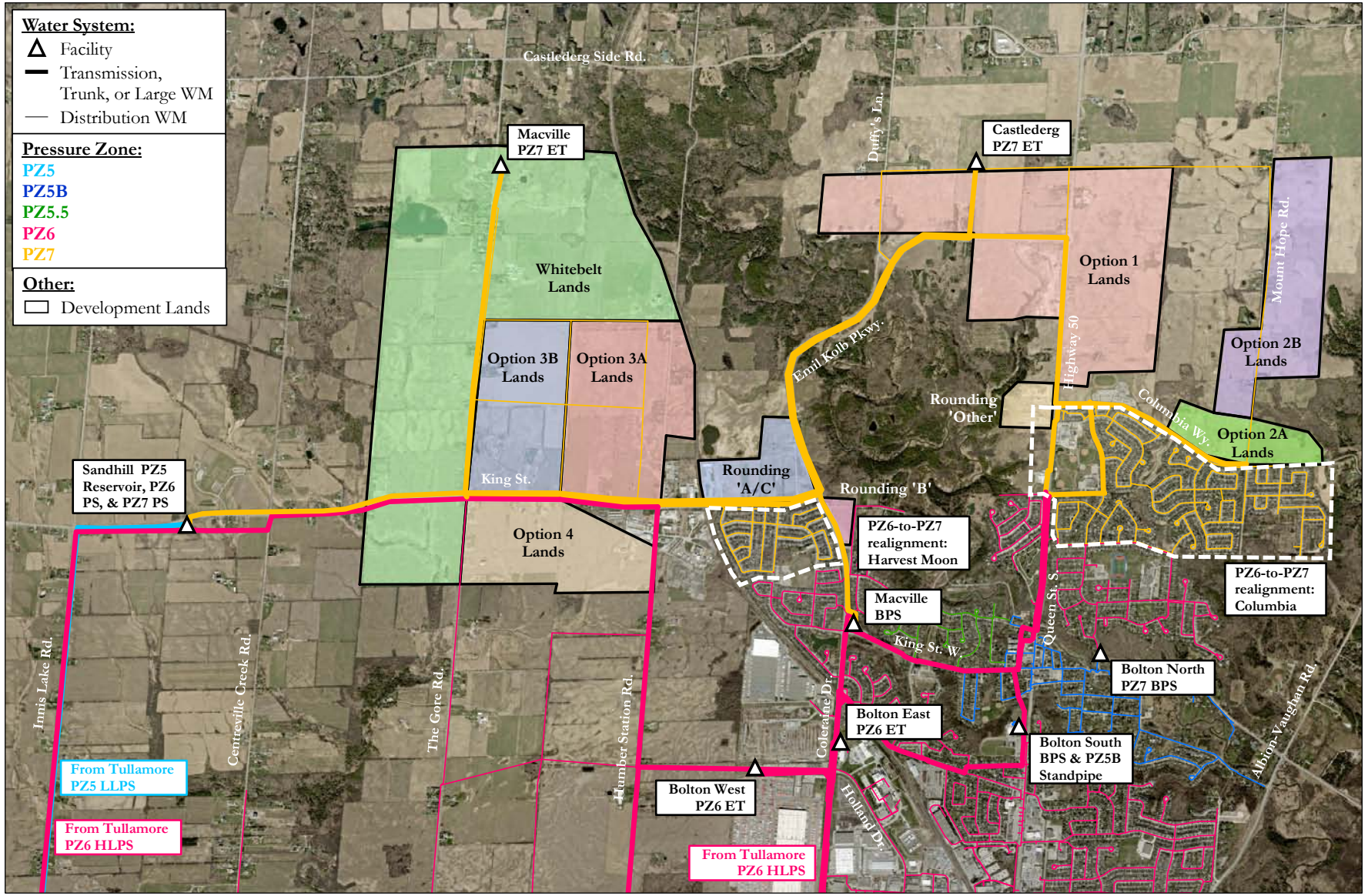

Figure 5: Background – Bolton water system with future zone boundaries, watermains, and development areas (districts)

Table 4: Background – list of Bolton water system upgrades from Region DC study

Pressure Zone	Description	Location	Region DC Study IDs		Year Active		
			Component	Project	Region DC Study	As-Received Model	Analysis
6	Tullamore LLPS Expansion	Tullamore LLPS	56933	27-1964	2029	n/a	n/a
	Sandhill PZ6 PS	King between Innis Lake/Centreville Creek	38090	29-1999	2031	2037	2036
	600 mm Humber Station PZ6 watermain	Humber Station (Healey to King)	32592 32594	24-1194 27-1191	2026 2029	2028	2026 2029
	600 mm West Bolton PZ6 watermain	The Gore to West Bolton ET	32590	24-1194	2026	2026	2026
	750 mm Healey PZ6 watermain	Healey (Humber Station to Coleraine)	32588	24-1267	2024	2026	2026
	900 mm Healey PZ6 watermain	Healey (Innis Lake to Humber Station)	37579	24-1268	2026	2031	2031
	1200 mm Innis Lake PZ6 watermain	Innis Lake (Tullamore PS to Healey)	30976	24-1269	2026	2031	2031
	750 mm King-Humber Station PZ6 watermain	King and Humber Station (The Gore to south of King)	56914	29-1199	2034	n/a	2036
	600 mm King PZ6 watermain	King (Sandhill PZ6 PS to The Gore)	Unk.	Unk.	2034	2037	2036
	600 mm Innis Lake PZ6 watermain	Innis Lake and King from Healey to Sandhill PZ6 PS	n/a	n/a	n/a	2037	2041
7	Macville BPS	Emil Kolb/King	n/a	n/a	2026	2027	2031
	Sandhill PZ7 PS	King between Innis Lake/ Centreville Creek	38090	29-1999	2031	2037	2036
	Macville ET	The Gore south of Castlederg	32010	29-1999	2032	n/a	2032
	Castlederg ET	Between Highway 50, Castlederg, Duffys	35616	25-1599 29-1999	2035	n/a	2036
	South Albion ET	Innis Lake/Castlederg Side	35758	29-1599 29-1999	2037	9999	n/a
	900 mm Emil Kolb PZ7 watermain	Emil Kolb (Macville BPS to King)	53990	24-1266	2026	2027	2031
	600 mm Emil Kolb PZ7 watermain	Emil Kolb (King to Highway 50)	54019	24-1191, 27-1199	2026	2027	2031

Pressure Zone	Description	Location	Region DC Study IDs		Year Active		
			Component	Project	Region DC Study	As-Received Model	Analysis
	600 mm King PZ7 watermain	King (Emil Kolb to west of Humber Station)	53992	24-1190	2026	2027	2031
	400 mm Highway 50 PZ7 watermain	Highway 50 (Emil Kolb to Columbia _	54021	24-1191	2026	2027	2031
	400 mm Columbia PZ7 watermain	Columbia (Highway 50 to Mount Hope)	56947	24-1191	2026	2027	2031
	900 mm King PZ7 watermain	King (The Gore to west of Humber Station)	31439	29-1299	2032	n/a	2032
	900 mm Macville PZ7 watermain	King and The Gore (Sandhill PS to Macville ET)	31439	29-1299	2032	n/a	2032
	750 mm Castlederg PZ7 watermain	King, Emil Kolb, and new road (Humber Station to Castlederg ET)	31817	29-1299	2035	n/a	2036
	400 mm Mount Hope PZ7 watermain	Mount Hope (Columbia to Option 2B lands)	n/a	n/a	n/a	2041	2041
	400/300 mm Northeast PZ7 watermains	Various around Option 1 and Option 2B lands	n/a	n/a	n/a	2041	2051

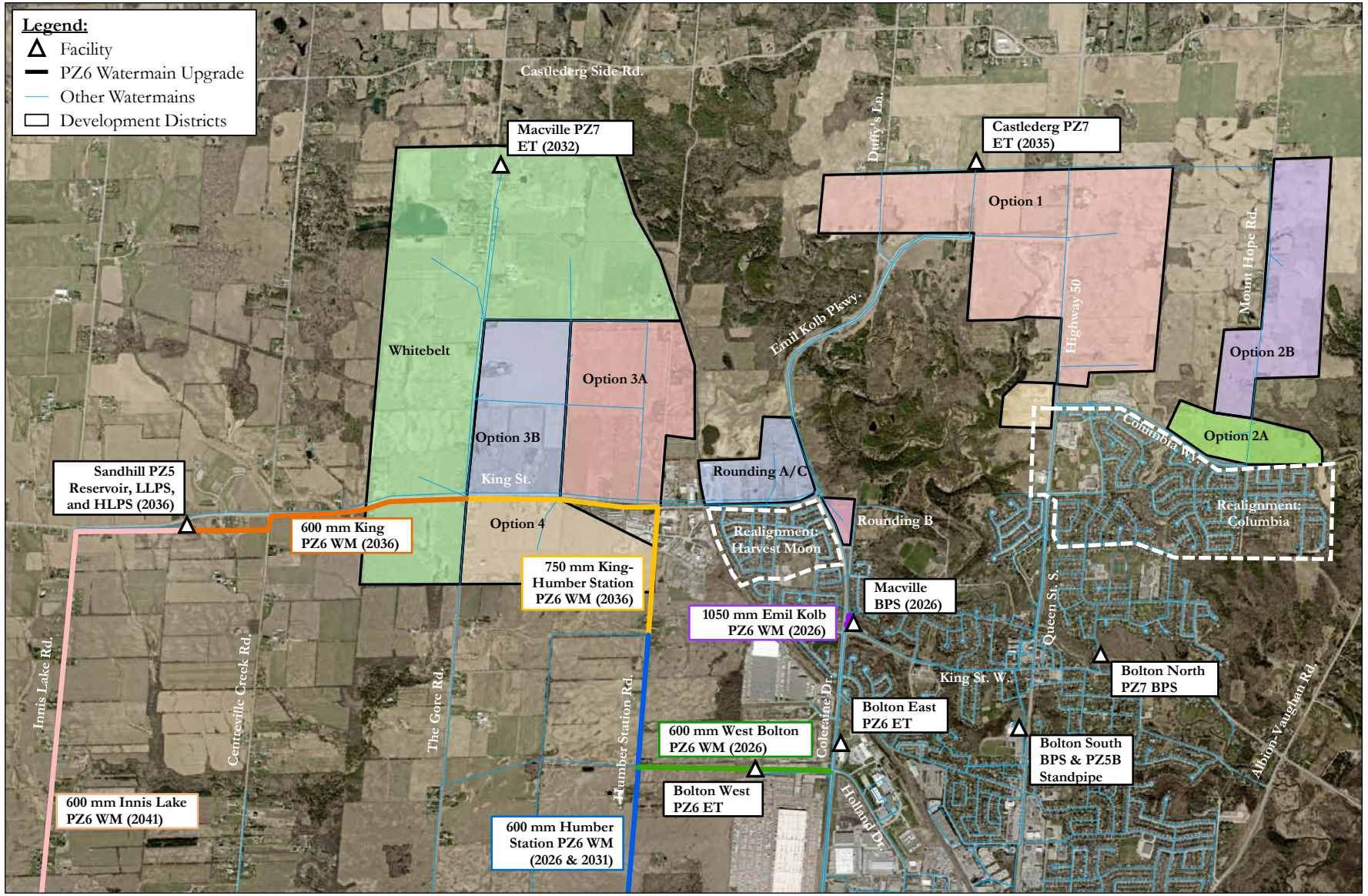

Figure 6: Background – map of Bolton PZ6 water system upgrades from Region DC study

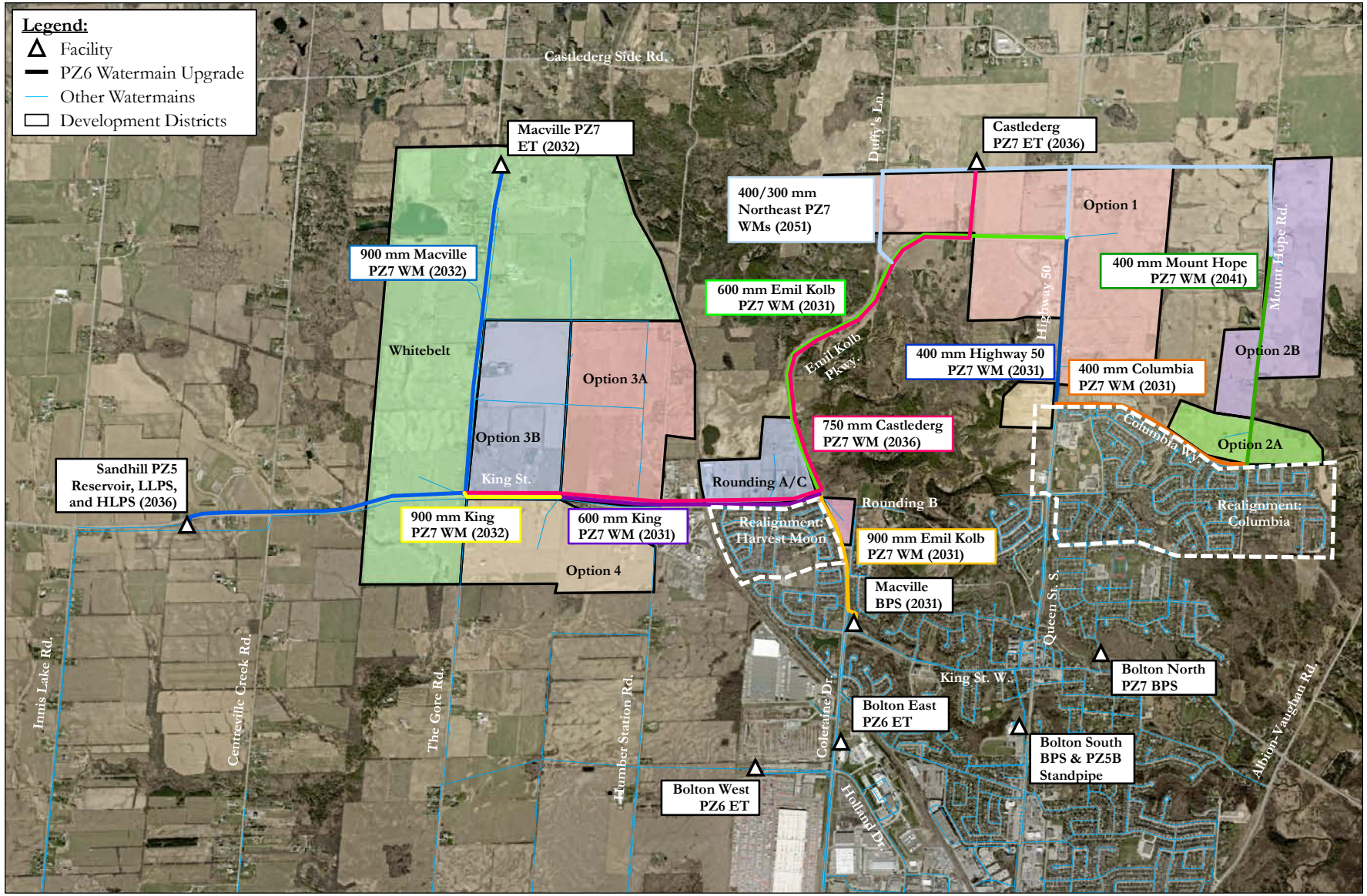

Figure 7: Background – map of Bolton PZ7 water system upgrades from Region DC study

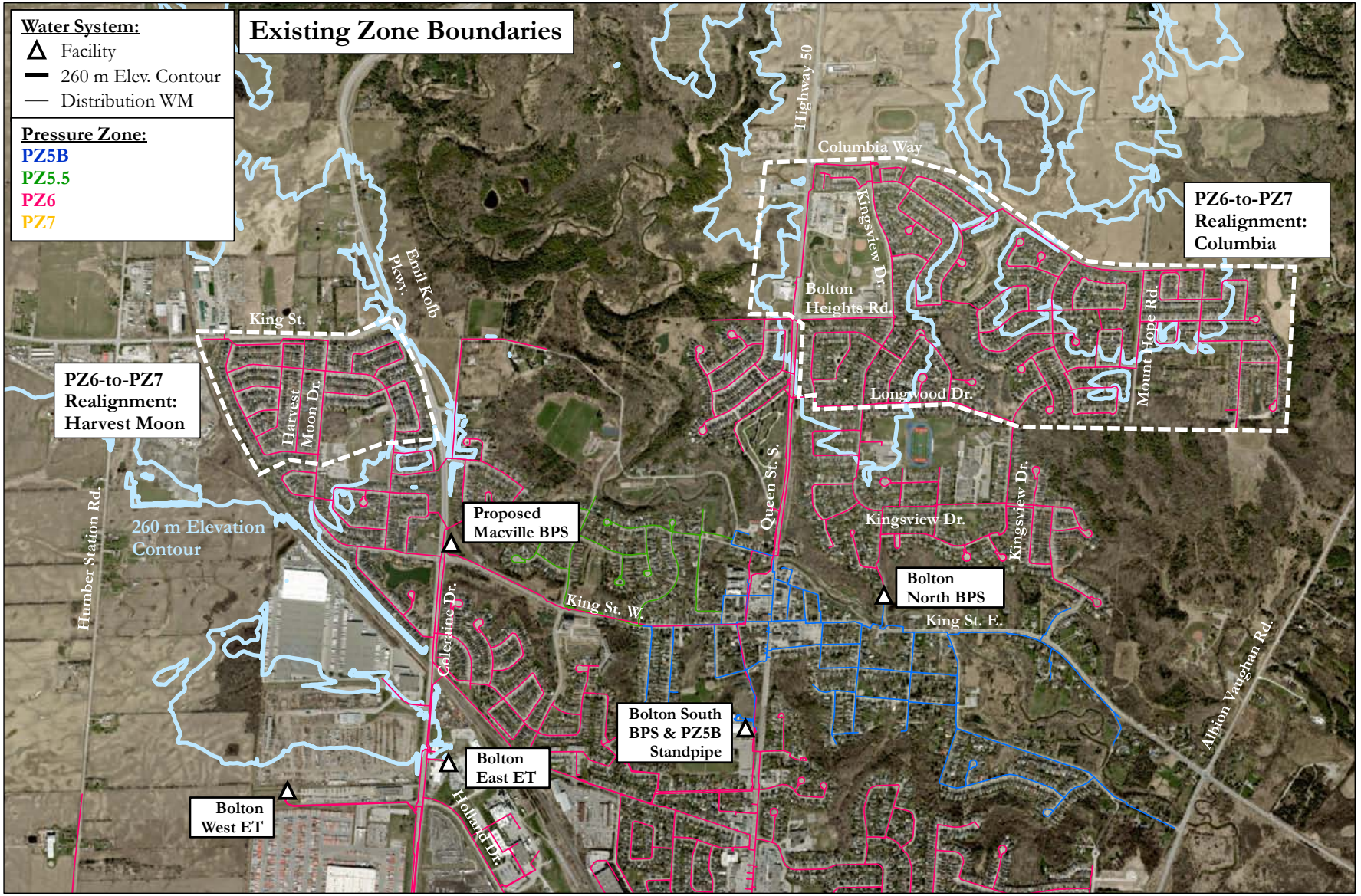

Figure 8: Zone realignment – target zone boundary contour with existing zone boundaries

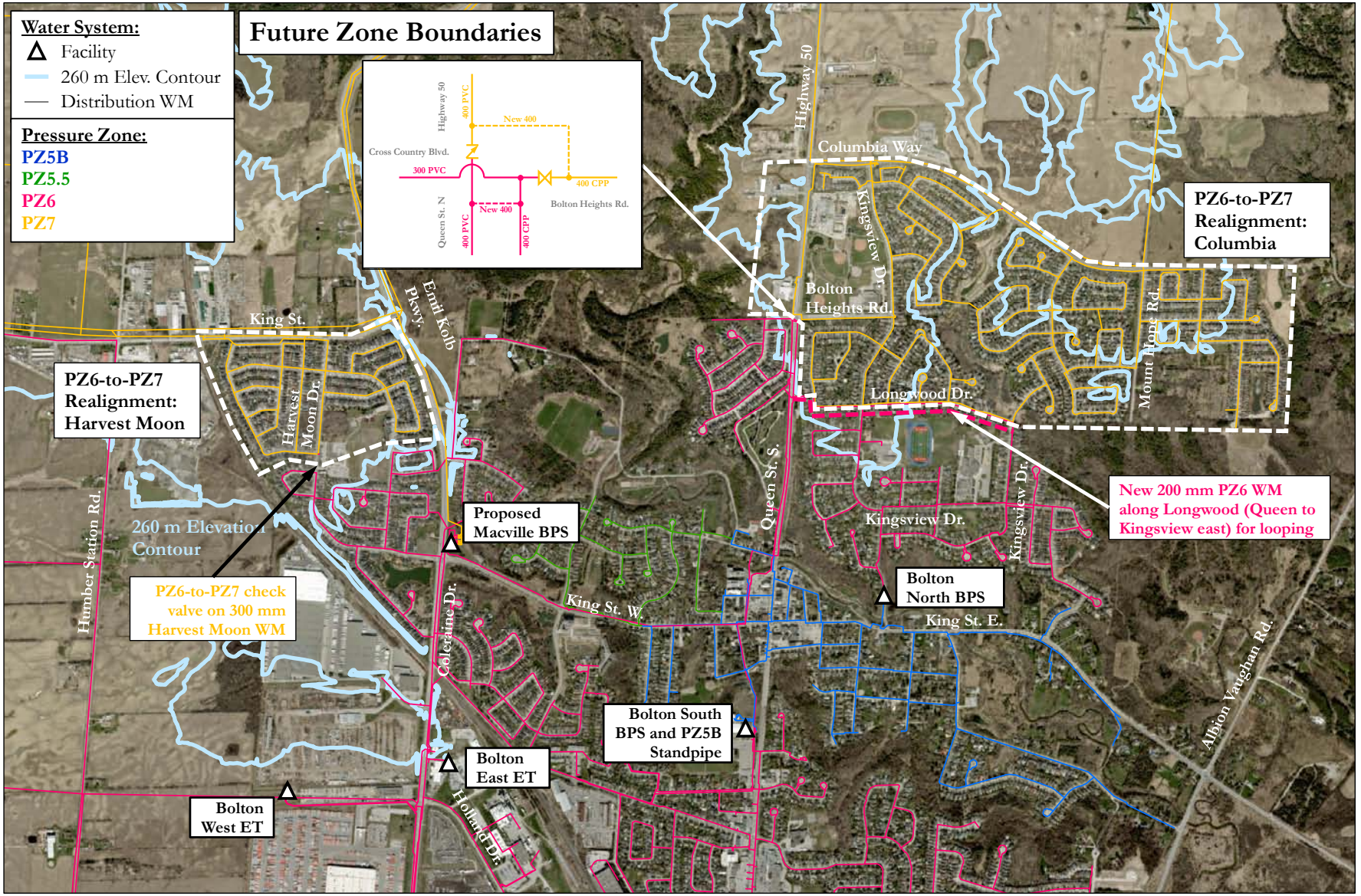

Figure 9: Zone realignment – target zone boundary contour with future zone boundaries

5. METHODOLOGY

A hydraulic modeling analysis was completed for Macville BPS, the proposed watermains, and the zone realignment. The Region's InfoWater EPS model was used as a basis, and it was updated according to the design drawings, future developments, and planned future infrastructure (Table 4, Figure 6, and Figure 7). Using the updated model, a range of conditions were tested to analyze the proposed system upgrades, including system (resistance) curves, station operating hydraulics, system pressures, and fire flow capacities. Details of the methodology, analysis, and assumptions are outlined below:

- Model years: 2026, 2031A (closed system), 2031B (open system), 2036, 2041, and 2051. Table 5 lists the corresponding infrastructure statuses.
- Analysis approach: Table 6 outlines the analysis approach. The first two analysis groups focus on Macville BPS (system curves and station operating hydraulics), while the latter two analysis groups test the system performance (e.g., system pressures, fire flow capacities), including for the existing system (pre-zone realignment) and future conditions (post-zone realignment).
- Development water demands: Table 7 lists the development district water demands for average day demand (ADD), MDD, and PHD. The demands were provided by Burnside (2024), and they are based on the Region's design criteria. Table 7 includes alternate PHDs, which were estimated based on Burnside's MDD values and the Region's InfoWater model diurnal demand pattern multiplier. The latter PHD values are slightly higher and thus more conservative, so they were used for the analysis.
- System demand: The analysis considers minimum hour demand (MHD), ADD, MDD, PHD, and MDD plus fire flow. Time-varying demands are considered for ADD EPSs and MDD EPSs, whereby the former intrinsically includes MHD and the latter includes PHD. Table 8 lists the updated Bolton PZ7 system water demands, which incorporate the development district water demands and zone realignment demands.
- System pumping: System pumping was modeled according to scenario-specific analysis objectives or using EPS controls. For interim closed system EPS scenarios, Macville BPS was modeled with VFD controls to maintain a target discharge HGL of 323 m (mid-way between the future 327.7 m TWL and the minimum required closed system HGL). For future open system conditions, Macville BPS and Sandhill PZ7 PS were configured to maintain target storage levels of 50-90% for Bolton PZ7 storage.
- Storage levels: For system curve scenarios, the following were considered: low water level (LWL) of 40%, average water level (AWL) of 70%, high water level (HWL) of 95%. The aforementioned LWL, AWL, and HWL values are based on discussions with the Region and a review of the Region's InfoWater model. For EPS scenarios, time-varying levels were modeled.
- Future Bolton PZ7 storage volume: The future Macville ET and Castlederg ET were each modeled with an assumed typical ET storage volume of 7 ML. The ETs are likely to have larger volumes in order to provide adequate floating storage according to MECP (2023; on the order of 10-15 ML each), so the smaller volume considered here is more conservative. Additionally, this only affects the pump-storage cycling period for EPS scenarios and not pumping capacity.
- Macville BPS:
    - Design flows: Table 9 outlines the Macville BPS design flows for different demand conditions and model years. The key design flows are summarized below:
        - Interim closed system, 2031 PHD: 290 L/s (25.0 ML/d).

  - Interim closed system, 2031 MDD plus fire: 438 L/s (37.8 ML/d) based on a 250 L/s design fire demand.
  - Future open system, 2051 MDD: 741 L/s (64.1 ML/d) with no Sandhill PZ7 PS, and 541 L/s (46.8 ML/d) with Sandhill PZ7 PS.
- Pumps: Macville BPS was modeled with four 21.4 ML/d pumps based on the 2051 MDD design flow (64.1 ML/d) and three duty pumps.
- Local losses: Table 10 lists the internal station local loss coefficients modeled for Macville BPS based on the 50% design drawings (Figure 3).
- System curves: Macville BPS system curves were modeled for closed system conditions (i.e., with no floating storage) and open system conditions. For the former, the system curve results represent the minimum required TDH to maintain system pressures above 40 psi for up to PHD, while the fire flow system curves considers a minimum system pressure of 20 psi at the design MDD plus fire flow state. From a review of the interim Bolton PZ7 system, minimum pressures are generally controlled by a high point at the Option 3A lands with a local ground elevation of 276.5 m.
- Closed system pressure control: Conditions were modeled using VFDs and/or RRVs for discharge pressure control under interim closed system conditions.
- RRVs: The proposed RRVs were modeled as inactive for system curve scenarios and open system scenarios. For all other scenarios, the RRVs were modeled as active with an HGL set point of 327.7 m to match the proposed future Bolton PZ7 TWL.

- Fire flows: Fire flows were analyzed using available fire flow (AFF) simulations. For a given location, the AFF represents the maximum flow that can be withdrawn under MDD conditions subject to (i) maintaining local and broader system pressures above 20 psi (140 kPa; 14.3 m) and (ii) conservatively limiting velocities to less than 5 m/s. The latter criterion, while not required per the Region's standards, yields more conservative results, and it is considered here as a reasonable limit for practical purposes.
- Hazen-Williams roughness (C-factors): From the MECP design criteria (2023), any new watermains were modeled with C = 100, 110, 120, and 130 for diameters of 150 mm or less, 200 mm, 300-600 mm, and above 600 mm, respectively. Existing system watermains were modeled with C-factors according to the Region's as-received InfoWater model.
- Other assumptions:
  - A skeleton network of 300 mm watermains was modeled for the Option 3A and 3B lands (Figure 5). The actual local network design has yet to be determined, and it will likely have more watermains with greater local capacity. Accordingly, the current approach is expected to provide a conservative representation.
  - For development districts with a completion time frame of 2051 (Table 7; e.g., Option 1B, Whitebelt), 2036 demands were allocated assuming 25% buildout, and 2041 demands were allocated assuming 50% buildout.
  - Sandhill PZ7 PS was modeled with a single 17.3 ML/d (200 L/s) pump based on the Region's as-received InfoWater model. Conditions are tested without and with this station.

Table 5: Methodology – model years and infrastructure statuses

Model Year	Pumping Stations		PZ7 Storage		Zone Boundaries	Active Development Districts
	Macville BPS	Sandhill PZ7 PS	Macville ET	Castlederg ET		
2026	Not Built	Not Built	Not Built	Not Built	Existing	None
2031A	Active	Not Built	Not Built	Not Built	Realigned	1A, 3A, Rounding 'B'
2031B	Active	Not Built	Active	Not Built	Realigned	1A, 3A, Rounding 'B'
2036	Active	Active	Active	Active	Realigned	All
2041	Active	Active	Active	Active	Realigned	All
2051	Active	Active	Active	Active	Realigned	All

Table 6: Methodology – analysis groups

No.	Group Description	Planning Years	Demands	Pumping	Storage Levels	Simulation Type
1	Macville BPS system curves for interim closed system and future open system	2031A, 2031B, 2051	Up to MDD+Fire	Scenario-Specific	Fixed	System Curve
2	Macville BPS operating hydraulics (flows, velocities, pressures, HGLs, NPSHa)	2031A, 2031B, 2051	Up to MDD+Fire	-	-	-
3	EPS of typical operating conditions for system pressures	2026, 2031A, 2031B, 2036, 2041, 2051	ADD EPS, MDD EPS	EPS Controls	Variable	EPS
4	Fire flow analysis of system available fire flows	2026, 2031A, 2031B, 2036, 2041, 2051	MDD	Scenario-Specific	LWL	AFF

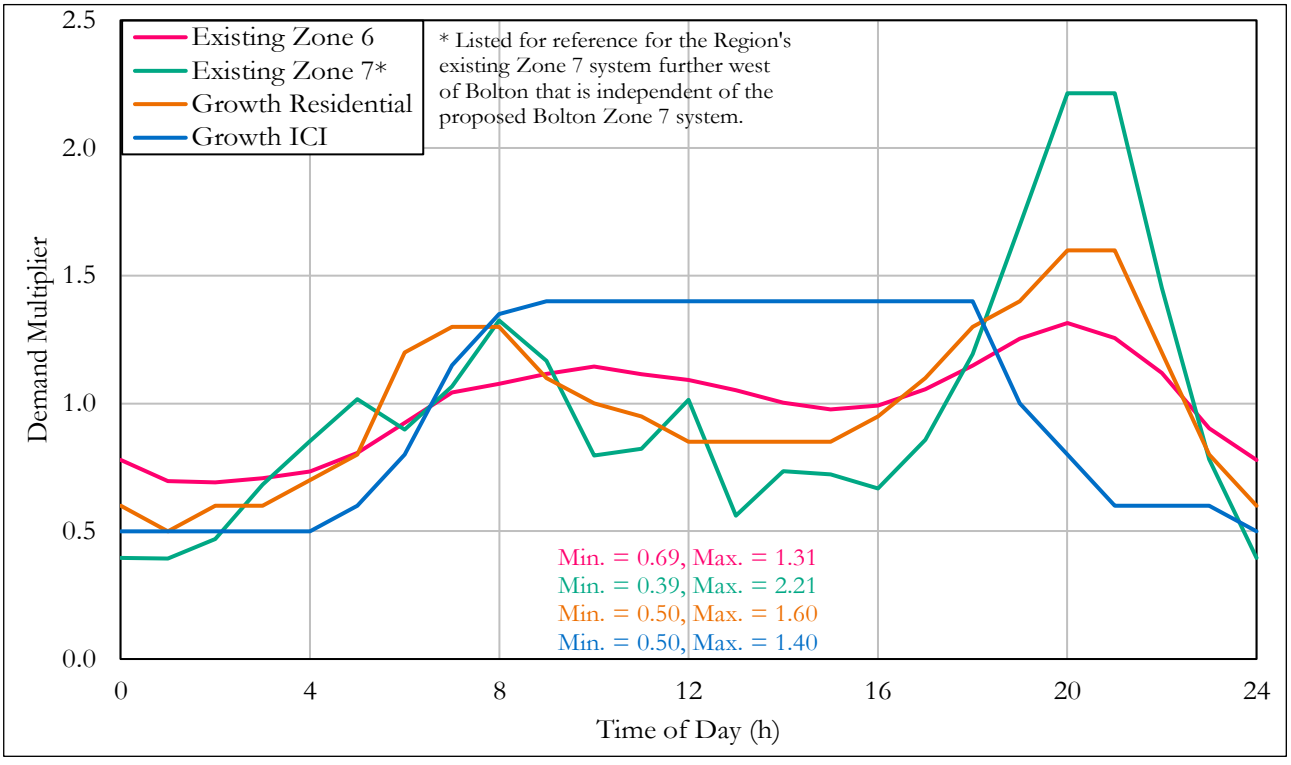

Figure 10: Methodology – InfoWater model, EPS diurnal demand patterns

Table 7: Methodology – development statistics and water demand estimates

Development Land	Time Frame	Area (ha)	Population	Demand (L/s)				Elevation Range (m)	
				ADD[1]	MDD[1]	PHD[1]	PHD[2]	Min.	Max.
Option 1A	2031	32.1	2,960	9.6	19.2	28.8	30.7	258	269
Option 1B	2051	146.5	12,700	41.5	81.1	125	130	246	277
Option 1 Total	-	178.6	15,700	51.1	100	153	160	246	277
Option 2A	2051	23.8	3,310	10.7	21.4	32.1	34.3	238	263
Option 2B	2051	71.3	9,920	32.1	64.3	96.4	103	235	265
Option 2 Total	2051	95.0	13,200	42.8	85.7	129	137	235	265
Option 3A	2031	77.5	19,100	62.2	122	187	196	261	277
Option 3B	2051	104.9	11,500	37.6	73.3	113	117	261	281
Option 3 Total	-	182.4	30,700	99.8	196	299	313	261	281
Option 4	2051	28.0	3,950	12.8	25.6	38.4	41.0	255	266
Rounding 'A/C'	2051	20.7	2,920	9.4	18.9	28.3	30.2	248	266
Rounding 'B'	2031	8.5	1,200	3.9	7.8	11.7	12.5	247	263
Rounding Total	-	29.2	4,120	13.3	26.7	40.0	42.7	247	266
Whitebelt	2051	290.0	40,900	133	265	398	424	250	299
Total 2031	**-**	**118.1**	**23,300**	**75.7**	**149**	**227**	**239**	**-**	**-**
Total 2051	**-**	**803.2**	**108,500**	**352**	**699**	**1057**	**1118**	**-**	**-**

1 Demand estimates were provided by Burnside and are based on the Region's design criteria.
2 Based on (i) MDD estimates provided by Burnside and (ii) a diurnal demand pattern hourly peaking factor of 1.60 from the Region's InfoWater model.

Table 8: Methodology – Bolton PZ7 system water demands

Model Year	Demand Condition	PZ7 Demand (L/s) by Area				PZ7 Demand (ML/d) by Area			
		Harvest Moon	Columbia	New PZ7	Total	Harvest Moon	Columbia	New PZ7	Total
2026*	MHD	5.02	11.0	0	16.0	0.43	0.95	0	1.39
	ADD	7.43	16.0	0	23.4	0.64	1.38	0	2.03
	MDD	11.4	25.4	0	36.9	0.99	2.20	0	3.18
	PHD	14.7	33.7	0	48.4	1.27	2.91	0	4.18
2031	MHD	5.24	11.3	38.4	54.9	0.5	0.98	3.31	4.74
	ADD	7.82	16.6	76.5	101	0.68	1.43	6.61	8.72
	MDD	12.0	26.4	149	188	1.04	2.28	12.9	16.2
	PHD	15.5	35.3	239	290	1.34	3.05	20.6	25.0
2036	MHD	5.93	12.2	72.7	90.7	0.5	1.05	6.28	7.84
	ADD	9.19	18.3	145	173	0.79	1.58	12.5	14.9
	MDD	14.4	29.5	287	331	1.24	2.54	24.8	28.6
	PHD	18.8	40.0	459	518	1.63	3.46	39.6	44.7
2041	MHD	5.40	12.2	107	125	0.47	1.05	9.25	10.8
	ADD	8.14	18.3	214	240	0.70	1.58	18.5	20.8
	MDD	12.7	28.2	424	465	1.10	2.44	36.6	40.2
	PHD	16.6	37.5	679	733	1.44	3.24	58.6	63.3
2051	MHD	5.56	12.4	176	194	0.48	1.07	15.2	16.8
	ADD	8.47	18.6	352	379	0.73	1.61	30.4	32.8
	MDD	13.3	29.1	699	741	1.15	2.52	60.4	64.1
	PHD	17.8	38.5	1118	1174	1.53	3.32	96.6	101

* 2026 demands represent the existing Harvest Moon and Columbia areas that will be realigned to PZ7.

Table 9: System curves – Macville BPS design flows

Bolton PZ7 Storage	Model Year	System Demand Condition	Design Flow		Notes
			(L/s)	(ML/d)	
None	2031	PHD	290	25.0	
	2031	MDD+Fire	408	35.2	220 L/s fire demand
	2031	MDD+Fire	438	37.8	250 L/s fire demand
Macville ET and/or Castlederg ET	2031	MDD	188	16.2	
	2036	MDD	326	28.2	
	2041	MDD	465	40.2	
	2051	MDD	741	64.1	With no Sandhill PZ7 PS
	2051	MDD	541	46.8	With Sandhill PZ7 PS

Table 10: Methodology – Macville BPS local loss coefficients

Section	Local Loss Sizes and Descriptions	Model Pipe Diameter (mm)	Total Resistance* (s^2/m^5)	Equivalent Local Loss Coeff.
Pump suction pipe	1050 mm tee branch, 1050×500 mm reducer, 500 mm bend, 500 mm BFV	500	2.26	1.7
	500×350 mm reducer, 350×300 mm reducer	350	1.10	0.2
Pump discharge pipe	300 mm check valve, 300×450 mm expansion	300	43.3	4.2
	450 mm BFV, 450×900 mm expansion, 900 mm tee branch	450	5.15	2.6
RRV (back pressure) line, upstream (PZ7)	600 mm tee branch, bends, BFV	600	3.30	5.2
	300 mm bend, BFV, tee branch	300	29.1	2.9
RRV (back pressure) line, downstream (PZ6)	300 mm bend, BFV, tee branch	300	29.1	2.9
	600 mm tee branch, bends, BFV	600	1.96	3.1
SRV line, upstream (PZ7)	900 mm tee branch, 900×300 mm reducer, 300 mm BFV, 300 mm tee branch	300	26.1	2.6
	200 mm bend, BFV	200	81.4	1.6
SRV line, downstream (PZ6)	200 mm bend, BFV	200	81.4	1.6
	300 mm tee branch, 300 mm BFV, 300 mm bend, 300×1050 mm expansion, 1050 mm tee branch	300	30.0	2.9
Station suction header, common	1050 mm BFV, 1050×750 reducers	1050	0.12	1.7
Station suction header, north	1050 mm tee lines and BFV	1050	0.20	3.0
Station suction header, south	1050 mm tee branch, tee lines, bend, BFVs	1050	0.35	5.1
Station discharge header	900 mm tee lines and BFVs, 900×750 reducers	900	0.69	5.5

* Based on local loss coefficients from "Advanced water distribution modeling and management" by Haestad Methods et al. (2003), Haestad Press.

6. RESULTS AND DISCUSSION

6.1 Macville BPS System Curves

Macville BPS system curves were modeled for various conditions to assess the design bases and overall range. Table 11 lists the system curve analysis scenarios, which consider different system states, demands, storage levels, and pumping conditions. For interim closed system conditions, Scenarios 1A to 1E test the minimum required Macville BPS TDH to maintain adequate minimum Bolton PZ7 system pressures (40 psi for non-emergency, and 20 psi for MDD plus fire). The remaining scenarios represent the Macville BPS TDH as it varies with total station flow for the given scenario system conditions. Scenarios used for design bases are marked as such in Table 11. System curve results are presented in Table 12 (design points) and Figure 11 to Figure 15 (system curve plots), and below are summary discussions of the results:

- System curve range: Figure 11 shows a relatively narrow band of system curves for the interim closed system state. This is because there is no discharge-side storage, and thus no discharge side storage level variations. Consequently, suction-side hydraulics are the key factors affecting the band of TDHs, namely, PZ6 storage levels and demands. Comparatively, Figure 14 and Figure 15 illustrate a wider band of system curves for Bolton PZ7 open system conditions.
- Design points: Table 12 lists the station and pump design points for different design bases. For interim closed system conditions, Table 12 includes design points based on maintaining adequate minimum system pressures (i.e., 40 psi for non-emergency conditions and 20 psi for MDD plus fire) and based on a station discharge HGL of 327.7 m to match the future Bolton PZ7 TWL. The governing design point is 2051 MDD (64.1 ML/d at 37.4 m pump TDH).
- Design-type pump curves: To characterize the operating ranges, the system curve plots include design-type pump curves based on the governing 2051 MDD design point. Design-type pump curves are a fictitious model representation derived from a given operating point, and they are intended to provide an approximation of what pumps may be installed. Indeed, since the pumps are proposed to be sized for 2051 MDD, the pumps are rather large for the interim period, particularly closed system conditions. Moderate to high flows will thus likely need to be recirculated using the RRVs in order to avoid high discharge pressures, and this is discussed more in the following subsection.
- Closed system discharge HGL: Figure 12 and Figure 13 plot the required Macville BPS discharge HGLs curves for the closed system state. These represent the minimum required discharge HGLs to maintain adequate minimum system pressures at different demands, that is, 40 psi for non-emergency conditions and 20 psi for MDD plus fire conditions. From these, the minimum required Macville BPS discharge HGLs are: (i) 315.1 m for 2031 PHD (25.0 ML/d) and (ii) 324.5 m for 2031 MDD plus fire (37.8 ML/d). Both of these are below the proposed Bolton PZ7 operating HGL of 327.7 m, thus indicating that an operating HGL range of 324.5-327.7 m HGL should maintain adequate minimum system pressures under PHD and MDD plus fire conditions.
- Station losses: Results from the system curve analysis indicate internal station head losses on the order of 2.4-4.1 m. For interim conditions, the station head loss corresponds to 6-11% of the design pump TDH, and this is fairly typical.

Table 11: System curves – list of analysis scenarios

Model Year	ID	Description	System Demand	No. Pumps On		Bolton SP Status	PZ7 Storage	Storage Levels*	
				Tullamore PZ6 PS	Sandhill PZ7 PS			PZ6	PZ7
2031 Closed System	1A	Typical	ADD	2	n/a	Draining	None	AWL	None
	1B	Typical	ADD	2	n/a	Filling	None	AWL	None
	1C	Lower	ADD	3	n/a	Draining	None	HWL	None
	1D	Upper	PHD	1	n/a	Filling	None	LWL	None
	1E	Fire	MDD+FF^	2	n/a	Filling	None	LWL	None
2031 Open System	2A	Typical	ADD	2	n/a	Filling	Macville	AWL	AWL
	2B	Lower	PHD	3	n/a	Draining	Macville	HWL	LWL
	2C	Upper	ADD	1	n/a	Filling	Macville	LWL	HWL
	2D	Design	MDD	2	n/a	Filling	Macville	AWL	AWL
	2E	Design	MDD	2	n/a	Filling	Castlederg	AWL	AWL
2051	3A	Typical	ADD	2	0	Filling	Both	AWL	AWL
	3B	Lower	PHD	3	0	Draining	Both	HWL	LWL
	3C	Upper	ADD	1	1	Filling	Both	LWL	HWL
	3D	Design	MDD	2	0	Filling	Both	AWL	AWL
	3E	Design	MDD	2	1	Filling	Both	AWL	AWL

* LWL = 40%, AWL = 70%, and HWL = 95% based on typical operating ranges.
^ Including a Bolton PZ7 fire flow demand of 250 L/s at the Option 3A lands high point.

Table 12: System curves – summary of design points

Design Conditions	Scenario	System Demand	No. Pumps On	Design Flow (ML/d)		TDH (m)	
				Station	Avg. Pump	Station	Avg. Pump
2031 Closed, Min. Required Pressures	1A	ADD	1	8.72	8.72	10.3	13.1
	1D	PHD	2	25.0	12.5	22.8	25.6
	1E	MDD+FF	2	37.8	18.9	32.2	35.2
2031 Closed, 327.7 m PZ7 HGL	1A	ADD	1	8.72	8.72	32.0	34.8
	1D	PHD	2	25.0	12.5	35.4	38.3
	1E	MDD+FF	2	37.8	18.9	35.4	38.4
2031 Open, Macville ET	2D	MDD	1	16.2	16.2	30.3	33.9
2031 Open, Castlederg ET	2E	MDD	1	16.2	16.2	29.9	33.5
2051, No Sandhill PZ7 PS	3D	MDD	3	64.1	21.4	33.3	37.4
2051, With Sandhill PZ7 PS	3E	MDD	3	46.8	15.6	31.7	35.6

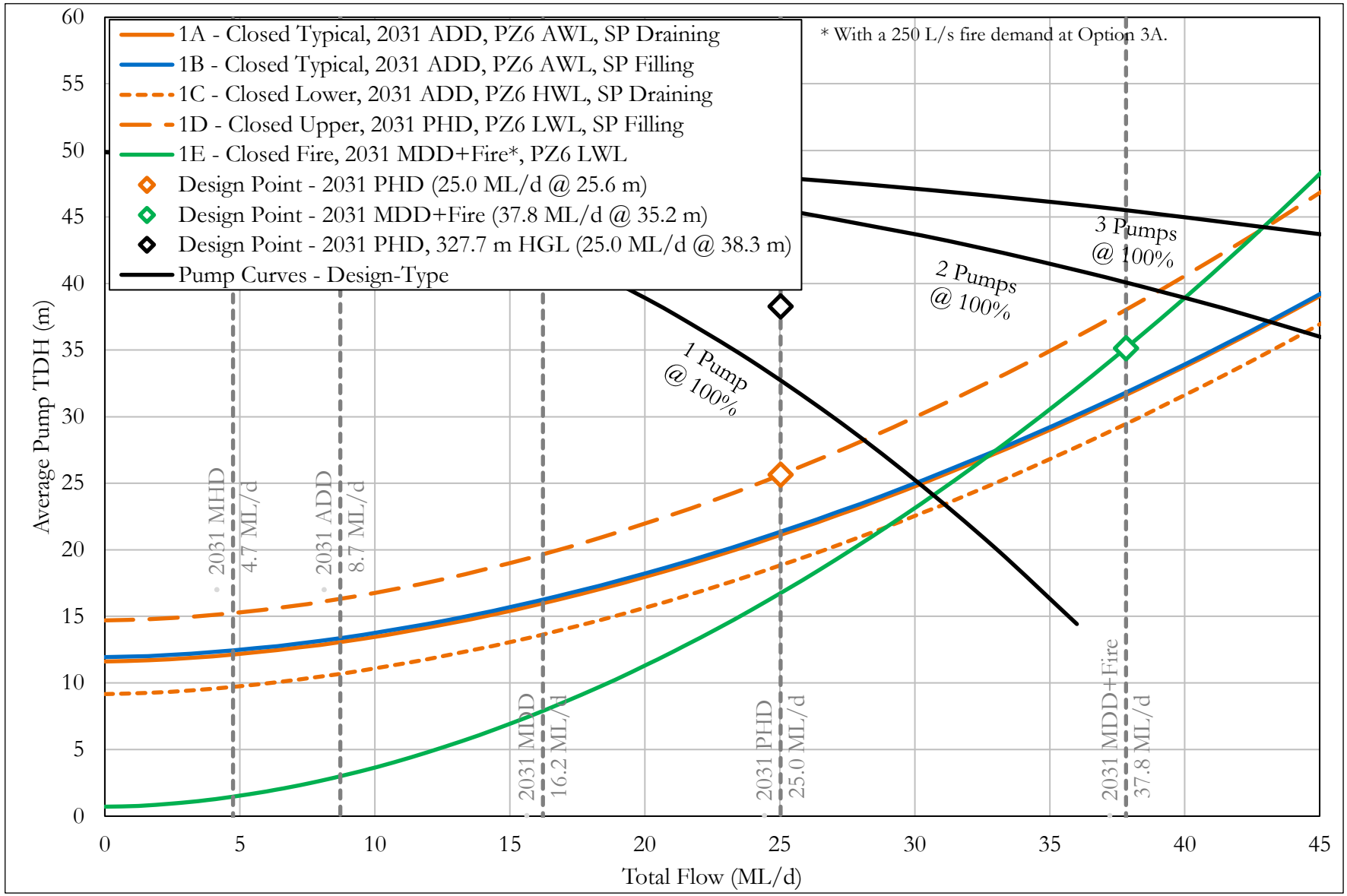

Figure 11: System curve results – 2031 closed system, pump TDH

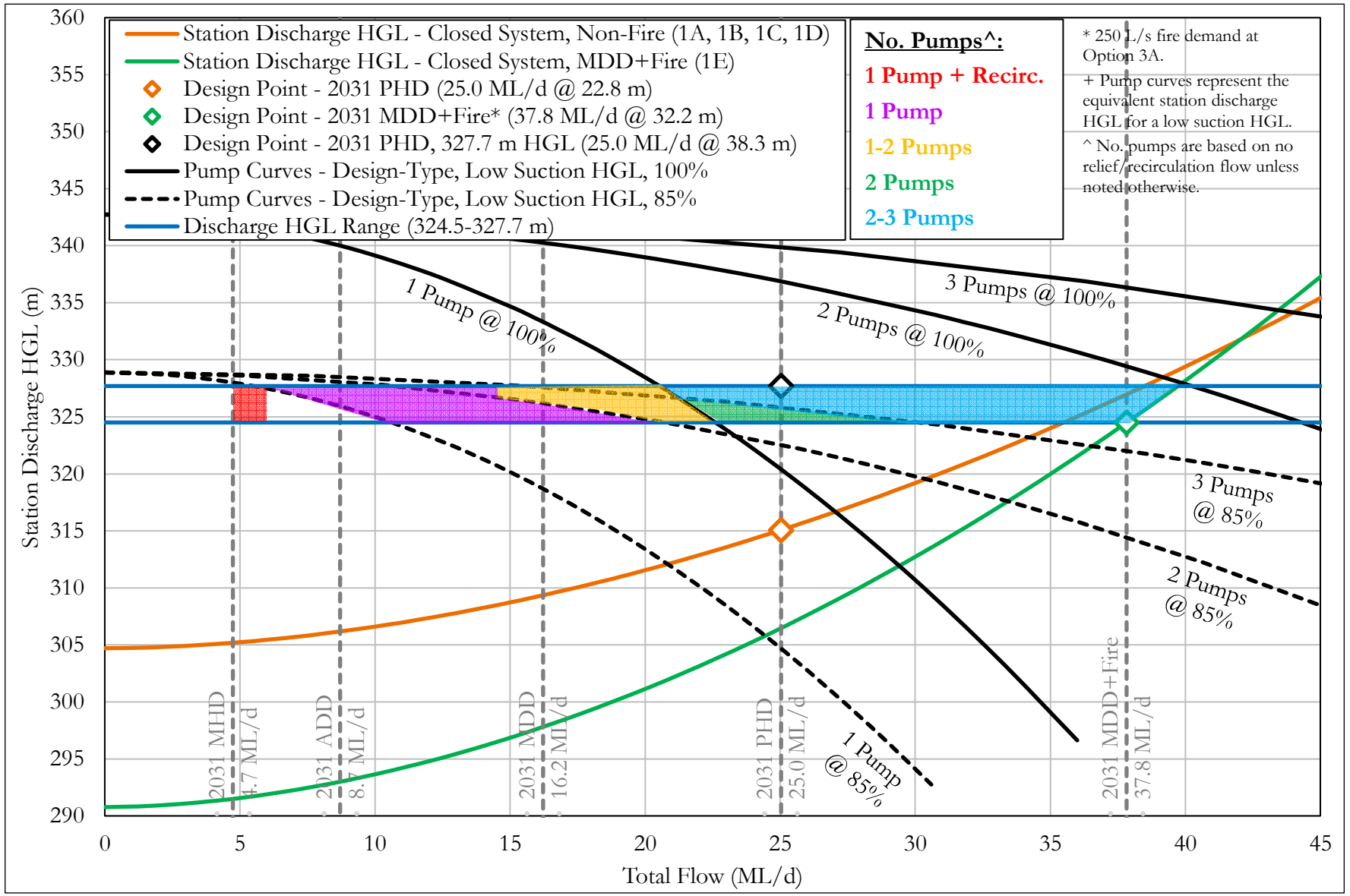

Figure 12: System curve results – 2031 closed system, Macville BPS discharge HGL for low suction HGL

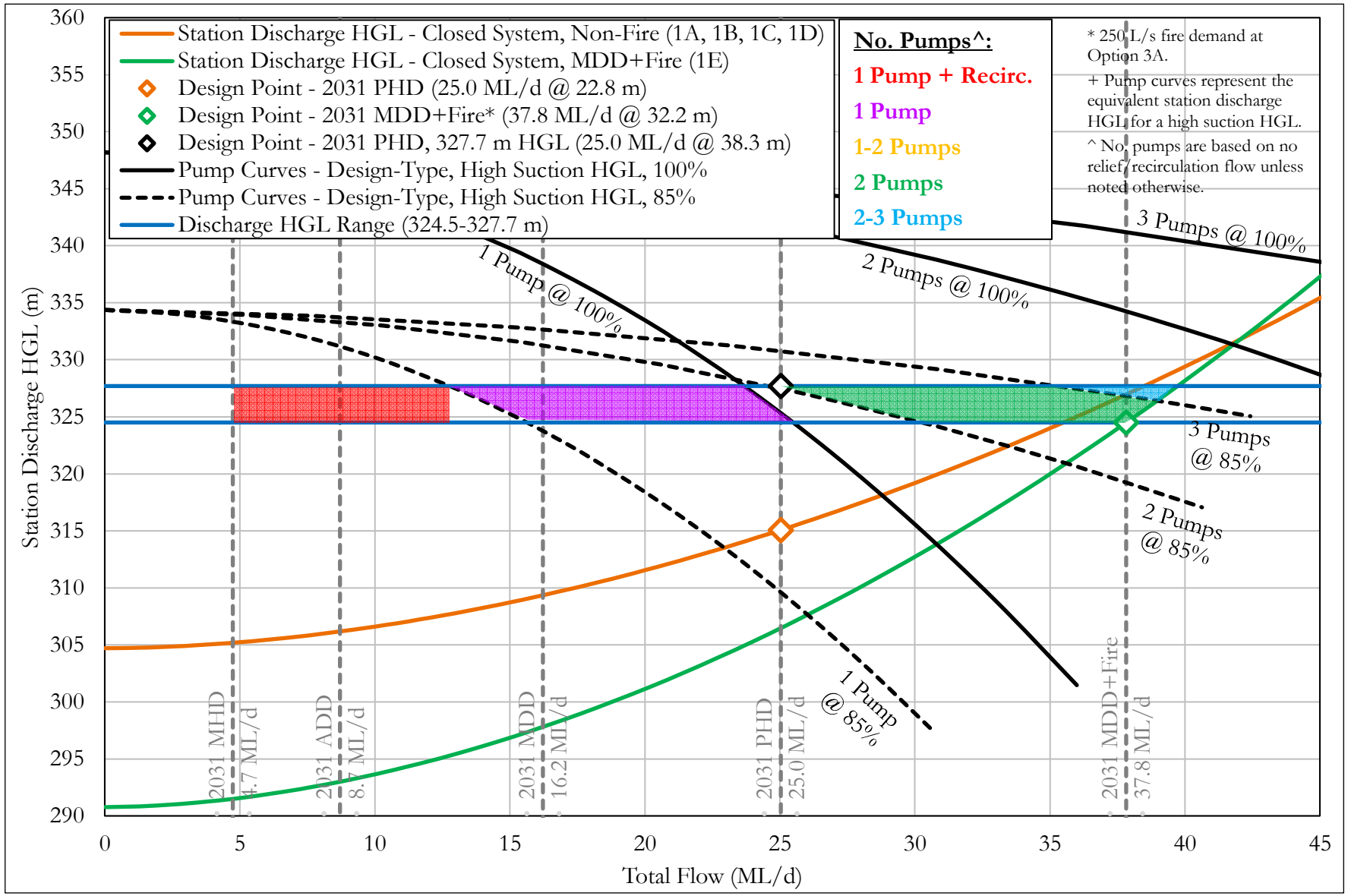

Figure 13: System curve results – 2031 closed system, Macville BPS discharge HGL for high suction HGL

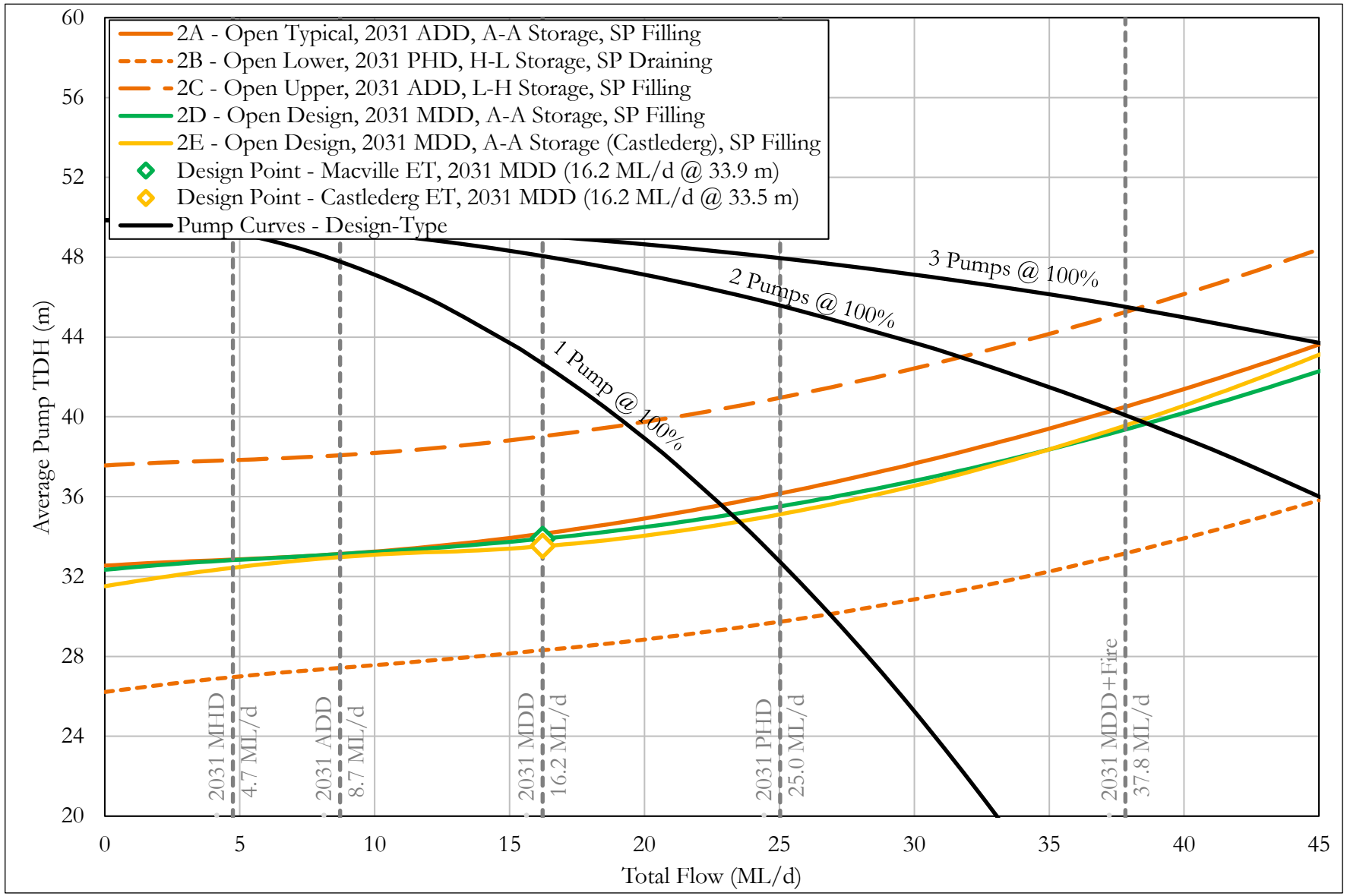

Figure 14: System curve results – 2031 open system, pump TDH

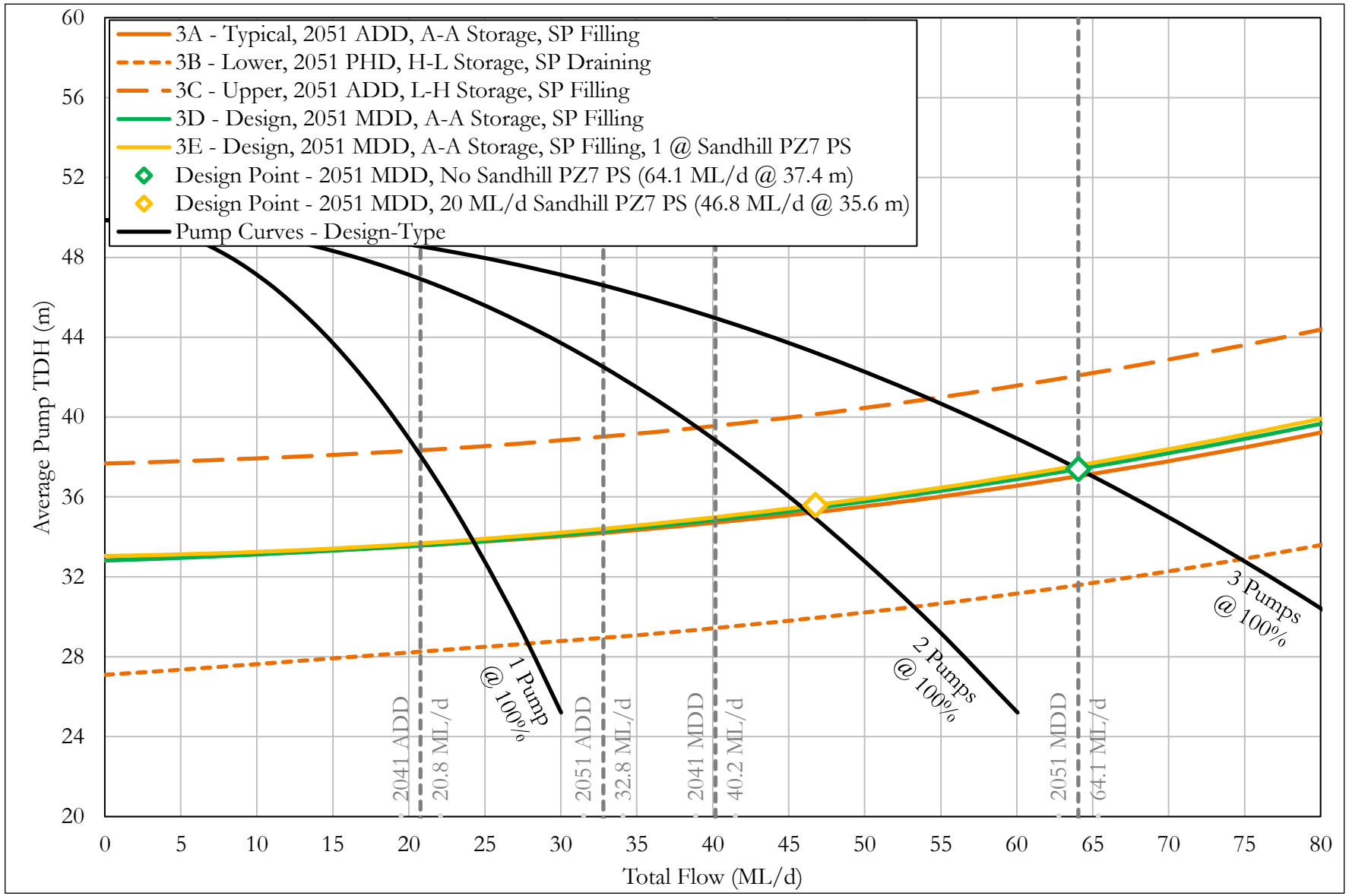

Figure 15: System curve results – 2051 open system, pump TDH

6.2 Macville BPS Operating Conditions

Macville BPS operating conditions were reviewed based on the system curve results and design-type pump curves. Regarding the latter, design-type pump curves were considered based on a station firm capacity of 64.1 ML/d for 2051 MDD (i.e., without Sandhill PZ7 PS). Table 13 lists the estimated total pump flow, individual pump flow, and pump TDH ranges for different system states, while Table 14 summarizes the Macville BPS hydraulics for select closed system operating conditions. Within Table 14, the station hydraulics are based on maintaining a discharge HGL of 327.7 m via a combination of VFDs and RRVs. Lastly, Table 15 and Table 16 summarize the estimated velocity and operating HGL (pressure) ranges, respectively. Below is a discussion of the station operating hydraulics:

- Overall operating ranges: Minimum and maximum values in Table 13 are based on the system curve bounds. The bounds and thus estimates are somewhat conservative, and typical minimum and maximum operating ranges are likely to be less extreme. Table 13 also indicates a narrower range of operating conditions for the closed system state compared to the future open system conditions with Bolton PZ7 floating storage. This is a result of the narrower system curves for the closed system state, which, in turn, are caused by the lack of discharge side storage level variations.
- Closed system pump flow ranges: From Figure 12 to Figure 15, the following is a summary of the estimated pump combinations for different potential flow ranges based on (i) maintaining a discharge HGL range of 324.5-327.7 m and (ii) typical VFD speed ranges of 85-100%:
    - One pump: 7.4 ML/d* to 28.0 ML/d (85% to 100% VFD speed).
    - Two pumps: 14.8 ML/d* to 42.1 ML/d (85% to 100% VFD speed).
    - Three pumps: Three pumps can provide greater flows, but this is not practical under closed system conditions due to: (i) low individual pump flows, (ii) marginal increase in capacity due to the system curve governing over the target discharge HGL, and (iii) pump flows greatly exceeding system demands, meaning much of the pump flow would have to be recirculated within the station to avoid over-pressurizing the system.
    - *Minimum pump flow: The minimum flow ranges are based on a minimum flow of 7.4 ML/d per pump. This corresponds to a minimum check valve velocity of 4 ft/s (1.2 m/s), which is necessary to avoid check valve flutter (and thus accelerated wear) for the Region's preferred type of check valve. Minimum acceptable pump flows may also be dictated by the pump-specific preferred operating range and minimum continuous flow.
- RRV flows: Functionally, the RRVs will recirculate water from the discharge header to the suction header[2] equal to the difference between the total pump flow and the system demand. Consequently, the relief/recirculation flow decreases as the pump VFD speeds decrease, but this also leads to lower pump flows, which is characterized by the 'relative pump flow' column in Table 14. Pump operation far from the pump rated flow is undesirable, since this can lead to lower pump efficiency, greater pump wear, and potentially premature pump failure. Suitable pump selection can help limit the impact of this. Moreover, low pump check valve velocities below 4 ft/s (1.2 m/s) may cause accelerated check valve wear as discussed in the preceding point.
- Closed system low demand periods: Minimum flows can be met through a combination of running a single pump at lower VFD speed and recirculating excess flows. During low demand periods such and MHD, some flows will need to be recirculated in order to (i) maintain the design discharge

[2] Recirculation/relief flows to the suction header may slightly increase the station suction pressure (HGL), but only marginally so due to the presence of nearby PZ6 storage at the Bolton ETs.

HGL below 327.7 m and (ii) prevent individual pumps from operating at too low pump flows[3]. Lower VFD speeds may be possible with even lower recirculation flows; though, as discussed in the preceding bullets, this can affect pump and check valve deterioration. .

- Closed system high demands: Peak demands (PHD and MDD plus fire) will be supplied by firm capacity pumping at Macville BPS with two duty pumps on. From the system curve results for interim closed system conditions (Figure 12 and Figure 13), two duty pumps can provide an estimated PHD firm capacity of 39 ML/d and MDD plus fire firm capacity of 40 ML/d based on the design-type pump curves. These exceed the respective design flows (25.0 ML/d for PHD, and 37.8 ML/d for MDD plus fire).
- Station velocities: Table 15 indicates generally adequate station velocities that are at/below 2.0 m/s. There are, however, some exceptions. High velocities are predicted at the 350 mm pump suction pipes (up to 3.4 m/s) and 300 mm pump discharge pipes (up to 4.6 m/s), although each of these is a relatively short section of pipe (less than 2 m) that is necessary to connect to the pump flanges. High maximum velocities are also predicted for the RRVs (up to 3.4 m/s). Though, such conditions will only arise if too many pumps and/or too high of pump VFD speeds are run during non-peak demand conditions, thus requiring excess flows to be recirculated.
- 2031 closed system firm capacity: Below are estimated firm capacities for 2031 closed system conditions based on a low suction-side supply HGL, a maximum station discharge HGL of 327.7 m, and minimum PZ7 system pressures of 40 psi for PHD and 20 psi for MDD plus fire:
    - PHD: 38.5 ML/d. This is governed by the upper station discharge HGL and the minimum system pressure criterion (40 psi), which is represented by the intersection of the orange and upper blue curves in Figure 12. The estimated spare capacities are (i) 13.5 ML/d with the zone realignment (system demand of 25.0 ML/d) and (ii) 17.9 ML/d with a deferred zone realignment (system demand of 20.6 ML/d).
    - MDD plus fire: 39.8 ML/d. This is governed by the upper station discharge HGL and the minimum system pressure criterion (20 psi), which is represented by the intersection of the green and upper blue curves in Figure 12. Moreover, this assumes pumping at the upper station discharge HGL limit during fire flow conditions. The estimated spare capacities are (i) 2.0 ML/d with the zone realignment (system demand of 37.8 ML/d) and (ii) 5.3 ML/d with a deferred zone realignment (system demand of 34.5 ML/d).

[3] Different-sized pumps can help meet low flows. Though, this is not preferred, since: (i) four same-sized pumps are operationally simpler; (ii) flow recirculation is still likely required; and (iii) there is less redundancy for either design low flows or firm capacity flows if any pump (small or large) is offline.

Table 13: Operating conditions – estimated ranges for station flow, pump flow, and pump TDH

System State	No. Pumps On	VFD Speed	Station Flow (ML/d)			Individual Pump Flow (ML/d)			Average Pump TDH (m)		
			Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.
2031 Closed*+	1	85%	7.4	9.0	10.6	7.4	9.0	10.6	35.8	37.1	38.4
		90%	12.0	13.7	15.3	12.0	13.7	15.3			
		95%	16.7	17.9	19.1	16.7	17.9	19.1			
		100%	20.5	21.6	22.6	20.5	21.6	22.6			
	2	85%	14.8	17.7	20.5	7.4	8.8	10.3	36.5	37.7	38.9
		90%	23.7	26.8	29.8	11.9	13.4	14.9			
		95%	32.6	34.9	37.2	16.3	17.5	18.6			
		100%	40.1	42.1	44.1	20.1	21.1	22.1			
2031 Open+ (Macville ET)	1	100%	19.3	22.9	26.9	19.3	22.9	26.9	30.1	35.5	39.7
	2	100%	31.5	37.2	45.3	15.8	18.6	22.7	35.8	40.4	43.1
	3	100%	38.2	45.0	55.4	12.7	15.0	18.5	40.5	43.7	45.4
2051 Open+	1	100%	20.6	24.2	28.0	20.6	24.2	28.0	28.4	33.4	38.2
	2	100%	39.0	46.1	53.0	19.5	23.1	26.5	30.6	35.3	39.4
	3	100%	54.5	65.0	75.0	18.2	21.7	25.0	32.7	36.6	40.8

* Station flows, pump flows, and average pump TDHs are for a Macville BPS discharge HGL of 324.5-327.7 m under conditions with no relief/recirculation flow.

\+ Values for minimum station flow, minimum pump flow, and maximum pump TDH are based on the upper system curve bounds (i.e., low suction-side storage levels, high discharge-side storage levels, and low demands). Conversely, values for maximum station flow, maximum pump flow, and minimum pump TDH reflect the lower system curve bounds (i.e., high suction-side storage levels, low discharge-side storage levels, and high demands).

^ Based on design-type pump curves.

Table 14: Operating conditions – station, pump, and RRV flows for interim closed system

System Conditions			Macville BPS					
Year and Demand Condition	Demand (ML/d)	Zone 6 Storage	No. Pumps On	VFD Speed	Total Flow* (ML/d)	Individual Pump Flow (ML/d)	Relative Pump Flow+	RRV Flow (ML/d)
2031 MHD	4.74	HWL	1	100%	23.8	23.8	11%	19.1
				95%	20.5	20.5	1%	15.8
				90%	17.0	17.0	-12%	12.3
				85%	12.8	12.8	-29%	8.1
				80%	7.4	7.4	-57%	2.7
2031 ADD	8.72	HWL	1	100%	23.8	23.8	11%	15.1
				95%	20.5	20.5	1%	11.8
				90%	17.0	17.0	-12%	8.3
				85%	12.8	12.8	-29%	4.1
2031 MDD	16.2	LWL	2	100%	40.2	20.1	-6%	24.0
				95%	32.6	16.3	-20%	16.4
				90%	23.5	11.8	-39%	7.3
				89%	16.2	8.1	-57%	0
2031 PHD	25.0	LWL	2	100%	40.2	20.1	-6%	15.2
				95%	32.6	16.3	-20%	7.6
				91%	25.0	12.5	-36%	0
			3	100%	58.0	19.3	-9%	33.0
				95%	47.5	15.8	-22%	22.5
				90%	34.1	11.4	-41%	9.1
				87%	25.0	8.3	-55%	0
2031 MDD+Fire	35.2	LWL	2	100%	40.1	20.1	-6%	2.3
				98%	37.8	18.9	-10%	0
			3	100%	58.5	19.5	-9%	20.7
				95%	47.5	15.8	-22%	9.7
				91%	37.8	12.6	-35%	0

* Estimated total Macville BPS pump flow based on maintaining a discharge HGL of 327.7 m.

^ Pump operating flow relative to pump design point flow at the corresponding speed. Most pumps have a preferred operating range of around -30% to +20% of their best efficient point (BEP) flow, which is typically (but not always) the design flow. Prolonged operation outside of the preferred range can lead to accelerated pump deterioration.

Table 15: Operating conditions – maximum estimated station velocities

System State	Year and Demand Condition	No. Pumps On	Maximum Velocity* (m/s)							
			Suction Side			Discharge Side				Two 300 mm RRVs
			1050 mm Header	750 mm Flow Meter	350 mm Pump+	300 mm Pump+	900 mm Header	750 mm Flow Meter	600 mm RRV Line	
2031 Closed	MHD	1	0.1	0.1	2.9	3.9	0.4	0.6	0.8	1.6
	ADD	1	0.1	0.2	2.9	3.9	0.4	0.6	0.6	1.2
		2	0.1	0.2	2.8	3.8	0.8	1.2	1.5	3.1
	MDD	1	0.2	0.4	2.9	3.9	0.4	0.6	0.3	0.6
		2	0.2	0.4	2.8	3.8	0.8	1.2	1.2	2.4
	PHD	2	0.3	0.7	2.8	3.8	0.8	1.2	0.9	1.7
		3	0.3	0.7	2.7	3.7	1.2	1.8	1.7	3.4
	MDD+ Fire	2	0.5	1.0	2.8	3.8	0.8	1.2	0.3	0.7
		3	0.5	1.0	2.7	3.7	1.2	1.8	1.2	2.4
2031 Open	Any	1	0.4	0.7	3.2	4.4	0.5	0.7	-	-
		2	0.6	1.2	2.7	3.7	0.8	1.2	-	-
		3	0.7	1.5	2.2	3.0	1.0	1.5	-	-
2051 Open	Any	1	0.4	0.7	3.4	4.6	0.5	0.7	-	-
		2	0.7	1.4	3.2	4.3	1.0	1.4	-	-
		3	1.0	2.0	3.0	4.1	1.4	2.0	-	-

* Velocities are reported for maximum anticipated flow conditions for the corresponding station pipe sections. Under closed system conditions, the proposed RRVs are assumed to limit the station discharge HGL to 327.7 m, and excess flows are recirculated. Green = adequate velocity (< 2 m/s), orange = moderately high velocity (2-3 m/s), and red = high velocity (> 3 m/s).

\+ The proposed pumps will have 500/350 mm suction pipes and 300/450 mm discharge pipes. Velocity results are presented for the short sections of smaller diameter pipes that connect directly to the pumps.

Table 16: Operating conditions – estimated ranges for station HGLs and pressures

Location	Pipe Centreline Elevation (m)	HGL* (m)		Operating Pressure (psi)	
		Min.	Max.	Min.	Max.
Suction Header	252.85	291.9	298.3	56	65
Pump Suction Pipe	256.08	291.6	298.3	51	60
Pump at Suction	256.47	291.3	298.3	50	60
Pump at Discharge	256.47	319.6	339.2	90	118
Pump Discharge Pipe	256.08	319.6	336.7	90	115
Discharge Header	255.85	319.6	334.1	91	111

* Minimum and maximum values are based on the overall range for 2031 closed system conditions, 2031 open system conditions, and 2051 open system conditions.

6.3 EPS of Typical Conditions

Table 17 lists the EPS analysis scenarios. Each scenario is based on a 48-hour EPS, which explores time varying flows, demands, and storage levels. Table 18, Table 19, and Table 20 summarize the analysis results for flows, watermain velocities, and system pressures, respectively, while Appendix A (Figure 16 to Figure 27) contains maps of minimum and maximum system pressures. Results from the EPS analysis are discussed below:

- System pressures:
  - 2026 existing conditions: Table 20 shows low Bolton PZ6 minimum pressures below 40 psi (as low as 37 psi). These low pressures occur under peak demand conditions in the two proposed realignment areas: around Highway 50/Columbia Way and around King St./ Trailview Ln. Both areas have high local elevations relative to typical PZ6 HGLs and are hydraulically distant from pumping and storage, which exacerbate low pressures.
  - 2031 interim closed system: Minimum local system pressures are improved and maintained above 40 psi with the recommended zone realignment. System pressures are predicted to increase by roughly 40 psi in the zone realignment areas. Overall, Bolton PZ7 system pressures are higher with maxima slightly above 100 psi (51-102 psi) for 2031 closed system conditions, and this is based on an average supply HGL of 323 m (mid-way between the future 327.7 m TWL and the minimum required closed system HGL). Actual PZ7 system pressures may vary from these values by up to ±7 psi depending on how Macville BPS is operated. Regarding high pressures above 100 psi, these are expected in low lying parts of the zone realignment, namely, the south end of the Columbia realignment area along Hathaway Ct. Indeed, there is a trade-off here: provide low pressures below 40 psi with PZ6 servicing, or provide high pressures above 100 psi with PZ7 servicing.
  - Future open system conditions (2036 to 2051): Bolton PZ7 system pressures are expected to vary more widely (42-108 psi) once floating storage is provided. This is due to the resulting variation in pumping at Macville BPS and, eventually, Sandhill PZ7 PS to cycle storage, which in turn leads to varying system HGLs and pressures. Some Bolton PZ7 areas are likely to experience high pressures of up to 108 psi. As noted in the preceding point, high pressures are predicted to occur in low-lying realigned areas from the existing PZ6 system.
- System flows:
  - Macville BPS: Table 18 shows a range of Macville BPS flows depending on the system state (open or closed), system demand, and status of Sandhill PZ7 PS. For interim closed system conditions, Macville BPS flows will vary significantly from MHD up to PHD and MDD plus fire, since the station flows will be dictated by the system demand. Station flows will shift once Macville ET is built, as system demands increase, and as Sandhill PZ7 PS begins supplying Bolton PZ7.
  - Bolton PZ7 supply capacity: With the proposed Macville BPS pumps sized for 2051 MDD, the system curve results and EPS results indicate that Macville BPS alone is expected to be capable of supplying foreseeable Bolton PZ7 demands, including 2031 PHD, 2031 MDD plus fire, and 2051 MDD. Together with Sandhill PZ7 PS at a nominal firm capacity of 17 ML/d, the combined Bolton PZ7 supply capacity (around 80 ML/d) greatly exceeds estimated system demands.
- Watermain velocities: From Table 20, average velocities in the subject proposed watermains are predicted to range from 0.1 to 1.2 m/s. Maximum velocities are below 1.3 m/s, suggesting that the proposed watermain diameters are suitable.

Table 17: EPS of typical conditions – list of analysis scenarios

Scenario	Model Year	Demand Condition	System Conditions			
			Zone Boundaries	PZ7 Storage		Sandhill PZ7 PS
				Macville ET	Castlederg ET	
4A	2026	ADD	Existing	Not Built	Not Built	Not Built
4B	2026	MDD	Existing	Not Built	Not Built	Not Built
5A	2031A	ADD	Realigned	Not Built	Not Built	Not Built
5B	2031A	MDD	Realigned	Not Built	Not Built	Not Built
6A	2031B	ADD	Realigned	Active	Not Built	Not Built
6B	2031B	MDD	Realigned	Active	Not Built	Not Built
7A	2036	ADD	Realigned	Active	Active	Active
7B	2036	MDD	Realigned	Active	Active	Active
8A	2041	ADD	Realigned	Active	Active	Active
8B	2041	MDD	Realigned	Active	Active	Active
9A	2051	ADD	Realigned	Active	Active	Active
9B	2051	MDD	Realigned	Active	Active	Active

Table 18: EPS of typical conditions – summary of facility and watermain flows

Scenario	Year and Demand	Flow (ML/d)							
		Macville BPS*		Sandhill PZ7 PS		600 mm Emil Kolb PZ7 WM		600 mm King PZ7 WM	
		Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.
5A	2031A ADD	8.6	13.2	-	-	2.3	3.2	5.3	9.5
5B	2031A MDD	16.2	25.0	-	-	3.9	5.7	10.4	18.2
6A	2031B ADD	8.8	21.5	-	-	2.3	3.2	6.9	19.7
6B	2031B MDD	16.4	22.6	-	-	3.9	5.7	10.6	18.8
7A	2036 ADD	13.0	33.3	3.1	19.4	2.6	7.8	2.5	4.9
7B	2036 MDD	18.0	33.3	12.0	20.0	4.7	11.9	2.8	5.9
8A	2041 ADD	14.3	31.8	5.5	19.8	3.4	9.3	2.7	4.9
8B	2041 MDD	23.4	33.3	15.9	20.0	6.5	17.4	3.7	8.0
9A	2051 ADD	29.2	49.1	5.0	19.8	5.3	13.0	6.0	10.2
9B	2051 MDD	50.6	67.6	13.7	19.9	9.6	24.8	10.2	17.4

* These flows (Macville BPS) are the same for the proposed 1050 mm Emil Kolb PZ6 watermain and 900 mm Emil Kolb PZ7 watermain.

Table 19: EPS of typical conditions – summary of watermain velocities

Scenario	Year and Demand	Velocity (m/s)							
		1050 mm Emil Kolb PZ6 WM		900 mm Emil Kolb PZ7 WM		600 mm Emil Kolb PZ7 WM		600 mm King PZ7 WM	
		Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.
5A	2031A ADD	0.12	0.18	0.16	0.24	0.09	0.13	0.22	0.39
5B	2031A MDD	0.22	0.33	0.29	0.46	0.16	0.23	0.43	0.75
6A	2031B ADD	0.12	0.29	0.16	0.39	0.09	0.13	0.28	0.81
6B	2031B MDD	0.22	0.30	0.30	0.41	0.16	0.23	0.43	0.77
7A	2036 ADD	0.17	0.45	0.24	0.61	0.10	0.32	0.10	0.20
7B	2036 MDD	0.24	0.44	0.33	0.61	0.19	0.49	0.11	0.24
8A	2041 ADD	0.19	0.43	0.26	0.58	0.14	0.38	0.11	0.20
8B	2041 MDD	0.31	0.45	0.43	0.61	0.27	0.71	0.15	0.33
9A	2051 ADD	0.39	0.66	0.53	0.89	0.22	0.53	0.25	0.42
9B	2051 MDD	0.68	0.90	0.92	1.23	0.39	1.02	0.42	0.71
Max.:		**0.68**	**0.90**	**0.92**	**1.23**	**0.39**	**1.02**	**0.43**	**0.81**

Table 20: EPS of typical conditions – summary of system pressures

Scenario	EPS System Pressures* (psi)											
	Bolton PZ6+				Bolton PZ7				Z6-to-Z7 Realignment			
	Min.		Max.		Min.		Max.		Min.		Max.	
	Min.	P5	P95	Max.	Min.	P5	P95	Max.	Min.	P5	P95	Max.
4A	41	44	70	83	-	-	-	-	41	43	59	64
4B	37	41	70	83	-	-	-	-	37	39	59	64
5A	43	47	70	82	62	78	96	102	80	82	97	102
5B	45	49	71	83	51	77	95	101	79	81	96	101
6A	45	48	71	83	60	76	102	108	81	83	103	108
6B	43	47	71	82	52	74	102	108	80	82	102	108
7A	45	48	71	83	47	65	101	106	80	82	101	106
7B	44	48	71	83	47	65	101	106	79	81	100	106
8A	44	48	71	83	47	65	101	106	79	82	101	106
8B	44	47	71	83	45	65	101	104	75	77	99	104
9A	44	48	71	83	46	65	102	107	79	82	101	107
9B	42	47	71	83	42	64	103	105	75	77	100	105

* Results are presented for the overall range (min. and max.) and select percentiles (e.g., P5 for minimum pressures represents the 5th percentile of minimum EPS pressures).
\+ For the Bolton PZ6 system north of Healey Rd./Queensgate Blvd.

6.4 Fire Flows

Table 21 lists the AFF analysis scenarios. AFFs were modeled for all of Bolton PZ7 and the PZ6 area north of Healey Rd./Queensgate Blvd. The scenarios consider different time periods (2026 to 2051), and each scenario is based on MDD with PZ6 and PZ7 storage at LWLs of 40%. Table 22 presents a summary of the results by area, while fire flow results maps are presented in Appendix B (Figure 28 to Figure 33). Results from the AFF scenarios show fire flow capacities that are generally above 100 L/s across the study area. This is largely due to a high degree of watermain looping. Some local areas have lower capacities, and these are mostly at small dead-ended older watermains with no looping and low capacity. Regarding the zone realignment, Table 22 and Appendix B (Figure 28 and Figure 29) indicate an immediate increase in AFFs by an aggregate of at least 50% for the PZ6-to-PZ7 realignment areas following the zone realignment, which is a benefit of higher static pressures with PZ7 servicing. Adjacent existing PZ6 lands are not materially affected. Over time, some areas experience a slight progressive drop in AFF capacity, and this is caused by increased system demand. However, some other areas experience an increase in AFF capacity as new infrastructure comes online, including the future Macville ET, Castlederg ET, and Sandhill PZ7 PS. Altogether, the fire flow results suggest that the proposed servicing strategy will improve the overall level of service for AFFs. For areas with low capacity concerns, modeling results can be compared against historical hydrant flow test data to verify risks.

Table 21: Fire flows – list of analysis scenarios

Scenario*	Model Year	System Conditions			
		Zone Boundaries	PZ7 Storage		Sandhill PZ7 PS
			Macville ET	Castlederg ET	
10A	2026	Existing	Not Built	Not Built	Not Built
10B	2031A	Realigned	Not Built	Not Built	Not Built
10C	2031B	Realigned	Active	Not Built	Not Built
10D	2036	Realigned	Active	Active	Active
10E	2041	Realigned	Active	Active	Active
10F	2051	Realigned	Active	Active	Active

* Fire flow analysis scenarios consider MDD, firm capacity pumping at Macville BPS and Sandhill PZ7 PS, one pump on at North Bolton BPS, and storage at LWLs of 40%.

Table 22: Fire flows – results summary

Scenario	AFF Results Summary*+ (L/s)											
	Bolton PZ6				Bolton PZ7				Z6-to-Z7 Realignment			
	Min.	P1%	P50%	P90%	Min.	P1%	P50%	P90%	Min.	P1%	P50%	P90%
10A	41	60	190	487	-	-	-	-	41	53	173	321
10B	54	61	200	580	70	88	285	582	70	88	272	570
10C	54	61	199	578	67	86	302	680	67	85	283	616
10D	54	62	202	606	66	86	327	796	66	85	285	649
10E	54	62	202	606	66	86	316	785	66	84	283	640
10F	52	60	192	586	63	85	361	806	63	82	287	629

* AFF results are presented for the minimum, maximum, and select percentiles for the corresponding noted areas. For example, a value of P1% = 88 L/s denotes the 1st percentile AFF result, whereby 1% of junctions have an AFF result less than 88 L/s and 99% of junctions have an AFF result greater than 88 L/s.

\+ For a given location, the AFF represents the maximum flow that can be withdrawn under MDD conditions subject to (i) maintaining local and broader system pressures above 20 psi (140 kPa; 14.3 m) and (ii) conservatively limiting velocities to less than 5 m/s. The latter criterion, while not required per the Region's standards, yields more conservative results, and it is considered here as a reasonable limit for practical purposes.

7. CONCLUSIONS AND RECOMMENDATIONS

A hydraulic modeling analysis was completed to support the detailed design of the proposed Macville BPS, various PZ7 watermains, and a local zone realignment. The Region's InfoWater Pro EPS model was used as a basis for the analysis, and updates were made according to design drawings, the North Bolton water servicing strategy, and the Region's draft 2024 DC update study. Key objectives for the analysis comprised: developing system (resistance) curves for Macville BPS over a range of conditions, identifying station design points, exploring station operating conditions, and assessing the Bolton PZ7 water system performance for system pressures and fire flows. Based on the analysis results, the following concluding remarks and recommendations are provided to support the design of the proposed water system upgrades:

7.1 Macville BPS:

1. Updated design flows: Below is a summary of updated design flows for Macville BPS based on the Region's InfoWater model and estimated development water demands:
    a. 2031 PHD: 25.0 ML/d (290 L/s)
    b. 2031 MDD plus fire: 37.8 ML/d (438 L/s) based on a 250 L/s fire demand.
    c. 2051 MDD without Sandhill PZ7 PS: 64.1 ML/d (741 L/s).
    d. 2051 MDD with Sandhill PZ7 PS: 46.8 ML/d (541 L/s) based on a nominal 17.3 ML/d (200 L/s) capacity for Sandhill PZ7 PS.

2. Pump design points: Design points are listed below for the proposed four pumps:
    a. Pump capacity for 2051 MDD [required]: 21.4 ML/d at 37.4 m pump TDH based on a station firm capacity of 64.1 ML/d for 2051 PHD, four pumps (three duty and one standby), no Sandhill PZ7 PS, and PZ6 storage at AWLs.
    b. Pump typical operating point #1 [optional]: 24.3 ML/d at 33.8 m pump TDH – this point is not a strict design requirement, rather, the selected pump should operate efficiently (and without any cavitation) around this point when run on its own under interim closed system conditions at full (100%) VFD speed with a station discharge HGL between 319.7 to 327.7 m.
    c. Pump typical operating point #2 [optional]: 22.9 ML/d at 35.6 m pump TDH – this point is not a strict design requirement, rather, the selected pump should operate efficiently (and without any cavitation) around this point when run on its own under future open system conditions at full (100%) VFD speed.
    d. Estimated overall pump flow range: 7.4 to 28.0 ML/d based on interim closed and future open system conditions and a VFD speed range of 85-100%.
    e. Estimated typical pump TDH range: 28.4 to 45.4 m based on interim closed and future open system conditions and a VFD speed range of 85-100%.
    f. Design minimum NPSHa: 40.9 m absolute, including a safety factor for the greater of 10% and 1.5 m according to HI standards.

3. Closed system firm capacity: Below are the estimated Macville BPS firm capacities based on 2031 closed system conditions, low station suction HGL conditions, a maximum station discharge HGL of 327.7 m, and minimum PZ7 system pressures of 40 psi for PHD and 20 psi for MDD plus fire:

a. 2031 PHD: 38.5 ML/d.

b. 2031 MDD plus fire: 39.8 ML/d.

4. Closed system spare firm capacity: Below are the estimated spare capacities based on a comparison of the preceding closed system firm capacities and system demands:
   a. With proposed PZ6/PZ7 zone realignment: 13.5 ML/d spare capacity for PHD and 2.0 ML/d spare capacity for MDD plus fire (with a 250 L/s fire demand).
   b. Deferred PZ6/PZ7 zone realignment: 17.9 ML/d spare capacity for PHD and 5.3 ML/d spare capacity for MDD plus fire (with a 250 L/s fire demand).

5. Station velocities: Maximum Macville BPS velocities are generally at/or less than 2.0 m/s for interim and future system conditions with the proposed pipe diameters and station layout. There are two exceptions to this:
   a. 350 mm pump suction and 300 mm pump discharge pipes: Maximum velocities are predicted to reach (i) 3.4 m/s at the 350 mm pump suction pipes and (ii) 4.6 m/s at the 300 mm pump discharge pipes. It is understood, however, that the corresponding sections of pipe are relatively short (less than 2 m), and the smaller diameters are necessary to connect to the pump flanges. If feasible, these pipe sections should be upsized to 400 mm to reduce peak velocities to less than 3 m/s.
   b. 750 mm suction header flow meter: Maximum velocities are predicted to reach up to 2.0 m/s under future conditions at the buildout firm capacity of 64.1 ML/d. Accordingly, the suction side flow meter may need to be upsized in the future, and this can be reviewed when Bolton PZ7 is converted to an open system and routine higher Macville BPS flows are possible.

6. Relief/recirculation valves: Two relief/recirculation valves are proposed for Macville BPS for secondary discharge pressure control to the proposed VFDs under interim closed system conditions. Recommendations are listed below for the relief/recirculation valve.
   a. Valve sizes: One 250 mm reduced-port globe-style valve and one 200 mm reduced-port globe-style valve[4]. The smaller valve can function as the lead valve with greater control at low flows, while the larger valve can function as the lag valve to provide additional recirculation capacity and redundancy. Together, these valves would have an estimated recirculation capacity of around 49 ML/d, which is more than sufficient for anticipated potential recirculation flows. The aforementioned should be checked and reviewed by a valve manufacturer.
   b. Line sizes: The proposed 600 mm main line and 300 mm RRV line sizes are adequate.
   c. HGL/pressure set points: 327.7 m for the smaller lead valve and 329.1 m for the larger lag valve. The corresponding pressure set points can be determined once the valve elevations are finalized and once the VFD control logic is optimized.
   d. Flow meter: A flow meter should be installed on the relief/recirculation main line in order to monitor station operating conditions and to calculate the total pump flow in conjunction with the station discharge flow meter.

[4] The current design drawings feature two 300 mm RRVs. Although larger RRVs have greater capacity, they can be slower to respond to hydraulic changes, and they provide less pressure control at low flows. Accordingly, a 250 mm RRV and a 200 mm RRV are recommended in order provide sufficient pressure control and flow capacity.

7. Bypass check valve: A bypass (PZ6 suction-to-PZ7 discharge) check valve should be included in the Macville BPS station design for emergency backup supply in the event of a loss of pumping. The current design drawings show a 750 mm bypass check valve, and this is adequate for bypass purposes.

8. Pressure control mode for interim closed system: The proposed Macville BPS VFDs should be used for primary pressure control with Bolton PZ7 as a closed system. The relief/recirculation valves can provide secondary control, whereby they will activate if required to prevent otherwise higher discharge pressures. The above are preliminary recommendations that need to be finalized as part of the process control design.

9. Discharge HGL for interim closed system: The pressure controls should be configured with a target station discharge HGL band of 324.5 m to 327.7 m (3 m band) to avoid VFD speed cycling and to minimize pump start-stop operations. The lower HGL limit (324.5 m) is based on servicing a maximum Bolton PZ7 elevation of 276.5 m and meeting a fire flow demand of 250 L/s. Moreover, if desired, a narrower operating HGL band can be considered, and the RRV set points should be reviewed and updated accordingly.

7.2 Proposed Watermains:

10. Watermain velocities and diameters: Maximum velocities are predicted to be below 1.3 m/s for the proposed PZ6 and PZ7 watermains. Accordingly, the proposed watermain diameters are suitable.

11. Watermain design pressures: Design operating and total (transient) pressures should be analyzed and confirmed as a part of the planned hydraulic transient analysis.

12. Additional watermain connections: Below are recommendations for proposed watermain connections in addition to the start and end points:
    a. 1050 mm Emil Kolb PZ6 watermain: None.
    b. 900 mm Emil Kolb PZ7 watermain: The design should consider providing a connection stub at Emil Kolb Pkwy./King St. for potential interconnection with the future 750 mm Castlederg PZ7 feedermain.
    c. 600 mm Emil Kolb PZ7 watermain: The design should consider providing a connection stub around Emil Kolb Pkwy./Duffy's Lane for potential interconnection with the future 750 mm Castlederg PZ7 feedermain.
    d. 600 mm King Street PZ7 watermain: Two connections should be provided to the existing local PZ6 (future PZ7) distribution system at the south side of King St.: a 300 mm connection near Trailview Ln. and a 300 mm connection near Headwater Rd.

7.3 Zone Realignment:

13. Watermain upgrades for zone realignment: The following water system upgrades are required for the zone realignment to maintain adequate supply, looping for redundancy, and water quality circulation after the zone realignment:
    a. Whitehead-Longwood watermain: 940 m of 200 mm watermain along Whitehead Cres. and Longwood Dr. from the existing 400 mm PZ6 watermain along Queen St. N. to the existing 200 mm PZ6 watermain along Kingsview Dr. (east intersection).

b. Highway 50/Bolton Heights interconnection: 400 mm interconnection between the two existing 400 mm watermains along Queen St. N. This interconnection should be designed south of the Highway 50 check valve and PZ7 bypass mentioned below.

c. Highway 50/Bolton Heights bypass: 40 m of 400 mm PZ7 bypass watermain at the northeast corner of Highway 50/Bolton Heights Rd. from the existing 400 mm watermain along Highway 50 (north of Bolton Heights Rd.) to the existing 400 mm watermain along Bolton Heights Rd. (east of Highway 50/Queen St. N.).

14. PZ6-to-PZ7 check valves: Check valves are recommended at the following distribution system locations to provide local emergency backup supply in the event of a loss of pumping at Macville BPS under interim closed system conditions:

    a. Highway 50 check valve: Along the existing 400 mm Highway 50 watermain to be located south of the proposed 400 mm Highway 50/Bolton Heights bypass discussed above. The purpose of this check valve is to provide emergency backup supply to the realigned PZ6-to-PZ7 area.

    b. Harvest Moon check valve: Along the existing 300 mm Harvest Moon watermain at Ironhorse Cres. The purpose of this check valve is to provide emergency backup supply to the realigned PZ6-to-PZ7 area.

7.4 Additional Considerations:

15. Changes to station design flow, layout, and pipes: If the proposed Macville BPS station design flow(s), layout, and/or pipe diameters change, the system curve results and design points should be updated accordingly to accurately consider system and station local losses.

16. Hydraulic transient analysis: A hydraulic transient analysis should be completed during late detailed design of the proposed Macville BPS and subject watermains to determine design pressures, identify surge protection requirements, and assess potential risks to the Region's existing PZ6 and future PZ7 water systems. Hydraulic transient risks are often lower for closed pressure systems due to having typically lower flows and a lack of a storage reflection point, but, given the long-term plan to have floating storage in Bolton PZ7, a hydraulic transient analysis is warranted. The hydraulic transient analysis can also explore the system response to routine pump start-stop operations, including assessing the sequencing and control logic for the proposed BPS pumps.

APPENDIX A: EPS SYSTEM PRESSURE RESULTS MAPS

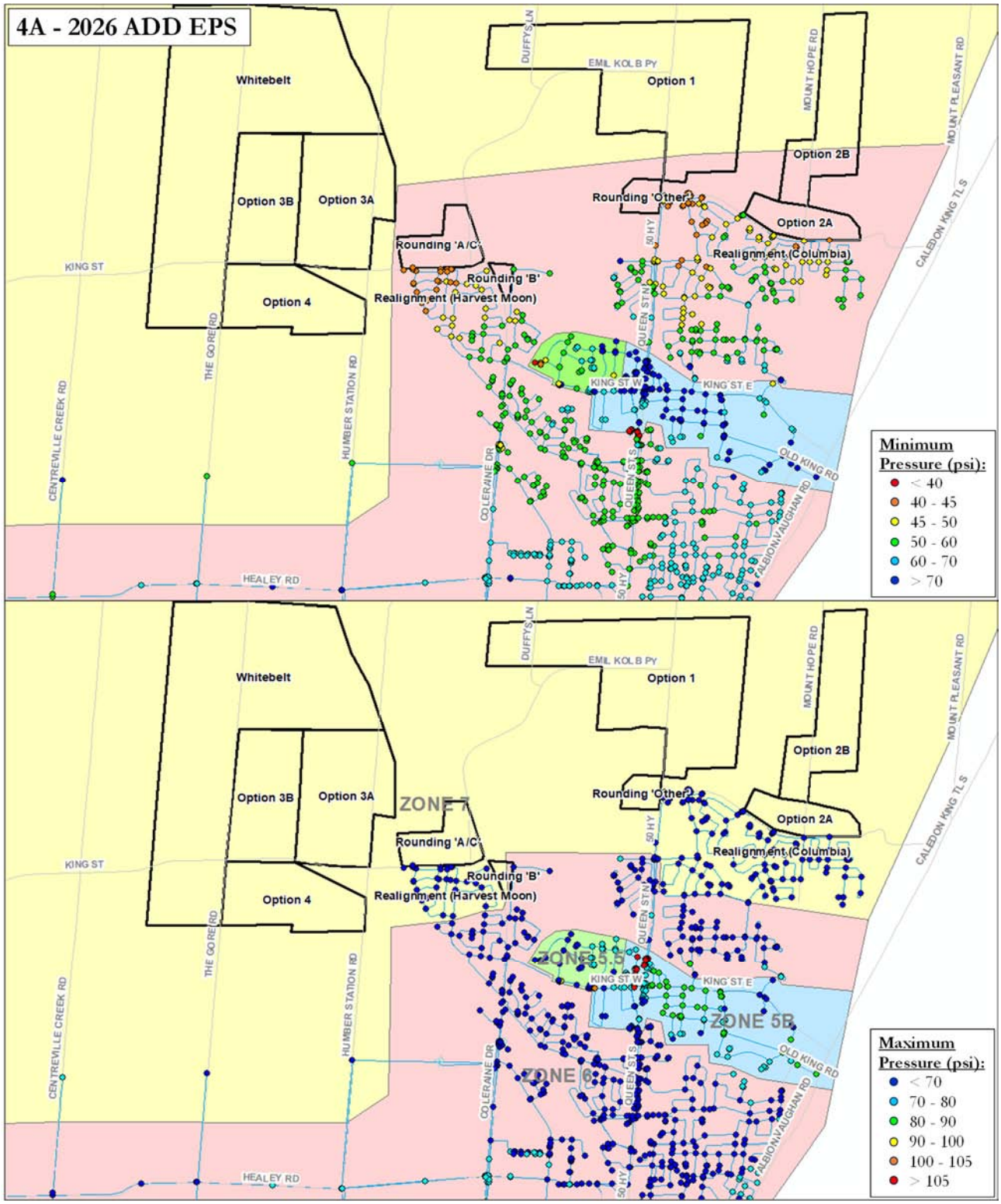

Figure 16: System pressures – Scenario 4A (2026 ADD EPS, existing zones)

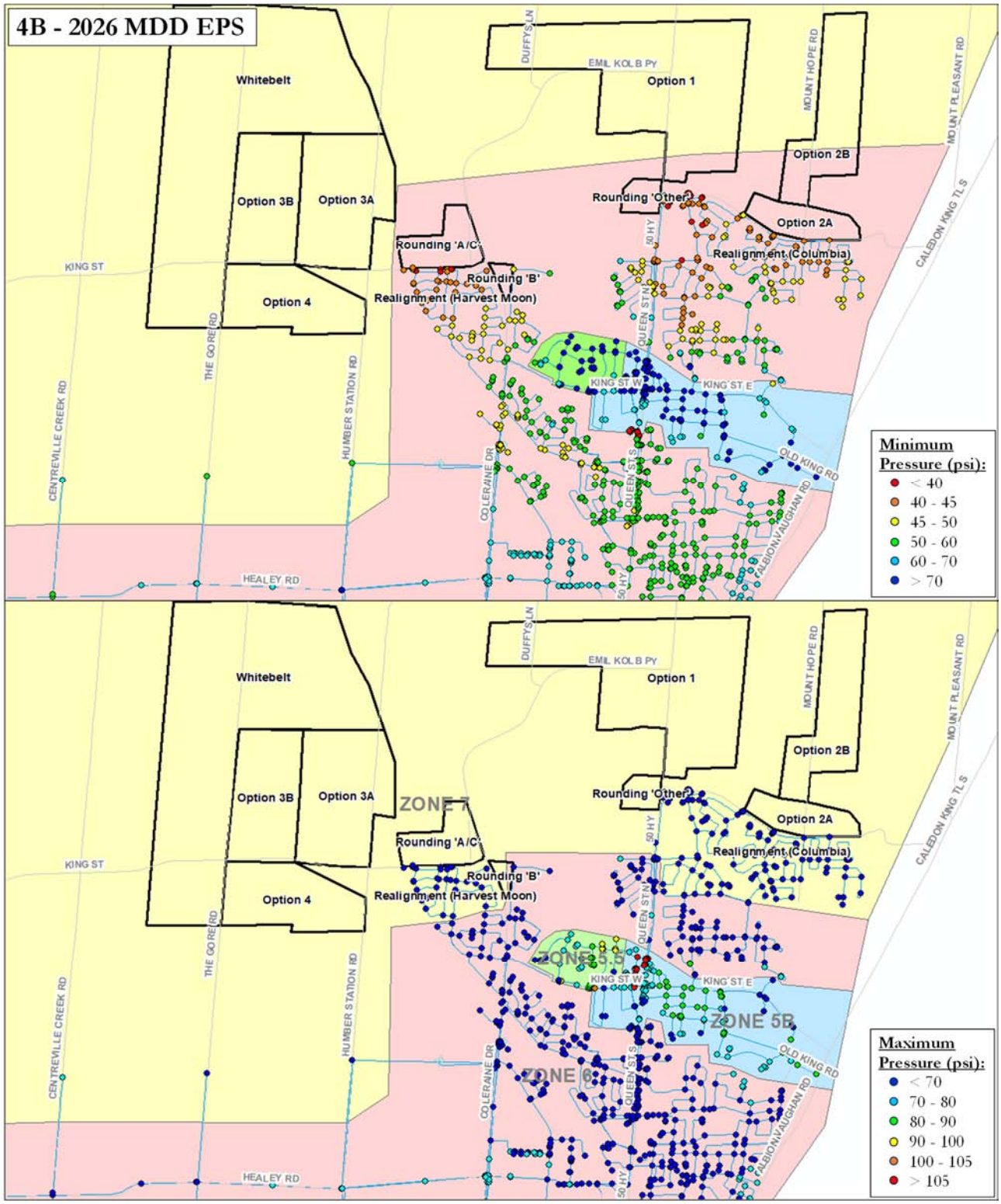

Figure 17: System pressures – Scenario 4B (2026 MDD EPS, existing zones)

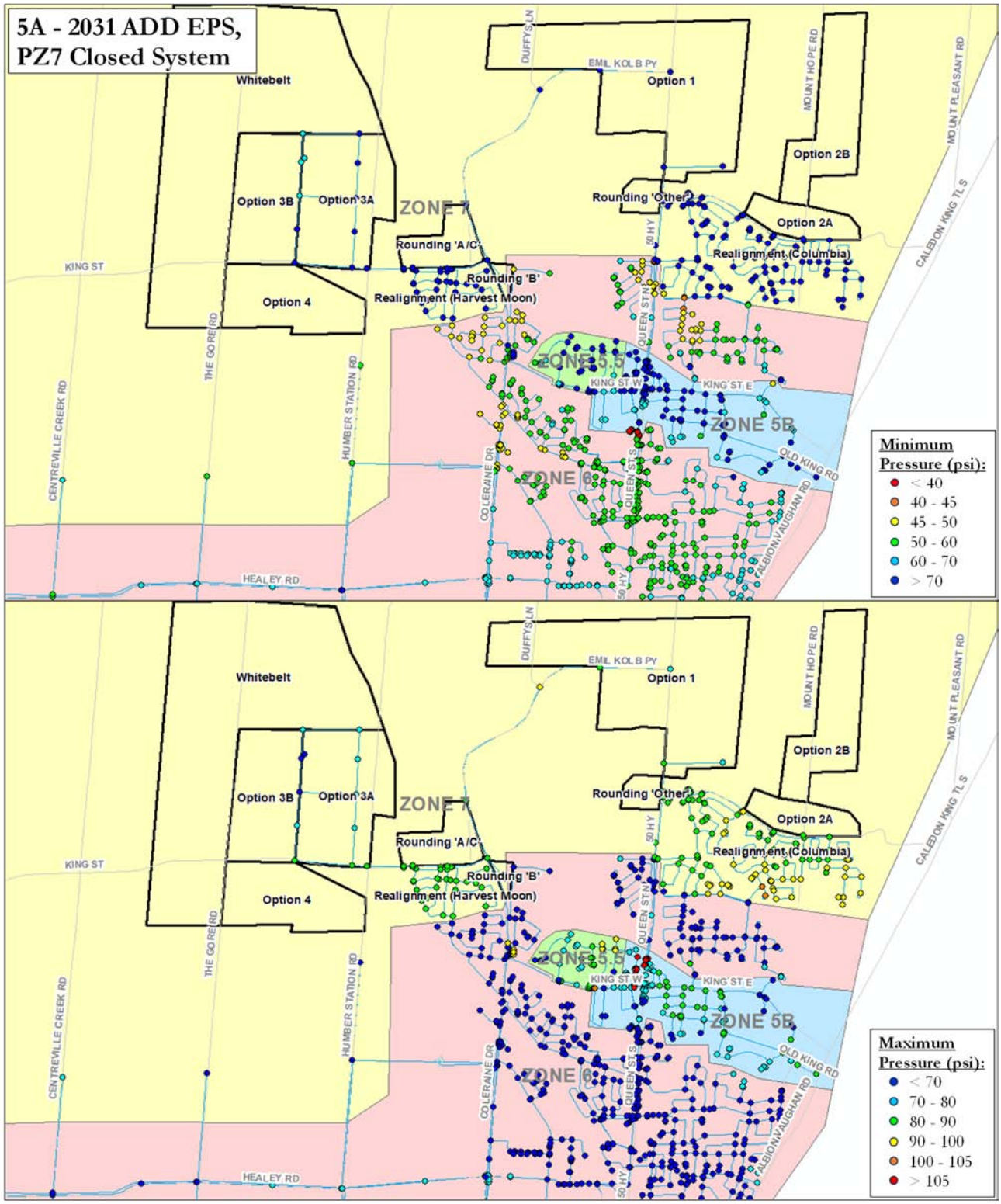

Figure 18: System pressures – Scenario 5A (2031 ADD EPS, PZ7 closed system)

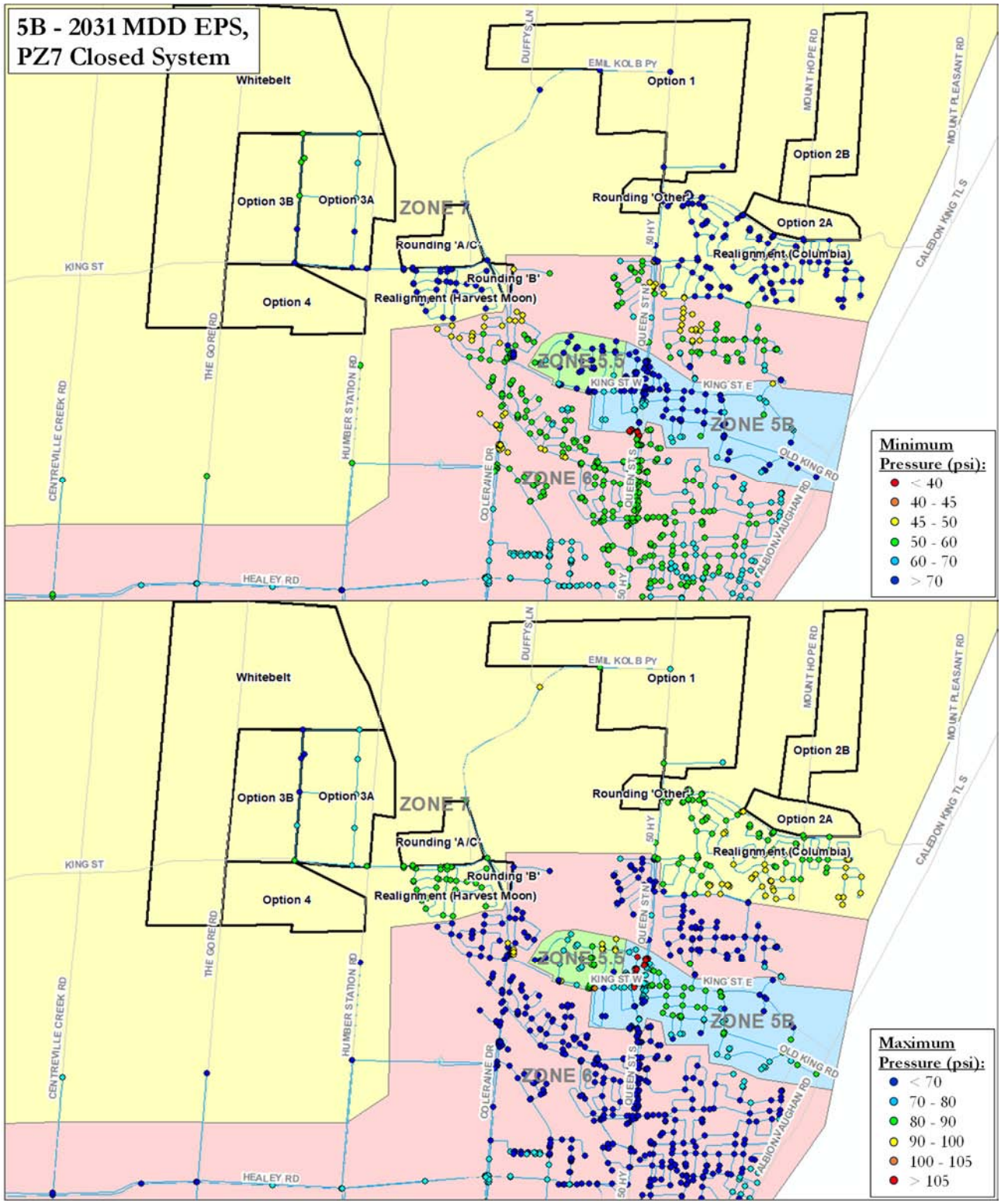

Figure 19: System pressures – Scenario 5B (2031 MDD EPS, PZ7 closed system)

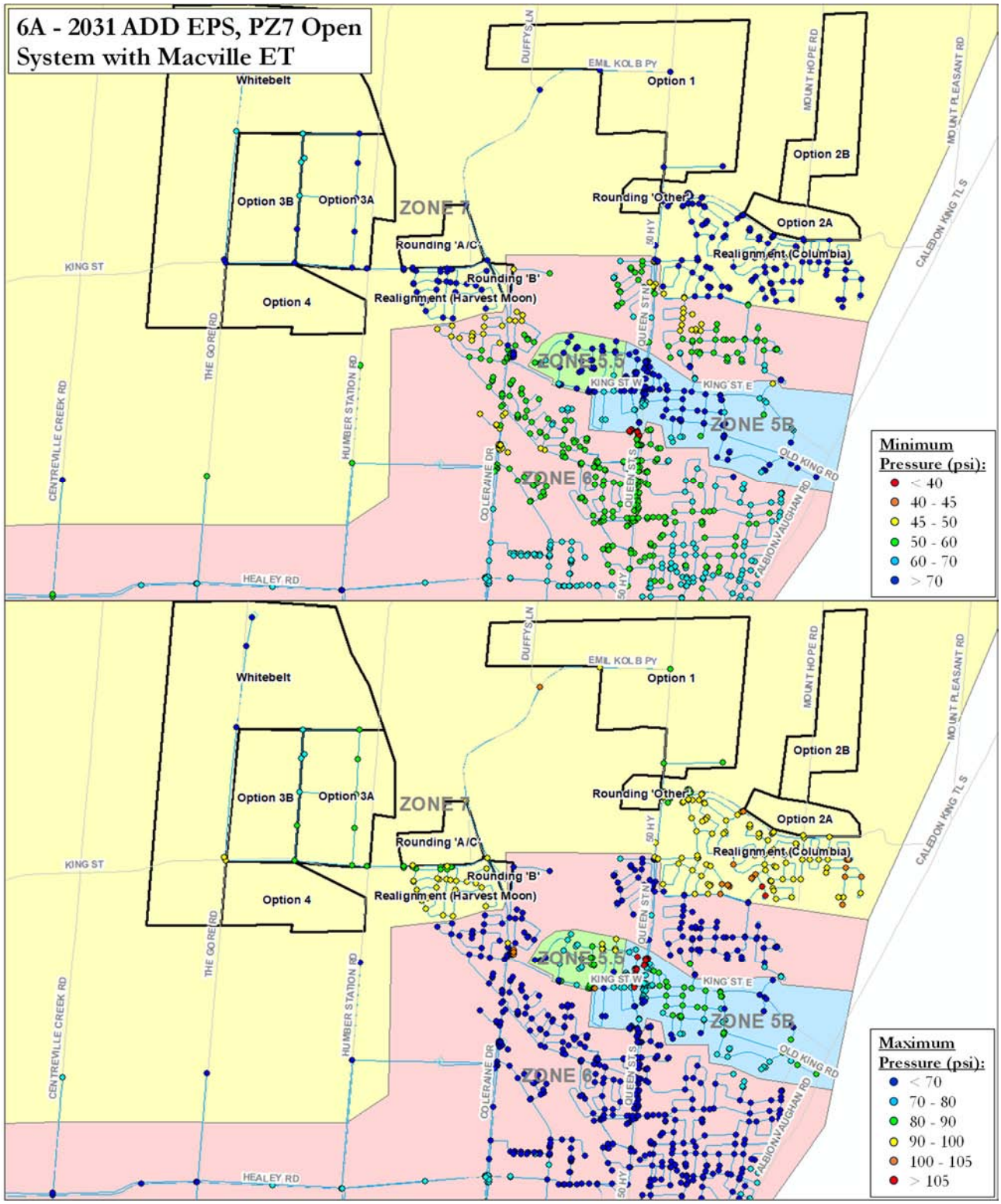

Figure 20: System pressures – Scenario 6A (2031 ADD EPS, PZ7 open system with Macville ET)

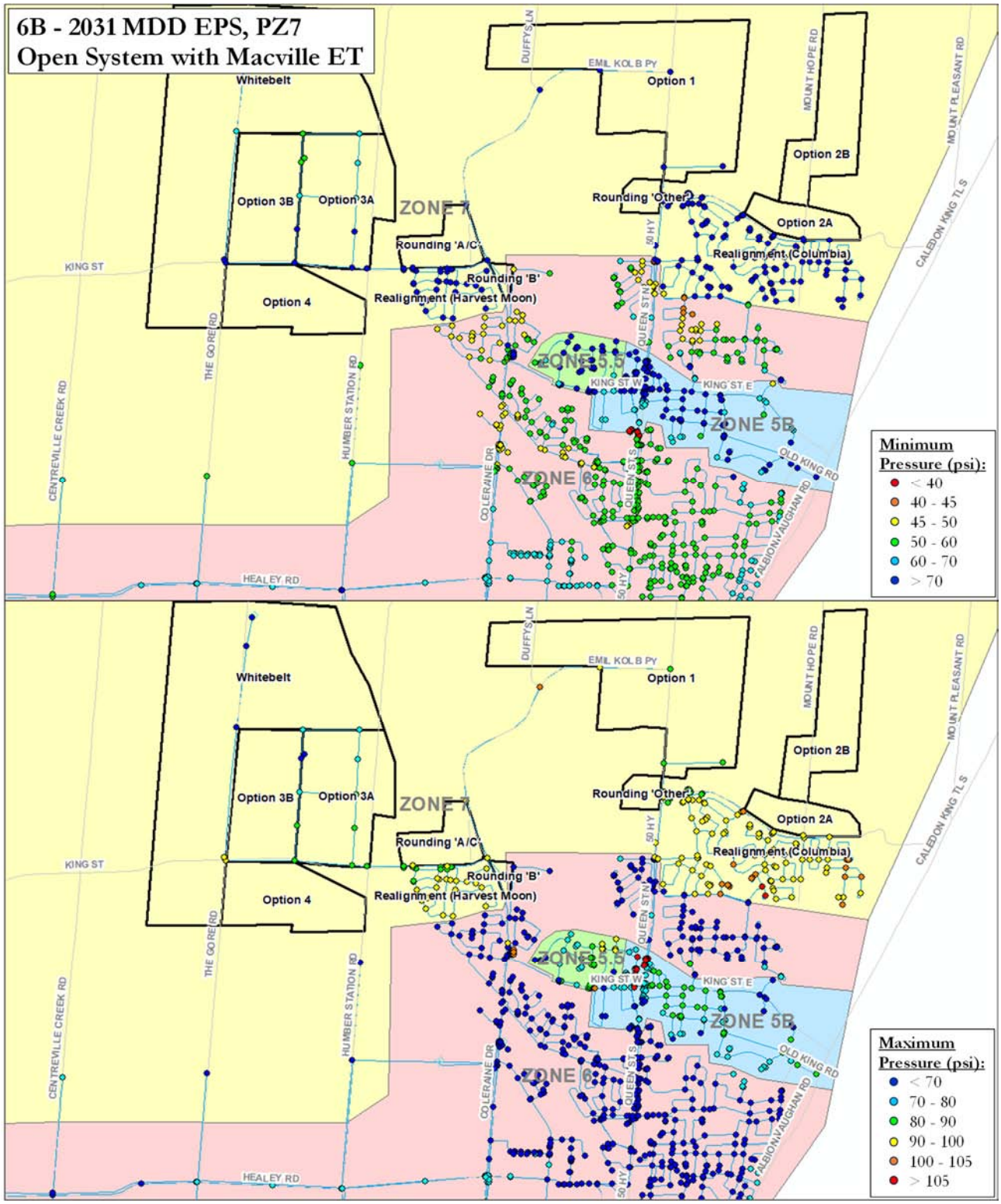

Figure 21: System pressures – Scenario 6B (2031 MDD EPS, PZ7 open system with Macville ET)

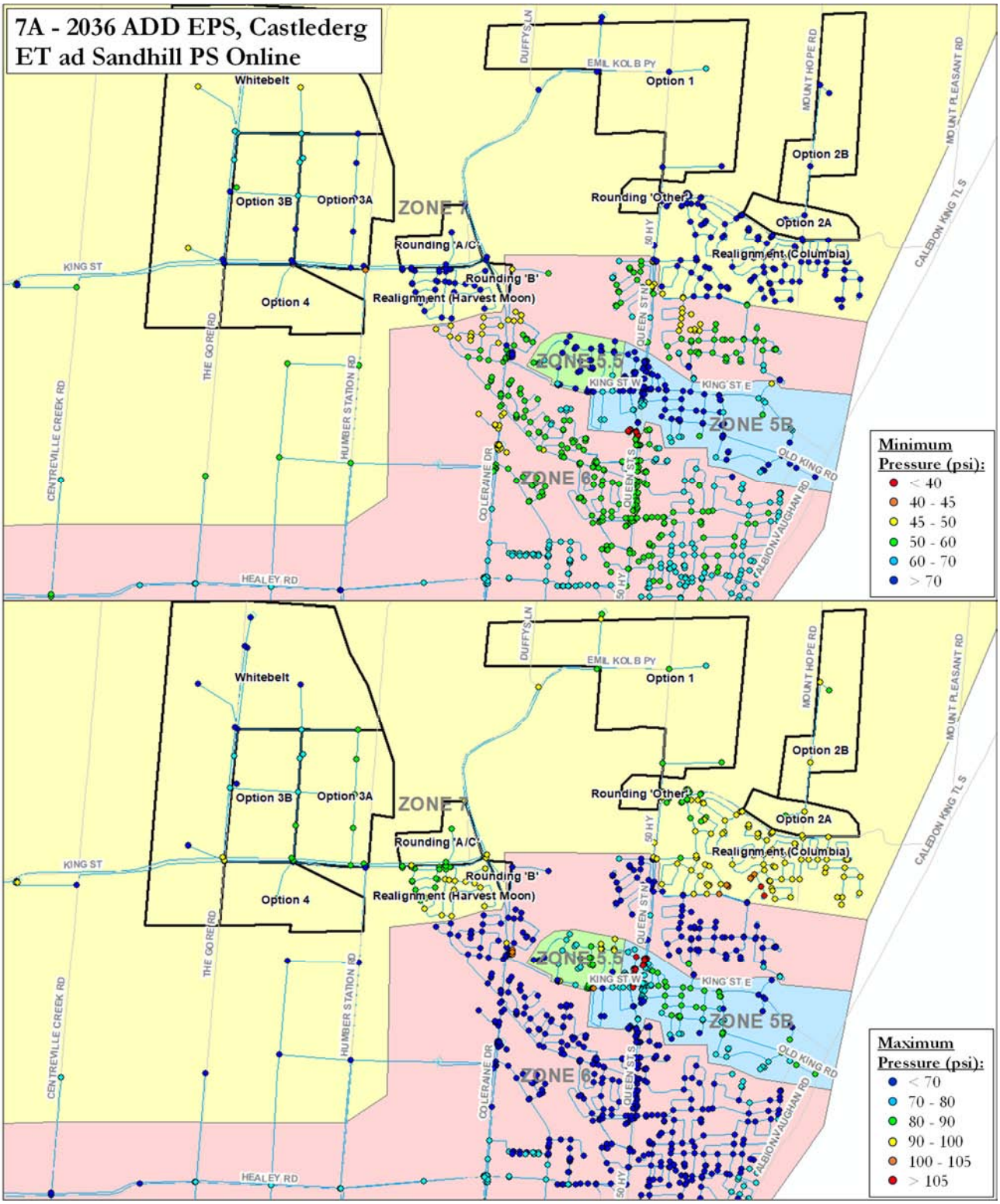

Figure 22: System pressures – Scenario 7A (2036 ADD EPS, with Castlederg ET & Sandhill PZ7 PS)

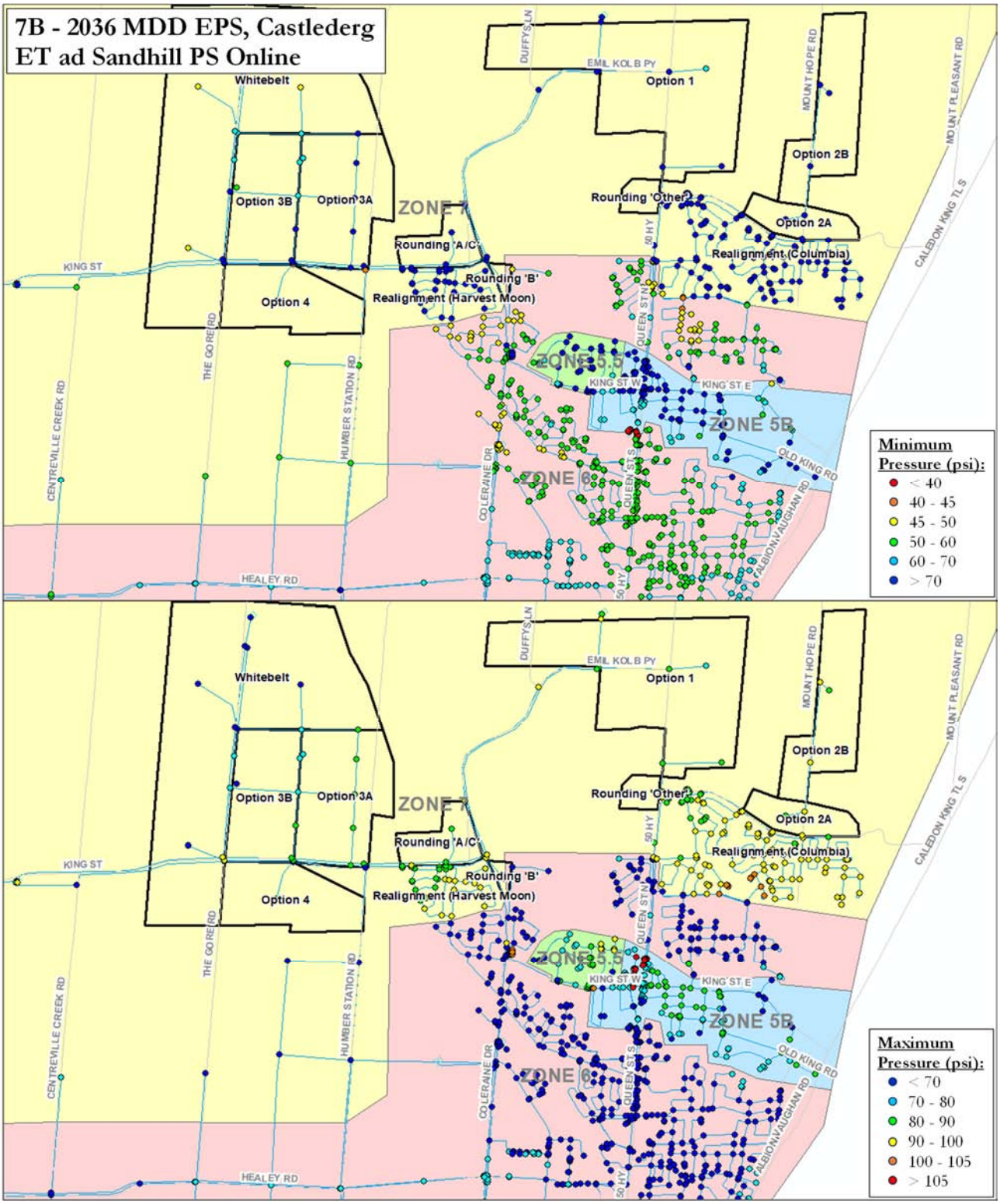

Figure 23: System pressures – Scenario 7B (2036 MDD EPS, with Castlederg ET & Sandhill PZ7 PS)

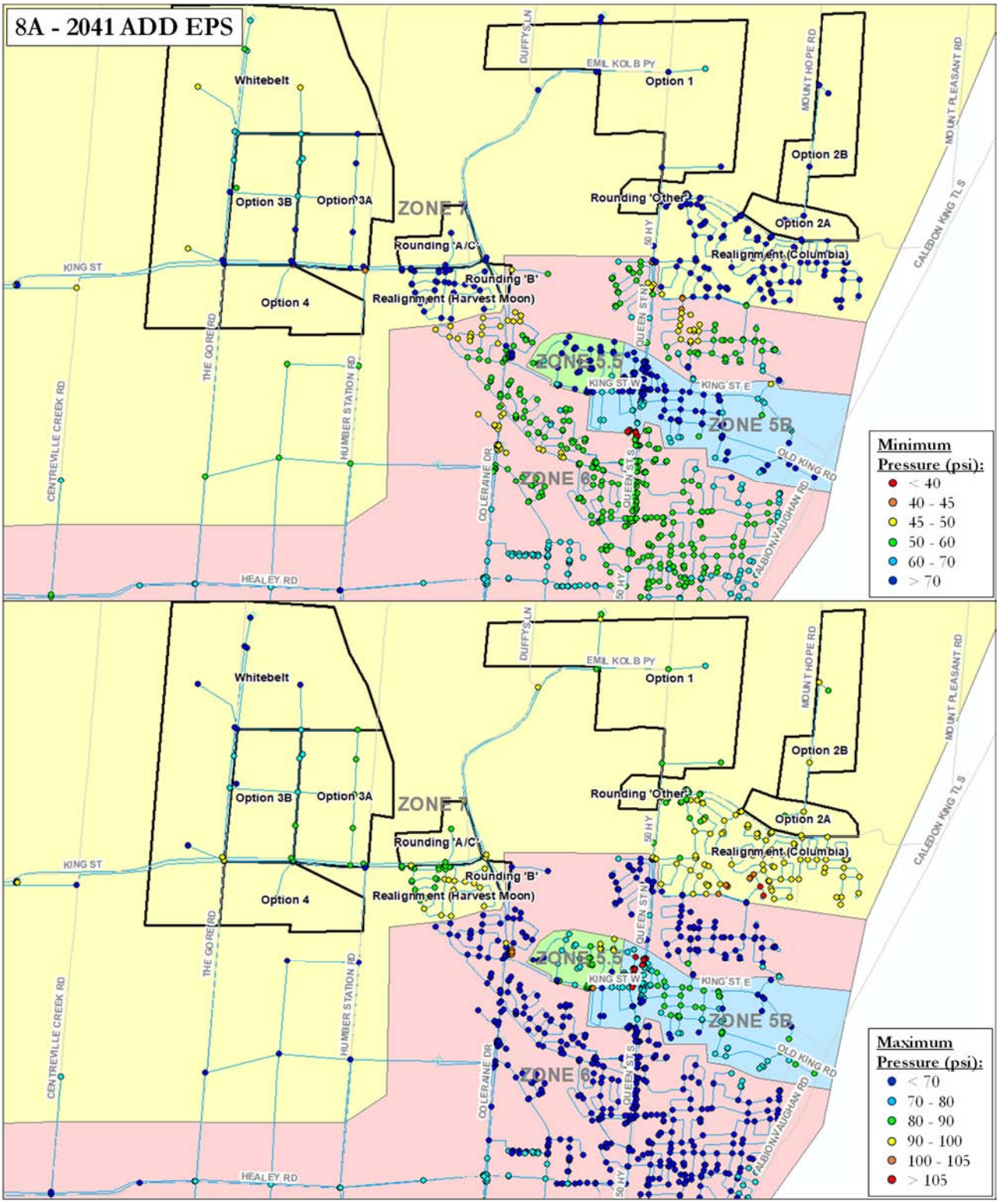

Figure 24: System pressures – Scenario 8A (2041 ADD EPS)

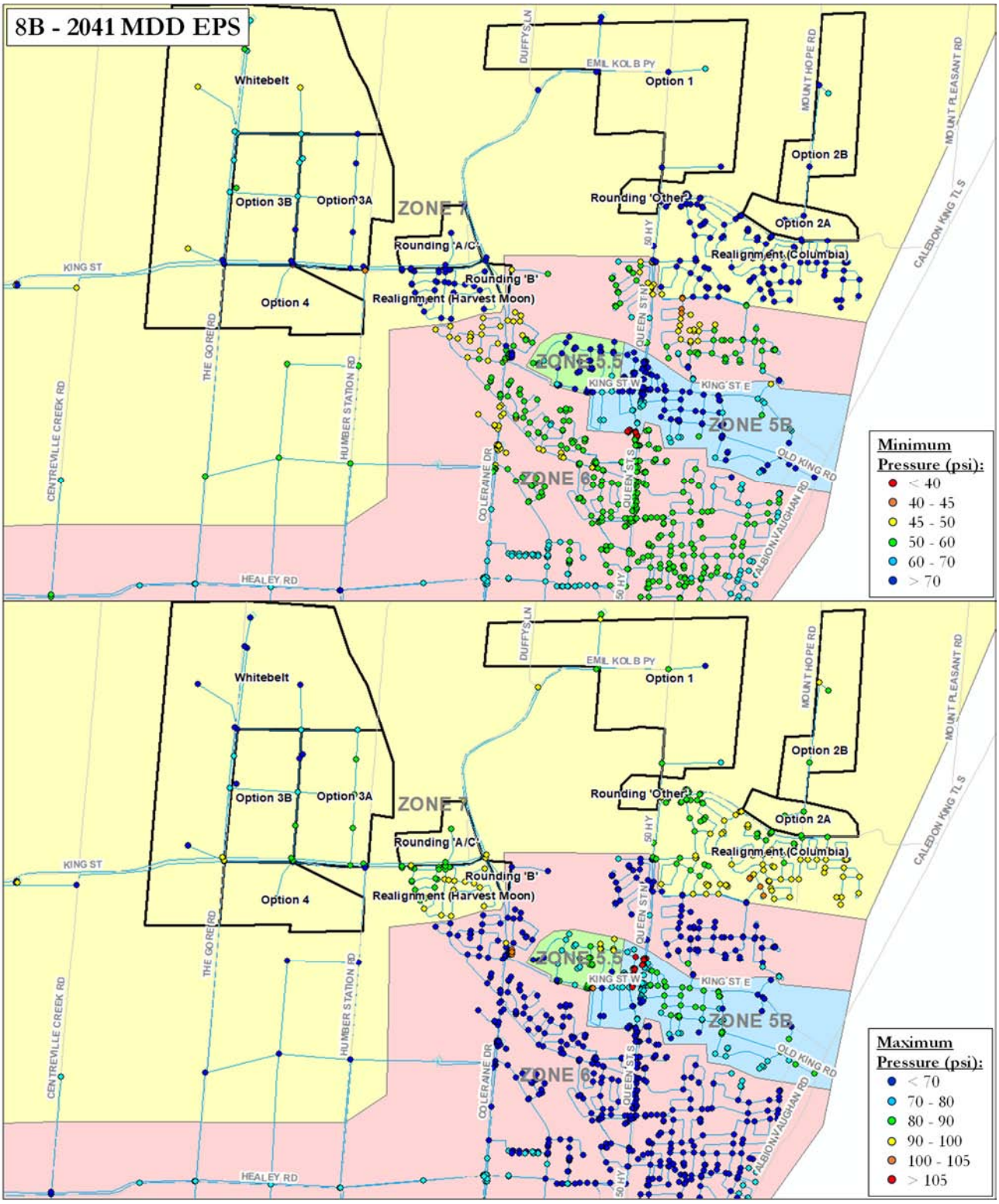

Figure 25: System pressures – Scenario 8B (2041 MDD EPS)

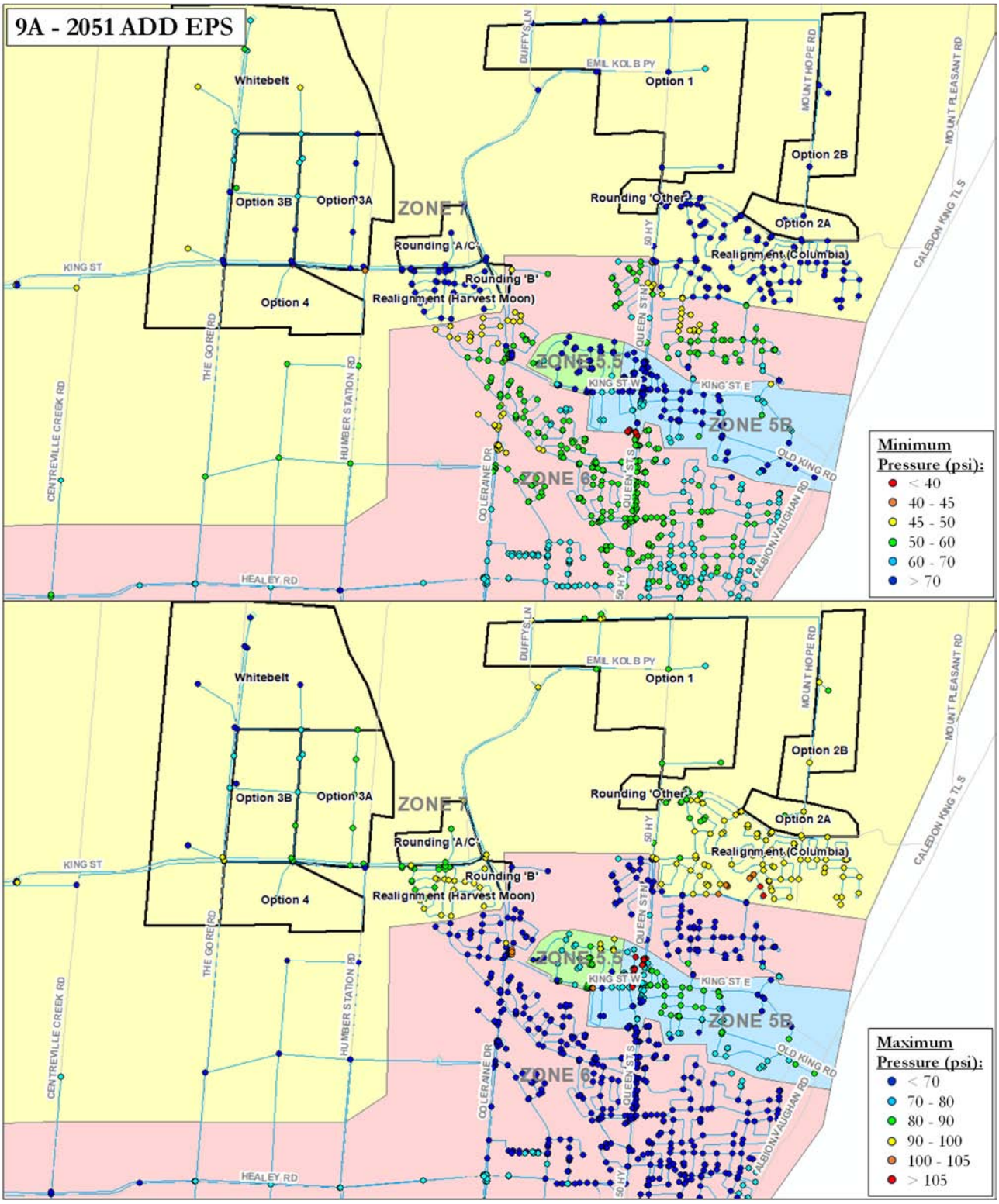

Figure 26: System pressures – Scenario 9A (2051 ADD EPS, future Macville BPS pumps)

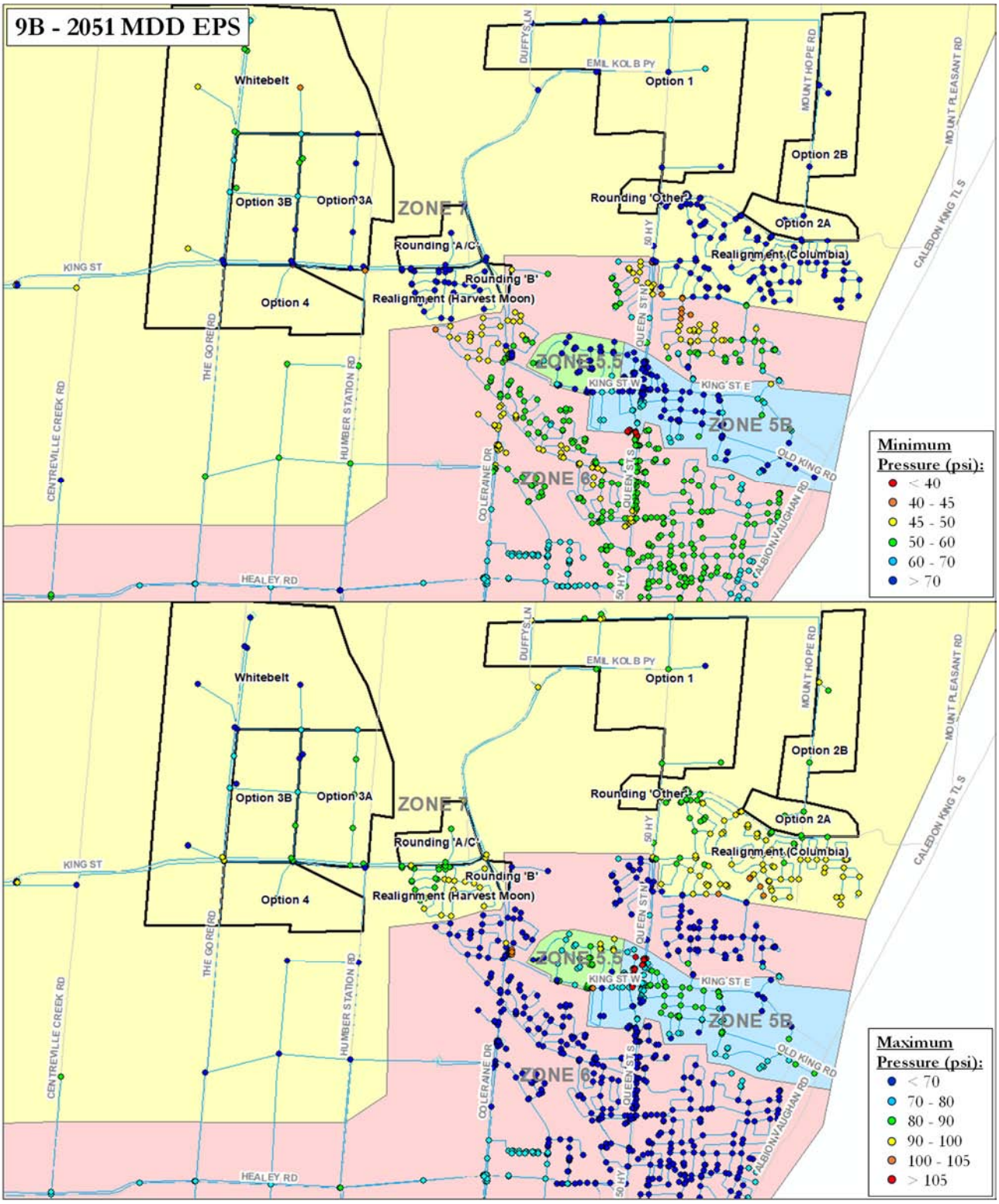

Figure 27: System pressures – Scenario 9B (2051 MDD EPS, future Macville BPS pumps)

APPENDIX B: AVAILABLE FIRE FLOW RESULTS MAPS

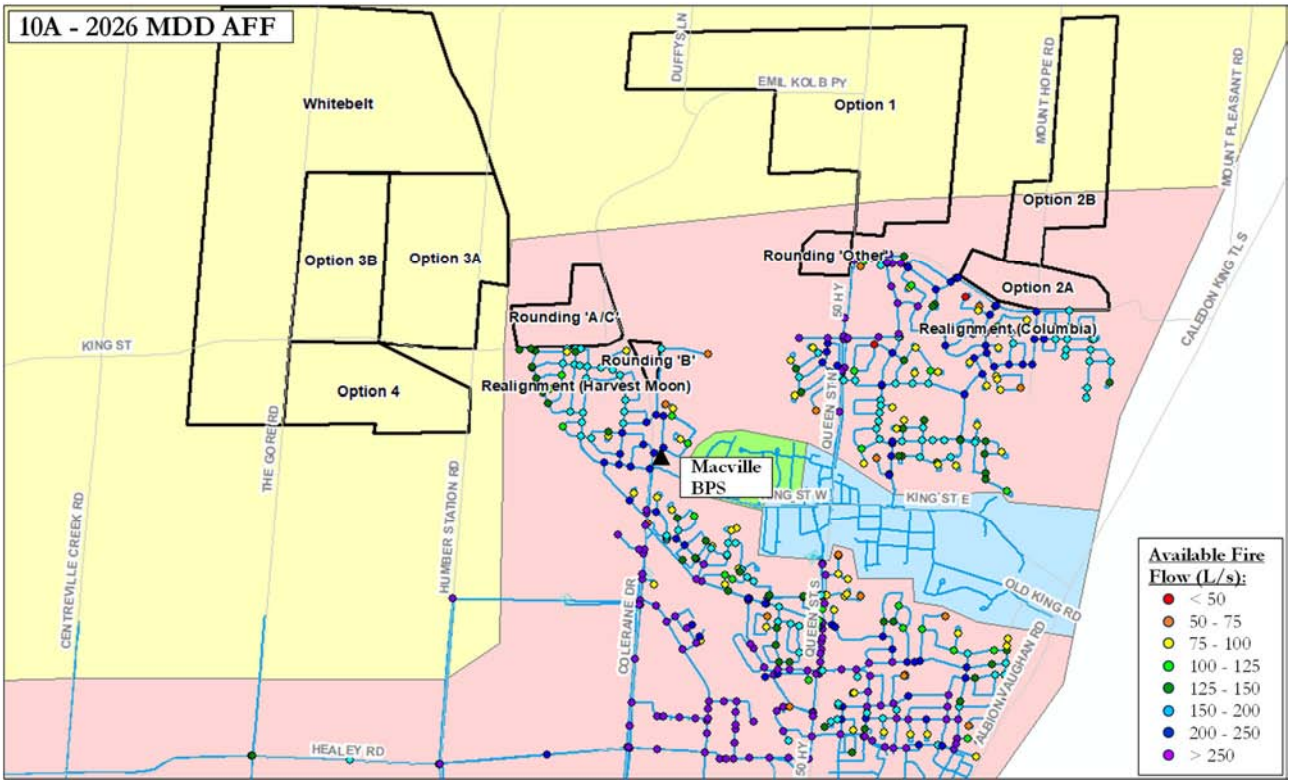

Figure 28: Available fire flows – Scenario 10A (2026 MDD, existing zones)

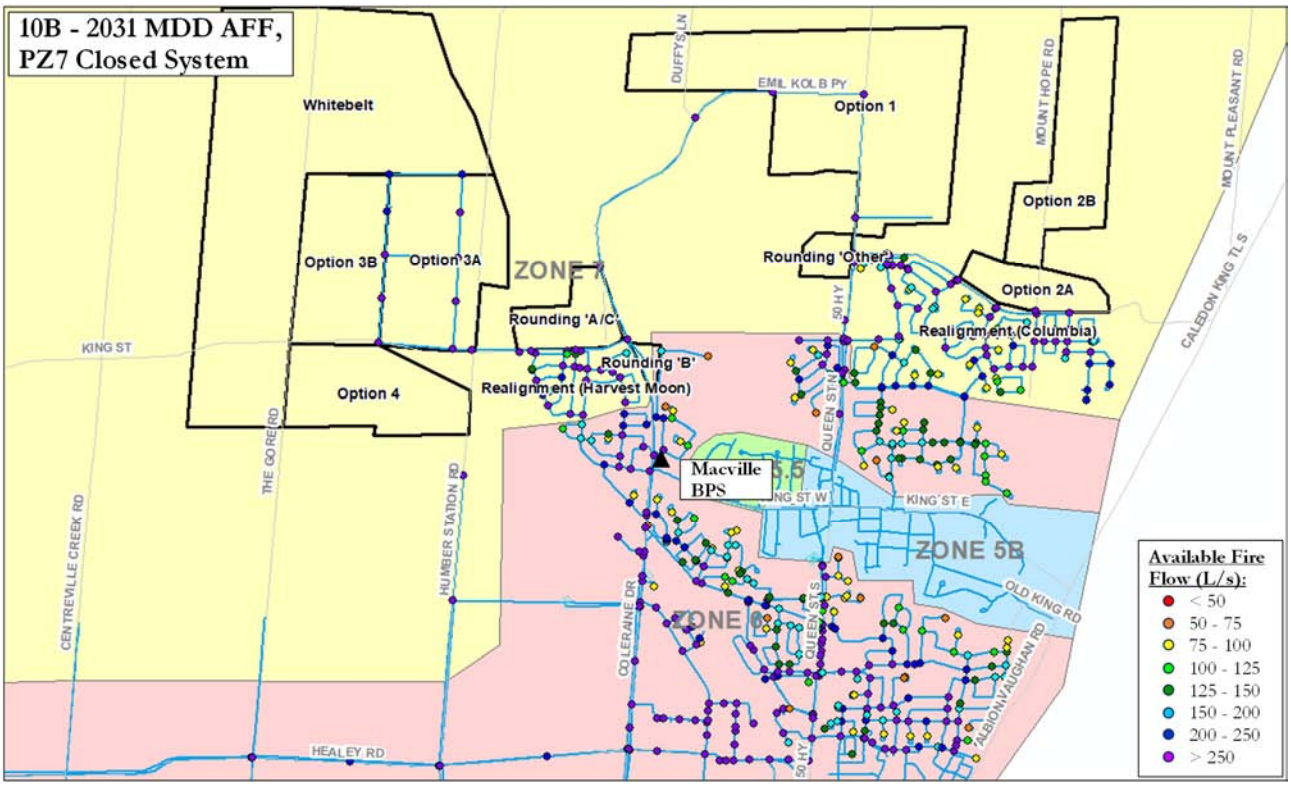

Figure 29: Available fire flows – Scenario 10B (2031 MDD, PZ7 closed system)

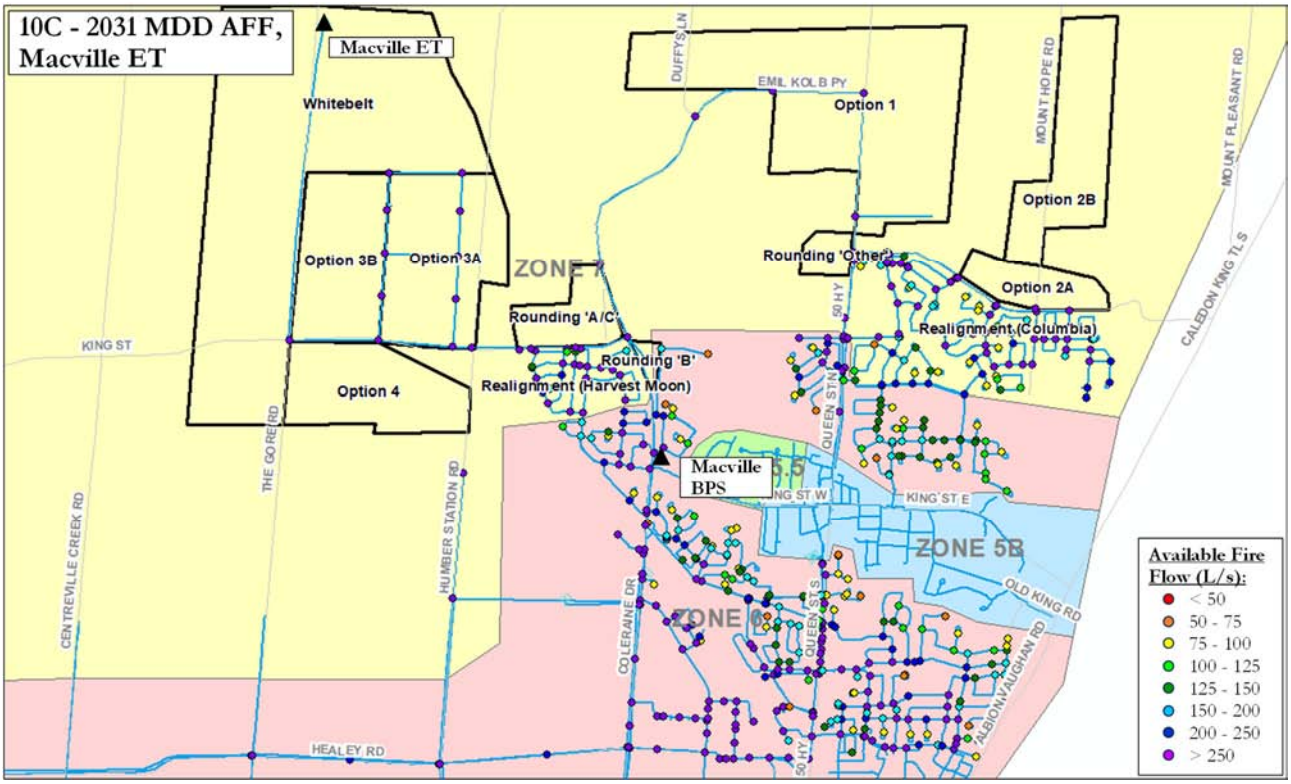

Figure 30: Available fire flows – Scenario 10C (2031 MDD, PZ7 open system with Macville ET)

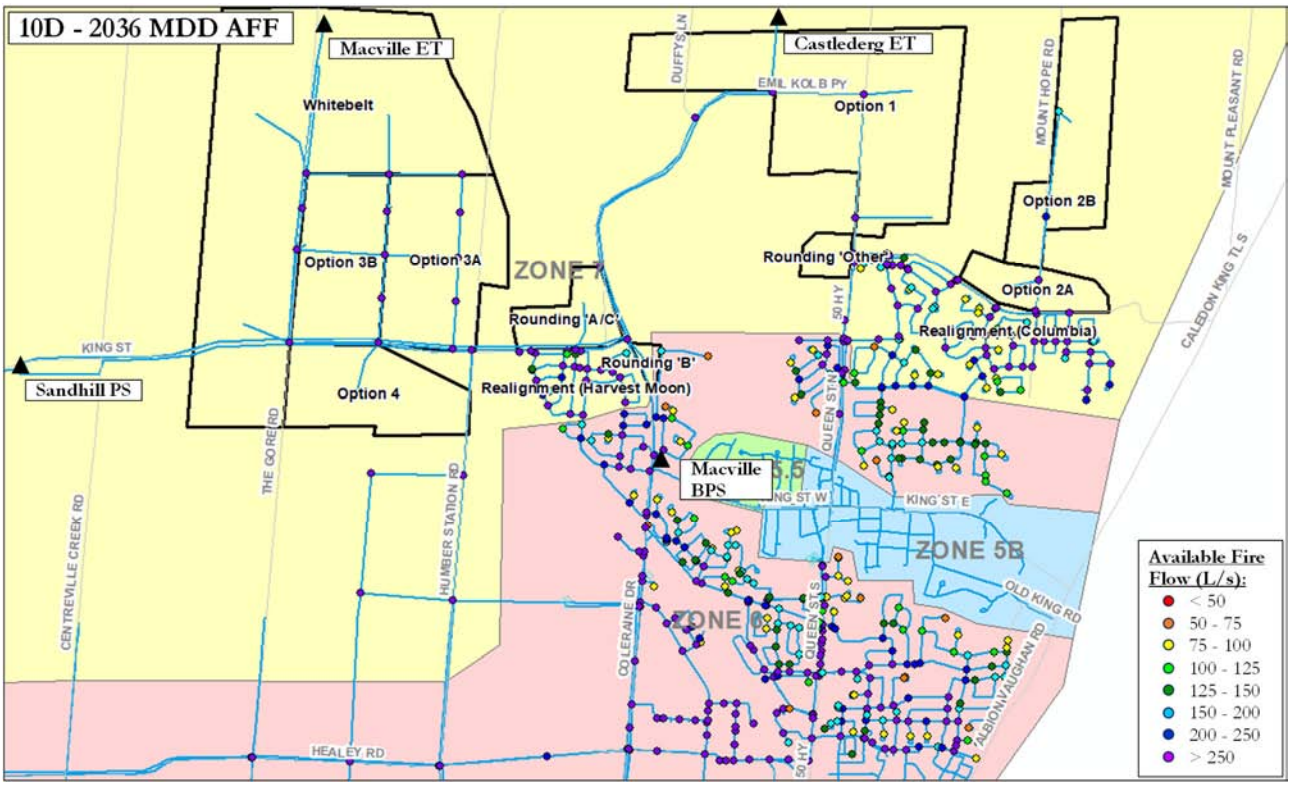

Figure 31: Available fire flows – Scenario 10D (2036 MDD, with Sandhill PZ7 PS & Castlederg ET)

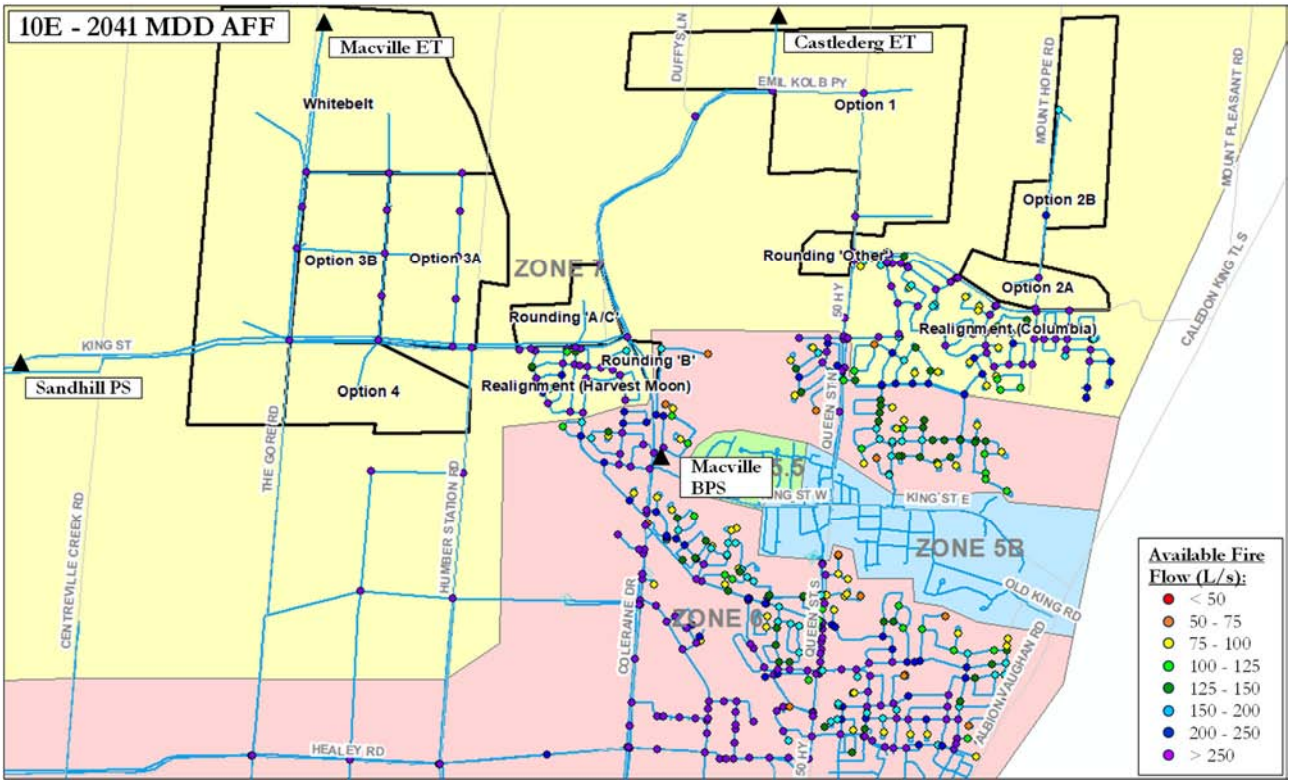

Figure 32: Available fire flows – Scenario 10E (2041 MDD, with Sandhill PZ7 PS & Castlederg ET)

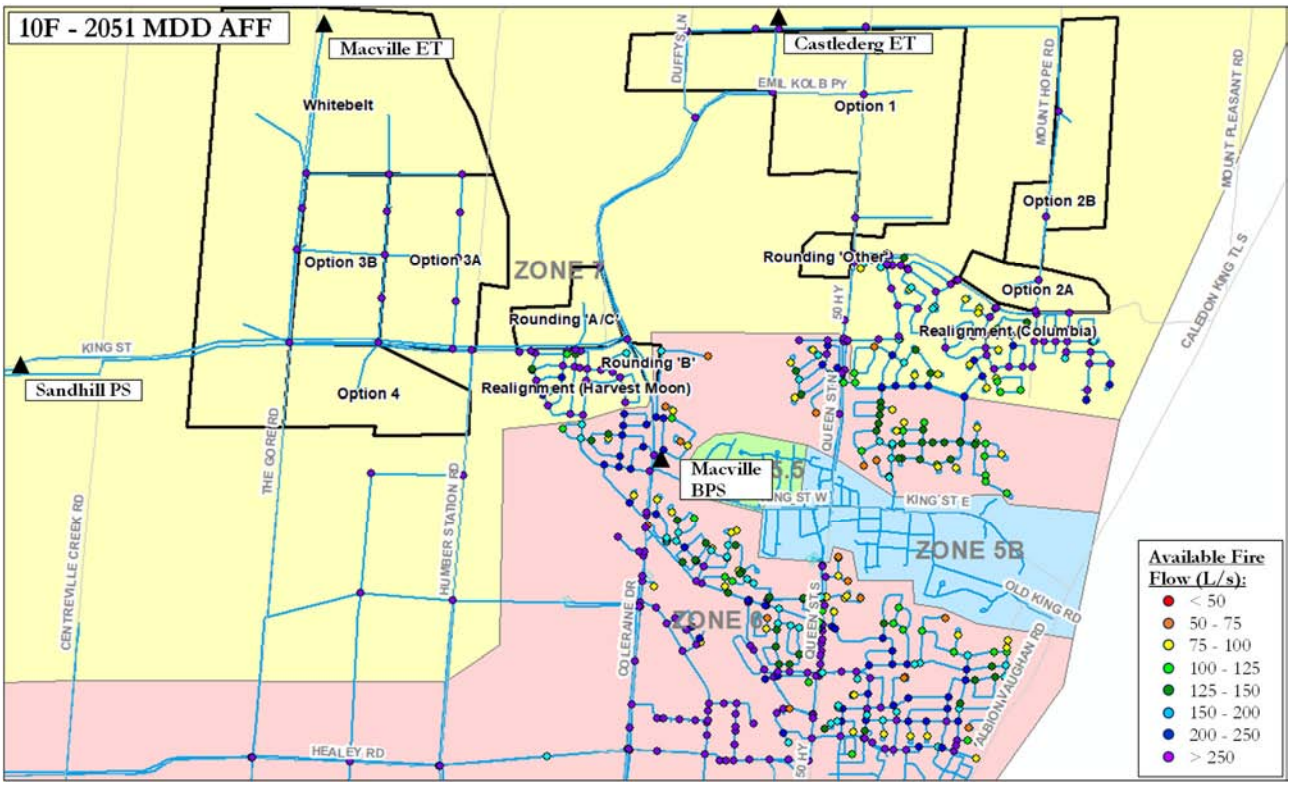

Figure 33: Available fire flows – Scenario 10F (2041 MDD, future Macville BPS pumps)

APPENDIX B

Sanitary Servicing Calculations

B1 – Sanitary Design Flow Calculations
B2 – Sanitary Sewer Sizing Calculations

Appendix B1 – Sanitary Design Flow Calculations

CROZIER & ASSOCIATES
Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

SANITARY DESIGN FLOW SUMMARY (Option 1)
BOLTON NORTH HILL LANDOWNERS GROUP

Sanitary Catchment	Total Average Daily Flow (Dry Flow and Infiltration)	Peak Flow Based on Population	Total Peak Design Flow (Peak Flow, Infiltration + 30% Contingency)
1	23.63	43.50	**70.41**
2	20.52	19.89	**31.40**
3	15.05	16.63	**27.09**
4	13.84	26.97	**42.50**
5	10.02	22.52	**34.25**
6	9.02	18.48	**29.23**
7	13.05	23.83	**39.33**
Total	**105.12 L/s**	**171.83 L/s**	**274.21 L/s**

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

POPULATION SUMMARY (Sanitary Catchment 1)
BOLTON NORTH HILL LANDOWNERS GROUP

Note: Unit counts and population yields received from Bousfields on April 8, 2024 (Bousfields, February 2026)

Residential Population Yields	Persons per Unit
Singles	4.2
Townhouses	3.4
MD/HD Blocks	3.1
Mixed Use	1.7

Employment Population Yields	Jobs/School	Jobs/Block	Jobs/ha
Schools	50	-	-
Apartments	-	10	-
Mixed Use	-	60	-

Statistics	Sanitary Catchment 1
Area	41.0
Units	
Singles at Average 11 m	317
Townhouses at 6.1 m	567
MD/HD Blocks	148
Mixed Use	36
Total Units	1068
Population	
Population	3779
Density	92.2
# of Schools	0.0
# of Apartment Blocks	3.0
# of MU Blocks	1.0
Jobs	90
Residential + Employment Pop	**3,869**

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

SANITARY DESIGN FLOW ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP

	SAN Catchment 1		References
Peaking Factor:			
Harmon Peak Factor: $M = 1 + 14 / (4 + P^{0.5})$			Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Page 106
Design population in thousands, P =	3.779		
Peaking factor, M =	3.4		
Infiltration:			
Unit infiltration allowance (Residential & Employment) =	0.26	L/s/ha	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 4
Area, A =	41.00	ha	
Infiltration Flows =	**10.7**	**L/s**	
Average Dry Weather Flow:			
Unit Dry Weather Flow, Residential =	290	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Residential =	3,779	persons	
Average Dry Weather Flow, Residential =	1,095,910	L/day	
	12.7	L/s	Peel Region 2020 Water & Wastewater Master Plan,
Unit Dry Weather Flow, Employment =	270	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Employment =	90	persons	
Average Dry Weather Flow, Employment =	24,300	L/day	
	0.28	L/s	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Total Dry Weather Flow	**13.0**	**L/s**	
Total Average Daily Flow (Dry Flow and Infiltration):	**23.6**	**L/s**	
Peak Flow Based on Population:	43.50	L/s	
Total Peak Design Flow (Peak Flow and Infiltration):	**54.2**	**L/s**	Peak Day Flow + Base Infiltration

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

POPULATION SUMMARY (Sanitary Catchment 2)
BOLTON NORTH HILL LANDOWNERS GROUP

Note: Unit counts and population yields received from Bousfields on April 8, 2024 (Bousfields, February 2026)

Residential Population Yields	Persons per Unit
Singles	4.2
Townhouses	3.4
MD/HD Blocks	3.1
Mixed Use	1.7

Employment Population Yields	Jobs/School	Jobs/Block	Jobs/ha
Schools	50	-	-
Apartments	-	10	-
Mixed Use	-	60	-

Statistics	Sanitary Catchment 2
Area	16.4
Units	
Singles at Average 11 m	16
Townhouses at 6.1 m	409
MD/HD Blocks	0
Mixed Use	28
Total Units	454
Population	
Population	1509
Density	92.0
# of Schools	1.0
# of Apartment Blocks	0.0
# of MU Blocks	1.0
Jobs	110
Residential + Employment Pop	**1,619**

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

SANITARY DESIGN FLOW ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP

	SAN Catchment 2		References
Peaking Factor:			
Harmon Peak Factor: $M = 1 + 14 / (4 + P^{0.5})$			Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Page 106
Design population in thousands, P =	1.509		
Peaking factor, M =	3.7		
Infiltration:			
Unit infiltration allowance (Residential & Employment) =	0.26	L/s/ha	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 4
Area, A =	16.40	ha	
Infiltration Flows =	**4.3**	**L/s**	
Average Dry Weather Flow:			
Unit Dry Weather Flow, Residential =	290	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Residential =	1,509	persons	
Average Dry Weather Flow, Residential =	437,610	L/day	
	5.1	L/s	Peel Region 2020 Water & Wastewater Master Plan,
Unit Dry Weather Flow, Employment =	270	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Employment =	110	persons	
Average Dry Weather Flow, Employment =	29,700	L/day	
	0.34	L/s	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Total Dry Weather Flow	**5.4**	**L/s**	
Total Average Daily Flow (Dry Flow and Infiltration):	**9.7**	**L/s**	
Peak Flow Based on Population:	19.89	L/s	
Total Peak Design Flow (Peak Flow and Infiltration):	**24.2**	**L/s**	Peak Day Flow + Base Infiltration

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

POPULATION SUMMARY (Sanitary Catchment 3)
BOLTON NORTH HILL LANDOWNERS GROUP

Note: Unit counts and population yields received from Bousfields on April 8, 2024 (Bousfields, February 2026)

Residential Population Yields	Persons per Unit
Singles	4.2
Townhouses	3.4
MD/HD Blocks	3.1
Mixed Use	1.7

Employment Population Yields	Jobs/School	Jobs/Block	Jobs/ha
Schools	50	-	-
Apartments	-	10	-
Mixed Use	-	60	-

Statistics	Sanitary Catchment 3
Area	16.2
Units	
Singles at Average 11 m	317
Townhouses at 6.1 m	0
MD/HD Blocks	0
Mixed Use	0
Total Units	317
Population	
Population	1333
Density	82.3
# of Schools	0.0
# of Apartment Blocks	0.0
# of MU Blocks	0.0
Jobs	-
Residential + Employment Pop	**1,333**

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

SANITARY DESIGN FLOW ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP

	SAN Catchment 3		References
Peaking Factor:			
Harmon Peak Factor: $M = 1 + 14 / (4 + P^{0.5})$			Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Page 106
Design population in thousands, P =	1.333		
Peaking factor, M =	3.7		
Infiltration:			
Unit infiltration allowance (Residential & Employment) =	0.26	L/s/ha	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 4
Area, A =	16.20	ha	
Infiltration Flows =	**4.2**	**L/s**	
Average Dry Weather Flow:			
Unit Dry Weather Flow, Residential =	290	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Residential =	1,333	persons	
Average Dry Weather Flow, Residential =	386,570	L/day	
	4.5	L/s	Peel Region 2020 Water & Wastewater Master Plan,
Unit Dry Weather Flow, Employment =	270	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Employment =	-	persons	
Average Dry Weather Flow, Employment =	-	L/day	
	-	L/s	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Total Dry Weather Flow	**4.5**	**L/s**	
Total Average Daily Flow (Dry Flow and Infiltration):	**8.7**	**L/s**	
Peak Flow Based on Population:	16.63	L/s	
Total Peak Design Flow (Peak Flow and Infiltration):	**20.8**	**L/s**	Peak Day Flow + Base Infiltration

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PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

POPULATION SUMMARY (Sanitary Catchment 4)
BOLTON NORTH HILL LANDOWNERS GROUP

Note: Unit counts and population yields received from Bousfields on April 8, 2024 (Bousfields, February 2026)

Residential Population Yields	Persons per Unit
Singles	4.2
Townhouses	3.4
MD/HD Blocks	3.1
Mixed Use	1.7

Employment Population Yields	Jobs/School	Jobs/Block	Jobs/ha
Schools	50	-	-
Apartments	-	10	-
Mixed Use	-	60	-

Statistics	Sanitary Catchment 4
Area	22.0
Units	
Singles at Average 11 m	124
Townhouses at 6.1 m	364
MD/HD Blocks	0
Mixed Use	258
Total Units	745
Population	
Population	2196
Density	99.8
# of Schools	0.0
# of Apartment Blocks	1.0
# of MU Blocks	1.0
Jobs	70
Residential + Employment Pop	**2,266**

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PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
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DATE:	2/12/2026

SANITARY DESIGN FLOW ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP

	SAN Catchment 4		References
Peaking Factor:			
Harmon Peak Factor: $M = 1 + 14 / (4 + P^{0.5})$			Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Page 106
Design population in thousands, P =	2.196		
Peaking factor, M =	3.6		
Infiltration:			
Unit infiltration allowance (Residential & Employment) =	0.26	L/s/ha	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 4
Area, A =	22.00	ha	
Infiltration Flows =	**5.7**	**L/s**	
Average Dry Weather Flow:			
Unit Dry Weather Flow, Residential =	290	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Residential =	2,196	persons	
Average Dry Weather Flow, Residential =	636,840	L/day	
	7.4	L/s	Peel Region 2020 Water & Wastewater Master Plan,
Unit Dry Weather Flow, Employment =	270	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Employment =	70	persons	
Average Dry Weather Flow, Employment =	18,900	L/day	
	0.22	L/s	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Total Dry Weather Flow	**7.6**	**L/s**	
Total Average Daily Flow (Dry Flow and Infiltration):	**13.3**	**L/s**	
Peak Flow Based on Population:	26.97	L/s	
Total Peak Design Flow (Peak Flow and Infiltration):	**32.7**	**L/s**	Peak Day Flow + Base Infiltration

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

POPULATION SUMMARY (Sanitary Catchment 5)
BOLTON NORTH HILL LANDOWNERS GROUP

Note: Unit counts and population yields received from Bousfields on April 8, 2024 (Bousfields, February 2026)

Residential Population Yields	Persons per Unit
Singles	4.2
Townhouses	3.4
MD/HD Blocks	3.1
Mixed Use	1.7

Employment Population Yields	Jobs/School	Jobs/Block	Jobs/ha
Schools	50	-	-
Apartments	-	10	-
Mixed Use	-	60	-

Statistics	Sanitary Catchment 5
Area	14.7
Units	
Singles at Average 11 m	0
Townhouses at 6.1 m	438
MD/HD Blocks	0
Mixed Use	138
Total Units	576
Population	
Population	1725
Density	117.3
# of Schools	0.0
# of Apartment Blocks	1.0
# of MU Blocks	2.0
Jobs	130
Residential + Employment Pop	**1,855**

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

SANITARY DESIGN FLOW ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP

	SAN Catchment 5		References
Peaking Factor:			
Harmon Peak Factor: $M = 1 + 14 / (4 + P^{0.5})$			Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Page 106
Design population in thousands, P =	1.725		
Peaking factor, M =	3.6		
Infiltration:			
Unit infiltration allowance (Residential & Employment) =	0.26	L/s/ha	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 4
Area, A =	14.70	ha	
Infiltration Flows =	**3.8**	**L/s**	
Average Dry Weather Flow:			
Unit Dry Weather Flow, Residential =	290	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Residential =	1,725	persons	
Average Dry Weather Flow, Residential =	500,250	L/day	
	5.8	L/s	Peel Region 2020 Water & Wastewater Master Plan,
Unit Dry Weather Flow, Employment =	270	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Employment =	130	persons	
Average Dry Weather Flow, Employment =	35,100	L/day	
	0.41	L/s	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Total Dry Weather Flow	**6.2**	**L/s**	
Total Average Daily Flow (Dry Flow and Infiltration):	**10.0**	**L/s**	
Peak Flow Based on Population:	22.52	L/s	
Total Peak Design Flow (Peak Flow and Infiltration):	**26.3**	**L/s**	Peak Day Flow + Base Infiltration

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PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

POPULATION SUMMARY (Sanitary Catchment 6)
BOLTON NORTH HILL LANDOWNERS GROUP

Note: Unit counts and population yields received from Bousfields on April 8, 2024 (Bousfields, February 2026)

Residential Population Yields	Persons per Unit
Singles	4.2
Townhouses	3.4
MD/HD Blocks	3.1
Mixed Use	1.7

Employment Population Yields	Jobs/School	Jobs/Block	Jobs/ha
Schools	50	-	-
Apartments	-	10	-
Mixed Use	-	60	-

Statistics	Sanitary Catchment 6
Area	15.4
Units	
Singles at Average 11 m	188
Townhouses at 6.1 m	193
MD/HD Blocks	0
Mixed Use	0
Total Units	381
Population	
Population	1445
Density	93.8
# of Schools	1.0
# of Apartment Blocks	0.0
# of MU Blocks	0.0
Jobs	50
Residential + Employment Pop	**1,495**

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

SANITARY DESIGN FLOW ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP

	SAN Catchment 6		References
Peaking Factor:			
Harmon Peak Factor: $M = 1 + 14 / (4 + P^{0.5})$			Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Page 106
Design population in thousands, P =	1.445		
Peaking factor, M =	3.7		
Infiltration:			
Unit infiltration allowance (Residential & Employment) =	0.26	L/s/ha	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 4
Area, A =	15.40	ha	
Infiltration Flows =	**4.0**	**L/s**	
Average Dry Weather Flow:			
Unit Dry Weather Flow, Residential =	290	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Residential =	1,445	persons	
Average Dry Weather Flow, Residential =	419,050	L/day	
	4.9	L/s	Peel Region 2020 Water & Wastewater Master Plan,
Unit Dry Weather Flow, Employment =	270	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Employment =	50	persons	
Average Dry Weather Flow, Employment =	13,500	L/day	
	0.16	L/s	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Total Dry Weather Flow	**5.0**	**L/s**	
Total Average Daily Flow (Dry Flow and Infiltration):	**9.0**	**L/s**	
Peak Flow Based on Population:	18.48	L/s	
Total Peak Design Flow (Peak Flow and Infiltration):	**22.5**	**L/s**	Peak Day Flow + Base Infiltration

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

POPULATION SUMMARY (Sanitary Catchment 7)
BOLTON NORTH HILL LANDOWNERS GROUP

Note: Unit counts and population yields received from Bousfields on April 8, 2024 (Bousfields, February 2026)

Residential Population Yields	Persons per Unit
Singles	4.2
Townhouses	3.4
MD/HD Blocks	3.1
Mixed Use	1.7

Employment Population Yields	Jobs/School	Jobs/Block	Jobs/ha
Schools	50	-	-
Apartments	-	10	-
Mixed Use	-	60	-

Statistics	Sanitary Catchment 7
Area	24.7
Units	
Singles at Average 11 m	321
Townhouses at 6.1 m	185
MD/HD Blocks	0
Mixed Use	0
Total Units	506
Population	
Population	1978
Density	80.1
# of Schools	0.0
# of Apartment Blocks	0.0
# of MU Blocks	0.0
Jobs	-
Residential + Employment Pop	**1,978**

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

SANITARY DESIGN FLOW ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP

	SAN Catchment 7		References
Peaking Factor:			
Harmon Peak Factor: $M = 1 + 14 / (4 + P^{0.5})$			Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Page 106
Design population in thousands, P =	1.978		
Peaking factor, M =	3.6		
Infiltration:			
Unit infiltration allowance (Residential & Employment) =	0.26	L/s/ha	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 4
Area, A =	24.70	ha	
Infiltration Flows =	**6.4**	**L/s**	
Average Dry Weather Flow:			
Unit Dry Weather Flow, Residential =	290	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Residential =	1,978	persons	
Average Dry Weather Flow, Residential =	573,620	L/day	
	6.6	L/s	Peel Region 2020 Water & Wastewater Master Plan,
Unit Dry Weather Flow, Employment =	270	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Employment =	-	persons	
Average Dry Weather Flow, Employment =	-	L/day	
	-	L/s	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Total Dry Weather Flow	**6.6**	**L/s**	
Total Average Daily Flow (Dry Flow and Infiltration):	**13.1**	**L/s**	
Peak Flow Based on Population:	23.83	L/s	
Total Peak Design Flow (Peak Flow and Infiltration):	**30.3**	**L/s**	Peak Day Flow + Base Infiltration

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PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

POPULATION SUMMARY (Sanitary Catchment 8)
BOLTON NORTH HILL LANDOWNERS GROUP

Note: Unit counts and population yields received from Bousfields on April 8, 2024 (Bousfields, February 2026)

Residential Population Yields	Persons per Unit
Singles	4.2
Townhouses	3.4
MD/HD Blocks	3.1
Mixed Use	1.7

Employment Population Yields	Jobs/School	Jobs/Block	Jobs/ha
Schools	50	-	-
Apartments	-	10	-
Mixed Use	-	60	-

Statistics	Sanitary Catchment 2
Area	4.6
Units	
Singles at Average 11 m	0
Townhouses at 6.1 m	142
MD/HD Blocks	0
Mixed Use	0
Total Units	142
Population	
Population	483
Density	104.1
# of Schools	0.0
# of Apartment Blocks	0.0
# of MU Blocks	0.0
Jobs	-
Residential + Employment Pop	**483**

CROZIER & ASSOCIATES Consulting Engineers

PROJECT:	Bolton North Hill Landowners Group
PROJ. NO.:	708-3446
DESIGN:	JGB
CHECK:	
DATE:	2/12/2026

SANITARY DESIGN FLOW ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP

	SAN Catchment 8		References
Peaking Factor:			
Harmon Peak Factor: $M = 1 + 14 / (4 + P^{0.5})$			Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Page 106
Design population in thousands, P =	0.483		
Peaking factor, M =	4.0		
Infiltration:			
Unit infiltration allowance (Residential & Employment) =	0.26	L/s/ha	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 4
Area, A =	4.64	ha	
Infiltration Flows =	**1.2**	**L/s**	
Average Dry Weather Flow:			
Unit Dry Weather Flow, Residential =	290	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Residential =	483	persons	
Average Dry Weather Flow, Residential =	140,070	L/day	
	1.6	L/s	Peel Region 2020 Water & Wastewater Master Plan,
Unit Dry Weather Flow, Employment =	270	L/person/day	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Population, Employment =	-	persons	
Average Dry Weather Flow, Employment =	-	L/day	
	-	L/s	Peel Region 2020 Water & Wastewater Master Plan, Volume 4 Table 2
Total Dry Weather Flow	**1.6**	**L/s**	
Total Average Daily Flow (Dry Flow and Infiltration):	**2.8**	**L/s**	
Peak Flow Based on Population:	6.46	L/s	
Total Peak Design Flow (Peak Flow and Infiltration):	**7.7**	**L/s**	Peak Day Flow + Base Infiltration

Appendix B2 – Sanitary Sewer Sizing Calculations

PROJECT: Bolton North Hill Landowners Group
PROJ. NO: 708-3446
DESIGN: JGB
CHECK:
DATE: 2026.02.12

SANITARY TRUNK SEWER ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP
DRAINAGE AREA POPULATION BREAKDOWN

Drainage Area	Total Area Serviced (ha)	Unit Breakdown	Total Population
Drainage Area 1	41.0	Townhomes/B2B = 567 Singles = 317 MU/MD/HD = 184	3869
Drainage Area 2	16.4	Townhomes/B2B = 409 Singles = 16	1619
Drainage Area 3	16.2	Singles = 317	1333
Drainage Area 4	22.0	Townhomes/B2B = 364 Singles = 124 MU/MD/HD = 258	2266
Drainage Area 5	14.7	Townhomes/B2B = 438 MU/MD/HD = 138	1855
Drainage Area 6	15.4	Townhomes/B2B = 193 Singles = 188	1495
Drainage Area 7	24.7	Townhomes/B2B = 185 Singles = 321	1978
Drainage Area 8	4.6	Townhomes/B2B = 142	483
			14898

Notes:
Person Per Unit used to calculate population: 4.2 for Singles, 3.4 for Towns & B2B, 2.76 (Average) for MD/HD Blocks/Apartments
Townhouse, B2B, singles and apartment population densities (PPU) based on Bousfields Unit Breakdown dated January 2024
Populations inclusive of Schools & Jobs per Hectare, see breakdown in Sanitary Design Flow sheets

CROZIER & ASSOCIATES
Consulting Engineers

Peak Factor (M) = 1+(14/4+(P/1000)^0.5)
Avg. Daily Flow= 290 L/cap/d
N = 0.013
Infiltration = 0.26 L/s/ha

PROJECT: Bolton North Hill Landowners Group
PROJ. NO: 708-3446
DESIGN: JGB
CHECK:
DATE: 2026.02.20

SANITARY TRUNK SEWER ANALYSIS
BOLTON NORTH HILL LANDOWNERS GROUP

INTERNAL TRUNK SEWER SIZING

Drainage Area	Total Area Serviced (ha)	Population	Total Trib. Pop.	Pop. Flow Q(p) (L/s)	Peak	Peak Design Flow (L/s)	Infiltration Flow (L/s)	Combined Design Flow (L/s)	Pipe Diameter (mm)	Slope	Pipe Cap. (L/s)	Remaining Capacity (L/s)	% Capacity
Drainage Area 8	4.64	483	483	1.62	3.98	6.46	1.21	7.66	250	0.005	42.05	34.39	18.22
Drainage Area 2	16.4	1619	1619	5.43	3.66	19.86	4.26	24.13	300	0.005	68.38	44.25	35.29
Drainage Area 3	16.2	1333	1333	4.47	3.72	16.63	4.21	20.84	250	0.005	42.05	21.21	49.56
Drainage Area 4	22.0	2266	2266	7.61	3.54	26.95	5.72	32.67	250	0.005	42.05	9.38	77.69
Drainage Area 1	41.0	3869	3869	12.99	3.35	43.46	10.66	54.12	375	0.006	135.81	81.70	39.85
Drainage Area 7	24.7	1978	1978	6.64	3.59	23.83	6.42	30.25	250	0.005	42.05	11.80	71.95
Drainage Area 6	15.4	1495	1495	5.02	3.68	18.47	10.43	28.90	250	0.005	42.05	13.15	68.72
Drainage Area 5	14.7	1855	1855	6.23	3.61	22.48	3.82	26.30	250	0.005	42.05	15.74	62.56
Flows to Pump Station 1	**155.04**	**0**	**14415**	**48.38**	**2.80**	**135.26**	**40.31**	**175.57**	-	-	-	-	-

Notes:
Region of Peel minimum pipe size = 250 mm dia.
Maximum pipe capacity (assumed) = 85%

APPENDIX C

Stormwater Management Design Calculations

C1 – Storm Sewer Sizing Calculations
C2 – Stormwater Management Pond Sizing Calculations
C3 – Pond Design Visual OTTHYMO Model Output

Appendix C1 – Storm Sewer Sizing Calculations

CROZIER & ASSOCIATES
Consulting Engineers

Inlet flows are extracted from the 10-year, 6 hour AES storm in the post-development VO model prepared by Crozier
Outlet flows for SWM Ponds 201-204 and 206-207 are extracted from the 100-year, 6 hour AES storm in the post-development VO model prepared by Crozier.
Outlet flows for SWM Ponds 205, 208 and 209 are from the unit flow rates (TRCA) and extracted from the post-development VO model prepared by Crozier.

Mannings "n" = 0.013

PROJ. NO: Bolton North Hill Landowners Group
PROJECT: 708-3446
DESIGN: JB
CHECK: CS
DATE: 2024.12.13

STORM SEWER PIPE SIZES

BOLTON NORTH HILL LANDOWNERS GROUP

SWM POND DRAINAGE AREA	Area (ha)	Composite Runoff Coefficient	INLET FLOW (L/s)	INLET PIPE DIA. (mm)	INLET PIPE SLOPE (m/m)	PIPE CAPACITY (L/s)	REMAINING CAPACITY (L/s)	VELOCITY (m/s)	% CAPACITY	OUTLET FLOW (L/s)	OUTLET PIPE DIA. (mm)	OUTLET PIPE SLOPE (m/m)	PIPE CAPACITY (L/s)	REMAINING CAPACITY (L/s)	VELOCITY (m/s)	% CAPACITY
201	27.43	0.6	2621	1200	0.01	3898.73	1277.73	3.45	67.23	967	750	0.01	1113.28	146.28	2.52	86.86
202	15.28	0.6	1884	1050	0.01	2730.73	846.73	3.15	68.99	1487	675	0.07	2143.09	656.09	5.99	69.39
203	20.04	0.64	2424	1050	0.01	2730.73	306.73	3.15	88.77	734	675	0.01	840.59	106.59	2.35	87.32
204	15.64	0.57	1782	1050	0.01	2730.73	948.73	3.15	65.26	1864	600	0.20	2745.94	881.94	9.71	67.88
205	27.24	0.6	2590	1200	0.01	3898.73	1308.73	3.45	66.43	11	250	0.01	59.47	48.47	1.21	18.50
206	25.23	0.72	3973	1350	0.01	4465.59	492.59	3.12	88.97	745	675	0.22	3942.71	3197.71	11.02	18.90
207	16.37	0.59	1054	825	0.01	1435.44	381.44	2.69	73.43	910	750	0.01	1113.28	203.28	2.52	81.74
208	17.48	0.61	1696	1050	0.01	2730.73	1034.73	3.15	62.11	11	250	0.02	79.78	68.78	1.63	13.79
209	5.13	0.61	654	675	0.01	840.59	186.59	2.35	77.80	12	250	0.11	194.52	182.52	3.96	6.17

Notes:
Development Standards Manual (Town of Caledon, 2019)
Min cover = 1.5 m
Min velocity = 0.75 m/s
Max velocity = 4.0 m/s
Max capacity = 90%
Min pipe size = 300 mm
Min slope = 0.40%
*Where velocities exceed the maximum velocity, opportunities to reduce slopes, such as incorporating drop structures or cascades will be evaluated at the detailed design stage

Appendix C2 – Stormwater Management Pond Sizing Calculations

CROZIER CONSULTING ENGINEERS

PROJECT: Bolton North Hill
PROJECT No.: 0708-3446

CREATED BY: Justin L
UPDATED BY:
CHECKED BY: Jess L

DATE: 2021-10-25
UPDATED: 2026-02-20

Proposed Conditions VO Parameters

Total Impervious and Directly Connected Impervious Values:

Landuse	TIMP (%)	XIMP (%)
Residential (Low-Density)	60%	50%
Residential (Medium-Density)	70%	60%
Residential (High-Density)	80%	80%
Commercial	95%	95%

Landuse	TIMP	XIMP
Institutional (Schools & Churches)	80%	75%
Parks / Open Space	10%	10%
Woodlot	0%	0%
SWM Pond	50%	50%

TIMP and XIMP values from Table 2-2 of the 2018 Humber River Hydrology update

Proposed Site Conditions

Catchment #	Landuse	Area (ha)	TIMP	XIMP
201	Residential (Low-Density)	8.15	60%	50%
	Parks and Open Space	0.35	10%	10%
	Total / Weighted Total:	**8.50**	**58%**	**48%**
202	Residential (Low-Density)	5.04	60%	50%
	Residential (Medium-Density)	1.28	70%	60%
	Parks and Open Space	1.02	10%	10%
	Total / Weighted Total:	**7.34**	**55%**	**46%**
203	Residential (Low-Density)	6.85	60%	50%
	Residential (Medium-Density)	1.85	70%	60%
	Total / Weighted Total:	**8.70**	**62%**	**52%**
204	Residential (Low-Density)	11.45	60%	50%
	Residential (Medium-Density)	3.30	70%	60%
	Parks and Open Space	1.26	10%	10%
	Institutional (School)	2.34	80%	75%
	Total / Weighted Total:	**18.35**	**61%**	**52%**
205	Residential (Low-Density)	2.00	60%	50%
	Residential (Medium-Density)	12.98	70%	60%
	Parks and Open Space	0.71	10%	10%
	Residential (High-Density/Mixed-Use)	2.02	80%	80%
	Total / Weighted Total:	**17.71**	**68%**	**59%**

CROZIER CONSULTING ENGINEERS

PROJECT: Bolton North Hill
PROJECT No.: 0708-3446

CREATED BY: Justin L
UPDATED BY:
CHECKED BY: Jess L

DATE: 2021-10-25
UPDATED: 2026-02-20

Proposed Conditions VO Parameters

Total Impervious and Directly Connected Impervious Values:

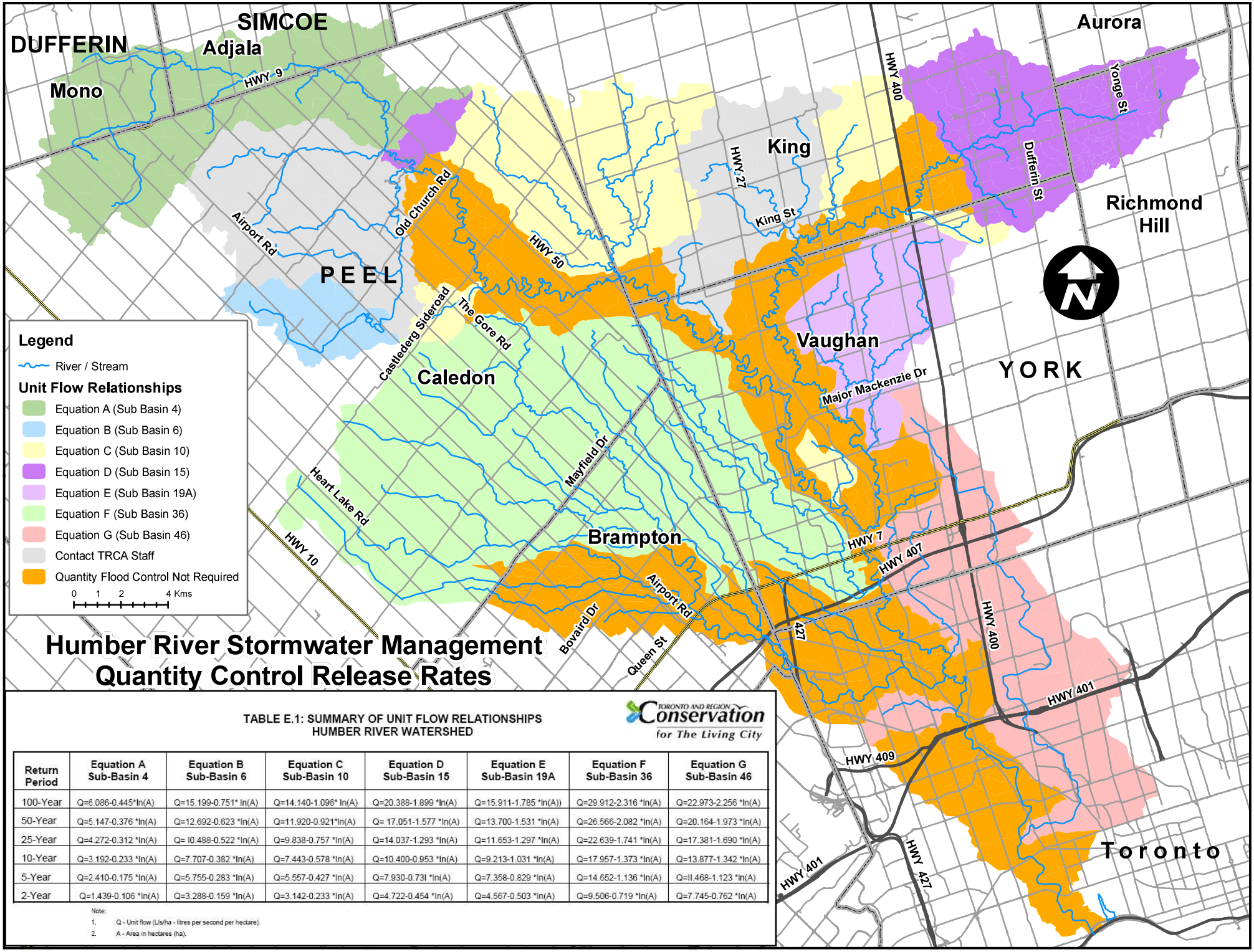
Landuse	TIMP (%)	XIMP (%)
Residential (Low-Density)	60%	50%
Residential (Medium-Density)	60%	50%
Residential (High-Density)	80%	80%
Commercial	95%	95%

Landuse	TIMP	XIMP
Institutional (Schools & Churches)	80%	75%
Parks / Open Space	10%	10%
Woodlot	0%	0%
SWM Pond	50%	50%

TIMP and XIMP values from Table 2-2 of the 2018 Humber River Hydrology update

Proposed Site Conditions

Catchment #	Landuse	Area (ha)	TIMP	XIMP
206	Residential (Low-Density)	4.29	60%	50%
	Residential (Medium-Density)	1.54	70%	60%
	Total / Weighted Total:	**5.83**	**63%**	**53%**
207	Residential (Low-Density)	3.35	60%	50%
	Residential (Medium-Density)	9.03	70%	60%
	Residential (High-Density/Mixed-Use)	3.58	80%	80%
	Parks and Open Space	1.92	10%	10%
	Total / Weighted Total:	**17.88**	**64%**	**57%**
208	Residential (Low-Density)	5.58	60%	50%
	Residential (Medium-Density)	27.56	70%	60%
	Residential (High-Density/Mixed-Use)	0.79	80%	80%
	Parks and Open Space	0.50	10%	10%
	Total / Weighted Total:	**34.43**	**68%**	**58%**
209A	Residential (Low-Density)	17.88	60%	50%
	Institutional (School)	3.78	80%	75%
	Parks and Open Space	0.59	10%	10%
	Total / Weighted Total:	**22.25**	**62%**	**53%**
209B	Residential (Low-Density)	1.33	60%	50%
	Total / Weighted Total:	**1.33**	**60%**	**50%**
210	Residential (Low-Density)	11.99	60%	50%
	Residential (Medium-Density)	5.33	70%	60%
	Parks and Open Space	0.34	10%	10%
	Total / Weighted Total:	**17.66**	**62%**	**52%**
211	Not included in Concept Plan			
	Total / Weighted Total:	**0.00**	**0%**	**0%**
212	Parks and Open Space	3.50	10%	10%
	Total / Weighted Total:	**3.50**	**10%**	**10%**
213	Residential (Medium-Density)	5.03	70%	60%
	Total / Weighted Total:	**5.03**	**70%**	**60%**
Total / Weighted Total:		**168.51**	**62%**	**54%**



Humber River Stormwater Management Quantity Control Release Rates

TABLE E.1: SUMMARY OF UNIT FLOW RELATIONSHIPS
HUMBER RIVER WATERSHED

Return Period	Equation A Sub-Basin 4	Equation B Sub-Basin 6	Equation C Sub-Basin 10	Equation D Sub-Basin 15	Equation E Sub-Basin 19A	Equation F Sub-Basin 36	Equation G Sub-Basin 46
100-Year	Q=6.086-0.445*ln(A)	Q=15.199-0.751* ln(A)	Q=14.140-1.096* ln(A)	Q=20.388-1.899 *ln(A)	Q=15.911-1.785 *ln(A))	Q=29.912-2.316 *ln(A)	Q=22.973-2.256 *ln(A)
50-Year	Q=5.147-0.376 *ln(A)	Q=12.692-0.623 *ln(A)	Q=11.920-0.921*ln(A)	Q= 17.051-1.577 *ln(A)	Q=13.700-1.531 *ln(A)	Q=26.566-2.082 *ln(A)	Q=20.164-1.973 *ln(A)
25-Year	Q=4.272-0.312 *ln(A)	Q= I0.488-0.522 *ln(A)	Q=9.838-0.757 *ln(A)	Q=14.037-1.293 *ln(A)	Q=11.653-1.297 *ln(A)	Q=22.639-1.741 *ln(A)	Q=17.381-1.690 *ln(A)
10-Year	Q=3.192-0.233 *ln(A)	Q=7.707-0.382 *ln(A)	Q=7.443-0.578 *ln(A)	Q=10.400-0.953 *ln(A)	Q=9.213-1.031 *ln(A)	Q=17.957-1.373 *ln(A)	Q=13.877-1.342 *ln(A)
5-Year	Q=2.410-0.175 *ln(A)	Q=5.755-0.283 *ln(A)	Q=5.557-0.427 *ln(A)	Q=7.930-0.73l *ln(A)	Q=7.358-0.829 *ln(A)	Q=14.652-1.136 *ln(A)	Q=II.468-1.123 *ln(A)
2-Year	Q=1.439-0.106 *ln(A)	Q=3.288-0.159 *ln(A)	Q=3.142-0.233 *ln(A)	Q=4.722-0.454 *ln(A)	Q=4.567-0.503 *ln(A)	Q=9.506-0.719 *ln(A)	Q=7.745-0.762 *ln(A)

Note:
1. Q - Unit flow (Ls/ha - litres per second per hectare).
2. A - Area in hectares (ha).

TORONTO AND REGION Conservation for The Living City

PROJECT: Bolton North Hill
PROJECT No.: 0708-3446

CREATED BY: ED
UPDATED BY: ED
CHECKED BY: JL

DATE: 2021-10-25
UPDATED: 2024-06-05

Existing Conditions VO Parameters

Existing Site Conditions

CN, CN*, CN III and IA values were determined through the Area Weighted calculator capabilities of Visual Otthymo 6.2

VO Parameters

Catchment #	Area (ha)	CN	CN*	CN III	IA (mm)	Tp (hr)
100	5.39	82	82	91	7.00	0.45
101	7.87	82	82	91	6.93	0.55
102	1.99	82	82	91	6.95	0.13
103	5.54	82	82	91	6.90	0.45
104	6.52	82	82	91	7.08	0.50
105	11.51	82	82	91	7.03	0.59
106	15.65	81	81	91	6.99	0.76
107	5.36	83	83	92	6.59	0.61
108	6.68	82	82	91	7.01	0.24
109	19.85	89	91	96	4.82	0.51
110	15.34	82	82	91	6.98	0.68
111	22.12	82	82	91	7.01	0.46
112	4.62	82	82	91	7.00	0.40
113	12.78	82	82	91	7.00	0.69
114	9.91	83	83	92	6.79	0.51
115	9.87	82	82	91	7.02	0.72
116	7.40	83	83	92	6.82	0.59
117	5.14	83	83	92	6.92	0.51
Total Site:	**173.54**	**83**	**83**	**92**	**6.71**	**0.56**

CROZIER CONSULTING ENGINEERS

PROJECT: Bolton North Hill
PROJECT No.: 0708-3446

CREATED BY: ED
UPDATED BY: ED
CHECKED BY: JL

DATE: 2021-10-25
UPDATED: 2024-06-05

Existing Conditions VO Parameters

Existing Site Conditions

CN, CN*, CN III and IA values were determined through the Area Weighted calculator capabilities of Visual Otthymo 6.2

VO Parameters

Catchment #	Area (ha)	CN	CN*	CN III	IA (mm)	Tp (hr)
EXT1	3.24	82	82	91	7.00	0.42
EXT2	13.39	83	83	92	7.02	0.77
EXT3	4.11	82	82	91	7.00	0.36
EXT4	44.26	71	69	84	6.82	1.32
EXT5	8.36	62	61	78	9.06	0.66
EXT6	6.35	84	85	93	5.78	1.39
EXT7	15.80	84	85	93	7.10	1.14
EXT8	18.96	84	93	93	8.39	0.84
EXT9	24.02	79	80	90	8.47	0.57
EXT10	9.26	76	76	88	9.45	0.34
EXT11	5.25	80	80	90	7.65	0.50
EXT12	10.28	82	81	91	8.13	0.42
EXT13	13.24	81	80	90	9.54	0.68
EXT14	15.14	76	76	88	9.38	0.59
EXT15	12.92	85	85	93	7.69	0.71
EXT16	22.09	83	83	92	7.86	0.51
EXT17	10.44	76	76	88	9.73	0.50
EXT18	6.98	79	80	90	10.16	0.29
EXT19	23.88	82	82	91	8.04	1.05
EXT20	17.82	83	83	92	7.76	0.99
EXT21	51.56	82	82	91	7.54	1.08
EXT22	59.54	83	83	92	7.53	0.94

Catchment ID	Area (ha)	TIMP (%)	XIMP (%)
EXT62	0.31	38	38
EXT64	1.42	31	31
EXT65	1.64	44	44
EXT66	0.62	44	44
EXT70	0.35	38	38
EXT86	0.62	44	44
EXT138	0.63	31	31
EXT139	0.59	31	31
EXT165	0.48	44	44
EXT166	0.68	31	31

CROZIER CONSULTING ENGINEERS

PROJECT: Bolton North Hill
PROJECT No.: 0708-3446

CREATED BY: ED
CHECKED BY: JL

DATE: 2021-10-25

Time to Peak Calculations

Time to Peak Inputs								Airport	
Drainage Area ID	Area (ha)	C	Length (m)	US Elev	DS Elev	Drop (m)	Slope (%)	Tc (hr)	**Tp (hr)**
100	5.39	0.25	447.4	266.4	252.9	13.5	3.0%	0.68	**0.45**
101	7.87	0.25	590.7	266.9	252.0	14.9	2.5%	0.83	**0.55**
102	1.99	0.25	121.6	261.5	237.0	24.5	20.1%	0.19	**0.13**
103	5.54	0.25	335.6	264.5	257.8	6.7	2.0%	0.67	**0.45**
104	6.52	0.25	393.1	264.5	257.0	7.5	1.9%	0.74	**0.50**
105	11.51	0.25	575.4	269.3	257.8	11.5	2.0%	0.88	**0.59**
106	15.65	0.25	771.1	274.4	263.2	11.1	1.4%	1.14	**0.76**
107	5.36	0.25	477.5	271.8	265.3	6.6	1.4%	0.91	**0.61**
108	6.68	0.25	178.6	266.5	256.7	9.8	5.5%	0.35	**0.24**
109	19.85	0.25	450.2	267.5	257.7	9.8	2.2%	0.76	**0.51**
110	15.34	0.25	596.1	271.1	263.0	8.1	1.4%	1.02	**0.68**
111	22.12	0.25	374.6	271.0	262.8	8.2	2.2%	0.69	**0.46**
112	4.62	0.25	284.3	268.5	262.0	6.5	2.3%	0.59	**0.40**
113	12.78	0.25	560.5	269.3	262.5	6.8	1.2%	1.03	**0.69**
114	9.91	0.25	333.8	266.1	261.6	4.4	1.3%	0.77	**0.51**
115	9.87	0.25	554.2	266.5	260.9	5.6	1.0%	1.08	**0.72**
116	7.40	0.25	286.1	266.3	264.3	1.9	0.7%	0.89	**0.59**
117	5.14	0.25	265.6	262.0	259.5	2.5	1.0%	0.76	**0.51**
EXT1	3.24	0.25	277.9	267.5	262.3	5.2	1.9%	0.63	**0.42**
EXT2	13.39	0.25	547.6	267.0	262.4	4.6	0.8%	1.15	**0.77**
EXT3	4.11	0.25	261.1	267.0	259.6	7.4	2.8%	0.53	**0.36**
EXT4	44.26	0.25	1685.7	278.5	263.5	15.0	0.9%	1.97	**1.32**
EXT5	8.36	0.25	512.6	274.0	267.8	6.2	1.2%	0.98	**0.66**
EXT6	6.35	0.25	717.0	273.0	271.5	1.5	0.2%	2.07	**1.39**
EXT7	15.80	0.25	959.0	278.2	272.5	5.7	0.6%	1.70	**1.14**
EXT8	18.96	0.25	790.3	278.5	269.8	8.7	1.1%	1.26	**0.84**
EXT9	24.02	0.25	826.2	259.5	226.9	32.6	3.9%	0.84	**0.57**
EXT10	9.26	0.25	406.9	252.0	226.5	25.5	6.3%	0.51	**0.34**
EXT11	5.25	0.25	504.7	263.0	248.9	14.1	2.8%	0.74	**0.50**
EXT12	10.28	0.25	338.8	265.5	257.0	8.5	2.5%	0.63	**0.42**
EXT13	13.24	0.25	612.5	257.0	248.3	8.7	1.4%	1.02	**0.68**
EXT14	15.14	0.25	509.1	248.3	240.0	8.4	1.6%	0.88	**0.59**
EXT15	12.92	0.25	951.5	264.3	241.0	23.2	2.4%	1.06	**0.71**
EXT16	22.09	0.25	768.5	265.5	227.5	38.0	4.9%	0.76	**0.51**
EXT17	10.44	0.25	482.6	240.0	227.5	12.4	2.6%	0.74	**0.50**
EXT18	6.98	0.25	408.1	263.0	220.0	43.0	10.5%	0.43	**0.29**
EXT19	23.88	0.25	1101.3	269.0	258.8	10.3	0.9%	1.57	**1.05**
EXT20	17.82	0.25	685.4	262.0	258.2	3.8	0.6%	1.47	**0.99**
EXT21	50.76	0.25	1136.5	263.6	253.3	10.3	0.9%	1.61	**1.08**
EXT22	59.54	0.25	1612.1	265.0	227.7	37.3	2.3%	1.41	**0.94**

CROZIER CONSULTING ENGINEERS

PROJECT: Bolton North Hill
PROJECT No.: 0708-3446

CREATED BY: ED
UPDATED BY: ED
CHECKED BY: JL

DATE: 2021-10-25
UPDATED: 2024-12-12

Proposed Conditions VO Parameters

Total Impervious and Directly Connected Impervious Values:

Landuse	TIMP (%)	XIMP (%)
Residential (Low-Density)	60%	50%
Residential (Medium-Density)	60%	50%
Residential (High-Density)	80%	80%
Commercial	95%	95%

Landuse	TIMP	XIMP
Institutional (Schools & Churches)	80%	75%
Parks / Open Space	10%	10%
Woodlot	0%	0%
SWM Pond	50%	50%

TIMP and XIMP values from Table 2-2 of the 2018 Humber River Hydrology update

Proposed Site Conditions

Percent Impervious (TIMP):

Catchment #	Landuse	Area (ha)	TIMP	XIMP
201	Residential (Low-Density)	14.70	60%	50%
	Residential (Medium-Density)	6.32	60%	50%
	Parks and Open Space	2.07	10%	10%
	Institutional (School)	2.45	80%	75%
	SWM Pond	1.57	50%	50%
	Commercial	0.32	95%	95%
	Total / Weighted Total:	**27.43**	**58%**	**50%**
202	Residential (Low-Density)	8.61	60%	50%
	Residential (Medium-Density)	2.18	60%	50%
	SWM Pond	2.98	50%	50%
	Institutional (School)	0.95	80%	75%
	Parks and Open Space	0.56	10%	10%
	Total / Weighted Total:	**15.28**	**57%**	**50%**
203	Commercial	2.09	95%	95%
	Residential (Low-Density)	1.47	60%	50%
	Residential (Medium-Density)	9.81	60%	50%
	Residential (High-Density)	3.42	80%	80%
	Parks and Open Space	1.33	10%	10%
	SWM Pond	1.92	50%	50%
	Total / Weighted Total:	**20.04**	**63%**	**57%**
204	Residential (Low-Density)	9.14	60%	50%
	Residential (Medium-Density)	3.03	60%	50%
	Parks and Open Space	1.84	10%	10%
	SWM Pond	1.63	50%	50%
	Total / Weighted Total:	**15.64**	**53%**	**45%**
205	Residential (Low-Density)	15.97	60%	50%
	Residential (Medium-Density)	2.69	60%	50%
	Parks and Open Space	2.56	10%	10%
	SWM Pond	2.63	50%	50%
	Institutional (School)	3.38	80%	75%
	Total / Weighted Total:	**27.24**	**57%**	**49%**

CROZIER CONSULTING ENGINEERS

PROJECT: Bolton North Hill
PROJECT No.: 0708-3446

CREATED BY: ED
UPDATED BY: ED
CHECKED BY: JL

DATE: 2021-10-25
UPDATED: 2024-12-12

Proposed Conditions VO Parameters

Total Impervious and Directly Connected Impervious Values:

Landuse	TIMP (%)	XIMP (%)
Residential (Low-Density)	60%	50%
Residential (Medium-Density)	60%	50%
Residential (High-Density)	80%	80%
Commercial	95%	95%

Landuse	TIMP	XIMP
Institutional (Schools & Churches)	80%	75%
Parks / Open Space	10%	10%
Woodlot	0%	0%
SWM Pond	50%	50%

TIMP and XIMP values from Table 2-2 of the 2018 Humber River Hydrology update

Proposed Site Conditions

Percent Impervious (TIMP):

Catchment #	Landuse	Area (ha)	TIMP	XIMP
206	Commercial	7.35	95%	95%
	Residential (Medium-Density)	9.22	60%	50%
	Residential (High-Density)	5.76	80%	80%
	SWM Pond	2.90	50%	50%
	Total / Weighted Total:	**25.23**	**74%**	**70%**
207	Residential (Medium-Density)	8.99	60%	50%
	Residential (High-Density)	5.10	60%	50%
	SWM Pond	1.08	50%	50%
	Parks and Open Space	1.20	10%	10%
	Total / Weighted Total:	**16.37**	**56%**	**47%**
208	Residential (Low-Density)	11.88	60%	50%
	Residential (Medium-Density)	4.33	60%	50%
	SWM Pond	1.27	50%	50%
	Total / Weighted Total:	**17.48**	**59%**	**50%**
209	Residential (Medium-Density)	4.52	60%	50%
	SWM Pond	0.60	50%	50%
	Total / Weighted Total:	**5.13**	**59%**	**50%**
210	Agricultural	**3.29**	**0%**	**0%**
	Total / Weighted Total:	**173.13**	**59%**	**52%**

CROZIER

Project: Bolton North Hill
File: 0708-3446
Designed by: E.D.
Checked by: J.L.
Date: October 15, 2021
Updated: February 20, 2026

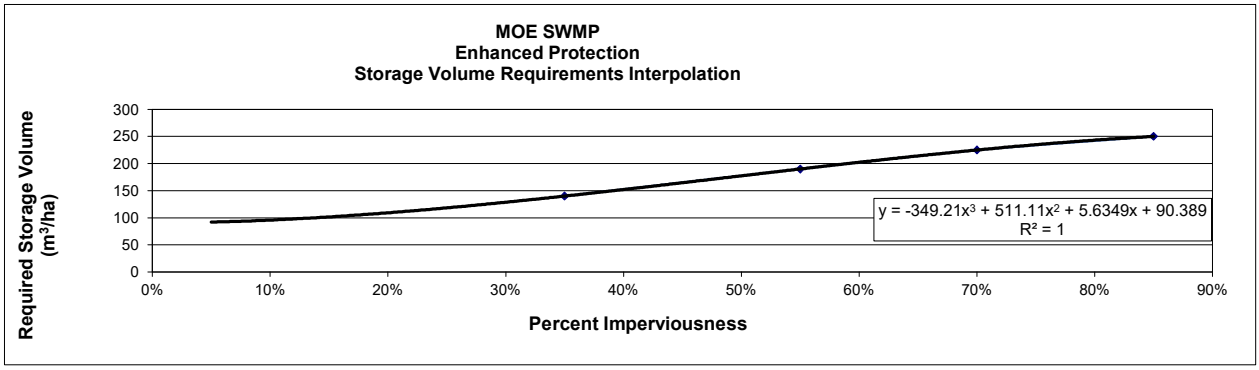
SWM Pond Permanent Pool Volume Calculations

Pond Name	Drainage Catchment	Area to Pond (ha)	Percent Impervious (%)	Storage Vol. Req'd (m^3/ha)	Extended Detention Volume Req'd (m^3/ha)	Permanent Pool Vol. Req'd (m^3/ha)	Extended Detention Volume Req'd (m^3)	Permanent Pool Vol. Req'd (m^3)
SWMP 10	201	8.50	58%	197	40	157	340	1,338
SWMP 1	202	7.34	55%	190	40	150	294	1,101
SWMP 2/3	203	8.71	62%	207	40	167	348	1,455
SWMP 4	204	18.33	61%	205	40	165	733	3,020
SWMP 5	205	17.71	68%	221	40	181	709	3,202
SWMP 8	206/207	23.69	63%	209	40	169	948	4,015
SWMP 7	208	34.45	68%	221	40	181	1,378	6,228
SWMP 6	209A/B	23.59	62%	207	40	167	943	3,942
SWMP 9	210	17.67	62%	207	40	167	707	2,952
SWMP 11	213	5.03	70%	225	40	185	201	931

MOE 2003 SWMP Manual: Water Quality Storage Requirements based on Receiving Waters *

PROTECTION LEVEL	SWMP Type	STORAGE VOLUME (m^3 / ha) FOR IMPERVIOUS LEVEL			
		35%	55%	70%	85%
Enhanced	Wet Pond	140	190	225	250
Normal	Wet Pond	90	110	130	150
Basic	Wet Pond	60	75	85	95

** Table 3.2 from the MOE SWMP Planning & Design Manual, 2004, pg 3-10*



CROZIER

Project: Bolton North Hill
File: 0708-3446
Designed by: E.D.
Checked by: J.N.L.
Date: October 15, 2021
Updated: February 20, 2026

SWM Pond Extended Detention Volume Calculations

Pond Name	Drainage Catchment	Area to Pond (ha)	Percent Impervious (%)	MOE Extended Detention Volume[1] (m^3/ha)	MOE Extended Detention Volume (m^3)	25mm Event Runoff Volume[2] (mm)	25mm Event Runoff Volume (m^3)
SWMP 10	201	8.50	58%	40	340	15.04	1,278
SWMP 1	202	7.34	55%	40	294	13.91	1,021
SWMP 2/3	203	8.71	62%	40	348	15.08	1,313
SWMP 4	204	18.33	61%	40	733	15.00	2,749
SWMP 5	205	17.71	68%	40	709	16.27	2,883
SWMP 8	206/207	23.69	63%	40	948	15.63	3,702
SWMP 7	208	34.45	68%	40	1,378	16.18	5,573
SWMP 6	209A/B	23.59	62%	40	943	15.15	3,574
SWMP 9	210	17.67	62%	40	707	15.08	2,664
SWMP 11	213	5.03	70%	40	201	16.54	832

Notes:
1) MOE Extended Detention Volume requirement of 40m^3/ha obtained from MOE SWMP Planning & Design Manual, 2004, Pg 3-10
2) 25mm Event Runoff Volume obtained from Visual Otthymo model

C3 – Pond Design Visual OTTHYMO Model Output

VO Schematics and Output files are available upon request

Justin Lawrence- jlawrence@cfcrozier.ca
Rebecca Archer – racher@cfcrozier.ca

APPENDIX D

Floodplain Analysis Documentation

D1 – HEC-RAS Model Schematics
D2 – HEC-RAS Flow Change Locations and Peak Flow Rates
D3 – HEC-RAS Water Surface Elevation and Velocity Results
D4 – Correspondence with Toronto and Region Conservation Authority

Appendix D1 – HEC-RAS Model Schematics

Emil Kolb Pkwy

HWY 50

Duffys Ln

Tributary E

Tributary D

Tributary C

Tributary B

Tributary A

Main Humber River

Tributary C+D

Bridge Crossing
Span: 21 m
Rise: 6.55 m

Culvert Crossing
Corrugated Steel Pipe
Length: 30.4 m
US Invert Elev.: 246.13 m
DS Invert Elev.: 242.53 m

0 0.25 0.5 1 Kilometres

Crossing
Watercourse
Cross Section
Bolton North Hills Property Boundary

CROZIER
CELEBRATING 20 YEARS SINCE 2004

Bolton North Hills

Middle Main HEC-RAS Model Schematic

Mt Hope Rd

Cold Creek

992

993

Tributary F

1126

1184

1245

1318

1373

1399.710

1450.99

1511.34

1539.69

1571.71

4370.082

4370.081

Tributary E

4370.079

4370.073

4370.043

4369.909

4388.863

4344

4308.669

4196.075

4007.722

3956.844

3899.436

3821.818

3789.828

3711.272

3653.272

3602.49

3483.216

3413.879

3378.892

3308.731

3216.276

3198.314

3190.241

3115.165

3054.114

3040.584

2972.104

Columbia Way

Hwy 50

Tributary D

Culvert Crossing
Corrugated Steel Pipe
Length: 62.51 m
US Invert Elev.: 252.86 m
DS Invert Elev.: 252.78 m

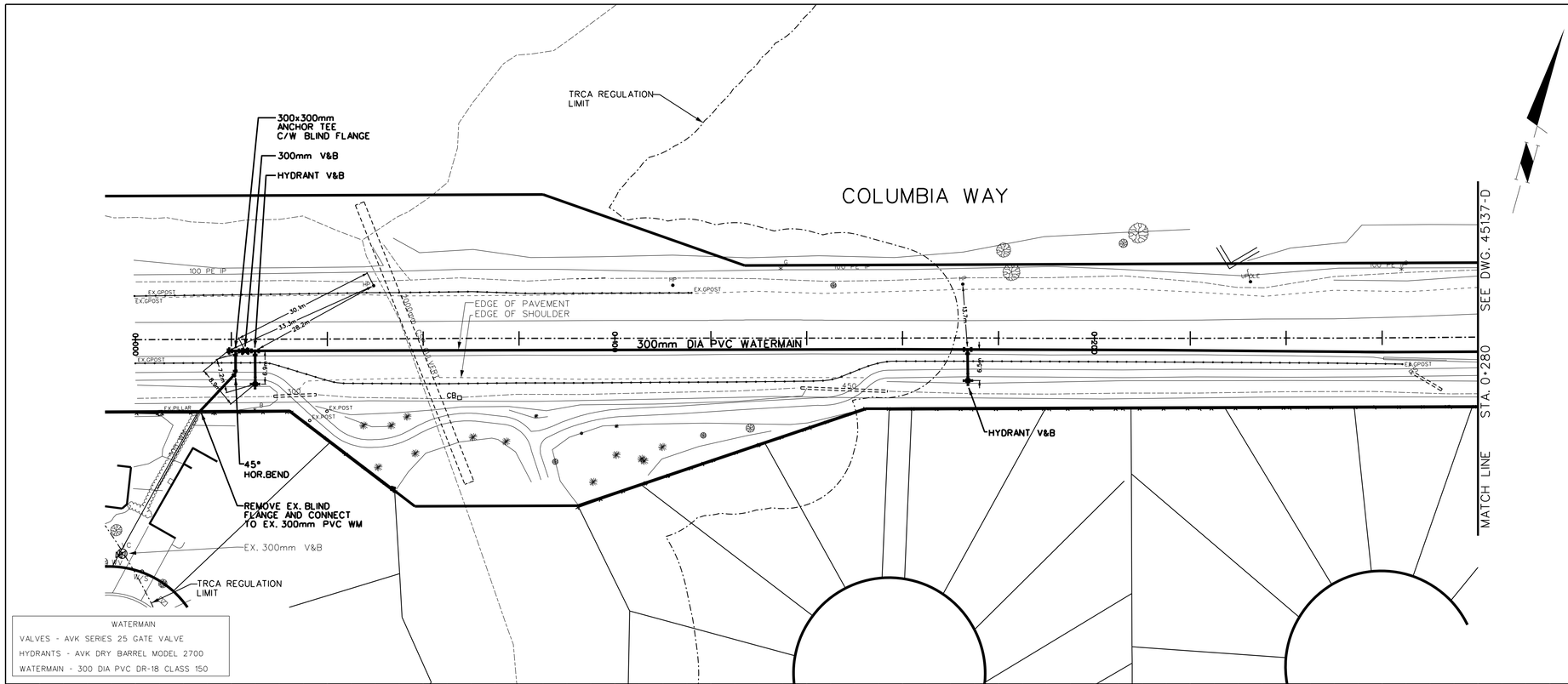
0 0.25 0.5 1 Kilometres

Crossing
Watercourse
Cross Section
Bolton North Hills Property Boundary

CROZIER

Bolton North Hills

Cold Creek HEC-RAS
Model Schematic

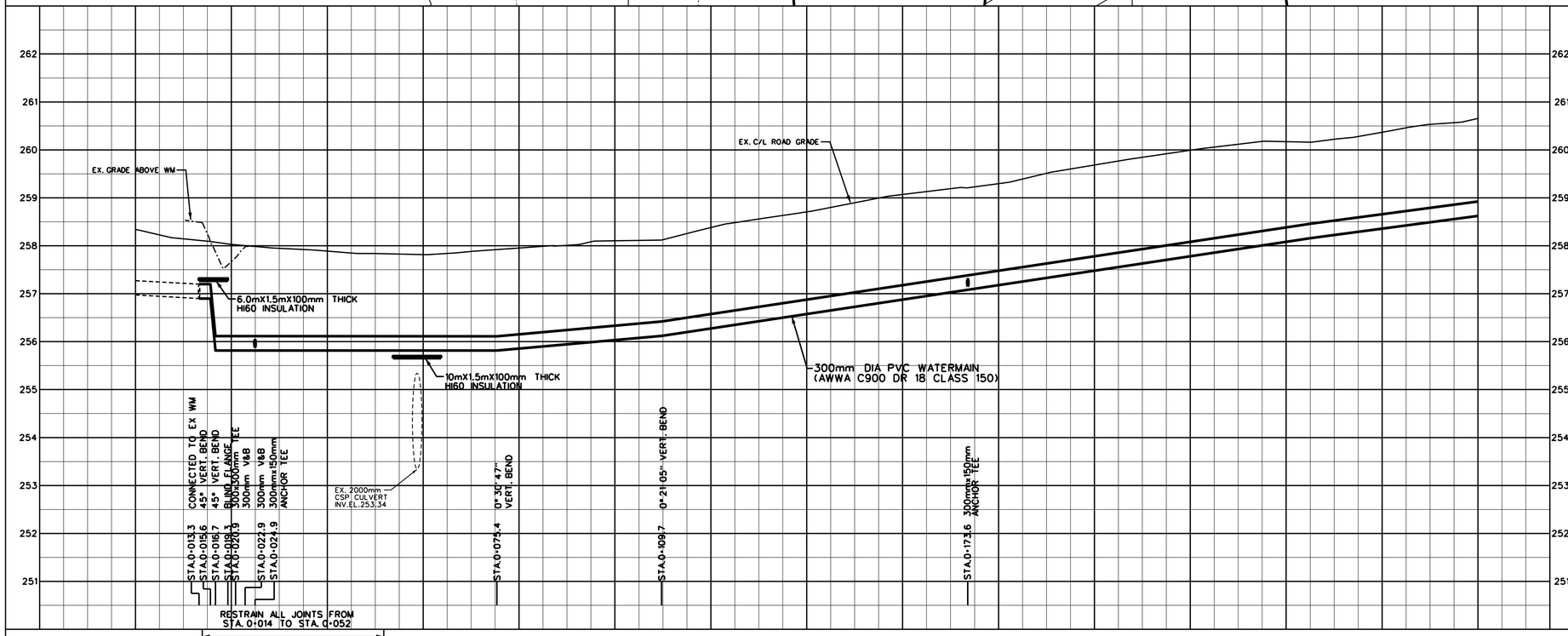


WATERMAIN

VALVES - AVK SERIES 25 GATE VALVE

HYDRANTS - AVK DRY BARREL MODEL 2700

WATERMAIN - 300 DIA PVC DR-18 CLASS 150



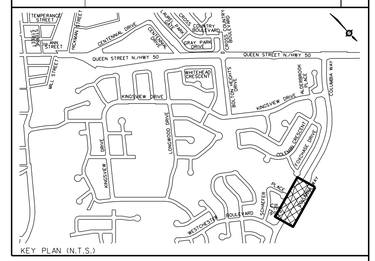
	255.81	255.81	255.81	255.85	256.03	256.27	256.58	256.88	257.18	257.48	257.78	258.08	258.36	258.62	BOT.EL. OF WM.
258.37	258.03	257.89	257.81	257.95	258.10	258.38	258.70	259.06	259.30	259.69	260.00	260.17	260.37	260.65	EX. ROAD ELEV.
0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	ROAD CHAINAGE

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			C.T.V.		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
JUN.13/2012	ISSUED FOR CONSTRUCTION	B.G.G.
APR.29/2013	AS-BUILT SUBMISSION	B.G.G.



LEGEND

W/S — 20mm DIA. or 25mm DIA. COPPER AS STATED ON THE DRAWING.

35 — HOUSE NUMBER

25mmC — W/S SIZE AND TYPE

Disclaimer

As-constructed dimensions, measurements and other details contained in this record drawing have been obtained by AECOM CANADA LTD. ("AECOM") from various sources. Such information represents the best information available to AECOM at the time of preparation of this record drawing. AECOM does not in any way represent or warrant that such information is accurate and assumes no responsibility for any errors or omissions contained therein.

AECOM

General Notes

- All Driveways ASPHALT Unless Otherwise Noted.
- All Service Locations Are Approximate And Must Be Located Accurately In The Field
- Denotes Building - Not Located
- Denotes Building Located
- Type 'B' Bedding Unless Otherwise Noted (SAN)

Region of Peel BM NO.73: On The North Face, West Corner Of A Red Brick House, No.166 King Street West Bolton. Elev. 226.567

B.M. No. 73 Elev. 226.567m

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction Location of Existing Utilities Approximate Only, To Be Verified In Field By Contractor.

ORIGINAL DESIGN STAMPED BY B.G.GRATRIX, P.ENG. JUNE 13, 2012

Designed by ____ Chkd. ____

Approved by ____

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

THE REGIONAL MUNICIPALITY OF PEEL	CABLE TELEVISION/FIBREOPTIC PROVIDERS:
CITY OF MISSISSAUGA WORKS DEPT.	BELL CANADA
CITY OF BRAMPTON WORKS DEPT.	ENERSOURCE TELECOM
TOWN OF CALEDON WORKS DEPT.	HYDRO ONE TELECOM
BELL CANADA	ROGERS CABLE
ENBRIDGE INCORPORATED-GAS DISTRIBUTION	ALLSTREAM
ONTARIO MINISTRY OF TRANSPORTATION	PSN (PUBLIC SECTOR NETWORK)
ONTARIO CLEAN WATER AGENCY	FUTUREWAY (FCI/BROADBAND)
HYDRO ONE NETWORKS	
ENERSOURCE, HYDRO MISSISSAUGA	
HYDRO ONE BRAMPTON	

10m 0 10 20 30m — HORIZONTAL SCALE

1m 0 1 2 3m — VERTICAL SCALE

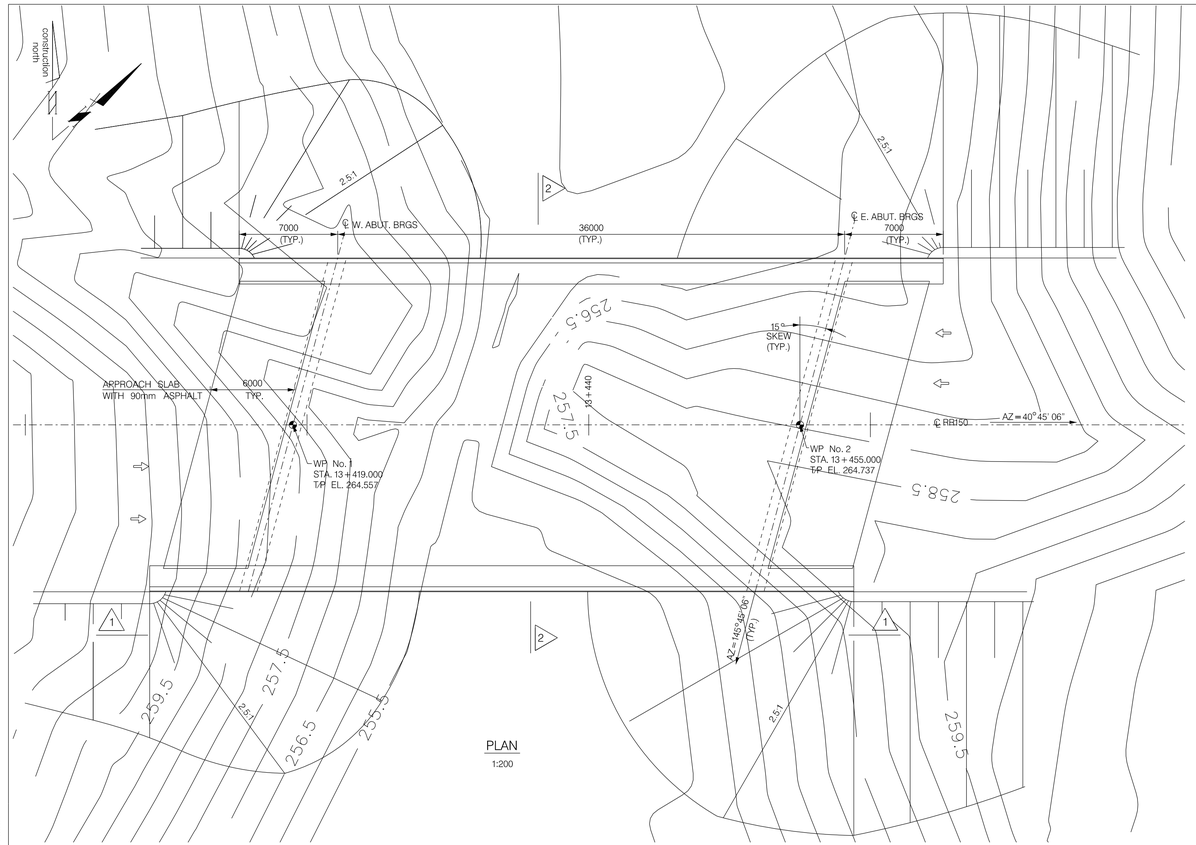
Region of Peel
Working for you

QUEEN ST. N/HIGHWAY 50

(FROM HUMBER RIVER TO COLUMBIA WAY)

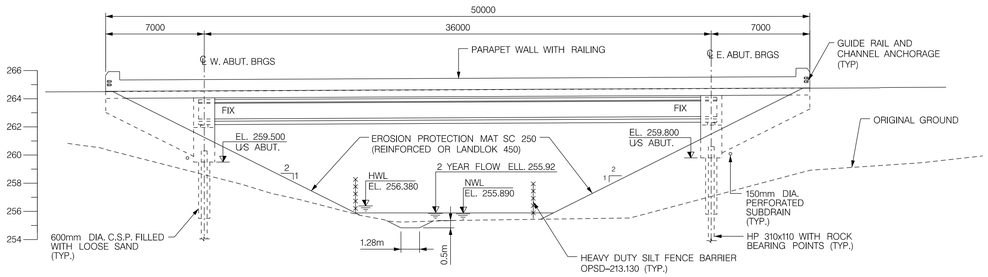
300mm WATERMAIN
PLAN AND PROFILE
STA. 0+000 TO STA. 0+280

CAD Area	Area C-22	Project No.	09-1970 09-1115
Checked by B.G.G.	Drawn by A.L.G.		
Date JUN. 13, 2012	Sheet 16 of 45	Plan No.	45136-D



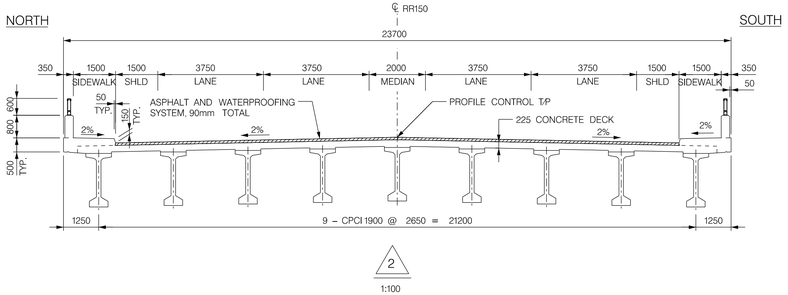
PLAN

1:200

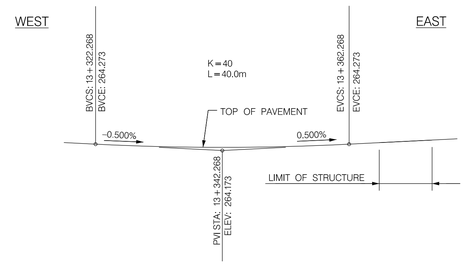


1 ELEVATION

1:200



2 1:100



PROFILE OF RR150

N.T.S.

ENVIRONMENTAL REQUIREMENTS

FOR DETAILS OF CHANNEL CROSS SECTION SEE CHANNEL RESTORATION DWGS

ALL SEDIMENT AND EROSION CONTROL MEASURES MUST BE INSTALLED PRIOR TO DISTURBING ANY AREAS. THE CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL ALL DISTURBED AREAS HAVE BEEN STABILIZED AND RESTORED.

ALL WORK MUST BE CARRIED OUT IN THE DRY. THE CONTRACTOR IS RESPONSIBLE FOR ANY UNWATERING REQUIRED TO REMOVE THE EXISTING STRUCTURE AND FOOTINGS AND TO CONSTRUCT THE NEW STRUCTURE AND FOOTINGS.

NO WORK IS PERMITTED IN THE CREEK WITH THE EXCEPTION OF DIVERSION BERMING AND NO MATERIAL SHALL BE RELEASED INTO THE CREEK, INCLUDING UNTREATED WATER FROM UNWATERING ACTIVITIES.

THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING PROTECTION MEASURES TO PREVENT ANY CONCRETE, RUBBLE, DUST OR EFFLUENT FROM ENTERING THE WATERCOURSE. ALL TEMPORARY SEDIMENT CONTROL MEASURES TO BE UNDERTAKEN OUTSIDE OF THE WATERCOUSE.

CROSSING THROUGH THE CREEK BY CONSTRUCTION EQUIPMENT IS NOT PERMITTED.

FISH TRAPPED DURING UNWATERING OF THE WORK ZONE SHALL BE NETTED BY A QUALIFIED FISHERIES BIOLOGIST AND RELEASED TO THE STREAM CHANNEL IMMEDIATELY UPSTREAM OF THE WORK ZONE TO ALLOW MIGRATORY FISH TO ACCESS THE WATERCOURSE UPSTREAM OF THE WORK ZONE.

LIST OF DRAWINGS:

133. GENERAL ARRANGEMENT
134. FOUNDATION LAYOUT
135. ABUTMENTS
136. WINGWALLS
137. PRESTRESSED GIRDERS AND BEARINGS
138. DECK DETAILS
139. DECK REINFORCEMENT
140. PARAPET WALL ON SIDEWALK WITH RAILING
141. RAILING FOR PARAPET WALL
142. 6000mm APPROACH SLAB
143. PILE DRIVING CONTROL
144. STANDARD DETAILS
145. ELECTRICAL EMBEDDED WORK

LEGEND

W.P. DENOTES WORKING POINT
T/P DENOTES TOP OF PAVEMENT
U/S ABUT. DENOTES UNDERSIDE OF ABUTMENT.

APPLICABLE STANDARD DRAWINGS:

OPSD – 3101.150 WALLS, ABUTMENT, BACKFILL, MINIMUM GRANULAR REQUIREMENT

OPSD – 3370.100 DECK, WATERPROOFING HOT APPLIED ASPHALT MEMEBRANE WITH PROTECTION BOARD.

OPSD – 3370.101 DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm WIDE AND CONSTRUCTION JOINTS.

OPSD – 3419.100 BARRIERS AND RAILINGS, STEEL BEAM, GUIDE RAIL AND CHANNEL ANCHORAGE.

OPSD – 3941.200 FIGURES IN CONCRETE, SITE NUMBER AND DATE, LAYOUT.

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		
TRANSIT			HYDRO ONE		
PARKS & REC.			CTV		
ONT. CLEAN WATER			COMMUNIC. CABLES		

REVISIONS

DATE	DETAILS	INIT.
2013 /01 /16	ISSUED FOR CONSTRUCTION	
2014 /04 /30	ISSUED FOR FIELD REVISION	
2015 /11 /30	AS-RECORDED	A.S.C.

GENERAL NOTES

DESIGN CODE: CHBDC CANCSA-S6-06
DESIGN LOAD: CL-625 ONT

1. CLASS OF CONCRETE

CLASS OF CONCRETE FOR PRECAST GIRDERS ARE GIVEN ON THE PRESTRESSED GIRDER DRAWINGS

REMAINDER,
UNLESS NOTED OTHERWISE.....35 MPa

2. CLEAR COVER TO REINFORCING STEEL

FOOTINGS.....100 + 25mm
DECK:
TOP.....70 + 20mm
BOTTOM.....40 + 10mm
REMAINDER (UNLESS OTHERWISE NOTED) .....70 + 20mm

3. REINFORCING STEEL

REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH PREFIX 'C' DENOTE COATED BARS.

STAINLESS REINFORCING STEEL SHALL BE TYPE 316 LN, DUPLEX 2205 OR XM-28 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa. BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.

UNLESS SHOWN OTHERWISE, TENSION LAP LENGTHS NOT INDICATED ON CONTRACT DRAWINGS SHALL BE CLASS B.

BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1 AND SS12-2, UNLESS INDICATED OTHERWISE.

4. CONSTRUCTION NOTES

THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESSES FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESS IS DIFFERENT FROM THOSE GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL TO SUIT.

NO BACKFILL SHALL BE PLACED UNTIL DECK CONCRETE HAS REACHED 75% OF ITS SPECIFIED STRENGTH.

BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH ABUTMENTS KEEPING THE HEIGHT OF BACKFILL APPROXIMATELY THE SAME, AT NO TIME SHALL THE DIFFERENCE IN BACKFILL ELEVATION BE GREATER THAN 0.5m.

THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS SHOWN ON THE STRUCTURE DRAWINGS AGAINST OTHER CONTRACT DOCUMENTS AND REPORT DISCREPANCIES TO ENGINEER BEFORE PROCEEDING WITH WORK.

PROVIDE MINIMUM 1.2m FROST PROTECTION TO BOTTOM OF ALL FOOTINGS UNTIL COMPLETION OF FINAL GRADING.

IBI GROUP
100-175 Galaxy Boulevard
Toronto ON M9W 0C9 Canada
tel 416 679 1930 fax 416 675 4620
ibigroup.com

Designed by Chkd.

Approved by

Region of Peel
Working for you

REGIONAL ROAD 150

(FROM KING STREET TO REGIONAL ROAD 50)

CROSSING No. 11
GENERAL ARRANGEMENT

CAD Area	Area C-12 /C-23	Project No.	05-4030
Checked by D.M.	Drawn by S.Z.		
Date MAR, 2013	Sheet 137 of 190	Plan No.	55280-D

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Appendix D2 – HEC-RAS Flow Change Locations and Peak Flow Rates

Existing Condition

HECRAS FLOW FILE							
River	Reach	RS	2-year	25-year	100-year	Regional	Notes
Cold_10_7	Tributary E	4822.04	0.054	0.054	0.054	2.448	
Cold_10_7	Tributary E	4460.59	0.086	0.086	0.086	3.914	
Cold_10_7	Tributary E	3837.47	0.198	0.198	0.198	9.002	No Areal reduction factor is applied - Regional flow from Future Model
Cold_10_7	Tributary E	10.011	3.348	34.326	51.028	303.179	97.1% Areal reduction factor is applied - Regional flow from Future Model
Humber River	Bolton Reach Up	109.642	4.682	22.258	37.351	369.034	
Humber River	Bolton R 2	107.45	4.694	22.262	37.377	369.640	
Humber River	Bolton R 1	107.233	8.142	36.108	55.233	385.589	89.4% Areal reduction factor is applied - Regional flow from Future Model
Humber River	Bolton R 1	106.631	8.125	36.084	55.184	384.227	89.4% Areal reduction factor is applied - Regional flow from Future Model
Humber River	Bolton R 1	102.613*	8.344	36.489	55.994	395.094	89.4% Areal reduction factor is applied - Regional flow from Future Model
Humber River	Bolton Reach	102.398	4.769	27.242	42.524	374.948	
Humber River	Bolton Reach	100.401	8.513	37.144	57.169	395.422	
Humber River	DOWNSTREAM	11.39	15.61	66.399	99.717	639.230	92% Areal reduction factor is applied - Regional flow from Future Model
Main_1	Tributary A	1017	0.009	0.140	0.187	0.503	
Main_1	Tributary A	996	0.051	0.786	1.046	2.821	
MM_9_2	Tributary C	2179.936	0.083	1.339	1.761	4.559	
MM_9_2	Tributary C	1855.838	0.096	1.564	2.057	5.325	
MM_9_2	Tributary C	993.3609	0.141	2.288	3.009	7.790	
MM_9_2	Tributary C + D	294	0.009	0.153	0.202	0.523	No Areal reduction factor is applied - Regional flow from Future Model
MM_9_2_trib	Tributary D	1195.922	0.095	1.535	2.019	5.227	
MM_9_2_trib	Tributary D	1192.146	0.162	2.623	3.449	8.930	
MM_9_2_trib	Tributary D	886.4161	0.221	3.586	4.716	12.209	
MM_9_2_trib	Tributary B	1005	0.031	0.475	0.632	1.703	
MM_9_2_trib	Tributary B	999	0.05	0.77	1.024	2.761	

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach Main_1-Tributary A XS 1017 - Existing Conditions

Equation:

Transposition of Flood Discharge

$Q2 = Q1 * (A2 / A1)^{0.75}$

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	3.79	37.79	0.051	**0.009**
25-year			0.786	**0.140**
100-year			1.046	**0.187**
Regional			2.821	**0.503**

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach MM_9_2_trib-Tributary B XS 1005 - Existing Conditions

Equation:

Transposition of Flood Discharge

$$Q2 = Q1 * (A2 / A1)^{0.75}$$

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	19.42	36.99	0.050	**0.031**
25-year			0.770	**0.475**
100-year			1.024	**0.632**
Regional			2.761	**1.703**

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach MM_9_2-Tributary C - Existing Conditions

Equation:

Transposition of Flood Discharge

$Q2 = Q1 * (A2 / A1)^{0.75}$

XS 2179.936

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	53.42	109.13	0.141	**0.083**
25-year			2.288	**1.339**
100-year			3.009	**1.761**
Regional			7.790	**4.559**

XS 1855.838

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	65.72	109.13	0.141	**0.096**
25-year			2.288	**1.564**
100-year			3.009	**2.057**
Regional			7.790	**5.325**

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach MM_9_2_trib-Tributary D - Existing Conditions

Equation:

Transposition of Flood Discharge

$Q2 = Q1 * (A2 / A1)^{0.75}$

XS 1195.922

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	54.26	168.18	0.221	**0.095**
25-year			3.586	**1.535**
100-year			4.716	**2.019**
Regional			12.209	**5.227**

XS 1192.146

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	110.83	168.18	0.221	**0.162**
25-year			3.586	**2.623**
100-year			4.716	**3.449**
Regional			12.209	**8.930**

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach Cold_10_7 -Tributary E - Existing Conditions

Equation:

Transposition of Flood Discharge

$Q2 = Q1 * (A2 / A1)^{0.75}$

XS 4370.082

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	26.77	151.92	0.198	**0.054**
25-year			0.198	**0.054**
100-year			0.198	**0.054**
Regional			9.002	**2.448**

XS 4369.909

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	50.03	151.92	0.198	**0.086**
25-year			0.198	**0.086**
100-year			0.198	**0.086**
Regional			9.002	**3.914**

Proposed Condition

HECRAS FLOW FILE							
River	Reach	RS	2-year	25-year	100-year	Regional	Notes
Cold_10_7	Tributary E	4822.04	0.05	0.50	0.68	2.92	
Cold_10_7	Tributary E	4460.59	0.08	0.80	1.08	4.67	
Cold_10_7	Tributary E	3837.47	0.19	1.84	2.49	10.74	No Areal reduction factor is applied - Regional flow from Future Model
Cold_10_7	Tributary E	10.011	3.36	34.13	50.61	300.39	97.1% Areal reduction factor is applied - Regional flow from Future Model
Humber River	Bolton Reach Up	109.642	4.68	22.26	37.35	369.03	
Humber River	Bolton R 2	107.45	4.69	22.26	37.38	369.64	
Humber River	Bolton R 1	107.233	8.15	36.12	55.23	384.84	89.4% Areal reduction factor is applied - Regional flow from Future Model
Humber River	Bolton R 1	106.631	8.14	36.08	55.19	383.84	89.4% Areal reduction factor is applied - Regional flow from Future Model
Humber River	Bolton R 1	102.613*	8.38	36.53	55.97	389.73	89.4% Areal reduction factor is applied - Regional flow from Future Model
Humber River	Bolton Reach	102.398	4.77	27.24	42.52	374.95	
Humber River	Bolton Reach	100.401	8.55	37.19	57.08	391.54	
Humber River	DOWNSTREAM	11.39	15.62	75.37	97.69	630.96	92% Areal reduction factor is applied - Regional flow from Future Model
Main_1	Tributary A	1017	0.01	0.12	0.20	0.47	
Main_1	Tributary A	996	0.05	0.68	1.13	2.65	
MM_9_2	Tributary C	2179.936	0.08	1.15	1.51	4.26	
MM_9_2	Tributary C	1855.838	0.09	1.34	1.77	4.98	
MM_9_2	Tributary C	993.3609	0.13	1.96	2.58	7.28	
MM_9_2	Tributary C + D	294	0.01	0.15	0.20	0.52	No Areal reduction factor is applied - Regional flow from Future Model
MM_9_2_trib	Tributary D	1195.922	0.09	1.26	1.75	6.09	
MM_9_2_trib	Tributary D	1192.146	0.15	2.15	2.99	10.41	
MM_9_2_trib	Tributary D	886.4161	0.20	2.94	4.09	14.23	
MM_9_2_trib	Tributary B	1005	0.03	0.43	0.60	2.12	
MM_9_2_trib	Tributary B	999	0.05	0.69	0.98	3.43	

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach Main_1-Tributary A XS 1017 - Existing Conditions

Equation:

Transposition of Flood Discharge

$Q2 = Q1 * (A2 / A1)^{0.75}$

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	3.79	37.79	0.048	**0.009**
25-year			0.684	**0.122**
100-year			1.132	**0.202**
Regional			2.654	**0.473**

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach MM_9_2_trib-Tributary B XS 1005 - Existing Conditions

Equation:

Transposition of Flood Discharge

$Q2 = Q1 * (A2 / A1)^{0.75}$

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	19.42	36.99	0.046	**0.028**
25-year			0.690	**0.426**
100-year			0.978	**0.603**
Regional			3.429	**2.115**

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach MM_9_2-Tributary C - Existing Conditions

Equation:

Transposition of Flood Discharge

$Q2 = Q1 * (A2 / A1)^{0.75}$

XS 2179.936

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	53.42	109.13	0.134	**0.078**
25-year			1.961	**1.148**
100-year			2.584	**1.512**
Regional			7.278	**4.259**

XS 1855.838

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	65.72	109.13	0.134	**0.092**
25-year			1.961	**1.341**
100-year			2.584	**1.766**
Regional			7.278	**4.975**

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach MM_9_2_trib-Tributary D - Existing Conditions

Equation:

Transposition of Flood Discharge

$Q2 = Q1 * (A2 / A1)^{0.75}$

XS 1195.922

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	54.26	168.18	0.202	**0.086**
25-year			2.940	**1.259**
100-year			4.089	**1.750**
Regional			14.233	**6.093**

XS 1192.146

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	110.83	168.18	0.202	**0.148**
25-year			2.940	**2.150**
100-year			4.089	**2.991**
Regional			14.233	**10.410**

Project: BNH
Project No.: 708-3446
Date: 2026-03-02
Designed By: JL

Transposition of Flood Discharge

Reach Cold_10_7 -Tributary E - Existing Conditions

Equation:

Transposition of Flood Discharge

$Q2 = Q1 * (A2 / A1)^{0.75}$

XS 4370.082

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	26.77	151.92	0.186	**0.051**
25-year			1.842	**0.501**
100-year			2.485	**0.676**
Regional			10.737	**2.920**

XS 4369.909

Storm Event	Site Area, A2 (ha)	Total Catchment Area, A1 (ha)	Catchment Peak Flow (m^3/s)	Site Peak Flow (m^3/s)
2-year	50.03	151.92	0.186	**0.081**
25-year			1.842	**0.801**
100-year			2.485	**1.080**
Regional			10.737	**4.668**

Appendix D3 – HEC-RAS Water Surface Elevation and Velocity Results

2-Year Storm Event

HEC-RAS Profile: 2-year

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2_trib	Tributary D	1195.922	2-year	EX	0.09	263.57	263.69	263.69	263.72	0.034558	0.79	0.12	2.04	1.05
MM_9_2_trib	Tributary D	1195.922	2-year	PR	0.09	263.57	263.69	263.69	263.71	0.031199	0.75	0.12	2.04	0.99
MM_9_2_trib	Tributary D	1194	2-year	EX	0.09	263.15	263.23	263.23	263.26	0.032863	0.68	0.14	2.91	0.99
MM_9_2_trib	Tributary D	1194	2-year	PR	0.09	263.15	263.23	263.23	263.25	0.034572	0.68	0.13	2.86	1.01
MM_9_2_trib	Tributary D	1193.146	2-year	EX	0.09	262.86	263.05		263.05	0.000311	0.09	1.04	14.01	0.11
MM_9_2_trib	Tributary D	1193.146	2-year	PR	0.09	262.86	263.05		263.05	0.000305	0.09	1.01	13.84	0.10
MM_9_2_trib	Tributary D	1193.1	2-year	EX	0.09	262.94	263.01	263.01	263.02	0.023386	0.54	0.22	10.38	0.83
MM_9_2_trib	Tributary D	1193.1	2-year	PR	0.09	262.94	263.01	263.01	263.02	0.024290	0.54	0.20	9.48	0.84
MM_9_2_trib	Tributary D	1193.002	2-year	EX	0.09	262.16	262.87		262.87	0.000000	0.01	14.20	44.25	0.00
MM_9_2_trib	Tributary D	1193.002	2-year	PR	0.09	262.16	262.87		262.87	0.000000	0.01	14.10	43.71	0.00
MM_9_2_trib	Tributary D	1193.001	2-year	EX	0.09	262.76	262.85	262.85	262.87	0.033382	0.62	0.17	5.77	0.98
MM_9_2_trib	Tributary D	1193.001	2-year	PR	0.09	262.76	262.86	262.86	262.87	0.027942	0.57	0.18	5.90	0.90
MM_9_2_trib	Tributary D	1193	2-year	EX	0.09	261.89	262.01		262.01	0.001557	0.19	0.51	7.59	0.23
MM_9_2_trib	Tributary D	1193	2-year	PR	0.09	261.89	262.01		262.01	0.001594	0.19	0.48	7.35	0.23
MM_9_2_trib	Tributary D	1192.777	2-year	EX	0.09	261.72	261.85	261.85	261.88	0.022043	0.71	0.13	1.95	0.86
MM_9_2_trib	Tributary D	1192.777	2-year	PR	0.09	261.72	261.85	261.84	261.88	0.022275	0.70	0.13	1.89	0.86
MM_9_2_trib	Tributary D	1192.631	2-year	EX	0.09	261.28	261.42	261.38	261.43	0.003898	0.34	0.28	3.38	0.37
MM_9_2_trib	Tributary D	1192.631	2-year	PR	0.09	261.28	261.42	261.37	261.43	0.003889	0.33	0.27	3.32	0.37
MM_9_2_trib	Tributary D	1192.407	2-year	EX	0.09	260.76	260.86	260.84	260.87	0.012224	0.43	0.22	4.27	0.61
MM_9_2_trib	Tributary D	1192.407	2-year	PR	0.09	260.76	260.86	260.84	260.87	0.012202	0.43	0.21	4.25	0.61
MM_9_2_trib	Tributary D	1192.296	2-year	EX	0.09	259.90	260.04	260.04	260.07	0.030451	0.82	0.12	1.72	1.01
MM_9_2_trib	Tributary D	1192.296	2-year	PR	0.09	259.90	260.03	260.03	260.07	0.030595	0.81	0.11	1.67	1.01
MM_9_2_trib	Tributary D	1192.146	2-year	EX	0.16	256.74	256.82	256.82	256.85	0.031099	0.75	0.22	3.73	1.00
MM_9_2_trib	Tributary D	1192.146	2-year	PR	0.15	256.74	256.82	256.82	256.85	0.031515	0.73	0.20	3.69	1.00
MM_9_2_trib	Tributary D	1158.742	2-year	EX	0.16	254.88	255.14	255.12	255.19	0.020725	0.99	0.16	1.26	0.88
MM_9_2_trib	Tributary D	1158.742	2-year	PR	0.15	254.88	255.13	255.12	255.18	0.020286	0.97	0.16	1.23	0.87
MM_9_2_trib	Tributary D	1117.042	2-year	EX	0.16	254.11	254.30	254.29	254.35	0.019597	0.92	0.18	1.53	0.87
MM_9_2_trib	Tributary D	1117.042	2-year	PR	0.15	254.11	254.30	254.29	254.34	0.019857	0.91	0.17	1.49	0.87
MM_9_2_trib	Tributary D	1085.498	2-year	EX	0.16	253.57	253.81	253.78	253.84	0.013042	0.79	0.21	1.62	0.70
MM_9_2_trib	Tributary D	1085.498	2-year	PR	0.15	253.57	253.81	253.78	253.84	0.012792	0.76	0.20	1.60	0.69
MM_9_2_trib	Tributary D	1056.979	2-year	EX	0.16	253.04	253.24	253.24	253.26	0.037218	0.62	0.26	6.72	1.02
MM_9_2_trib	Tributary D	1056.979	2-year	PR	0.15	253.04	253.23	253.23	253.25	0.037821	0.64	0.23	5.97	1.03
MM_9_2_trib	Tributary D	1006.094	2-year	EX	0.16	249.20	249.38	249.38	249.44	0.027891	1.10	0.15	1.20	1.00
MM_9_2_trib	Tributary D	1006.094	2-year	PR	0.15	249.20	249.37	249.37	249.43	0.028015	1.07	0.14	1.19	1.00
MM_9_2_trib	Tributary D	954.6843	2-year	EX	0.16	247.18	247.35	247.35	247.40	0.028204	0.95	0.17	1.88	1.01
MM_9_2_trib	Tributary D	954.6843	2-year	PR	0.15	247.18	247.35	247.35	247.39	0.027671	0.93	0.16	1.84	1.00
MM_9_2_trib	Tributary D	927.8772	2-year	EX	0.16	246.33	246.52	246.52	246.58	0.027936	1.05	0.15	1.42	1.01
MM_9_2_trib	Tributary D	927.8772	2-year	PR	0.15	246.33	246.51	246.51	246.57	0.028571	1.03	0.15	1.40	1.02
MM_9_2_trib	Tributary D	886.4161	2-year	EX	0.22	245.71	245.87		245.89	0.011243	0.65	0.34	3.14	0.64
MM_9_2_trib	Tributary D	886.4161	2-year	PR	0.20	245.71	245.87		245.89	0.011098	0.63	0.32	3.08	0.63
MM_9_2_trib	Tributary D	830.2587	2-year	EX	0.22	245.01	245.18		245.21	0.013216	0.73	0.30	2.87	0.72
MM_9_2_trib	Tributary D	830.2587	2-year	PR	0.20	245.01	245.18		245.20	0.013401	0.71	0.28	2.79	0.72
MM_9_2_trib	Tributary D	765.2102	2-year	EX	0.22	244.36	244.54		244.56	0.007863	0.58	0.38	3.48	0.56
MM_9_2_trib	Tributary D	765.2102	2-year	PR	0.20	244.36	244.53		244.55	0.007821	0.56	0.36	3.38	0.55
MM_9_2_trib	Tributary D	719.386	2-year	EX	0.22	244.08	244.20		244.21	0.007208	0.37	0.59	9.82	0.48
MM_9_2_trib	Tributary D	719.386	2-year	PR	0.20	244.08	244.20		244.20	0.007069	0.36	0.56	9.68	0.48
MM_9_2_trib	Tributary D	691.6686	2-year	EX	0.22	243.69	243.81	243.81	243.83	0.032951	0.70	0.31	6.25	1.00
MM_9_2_trib	Tributary D	691.6686	2-year	PR	0.20	243.69	243.81	243.81	243.83	0.034312	0.70	0.29	5.99	1.02
MM_9_2_trib	Tributary D	639.0789	2-year	EX	0.22	241.96	242.18		242.21	0.012416	0.85	0.26	1.82	0.71
MM_9_2_trib	Tributary D	639.0789	2-year	PR	0.20	241.96	242.17		242.20	0.012224	0.82	0.25	1.78	0.70
MM_9_2_trib	Tributary D	605.7167	2-year	EX	0.22	241.38	241.57	241.57	241.63	0.026196	1.09	0.20	1.69	1.01
MM_9_2_trib	Tributary D	605.7167	2-year	PR	0.20	241.38	241.56	241.56	241.62	0.026693	1.07	0.19	1.66	1.01
MM_9_2_trib	Tributary D	552.2101	2-year	EX	0.22	239.59	239.83	239.83	239.89	0.025883	1.14	0.19	1.49	1.01
MM_9_2_trib	Tributary D	552.2101	2-year	PR	0.20	239.59	239.82	239.82	239.88	0.026535	1.11	0.18	1.45	1.01
MM_9_2_trib	Tributary D	508.8769	2-year	EX	0.22	238.89	239.15		239.17	0.004095	0.56	0.40	2.25	0.42
MM_9_2_trib	Tributary D	508.8769	2-year	PR	0.20	238.89	239.14		239.15	0.004042	0.54	0.37	2.21	0.42
MM_9_2_trib	Tributary D	457.6058	2-year	EX	0.22	238.50	238.70	238.70	238.75	0.022569	0.99	0.22	1.99	0.94
MM_9_2_trib	Tributary D	457.6058	2-year	PR	0.20	238.50	238.69	238.69	238.74	0.022880	0.96	0.21	1.93	0.94
MM_9_2_trib	Tributary D	393.3919	2-year	EX	0.22	236.93	237.09	237.09	237.13	0.028249	0.93	0.24	2.76	1.01
MM_9_2_trib	Tributary D	393.3919	2-year	PR	0.20	236.93	237.08	237.08	237.13	0.027748	0.90	0.22	2.63	0.99
MM_9_2_trib	Tributary D	345.8717	2-year	EX	0.22	236.53	236.67		236.67	0.002392	0.28	0.79	8.91	0.30
MM_9_2_trib	Tributary D	345.8717	2-year	PR	0.20	236.53	236.67		236.67	0.002313	0.27	0.75	8.75	0.29
MM_9_2_trib	Tributary D	308.4069	2-year	EX	0.22	236.36	236.46	236.45	236.47	0.022551	0.55	0.40	8.61	0.82
MM_9_2_trib	Tributary D	308.4069	2-year	PR	0.20	236.36	236.45	236.45	236.47	0.022973	0.54	0.37	8.32	0.82
MM_9_2_trib	Tributary D	261.2717	2-year	EX	0.22	234.87	235.19	235.19	235.26	0.029508	1.18	0.19	1.34	1.01
MM_9_2_trib	Tributary D	261.2717	2-year	PR	0.20	234.87	235.17	235.17	235.24	0.029423	1.18	0.17	1.22	1.00
MM_9_2_trib	Tributary D	237.4458	2-year	EX	0.22	234.36	234.53	234.53	234.59	0.026083	1.11	0.20	1.59	1.01
MM_9_2_trib	Tributary D	237.4458	2-year	PR	0.20	234.36	234.52	234.52	234.58	0.026388	1.08	0.18	1.56	1.01
MM_9_2_trib	Tributary D	197.6155	2-year	EX	0.22	233.46	233.57		233.58	0.010820	0.48	0.46	6.97	0.60
MM_9_2_trib	Tributary D	197.6155	2-year	PR	0.20	233.46	233.57		233.58	0.011172	0.47	0.42	6.74	0.60
MM_9_2_trib	Tributary D	176.7205	2-year	EX	0.22	233.02	233.22	233.21	233.26	0.022728	0.91	0.24	2.44	0.92

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2_trib	Tributary D	176.7205	2-year	PR	0.20	233.02	233.21	233.21	233.25	0.022261	0.89	0.23	2.34	0.91
MM_9_2_trib	Tributary D	163.5648	2-year	EX	0.22	232.73	232.89	232.89	232.93	0.028956	0.91	0.24	3.01	1.02
MM_9_2_trib	Tributary D	163.5648	2-year	PR	0.20	232.73	232.88	232.88	232.92	0.029472	0.88	0.23	2.94	1.02
MM_9_2_trib	Tributary D	151.4771	2-year	EX	0.22	231.39	231.55		231.58	0.015947	0.71	0.31	3.52	0.76
MM_9_2_trib	Tributary D	151.4771	2-year	PR	0.20	231.39	231.54		231.57	0.016510	0.70	0.29	3.39	0.77
MM_9_2_trib	Tributary D	140.92	2-year	EX	0.22	231.16	231.31	231.31	231.35	0.029893	0.86	0.26	3.50	1.02
MM_9_2_trib	Tributary D	140.92	2-year	PR	0.20	231.16	231.31	231.31	231.34	0.029309	0.83	0.24	3.42	1.00
MM_9_2_trib	Tributary D	123.28	2-year	EX	0.22	229.65	229.91	229.90	229.97	0.020646	1.05	0.21	1.51	0.89
MM_9_2_trib	Tributary D	123.28	2-year	PR	0.20	229.65	229.90	229.89	229.96	0.020291	1.01	0.20	1.49	0.88
MM_9_2_trib	Tributary D	89.70679	2-year	EX	0.22	228.90	229.12	229.12	229.19	0.026181	1.15	0.19	1.46	1.01
MM_9_2_trib	Tributary D	89.70679	2-year	PR	0.20	228.90	229.11	229.11	229.17	0.026826	1.12	0.18	1.43	1.01
MM_9_2_trib	Tributary D	72.5771	2-year	EX	0.22	228.51	228.70	228.69	228.75	0.019479	0.92	0.24	2.02	0.86
MM_9_2_trib	Tributary D	72.5771	2-year	PR	0.20	228.51	228.69	228.68	228.74	0.019230	0.90	0.22	1.90	0.85
MM_9_2_trib	Tributary D	51.16022	2-year	EX	0.22	228.00	228.20	228.20	228.26	0.026492	1.07	0.21	1.79	1.01
MM_9_2_trib	Tributary D	51.16022	2-year	PR	0.20	228.00	228.20	228.20	228.25	0.026893	1.05	0.19	1.74	1.01
MM_9_2_trib	Tributary D	26.54893	2-year	EX	0.22	227.45	227.53	227.52	227.55	0.026617	0.71	0.31	5.31	0.93
MM_9_2_trib	Tributary D	26.54893	2-year	PR	0.20	227.45	227.52	227.52	227.55	0.026216	0.68	0.29	5.24	0.91
MM_9_2_trib	Tributary B	1005	2-year	EX	0.03	256.65	256.71	256.71	256.73	0.035961	0.62	0.05	1.26	1.00
MM_9_2_trib	Tributary B	1005	2-year	PR	0.03	256.65	256.71	256.71	256.73	0.035677	0.62	0.05	1.25	1.00
MM_9_2_trib	Tributary B	1004.6	2-year	EX	0.03	255.56	255.63	255.62	255.64	0.019825	0.45	0.07	1.88	0.74
MM_9_2_trib	Tributary B	1004.6	2-year	PR	0.03	255.56	255.63	255.62	255.64	0.019727	0.44	0.07	1.87	0.74
MM_9_2_trib	Tributary B	1004	2-year	EX	0.03	254.60	254.67	254.67	254.69	0.035774	0.61	0.05	1.32	1.00
MM_9_2_trib	Tributary B	1004	2-year	PR	0.03	254.60	254.67	254.67	254.69	0.035995	0.61	0.05	1.30	1.00
MM_9_2_trib	Tributary B	1003	2-year	EX	0.03	251.29	251.35	251.34	251.36	0.027216	0.53	0.06	1.57	0.87
MM_9_2_trib	Tributary B	1003	2-year	PR	0.03	251.29	251.35	251.34	251.36	0.027132	0.52	0.06	1.57	0.86
MM_9_2_trib	Tributary B	1002	2-year	EX	0.03	249.03	249.14	249.14	249.17	0.034760	0.73	0.04	0.78	1.01
MM_9_2_trib	Tributary B	1002	2-year	PR	0.03	249.03	249.14	249.14	249.16	0.034866	0.73	0.04	0.77	1.01
MM_9_2_trib	Tributary B	1001.4	2-year	EX	0.03	247.85	248.00		248.01	0.002126	0.24	0.13	1.56	0.27
MM_9_2_trib	Tributary B	1001.4	2-year	PR	0.03	247.85	248.00		248.00	0.002106	0.24	0.13	1.55	0.27
MM_9_2_trib	Tributary B	1001	2-year	EX	0.03	247.79	247.86	247.86	247.88	0.047983	0.57	0.05	2.01	1.09
MM_9_2_trib	Tributary B	1001	2-year	PR	0.03	247.79	247.86	247.86	247.88	0.047200	0.56	0.05	2.00	1.08
MM_9_2_trib	Tributary B	1000.8	2-year	EX	0.03	247.16	247.25	247.22	247.25	0.003574	0.24	0.13	2.45	0.33
MM_9_2_trib	Tributary B	1000.8	2-year	PR	0.03	247.16	247.25	247.21	247.25	0.003593	0.24	0.13	2.42	0.33
MM_9_2_trib	Tributary B	1000.2	2-year	EX	0.03	246.61	246.66	246.66	246.67	0.050065	0.43	0.07	4.14	1.04
MM_9_2_trib	Tributary B	1000.2	2-year	PR	0.03	246.61	246.66	246.66	246.67	0.049392	0.42	0.07	4.12	1.03
MM_9_2_trib	Tributary B	1000	2-year	EX	0.03	245.34	246.30	245.40	246.30	0.000001	0.03	1.13	10.71	0.01
MM_9_2_trib	Tributary B	1000	2-year	PR	0.03	245.34	246.30	245.40	246.30	0.000001	0.03	1.13	10.68	0.01
MM_9_2_trib	Tributary B	999.64			Culvert									
MM_9_2_trib	Tributary B	999	2-year	EX	0.05	242.45	242.55	242.55	242.57	0.029873	0.73	0.07	1.17	0.97
MM_9_2_trib	Tributary B	999	2-year	PR	0.05	242.45	242.55	242.55	242.57	0.029873	0.73	0.07	1.17	0.97
MM_9_2_trib	Tributary B	998	2-year	EX	0.05	240.71	240.81	240.81	240.85	0.029213	0.80	0.06	0.90	0.97
MM_9_2_trib	Tributary B	998	2-year	PR	0.05	240.71	240.81	240.81	240.85	0.029213	0.80	0.06	0.90	0.97
MM_9_2_trib	Tributary B	997.4	2-year	EX	0.05	238.99	239.06	239.06	239.08	0.033594	0.68	0.07	1.58	1.00
MM_9_2_trib	Tributary B	997.4	2-year	PR	0.05	238.99	239.06	239.06	239.08	0.033594	0.68	0.07	1.58	1.00
MM_9_2_trib	Tributary B	997	2-year	EX	0.05	236.98	237.08	237.08	237.11	0.035105	0.70	0.07	1.49	1.02
MM_9_2_trib	Tributary B	997	2-year	PR	0.05	236.98	237.08	237.08	237.11	0.035105	0.70	0.07	1.49	1.02
MM_9_2_trib	Tributary B	996	2-year	EX	0.05	234.21	234.34	234.33	234.37	0.022337	0.72	0.07	0.97	0.86
MM_9_2_trib	Tributary B	996	2-year	PR	0.05	234.21	234.34	234.33	234.37	0.022337	0.72	0.07	0.97	0.86
MM_9_2_trib	Tributary B	995.4	2-year	EX	0.05	231.73	231.80	231.80	231.82	0.033458	0.68	0.07	1.55	1.00
MM_9_2_trib	Tributary B	995.4	2-year	PR	0.05	231.73	231.80	231.80	231.82	0.033458	0.68	0.07	1.55	1.00
MM_9_2_trib	Tributary B	994.4	2-year	EX	0.05	229.20	229.11	229.11	229.12	0.217272		0.11	5.81	0.00
MM_9_2_trib	Tributary B	994.4	2-year	PR	0.05	229.20	229.11	229.11	229.12	0.217272		0.11	5.81	0.00
MM_9_2_trib	Tributary B	994	2-year	EX	0.05	227.10	227.24		227.24	0.001411	0.24	0.21	2.01	0.23
MM_9_2_trib	Tributary B	994	2-year	PR	0.05	227.10	227.24		227.24	0.001392	0.23	0.21	2.02	0.23
MM_9_2	Tributary C	2179.936	2-year	EX	0.08	256.76	256.83	256.83	256.84	0.042191	0.47	0.17	7.61	1.00
MM_9_2	Tributary C	2179.936	2-year	PR	0.08	256.76	256.83	256.83	256.84	0.042486	0.47	0.17	7.41	1.00
MM_9_2	Tributary C	2159.385	2-year	EX	0.08	256.64	256.72	256.68	256.72	0.001585	0.16	0.52	9.98	0.22
MM_9_2	Tributary C	2159.385	2-year	PR	0.08	256.64	256.72	256.68	256.72	0.001545	0.16	0.51	9.94	0.22
MM_9_2	Tributary C	2097.132	2-year	EX	0.08	256.48	256.54	256.53	256.55	0.006094	0.19	0.43	17.13	0.39
MM_9_2	Tributary C	2097.132	2-year	PR	0.08	256.48	256.54	256.53	256.54	0.006353	0.19	0.41	16.76	0.39
MM_9_2	Tributary C	2030.564	2-year	EX	0.08	256.04	256.11	256.10	256.12	0.006871	0.27	0.31	8.25	0.44
MM_9_2	Tributary C	2030.564	2-year	PR	0.08	256.04	256.11	256.09	256.11	0.006566	0.26	0.31	8.25	0.43
MM_9_2	Tributary C	1994	2-year	EX	0.08	255.61	255.65		255.66	0.017159	0.35	0.24	8.46	0.66
MM_9_2	Tributary C	1994	2-year	PR	0.08	255.61	255.65		255.66	0.018847	0.36	0.22	8.20	0.69
MM_9_2	Tributary C	1970.384	2-year	EX	0.08	255.41	255.66		255.66	0.000007	0.02	3.86	25.08	0.02
MM_9_2	Tributary C	1970.384	2-year	PR	0.08	255.41	255.66		255.66	0.000007	0.02	3.82	25.05	0.02
MM_9_2	Tributary C	1911.614	2-year	EX	0.08	255.36	255.66	255.44	255.66	0.000003	0.02	5.28	27.99	0.01
MM_9_2	Tributary C	1911.614	2-year	PR	0.08	255.36	255.66	255.44	255.66	0.000003	0.02	5.24	27.98	0.01
MM_9_2	Tributary C	1881.066			Bridge									
MM_9_2	Tributary C	1855.838	2-year	EX	0.10	255.52	255.58	255.58	255.59	0.042065	0.50	0.19	7.76	1.01

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2	Tributary C	1855.838	2-year	PR	0.09	255.52	255.58	255.58	255.59	0.042297	0.49	0.18	7.61	1.01
MM_9_2	Tributary C	1813.506	2-year	EX	0.10	254.71	254.77	254.76	254.77	0.007984	0.24	0.40	13.85	0.45
MM_9_2	Tributary C	1813.506	2-year	PR	0.09	254.71	254.77	254.76	254.77	0.007905	0.23	0.38	13.71	0.45
MM_9_2	Tributary C	1775.696	2-year	EX	0.10	254.15	254.19	254.18	254.19	0.015668	0.32	0.30	11.64	0.62
MM_9_2	Tributary C	1775.696	2-year	PR	0.09	254.15	254.19	254.18	254.19	0.015891	0.31	0.29	11.56	0.62
MM_9_2	Tributary C	1726.57	2-year	EX	0.10	252.83	252.92		252.94	0.017509	0.55	0.17	3.13	0.74
MM_9_2	Tributary C	1726.57	2-year	PR	0.09	252.83	252.92		252.93	0.017325	0.54	0.17	3.07	0.74
MM_9_2	Tributary C	1684.01	2-year	EX	0.10	251.82	251.92	251.92	251.94	0.032559	0.69	0.14	2.81	1.00
MM_9_2	Tributary C	1684.01	2-year	PR	0.09	251.82	251.92	251.92	251.94	0.032839	0.69	0.13	2.71	1.00
MM_9_2	Tributary C	1603.573	2-year	EX	0.10	251.65	251.75		251.75	0.000235	0.05	1.85	45.55	0.08
MM_9_2	Tributary C	1603.573	2-year	PR	0.09	251.65	251.75		251.75	0.000216	0.05	1.82	45.20	0.08
MM_9_2	Tributary C	1539.326	2-year	EX	0.10	251.65	251.70		251.71	0.015338	0.30	0.32	13.39	0.61
MM_9_2	Tributary C	1539.326	2-year	PR	0.09	251.65	251.70		251.71	0.015086	0.29	0.31	13.22	0.60
MM_9_2	Tributary C	1486.021	2-year	EX	0.10	250.90	251.00		251.01	0.011440	0.39	0.25	5.38	0.58
MM_9_2	Tributary C	1486.021	2-year	PR	0.09	250.90	251.00		251.00	0.011594	0.38	0.24	5.35	0.58
MM_9_2	Tributary C	1450.067	2-year	EX	0.10	250.28	250.40	250.40	250.43	0.024011	0.74	0.13	1.86	0.90
MM_9_2	Tributary C	1450.067	2-year	PR	0.09	250.28	250.40	250.39	250.42	0.023730	0.72	0.12	1.84	0.89
MM_9_2	Tributary C	1406.638	2-year	EX	0.10	249.69	249.82		249.83	0.008765	0.40	0.24	4.06	0.53
MM_9_2	Tributary C	1406.638	2-year	PR	0.09	249.69	249.82	249.79	249.83	0.008827	0.40	0.23	3.90	0.53
MM_9_2	Tributary C	1338.455	2-year	EX	0.10	248.69	248.79	248.79	248.82	0.029676	0.86	0.11	1.52	1.00
MM_9_2	Tributary C	1338.455	2-year	PR	0.09	248.69	248.78	248.78	248.82	0.029543	0.84	0.11	1.50	1.00
MM_9_2	Tributary C	1304.352	2-year	EX	0.10	247.99	248.14	248.12	248.15	0.010843	0.47	0.21	3.22	0.59
MM_9_2	Tributary C	1304.352	2-year	PR	0.09	247.99	248.14	248.12	248.15	0.010322	0.45	0.20	3.20	0.57
MM_9_2	Tributary C	1265.187	2-year	EX	0.10	247.35	247.43	247.43	247.46	0.033527	0.70	0.14	2.77	1.01
MM_9_2	Tributary C	1265.187	2-year	PR	0.09	247.35	247.43	247.43	247.46	0.036671	0.71	0.13	2.69	1.05
MM_9_2	Tributary C	1206.875	2-year	EX	0.10	246.19	246.32		246.32	0.005863	0.38	0.25	3.56	0.45
MM_9_2	Tributary C	1206.875	2-year	PR	0.09	246.19	246.31		246.32	0.005929	0.37	0.24	3.52	0.45
MM_9_2	Tributary C	1175.661	2-year	EX	0.10	245.83	245.93	245.93	245.97	0.029831	0.80	0.12	1.81	1.00
MM_9_2	Tributary C	1175.661	2-year	PR	0.09	245.83	245.93	245.93	245.96	0.030397	0.79	0.11	1.78	1.00
MM_9_2	Tributary C	1120.613	2-year	EX	0.10	244.63	244.79	244.76	244.81	0.010874	0.65	0.15	1.39	0.64
MM_9_2	Tributary C	1120.613	2-year	PR	0.09	244.63	244.79		244.81	0.010814	0.64	0.14	1.37	0.63
MM_9_2	Tributary C	1083.716	2-year	EX	0.10	244.05	244.15	244.15	244.18	0.030412	0.81	0.12	1.78	1.01
MM_9_2	Tributary C	1083.716	2-year	PR	0.09	244.05	244.15	244.15	244.18	0.030455	0.80	0.11	1.75	1.00
MM_9_2	Tributary C	1042.153	2-year	EX	0.10	243.04	243.19	243.16	243.21	0.010434	0.53	0.18	2.30	0.60
MM_9_2	Tributary C	1042.153	2-year	PR	0.09	243.04	243.19	243.16	243.20	0.010729	0.52	0.17	2.27	0.60
MM_9_2	Tributary C	1006.177	2-year	EX	0.10	242.45	242.56	242.56	242.60	0.031418	0.87	0.11	1.49	1.02
MM_9_2	Tributary C	1006.177	2-year	PR	0.09	242.45	242.56	242.56	242.59	0.030213	0.84	0.11	1.48	1.00
MM_9_2	Tributary C	993.3609	2-year	EX	0.14	241.83	242.08	242.01	242.09	0.004823	0.47	0.30	2.56	0.44
MM_9_2	Tributary C	993.3609	2-year	PR	0.13	241.83	242.07	242.00	242.08	0.004833	0.46	0.28	2.49	0.43
MM_9_2	Tributary C	935.4169	2-year	EX	0.14	241.33	241.48	241.48	241.53	0.027737	0.92	0.15	1.74	0.99
MM_9_2	Tributary C	935.4169	2-year	PR	0.13	241.33	241.48	241.48	241.52	0.027817	0.90	0.15	1.72	0.99
MM_9_2	Tributary C	870.5434	2-year	EX	0.14	239.51	239.67	239.67	239.72	0.027815	0.99	0.14	1.45	1.01
MM_9_2	Tributary C	870.5434	2-year	PR	0.13	239.51	239.67	239.67	239.72	0.027740	0.97	0.13	1.40	1.00
MM_9_2	Tributary C	836.4684	2-year	EX	0.14	238.61	238.74		238.76	0.013304	0.65	0.22	2.41	0.70
MM_9_2	Tributary C	836.4684	2-year	PR	0.13	238.61	238.74		238.76	0.012213	0.62	0.21	2.40	0.66
MM_9_2	Tributary C	799.8246	2-year	EX	0.14	237.89	238.05	238.05	238.09	0.026733	0.86	0.16	2.02	0.97
MM_9_2	Tributary C	799.8246	2-year	PR	0.13	237.89	238.04	238.04	238.08	0.030483	0.89	0.15	1.91	1.03
MM_9_2	Tributary C	745.4448	2-year	EX	0.14	235.79	235.88	235.88	235.91	0.031680	0.75	0.19	3.32	1.00
MM_9_2	Tributary C	745.4448	2-year	PR	0.13	235.79	235.88	235.88	235.91	0.033168	0.74	0.18	3.28	1.02
MM_9_2	Tributary C	716.4415	2-year	EX	0.14	234.84	234.94	234.92	234.95	0.011411	0.52	0.27	3.88	0.62
MM_9_2	Tributary C	716.4415	2-year	PR	0.13	234.84	234.93		234.95	0.011234	0.50	0.26	3.85	0.61
MM_9_2	Tributary C	687.3773	2-year	EX	0.14	234.27	234.42	234.42	234.46	0.027603	0.91	0.15	1.80	1.00
MM_9_2	Tributary C	687.3773	2-year	PR	0.13	234.27	234.41	234.41	234.45	0.028672	0.90	0.14	1.77	1.01
MM_9_2	Tributary C	661.4518	2-year	EX	0.14	233.56	233.64	233.64	233.67	0.024092	0.71	0.20	3.04	0.89
MM_9_2	Tributary C	661.4518	2-year	PR	0.13	233.56	233.64	233.63	233.66	0.023454	0.69	0.19	3.00	0.88
MM_9_2	Tributary C	627.6722	2-year	EX	0.14	232.58	232.71	232.71	232.74	0.031500	0.82	0.17	2.58	1.01
MM_9_2	Tributary C	627.6722	2-year	PR	0.13	232.58	232.70	232.70	232.74	0.032376	0.80	0.16	2.57	1.02
MM_9_2	Tributary C	589.2625	2-year	EX	0.14	231.90	232.03	231.99	232.04	0.006046	0.45	0.31	3.36	0.47
MM_9_2	Tributary C	589.2625	2-year	PR	0.13	231.90	232.03	231.99	232.04	0.006336	0.45	0.29	3.27	0.48
MM_9_2	Tributary C	540.5079	2-year	EX	0.14	231.39	231.51	231.50	231.53	0.022113	0.70	0.20	2.96	0.86
MM_9_2	Tributary C	540.5079	2-year	PR	0.13	231.39	231.51		231.53	0.020158	0.66	0.20	2.96	0.82
MM_9_2	Tributary C	510.2238	2-year	EX	0.14	230.56	230.68	230.68	230.71	0.033844	0.76	0.19	3.32	1.03
MM_9_2	Tributary C	510.2238	2-year	PR	0.13	230.56	230.68	230.68	230.71	0.038621	0.77	0.17	3.30	1.08
MM_9_2	Tributary C	457.5412	2-year	EX	0.14	228.97	229.10	229.09	229.14	0.020392	0.80	0.18	1.98	0.86
MM_9_2	Tributary C	457.5412	2-year	PR	0.13	228.97	229.10	229.09	229.13	0.021035	0.79	0.16	1.93	0.87
MM_9_2	Tributary C	414.0466	2-year	EX	0.14	228.37	228.57		228.59	0.008472	0.58	0.24	2.21	0.56
MM_9_2	Tributary C	414.0466	2-year	PR	0.13	228.37	228.57		228.58	0.008305	0.56	0.23	2.19	0.55
MM_9_2	Tributary C	374.4607	2-year	EX	0.14	227.94	228.07	228.06	228.10	0.018965	0.80	0.18	1.88	0.84
MM_9_2	Tributary C	374.4607	2-year	PR	0.13	227.94	228.07	228.06	228.10	0.019560	0.79	0.16	1.83	0.84
MM_9_2	Tributary C	330.2584	2-year	EX	0.14	227.43	227.53		227.54	0.008950	0.44	0.32	4.85	0.55
MM_9_2	Tributary C	330.2584	2-year	PR	0.13	227.43	227.53		227.54	0.008710	0.43	0.30	4.68	0.54

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2	Tributary C + D	294	2-year	EX	0.01	226.97	227.01	227.01	227.02	0.035374	0.37	0.02	1.32	0.88
MM_9_2	Tributary C + D	294	2-year	PR	0.01	226.97	227.01	227.01	227.02	0.036460	0.39	0.03	1.36	0.90
MM_9_2	Tributary C + D	266.3048	2-year	EX	0.01	224.85	224.88	224.88	224.88	0.036689	0.39	0.02	1.24	0.90
MM_9_2	Tributary C + D	266.3048	2-year	PR	0.01	224.85	224.88	224.88	224.89	0.054475	0.45	0.02	1.23	1.08
MM_9_2	Tributary C + D	236.2558	2-year	EX	0.01	223.38	223.45	223.44	223.45	0.017117	0.38	0.02	0.70	0.67
MM_9_2	Tributary C + D	236.2558	2-year	PR	0.01	223.38	223.45	223.44	223.46	0.015948	0.38	0.03	0.74	0.65
MM_9_2	Tributary C + D	205.6305	2-year	EX	0.01	222.98	223.03		223.03	0.011268	0.31	0.03	0.89	0.54
MM_9_2	Tributary C + D	205.6305	2-year	PR	0.01	222.98	223.03		223.04	0.012168	0.33	0.03	0.90	0.57
MM_9_2	Tributary C + D	173.8239	2-year	EX	0.01	222.27	222.32	222.32	222.33	0.062154	0.48	0.02	1.04	1.15
MM_9_2	Tributary C + D	173.8239	2-year	PR	0.01	222.27	222.32	222.32	222.33	0.052591	0.46	0.02	1.13	1.07
MM_9_2	Tributary C + D	151.7834	2-year	EX	0.01	221.52	221.58	221.57	221.59	0.005901	0.20	0.04	1.53	0.39
MM_9_2	Tributary C + D	151.7834	2-year	PR	0.01	221.52	221.59	221.57	221.59	0.005991	0.21	0.05	1.55	0.39
MM_9_2	Tributary C + D	116.6732	2-year	EX	0.01	221.27	221.31		221.31	0.010712	0.26	0.03	1.29	0.51
MM_9_2	Tributary C + D	116.6732	2-year	PR	0.01	221.27	221.31		221.32	0.010623	0.27	0.04	1.31	0.52
MM_9_2	Tributary C + D	66.5837	2-year	EX	0.01	220.30	220.35	220.35	220.36	0.043083	0.47	0.02	0.81	0.99
MM_9_2	Tributary C + D	66.5837	2-year	PR	0.01	220.30	220.35	220.35	220.36	0.043523	0.49	0.02	0.85	1.01
MM_9_2	Tributary C + D	34.76245	2-year	EX	0.01	219.88	219.97	219.91	219.97	0.000947	0.12	0.07	1.34	0.17
MM_9_2	Tributary C + D	34.76245	2-year	PR	0.01	219.88	219.97	219.91	219.97	0.001172	0.14	0.07	1.33	0.19
Main_1	Tributary A	1017	2-year	EX	0.01	254.63	254.68	254.68	254.69	0.051124	0.54	0.02	0.69	1.10
Main_1	Tributary A	1017	2-year	PR	0.01	254.63	254.68	254.68	254.70	0.053421	0.56	0.02	0.71	1.13
Main_1	Tributary A	1000	2-year	EX	0.01	253.30	253.36	253.36	253.37	0.030851	0.44	0.02	0.79	0.87
Main_1	Tributary A	1000	2-year	PR	0.01	253.30	253.36	253.36	253.37	0.033500	0.46	0.02	0.81	0.91
Main_1	Tributary A	999	2-year	EX	0.01	252.17	252.24		252.24	0.000179	0.02	0.37	13.49	0.05
Main_1	Tributary A	999	2-year	PR	0.01	252.17	252.24		252.24	0.000170	0.02	0.41	14.09	0.05
Main_1	Tributary A	998.6	2-year	EX	0.01	252.16	252.24		252.24	0.000029	0.02	0.47	10.36	0.03
Main_1	Tributary A	998.6	2-year	PR	0.01	252.16	252.24		252.24	0.000033	0.02	0.49	11.40	0.03
Main_1	Tributary A	998.4	2-year	EX	0.01	252.18	252.23	252.21	252.23	0.004064	0.16	0.06	2.16	0.32
Main_1	Tributary A	998.4	2-year	PR	0.01	252.18	252.23		252.24	0.004185	0.16	0.06	2.33	0.32
Main_1	Tributary A	998	2-year	EX	0.01	251.77	251.80	251.80	251.81	0.057776	0.36	0.02	2.02	1.05
Main_1	Tributary A	998	2-year	PR	0.01	251.77	251.80	251.80	251.81	0.051576	0.35	0.03	2.32	1.00
Main_1	Tributary A	997.7	2-year	EX	0.01	249.12	249.19	249.19	249.21	0.039611	0.58	0.02	0.45	1.00
Main_1	Tributary A	997.7	2-year	PR	0.01	249.12	249.19	249.19	249.21	0.038195	0.59	0.02	0.47	0.99
Main_1	Tributary A	997	2-year	EX	0.01	245.46	245.53	245.53	245.54	0.039599	0.57	0.02	0.49	1.00
Main_1	Tributary A	997	2-year	PR	0.01	245.46	245.53	245.53	245.55	0.038389	0.57	0.02	0.51	0.99
Main_1	Tributary A	996.6	2-year	EX	0.01	242.09	242.13	242.13	242.14	0.045114	0.43	0.02	1.13	1.00
Main_1	Tributary A	996.6	2-year	PR	0.01	242.09	242.13	242.13	242.14	0.046389	0.44	0.02	1.17	1.02
Main_1	Tributary A	996	2-year	EX	0.05	237.55	237.61	237.60	237.62	0.022154	0.35	0.15	6.22	0.73
Main_1	Tributary A	996	2-year	PR	0.05	237.55	237.61	237.60	237.62	0.022460	0.35	0.14	6.17	0.73
Main_1	Tributary A	995.8	2-year	EX	0.05	235.82	235.86	235.86	235.87	0.079235	0.54	0.10	5.55	1.30
Main_1	Tributary A	995.8	2-year	PR	0.05	235.82	235.86	235.86	235.87	0.077147	0.53	0.09	5.54	1.29
Main_1	Tributary A	995.6	2-year	EX	0.05	234.22	234.33	234.30	234.33	0.010045	0.44	0.12	1.94	0.57
Main_1	Tributary A	995.6	2-year	PR	0.05	234.22	234.32	234.30	234.33	0.010041	0.44	0.11	1.93	0.57
Main_1	Tributary A	995	2-year	EX	0.05	232.05	232.16	232.16	232.19	0.031871	0.74	0.07	1.24	1.00
Main_1	Tributary A	995	2-year	PR	0.05	232.05	232.16	232.16	232.19	0.031884	0.73	0.07	1.23	0.99
Main_1	Tributary A	932	2-year	EX	0.05	228.37	228.43	228.43	228.45	0.035285	0.62	0.08	2.08	1.00
Main_1	Tributary A	932	2-year	PR	0.05	228.37	228.43	228.43	228.45	0.035475	0.62	0.08	2.07	1.00
Humber River	Bolton Reach Up	109.642 09.08.18	2-year	EX	4.68	230.51	231.08		231.10	0.001057	0.62	7.52	15.46	0.29
Humber River	Bolton Reach Up	109.642 09.08.18	2-year	PR	4.68	230.51	231.08		231.10	0.001057	0.62	7.51	15.46	0.29
Humber River	Bolton Reach Up	109.442 09.08.17	2-year	EX	4.68	230.27	230.76		230.80	0.002304	0.81	5.76	14.22	0.41
Humber River	Bolton Reach Up	109.442 09.08.17	2-year	PR	4.68	230.27	230.76		230.80	0.002303	0.81	5.76	14.22	0.41
Humber River	Bolton Reach Up	109.242 09.08.16	2-year	EX	4.68	229.82	230.40		230.43	0.001536	0.77	6.11	12.05	0.34
Humber River	Bolton Reach Up	109.242 09.08.16	2-year	PR	4.68	229.82	230.40		230.43	0.001536	0.77	6.11	12.05	0.34
Humber River	Bolton Reach Up	109.040 09.08.15	2-year	EX	4.68	229.52	230.11		230.14	0.001310	0.68	7.23	17.54	0.31
Humber River	Bolton Reach Up	109.040 09.08.15	2-year	PR	4.68	229.52	230.11		230.14	0.001310	0.68	7.23	17.54	0.31
Humber River	Bolton Reach Up	108.839 09.08.14	2-year	EX	4.68	229.22	229.77		229.81	0.002094	0.86	5.43	11.34	0.40
Humber River	Bolton Reach Up	108.839 09.08.14	2-year	PR	4.68	229.22	229.77		229.81	0.002094	0.86	5.43	11.34	0.40
Humber River	Bolton Reach Up	108.638 09.08.13	2-year	EX	4.68	228.86	229.46		229.48	0.001247	0.67	7.06	16.34	0.31
Humber River	Bolton Reach Up	108.638 09.08.13	2-year	PR	4.68	228.86	229.46		229.48	0.001247	0.67	7.06	16.33	0.31
Humber River	Bolton Reach Up	108.437 09.08.12	2-year	EX	4.68	228.56	229.00		229.05	0.004499	0.98	4.76	14.76	0.55
Humber River	Bolton Reach Up	108.437 09.08.12	2-year	PR	4.68	228.56	229.00		229.05	0.004501	0.98	4.76	14.76	0.55
Humber River	Bolton Reach Up	108.235 09.08.11	2-year	EX	4.68	228.02	228.57		228.60	0.001320	0.67	6.99	15.60	0.32
Humber River	Bolton Reach Up	108.235 09.08.11	2-year	PR	4.68	228.02	228.57		228.60	0.001320	0.67	6.99	15.60	0.32
Humber River	Bolton Reach Up	108.034 09.08.10	2-year	EX	4.68	227.54	227.97		228.07	0.007360	1.39	3.36	8.79	0.72
Humber River	Bolton Reach Up	108.034 09.08.10	2-year	PR	4.68	227.54	227.97		228.07	0.007362	1.39	3.36	8.79	0.72
Humber River	Bolton Reach Up	107.834 09.08.09	2-year	EX	4.68	227.00	227.55		227.57	0.001152	0.64	7.32	17.11	0.30
Humber River	Bolton Reach Up	107.834 09.08.09	2-year	PR	4.68	227.00	227.55		227.57	0.001152	0.64	7.32	17.10	0.30
Humber River	Bolton Reach Up	107.633 09.08.08	2-year	EX	4.68	226.76	227.39		227.41	0.000578	0.48	9.80	19.21	0.21
Humber River	Bolton Reach Up	107.633 09.08.08	2-year	PR	4.68	226.76	227.39		227.41	0.000578	0.48	9.80	19.21	0.21
Humber River	Bolton R 2	107.45	2-year	EX	4.69	226.33	227.29		227.30	0.000444	0.48	9.81	13.42	0.18
Humber River	Bolton R 2	107.45	2-year	PR	4.69	226.33	227.29		227.31	0.000443	0.48	9.81	13.42	0.18

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton R 2	107.433 09.08.07	2-year	EX	4.69	226.49	227.28		227.29	0.000328	0.45	10.46	14.64	0.17
Humber River	Bolton R 2	107.433 09.08.07	2-year	PR	4.69	226.49	227.28		227.29	0.000327	0.45	10.46	14.64	0.17
Humber River	Bolton R 1	107.233 09.08.06	2-year	EX	8.14	226.34	227.10		227.16	0.002148	1.07	7.67	13.00	0.42
Humber River	Bolton R 1	107.233 09.08.06	2-year	PR	8.15	226.34	227.10		227.16	0.002148	1.07	7.67	13.01	0.42
Humber River	Bolton R 1	107.1544 09.08.05	2-year	EX	8.14	226.10	226.83		226.88	0.002176	1.01	10.04	21.20	0.42
Humber River	Bolton R 1	107.1544 09.08.05	2-year	PR	8.15	226.10	226.83		226.88	0.002175	1.01	10.04	21.20	0.42
Humber River	Bolton R 1	107.032 09.08.04	2-year	EX	8.14	225.92	226.74		226.75	0.000529	0.56	14.63	21.22	0.21
Humber River	Bolton R 1	107.032 09.08.04	2-year	PR	8.15	225.92	226.74		226.75	0.000529	0.56	14.64	21.22	0.21
Humber River	Bolton R 1	106.832 09.08.03	2-year	EX	8.14	225.77	226.25	226.25	226.44	0.012567	2.04	5.22	14.92	0.97
Humber River	Bolton R 1	106.832 09.08.03	2-year	PR	8.15	225.77	226.25	226.25	226.44	0.012583	2.04	5.22	14.92	0.97
Humber River	Bolton R 1	106.6823 09.08.02	2-year	EX	8.14	225.26	226.11		226.13	0.000357	0.53	15.67	22.70	0.18
Humber River	Bolton R 1	106.6823 09.08.02	2-year	PR	8.15	225.26	226.11		226.13	0.000356	0.53	15.69	22.71	0.18
Humber River	Bolton R 1	106.6592 09.08.01	2-year	EX	8.14	225.17	226.11	225.59	226.12	0.000367	0.54	15.58	28.09	0.19
Humber River	Bolton R 1	106.6592 09.08.01	2-year	PR	8.15	225.17	226.11	225.59	226.12	0.000367	0.54	15.60	28.11	0.19
Humber River	Bolton R 1	106.6454 x-94 (09.09.24)			Bridge									
Humber River	Bolton R 1	106.631 09.09.23	2-year	EX	8.13	225.17	226.04	225.60	226.08	0.001092	0.90	10.12	15.83	0.32
Humber River	Bolton R 1	106.631 09.09.23	2-year	PR	8.14	225.17	226.04	225.61	226.09	0.001093	0.91	10.13	15.83	0.32
Humber River	Bolton R 1	106.6142 09.09.22	2-year	EX	8.13	225.20	226.03		226.07	0.001244	0.90	9.66	15.93	0.33
Humber River	Bolton R 1	106.6142 09.09.22	2-year	PR	8.14	225.20	226.03		226.08	0.001245	0.90	9.67	15.93	0.33
Humber River	Bolton R 1	106.5615 09.09.21	2-year	EX	8.13	225.08	225.94		225.99	0.002058	1.01	8.01	12.98	0.41
Humber River	Bolton R 1	106.5615 09.09.21	2-year	PR	8.14	225.08	225.94		225.99	0.002060	1.02	8.01	12.98	0.41
Humber River	Bolton R 1	106.429 09.09.20	2-year	EX	8.13	225.02	225.73		225.76	0.001434	0.84	13.71	42.26	0.35
Humber River	Bolton R 1	106.429 09.09.20	2-year	PR	8.14	225.02	225.73		225.76	0.001433	0.84	13.74	42.28	0.35
Humber River	Bolton R 1	106.229 09.09.19	2-year	EX	8.13	224.63	225.41		225.46	0.001645	0.99	11.23	21.77	0.37
Humber River	Bolton R 1	106.229 09.09.19	2-year	PR	8.14	224.63	225.41		225.46	0.001645	0.99	11.24	21.78	0.37
Humber River	Bolton R 1	106.029 09.09.18	2-year	EX	8.13	224.36	225.24		225.26	0.000597	0.66	13.98	23.10	0.23
Humber River	Bolton R 1	106.029 09.09.18	2-year	PR	8.14	224.36	225.24		225.26	0.000598	0.66	14.00	23.10	0.23
Humber River	Bolton R 1	105.827 09.09.17	2-year	EX	8.13	224.18	225.11		225.13	0.000513	0.65	17.41	49.41	0.22
Humber River	Bolton R 1	105.827 09.09.17	2-year	PR	8.14	224.18	225.11		225.13	0.000513	0.65	17.45	49.49	0.22
Humber River	Bolton R 1	105.627 09.09.16	2-year	EX	8.13	224.09	224.55	224.55	224.74	0.012852	1.98	5.03	15.21	0.98
Humber River	Bolton R 1	105.627 09.09.16	2-year	PR	8.14	224.09	224.55	224.55	224.74	0.012859	1.98	5.04	15.21	0.98
Humber River	Bolton R 1	105.427 09.09.15	2-year	EX	8.13	223.43	224.19	223.85	224.23	0.001483	0.95	9.91	18.23	0.36
Humber River	Bolton R 1	105.427 09.09.15	2-year	PR	8.14	223.43	224.19	223.85	224.23	0.001483	0.95	9.93	18.24	0.36
Humber River	Bolton R 1	105.224 09.09.14	2-year	EX	8.13	223.01	223.80		223.86	0.001734	1.07	8.47	15.85	0.39
Humber River	Bolton R 1	105.224 09.09.14	2-year	PR	8.14	223.01	223.80		223.86	0.001735	1.07	8.48	15.87	0.39
Humber River	Bolton R 1	105.022 09.09.13	2-year	EX	8.13	222.83	223.62		223.65	0.001096	0.77	10.49	16.01	0.31
Humber River	Bolton R 1	105.022 09.09.13	2-year	PR	8.14	222.83	223.62		223.65	0.001096	0.78	10.50	16.01	0.31
Humber River	Bolton R 1	104.823 09.09.12	2-year	EX	8.13	222.59	223.39		223.43	0.001133	0.86	10.43	19.29	0.32
Humber River	Bolton R 1	104.823 09.09.12	2-year	PR	8.14	222.59	223.39		223.43	0.001133	0.86	10.44	19.30	0.32
Humber River	Bolton R 1	104.621 09.09.11	2-year	EX	8.13	222.32	223.22		223.25	0.000718	0.68	11.91	15.84	0.25
Humber River	Bolton R 1	104.621 09.09.11	2-year	PR	8.14	222.32	223.22		223.25	0.000719	0.68	11.92	15.84	0.25
Humber River	Bolton R 1	104.421 09.09.10	2-year	EX	8.13	222.17	223.02		223.06	0.001274	0.91	11.58	23.50	0.34
Humber River	Bolton R 1	104.421 09.09.10	2-year	PR	8.14	222.17	223.02		223.06	0.001274	0.91	11.60	23.51	0.34
Humber River	Bolton R 1	104.218 09.09.09	2-year	EX	8.13	221.96	222.70		222.75	0.001743	1.01	10.62	24.53	0.39
Humber River	Bolton R 1	104.218 09.09.09	2-year	PR	8.14	221.96	222.70		222.75	0.001744	1.01	10.64	24.55	0.39
Humber River	Bolton R 1	104.018 09.09.08	2-year	EX	8.13	221.69	222.31		222.36	0.002382	1.05	9.63	23.35	0.44
Humber River	Bolton R 1	104.018 09.09.08	2-year	PR	8.14	221.69	222.31		222.36	0.002380	1.05	9.65	23.35	0.44
Humber River	Bolton R 1	103.819 09.09.07	2-year	EX	8.13	221.24	222.03		222.06	0.001032	0.83	11.61	19.90	0.30
Humber River	Bolton R 1	103.819 09.09.07	2-year	PR	8.14	221.24	222.03		222.06	0.001033	0.84	11.62	19.95	0.30
Humber River	Bolton R 1	103.616 09.09.06	2-year	EX	8.13	220.94	221.73		221.78	0.001590	1.03	10.62	30.89	0.38
Humber River	Bolton R 1	103.616 09.09.06	2-year	PR	8.14	220.94	221.73		221.78	0.001590	1.03	10.64	30.91	0.38
Humber River	Bolton R 1	103.417 09.09.05	2-year	EX	8.13	220.64	221.44		221.49	0.001640	0.97	8.51	15.49	0.38
Humber River	Bolton R 1	103.417 09.09.05	2-year	PR	8.14	220.64	221.44		221.49	0.001639	0.97	8.52	15.52	0.38
Humber River	Bolton R 1	103.215 09.09.04	2-year	EX	8.13	220.31	221.23		221.26	0.000804	0.76	11.19	18.53	0.27
Humber River	Bolton R 1	103.215 09.09.04	2-year	PR	8.14	220.31	221.23		221.26	0.000804	0.76	11.21	18.55	0.27
Humber River	Bolton R 1	103.014 09.09.03	2-year	EX	8.13	220.07	221.07		221.10	0.000782	0.79	11.40	17.39	0.27
Humber River	Bolton R 1	103.014 09.09.03	2-year	PR	8.14	220.07	221.07		221.10	0.000781	0.79	11.43	17.46	0.27
Humber River	Bolton R 1	102.814 09.09.02	2-year	EX	8.13	219.98	220.99		221.03	0.000941	0.93	12.11	29.47	0.30
Humber River	Bolton R 1	102.814 09.09.02	2-year	PR	8.14	219.98	220.99		221.03	0.000939	0.93	12.15	29.50	0.30
Humber River	Bolton R 1	102.613 09.09.01	2-year	EX	8.34	219.74	220.18	220.14	220.32	0.009798	1.66	5.10	13.37	0.84
Humber River	Bolton R 1	102.613 09.09.01	2-year	PR	8.38	219.74	220.18	220.14	220.32	0.009797	1.67	5.11	13.38	0.84
Humber River	Bolton Reach	102.398 09.01.13	2-year	EX	4.77	219.10	219.87		219.88	0.000310	0.42	11.41	18.90	0.16
Humber River	Bolton Reach	102.398 09.01.13	2-year	PR	4.77	219.10	219.87		219.88	0.000310	0.42	11.41	18.90	0.16
Humber River	Bolton Reach	102.208 09.01.12	2-year	EX	4.77	219.02	219.81		219.83	0.000709	0.62	7.69	12.38	0.24
Humber River	Bolton Reach	102.208 09.01.12	2-year	PR	4.77	219.02	219.81		219.83	0.000709	0.62	7.70	12.38	0.24
Humber River	Bolton Reach	102.011 09.01.11	2-year	EX	4.77	218.86	219.74		219.75	0.000399	0.50	11.59	25.02	0.19
Humber River	Bolton Reach	102.011 09.01.11	2-year	PR	4.77	218.86	219.74		219.75	0.000399	0.50	11.59	25.02	0.19
Humber River	Bolton Reach	101.9462 09.01.10	2-year	EX	4.77	218.78	219.66		219.68	0.000546	0.59	9.54	20.58	0.22
Humber River	Bolton Reach	101.9462 09.01.10	2-year	PR	4.77	218.78	219.66		219.68	0.000546	0.59	9.54	20.58	0.22
Humber River	Bolton Reach	101.809 09.01.09	2-year	EX	4.77	218.20	218.87		218.88	0.000415	0.44	11.05	21.90	0.18
Humber River	Bolton Reach	101.809 09.01.09	2-year	PR	4.77	218.20	218.87		218.88	0.000415	0.44	11.05	21.90	0.18

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	101.608 09.01.08	2-year	EX	4.77	218.06	218.66		218.71	0.002672	1.00	4.77	9.58	0.45
Humber River	Bolton Reach	101.608 09.01.08	2-year	PR	4.77	218.06	218.66		218.71	0.002672	1.00	4.77	9.58	0.45
Humber River	Bolton Reach	101.407 09.01.07	2-year	EX	4.77	217.85	218.48		218.51	0.001127	0.69	6.96	12.88	0.30
Humber River	Bolton Reach	101.407 09.01.07	2-year	PR	4.77	217.85	218.48		218.51	0.001127	0.69	6.96	12.88	0.30
Humber River	Bolton Reach	101.206 09.01.06	2-year	EX	4.77	217.39	217.97		218.02	0.002730	0.99	4.83	9.96	0.45
Humber River	Bolton Reach	101.206 09.01.06	2-year	PR	4.77	217.39	217.97		218.02	0.002730	0.99	4.83	9.96	0.45
Humber River	Bolton Reach	101.004 09.01.05	2-year	EX	4.77	216.95	217.54		217.57	0.001906	0.81	5.89	12.64	0.38
Humber River	Bolton Reach	101.004 09.01.05	2-year	PR	4.77	216.95	217.54		217.57	0.001906	0.81	5.89	12.64	0.38
Humber River	Bolton Reach	100.803 09.01.04	2-year	EX	4.77	216.63	217.28		217.30	0.000960	0.62	7.66	14.63	0.28
Humber River	Bolton Reach	100.803 09.01.04	2-year	PR	4.77	216.63	217.28		217.30	0.000960	0.62	7.66	14.64	0.27
Humber River	Bolton Reach	100.602 09.01.03	2-year	EX	4.77	216.43	217.05		217.07	0.001402	0.69	6.89	14.89	0.32
Humber River	Bolton Reach	100.602 09.01.03	2-year	PR	4.77	216.43	217.05		217.07	0.001396	0.69	6.90	14.90	0.32
Humber River	Bolton Reach	100.5208 09.01.02	2-year	EX	4.77	216.19	216.96		216.98	0.000877	0.59	8.04	15.42	0.26
Humber River	Bolton Reach	100.5208 09.01.02	2-year	PR	4.77	216.19	216.96		216.98	0.000870	0.59	8.06	15.43	0.26
Humber River	Bolton Reach	100.401 09.01.01	2-year	EX	8.51	216.08	216.81	216.48	216.84	0.001369	0.84	11.52	28.89	0.34
Humber River	Bolton Reach	100.401 09.01.01	2-year	PR	8.55	216.08	216.81	216.48	216.84	0.001368	0.84	11.56	28.91	0.34
Humber River	Bolton Reach	100.200 09.04.02	2-year	EX	8.51	215.87	216.60		216.65	0.003338	1.01	8.42	19.78	0.49
Humber River	Bolton Reach	100.200 09.04.02	2-year	PR	8.55	215.87	216.60		216.65	0.003338	1.01	8.45	19.84	0.49
Humber River	Bolton Reach	100.1076 09.04.01	2-year	EX	8.51	215.68	216.41		216.44	0.001531	0.82	10.35	18.42	0.35
Humber River	Bolton Reach	100.1076 09.04.01	2-year	PR	8.55	215.68	216.41		216.44	0.001531	0.82	10.38	18.43	0.35
Humber River	Bolton Reach	9.216	2-year	EX	8.51	215.63	216.25		216.32	0.004414	1.21	7.63	18.42	0.54
Humber River	Bolton Reach	9.216	2-year	PR	8.55	215.63	216.25		216.32	0.004411	1.21	7.66	18.45	0.54
Humber River	Bolton Reach	9.213	2-year	EX	8.51	215.39	216.10		216.16	0.002992	1.09	7.92	15.45	0.45
Humber River	Bolton Reach	9.213	2-year	PR	8.55	215.39	216.11		216.17	0.002988	1.09	7.95	15.63	0.45
Humber River	Bolton Reach	9.21	2-year	EX	8.51	215.31	216.05		216.09	0.001632	0.82	10.35	16.86	0.34
Humber River	Bolton Reach	9.21	2-year	PR	8.55	215.31	216.05		216.09	0.001632	0.82	10.38	16.87	0.34
Humber River	Bolton Reach	9.207	2-year	EX	8.51	215.09	215.98		216.00	0.000712	0.61	14.00	19.11	0.23
Humber River	Bolton Reach	9.207	2-year	PR	8.55	215.09	215.98		216.00	0.000713	0.61	14.04	19.12	0.23
Humber River	Bolton Reach	9.204	2-year	EX	8.51	215.00	215.87		215.90	0.001226	0.74	11.53	17.86	0.29
Humber River	Bolton Reach	9.204	2-year	PR	8.55	215.00	215.87		215.90	0.001227	0.74	11.56	17.87	0.29
Humber River	Bolton Reach	9.201	2-year	EX	8.51	214.97	215.78	215.37	215.81	0.001472	0.79	11.31	22.90	0.32
Humber River	Bolton Reach	9.201	2-year	PR	8.55	214.97	215.78	215.37	215.81	0.001472	0.79	11.34	22.94	0.32
Humber River	Bolton Reach	9.198	2-year	EX	8.51	214.74	215.22	215.22	215.42	0.016842	1.99	4.28	10.69	1.01
Humber River	Bolton Reach	9.198	2-year	PR	8.55	214.74	215.22	215.22	215.42	0.016828	1.99	4.29	10.70	1.01
Humber River	Bolton Reach	9.195	2-year	EX	8.51	213.50	214.24		214.26	0.001374	0.71	11.92	21.22	0.30
Humber River	Bolton Reach	9.195	2-year	PR	8.55	213.50	214.24		214.26	0.001374	0.72	11.96	21.22	0.30
Humber River	Bolton Reach	9.192	2-year	EX	8.51	213.23	214.04		214.08	0.002656	0.92	9.20	18.19	0.42
Humber River	Bolton Reach	9.192	2-year	PR	8.55	213.23	214.04		214.08	0.002655	0.93	9.23	18.20	0.42
Humber River	Bolton Reach	9.189	2-year	EX	8.51	213.35	213.94	213.71	213.99	0.003123	1.01	8.42	16.48	0.45
Humber River	Bolton Reach	9.189	2-year	PR	8.55	213.35	213.94	213.71	214.00	0.003121	1.01	8.44	16.49	0.45
Humber River	Bolton Reach	9.186			Bridge									
Humber River	Bolton Reach	9.183	2-year	EX	8.51	213.31	213.87	213.68	213.94	0.004577	1.23	6.93	13.36	0.54
Humber River	Bolton Reach	9.183	2-year	PR	8.55	213.31	213.87	213.69	213.94	0.004576	1.23	6.95	13.37	0.54
Humber River	Bolton Reach	9.18	2-year	EX	8.51	213.02	213.60		213.65	0.002829	0.95	8.97	17.99	0.43
Humber River	Bolton Reach	9.18	2-year	PR	8.55	213.02	213.60		213.65	0.002825	0.95	9.00	18.01	0.43
Humber River	Bolton Reach	9.177	2-year	EX	8.51	212.57	213.33		213.37	0.001750	0.88	9.70	15.12	0.35
Humber River	Bolton Reach	9.177	2-year	PR	8.55	212.57	213.33		213.37	0.001751	0.88	9.72	15.13	0.35
Humber River	Bolton Reach	9.174	2-year	EX	8.51	212.55	213.31		213.36	0.001968	0.92	9.25	14.70	0.37
Humber River	Bolton Reach	9.174	2-year	PR	8.55	212.55	213.32		213.36	0.001969	0.92	9.28	14.71	0.37
Humber River	Bolton Reach	9.171	2-year	EX	8.51	212.49	213.30		213.33	0.001549	0.85	10.03	14.98	0.33
Humber River	Bolton Reach	9.171	2-year	PR	8.55	212.49	213.30		213.33	0.001550	0.85	10.05	14.98	0.33
Humber River	Bolton Reach	9.168	2-year	EX	8.51	212.44	213.23		213.29	0.003103	1.07	7.97	14.34	0.46
Humber River	Bolton Reach	9.168	2-year	PR	8.55	212.44	213.23		213.29	0.003103	1.07	7.99	14.36	0.46
Humber River	Bolton Reach	9.165	2-year	EX	8.51	212.37	213.17		213.23	0.003333	1.08	7.87	14.67	0.47
Humber River	Bolton Reach	9.165	2-year	PR	8.55	212.37	213.17		213.23	0.003333	1.08	7.89	14.69	0.47
Humber River	Bolton Reach	9.162	2-year	EX	8.51	212.33	213.08		213.16	0.004648	1.22	6.95	13.82	0.55
Humber River	Bolton Reach	9.162	2-year	PR	8.55	212.33	213.08		213.16	0.004644	1.23	6.98	13.84	0.55
Humber River	Bolton Reach	9.159	2-year	EX	8.51	212.18	213.03		213.09	0.003145	1.10	7.75	13.46	0.46
Humber River	Bolton Reach	9.159	2-year	PR	8.55	212.18	213.03		213.10	0.003145	1.10	7.77	13.47	0.46
Humber River	Bolton Reach	9.156	2-year	EX	8.51	211.93	213.03	212.31	213.05	0.000474	0.59	14.49	15.15	0.19
Humber River	Bolton Reach	9.156	2-year	PR	8.55	211.93	213.03	212.31	213.05	0.000475	0.59	14.52	15.16	0.19
Humber River	Bolton Reach	9.153			Bridge									
Humber River	Bolton Reach	9.15	2-year	EX	8.51	211.79	213.03	212.25	213.04	0.000252	0.43	19.78	21.00	0.14
Humber River	Bolton Reach	9.15	2-year	PR	8.55	211.79	213.03	212.25	213.04	0.000253	0.43	19.81	21.01	0.14
Humber River	Bolton Reach	9.147	2-year	EX	8.51	211.79	213.00		213.02	0.000519	0.60	14.08	15.25	0.20
Humber River	Bolton Reach	9.147	2-year	PR	8.55	211.79	213.00		213.02	0.000521	0.61	14.10	15.26	0.20
Humber River	Bolton Reach	9.144	2-year	EX	8.51	211.74	212.99		213.01	0.000475	0.58	14.63	15.61	0.19
Humber River	Bolton Reach	9.144	2-year	PR	8.55	211.74	213.00		213.01	0.000477	0.58	14.65	15.61	0.19
Humber River	Bolton Reach	9.141	2-year	EX	8.51	211.64	212.97		212.98	0.000324	0.50	17.07	17.36	0.16
Humber River	Bolton Reach	9.141	2-year	PR	8.55	211.64	212.97		212.98	0.000326	0.50	17.09	17.37	0.16

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	9.138	2-year	EX	8.51	211.64	212.95		212.97	0.000304	0.47	17.98	19.00	0.16
Humber River	Bolton Reach	9.138	2-year	PR	8.55	211.64	212.96		212.97	0.000306	0.47	18.01	19.00	0.16
Humber River	Bolton Reach	9.135	2-year	EX	8.51	211.64	212.94		212.95	0.000187	0.38	22.48	23.08	0.12
Humber River	Bolton Reach	9.135	2-year	PR	8.55	211.64	212.94		212.95	0.000188	0.38	22.51	23.09	0.12
Humber River	Bolton Reach	9.132	2-year	EX	8.51	211.64	212.92		212.94	0.000375	0.50	17.01	19.37	0.17
Humber River	Bolton Reach	9.132	2-year	PR	8.55	211.64	212.93		212.94	0.000377	0.50	17.03	19.38	0.17
Humber River	Bolton Reach	9.129	2-year	EX	8.51	211.64	212.92		212.93	0.000299	0.46	18.54	20.31	0.15
Humber River	Bolton Reach	9.129	2-year	PR	8.55	211.64	212.92		212.93	0.000301	0.46	18.56	20.32	0.15
Humber River	Bolton Reach	9.126	2-year	EX	8.51	211.64	212.92		212.92	0.000226	0.40	21.11	22.80	0.13
Humber River	Bolton Reach	9.126	2-year	PR	8.55	211.64	212.92		212.92	0.000227	0.40	21.13	22.81	0.13
Humber River	Bolton Reach	9.123	2-year	EX	8.51	211.64	212.91		212.92	0.000231	0.41	22.04	31.32	0.14
Humber River	Bolton Reach	9.123	2-year	PR	8.55	211.64	212.91		212.92	0.000232	0.41	22.07	31.54	0.14
Humber River	Bolton Reach	9.12	2-year	EX	8.51	213.30	212.77	212.77	212.89	0.039475		5.48	22.41	0.00
Humber River	Bolton Reach	9.12	2-year	PR	8.55	213.30	212.77	212.77	212.90	0.039390		5.50	22.43	0.00
Humber River	Bolton Reach	9.117	2-year	EX	8.51	211.64	212.28		212.31	0.002336	0.75	11.38	28.45	0.38
Humber River	Bolton Reach	9.117	2-year	PR	8.55	211.64	212.28		212.31	0.002335	0.75	11.42	28.45	0.38
Humber River	Bolton Reach	9.114	2-year	EX	8.51	211.64	212.18		212.23	0.006274	1.02	8.34	27.49	0.59
Humber River	Bolton Reach	9.114	2-year	PR	8.55	211.64	212.18		212.23	0.006225	1.02	8.38	27.50	0.59
Humber River	Bolton Reach	9.111	2-year	EX	8.51	211.41	212.16		212.18	0.000733	0.59	14.48	21.47	0.23
Humber River	Bolton Reach	9.111	2-year	PR	8.55	211.41	212.16		212.18	0.000734	0.59	14.52	21.47	0.23
Humber River	Bolton Reach	9.108	2-year	EX	8.51	211.41	212.12		212.16	0.001719	0.86	9.95	15.83	0.34
Humber River	Bolton Reach	9.108	2-year	PR	8.55	211.41	212.12		212.16	0.001722	0.86	9.97	15.83	0.34
Humber River	Bolton Reach	9.105	2-year	EX	8.51	211.40	212.09		212.14	0.002630	1.01	8.47	14.61	0.42
Humber River	Bolton Reach	9.105	2-year	PR	8.55	211.40	212.09		212.14	0.002634	1.01	8.49	14.62	0.42
Humber River	Bolton Reach	9.102	2-year	EX	8.51	211.39	211.83	211.83	212.01	0.017495	1.89	4.51	12.64	1.01
Humber River	Bolton Reach	9.102	2-year	PR	8.55	211.39	211.83	211.83	212.01	0.017407	1.89	4.53	12.65	1.01
Humber River	Bolton Reach	9.099	2-year	EX	8.51	211.16	211.63		211.65	0.002024	0.62	14.10	29.78	0.34
Humber River	Bolton Reach	9.099	2-year	PR	8.55	211.16	211.63		211.65	0.002025	0.62	14.14	29.81	0.34
Humber River	Bolton Reach	9.096	2-year	EX	8.51	211.29	211.52	211.31	211.57	0.006712	0.55	8.58	21.61	0.52
Humber River	Bolton Reach	9.096	2-year	PR	8.55	211.29	211.52	211.31	211.57	0.006719	0.56	8.60	21.65	0.52
Humber River	Bolton Reach	9.093			Mult Open									
Humber River	Bolton Reach	9.09	2-year	EX	8.51	211.28	211.40	211.21	211.44	0.006294	0.35	9.72	26.71	0.45
Humber River	Bolton Reach	9.09	2-year	PR	8.55	211.28	211.40	211.21	211.44	0.006309	0.35	9.74	26.74	0.45
Humber River	Bolton Reach	9.087	2-year	EX	8.51	210.58	211.01		211.12	0.009388	1.45	6.45	22.08	0.75
Humber River	Bolton Reach	9.087	2-year	PR	8.55	210.58	211.01		211.12	0.009335	1.44	6.48	22.14	0.75
Humber River	Bolton Reach	9.084	2-year	EX	8.51	209.90	210.82		210.86	0.002078	0.93	9.12	14.83	0.38
Humber River	Bolton Reach	9.084	2-year	PR	8.55	209.90	210.82		210.87	0.002081	0.94	9.14	14.84	0.38
Humber River	Bolton Reach	9.081	2-year	EX	8.51	209.90	210.78		210.82	0.002203	0.97	8.78	14.10	0.39
Humber River	Bolton Reach	9.081	2-year	PR	8.55	209.90	210.78		210.83	0.002207	0.97	8.80	14.11	0.39
Humber River	Bolton Reach	9.078	2-year	EX	8.51	209.90	210.55		210.59	0.002454	0.87	9.76	20.05	0.40
Humber River	Bolton Reach	9.078	2-year	PR	8.55	209.90	210.55		210.59	0.002458	0.87	9.78	20.06	0.40
Humber River	Bolton Reach	9.075	2-year	EX	8.51	209.90	210.44		210.50	0.005013	1.08	7.87	20.04	0.55
Humber River	Bolton Reach	9.075	2-year	PR	8.55	209.90	210.44		210.50	0.005018	1.08	7.89	20.05	0.55
Humber River	Bolton Reach	9.072	2-year	EX	8.51	209.70	210.18	210.18	210.32	0.019173	1.65	5.15	18.99	1.01
Humber River	Bolton Reach	9.072	2-year	PR	8.55	209.70	210.18	210.18	210.32	0.019140	1.66	5.16	19.00	1.01
Humber River	Bolton Reach	9.069	2-year	EX	8.51	209.36	210.00	209.79	210.05	0.003020	0.93	9.20	20.22	0.44
Humber River	Bolton Reach	9.069	2-year	PR	8.55	209.36	210.00	209.79	210.05	0.003015	0.93	9.23	20.24	0.44
Humber River	Bolton Reach	9.066			Bridge									
Humber River	Bolton Reach	9.063	2-year	EX	8.51	209.17	209.96	209.66	209.98	0.001579	0.72	11.77	23.04	0.32
Humber River	Bolton Reach	9.063	2-year	PR	8.55	209.17	209.96	209.66	209.99	0.001577	0.72	11.81	23.06	0.32
Humber River	Bolton Reach	9.06	2-year	EX	8.51	209.05	209.90		209.93	0.001389	0.77	11.04	17.65	0.31
Humber River	Bolton Reach	9.06	2-year	PR	8.55	209.05	209.90		209.93	0.001391	0.77	11.07	17.67	0.31
Humber River	Bolton Reach	9.057	2-year	EX	8.51	209.05	209.88		209.90	0.001008	0.68	12.46	18.79	0.27
Humber River	Bolton Reach	9.057	2-year	PR	8.55	209.05	209.88		209.90	0.001011	0.68	12.49	18.81	0.27
Humber River	Bolton Reach	9.054	2-year	EX	8.51	209.05	209.84		209.86	0.001134	0.69	12.27	19.78	0.28
Humber River	Bolton Reach	9.054	2-year	PR	8.55	209.05	209.84		209.86	0.001136	0.70	12.30	19.80	0.28
Humber River	Bolton Reach	9.051	2-year	EX	8.51	209.05	209.65	209.43	209.71	0.003360	1.07	8.02	61.24	0.47
Humber River	Bolton Reach	9.051	2-year	PR	8.55	209.05	209.65	209.43	209.71	0.003373	1.08	8.03	61.30	0.47
Humber River	Bolton Reach	9.048	2-year	EX	8.51	209.05	209.52	209.27	209.52	0.000754	0.43	49.38	195.64	0.21
Humber River	Bolton Reach	9.048	2-year	PR	8.55	209.05	209.52	209.27	209.53	0.000749	0.43	49.67	196.20	0.21
Humber River	Bolton Reach	9.045	2-year	EX	8.51	208.40	209.36		209.38	0.000774	0.70	14.51	35.28	0.24
Humber River	Bolton Reach	9.045	2-year	PR	8.55	208.40	209.36		209.38	0.000775	0.70	14.57	35.42	0.24
Humber River	Bolton Reach	9.042	2-year	EX	8.51	208.41	208.83	208.83	208.97	0.018613	1.69	5.04	17.55	1.01
Humber River	Bolton Reach	9.042	2-year	PR	8.55	208.41	208.83	208.83	208.97	0.018631	1.69	5.05	17.57	1.01
Humber River	Bolton Reach	9.039	2-year	EX	8.51	207.60	208.22		208.25	0.001769	0.72	11.76	25.05	0.34
Humber River	Bolton Reach	9.039	2-year	PR	8.55	207.60	208.22		208.25	0.001770	0.72	11.79	25.08	0.34
Humber River	Bolton Reach	9.036	2-year	EX	8.51	207.60	208.04		208.10	0.005665	1.03	8.23	24.44	0.57
Humber River	Bolton Reach	9.036	2-year	PR	8.55	207.60	208.05		208.10	0.005631	1.03	8.27	24.48	0.57
Humber River	Bolton Reach	9.033	2-year	EX	8.51	207.10	207.99	207.40	208.01	0.000455	0.54	15.90	19.20	0.19
Humber River	Bolton Reach	9.033	2-year	PR	8.55	207.10	207.99	207.40	208.01	0.000456	0.54	15.93	19.21	0.19

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	9.03			Bridge									
Humber River	Bolton Reach	9.027	2-year	EX	8.51	207.11	207.98	207.40	208.00	0.000440	0.53	16.03	25.24	0.18
Humber River	Bolton Reach	9.027	2-year	PR	8.55	207.11	207.99	207.40	208.00	0.000442	0.53	16.06	25.25	0.18
Humber River	Bolton Reach	9.024	2-year	EX	8.51	207.09	207.96		207.99	0.001732	0.76	11.13	21.34	0.34
Humber River	Bolton Reach	9.024	2-year	PR	8.55	207.09	207.96		207.99	0.001734	0.77	11.16	21.37	0.34
Humber River	Bolton Reach	9.021	2-year	EX	8.51	207.11	207.85		207.88	0.001469	0.84	11.84	30.45	0.33
Humber River	Bolton Reach	9.021	2-year	PR	8.55	207.11	207.85		207.89	0.001472	0.84	11.88	30.53	0.33
Humber River	Bolton Reach	9.018	2-year	EX	8.51	206.75	207.77		207.79	0.000568	0.56	15.94	29.97	0.21
Humber River	Bolton Reach	9.018	2-year	PR	8.55	206.75	207.77		207.79	0.000571	0.56	15.97	30.02	0.21
Humber River	Bolton Reach	9.015	2-year	EX	8.51	206.42	207.70		207.71	0.000395	0.50	17.62	31.88	0.17
Humber River	Bolton Reach	9.015	2-year	PR	8.55	206.42	207.70		207.71	0.000398	0.50	17.63	31.94	0.17
Humber River	Bolton Reach	9.012	2-year	EX	8.51	206.41	207.70		207.71	0.000309	0.45	19.78	44.07	0.15
Humber River	Bolton Reach	9.012	2-year	PR	8.55	206.41	207.70		207.71	0.000312	0.46	19.80	44.18	0.16
Humber River	Bolton Reach	9.009	2-year	EX	8.51	206.42	207.69	206.75	207.70	0.000173	0.35	25.18	40.61	0.12
Humber River	Bolton Reach	9.009	2-year	PR	8.55	206.42	207.69	206.75	207.70	0.000174	0.35	25.19	40.62	0.12
Humber River	Bolton Reach	9.006			Bridge									
Humber River	Bolton Reach	9.003	2-year	EX	8.51	206.18	207.68	206.58	207.69	0.000183	0.31	27.55	125.31	0.12
Humber River	Bolton Reach	9.003	2-year	PR	8.55	206.18	207.68	206.58	207.69	0.000185	0.32	27.57	125.33	0.12
Humber River	Bolton Reach	9	2-year	EX	8.51	206.18	207.68		207.68	0.000074	0.30	50.01	107.08	0.08
Humber River	Bolton Reach	9	2-year	PR	8.55	206.18	207.68		207.68	0.000074	0.30	50.04	107.11	0.08
Humber River	DOWNSTREAM	11.39	2-year	EX	15.61	206.18	207.64		207.67	0.000653	0.72	23.57	67.60	0.23
Humber River	DOWNSTREAM	11.39	2-year	PR	15.62	206.18	207.64		207.67	0.000653	0.72	23.58	67.61	0.23
Humber River	DOWNSTREAM	11.38	2-year	EX	15.61	206.17	207.54		207.59	0.001099	1.00	15.64	13.63	0.30
Humber River	DOWNSTREAM	11.38	2-year	PR	15.62	206.17	207.54		207.59	0.001100	1.00	15.64	13.64	0.30
Humber River	DOWNSTREAM	11.37	2-year	EX	15.61	206.18	207.45		207.50	0.000942	0.95	17.14	18.69	0.28
Humber River	DOWNSTREAM	11.37	2-year	PR	15.62	206.18	207.45		207.50	0.000943	0.95	17.15	18.70	0.28
Humber River	DOWNSTREAM	11.36	2-year	EX	15.61	206.17	207.41		207.44	0.000595	0.72	25.79	49.62	0.22
Humber River	DOWNSTREAM	11.36	2-year	PR	15.62	206.17	207.41		207.44	0.000596	0.72	25.80	49.62	0.22
Humber River	DOWNSTREAM	11.35	2-year	EX	15.61	206.03	207.40		207.41	0.000229	0.50	53.07	86.57	0.14
Humber River	DOWNSTREAM	11.35	2-year	PR	15.62	206.03	207.40		207.41	0.000229	0.50	53.07	86.58	0.14
Humber River	DOWNSTREAM	11.34	2-year	EX	15.61	205.60	207.36	206.10	207.38	0.000222	0.59	33.56	29.37	0.14
Humber River	DOWNSTREAM	11.34	2-year	PR	15.62	205.60	207.36	206.10	207.38	0.000222	0.59	33.56	29.37	0.14
Cold_10_7	Tributary E	4822.04	2-year	EX	0.05	263.04	263.13		263.15	0.130082	0.64	0.08	1.58	0.88
Cold_10_7	Tributary E	4822.04	2-year	PR	0.05	263.04	263.13		263.15	0.133585	0.63	0.08	1.53	0.88
Cold_10_7	Tributary E	4783.59	2-year	EX	0.05	262.40	262.61	262.49	262.61	0.005012	0.22	0.24	1.86	0.20
Cold_10_7	Tributary E	4783.59	2-year	PR	0.05	262.40	262.60	262.49	262.60	0.004997	0.22	0.23	1.82	0.20
Cold_10_7	Tributary E	4731.68	2-year	EX	0.05	261.73	261.81	261.81	261.83	0.216858	0.59	0.09	2.76	1.05
Cold_10_7	Tributary E	4731.68	2-year	PR	0.05	261.73	261.80	261.80	261.82	0.207112	0.66	0.08	1.91	1.06
Cold_10_7	Tributary E	4652.11	2-year	EX	0.05	261.35	261.49		261.49	0.000021	0.02	2.54	32.62	0.02
Cold_10_7	Tributary E	4652.11	2-year	PR	0.05	261.35	261.49		261.49	0.000020	0.02	2.43	32.52	0.02
Cold_10_7	Tributary E	4592.65	2-year	EX	0.05	261.40	261.49		261.49	0.000055	0.03	1.75	29.55	0.04
Cold_10_7	Tributary E	4592.65	2-year	PR	0.05	261.40	261.49		261.49	0.000056	0.03	1.65	29.39	0.04
Cold_10_7	Tributary E	4515.64	2-year	EX	0.05	261.39	261.46		261.47	0.095750	0.50	0.11	2.30	0.74
Cold_10_7	Tributary E	4515.64	2-year	PR	0.05	261.39	261.46		261.47	0.106941	0.51	0.10	2.25	0.77
Cold_10_7	Tributary E	4460.59	2-year	EX	0.09	261.30	261.45		261.45	0.000162	0.03	2.67	29.18	0.03
Cold_10_7	Tributary E	4460.59	2-year	PR	0.08	261.30	261.44		261.44	0.000160	0.03	2.56	29.08	0.03
Cold_10_7	Tributary E	4407.62	2-year	EX	0.09	261.31	261.42		261.42	0.008016	0.18	0.47	7.26	0.23
Cold_10_7	Tributary E	4407.62	2-year	PR	0.08	261.31	261.42		261.42	0.008291	0.18	0.45	7.19	0.23
Cold_10_7	Tributary E	4354.33	2-year	EX	0.09	260.86	261.04		261.04	0.006319	0.24	0.36	3.11	0.22
Cold_10_7	Tributary E	4354.33	2-year	PR	0.08	260.86	261.04		261.04	0.006169	0.23	0.35	3.07	0.22
Cold_10_7	Tributary E	4322.62	2-year	EX	0.09	260.68	260.86		260.86	0.005414	0.22	0.39	3.26	0.20
Cold_10_7	Tributary E	4322.62	2-year	PR	0.08	260.68	260.85		260.85	0.005569	0.22	0.37	3.19	0.21
Cold_10_7	Tributary E	4293.51	2-year	EX	0.09	260.49	260.73		260.73	0.003422	0.21	0.41	2.53	0.17
Cold_10_7	Tributary E	4293.51	2-year	PR	0.08	260.49	260.72		260.73	0.003374	0.21	0.39	2.48	0.17
Cold_10_7	Tributary E	4265.3	2-year	EX	0.09	260.37	260.50		260.51	0.031163	0.41	0.21	2.59	0.46
Cold_10_7	Tributary E	4265.3	2-year	PR	0.08	260.37	260.50		260.51	0.032289	0.41	0.19	2.46	0.47
Cold_10_7	Tributary E	4240.34	2-year	EX	0.09	259.55	259.73		259.74	0.030229	0.49	0.17	1.57	0.47
Cold_10_7	Tributary E	4240.34	2-year	PR	0.08	259.55	259.73		259.74	0.029192	0.48	0.17	1.55	0.46
Cold_10_7	Tributary E	4181.11	2-year	EX	0.09	259.05	259.38		259.39	0.002500	0.18	0.47	2.81	0.14
Cold_10_7	Tributary E	4181.11	2-year	PR	0.08	259.05	259.37		259.37	0.002586	0.19	0.43	2.67	0.15
Cold_10_7	Tributary E	4121.04	2-year	EX	0.09	258.89	258.99		259.00	0.041696	0.33	0.26	5.46	0.49
Cold_10_7	Tributary E	4121.04	2-year	PR	0.08	258.89	259.00		259.00	0.030568	0.29	0.27	5.60	0.42
Cold_10_7	Tributary E	4055.36	2-year	EX	0.09	258.17	258.27		258.27	0.005042	0.11	0.77	17.20	0.17
Cold_10_7	Tributary E	4055.36	2-year	PR	0.08	258.17	258.27		258.27	0.005713	0.11	0.71	16.99	0.18
Cold_10_7	Tributary E	4004.48	2-year	EX	0.09	258.09	258.27		258.27	0.000026	0.01	6.05	58.14	0.01
Cold_10_7	Tributary E	4004.48	2-year	PR	0.08	258.09	258.26		258.26	0.000025	0.01	5.85	57.61	0.01
Cold_10_7	Tributary E	3947.08	2-year	EX	0.09	258.09	258.27		258.27	0.000001	0.01	13.42	105.07	0.01
Cold_10_7	Tributary E	3947.08	2-year	PR	0.08	258.09	258.26		258.26	0.000001	0.01	13.05	104.91	0.01
Cold_10_7	Tributary E	3869.46	2-year	EX	0.09	258.09	258.27		258.27	0.000052	0.02	4.12	36.91	0.02
Cold_10_7	Tributary E	3869.46	2-year	PR	0.08	258.09	258.26		258.26	0.000049	0.02	3.99	36.59	0.02

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Cold_10_7	Tributary E	3837.47	2-year	EX	0.20	258.09	258.21	258.21	258.25	0.153880	0.87	0.23	3.07	1.01
Cold_10_7	Tributary E	3837.47	2-year	PR	0.19	258.09	258.21	258.21	258.24	0.149412	0.85	0.22	3.04	1.00
Cold_10_7	Tributary E	3758.91	2-year	EX	0.20	257.76	257.95		257.95	0.000640	0.09	2.42	20.69	0.07
Cold_10_7	Tributary E	3758.91	2-year	PR	0.19	257.76	257.95		257.95	0.000634	0.09	2.36	20.20	0.07
Cold_10_7	Tributary E	3700.91	2-year	EX	0.20	257.72	257.90		257.90	0.001294	0.11	1.88	18.66	0.10
Cold_10_7	Tributary E	3700.91	2-year	PR	0.19	257.72	257.90		257.90	0.001287	0.11	1.83	18.54	0.10
Cold_10_7	Tributary E	3650.13	2-year	EX	0.20	257.64	257.80		257.80	0.003320	0.15	1.41	16.54	0.16
Cold_10_7	Tributary E	3650.13	2-year	PR	0.19	257.64	257.80		257.80	0.003329	0.15	1.38	16.46	0.15
Cold_10_7	Tributary E	3587.5	2-year	EX	0.20	257.51	257.64		257.64	0.002258	0.12	1.83	24.36	0.13
Cold_10_7	Tributary E	3587.5	2-year	PR	0.19	257.51	257.63		257.63	0.002242	0.12	1.78	24.24	0.13
Cold_10_7	Tributary E	3530.86	2-year	EX	0.20	257.24	257.37		257.37	0.014571	0.26	0.81	14.41	0.31
Cold_10_7	Tributary E	3530.86	2-year	PR	0.19	257.24	257.37		257.37	0.014710	0.26	0.78	14.25	0.31
Cold_10_7	Tributary E	3486.25	2-year	EX	0.20	256.89	257.02		257.02	0.003818	0.15	1.55	24.03	0.16
Cold_10_7	Tributary E	3486.25	2-year	PR	0.19	256.89	257.02		257.02	0.003801	0.15	1.49	23.84	0.16
Cold_10_7	Tributary E	3456.94	2-year	EX	0.20	256.66	256.76	256.76	256.78	0.118921	0.76	0.29	5.12	0.89
Cold_10_7	Tributary E	3456.94	2-year	PR	0.19	256.66	256.75	256.75	256.78	0.117397	0.74	0.28	5.09	0.88
Cold_10_7	Tributary E	3435.76	2-year	EX	0.20	256.29	256.37	256.37	256.37	0.002290	0.08	1.50	18.41	0.12
Cold_10_7	Tributary E	3435.76	2-year	PR	0.19	256.29	256.37	256.37	256.37	0.002108	0.08	1.50	18.41	0.11
Cold_10_7	Tributary E	3426.56	2-year	EX	0.20	256.08	256.14	256.14	256.14	0.000746	0.05	2.46	24.30	0.07
Cold_10_7	Tributary E	3426.56	2-year	PR	0.19	256.08	256.14	256.14	256.14	0.000686	0.05	2.46	24.30	0.06
Cold_10_7	Tributary E	3396.62	2-year	EX	0.20	255.66	255.77		255.77	0.020960	0.30	0.90	23.43	0.37
Cold_10_7	Tributary E	3396.62	2-year	PR	0.19	255.66	255.77		255.77	0.021244	0.30	0.87	23.36	0.37
Cold_10_7	Tributary E	3377.5	2-year	EX	0.20	255.40	255.47		255.47	0.008427	0.12	1.25	26.14	0.21
Cold_10_7	Tributary E	3377.5	2-year	PR	0.19	255.40	255.47		255.47	0.008311	0.12	1.22	25.97	0.21
Cold_10_7	Tributary E	3359.36	2-year	EX	0.20	255.17	255.24		255.24	0.014881	0.21	0.98	23.11	0.30
Cold_10_7	Tributary E	3359.36	2-year	PR	0.19	255.17	255.23		255.24	0.015286	0.20	0.93	22.80	0.30
Cold_10_7	Tributary E	3339.67	2-year	EX	0.20	254.81	254.90		254.91	0.019505	0.33	0.69	12.38	0.37
Cold_10_7	Tributary E	3339.67	2-year	PR	0.19	254.81	254.90		254.91	0.019380	0.32	0.67	12.25	0.36
Cold_10_7	Tributary E	3321.23	2-year	EX	0.20	254.35	254.61		254.61	0.013797	0.38	0.52	4.55	0.33
Cold_10_7	Tributary E	3321.23	2-year	PR	0.19	254.35	254.60		254.61	0.014130	0.38	0.50	3.95	0.34
Cold_10_7	Tributary E	3287.37	2-year	EX	0.20	253.96	254.23	254.12	254.24	0.009013	0.32	0.71	8.77	0.27
Cold_10_7	Tributary E	3287.37	2-year	PR	0.19	253.96	254.23	254.12	254.24	0.008745	0.32	0.67	8.34	0.27
Cold_10_7	Tributary E	3269.41	2-year	EX	0.20	253.68	253.85	253.83	253.87	0.083616	0.69	0.28	3.35	0.76
Cold_10_7	Tributary E	3269.41	2-year	PR	0.19	253.68	253.84	253.83	253.87	0.089660	0.70	0.27	3.31	0.78
Cold_10_7	Tributary E	3191.63	2-year	EX	0.20	252.91	253.21		253.21	0.003308	0.24	0.84	4.42	0.17
Cold_10_7	Tributary E	3191.63	2-year	PR	0.19	252.91	253.21		253.21	0.003271	0.23	0.82	4.40	0.17
Cold_10_7	Tributary E	3188.65	2-year	EX	0.20	252.84	253.19	252.97	253.19	0.001815	0.19	1.02	7.04	0.13
Cold_10_7	Tributary E	3188.65	2-year	PR	0.19	252.84	253.18	252.97	253.18	0.001766	0.19	1.00	7.02	0.13
Cold_10_7	Tributary E	3158.51 hum_426			Culvert									
Cold_10_7	Tributary E	3123.12	2-year	EX	0.20	252.73	252.96	252.88	252.97	0.019582	0.34	0.58	6.79	0.37
Cold_10_7	Tributary E	3123.12	2-year	PR	0.19	252.73	252.96	252.89	252.97	0.019966	0.34	0.56	6.71	0.37
Cold_10_7	Tributary E	3107.01	2-year	EX	0.20	252.50	252.64		252.64	0.021278	0.29	0.68	10.73	0.37
Cold_10_7	Tributary E	3107.01	2-year	PR	0.19	252.50	252.64		252.64	0.020684	0.29	0.67	10.54	0.36
Cold_10_7	Tributary E	3043.25	2-year	EX	0.20	252.01	252.13		252.13	0.004120	0.12	1.63	27.78	0.16
Cold_10_7	Tributary E	3043.25	2-year	PR	0.19	252.01	252.13		252.13	0.004166	0.12	1.59	27.72	0.16
Cold_10_7	Tributary E	2991.29	2-year	EX	0.20	251.56	251.46	251.46	251.50	0.147498		0.21	2.20	0.00
Cold_10_7	Tributary E	2991.29	2-year	PR	0.19	251.56	251.45	251.45	251.50	0.145438		0.20	2.14	0.00
Cold_10_7	Tributary E	2930.14	2-year	EX	0.20	250.15	250.27		250.27	0.001313	0.10	2.16	25.47	0.10
Cold_10_7	Tributary E	2930.14	2-year	PR	0.19	250.15	250.27		250.27	0.001340	0.10	2.09	25.33	0.10
Cold_10_7	Tributary E	2887.5	2-year	EX	0.20	249.94	250.24		250.24	0.000564	0.11	2.54	24.37	0.07
Cold_10_7	Tributary E	2887.5	2-year	PR	0.19	249.94	250.23		250.23	0.000558	0.11	2.47	24.27	0.07
Cold_10_7	Tributary E	2802.56	2-year	EX	0.20	250.05	250.12		250.12	0.006001	0.11	1.11	15.66	0.18
Cold_10_7	Tributary E	2802.56	2-year	PR	0.19	250.05	250.12		250.12	0.005983	0.11	1.07	15.38	0.18
Cold_10_7	Tributary E	2775.8	2-year	EX	0.20	249.52	249.68		249.70	0.050127	0.55	0.36	4.10	0.59
Cold_10_7	Tributary E	2775.8	2-year	PR	0.19	249.52	249.68		249.69	0.051747	0.55	0.34	4.01	0.60
Cold_10_7	Tributary E	2760.75	2-year	EX	0.20	249.25	249.55	249.40	249.55	0.003588	0.25	0.79	4.03	0.18
Cold_10_7	Tributary E	2760.75	2-year	PR	0.19	249.25	249.54	249.40	249.55	0.003637	0.25	0.77	4.01	0.18
Cold_10_7	Tributary E	2732.6 hum_604			Culvert									
Cold_10_7	Tributary E	2706.72	2-year	EX	0.20	249.08	249.40	249.29	249.41	0.018507	0.52	0.38	2.19	0.39
Cold_10_7	Tributary E	2706.72	2-year	PR	0.19	249.08	249.39	249.28	249.40	0.018895	0.52	0.37	2.12	0.40
Cold_10_7	Tributary E	2688.78	2-year	EX	0.20	248.89	249.12		249.13	0.015423	0.38	0.52	4.30	0.35
Cold_10_7	Tributary E	2688.78	2-year	PR	0.19	248.89	249.12		249.12	0.015078	0.37	0.51	4.26	0.34
Cold_10_7	Tributary E	2611.59	2-year	EX	0.20	247.47	247.64		247.65	0.026229	0.36	0.57	8.11	0.42
Cold_10_7	Tributary E	2611.59	2-year	PR	0.19	247.47	247.64		247.64	0.027043	0.36	0.55	8.01	0.42
Cold_10_7	Tributary E	2560.8	2-year	EX	0.20	246.62	246.94		246.94	0.008214	0.37	0.53	2.63	0.26
Cold_10_7	Tributary E	2560.8	2-year	PR	0.19	246.62	246.93		246.94	0.008115	0.37	0.52	2.59	0.26
Cold_10_7	Tributary E	2506.61	2-year	EX	0.20	246.27	246.58		246.58	0.005839	0.31	0.65	3.45	0.23
Cold_10_7	Tributary E	2506.61	2-year	PR	0.19	246.27	246.57		246.57	0.005911	0.30	0.63	3.42	0.23
Cold_10_7	Tributary E	2483.51	2-year	EX	0.20	245.99	246.44		246.45	0.005908	0.34	0.58	2.59	0.23
Cold_10_7	Tributary E	2483.51	2-year	PR	0.19	245.99	246.43		246.44	0.005976	0.34	0.56	2.55	0.23

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Cold_10_7	Tributary E	2452.23	2-year	EX	0.20	245.92	246.29		246.29	0.004147	0.28	0.70	3.31	0.19
Cold_10_7	Tributary E	2452.23	2-year	PR	0.19	245.92	246.28		246.28	0.004064	0.28	0.68	3.20	0.19
Cold_10_7	Tributary E	2401.32	2-year	EX	0.20	245.83	246.07		246.07	0.004354	0.22	1.02	11.21	0.19
Cold_10_7	Tributary E	2401.32	2-year	PR	0.19	245.83	246.07		246.07	0.004370	0.22	0.99	10.90	0.19
Cold_10_7	Tributary E	2367.56	2-year	EX	0.20	245.65	245.81		245.81	0.012820	0.30	0.66	6.78	0.31
Cold_10_7	Tributary E	2367.56	2-year	PR	0.19	245.65	245.80		245.81	0.012984	0.30	0.64	6.76	0.31
Cold_10_7	Tributary E	2338.9	2-year	EX	0.20	245.20	245.35		245.35	0.020394	0.34	0.63	9.45	0.38
Cold_10_7	Tributary E	2338.9	2-year	PR	0.19	245.20	245.34		245.35	0.020123	0.34	0.61	8.99	0.37
Cold_10_7	Tributary E	2310.58	2-year	EX	0.20	244.39	244.58		244.60	0.037222	0.64	0.31	2.17	0.54
Cold_10_7	Tributary E	2310.58	2-year	PR	0.19	244.39	244.58		244.60	0.038136	0.64	0.30	2.15	0.55
Cold_10_7	Tributary E	2264.91	2-year	EX	0.20	243.75	244.13		244.14	0.005466	0.32	0.63	2.96	0.22
Cold_10_7	Tributary E	2264.91	2-year	PR	0.19	243.75	244.13		244.13	0.005427	0.31	0.61	2.91	0.22
Cold_10_7	Tributary E	2209.07	2-year	EX	0.20	243.51	243.78		243.79	0.007324	0.33	0.60	3.32	0.25
Cold_10_7	Tributary E	2209.07	2-year	PR	0.19	243.51	243.78		243.78	0.007365	0.33	0.58	3.27	0.25
Cold_10_7	Tributary E	2169.34	2-year	EX	0.20	243.13	243.41		243.42	0.012037	0.41	0.48	2.80	0.32
Cold_10_7	Tributary E	2169.34	2-year	PR	0.19	243.13	243.41		243.42	0.011867	0.41	0.47	2.78	0.32
Cold_10_7	Tributary E	2156.52	2-year	EX	0.20	242.99	243.31	243.17	243.31	0.005992	0.27	0.72	4.74	0.22
Cold_10_7	Tributary E	2156.52	2-year	PR	0.19	242.99	243.30	243.17	243.31	0.006240	0.27	0.69	4.70	0.23
Cold_10_7	Tributary E	2127.4 hum_427			Culvert									
Cold_10_7	Tributary E	2093.17	2-year	EX	0.20	242.09	242.22	242.22	242.25	0.151612	0.84	0.23	3.21	1.00
Cold_10_7	Tributary E	2093.17	2-year	PR	0.19	242.09	242.21	242.21	242.25	0.160623	0.85	0.22	3.18	1.02
Cold_10_7	Tributary E	2079.21	2-year	EX	0.20	241.19	241.63		241.63	0.002049	0.24	0.84	2.89	0.14
Cold_10_7	Tributary E	2079.21	2-year	PR	0.19	241.19	241.62		241.62	0.002027	0.23	0.82	2.87	0.14
Cold_10_7	Tributary E	2055.25	2-year	EX	0.20	241.15	241.41	241.41	241.47	0.154773	1.07	0.18	1.65	1.02
Cold_10_7	Tributary E	2055.25	2-year	PR	0.19	241.15	241.40	241.40	241.46	0.149044	1.04	0.18	1.63	1.00
Cold_10_7	Tributary E	2016.73	2-year	EX	0.20	240.24	240.47		240.47	0.008870	0.33	0.60	3.93	0.27
Cold_10_7	Tributary E	2016.73	2-year	PR	0.19	240.24	240.46		240.47	0.008780	0.33	0.58	3.92	0.27
Cold_10_7	Tributary E	1965.37	2-year	EX	0.20	239.78	239.97		239.97	0.010616	0.30	0.65	5.65	0.29
Cold_10_7	Tributary E	1965.37	2-year	PR	0.19	239.78	239.97		239.97	0.010696	0.30	0.63	5.61	0.29
Cold_10_7	Tributary E	1917.19	2-year	EX	0.20	239.12	239.51	239.35	239.52	0.008535	0.36	0.55	3.02	0.27
Cold_10_7	Tributary E	1917.19	2-year	PR	0.19	239.12	239.51	239.34	239.51	0.008452	0.36	0.53	2.98	0.27
Cold_10_7	Tributary E	1875.03	2-year	EX	0.20	238.41	238.54	238.54	238.59	0.139174	0.97	0.20	2.11	1.00
Cold_10_7	Tributary E	1875.03	2-year	PR	0.19	238.41	238.54	238.54	238.58	0.143811	0.97	0.20	2.08	1.01
Cold_10_7	Tributary E	1862.94	2-year	EX	0.20	237.78	237.97		237.98	0.006337	0.40	0.50	4.00	0.36
Cold_10_7	Tributary E	1862.94	2-year	PR	0.19	237.78	237.97		237.98	0.006353	0.39	0.49	3.99	0.36
Cold_10_7	Tributary E	1801.09	2-year	EX	0.20	237.21	237.48		237.49	0.010561	0.35	0.56	3.86	0.29
Cold_10_7	Tributary E	1801.09	2-year	PR	0.19	237.21	237.48		237.48	0.010568	0.35	0.55	3.82	0.29
Cold_10_7	Tributary E	1765.21	2-year	EX	0.20	236.57	236.74	236.74	236.78	0.150807	0.95	0.21	2.36	1.01
Cold_10_7	Tributary E	1765.21	2-year	PR	0.19	236.57	236.73	236.73	236.78	0.149606	0.93	0.20	2.35	1.01
Cold_10_7	Tributary E	1718.91	2-year	EX	0.20	235.76	235.97		235.97	0.002152	0.17	1.13	6.74	0.14
Cold_10_7	Tributary E	1718.91	2-year	PR	0.19	235.76	235.97		235.97	0.002140	0.17	1.10	6.68	0.14
Cold_10_7	Tributary E	1661.15	2-year	EX	0.20	235.41	235.55	235.55	235.58	0.137920	0.78	0.26	3.68	0.94
Cold_10_7	Tributary E	1661.15	2-year	PR	0.19	235.41	235.54	235.54	235.57	0.137195	0.77	0.25	3.61	0.94
Cold_10_7	Tributary E	1612.45	2-year	EX	0.20	234.02	234.32	234.18	234.33	0.010298	0.41	0.48	2.49	0.30
Cold_10_7	Tributary E	1612.45	2-year	PR	0.19	234.02	234.32	234.18	234.33	0.010169	0.40	0.47	2.46	0.30
Cold_10_7	Tributary E	1568.23	2-year	EX	0.20	233.00	233.15	233.15	233.19	0.145999	0.91	0.22	2.61	1.00
Cold_10_7	Tributary E	1568.23	2-year	PR	0.19	233.00	233.14	233.14	233.19	0.152034	0.90	0.21	2.59	1.01
Cold_10_7	Tributary E	1541.88	2-year	EX	0.20	232.24	232.54		232.55	0.006651	0.33	0.59	3.03	0.24
Cold_10_7	Tributary E	1541.88	2-year	PR	0.19	232.24	232.54		232.54	0.006650	0.33	0.58	3.00	0.24
Cold_10_7	Tributary E	1489.67	2-year	EX	0.20	231.67	231.84		231.86	0.037822	0.62	0.32	2.37	0.54
Cold_10_7	Tributary E	1489.67	2-year	PR	0.19	231.67	231.83		231.85	0.037722	0.61	0.31	2.36	0.54
Cold_10_7	Tributary E	1435.23	2-year	EX	0.20	230.09	230.30	230.23	230.30	0.022255	0.35	0.57	6.87	0.39
Cold_10_7	Tributary E	1435.23	2-year	PR	0.19	230.09	230.29	230.23	230.30	0.022283	0.35	0.55	6.78	0.39
Cold_10_7	Tributary E	1380.7	2-year	EX	0.20	228.76	229.07		229.08	0.023110	0.56	0.36	2.03	0.42
Cold_10_7	Tributary E	1380.7	2-year	PR	0.19	228.76	229.06		229.08	0.023083	0.55	0.35	2.01	0.42
Cold_10_7	Tributary E	1332.54	2-year	EX	0.20	227.38	227.63		227.65	0.040764	0.65	0.31	2.22	0.56
Cold_10_7	Tributary E	1332.54	2-year	PR	0.19	227.38	227.62		227.64	0.041074	0.64	0.30	2.20	0.56
Cold_10_7	Tributary E	1302.84	2-year	EX	0.20	226.30	226.54		226.55	0.033584	0.55	0.36	2.99	0.51
Cold_10_7	Tributary E	1302.84	2-year	PR	0.19	226.30	226.53		226.55	0.033356	0.54	0.35	2.92	0.50
Cold_10_7	Tributary E	1263.71	2-year	EX	0.20	225.10	225.31		225.32	0.029491	0.51	0.39	3.26	0.48
Cold_10_7	Tributary E	1263.71	2-year	PR	0.19	225.10	225.30		225.32	0.029653	0.51	0.37	3.22	0.48
Cold_10_7	Tributary E	1215.31	2-year	EX	0.20	223.65	223.88	223.82	223.90	0.029147	0.50	0.40	3.48	0.47
Cold_10_7	Tributary E	1215.31	2-year	PR	0.19	223.65	223.88	223.82	223.89	0.029013	0.49	0.39	3.42	0.47
Cold_10_7	Tributary E	1168.81	2-year	EX	0.20	222.35	222.55		222.57	0.028361	0.54	0.37	2.79	0.47
Cold_10_7	Tributary E	1168.81	2-year	PR	0.19	222.35	222.55		222.56	0.028476	0.53	0.36	2.77	0.47
Cold_10_7	Tributary E	1130.29	2-year	EX	0.20	221.17	221.35		221.36	0.034720	0.56	0.35	2.89	0.52
Cold_10_7	Tributary E	1130.29	2-year	PR	0.19	221.17	221.34		221.36	0.034447	0.56	0.34	2.88	0.51
Cold_10_7	Tributary E	1111.06	2-year	EX	0.20	220.65	220.92		220.93	0.015464	0.45	0.44	2.71	0.36
Cold_10_7	Tributary E	1111.06	2-year	PR	0.19	220.65	220.92		220.93	0.015638	0.45	0.42	2.68	0.36
Cold_10_7	Tributary E	1084.58	2-year	EX	0.20	220.10	220.34		220.36	0.032385	0.59	0.34	2.45	0.51

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	1084.58	2-year	PR	0.19	220.10	220.34		220.36	0.031643	0.58	0.33	2.44	0.50
Cold_10_7	Tributary E	1048.15	2-year	EX	0.20	219.11	219.36		219.37	0.023044	0.50	0.39	2.84	0.43
Cold_10_7	Tributary E	1048.15	2-year	PR	0.19	219.11	219.35		219.37	0.023560	0.50	0.38	2.81	0.43
Cold_10_7	Tributary E	1028.59	2-year	EX	0.20	218.71	218.99		219.00	0.015897	0.46	0.43	2.62	0.36
Cold_10_7	Tributary E	1028.59	2-year	PR	0.19	218.71	218.99		219.00	0.015176	0.45	0.42	2.61	0.35
Cold_10_7	Tributary E	996.29	2-year	EX	0.20	218.32	218.57		218.58	0.010992	0.40	0.50	2.84	0.30
Cold_10_7	Tributary E	996.29	2-year	PR	0.19	218.32	218.56		218.57	0.011815	0.40	0.47	2.79	0.31
Cold_10_7	Tributary E	965.91	2-year	EX	0.20	217.92	218.10		218.11	0.022566	0.46	0.43	3.51	0.42
Cold_10_7	Tributary E	965.91	2-year	PR	0.19	217.92	218.10		218.11	0.019335	0.43	0.44	3.55	0.39
Cold_10_7	Tributary E	908.46	2-year	EX	0.20	216.79	217.03		217.04	0.015695	0.48	0.41	2.30	0.36
Cold_10_7	Tributary E	908.46	2-year	PR	0.19	216.79	217.01		217.03	0.018454	0.50	0.38	2.23	0.39
Cold_10_7	Tributary E	879.06	2-year	EX	0.20	216.23	216.45		216.46	0.025132	0.57	0.35	2.14	0.45
Cold_10_7	Tributary E	879.06	2-year	PR	0.19	216.23	216.46		216.47	0.019710	0.52	0.37	2.18	0.40
Cold_10_7	Tributary E	847.19	2-year	EX	0.20	215.85	216.17		216.17	0.004610	0.29	0.68	3.26	0.20
Cold_10_7	Tributary E	847.19	2-year	PR	0.19	215.85	216.14		216.15	0.005997	0.31	0.60	3.15	0.23
Cold_10_7	Tributary E	820.81	2-year	EX	0.20	215.47	216.15		216.15	0.000382	0.12	1.94	8.23	0.06
Cold_10_7	Tributary E	820.81	2-year	PR	0.19	215.47	216.12		216.12	0.000477	0.13	1.70	7.81	0.07
Cold_10_7	Tributary E	807.34	2-year	EX	0.20	215.44	216.14	215.62	216.14	0.000100	0.14	1.43	11.33	0.06
Cold_10_7	Tributary E	807.34	2-year	PR	0.19	215.44	216.11	215.62	216.11	0.000109	0.14	1.36	10.43	0.06
Cold_10_7	Tributary E	802.05 hum_427a			Culvert									
Cold_10_7	Tributary E	794.25	2-year	EX	0.20	214.77	214.97	214.85	214.98	0.002028	0.31	0.64	5.82	0.22
Cold_10_7	Tributary E	794.25	2-year	PR	0.19	214.77	214.97	214.84	214.97	0.002010	0.30	0.63	5.80	0.22
Cold_10_7	Tributary E	770.45	2-year	EX	0.20	214.67	214.83		214.84	0.047630	0.55	0.36	4.02	0.58
Cold_10_7	Tributary E	770.45	2-year	PR	0.19	214.67	214.83		214.84	0.047923	0.54	0.35	4.00	0.58
Cold_10_7	Tributary E	738	2-year	EX	0.20	213.98	214.28		214.29	0.008642	0.37	0.54	2.88	0.27
Cold_10_7	Tributary E	738	2-year	PR	0.19	213.98	214.28		214.28	0.008678	0.36	0.52	2.86	0.27
Cold_10_7	Tributary E	686.51	2-year	EX	0.20	213.33	213.52		213.53	0.030349	0.56	0.36	2.69	0.49
Cold_10_7	Tributary E	686.51	2-year	PR	0.19	213.33	213.51		213.53	0.030134	0.55	0.35	2.68	0.49
Cold_10_7	Tributary E	661.93	2-year	EX	0.20	212.92	213.10		213.11	0.011151	0.35	0.56	4.00	0.30
Cold_10_7	Tributary E	661.93	2-year	PR	0.19	212.92	213.09		213.10	0.011281	0.35	0.54	3.99	0.30
Cold_10_7	Tributary E	615.04	2-year	EX	0.20	212.33	212.51		212.52	0.013012	0.37	0.54	3.95	0.32
Cold_10_7	Tributary E	615.04	2-year	PR	0.19	212.33	212.51		212.51	0.012879	0.36	0.52	3.94	0.32
Cold_10_7	Tributary E	580.25	2-year	EX	0.20	211.91	212.11	212.02	212.11	0.010586	0.34	0.58	4.22	0.29
Cold_10_7	Tributary E	580.25	2-year	PR	0.19	211.91	212.10	212.01	212.11	0.010764	0.34	0.56	4.20	0.29
Cold_10_7	Tributary E	544.59	2-year	EX	0.20	211.47	211.78		211.79	0.007942	0.36	0.55	2.83	0.26
Cold_10_7	Tributary E	544.59	2-year	PR	0.19	211.47	211.78		211.78	0.007864	0.36	0.53	2.80	0.26
Cold_10_7	Tributary E	515.79	2-year	EX	0.20	211.17	211.49	211.37	211.50	0.013413	0.41	0.48	3.13	0.33
Cold_10_7	Tributary E	515.79	2-year	PR	0.19	211.17	211.48	211.37	211.49	0.013650	0.41	0.47	3.08	0.33
Cold_10_7	Tributary E	490.99	2-year	EX	0.20	211.02	211.31	211.15	211.32	0.004503	0.28	0.70	3.51	0.20
Cold_10_7	Tributary E	490.99	2-year	PR	0.19	211.02	211.31	211.15	211.31	0.004466	0.28	0.68	3.49	0.20
Cold_10_7	Tributary E	454.35	2-year	EX	0.20	210.82	211.09	210.95	211.10	0.006108	0.30	0.67	3.89	0.23
Cold_10_7	Tributary E	454.35	2-year	PR	0.19	210.82	211.09	210.95	211.09	0.006132	0.29	0.65	3.86	0.23
Cold_10_7	Tributary E	325.04	2-year	EX	0.20	210.06	210.32	210.20	210.32	0.006399	0.30	0.67	4.08	0.23
Cold_10_7	Tributary E	325.04	2-year	PR	0.19	210.06	210.31	210.20	210.32	0.006378	0.29	0.65	4.05	0.23
Cold_10_7	Tributary E	257.06	2-year	EX	0.20	209.82	210.10	209.97	210.10	0.001952	0.16	1.23	7.66	0.13
Cold_10_7	Tributary E	257.06	2-year	PR	0.19	209.82	210.09	209.97	210.10	0.001954	0.16	1.19	7.61	0.13
Cold_10_7	Tributary E	151.19	2-year	EX	0.20	209.26	209.39	209.39	209.43	0.146439	0.91	0.22	2.57	1.00
Cold_10_7	Tributary E	151.19	2-year	PR	0.19	209.26	209.38	209.38	209.43	0.151230	0.91	0.21	2.54	1.01
Cold_10_7	Tributary E	10.011	2-year	EX	3.35	207.93	208.47		208.51	0.002823	0.88	3.81	8.43	0.42
Cold_10_7	Tributary E	10.011	2-year	PR	3.36	207.93	208.47		208.51	0.002828	0.88	3.81	8.44	0.42
Cold_10_7	Tributary E	10.01	2-year	EX	3.35	207.54	207.98		208.01	0.003006	0.66	5.04	18.20	0.40
Cold_10_7	Tributary E	10.01	2-year	PR	3.36	207.54	207.98		208.01	0.002999	0.66	5.06	18.23	0.40
Cold_10_7	Tributary E	10.009	2-year	EX	3.35	206.42	208.00	206.68	208.00	0.000011	0.10	37.67	46.98	0.03
Cold_10_7	Tributary E	10.009	2-year	PR	3.36	206.42	208.00	206.68	208.00	0.000011	0.10	37.72	47.00	0.03
Cold_10_7	Tributary E	10.008	2-year	EX	3.35	207.54	207.96	207.77	207.99	0.002394	0.73	4.59	15.37	0.38
Cold_10_7	Tributary E	10.008	2-year	PR	3.36	207.54	207.96	207.77	207.99	0.002393	0.73	4.60	15.39	0.38
Cold_10_7	Tributary E	10.0075			Bridge									
Cold_10_7	Tributary E	10.007	2-year	EX	3.35	207.35	207.68	207.65	207.78	0.014417	1.44	2.33	8.47	0.88
Cold_10_7	Tributary E	10.007	2-year	PR	3.36	207.35	207.68	207.65	207.79	0.014515	1.44	2.33	8.47	0.88
Cold Creek West	Reach1	1784.71	2-year	EX	0.16	254.04	254.27		254.32	0.036280	0.95	0.17	1.26	0.83
Cold Creek West	Reach1	1784.71	2-year	PR	0.11	254.04	254.22	254.22	254.27	0.057199	1.00	0.11	1.05	1.00
Cold Creek West	Reach1	1752.69	2-year	EX	0.16	253.15	253.37	253.34	253.39	0.023183	0.63	0.26	2.67	0.65
Cold Creek West	Reach1	1752.69	2-year	PR	0.11	253.15	253.36		253.37	0.013070	0.45	0.24	2.63	0.48
Cold Creek West	Reach1	1724.34	2-year	EX	0.16	252.47	252.62	252.61	252.63	0.031041	0.47	0.34	7.15	0.68
Cold Creek West	Reach1	1724.34	2-year	PR	0.11	252.47	252.59	252.59	252.61	0.084043	0.64	0.16	4.41	1.07
Cold Creek West	Reach1	1663.99	2-year	EX	0.16	249.77	250.04	250.04	250.11	0.057900	1.17	0.14	1.00	1.01
Cold Creek West	Reach1	1663.99	2-year	PR	0.11	249.77	250.06	250.00	250.08	0.016709	0.66	0.16	1.08	0.55
Cold Creek West	Reach1	1612.71	2-year	EX	0.28	248.03	248.33	248.22	248.34	0.005088	0.43	0.65	3.90	0.33
Cold Creek West	Reach1	1612.71	2-year	PR	0.21	248.03	248.21	248.21	248.25	0.061732	0.89	0.24	3.12	1.02
Cold Creek West	Reach1	1586	2-year	EX	0.28	246.87	247.05	247.05	247.09	0.057517	0.89	0.32	3.95	1.00

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold Creek West	Reach1	1586	2-year	PR	0.21	246.87	247.03	247.03	247.07	0.055655	0.85	0.25	3.27	0.98
Cold Creek West	Reach1	1531	2-year	EX	0.28	243.80	244.00	244.00	244.05	0.053210	1.07	0.26	2.31	1.01
Cold Creek West	Reach1	1531	2-year	PR	0.21	243.80	243.97	243.97	244.02	0.055253	1.00	0.21	2.13	1.01
Cold Creek West	Reach1	1458	2-year	EX	0.28	238.86	239.18	239.15	239.23	0.031244	1.02	0.27	1.63	0.80
Cold Creek West	Reach1	1458	2-year	PR	0.21	238.86	239.15	239.12	239.20	0.026578	0.89	0.24	1.52	0.73
Cold Creek West	Reach1	1397	2-year	EX	0.73	236.18	236.37	236.37	236.43	0.054543	1.02	0.71	6.93	1.02
Cold Creek West	Reach1	1397	2-year	PR	0.74	236.18	236.37	236.37	236.43	0.054385	1.03	0.72	6.94	1.02
Cold Creek West	Reach1	1339	2-year	EX	0.73	233.69	234.09	234.05	234.17	0.027230	1.25	0.59	2.36	0.80
Cold Creek West	Reach1	1339	2-year	PR	0.74	233.69	234.10	234.05	234.18	0.027216	1.25	0.59	2.37	0.80
Cold Creek West	Reach1	1206	2-year	EX	0.73	231.11	231.48		231.53	0.014857	0.98	0.74	2.71	0.60
Cold Creek West	Reach1	1206	2-year	PR	0.74	231.11	231.48		231.53	0.014868	0.99	0.75	2.72	0.60
Cold Creek West	Reach1	1205	2-year	EX	0.73	228.43	228.81	228.81	228.93	0.045188	1.52	0.48	2.09	1.01
Cold Creek West	Reach1	1205	2-year	PR	0.74	228.43	228.81	228.81	228.93	0.045192	1.53	0.49	2.10	1.01
Cold Creek West	Reach1	1202.128 10.09.38	2-year	EX	0.64	226.88	227.12		227.14	0.002442	0.53	1.20	5.89	0.37
Cold Creek West	Reach1	1202.128 10.09.38	2-year	PR	0.64	226.88	227.12		227.14	0.002442	0.53	1.20	5.89	0.37
Cold Creek West	Reach1	1202.052 10.09.37	2-year	EX	0.64	226.67	226.99		227.00	0.000735	0.35	1.82	6.72	0.22
Cold Creek West	Reach1	1202.052 10.09.37	2-year	PR	0.64	226.67	226.99		227.00	0.000735	0.35	1.82	6.72	0.22
Cold Creek West	Reach1	1201.976 10.09.36	2-year	EX	0.64	226.67	226.94		226.95	0.002119	0.47	1.71	9.27	0.35
Cold Creek West	Reach1	1201.976 10.09.36	2-year	PR	0.64	226.67	226.94		226.95	0.002119	0.47	1.71	9.27	0.35
Cold Creek West	Reach1	1201.9 10.09.35	2-year	EX	0.64	226.43	226.65		226.67	0.007385	0.71	0.90	6.56	0.61
Cold Creek West	Reach1	1201.9 10.09.35	2-year	PR	0.64	226.43	226.65		226.67	0.007385	0.71	0.90	6.56	0.61
Cold Creek West	Reach1	1201.824 10.09.34	2-year	EX	0.64	226.01	226.32		226.34	0.002809	0.51	1.27	7.91	0.39
Cold Creek West	Reach1	1201.824 10.09.34	2-year	PR	0.64	226.01	226.32		226.34	0.002809	0.51	1.27	7.91	0.39
Cold Creek West	Reach1	1201.748 10.09.33	2-year	EX	0.64	225.86	226.10		226.12	0.003123	0.58	1.10	5.66	0.42
Cold Creek West	Reach1	1201.748 10.09.33	2-year	PR	0.64	225.86	226.10		226.12	0.003123	0.58	1.10	5.66	0.42
Cold Creek West	Reach1	1201.672 10.09.32	2-year	EX	0.64	225.59	225.96		225.97	0.001185	0.43	1.53	8.20	0.27
Cold Creek West	Reach1	1201.672 10.09.32	2-year	PR	0.64	225.59	225.96		225.97	0.001185	0.43	1.53	8.20	0.27
Cold Creek West	Reach1	1201.596 10.09.31	2-year	EX	0.64	225.53	225.74	225.68	225.76	0.003685	0.57	1.14	7.35	0.45
Cold Creek West	Reach1	1201.596 10.09.31	2-year	PR	0.64	225.53	225.74	225.68	225.76	0.003685	0.57	1.14	7.35	0.45
Cold Creek West	Reach1	1201.49 10.09.30	2-year	EX	0.64	225.05	225.19	225.19	225.23	0.021997	0.97	0.65	6.79	1.00
Cold Creek West	Reach1	1201.49 10.09.30	2-year	PR	0.64	225.05	225.19	225.19	225.23	0.021997	0.97	0.65	6.79	1.00
Cold Creek West	Reach1	1201.444 10.09.29	2-year	EX	0.64	224.42	224.73	224.58	224.73	0.000939	0.36	1.85	8.62	0.24
Cold Creek West	Reach1	1201.444 10.09.29	2-year	PR	0.64	224.42	224.73	224.58	224.73	0.000939	0.36	1.85	8.62	0.24
Cold Creek West	Reach1	1201.368 10.09.28	2-year	EX	0.64	224.24	224.62		224.64	0.001753	0.60	1.11	4.06	0.34
Cold Creek West	Reach1	1201.368 10.09.28	2-year	PR	0.64	224.24	224.62		224.64	0.001753	0.60	1.11	4.06	0.34
Cold Creek West	Reach1	1201.292 10.09.27	2-year	EX	0.64	224.15	224.50		224.52	0.001608	0.57	1.42	5.93	0.33
Cold Creek West	Reach1	1201.292 10.09.27	2-year	PR	0.64	224.15	224.50		224.52	0.001608	0.57	1.42	5.93	0.33
Cold Creek West	Reach1	1201.216 10.09.26	2-year	EX	0.64	224.12	224.42		224.43	0.002464	0.55	1.17	5.51	0.38
Cold Creek West	Reach1	1201.216 10.09.26	2-year	PR	0.64	224.12	224.42		224.43	0.002464	0.55	1.17	5.51	0.38
Cold Creek West	Reach1	1201.198 10.09.25	2-year	EX	0.64	223.94	224.29		224.31	0.002933	0.62	1.02	4.51	0.42
Cold Creek West	Reach1	1201.198 10.09.25	2-year	PR	0.64	223.94	224.29		224.31	0.002933	0.62	1.02	4.51	0.42
Cold Creek West	Reach1	1201.174 10.09.24	2-year	EX	0.64	223.94	224.28	224.15	224.29	0.002479	0.57	1.13	5.42	0.39
Cold Creek West	Reach1	1201.174 10.09.24	2-year	PR	0.64	223.94	224.28	224.15	224.29	0.002479	0.57	1.13	5.42	0.39
Cold Creek West	Reach1	1201.162 x-99 (10.09.23)			Bridge									
Cold Creek West	Reach1	1201.154 10.09.22	2-year	EX	0.64	223.94	224.23	224.09	224.24	0.001625	0.48	1.34	5.68	0.31
Cold Creek West	Reach1	1201.154 10.09.22	2-year	PR	0.64	223.94	224.23	224.09	224.24	0.001625	0.48	1.34	5.68	0.31
Cold Creek West	Reach1	1201.148 10.09.21	2-year	EX	0.64	223.97	224.14	224.14	224.20	0.020793	1.11	0.57	4.61	1.01
Cold Creek West	Reach1	1201.148 10.09.21	2-year	PR	0.64	223.97	224.14	224.14	224.20	0.020793	1.11	0.57	4.61	1.01
Cold Creek West	Reach1	1201.14 10.09.20	2-year	EX	0.64	223.73	224.06		224.07	0.001619	0.51	1.25	4.75	0.32
Cold Creek West	Reach1	1201.14 10.09.20	2-year	PR	0.64	223.73	224.06		224.07	0.001619	0.51	1.25	4.75	0.32
Cold Creek West	Reach1	1201.064 10.09.19	2-year	EX	0.64	223.58	223.83		223.85	0.004622	0.71	0.89	4.52	0.51
Cold Creek West	Reach1	1201.064 10.09.19	2-year	PR	0.64	223.58	223.83		223.85	0.004622	0.71	0.89	4.52	0.51
Cold Creek West	Reach1	1200.988 10.09.18	2-year	EX	0.64	223.37	223.67		223.68	0.001604	0.49	1.31	5.28	0.31
Cold Creek West	Reach1	1200.988 10.09.18	2-year	PR	0.64	223.37	223.67		223.68	0.001604	0.49	1.31	5.28	0.31
Cold Creek West	Reach1	1200.912 10.09.17	2-year	EX	0.64	223.04	223.29	223.29	223.38	0.018600	1.35	0.47	2.54	1.00
Cold Creek West	Reach1	1200.912 10.09.17	2-year	PR	0.64	223.04	223.29	223.29	223.38	0.018600	1.35	0.47	2.54	1.00
Cold Creek West	Reach1	1200.836 10.09.16	2-year	EX	0.64	222.71	223.06		223.07	0.000871	0.39	1.64	5.87	0.24
Cold Creek West	Reach1	1200.836 10.09.16	2-year	PR	0.64	222.71	223.06		223.07	0.000871	0.39	1.64	5.87	0.24
Cold Creek West	Reach1	1200.76 10.09.15	2-year	EX	0.64	222.68	222.95	222.88	222.98	0.005737	0.82	0.78	3.73	0.57
Cold Creek West	Reach1	1200.76 10.09.15	2-year	PR	0.64	222.68	222.95	222.88	222.98	0.005737	0.82	0.78	3.73	0.57
Cold Creek West	Reach1	1200.684 10.09.14	2-year	EX	0.64	222.35	222.59		222.60	0.002452	0.46	1.39	8.56	0.36
Cold Creek West	Reach1	1200.684 10.09.14	2-year	PR	0.64	222.35	222.59		222.60	0.002452	0.46	1.39	8.56	0.36
Cold Creek West	Reach1	1200.608 10.09.13	2-year	EX	0.64	222.05	222.27		222.29	0.004188	0.65	0.98	5.38	0.48
Cold Creek West	Reach1	1200.608 10.09.13	2-year	PR	0.64	222.05	222.27		222.29	0.004188	0.65	0.98	5.38	0.48
Cold Creek West	Reach1	1200.532 10.09.12	2-year	EX	0.64	221.81	222.14		222.15	0.001457	0.47	1.36	5.40	0.30
Cold Creek West	Reach1	1200.532 10.09.12	2-year	PR	0.64	221.81	222.14		222.15	0.001457	0.47	1.36	5.40	0.30
Cold Creek West	Reach1	1200.456 10.09.11	2-year	EX	0.64	221.69	222.12		222.12	0.000210	0.23	2.83	7.94	0.12
Cold Creek West	Reach1	1200.456 10.09.11	2-year	PR	0.64	221.69	222.12		222.12	0.000210	0.23	2.83	7.94	0.12
Cold Creek West	Reach1	1200.38 10.09.10	2-year	EX	0.64	221.72	222.08		222.09	0.001082	0.42	1.51	5.62	0.26
Cold Creek West	Reach1	1200.38 10.09.10	2-year	PR	0.64	221.72	222.08		222.09	0.001082	0.42	1.51	5.62	0.26

HEC-RAS Profile: 2-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold Creek West	Reach1	1200.304 10.09.09	2-year	EX	0.64	221.69	221.88	221.88	221.95	0.020659	1.13	0.57	4.46	1.01
Cold Creek West	Reach1	1200.304 10.09.09	2-year	PR	0.64	221.69	221.88	221.88	221.95	0.020659	1.13	0.57	4.46	1.01
Cold Creek West	Reach1	1200.278 10.09.08	2-year	EX	0.64	221.09	221.41		221.43	0.001979	0.53	1.21	5.07	0.35
Cold Creek West	Reach1	1200.278 10.09.08	2-year	PR	0.64	221.09	221.41		221.43	0.001979	0.53	1.21	5.07	0.35
Cold Creek West	Reach1	1200.228 10.09.07	2-year	EX	0.64	220.94	221.17		221.20	0.004697	0.71	0.90	4.62	0.51
Cold Creek West	Reach1	1200.228 10.09.07	2-year	PR	0.64	220.94	221.17		221.20	0.004697	0.71	0.90	4.62	0.51
Cold Creek West	Reach1	1200.152 10.09.06	2-year	EX	0.64	220.70	221.11		221.12	0.000717	0.40	1.58	4.47	0.22
Cold Creek West	Reach1	1200.152 10.09.06	2-year	PR	0.64	220.70	221.11		221.12	0.000717	0.40	1.58	4.47	0.22
Cold Creek West	Reach1	1200.076 10.09.05	2-year	EX	0.64	220.67	221.03	220.80	221.04	0.000604	0.33	2.11	8.29	0.20
Cold Creek West	Reach1	1200.076 10.09.05	2-year	PR	0.64	220.67	221.03	220.80	221.04	0.000604	0.33	2.11	8.29	0.20
Cold Creek West	Reach1	1200 10.09.04	2-year	EX	0.64	220.70	221.03	220.86	221.03	0.000670	0.32	2.11	11.72	0.21
Cold Creek West	Reach1	1200 10.09.04	2-year	PR	0.64	220.70	221.03	220.86	221.03	0.000670	0.32	2.11	11.72	0.21
Cold Creek West	Reach1	1199.984 x-98 (10.09.03)			Culvert									
Cold Creek West	Reach1	1199.963 10.09.02	2-year	EX	0.64	220.52	220.96	220.67	220.96	0.000355	0.30	2.10	5.98	0.16
Cold Creek West	Reach1	1199.963 10.09.02	2-year	PR	0.64	220.52	220.96	220.67	220.96	0.000355	0.30	2.10	5.98	0.16
Cold Creek West	Reach1	1199.934 10.09.01	2-year	EX	0.64	220.64	220.93	220.84	220.95	0.003420	0.57	1.12	6.34	0.43
Cold Creek West	Reach1	1199.934 10.09.01	2-year	PR	0.64	220.64	220.93	220.84	220.95	0.003420	0.57	1.12	6.34	0.43

25-Year Storm Event

HEC-RAS Profile: 25-year

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2_trib	Tributary D	1195.922	25-year	EX	1.54	263.57	263.97	263.97	264.10	0.020187	1.60	0.96	3.77	1.01
MM_9_2_trib	Tributary D	1195.922	25-year	PR	1.26	263.57	263.94	263.94	264.05	0.020753	1.52	0.83	3.57	1.01
MM_9_2_trib	Tributary D	1194	25-year	EX	1.54	263.15	263.48	263.46	263.54	0.012120	1.11	1.61	11.45	0.77
MM_9_2_trib	Tributary D	1194	25-year	PR	1.26	263.15	263.45	263.44	263.51	0.013552	1.11	1.27	10.15	0.80
MM_9_2_trib	Tributary D	1193.146	25-year	EX	1.54	262.86	263.24		263.24	0.001277	0.34	4.84	26.79	0.25
MM_9_2_trib	Tributary D	1193.146	25-year	PR	1.26	262.86	263.22		263.22	0.001173	0.31	4.34	25.82	0.23
MM_9_2_trib	Tributary D	1193.1	25-year	EX	1.54	262.94	263.10	263.10	263.14	0.029166	1.15	2.01	24.13	1.08
MM_9_2_trib	Tributary D	1193.1	25-year	PR	1.26	262.94	263.09	263.09	263.13	0.031451	1.11	1.68	22.05	1.11
MM_9_2_trib	Tributary D	1193.002	25-year	EX	1.54	262.16	263.03		263.03	0.000015	0.08	22.96	70.53	0.03
MM_9_2_trib	Tributary D	1193.002	25-year	PR	1.26	262.16	263.01		263.01	0.000012	0.07	21.55	69.24	0.03
MM_9_2_trib	Tributary D	1193.001	25-year	EX	1.54	262.76	262.96	262.96	263.02	0.033523	1.21	1.67	18.36	1.16
MM_9_2_trib	Tributary D	1193.001	25-year	PR	1.26	262.76	262.96	262.96	263.00	0.024594	1.02	1.62	18.28	0.99
MM_9_2_trib	Tributary D	1193	25-year	EX	1.54	261.89	262.26		262.27	0.001727	0.46	3.37	14.15	0.30
MM_9_2_trib	Tributary D	1193	25-year	PR	1.26	261.89	262.23		262.24	0.001648	0.42	3.01	13.84	0.29
MM_9_2_trib	Tributary D	1192.777	25-year	EX	1.54	261.72	262.12		262.15	0.010531	0.82	1.88	12.75	0.68
MM_9_2_trib	Tributary D	1192.777	25-year	PR	1.26	261.72	262.09		262.12	0.011489	0.78	1.61	12.33	0.69
MM_9_2_trib	Tributary D	1192.631	25-year	EX	1.54	261.28	261.74		261.77	0.004634	0.81	1.90	6.95	0.50
MM_9_2_trib	Tributary D	1192.631	25-year	PR	1.26	261.28	261.70		261.73	0.004582	0.76	1.66	6.68	0.49
MM_9_2_trib	Tributary D	1192.407	25-year	EX	1.54	260.76	261.07	261.03	261.13	0.012730	1.13	1.36	6.57	0.79
MM_9_2_trib	Tributary D	1192.407	25-year	PR	1.26	260.76	261.04	261.01	261.10	0.012703	1.05	1.20	6.40	0.77
MM_9_2_trib	Tributary D	1192.296	25-year	EX	1.54	259.90	260.31	260.31	260.43	0.020789	1.50	1.02	4.53	1.01
MM_9_2_trib	Tributary D	1192.296	25-year	PR	1.26	259.90	260.28	260.28	260.38	0.021492	1.46	0.86	4.09	1.02
MM_9_2_trib	Tributary D	1192.146	25-year	EX	2.62	256.74	257.10	257.10	257.23	0.019588	1.60	1.64	6.42	1.01
MM_9_2_trib	Tributary D	1192.146	25-year	PR	2.15	256.74	257.06	257.06	257.18	0.020253	1.52	1.42	6.14	1.01
MM_9_2_trib	Tributary D	1158.742	25-year	EX	2.62	254.88	255.63	255.63	255.71	0.024605	1.22	2.16	14.92	1.02
MM_9_2_trib	Tributary D	1158.742	25-year	PR	2.15	254.88	255.61	255.60	255.68	0.027751	1.18	1.82	14.43	1.06
MM_9_2_trib	Tributary D	1117.042	25-year	EX	2.62	254.11	254.73	254.71	254.86	0.016625	1.64	1.60	5.19	0.94
MM_9_2_trib	Tributary D	1117.042	25-year	PR	2.15	254.11	254.69	254.66	254.81	0.016145	1.54	1.40	4.87	0.92
MM_9_2_trib	Tributary D	1085.498	25-year	EX	2.62	253.57	254.14	254.14	254.27	0.021287	1.58	1.66	6.79	1.02
MM_9_2_trib	Tributary D	1085.498	25-year	PR	2.15	253.57	254.11	254.11	254.22	0.021167	1.47	1.47	6.70	1.00
MM_9_2_trib	Tributary D	1056.979	25-year	EX	2.62	253.04	253.36	253.36	253.41	0.025618	0.95	2.76	29.00	0.98
MM_9_2_trib	Tributary D	1056.979	25-year	PR	2.15	253.04	253.35	253.35	253.39	0.025962	0.90	2.39	27.52	0.97
MM_9_2_trib	Tributary D	1006.094	25-year	EX	2.62	249.20	249.87	249.87	250.06	0.023508	1.95	1.34	3.54	1.01
MM_9_2_trib	Tributary D	1006.094	25-year	PR	2.15	249.20	249.82	249.82	249.99	0.023781	1.86	1.16	3.37	1.01
MM_9_2_trib	Tributary D	954.6843	25-year	EX	2.62	247.18	247.75	247.75	247.94	0.018908	1.89	1.39	3.93	1.01
MM_9_2_trib	Tributary D	954.6843	25-year	PR	2.15	247.18	247.70	247.70	247.87	0.019287	1.79	1.20	3.74	1.01
MM_9_2_trib	Tributary D	927.8772	25-year	EX	2.62	246.33	247.01	247.01	247.23	0.019049	2.04	1.28	3.03	1.00
MM_9_2_trib	Tributary D	927.8772	25-year	PR	2.15	246.33	246.95	246.95	247.15	0.019803	1.96	1.10	2.87	1.01
MM_9_2_trib	Tributary D	886.4161	25-year	EX	3.59	245.71	246.32		246.45	0.011233	1.60	2.24	5.05	0.77
MM_9_2_trib	Tributary D	886.4161	25-year	PR	2.94	245.71	246.26		246.38	0.011467	1.51	1.95	4.86	0.76
MM_9_2_trib	Tributary D	830.2587	25-year	EX	3.59	245.01	245.68	245.60	245.83	0.010879	1.73	2.08	4.38	0.80
MM_9_2_trib	Tributary D	830.2587	25-year	PR	2.94	245.01	245.61	245.54	245.75	0.010942	1.63	1.80	4.18	0.79
MM_9_2_trib	Tributary D	765.2102	25-year	EX	3.59	244.36	244.87	244.84	245.01	0.014688	1.65	2.17	6.43	0.91
MM_9_2_trib	Tributary D	765.2102	25-year	PR	2.94	244.36	244.83	244.80	244.95	0.013731	1.52	1.94	6.24	0.87
MM_9_2_trib	Tributary D	719.386	25-year	EX	3.59	244.08	244.41	244.35	244.45	0.009239	0.94	3.81	18.97	0.67
MM_9_2_trib	Tributary D	719.386	25-year	PR	2.94	244.08	244.38	244.33	244.42	0.008979	0.87	3.37	18.30	0.65
MM_9_2_trib	Tributary D	691.6686	25-year	EX	3.59	243.69	243.99	243.99	244.05	0.025305	1.14	3.14	24.74	1.03
MM_9_2_trib	Tributary D	691.6686	25-year	PR	2.94	243.69	243.97	243.97	244.03	0.024983	1.07	2.75	23.73	1.00
MM_9_2_trib	Tributary D	639.0789	25-year	EX	3.59	241.96	242.69	242.69	242.90	0.017730	2.06	1.74	4.04	1.00
MM_9_2_trib	Tributary D	639.0789	25-year	PR	2.94	241.96	242.63	242.62	242.82	0.017015	1.94	1.51	3.72	0.97
MM_9_2_trib	Tributary D	605.7167	25-year	EX	3.59	241.38	242.10	242.10	242.31	0.017764	2.04	1.76	4.18	1.00
MM_9_2_trib	Tributary D	605.7167	25-year	PR	2.94	241.38	242.03	242.03	242.23	0.018462	1.96	1.50	3.89	1.01
MM_9_2_trib	Tributary D	552.2101	25-year	EX	3.59	239.59	240.37	240.37	240.61	0.019355	2.13	1.68	3.89	1.04
MM_9_2_trib	Tributary D	552.2101	25-year	PR	2.94	239.59	240.32	240.32	240.52	0.018440	1.98	1.49	3.75	1.00
MM_9_2_trib	Tributary D	508.8769	25-year	EX	3.59	238.89	239.68	239.58	239.82	0.009813	1.65	2.17	4.50	0.76
MM_9_2_trib	Tributary D	508.8769	25-year	PR	2.94	238.89	239.63	239.51	239.75	0.008972	1.52	1.93	4.23	0.72
MM_9_2_trib	Tributary D	457.6058	25-year	EX	3.59	238.50	238.97	238.97	239.05	0.024270	1.23	2.90	19.69	1.03
MM_9_2_trib	Tributary D	457.6058	25-year	PR	2.94	238.50	238.96	238.96	239.02	0.023876	1.15	2.55	19.00	1.00
MM_9_2_trib	Tributary D	393.3919	25-year	EX	3.59	236.93	237.40	237.40	237.54	0.019321	1.67	2.15	7.77	1.01
MM_9_2_trib	Tributary D	393.3919	25-year	PR	2.94	236.93	237.36	237.36	237.49	0.020014	1.58	1.86	7.53	1.01
MM_9_2_trib	Tributary D	345.8717	25-year	EX	3.59	236.53	236.95		236.98	0.004208	0.83	4.34	14.48	0.48
MM_9_2_trib	Tributary D	345.8717	25-year	PR	2.94	236.53	236.92		236.95	0.004019	0.76	3.89	14.31	0.46
MM_9_2_trib	Tributary D	308.4069	25-year	EX	3.59	236.36	236.64	236.63	236.70	0.016715	1.07	3.34	21.22	0.86
MM_9_2_trib	Tributary D	308.4069	25-year	PR	2.94	236.36	236.63	236.61	236.68	0.016066	0.99	2.98	20.82	0.83
MM_9_2_trib	Tributary D	261.2717	25-year	EX	3.59	234.87	235.70	235.70	235.81	0.021473	1.49	2.41	10.61	1.00
MM_9_2_trib	Tributary D	261.2717	25-year	PR	2.94	234.87	235.66	235.66	235.77	0.023228	1.43	2.06	10.15	1.01
MM_9_2_trib	Tributary D	237.4458	25-year	EX	3.59	234.36	235.03	235.03	235.21	0.019487	1.88	1.91	5.46	1.02
MM_9_2_trib	Tributary D	237.4458	25-year	PR	2.94	234.36	234.98	234.98	235.14	0.020266	1.78	1.65	5.27	1.02
MM_9_2_trib	Tributary D	197.6155	25-year	EX	3.59	233.46	233.85		233.89	0.007476	0.95	3.76	15.27	0.61
MM_9_2_trib	Tributary D	197.6155	25-year	PR	2.94	233.46	233.81		233.85	0.008011	0.91	3.22	14.74	0.62
MM_9_2_trib	Tributary D	176.7205	25-year	EX	3.59	233.02	233.52	233.52	233.64	0.020304	1.55	2.32	9.77	1.01

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2_trib	Tributary D	176.7205	25-year	PR	2.94	233.02	233.49	233.49	233.60	0.019770	1.44	2.04	9.33	0.99
MM_9_2_trib	Tributary D	163.5648	25-year	EX	3.59	232.73	233.22	233.22	233.33	0.021305	1.50	2.39	11.00	1.02
MM_9_2_trib	Tributary D	163.5648	25-year	PR	2.94	232.73	233.19	233.19	233.29	0.020488	1.42	2.07	9.95	1.00
MM_9_2_trib	Tributary D	151.4771	25-year	EX	3.59	231.39	231.89	231.89	232.06	0.018441	1.86	1.93	5.62	1.01
MM_9_2_trib	Tributary D	151.4771	25-year	PR	2.94	231.39	231.84	231.84	232.00	0.019090	1.75	1.68	5.49	1.01
MM_9_2_trib	Tributary D	140.92	25-year	EX	3.59	231.16	231.58	231.58	231.69	0.020615	1.47	2.43	11.20	1.01
MM_9_2_trib	Tributary D	140.92	25-year	PR	2.94	231.16	231.55	231.55	231.65	0.021916	1.40	2.10	10.91	1.02
MM_9_2_trib	Tributary D	123.28	25-year	EX	3.59	229.65	230.51	230.51	230.68	0.020050	1.83	1.96	5.84	1.01
MM_9_2_trib	Tributary D	123.28	25-year	PR	2.94	229.65	230.45	230.45	230.62	0.020780	1.80	1.64	5.14	1.02
MM_9_2_trib	Tributary D	89.70679	25-year	EX	3.59	228.90	229.72	229.72	229.96	0.018401	2.18	1.65	3.46	1.01
MM_9_2_trib	Tributary D	89.70679	25-year	PR	2.94	228.90	229.64	229.64	229.87	0.018871	2.10	1.40	3.17	1.01
MM_9_2_trib	Tributary D	72.5771	25-year	EX	3.59	228.51	229.15	229.15	229.36	0.018324	2.02	1.77	4.33	1.01
MM_9_2_trib	Tributary D	72.5771	25-year	PR	2.94	228.51	229.10	229.10	229.28	0.018740	1.91	1.54	4.21	1.01
MM_9_2_trib	Tributary D	51.16022	25-year	EX	3.59	228.00	228.77	228.77	228.85	0.022700	1.28	2.81	17.08	1.01
MM_9_2_trib	Tributary D	51.16022	25-year	PR	2.94	228.00	228.67	228.67	228.81	0.019847	1.64	1.79	6.66	1.01
MM_9_2_trib	Tributary D	26.54893	25-year	EX	3.59	227.45	227.80	227.80	227.94	0.018997	1.64	2.18	8.00	1.00
MM_9_2_trib	Tributary D	26.54893	25-year	PR	2.94	227.45	227.76	227.76	227.89	0.019468	1.57	1.88	7.54	1.00
MM_9_2_trib	Tributary B	1005	25-year	EX	0.48	256.65	256.89	256.89	256.98	0.023309	1.29	0.37	2.20	1.01
MM_9_2_trib	Tributary B	1005	25-year	PR	0.43	256.65	256.88	256.88	256.96	0.023648	1.26	0.34	2.15	1.01
MM_9_2_trib	Tributary B	1004.6	25-year	EX	0.48	255.56	255.76	255.76	255.83	0.024137	1.20	0.40	2.77	1.01
MM_9_2_trib	Tributary B	1004.6	25-year	PR	0.43	255.56	255.75	255.75	255.82	0.024184	1.16	0.37	2.74	1.00
MM_9_2_trib	Tributary B	1004	25-year	EX	0.48	254.60	254.80	254.80	254.87	0.025261	1.11	0.43	3.51	1.01
MM_9_2_trib	Tributary B	1004	25-year	PR	0.43	254.60	254.80	254.80	254.85	0.025793	1.08	0.40	3.45	1.01
MM_9_2_trib	Tributary B	1003	25-year	EX	0.48	251.29	251.51	251.51	251.58	0.023071	1.23	0.39	2.51	1.00
MM_9_2_trib	Tributary B	1003	25-year	PR	0.43	251.29	251.50	251.50	251.57	0.023768	1.20	0.36	2.45	1.01
MM_9_2_trib	Tributary B	1002	25-year	EX	0.48	249.03	249.35	249.35	249.44	0.024035	1.31	0.36	2.10	1.01
MM_9_2_trib	Tributary B	1002	25-year	PR	0.43	249.03	249.34	249.34	249.43	0.023988	1.28	0.34	2.02	1.00
MM_9_2_trib	Tributary B	1001.4	25-year	EX	0.48	247.85	248.23		248.26	0.005280	0.71	0.67	3.16	0.50
MM_9_2_trib	Tributary B	1001.4	25-year	PR	0.43	247.85	248.22		248.25	0.005159	0.69	0.62	3.08	0.49
MM_9_2_trib	Tributary B	1001	25-year	EX	0.48	247.79	247.98	247.98	248.04	0.026177	1.04	0.46	4.28	1.01
MM_9_2_trib	Tributary B	1001	25-year	PR	0.43	247.79	247.97	247.97	248.03	0.025835	1.00	0.43	4.23	1.00
MM_9_2_trib	Tributary B	1000.8	25-year	EX	0.48	247.16	247.35	247.35	247.38	0.029888	0.81	0.59	8.76	1.00
MM_9_2_trib	Tributary B	1000.8	25-year	PR	0.43	247.16	247.34	247.34	247.38	0.032215	0.82	0.52	8.14	1.03
MM_9_2_trib	Tributary B	1000.2	25-year	EX	0.48	246.61	246.91		246.91	0.000233	0.14	3.30	17.27	0.11
MM_9_2_trib	Tributary B	1000.2	25-year	PR	0.43	246.61	246.86		246.86	0.000529	0.18	2.40	16.76	0.15
MM_9_2_trib	Tributary B	1000	25-year	EX	0.48	245.34	246.91	245.61	246.91	0.000044	0.25	1.86	15.32	0.07
MM_9_2_trib	Tributary B	1000	25-year	PR	0.43	245.34	246.86	245.59	246.86	0.000041	0.24	1.80	14.78	0.06
MM_9_2_trib	Tributary B	999.64			Culvert									
MM_9_2_trib	Tributary B	999	25-year	EX	0.77	242.45	242.83	242.83	243.01	0.017849	1.85	0.42	2.32	1.00
MM_9_2_trib	Tributary B	999	25-year	PR	0.69	242.45	242.81	242.81	242.97	0.017874	1.77	0.39	2.28	0.99
MM_9_2_trib	Tributary B	998	25-year	EX	0.77	240.71	241.10	241.10	241.22	0.021890	1.56	0.49	2.03	1.01
MM_9_2_trib	Tributary B	998	25-year	PR	0.69	240.71	241.08	241.08	241.20	0.022120	1.52	0.45	1.96	1.01
MM_9_2_trib	Tributary B	997.4	25-year	EX	0.77	238.99	239.27	239.27	239.35	0.022710	1.30	0.59	3.48	1.01
MM_9_2_trib	Tributary B	997.4	25-year	PR	0.69	238.99	239.25	239.25	239.33	0.022772	1.27	0.54	3.37	1.00
MM_9_2_trib	Tributary B	997	25-year	EX	0.77	236.98	237.29	237.29	237.34	0.026060	1.01	0.76	7.35	1.00
MM_9_2_trib	Tributary B	997	25-year	PR	0.69	236.98	237.28	237.28	237.33	0.027711	1.01	0.68	6.88	1.03
MM_9_2_trib	Tributary B	996	25-year	EX	0.77	234.21	234.59	234.59	234.69	0.021995	1.41	0.55	2.76	1.01
MM_9_2_trib	Tributary B	996	25-year	PR	0.69	234.21	234.57	234.57	234.67	0.022236	1.37	0.50	2.66	1.00
MM_9_2_trib	Tributary B	995.4	25-year	EX	0.77	231.73	232.00	232.00	232.10	0.022042	1.40	0.55	2.81	1.01
MM_9_2_trib	Tributary B	995.4	25-year	PR	0.69	231.73	231.99	231.99	232.08	0.022243	1.35	0.51	2.75	1.00
MM_9_2_trib	Tributary B	994.4	25-year	EX	0.77	229.20	229.20	229.20	229.24	0.143448		0.88	10.99	0.00
MM_9_2_trib	Tributary B	994.4	25-year	PR	0.69	229.20	229.19	229.19	229.23	0.149853		0.80	10.60	0.00
MM_9_2_trib	Tributary B	994	25-year	EX	0.77	227.10	228.11		228.12	0.000108	0.15	9.45	55.70	0.08
MM_9_2_trib	Tributary B	994	25-year	PR	0.69	227.10	228.11		228.12	0.000087	0.14	9.45	55.72	0.07
MM_9_2	Tributary C	2179.936	25-year	EX	1.34	256.76	256.95		256.96	0.010579	0.57	2.34	27.24	0.62
MM_9_2	Tributary C	2179.936	25-year	PR	1.15	256.76	256.94		256.95	0.010902	0.56	2.07	25.76	0.63
MM_9_2	Tributary C	2159.385	25-year	EX	1.34	256.64	256.85		256.86	0.002886	0.36	3.72	32.67	0.34
MM_9_2	Tributary C	2159.385	25-year	PR	1.15	256.64	256.84		256.84	0.002920	0.35	3.33	31.35	0.34
MM_9_2	Tributary C	2097.132	25-year	EX	1.34	256.48	256.68		256.68	0.002736	0.39	3.47	26.49	0.34
MM_9_2	Tributary C	2097.132	25-year	PR	1.15	256.48	256.66		256.67	0.002750	0.37	3.14	26.02	0.34
MM_9_2	Tributary C	2030.564	25-year	EX	1.34	256.04	256.21	256.21	256.26	0.025907	1.03	1.30	12.24	1.01
MM_9_2	Tributary C	2030.564	25-year	PR	1.15	256.04	256.20	256.20	256.25	0.026452	0.99	1.16	11.69	1.01
MM_9_2	Tributary C	1994	25-year	EX	1.34	255.61	255.93		255.93	0.000453	0.23	5.82	25.00	0.15
MM_9_2	Tributary C	1994	25-year	PR	1.15	255.61	255.90		255.90	0.000472	0.22	5.21	24.56	0.15
MM_9_2	Tributary C	1970.384	25-year	EX	1.34	255.41	255.92		255.92	0.000062	0.11	12.04	34.36	0.06
MM_9_2	Tributary C	1970.384	25-year	PR	1.15	255.41	255.90		255.90	0.000056	0.10	11.20	33.80	0.06
MM_9_2	Tributary C	1911.614	25-year	EX	1.34	255.36	255.92	255.52	255.92	0.000040	0.10	12.95	29.99	0.05
MM_9_2	Tributary C	1911.614	25-year	PR	1.15	255.36	255.90	255.51	255.90	0.000036	0.09	12.23	29.80	0.05
MM_9_2	Tributary C	1881.066			Bridge									
MM_9_2	Tributary C	1855.838	25-year	EX	1.56	255.52	255.69	255.69	255.75	0.024464	1.03	1.52	13.58	0.99

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2	Tributary C	1855.838	25-year	PR	1.34	255.52	255.68	255.68	255.73	0.026093	1.00	1.34	13.33	1.00
MM_9_2	Tributary C	1813.506	25-year	EX	1.56	254.71	254.87		254.90	0.011741	0.72	2.18	19.49	0.69
MM_9_2	Tributary C	1813.506	25-year	PR	1.34	254.71	254.86		254.88	0.011566	0.68	1.98	19.20	0.67
MM_9_2	Tributary C	1775.696	25-year	EX	1.56	254.15	254.30	254.27	254.32	0.010101	0.63	2.48	24.03	0.63
MM_9_2	Tributary C	1775.696	25-year	PR	1.34	254.15	254.29	254.26	254.30	0.010352	0.60	2.23	23.75	0.63
MM_9_2	Tributary C	1726.57	25-year	EX	1.56	252.83	253.11	253.11	253.20	0.023227	1.28	1.22	7.61	1.02
MM_9_2	Tributary C	1726.57	25-year	PR	1.34	252.83	253.10	253.10	253.17	0.023007	1.22	1.10	7.36	1.01
MM_9_2	Tributary C	1684.01	25-year	EX	1.56	251.82	252.07	252.07	252.10	0.026050	0.83	1.88	24.41	0.96
MM_9_2	Tributary C	1684.01	25-year	PR	1.34	251.82	252.06	252.06	252.09	0.027659	0.81	1.66	23.63	0.97
MM_9_2	Tributary C	1603.573	25-year	EX	1.56	251.65	251.88		251.88	0.000410	0.14	11.26	95.64	0.13
MM_9_2	Tributary C	1603.573	25-year	PR	1.34	251.65	251.87		251.87	0.000398	0.13	10.23	92.71	0.13
MM_9_2	Tributary C	1539.326	25-year	EX	1.56	251.65	251.79		251.80	0.012419	0.53	2.92	42.36	0.65
MM_9_2	Tributary C	1539.326	25-year	PR	1.34	251.65	251.78		251.79	0.013206	0.52	2.56	40.25	0.66
MM_9_2	Tributary C	1486.021	25-year	EX	1.56	250.90	251.17		251.21	0.010096	0.82	1.91	12.52	0.67
MM_9_2	Tributary C	1486.021	25-year	PR	1.34	250.90	251.16		251.19	0.009810	0.77	1.75	12.35	0.65
MM_9_2	Tributary C	1450.067	25-year	EX	1.56	250.28	250.63	250.63	250.69	0.022432	1.09	1.44	11.08	0.97
MM_9_2	Tributary C	1450.067	25-year	PR	1.34	250.28	250.61	250.61	250.67	0.023253	1.04	1.28	10.87	0.97
MM_9_2	Tributary C	1406.638	25-year	EX	1.56	249.69	250.02	249.97	250.05	0.008000	0.75	2.08	12.98	0.60
MM_9_2	Tributary C	1406.638	25-year	PR	1.34	249.69	250.00	249.95	250.03	0.008241	0.71	1.88	12.88	0.60
MM_9_2	Tributary C	1338.455	25-year	EX	1.56	248.69	249.08	249.08	249.21	0.020748	1.56	1.01	4.21	1.02
MM_9_2	Tributary C	1338.455	25-year	PR	1.34	248.69	249.06	249.06	249.17	0.020875	1.50	0.90	4.00	1.01
MM_9_2	Tributary C	1304.352	25-year	EX	1.56	247.99	248.36	248.33	248.42	0.013977	1.11	1.40	7.23	0.81
MM_9_2	Tributary C	1304.352	25-year	PR	1.34	247.99	248.34	248.30	248.39	0.013811	1.05	1.28	7.09	0.79
MM_9_2	Tributary C	1265.187	25-year	EX	1.56	247.35	247.64	247.64	247.75	0.021526	1.42	1.10	5.41	1.01
MM_9_2	Tributary C	1265.187	25-year	PR	1.34	247.35	247.62	247.62	247.72	0.022035	1.36	0.99	5.31	1.01
MM_9_2	Tributary C	1206.875	25-year	EX	1.56	246.19	246.58		246.64	0.009155	1.07	1.47	5.90	0.68
MM_9_2	Tributary C	1206.875	25-year	PR	1.34	246.19	246.56		246.61	0.008550	0.99	1.35	5.77	0.65
MM_9_2	Tributary C	1175.661	25-year	EX	1.56	245.83	246.15	246.15	246.21	0.023649	1.03	1.52	13.38	0.97
MM_9_2	Tributary C	1175.661	25-year	PR	1.34	245.83	246.14	246.14	246.19	0.024862	0.98	1.36	13.33	0.98
MM_9_2	Tributary C	1120.613	25-year	EX	1.56	244.63	245.07		245.12	0.010370	1.01	1.54	7.27	0.70
MM_9_2	Tributary C	1120.613	25-year	PR	1.34	244.63	245.05	245.00	245.09	0.010763	0.98	1.37	7.01	0.71
MM_9_2	Tributary C	1083.716	25-year	EX	1.56	244.05	244.45	244.45	244.60	0.019748	1.67	0.93	3.33	1.01
MM_9_2	Tributary C	1083.716	25-year	PR	1.34	244.05	244.42	244.42	244.55	0.020177	1.60	0.84	3.23	1.01
MM_9_2	Tributary C	1042.153	25-year	EX	1.56	243.04	243.51	243.47	243.55	0.011825	0.93	1.69	10.12	0.73
MM_9_2	Tributary C	1042.153	25-year	PR	1.34	243.04	243.49	243.45	243.53	0.011983	0.90	1.50	9.56	0.72
MM_9_2	Tributary C	1006.177	25-year	EX	1.56	242.45	242.87	242.87	242.98	0.022128	1.47	1.07	5.05	1.02
MM_9_2	Tributary C	1006.177	25-year	PR	1.34	242.45	242.85	242.85	242.95	0.022474	1.40	0.96	4.90	1.01
MM_9_2	Tributary C	993.3609	25-year	EX	2.29	241.83	242.52		242.57	0.004286	0.94	2.44	6.62	0.49
MM_9_2	Tributary C	993.3609	25-year	PR	1.96	241.83	242.48		242.53	0.004459	0.90	2.18	6.52	0.50
MM_9_2	Tributary C	935.4169	25-year	EX	2.29	241.33	241.91	241.91	242.10	0.019127	1.93	1.18	3.15	1.01
MM_9_2	Tributary C	935.4169	25-year	PR	1.96	241.33	241.86	241.86	242.04	0.019281	1.86	1.05	2.99	1.00
MM_9_2	Tributary C	870.5434	25-year	EX	2.29	239.51	240.10	240.10	240.31	0.019682	2.01	1.14	2.82	1.01
MM_9_2	Tributary C	870.5434	25-year	PR	1.96	239.51	240.06	240.06	240.25	0.019910	1.94	1.01	2.68	1.01
MM_9_2	Tributary C	836.4684	25-year	EX	2.29	238.61	239.08	239.08	239.26	0.018995	1.88	1.22	3.42	1.01
MM_9_2	Tributary C	836.4684	25-year	PR	1.96	238.61	239.04	239.04	239.21	0.019294	1.80	1.09	3.31	1.01
MM_9_2	Tributary C	799.8246	25-year	EX	2.29	237.89	238.37	238.37	238.53	0.019361	1.73	1.32	4.39	1.01
MM_9_2	Tributary C	799.8246	25-year	PR	1.96	237.89	238.34	238.34	238.48	0.019901	1.67	1.18	4.25	1.01
MM_9_2	Tributary C	745.4448	25-year	EX	2.29	235.79	236.17	236.17	236.31	0.019283	1.70	1.35	4.66	1.01
MM_9_2	Tributary C	745.4448	25-year	PR	1.96	235.79	236.13	236.13	236.27	0.019773	1.63	1.21	4.54	1.01
MM_9_2	Tributary C	716.4415	25-year	EX	2.29	234.84	235.24		235.32	0.010521	1.24	1.85	6.44	0.74
MM_9_2	Tributary C	716.4415	25-year	PR	1.96	234.84	235.21		235.28	0.010278	1.17	1.68	6.26	0.72
MM_9_2	Tributary C	687.3773	25-year	EX	2.29	234.27	234.79	234.79	234.90	0.020039	1.48	1.54	6.73	0.99
MM_9_2	Tributary C	687.3773	25-year	PR	1.96	234.27	234.76	234.76	234.87	0.020778	1.42	1.38	6.63	0.99
MM_9_2	Tributary C	661.4518	25-year	EX	2.29	233.56	233.92	233.92	234.06	0.019416	1.64	1.39	5.15	1.01
MM_9_2	Tributary C	661.4518	25-year	PR	1.96	233.56	233.89	233.89	234.02	0.019872	1.57	1.25	5.03	1.01
MM_9_2	Tributary C	627.6722	25-year	EX	2.29	232.58	233.02	233.02	233.17	0.020193	1.73	1.33	4.45	1.01
MM_9_2	Tributary C	627.6722	25-year	PR	1.96	232.58	232.99	232.99	233.13	0.020695	1.65	1.19	4.33	1.01
MM_9_2	Tributary C	589.2625	25-year	EX	2.29	231.90	232.38		232.43	0.005905	0.98	2.34	7.75	0.57
MM_9_2	Tributary C	589.2625	25-year	PR	1.96	231.90	232.35		232.39	0.005957	0.94	2.08	7.34	0.56
MM_9_2	Tributary C	540.5079	25-year	EX	2.29	231.39	231.80	231.80	231.94	0.019420	1.69	1.35	4.71	1.01
MM_9_2	Tributary C	540.5079	25-year	PR	1.96	231.39	231.77	231.77	231.90	0.020013	1.62	1.21	4.62	1.01
MM_9_2	Tributary C	510.2238	25-year	EX	2.29	230.56	230.93	230.93	231.04	0.021995	1.44	1.59	7.80	1.02
MM_9_2	Tributary C	510.2238	25-year	PR	1.96	230.56	230.91	230.91	231.01	0.021935	1.39	1.41	7.25	1.01
MM_9_2	Tributary C	457.5412	25-year	EX	2.29	228.97	229.50	229.48	229.66	0.016166	1.73	1.32	3.53	0.91
MM_9_2	Tributary C	457.5412	25-year	PR	1.96	228.97	229.46	229.44	229.61	0.016600	1.67	1.18	3.42	0.91
MM_9_2	Tributary C	414.0466	25-year	EX	2.29	228.37	228.99		229.08	0.010501	1.36	1.68	4.99	0.75
MM_9_2	Tributary C	414.0466	25-year	PR	1.96	228.37	228.95		229.04	0.009982	1.29	1.52	4.69	0.73
MM_9_2	Tributary C	374.4607	25-year	EX	2.29	227.94	228.39	228.39	228.51	0.020955	1.52	1.51	6.65	1.02
MM_9_2	Tributary C	374.4607	25-year	PR	1.96	227.94	228.37	228.37	228.47	0.021762	1.45	1.35	6.55	1.02
MM_9_2	Tributary C	330.2584	25-year	EX	2.29	227.43	227.72	227.68	227.74	0.011040	0.73	3.13	25.71	0.67
MM_9_2	Tributary C	330.2584	25-year	PR	1.96	227.43	227.70	227.67	227.73	0.010722	0.69	2.83	24.62	0.65

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2	Tributary C + D	294	25-year	EX	0.15	226.97	227.09	227.09	227.11	0.036759	0.64	0.24	5.94	1.02
MM_9_2	Tributary C + D	294	25-year	PR	0.15	226.97	227.08	227.08	227.11	0.037407	0.64	0.23	5.84	1.03
MM_9_2	Tributary C + D	266.3048	25-year	EX	0.15	224.85	224.97	224.97	225.01	0.027918	0.93	0.16	1.86	1.00
MM_9_2	Tributary C + D	266.3048	25-year	PR	0.15	224.85	224.97	224.97	225.01	0.028077	0.93	0.16	1.85	1.01
MM_9_2	Tributary C + D	236.2558	25-year	EX	0.15	223.38	223.60		223.63	0.011707	0.77	0.20	1.53	0.68
MM_9_2	Tributary C + D	236.2558	25-year	PR	0.15	223.38	223.60		223.63	0.011758	0.77	0.20	1.52	0.68
MM_9_2	Tributary C + D	205.6305	25-year	EX	0.15	222.98	223.14	223.13	223.18	0.018636	0.86	0.18	1.66	0.84
MM_9_2	Tributary C + D	205.6305	25-year	PR	0.15	222.98	223.14	223.13	223.18	0.018534	0.86	0.18	1.65	0.84
MM_9_2	Tributary C + D	173.8239	25-year	EX	0.15	222.27	222.40	222.40	222.43	0.030691	0.80	0.19	2.91	1.01
MM_9_2	Tributary C + D	173.8239	25-year	PR	0.15	222.27	222.40	222.40	222.43	0.030783	0.80	0.19	2.91	1.01
MM_9_2	Tributary C + D	151.7834	25-year	EX	0.15	221.52	221.72	221.65	221.72	0.003888	0.43	0.35	2.86	0.40
MM_9_2	Tributary C + D	151.7834	25-year	PR	0.15	221.52	221.71	221.65	221.72	0.003880	0.43	0.35	2.85	0.39
MM_9_2	Tributary C + D	116.6732	25-year	EX	0.15	221.27	221.39	221.39	221.43	0.029227	0.89	0.17	2.18	1.01
MM_9_2	Tributary C + D	116.6732	25-year	PR	0.15	221.27	221.39	221.39	221.43	0.029359	0.88	0.17	2.17	1.01
MM_9_2	Tributary C + D	66.5837	25-year	EX	0.15	220.30	220.95		220.95	0.000032	0.07	2.17	7.28	0.04
MM_9_2	Tributary C + D	66.5837	25-year	PR	0.15	220.30	220.95		220.95	0.000031	0.07	2.17	7.28	0.04
MM_9_2	Tributary C + D	34.76245	25-year	EX	0.15	219.88	220.95		220.95	0.000003	0.03	5.53	13.87	0.01
MM_9_2	Tributary C + D	34.76245	25-year	PR	0.15	219.88	220.95		220.95	0.000003	0.03	5.53	13.86	0.01
Main_1	Tributary A	1017	25-year	EX	0.14	254.63	254.79	254.79	254.82	0.031595	0.76	0.18	3.15	1.01
Main_1	Tributary A	1017	25-year	PR	0.12	254.63	254.78	254.78	254.81	0.030431	0.78	0.15	2.43	1.00
Main_1	Tributary A	1000	25-year	EX	0.14	253.30	253.46	253.46	253.48	0.031681	0.74	0.19	3.36	1.00
Main_1	Tributary A	1000	25-year	PR	0.12	253.30	253.45	253.45	253.48	0.031687	0.75	0.16	2.82	1.00
Main_1	Tributary A	999	25-year	EX	0.14	252.17	252.32		252.32	0.000268	0.07	2.09	22.72	0.07
Main_1	Tributary A	999	25-year	PR	0.12	252.17	252.32		252.32	0.000255	0.06	1.93	22.52	0.07
Main_1	Tributary A	998.6	25-year	EX	0.14	252.16	252.31		252.31	0.000247	0.10	1.41	13.60	0.10
Main_1	Tributary A	998.6	25-year	PR	0.12	252.16	252.31		252.31	0.000218	0.09	1.33	13.41	0.09
Main_1	Tributary A	998.4	25-year	EX	0.14	252.18	252.29	252.27	252.30	0.004580	0.23	0.62	15.57	0.36
Main_1	Tributary A	998.4	25-year	PR	0.12	252.18	252.29	252.27	252.29	0.004634	0.22	0.55	14.94	0.36
Main_1	Tributary A	998	25-year	EX	0.14	251.77	251.86	251.86	251.89	0.032701	0.74	0.19	3.51	1.01
Main_1	Tributary A	998	25-year	PR	0.12	251.77	251.85	251.85	251.88	0.032311	0.70	0.17	3.41	1.00
Main_1	Tributary A	997.7	25-year	EX	0.14	249.12	249.33	249.33	249.38	0.027986	1.02	0.14	1.33	1.01
Main_1	Tributary A	997.7	25-year	PR	0.12	249.12	249.31	249.31	249.36	0.028319	0.99	0.12	1.25	1.01
Main_1	Tributary A	997	25-year	EX	0.14	245.46	245.66	245.66	245.71	0.028349	0.99	0.14	1.46	1.02
Main_1	Tributary A	997	25-year	PR	0.12	245.46	245.64	245.64	245.69	0.028788	0.96	0.13	1.37	1.01
Main_1	Tributary A	996.6	25-year	EX	0.14	242.09	242.20	242.20	242.22	0.031956	0.71	0.20	3.85	0.99
Main_1	Tributary A	996.6	25-year	PR	0.12	242.09	242.19	242.19	242.22	0.029977	0.66	0.18	3.79	0.95
Main_1	Tributary A	996	25-year	EX	0.79	237.55	237.69	237.69	237.73	0.027779	0.88	0.89	11.28	1.00
Main_1	Tributary A	996	25-year	PR	0.68	237.55	237.68	237.68	237.72	0.028405	0.84	0.81	10.94	0.99
Main_1	Tributary A	995.8	25-year	EX	0.79	235.82	235.94	235.94	235.97	0.028775	0.87	0.90	11.80	1.01
Main_1	Tributary A	995.8	25-year	PR	0.68	235.82	235.93	235.93	235.96	0.028942	0.82	0.82	11.77	0.99
Main_1	Tributary A	995.6	25-year	EX	0.79	234.22	234.58		234.60	0.011834	0.66	1.18	11.95	0.67
Main_1	Tributary A	995.6	25-year	PR	0.68	234.22	234.52		234.56	0.011944	0.90	0.76	4.85	0.73
Main_1	Tributary A	995	25-year	EX	0.79	232.05	232.38	232.38	232.47	0.023907	1.32	0.60	3.56	1.03
Main_1	Tributary A	995	25-year	PR	0.68	232.05	232.37	232.37	232.45	0.023214	1.25	0.54	3.45	1.01
Main_1	Tributary A	932	25-year	EX	0.79	228.37	228.61	228.61	228.69	0.022592	1.31	0.60	3.49	1.01
Main_1	Tributary A	932	25-year	PR	0.68	228.37	228.59	228.59	228.67	0.023172	1.26	0.54	3.42	1.01
Humber River	Bolton Reach Up	109.642 09.08.18	25-year	EX	22.26	230.51	231.75		231.82	0.001330	1.19	19.23	26.77	0.36
Humber River	Bolton Reach Up	109.642 09.08.18	25-year	PR	22.26	230.51	231.75		231.82	0.001330	1.19	19.23	26.77	0.36
Humber River	Bolton Reach Up	109.442 09.08.17	25-year	EX	22.26	230.27	231.47		231.54	0.001478	1.23	23.38	37.63	0.38
Humber River	Bolton Reach Up	109.442 09.08.17	25-year	PR	22.26	230.27	231.47		231.54	0.001478	1.23	23.38	37.63	0.38
Humber River	Bolton Reach Up	109.242 09.08.16	25-year	EX	22.26	229.82	231.10		231.21	0.001917	1.46	16.65	34.27	0.44
Humber River	Bolton Reach Up	109.242 09.08.16	25-year	PR	22.26	229.82	231.10		231.21	0.001917	1.46	16.65	34.28	0.44
Humber River	Bolton Reach Up	109.040 09.08.15	25-year	EX	22.26	229.52	230.81		230.88	0.001268	1.22	23.11	38.32	0.36
Humber River	Bolton Reach Up	109.040 09.08.15	25-year	PR	22.26	229.52	230.81		230.88	0.001268	1.22	23.11	38.32	0.36
Humber River	Bolton Reach Up	108.839 09.08.14	25-year	EX	22.26	229.22	230.41		230.53	0.002560	1.55	17.17	31.61	0.50
Humber River	Bolton Reach Up	108.839 09.08.14	25-year	PR	22.26	229.22	230.41		230.53	0.002560	1.55	17.17	31.61	0.50
Humber River	Bolton Reach Up	108.638 09.08.13	25-year	EX	22.26	228.86	230.07		230.13	0.001459	1.18	25.81	41.15	0.38
Humber River	Bolton Reach Up	108.638 09.08.13	25-year	PR	22.26	228.86	230.07		230.13	0.001459	1.18	25.81	41.15	0.38
Humber River	Bolton Reach Up	108.437 09.08.12	25-year	EX	22.26	228.56	229.61		229.72	0.003100	1.47	15.16	19.27	0.53
Humber River	Bolton Reach Up	108.437 09.08.12	25-year	PR	22.26	228.56	229.61		229.72	0.003100	1.47	15.16	19.27	0.53
Humber River	Bolton Reach Up	108.235 09.08.11	25-year	EX	22.26	228.02	229.24		229.31	0.001383	1.25	21.28	26.62	0.38
Humber River	Bolton Reach Up	108.235 09.08.11	25-year	PR	22.26	228.02	229.24		229.31	0.001383	1.25	21.29	26.62	0.38
Humber River	Bolton Reach Up	108.034 09.08.10	25-year	EX	22.26	227.54	228.60		228.82	0.005094	2.17	13.58	19.44	0.70
Humber River	Bolton Reach Up	108.034 09.08.10	25-year	PR	22.26	227.54	228.60		228.82	0.005093	2.17	13.58	19.44	0.70
Humber River	Bolton Reach Up	107.834 09.08.09	25-year	EX	22.26	227.00	228.38		228.43	0.000825	1.06	24.51	25.77	0.30
Humber River	Bolton Reach Up	107.834 09.08.09	25-year	PR	22.26	227.00	228.38		228.43	0.000825	1.06	24.52	25.78	0.30
Humber River	Bolton Reach Up	107.633 09.08.08	25-year	EX	22.26	226.76	228.28		228.31	0.000412	0.75	34.57	54.69	0.21
Humber River	Bolton Reach Up	107.633 09.08.08	25-year	PR	22.26	226.76	228.28		228.31	0.000411	0.75	34.57	54.71	0.21
Humber River	Bolton R 2	107.45	25-year	EX	22.26	226.33	228.17		228.21	0.000640	0.95	32.61	69.53	0.24
Humber River	Bolton R 2	107.45	25-year	PR	22.26	226.33	228.17		228.21	0.000640	0.95	32.62	69.54	0.24

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton R 2	107.433 09.08.07	25-year	EX	22.26	226.49	228.16		228.19	0.000443	0.87	38.95	70.67	0.22
Humber River	Bolton R 2	107.433 09.08.07	25-year	PR	22.26	226.49	228.16		228.19	0.000442	0.87	38.96	70.69	0.22
Humber River	Bolton R 1	107.233 09.08.06	25-year	EX	36.11	226.34	227.85		228.02	0.002510	1.93	27.43	36.61	0.52
Humber River	Bolton R 1	107.233 09.08.06	25-year	PR	36.12	226.34	227.85		228.02	0.002511	1.93	27.43	36.62	0.52
Humber River	Bolton R 1	107.1544 09.08.05	25-year	EX	36.11	226.10	227.61		227.72	0.001906	1.66	36.97	61.23	0.46
Humber River	Bolton R 1	107.1544 09.08.05	25-year	PR	36.12	226.10	227.61		227.72	0.001907	1.66	36.98	61.24	0.46
Humber River	Bolton R 1	107.032 09.08.04	25-year	EX	36.11	225.92	227.53		227.57	0.000670	1.02	52.22	78.61	0.27
Humber River	Bolton R 1	107.032 09.08.04	25-year	PR	36.12	225.92	227.53		227.57	0.000670	1.02	52.24	78.62	0.27
Humber River	Bolton R 1	106.832 09.08.03	25-year	EX	36.11	225.77	227.10		227.29	0.004082	2.34	34.35	56.84	0.66
Humber River	Bolton R 1	106.832 09.08.03	25-year	PR	36.12	225.77	227.10		227.29	0.004081	2.34	34.37	56.84	0.66
Humber River	Bolton R 1	106.6823 09.08.02	25-year	EX	36.11	225.26	227.04		227.08	0.000438	0.96	41.61	36.87	0.23
Humber River	Bolton R 1	106.6823 09.08.02	25-year	PR	36.12	225.26	227.04		227.08	0.000438	0.96	41.62	36.88	0.23
Humber River	Bolton R 1	106.6592 09.08.01	25-year	EX	36.11	225.17	227.02	226.06	227.07	0.000422	0.94	39.58	48.22	0.23
Humber River	Bolton R 1	106.6592 09.08.01	25-year	PR	36.12	225.17	227.02	226.06	227.07	0.000422	0.94	39.59	48.22	0.23
Humber River	Bolton R 1	106.6454 x-94 (09.09.24)			Bridge									
Humber River	Bolton R 1	106.631 09.09.23	25-year	EX	36.08	225.17	226.75	226.28	226.94	0.002424	2.03	24.03	25.02	0.52
Humber River	Bolton R 1	106.631 09.09.23	25-year	PR	36.08	225.17	226.75	226.28	226.94	0.002423	2.03	24.03	25.02	0.52
Humber River	Bolton R 1	106.6142 09.09.22	25-year	EX	36.08	225.20	226.75		226.90	0.002092	1.83	30.46	58.57	0.48
Humber River	Bolton R 1	106.6142 09.09.22	25-year	PR	36.08	225.20	226.75		226.90	0.002092	1.83	30.46	58.56	0.48
Humber River	Bolton R 1	106.5615 09.09.21	25-year	EX	36.08	225.08	226.66		226.78	0.002011	1.66	38.41	62.99	0.46
Humber River	Bolton R 1	106.5615 09.09.21	25-year	PR	36.08	225.08	226.66		226.78	0.002011	1.66	38.40	62.99	0.46
Humber River	Bolton R 1	106.429 09.09.20	25-year	EX	36.08	225.02	226.54		226.59	0.000915	1.19	56.77	67.29	0.32
Humber River	Bolton R 1	106.429 09.09.20	25-year	PR	36.08	225.02	226.54		226.59	0.000915	1.19	56.76	67.28	0.32
Humber River	Bolton R 1	106.229 09.09.19	25-year	EX	36.08	224.63	226.21		226.34	0.002039	1.81	38.44	55.21	0.47
Humber River	Bolton R 1	106.229 09.09.19	25-year	PR	36.08	224.63	226.21		226.34	0.002039	1.81	38.44	55.21	0.47
Humber River	Bolton R 1	106.029 09.09.18	25-year	EX	36.08	224.36	225.98		226.05	0.000954	1.28	57.86	121.45	0.33
Humber River	Bolton R 1	106.029 09.09.18	25-year	PR	36.08	224.36	225.98		226.05	0.000954	1.28	57.85	121.44	0.33
Humber River	Bolton R 1	105.827 09.09.17	25-year	EX	36.08	224.18	225.80		225.85	0.000756	1.16	64.06	71.51	0.30
Humber River	Bolton R 1	105.827 09.09.17	25-year	PR	36.08	224.18	225.80		225.85	0.000756	1.16	64.06	71.50	0.30
Humber River	Bolton R 1	105.627 09.09.16	25-year	EX	36.08	224.09	225.29		225.47	0.004326	2.26	34.55	57.23	0.67
Humber River	Bolton R 1	105.627 09.09.16	25-year	PR	36.08	224.09	225.29		225.47	0.004327	2.26	34.55	57.23	0.67
Humber River	Bolton R 1	105.427 09.09.15	25-year	EX	36.08	223.43	225.09	224.46	225.19	0.001376	1.58	40.91	67.80	0.40
Humber River	Bolton R 1	105.427 09.09.15	25-year	PR	36.08	223.43	225.09	224.46	225.19	0.001376	1.58	40.90	67.78	0.40
Humber River	Bolton R 1	105.224 09.09.14	25-year	EX	36.08	223.01	224.66		224.81	0.001943	1.89	31.86	36.94	0.47
Humber River	Bolton R 1	105.224 09.09.14	25-year	PR	36.08	223.01	224.66		224.81	0.001943	1.89	31.85	36.94	0.47
Humber River	Bolton R 1	105.022 09.09.13	25-year	EX	36.08	222.83	224.53		224.60	0.000954	1.28	46.86	83.98	0.33
Humber River	Bolton R 1	105.022 09.09.13	25-year	PR	36.08	222.83	224.53		224.60	0.000954	1.28	46.85	83.97	0.33
Humber River	Bolton R 1	104.823 09.09.12	25-year	EX	36.08	222.59	224.28		224.38	0.001271	1.53	38.51	48.90	0.38
Humber River	Bolton R 1	104.823 09.09.12	25-year	PR	36.08	222.59	224.28		224.38	0.001271	1.53	38.51	48.90	0.38
Humber River	Bolton R 1	104.621 09.09.11	25-year	EX	36.08	222.32	224.08		224.15	0.000979	1.24	41.53	64.00	0.33
Humber River	Bolton R 1	104.621 09.09.11	25-year	PR	36.08	222.32	224.08		224.15	0.000979	1.24	41.53	64.00	0.33
Humber River	Bolton R 1	104.421 09.09.10	25-year	EX	36.08	222.17	223.77		223.89	0.001844	1.74	41.26	82.94	0.45
Humber River	Bolton R 1	104.421 09.09.10	25-year	PR	36.08	222.17	223.77		223.89	0.001844	1.74	41.25	82.93	0.45
Humber River	Bolton R 1	104.218 09.09.09	25-year	EX	36.08	221.96	223.45		223.54	0.001637	1.60	45.82	58.26	0.43
Humber River	Bolton R 1	104.218 09.09.09	25-year	PR	36.08	221.96	223.45		223.54	0.001637	1.60	45.81	58.26	0.43
Humber River	Bolton R 1	104.018 09.09.08	25-year	EX	36.08	221.69	223.06		223.19	0.002144	1.74	37.65	59.57	0.48
Humber River	Bolton R 1	104.018 09.09.08	25-year	PR	36.08	221.69	223.06		223.19	0.002144	1.74	37.64	59.57	0.48
Humber River	Bolton R 1	103.819 09.09.07	25-year	EX	36.08	221.24	222.83		222.90	0.001020	1.34	55.31	69.56	0.34
Humber River	Bolton R 1	103.819 09.09.07	25-year	PR	36.08	221.24	222.83		222.90	0.001020	1.34	55.31	69.56	0.34
Humber River	Bolton R 1	103.616 09.09.06	25-year	EX	36.08	220.94	222.54		222.64	0.001524	1.63	43.83	50.53	0.42
Humber River	Bolton R 1	103.616 09.09.06	25-year	PR	36.08	220.94	222.54		222.64	0.001523	1.63	43.83	50.53	0.42
Humber River	Bolton R 1	103.417 09.09.05	25-year	EX	36.08	220.64	222.30		222.40	0.001318	1.50	47.92	75.21	0.39
Humber River	Bolton R 1	103.417 09.09.05	25-year	PR	36.08	220.64	222.30		222.40	0.001318	1.50	47.92	75.21	0.39
Humber River	Bolton R 1	103.215 09.09.04	25-year	EX	36.08	220.31	222.02		222.13	0.001335	1.54	34.18	45.61	0.39
Humber River	Bolton R 1	103.215 09.09.04	25-year	PR	36.08	220.31	222.02		222.13	0.001335	1.54	34.18	45.60	0.39
Humber River	Bolton R 1	103.014 09.09.03	25-year	EX	36.08	220.07	221.69		221.82	0.001902	1.76	39.52	78.45	0.46
Humber River	Bolton R 1	103.014 09.09.03	25-year	PR	36.08	220.07	221.69		221.82	0.001902	1.76	39.52	78.45	0.46
Humber River	Bolton R 1	102.814 09.09.02	25-year	EX	36.08	219.98	221.55	221.23	221.65	0.001867	1.77	63.79	162.39	0.46
Humber River	Bolton R 1	102.814 09.09.02	25-year	PR	36.08	219.98	221.55	221.23	221.65	0.001863	1.77	63.84	162.39	0.46
Humber River	Bolton R 1	102.613 09.09.01	25-year	EX	36.49	219.74	221.01		221.10	0.001981	1.58	57.39	134.79	0.46
Humber River	Bolton R 1	102.613 09.09.01	25-year	PR	36.53	219.74	221.01		221.10	0.001985	1.58	57.40	134.79	0.46
Humber River	Bolton Reach	102.398 09.01.13	25-year	EX	27.24	219.10	220.84		220.86	0.000327	0.75	63.77	74.27	0.19
Humber River	Bolton Reach	102.398 09.01.13	25-year	PR	27.24	219.10	220.84		220.86	0.000327	0.75	63.77	74.27	0.19
Humber River	Bolton Reach	102.208 09.01.12	25-year	EX	27.24	219.02	220.78		220.81	0.000599	0.98	56.19	78.23	0.25
Humber River	Bolton Reach	102.208 09.01.12	25-year	PR	27.24	219.02	220.78		220.81	0.000599	0.98	56.18	78.23	0.25
Humber River	Bolton Reach	102.011 09.01.11	25-year	EX	27.24	218.86	220.70		220.74	0.000460	0.94	60.07	89.18	0.23
Humber River	Bolton Reach	102.011 09.01.11	25-year	PR	27.24	218.86	220.70		220.74	0.000460	0.94	60.07	89.18	0.23
Humber River	Bolton Reach	101.9462 09.01.10	25-year	EX	27.24	218.78	220.61		220.65	0.000609	1.08	55.49	76.50	0.26
Humber River	Bolton Reach	101.9462 09.01.10	25-year	PR	27.24	218.78	220.61		220.65	0.000609	1.08	55.49	76.50	0.26
Humber River	Bolton Reach	101.809 09.01.09	25-year	EX	27.24	218.20	219.77		219.80	0.000463	0.83	49.72	62.87	0.22
Humber River	Bolton Reach	101.809 09.01.09	25-year	PR	27.24	218.20	219.77		219.80	0.000463	0.83	49.72	62.87	0.22

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	101.608 09.01.08	25-year	EX	27.24	218.06	219.39		219.59	0.003621	2.04	17.32	29.97	0.60
Humber River	Bolton Reach	101.608 09.01.08	25-year	PR	27.24	218.06	219.39		219.59	0.003621	2.04	17.32	29.97	0.60
Humber River	Bolton Reach	101.407 09.01.07	25-year	EX	27.24	217.85	219.32		219.36	0.000857	1.08	54.93	116.51	0.30
Humber River	Bolton Reach	101.407 09.01.07	25-year	PR	27.24	217.85	219.32		219.36	0.000857	1.08	54.93	116.50	0.30
Humber River	Bolton Reach	101.206 09.01.06	25-year	EX	27.24	217.39	218.81		218.94	0.003058	1.63	16.75	17.84	0.53
Humber River	Bolton Reach	101.206 09.01.06	25-year	PR	27.24	217.39	218.81		218.94	0.003058	1.63	16.75	17.84	0.53
Humber River	Bolton Reach	101.004 09.01.05	25-year	EX	27.24	216.95	218.40		218.48	0.001730	1.28	21.33	21.25	0.41
Humber River	Bolton Reach	101.004 09.01.05	25-year	PR	27.24	216.95	218.40		218.48	0.001730	1.28	21.33	21.25	0.41
Humber River	Bolton Reach	100.803 09.01.04	25-year	EX	27.24	216.63	218.12		218.20	0.001205	1.24	24.37	28.59	0.35
Humber River	Bolton Reach	100.803 09.01.04	25-year	PR	27.24	216.63	218.12		218.20	0.001204	1.24	24.38	28.59	0.35
Humber River	Bolton Reach	100.602 09.01.03	25-year	EX	27.24	216.43	217.83		217.92	0.001612	1.33	22.07	28.23	0.40
Humber River	Bolton Reach	100.602 09.01.03	25-year	PR	27.24	216.43	217.83		217.92	0.001610	1.33	22.09	28.24	0.40
Humber River	Bolton Reach	100.5208 09.01.02	25-year	EX	27.24	216.19	217.70		217.78	0.001610	1.31	21.10	22.65	0.40
Humber River	Bolton Reach	100.5208 09.01.02	25-year	PR	27.24	216.19	217.70		217.78	0.001605	1.31	21.12	22.66	0.40
Humber River	Bolton Reach	100.401 09.01.01	25-year	EX	37.14	216.08	217.51	217.02	217.60	0.001515	1.46	38.87	45.59	0.40
Humber River	Bolton Reach	100.401 09.01.01	25-year	PR	37.19	216.08	217.51	217.01	217.60	0.001515	1.46	38.91	45.59	0.40
Humber River	Bolton Reach	100.200 09.04.02	25-year	EX	37.14	215.87	217.32		217.43	0.002094	1.49	30.26	57.45	0.46
Humber River	Bolton Reach	100.200 09.04.02	25-year	PR	37.19	215.87	217.32		217.43	0.002094	1.49	30.31	57.60	0.46
Humber River	Bolton Reach	100.1076 09.04.01	25-year	EX	37.14	215.68	217.15		217.25	0.001703	1.45	32.71	86.41	0.42
Humber River	Bolton Reach	100.1076 09.04.01	25-year	PR	37.19	215.68	217.15		217.26	0.001702	1.45	32.79	86.96	0.42
Humber River	Bolton Reach	9.216	25-year	EX	37.14	215.63	217.08		217.16	0.001868	1.41	47.67	84.97	0.40
Humber River	Bolton Reach	9.216	25-year	PR	37.19	215.63	217.08		217.16	0.001865	1.41	47.76	85.05	0.40
Humber River	Bolton Reach	9.213	25-year	EX	37.14	215.39	216.89		217.06	0.002983	1.91	25.20	40.95	0.52
Humber River	Bolton Reach	9.213	25-year	PR	37.19	215.39	216.89		217.06	0.002980	1.91	25.25	41.16	0.52
Humber River	Bolton Reach	9.21	25-year	EX	37.14	215.31	216.86		216.97	0.001682	1.45	32.58	57.24	0.39
Humber River	Bolton Reach	9.21	25-year	PR	37.19	215.31	216.86		216.97	0.001681	1.45	32.65	57.36	0.39
Humber River	Bolton Reach	9.207	25-year	EX	37.14	215.09	216.78		216.85	0.001139	1.17	42.66	105.43	0.32
Humber River	Bolton Reach	9.207	25-year	PR	37.19	215.09	216.78		216.85	0.001137	1.17	42.81	105.51	0.32
Humber River	Bolton Reach	9.204	25-year	EX	37.14	215.00	216.64		216.71	0.001363	1.30	47.33	113.47	0.35
Humber River	Bolton Reach	9.204	25-year	PR	37.19	215.00	216.64		216.71	0.001358	1.30	47.55	113.98	0.35
Humber River	Bolton Reach	9.201	25-year	EX	37.14	214.97	216.53	215.95	216.61	0.001579	1.38	40.60	72.65	0.38
Humber River	Bolton Reach	9.201	25-year	PR	37.19	214.97	216.53	215.95	216.61	0.001571	1.38	40.78	73.05	0.38
Humber River	Bolton Reach	9.198	25-year	EX	37.14	214.74	215.88	215.88	216.23	0.011156	2.68	16.73	36.39	0.93
Humber River	Bolton Reach	9.198	25-year	PR	37.19	214.74	215.87	215.87	216.23	0.011364	2.69	16.60	35.91	0.93
Humber River	Bolton Reach	9.195	25-year	EX	37.14	213.50	215.06		215.14	0.001334	1.19	34.93	51.44	0.34
Humber River	Bolton Reach	9.195	25-year	PR	37.19	213.50	215.07		215.14	0.001333	1.19	34.98	51.50	0.34
Humber River	Bolton Reach	9.192	25-year	EX	37.14	213.23	214.88		214.98	0.002065	1.39	26.79	23.56	0.42
Humber River	Bolton Reach	9.192	25-year	PR	37.19	213.23	214.88		214.98	0.002064	1.39	26.81	23.56	0.42
Humber River	Bolton Reach	9.189	25-year	EX	37.14	213.35	214.78	214.24	214.90	0.002394	1.53	24.20	20.44	0.45
Humber River	Bolton Reach	9.189	25-year	PR	37.19	213.35	214.79	214.24	214.91	0.002394	1.54	24.23	20.44	0.45
Humber River	Bolton Reach	9.186			Bridge									
Humber River	Bolton Reach	9.183	25-year	EX	37.14	213.31	214.61	214.28	214.83	0.004935	2.08	17.90	16.33	0.63
Humber River	Bolton Reach	9.183	25-year	PR	37.19	213.31	214.61	214.28	214.83	0.004938	2.08	17.91	16.34	0.63
Humber River	Bolton Reach	9.18	25-year	EX	37.14	213.02	214.46		214.55	0.001781	1.34	28.99	31.48	0.39
Humber River	Bolton Reach	9.18	25-year	PR	37.19	213.02	214.46		214.55	0.001780	1.34	29.03	31.50	0.39
Humber River	Bolton Reach	9.177	25-year	EX	37.14	212.57	214.18		214.29	0.002243	1.50	24.77	20.62	0.44
Humber River	Bolton Reach	9.177	25-year	PR	37.19	212.57	214.18		214.30	0.002243	1.50	24.79	20.63	0.44
Humber River	Bolton Reach	9.174	25-year	EX	37.14	212.55	214.15		214.28	0.002488	1.56	23.83	20.31	0.46
Humber River	Bolton Reach	9.174	25-year	PR	37.19	212.55	214.15		214.28	0.002489	1.56	23.85	20.31	0.46
Humber River	Bolton Reach	9.171	25-year	EX	37.14	212.49	214.12		214.24	0.002277	1.53	24.22	19.68	0.44
Humber River	Bolton Reach	9.171	25-year	PR	37.19	212.49	214.13		214.25	0.002278	1.53	24.24	19.69	0.44
Humber River	Bolton Reach	9.168	25-year	EX	37.14	212.44	214.05		214.19	0.003064	1.64	22.60	20.96	0.51
Humber River	Bolton Reach	9.168	25-year	PR	37.19	212.44	214.05		214.19	0.003064	1.64	22.62	20.97	0.51
Humber River	Bolton Reach	9.165	25-year	EX	37.14	212.37	214.00		214.13	0.002964	1.61	23.10	21.62	0.50
Humber River	Bolton Reach	9.165	25-year	PR	37.19	212.37	214.00		214.13	0.002963	1.61	23.12	21.62	0.50
Humber River	Bolton Reach	9.162	25-year	EX	37.14	212.33	213.92		214.07	0.003595	1.76	21.14	19.96	0.55
Humber River	Bolton Reach	9.162	25-year	PR	37.19	212.33	213.92		214.07	0.003594	1.76	21.16	19.96	0.55
Humber River	Bolton Reach	9.159	25-year	EX	37.14	212.18	213.87		214.02	0.003323	1.70	21.82	20.34	0.52
Humber River	Bolton Reach	9.159	25-year	PR	37.19	212.18	213.87		214.02	0.003323	1.70	21.84	20.34	0.52
Humber River	Bolton Reach	9.156	25-year	EX	37.14	211.93	213.85	212.91	213.93	0.001318	1.29	28.77	19.71	0.34
Humber River	Bolton Reach	9.156	25-year	PR	37.19	211.93	213.85	212.91	213.93	0.001319	1.29	28.79	19.71	0.34
Humber River	Bolton Reach	9.153			Bridge									
Humber River	Bolton Reach	9.15	25-year	EX	37.14	211.79	213.84	212.74	213.89	0.000598	0.99	37.55	25.12	0.24
Humber River	Bolton Reach	9.15	25-year	PR	37.19	211.79	213.84	212.74	213.89	0.000598	0.99	37.57	25.13	0.24
Humber River	Bolton Reach	9.147	25-year	EX	37.14	211.79	213.75		213.85	0.001554	1.40	26.62	18.50	0.37
Humber River	Bolton Reach	9.147	25-year	PR	37.19	211.79	213.75		213.85	0.001555	1.40	26.64	18.50	0.37
Humber River	Bolton Reach	9.144	25-year	EX	37.14	211.74	213.72		213.82	0.001488	1.38	26.87	18.11	0.36
Humber River	Bolton Reach	9.144	25-year	PR	37.19	211.74	213.72		213.82	0.001490	1.38	26.88	18.11	0.36
Humber River	Bolton Reach	9.141	25-year	EX	37.14	211.64	213.63		213.71	0.001230	1.26	29.38	19.88	0.33
Humber River	Bolton Reach	9.141	25-year	PR	37.19	211.64	213.63		213.71	0.001231	1.27	29.40	19.88	0.33

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	9.138	25-year	EX	37.14	211.64	213.58		213.65	0.001217	1.20	31.01	22.92	0.33
Humber River	Bolton Reach	9.138	25-year	PR	37.19	211.64	213.58		213.65	0.001219	1.20	31.03	22.92	0.33
Humber River	Bolton Reach	9.135	25-year	EX	37.14	211.64	213.54		213.59	0.000698	0.99	42.13	61.74	0.26
Humber River	Bolton Reach	9.135	25-year	PR	37.19	211.64	213.54		213.59	0.000699	0.99	42.17	61.78	0.26
Humber River	Bolton Reach	9.132	25-year	EX	37.14	211.64	213.45		213.54	0.001558	1.33	28.80	26.54	0.37
Humber River	Bolton Reach	9.132	25-year	PR	37.19	211.64	213.45		213.54	0.001560	1.33	28.81	26.55	0.37
Humber River	Bolton Reach	9.129	25-year	EX	37.14	211.64	213.42		213.50	0.001622	1.23	30.09	26.52	0.37
Humber River	Bolton Reach	9.129	25-year	PR	37.19	211.64	213.42		213.50	0.001625	1.24	30.10	26.53	0.37
Humber River	Bolton Reach	9.126	25-year	EX	37.14	211.64	213.41		213.47	0.001121	1.08	38.71	60.88	0.31
Humber River	Bolton Reach	9.126	25-year	PR	37.19	211.64	213.41		213.47	0.001123	1.08	38.73	60.95	0.31
Humber River	Bolton Reach	9.123	25-year	EX	37.14	211.64	213.41		213.45	0.000756	0.90	59.55	96.62	0.26
Humber River	Bolton Reach	9.123	25-year	PR	37.19	211.64	213.41		213.45	0.000757	0.90	59.59	96.64	0.26
Humber River	Bolton Reach	9.12	25-year	EX	37.14	213.30	213.19	213.19	213.39	0.028606		18.46	45.31	0.00
Humber River	Bolton Reach	9.12	25-year	PR	37.19	213.30	213.19	213.19	213.39	0.028515		18.50	45.45	0.00
Humber River	Bolton Reach	9.117	25-year	EX	37.14	211.64	213.00		213.04	0.001132	0.98	48.22	86.59	0.31
Humber River	Bolton Reach	9.117	25-year	PR	37.19	211.64	213.00		213.04	0.001131	0.98	48.30	86.62	0.31
Humber River	Bolton Reach	9.114	25-year	EX	37.14	211.64	212.97		213.02	0.001208	0.99	46.66	73.06	0.32
Humber River	Bolton Reach	9.114	25-year	PR	37.19	211.64	212.98		213.02	0.001207	0.99	46.73	73.09	0.31
Humber River	Bolton Reach	9.111	25-year	EX	37.14	211.41	212.95		212.99	0.000780	0.96	56.87	108.50	0.26
Humber River	Bolton Reach	9.111	25-year	PR	37.19	211.41	212.95		212.99	0.000779	0.96	56.98	108.54	0.26
Humber River	Bolton Reach	9.108	25-year	EX	37.14	211.41	212.89		212.97	0.001660	1.34	41.23	104.31	0.37
Humber River	Bolton Reach	9.108	25-year	PR	37.19	211.41	212.90		212.97	0.001657	1.34	41.34	104.63	0.37
Humber River	Bolton Reach	9.105	25-year	EX	37.14	211.40	212.91	212.59	212.95	0.001018	1.03	68.69	153.26	0.29
Humber River	Bolton Reach	9.105	25-year	PR	37.19	211.40	212.91	212.59	212.95	0.001015	1.03	68.85	153.29	0.29
Humber River	Bolton Reach	9.102	25-year	EX	37.14	211.39	212.42	212.42	212.85	0.013369	2.91	12.78	15.04	1.01
Humber River	Bolton Reach	9.102	25-year	PR	37.19	211.39	212.42	212.42	212.86	0.013378	2.91	12.79	15.04	1.01
Humber River	Bolton Reach	9.099	25-year	EX	37.14	211.16	212.21		212.27	0.002747	1.27	35.19	40.61	0.45
Humber River	Bolton Reach	9.099	25-year	PR	37.19	211.16	212.21		212.27	0.002749	1.28	35.21	40.62	0.45
Humber River	Bolton Reach	9.096	25-year	EX	37.14	211.29	212.12	211.82	212.19	0.006536	1.48	32.17	59.78	0.66
Humber River	Bolton Reach	9.096	25-year	PR	37.19	211.29	212.12	211.83	212.19	0.006534	1.48	32.20	59.80	0.66
Humber River	Bolton Reach	9.093			Mult Open									
Humber River	Bolton Reach	9.09	25-year	EX	37.14	211.28	212.02	211.68	212.06	0.004517	1.21	43.01	93.09	0.54
Humber River	Bolton Reach	9.09	25-year	PR	37.19	211.28	212.02	211.67	212.06	0.004511	1.21	43.08	93.19	0.54
Humber River	Bolton Reach	9.087	25-year	EX	37.14	210.58	211.80		211.90	0.003140	1.50	33.72	62.75	0.50
Humber River	Bolton Reach	9.087	25-year	PR	37.19	210.58	211.80		211.90	0.003138	1.50	33.78	62.88	0.50
Humber River	Bolton Reach	9.084	25-year	EX	37.14	209.90	211.58		211.71	0.002968	1.56	24.49	33.94	0.49
Humber River	Bolton Reach	9.084	25-year	PR	37.19	209.90	211.59		211.71	0.002969	1.56	24.52	33.98	0.49
Humber River	Bolton Reach	9.081	25-year	EX	37.14	209.90	211.48		211.64	0.003952	1.77	21.38	28.84	0.57
Humber River	Bolton Reach	9.081	25-year	PR	37.19	209.90	211.48		211.64	0.003954	1.77	21.40	28.86	0.57
Humber River	Bolton Reach	9.078	25-year	EX	37.14	209.90	211.12		211.25	0.003592	1.59	24.46	34.53	0.53
Humber River	Bolton Reach	9.078	25-year	PR	37.19	209.90	211.12		211.25	0.003592	1.59	24.48	34.58	0.53
Humber River	Bolton Reach	9.075	25-year	EX	37.14	209.90	210.93		211.12	0.007104	1.95	19.14	27.46	0.73
Humber River	Bolton Reach	9.075	25-year	PR	37.19	209.90	210.93		211.12	0.007106	1.95	19.16	27.47	0.73
Humber River	Bolton Reach	9.072	25-year	EX	37.14	209.70	210.81	210.68	210.98	0.006534	1.88	23.63	52.11	0.70
Humber River	Bolton Reach	9.072	25-year	PR	37.19	209.70	210.81	210.68	210.98	0.006529	1.88	23.67	52.14	0.70
Humber River	Bolton Reach	9.069	25-year	EX	37.14	209.36	210.76	210.26	210.83	0.001924	1.23	30.19	30.63	0.40
Humber River	Bolton Reach	9.069	25-year	PR	37.19	209.36	210.76	210.26	210.83	0.001925	1.23	30.21	30.63	0.40
Humber River	Bolton Reach	9.066			Bridge									
Humber River	Bolton Reach	9.063	25-year	EX	37.14	209.17	210.72	210.10	210.79	0.001466	1.16	32.03	31.56	0.35
Humber River	Bolton Reach	9.063	25-year	PR	37.19	209.17	210.72	210.10	210.79	0.001466	1.16	32.05	31.57	0.35
Humber River	Bolton Reach	9.06	25-year	EX	37.14	209.05	210.62		210.72	0.001808	1.40	29.69	35.83	0.40
Humber River	Bolton Reach	9.06	25-year	PR	37.19	209.05	210.62		210.72	0.001809	1.40	29.72	35.83	0.40
Humber River	Bolton Reach	9.057	25-year	EX	37.14	209.05	210.60		210.69	0.001568	1.33	30.79	34.80	0.37
Humber River	Bolton Reach	9.057	25-year	PR	37.19	209.05	210.60		210.69	0.001570	1.33	30.81	34.82	0.37
Humber River	Bolton Reach	9.054	25-year	EX	37.14	209.05	210.54		210.62	0.001640	1.30	31.15	36.94	0.38
Humber River	Bolton Reach	9.054	25-year	PR	37.19	209.05	210.54		210.62	0.001642	1.30	31.17	36.95	0.38
Humber River	Bolton Reach	9.051	25-year	EX	37.14	209.05	210.02	210.02	210.33	0.009477	2.56	19.69	91.53	0.86
Humber River	Bolton Reach	9.051	25-year	PR	37.19	209.05	210.02	210.02	210.33	0.009445	2.56	19.75	91.64	0.86
Humber River	Bolton Reach	9.048	25-year	EX	37.14	209.05	210.12	209.47	210.12	0.000225	0.42	213.45	284.93	0.14
Humber River	Bolton Reach	9.048	25-year	PR	37.19	209.05	210.12	209.47	210.12	0.000225	0.42	213.61	284.94	0.14
Humber River	Bolton Reach	9.045	25-year	EX	37.14	208.40	209.97		210.03	0.001307	1.31	61.61	110.05	0.35
Humber River	Bolton Reach	9.045	25-year	PR	37.19	208.40	209.97	209.47	210.03	0.001308	1.31	61.67	110.08	0.35
Humber River	Bolton Reach	9.042	25-year	EX	37.14	208.41	209.30	209.30	209.50	0.009585	2.07	26.96	87.55	0.83
Humber River	Bolton Reach	9.042	25-year	PR	37.19	208.41	209.30	209.30	209.50	0.009571	2.07	27.02	87.60	0.82
Humber River	Bolton Reach	9.039	25-year	EX	37.14	207.60	209.05		209.09	0.000921	0.94	50.08	88.75	0.28
Humber River	Bolton Reach	9.039	25-year	PR	37.19	207.60	209.08		209.12	0.000841	0.91	52.61	92.23	0.27
Humber River	Bolton Reach	9.036	25-year	EX	37.14	207.60	209.01		209.05	0.000775	0.83	54.49	73.33	0.26
Humber River	Bolton Reach	9.036	25-year	PR	37.19	207.60	209.04		209.08	0.000698	0.80	56.82	74.00	0.24
Humber River	Bolton Reach	9.033	25-year	EX	37.14	207.10	208.93	207.88	208.99	0.000726	1.11	33.46	26.51	0.27
Humber River	Bolton Reach	9.033	25-year	PR	37.19	207.10	208.96	207.88	209.02	0.000681	1.09	34.13	26.89	0.26

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	9.03			Bridge									
Humber River	Bolton Reach	9.027	25-year	EX	37.14	207.11	208.90	207.87	208.97	0.000726	1.11	33.40	37.74	0.27
Humber River	Bolton Reach	9.027	25-year	PR	37.19	207.11	208.94	207.87	209.00	0.000680	1.09	34.10	38.53	0.26
Humber River	Bolton Reach	9.024	25-year	EX	37.14	207.09	208.91		208.95	0.000844	0.86	44.99	51.22	0.27
Humber River	Bolton Reach	9.024	25-year	PR	37.19	207.09	208.95		208.98	0.000754	0.83	46.93	52.45	0.25
Humber River	Bolton Reach	9.021	25-year	EX	37.14	207.11	208.86		208.90	0.000663	1.04	71.97	85.04	0.25
Humber River	Bolton Reach	9.021	25-year	PR	37.19	207.11	208.90		208.94	0.000593	1.00	75.71	87.01	0.24
Humber River	Bolton Reach	9.018	25-year	EX	37.14	206.75	208.83		208.85	0.000308	0.74	103.44	136.06	0.18
Humber River	Bolton Reach	9.018	25-year	PR	37.19	206.75	208.87		208.89	0.000270	0.71	110.04	137.60	0.17
Humber River	Bolton Reach	9.015	25-year	EX	37.14	206.42	208.80		208.81	0.000182	0.59	154.28	203.81	0.13
Humber River	Bolton Reach	9.015	25-year	PR	37.19	206.42	208.85		208.86	0.000156	0.55	164.96	205.43	0.13
Humber River	Bolton Reach	9.012	25-year	EX	37.14	206.41	208.80		208.81	0.000140	0.52	161.25	172.64	0.12
Humber River	Bolton Reach	9.012	25-year	PR	37.19	206.41	208.85		208.86	0.000124	0.50	170.40	178.36	0.11
Humber River	Bolton Reach	9.009	25-year	EX	37.14	206.42	208.78	207.29	208.80	0.000193	0.62	74.38	198.94	0.14
Humber River	Bolton Reach	9.009	25-year	PR	37.19	206.42	208.83	207.29	208.85	0.000176	0.61	76.96	200.87	0.14
Humber River	Bolton Reach	9.006			Bridge									
Humber River	Bolton Reach	9.003	25-year	EX	37.14	206.18	208.77	207.28	208.78	0.000154	0.53	80.63	204.32	0.12
Humber River	Bolton Reach	9.003	25-year	PR	37.19	206.18	208.82	207.28	208.83	0.000139	0.51	83.34	205.81	0.12
Humber River	Bolton Reach	9	25-year	EX	37.14	206.18	208.77		208.77	0.000060	0.40	256.95	240.31	0.08
Humber River	Bolton Reach	9	25-year	PR	37.19	206.18	208.82		208.83	0.000053	0.38	270.03	241.82	0.08
Humber River	DOWNSTREAM	11.39	25-year	EX	66.40	206.18	208.74		208.76	0.000378	0.89	172.83	196.65	0.20
Humber River	DOWNSTREAM	11.39	25-year	PR	75.37	206.18	208.79		208.82	0.000429	0.96	182.58	198.02	0.21
Humber River	DOWNSTREAM	11.38	25-year	EX	66.40	206.17	208.68		208.72	0.000601	1.16	163.02	221.30	0.25
Humber River	DOWNSTREAM	11.38	25-year	PR	75.37	206.17	208.73		208.77	0.000678	1.25	172.62	221.92	0.26
Humber River	DOWNSTREAM	11.37	25-year	EX	66.40	206.18	208.65		208.67	0.000419	1.01	182.92	202.02	0.21
Humber River	DOWNSTREAM	11.37	25-year	PR	75.37	206.18	208.68		208.72	0.000489	1.11	190.37	202.36	0.23
Humber River	DOWNSTREAM	11.36	25-year	EX	66.40	206.17	208.62		208.65	0.000389	0.96	142.67	127.24	0.20
Humber River	DOWNSTREAM	11.36	25-year	PR	75.37	206.17	208.65		208.68	0.000472	1.07	146.37	127.95	0.23
Humber River	DOWNSTREAM	11.35	25-year	EX	66.40	206.03	208.60		208.62	0.000203	0.74	208.54	170.85	0.15
Humber River	DOWNSTREAM	11.35	25-year	PR	75.37	206.03	208.63		208.65	0.000249	0.82	213.02	172.08	0.17
Humber River	DOWNSTREAM	11.34	25-year	EX	66.40	205.60	208.51	206.94	208.57	0.000518	1.25	111.42	122.23	0.23
Humber River	DOWNSTREAM	11.34	25-year	PR	75.37	205.60	208.51	207.05	208.59	0.000667	1.42	111.42	122.23	0.27
Cold_10_7	Tributary E	4822.04	25-year	EX	0.05	263.04	263.13		263.15	0.130082	0.64	0.08	1.58	0.88
Cold_10_7	Tributary E	4822.04	25-year	PR	0.50	263.04	263.37		263.40	0.030637	0.70	0.71	3.83	0.52
Cold_10_7	Tributary E	4783.59	25-year	EX	0.05	262.40	262.61	262.49	262.61	0.005012	0.22	0.24	1.86	0.20
Cold_10_7	Tributary E	4783.59	25-year	PR	0.50	262.40	262.90	262.68	262.91	0.006726	0.45	1.22	6.35	0.26
Cold_10_7	Tributary E	4731.68	25-year	EX	0.05	261.73	261.81	261.81	261.83	0.216858	0.59	0.09	2.76	1.05
Cold_10_7	Tributary E	4731.68	25-year	PR	0.50	261.73	261.91	261.91	261.97	0.136488	1.05	0.47	4.31	1.01
Cold_10_7	Tributary E	4652.11	25-year	EX	0.05	261.35	261.49		261.49	0.000021	0.02	2.54	32.62	0.02
Cold_10_7	Tributary E	4652.11	25-year	PR	0.50	261.35	261.71		261.71	0.000021	0.05	10.84	46.56	0.03
Cold_10_7	Tributary E	4592.65	25-year	EX	0.05	261.40	261.49		261.49	0.000055	0.03	1.75	29.55	0.04
Cold_10_7	Tributary E	4592.65	25-year	PR	0.50	261.40	261.71		261.71	0.000030	0.05	9.92	52.06	0.03
Cold_10_7	Tributary E	4515.64	25-year	EX	0.05	261.39	261.46		261.47	0.095750	0.50	0.11	2.30	0.74
Cold_10_7	Tributary E	4515.64	25-year	PR	0.50	261.39	261.68		261.70	0.015249	0.53	0.95	4.68	0.37
Cold_10_7	Tributary E	4460.59	25-year	EX	0.09	261.30	261.45		261.45	0.000162	0.03	2.67	29.18	0.03
Cold_10_7	Tributary E	4460.59	25-year	PR	0.80	261.30	261.67		261.67	0.000203	0.08	10.20	37.55	0.05
Cold_10_7	Tributary E	4407.62	25-year	EX	0.09	261.31	261.42		261.42	0.008016	0.18	0.47	7.26	0.23
Cold_10_7	Tributary E	4407.62	25-year	PR	0.80	261.31	261.63		261.64	0.004809	0.31	2.55	11.66	0.21
Cold_10_7	Tributary E	4354.33	25-year	EX	0.09	260.86	261.04		261.04	0.006319	0.24	0.36	3.11	0.22
Cold_10_7	Tributary E	4354.33	25-year	PR	0.80	260.86	261.37		261.38	0.004926	0.43	1.98	8.51	0.23
Cold_10_7	Tributary E	4322.62	25-year	EX	0.09	260.68	260.86		260.86	0.005414	0.22	0.39	3.26	0.20
Cold_10_7	Tributary E	4322.62	25-year	PR	0.80	260.68	261.23		261.24	0.003897	0.39	2.03	5.47	0.21
Cold_10_7	Tributary E	4293.51	25-year	EX	0.09	260.49	260.73		260.73	0.003422	0.21	0.41	2.53	0.17
Cold_10_7	Tributary E	4293.51	25-year	PR	0.80	260.49	261.09		261.10	0.005612	0.51	1.60	4.60	0.25
Cold_10_7	Tributary E	4265.3	25-year	EX	0.09	260.37	260.50		260.51	0.031163	0.41	0.21	2.59	0.46
Cold_10_7	Tributary E	4265.3	25-year	PR	0.80	260.37	260.67		260.73	0.063611	1.02	0.79	4.24	0.75
Cold_10_7	Tributary E	4240.34	25-year	EX	0.09	259.55	259.73		259.74	0.030229	0.49	0.17	1.57	0.47
Cold_10_7	Tributary E	4240.34	25-year	PR	0.80	259.55	259.98	259.90	259.99	0.015069	0.53	2.00	16.62	0.37
Cold_10_7	Tributary E	4181.11	25-year	EX	0.09	259.05	259.38		259.39	0.002500	0.18	0.47	2.81	0.14
Cold_10_7	Tributary E	4181.11	25-year	PR	0.80	259.05	259.65	259.43	259.66	0.003308	0.31	3.09	16.08	0.18
Cold_10_7	Tributary E	4121.04	25-year	EX	0.09	258.89	258.99		259.00	0.041696	0.33	0.26	5.46	0.49
Cold_10_7	Tributary E	4121.04	25-year	PR	0.80	258.89	259.08	259.08	259.11	0.095358	0.86	1.06	16.16	0.85
Cold_10_7	Tributary E	4055.36	25-year	EX	0.09	258.17	258.27		258.27	0.005042	0.11	0.77	17.20	0.17
Cold_10_7	Tributary E	4055.36	25-year	PR	0.80	258.17	258.55		258.55	0.000175	0.06	13.01	64.64	0.04
Cold_10_7	Tributary E	4004.48	25-year	EX	0.09	258.09	258.27		258.27	0.000026	0.01	6.05	58.14	0.01
Cold_10_7	Tributary E	4004.48	25-year	PR	0.80	258.09	258.55		258.55	0.000026	0.03	26.14	78.74	0.02
Cold_10_7	Tributary E	3947.08	25-year	EX	0.09	258.09	258.27		258.27	0.000001	0.01	13.42	105.07	0.01
Cold_10_7	Tributary E	3947.08	25-year	PR	0.80	258.09	258.55		258.55	0.000002	0.02	43.85	113.28	0.01
Cold_10_7	Tributary E	3869.46	25-year	EX	0.09	258.09	258.27		258.27	0.000052	0.02	4.12	36.91	0.02
Cold_10_7	Tributary E	3869.46	25-year	PR	0.80	258.09	258.55		258.55	0.000066	0.05	16.08	53.44	0.03

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	3837.47	25-year	EX	0.20	258.09	258.21	258.21	258.25	0.153880	0.87	0.23	3.07	1.01
Cold_10_7	Tributary E	3837.47	25-year	PR	1.84	258.09	258.43	258.43	258.52	0.125018	1.31	1.40	8.65	1.04
Cold_10_7	Tributary E	3758.91	25-year	EX	0.20	257.76	257.95		257.95	0.000640	0.09	2.42	20.69	0.07
Cold_10_7	Tributary E	3758.91	25-year	PR	1.84	257.76	258.22		258.22	0.000918	0.21	10.62	37.88	0.10
Cold_10_7	Tributary E	3700.91	25-year	EX	0.20	257.72	257.90		257.90	0.001294	0.11	1.88	18.66	0.10
Cold_10_7	Tributary E	3700.91	25-year	PR	1.84	257.72	258.15		258.15	0.001810	0.28	7.53	25.60	0.14
Cold_10_7	Tributary E	3650.13	25-year	EX	0.20	257.64	257.80		257.80	0.003320	0.15	1.41	16.54	0.16
Cold_10_7	Tributary E	3650.13	25-year	PR	1.84	257.64	258.02		258.02	0.003844	0.35	5.83	23.63	0.20
Cold_10_7	Tributary E	3587.5	25-year	EX	0.20	257.51	257.64		257.64	0.002258	0.12	1.83	24.36	0.13
Cold_10_7	Tributary E	3587.5	25-year	PR	1.84	257.51	257.82		257.82	0.002974	0.29	7.26	32.25	0.18
Cold_10_7	Tributary E	3530.86	25-year	EX	0.20	257.24	257.37		257.37	0.014571	0.26	0.81	14.41	0.31
Cold_10_7	Tributary E	3530.86	25-year	PR	1.84	257.24	257.54		257.55	0.009149	0.46	4.72	27.42	0.30
Cold_10_7	Tributary E	3486.25	25-year	EX	0.20	256.89	257.02		257.02	0.003818	0.15	1.55	24.03	0.16
Cold_10_7	Tributary E	3486.25	25-year	PR	1.84	256.89	257.18		257.19	0.005480	0.36	5.74	28.79	0.23
Cold_10_7	Tributary E	3456.94	25-year	EX	0.20	256.66	256.76	256.76	256.78	0.118921	0.76	0.29	5.12	0.89
Cold_10_7	Tributary E	3456.94	25-year	PR	1.84	256.66	256.95		256.97	0.023056	0.79	3.37	24.02	0.49
Cold_10_7	Tributary E	3435.76	25-year	EX	0.20	256.29	256.37	256.37	256.37	0.002290	0.08	1.50	18.41	0.12
Cold_10_7	Tributary E	3435.76	25-year	PR	1.84	256.29	256.47	256.40	256.48	0.021054	0.50	3.48	22.57	0.42
Cold_10_7	Tributary E	3426.56	25-year	EX	0.20	256.08	256.14	256.14	256.14	0.000746	0.05	2.46	24.30	0.07
Cold_10_7	Tributary E	3426.56	25-year	PR	1.84	256.08	256.22	256.14	256.23	0.010698	0.34	4.51	26.26	0.30
Cold_10_7	Tributary E	3396.62	25-year	EX	0.20	255.66	255.77		255.77	0.020960	0.30	0.90	23.43	0.37
Cold_10_7	Tributary E	3396.62	25-year	PR	1.84	255.66	255.89		255.90	0.019584	0.56	3.84	27.08	0.42
Cold_10_7	Tributary E	3377.5	25-year	EX	0.20	255.40	255.47		255.47	0.008427	0.12	1.25	26.14	0.21
Cold_10_7	Tributary E	3377.5	25-year	PR	1.84	255.40	255.60		255.60	0.009370	0.35	4.96	29.43	0.28
Cold_10_7	Tributary E	3359.36	25-year	EX	0.20	255.17	255.24		255.24	0.014881	0.21	0.98	23.11	0.30
Cold_10_7	Tributary E	3359.36	25-year	PR	1.84	255.17	255.35		255.36	0.018371	0.51	3.81	25.29	0.40
Cold_10_7	Tributary E	3339.67	25-year	EX	0.20	254.81	254.90		254.91	0.019505	0.33	0.69	12.38	0.37
Cold_10_7	Tributary E	3339.67	25-year	PR	1.84	254.81	255.07		255.09	0.011813	0.54	4.20	24.21	0.34
Cold_10_7	Tributary E	3321.23	25-year	EX	0.20	254.35	254.61		254.61	0.013797	0.38	0.52	4.55	0.33
Cold_10_7	Tributary E	3321.23	25-year	PR	1.84	254.35	254.83		254.85	0.013908	0.73	3.38	17.53	0.39
Cold_10_7	Tributary E	3287.37	25-year	EX	0.20	253.96	254.23	254.12	254.24	0.009013	0.32	0.71	8.77	0.27
Cold_10_7	Tributary E	3287.37	25-year	PR	1.84	253.96	254.48		254.49	0.008431	0.54	3.89	16.14	0.30
Cold_10_7	Tributary E	3269.41	25-year	EX	0.20	253.68	253.85	253.83	253.87	0.083616	0.69	0.28	3.35	0.76
Cold_10_7	Tributary E	3269.41	25-year	PR	1.84	253.68	254.18		254.23	0.031409	1.02	1.81	5.71	0.58
Cold_10_7	Tributary E	3191.63	25-year	EX	0.20	252.91	253.21		253.21	0.003308	0.24	0.84	4.42	0.17
Cold_10_7	Tributary E	3191.63	25-year	PR	1.84	252.91	253.86		253.87	0.001915	0.39	4.72	7.50	0.16
Cold_10_7	Tributary E	3188.65	25-year	EX	0.20	252.84	253.19	252.97	253.19	0.001815	0.19	1.02	7.04	0.13
Cold_10_7	Tributary E	3188.65	25-year	PR	1.84	252.84	253.84	253.22	253.85	0.001513	0.41	4.46	10.21	0.15
Cold_10_7	Tributary E	3158.51 hum_426			Culvert									
Cold_10_7	Tributary E	3123.12	25-year	EX	0.20	252.73	252.96	252.88	252.97	0.019582	0.34	0.58	6.79	0.37
Cold_10_7	Tributary E	3123.12	25-year	PR	1.84	252.73	253.17	253.08	253.21	0.030570	0.90	2.05	8.93	0.55
Cold_10_7	Tributary E	3107.01	25-year	EX	0.20	252.50	252.64		252.64	0.021278	0.29	0.68	10.73	0.37
Cold_10_7	Tributary E	3107.01	25-year	PR	1.84	252.50	252.80		252.82	0.018756	0.54	3.42	19.39	0.41
Cold_10_7	Tributary E	3043.25	25-year	EX	0.20	252.01	252.13		252.13	0.004120	0.12	1.63	27.78	0.16
Cold_10_7	Tributary E	3043.25	25-year	PR	1.84	252.01	252.29		252.29	0.004520	0.28	6.62	34.80	0.20
Cold_10_7	Tributary E	2991.29	25-year	EX	0.20	251.56	251.46	251.46	251.50	0.147498		0.21	2.20	0.00
Cold_10_7	Tributary E	2991.29	25-year	PR	1.84	251.56	251.64	251.64	251.68	0.081884	0.50	2.21	23.28	0.70
Cold_10_7	Tributary E	2930.14	25-year	EX	0.20	250.15	250.27		250.27	0.001313	0.10	2.16	25.47	0.10
Cold_10_7	Tributary E	2930.14	25-year	PR	1.84	250.15	250.53		250.53	0.001063	0.21	9.89	32.13	0.11
Cold_10_7	Tributary E	2887.5	25-year	EX	0.20	249.94	250.24		250.24	0.000564	0.11	2.54	24.37	0.07
Cold_10_7	Tributary E	2887.5	25-year	PR	1.84	249.94	250.48		250.48	0.001073	0.25	9.50	29.98	0.11
Cold_10_7	Tributary E	2802.56	25-year	EX	0.20	250.05	250.12		250.12	0.006001	0.11	1.11	15.66	0.18
Cold_10_7	Tributary E	2802.56	25-year	PR	1.84	250.05	250.29		250.29	0.007382	0.30	5.79	38.80	0.25
Cold_10_7	Tributary E	2775.8	25-year	EX	0.20	249.52	249.68		249.70	0.050127	0.55	0.36	4.10	0.59
Cold_10_7	Tributary E	2775.8	25-year	PR	1.84	249.52	250.23		250.23	0.000937	0.24	9.20	31.57	0.11
Cold_10_7	Tributary E	2760.75	25-year	EX	0.20	249.25	249.55	249.40	249.55	0.003588	0.25	0.79	4.03	0.18
Cold_10_7	Tributary E	2760.75	25-year	PR	1.84	249.25	250.20	249.64	250.20	0.002234	0.44	4.21	7.47	0.17
Cold_10_7	Tributary E	2732.6 hum_604			Culvert									
Cold_10_7	Tributary E	2706.72	25-year	EX	0.20	249.08	249.40	249.29	249.41	0.018507	0.52	0.38	2.19	0.39
Cold_10_7	Tributary E	2706.72	25-year	PR	1.84	249.08	249.84	249.63	249.89	0.020640	0.96	1.91	4.58	0.48
Cold_10_7	Tributary E	2688.78	25-year	EX	0.20	248.89	249.12		249.13	0.015423	0.38	0.52	4.30	0.35
Cold_10_7	Tributary E	2688.78	25-year	PR	1.84	248.89	249.29	249.27	249.34	0.059866	1.10	1.94	15.48	0.75
Cold_10_7	Tributary E	2611.59	25-year	EX	0.20	247.47	247.64		247.65	0.026229	0.36	0.57	8.11	0.42
Cold_10_7	Tributary E	2611.59	25-year	PR	1.84	247.47	247.85		247.85	0.009945	0.44	4.85	30.32	0.31
Cold_10_7	Tributary E	2560.8	25-year	EX	0.20	246.62	246.94		246.94	0.008214	0.37	0.53	2.63	0.26
Cold_10_7	Tributary E	2560.8	25-year	PR	1.84	246.62	247.36		247.37	0.009826	0.61	3.73	23.36	0.32
Cold_10_7	Tributary E	2506.61	25-year	EX	0.20	246.27	246.58		246.58	0.005839	0.31	0.65	3.45	0.23
Cold_10_7	Tributary E	2506.61	25-year	PR	1.84	246.27	246.96		246.97	0.006114	0.55	4.58	23.41	0.26
Cold_10_7	Tributary E	2483.51	25-year	EX	0.20	245.99	246.44		246.45	0.005908	0.34	0.58	2.59	0.23
Cold_10_7	Tributary E	2483.51	25-year	PR	1.84	245.99	246.78		246.79	0.008496	0.58	4.01	17.55	0.30

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	2452.23	25-year	EX	0.20	245.92	246.29		246.29	0.004147	0.28	0.70	3.31	0.19
Cold_10_7	Tributary E	2452.23	25-year	PR	1.84	245.92	246.57		246.57	0.005899	0.44	5.36	27.56	0.25
Cold_10_7	Tributary E	2401.32	25-year	EX	0.20	245.83	246.07		246.07	0.004354	0.22	1.02	11.21	0.19
Cold_10_7	Tributary E	2401.32	25-year	PR	1.84	245.83	246.29		246.30	0.004744	0.43	5.20	21.45	0.23
Cold_10_7	Tributary E	2367.56	25-year	EX	0.20	245.65	245.81		245.81	0.012820	0.30	0.66	6.78	0.31
Cold_10_7	Tributary E	2367.56	25-year	PR	1.84	245.65	245.99		246.01	0.016080	0.67	3.44	20.84	0.41
Cold_10_7	Tributary E	2338.9	25-year	EX	0.20	245.20	245.35		245.35	0.020394	0.34	0.63	9.45	0.38
Cold_10_7	Tributary E	2338.9	25-year	PR	1.84	245.20	245.53		245.54	0.016412	0.64	3.52	20.81	0.41
Cold_10_7	Tributary E	2310.58	25-year	EX	0.20	244.39	244.58		244.60	0.037222	0.64	0.31	2.17	0.54
Cold_10_7	Tributary E	2310.58	25-year	PR	1.84	244.39	245.01		245.05	0.020972	0.83	2.23	7.78	0.47
Cold_10_7	Tributary E	2264.91	25-year	EX	0.20	243.75	244.13		244.14	0.005466	0.32	0.63	2.96	0.22
Cold_10_7	Tributary E	2264.91	25-year	PR	1.84	243.75	244.59		244.60	0.006758	0.56	3.49	12.01	0.27
Cold_10_7	Tributary E	2209.07	25-year	EX	0.20	243.51	243.78		243.79	0.007324	0.33	0.60	3.32	0.25
Cold_10_7	Tributary E	2209.07	25-year	PR	1.84	243.51	244.23		244.25	0.006016	0.56	3.64	12.05	0.26
Cold_10_7	Tributary E	2169.34	25-year	EX	0.20	243.13	243.41		243.42	0.012037	0.41	0.48	2.80	0.32
Cold_10_7	Tributary E	2169.34	25-year	PR	1.84	243.13	243.97		243.99	0.007057	0.62	2.97	6.25	0.29
Cold_10_7	Tributary E	2156.52	25-year	EX	0.20	242.99	243.31	243.17	243.31	0.005992	0.27	0.72	4.74	0.22
Cold_10_7	Tributary E	2156.52	25-year	PR	1.84	242.99	243.94	243.41	243.95	0.001673	0.42	4.64	8.66	0.15
Cold_10_7	Tributary E	2127.4 hum_427			Culvert									
Cold_10_7	Tributary E	2093.17	25-year	EX	0.20	242.09	242.22	242.22	242.25	0.151612	0.84	0.23	3.21	1.00
Cold_10_7	Tributary E	2093.17	25-year	PR	1.84	242.09	242.45	242.45	242.54	0.113791	1.39	1.32	6.84	1.01
Cold_10_7	Tributary E	2079.21	25-year	EX	0.20	241.19	241.63		241.63	0.002049	0.24	0.84	2.89	0.14
Cold_10_7	Tributary E	2079.21	25-year	PR	1.84	241.19	242.08		242.09	0.005409	0.65	3.42	9.43	0.26
Cold_10_7	Tributary E	2055.25	25-year	EX	0.20	241.15	241.41	241.41	241.47	0.154773	1.07	0.18	1.65	1.02
Cold_10_7	Tributary E	2055.25	25-year	PR	1.84	241.15	241.75		241.81	0.044235	1.11	1.69	6.29	0.65
Cold_10_7	Tributary E	2016.73	25-year	EX	0.20	240.24	240.47		240.47	0.008870	0.33	0.60	3.93	0.27
Cold_10_7	Tributary E	2016.73	25-year	PR	1.84	240.24	240.80		240.83	0.016232	0.76	2.43	7.24	0.42
Cold_10_7	Tributary E	1965.37	25-year	EX	0.20	239.78	239.97		239.97	0.010616	0.30	0.65	5.65	0.29
Cold_10_7	Tributary E	1965.37	25-year	PR	1.84	239.78	240.36		240.37	0.005593	0.49	3.78	9.95	0.25
Cold_10_7	Tributary E	1917.19	25-year	EX	0.20	239.12	239.51	239.35	239.52	0.008535	0.36	0.55	3.02	0.27
Cold_10_7	Tributary E	1917.19	25-year	PR	1.84	239.12	239.98	239.67	240.00	0.010621	0.73	2.53	6.26	0.35
Cold_10_7	Tributary E	1875.03	25-year	EX	0.20	238.41	238.54	238.54	238.59	0.139174	0.97	0.20	2.11	1.00
Cold_10_7	Tributary E	1875.03	25-year	PR	1.84	238.41	238.84	238.84	239.00	0.092182	1.76	1.06	3.60	0.98
Cold_10_7	Tributary E	1862.94	25-year	EX	0.20	237.78	237.97		237.98	0.006337	0.40	0.50	4.00	0.36
Cold_10_7	Tributary E	1862.94	25-year	PR	1.84	237.78	238.34		238.38	0.005930	0.85	2.17	5.03	0.41
Cold_10_7	Tributary E	1801.09	25-year	EX	0.20	237.21	237.48		237.49	0.010561	0.35	0.56	3.86	0.29
Cold_10_7	Tributary E	1801.09	25-year	PR	1.84	237.21	237.85		237.88	0.011756	0.72	2.56	6.39	0.36
Cold_10_7	Tributary E	1765.21	25-year	EX	0.20	236.57	236.74	236.74	236.78	0.150807	0.95	0.21	2.36	1.01
Cold_10_7	Tributary E	1765.21	25-year	PR	1.84	236.57	237.02	237.02	237.17	0.103339	1.70	1.08	3.77	1.01
Cold_10_7	Tributary E	1718.91	25-year	EX	0.20	235.76	235.97		235.97	0.002152	0.17	1.13	6.74	0.14
Cold_10_7	Tributary E	1718.91	25-year	PR	1.84	235.76	236.33		236.34	0.004128	0.47	3.90	8.37	0.22
Cold_10_7	Tributary E	1661.15	25-year	EX	0.20	235.41	235.55	235.55	235.58	0.137920	0.78	0.26	3.68	0.94
Cold_10_7	Tributary E	1661.15	25-year	PR	1.84	235.41	235.80		235.83	0.029332	0.80	2.31	9.99	0.53
Cold_10_7	Tributary E	1612.45	25-year	EX	0.20	234.02	234.32	234.18	234.33	0.010298	0.41	0.48	2.49	0.30
Cold_10_7	Tributary E	1612.45	25-year	PR	1.84	234.02	234.80	234.51	234.84	0.015085	0.84	2.19	5.00	0.41
Cold_10_7	Tributary E	1568.23	25-year	EX	0.20	233.00	233.15	233.15	233.19	0.145999	0.91	0.22	2.61	1.00
Cold_10_7	Tributary E	1568.23	25-year	PR	1.84	233.00	233.45	233.42	233.57	0.072592	1.49	1.24	4.00	0.86
Cold_10_7	Tributary E	1541.88	25-year	EX	0.20	232.24	232.54		232.55	0.006651	0.33	0.59	3.03	0.24
Cold_10_7	Tributary E	1541.88	25-year	PR	1.84	232.24	233.08		233.11	0.007090	0.68	2.71	4.61	0.28
Cold_10_7	Tributary E	1489.67	25-year	EX	0.20	231.67	231.84		231.86	0.037822	0.62	0.32	2.37	0.54
Cold_10_7	Tributary E	1489.67	25-year	PR	1.84	231.67	232.16		232.27	0.061059	1.51	1.21	3.23	0.79
Cold_10_7	Tributary E	1435.23	25-year	EX	0.20	230.09	230.30	230.23	230.30	0.022255	0.35	0.57	6.87	0.39
Cold_10_7	Tributary E	1435.23	25-year	PR	1.84	230.09	230.53		230.56	0.018677	0.74	2.56	10.31	0.44
Cold_10_7	Tributary E	1380.7	25-year	EX	0.20	228.76	229.07		229.08	0.023110	0.56	0.36	2.03	0.42
Cold_10_7	Tributary E	1380.7	25-year	PR	1.84	228.76	229.49	229.35	229.53	0.020839	0.96	2.35	10.68	0.47
Cold_10_7	Tributary E	1332.54	25-year	EX	0.20	227.38	227.63		227.65	0.040764	0.65	0.31	2.22	0.56
Cold_10_7	Tributary E	1332.54	25-year	PR	1.84	227.38	227.97	227.90	228.06	0.051751	1.33	1.48	6.80	0.72
Cold_10_7	Tributary E	1302.84	25-year	EX	0.20	226.30	226.54		226.55	0.033584	0.55	0.36	2.99	0.51
Cold_10_7	Tributary E	1302.84	25-year	PR	1.84	226.30	226.86		226.91	0.029278	1.01	1.83	5.43	0.55
Cold_10_7	Tributary E	1263.71	25-year	EX	0.20	225.10	225.31		225.32	0.029491	0.51	0.39	3.26	0.48
Cold_10_7	Tributary E	1263.71	25-year	PR	1.84	225.10	225.60		225.65	0.035532	0.97	1.90	7.02	0.59
Cold_10_7	Tributary E	1215.31	25-year	EX	0.20	223.65	223.88	223.82	223.90	0.029147	0.50	0.40	3.48	0.47
Cold_10_7	Tributary E	1215.31	25-year	PR	1.84	223.65	224.23		224.27	0.023055	0.91	2.01	5.87	0.50
Cold_10_7	Tributary E	1168.81	25-year	EX	0.20	222.35	222.55		222.57	0.028361	0.54	0.37	2.79	0.47
Cold_10_7	Tributary E	1168.81	25-year	PR	1.84	222.35	222.88		222.95	0.036061	1.16	1.58	4.42	0.62
Cold_10_7	Tributary E	1130.29	25-year	EX	0.20	221.17	221.35		221.36	0.034720	0.56	0.35	2.89	0.52
Cold_10_7	Tributary E	1130.29	25-year	PR	1.84	221.17	221.74		221.80	0.025330	1.07	1.72	4.09	0.53
Cold_10_7	Tributary E	1111.06	25-year	EX	0.20	220.65	220.92		220.93	0.015464	0.45	0.44	2.71	0.36
Cold_10_7	Tributary E	1111.06	25-year	PR	1.84	220.65	221.35		221.40	0.016941	0.93	1.99	4.31	0.44
Cold_10_7	Tributary E	1084.58	25-year	EX	0.20	220.10	220.34		220.36	0.032385	0.59	0.34	2.45	0.51

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	1084.58	25-year	PR	1.84	220.10	220.71		220.77	0.035013	1.11	1.65	4.85	0.61
Cold_10_7	Tributary E	1048.15	25-year	EX	0.20	219.11	219.36		219.37	0.023044	0.50	0.39	2.84	0.43
Cold_10_7	Tributary E	1048.15	25-year	PR	1.84	219.11	219.78		219.83	0.019802	0.95	1.93	4.58	0.47
Cold_10_7	Tributary E	1028.59	25-year	EX	0.20	218.71	218.99		219.00	0.015897	0.46	0.43	2.62	0.36
Cold_10_7	Tributary E	1028.59	25-year	PR	1.84	218.71	219.45		219.49	0.015421	0.88	2.09	4.61	0.42
Cold_10_7	Tributary E	996.29	25-year	EX	0.20	218.32	218.57		218.58	0.010992	0.40	0.50	2.84	0.30
Cold_10_7	Tributary E	996.29	25-year	PR	1.84	218.32	218.95		218.98	0.016512	0.77	2.72	12.39	0.42
Cold_10_7	Tributary E	965.91	25-year	EX	0.20	217.92	218.10		218.11	0.022566	0.46	0.43	3.51	0.42
Cold_10_7	Tributary E	965.91	25-year	PR	1.84	217.92	218.45		218.48	0.016976	0.78	2.74	14.93	0.43
Cold_10_7	Tributary E	908.46	25-year	EX	0.20	216.79	217.03		217.04	0.015695	0.48	0.41	2.30	0.36
Cold_10_7	Tributary E	908.46	25-year	PR	1.84	216.79	217.46		217.50	0.018013	0.93	2.29	10.56	0.45
Cold_10_7	Tributary E	879.06	25-year	EX	0.20	216.23	216.45		216.46	0.025132	0.57	0.35	2.14	0.45
Cold_10_7	Tributary E	879.06	25-year	PR	1.84	216.23	217.01		217.04	0.013531	0.77	2.40	6.75	0.38
Cold_10_7	Tributary E	847.19	25-year	EX	0.20	215.85	216.17		216.17	0.004610	0.29	0.68	3.26	0.20
Cold_10_7	Tributary E	847.19	25-year	PR	1.84	215.85	216.54		216.57	0.015893	0.82	2.26	5.76	0.42
Cold_10_7	Tributary E	820.81	25-year	EX	0.20	215.47	216.15		216.15	0.000382	0.12	1.94	8.23	0.06
Cold_10_7	Tributary E	820.81	25-year	PR	1.84	215.47	216.40		216.41	0.003133	0.41	5.21	19.59	0.18
Cold_10_7	Tributary E	807.34	25-year	EX	0.20	215.44	216.14	215.62	216.14	0.000100	0.14	1.43	11.33	0.06
Cold_10_7	Tributary E	807.34	25-year	PR	1.84	215.44	216.28	215.94	216.34	0.004269	1.04	1.77	17.79	0.39
Cold_10_7	Tributary E	802.05 hum_427a			Culvert									
Cold_10_7	Tributary E	794.25	25-year	EX	0.20	214.77	214.97	214.85	214.98	0.002030	0.31	0.64	5.82	0.22
Cold_10_7	Tributary E	794.25	25-year	PR	1.84	214.77	215.37	215.10	215.42	0.004647	0.96	1.91	7.87	0.40
Cold_10_7	Tributary E	770.45	25-year	EX	0.20	214.67	214.83		214.84	0.046648	0.54	0.37	4.02	0.57
Cold_10_7	Tributary E	770.45	25-year	PR	1.84	214.67	215.16		215.20	0.024282	0.92	2.01	6.04	0.51
Cold_10_7	Tributary E	738	25-year	EX	0.20	213.98	214.28		214.29	0.008737	0.37	0.54	2.88	0.27
Cold_10_7	Tributary E	738	25-year	PR	1.84	213.98	214.70		214.73	0.009601	0.75	2.92	9.18	0.33
Cold_10_7	Tributary E	686.51	25-year	EX	0.20	213.33	213.52		213.53	0.029572	0.55	0.36	2.70	0.48
Cold_10_7	Tributary E	686.51	25-year	PR	1.84	213.33	213.88		213.94	0.029451	1.09	1.68	4.39	0.56
Cold_10_7	Tributary E	661.93	25-year	EX	0.20	212.92	213.10		213.10	0.011398	0.36	0.56	4.00	0.30
Cold_10_7	Tributary E	661.93	25-year	PR	1.84	212.92	213.47		213.49	0.011920	0.72	2.55	6.41	0.37
Cold_10_7	Tributary E	615.04	25-year	EX	0.20	212.33	212.51		212.52	0.012771	0.37	0.54	3.95	0.32
Cold_10_7	Tributary E	615.04	25-year	PR	1.84	212.33	212.88		212.91	0.011908	0.73	2.63	10.55	0.36
Cold_10_7	Tributary E	580.25	25-year	EX	0.20	211.91	212.11	212.02	212.11	0.010911	0.34	0.57	4.21	0.30
Cold_10_7	Tributary E	580.25	25-year	PR	1.84	211.91	212.49	212.24	212.52	0.010977	0.72	2.56	6.09	0.35
Cold_10_7	Tributary E	544.59	25-year	EX	0.20	211.47	211.79		211.79	0.007549	0.36	0.56	2.85	0.26
Cold_10_7	Tributary E	544.59	25-year	PR	1.84	211.47	212.19		212.21	0.006981	0.58	3.90	24.10	0.28
Cold_10_7	Tributary E	515.79	25-year	EX	0.20	211.17	211.48	211.37	211.49	0.015807	0.44	0.45	3.02	0.36
Cold_10_7	Tributary E	515.79	25-year	PR	1.84	211.17	211.82	211.67	211.87	0.025833	1.02	1.81	17.25	0.53
Cold_10_7	Tributary E	490.99	25-year	EX	0.20	211.02	211.35	211.15	211.35	0.002749	0.24	0.83	3.68	0.16
Cold_10_7	Tributary E	490.99	25-year	PR	1.84	211.02	211.59	211.49	211.59	0.004962	0.45	5.03	67.75	0.23
Cold_10_7	Tributary E	454.35	25-year	EX	0.20	210.82	210.95	210.95	210.99	0.147771	0.90	0.22	2.67	1.01
Cold_10_7	Tributary E	454.35	25-year	PR	1.84	210.82	211.37	211.25	211.38	0.006189	0.48	5.19	38.65	0.26
Cold_10_7	Tributary E	325.04	25-year	EX	0.20	210.06	210.78	210.20	210.78	0.000070	0.06	3.23	7.86	0.03
Cold_10_7	Tributary E	325.04	25-year	PR	1.84	210.06	210.89	210.43	210.90	0.002803	0.43	5.05	22.03	0.19
Cold_10_7	Tributary E	257.06	25-year	EX	0.20	209.82	210.78	209.97	210.78	0.000005	0.02	10.82	36.37	0.01
Cold_10_7	Tributary E	257.06	25-year	PR	1.84	209.82	210.86	210.12	210.86	0.000255	0.16	14.19	43.05	0.06
Cold_10_7	Tributary E	151.19	25-year	EX	0.20	209.26	210.78	209.39	210.78	0.000004	0.02	8.94	20.28	0.01
Cold_10_7	Tributary E	151.19	25-year	PR	1.84	209.26	210.83	209.65	210.83	0.000309	0.19	9.53	20.88	0.07
Cold_10_7	Tributary E	10.011	25-year	EX	34.33	207.93	209.22	209.22	209.68	0.009818	3.08	14.07	23.35	0.91
Cold_10_7	Tributary E	10.011	25-year	PR	34.13	207.93	209.22	209.22	209.68	0.009890	3.08	13.93	23.07	0.91
Cold_10_7	Tributary E	10.01	25-year	EX	34.33	207.54	209.31		209.33	0.000406	0.77	86.57	127.19	0.20
Cold_10_7	Tributary E	10.01	25-year	PR	34.13	207.54	209.31		209.33	0.000401	0.76	86.63	127.22	0.20
Cold_10_7	Tributary E	10.009	25-year	EX	34.33	206.42	209.32	207.32	209.32	0.000024	0.25	377.79	391.02	0.05
Cold_10_7	Tributary E	10.009	25-year	PR	34.13	206.42	209.32	207.31	209.32	0.000023	0.25	377.90	391.06	0.05
Cold_10_7	Tributary E	10.008	25-year	EX	34.33	207.54	209.11	208.51	209.27	0.002239	1.76	19.51	358.82	0.46
Cold_10_7	Tributary E	10.008	25-year	PR	34.13	207.54	209.12	208.51	209.27	0.002196	1.75	19.55	360.50	0.45
Cold_10_7	Tributary E	10.0075			Bridge									
Cold_10_7	Tributary E	10.007	25-year	EX	34.33	207.35	208.64	208.49	208.98	0.007397	2.58	13.71	97.20	0.79
Cold_10_7	Tributary E	10.007	25-year	PR	34.13	207.35	208.72	208.49	209.01	0.005819	2.39	14.72	99.66	0.71
Cold Creek West	Reach1	1784.71	25-year	EX	0.49	254.04	254.41	254.39	254.50	0.036625	1.30	0.38	1.75	0.89
Cold Creek West	Reach1	1784.71	25-year	PR	0.33	254.04	254.35	254.33	254.42	0.037296	1.18	0.28	1.54	0.88
Cold Creek West	Reach1	1752.69	25-year	EX	0.49	253.15	253.46		253.51	0.025969	0.95	0.52	3.15	0.75
Cold Creek West	Reach1	1752.69	25-year	PR	0.33	253.15	253.42		253.46	0.024435	0.82	0.41	2.96	0.71
Cold Creek West	Reach1	1724.34	25-year	EX	0.49	252.47	252.67		252.69	0.031321	0.69	0.71	8.26	0.75
Cold Creek West	Reach1	1724.34	25-year	PR	0.33	252.47	252.65	252.63	252.67	0.031980	0.60	0.55	7.96	0.73
Cold Creek West	Reach1	1663.99	25-year	EX	0.49	249.77	250.19	250.19	250.30	0.050076	1.47	0.33	1.54	1.01
Cold Creek West	Reach1	1663.99	25-year	PR	0.33	249.77	250.13	250.13	250.23	0.051440	1.35	0.25	1.33	1.00
Cold Creek West	Reach1	1612.71	25-year	EX	0.88	248.03	248.50	248.33	248.52	0.005655	0.58	1.51	6.17	0.37
Cold Creek West	Reach1	1612.71	25-year	PR	0.66	248.03	248.45	248.30	248.47	0.005627	0.55	1.21	5.41	0.37
Cold Creek West	Reach1	1586	25-year	EX	0.88	246.87	247.14	247.14	247.19	0.053476	1.05	0.84	7.78	1.02

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold Creek West	Reach1	1586	25-year	PR	0.66	246.87	247.12	247.12	247.17	0.050264	0.94	0.70	7.31	0.97
Cold Creek West	Reach1	1531	25-year	EX	0.88	243.80	244.13	244.13	244.22	0.044002	1.37	0.64	3.39	1.00
Cold Creek West	Reach1	1531	25-year	PR	0.66	243.80	244.09	244.09	244.17	0.046688	1.29	0.51	3.06	1.01
Cold Creek West	Reach1	1458	25-year	EX	0.88	238.86	239.34	239.34	239.42	0.046939	1.27	0.70	4.16	0.99
Cold Creek West	Reach1	1458	25-year	PR	0.66	238.86	239.30	239.30	239.38	0.052342	1.23	0.54	3.67	1.02
Cold Creek West	Reach1	1397	25-year	EX	2.28	236.18	236.49	236.49	236.60	0.043240	1.43	1.60	7.89	1.01
Cold Creek West	Reach1	1397	25-year	PR	2.22	236.18	236.49	236.49	236.59	0.043557	1.42	1.57	7.86	1.01
Cold Creek West	Reach1	1339	25-year	EX	2.28	233.69	234.39	234.32	234.49	0.024926	1.44	1.58	4.78	0.80
Cold Creek West	Reach1	1339	25-year	PR	2.22	233.69	234.38	234.31	234.48	0.024983	1.43	1.55	4.70	0.80
Cold Creek West	Reach1	1206	25-year	EX	2.28	231.11	231.76		231.86	0.015867	1.40	1.63	3.59	0.66
Cold Creek West	Reach1	1206	25-year	PR	2.22	231.11	231.75		231.85	0.015851	1.39	1.60	3.57	0.66
Cold Creek West	Reach1	1205	25-year	EX	2.28	228.43	229.07	229.07	229.28	0.039419	2.02	1.13	2.77	1.01
Cold Creek West	Reach1	1205	25-year	PR	2.22	228.43	229.07	229.07	229.27	0.039524	2.00	1.11	2.75	1.01
Cold Creek West	Reach1	1202.128 10.09.38	25-year	EX	10.03	226.88	227.94		228.03	0.002210	1.41	9.37	15.91	0.46
Cold Creek West	Reach1	1202.128 10.09.38	25-year	PR	10.03	226.88	227.94		228.03	0.002210	1.41	9.37	15.91	0.46
Cold Creek West	Reach1	1202.052 10.09.37	25-year	EX	10.03	226.67	227.69		227.78	0.002421	1.36	8.47	21.88	0.47
Cold Creek West	Reach1	1202.052 10.09.37	25-year	PR	10.03	226.67	227.69		227.78	0.002421	1.36	8.47	21.88	0.47
Cold Creek West	Reach1	1201.976 10.09.36	25-year	EX	10.03	226.67	227.59		227.67	0.002752	1.44	12.05	21.34	0.51
Cold Creek West	Reach1	1201.976 10.09.36	25-year	PR	10.03	226.67	227.59		227.67	0.002752	1.44	12.05	21.34	0.51
Cold Creek West	Reach1	1201.9 10.09.35	25-year	EX	10.03	226.43	227.19		227.36	0.006228	1.85	6.81	14.69	0.73
Cold Creek West	Reach1	1201.9 10.09.35	25-year	PR	10.03	226.43	227.19		227.36	0.006228	1.85	6.81	14.69	0.73
Cold Creek West	Reach1	1201.824 10.09.34	25-year	EX	10.03	226.01	227.06		227.11	0.001557	1.05	12.55	21.17	0.37
Cold Creek West	Reach1	1201.824 10.09.34	25-year	PR	10.03	226.01	227.06		227.11	0.001557	1.05	12.55	21.17	0.37
Cold Creek West	Reach1	1201.748 10.09.33	25-year	EX	10.03	225.86	226.77		226.92	0.004220	1.76	6.65	10.80	0.62
Cold Creek West	Reach1	1201.748 10.09.33	25-year	PR	10.03	225.86	226.77		226.92	0.004220	1.76	6.65	10.80	0.62
Cold Creek West	Reach1	1201.672 10.09.32	25-year	EX	10.03	225.59	226.65		226.70	0.001639	1.18	16.95	33.08	0.39
Cold Creek West	Reach1	1201.672 10.09.32	25-year	PR	10.03	225.59	226.65		226.70	0.001639	1.18	16.95	33.08	0.39
Cold Creek West	Reach1	1201.596 10.09.31	25-year	EX	10.03	225.53	226.18	226.18	226.35	0.008382	2.02	8.54	28.41	0.84
Cold Creek West	Reach1	1201.596 10.09.31	25-year	PR	10.03	225.53	226.18	226.18	226.35	0.008382	2.02	8.54	28.41	0.84
Cold Creek West	Reach1	1201.49 10.09.30	25-year	EX	10.03	225.05	225.78		225.88	0.004859	1.41	7.64	23.18	0.62
Cold Creek West	Reach1	1201.49 10.09.30	25-year	PR	10.03	225.05	225.78		225.88	0.004859	1.41	7.64	23.18	0.62
Cold Creek West	Reach1	1201.444 10.09.29	25-year	EX	10.03	224.42	225.69	225.05	225.74	0.000845	1.03	13.23	16.15	0.30
Cold Creek West	Reach1	1201.444 10.09.29	25-year	PR	10.03	224.42	225.69	225.05	225.74	0.000845	1.03	13.23	16.15	0.30
Cold Creek West	Reach1	1201.368 10.09.28	25-year	EX	10.03	224.24	225.55		225.65	0.002253	1.68	13.03	23.59	0.48
Cold Creek West	Reach1	1201.368 10.09.28	25-year	PR	10.03	224.24	225.55		225.65	0.002253	1.68	13.03	23.59	0.48
Cold Creek West	Reach1	1201.292 10.09.27	25-year	EX	10.03	224.15	225.32		225.46	0.003409	1.95	11.09	25.23	0.59
Cold Creek West	Reach1	1201.292 10.09.27	25-year	PR	10.03	224.15	225.32		225.46	0.003409	1.95	11.09	25.23	0.59
Cold Creek West	Reach1	1201.216 10.09.26	25-year	EX	10.03	224.12	225.25		225.33	0.002063	1.33	8.98	14.98	0.44
Cold Creek West	Reach1	1201.216 10.09.26	25-year	PR	10.03	224.12	225.25		225.33	0.002063	1.33	8.98	14.98	0.44
Cold Creek West	Reach1	1201.198 10.09.25	25-year	EX	10.03	223.94	225.08		225.21	0.003173	1.70	9.51	23.29	0.55
Cold Creek West	Reach1	1201.198 10.09.25	25-year	PR	10.03	223.94	225.08		225.21	0.003173	1.70	9.51	23.29	0.55
Cold Creek West	Reach1	1201.174 10.09.24	25-year	EX	10.03	223.94	225.07	224.74	225.18	0.002649	1.53	9.04	16.75	0.50
Cold Creek West	Reach1	1201.174 10.09.24	25-year	PR	10.03	223.94	225.07	224.74	225.18	0.002649	1.53	9.04	16.75	0.50
Cold Creek West	Reach1	1201.162 x-99 (10.09.23)			Bridge									
Cold Creek West	Reach1	1201.154 10.09.22	25-year	EX	10.03	223.94	225.01	224.66	225.12	0.002424	1.48	7.66	9.80	0.48
Cold Creek West	Reach1	1201.154 10.09.22	25-year	PR	10.03	223.94	225.01	224.66	225.12	0.002424	1.48	7.66	9.80	0.48
Cold Creek West	Reach1	1201.148 10.09.21	25-year	EX	10.03	223.97	224.89		225.08	0.005364	1.93	5.82	9.75	0.69
Cold Creek West	Reach1	1201.148 10.09.21	25-year	PR	10.03	223.97	224.89		225.08	0.005364	1.93	5.82	9.75	0.69
Cold Creek West	Reach1	1201.14 10.09.20	25-year	EX	10.03	223.73	224.90		225.03	0.002758	1.65	7.78	15.25	0.52
Cold Creek West	Reach1	1201.14 10.09.20	25-year	PR	10.03	223.73	224.90		225.03	0.002758	1.65	7.78	15.25	0.52
Cold Creek West	Reach1	1201.064 10.09.19	25-year	EX	10.03	223.58	224.75		224.83	0.001742	1.33	13.26	26.89	0.41
Cold Creek West	Reach1	1201.064 10.09.19	25-year	PR	10.03	223.58	224.75		224.83	0.001742	1.33	13.26	26.89	0.41
Cold Creek West	Reach1	1200.988 10.09.18	25-year	EX	10.03	223.37	224.67		224.73	0.001151	1.18	13.58	21.72	0.34
Cold Creek West	Reach1	1200.988 10.09.18	25-year	PR	10.03	223.37	224.67		224.73	0.001151	1.18	13.58	21.72	0.34
Cold Creek West	Reach1	1200.912 10.09.17	25-year	EX	10.03	223.04	224.14	224.14	224.51	0.009651	2.76	4.34	8.24	0.92
Cold Creek West	Reach1	1200.912 10.09.17	25-year	PR	10.03	223.04	224.14	224.14	224.51	0.009651	2.76	4.34	8.24	0.92
Cold Creek West	Reach1	1200.836 10.09.16	25-year	EX	10.03	222.71	223.97		224.05	0.001588	1.25	8.13	8.29	0.39
Cold Creek West	Reach1	1200.836 10.09.16	25-year	PR	10.03	222.71	223.97		224.05	0.001588	1.25	8.13	8.29	0.39
Cold Creek West	Reach1	1200.76 10.09.15	25-year	EX	10.03	222.68	223.57	223.57	223.88	0.010946	2.50	4.52	8.59	0.96
Cold Creek West	Reach1	1200.76 10.09.15	25-year	PR	10.03	222.68	223.57	223.57	223.88	0.010946	2.50	4.52	8.59	0.96
Cold Creek West	Reach1	1200.684 10.09.14	25-year	EX	10.03	222.35	223.39		223.45	0.001558	1.07	9.60	13.80	0.37
Cold Creek West	Reach1	1200.684 10.09.14	25-year	PR	10.03	222.35	223.39		223.45	0.001558	1.07	9.60	13.80	0.37
Cold Creek West	Reach1	1200.608 10.09.13	25-year	EX	10.03	222.05	223.12		223.25	0.002635	1.57	6.97	9.39	0.50
Cold Creek West	Reach1	1200.608 10.09.13	25-year	PR	10.03	222.05	223.12		223.25	0.002635	1.57	6.97	9.39	0.50
Cold Creek West	Reach1	1200.532 10.09.12	25-year	EX	10.03	221.81	223.01		223.10	0.002259	1.35	7.84	11.34	0.45
Cold Creek West	Reach1	1200.532 10.09.12	25-year	PR	10.03	221.81	223.01		223.10	0.002259	1.35	7.84	11.34	0.45
Cold Creek West	Reach1	1200.456 10.09.11	25-year	EX	10.03	221.69	222.94		222.98	0.000886	0.91	11.39	12.72	0.29
Cold Creek West	Reach1	1200.456 10.09.11	25-year	PR	10.03	221.69	222.94		222.98	0.000886	0.91	11.39	12.72	0.29
Cold Creek West	Reach1	1200.38 10.09.10	25-year	EX	10.03	221.72	222.64	222.50	222.83	0.005368	1.94	6.09	10.78	0.69
Cold Creek West	Reach1	1200.38 10.09.10	25-year	PR	10.03	221.72	222.64	222.50	222.83	0.005368	1.94	6.09	10.78	0.69

HEC-RAS Profile: 25-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold Creek West	Reach1	1200.304 10.09.09	25-year	EX	10.03	221.69	222.45		222.55	0.005722	1.70	12.00	32.07	0.69
Cold Creek West	Reach1	1200.304 10.09.09	25-year	PR	10.03	221.69	222.45		222.55	0.005722	1.70	12.00	32.07	0.69
Cold Creek West	Reach1	1200.278 10.09.08	25-year	EX	10.03	221.09	222.37		222.43	0.001159	1.09	12.72	19.63	0.34
Cold Creek West	Reach1	1200.278 10.09.08	25-year	PR	10.03	221.09	222.37		222.43	0.001159	1.09	12.72	19.63	0.34
Cold Creek West	Reach1	1200.228 10.09.07	25-year	EX	10.03	220.94	222.21		222.31	0.001825	1.46	9.12	15.31	0.43
Cold Creek West	Reach1	1200.228 10.09.07	25-year	PR	10.03	220.94	222.21		222.31	0.001825	1.46	9.12	15.31	0.43
Cold Creek West	Reach1	1200.152 10.09.06	25-year	EX	10.03	220.70	222.15		222.23	0.001463	1.28	9.25	20.41	0.37
Cold Creek West	Reach1	1200.152 10.09.06	25-year	PR	10.03	220.70	222.15		222.23	0.001463	1.28	9.25	20.41	0.37
Cold Creek West	Reach1	1200.076 10.09.05	25-year	EX	10.03	220.67	222.05	221.34	222.10	0.000732	1.00	16.55	32.92	0.28
Cold Creek West	Reach1	1200.076 10.09.05	25-year	PR	10.03	220.67	222.05	221.34	222.10	0.000732	1.00	16.55	32.92	0.28
Cold Creek West	Reach1	1200 10.09.04	25-year	EX	10.03	220.70	222.05	221.32	222.09	0.000692	0.96	11.98	20.77	0.27
Cold Creek West	Reach1	1200 10.09.04	25-year	PR	10.03	220.70	222.05	221.32	222.09	0.000692	0.96	11.98	20.77	0.27
Cold Creek West	Reach1	1199.984 x-98 (10.09.03)			Culvert									
Cold Creek West	Reach1	1199.963 10.09.02	25-year	EX	10.03	220.52	221.63	221.29	221.75	0.003212	1.57	6.39	12.11	0.54
Cold Creek West	Reach1	1199.963 10.09.02	25-year	PR	10.03	220.52	221.63	221.29	221.75	0.003213	1.57	6.39	12.11	0.54
Cold Creek West	Reach1	1199.934 10.09.01	25-year	EX	10.03	220.64	221.36	221.36	221.61	0.011699	2.23	4.80	12.31	0.97
Cold Creek West	Reach1	1199.934 10.09.01	25-year	PR	10.03	220.64	221.36	221.36	221.61	0.011699	2.23	4.80	12.31	0.97

100-Year Storm Event

HEC-RAS Profile: 100-year

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2_trib	Tributary D	1195.922	100-year	EX	2.02	263.57	264.03	264.03	264.18	0.019120	1.70	1.19	4.09	1.00
MM_9_2_trib	Tributary D	1195.922	100-year	PR	1.75	263.57	264.00	264.00	264.14	0.019780	1.65	1.06	3.91	1.01
MM_9_2_trib	Tributary D	1194	100-year	EX	2.02	263.15	263.54		263.59	0.008827	1.05	2.43	15.84	0.67
MM_9_2_trib	Tributary D	1194	100-year	PR	1.75	263.15	263.51	263.49	263.56	0.011434	1.12	1.86	12.72	0.76
MM_9_2_trib	Tributary D	1193.146	100-year	EX	2.02	262.86	263.27	263.12	263.28	0.001554	0.36	5.96	33.78	0.27
MM_9_2_trib	Tributary D	1193.146	100-year	PR	1.75	262.86	263.25		263.26	0.001341	0.36	5.22	27.50	0.26
MM_9_2_trib	Tributary D	1193.1	100-year	EX	2.02	262.94	263.12	263.12	263.16	0.028545	1.22	2.45	25.11	1.09
MM_9_2_trib	Tributary D	1193.1	100-year	PR	1.75	262.94	263.11	263.11	263.15	0.028940	1.18	2.21	24.57	1.09
MM_9_2_trib	Tributary D	1193.002	100-year	EX	2.02	262.16	263.05		263.05	0.000022	0.10	25.08	77.97	0.04
MM_9_2_trib	Tributary D	1193.002	100-year	PR	1.75	262.16	263.04		263.04	0.000018	0.09	23.96	71.70	0.04
MM_9_2_trib	Tributary D	1193.001	100-year	EX	2.02	262.76	263.00	263.00	263.05	0.024756	1.19	2.35	23.07	1.03
MM_9_2_trib	Tributary D	1193.001	100-year	PR	1.75	262.76	262.99	262.99	263.03	0.024149	1.13	2.13	22.11	1.01
MM_9_2_trib	Tributary D	1193	100-year	EX	2.02	261.89	262.30		262.31	0.001851	0.51	3.95	14.64	0.31
MM_9_2_trib	Tributary D	1193	100-year	PR	1.75	261.89	262.28		262.29	0.001792	0.48	3.63	14.37	0.31
MM_9_2_trib	Tributary D	1192.777	100-year	EX	2.02	261.72	262.15		262.19	0.008761	0.84	2.40	13.55	0.64
MM_9_2_trib	Tributary D	1192.777	100-year	PR	1.75	261.72	262.13		262.17	0.009513	0.82	2.13	13.19	0.65
MM_9_2_trib	Tributary D	1192.631	100-year	EX	2.02	261.28	261.79		261.83	0.004737	0.88	2.30	7.62	0.51
MM_9_2_trib	Tributary D	1192.631	100-year	PR	1.75	261.28	261.76		261.80	0.004696	0.84	2.07	7.22	0.50
MM_9_2_trib	Tributary D	1192.407	100-year	EX	2.02	260.76	261.11		261.18	0.012793	1.24	1.63	6.81	0.81
MM_9_2_trib	Tributary D	1192.407	100-year	PR	1.75	260.76	261.08		261.16	0.012762	1.18	1.49	6.68	0.80
MM_9_2_trib	Tributary D	1192.296	100-year	EX	2.02	259.90	260.36	260.36	260.49	0.019932	1.61	1.26	4.87	1.01
MM_9_2_trib	Tributary D	1192.296	100-year	PR	1.75	259.90	260.34	260.34	260.46	0.020382	1.55	1.13	4.70	1.01
MM_9_2_trib	Tributary D	1192.146	100-year	EX	3.45	256.74	257.16	257.16	257.31	0.018705	1.71	2.01	6.85	1.01
MM_9_2_trib	Tributary D	1192.146	100-year	PR	2.99	256.74	257.13	257.13	257.26	0.018945	1.65	1.82	6.62	1.00
MM_9_2_trib	Tributary D	1158.742	100-year	EX	3.45	254.88	255.67	255.66	255.75	0.019232	1.23	2.81	16.03	0.93
MM_9_2_trib	Tributary D	1158.742	100-year	PR	2.99	254.88	255.65	255.64	255.73	0.022213	1.22	2.45	15.60	0.99
MM_9_2_trib	Tributary D	1117.042	100-year	EX	3.45	254.11	254.77	254.77	254.95	0.018657	1.86	1.85	5.41	1.02
MM_9_2_trib	Tributary D	1117.042	100-year	PR	2.99	254.11	254.75	254.74	254.90	0.017351	1.74	1.72	5.30	0.97
MM_9_2_trib	Tributary D	1085.498	100-year	EX	3.45	253.57	254.20	254.20	254.34	0.019351	1.70	2.03	6.95	1.00
MM_9_2_trib	Tributary D	1085.498	100-year	PR	2.99	253.57	254.16	254.16	254.30	0.020695	1.65	1.82	6.86	1.02
MM_9_2_trib	Tributary D	1056.979	100-year	EX	3.45	253.04	253.38	253.38	253.44	0.025239	1.04	3.31	29.86	1.00
MM_9_2_trib	Tributary D	1056.979	100-year	PR	2.99	253.04	253.37	253.37	253.42	0.025300	0.99	3.02	29.60	0.99
MM_9_2_trib	Tributary D	1006.094	100-year	EX	3.45	249.20	249.96	249.96	250.18	0.022802	2.07	1.67	3.90	1.01
MM_9_2_trib	Tributary D	1006.094	100-year	PR	2.99	249.20	249.91	249.91	250.12	0.023104	2.01	1.49	3.70	1.01
MM_9_2_trib	Tributary D	954.6843	100-year	EX	3.45	247.18	247.83	247.83	248.04	0.018340	2.05	1.68	4.02	1.01
MM_9_2_trib	Tributary D	954.6843	100-year	PR	2.99	247.18	247.79	247.79	247.98	0.018661	1.97	1.52	3.97	1.01
MM_9_2_trib	Tributary D	927.8772	100-year	EX	3.45	246.33	247.11	247.11	247.35	0.018750	2.20	1.57	3.27	1.01
MM_9_2_trib	Tributary D	927.8772	100-year	PR	2.99	246.33	247.06	247.06	247.28	0.019008	2.12	1.41	3.14	1.01
MM_9_2_trib	Tributary D	886.4161	100-year	EX	4.72	245.71	246.40		246.56	0.011776	1.78	2.65	5.27	0.80
MM_9_2_trib	Tributary D	886.4161	100-year	PR	4.09	245.71	246.36		246.51	0.011212	1.67	2.45	5.16	0.77
MM_9_2_trib	Tributary D	830.2587	100-year	EX	4.72	245.01	245.80		245.96	0.009780	1.81	2.61	4.69	0.77
MM_9_2_trib	Tributary D	830.2587	100-year	PR	4.09	245.01	245.72	245.64	245.89	0.010825	1.79	2.28	4.51	0.80
MM_9_2_trib	Tributary D	765.2102	100-year	EX	4.72	244.36	244.99	244.98	245.11	0.017708	1.51	3.12	12.29	0.96
MM_9_2_trib	Tributary D	765.2102	100-year	PR	4.09	244.36	244.89	244.87	245.05	0.015495	1.76	2.33	6.56	0.94
MM_9_2_trib	Tributary D	719.386	100-year	EX	4.72	244.08	244.44		244.50	0.009927	1.07	4.43	19.24	0.71
MM_9_2_trib	Tributary D	719.386	100-year	PR	4.09	244.08	244.42	244.37	244.47	0.009387	0.99	4.12	19.11	0.68
MM_9_2_trib	Tributary D	691.6686	100-year	EX	4.72	243.69	244.01	244.01	244.09	0.023301	1.24	3.81	25.07	1.01
MM_9_2_trib	Tributary D	691.6686	100-year	PR	4.09	243.69	244.00	244.00	244.07	0.024610	1.19	3.43	24.89	1.03
MM_9_2_trib	Tributary D	639.0789	100-year	EX	4.72	241.96	242.80	242.80	243.02	0.017386	2.11	2.23	4.95	1.01
MM_9_2_trib	Tributary D	639.0789	100-year	PR	4.09	241.96	242.74	242.74	242.96	0.017509	2.07	1.97	4.53	1.00
MM_9_2_trib	Tributary D	605.7167	100-year	EX	4.72	241.38	242.20	242.20	242.43	0.017574	2.11	2.23	5.02	1.01
MM_9_2_trib	Tributary D	605.7167	100-year	PR	4.09	241.38	242.15	242.15	242.37	0.017414	2.05	1.99	4.63	1.00
MM_9_2_trib	Tributary D	552.2101	100-year	EX	4.72	239.59	240.53	240.53	240.70	0.018983	1.81	2.60	7.81	1.00
MM_9_2_trib	Tributary D	552.2101	100-year	PR	4.09	239.59	240.50	240.50	240.65	0.019378	1.75	2.33	7.48	1.00
MM_9_2_trib	Tributary D	508.8769	100-year	EX	4.72	238.89	239.75		239.93	0.012427	1.90	2.48	5.00	0.86
MM_9_2_trib	Tributary D	508.8769	100-year	PR	4.09	238.89	239.71		239.87	0.010930	1.78	2.30	4.64	0.80
MM_9_2_trib	Tributary D	457.6058	100-year	EX	4.72	238.50	239.01	239.01	239.10	0.020523	1.29	3.66	20.47	0.97
MM_9_2_trib	Tributary D	457.6058	100-year	PR	4.09	238.50	238.99	238.99	239.07	0.022336	1.26	3.25	20.05	1.00
MM_9_2_trib	Tributary D	393.3919	100-year	EX	4.72	236.93	237.46	237.46	237.63	0.018637	1.81	2.61	8.13	1.02
MM_9_2_trib	Tributary D	393.3919	100-year	PR	4.09	236.93	237.43	237.43	237.58	0.018797	1.73	2.36	7.94	1.01
MM_9_2_trib	Tributary D	345.8717	100-year	EX	4.72	236.53	237.00		237.04	0.004617	0.94	5.02	14.76	0.51
MM_9_2_trib	Tributary D	345.8717	100-year	PR	4.09	236.53	236.97		237.01	0.004322	0.87	4.68	14.60	0.49
MM_9_2_trib	Tributary D	308.4069	100-year	EX	4.72	236.36	236.68	236.66	236.75	0.015851	1.17	4.03	21.55	0.86
MM_9_2_trib	Tributary D	308.4069	100-year	PR	4.09	236.36	236.66	236.64	236.72	0.017061	1.13	3.60	21.35	0.88
MM_9_2_trib	Tributary D	261.2717	100-year	EX	4.72	234.87	235.75	235.75	235.88	0.021278	1.60	2.94	11.53	1.01
MM_9_2_trib	Tributary D	261.2717	100-year	PR	4.09	234.87	235.72	235.72	235.84	0.020293	1.53	2.68	10.90	0.98
MM_9_2_trib	Tributary D	237.4458	100-year	EX	4.72	234.36	235.10	235.10	235.31	0.018519	2.02	2.33	5.76	1.01
MM_9_2_trib	Tributary D	237.4458	100-year	PR	4.09	234.36	235.07	235.07	235.26	0.018437	1.93	2.12	5.61	1.00
MM_9_2_trib	Tributary D	197.6155	100-year	EX	4.72	233.46	233.90		233.95	0.007127	1.03	4.59	16.16	0.61
MM_9_2_trib	Tributary D	197.6155	100-year	PR	4.09	233.46	233.87		233.92	0.007403	0.99	4.12	15.66	0.62
MM_9_2_trib	Tributary D	176.7205	100-year	EX	4.72	233.02	233.57	233.57	233.71	0.019756	1.67	2.83	10.41	1.02

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2_trib	Tributary D	176.7205	100-year	PR	4.09	233.02	233.54	233.54	233.67	0.019910	1.60	2.56	10.12	1.01
MM_9_2_trib	Tributary D	163.5648	100-year	EX	4.72	232.73	233.26	233.26	233.40	0.020333	1.60	2.94	11.77	1.02
MM_9_2_trib	Tributary D	163.5648	100-year	PR	4.09	232.73	233.24	233.24	233.36	0.020536	1.54	2.65	11.29	1.02
MM_9_2_trib	Tributary D	151.4771	100-year	EX	4.72	231.39	231.96	231.96	232.16	0.017633	2.01	2.35	5.80	1.01
MM_9_2_trib	Tributary D	151.4771	100-year	PR	4.09	231.39	231.92	231.92	232.11	0.017937	1.92	2.13	5.70	1.01
MM_9_2_trib	Tributary D	140.92	100-year	EX	4.72	231.16	231.63	231.63	231.76	0.019896	1.59	2.97	11.88	1.02
MM_9_2_trib	Tributary D	140.92	100-year	PR	4.09	231.16	231.60	231.60	231.72	0.020562	1.53	2.68	11.65	1.02
MM_9_2_trib	Tributary D	123.28	100-year	EX	4.72	229.65	230.58	230.58	230.78	0.019719	1.97	2.39	6.33	1.02
MM_9_2_trib	Tributary D	123.28	100-year	PR	4.09	229.65	230.55	230.55	230.73	0.019473	1.87	2.19	6.22	1.01
MM_9_2_trib	Tributary D	89.70679	100-year	EX	4.72	228.90	229.83	229.83	230.09	0.017782	2.27	2.08	4.05	1.01
MM_9_2_trib	Tributary D	89.70679	100-year	PR	4.09	228.90	229.77	229.77	230.02	0.018072	2.22	1.84	3.74	1.01
MM_9_2_trib	Tributary D	72.5771	100-year	EX	4.72	228.51	229.24	229.24	229.48	0.017554	2.18	2.17	4.57	1.01
MM_9_2_trib	Tributary D	72.5771	100-year	PR	4.09	228.51	229.19	229.19	229.42	0.017973	2.10	1.95	4.43	1.01
MM_9_2_trib	Tributary D	51.16022	100-year	EX	4.72	228.00	228.81	228.81	228.90	0.023698	1.27	3.70	23.42	1.02
MM_9_2_trib	Tributary D	51.16022	100-year	PR	4.09	228.00	228.80	228.80	228.87	0.023088	1.24	3.29	21.19	1.01
MM_9_2_trib	Tributary D	26.54893	100-year	EX	4.72	227.45	227.86	227.86	228.02	0.018415	1.75	2.69	8.69	1.01
MM_9_2_trib	Tributary D	26.54893	100-year	PR	4.09	227.45	227.83	227.83	227.98	0.018741	1.70	2.41	8.32	1.01
MM_9_2_trib	Tributary B	1005	100-year	EX	0.63	256.65	256.93	256.93	257.03	0.022285	1.38	0.46	2.38	1.01
MM_9_2_trib	Tributary B	1005	100-year	PR	0.60	256.65	256.93	256.93	257.02	0.022627	1.37	0.44	2.35	1.01
MM_9_2_trib	Tributary B	1004.6	100-year	EX	0.63	255.56	255.79	255.79	255.88	0.022916	1.30	0.49	2.89	1.01
MM_9_2_trib	Tributary B	1004.6	100-year	PR	0.60	255.56	255.79	255.79	255.87	0.023141	1.28	0.47	2.87	1.01
MM_9_2_trib	Tributary B	1004	100-year	EX	0.63	254.60	254.83	254.83	254.90	0.023950	1.20	0.53	3.69	1.01
MM_9_2_trib	Tributary B	1004	100-year	PR	0.60	254.60	254.83	254.83	254.90	0.024301	1.18	0.51	3.65	1.01
MM_9_2_trib	Tributary B	1003	100-year	EX	0.63	251.29	251.54	251.54	251.63	0.022812	1.33	0.47	2.68	1.01
MM_9_2_trib	Tributary B	1003	100-year	PR	0.60	251.29	251.53	251.53	251.62	0.022646	1.31	0.46	2.65	1.01
MM_9_2_trib	Tributary B	1002	100-year	EX	0.63	249.03	249.39	249.39	249.50	0.023121	1.41	0.45	2.27	1.01
MM_9_2_trib	Tributary B	1002	100-year	PR	0.60	249.03	249.39	249.39	249.49	0.022948	1.38	0.43	2.25	1.00
MM_9_2_trib	Tributary B	1001.4	100-year	EX	0.63	247.85	248.27		248.30	0.005800	0.80	0.79	3.34	0.53
MM_9_2_trib	Tributary B	1001.4	100-year	PR	0.60	247.85	248.27		248.30	0.005676	0.79	0.76	3.31	0.52
MM_9_2_trib	Tributary B	1001	100-year	EX	0.63	247.79	248.01	248.01	248.07	0.024379	1.12	0.57	4.49	1.00
MM_9_2_trib	Tributary B	1001	100-year	PR	0.60	247.79	248.00	248.00	248.06	0.024978	1.11	0.54	4.45	1.01
MM_9_2_trib	Tributary B	1000.8	100-year	EX	0.63	247.16	247.36	247.36	247.40	0.032779	0.90	0.71	9.76	1.06
MM_9_2_trib	Tributary B	1000.8	100-year	PR	0.60	247.16	247.36	247.36	247.40	0.032075	0.88	0.68	9.64	1.05
MM_9_2_trib	Tributary B	1000.2	100-year	EX	0.63	246.61	247.13		247.13	0.000034	0.09	7.24	18.76	0.04
MM_9_2_trib	Tributary B	1000.2	100-year	PR	0.60	246.61	247.07		247.07	0.000052	0.10	6.10	18.45	0.05
MM_9_2_trib	Tributary B	1000	100-year	EX	0.63	245.34	247.12	245.66	247.13	0.000051	0.30	2.12	17.26	0.07
MM_9_2_trib	Tributary B	1000	100-year	PR	0.60	245.34	247.06	245.65	247.07	0.000052	0.29	2.05	16.77	0.07
MM_9_2_trib	Tributary B	999.64			Culvert									
MM_9_2_trib	Tributary B	999	100-year	EX	1.02	242.45	242.91	242.91	243.12	0.016941	2.04	0.50	2.48	1.01
MM_9_2_trib	Tributary B	999	100-year	PR	0.98	242.45	242.90	242.90	243.10	0.016664	2.00	0.49	2.46	1.00
MM_9_2_trib	Tributary B	998	100-year	EX	1.02	240.71	241.16	241.16	241.30	0.021152	1.67	0.61	2.19	1.01
MM_9_2_trib	Tributary B	998	100-year	PR	0.98	240.71	241.15	241.15	241.29	0.021215	1.65	0.59	2.17	1.01
MM_9_2_trib	Tributary B	997.4	100-year	EX	1.02	238.99	239.30	239.30	239.40	0.021651	1.40	0.73	3.76	1.01
MM_9_2_trib	Tributary B	997.4	100-year	PR	0.98	238.99	239.30	239.30	239.40	0.021895	1.38	0.71	3.71	1.01
MM_9_2_trib	Tributary B	997	100-year	EX	1.02	236.98	237.31	237.31	237.38	0.026966	1.11	0.92	7.95	1.04
MM_9_2_trib	Tributary B	997	100-year	PR	0.98	236.98	237.31	237.31	237.37	0.023318	1.04	0.94	7.97	0.97
MM_9_2_trib	Tributary B	996	100-year	EX	1.02	234.21	234.67	234.67	234.75	0.022775	1.27	0.81	4.91	1.00
MM_9_2_trib	Tributary B	996	100-year	PR	0.98	234.21	234.64	234.64	234.74	0.019704	1.44	0.68	3.04	0.97
MM_9_2_trib	Tributary B	995.4	100-year	EX	1.02	231.73	232.05	232.05	232.16	0.021078	1.51	0.68	2.98	1.01
MM_9_2_trib	Tributary B	995.4	100-year	PR	0.98	231.73	232.04	232.04	232.15	0.021287	1.49	0.66	2.95	1.01
MM_9_2_trib	Tributary B	994.4	100-year	EX	1.02	229.20	229.22	229.22	229.26	0.134864	0.69	1.14	13.80	1.69
MM_9_2_trib	Tributary B	994.4	100-year	PR	0.98	229.20	229.22	229.22	229.26	0.135714	0.63	1.10	13.42	1.66
MM_9_2_trib	Tributary B	994	100-year	EX	1.02	227.10	228.45		228.45	0.000010	0.06	37.30	102.30	0.02
MM_9_2_trib	Tributary B	994	100-year	PR	0.98	227.10	228.45		228.45	0.000009	0.05	37.29	102.29	0.02
MM_9_2	Tributary C	2179.936	100-year	EX	1.76	256.76	256.97		256.99	0.010241	0.60	2.94	31.13	0.62
MM_9_2	Tributary C	2179.936	100-year	PR	1.51	256.76	256.95		256.97	0.010495	0.59	2.57	28.47	0.63
MM_9_2	Tributary C	2159.385	100-year	EX	1.76	256.64	256.88		256.88	0.002801	0.39	4.52	34.53	0.34
MM_9_2	Tributary C	2159.385	100-year	PR	1.51	256.64	256.86		256.87	0.002830	0.37	4.04	33.20	0.34
MM_9_2	Tributary C	2097.132	100-year	EX	1.76	256.48	256.70		256.71	0.002758	0.43	4.13	27.27	0.35
MM_9_2	Tributary C	2097.132	100-year	PR	1.51	256.48	256.69		256.69	0.002783	0.40	3.74	26.90	0.35
MM_9_2	Tributary C	2030.564	100-year	EX	1.76	256.04	256.23	256.23	256.29	0.024770	1.11	1.59	12.92	1.01
MM_9_2	Tributary C	2030.564	100-year	PR	1.51	256.04	256.22	256.22	256.27	0.025001	1.06	1.43	12.54	1.00
MM_9_2	Tributary C	1994	100-year	EX	1.76	255.61	255.97		255.98	0.000427	0.25	7.06	25.68	0.15
MM_9_2	Tributary C	1994	100-year	PR	1.51	255.61	255.95		255.95	0.000443	0.24	6.33	25.29	0.15
MM_9_2	Tributary C	1970.384	100-year	EX	1.76	255.41	255.97		255.97	0.000072	0.13	13.74	35.62	0.07
MM_9_2	Tributary C	1970.384	100-year	PR	1.51	255.41	255.94		255.94	0.000066	0.12	12.73	34.77	0.06
MM_9_2	Tributary C	1911.614	100-year	EX	1.76	255.36	255.97	255.53	255.97	0.000050	0.12	14.41	30.39	0.06
MM_9_2	Tributary C	1911.614	100-year	PR	1.51	255.36	255.94	255.53	255.94	0.000044	0.11	13.55	30.16	0.05
MM_9_2	Tributary C	1881.066			Bridge									
MM_9_2	Tributary C	1855.838	100-year	EX	2.06	255.52	255.72	255.72	255.78	0.024014	1.13	1.82	14.04	1.00

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2	Tributary C	1855.838	100-year	PR	1.77	255.52	255.70	255.70	255.76	0.024651	1.08	1.64	13.76	1.00
MM_9_2	Tributary C	1813.506	100-year	EX	2.06	254.71	254.89	254.86	254.92	0.012334	0.81	2.55	19.89	0.72
MM_9_2	Tributary C	1813.506	100-year	PR	1.77	254.71	254.88		254.91	0.012042	0.76	2.34	19.66	0.70
MM_9_2	Tributary C	1775.696	100-year	EX	2.06	254.15	254.32	254.28	254.34	0.009689	0.69	2.98	24.57	0.63
MM_9_2	Tributary C	1775.696	100-year	PR	1.77	254.15	254.30	254.27	254.33	0.010004	0.66	2.69	24.25	0.63
MM_9_2	Tributary C	1726.57	100-year	EX	2.06	252.83	253.16	253.16	253.24	0.023915	1.22	1.69	11.61	1.02
MM_9_2	Tributary C	1726.57	100-year	PR	1.77	252.83	253.15	253.15	253.22	0.023161	1.17	1.51	10.70	1.00
MM_9_2	Tributary C	1684.01	100-year	EX	2.06	251.82	252.08	252.08	252.12	0.026617	0.92	2.25	25.79	0.99
MM_9_2	Tributary C	1684.01	100-year	PR	1.77	251.82	252.07	252.07	252.11	0.025449	0.86	2.06	25.10	0.96
MM_9_2	Tributary C	1603.573	100-year	EX	2.06	251.65	251.90		251.90	0.000437	0.16	13.20	98.95	0.14
MM_9_2	Tributary C	1603.573	100-year	PR	1.77	251.65	251.89		251.89	0.000416	0.15	12.17	97.51	0.13
MM_9_2	Tributary C	1539.326	100-year	EX	2.06	251.65	251.81		251.82	0.011341	0.57	3.61	44.49	0.64
MM_9_2	Tributary C	1539.326	100-year	PR	1.77	251.65	251.80		251.81	0.012215	0.55	3.19	43.16	0.65
MM_9_2	Tributary C	1486.021	100-year	EX	2.06	250.90	251.20		251.24	0.010342	0.89	2.30	13.45	0.69
MM_9_2	Tributary C	1486.021	100-year	PR	1.77	250.90	251.19		251.22	0.009988	0.85	2.08	12.70	0.67
MM_9_2	Tributary C	1450.067	100-year	EX	2.06	250.28	250.65	250.65	250.73	0.021482	1.19	1.73	11.41	0.97
MM_9_2	Tributary C	1450.067	100-year	PR	1.77	250.28	250.64	250.64	250.70	0.022560	1.14	1.55	11.23	0.98
MM_9_2	Tributary C	1406.638	100-year	EX	2.06	249.69	250.05		250.09	0.007189	0.81	2.55	13.21	0.58
MM_9_2	Tributary C	1406.638	100-year	PR	1.77	249.69	250.03	249.98	250.06	0.007975	0.79	2.25	13.06	0.60
MM_9_2	Tributary C	1338.455	100-year	EX	2.06	248.69	249.19	249.19	249.27	0.023594	1.25	1.64	10.60	1.02
MM_9_2	Tributary C	1338.455	100-year	PR	1.77	248.69	249.11	249.11	249.24	0.019956	1.57	1.13	4.54	1.00
MM_9_2	Tributary C	1304.352	100-year	EX	2.06	247.99	248.39	248.36	248.47	0.014181	1.23	1.68	7.53	0.83
MM_9_2	Tributary C	1304.352	100-year	PR	1.77	247.99	248.37	248.34	248.44	0.014036	1.16	1.52	7.36	0.82
MM_9_2	Tributary C	1265.187	100-year	EX	2.06	247.35	247.69	247.69	247.81	0.020178	1.53	1.34	5.63	1.00
MM_9_2	Tributary C	1265.187	100-year	PR	1.77	247.35	247.66	247.66	247.77	0.021038	1.48	1.20	5.50	1.01
MM_9_2	Tributary C	1206.875	100-year	EX	2.06	246.19	246.63		246.70	0.009432	1.18	1.75	6.19	0.71
MM_9_2	Tributary C	1206.875	100-year	PR	1.77	246.19	246.60		246.66	0.009529	1.12	1.58	6.02	0.70
MM_9_2	Tributary C	1175.661	100-year	EX	2.06	245.83	246.17	246.17	246.24	0.026084	1.18	1.75	13.46	1.04
MM_9_2	Tributary C	1175.661	100-year	PR	1.77	245.83	246.16	246.16	246.22	0.023259	1.07	1.65	13.43	0.98
MM_9_2	Tributary C	1120.613	100-year	EX	2.06	244.63	245.12		245.18	0.009635	1.07	1.92	7.83	0.69
MM_9_2	Tributary C	1120.613	100-year	PR	1.77	244.63	245.09		245.15	0.010072	1.04	1.70	7.49	0.70
MM_9_2	Tributary C	1083.716	100-year	EX	2.06	244.05	244.51	244.51	244.68	0.019002	1.81	1.14	3.48	1.01
MM_9_2	Tributary C	1083.716	100-year	PR	1.77	244.05	244.48	244.48	244.63	0.019424	1.73	1.02	3.40	1.01
MM_9_2	Tributary C	1042.153	100-year	EX	2.06	243.04	243.55	243.50	243.60	0.011458	0.99	2.07	10.95	0.73
MM_9_2	Tributary C	1042.153	100-year	PR	1.77	243.04	243.52	243.48	243.57	0.011817	0.96	1.85	10.53	0.73
MM_9_2	Tributary C	1006.177	100-year	EX	2.06	242.45	242.91	242.91	243.04	0.020969	1.58	1.30	5.25	1.02
MM_9_2	Tributary C	1006.177	100-year	PR	1.77	242.45	242.89	242.89	243.01	0.021311	1.51	1.17	5.14	1.01
MM_9_2	Tributary C	993.3609	100-year	EX	3.01	241.83	242.61		242.66	0.004009	1.00	3.00	7.01	0.49
MM_9_2	Tributary C	993.3609	100-year	PR	2.58	241.83	242.56		242.61	0.004167	0.97	2.66	6.73	0.49
MM_9_2	Tributary C	935.4169	100-year	EX	3.01	241.33	241.99	241.99	242.21	0.018630	2.06	1.46	3.46	1.01
MM_9_2	Tributary C	935.4169	100-year	PR	2.58	241.33	241.94	241.94	242.14	0.018838	1.98	1.30	3.29	1.01
MM_9_2	Tributary C	870.5434	100-year	EX	3.01	239.51	240.19	240.19	240.43	0.019129	2.13	1.41	3.09	1.01
MM_9_2	Tributary C	870.5434	100-year	PR	2.58	239.51	240.14	240.14	240.36	0.019402	2.06	1.25	2.93	1.01
MM_9_2	Tributary C	836.4684	100-year	EX	3.01	238.61	239.16	239.16	239.37	0.018320	2.02	1.49	3.64	1.01
MM_9_2	Tributary C	836.4684	100-year	PR	2.58	238.61	239.11	239.11	239.30	0.018608	1.94	1.33	3.51	1.01
MM_9_2	Tributary C	799.8246	100-year	EX	3.01	237.89	238.44	238.44	238.62	0.018591	1.86	1.62	4.67	1.01
MM_9_2	Tributary C	799.8246	100-year	PR	2.58	237.89	238.40	238.40	238.56	0.019035	1.79	1.44	4.51	1.01
MM_9_2	Tributary C	745.4448	100-year	EX	3.01	235.79	236.23	236.23	236.40	0.018429	1.83	1.65	4.91	1.01
MM_9_2	Tributary C	745.4448	100-year	PR	2.58	235.79	236.19	236.19	236.35	0.018751	1.75	1.48	4.77	1.00
MM_9_2	Tributary C	716.4415	100-year	EX	3.01	234.84	235.29		235.39	0.010826	1.36	2.21	6.79	0.76
MM_9_2	Tributary C	716.4415	100-year	PR	2.58	234.84	235.26		235.34	0.010881	1.30	1.98	6.58	0.76
MM_9_2	Tributary C	687.3773	100-year	EX	3.01	234.27	234.84	234.84	234.97	0.019991	1.60	1.88	7.31	1.01
MM_9_2	Tributary C	687.3773	100-year	PR	2.58	234.27	234.81	234.81	234.93	0.019638	1.52	1.69	6.95	0.99
MM_9_2	Tributary C	661.4518	100-year	EX	3.01	233.56	233.98	233.98	234.14	0.018589	1.78	1.69	5.28	1.01
MM_9_2	Tributary C	661.4518	100-year	PR	2.58	233.56	233.95	233.95	234.09	0.019066	1.70	1.52	5.21	1.01
MM_9_2	Tributary C	627.6722	100-year	EX	3.01	232.58	233.09	233.09	233.26	0.019293	1.86	1.62	4.69	1.01
MM_9_2	Tributary C	627.6722	100-year	PR	2.58	232.58	233.05	233.05	233.21	0.019471	1.77	1.45	4.56	1.00
MM_9_2	Tributary C	589.2625	100-year	EX	3.01	231.90	232.45		232.51	0.005789	1.03	2.91	8.71	0.57
MM_9_2	Tributary C	589.2625	100-year	PR	2.58	231.90	232.41		232.46	0.005955	0.99	2.59	8.39	0.57
MM_9_2	Tributary C	540.5079	100-year	EX	3.01	231.39	231.86	231.86	232.03	0.018674	1.81	1.66	5.05	1.01
MM_9_2	Tributary C	540.5079	100-year	PR	2.58	231.39	231.82	231.82	231.98	0.018892	1.74	1.48	4.86	1.00
MM_9_2	Tributary C	510.2238	100-year	EX	3.01	230.56	230.98	230.98	231.10	0.021266	1.53	1.97	8.59	1.02
MM_9_2	Tributary C	510.2238	100-year	PR	2.58	230.56	230.96	230.96	231.06	0.021043	1.45	1.78	8.29	1.00
MM_9_2	Tributary C	457.5412	100-year	EX	3.01	228.97	229.58	229.55	229.76	0.015960	1.88	1.60	3.75	0.92
MM_9_2	Tributary C	457.5412	100-year	PR	2.58	228.97	229.54	229.51	229.70	0.015899	1.79	1.44	3.63	0.91
MM_9_2	Tributary C	414.0466	100-year	EX	3.01	228.37	229.04		229.16	0.011333	1.52	1.98	5.30	0.79
MM_9_2	Tributary C	414.0466	100-year	PR	2.58	228.37	229.01		229.11	0.011001	1.43	1.80	5.16	0.77
MM_9_2	Tributary C	374.4607	100-year	EX	3.01	227.94	228.44	228.44	228.58	0.019816	1.64	1.83	6.85	1.02
MM_9_2	Tributary C	374.4607	100-year	PR	2.58	227.94	228.41	228.41	228.54	0.020105	1.56	1.65	6.74	1.01
MM_9_2	Tributary C	330.2584	100-year	EX	3.01	227.43	227.74		227.77	0.011311	0.79	3.82	28.59	0.69
MM_9_2	Tributary C	330.2584	100-year	PR	2.58	227.43	227.73	227.69	227.76	0.010900	0.75	3.44	26.98	0.67

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2	Tributary C + D	294	100-year	EX	0.20	226.97	227.10	227.10	227.12	0.037254	0.64	0.32	7.93	1.03
MM_9_2	Tributary C + D	294	100-year	PR	0.20	226.97	227.10	227.10	227.12	0.038080	0.65	0.31	7.79	1.04
MM_9_2	Tributary C + D	266.3048	100-year	EX	0.20	224.85	224.99	224.99	225.04	0.026872	1.01	0.20	1.98	1.01
MM_9_2	Tributary C + D	266.3048	100-year	PR	0.20	224.85	224.99	224.99	225.04	0.026823	1.00	0.20	1.98	1.01
MM_9_2	Tributary C + D	236.2558	100-year	EX	0.20	223.38	223.63		223.66	0.011401	0.82	0.25	1.66	0.68
MM_9_2	Tributary C + D	236.2558	100-year	PR	0.20	223.38	223.63		223.66	0.011378	0.82	0.24	1.66	0.68
MM_9_2	Tributary C + D	205.6305	100-year	EX	0.20	222.98	223.17	223.15	223.21	0.019382	0.94	0.21	1.80	0.87
MM_9_2	Tributary C + D	205.6305	100-year	PR	0.20	222.98	223.17	223.15	223.21	0.019396	0.94	0.21	1.79	0.87
MM_9_2	Tributary C + D	173.8239	100-year	EX	0.20	222.27	222.41	222.41	222.45	0.029914	0.88	0.23	3.01	1.02
MM_9_2	Tributary C + D	173.8239	100-year	PR	0.20	222.27	222.41	222.41	222.45	0.029864	0.88	0.23	3.01	1.02
MM_9_2	Tributary C + D	151.7834	100-year	EX	0.20	221.52	221.74	221.67	221.75	0.004023	0.47	0.43	3.11	0.41
MM_9_2	Tributary C + D	151.7834	100-year	PR	0.20	221.52	221.74	221.67	221.75	0.004012	0.47	0.42	3.10	0.41
MM_9_2	Tributary C + D	116.6732	100-year	EX	0.20	221.27	221.41	221.41	221.45	0.027248	0.94	0.21	2.36	1.00
MM_9_2	Tributary C + D	116.6732	100-year	PR	0.20	221.27	221.40	221.40	221.45	0.027371	0.94	0.21	2.35	1.00
MM_9_2	Tributary C + D	66.5837	100-year	EX	0.20	220.30	221.29		221.29	0.000004	0.03	6.86	19.38	0.02
MM_9_2	Tributary C + D	66.5837	100-year	PR	0.20	220.30	221.29		221.29	0.000004	0.03	6.86	19.38	0.02
MM_9_2	Tributary C + D	34.76245	100-year	EX	0.20	219.88	221.29		221.29	0.000001	0.01	14.81	51.14	0.01
MM_9_2	Tributary C + D	34.76245	100-year	PR	0.20	219.88	221.29		221.29	0.000001	0.01	14.80	51.12	0.01
Main_1	Tributary A	1017	100-year	EX	0.19	254.63	254.80	254.80	254.83	0.031860	0.76	0.25	4.23	1.01
Main_1	Tributary A	1017	100-year	PR	0.20	254.63	254.81	254.81	254.84	0.033578	0.78	0.25	4.37	1.04
Main_1	Tributary A	1000	100-year	EX	0.19	253.30	253.47	253.47	253.50	0.030303	0.77	0.24	3.96	0.99
Main_1	Tributary A	1000	100-year	PR	0.20	253.30	253.47	253.47	253.51	0.030164	0.78	0.26	4.09	1.00
Main_1	Tributary A	999	100-year	EX	0.19	252.17	252.34		252.34	0.000299	0.08	2.43	23.14	0.08
Main_1	Tributary A	999	100-year	PR	0.20	252.17	252.34		252.34	0.000300	0.08	2.53	23.26	0.08
Main_1	Tributary A	998.6	100-year	EX	0.19	252.16	252.32		252.33	0.000311	0.12	1.59	13.99	0.11
Main_1	Tributary A	998.6	100-year	PR	0.20	252.16	252.33		252.33	0.000319	0.12	1.64	14.13	0.11
Main_1	Tributary A	998.4	100-year	EX	0.19	252.18	252.30	252.27	252.30	0.004645	0.25	0.76	16.76	0.37
Main_1	Tributary A	998.4	100-year	PR	0.20	252.18	252.30	252.27	252.31	0.004550	0.25	0.80	17.10	0.37
Main_1	Tributary A	998	100-year	EX	0.19	251.77	251.87	251.87	251.90	0.029938	0.79	0.24	3.75	1.00
Main_1	Tributary A	998	100-year	PR	0.20	251.77	251.87	251.87	251.91	0.030697	0.81	0.25	3.79	1.01
Main_1	Tributary A	997.7	100-year	EX	0.19	249.12	249.35	249.35	249.41	0.026666	1.08	0.17	1.50	1.01
Main_1	Tributary A	997.7	100-year	PR	0.20	249.12	249.36	249.36	249.42	0.026827	1.10	0.18	1.53	1.02
Main_1	Tributary A	997	100-year	EX	0.19	245.46	245.68	245.68	245.74	0.026647	1.03	0.18	1.70	1.00
Main_1	Tributary A	997	100-year	PR	0.20	245.46	245.69	245.69	245.74	0.027058	1.04	0.19	1.77	1.01
Main_1	Tributary A	996.6	100-year	EX	0.19	242.09	242.21	242.21	242.24	0.030428	0.77	0.24	4.02	0.99
Main_1	Tributary A	996.6	100-year	PR	0.20	242.09	242.21	242.21	242.24	0.031441	0.79	0.25	4.06	1.02
Main_1	Tributary A	996	100-year	EX	1.05	237.55	237.71	237.71	237.76	0.027013	0.95	1.10	12.00	1.01
Main_1	Tributary A	996	100-year	PR	1.13	237.55	237.71	237.71	237.76	0.027466	0.98	1.15	12.18	1.02
Main_1	Tributary A	995.8	100-year	EX	1.05	235.82	235.95	235.95	236.00	0.026648	0.95	1.10	11.90	1.00
Main_1	Tributary A	995.8	100-year	PR	1.13	235.82	235.96	235.96	236.01	0.026884	0.98	1.15	11.92	1.01
Main_1	Tributary A	995.6	100-year	EX	1.05	234.22	234.60	234.53	234.62	0.011534	0.73	1.44	12.46	0.68
Main_1	Tributary A	995.6	100-year	PR	1.13	234.22	234.57	234.57	234.62	0.026178	0.98	1.16	11.86	1.00
Main_1	Tributary A	995	100-year	EX	1.05	232.05	232.44	232.44	232.52	0.024176	1.26	0.83	5.39	1.02
Main_1	Tributary A	995	100-year	PR	1.13	232.05	232.45	232.45	232.53	0.024003	1.29	0.88	5.47	1.03
Main_1	Tributary A	932	100-year	EX	1.05	228.37	228.64	228.64	228.75	0.021455	1.42	0.74	3.66	1.01
Main_1	Tributary A	932	100-year	PR	1.13	228.37	228.66	228.66	228.76	0.021161	1.45	0.78	3.71	1.01
Humber River	Bolton Reach Up	109.642 09.08.18	100-year	EX	37.35	230.51	232.09		232.19	0.001380	1.45	30.57	37.97	0.39
Humber River	Bolton Reach Up	109.642 09.08.18	100-year	PR	37.35	230.51	232.09		232.19	0.001380	1.45	30.57	37.97	0.39
Humber River	Bolton Reach Up	109.442 09.08.17	100-year	EX	37.35	230.27	231.81		231.91	0.001424	1.46	38.23	46.06	0.39
Humber River	Bolton Reach Up	109.442 09.08.17	100-year	PR	37.35	230.27	231.81		231.91	0.001424	1.46	38.23	46.06	0.39
Humber River	Bolton Reach Up	109.242 09.08.16	100-year	EX	37.35	229.82	231.43		231.58	0.001944	1.74	31.36	47.60	0.46
Humber River	Bolton Reach Up	109.242 09.08.16	100-year	PR	37.35	229.82	231.43		231.58	0.001944	1.74	31.36	47.60	0.46
Humber River	Bolton Reach Up	109.040 09.08.15	100-year	EX	37.35	229.52	231.14		231.24	0.001328	1.48	38.79	51.83	0.38
Humber River	Bolton Reach Up	109.040 09.08.15	100-year	PR	37.35	229.52	231.14		231.24	0.001328	1.48	38.79	51.83	0.38
Humber River	Bolton Reach Up	108.839 09.08.14	100-year	EX	37.35	229.22	230.71		230.87	0.002613	1.87	29.32	46.55	0.52
Humber River	Bolton Reach Up	108.839 09.08.14	100-year	PR	37.35	229.22	230.71		230.87	0.002613	1.87	29.32	46.55	0.52
Humber River	Bolton Reach Up	108.638 09.08.13	100-year	EX	37.35	228.86	230.40		230.48	0.001370	1.39	43.14	79.98	0.38
Humber River	Bolton Reach Up	108.638 09.08.13	100-year	PR	37.35	228.86	230.40		230.48	0.001370	1.39	43.13	79.98	0.38
Humber River	Bolton Reach Up	108.437 09.08.12	100-year	EX	37.35	228.56	229.98		230.11	0.002671	1.64	23.95	42.04	0.51
Humber River	Bolton Reach Up	108.437 09.08.12	100-year	PR	37.35	228.56	229.98		230.11	0.002671	1.64	23.95	42.04	0.51
Humber River	Bolton Reach Up	108.235 09.08.11	100-year	EX	37.35	228.02	229.63		229.73	0.001343	1.50	35.16	49.39	0.39
Humber River	Bolton Reach Up	108.235 09.08.11	100-year	PR	37.35	228.02	229.63		229.73	0.001343	1.50	35.16	49.39	0.39
Humber River	Bolton Reach Up	108.034 09.08.10	100-year	EX	37.35	227.54	228.97	228.73	229.26	0.004611	2.55	24.05	47.06	0.70
Humber River	Bolton Reach Up	108.034 09.08.10	100-year	PR	37.35	227.54	228.97	228.73	229.26	0.004611	2.55	24.05	47.06	0.70
Humber River	Bolton Reach Up	107.834 09.08.09	100-year	EX	37.35	227.00	228.74		228.83	0.001018	1.38	35.97	45.40	0.34
Humber River	Bolton Reach Up	107.834 09.08.09	100-year	PR	37.35	227.00	228.73		228.83	0.001018	1.38	35.97	45.40	0.34
Humber River	Bolton Reach Up	107.633 09.08.08	100-year	EX	37.35	226.76	228.64		228.68	0.000444	0.92	62.88	93.42	0.23
Humber River	Bolton Reach Up	107.633 09.08.08	100-year	PR	37.35	226.76	228.64		228.68	0.000444	0.92	62.88	93.42	0.23
Humber River	Bolton R 2	107.45	100-year	EX	37.38	226.33	228.52		228.57	0.000700	1.14	58.00	74.68	0.26
Humber River	Bolton R 2	107.45	100-year	PR	37.38	226.33	228.52		228.57	0.000700	1.14	58.00	74.68	0.26

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton R 2	107.433 09.08.07	100-year	EX	37.38	226.49	228.51		228.55	0.000493	1.05	66.38	81.94	0.24
Humber River	Bolton R 2	107.433 09.08.07	100-year	PR	37.38	226.49	228.51		228.55	0.000493	1.05	66.37	81.94	0.24
Humber River	Bolton R 1	107.233 09.08.06	100-year	EX	55.23	226.34	228.15		228.37	0.002678	2.27	40.69	53.18	0.56
Humber River	Bolton R 1	107.233 09.08.06	100-year	PR	55.23	226.34	228.15		228.37	0.002678	2.27	40.69	53.18	0.56
Humber River	Bolton R 1	107.1544 09.08.05	100-year	EX	55.23	226.10	227.93		228.06	0.001810	1.86	58.94	82.79	0.46
Humber River	Bolton R 1	107.1544 09.08.05	100-year	PR	55.23	226.10	227.93		228.06	0.001810	1.86	58.93	82.79	0.46
Humber River	Bolton R 1	107.032 09.08.04	100-year	EX	55.23	225.92	227.86		227.91	0.000651	1.16	78.69	80.72	0.28
Humber River	Bolton R 1	107.032 09.08.04	100-year	PR	55.23	225.92	227.86		227.91	0.000651	1.16	78.68	80.72	0.28
Humber River	Bolton R 1	106.832 09.08.03	100-year	EX	55.23	225.77	227.58		227.70	0.002136	2.08	63.84	66.07	0.50
Humber River	Bolton R 1	106.832 09.08.03	100-year	PR	55.23	225.77	227.58		227.70	0.002135	2.08	63.84	66.07	0.50
Humber River	Bolton R 1	106.6823 09.08.02	100-year	EX	55.23	225.26	227.50		227.54	0.000409	1.08	67.29	67.26	0.23
Humber River	Bolton R 1	106.6823 09.08.02	100-year	PR	55.23	225.26	227.50		227.54	0.000409	1.08	67.29	67.26	0.23
Humber River	Bolton R 1	106.6592 09.08.01	100-year	EX	55.23	225.17	227.47	226.29	227.53	0.000402	1.07	52.72	72.77	0.23
Humber River	Bolton R 1	106.6592 09.08.01	100-year	PR	55.23	225.17	227.47	226.28	227.53	0.000402	1.07	52.72	72.77	0.23
Humber River	Bolton R 1	106.6454 x-94 (09.09.24)			Bridge									
Humber River	Bolton R 1	106.631 09.09.23	100-year	EX	55.18	225.17	227.00	226.63	227.29	0.003128	2.55	30.76	27.71	0.61
Humber River	Bolton R 1	106.631 09.09.23	100-year	PR	55.19	225.17	227.00	226.63	227.29	0.003128	2.55	30.76	27.71	0.61
Humber River	Bolton R 1	106.6142 09.09.22	100-year	EX	55.18	225.20	227.06		227.20	0.001775	1.92	50.66	69.91	0.46
Humber River	Bolton R 1	106.6142 09.09.22	100-year	PR	55.19	225.20	227.06		227.20	0.001775	1.92	50.66	69.91	0.46
Humber River	Bolton R 1	106.5615 09.09.21	100-year	EX	55.18	225.08	226.97		227.10	0.001819	1.81	58.22	65.76	0.46
Humber River	Bolton R 1	106.5615 09.09.21	100-year	PR	55.19	225.08	226.97		227.10	0.001819	1.81	58.22	65.76	0.46
Humber River	Bolton R 1	106.429 09.09.20	100-year	EX	55.18	225.02	226.84		226.91	0.001016	1.42	78.61	76.34	0.35
Humber River	Bolton R 1	106.429 09.09.20	100-year	PR	55.19	225.02	226.84		226.91	0.001016	1.42	78.61	76.34	0.35
Humber River	Bolton R 1	106.229 09.09.19	100-year	EX	55.18	224.63	226.47		226.63	0.002219	2.10	53.44	57.52	0.51
Humber River	Bolton R 1	106.229 09.09.19	100-year	PR	55.19	224.63	226.47		226.63	0.002219	2.10	53.44	57.52	0.51
Humber River	Bolton R 1	106.029 09.09.18	100-year	EX	55.18	224.36	226.28		226.35	0.000846	1.36	97.16	133.87	0.32
Humber River	Bolton R 1	106.029 09.09.18	100-year	PR	55.19	224.36	226.28		226.35	0.000846	1.36	97.17	133.87	0.32
Humber River	Bolton R 1	105.827 09.09.17	100-year	EX	55.18	224.18	226.10		226.16	0.000818	1.36	85.50	72.36	0.32
Humber River	Bolton R 1	105.827 09.09.17	100-year	PR	55.19	224.18	226.10		226.16	0.000818	1.36	85.51	72.36	0.32
Humber River	Bolton R 1	105.627 09.09.16	100-year	EX	55.18	224.09	225.60		225.78	0.003629	2.43	56.48	81.43	0.64
Humber River	Bolton R 1	105.627 09.09.16	100-year	PR	55.19	224.09	225.60		225.78	0.003629	2.43	56.49	81.43	0.64
Humber River	Bolton R 1	105.427 09.09.15	100-year	EX	55.18	223.43	225.44	224.79	225.54	0.001223	1.70	74.73	121.70	0.39
Humber River	Bolton R 1	105.427 09.09.15	100-year	PR	55.19	223.43	225.44	224.79	225.54	0.001222	1.70	74.75	121.70	0.39
Humber River	Bolton R 1	105.224 09.09.14	100-year	EX	55.18	223.01	224.96		225.16	0.002243	2.27	44.27	53.05	0.52
Humber River	Bolton R 1	105.224 09.09.14	100-year	PR	55.19	223.01	224.96		225.16	0.002243	2.27	44.27	53.06	0.52
Humber River	Bolton R 1	105.022 09.09.13	100-year	EX	55.18	222.83	224.86		224.94	0.000889	1.41	75.43	87.49	0.33
Humber River	Bolton R 1	105.022 09.09.13	100-year	PR	55.19	222.83	224.86		224.94	0.000889	1.41	75.43	87.49	0.33
Humber River	Bolton R 1	104.823 09.09.12	100-year	EX	55.18	222.59	224.58		224.72	0.001436	1.82	53.78	52.15	0.42
Humber River	Bolton R 1	104.823 09.09.12	100-year	PR	55.19	222.59	224.58		224.72	0.001436	1.82	53.78	52.15	0.42
Humber River	Bolton R 1	104.621 09.09.11	100-year	EX	55.18	222.32	224.36		224.45	0.001097	1.47	60.03	67.10	0.36
Humber River	Bolton R 1	104.621 09.09.11	100-year	PR	55.19	222.32	224.36		224.45	0.001097	1.47	60.04	67.10	0.36
Humber River	Bolton R 1	104.421 09.09.10	100-year	EX	55.18	222.17	224.05		224.18	0.001771	1.92	74.11	123.48	0.46
Humber River	Bolton R 1	104.421 09.09.10	100-year	PR	55.19	222.17	224.05		224.18	0.001770	1.92	74.12	123.48	0.46
Humber River	Bolton R 1	104.218 09.09.09	100-year	EX	55.18	221.96	223.75		223.85	0.001653	1.82	63.42	60.03	0.44
Humber River	Bolton R 1	104.218 09.09.09	100-year	PR	55.19	221.96	223.75		223.85	0.001653	1.82	63.43	60.03	0.44
Humber River	Bolton R 1	104.018 09.09.08	100-year	EX	55.18	221.69	223.37		223.51	0.002019	1.94	57.94	71.39	0.48
Humber River	Bolton R 1	104.018 09.09.08	100-year	PR	55.19	221.69	223.37		223.51	0.002019	1.94	57.94	71.39	0.48
Humber River	Bolton R 1	103.819 09.09.07	100-year	EX	55.18	221.24	223.16		223.23	0.000998	1.50	78.65	72.67	0.35
Humber River	Bolton R 1	103.819 09.09.07	100-year	PR	55.19	221.24	223.16		223.23	0.000998	1.50	78.65	72.67	0.35
Humber River	Bolton R 1	103.616 09.09.06	100-year	EX	55.18	220.94	222.85		222.97	0.001653	1.92	60.15	56.41	0.45
Humber River	Bolton R 1	103.616 09.09.06	100-year	PR	55.19	220.94	222.85		222.97	0.001653	1.92	60.15	56.41	0.45
Humber River	Bolton R 1	103.417 09.09.05	100-year	EX	55.18	220.64	222.64		222.73	0.001197	1.63	74.24	82.10	0.38
Humber River	Bolton R 1	103.417 09.09.05	100-year	PR	55.19	220.64	222.64		222.73	0.001197	1.63	74.25	82.11	0.38
Humber River	Bolton R 1	103.215 09.09.04	100-year	EX	55.18	220.31	222.30		222.45	0.001606	1.88	50.06	59.51	0.44
Humber River	Bolton R 1	103.215 09.09.04	100-year	PR	55.19	220.31	222.30		222.45	0.001606	1.88	50.06	59.51	0.44
Humber River	Bolton R 1	103.014 09.09.03	100-year	EX	55.18	220.07	221.85		222.05	0.002727	2.25	53.14	91.01	0.56
Humber River	Bolton R 1	103.014 09.09.03	100-year	PR	55.19	220.07	221.85		222.05	0.002728	2.25	53.14	91.01	0.56
Humber River	Bolton R 1	102.814 09.09.02	100-year	EX	55.18	219.98	221.72	221.59	221.82	0.001969	1.95	92.05	164.40	0.48
Humber River	Bolton R 1	102.814 09.09.02	100-year	PR	55.19	219.98	221.72	221.59	221.82	0.001970	1.95	92.02	164.40	0.48
Humber River	Bolton R 1	102.613 09.09.01	100-year	EX	55.99	219.74	221.34		221.40	0.001215	1.45	103.77	144.56	0.37
Humber River	Bolton R 1	102.613 09.09.01	100-year	PR	55.97	219.74	221.34		221.40	0.001214	1.45	103.75	144.56	0.37
Humber River	Bolton Reach	102.398 09.01.13	100-year	EX	42.52	219.10	221.17		221.20	0.000347	0.88	89.01	76.06	0.20
Humber River	Bolton Reach	102.398 09.01.13	100-year	PR	42.52	219.10	221.17		221.20	0.000347	0.88	89.00	76.06	0.20
Humber River	Bolton Reach	102.208 09.01.12	100-year	EX	42.52	219.02	221.12		221.16	0.000558	1.08	82.98	79.15	0.25
Humber River	Bolton Reach	102.208 09.01.12	100-year	PR	42.52	219.02	221.12		221.16	0.000558	1.08	82.97	79.15	0.25
Humber River	Bolton Reach	102.011 09.01.11	100-year	EX	42.52	218.86	221.05		221.08	0.000448	1.05	91.52	93.62	0.23
Humber River	Bolton Reach	102.011 09.01.11	100-year	PR	42.52	218.86	221.05		221.08	0.000448	1.05	91.51	93.62	0.23
Humber River	Bolton Reach	101.9462 09.01.10	100-year	EX	42.52	218.78	220.95		221.00	0.000614	1.22	84.61	93.90	0.27
Humber River	Bolton Reach	101.9462 09.01.10	100-year	PR	42.52	218.78	220.95		221.00	0.000614	1.22	84.60	93.89	0.27
Humber River	Bolton Reach	101.809 09.01.09	100-year	EX	42.52	218.20	220.11		220.15	0.000475	0.97	72.69	70.36	0.23
Humber River	Bolton Reach	101.809 09.01.09	100-year	PR	42.52	218.20	220.11		220.15	0.000475	0.97	72.69	70.36	0.23

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	101.608 09.01.08	100-year	EX	42.52	218.06	219.61	219.44	219.91	0.004532	2.57	26.34	56.78	0.70
Humber River	Bolton Reach	101.608 09.01.08	100-year	PR	42.52	218.06	219.61	219.44	219.91	0.004532	2.57	26.34	56.78	0.70
Humber River	Bolton Reach	101.407 09.01.07	100-year	EX	42.52	217.85	219.62		219.66	0.000713	1.13	98.98	158.17	0.28
Humber River	Bolton Reach	101.407 09.01.07	100-year	PR	42.52	217.85	219.62		219.66	0.000713	1.13	98.97	158.17	0.28
Humber River	Bolton Reach	101.206 09.01.06	100-year	EX	42.52	217.39	219.12		219.30	0.002869	1.89	24.40	42.93	0.54
Humber River	Bolton Reach	101.206 09.01.06	100-year	PR	42.52	217.39	219.12		219.30	0.002870	1.89	24.39	42.92	0.54
Humber River	Bolton Reach	101.004 09.01.05	100-year	EX	42.52	216.95	218.74		218.85	0.001729	1.48	29.35	33.90	0.42
Humber River	Bolton Reach	101.004 09.01.05	100-year	PR	42.52	216.95	218.74		218.85	0.001729	1.48	29.34	33.88	0.42
Humber River	Bolton Reach	100.803 09.01.04	100-year	EX	42.52	216.63	218.45		218.55	0.001276	1.49	34.68	35.20	0.38
Humber River	Bolton Reach	100.803 09.01.04	100-year	PR	42.52	216.63	218.45		218.55	0.001277	1.49	34.66	35.20	0.38
Humber River	Bolton Reach	100.602 09.01.03	100-year	EX	42.52	216.43	218.14		218.26	0.001714	1.59	32.09	40.73	0.43
Humber River	Bolton Reach	100.602 09.01.03	100-year	PR	42.52	216.43	218.13		218.26	0.001718	1.59	32.06	40.71	0.43
Humber River	Bolton Reach	100.5208 09.01.02	100-year	EX	42.52	216.19	217.99		218.12	0.001736	1.57	30.56	36.50	0.43
Humber River	Bolton Reach	100.5208 09.01.02	100-year	PR	42.52	216.19	217.99		218.12	0.001741	1.58	30.52	36.39	0.43
Humber River	Bolton Reach	100.401 09.01.01	100-year	EX	57.17	216.08	217.78	217.27	217.91	0.001730	1.76	51.65	47.60	0.45
Humber River	Bolton Reach	100.401 09.01.01	100-year	PR	57.08	216.08	217.78	217.27	217.91	0.001728	1.76	51.61	47.60	0.45
Humber River	Bolton Reach	100.200 09.04.02	100-year	EX	57.17	215.87	217.60		217.73	0.002076	1.73	48.57	69.93	0.47
Humber River	Bolton Reach	100.200 09.04.02	100-year	PR	57.08	215.87	217.59		217.73	0.002075	1.72	48.50	69.93	0.47
Humber River	Bolton Reach	100.1076 09.04.01	100-year	EX	57.17	215.68	217.45		217.56	0.001544	1.59	66.05	129.66	0.41
Humber River	Bolton Reach	100.1076 09.04.01	100-year	PR	57.08	215.68	217.45		217.56	0.001545	1.59	65.91	129.62	0.41
Humber River	Bolton Reach	9.216	100-year	EX	57.17	215.63	217.40		217.47	0.001504	1.47	80.79	119.65	0.38
Humber River	Bolton Reach	9.216	100-year	PR	57.08	215.63	217.40		217.47	0.001504	1.47	80.66	119.47	0.38
Humber River	Bolton Reach	9.213	100-year	EX	57.17	215.39	217.15	216.72	217.38	0.003367	2.28	45.97	107.53	0.57
Humber River	Bolton Reach	9.213	100-year	PR	57.08	215.39	217.15	216.72	217.38	0.003377	2.28	45.78	107.31	0.57
Humber River	Bolton Reach	9.21	100-year	EX	57.17	215.31	217.12		217.26	0.001976	1.76	55.23	118.75	0.44
Humber River	Bolton Reach	9.21	100-year	PR	57.08	215.31	217.12		217.26	0.001976	1.76	55.11	118.71	0.44
Humber River	Bolton Reach	9.207	100-year	EX	57.17	215.09	217.05		217.13	0.001191	1.34	72.81	116.14	0.33
Humber River	Bolton Reach	9.207	100-year	PR	57.08	215.09	217.05		217.13	0.001190	1.34	72.69	116.12	0.33
Humber River	Bolton Reach	9.204	100-year	EX	57.17	215.00	216.91		216.99	0.001316	1.44	78.85	119.67	0.36
Humber River	Bolton Reach	9.204	100-year	PR	57.08	215.00	216.91		216.99	0.001316	1.44	78.73	119.65	0.36
Humber River	Bolton Reach	9.201	100-year	EX	57.17	214.97	216.77	216.21	216.88	0.001775	1.64	61.74	91.01	0.41
Humber River	Bolton Reach	9.201	100-year	PR	57.08	214.97	216.77	216.21	216.88	0.001774	1.64	61.65	90.97	0.41
Humber River	Bolton Reach	9.198	100-year	EX	57.17	214.74	216.20	216.20	216.52	0.007307	2.69	33.65	69.56	0.79
Humber River	Bolton Reach	9.198	100-year	PR	57.08	214.74	216.20	216.20	216.52	0.007310	2.69	33.59	69.36	0.79
Humber River	Bolton Reach	9.195	100-year	EX	57.17	213.50	215.46		215.54	0.001095	1.30	64.36	94.71	0.32
Humber River	Bolton Reach	9.195	100-year	PR	57.08	213.50	215.46		215.54	0.001096	1.30	64.22	94.47	0.32
Humber River	Bolton Reach	9.192	100-year	EX	57.17	213.23	215.27		215.40	0.001958	1.56	36.55	25.60	0.42
Humber River	Bolton Reach	9.192	100-year	PR	57.08	213.23	215.27		215.40	0.001958	1.56	36.51	25.60	0.42
Humber River	Bolton Reach	9.189	100-year	EX	57.17	213.35	215.16	214.51	215.32	0.002380	1.78	32.19	21.71	0.46
Humber River	Bolton Reach	9.189	100-year	PR	57.08	213.35	215.16	214.51	215.32	0.002380	1.77	32.16	21.70	0.46
Humber River	Bolton Reach	9.186			Bridge									
Humber River	Bolton Reach	9.183	100-year	EX	57.17	213.31	214.96	214.58	215.24	0.005394	2.35	24.32	20.69	0.68
Humber River	Bolton Reach	9.183	100-year	PR	57.08	213.31	214.96	214.59	215.24	0.005396	2.35	24.29	20.68	0.68
Humber River	Bolton Reach	9.18	100-year	EX	57.17	213.02	214.84		214.95	0.001564	1.51	42.49	40.56	0.38
Humber River	Bolton Reach	9.18	100-year	PR	57.08	213.02	214.84		214.95	0.001565	1.51	42.43	40.51	0.38
Humber River	Bolton Reach	9.177	100-year	EX	57.17	212.57	214.55		214.70	0.002406	1.74	32.84	22.90	0.46
Humber River	Bolton Reach	9.177	100-year	PR	57.08	212.57	214.55		214.70	0.002405	1.74	32.81	22.89	0.46
Humber River	Bolton Reach	9.174	100-year	EX	57.17	212.55	214.52		214.69	0.002671	1.80	31.77	22.96	0.49
Humber River	Bolton Reach	9.174	100-year	PR	57.08	212.55	214.52		214.68	0.002670	1.80	31.73	22.94	0.49
Humber River	Bolton Reach	9.171	100-year	EX	57.17	212.49	214.49		214.65	0.002564	1.80	31.77	22.18	0.48
Humber River	Bolton Reach	9.171	100-year	PR	57.08	212.49	214.48		214.65	0.002563	1.80	31.74	22.17	0.48
Humber River	Bolton Reach	9.168	100-year	EX	57.17	212.44	214.42		214.59	0.003071	1.86	30.75	23.70	0.52
Humber River	Bolton Reach	9.168	100-year	PR	57.08	212.44	214.41		214.59	0.003071	1.86	30.72	23.69	0.52
Humber River	Bolton Reach	9.165	100-year	EX	57.17	212.37	214.37		214.53	0.002929	1.81	31.56	24.41	0.51
Humber River	Bolton Reach	9.165	100-year	PR	57.08	212.37	214.36		214.53	0.002929	1.81	31.52	24.40	0.51
Humber River	Bolton Reach	9.162	100-year	EX	57.17	212.33	214.27		214.48	0.003579	1.99	28.68	22.27	0.56
Humber River	Bolton Reach	9.162	100-year	PR	57.08	212.33	214.27		214.47	0.003579	1.99	28.65	22.26	0.56
Humber River	Bolton Reach	9.159	100-year	EX	57.17	212.18	214.23		214.42	0.003350	1.93	29.62	22.95	0.54
Humber River	Bolton Reach	9.159	100-year	PR	57.08	212.18	214.23		214.41	0.003350	1.93	29.58	22.94	0.54
Humber River	Bolton Reach	9.156	100-year	EX	57.17	211.93	214.20	213.22	214.33	0.001633	1.59	35.95	21.35	0.39
Humber River	Bolton Reach	9.156	100-year	PR	57.08	211.93	214.20	213.22	214.32	0.001632	1.59	35.92	21.34	0.39
Humber River	Bolton Reach	9.153			Bridge									
Humber River	Bolton Reach	9.15	100-year	EX	57.17	211.79	214.19	212.99	214.27	0.000767	1.27	45.13	26.83	0.28
Humber River	Bolton Reach	9.15	100-year	PR	57.08	211.79	214.19	212.99	214.27	0.000766	1.27	45.10	26.82	0.28
Humber River	Bolton Reach	9.147	100-year	EX	57.17	211.79	214.05		214.21	0.002119	1.76	32.43	19.96	0.44
Humber River	Bolton Reach	9.147	100-year	PR	57.08	211.79	214.05		214.21	0.002117	1.76	32.40	19.96	0.44
Humber River	Bolton Reach	9.144	100-year	EX	57.17	211.74	214.01		214.17	0.002093	1.77	32.26	19.29	0.44
Humber River	Bolton Reach	9.144	100-year	PR	57.08	211.74	214.01		214.17	0.002091	1.77	32.24	19.28	0.44
Humber River	Bolton Reach	9.141	100-year	EX	57.17	211.64	213.87		214.01	0.001864	1.67	34.32	20.91	0.42
Humber River	Bolton Reach	9.141	100-year	PR	57.08	211.64	213.87		214.01	0.001861	1.66	34.30	20.90	0.41

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	9.138	100-year	EX	57.17	211.64	213.80		213.92	0.001742	1.58	37.67	53.28	0.40
Humber River	Bolton Reach	9.138	100-year	PR	57.08	211.64	213.80		213.92	0.001740	1.58	37.62	53.01	0.40
Humber River	Bolton Reach	9.135	100-year	EX	57.17	211.64	213.76		213.84	0.000971	1.28	58.26	96.85	0.31
Humber River	Bolton Reach	9.135	100-year	PR	57.08	211.64	213.76		213.84	0.000971	1.28	58.17	96.49	0.31
Humber River	Bolton Reach	9.132	100-year	EX	57.17	211.64	213.58		213.75	0.002721	1.86	32.31	28.62	0.49
Humber River	Bolton Reach	9.132	100-year	PR	57.08	211.64	213.57		213.75	0.002716	1.86	32.30	28.61	0.49
Humber River	Bolton Reach	9.129	100-year	EX	57.17	211.64	213.53		213.68	0.003054	1.73	33.04	28.21	0.51
Humber River	Bolton Reach	9.129	100-year	PR	57.08	211.64	213.53		213.68	0.003047	1.73	33.03	28.20	0.51
Humber River	Bolton Reach	9.126	100-year	EX	57.17	211.64	213.52		213.62	0.002006	1.48	45.58	68.28	0.42
Humber River	Bolton Reach	9.126	100-year	PR	57.08	211.64	213.51		213.62	0.002002	1.48	45.56	68.26	0.42
Humber River	Bolton Reach	9.123	100-year	EX	57.17	211.64	213.53		213.58	0.001210	1.18	71.51	113.76	0.33
Humber River	Bolton Reach	9.123	100-year	PR	57.08	211.64	213.53		213.58	0.001208	1.18	71.46	113.73	0.33
Humber River	Bolton Reach	9.12	100-year	EX	57.17	213.30	213.37	213.37	213.52	0.026359	0.81	34.62	122.50	0.96
Humber River	Bolton Reach	9.12	100-year	PR	57.08	213.30	213.37	213.37	213.52	0.026348	0.81	34.58	122.47	0.96
Humber River	Bolton Reach	9.117	100-year	EX	57.17	211.64	213.37		213.40	0.000740	0.94	87.13	136.33	0.26
Humber River	Bolton Reach	9.117	100-year	PR	57.08	211.64	213.37		213.40	0.000743	0.94	86.82	135.94	0.26
Humber River	Bolton Reach	9.114	100-year	EX	57.17	211.64	213.35		213.39	0.000789	0.95	84.54	137.36	0.27
Humber River	Bolton Reach	9.114	100-year	PR	57.08	211.64	213.35		213.39	0.000775	0.95	84.37	137.01	0.26
Humber River	Bolton Reach	9.111	100-year	EX	57.17	211.41	213.34		213.37	0.000464	0.85	122.07	225.04	0.21
Humber River	Bolton Reach	9.111	100-year	PR	57.08	211.41	213.34		213.37	0.000465	0.85	121.68	224.89	0.21
Humber River	Bolton Reach	9.108	100-year	EX	57.17	211.41	213.33		213.36	0.000753	1.03	103.55	183.46	0.26
Humber River	Bolton Reach	9.108	100-year	PR	57.08	211.41	213.32		213.36	0.000756	1.03	103.23	183.11	0.26
Humber River	Bolton Reach	9.105	100-year	EX	57.17	211.40	213.33		213.35	0.000440	0.78	148.90	231.06	0.20
Humber River	Bolton Reach	9.105	100-year	PR	57.08	211.40	213.33		213.35	0.000442	0.78	148.50	230.88	0.20
Humber River	Bolton Reach	9.102	100-year	EX	57.17	211.39	212.73	212.73	213.27	0.012282	3.25	17.64	17.37	1.00
Humber River	Bolton Reach	9.102	100-year	PR	57.08	211.39	212.73	212.73	213.27	0.012278	3.25	17.62	17.35	1.00
Humber River	Bolton Reach	9.099	100-year	EX	57.17	211.16	212.40		212.50	0.003561	1.62	43.25	43.32	0.53
Humber River	Bolton Reach	9.099	100-year	PR	57.08	211.16	212.40		212.50	0.003557	1.62	43.22	43.31	0.53
Humber River	Bolton Reach	9.096	100-year	EX	57.17	211.29	212.32	212.00	212.41	0.006004	1.70	45.13	68.83	0.66
Humber River	Bolton Reach	9.096	100-year	PR	57.08	211.29	212.32	212.00	212.41	0.006004	1.70	45.09	68.79	0.66
Humber River	Bolton Reach	9.093			Mult Open									
Humber River	Bolton Reach	9.09	100-year	EX	57.17	211.28	212.27	211.83	212.31	0.002807	1.17	68.71	109.46	0.45
Humber River	Bolton Reach	9.09	100-year	PR	57.08	211.28	212.27	211.82	212.31	0.002810	1.17	68.62	109.43	0.45
Humber River	Bolton Reach	9.087	100-year	EX	57.17	210.58	212.11		212.19	0.002445	1.47	59.21	103.27	0.45
Humber River	Bolton Reach	9.087	100-year	PR	57.08	210.58	212.11		212.19	0.002450	1.47	59.09	103.22	0.45
Humber River	Bolton Reach	9.084	100-year	EX	57.17	209.90	211.85		212.02	0.003011	1.83	35.47	45.19	0.52
Humber River	Bolton Reach	9.084	100-year	PR	57.08	209.90	211.85		212.02	0.003011	1.83	35.42	45.18	0.52
Humber River	Bolton Reach	9.081	100-year	EX	57.17	209.90	211.72		211.94	0.004541	2.11	29.93	41.67	0.62
Humber River	Bolton Reach	9.081	100-year	PR	57.08	209.90	211.72		211.94	0.004539	2.11	29.89	41.64	0.62
Humber River	Bolton Reach	9.078	100-year	EX	57.17	209.90	211.37		211.53	0.003414	1.83	40.24	76.32	0.54
Humber River	Bolton Reach	9.078	100-year	PR	57.08	209.90	211.37		211.53	0.003412	1.82	40.18	76.28	0.54
Humber River	Bolton Reach	9.075	100-year	EX	57.17	209.90	211.16	210.99	211.40	0.007056	2.22	29.83	101.57	0.75
Humber River	Bolton Reach	9.075	100-year	PR	57.08	209.90	211.16	210.99	211.40	0.007067	2.22	29.72	101.54	0.75
Humber River	Bolton Reach	9.072	100-year	EX	57.17	209.70	211.10		211.26	0.004966	1.89	40.88	66.86	0.63
Humber River	Bolton Reach	9.072	100-year	PR	57.08	209.70	211.10		211.26	0.004973	1.89	40.80	66.79	0.63
Humber River	Bolton Reach	9.069	100-year	EX	57.17	209.36	211.03	210.46	211.14	0.002075	1.48	38.64	31.96	0.43
Humber River	Bolton Reach	9.069	100-year	PR	57.08	209.36	211.03	210.46	211.14	0.002075	1.48	38.60	31.95	0.43
Humber River	Bolton Reach	9.066			Bridge									
Humber River	Bolton Reach	9.063	100-year	EX	57.17	209.17	210.99	210.32	211.09	0.001788	1.43	39.90	33.57	0.40
Humber River	Bolton Reach	9.063	100-year	PR	57.08	209.17	210.98	210.31	211.09	0.001787	1.43	39.86	33.56	0.40
Humber River	Bolton Reach	9.06	100-year	EX	57.17	209.05	210.85		211.00	0.002268	1.75	38.28	38.91	0.46
Humber River	Bolton Reach	9.06	100-year	PR	57.08	209.05	210.85		211.00	0.002267	1.75	38.23	38.89	0.46
Humber River	Bolton Reach	9.057	100-year	EX	57.17	209.05	210.81		210.96	0.002154	1.73	39.16	43.24	0.45
Humber River	Bolton Reach	9.057	100-year	PR	57.08	209.05	210.81		210.96	0.002153	1.73	39.11	43.19	0.45
Humber River	Bolton Reach	9.054	100-year	EX	57.17	209.05	210.73		210.87	0.002340	1.71	39.12	50.59	0.46
Humber River	Bolton Reach	9.054	100-year	PR	57.08	209.05	210.72		210.87	0.002339	1.71	39.07	50.49	0.46
Humber River	Bolton Reach	9.051	100-year	EX	57.17	209.05	210.32	210.32	210.57	0.005958	2.47	48.12	170.00	0.72
Humber River	Bolton Reach	9.051	100-year	PR	57.08	209.05	210.32	210.32	210.56	0.005940	2.47	48.12	170.00	0.72
Humber River	Bolton Reach	9.048	100-year	EX	57.17	209.05	210.33	209.56	210.34	0.000237	0.50	274.43	286.23	0.14
Humber River	Bolton Reach	9.048	100-year	PR	57.08	209.05	210.33	209.56	210.34	0.000237	0.50	274.32	286.23	0.14
Humber River	Bolton Reach	9.045	100-year	EX	57.17	208.40	210.14	209.79	210.23	0.001692	1.61	82.11	120.96	0.40
Humber River	Bolton Reach	9.045	100-year	PR	57.08	208.40	210.14	209.79	210.23	0.001685	1.61	82.13	120.97	0.40
Humber River	Bolton Reach	9.042	100-year	EX	57.17	208.41	209.56		209.71	0.005385	1.94	51.96	107.35	0.65
Humber River	Bolton Reach	9.042	100-year	PR	57.08	208.41	209.55		209.70	0.005472	1.95	51.53	107.05	0.66
Humber River	Bolton Reach	9.039	100-year	EX	57.17	207.60	209.42		209.46	0.000698	0.99	89.21	119.44	0.26
Humber River	Bolton Reach	9.039	100-year	PR	57.08	207.60	209.42		209.46	0.000708	0.99	88.49	118.98	0.26
Humber River	Bolton Reach	9.036	100-year	EX	57.17	207.60	209.39		209.43	0.000605	0.89	84.19	83.89	0.24
Humber River	Bolton Reach	9.036	100-year	PR	57.08	207.60	209.39		209.42	0.000613	0.90	83.65	83.70	0.24
Humber River	Bolton Reach	9.033	100-year	EX	57.17	207.10	209.25	208.13	209.36	0.000977	1.44	39.64	42.03	0.32
Humber River	Bolton Reach	9.033	100-year	PR	57.08	207.10	209.25	208.12	209.35	0.000985	1.44	39.51	41.43	0.32

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	9.03			Bridge									
Humber River	Bolton Reach	9.027	100-year	EX	57.17	207.11	209.22	208.12	209.33	0.000998	1.45	39.34	47.28	0.32
Humber River	Bolton Reach	9.027	100-year	PR	57.08	207.11	209.21	208.11	209.32	0.001006	1.46	39.20	46.95	0.32
Humber River	Bolton Reach	9.024	100-year	EX	57.17	207.09	209.24		209.29	0.000796	0.99	63.76	63.64	0.27
Humber River	Bolton Reach	9.024	100-year	PR	57.08	207.09	209.23		209.28	0.000808	0.99	63.29	63.32	0.27
Humber River	Bolton Reach	9.021	100-year	EX	57.17	207.11	209.19		209.24	0.000702	1.20	102.68	100.06	0.27
Humber River	Bolton Reach	9.021	100-year	PR	57.08	207.11	209.18		209.23	0.000712	1.21	101.87	99.69	0.27
Humber River	Bolton Reach	9.018	100-year	EX	57.17	206.75	209.16		209.18	0.000312	0.83	150.81	147.94	0.18
Humber River	Bolton Reach	9.018	100-year	PR	57.08	206.75	209.15		209.17	0.000317	0.84	149.52	147.49	0.18
Humber River	Bolton Reach	9.015	100-year	EX	57.17	206.42	209.14		209.15	0.000173	0.64	225.10	222.45	0.13
Humber River	Bolton Reach	9.015	100-year	PR	57.08	206.42	209.13		209.14	0.000176	0.64	223.03	222.06	0.14
Humber River	Bolton Reach	9.012	100-year	EX	57.17	206.41	209.13		209.14	0.000157	0.62	226.82	237.67	0.13
Humber River	Bolton Reach	9.012	100-year	PR	57.08	206.41	209.12		209.13	0.000160	0.62	224.61	236.68	0.13
Humber River	Bolton Reach	9.009	100-year	EX	57.17	206.42	209.11	207.55	209.13	0.000230	0.75	118.32	211.64	0.16
Humber River	Bolton Reach	9.009	100-year	PR	57.08	206.42	209.10	207.55	209.12	0.000241	0.77	109.36	210.50	0.16
Humber River	Bolton Reach	9.006			Bridge									
Humber River	Bolton Reach	9.003	100-year	EX	57.17	206.18	209.09	207.56	209.10	0.000150	0.58	162.49	213.22	0.13
Humber River	Bolton Reach	9.003	100-year	PR	57.08	206.18	209.08	207.55	209.09	0.000152	0.58	161.20	212.95	0.13
Humber River	Bolton Reach	9	100-year	EX	57.17	206.18	209.09		209.09	0.000070	0.47	335.61	249.16	0.09
Humber River	Bolton Reach	9	100-year	PR	57.08	206.18	209.08		209.08	0.000071	0.47	333.15	248.91	0.09
Humber River	DOWNSTREAM	11.39	100-year	EX	99.72	206.18	209.06		209.08	0.000401	1.01	236.73	205.48	0.21
Humber River	DOWNSTREAM	11.39	100-year	PR	97.69	206.18	209.05		209.07	0.000393	0.99	234.88	205.23	0.20
Humber River	DOWNSTREAM	11.38	100-year	EX	99.72	206.17	209.01		209.05	0.000542	1.21	236.37	226.04	0.24
Humber River	DOWNSTREAM	11.38	100-year	PR	97.69	206.17	209.00		209.04	0.000531	1.19	234.51	225.92	0.24
Humber River	DOWNSTREAM	11.37	100-year	EX	99.72	206.18	208.97		209.00	0.000422	1.11	249.24	205.05	0.22
Humber River	DOWNSTREAM	11.37	100-year	PR	97.69	206.18	208.97		208.99	0.000412	1.09	247.76	204.98	0.21
Humber River	DOWNSTREAM	11.36	100-year	EX	99.72	206.17	208.93		208.97	0.000477	1.16	183.58	134.89	0.23
Humber River	DOWNSTREAM	11.36	100-year	PR	97.69	206.17	208.92		208.96	0.000462	1.14	182.81	134.75	0.23
Humber River	DOWNSTREAM	11.35	100-year	EX	99.72	206.03	208.91		208.93	0.000259	0.90	263.55	185.33	0.17
Humber River	DOWNSTREAM	11.35	100-year	PR	97.69	206.03	208.91		208.93	0.000251	0.89	262.59	185.09	0.17
Humber River	DOWNSTREAM	11.34	100-year	EX	99.72	205.60	208.78	207.33	208.87	0.000728	1.58	148.02	148.84	0.28
Humber River	DOWNSTREAM	11.34	100-year	PR	97.69	205.60	208.78	207.31	208.87	0.000699	1.55	148.02	148.84	0.28
Cold_10_7	Tributary E	4822.04	100-year	EX	0.05	263.04	263.13		263.15	0.130082	0.64	0.08	1.58	0.88
Cold_10_7	Tributary E	4822.04	100-year	PR	0.68	263.04	263.42		263.45	0.029118	0.74	0.94	5.69	0.52
Cold_10_7	Tributary E	4783.59	100-year	EX	0.05	262.40	262.61	262.49	262.61	0.005012	0.22	0.24	1.86	0.20
Cold_10_7	Tributary E	4783.59	100-year	PR	0.68	262.40	262.95	262.72	262.96	0.006966	0.50	1.60	8.37	0.27
Cold_10_7	Tributary E	4731.68	100-year	EX	0.05	261.73	261.81	261.81	261.83	0.216858	0.59	0.09	2.76	1.05
Cold_10_7	Tributary E	4731.68	100-year	PR	0.68	261.73	261.94	261.94	262.01	0.129100	1.13	0.60	4.74	1.01
Cold_10_7	Tributary E	4652.11	100-year	EX	0.05	261.35	261.49		261.49	0.000021	0.02	2.54	32.62	0.02
Cold_10_7	Tributary E	4652.11	100-year	PR	0.68	261.35	261.76		261.76	0.000022	0.05	13.44	49.48	0.03
Cold_10_7	Tributary E	4592.65	100-year	EX	0.05	261.40	261.49		261.49	0.000055	0.03	1.75	29.55	0.04
Cold_10_7	Tributary E	4592.65	100-year	PR	0.68	261.40	261.76		261.76	0.000029	0.06	12.86	57.06	0.03
Cold_10_7	Tributary E	4515.64	100-year	EX	0.05	261.39	261.46		261.47	0.095750	0.50	0.11	2.30	0.74
Cold_10_7	Tributary E	4515.64	100-year	PR	0.68	261.39	261.74		261.75	0.014409	0.57	1.20	5.12	0.37
Cold_10_7	Tributary E	4460.59	100-year	EX	0.09	261.30	261.45		261.45	0.000162	0.03	2.67	29.18	0.03
Cold_10_7	Tributary E	4460.59	100-year	PR	1.08	261.30	261.72		261.72	0.000213	0.09	12.20	38.84	0.05
Cold_10_7	Tributary E	4407.62	100-year	EX	0.09	261.31	261.42		261.42	0.008016	0.18	0.47	7.26	0.23
Cold_10_7	Tributary E	4407.62	100-year	PR	1.08	261.31	261.68		261.69	0.004630	0.34	3.15	12.21	0.22
Cold_10_7	Tributary E	4354.33	100-year	EX	0.09	260.86	261.04		261.04	0.006319	0.24	0.36	3.11	0.22
Cold_10_7	Tributary E	4354.33	100-year	PR	1.08	260.86	261.45		261.46	0.004172	0.45	2.70	9.50	0.22
Cold_10_7	Tributary E	4322.62	100-year	EX	0.09	260.68	260.86		260.86	0.005414	0.22	0.39	3.26	0.20
Cold_10_7	Tributary E	4322.62	100-year	PR	1.08	260.68	261.32		261.33	0.003806	0.42	2.56	6.13	0.21
Cold_10_7	Tributary E	4293.51	100-year	EX	0.09	260.49	260.73		260.73	0.003422	0.21	0.41	2.53	0.17
Cold_10_7	Tributary E	4293.51	100-year	PR	1.08	260.49	261.18		261.20	0.005853	0.55	2.09	6.12	0.26
Cold_10_7	Tributary E	4265.3	100-year	EX	0.09	260.37	260.50		260.51	0.031163	0.41	0.21	2.59	0.46
Cold_10_7	Tributary E	4265.3	100-year	PR	1.08	260.37	260.69	260.67	260.77	0.086960	1.24	0.87	4.42	0.89
Cold_10_7	Tributary E	4240.34	100-year	EX	0.09	259.55	259.73		259.74	0.030229	0.49	0.17	1.57	0.47
Cold_10_7	Tributary E	4240.34	100-year	PR	1.08	259.55	260.02	259.94	260.03	0.013079	0.54	2.61	20.01	0.35
Cold_10_7	Tributary E	4181.11	100-year	EX	0.09	259.05	259.38		259.39	0.002500	0.18	0.47	2.81	0.14
Cold_10_7	Tributary E	4181.11	100-year	PR	1.08	259.05	259.69	259.50	259.70	0.003513	0.34	3.75	16.79	0.19
Cold_10_7	Tributary E	4121.04	100-year	EX	0.09	258.89	258.99		259.00	0.041696	0.33	0.26	5.46	0.49
Cold_10_7	Tributary E	4121.04	100-year	PR	1.08	258.89	259.10	259.10	259.13	0.092402	0.92	1.37	17.54	0.85
Cold_10_7	Tributary E	4055.36	100-year	EX	0.09	258.17	258.27		258.27	0.005042	0.11	0.77	17.20	0.17
Cold_10_7	Tributary E	4055.36	100-year	PR	1.08	258.17	258.60		258.60	0.000152	0.07	16.76	70.14	0.04
Cold_10_7	Tributary E	4004.48	100-year	EX	0.09	258.09	258.27		258.27	0.000026	0.01	6.05	58.14	0.01
Cold_10_7	Tributary E	4004.48	100-year	PR	1.08	258.09	258.60		258.60	0.000029	0.04	30.58	81.30	0.02
Cold_10_7	Tributary E	3947.08	100-year	EX	0.09	258.09	258.27		258.27	0.000001	0.01	13.42	105.07	0.01
Cold_10_7	Tributary E	3947.08	100-year	PR	1.08	258.09	258.60		258.60	0.000002	0.02	50.19	115.21	0.01
Cold_10_7	Tributary E	3869.46	100-year	EX	0.09	258.09	258.27		258.27	0.000052	0.02	4.12	36.91	0.02
Cold_10_7	Tributary E	3869.46	100-year	PR	1.08	258.09	258.60		258.60	0.000073	0.06	19.23	60.37	0.03

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	3837.47	100-year	EX	0.20	258.09	258.21	258.21	258.25	0.153880	0.87	0.23	3.07	1.01
Cold_10_7	Tributary E	3837.47	100-year	PR	2.49	258.09	258.48	258.48	258.57	0.110963	1.35	1.85	11.38	1.00
Cold_10_7	Tributary E	3758.91	100-year	EX	0.20	257.76	257.95		257.95	0.000640	0.09	2.42	20.69	0.07
Cold_10_7	Tributary E	3758.91	100-year	PR	2.49	257.76	258.28		258.28	0.000928	0.23	12.99	40.41	0.11
Cold_10_7	Tributary E	3700.91	100-year	EX	0.20	257.72	257.90		257.90	0.001294	0.11	1.88	18.66	0.10
Cold_10_7	Tributary E	3700.91	100-year	PR	2.49	257.72	258.21		258.21	0.001929	0.32	9.06	27.14	0.15
Cold_10_7	Tributary E	3650.13	100-year	EX	0.20	257.64	257.80		257.80	0.003320	0.15	1.41	16.54	0.16
Cold_10_7	Tributary E	3650.13	100-year	PR	2.49	257.64	258.07		258.08	0.003968	0.40	7.07	24.61	0.21
Cold_10_7	Tributary E	3587.5	100-year	EX	0.20	257.51	257.64		257.64	0.002258	0.12	1.83	24.36	0.13
Cold_10_7	Tributary E	3587.5	100-year	PR	2.49	257.51	257.86		257.87	0.003143	0.33	8.70	33.43	0.19
Cold_10_7	Tributary E	3530.86	100-year	EX	0.20	257.24	257.37		257.37	0.014571	0.26	0.81	14.41	0.31
Cold_10_7	Tributary E	3530.86	100-year	PR	2.49	257.24	257.58		257.59	0.008825	0.50	5.88	28.72	0.30
Cold_10_7	Tributary E	3486.25	100-year	EX	0.20	256.89	257.02		257.02	0.003818	0.15	1.55	24.03	0.16
Cold_10_7	Tributary E	3486.25	100-year	PR	2.49	256.89	257.22		257.23	0.005748	0.41	6.86	29.55	0.24
Cold_10_7	Tributary E	3456.94	100-year	EX	0.20	256.66	256.76	256.76	256.78	0.118921	0.76	0.29	5.12	0.89
Cold_10_7	Tributary E	3456.94	100-year	PR	2.49	256.66	256.99		257.01	0.023106	0.85	4.12	24.59	0.49
Cold_10_7	Tributary E	3435.76	100-year	EX	0.20	256.29	256.37	256.37	256.37	0.002290	0.08	1.50	18.41	0.12
Cold_10_7	Tributary E	3435.76	100-year	PR	2.49	256.29	256.50	256.42	256.52	0.020663	0.57	4.27	23.48	0.43
Cold_10_7	Tributary E	3426.56	100-year	EX	0.20	256.08	256.14	256.14	256.14	0.000746	0.05	2.46	24.30	0.07
Cold_10_7	Tributary E	3426.56	100-year	PR	2.49	256.08	256.25	256.14	256.27	0.010946	0.40	5.41	26.71	0.31
Cold_10_7	Tributary E	3396.62	100-year	EX	0.20	255.66	255.77		255.77	0.020960	0.30	0.90	23.43	0.37
Cold_10_7	Tributary E	3396.62	100-year	PR	2.49	255.66	255.92		255.93	0.019022	0.62	4.69	27.66	0.43
Cold_10_7	Tributary E	3377.5	100-year	EX	0.20	255.40	255.47		255.47	0.008427	0.12	1.25	26.14	0.21
Cold_10_7	Tributary E	3377.5	100-year	PR	2.49	255.40	255.63		255.64	0.009573	0.40	5.95	29.75	0.29
Cold_10_7	Tributary E	3359.36	100-year	EX	0.20	255.17	255.24		255.24	0.014881	0.21	0.98	23.11	0.30
Cold_10_7	Tributary E	3359.36	100-year	PR	2.49	255.17	255.38		255.40	0.018304	0.57	4.60	25.61	0.41
Cold_10_7	Tributary E	3339.67	100-year	EX	0.20	254.81	254.90		254.91	0.019505	0.33	0.69	12.38	0.37
Cold_10_7	Tributary E	3339.67	100-year	PR	2.49	254.81	255.12		255.13	0.011088	0.58	5.19	24.40	0.34
Cold_10_7	Tributary E	3321.23	100-year	EX	0.20	254.35	254.61		254.61	0.013797	0.38	0.52	4.55	0.33
Cold_10_7	Tributary E	3321.23	100-year	PR	2.49	254.35	254.88		254.90	0.014293	0.81	4.22	19.37	0.41
Cold_10_7	Tributary E	3287.37	100-year	EX	0.20	253.96	254.23	254.12	254.24	0.009013	0.32	0.71	8.77	0.27
Cold_10_7	Tributary E	3287.37	100-year	PR	2.49	253.96	254.54		254.56	0.007499	0.57	4.95	16.99	0.29
Cold_10_7	Tributary E	3269.41	100-year	EX	0.20	253.68	253.85	253.83	253.87	0.083616	0.69	0.28	3.35	0.76
Cold_10_7	Tributary E	3269.41	100-year	PR	2.49	253.68	254.30		254.35	0.021502	0.98	2.55	6.36	0.49
Cold_10_7	Tributary E	3191.63	100-year	EX	0.20	252.91	253.21		253.21	0.003308	0.24	0.84	4.42	0.17
Cold_10_7	Tributary E	3191.63	100-year	PR	2.49	252.91	254.03		254.04	0.001759	0.41	6.02	8.19	0.15
Cold_10_7	Tributary E	3188.65	100-year	EX	0.20	252.84	253.19	252.97	253.19	0.001815	0.19	1.02	7.04	0.13
Cold_10_7	Tributary E	3188.65	100-year	PR	2.49	252.84	254.01	253.28	254.02	0.001484	0.46	5.38	11.06	0.15
Cold_10_7	Tributary E	3158.51 hum_426			Culvert									
Cold_10_7	Tributary E	3123.12	100-year	EX	0.20	252.73	252.96	252.88	252.97	0.019582	0.34	0.58	6.79	0.37
Cold_10_7	Tributary E	3123.12	100-year	PR	2.49	252.73	253.22	253.12	253.27	0.032562	1.02	2.43	9.29	0.59
Cold_10_7	Tributary E	3107.01	100-year	EX	0.20	252.50	252.64		252.64	0.021278	0.29	0.68	10.73	0.37
Cold_10_7	Tributary E	3107.01	100-year	PR	2.49	252.50	252.84		252.86	0.019149	0.60	4.12	19.88	0.42
Cold_10_7	Tributary E	3043.25	100-year	EX	0.20	252.01	252.13		252.13	0.004120	0.12	1.63	27.78	0.16
Cold_10_7	Tributary E	3043.25	100-year	PR	2.49	252.01	252.33		252.34	0.004455	0.31	8.06	35.67	0.21
Cold_10_7	Tributary E	2991.29	100-year	EX	0.20	251.56	251.46	251.46	251.50	0.147498		0.21	2.20	0.00
Cold_10_7	Tributary E	2991.29	100-year	PR	2.49	251.56	251.66	251.66	251.71	0.097148	0.66	2.64	25.17	0.80
Cold_10_7	Tributary E	2930.14	100-year	EX	0.20	250.15	250.27		250.27	0.001313	0.10	2.16	25.47	0.10
Cold_10_7	Tributary E	2930.14	100-year	PR	2.49	250.15	250.59		250.59	0.001094	0.23	11.85	32.69	0.11
Cold_10_7	Tributary E	2887.5	100-year	EX	0.20	249.94	250.24		250.24	0.000564	0.11	2.54	24.37	0.07
Cold_10_7	Tributary E	2887.5	100-year	PR	2.49	249.94	250.54		250.54	0.001151	0.28	11.27	30.51	0.12
Cold_10_7	Tributary E	2802.56	100-year	EX	0.20	250.05	250.12		250.12	0.006001	0.11	1.11	15.66	0.18
Cold_10_7	Tributary E	2802.56	100-year	PR	2.49	250.05	250.41		250.41	0.002159	0.21	10.79	43.76	0.14
Cold_10_7	Tributary E	2775.8	100-year	EX	0.20	249.52	249.68		249.70	0.050127	0.55	0.36	4.10	0.59
Cold_10_7	Tributary E	2775.8	100-year	PR	2.49	249.52	250.38		250.38	0.000449	0.20	16.48	50.28	0.08
Cold_10_7	Tributary E	2760.75	100-year	EX	0.20	249.25	249.55	249.40	249.55	0.003588	0.25	0.79	4.03	0.18
Cold_10_7	Tributary E	2760.75	100-year	PR	2.49	249.25	250.36	249.70	250.37	0.002155	0.47	5.27	8.56	0.17
Cold_10_7	Tributary E	2732.6 hum_604			Culvert									
Cold_10_7	Tributary E	2706.72	100-year	EX	0.20	249.08	249.40	249.29	249.41	0.018507	0.52	0.38	2.19	0.39
Cold_10_7	Tributary E	2706.72	100-year	PR	2.49	249.08	249.94	249.71	249.99	0.022200	1.05	2.37	5.30	0.50
Cold_10_7	Tributary E	2688.78	100-year	EX	0.20	248.89	249.12		249.13	0.015423	0.38	0.52	4.30	0.35
Cold_10_7	Tributary E	2688.78	100-year	PR	2.49	248.89	249.31	249.31	249.38	0.070363	1.26	2.33	16.45	0.83
Cold_10_7	Tributary E	2611.59	100-year	EX	0.20	247.47	247.64		247.65	0.026229	0.36	0.57	8.11	0.42
Cold_10_7	Tributary E	2611.59	100-year	PR	2.49	247.47	247.88		247.89	0.009315	0.47	6.07	32.87	0.30
Cold_10_7	Tributary E	2560.8	100-year	EX	0.20	246.62	246.94		246.94	0.008214	0.37	0.53	2.63	0.26
Cold_10_7	Tributary E	2560.8	100-year	PR	2.49	246.62	247.42		247.43	0.009987	0.62	5.51	35.56	0.33
Cold_10_7	Tributary E	2506.61	100-year	EX	0.20	246.27	246.58		246.58	0.005839	0.31	0.65	3.45	0.23
Cold_10_7	Tributary E	2506.61	100-year	PR	2.49	246.27	247.01		247.03	0.006001	0.57	5.89	24.39	0.27
Cold_10_7	Tributary E	2483.51	100-year	EX	0.20	245.99	246.44		246.45	0.005908	0.34	0.58	2.59	0.23
Cold_10_7	Tributary E	2483.51	100-year	PR	2.49	245.99	246.83		246.84	0.009076	0.64	4.86	19.78	0.32

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	2452.23	100-year	EX	0.20	245.92	246.29		246.29	0.004147	0.28	0.70	3.31	0.19
Cold_10_7	Tributary E	2452.23	100-year	PR	2.49	245.92	246.62		246.62	0.005596	0.47	6.78	30.39	0.25
Cold_10_7	Tributary E	2401.32	100-year	EX	0.20	245.83	246.07		246.07	0.004354	0.22	1.02	11.21	0.19
Cold_10_7	Tributary E	2401.32	100-year	PR	2.49	245.83	246.34		246.35	0.004933	0.48	6.27	21.88	0.24
Cold_10_7	Tributary E	2367.56	100-year	EX	0.20	245.65	245.81		245.81	0.012820	0.30	0.66	6.78	0.31
Cold_10_7	Tributary E	2367.56	100-year	PR	2.49	245.65	246.02		246.04	0.016944	0.75	4.17	21.35	0.43
Cold_10_7	Tributary E	2338.9	100-year	EX	0.20	245.20	245.35		245.35	0.020394	0.34	0.63	9.45	0.38
Cold_10_7	Tributary E	2338.9	100-year	PR	2.49	245.20	245.57		245.59	0.015264	0.68	4.41	21.53	0.40
Cold_10_7	Tributary E	2310.58	100-year	EX	0.20	244.39	244.58		244.60	0.037222	0.64	0.31	2.17	0.54
Cold_10_7	Tributary E	2310.58	100-year	PR	2.49	244.39	245.09		245.13	0.019206	0.89	2.87	8.55	0.46
Cold_10_7	Tributary E	2264.91	100-year	EX	0.20	243.75	244.13		244.14	0.005466	0.32	0.63	2.96	0.22
Cold_10_7	Tributary E	2264.91	100-year	PR	2.49	243.75	244.67		244.69	0.007036	0.60	4.66	16.38	0.28
Cold_10_7	Tributary E	2209.07	100-year	EX	0.20	243.51	243.78		243.79	0.007324	0.33	0.60	3.32	0.25
Cold_10_7	Tributary E	2209.07	100-year	PR	2.49	243.51	244.34		244.35	0.005310	0.57	5.00	16.32	0.25
Cold_10_7	Tributary E	2169.34	100-year	EX	0.20	243.13	243.41		243.42	0.012037	0.41	0.48	2.80	0.32
Cold_10_7	Tributary E	2169.34	100-year	PR	2.49	243.13	244.13		244.15	0.005021	0.62	4.19	9.33	0.25
Cold_10_7	Tributary E	2156.52	100-year	EX	0.20	242.99	243.31	243.17	243.31	0.005992	0.27	0.72	4.74	0.22
Cold_10_7	Tributary E	2156.52	100-year	PR	2.49	242.99	244.10	243.46	244.11	0.001530	0.45	5.81	9.93	0.15
Cold_10_7	Tributary E	2127.4 hum_427			Culvert									
Cold_10_7	Tributary E	2093.17	100-year	EX	0.20	242.09	242.22	242.22	242.25	0.151612	0.84	0.23	3.21	1.00
Cold_10_7	Tributary E	2093.17	100-year	PR	2.49	242.09	242.49	242.49	242.61	0.106591	1.49	1.67	7.36	1.00
Cold_10_7	Tributary E	2079.21	100-year	EX	0.20	241.19	241.63		241.63	0.002049	0.24	0.84	2.89	0.14
Cold_10_7	Tributary E	2079.21	100-year	PR	2.49	241.19	242.16		242.19	0.005867	0.73	4.43	16.86	0.27
Cold_10_7	Tributary E	2055.25	100-year	EX	0.20	241.15	241.41	241.41	241.47	0.154773	1.07	0.18	1.65	1.02
Cold_10_7	Tributary E	2055.25	100-year	PR	2.49	241.15	241.81		241.88	0.044331	1.23	2.09	8.36	0.67
Cold_10_7	Tributary E	2016.73	100-year	EX	0.20	240.24	240.47		240.47	0.008870	0.33	0.60	3.93	0.27
Cold_10_7	Tributary E	2016.73	100-year	PR	2.49	240.24	240.88		240.91	0.015912	0.83	3.00	7.68	0.42
Cold_10_7	Tributary E	1965.37	100-year	EX	0.20	239.78	239.97		239.97	0.010616	0.30	0.65	5.65	0.29
Cold_10_7	Tributary E	1965.37	100-year	PR	2.49	239.78	240.44		240.46	0.005549	0.53	4.68	10.70	0.26
Cold_10_7	Tributary E	1917.19	100-year	EX	0.20	239.12	239.51	239.35	239.52	0.008535	0.36	0.55	3.02	0.27
Cold_10_7	Tributary E	1917.19	100-year	PR	2.49	239.12	240.06	239.74	240.09	0.010876	0.82	3.23	9.35	0.36
Cold_10_7	Tributary E	1875.03	100-year	EX	0.20	238.41	238.54	238.54	238.59	0.139174	0.97	0.20	2.11	1.00
Cold_10_7	Tributary E	1875.03	100-year	PR	2.49	238.41	238.91	238.91	239.10	0.082987	1.92	1.35	3.93	0.97
Cold_10_7	Tributary E	1862.94	100-year	EX	0.20	237.78	237.97		237.98	0.006337	0.40	0.50	4.00	0.36
Cold_10_7	Tributary E	1862.94	100-year	PR	2.49	237.78	238.44		238.48	0.006053	0.94	2.65	5.26	0.42
Cold_10_7	Tributary E	1801.09	100-year	EX	0.20	237.21	237.48		237.49	0.010561	0.35	0.56	3.86	0.29
Cold_10_7	Tributary E	1801.09	100-year	PR	2.49	237.21	237.94		237.97	0.011908	0.79	3.14	6.80	0.37
Cold_10_7	Tributary E	1765.21	100-year	EX	0.20	236.57	236.74	236.74	236.78	0.150807	0.95	0.21	2.36	1.01
Cold_10_7	Tributary E	1765.21	100-year	PR	2.49	236.57	237.09	237.09	237.26	0.098735	1.83	1.36	4.05	1.01
Cold_10_7	Tributary E	1718.91	100-year	EX	0.20	235.76	235.97		235.97	0.002152	0.17	1.13	6.74	0.14
Cold_10_7	Tributary E	1718.91	100-year	PR	2.49	235.76	236.40		236.42	0.004647	0.55	4.55	8.66	0.24
Cold_10_7	Tributary E	1661.15	100-year	EX	0.20	235.41	235.55	235.55	235.58	0.137920	0.78	0.26	3.68	0.94
Cold_10_7	Tributary E	1661.15	100-year	PR	2.49	235.41	235.87		235.91	0.023203	0.82	3.03	10.49	0.49
Cold_10_7	Tributary E	1612.45	100-year	EX	0.20	234.02	234.32	234.18	234.33	0.010298	0.41	0.48	2.49	0.30
Cold_10_7	Tributary E	1612.45	100-year	PR	2.49	234.02	234.89	234.59	234.93	0.017337	0.94	2.66	5.83	0.44
Cold_10_7	Tributary E	1568.23	100-year	EX	0.20	233.00	233.15	233.15	233.19	0.145999	0.91	0.22	2.61	1.00
Cold_10_7	Tributary E	1568.23	100-year	PR	2.49	233.00	233.57		233.67	0.054434	1.44	1.73	4.74	0.76
Cold_10_7	Tributary E	1541.88	100-year	EX	0.20	232.24	232.54		232.55	0.006651	0.33	0.59	3.03	0.24
Cold_10_7	Tributary E	1541.88	100-year	PR	2.49	232.24	233.21		233.24	0.007215	0.75	3.32	4.91	0.29
Cold_10_7	Tributary E	1489.67	100-year	EX	0.20	231.67	231.84		231.86	0.037822	0.62	0.32	2.37	0.54
Cold_10_7	Tributary E	1489.67	100-year	PR	2.49	231.67	232.23	232.17	232.38	0.066123	1.70	1.46	3.43	0.83
Cold_10_7	Tributary E	1435.23	100-year	EX	0.20	230.09	230.30	230.23	230.30	0.022255	0.35	0.57	6.87	0.39
Cold_10_7	Tributary E	1435.23	100-year	PR	2.49	230.09	230.59		230.62	0.018591	0.83	3.15	11.30	0.45
Cold_10_7	Tributary E	1380.7	100-year	EX	0.20	228.76	229.07		229.08	0.023110	0.56	0.36	2.03	0.42
Cold_10_7	Tributary E	1380.7	100-year	PR	2.49	228.76	229.54	229.45	229.59	0.021447	1.06	2.93	11.08	0.49
Cold_10_7	Tributary E	1332.54	100-year	EX	0.20	227.38	227.63		227.65	0.040764	0.65	0.31	2.22	0.56
Cold_10_7	Tributary E	1332.54	100-year	PR	2.49	227.38	228.03	227.99	228.13	0.049176	1.45	1.92	7.48	0.72
Cold_10_7	Tributary E	1302.84	100-year	EX	0.20	226.30	226.54		226.55	0.033584	0.55	0.36	2.99	0.51
Cold_10_7	Tributary E	1302.84	100-year	PR	2.49	226.30	226.93		226.99	0.030515	1.13	2.20	5.64	0.58
Cold_10_7	Tributary E	1263.71	100-year	EX	0.20	225.10	225.31		225.32	0.029491	0.51	0.39	3.26	0.48
Cold_10_7	Tributary E	1263.71	100-year	PR	2.49	225.10	225.66		225.72	0.034598	1.07	2.33	7.20	0.60
Cold_10_7	Tributary E	1215.31	100-year	EX	0.20	223.65	223.88	223.82	223.90	0.029147	0.50	0.40	3.48	0.47
Cold_10_7	Tributary E	1215.31	100-year	PR	2.49	223.65	224.32		224.36	0.022881	0.97	2.57	6.82	0.50
Cold_10_7	Tributary E	1168.81	100-year	EX	0.20	222.35	222.55		222.57	0.028361	0.54	0.37	2.79	0.47
Cold_10_7	Tributary E	1168.81	100-year	PR	2.49	222.35	222.96		223.05	0.036293	1.28	1.94	4.64	0.63
Cold_10_7	Tributary E	1130.29	100-year	EX	0.20	221.17	221.35		221.36	0.034720	0.56	0.35	2.89	0.52
Cold_10_7	Tributary E	1130.29	100-year	PR	2.49	221.17	221.84		221.91	0.024342	1.15	2.16	4.41	0.53
Cold_10_7	Tributary E	1111.06	100-year	EX	0.20	220.65	220.92		220.93	0.015464	0.45	0.44	2.71	0.36
Cold_10_7	Tributary E	1111.06	100-year	PR	2.49	220.65	221.45		221.50	0.017935	1.03	2.43	4.69	0.46
Cold_10_7	Tributary E	1084.58	100-year	EX	0.20	220.10	220.34		220.36	0.032385	0.59	0.34	2.45	0.51

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	1084.58	100-year	PR	2.49	220.10	220.79		220.87	0.033924	1.19	2.10	5.45	0.61
Cold_10_7	Tributary E	1048.15	100-year	EX	0.20	219.11	219.36		219.37	0.023044	0.50	0.39	2.84	0.43
Cold_10_7	Tributary E	1048.15	100-year	PR	2.49	219.11	219.89		219.94	0.019489	1.01	2.47	5.29	0.47
Cold_10_7	Tributary E	1028.59	100-year	EX	0.20	218.71	218.99		219.00	0.015897	0.46	0.43	2.62	0.36
Cold_10_7	Tributary E	1028.59	100-year	PR	2.49	218.71	219.53		219.58	0.017821	1.01	2.48	4.95	0.45
Cold_10_7	Tributary E	996.29	100-year	EX	0.20	218.32	218.57		218.58	0.010992	0.40	0.50	2.84	0.30
Cold_10_7	Tributary E	996.29	100-year	PR	2.49	218.32	219.00		219.04	0.016262	0.84	3.44	13.55	0.43
Cold_10_7	Tributary E	965.91	100-year	EX	0.20	217.92	218.10		218.11	0.022566	0.46	0.43	3.51	0.42
Cold_10_7	Tributary E	965.91	100-year	PR	2.49	217.92	218.50		218.53	0.018253	0.85	3.50	16.00	0.45
Cold_10_7	Tributary E	908.46	100-year	EX	0.20	216.79	217.03		217.04	0.015695	0.48	0.41	2.30	0.36
Cold_10_7	Tributary E	908.46	100-year	PR	2.49	216.79	217.53		217.57	0.016772	0.98	3.19	13.56	0.44
Cold_10_7	Tributary E	879.06	100-year	EX	0.20	216.23	216.45		216.46	0.025132	0.57	0.35	2.14	0.45
Cold_10_7	Tributary E	879.06	100-year	PR	2.49	216.23	217.12		217.15	0.012930	0.79	3.26	8.82	0.38
Cold_10_7	Tributary E	847.19	100-year	EX	0.20	215.85	216.17		216.17	0.004610	0.29	0.68	3.26	0.20
Cold_10_7	Tributary E	847.19	100-year	PR	2.49	215.85	216.62		216.66	0.018489	0.90	2.76	6.78	0.45
Cold_10_7	Tributary E	820.81	100-year	EX	0.20	215.47	216.15		216.15	0.000382	0.12	1.94	8.23	0.06
Cold_10_7	Tributary E	820.81	100-year	PR	2.49	215.47	216.43		216.44	0.004413	0.49	5.86	22.39	0.22
Cold_10_7	Tributary E	807.34	100-year	EX	0.20	215.44	216.14	215.62	216.14	0.000100	0.14	1.43	11.33	0.06
Cold_10_7	Tributary E	807.34	100-year	PR	2.49	215.44	216.37	216.03	216.39	0.002496	0.72	5.41	22.88	0.28
Cold_10_7	Tributary E	802.05 hum_427a			Culvert									
Cold_10_7	Tributary E	794.25	100-year	EX	0.20	214.77	214.97	214.85	214.98	0.002030	0.31	0.64	5.82	0.22
Cold_10_7	Tributary E	794.25	100-year	PR	2.49	214.77	215.46	215.17	215.52	0.005307	1.13	2.20	8.14	0.44
Cold_10_7	Tributary E	770.45	100-year	EX	0.20	214.67	214.83		214.84	0.046648	0.54	0.37	4.02	0.57
Cold_10_7	Tributary E	770.45	100-year	PR	2.49	214.67	215.23		215.28	0.024380	1.01	2.46	6.35	0.52
Cold_10_7	Tributary E	738	100-year	EX	0.20	213.98	214.28		214.29	0.008737	0.37	0.54	2.88	0.27
Cold_10_7	Tributary E	738	100-year	PR	2.49	213.98	214.78		214.81	0.009466	0.80	3.68	9.64	0.34
Cold_10_7	Tributary E	686.51	100-year	EX	0.20	213.33	213.52		213.53	0.029572	0.55	0.36	2.70	0.48
Cold_10_7	Tributary E	686.51	100-year	PR	2.49	213.33	213.97		214.05	0.028709	1.18	2.11	4.76	0.57
Cold_10_7	Tributary E	661.93	100-year	EX	0.20	212.92	213.10		213.10	0.011398	0.36	0.56	4.00	0.30
Cold_10_7	Tributary E	661.93	100-year	PR	2.49	212.92	213.54		213.57	0.013153	0.82	3.03	6.73	0.39
Cold_10_7	Tributary E	615.04	100-year	EX	0.20	212.33	212.51		212.52	0.012771	0.37	0.54	3.95	0.32
Cold_10_7	Tributary E	615.04	100-year	PR	2.49	212.33	212.98		213.00	0.010396	0.75	3.74	13.19	0.35
Cold_10_7	Tributary E	580.25	100-year	EX	0.20	211.91	212.11	212.02	212.11	0.010911	0.34	0.57	4.21	0.30
Cold_10_7	Tributary E	580.25	100-year	PR	2.49	211.91	212.54	212.30	212.58	0.014657	0.87	2.87	6.39	0.41
Cold_10_7	Tributary E	544.59	100-year	EX	0.20	211.47	211.79		211.79	0.007549	0.36	0.56	2.85	0.26
Cold_10_7	Tributary E	544.59	100-year	PR	2.49	211.47	212.25		212.26	0.005922	0.56	5.30	28.11	0.26
Cold_10_7	Tributary E	515.79	100-year	EX	0.20	211.17	211.48	211.37	211.49	0.015807	0.44	0.45	3.02	0.36
Cold_10_7	Tributary E	515.79	100-year	PR	2.49	211.17	211.89	211.73	211.96	0.029675	1.16	2.14	49.84	0.58
Cold_10_7	Tributary E	490.99	100-year	EX	0.20	211.02	211.35	211.15	211.35	0.002749	0.24	0.83	3.68	0.16
Cold_10_7	Tributary E	490.99	100-year	PR	2.49	211.02	211.61	211.51	211.62	0.005919	0.51	5.97	74.21	0.26
Cold_10_7	Tributary E	454.35	100-year	EX	0.20	210.82	210.95	210.95	210.99	0.147771	0.90	0.22	2.67	1.01
Cold_10_7	Tributary E	454.35	100-year	PR	2.49	210.82	211.43	211.30	211.44	0.004163	0.43	7.64	46.33	0.22
Cold_10_7	Tributary E	325.04	100-year	EX	0.20	210.06	210.73	210.20	210.73	0.000091	0.07	2.91	6.50	0.03
Cold_10_7	Tributary E	325.04	100-year	PR	2.49	210.06	210.91	210.50	210.93	0.004491	0.55	5.51	26.56	0.24
Cold_10_7	Tributary E	257.06	100-year	EX	0.20	209.82	210.73	209.97	210.73	0.000007	0.02	9.28	32.65	0.01
Cold_10_7	Tributary E	257.06	100-year	PR	2.49	209.82	210.85	210.16	210.85	0.000514	0.23	13.59	42.59	0.08
Cold_10_7	Tributary E	151.19	100-year	EX	0.20	209.26	210.73	209.39	210.73	0.000005	0.02	8.47	19.82	0.01
Cold_10_7	Tributary E	151.19	100-year	PR	2.49	209.26	210.78	209.71	210.79	0.000653	0.28	9.03	20.38	0.10
Cold_10_7	Tributary E	10.011	100-year	EX	51.03	207.93	209.75	209.63	210.06	0.004673	2.72	32.42	42.54	0.67
Cold_10_7	Tributary E	10.011	100-year	PR	50.61	207.93	209.73	209.62	210.05	0.004847	2.75	31.60	42.41	0.68
Cold_10_7	Tributary E	10.01	100-year	EX	51.03	207.54	209.85		209.86	0.000220	0.69	163.76	162.01	0.15
Cold_10_7	Tributary E	10.01	100-year	PR	50.61	207.54	209.83		209.85	0.000224	0.69	161.29	160.87	0.15
Cold_10_7	Tributary E	10.009	100-year	EX	51.03	206.42	209.85	207.53	209.86	0.000017	0.24	603.24	441.28	0.04
Cold_10_7	Tributary E	10.009	100-year	PR	50.61	206.42	209.84	207.53	209.84	0.000017	0.24	596.54	441.00	0.04
Cold_10_7	Tributary E	10.008	100-year	EX	51.03	207.54	209.85	208.77	209.85	0.000021	0.20	603.31	441.28	0.05
Cold_10_7	Tributary E	10.008	100-year	PR	50.61	207.54	209.84	208.77	209.84	0.000021	0.20	596.61	441.00	0.05
Cold_10_7	Tributary E	10.0075			Bridge									
Cold_10_7	Tributary E	10.007	100-year	EX	51.03	207.35	208.89	208.77	209.38	0.008206	3.11	16.98	105.15	0.86
Cold_10_7	Tributary E	10.007	100-year	PR	50.61	207.35	208.88	208.77	209.37	0.008274	3.11	16.85	104.83	0.86
Cold Creek West	Reach1	1784.71	100-year	EX	0.68	254.04	254.47	254.45	254.57	0.036010	1.40	0.48	1.96	0.90
Cold Creek West	Reach1	1784.71	100-year	PR	0.47	254.04	254.40	254.38	254.49	0.036741	1.28	0.36	1.72	0.89
Cold Creek West	Reach1	1752.69	100-year	EX	0.68	253.15	253.50	253.46	253.56	0.027368	1.07	0.63	3.34	0.79
Cold Creek West	Reach1	1752.69	100-year	PR	0.47	253.15	253.46		253.50	0.025609	0.93	0.50	3.12	0.74
Cold Creek West	Reach1	1724.34	100-year	EX	0.68	252.47	252.69		252.72	0.031343	0.77	0.88	8.56	0.77
Cold Creek West	Reach1	1724.34	100-year	PR	0.47	252.47	252.66	252.65	252.69	0.031710	0.68	0.69	8.21	0.75
Cold Creek West	Reach1	1663.99	100-year	EX	0.68	249.77	250.25	250.25	250.38	0.047873	1.57	0.43	1.75	1.01
Cold Creek West	Reach1	1663.99	100-year	PR	0.47	249.77	250.19	250.19	250.29	0.049817	1.45	0.32	1.52	1.01
Cold Creek West	Reach1	1612.71	100-year	EX	1.22	248.03	248.56		248.58	0.005722	0.65	1.87	6.49	0.39
Cold Creek West	Reach1	1612.71	100-year	PR	0.93	248.03	248.51	248.34	248.53	0.005497	0.59	1.58	6.23	0.37
Cold Creek West	Reach1	1586	100-year	EX	1.22	246.87	247.17	247.17	247.23	0.055171	1.06	1.15	10.62	1.03

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold Creek West	Reach1	1586	100-year	PR	0.93	246.87	247.14	247.14	247.20	0.058779	1.10	0.84	7.79	1.07
Cold Creek West	Reach1	1531	100-year	EX	1.22	243.80	244.18	244.18	244.29	0.043134	1.48	0.83	3.80	1.01
Cold Creek West	Reach1	1531	100-year	PR	0.93	243.80	244.14	244.14	244.23	0.044089	1.39	0.67	3.45	1.01
Cold Creek West	Reach1	1458	100-year	EX	1.22	238.86	239.38	239.38	239.48	0.047195	1.39	0.88	4.60	1.01
Cold Creek West	Reach1	1458	100-year	PR	0.93	238.86	239.35	239.35	239.43	0.046729	1.28	0.72	4.23	0.99
Cold Creek West	Reach1	1397	100-year	EX	3.18	236.18	236.54	236.54	236.67	0.043120	1.60	1.99	8.25	1.04
Cold Creek West	Reach1	1397	100-year	PR	3.07	236.18	236.54	236.54	236.66	0.040202	1.54	1.99	8.25	1.00
Cold Creek West	Reach1	1339	100-year	EX	3.18	233.69	234.49	234.41	234.60	0.023959	1.50	2.12	5.80	0.79
Cold Creek West	Reach1	1339	100-year	PR	3.07	233.69	234.48	234.40	234.59	0.024075	1.50	2.05	5.69	0.80
Cold Creek West	Reach1	1206	100-year	EX	3.18	231.11	231.88		232.00	0.016092	1.54	2.06	3.92	0.68
Cold Creek West	Reach1	1206	100-year	PR	3.07	231.11	231.86		231.98	0.016078	1.53	2.01	3.88	0.68
Cold Creek West	Reach1	1205	100-year	EX	3.18	228.43	229.19	229.19	229.43	0.038094	2.18	1.46	3.07	1.01
Cold Creek West	Reach1	1205	100-year	PR	3.07	228.43	229.17	229.17	229.41	0.038205	2.16	1.42	3.03	1.01
Cold Creek West	Reach1	1202.128 10.09.38	100-year	EX	16.28	226.88	228.18		228.31	0.002511	1.74	13.33	17.11	0.50
Cold Creek West	Reach1	1202.128 10.09.38	100-year	PR	16.28	226.88	228.18		228.31	0.002511	1.74	13.33	17.11	0.50
Cold Creek West	Reach1	1202.052 10.09.37	100-year	EX	16.28	226.67	227.92		228.04	0.002503	1.61	14.43	27.63	0.49
Cold Creek West	Reach1	1202.052 10.09.37	100-year	PR	16.28	226.67	227.92		228.04	0.002503	1.61	14.43	27.63	0.49
Cold Creek West	Reach1	1201.976 10.09.36	100-year	EX	16.28	226.67	227.82		227.93	0.002787	1.71	17.15	22.86	0.53
Cold Creek West	Reach1	1201.976 10.09.36	100-year	PR	16.28	226.67	227.82		227.93	0.002787	1.71	17.15	22.86	0.53
Cold Creek West	Reach1	1201.9 10.09.35	100-year	EX	16.28	226.43	227.44		227.63	0.005118	2.08	10.57	15.82	0.70
Cold Creek West	Reach1	1201.9 10.09.35	100-year	PR	16.28	226.43	227.44		227.63	0.005118	2.08	10.57	15.82	0.70
Cold Creek West	Reach1	1201.824 10.09.34	100-year	EX	16.28	226.01	227.35		227.41	0.001408	1.20	19.11	26.07	0.37
Cold Creek West	Reach1	1201.824 10.09.34	100-year	PR	16.28	226.01	227.35		227.41	0.001408	1.20	19.11	26.07	0.37
Cold Creek West	Reach1	1201.748 10.09.33	100-year	EX	16.28	225.86	226.98		227.22	0.004955	2.22	9.05	11.99	0.70
Cold Creek West	Reach1	1201.748 10.09.33	100-year	PR	16.28	225.86	226.98		227.22	0.004955	2.22	9.05	11.99	0.70
Cold Creek West	Reach1	1201.672 10.09.32	100-year	EX	16.28	225.59	226.87		226.94	0.001961	1.49	25.09	46.65	0.45
Cold Creek West	Reach1	1201.672 10.09.32	100-year	PR	16.28	225.59	226.87		226.94	0.001961	1.49	25.09	46.65	0.45
Cold Creek West	Reach1	1201.596 10.09.31	100-year	EX	16.28	225.53	226.31	226.31	226.54	0.009158	2.42	12.54	31.83	0.90
Cold Creek West	Reach1	1201.596 10.09.31	100-year	PR	16.28	225.53	226.31	226.31	226.54	0.009158	2.42	12.54	31.83	0.90
Cold Creek West	Reach1	1201.49 10.09.30	100-year	EX	16.28	225.05	226.08		226.16	0.002461	1.32	19.37	58.74	0.47
Cold Creek West	Reach1	1201.49 10.09.30	100-year	PR	16.28	225.05	226.08		226.16	0.002461	1.32	19.37	58.74	0.47
Cold Creek West	Reach1	1201.444 10.09.29	100-year	EX	16.28	224.42	225.95	225.26	226.04	0.001136	1.36	17.96	24.03	0.36
Cold Creek West	Reach1	1201.444 10.09.29	100-year	PR	16.28	224.42	225.95	225.26	226.04	0.001136	1.36	17.96	24.03	0.36
Cold Creek West	Reach1	1201.368 10.09.28	100-year	EX	16.28	224.24	225.79		225.92	0.002586	2.03	19.87	39.08	0.53
Cold Creek West	Reach1	1201.368 10.09.28	100-year	PR	16.28	224.24	225.79		225.92	0.002586	2.03	19.87	39.08	0.53
Cold Creek West	Reach1	1201.292 10.09.27	100-year	EX	16.28	224.15	225.61		225.75	0.002865	2.09	21.07	43.02	0.56
Cold Creek West	Reach1	1201.292 10.09.27	100-year	PR	16.28	224.15	225.61		225.75	0.002865	2.09	21.07	43.02	0.56
Cold Creek West	Reach1	1201.216 10.09.26	100-year	EX	16.28	224.12	225.52		225.64	0.002008	1.56	16.11	46.24	0.45
Cold Creek West	Reach1	1201.216 10.09.26	100-year	PR	16.28	224.12	225.52		225.64	0.002008	1.56	16.11	46.24	0.45
Cold Creek West	Reach1	1201.198 10.09.25	100-year	EX	16.28	223.94	225.45		225.54	0.001845	1.61	22.17	39.66	0.44
Cold Creek West	Reach1	1201.198 10.09.25	100-year	PR	16.28	223.94	225.45		225.54	0.001845	1.61	22.17	39.66	0.44
Cold Creek West	Reach1	1201.174 10.09.24	100-year	EX	16.28	223.94	225.40	225.02	225.52	0.002195	1.70	14.64	25.44	0.48
Cold Creek West	Reach1	1201.174 10.09.24	100-year	PR	16.28	223.94	225.40	225.02	225.52	0.002195	1.70	14.64	25.44	0.48
Cold Creek West	Reach1	1201.162 x-99 (10.09.23)			Bridge									
Cold Creek West	Reach1	1201.154 10.09.22	100-year	EX	16.28	223.94	225.28	224.89	225.45	0.002696	1.84	10.39	10.34	0.53
Cold Creek West	Reach1	1201.154 10.09.22	100-year	PR	16.28	223.94	225.28	224.89	225.45	0.002696	1.84	10.39	10.34	0.53
Cold Creek West	Reach1	1201.148 10.09.21	100-year	EX	16.28	223.97	225.12	224.98	225.39	0.005920	2.39	8.14	10.98	0.76
Cold Creek West	Reach1	1201.148 10.09.21	100-year	PR	16.28	223.97	225.12	224.98	225.39	0.005920	2.39	8.14	10.98	0.76
Cold Creek West	Reach1	1201.14 10.09.20	100-year	EX	16.28	223.73	225.14		225.33	0.003202	2.04	11.88	18.49	0.57
Cold Creek West	Reach1	1201.14 10.09.20	100-year	PR	16.28	223.73	225.14		225.33	0.003202	2.04	11.88	18.49	0.57
Cold Creek West	Reach1	1201.064 10.09.19	100-year	EX	16.28	223.58	225.01		225.10	0.001821	1.57	20.78	32.56	0.44
Cold Creek West	Reach1	1201.064 10.09.19	100-year	PR	16.28	223.58	225.01		225.10	0.001821	1.57	20.78	32.56	0.44
Cold Creek West	Reach1	1200.988 10.09.18	100-year	EX	16.28	223.37	224.90		224.99	0.001486	1.50	18.82	24.45	0.40
Cold Creek West	Reach1	1200.988 10.09.18	100-year	PR	16.28	223.37	224.90		224.99	0.001486	1.50	18.82	24.45	0.40
Cold Creek West	Reach1	1200.912 10.09.17	100-year	EX	16.28	223.04	224.57	224.57	224.81	0.004388	2.42	15.44	39.55	0.66
Cold Creek West	Reach1	1200.912 10.09.17	100-year	PR	16.28	223.04	224.57	224.57	224.81	0.004388	2.42	15.44	39.55	0.66
Cold Creek West	Reach1	1200.836 10.09.16	100-year	EX	16.28	222.71	224.29		224.41	0.001781	1.57	11.06	13.39	0.43
Cold Creek West	Reach1	1200.836 10.09.16	100-year	PR	16.28	222.71	224.29		224.41	0.001781	1.57	11.06	13.39	0.43
Cold Creek West	Reach1	1200.76 10.09.15	100-year	EX	16.28	222.68	223.83	223.83	224.23	0.009505	2.88	6.96	20.78	0.94
Cold Creek West	Reach1	1200.76 10.09.15	100-year	PR	16.28	222.68	223.83	223.83	224.23	0.009505	2.88	6.96	20.78	0.94
Cold Creek West	Reach1	1200.684 10.09.14	100-year	EX	16.28	222.35	223.71		223.79	0.001348	1.23	14.37	16.25	0.37
Cold Creek West	Reach1	1200.684 10.09.14	100-year	PR	16.28	222.35	223.71		223.79	0.001348	1.23	14.37	16.25	0.37
Cold Creek West	Reach1	1200.608 10.09.13	100-year	EX	16.28	222.05	223.40		223.59	0.002915	1.95	9.95	11.72	0.55
Cold Creek West	Reach1	1200.608 10.09.13	100-year	PR	16.28	222.05	223.40		223.59	0.002915	1.95	9.95	11.72	0.55
Cold Creek West	Reach1	1200.532 10.09.12	100-year	EX	16.28	221.81	223.30		223.43	0.002251	1.62	11.93	22.87	0.47
Cold Creek West	Reach1	1200.532 10.09.12	100-year	PR	16.28	221.81	223.30		223.43	0.002251	1.62	11.93	22.87	0.47
Cold Creek West	Reach1	1200.456 10.09.11	100-year	EX	16.28	221.69	223.24		223.30	0.000934	1.10	19.55	52.63	0.31
Cold Creek West	Reach1	1200.456 10.09.11	100-year	PR	16.28	221.69	223.24		223.30	0.000934	1.10	19.55	52.63	0.31
Cold Creek West	Reach1	1200.38 10.09.10	100-year	EX	16.28	221.72	222.80	222.75	223.12	0.007424	2.57	8.02	13.68	0.84
Cold Creek West	Reach1	1200.38 10.09.10	100-year	PR	16.28	221.72	222.80	222.75	223.12	0.007424	2.57	8.02	13.68	0.84

HEC-RAS Profile: 100-year (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold Creek West	Reach1	1200.304 10.09.09	100-year	EX	16.28	221.69	222.81		222.87	0.002230	1.44	24.36	36.68	0.46
Cold Creek West	Reach1	1200.304 10.09.09	100-year	PR	16.28	221.69	222.81		222.87	0.002230	1.44	24.36	36.68	0.46
Cold Creek West	Reach1	1200.278 10.09.08	100-year	EX	16.28	221.09	222.75		222.81	0.000935	1.19	23.89	59.35	0.32
Cold Creek West	Reach1	1200.278 10.09.08	100-year	PR	16.28	221.09	222.75		222.81	0.000935	1.19	23.89	59.35	0.32
Cold Creek West	Reach1	1200.228 10.09.07	100-year	EX	16.28	220.94	222.61		222.72	0.001409	1.56	19.89	35.98	0.40
Cold Creek West	Reach1	1200.228 10.09.07	100-year	PR	16.28	220.94	222.61		222.72	0.001409	1.56	19.89	35.98	0.40
Cold Creek West	Reach1	1200.152 10.09.06	100-year	EX	16.28	220.70	222.58		222.65	0.000970	1.28	25.08	46.46	0.32
Cold Creek West	Reach1	1200.152 10.09.06	100-year	PR	16.28	220.70	222.58		222.65	0.000970	1.28	25.08	46.46	0.32
Cold Creek West	Reach1	1200.076 10.09.05	100-year	EX	16.28	220.67	222.54	221.56	222.57	0.000456	0.98	33.54	37.48	0.23
Cold Creek West	Reach1	1200.076 10.09.05	100-year	PR	16.28	220.67	222.54	221.56	222.57	0.000456	0.98	33.54	37.48	0.23
Cold Creek West	Reach1	1200 10.09.04	100-year	EX	16.28	220.70	222.49	221.52	222.55	0.000662	1.15	16.39	32.72	0.28
Cold Creek West	Reach1	1200 10.09.04	100-year	PR	16.28	220.70	222.49	221.52	222.55	0.000662	1.15	16.39	32.72	0.28
Cold Creek West	Reach1	1199.984 x-98 (10.09.03)			Culvert									
Cold Creek West	Reach1	1199.963 10.09.02	100-year	EX	16.28	220.52	221.76	221.54	222.00	0.005794	2.20	7.40	13.68	0.73
Cold Creek West	Reach1	1199.963 10.09.02	100-year	PR	16.28	220.52	221.76	221.54	222.00	0.005793	2.20	7.40	13.68	0.73
Cold Creek West	Reach1	1199.934 10.09.01	100-year	EX	16.28	220.64	221.57	221.57	221.88	0.009547	2.51	8.03	18.12	0.92
Cold Creek West	Reach1	1199.934 10.09.01	100-year	PR	16.28	220.64	221.57	221.57	221.88	0.009547	2.51	8.03	18.12	0.92

Regional Storm Event

HEC-RAS Profile: Regional

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2_trib	Tributary D	1195.922	Regional	EX	5.23	263.57	264.33	264.33	264.43	0.012346	1.48	4.40	26.06	0.83
MM_9_2_trib	Tributary D	1195.922	Regional	PR	6.09	263.57	264.36	264.36	264.47	0.011874	1.53	5.12	27.29	0.82
MM_9_2_trib	Tributary D	1194	Regional	EX	5.23	263.15	263.71		263.76	0.007850	1.24	6.05	30.08	0.67
MM_9_2_trib	Tributary D	1194	Regional	PR	6.09	263.15	263.74		263.80	0.007790	1.30	7.06	37.84	0.68
MM_9_2_trib	Tributary D	1193.146	Regional	EX	5.23	262.86	263.40	263.21	263.41	0.001888	0.52	10.83	41.59	0.32
MM_9_2_trib	Tributary D	1193.146	Regional	PR	6.09	262.86	263.43	263.23	263.44	0.001944	0.55	11.96	43.23	0.33
MM_9_2_trib	Tributary D	1193.1	Regional	EX	5.23	262.94	263.20	263.20	263.28	0.029578	1.60	4.62	28.90	1.18
MM_9_2_trib	Tributary D	1193.1	Regional	PR	6.09	262.94	263.22	263.22	263.30	0.029550	1.68	5.11	29.41	1.19
MM_9_2_trib	Tributary D	1193.002	Regional	EX	5.23	262.16	263.18		263.18	0.000069	0.20	36.69	99.75	0.07
MM_9_2_trib	Tributary D	1193.002	Regional	PR	6.09	262.16	263.20		263.20	0.000083	0.22	38.75	100.49	0.08
MM_9_2_trib	Tributary D	1193.001	Regional	EX	5.23	262.76	263.08	263.08	263.16	0.026463	1.60	4.93	36.39	1.13
MM_9_2_trib	Tributary D	1193.001	Regional	PR	6.09	262.76	263.12	263.12	263.18	0.019125	1.48	6.32	40.46	0.98
MM_9_2_trib	Tributary D	1193	Regional	EX	5.23	261.89	262.48		262.51	0.002280	0.76	6.93	17.66	0.38
MM_9_2_trib	Tributary D	1193	Regional	PR	6.09	261.89	262.52		262.56	0.002370	0.81	7.61	18.85	0.39
MM_9_2_trib	Tributary D	1192.777	Regional	EX	5.23	261.72	262.36		262.40	0.005226	0.94	5.55	17.90	0.54
MM_9_2_trib	Tributary D	1192.777	Regional	PR	6.09	261.72	262.39		262.44	0.005209	0.99	6.18	18.61	0.55
MM_9_2_trib	Tributary D	1192.631	Regional	EX	5.23	261.28	262.07		262.11	0.004865	0.94	5.53	16.80	0.53
MM_9_2_trib	Tributary D	1192.631	Regional	PR	6.09	261.28	262.11		262.16	0.004694	0.98	6.24	17.55	0.52
MM_9_2_trib	Tributary D	1192.407	Regional	EX	5.23	260.76	261.30	261.26	261.45	0.012751	1.70	3.08	7.93	0.87
MM_9_2_trib	Tributary D	1192.407	Regional	PR	6.09	260.76	261.34	261.31	261.51	0.012945	1.79	3.42	10.05	0.89
MM_9_2_trib	Tributary D	1192.296	Regional	EX	5.23	259.90	260.60	260.60	260.80	0.017425	1.96	2.66	6.92	1.01
MM_9_2_trib	Tributary D	1192.296	Regional	PR	6.09	259.90	260.65	260.65	260.86	0.016874	2.03	3.00	7.19	1.01
MM_9_2_trib	Tributary D	1192.146	Regional	EX	8.93	256.74	257.43	257.43	257.67	0.016135	2.15	4.16	8.96	1.01
MM_9_2_trib	Tributary D	1192.146	Regional	PR	10.41	256.74	257.49	257.49	257.74	0.015943	2.22	4.68	9.47	1.01
MM_9_2_trib	Tributary D	1158.742	Regional	EX	8.93	254.88	255.85		255.97	0.012392	1.51	5.91	17.66	0.83
MM_9_2_trib	Tributary D	1158.742	Regional	PR	10.41	254.88	255.90		256.02	0.011003	1.54	6.78	18.09	0.80
MM_9_2_trib	Tributary D	1117.042	Regional	EX	8.93	254.11	255.09	255.09	255.37	0.015982	2.34	3.82	7.00	1.01
MM_9_2_trib	Tributary D	1117.042	Regional	PR	10.41	254.11	255.16	255.16	255.46	0.015706	2.44	4.27	7.20	1.01
MM_9_2_trib	Tributary D	1085.498	Regional	EX	8.93	253.57	254.46	254.46	254.71	0.016929	2.23	4.01	8.15	1.02
MM_9_2_trib	Tributary D	1085.498	Regional	PR	10.41	253.57	254.52	254.52	254.79	0.016200	2.31	4.51	8.41	1.01
MM_9_2_trib	Tributary D	1056.979	Regional	EX	8.93	253.04	253.48	253.48	253.58	0.022056	1.43	6.26	31.87	1.03
MM_9_2_trib	Tributary D	1056.979	Regional	PR	10.41	253.04	253.50	253.50	253.61	0.021120	1.49	7.00	32.42	1.02
MM_9_2_trib	Tributary D	1006.094	Regional	EX	8.93	249.20	250.35	250.35	250.68	0.020562	2.51	3.55	5.60	1.01
MM_9_2_trib	Tributary D	1006.094	Regional	PR	10.41	249.20	250.43	250.43	250.78	0.020307	2.60	4.01	5.95	1.01
MM_9_2_trib	Tributary D	954.6843	Regional	EX	8.93	247.18	248.23	248.23	248.56	0.016249	2.57	3.47	5.15	1.00
MM_9_2_trib	Tributary D	954.6843	Regional	PR	10.41	247.18	248.31	248.31	248.67	0.015966	2.67	3.90	5.37	1.00
MM_9_2_trib	Tributary D	927.8772	Regional	EX	8.93	246.33	247.55	247.55	247.93	0.016880	2.74	3.25	4.32	1.01
MM_9_2_trib	Tributary D	927.8772	Regional	PR	10.41	246.33	247.64	247.64	248.05	0.016335	2.83	3.68	4.52	1.00
MM_9_2_trib	Tributary D	886.4161	Regional	EX	12.21	245.71	246.94		247.16	0.007950	2.07	5.90	6.84	0.71
MM_9_2_trib	Tributary D	886.4161	Regional	PR	14.23	245.71	247.05		247.28	0.008155	2.11	6.74	7.83	0.73
MM_9_2_trib	Tributary D	830.2587	Regional	EX	12.21	245.01	246.14	246.14	246.54	0.015231	2.78	4.40	5.64	1.00
MM_9_2_trib	Tributary D	830.2587	Regional	PR	14.23	245.01	246.25	246.25	246.66	0.014969	2.84	5.02	6.17	1.00
MM_9_2_trib	Tributary D	765.2102	Regional	EX	12.21	244.36	245.23	245.20	245.39	0.013987	1.75	6.96	18.40	0.91
MM_9_2_trib	Tributary D	765.2102	Regional	PR	14.23	244.36	245.30	245.25	245.45	0.013419	1.73	8.21	21.42	0.89
MM_9_2_trib	Tributary D	719.386	Regional	EX	12.21	244.08	244.58	244.56	244.72	0.015213	1.69	7.21	21.50	0.93
MM_9_2_trib	Tributary D	719.386	Regional	PR	14.23	244.08	244.60	244.60	244.77	0.016219	1.82	7.82	22.01	0.97
MM_9_2_trib	Tributary D	691.6686	Regional	EX	12.21	243.69	244.17	244.15	244.29	0.015274	1.54	7.92	27.28	0.91
MM_9_2_trib	Tributary D	691.6686	Regional	PR	14.23	243.69	244.21	244.18	244.34	0.014509	1.59	8.97	28.49	0.90
MM_9_2_trib	Tributary D	639.0789	Regional	EX	12.21	241.96	243.24	243.24	243.43	0.017647	1.89	6.47	17.71	1.00
MM_9_2_trib	Tributary D	639.0789	Regional	PR	14.23	241.96	243.29	243.29	243.48	0.017985	1.95	7.30	19.41	1.01
MM_9_2_trib	Tributary D	605.7167	Regional	EX	12.21	241.38	242.58	242.58	242.76	0.017990	1.87	6.54	18.71	1.01
MM_9_2_trib	Tributary D	605.7167	Regional	PR	14.23	241.38	242.62	242.62	242.81	0.017711	1.96	7.26	19.14	1.02
MM_9_2_trib	Tributary D	552.2101	Regional	EX	12.21	239.59	240.90	240.85	241.10	0.014721	1.98	6.18	13.43	0.93
MM_9_2_trib	Tributary D	552.2101	Regional	PR	14.23	239.59	240.98	240.95	241.17	0.014445	1.90	7.48	17.11	0.92
MM_9_2_trib	Tributary D	508.8769	Regional	EX	12.21	238.89	240.12	240.12	240.43	0.015943	2.45	4.98	8.32	1.01
MM_9_2_trib	Tributary D	508.8769	Regional	PR	14.23	238.89	240.21	240.21	240.52	0.014861	2.48	5.74	8.95	0.99
MM_9_2_trib	Tributary D	457.6058	Regional	EX	12.21	238.50	239.16	239.16	239.32	0.018750	1.78	6.84	21.97	1.02
MM_9_2_trib	Tributary D	457.6058	Regional	PR	14.23	238.50	239.20	239.20	239.37	0.017453	1.85	7.71	22.24	1.00
MM_9_2_trib	Tributary D	393.3919	Regional	EX	12.21	236.93	237.75	237.75	237.99	0.015782	2.16	5.65	11.86	1.00
MM_9_2_trib	Tributary D	393.3919	Regional	PR	14.23	236.93	237.80	237.80	238.06	0.015386	2.26	6.31	12.20	1.00
MM_9_2_trib	Tributary D	345.8717	Regional	EX	12.21	236.53	237.22		237.33	0.005868	1.43	8.52	15.87	0.62
MM_9_2_trib	Tributary D	345.8717	Regional	PR	14.23	236.53	237.27		237.39	0.006231	1.54	9.22	16.03	0.65
MM_9_2_trib	Tributary D	308.4069	Regional	EX	12.21	236.36	236.81	236.81	236.97	0.018351	1.76	6.95	22.53	1.01
MM_9_2_trib	Tributary D	308.4069	Regional	PR	14.23	236.36	236.84	236.84	237.02	0.017789	1.84	7.72	22.73	1.01
MM_9_2_trib	Tributary D	261.2717	Regional	EX	12.21	234.87	236.03	235.98	236.17	0.012398	1.67	7.32	18.28	0.84
MM_9_2_trib	Tributary D	261.2717	Regional	PR	14.23	234.87	236.11		236.24	0.009819	1.64	8.67	18.60	0.77
MM_9_2_trib	Tributary D	237.4458	Regional	EX	12.21	234.36	235.48	235.48	235.82	0.015937	2.60	4.69	6.93	1.01
MM_9_2_trib	Tributary D	237.4458	Regional	PR	14.23	234.36	235.55	235.55	235.93	0.015619	2.71	5.25	7.14	1.01
MM_9_2_trib	Tributary D	197.6155	Regional	EX	12.21	233.46	234.13		234.23	0.007251	1.39	8.80	19.90	0.67
MM_9_2_trib	Tributary D	197.6155	Regional	PR	14.23	233.46	234.17		234.29	0.007400	1.48	9.63	20.08	0.68
MM_9_2_trib	Tributary D	176.7205	Regional	EX	12.21	233.02	233.84	233.84	234.00	0.017573	1.78	6.86	21.00	0.99

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2_trib	Tributary D	176.7205	Regional	PR	14.23	233.02	233.87	233.87	234.05	0.017250	1.88	7.59	21.14	1.00
MM_9_2_trib	Tributary D	163.5648	Regional	EX	12.21	232.73	233.51	233.51	233.68	0.017479	1.85	6.58	18.91	1.00
MM_9_2_trib	Tributary D	163.5648	Regional	PR	14.23	232.73	233.55	233.55	233.74	0.017379	1.92	7.40	20.00	1.01
MM_9_2_trib	Tributary D	151.4771	Regional	EX	12.21	231.39	232.33	232.33	232.68	0.015348	2.63	4.65	6.70	1.01
MM_9_2_trib	Tributary D	151.4771	Regional	PR	14.23	231.39	232.42	232.42	232.79	0.014837	2.72	5.24	6.97	1.00
MM_9_2_trib	Tributary D	140.92	Regional	EX	12.21	231.16	231.85	231.85	232.07	0.016625	2.07	5.91	13.91	1.01
MM_9_2_trib	Tributary D	140.92	Regional	PR	14.23	231.16	231.90	231.90	232.14	0.016107	2.16	6.60	14.22	1.01
MM_9_2_trib	Tributary D	123.28	Regional	EX	12.21	229.65	230.94	230.94	231.25	0.016163	2.49	4.90	7.77	1.00
MM_9_2_trib	Tributary D	123.28	Regional	PR	14.23	229.65	231.01	231.01	231.36	0.015808	2.59	5.49	8.05	1.00
MM_9_2_trib	Tributary D	89.70679	Regional	EX	12.21	228.90	230.31	230.31	230.67	0.015594	2.65	4.62	6.54	1.01
MM_9_2_trib	Tributary D	89.70679	Regional	PR	14.23	228.90	230.41	230.41	230.78	0.015153	2.72	5.23	6.97	1.00
MM_9_2_trib	Tributary D	72.5771	Regional	EX	12.21	228.51	229.73	229.73	229.96	0.017343	2.10	5.82	13.23	1.01
MM_9_2_trib	Tributary D	72.5771	Regional	PR	14.23	228.51	229.79	229.79	230.03	0.016435	2.17	6.55	13.57	1.00
MM_9_2_trib	Tributary D	51.16022	Regional	EX	12.21	228.00	228.96	228.96	229.08	0.021098	1.57	7.75	32.78	1.03
MM_9_2_trib	Tributary D	51.16022	Regional	PR	14.23	228.00	228.99	228.99	229.12	0.020304	1.63	8.71	33.83	1.03
MM_9_2_trib	Tributary D	26.54893	Regional	EX	12.21	227.45	228.21	228.21	228.37	0.019316	1.75	6.96	23.39	1.03
MM_9_2_trib	Tributary D	26.54893	Regional	PR	14.23	227.45	228.25	228.25	228.41	0.018948	1.80	7.92	25.26	1.03
MM_9_2_trib	Tributary B	1005	Regional	EX	1.70	256.65	257.12	257.12	257.27	0.019729	1.72	0.99	3.33	1.01
MM_9_2_trib	Tributary B	1005	Regional	PR	2.12	256.65	257.17	257.17	257.34	0.019198	1.80	1.17	3.60	1.01
MM_9_2_trib	Tributary B	1004.6	Regional	EX	1.70	255.56	255.95	255.95	256.10	0.019675	1.70	1.00	3.44	1.01
MM_9_2_trib	Tributary B	1004.6	Regional	PR	2.12	255.56	256.00	256.00	256.17	0.019082	1.80	1.17	3.59	1.01
MM_9_2_trib	Tributary B	1004	Regional	EX	1.70	254.60	254.97	254.97	255.09	0.020214	1.58	1.08	4.35	1.01
MM_9_2_trib	Tributary B	1004	Regional	PR	2.12	254.60	255.01	255.01	255.15	0.019457	1.67	1.27	4.52	1.01
MM_9_2_trib	Tributary B	1003	Regional	EX	1.70	251.29	251.72	251.72	251.83	0.020628	1.52	1.12	4.77	1.01
MM_9_2_trib	Tributary B	1003	Regional	PR	2.12	251.29	251.76	251.76	251.89	0.020454	1.58	1.34	5.37	1.01
MM_9_2_trib	Tributary B	1002	Regional	EX	1.70	249.03	250.89		250.89	0.000054	0.18	9.21	10.29	0.06
MM_9_2_trib	Tributary B	1002	Regional	PR	2.12	249.03	250.96		250.96	0.000065	0.21	9.99	10.58	0.07
MM_9_2_trib	Tributary B	1001.4	Regional	EX	1.70	247.85	250.89		250.89	0.000003	0.06	27.20	15.32	0.02
MM_9_2_trib	Tributary B	1001.4	Regional	PR	2.12	247.85	250.96		250.96	0.000004	0.07	28.36	15.69	0.02
MM_9_2_trib	Tributary B	1001	Regional	EX	1.70	247.79	250.89		250.89	0.000002	0.05	32.98	20.29	0.01
MM_9_2_trib	Tributary B	1001	Regional	PR	2.12	247.79	250.96		250.96	0.000003	0.06	34.54	21.31	0.02
MM_9_2_trib	Tributary B	1000.8	Regional	EX	1.70	247.16	250.89		250.89	0.000000	0.01	208.71	79.62	0.00
MM_9_2_trib	Tributary B	1000.8	Regional	PR	2.12	247.16	250.96		250.96	0.000000	0.01	214.70	80.18	0.00
MM_9_2_trib	Tributary B	1000.2	Regional	EX	1.70	246.61	250.89		250.89	0.000000	0.02	110.30	35.02	0.00
MM_9_2_trib	Tributary B	1000.2	Regional	PR	2.12	246.61	250.96		250.96	0.000000	0.02	112.94	35.33	0.00
MM_9_2_trib	Tributary B	1000	Regional	EX	1.70	245.34	250.89	245.95	250.89	0.000000	0.01	123.57	39.48	0.00
MM_9_2_trib	Tributary B	1000	Regional	PR	2.12	245.34	250.96	246.04	250.96	0.000000	0.02	126.55	40.06	0.00
MM_9_2_trib	Tributary B	999.64			Culvert									
MM_9_2_trib	Tributary B	999	Regional	EX	2.76	242.45	243.30	243.30	243.71	0.013256	2.82	0.98	3.35	1.00
MM_9_2_trib	Tributary B	999	Regional	PR	3.43	242.45	243.43	243.43	243.90	0.012610	3.03	1.13	3.64	1.00
MM_9_2_trib	Tributary B	998	Regional	EX	2.76	240.71	241.43	241.43	241.65	0.018847	2.10	1.32	2.99	1.01
MM_9_2_trib	Tributary B	998	Regional	PR	3.43	240.71	241.50	241.50	241.75	0.018393	2.20	1.56	3.22	1.01
MM_9_2_trib	Tributary B	997.4	Regional	EX	2.76	238.99	239.49	239.49	239.66	0.018421	1.78	1.55	4.81	1.01
MM_9_2_trib	Tributary B	997.4	Regional	PR	3.43	238.99	239.55	239.55	239.73	0.017963	1.89	1.81	5.04	1.01
MM_9_2_trib	Tributary B	997	Regional	EX	2.76	236.98	237.43	237.43	237.54	0.021510	1.47	1.88	8.92	1.02
MM_9_2_trib	Tributary B	997	Regional	PR	3.43	236.98	237.46	237.46	237.58	0.020430	1.54	2.23	9.56	1.01
MM_9_2_trib	Tributary B	996	Regional	EX	2.76	234.21	234.81	234.81	234.91	0.021377	1.43	1.93	9.43	1.01
MM_9_2_trib	Tributary B	996	Regional	PR	3.43	234.21	234.84	234.84	234.96	0.020198	1.51	2.27	9.76	1.00
MM_9_2_trib	Tributary B	995.4	Regional	EX	2.76	231.73	232.27	232.27	232.46	0.018396	1.92	1.44	3.87	1.01
MM_9_2_trib	Tributary B	995.4	Regional	PR	3.43	231.73	232.33	232.33	232.54	0.017961	2.02	1.69	4.14	1.01
MM_9_2_trib	Tributary B	994.4	Regional	EX	2.76	229.20	231.85		231.85	0.000000	0.03	207.71	122.28	0.01
MM_9_2_trib	Tributary B	994.4	Regional	PR	3.43	229.20	231.85		231.85	0.000001	0.03	207.20	122.20	0.01
MM_9_2_trib	Tributary B	994	Regional	EX	2.76	227.10	231.85		231.85	0.000000	0.01	718.84	230.20	0.00
MM_9_2_trib	Tributary B	994	Regional	PR	3.43	227.10	231.85		231.85	0.000000	0.01	717.88	230.17	0.00
MM_9_2	Tributary C	2179.936	Regional	EX	4.56	256.76	257.07		257.09	0.007013	0.70	6.47	40.53	0.56
MM_9_2	Tributary C	2179.936	Regional	PR	4.26	256.76	257.06		257.08	0.007376	0.70	6.09	40.00	0.57
MM_9_2	Tributary C	2159.385	Regional	EX	4.56	256.64	256.99		257.01	0.002510	0.50	9.05	43.33	0.35
MM_9_2	Tributary C	2159.385	Regional	PR	4.26	256.64	256.98		256.99	0.002548	0.50	8.58	42.50	0.35
MM_9_2	Tributary C	2097.132	Regional	EX	4.56	256.48	256.83		256.84	0.002710	0.58	7.85	32.12	0.38
MM_9_2	Tributary C	2097.132	Regional	PR	4.26	256.48	256.82		256.83	0.002689	0.57	7.49	31.51	0.37
MM_9_2	Tributary C	2030.564	Regional	EX	4.56	256.04	256.34	256.34	256.45	0.020395	1.45	3.15	14.84	1.00
MM_9_2	Tributary C	2030.564	Regional	PR	4.26	256.04	256.33	256.33	256.43	0.020872	1.42	2.99	14.70	1.01
MM_9_2	Tributary C	1994	Regional	EX	4.56	255.61	256.21		256.21	0.000399	0.34	13.38	28.95	0.16
MM_9_2	Tributary C	1994	Regional	PR	4.26	255.61	256.19		256.19	0.000397	0.33	12.81	28.67	0.16
MM_9_2	Tributary C	1970.384	Regional	EX	4.56	255.41	256.20		256.21	0.000109	0.20	22.65	40.71	0.09
MM_9_2	Tributary C	1970.384	Regional	PR	4.26	255.41	256.18		256.19	0.000106	0.19	21.85	40.32	0.08
MM_9_2	Tributary C	1911.614	Regional	EX	4.56	255.36	256.20	255.61	256.20	0.000095	0.21	21.62	32.67	0.08
MM_9_2	Tributary C	1911.614	Regional	PR	4.26	255.36	256.18	255.60	256.18	0.000091	0.20	20.98	32.51	0.08
MM_9_2	Tributary C	1881.066			Bridge									
MM_9_2	Tributary C	1855.838	Regional	EX	5.33	255.52	255.84	255.84	255.94	0.020570	1.39	3.82	19.17	1.00

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2	Tributary C	1855.838	Regional	PR	4.98	255.52	255.83	255.83	255.92	0.020785	1.37	3.62	18.69	1.00
MM_9_2	Tributary C	1813.506	Regional	EX	5.33	254.71	254.99	254.96	255.06	0.012706	1.15	4.61	21.48	0.80
MM_9_2	Tributary C	1813.506	Regional	PR	4.98	254.71	254.98	254.95	255.05	0.012564	1.12	4.44	21.38	0.79
MM_9_2	Tributary C	1775.696	Regional	EX	5.33	254.15	254.41	254.37	254.46	0.009747	0.95	5.63	29.03	0.69
MM_9_2	Tributary C	1775.696	Regional	PR	4.98	254.15	254.41	254.36	254.45	0.009788	0.92	5.39	28.89	0.68
MM_9_2	Tributary C	1726.57	Regional	EX	5.33	252.83	253.30	253.30	253.40	0.021429	1.37	3.88	20.54	1.01
MM_9_2	Tributary C	1726.57	Regional	PR	4.98	252.83	253.29	253.29	253.39	0.021464	1.35	3.68	19.91	1.01
MM_9_2	Tributary C	1684.01	Regional	EX	5.33	251.82	252.16	252.16	252.23	0.023434	1.17	4.54	32.60	1.00
MM_9_2	Tributary C	1684.01	Regional	PR	4.98	251.82	252.15	252.15	252.22	0.024831	1.18	4.23	31.57	1.03
MM_9_2	Tributary C	1603.573	Regional	EX	5.33	251.65	252.00		252.00	0.000505	0.23	22.87	104.59	0.16
MM_9_2	Tributary C	1603.573	Regional	PR	4.98	251.65	251.99		251.99	0.000503	0.23	21.96	104.36	0.16
MM_9_2	Tributary C	1539.326	Regional	EX	5.33	251.65	251.89		251.91	0.008342	0.71	7.52	52.95	0.60
MM_9_2	Tributary C	1539.326	Regional	PR	4.98	251.65	251.88		251.90	0.008611	0.70	7.07	51.56	0.61
MM_9_2	Tributary C	1486.021	Regional	EX	5.33	250.90	251.35		251.42	0.010125	1.18	4.51	17.09	0.73
MM_9_2	Tributary C	1486.021	Regional	PR	4.98	250.90	251.33		251.40	0.010113	1.16	4.31	16.85	0.73
MM_9_2	Tributary C	1450.067	Regional	EX	5.33	250.28	250.78	250.78	250.92	0.019927	1.61	3.30	12.96	1.02
MM_9_2	Tributary C	1450.067	Regional	PR	4.98	250.28	250.77	250.77	250.90	0.020188	1.58	3.15	12.83	1.02
MM_9_2	Tributary C	1406.638	Regional	EX	5.33	249.69	250.20	250.12	250.27	0.007921	1.17	4.54	14.32	0.67
MM_9_2	Tributary C	1406.638	Regional	PR	4.98	249.69	250.18	250.10	250.25	0.007880	1.14	4.35	14.21	0.66
MM_9_2	Tributary C	1338.455	Regional	EX	5.33	248.69	249.33	249.33	249.46	0.019554	1.58	3.38	13.47	1.00
MM_9_2	Tributary C	1338.455	Regional	PR	4.98	248.69	249.32	249.32	249.44	0.019748	1.55	3.22	13.30	1.00
MM_9_2	Tributary C	1304.352	Regional	EX	5.33	247.99	248.58	248.54	248.72	0.013836	1.67	3.20	8.91	0.89
MM_9_2	Tributary C	1304.352	Regional	PR	4.98	247.99	248.56	248.53	248.70	0.014272	1.65	3.02	8.75	0.90
MM_9_2	Tributary C	1265.187	Regional	EX	5.33	247.35	247.93	247.93	248.10	0.018116	1.80	2.96	9.05	1.00
MM_9_2	Tributary C	1265.187	Regional	PR	4.98	247.35	247.89	247.89	248.07	0.017620	1.90	2.62	7.21	1.00
MM_9_2	Tributary C	1206.875	Regional	EX	5.33	246.19	246.81	246.78	246.97	0.015121	1.76	3.03	8.33	0.93
MM_9_2	Tributary C	1206.875	Regional	PR	4.98	246.19	246.78	246.76	246.94	0.014509	1.76	2.83	7.51	0.92
MM_9_2	Tributary C	1175.661	Regional	EX	5.33	245.83	246.29	246.29	246.41	0.020145	1.57	3.40	14.00	1.02
MM_9_2	Tributary C	1175.661	Regional	PR	4.98	245.83	246.28	246.28	246.40	0.020386	1.53	3.25	13.95	1.01
MM_9_2	Tributary C	1120.613	Regional	EX	5.33	244.63	245.37		245.44	0.006385	1.18	4.50	11.52	0.61
MM_9_2	Tributary C	1120.613	Regional	PR	4.98	244.63	245.35		245.42	0.006365	1.15	4.31	11.44	0.60
MM_9_2	Tributary C	1083.716	Regional	EX	5.33	244.05	244.89	244.89	245.06	0.018362	1.84	2.89	8.39	1.00
MM_9_2	Tributary C	1083.716	Regional	PR	4.98	244.05	244.86	244.86	245.04	0.019024	1.85	2.68	7.92	1.02
MM_9_2	Tributary C	1042.153	Regional	EX	5.33	243.04	243.73		243.79	0.009153	1.15	4.63	16.62	0.70
MM_9_2	Tributary C	1042.153	Regional	PR	4.98	243.04	243.71		243.78	0.009359	1.13	4.40	16.49	0.70
MM_9_2	Tributary C	1006.177	Regional	EX	5.33	242.45	243.16	243.16	243.32	0.019156	1.81	2.95	9.16	1.02
MM_9_2	Tributary C	1006.177	Regional	PR	4.98	242.45	243.14	243.14	243.30	0.019156	1.77	2.81	8.99	1.01
MM_9_2	Tributary C	993.3609	Regional	EX	7.79	241.83	243.04		243.10	0.004643	1.04	7.50	18.84	0.53
MM_9_2	Tributary C	993.3609	Regional	PR	7.28	241.83	243.02		243.07	0.004501	1.02	7.14	18.01	0.52
MM_9_2	Tributary C	935.4169	Regional	EX	7.79	241.33	242.42	242.42	242.61	0.018026	1.90	4.10	11.31	1.01
MM_9_2	Tributary C	935.4169	Regional	PR	7.28	241.33	242.40	242.40	242.58	0.019349	1.90	3.83	11.12	1.03
MM_9_2	Tributary C	870.5434	Regional	EX	7.79	239.51	240.62	240.62	240.96	0.016802	2.59	3.01	4.42	1.00
MM_9_2	Tributary C	870.5434	Regional	PR	7.28	239.51	240.58	240.58	240.91	0.016924	2.55	2.86	4.33	1.00
MM_9_2	Tributary C	836.4684	Regional	EX	7.79	238.61	239.53	239.53	239.87	0.016391	2.57	3.03	4.58	1.01
MM_9_2	Tributary C	836.4684	Regional	PR	7.28	238.61	239.50	239.50	239.82	0.016522	2.53	2.88	4.49	1.01
MM_9_2	Tributary C	799.8246	Regional	EX	7.79	237.89	238.76	238.76	239.05	0.016359	2.42	3.22	5.46	1.01
MM_9_2	Tributary C	799.8246	Regional	PR	7.28	237.89	238.73	238.73	239.01	0.016371	2.37	3.07	5.39	1.00
MM_9_2	Tributary C	745.4448	Regional	EX	7.79	235.79	236.54	236.54	236.81	0.016040	2.30	3.39	6.34	1.01
MM_9_2	Tributary C	745.4448	Regional	PR	7.28	235.79	236.51	236.51	236.77	0.016321	2.27	3.21	6.22	1.01
MM_9_2	Tributary C	716.4415	Regional	EX	7.79	234.84	235.51	235.48	235.73	0.014375	2.06	3.79	7.66	0.93
MM_9_2	Tributary C	716.4415	Regional	PR	7.28	234.84	235.50	235.46	235.70	0.013447	1.97	3.70	7.60	0.90
MM_9_2	Tributary C	687.3773	Regional	EX	7.79	234.27	235.10	235.10	235.23	0.018438	1.64	4.74	16.84	0.99
MM_9_2	Tributary C	687.3773	Regional	PR	7.28	234.27	235.07	235.07	235.21	0.019543	1.67	4.37	15.84	1.01
MM_9_2	Tributary C	661.4518	Regional	EX	7.79	233.56	234.27	234.27	234.55	0.016045	2.35	3.32	5.97	1.01
MM_9_2	Tributary C	661.4518	Regional	PR	7.28	233.56	234.24	234.24	234.51	0.016208	2.30	3.16	5.91	1.01
MM_9_2	Tributary C	627.6722	Regional	EX	7.79	232.58	233.40	233.40	233.69	0.016825	2.36	3.30	5.90	1.01
MM_9_2	Tributary C	627.6722	Regional	PR	7.28	232.58	233.37	233.37	233.65	0.017017	2.32	3.13	5.79	1.01
MM_9_2	Tributary C	589.2625	Regional	EX	7.79	231.90	232.75		232.85	0.004943	1.35	5.79	10.22	0.57
MM_9_2	Tributary C	589.2625	Regional	PR	7.28	231.90	232.73		232.81	0.005016	1.32	5.51	10.12	0.57
MM_9_2	Tributary C	540.5079	Regional	EX	7.79	231.39	232.16	232.16	232.43	0.016157	2.30	3.39	6.39	1.01
MM_9_2	Tributary C	540.5079	Regional	PR	7.28	231.39	232.13	232.13	232.39	0.016344	2.26	3.22	6.29	1.01
MM_9_2	Tributary C	510.2238	Regional	EX	7.79	230.56	231.19	231.19	231.40	0.017428	2.03	3.84	9.37	1.01
MM_9_2	Tributary C	510.2238	Regional	PR	7.28	230.56	231.17	231.17	231.37	0.017586	1.98	3.67	9.29	1.01
MM_9_2	Tributary C	457.5412	Regional	EX	7.79	228.97	229.95	229.94	230.25	0.016028	2.45	3.18	5.01	0.98
MM_9_2	Tributary C	457.5412	Regional	PR	7.28	228.97	229.91	229.90	230.21	0.016162	2.41	3.02	4.90	0.98
MM_9_2	Tributary C	414.0466	Regional	EX	7.79	228.37	229.30	229.28	229.56	0.015255	2.25	3.46	6.31	0.97
MM_9_2	Tributary C	414.0466	Regional	PR	7.28	228.37	229.28	229.26	229.52	0.014761	2.18	3.34	6.23	0.95
MM_9_2	Tributary C	374.4607	Regional	EX	7.79	227.94	228.69	228.69	228.91	0.016771	2.08	3.75	8.65	1.01
MM_9_2	Tributary C	374.4607	Regional	PR	7.28	227.94	228.67	228.67	228.88	0.017157	2.05	3.55	8.53	1.01
MM_9_2	Tributary C	330.2584	Regional	EX	7.79	227.43	227.84	227.81	227.90	0.012917	1.10	7.11	35.85	0.79
MM_9_2	Tributary C	330.2584	Regional	PR	7.28	227.43	227.80	227.80	227.89	0.023246	1.31	5.57	33.53	1.02

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
MM_9_2	Tributary C + D	294	Regional	EX	0.52	226.97	227.13	227.13	227.15	0.034341	0.62	0.85	21.16	0.99
MM_9_2	Tributary C + D	294	Regional	PR	0.52	226.97	227.13	227.13	227.15	0.034341	0.62	0.85	21.16	0.99
MM_9_2	Tributary C + D	266.3048	Regional	EX	0.52	224.85	225.08	225.08	225.16	0.023171	1.25	0.42	2.65	1.00
MM_9_2	Tributary C + D	266.3048	Regional	PR	0.52	224.85	225.08	225.08	225.16	0.023247	1.25	0.42	2.65	1.01
MM_9_2	Tributary C + D	236.2558	Regional	EX	0.52	223.38	224.21		224.21	0.000168	0.20	2.59	6.14	0.10
MM_9_2	Tributary C + D	236.2558	Regional	PR	0.52	223.38	224.21		224.21	0.000168	0.20	2.59	6.14	0.10
MM_9_2	Tributary C + D	205.6305	Regional	EX	0.52	222.98	224.21		224.21	0.000023	0.11	4.84	6.28	0.04
MM_9_2	Tributary C + D	205.6305	Regional	PR	0.52	222.98	224.21		224.21	0.000023	0.11	4.84	6.28	0.04
MM_9_2	Tributary C + D	173.8239	Regional	EX	0.52	222.27	224.21		224.21	0.000002	0.04	12.73	9.34	0.01
MM_9_2	Tributary C + D	173.8239	Regional	PR	0.52	222.27	224.21		224.21	0.000002	0.04	12.73	9.34	0.01
MM_9_2	Tributary C + D	151.7834	Regional	EX	0.52	221.52	224.21		224.21	0.000000	0.02	32.30	23.23	0.00
MM_9_2	Tributary C + D	151.7834	Regional	PR	0.52	221.52	224.21		224.21	0.000000	0.02	32.30	23.23	0.00
MM_9_2	Tributary C + D	116.6732	Regional	EX	0.52	221.27	224.21		224.21	0.000000	0.01	77.19	46.01	0.00
MM_9_2	Tributary C + D	116.6732	Regional	PR	0.52	221.27	224.21		224.21	0.000000	0.01	77.19	46.01	0.00
MM_9_2	Tributary C + D	66.5837	Regional	EX	0.52	220.30	224.21		224.21	0.000000	0.00	142.18	67.86	0.00
MM_9_2	Tributary C + D	66.5837	Regional	PR	0.52	220.30	224.21		224.21	0.000000	0.00	142.17	67.86	0.00
MM_9_2	Tributary C + D	34.76245	Regional	EX	0.52	219.88	224.21		224.21	0.000000	0.00	289.91	117.14	0.00
MM_9_2	Tributary C + D	34.76245	Regional	PR	0.52	219.88	224.21		224.21	0.000000	0.00	289.90	117.14	0.00
Main_1	Tributary A	1017	Regional	EX	0.50	254.63	254.86	254.86	254.91	0.026521	0.96	0.52	5.52	1.00
Main_1	Tributary A	1017	Regional	PR	0.47	254.63	254.85	254.85	254.90	0.026597	0.95	0.50	5.45	1.00
Main_1	Tributary A	1000	Regional	EX	0.50	253.30	253.53	253.53	253.57	0.029271	0.90	0.56	7.05	1.02
Main_1	Tributary A	1000	Regional	PR	0.47	253.30	253.53	253.53	253.57	0.029408	0.89	0.53	6.76	1.02
Main_1	Tributary A	999	Regional	EX	0.50	252.17	252.40		252.41	0.000446	0.12	4.04	25.18	0.10
Main_1	Tributary A	999	Regional	PR	0.47	252.17	252.40		252.40	0.000438	0.12	3.90	24.99	0.10
Main_1	Tributary A	998.6	Regional	EX	0.50	252.16	252.38		252.38	0.000653	0.21	2.42	15.93	0.17
Main_1	Tributary A	998.6	Regional	PR	0.47	252.16	252.38		252.38	0.000632	0.20	2.35	15.76	0.17
Main_1	Tributary A	998.4	Regional	EX	0.50	252.18	252.34	252.30	252.35	0.004404	0.34	1.49	19.75	0.39
Main_1	Tributary A	998.4	Regional	PR	0.47	252.18	252.34	252.30	252.34	0.004387	0.33	1.43	19.67	0.39
Main_1	Tributary A	998	Regional	EX	0.50	251.77	251.93	251.93	251.97	0.028292	0.85	0.59	7.98	0.99
Main_1	Tributary A	998	Regional	PR	0.47	251.77	251.93	251.93	251.96	0.028663	0.83	0.57	7.95	0.99
Main_1	Tributary A	997.7	Regional	EX	0.50	249.12	249.47	249.47	249.55	0.023696	1.29	0.39	2.33	1.01
Main_1	Tributary A	997.7	Regional	PR	0.47	249.12	249.46	249.46	249.54	0.023900	1.28	0.37	2.26	1.01
Main_1	Tributary A	997	Regional	EX	0.50	245.46	245.80	245.80	245.86	0.025762	1.04	0.48	4.36	1.00
Main_1	Tributary A	997	Regional	PR	0.47	245.46	245.79	245.79	245.85	0.025121	1.07	0.44	3.75	1.00
Main_1	Tributary A	996.6	Regional	EX	0.50	242.09	242.27	242.27	242.32	0.026543	1.01	0.50	4.89	1.01
Main_1	Tributary A	996.6	Regional	PR	0.47	242.09	242.26	242.26	242.31	0.026535	0.99	0.48	4.83	1.01
Main_1	Tributary A	996	Regional	EX	2.82	237.55	237.80	237.80	237.86	0.024446	1.15	2.44	18.57	1.02
Main_1	Tributary A	996	Regional	PR	2.65	237.55	237.79	237.79	237.86	0.024949	1.14	2.34	18.44	1.02
Main_1	Tributary A	995.8	Regional	EX	2.82	235.82	236.04	236.04	236.13	0.022009	1.32	2.14	12.34	1.01
Main_1	Tributary A	995.8	Regional	PR	2.65	235.82	236.03	236.03	236.12	0.022258	1.29	2.06	12.30	1.01
Main_1	Tributary A	995.6	Regional	EX	2.82	234.22	234.69		234.75	0.012254	1.02	2.76	15.00	0.76
Main_1	Tributary A	995.6	Regional	PR	2.65	234.22	234.69		234.74	0.012251	1.01	2.63	14.56	0.76
Main_1	Tributary A	995	Regional	EX	2.82	232.05	232.59	232.59	232.72	0.020181	1.63	1.73	6.60	1.02
Main_1	Tributary A	995	Regional	PR	2.65	232.05	232.58	232.58	232.71	0.020363	1.60	1.65	6.52	1.02
Main_1	Tributary A	932	Regional	EX	2.82	228.37	232.00		232.00	0.000001	0.05	97.51	67.25	0.01
Main_1	Tributary A	932	Regional	PR	2.65	228.37	232.00		232.00	0.000001	0.04	97.26	67.21	0.01
Humber River	Bolton Reach Up	109.642 09.08.18	Regional	EX	369.03	230.51	234.97		235.15	0.000932	2.49	272.86	120.95	0.38
Humber River	Bolton Reach Up	109.642 09.08.18	Regional	PR	369.03	230.51	234.97		235.15	0.000932	2.49	272.86	120.95	0.38
Humber River	Bolton Reach Up	109.442 09.08.17	Regional	EX	369.03	230.27	234.37		234.85	0.002358	3.76	206.15	90.64	0.60
Humber River	Bolton Reach Up	109.442 09.08.17	Regional	PR	369.03	230.27	234.37		234.85	0.002358	3.76	206.15	90.64	0.60
Humber River	Bolton Reach Up	109.242 09.08.16	Regional	EX	369.03	229.82	233.86		234.35	0.002854	4.03	214.14	104.87	0.65
Humber River	Bolton Reach Up	109.242 09.08.16	Regional	PR	369.03	229.82	233.86		234.35	0.002855	4.03	214.12	104.87	0.65
Humber River	Bolton Reach Up	109.040 09.08.15	Regional	EX	369.03	229.52	233.57		233.85	0.001764	3.23	284.37	135.78	0.52
Humber River	Bolton Reach Up	109.040 09.08.15	Regional	PR	369.03	229.52	233.57		233.85	0.001765	3.23	284.31	135.77	0.52
Humber River	Bolton Reach Up	108.839 09.08.14	Regional	EX	369.03	229.22	233.23		233.50	0.001819	3.20	289.81	135.55	0.52
Humber River	Bolton Reach Up	108.839 09.08.14	Regional	PR	369.03	229.22	233.23		233.50	0.001821	3.21	289.71	135.54	0.52
Humber River	Bolton Reach Up	108.638 09.08.13	Regional	EX	369.03	228.86	233.01		233.21	0.001216	2.70	330.72	147.11	0.43
Humber River	Bolton Reach Up	108.638 09.08.13	Regional	PR	369.03	228.86	233.01		233.21	0.001217	2.70	330.57	147.10	0.43
Humber River	Bolton Reach Up	108.437 09.08.12	Regional	EX	369.03	228.56	232.74		232.98	0.001265	2.68	276.14	109.70	0.44
Humber River	Bolton Reach Up	108.437 09.08.12	Regional	PR	369.03	228.56	232.74		232.98	0.001267	2.68	275.99	109.67	0.44
Humber River	Bolton Reach Up	108.235 09.08.11	Regional	EX	369.03	228.02	232.55		232.75	0.001076	2.75	333.29	136.16	0.42
Humber River	Bolton Reach Up	108.235 09.08.11	Regional	PR	369.03	228.02	232.54		232.75	0.001078	2.75	333.05	136.14	0.42
Humber River	Bolton Reach Up	108.034 09.08.10	Regional	EX	369.03	227.54	232.21		232.49	0.001702	3.50	257.62	85.76	0.52
Humber River	Bolton Reach Up	108.034 09.08.10	Regional	PR	369.03	227.54	232.20		232.49	0.001706	3.50	257.41	85.74	0.52
Humber River	Bolton Reach Up	107.834 09.08.09	Regional	EX	369.03	227.00	231.91		232.21	0.001211	3.07	288.26	130.06	0.45
Humber River	Bolton Reach Up	107.834 09.08.09	Regional	PR	369.03	227.00	231.90		232.21	0.001216	3.08	287.72	130.01	0.45
Humber River	Bolton Reach Up	107.633 09.08.08	Regional	EX	369.03	226.76	231.97		232.04	0.000294	1.56	547.79	163.46	0.22
Humber River	Bolton Reach Up	107.633 09.08.08	Regional	PR	369.03	226.76	231.97		232.03	0.000295	1.56	547.16	163.43	0.22
Humber River	Bolton R 2	107.45	Regional	EX	369.64	226.33	231.82		231.94	0.000682	2.20	394.37	137.31	0.31
Humber River	Bolton R 2	107.45	Regional	PR	369.64	226.33	231.82		231.94	0.000685	2.20	393.77	137.25	0.31

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton R 2	107.433 09.08.07	Regional	EX	369.64	226.49	231.83		231.93	0.000460	1.99	462.21	151.03	0.28
Humber River	Bolton R 2	107.433 09.08.07	Regional	PR	369.64	226.49	231.83		231.92	0.000462	1.99	461.55	151.00	0.28
Humber River	Bolton R 1	107.233 09.08.06	Regional	EX	385.59	226.34	231.69		231.83	0.000740	2.53	413.47	147.08	0.35
Humber River	Bolton R 1	107.233 09.08.06	Regional	PR	384.84	226.34	231.68		231.83	0.000740	2.53	412.87	146.91	0.35
Humber River	Bolton R 1	107.1544 09.08.05	Regional	EX	385.59	226.10	231.64		231.74	0.000515	2.16	473.12	153.34	0.30
Humber River	Bolton R 1	107.1544 09.08.05	Regional	PR	384.84	226.10	231.64		231.74	0.000515	2.16	472.50	153.15	0.30
Humber River	Bolton R 1	107.032 09.08.04	Regional	EX	385.59	225.92	231.58		231.69	0.000360	1.83	443.72	133.88	0.25
Humber River	Bolton R 1	107.032 09.08.04	Regional	PR	384.84	225.92	231.58		231.69	0.000360	1.83	443.21	133.72	0.25
Humber River	Bolton R 1	106.832 09.08.03	Regional	EX	385.59	225.77	231.53		231.60	0.000480	2.16	514.75	151.90	0.29
Humber River	Bolton R 1	106.832 09.08.03	Regional	PR	384.84	225.77	231.53		231.60	0.000479	2.16	514.16	151.87	0.29
Humber River	Bolton R 1	106.6823 09.08.02	Regional	EX	385.59	225.26	231.55		231.56	0.000060	0.82	724.75	231.48	0.10
Humber River	Bolton R 1	106.6823 09.08.02	Regional	PR	384.84	225.26	231.54		231.56	0.000060	0.82	723.85	231.39	0.10
Humber River	Bolton R 1	106.6592 09.08.01	Regional	EX	385.59	225.17	231.54	228.36	231.56	0.000061	0.83	579.34	199.58	0.11
Humber River	Bolton R 1	106.6592 09.08.01	Regional	PR	384.84	225.17	231.53	228.36	231.56	0.000061	0.83	578.71	199.50	0.11
Humber River	Bolton R 1	106.6454 x-94 (09.09.24)			Bridge									
Humber River	Bolton R 1	106.631 09.09.23	Regional	EX	384.23	225.17	229.17	229.17	230.61	0.006433	6.21	93.03	105.86	1.00
Humber River	Bolton R 1	106.631 09.09.23	Regional	PR	383.84	225.17	229.17	229.17	230.60	0.006403	6.20	93.11	105.91	1.00
Humber River	Bolton R 1	106.6142 09.09.22	Regional	EX	384.23	225.20	229.64		229.79	0.000730	2.24	310.98	128.28	0.34
Humber River	Bolton R 1	106.6142 09.09.22	Regional	PR	383.84	225.20	229.64		229.78	0.000730	2.24	310.73	128.25	0.34
Humber River	Bolton R 1	106.5615 09.09.21	Regional	EX	384.23	225.08	229.38		229.70	0.001909	3.41	235.53	80.26	0.54
Humber River	Bolton R 1	106.5615 09.09.21	Regional	PR	383.84	225.08	229.38		229.70	0.001908	3.41	235.39	80.25	0.54
Humber River	Bolton R 1	106.429 09.09.20	Regional	EX	384.23	225.02	229.27		229.48	0.001266	2.85	330.04	131.31	0.45
Humber River	Bolton R 1	106.429 09.09.20	Regional	PR	383.84	225.02	229.27		229.48	0.001266	2.85	329.81	131.26	0.45
Humber River	Bolton R 1	106.229 09.09.19	Regional	EX	384.23	224.63	228.70		229.14	0.002939	4.17	231.25	117.37	0.67
Humber River	Bolton R 1	106.229 09.09.19	Regional	PR	383.84	224.63	228.70		229.14	0.002940	4.17	231.03	117.34	0.67
Humber River	Bolton R 1	106.029 09.09.18	Regional	EX	384.23	224.36	228.69		228.79	0.000717	2.18	455.67	166.73	0.34
Humber River	Bolton R 1	106.029 09.09.18	Regional	PR	383.84	224.36	228.69		228.79	0.000717	2.18	455.35	166.71	0.34
Humber River	Bolton R 1	105.827 09.09.17	Regional	EX	384.23	224.18	228.25		228.54	0.001781	3.33	248.94	80.20	0.53
Humber River	Bolton R 1	105.827 09.09.17	Regional	PR	383.84	224.18	228.25		228.54	0.001781	3.33	248.81	80.19	0.53
Humber River	Bolton R 1	105.627 09.09.16	Regional	EX	384.23	224.09	228.08		228.18	0.001055	2.53	438.65	175.25	0.41
Humber River	Bolton R 1	105.627 09.09.16	Regional	PR	383.84	224.09	228.08		228.18	0.001055	2.53	438.33	175.24	0.41
Humber River	Bolton R 1	105.427 09.09.15	Regional	EX	384.23	223.43	228.02	226.43	228.10	0.000618	2.12	503.72	208.29	0.32
Humber River	Bolton R 1	105.427 09.09.15	Regional	PR	383.84	223.43	228.01	226.44	228.09	0.000618	2.12	503.40	208.26	0.32
Humber River	Bolton R 1	105.224 09.09.14	Regional	EX	384.23	223.01	227.58		227.87	0.001743	3.55	281.22	105.24	0.53
Humber River	Bolton R 1	105.224 09.09.14	Regional	PR	383.84	223.01	227.57		227.87	0.001742	3.55	281.05	105.23	0.53
Humber River	Bolton R 1	105.022 09.09.13	Regional	EX	384.23	222.83	227.49		227.67	0.000921	2.56	324.90	101.10	0.39
Humber River	Bolton R 1	105.022 09.09.13	Regional	PR	383.84	222.83	227.49		227.67	0.000921	2.56	324.74	101.09	0.39
Humber River	Bolton R 1	104.823 09.09.12	Regional	EX	384.23	222.59	226.99		227.40	0.002141	3.81	278.35	149.97	0.58
Humber River	Bolton R 1	104.823 09.09.12	Regional	PR	383.84	222.59	226.99		227.40	0.002142	3.81	278.05	149.96	0.58
Humber River	Bolton R 1	104.621 09.09.11	Regional	EX	384.23	222.32	226.79		227.03	0.001274	2.83	283.15	102.61	0.44
Humber River	Bolton R 1	104.621 09.09.11	Regional	PR	383.84	222.32	226.78		227.03	0.001274	2.83	282.97	102.60	0.44
Humber River	Bolton R 1	104.421 09.09.10	Regional	EX	384.23	222.17	226.70		226.80	0.000783	2.34	435.51	150.16	0.35
Humber River	Bolton R 1	104.421 09.09.10	Regional	PR	383.84	222.17	226.70		226.80	0.000783	2.34	435.23	150.09	0.35
Humber River	Bolton R 1	104.218 09.09.09	Regional	EX	384.23	221.96	226.05		226.53	0.002950	4.28	235.24	115.18	0.68
Humber River	Bolton R 1	104.218 09.09.09	Regional	PR	383.84	221.96	226.05		226.53	0.002950	4.28	235.03	115.14	0.68
Humber River	Bolton R 1	104.018 09.09.08	Regional	EX	384.23	221.69	225.86		226.08	0.001494	3.09	338.83	154.00	0.49
Humber River	Bolton R 1	104.018 09.09.08	Regional	PR	383.84	221.69	225.86		226.08	0.001494	3.09	338.53	153.93	0.49
Humber River	Bolton R 1	103.819 09.09.07	Regional	EX	384.23	221.24	225.58		225.82	0.001471	3.15	295.36	107.30	0.48
Humber River	Bolton R 1	103.819 09.09.07	Regional	PR	383.84	221.24	225.57		225.81	0.001471	3.15	295.16	107.29	0.48
Humber River	Bolton R 1	103.616 09.09.06	Regional	EX	384.23	220.94	225.31		225.52	0.001520	3.21	331.03	134.21	0.49
Humber River	Bolton R 1	103.616 09.09.06	Regional	PR	383.84	220.94	225.31		225.52	0.001520	3.21	330.77	134.19	0.49
Humber River	Bolton R 1	103.417 09.09.05	Regional	EX	384.23	220.64	225.11		225.30	0.001244	2.90	325.57	114.85	0.44
Humber River	Bolton R 1	103.417 09.09.05	Regional	PR	383.84	220.64	225.11		225.30	0.001244	2.90	325.36	114.83	0.44
Humber River	Bolton R 1	103.215 09.09.04	Regional	EX	384.23	220.31	224.36		224.91	0.003064	4.26	216.31	128.57	0.69
Humber River	Bolton R 1	103.215 09.09.04	Regional	PR	383.84	220.31	224.35		224.91	0.003069	4.26	215.95	128.51	0.69
Humber River	Bolton R 1	103.014 09.09.03	Regional	EX	384.23	220.07	224.39		224.50	0.000913	2.42	498.48	237.83	0.38
Humber River	Bolton R 1	103.014 09.09.03	Regional	PR	383.84	220.07	224.39		224.49	0.000915	2.42	497.75	237.80	0.38
Humber River	Bolton R 1	102.814 09.09.02	Regional	EX	384.23	219.98	224.37		224.42	0.000537	1.91	572.84	194.78	0.29
Humber River	Bolton R 1	102.814 09.09.02	Regional	PR	383.84	219.98	224.37		224.42	0.000538	1.91	572.24	194.75	0.29
Humber River	Bolton R 1	102.613 09.09.01	Regional	EX	395.09	219.74	224.26		224.31	0.000387	1.66	620.52	189.82	0.25
Humber River	Bolton R 1	102.613 09.09.01	Regional	PR	389.73	219.74	224.26		224.31	0.000376	1.64	620.36	189.81	0.25
Humber River	Bolton Reach	102.398 09.01.13	Regional	EX	374.95	219.10	223.98		224.14	0.000750	2.36	319.43	90.24	0.35
Humber River	Bolton Reach	102.398 09.01.13	Regional	PR	374.95	219.10	223.98		224.14	0.000750	2.36	319.42	90.23	0.35
Humber River	Bolton Reach	102.208 09.01.12	Regional	EX	374.95	219.02	223.94		224.06	0.000759	2.32	387.52	132.30	0.34
Humber River	Bolton Reach	102.208 09.01.12	Regional	PR	374.95	219.02	223.94		224.06	0.000759	2.32	387.51	132.30	0.34
Humber River	Bolton Reach	102.011 09.01.11	Regional	EX	374.95	218.86	223.83		223.96	0.000702	2.33	389.88	116.93	0.34
Humber River	Bolton Reach	102.011 09.01.11	Regional	PR	374.95	218.86	223.83		223.96	0.000702	2.33	389.87	116.93	0.34
Humber River	Bolton Reach	101.9462 09.01.10	Regional	EX	374.95	218.78	223.75		223.84	0.000645	2.23	499.23	189.71	0.32
Humber River	Bolton Reach	101.9462 09.01.10	Regional	PR	374.95	218.78	223.75		223.84	0.000645	2.23	499.22	189.70	0.32
Humber River	Bolton Reach	101.809 09.01.09	Regional	EX	374.95	218.20	222.38		222.59	0.001134	2.60	351.32	184.64	0.41
Humber River	Bolton Reach	101.809 09.01.09	Regional	PR	374.95	218.20	222.38		222.58	0.001136	2.60	351.11	184.59	0.41

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	101.608 09.01.08	Regional	EX	374.95	218.06	222.14		222.35	0.001727	3.16	341.37	184.51	0.51
Humber River	Bolton Reach	101.608 09.01.08	Regional	PR	374.95	218.06	222.14		222.35	0.001731	3.17	341.02	184.49	0.51
Humber River	Bolton Reach	101.407 09.01.07	Regional	EX	374.95	217.85	222.15		222.21	0.000514	1.79	529.86	178.10	0.28
Humber River	Bolton Reach	101.407 09.01.07	Regional	PR	374.95	217.85	222.15		222.21	0.000515	1.79	529.52	178.09	0.28
Humber River	Bolton Reach	101.206 09.01.06	Regional	EX	374.95	217.39	221.75		221.99	0.001478	2.89	346.45	201.68	0.47
Humber River	Bolton Reach	101.206 09.01.06	Regional	PR	374.95	217.39	221.75		221.99	0.001485	2.90	345.72	201.60	0.47
Humber River	Bolton Reach	101.004 09.01.05	Regional	EX	374.95	216.95	221.55		221.75	0.000997	2.45	333.39	148.94	0.39
Humber River	Bolton Reach	101.004 09.01.05	Regional	PR	374.95	216.95	221.55		221.74	0.001002	2.46	332.69	148.91	0.39
Humber River	Bolton Reach	100.803 09.01.04	Regional	EX	374.95	216.63	220.83		221.42	0.002620	3.95	178.20	78.13	0.63
Humber River	Bolton Reach	100.803 09.01.04	Regional	PR	374.95	216.63	220.82		221.41	0.002649	3.96	177.34	77.59	0.64
Humber River	Bolton Reach	100.602 09.01.03	Regional	EX	374.95	216.43	220.52		220.90	0.002049	3.36	227.43	98.49	0.55
Humber River	Bolton Reach	100.602 09.01.03	Regional	PR	374.95	216.43	220.50		220.89	0.002098	3.39	225.39	98.30	0.56
Humber River	Bolton Reach	100.5208 09.01.02	Regional	EX	374.95	216.19	220.48		220.72	0.001388	2.81	302.68	136.73	0.46
Humber River	Bolton Reach	100.5208 09.01.02	Regional	PR	374.95	216.19	220.46		220.70	0.001427	2.84	299.49	136.52	0.46
Humber River	Bolton Reach	100.401 09.01.01	Regional	EX	395.42	216.08	219.50	219.19	220.36	0.005149	4.95	144.70	59.92	0.87
Humber River	Bolton Reach	100.401 09.01.01	Regional	PR	391.54	216.08	219.49	219.18	220.34	0.005101	4.92	144.16	59.87	0.86
Humber River	Bolton Reach	100.200 09.04.02	Regional	EX	395.42	215.87	219.36		219.88	0.003437	3.86	213.09	125.49	0.70
Humber River	Bolton Reach	100.200 09.04.02	Regional	PR	391.54	215.87	219.35		219.87	0.003443	3.85	211.25	125.35	0.70
Humber River	Bolton Reach	100.1076 09.04.01	Regional	EX	395.42	215.68	219.44		219.59	0.001254	2.50	398.32	226.58	0.43
Humber River	Bolton Reach	100.1076 09.04.01	Regional	PR	391.54	215.68	219.42		219.58	0.001255	2.50	394.87	224.88	0.43
Humber River	Bolton Reach	9.216	Regional	EX	395.42	215.63	219.43		219.51	0.001017	2.11	509.37	261.58	0.36
Humber River	Bolton Reach	9.216	Regional	PR	391.54	215.63	219.42		219.50	0.001020	2.11	505.30	260.92	0.36
Humber River	Bolton Reach	9.213	Regional	EX	395.42	215.39	219.19		219.43	0.002363	3.28	306.30	152.00	0.55
Humber River	Bolton Reach	9.213	Regional	PR	391.54	215.39	219.17		219.42	0.002365	3.27	304.02	151.74	0.55
Humber River	Bolton Reach	9.21	Regional	EX	395.42	215.31	219.14		219.34	0.001740	2.80	337.26	163.30	0.47
Humber River	Bolton Reach	9.21	Regional	PR	391.54	215.31	219.13		219.33	0.001740	2.79	334.80	163.08	0.47
Humber River	Bolton Reach	9.207	Regional	EX	395.42	215.09	219.04		219.21	0.001381	2.44	350.80	156.99	0.41
Humber River	Bolton Reach	9.207	Regional	PR	391.54	215.09	219.03		219.19	0.001377	2.43	348.53	156.54	0.41
Humber River	Bolton Reach	9.204	Regional	EX	395.42	215.00	218.88		219.04	0.001491	2.58	339.22	140.69	0.43
Humber River	Bolton Reach	9.204	Regional	PR	391.54	215.00	218.86		219.03	0.001487	2.57	337.25	140.59	0.43
Humber River	Bolton Reach	9.201	Regional	EX	395.42	214.97	218.64	217.92	218.91	0.002358	3.16	286.29	140.98	0.54
Humber River	Bolton Reach	9.201	Regional	PR	391.54	214.97	218.63	217.91	218.90	0.002355	3.15	284.36	140.85	0.54
Humber River	Bolton Reach	9.198	Regional	EX	395.42	214.74	218.48		218.67	0.001948	2.85	333.37	171.32	0.49
Humber River	Bolton Reach	9.198	Regional	PR	391.54	214.74	218.47		218.65	0.001944	2.84	331.08	170.16	0.49
Humber River	Bolton Reach	9.195	Regional	EX	395.42	213.50	218.36		218.45	0.000533	1.78	519.64	214.89	0.27
Humber River	Bolton Reach	9.195	Regional	PR	391.54	213.50	218.35		218.43	0.000530	1.77	516.89	214.22	0.26
Humber River	Bolton Reach	9.192	Regional	EX	395.42	213.23	218.24		218.38	0.000774	2.00	410.49	222.38	0.31
Humber River	Bolton Reach	9.192	Regional	PR	391.54	213.23	218.23		218.37	0.000770	2.00	407.76	221.88	0.31
Humber River	Bolton Reach	9.189	Regional	EX	395.42	213.35	218.20	216.91	218.35	0.000949	2.15	362.49	192.25	0.34
Humber River	Bolton Reach	9.189	Regional	PR	391.54	213.35	218.18	216.89	218.34	0.000944	2.14	360.23	191.77	0.34
Humber River	Bolton Reach	9.186			Bridge									
Humber River	Bolton Reach	9.183	Regional	EX	395.42	213.31	217.61	216.96	217.78	0.001489	2.35	280.96	168.77	0.41
Humber River	Bolton Reach	9.183	Regional	PR	391.54	213.31	217.59	216.95	217.77	0.001497	2.35	278.30	168.25	0.41
Humber River	Bolton Reach	9.18	Regional	EX	395.42	213.02	217.56		217.68	0.000767	2.07	363.36	196.85	0.32
Humber River	Bolton Reach	9.18	Regional	PR	391.54	213.02	217.54		217.67	0.000769	2.06	360.21	196.78	0.32
Humber River	Bolton Reach	9.177	Regional	EX	395.42	212.57	216.84	216.57	217.46	0.003613	3.78	149.15	102.81	0.63
Humber River	Bolton Reach	9.177	Regional	PR	391.54	212.57	216.83	216.55	217.44	0.003614	3.78	147.58	102.70	0.63
Humber River	Bolton Reach	9.174	Regional	EX	395.42	212.55	216.97		217.37	0.002244	3.23	201.00	140.51	0.53
Humber River	Bolton Reach	9.174	Regional	PR	391.54	212.55	216.95		217.35	0.002255	3.23	198.64	140.31	0.53
Humber River	Bolton Reach	9.171	Regional	EX	395.42	212.49	217.05		217.30	0.001493	2.70	277.05	210.14	0.43
Humber River	Bolton Reach	9.171	Regional	PR	391.54	212.49	217.04		217.28	0.001506	2.70	273.40	209.81	0.44
Humber River	Bolton Reach	9.168	Regional	EX	395.42	212.44	217.14		217.23	0.000708	1.87	412.18	257.35	0.30
Humber River	Bolton Reach	9.168	Regional	PR	391.54	212.44	217.12		217.22	0.000713	1.87	407.92	255.94	0.30
Humber River	Bolton Reach	9.165	Regional	EX	395.42	212.37	217.16		217.21	0.000450	1.50	520.67	306.28	0.24
Humber River	Bolton Reach	9.165	Regional	PR	391.54	212.37	217.14		217.20	0.000452	1.50	515.63	305.33	0.24
Humber River	Bolton Reach	9.162	Regional	EX	395.42	212.33	217.14		217.20	0.000533	1.64	479.33	267.55	0.26
Humber River	Bolton Reach	9.162	Regional	PR	391.54	212.33	217.12		217.19	0.000536	1.64	474.93	267.04	0.26
Humber River	Bolton Reach	9.159	Regional	EX	395.42	212.18	217.10		217.19	0.000675	1.85	420.94	244.27	0.29
Humber River	Bolton Reach	9.159	Regional	PR	391.54	212.18	217.08		217.17	0.000678	1.85	416.89	244.03	0.29
Humber River	Bolton Reach	9.156	Regional	EX	395.42	211.93	217.07	216.06	217.17	0.000690	1.85	398.99	226.99	0.29
Humber River	Bolton Reach	9.156	Regional	PR	391.54	211.93	217.05	216.04	217.15	0.000693	1.85	395.25	226.17	0.29
Humber River	Bolton Reach	9.153			Bridge									
Humber River	Bolton Reach	9.15	Regional	EX	395.42	211.79	216.76	215.68	216.95	0.001125	2.23	265.83	144.52	0.37
Humber River	Bolton Reach	9.15	Regional	PR	391.54	211.79	216.74	215.67	216.94	0.001124	2.23	263.72	144.00	0.37
Humber River	Bolton Reach	9.147	Regional	EX	395.42	211.79	216.06	216.06	216.74	0.004000	4.13	158.87	124.37	0.69
Humber River	Bolton Reach	9.147	Regional	PR	391.54	211.79	216.06	216.06	216.73	0.003960	4.10	158.12	124.31	0.69
Humber River	Bolton Reach	9.144	Regional	EX	395.42	211.74	216.14	215.83	216.39	0.001876	2.88	284.84	227.16	0.47
Humber River	Bolton Reach	9.144	Regional	PR	391.54	211.74	216.13	215.83	216.37	0.001887	2.88	281.80	227.09	0.47
Humber River	Bolton Reach	9.141	Regional	EX	395.42	211.64	215.52	215.52	216.13	0.004494	4.04	165.76	138.03	0.72
Humber River	Bolton Reach	9.141	Regional	PR	391.54	211.64	215.51	215.51	216.12	0.004483	4.02	164.40	137.87	0.72

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	9.138	Regional	EX	395.42	211.64	215.65		215.80	0.001328	2.32	317.92	197.32	0.40
Humber River	Bolton Reach	9.138	Regional	PR	391.54	211.64	215.64		215.79	0.001320	2.31	316.35	197.27	0.40
Humber River	Bolton Reach	9.135	Regional	EX	395.42	211.64	215.62		215.72	0.000867	1.95	392.85	215.06	0.33
Humber River	Bolton Reach	9.135	Regional	PR	391.54	211.64	215.61		215.71	0.000860	1.94	391.20	214.99	0.33
Humber River	Bolton Reach	9.132	Regional	EX	395.42	211.64	215.19	215.19	215.61	0.003911	3.64	234.38	246.99	0.66
Humber River	Bolton Reach	9.132	Regional	PR	391.54	211.64	215.18	215.18	215.60	0.003899	3.63	232.64	246.75	0.66
Humber River	Bolton Reach	9.129	Regional	EX	395.42	211.64	214.94	214.94	215.36	0.004472	3.47	213.15	251.03	0.70
Humber River	Bolton Reach	9.129	Regional	PR	391.54	211.64	214.93	214.93	215.35	0.004465	3.46	211.32	250.46	0.69
Humber River	Bolton Reach	9.126	Regional	EX	395.42	211.64	214.54	214.54	214.97	0.005686	3.60	200.31	252.19	0.77
Humber River	Bolton Reach	9.126	Regional	PR	391.54	211.64	214.53	214.53	214.96	0.005691	3.60	198.32	249.42	0.77
Humber River	Bolton Reach	9.123	Regional	EX	395.42	211.64	214.65		214.82	0.002563	2.57	277.54	279.28	0.53
Humber River	Bolton Reach	9.123	Regional	PR	391.54	211.64	214.64		214.81	0.002565	2.56	274.92	277.18	0.53
Humber River	Bolton Reach	9.12	Regional	EX	395.42	213.30	214.67		214.75	0.002807	1.76	318.94	299.04	0.50
Humber River	Bolton Reach	9.12	Regional	PR	391.54	213.30	214.66		214.74	0.002817	1.75	316.10	297.07	0.50
Humber River	Bolton Reach	9.117	Regional	EX	395.42	211.64	214.60		214.71	0.001452	2.00	341.64	268.63	0.40
Humber River	Bolton Reach	9.117	Regional	PR	391.54	211.64	214.59		214.70	0.001450	2.00	339.15	268.08	0.40
Humber River	Bolton Reach	9.114	Regional	EX	395.42	211.64	214.58		214.68	0.001285	1.87	373.75	288.49	0.38
Humber River	Bolton Reach	9.114	Regional	PR	391.54	211.64	214.58		214.67	0.001285	1.86	371.05	288.04	0.38
Humber River	Bolton Reach	9.111	Regional	EX	395.42	211.41	214.58		214.64	0.000870	1.67	439.86	297.66	0.31
Humber River	Bolton Reach	9.111	Regional	PR	391.54	211.41	214.57		214.63	0.000868	1.66	437.08	296.19	0.31
Humber River	Bolton Reach	9.108	Regional	EX	395.42	211.41	214.56		214.63	0.001148	1.67	415.14	292.84	0.34
Humber River	Bolton Reach	9.108	Regional	PR	391.54	211.41	214.55		214.62	0.001147	1.66	412.40	292.69	0.34
Humber River	Bolton Reach	9.105	Regional	EX	395.42	211.40	214.57		214.61	0.000791	1.37	499.44	330.19	0.28
Humber River	Bolton Reach	9.105	Regional	PR	391.54	211.40	214.56		214.60	0.000790	1.37	496.34	329.54	0.28
Humber River	Bolton Reach	9.102	Regional	EX	395.42	211.39	214.30		214.56	0.004348	3.26	238.84	243.76	0.67
Humber River	Bolton Reach	9.102	Regional	PR	391.54	211.39	214.28		214.55	0.004428	3.27	235.41	241.49	0.68
Humber River	Bolton Reach	9.099	Regional	EX	395.42	211.16	214.25		214.46	0.003316	2.77	221.67	167.49	0.58
Humber River	Bolton Reach	9.099	Regional	PR	391.54	211.16	214.24		214.44	0.003329	2.76	219.62	167.37	0.58
Humber River	Bolton Reach	9.096	Regional	EX	395.42	211.29	214.22	213.23	214.38	0.002507	2.32	237.97	166.75	0.51
Humber River	Bolton Reach	9.096	Regional	PR	391.54	211.29	214.21	213.22	214.37	0.002511	2.32	235.94	166.33	0.51
Humber River	Bolton Reach	9.093			Mult Open									
Humber River	Bolton Reach	9.09	Regional	EX	395.42	211.28	214.20	212.79	214.27	0.001166	1.71	364.30	224.37	0.35
Humber River	Bolton Reach	9.09	Regional	PR	391.54	211.28	214.19	212.78	214.26	0.001169	1.71	361.53	223.75	0.35
Humber River	Bolton Reach	9.087	Regional	EX	395.42	210.58	214.16		214.23	0.000801	1.72	431.03	273.02	0.31
Humber River	Bolton Reach	9.087	Regional	PR	391.54	210.58	214.15		214.22	0.000804	1.71	427.54	272.55	0.31
Humber River	Bolton Reach	9.084	Regional	EX	395.42	209.90	213.41	213.41	214.08	0.005460	4.19	146.67	123.09	0.79
Humber River	Bolton Reach	9.084	Regional	PR	391.54	209.90	213.40	213.40	214.06	0.005463	4.18	145.25	122.58	0.79
Humber River	Bolton Reach	9.081	Regional	EX	395.42	209.90	213.50		213.89	0.003556	3.46	191.95	138.85	0.64
Humber River	Bolton Reach	9.081	Regional	PR	391.54	209.90	213.48		213.88	0.003594	3.47	189.58	137.64	0.65
Humber River	Bolton Reach	9.078	Regional	EX	395.42	209.90	213.59		213.66	0.000756	1.75	454.42	270.05	0.31
Humber River	Bolton Reach	9.078	Regional	PR	391.54	209.90	213.57		213.64	0.000761	1.75	449.93	269.15	0.31
Humber River	Bolton Reach	9.075	Regional	EX	395.42	209.90	213.58		213.64	0.000626	1.58	504.54	257.55	0.28
Humber River	Bolton Reach	9.075	Regional	PR	391.54	209.90	213.56		213.62	0.000629	1.58	500.30	254.06	0.28
Humber River	Bolton Reach	9.072	Regional	EX	395.42	209.70	213.57		213.62	0.000508	1.44	578.05	321.85	0.25
Humber River	Bolton Reach	9.072	Regional	PR	391.54	209.70	213.56		213.60	0.000512	1.44	572.65	321.72	0.25
Humber River	Bolton Reach	9.069	Regional	EX	395.42	209.36	213.52	212.50	213.59	0.000530	1.55	521.81	331.45	0.26
Humber River	Bolton Reach	9.069	Regional	PR	391.54	209.36	213.51	212.50	213.57	0.000534	1.55	516.14	330.28	0.26
Humber River	Bolton Reach	9.066			Bridge									
Humber River	Bolton Reach	9.063	Regional	EX	395.42	209.17	213.37	212.45	213.52	0.000981	2.08	334.42	239.26	0.35
Humber River	Bolton Reach	9.063	Regional	PR	391.54	209.17	213.35	212.43	213.50	0.000993	2.08	329.78	239.02	0.35
Humber River	Bolton Reach	9.06	Regional	EX	395.42	209.05	212.79	212.39	213.34	0.003630	3.87	175.70	115.71	0.67
Humber River	Bolton Reach	9.06	Regional	PR	391.54	209.05	212.77	212.38	213.32	0.003644	3.87	173.66	114.38	0.67
Humber River	Bolton Reach	9.057	Regional	EX	395.42	209.05	212.31	212.31	213.22	0.006528	4.77	143.24	93.96	0.88
Humber River	Bolton Reach	9.057	Regional	PR	391.54	209.05	212.30	212.30	213.20	0.006533	4.75	141.88	93.45	0.88
Humber River	Bolton Reach	9.054	Regional	EX	395.42	209.05	212.12	212.12	212.83	0.006069	4.36	173.51	127.22	0.83
Humber River	Bolton Reach	9.054	Regional	PR	391.54	209.05	212.08	212.08	212.81	0.006294	4.41	169.28	124.96	0.85
Humber River	Bolton Reach	9.051	Regional	EX	395.42	209.05	212.44	211.42	212.48	0.000640	1.60	720.74	384.04	0.28
Humber River	Bolton Reach	9.051	Regional	PR	391.54	209.05	212.43	211.41	212.46	0.000643	1.59	715.04	383.71	0.28
Humber River	Bolton Reach	9.048	Regional	EX	395.42	209.05	212.43	210.11	212.44	0.000205	0.90	1009.95	348.29	0.16
Humber River	Bolton Reach	9.048	Regional	PR	391.54	209.05	212.41	210.10	212.42	0.000205	0.90	1004.80	348.21	0.16
Humber River	Bolton Reach	9.045	Regional	EX	395.42	208.40	212.23		212.34	0.001297	2.44	435.14	211.31	0.40
Humber River	Bolton Reach	9.045	Regional	PR	391.54	208.40	212.21		212.33	0.001297	2.43	432.13	211.00	0.40
Humber River	Bolton Reach	9.042	Regional	EX	395.42	208.41	212.11		212.17	0.000612	1.61	549.96	217.59	0.28
Humber River	Bolton Reach	9.042	Regional	PR	391.54	208.41	212.10		212.15	0.000610	1.60	546.97	217.30	0.28
Humber River	Bolton Reach	9.039	Regional	EX	395.42	207.60	212.03		212.09	0.000433	1.52	539.28	202.03	0.24
Humber River	Bolton Reach	9.039	Regional	PR	391.54	207.60	212.01		212.08	0.000431	1.51	536.61	201.79	0.24
Humber River	Bolton Reach	9.036	Regional	EX	395.42	207.60	211.96		212.06	0.000550	1.68	406.88	151.96	0.27
Humber River	Bolton Reach	9.036	Regional	PR	391.54	207.60	211.95		212.05	0.000546	1.67	404.97	151.82	0.27
Humber River	Bolton Reach	9.033	Regional	EX	395.42	207.10	211.74	210.57	211.98	0.001210	2.50	285.31	130.12	0.39
Humber River	Bolton Reach	9.033	Regional	PR	391.54	207.10	211.73	210.56	211.97	0.001199	2.48	283.97	129.90	0.39

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Humber River	Bolton Reach	9.03			Bridge									
Humber River	Bolton Reach	9.027	Regional	EX	395.42	207.11	211.40	210.11	211.69	0.001399	2.63	245.03	120.07	0.42
Humber River	Bolton Reach	9.027	Regional	PR	391.54	207.11	211.38	210.08	211.67	0.001397	2.62	243.01	119.70	0.42
Humber River	Bolton Reach	9.024	Regional	EX	395.42	207.09	211.43		211.64	0.001118	2.21	275.68	128.40	0.37
Humber River	Bolton Reach	9.024	Regional	PR	391.54	207.09	211.41		211.62	0.001117	2.20	273.51	127.85	0.37
Humber River	Bolton Reach	9.021	Regional	EX	395.42	207.11	211.41		211.55	0.001112	2.48	386.51	149.45	0.38
Humber River	Bolton Reach	9.021	Regional	PR	391.54	207.11	211.39		211.53	0.001110	2.47	383.93	149.12	0.38
Humber River	Bolton Reach	9.018	Regional	EX	395.42	206.75	211.38		211.45	0.000491	1.68	549.55	195.30	0.26
Humber River	Bolton Reach	9.018	Regional	PR	391.54	206.75	211.36		211.43	0.000490	1.68	546.15	195.12	0.26
Humber River	Bolton Reach	9.015	Regional	EX	395.42	206.42	211.36		211.39	0.000258	1.23	846.26	315.66	0.18
Humber River	Bolton Reach	9.015	Regional	PR	391.54	206.42	211.34		211.37	0.000258	1.22	840.72	315.48	0.18
Humber River	Bolton Reach	9.012	Regional	EX	395.42	206.41	211.36		211.38	0.000226	1.16	894.52	330.92	0.17
Humber River	Bolton Reach	9.012	Regional	PR	391.54	206.41	211.34		211.36	0.000226	1.16	888.71	330.68	0.17
Humber River	Bolton Reach	9.009	Regional	EX	395.42	206.42	211.36	209.25	211.37	0.000117	0.84	1249.58	499.18	0.13
Humber River	Bolton Reach	9.009	Regional	PR	391.54	206.42	211.34	209.24	211.35	0.000116	0.84	1241.62	498.84	0.13
Humber River	Bolton Reach	9.006			Bridge									
Humber River	Bolton Reach	9.003	Regional	EX	395.42	206.18	211.32	209.10	211.33	0.000097	0.75	1302.27	479.87	0.11
Humber River	Bolton Reach	9.003	Regional	PR	391.54	206.18	211.30	209.09	211.31	0.000096	0.74	1294.20	479.01	0.11
Humber River	Bolton Reach	9	Regional	EX	395.42	206.18	211.30		211.32	0.000175	1.09	935.91	288.32	0.16
Humber River	Bolton Reach	9	Regional	PR	391.54	206.18	211.29		211.31	0.000175	1.09	930.75	288.11	0.16
Humber River	DOWNSTREAM	11.39	Regional	EX	639.23	206.18	211.21		211.30	0.000769	2.13	722.65	243.64	0.32
Humber River	DOWNSTREAM	11.39	Regional	PR	630.96	206.18	211.19		211.28	0.000762	2.11	718.62	243.40	0.32
Humber River	DOWNSTREAM	11.38	Regional	EX	639.23	206.17	211.16		211.23	0.000805	2.20	758.72	256.91	0.32
Humber River	DOWNSTREAM	11.38	Regional	PR	630.96	206.17	211.14		211.22	0.000798	2.18	754.57	256.79	0.32
Humber River	DOWNSTREAM	11.37	Regional	EX	639.23	206.18	211.07		211.16	0.000863	2.33	697.44	222.08	0.34
Humber River	DOWNSTREAM	11.37	Regional	PR	630.96	206.18	211.05		211.14	0.000853	2.31	694.11	221.98	0.34
Humber River	DOWNSTREAM	11.36	Regional	EX	639.23	206.17	210.83		211.07	0.001646	3.12	509.57	211.19	0.47
Humber River	DOWNSTREAM	11.36	Regional	PR	630.96	206.17	210.82		211.06	0.001621	3.09	507.27	210.59	0.47
Humber River	DOWNSTREAM	11.35	Regional	EX	639.23	206.03	210.80		210.93	0.000919	2.41	689.30	262.78	0.36
Humber River	DOWNSTREAM	11.35	Regional	PR	630.96	206.03	210.79		210.91	0.000905	2.38	686.50	262.44	0.35
Humber River	DOWNSTREAM	11.34	Regional	EX	639.23	205.60	210.38	209.88	210.69	0.002423	3.78	488.07	244.48	0.55
Humber River	DOWNSTREAM	11.34	Regional	PR	630.96	205.60	210.38	209.86	210.69	0.002361	3.73	488.07	244.48	0.54
Cold_10_7	Tributary E	4822.04	Regional	EX	2.45	263.04	263.65		263.67	0.018632	0.81	3.52	15.26	0.45
Cold_10_7	Tributary E	4822.04	Regional	PR	2.92	263.04	263.69		263.72	0.015856	0.81	4.24	16.30	0.42
Cold_10_7	Tributary E	4783.59	Regional	EX	2.45	262.40	263.17	262.98	263.19	0.009098	0.78	4.16	14.86	0.33
Cold_10_7	Tributary E	4783.59	Regional	PR	2.92	262.40	263.18	263.02	263.21	0.011187	0.89	4.43	15.34	0.37
Cold_10_7	Tributary E	4731.68	Regional	EX	2.45	261.73	262.11	262.11	262.17	0.067722	1.18	2.53	20.66	0.80
Cold_10_7	Tributary E	4731.68	Regional	PR	2.92	261.73	262.15		262.20	0.042269	1.05	3.47	23.15	0.65
Cold_10_7	Tributary E	4652.11	Regional	EX	2.45	261.35	262.11		262.11	0.000023	0.09	34.82	71.77	0.03
Cold_10_7	Tributary E	4652.11	Regional	PR	2.92	261.35	262.18		262.18	0.000023	0.09	39.66	74.97	0.03
Cold_10_7	Tributary E	4592.65	Regional	EX	2.45	261.40	262.11		262.11	0.000023	0.08	40.47	99.85	0.03
Cold_10_7	Tributary E	4592.65	Regional	PR	2.92	261.40	262.18		262.18	0.000023	0.09	47.18	105.55	0.03
Cold_10_7	Tributary E	4515.64	Regional	EX	2.45	261.39	262.08		262.10	0.007297	0.67	4.20	12.69	0.30
Cold_10_7	Tributary E	4515.64	Regional	PR	2.92	261.39	262.15		262.17	0.006349	0.67	5.11	14.89	0.29
Cold_10_7	Tributary E	4460.59	Regional	EX	3.91	261.30	262.07		262.07	0.000248	0.16	27.40	48.44	0.06
Cold_10_7	Tributary E	4460.59	Regional	PR	4.67	261.30	262.13		262.13	0.000253	0.17	30.62	49.77	0.06
Cold_10_7	Tributary E	4407.62	Regional	EX	3.91	261.31	262.02		262.04	0.003194	0.49	8.75	20.93	0.20
Cold_10_7	Tributary E	4407.62	Regional	PR	4.67	261.31	262.09		262.10	0.003035	0.51	10.16	22.67	0.20
Cold_10_7	Tributary E	4354.33	Regional	EX	3.91	260.86	261.84		261.86	0.003556	0.63	7.52	15.60	0.22
Cold_10_7	Tributary E	4354.33	Regional	PR	4.67	260.86	261.91		261.93	0.003631	0.67	8.62	17.20	0.23
Cold_10_7	Tributary E	4322.62	Regional	EX	3.91	260.68	261.72		261.74	0.004505	0.65	6.71	14.64	0.25
Cold_10_7	Tributary E	4322.62	Regional	PR	4.67	260.68	261.78		261.81	0.004571	0.69	7.71	16.72	0.25
Cold_10_7	Tributary E	4293.51	Regional	EX	3.91	260.49	261.53		261.56	0.008265	0.91	5.15	12.97	0.33
Cold_10_7	Tributary E	4293.51	Regional	PR	4.67	260.49	261.59		261.63	0.008453	0.97	5.94	13.89	0.34
Cold_10_7	Tributary E	4265.3	Regional	EX	3.91	260.37	260.95	260.95	261.06	0.059417	1.52	2.90	13.86	0.81
Cold_10_7	Tributary E	4265.3	Regional	PR	4.67	260.37	260.98	260.98	261.10	0.066181	1.62	3.30	15.14	0.86
Cold_10_7	Tributary E	4240.34	Regional	EX	3.91	259.55	260.23		260.24	0.008726	0.62	7.79	29.00	0.31
Cold_10_7	Tributary E	4240.34	Regional	PR	4.67	259.55	260.27		260.28	0.008816	0.65	8.94	30.60	0.32
Cold_10_7	Tributary E	4181.11	Regional	EX	3.91	259.05	259.92	259.66	259.93	0.004297	0.52	9.70	33.76	0.23
Cold_10_7	Tributary E	4181.11	Regional	PR	4.67	259.05	259.96	259.68	259.97	0.004390	0.55	10.99	35.06	0.24
Cold_10_7	Tributary E	4121.04	Regional	EX	3.91	258.89	259.20	259.20	259.27	0.093430	1.37	3.32	20.86	0.94
Cold_10_7	Tributary E	4121.04	Regional	PR	4.67	258.89	259.22	259.22	259.30	0.091836	1.44	3.75	21.34	0.95
Cold_10_7	Tributary E	4055.36	Regional	EX	3.91	258.17	258.95		258.95	0.000111	0.10	44.42	88.09	0.04
Cold_10_7	Tributary E	4055.36	Regional	PR	4.67	258.17	259.01		259.02	0.000112	0.11	50.04	91.99	0.04
Cold_10_7	Tributary E	4004.48	Regional	EX	3.91	258.09	258.95		258.95	0.000042	0.07	61.37	94.27	0.02
Cold_10_7	Tributary E	4004.48	Regional	PR	4.67	258.09	259.01		259.01	0.000045	0.07	67.32	97.72	0.03
Cold_10_7	Tributary E	3947.08	Regional	EX	3.91	258.09	258.95		258.95	0.000004	0.04	92.77	133.78	0.02
Cold_10_7	Tributary E	3947.08	Regional	PR	4.67	258.09	259.01		259.01	0.000005	0.05	101.13	136.47	0.02
Cold_10_7	Tributary E	3869.46	Regional	EX	3.91	258.09	258.95		258.95	0.000096	0.10	43.09	76.13	0.04
Cold_10_7	Tributary E	3869.46	Regional	PR	4.67	258.09	259.01		259.01	0.000100	0.11	47.85	78.14	0.04

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	3837.47	Regional	EX	9.00	258.09	258.84		258.91	0.025434	1.33	8.42	30.69	0.57
Cold_10_7	Tributary E	3837.47	Regional	PR	10.74	258.09	258.91		258.98	0.020793	1.30	10.83	37.50	0.53
Cold_10_7	Tributary E	3758.91	Regional	EX	9.00	257.76	258.66		258.66	0.001079	0.37	31.22	57.03	0.13
Cold_10_7	Tributary E	3758.91	Regional	PR	10.74	257.76	258.73		258.73	0.001104	0.39	35.19	60.95	0.13
Cold_10_7	Tributary E	3700.91	Regional	EX	9.00	257.72	258.56		258.57	0.002507	0.54	19.82	33.77	0.19
Cold_10_7	Tributary E	3700.91	Regional	PR	10.74	257.72	258.63		258.64	0.002602	0.57	22.02	34.80	0.20
Cold_10_7	Tributary E	3650.13	Regional	EX	9.00	257.64	258.39		258.41	0.004685	0.66	16.20	32.68	0.26
Cold_10_7	Tributary E	3650.13	Regional	PR	10.74	257.64	258.45		258.47	0.004788	0.70	18.17	33.85	0.26
Cold_10_7	Tributary E	3587.5	Regional	EX	9.00	257.51	258.15		258.16	0.003651	0.54	19.11	38.81	0.22
Cold_10_7	Tributary E	3587.5	Regional	PR	10.74	257.51	258.20		258.22	0.003705	0.58	21.28	39.38	0.23
Cold_10_7	Tributary E	3530.86	Regional	EX	9.00	257.24	257.85		257.87	0.007882	0.74	14.22	33.89	0.32
Cold_10_7	Tributary E	3530.86	Regional	PR	10.74	257.24	257.90		257.92	0.007794	0.79	16.05	34.86	0.32
Cold_10_7	Tributary E	3486.25	Regional	EX	9.00	256.89	257.47		257.49	0.007013	0.69	14.87	34.83	0.30
Cold_10_7	Tributary E	3486.25	Regional	PR	10.74	256.89	257.52		257.54	0.007205	0.74	16.67	36.77	0.31
Cold_10_7	Tributary E	3456.94	Regional	EX	9.00	256.66	257.19		257.24	0.022900	1.20	9.49	27.34	0.54
Cold_10_7	Tributary E	3456.94	Regional	PR	10.74	256.66	257.23		257.29	0.023032	1.27	10.62	27.88	0.55
Cold_10_7	Tributary E	3435.76	Regional	EX	9.00	256.29	256.73	256.57	256.77	0.019365	0.95	10.04	27.66	0.48
Cold_10_7	Tributary E	3435.76	Regional	PR	10.74	256.29	256.77	256.60	256.82	0.019206	1.01	11.30	28.29	0.48
Cold_10_7	Tributary E	3426.56	Regional	EX	9.00	256.08	256.48	256.28	256.51	0.012809	0.75	11.52	28.60	0.39
Cold_10_7	Tributary E	3426.56	Regional	PR	10.74	256.08	256.52	256.31	256.56	0.013064	0.82	12.80	28.92	0.40
Cold_10_7	Tributary E	3396.62	Regional	EX	9.00	255.66	256.13		256.17	0.016616	0.91	11.19	31.77	0.45
Cold_10_7	Tributary E	3396.62	Regional	PR	10.74	255.66	256.18		256.21	0.016455	0.97	12.56	32.27	0.45
Cold_10_7	Tributary E	3377.5	Regional	EX	9.00	255.40	255.86		255.88	0.010342	0.70	12.78	30.86	0.35
Cold_10_7	Tributary E	3377.5	Regional	PR	10.74	255.40	255.92		255.95	0.009130	0.73	14.82	31.17	0.34
Cold_10_7	Tributary E	3359.36	Regional	EX	9.00	255.17	255.64		255.67	0.013013	0.84	11.59	28.69	0.40
Cold_10_7	Tributary E	3359.36	Regional	PR	10.74	255.17	255.77		255.80	0.007563	0.76	15.52	30.44	0.32
Cold_10_7	Tributary E	3339.67	Regional	EX	9.00	254.81	255.50		255.52	0.005045	0.68	14.92	26.49	0.27
Cold_10_7	Tributary E	3339.67	Regional	PR	10.74	254.81	255.69		255.71	0.002770	0.60	20.27	27.82	0.21
Cold_10_7	Tributary E	3321.23	Regional	EX	9.00	254.35	255.43		255.45	0.002980	0.66	17.30	26.61	0.21
Cold_10_7	Tributary E	3321.23	Regional	PR	10.74	254.35	255.66		255.67	0.001671	0.57	23.52	28.27	0.17
Cold_10_7	Tributary E	3287.37	Regional	EX	9.00	253.96	255.38		255.39	0.001052	0.46	22.53	23.78	0.13
Cold_10_7	Tributary E	3287.37	Regional	PR	10.74	253.96	255.63		255.63	0.000743	0.44	28.52	25.27	0.12
Cold_10_7	Tributary E	3269.41	Regional	EX	9.00	253.68	255.33		255.36	0.003764	0.72	12.42	13.01	0.24
Cold_10_7	Tributary E	3269.41	Regional	PR	10.74	253.68	255.59		255.61	0.002503	0.67	16.20	16.36	0.20
Cold_10_7	Tributary E	3191.63	Regional	EX	9.00	252.91	255.24		255.25	0.000732	0.43	23.13	25.24	0.11
Cold_10_7	Tributary E	3191.63	Regional	PR	10.74	252.91	255.53		255.54	0.000506	0.40	30.74	27.52	0.10
Cold_10_7	Tributary E	3188.65	Regional	EX	9.00	252.84	255.21	253.68	255.24	0.001329	0.75	12.02	16.12	0.16
Cold_10_7	Tributary E	3188.65	Regional	PR	10.74	252.84	255.49	253.76	255.52	0.001256	0.79	13.59	17.34	0.16
Cold_10_7	Tributary E	3158.51 hum_426			Culvert									
Cold_10_7	Tributary E	3123.12	Regional	EX	9.00	252.73	253.48	253.42	253.67	0.057836	1.96	4.60	10.83	0.85
Cold_10_7	Tributary E	3123.12	Regional	PR	10.74	252.73	253.53	253.49	253.76	0.062914	2.14	5.01	11.04	0.90
Cold_10_7	Tributary E	3107.01	Regional	EX	9.00	252.50	253.10		253.15	0.016584	0.92	9.74	22.24	0.45
Cold_10_7	Tributary E	3107.01	Regional	PR	10.74	252.50	253.16		253.20	0.016456	0.98	10.93	22.64	0.45
Cold_10_7	Tributary E	3043.25	Regional	EX	9.00	252.01	252.57		252.59	0.005256	0.52	17.19	38.98	0.25
Cold_10_7	Tributary E	3043.25	Regional	PR	10.74	252.01	252.62		252.64	0.005392	0.56	19.06	39.49	0.26
Cold_10_7	Tributary E	2991.29	Regional	EX	9.00	251.56	251.79	251.79	251.89	0.084311	1.28	7.05	35.98	0.89
Cold_10_7	Tributary E	2991.29	Regional	PR	10.74	251.56	251.82	251.82	251.92	0.084079	1.37	7.91	36.28	0.91
Cold_10_7	Tributary E	2930.14	Regional	EX	9.00	250.15	251.56		251.56	0.000182	0.21	47.80	40.23	0.06
Cold_10_7	Tributary E	2930.14	Regional	PR	10.74	250.15	251.82		251.82	0.000140	0.21	58.46	41.89	0.05
Cold_10_7	Tributary E	2887.5	Regional	EX	9.00	249.94	251.56		251.56	0.000184	0.23	47.45	40.03	0.06
Cold_10_7	Tributary E	2887.5	Regional	PR	10.74	249.94	251.82		251.82	0.000142	0.22	58.22	42.14	0.05
Cold_10_7	Tributary E	2802.56	Regional	EX	9.00	250.05	251.55		251.55	0.000079	0.13	70.41	56.49	0.04
Cold_10_7	Tributary E	2802.56	Regional	PR	10.74	250.05	251.81		251.81	0.000061	0.13	85.52	57.99	0.03
Cold_10_7	Tributary E	2775.8	Regional	EX	9.00	249.52	251.54		251.55	0.000052	0.13	80.46	58.71	0.03
Cold_10_7	Tributary E	2775.8	Regional	PR	10.74	249.52	251.81		251.81	0.000042	0.13	96.14	59.92	0.03
Cold_10_7	Tributary E	2760.75	Regional	EX	9.00	249.25	251.51	250.11	251.54	0.001329	0.68	13.20	47.07	0.16
Cold_10_7	Tributary E	2760.75	Regional	PR	10.74	249.25	251.77	250.19	251.80	0.001236	0.72	14.99	48.65	0.15
Cold_10_7	Tributary E	2732.6 hum_604			Culvert									
Cold_10_7	Tributary E	2706.72	Regional	EX	9.00	249.08	250.26	250.18	250.45	0.052587	1.97	4.64	8.58	0.81
Cold_10_7	Tributary E	2706.72	Regional	PR	10.74	249.08	250.30	250.26	250.54	0.059040	2.16	5.06	9.01	0.87
Cold_10_7	Tributary E	2688.78	Regional	EX	9.00	248.89	249.54	249.50	249.62	0.040817	1.46	7.63	26.68	0.70
Cold_10_7	Tributary E	2688.78	Regional	PR	10.74	248.89	249.58	249.53	249.67	0.039129	1.51	8.74	27.22	0.70
Cold_10_7	Tributary E	2611.59	Regional	EX	9.00	247.47	248.07		248.10	0.012784	0.81	12.80	38.93	0.39
Cold_10_7	Tributary E	2611.59	Regional	PR	10.74	247.47	248.11		248.14	0.013228	0.87	14.23	39.84	0.40
Cold_10_7	Tributary E	2560.8	Regional	EX	9.00	246.62	247.67		247.68	0.006631	0.71	17.59	55.62	0.29
Cold_10_7	Tributary E	2560.8	Regional	PR	10.74	246.62	247.71		247.73	0.006223	0.72	20.29	57.77	0.28
Cold_10_7	Tributary E	2506.61	Regional	EX	9.00	246.27	247.33		247.35	0.005897	0.72	15.07	35.67	0.28
Cold_10_7	Tributary E	2506.61	Regional	PR	10.74	246.27	247.39		247.41	0.005861	0.76	17.16	37.37	0.28
Cold_10_7	Tributary E	2483.51	Regional	EX	9.00	245.99	247.12		247.15	0.010564	0.88	11.77	27.88	0.36
Cold_10_7	Tributary E	2483.51	Regional	PR	10.74	245.99	247.18		247.21	0.010441	0.92	13.43	29.80	0.37

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	2452.23	Regional	EX	9.00	245.92	246.93		246.94	0.004358	0.63	17.27	35.48	0.24
Cold_10_7	Tributary E	2452.23	Regional	PR	10.74	245.92	246.99		247.01	0.004277	0.66	19.49	36.15	0.25
Cold_10_7	Tributary E	2401.32	Regional	EX	9.00	245.83	246.65		246.68	0.006176	0.78	13.45	24.46	0.30
Cold_10_7	Tributary E	2401.32	Regional	PR	10.74	245.83	246.71		246.73	0.006571	0.85	14.79	24.88	0.31
Cold_10_7	Tributary E	2367.56	Regional	EX	9.00	245.65	246.24		246.29	0.020511	1.17	9.45	25.92	0.51
Cold_10_7	Tributary E	2367.56	Regional	PR	10.74	245.65	246.30		246.35	0.018842	1.20	10.90	26.40	0.50
Cold_10_7	Tributary E	2338.9	Regional	EX	9.00	245.20	245.89		245.91	0.009237	0.86	12.67	30.78	0.35
Cold_10_7	Tributary E	2338.9	Regional	PR	10.74	245.20	245.91		245.95	0.011194	0.97	13.42	31.91	0.39
Cold_10_7	Tributary E	2310.58	Regional	EX	9.00	244.39	245.40	245.26	245.51	0.029756	1.58	6.71	21.89	0.62
Cold_10_7	Tributary E	2310.58	Regional	PR	10.74	244.39	245.61		245.66	0.010841	1.15	12.72	32.91	0.39
Cold_10_7	Tributary E	2264.91	Regional	EX	9.00	243.75	245.33		245.34	0.001250	0.46	24.40	33.76	0.14
Cold_10_7	Tributary E	2264.91	Regional	PR	10.74	243.75	245.57		245.57	0.000754	0.40	32.40	35.15	0.11
Cold_10_7	Tributary E	2209.07	Regional	EX	9.00	243.51	245.29		245.30	0.000612	0.39	30.16	33.80	0.10
Cold_10_7	Tributary E	2209.07	Regional	PR	10.74	243.51	245.54		245.54	0.000424	0.36	38.84	36.56	0.09
Cold_10_7	Tributary E	2169.34	Regional	EX	9.00	243.13	245.26		245.27	0.000716	0.47	24.90	26.04	0.11
Cold_10_7	Tributary E	2169.34	Regional	PR	10.74	243.13	245.52		245.52	0.000539	0.45	32.07	29.99	0.10
Cold_10_7	Tributary E	2156.52	Regional	EX	9.00	242.99	245.23	243.84	245.25	0.001106	0.66	14.20	19.70	0.15
Cold_10_7	Tributary E	2156.52	Regional	PR	10.74	242.99	245.49	243.91	245.51	0.001046	0.69	16.07	22.70	0.15
Cold_10_7	Tributary E	2127.4 hum_427			Culvert									
Cold_10_7	Tributary E	2093.17	Regional	EX	9.00	242.09	242.82	242.82	243.04	0.078524	2.11	4.33	10.20	0.97
Cold_10_7	Tributary E	2093.17	Regional	PR	10.74	242.09	242.88	242.88	243.12	0.073111	2.20	4.98	14.77	0.96
Cold_10_7	Tributary E	2079.21	Regional	EX	9.00	241.19	242.55		242.59	0.006402	1.01	12.44	22.10	0.30
Cold_10_7	Tributary E	2079.21	Regional	PR	10.74	241.19	242.63		242.66	0.006435	1.06	14.07	22.75	0.31
Cold_10_7	Tributary E	2055.25	Regional	EX	9.00	241.15	242.14		242.28	0.038185	1.81	5.89	13.50	0.70
Cold_10_7	Tributary E	2055.25	Regional	PR	10.74	241.15	242.21		242.36	0.037021	1.90	6.88	15.25	0.70
Cold_10_7	Tributary E	2016.73	Regional	EX	9.00	240.24	241.35		241.43	0.014638	1.21	7.74	13.72	0.45
Cold_10_7	Tributary E	2016.73	Regional	PR	10.74	240.24	241.43		241.51	0.014879	1.28	8.80	14.14	0.46
Cold_10_7	Tributary E	1965.37	Regional	EX	9.00	239.78	240.91		240.95	0.006226	0.84	11.34	22.37	0.30
Cold_10_7	Tributary E	1965.37	Regional	PR	10.74	239.78	240.99		241.03	0.006295	0.90	13.09	24.05	0.31
Cold_10_7	Tributary E	1917.19	Regional	EX	9.00	239.12	240.44	240.21	240.52	0.015453	1.33	7.90	13.79	0.46
Cold_10_7	Tributary E	1917.19	Regional	PR	10.74	239.12	240.51	240.27	240.60	0.015582	1.41	9.09	19.14	0.47
Cold_10_7	Tributary E	1875.03	Regional	EX	9.00	238.41	239.51	239.51	239.68	0.030052	2.11	6.10	15.96	0.68
Cold_10_7	Tributary E	1875.03	Regional	PR	10.74	238.41	239.55	239.55	239.75	0.032191	2.25	6.88	16.28	0.70
Cold_10_7	Tributary E	1862.94	Regional	EX	9.00	237.78	238.98		239.09	0.006905	1.48	6.53	11.33	0.49
Cold_10_7	Tributary E	1862.94	Regional	PR	10.74	237.78	239.05		239.17	0.007439	1.62	7.33	12.27	0.52
Cold_10_7	Tributary E	1801.09	Regional	EX	9.00	237.21	238.47		238.53	0.011708	1.10	8.89	26.51	0.40
Cold_10_7	Tributary E	1801.09	Regional	PR	10.74	237.21	238.55		238.61	0.011045	1.14	11.14	31.09	0.40
Cold_10_7	Tributary E	1765.21	Regional	EX	9.00	236.57	237.53	237.53	237.85	0.083436	2.50	3.61	5.82	1.01
Cold_10_7	Tributary E	1765.21	Regional	PR	10.74	236.57	237.63	237.63	237.97	0.079031	2.57	4.18	6.18	1.00
Cold_10_7	Tributary E	1718.91	Regional	EX	9.00	235.76	236.89		236.94	0.007400	1.01	9.09	10.12	0.33
Cold_10_7	Tributary E	1718.91	Regional	PR	10.74	235.76	236.98		237.04	0.007977	1.09	9.98	10.40	0.35
Cold_10_7	Tributary E	1661.15	Regional	EX	9.00	235.41	236.33		236.38	0.012989	1.06	8.61	15.89	0.42
Cold_10_7	Tributary E	1661.15	Regional	PR	10.74	235.41	236.40		236.47	0.012621	1.12	9.86	16.92	0.42
Cold_10_7	Tributary E	1612.45	Regional	EX	9.00	234.02	235.17		235.35	0.041383	1.94	4.99	9.59	0.73
Cold_10_7	Tributary E	1612.45	Regional	PR	10.74	234.02	235.23	235.16	235.44	0.043959	2.11	5.55	9.90	0.76
Cold_10_7	Tributary E	1568.23	Regional	EX	9.00	233.00	234.14		234.23	0.017690	1.47	7.41	13.82	0.50
Cold_10_7	Tributary E	1568.23	Regional	PR	10.74	233.00	234.23		234.33	0.016755	1.53	8.75	15.70	0.49
Cold_10_7	Tributary E	1541.88	Regional	EX	9.00	232.24	233.87		233.93	0.008660	1.14	8.62	10.22	0.34
Cold_10_7	Tributary E	1541.88	Regional	PR	10.74	232.24	233.94		234.01	0.009865	1.25	9.39	10.56	0.37
Cold_10_7	Tributary E	1489.67	Regional	EX	9.00	231.67	232.68	232.68	232.94	0.066479	2.39	4.23	8.95	0.90
Cold_10_7	Tributary E	1489.67	Regional	PR	10.74	231.67	232.81	232.81	233.04	0.049064	2.25	5.69	12.32	0.79
Cold_10_7	Tributary E	1435.23	Regional	EX	9.00	230.09	230.93		231.02	0.018982	1.33	7.43	13.52	0.51
Cold_10_7	Tributary E	1435.23	Regional	PR	10.74	230.09	231.00		231.09	0.019500	1.43	8.29	13.91	0.53
Cold_10_7	Tributary E	1380.7	Regional	EX	9.00	228.76	229.87		229.96	0.023383	1.57	7.04	13.34	0.55
Cold_10_7	Tributary E	1380.7	Regional	PR	10.74	228.76	229.94		230.04	0.022761	1.63	8.01	13.71	0.56
Cold_10_7	Tributary E	1332.54	Regional	EX	9.00	227.38	228.40	228.33	228.58	0.041973	2.05	5.18	9.69	0.74
Cold_10_7	Tributary E	1332.54	Regional	PR	10.74	227.38	228.46	228.39	228.66	0.043593	2.19	5.76	9.90	0.76
Cold_10_7	Tributary E	1302.84	Regional	EX	9.00	226.30	227.40	227.19	227.54	0.029532	1.66	5.74	13.70	0.62
Cold_10_7	Tributary E	1302.84	Regional	PR	10.74	226.30	227.48	227.27	227.63	0.028339	1.73	6.92	15.31	0.61
Cold_10_7	Tributary E	1263.71	Regional	EX	9.00	225.10	226.01		226.17	0.042150	1.75	5.15	8.72	0.73
Cold_10_7	Tributary E	1263.71	Regional	PR	10.74	225.10	226.07		226.26	0.044687	1.90	5.66	8.84	0.76
Cold_10_7	Tributary E	1215.31	Regional	EX	9.00	223.65	224.85		224.93	0.016613	1.30	6.95	9.20	0.48
Cold_10_7	Tributary E	1215.31	Regional	PR	10.74	223.65	224.97		225.06	0.015043	1.33	8.10	9.57	0.46
Cold_10_7	Tributary E	1168.81	Regional	EX	9.00	222.35	223.36	223.28	223.61	0.057435	2.23	4.06	6.37	0.85
Cold_10_7	Tributary E	1168.81	Regional	PR	10.74	222.35	223.39	223.37	223.72	0.072185	2.55	4.24	6.64	0.96
Cold_10_7	Tributary E	1130.29	Regional	EX	9.00	221.17	222.41		222.51	0.016381	1.50	7.51	15.32	0.48
Cold_10_7	Tributary E	1130.29	Regional	PR	10.74	221.17	222.51		222.60	0.014532	1.51	9.03	15.79	0.46
Cold_10_7	Tributary E	1111.06	Regional	EX	9.00	220.65	221.93		222.09	0.030057	1.77	5.09	6.24	0.63
Cold_10_7	Tributary E	1111.06	Regional	PR	10.74	220.65	222.00		222.20	0.033807	1.94	5.53	6.42	0.67
Cold_10_7	Tributary E	1084.58	Regional	EX	9.00	220.10	221.24		221.34	0.026267	1.53	6.69	13.96	0.58

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold_10_7	Tributary E	1084.58	Regional	PR	10.74	220.10	221.32		221.43	0.024449	1.56	7.82	14.59	0.57
Cold_10_7	Tributary E	1048.15	Regional	EX	9.00	219.11	220.50		220.59	0.017044	1.32	6.82	8.72	0.48
Cold_10_7	Tributary E	1048.15	Regional	PR	10.74	219.11	220.61		220.70	0.016843	1.38	7.79	9.60	0.48
Cold_10_7	Tributary E	1028.59	Regional	EX	9.00	218.71	219.97		220.13	0.032715	1.76	5.10	6.86	0.65
Cold_10_7	Tributary E	1028.59	Regional	PR	10.74	218.71	220.05		220.23	0.035161	1.90	5.65	7.15	0.68
Cold_10_7	Tributary E	996.29	Regional	EX	9.00	218.32	219.32		219.39	0.017115	1.28	8.48	17.51	0.48
Cold_10_7	Tributary E	996.29	Regional	PR	10.74	218.32	219.38		219.46	0.017602	1.37	9.53	18.38	0.50
Cold_10_7	Tributary E	965.91	Regional	EX	9.00	217.92	218.75		218.83	0.023929	1.36	7.69	17.27	0.56
Cold_10_7	Tributary E	965.91	Regional	PR	10.74	217.92	218.81		218.89	0.023788	1.44	8.64	17.45	0.57
Cold_10_7	Tributary E	908.46	Regional	EX	9.00	216.79	217.95		218.00	0.012095	1.13	9.23	15.43	0.40
Cold_10_7	Tributary E	908.46	Regional	PR	10.74	216.79	218.03		218.08	0.011708	1.16	10.49	15.74	0.40
Cold_10_7	Tributary E	879.06	Regional	EX	9.00	216.23	217.59		217.66	0.013422	1.21	7.82	10.82	0.43
Cold_10_7	Tributary E	879.06	Regional	PR	10.74	216.23	217.65		217.74	0.014903	1.33	8.56	12.79	0.46
Cold_10_7	Tributary E	847.19	Regional	EX	9.00	215.85	216.95		217.06	0.028233	1.50	7.02	18.97	0.60
Cold_10_7	Tributary E	847.19	Regional	PR	10.74	215.85	217.03		217.13	0.025479	1.50	8.50	20.33	0.57
Cold_10_7	Tributary E	820.81	Regional	EX	9.00	215.47	216.68		216.71	0.007002	0.76	13.07	32.31	0.29
Cold_10_7	Tributary E	820.81	Regional	PR	10.74	215.47	216.73		216.76	0.008271	0.83	14.72	38.48	0.32
Cold_10_7	Tributary E	807.34	Regional	EX	9.00	215.44	216.57	216.42	216.61	0.006318	1.15	12.32	42.43	0.45
Cold_10_7	Tributary E	807.34	Regional	PR	10.74	215.44	216.60	216.45	216.65	0.006840	1.24	13.66	42.90	0.47
Cold_10_7	Tributary E	802.05 hum_427a			Culvert									
Cold_10_7	Tributary E	794.25	Regional	EX	9.00	214.77	215.93	215.67	215.98	0.003695	1.02	9.23	17.56	0.35
Cold_10_7	Tributary E	794.25	Regional	PR	10.74	214.77	216.00	215.67	216.07	0.003904	1.10	10.85	26.52	0.36
Cold_10_7	Tributary E	770.45	Regional	EX	9.00	214.67	215.70		215.80	0.021052	1.40	7.04	14.54	0.53
Cold_10_7	Tributary E	770.45	Regional	PR	10.74	214.67	215.77		215.87	0.020726	1.48	8.07	15.17	0.53
Cold_10_7	Tributary E	738	Regional	EX	9.00	213.98	215.19		215.25	0.013302	1.25	8.94	17.14	0.43
Cold_10_7	Tributary E	738	Regional	PR	10.74	213.98	215.24		215.31	0.014609	1.36	9.90	22.65	0.45
Cold_10_7	Tributary E	686.51	Regional	EX	9.00	213.33	214.43		214.52	0.018494	1.41	8.24	21.40	0.50
Cold_10_7	Tributary E	686.51	Regional	PR	10.74	213.33	214.51		214.58	0.016753	1.42	9.77	22.30	0.49
Cold_10_7	Tributary E	661.93	Regional	EX	9.00	212.92	213.92		214.03	0.021403	1.46	6.47	11.31	0.54
Cold_10_7	Tributary E	661.93	Regional	PR	10.74	212.92	213.99		214.11	0.022422	1.58	7.23	12.33	0.56
Cold_10_7	Tributary E	615.04	Regional	EX	9.00	212.33	213.48		213.51	0.006061	0.84	12.59	21.88	0.29
Cold_10_7	Tributary E	615.04	Regional	PR	10.74	212.33	213.56		213.59	0.005845	0.88	14.38	22.76	0.29
Cold_10_7	Tributary E	580.25	Regional	EX	9.00	211.91	212.69	212.69	212.97	0.081120	2.32	3.88	7.12	1.00
Cold_10_7	Tributary E	580.25	Regional	PR	10.74	211.91	212.77	212.77	213.07	0.077827	2.41	4.46	18.11	1.00
Cold_10_7	Tributary E	544.59	Regional	EX	9.00	211.47	212.76		212.76	0.000567	0.24	31.44	63.41	0.09
Cold_10_7	Tributary E	544.59	Regional	PR	10.74	211.47	212.75		212.75	0.000861	0.30	30.76	63.07	0.11
Cold_10_7	Tributary E	515.79	Regional	EX	9.00	211.17	212.76	212.17	212.76	0.000050	0.09	79.76	95.16	0.03
Cold_10_7	Tributary E	515.79	Regional	PR	10.74	211.17	212.75	212.26	212.75	0.000074	0.11	78.75	95.11	0.03
Cold_10_7	Tributary E	490.99	Regional	EX	9.00	211.02	212.76	211.65	212.76	0.000006	0.03	191.86	185.28	0.01
Cold_10_7	Tributary E	490.99	Regional	PR	10.74	211.02	212.75	211.67	212.75	0.000008	0.04	189.89	185.22	0.01
Cold_10_7	Tributary E	454.35	Regional	EX	9.00	210.82	212.76	211.44	212.76	0.000004	0.03	242.99	238.40	0.01
Cold_10_7	Tributary E	454.35	Regional	PR	10.74	210.82	212.75	211.45	212.75	0.000006	0.04	240.44	238.06	0.01
Cold_10_7	Tributary E	325.04	Regional	EX	9.00	210.06	212.76	210.98	212.76	0.000001	0.02	399.00	341.48	0.01
Cold_10_7	Tributary E	325.04	Regional	PR	10.74	210.06	212.75	211.02	212.75	0.000002	0.03	395.31	341.37	0.01
Cold_10_7	Tributary E	257.06	Regional	EX	9.00	209.82	212.76	210.44	212.76	0.000001	0.03	401.16	339.46	0.01
Cold_10_7	Tributary E	257.06	Regional	PR	10.74	209.82	212.75	210.49	212.75	0.000002	0.03	397.48	339.39	0.01
Cold_10_7	Tributary E	151.19	Regional	EX	9.00	209.26	212.76	210.17	212.76	0.000006	0.06	220.10	328.37	0.01
Cold_10_7	Tributary E	151.19	Regional	PR	10.74	209.26	212.75	210.27	212.75	0.000009	0.07	217.62	325.25	0.01
Cold_10_7	Tributary E	10.011	Regional	EX	303.18	207.93	211.33	211.33	212.32	0.008456	5.69	108.56	53.01	1.00
Cold_10_7	Tributary E	10.011	Regional	PR	300.39	207.93	211.32	211.32	212.30	0.008445	5.67	107.86	52.94	1.00
Cold_10_7	Tributary E	10.01	Regional	EX	303.18	207.54	211.33		211.39	0.000579	1.60	435.44	188.44	0.27
Cold_10_7	Tributary E	10.01	Regional	PR	300.39	207.54	211.32		211.38	0.000582	1.60	432.05	188.34	0.27
Cold_10_7	Tributary E	10.009	Regional	EX	303.18	206.42	211.37	208.92	211.37	0.000067	0.63	1307.12	499.39	0.10
Cold_10_7	Tributary E	10.009	Regional	PR	300.39	206.42	211.35	208.92	211.35	0.000067	0.63	1298.12	499.03	0.10
Cold_10_7	Tributary E	10.008	Regional	EX	303.18	207.54	211.36	209.60	211.37	0.000073	0.55	1306.86	499.37	0.10
Cold_10_7	Tributary E	10.008	Regional	PR	300.39	207.54	211.35	209.60	211.35	0.000073	0.55	1297.85	499.02	0.10
Cold_10_7	Tributary E	10.0075			Bridge									
Cold_10_7	Tributary E	10.007	Regional	EX	303.18	207.35	211.34	209.50	211.35	0.000072	0.58	1347.63	480.91	0.10
Cold_10_7	Tributary E	10.007	Regional	PR	300.39	207.35	211.33	209.50	211.33	0.000072	0.58	1338.87	480.04	0.10
Cold Creek West	Reach1	1784.71	Regional	EX	1.43	254.04	254.64	254.61	254.78	0.034004	1.66	0.86	2.57	0.92
Cold Creek West	Reach1	1784.71	Regional	PR	1.04	254.04	254.56	254.53	254.68	0.034951	1.55	0.67	2.28	0.91
Cold Creek West	Reach1	1752.69	Regional	EX	1.43	253.15	253.60	253.58	253.70	0.032338	1.42	1.01	3.92	0.89
Cold Creek West	Reach1	1752.69	Regional	PR	1.04	253.15	253.55	253.52	253.63	0.029898	1.26	0.83	3.65	0.84
Cold Creek West	Reach1	1724.34	Regional	EX	1.43	252.47	252.75		252.80	0.030139	0.99	1.44	9.40	0.81
Cold Creek West	Reach1	1724.34	Regional	PR	1.04	252.47	252.72	252.70	252.76	0.030837	0.89	1.16	9.06	0.79
Cold Creek West	Reach1	1663.99	Regional	EX	1.43	249.77	250.42	250.42	250.60	0.043790	1.84	0.78	2.33	1.01
Cold Creek West	Reach1	1663.99	Regional	PR	1.04	249.77	250.34	250.34	250.49	0.045378	1.72	0.60	2.06	1.01
Cold Creek West	Reach1	1612.71	Regional	EX	2.58	248.03	248.72	248.52	248.75	0.006674	0.87	2.95	7.32	0.44
Cold Creek West	Reach1	1612.71	Regional	PR	2.79	248.03	248.74	248.53	248.78	0.006698	0.90	3.11	7.41	0.44
Cold Creek West	Reach1	1586	Regional	EX	2.58	246.87	247.25	247.25	247.32	0.045376	1.14	2.27	16.47	0.98

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold Creek West	Reach1	1586	Regional	PR	2.79	246.87	247.26	247.26	247.33	0.046353	1.18	2.37	16.54	0.99
Cold Creek West	Reach1	1531	Regional	EX	2.58	243.80	244.34	244.34	244.42	0.043170	1.30	1.99	11.28	0.99
Cold Creek West	Reach1	1531	Regional	PR	2.79	243.80	244.35	244.35	244.44	0.043349	1.34	2.09	11.36	0.99
Cold Creek West	Reach1	1458	Regional	EX	2.58	238.86	239.52	239.52	239.65	0.041890	1.60	1.61	6.19	1.00
Cold Creek West	Reach1	1458	Regional	PR	2.79	238.86	239.53	239.53	239.67	0.041577	1.63	1.71	6.35	1.00
Cold Creek West	Reach1	1397	Regional	EX	7.02	236.18	236.72	236.72	236.86	0.039719	1.65	4.26	15.87	1.02
Cold Creek West	Reach1	1397	Regional	PR	6.97	236.18	236.72	236.72	236.86	0.039743	1.64	4.24	15.84	1.02
Cold Creek West	Reach1	1339	Regional	EX	7.02	233.69	234.88	234.71	234.93	0.012063	1.02	6.85	20.90	0.57
Cold Creek West	Reach1	1339	Regional	PR	6.97	233.69	234.87	234.71	234.93	0.012070	1.02	6.82	20.86	0.57
Cold Creek West	Reach1	1206	Regional	EX	7.02	231.11	232.06	232.06	232.37	0.033763	2.48	2.83	4.58	1.01
Cold Creek West	Reach1	1206	Regional	PR	6.97	231.11	232.05	232.05	232.37	0.033775	2.48	2.82	4.57	1.01
Cold Creek West	Reach1	1205	Regional	EX	7.02	228.43	230.83		230.84	0.000868	0.40	17.77	31.07	0.17
Cold Creek West	Reach1	1205	Regional	PR	6.97	228.43	230.83		230.84	0.000857	0.39	17.77	31.07	0.17
Cold Creek West	Reach1	1202.128 10.09.38	Regional	EX	161.51	226.88	230.23		230.62	0.003135	3.77	116.16	78.67	0.67
Cold Creek West	Reach1	1202.128 10.09.38	Regional	PR	161.51	226.88	230.23		230.62	0.003135	3.77	116.16	78.67	0.67
Cold Creek West	Reach1	1202.052 10.09.37	Regional	EX	161.51	226.67	230.20		230.35	0.001346	2.51	168.11	92.05	0.44
Cold Creek West	Reach1	1202.052 10.09.37	Regional	PR	161.51	226.67	230.20		230.35	0.001346	2.51	168.11	92.05	0.44
Cold Creek West	Reach1	1201.976 10.09.36	Regional	EX	161.51	226.67	229.92		230.26	0.003066	3.71	113.32	66.80	0.67
Cold Creek West	Reach1	1201.976 10.09.36	Regional	PR	161.51	226.67	229.92		230.26	0.003066	3.71	113.32	66.80	0.67
Cold Creek West	Reach1	1201.9 10.09.35	Regional	EX	161.51	226.43	229.50	229.41	229.98	0.003923	4.03	106.62	84.20	0.75
Cold Creek West	Reach1	1201.9 10.09.35	Regional	PR	161.51	226.43	229.50	229.41	229.98	0.003923	4.03	106.62	84.20	0.75
Cold Creek West	Reach1	1201.824 10.09.34	Regional	EX	161.51	226.01	229.64		229.75	0.000898	2.06	185.03	90.02	0.36
Cold Creek West	Reach1	1201.824 10.09.34	Regional	PR	161.51	226.01	229.64		229.75	0.000898	2.06	185.03	90.02	0.36
Cold Creek West	Reach1	1201.748 10.09.33	Regional	EX	161.51	225.86	228.93	228.93	229.57	0.005207	4.61	89.20	65.50	0.85
Cold Creek West	Reach1	1201.748 10.09.33	Regional	PR	161.51	225.86	228.93	228.93	229.57	0.005207	4.61	89.20	65.50	0.85
Cold Creek West	Reach1	1201.672 10.09.32	Regional	EX	161.51	225.59	228.97		229.10	0.001389	2.52	164.26	72.95	0.45
Cold Creek West	Reach1	1201.672 10.09.32	Regional	PR	161.51	225.59	228.97		229.10	0.001389	2.52	164.26	72.95	0.45
Cold Creek West	Reach1	1201.596 10.09.31	Regional	EX	161.51	225.53	228.81		228.95	0.001429	2.57	155.03	67.80	0.46
Cold Creek West	Reach1	1201.596 10.09.31	Regional	PR	161.51	225.53	228.81		228.95	0.001429	2.57	155.03	67.80	0.46
Cold Creek West	Reach1	1201.49 10.09.30	Regional	EX	161.51	225.05	228.84		228.88	0.000354	1.35	292.76	127.89	0.23
Cold Creek West	Reach1	1201.49 10.09.30	Regional	PR	161.51	225.05	228.84		228.88	0.000354	1.35	292.76	127.89	0.23
Cold Creek West	Reach1	1201.444 10.09.29	Regional	EX	161.51	224.42	228.73	227.30	228.84	0.000740	2.22	201.28	91.54	0.34
Cold Creek West	Reach1	1201.444 10.09.29	Regional	PR	161.51	224.42	228.73	227.30	228.84	0.000740	2.22	201.28	91.54	0.34
Cold Creek West	Reach1	1201.368 10.09.28	Regional	EX	161.51	224.24	228.72		228.78	0.000736	2.25	239.53	105.16	0.34
Cold Creek West	Reach1	1201.368 10.09.28	Regional	PR	161.51	224.24	228.72		228.78	0.000736	2.25	239.53	105.16	0.34
Cold Creek West	Reach1	1201.292 10.09.27	Regional	EX	161.51	224.15	228.70		228.74	0.000502	1.90	255.85	90.63	0.29
Cold Creek West	Reach1	1201.292 10.09.27	Regional	PR	161.51	224.15	228.70		228.74	0.000502	1.90	255.85	90.63	0.29
Cold Creek West	Reach1	1201.216 10.09.26	Regional	EX	161.51	224.12	228.68		228.73	0.000356	1.55	262.56	87.11	0.24
Cold Creek West	Reach1	1201.216 10.09.26	Regional	PR	161.51	224.12	228.68		228.73	0.000356	1.55	262.56	87.11	0.24
Cold Creek West	Reach1	1201.198 10.09.25	Regional	EX	161.51	223.94	228.65		228.71	0.000486	1.86	254.11	97.79	0.28
Cold Creek West	Reach1	1201.198 10.09.25	Regional	PR	161.51	223.94	228.65		228.71	0.000486	1.86	254.11	97.79	0.28
Cold Creek West	Reach1	1201.174 10.09.24	Regional	EX	161.51	223.94	228.62	227.08	228.70	0.000541	1.96	238.54	102.12	0.30
Cold Creek West	Reach1	1201.174 10.09.24	Regional	PR	161.51	223.94	228.62	227.08	228.70	0.000541	1.96	238.54	102.12	0.30
Cold Creek West	Reach1	1201.162 x-99 (10.09.23)			Bridge									
Cold Creek West	Reach1	1201.154 10.09.22	Regional	EX	161.51	223.94	227.86	227.86	228.68	0.003783	4.62	76.00	65.35	0.76
Cold Creek West	Reach1	1201.154 10.09.22	Regional	PR	161.51	223.94	227.86	227.86	228.68	0.003783	4.62	76.00	65.35	0.76
Cold Creek West	Reach1	1201.148 10.09.21	Regional	EX	161.51	223.97	227.30	227.30	228.21	0.006005	5.17	66.70	39.94	0.92
Cold Creek West	Reach1	1201.148 10.09.21	Regional	PR	161.51	223.97	227.30	227.30	228.21	0.006005	5.17	66.70	39.94	0.92
Cold Creek West	Reach1	1201.14 10.09.20	Regional	EX	161.51	223.73	227.26		227.94	0.004816	4.79	74.64	35.14	0.83
Cold Creek West	Reach1	1201.14 10.09.20	Regional	PR	161.51	223.73	227.26		227.94	0.004816	4.79	74.64	35.14	0.83
Cold Creek West	Reach1	1201.064 10.09.19	Regional	EX	161.51	223.58	227.42		227.58	0.001412	2.77	163.61	80.12	0.46
Cold Creek West	Reach1	1201.064 10.09.19	Regional	PR	161.51	223.58	227.42		227.58	0.001412	2.77	163.61	80.12	0.46
Cold Creek West	Reach1	1200.988 10.09.18	Regional	EX	161.51	223.37	226.92		227.42	0.003516	4.15	89.01	45.53	0.71
Cold Creek West	Reach1	1200.988 10.09.18	Regional	PR	161.51	223.37	226.92		227.42	0.003516	4.15	89.01	45.53	0.71
Cold Creek West	Reach1	1200.912 10.09.17	Regional	EX	161.51	223.04	227.03		227.16	0.001495	2.81	165.80	83.20	0.46
Cold Creek West	Reach1	1200.912 10.09.17	Regional	PR	161.51	223.04	227.03		227.16	0.001495	2.81	165.80	83.20	0.46
Cold Creek West	Reach1	1200.836 10.09.16	Regional	EX	161.51	222.71	226.63		227.00	0.002331	3.47	112.55	65.16	0.57
Cold Creek West	Reach1	1200.836 10.09.16	Regional	PR	161.51	222.71	226.63		227.00	0.002331	3.47	112.55	65.16	0.57
Cold Creek West	Reach1	1200.76 10.09.15	Regional	EX	161.51	222.68	226.56	225.65	226.88	0.002358	3.53	108.74	51.14	0.59
Cold Creek West	Reach1	1200.76 10.09.15	Regional	PR	161.51	222.68	226.56	225.65	226.88	0.002358	3.53	108.74	51.14	0.59
Cold Creek West	Reach1	1200.684 10.09.14	Regional	EX	161.51	222.35	226.69		226.74	0.000296	1.36	307.31	123.09	0.21
Cold Creek West	Reach1	1200.684 10.09.14	Regional	PR	161.51	222.35	226.69		226.74	0.000296	1.36	307.31	123.09	0.21
Cold Creek West	Reach1	1200.608 10.09.13	Regional	EX	161.51	222.05	226.67		226.71	0.000332	1.54	310.29	119.61	0.23
Cold Creek West	Reach1	1200.608 10.09.13	Regional	PR	161.51	222.05	226.67		226.71	0.000332	1.54	310.29	119.61	0.23
Cold Creek West	Reach1	1200.532 10.09.12	Regional	EX	161.51	221.81	226.66		226.69	0.000259	1.34	354.70	145.37	0.20
Cold Creek West	Reach1	1200.532 10.09.12	Regional	PR	161.51	221.81	226.66		226.69	0.000259	1.34	354.70	145.37	0.20
Cold Creek West	Reach1	1200.456 10.09.11	Regional	EX	161.51	221.69	226.64		226.68	0.000214	1.25	343.02	132.32	0.18
Cold Creek West	Reach1	1200.456 10.09.11	Regional	PR	161.51	221.69	226.64		226.68	0.000214	1.25	343.02	132.32	0.18
Cold Creek West	Reach1	1200.38 10.09.10	Regional	EX	161.51	221.72	226.56		226.65	0.000596	2.10	250.23	129.69	0.31
Cold Creek West	Reach1	1200.38 10.09.10	Regional	PR	161.51	221.72	226.56		226.65	0.000596	2.10	250.23	129.69	0.31

HEC-RAS Profile: Regional (Continued)

River	Reach	River Sta	Profile	Plan	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)	
Cold Creek West	Reach1	1200.304 10.09.09	Regional	EX	161.51	221.69	226.60		226.62	0.000185	1.19	396.90	133.47	0.17
Cold Creek West	Reach1	1200.304 10.09.09	Regional	PR	161.51	221.69	226.60		226.62	0.000185	1.19	396.90	133.47	0.17
Cold Creek West	Reach1	1200.278 10.09.08	Regional	EX	161.51	221.09	226.59		226.61	0.000129	1.06	439.24	138.05	0.15
Cold Creek West	Reach1	1200.278 10.09.08	Regional	PR	161.51	221.09	226.59		226.61	0.000129	1.06	439.24	138.05	0.15
Cold Creek West	Reach1	1200.228 10.09.07	Regional	EX	161.51	220.94	226.55		226.60	0.000291	1.63	284.93	90.46	0.22
Cold Creek West	Reach1	1200.228 10.09.07	Regional	PR	161.51	220.94	226.55		226.60	0.000291	1.63	284.93	90.46	0.22
Cold Creek West	Reach1	1200.152 10.09.06	Regional	EX	161.51	220.70	226.55		226.58	0.000221	1.39	312.63	92.56	0.19
Cold Creek West	Reach1	1200.152 10.09.06	Regional	PR	161.51	220.70	226.55		226.58	0.000221	1.39	312.63	92.56	0.19
Cold Creek West	Reach1	1200.076 10.09.05	Regional	EX	161.51	220.67	226.53	223.68	226.56	0.000181	1.35	361.99	120.18	0.18
Cold Creek West	Reach1	1200.076 10.09.05	Regional	PR	161.51	220.67	226.53	223.68	226.56	0.000181	1.35	361.99	120.18	0.18
Cold Creek West	Reach1	1200 10.09.04	Regional	EX	161.51	220.70	226.52	224.06	226.56	0.000157	1.26	367.00	127.85	0.17
Cold Creek West	Reach1	1200 10.09.04	Regional	PR	161.51	220.70	226.52	224.06	226.56	0.000157	1.26	367.00	127.85	0.17
Cold Creek West	Reach1	1199.984 x-98 (10.09.03)			Culvert									
Cold Creek West	Reach1	1199.963 10.09.02	Regional	EX	161.51	220.52	224.17	224.17	225.75	0.006998	5.70	31.45	128.74	1.00
Cold Creek West	Reach1	1199.963 10.09.02	Regional	PR	161.51	220.52	224.17	224.17	225.75	0.006998	5.70	31.45	128.74	1.00
Cold Creek West	Reach1	1199.934 10.09.01	Regional	EX	161.51	220.64	223.11	223.10	223.49	0.005417	3.96	121.97	129.50	0.83
Cold Creek West	Reach1	1199.934 10.09.01	Regional	PR	161.51	220.64	223.11	223.10	223.49	0.005417	3.96	121.97	129.50	0.83

Appendix D4 – Correspondence with Toronto and Region Conservation Authority

Hi Josh,
Thanks for your email.
I noticed that the engineered model was not properly transferred into the shared online folder. Please access the shared folder now and check whether you can download the engineered model.

Please let me know if you have any difficulty.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

Toronto and Region Conservation Authority

From: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Sent: November 23, 2021 10:16 AM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Jason Wagler <Jason.Wagler@trca.ca>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>; Jessica Lysecki <jlysecki@cfcrozier.ca>; Travis Gibson <tgibson@cfcrozier.ca>; Erin Dodd <edodd@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Priyantha,

I have been working on the estimated portion of the hydraulic model and need to begin looking at the engineered watercourses of the Main Humber and Cold Creek. As per our data sharing agreement, we had requested the hec ras projects for the engineered and estimated models. From what I can see, the Cold Creek and Main Humber models only contain the estimated reaches (no geometry for the engineered model).

Can you please confirm that the engineered hydraulic models were sent to us? I think that I only received the CAD drawings for the engineered model.

Thank you,

Josh Wagemaker | Engineering Intern
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
T: 905.875.0026

Crozier Connections:

Read our latest news and announcements here.

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: November 4, 2021 2:43 PM
To: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Cc: Jason Wagler <Jason.Wagler@trca.ca>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>; Jessica Lysecki <jlysecki@cfcrozier.ca>; Travis Gibson <tgibson@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Josh,
Please access the following link to download the Hydraulic models.

Regional Road 50 and Emil Kolb Parkway_Corzier(Josh Wagemaker)

As mentioned in my previous emails, please note that TRCA's Estimated floodplain modeling and mapping was intended to be used as a screening tool for development applications submitted to the TRCA, to determine whether existing or proposed sites, properties, or structures are potentially susceptible to flooding. This information is the best available at this time but is not appropriate for many uses since the model doesn't include crossing structures, doesn't have refined Manning's n values, and the crossing geometry is not detailed. Thus, the TRCA water resources engineering staff recommend that the proponent use TRCA's available modeling and mapping to conduct the hydraulic analysis for their project, refine the model and create an engineered HEC-RAS model. The Estimated HEC-RAS model is based on old topographic information and therefore updating the topographic information will also be required.

If you need any clarification, please let me know.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480

E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

From: Priyantha Hunukumbura
Sent: November 2, 2021 12:03 PM
To: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Cc: Jason Wagler <Jason.Wagler@trca.ca>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>; Jessica Lysecki <jlysecki@cfcrozier.ca>; Travis Gibson <tgibson@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Josh,
Thanks for completing the online payment. Please access the following link to download the Hydrologic model, hydrology report, subcatchment shape file and the floodplain mapping (CAD) sheets(hum_81, hum_82 & hum_77). Once I prepare the hydraulic models, I will copy them to the same location and let you know.

Regional Road 50 and Emil Kolb Parkway_Corzier(Josh Wagemaker)

If you have any difficulty to access the above link, please let me know.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

From: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Sent: November 2, 2021 10:18 AM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Jason Wagler <Jason.Wagler@trca.ca>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>; Jessica Lysecki

<jlysecki@cfcrozier.ca>; Travis Gibson <tgibson@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Priyantha,

I have processed payment. Thanks again for your help.

Based on past experience, the hydraulic model usually takes some time to prepare. If this is the case, and if it isn't too much trouble, would it be possible to receive the subcatchments as soon as possible?

Regards,

Josh Wagemaker | Engineering Intern
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
T: 905.875.0026

Crozier Connections:

Read our latest news and announcements here.

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: Monday, November 1, 2021 1:22 PM
To: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Cc: Jason Wagler <Jason.Wagler@trca.ca>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: RE: TRCA Data Request

Hi Josh,
Thanks for sending us the completed data sharing agreement.
The invoice for the requested data has been sent through TRCA's online payment system. Once we have received the payment and data has been prepared, I will direct you on how to access the data.

If you need any other information, please let me know.

Thank you.

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources

Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

From: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Sent: October 29, 2021 2:15 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Jessica Lysecki <jlysecki@cfcrozier.ca>; Andrea Giampuzzi <agiampuzzi@cfcrozier.ca>; Jason Wagler <Jason.Wagler@trca.ca>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>; Travis Gibson <tgibson@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Priyantha,

Thank you for your help. I have attached our data sharing agreement. Please send the invoice and we will provide payment as soon as possible.

Regards,

Josh Wagemaker | Engineering Intern
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
T: 905.875.0026

Crozier Connections:

Read our latest news and announcements here.

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: Friday, October 29, 2021 10:01 AM

To: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Josh,
The buffer shown in the figure (in Pink Color) is just for the Floodplain Mapping Sheet reference.
You can get some information on regulatory area mapping from Regulated Area Search - Toronto and Region Conservation Authority (TRCA) .
if you need the engineered HEC-RAS model as well, we can provide. In this case we will charge only $150 for the hydraulic Modelling.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

From: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Sent: October 29, 2021 9:32 AM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Subject: RE: TRCA Data Request

Hi Priyantha,

I am a little concerned about the buffer from **hum_82** and **hum_77** encroaching on the property. The shapefile provided may be a little coarse, it is possible that the property boundary is touching.
I wasn't aware that the estimated and engineered models were completely separate. Would it be another $150 for the engineered model?

I am having an internal meeting to discuss if we will need the sheets. I will get back to you with the Data Sharing Agreeement shortly.

Thanks,

Josh Wagemaker | Engineering Intern
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
T: 905.875.0026

Crozier Connections:

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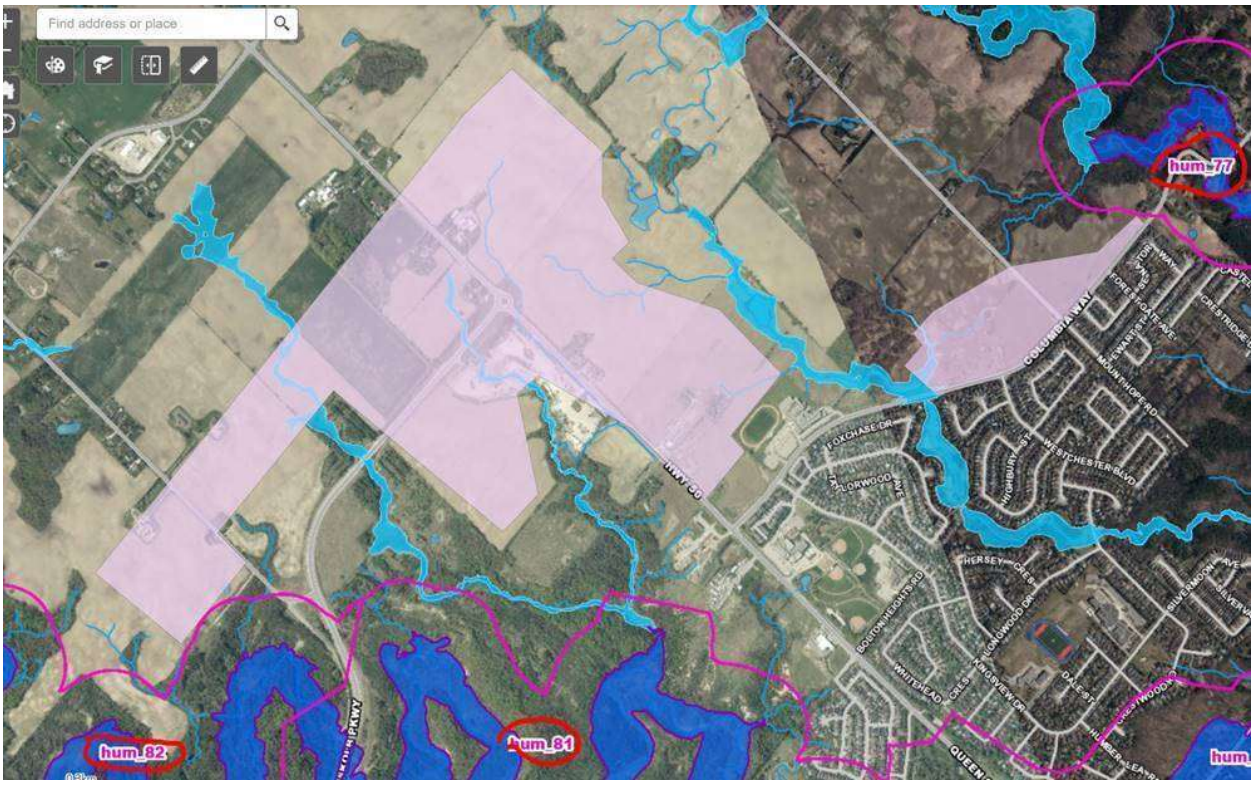
From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: Thursday, October 28, 2021 3:31 PM
To: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Josh,
No worries.
Please see the figure below. As I mentioned before, your subject area is outside of TRCA's Engineered Floodplain. However, if you need the Engineered Floodplain sheets (Hum_82, Hum_81 or Hum_77), please include them in the data sharing agreement. Those sheets are available in CAD($125 +Tax per sheet) or in PDF ($30+ Tax per sheet) . We typically do not provide Estimated floodplain shapefile as you will be able to generate it from the Estimated HEC-RAS model.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca



From: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Sent: October 28, 2021 3:01 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Subject: RE: TRCA Data Request

I apologize for the number of emails but could we get the shapefile for the combined engineered-estimated floodplain map. I think that I have downloaded this before but the link on the TRCA website appears to be broken right now..

Thanks,

Josh Wagemaker | Engineering Intern
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
T: 905.875.0026

CROZIER
CONSULTING ENGINEERS

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From: Josh Wagemaker
Sent: Thursday, October 28, 2021 2:56 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Jason Wagler <Jason.Wagler@trca.ca>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: RE: TRCA Data Request

Hi Priyantha,

Thank you for your response. Would it be possible to get the shapefile of subcatchments without requesting the entire hydrologic model? Or does the $150 fee still apply?

Thanks,

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: Thursday, October 28, 2021 2:24 PM
To: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Cc: Jason Wagler <Jason.Wagler@trca.ca>; Dilnesaw Chekol <Dilnesaw.Chekol@trca.ca>
Subject: RE: TRCA Data Request

Hi Josh,
Thanks for your email.
Information on the data availability is shown in Red below.

1. **The hydraulic model for the area previously identified. – You can purchase the Estimated Hydraulic model ($150 + Tax)**
2. **Shapefile of Subcatchments (not subwatersheds) – (If you need the hydrologic model for the Humber River($150 + Tax), please list it in the data sharing agreement. We can provide the Subcatchment shapefile)**
3. **Shapefile of Floodplain and Associated Maps - The subject area is within our Estimated Hydraulic modeling area. therefore, we do not have Engineered Floodplain maps for the area.**
4. **Infrastructure – Crossings (culverts and bridges only)- Please contact the Region/Town to obtain culvert information**
5. **Shapefile of Erosion/Hazardous Areas – Not available**

Based on the information provided, the subject site is within TRCA's Estimated Hydraulic Modeling boundary. Therefore, please note that the Estimated floodplain modeling and mapping was intended to be used as a screening tool for development applications submitted to the TRCA, to determine whether existing or proposed sites, properties, or structures are potentially susceptible to flooding. This information is the best available at this time but is not appropriate for many uses since the model doesn't include crossing structures, doesn't have refined Manning's n values, and the crossing geometry is not detailed. Thus, the TRCA water resources engineering staff recommend that the proponent use TRCA's available modeling and mapping to conduct the hydraulic analysis for their project, refine the model and create an engineered HEC-RAS model. The Estimated HEC-RAS model is based on old topographic information and therefore updating the topographic information will also be required.

Herewith I attached TRCA's data sharing agreement. Please complete it and send me back. Once we received the signed data sharing agreement, I will prepare the requested data and send you an invoice. Once we have received the necessary fee, I will make an arrangement to send you the data.

If you need further clarification, please do contact me.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

From: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Sent: October 28, 2021 1:22 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Subject: RE: TRCA Data Request

Hi Priyantha,

I have found some of the information that I had requested before. I thought that I should send you an updated list so that you don't have to collect everything. The reduced list of items includes:

1. **The hydraulic model for the area previously identified.**
2. **Shapefile of Subcatchments (not subwatersheds)**
3. **Shapefile of Floodplain and Associated Maps**
4. **Infrastructure – Crossings (culverts and bridges only)**
5. **Shapefile of Erosion/Hazardous Areas**

I understand that this process takes some time but if you are able to provide an approximate ETA it would be much appreciated.

Thank you,

Josh Wagemaker | Engineering Intern
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
T: 905.875.0026

Crozier Connections:

Read our latest news and announcements here.

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: Tuesday, October 26, 2021 2:56 PM
To: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Josh,
Thanks.
I will discuss with the planner and will let you know if I need to clarify anything.
Otherwise, I will send you TRCA's data sharing agreement for you to complete and send me back.

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

From: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Sent: October 26, 2021 2:53 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Subject: RE: TRCA Data Request

Hello,

No permit applications have been made yet. Let me know if there is anything I can do.

Thanks,

Josh Wagemaker | Engineering Intern
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
T: 905.875.0026

Crozier Connections:

Read our latest news and announcements here.

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: Tuesday, October 26, 2021 2:25 PM
To: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Josh,
Yes, I received the data you sent yesterday. Thanks.
As you need various types of data, I will discuss with the corresponding planner and get back to you on how we should proceed.
Can you please let me know whether the data is for a current/ existing permit application?

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

From: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Sent: October 26, 2021 2:18 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Subject: RE: TRCA Data Request

Hi Priyantha,

Could you please confirm receipt of my email that was sent yesterday? I have provided the same information in a zip file just in case there is an issue with file size. Thank you for your help.

Sincerely,

Josh Wagemaker | Engineering Intern
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
T: 905.875.0026

Crozier Connections:

Read our latest news and announcements here.

From: Josh Wagemaker
Sent: Monday, October 25, 2021 12:47 PM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Subject: RE: TRCA Data Request

Hi Priyantha,

I apologize but I believe that your email went to my spam. I was just about to email you asking for an update. Below is the information that you had requested.

There is not a specific address for the project. It is owned the Bolton North Hill Landowners Group and is a collection of properties. One of the addresses is 14475 Hwy 50, Kleinburg, ON. One of the large areas is located north of Columbia Way, at Columbia Way and Mount Hope Rd. The other Site is located at HWY 50 and Emil Kolb Parkway. I have attached a map and shapefile for reference.

Assuming that the entire hydraulic model is too much data to send, I had sent Alwish a shapefile of the extents of the watercourse that we require. I have attached this shapefile and map as well.

In addition to the **Hydraulic Model**, we would like to request the following data.

2. **Hydrologic Model of Humber River Watershed**
3. **Shapefile of Subwatershed Drainage Areas or Subcatchments**
4. **Shapefile of Existing Land Use Conditions**
5. **Any Available Contour/Topographic Data**
6. **Shapefile of Floodplain and Associated Maps**
7. **Stormwater Management Ponds and Infrastructure**
8. **Shapefile of Erosion/Hazardous Areas**

We are running a little short on time for this project, so please let me know if there is anything that I can do to help with the process. I would really appreciate it if you could send the data that is immediately available, just in case the hydraulics part takes a some time to complete.

Please do not hesitate to call at (807)-356-4282. We are happy to take care of any licensing agreements or fees.

Thank you,

From: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Sent: Tuesday, October 19, 2021 1:03 PM
To: Jessica Lysecki <jlysecki@cfcrozier.ca>
Cc: Andrea Giampuzzi <agiampuzzi@cfcrozier.ca>; Josh Wagemaker <jwagemaker@cfcrozier.ca>
Subject: RE: TRCA Data Request

Hi Josh,
Can you please provide me the address of the subject property and a clear map (or Shape File) showing the project boundary for me to check the data availability?

Thanks,

Priyantha Hunukumbura, Ph.D., P.Eng.
Technologist, Water Resources
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 6480
E: priyantha.hunukumbura@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

From: Alwish Gnanaraj <Alwish.Gnanaraj@trca.ca>
Sent: October 19, 2021 10:01 AM
To: Priyantha Hunukumbura <PRIYANTHA.HUNUKUMBURA@trca.ca>
Cc: Jessica Lysecki <jlysecki@cfcrozier.ca>; Andrea Giampuzzi <agiampuzzi@cfcrozier.ca>; Josh Wagemaker <jwagemaker@cfcrozier.ca>
Subject: Fw: TRCA Data Request

Hi Priyantha,

Could you please send this data request to Josh Wagemaker <jwagemaker@cfcrozier.ca>?

Josh: Peel region is in Priyantha's jurisdiction. He will be able to help you.

Thanks,
Alwish.

Alwish Gnanaraj, M.A.Sc.
Technologist, Water Resources Engineering
Engineering Services | Development and Engineering Services

T: (416) 661-6600 ext. 5390
E: alwish.gnanaraj@trca.ca
A: 101 Exchange Avenue, Vaughan, Ontario L4K 5R6

Toronto and Region Conservation Authority (TRCA) | trca.ca

From: Josh Wagemaker <jwagemaker@cfcrozier.ca>
Sent: October 19, 2021 9:56 AM
To: Alwish Gnanaraj <Alwish.Gnanaraj@trca.ca>
Cc: Jessica Lysecki <jlysecki@cfcrozier.ca>; Andrea Giampuzzi <agiampuzzi@cfcrozier.ca>
Subject: FW: TRCA Data Request

Hey Alwish,

I just wanted to follow up on my email last week. Would you be able to provide the license agreement and timeline for this information?

I could also try going through Development Planning if you are very busy right now.

Thank you,

Josh Wagemaker | Engineering Intern
2800 High Point Drive, Suite 100 | Milton, ON L9T 6P4
T: 905.875.0026

Crozier Connections:

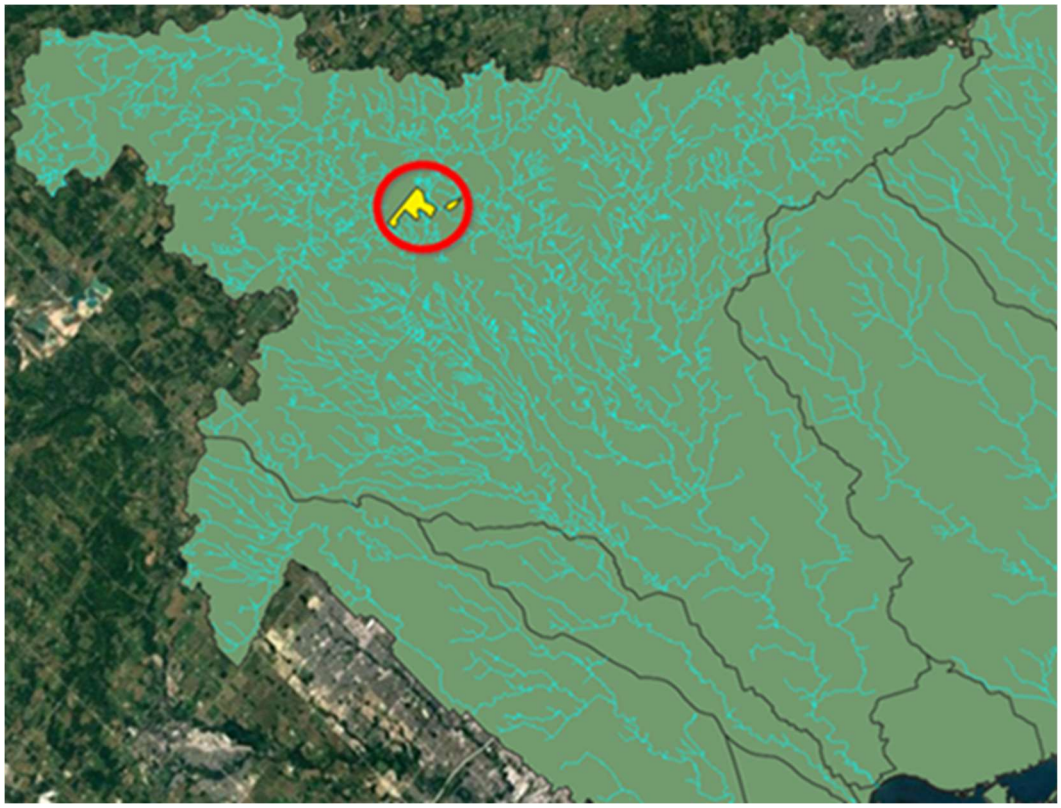
Read our latest news and announcements here.

From: Josh Wagemaker
Sent: Thursday, October 14, 2021 2:27 PM
To: alwish.gnanaraj@trca.ca
Cc: Jessica Lysecki <jlysecki@cfcrozier.ca>
Subject: TRCA Data Request

Hi Alwish,

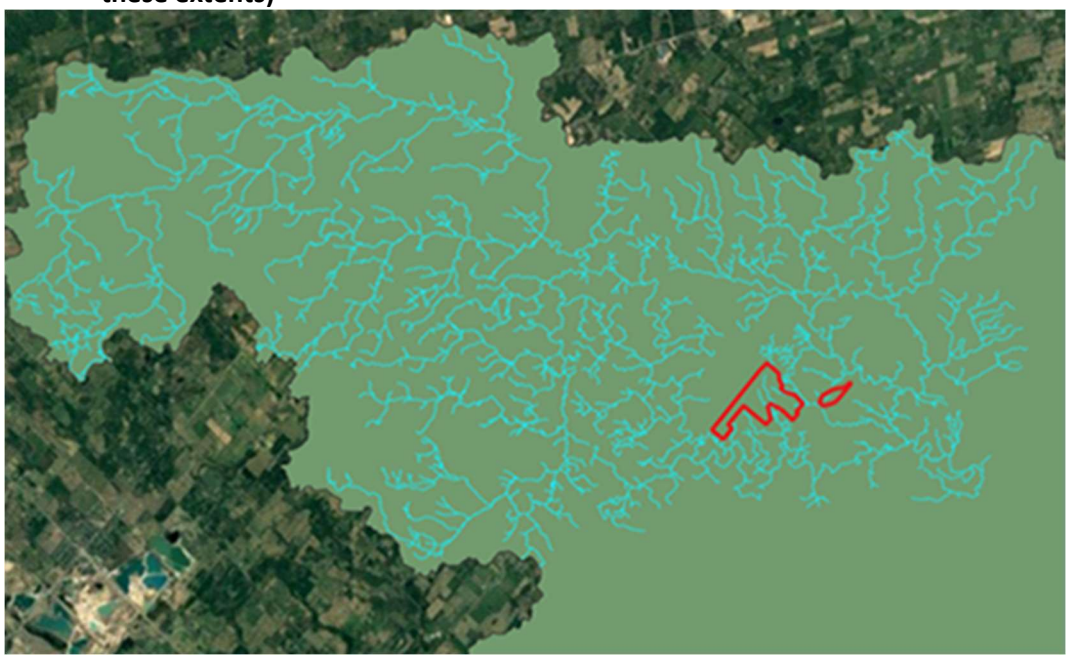
I hope that you are doing well. I am emailing you because I require some data that is not available on the TRCA's online portal. Last year I was in a similar situation and I remember that you were very helpful.

I am currently working on a project for the Bolton North Hill Landowners Group. We are developing the Functional Servicing Report with a focus on stormwater management. Our project is located within the Humber River Watershed at the intersection of Regional Road 50 and Emil Kolb Parkway. An overview of our sites location is shown below.



Below is a list of the data that I would like to request:

1. **Hydraulic Model for Watercourse Area Shown Below (I have attached a shapefile that includes these extents)**



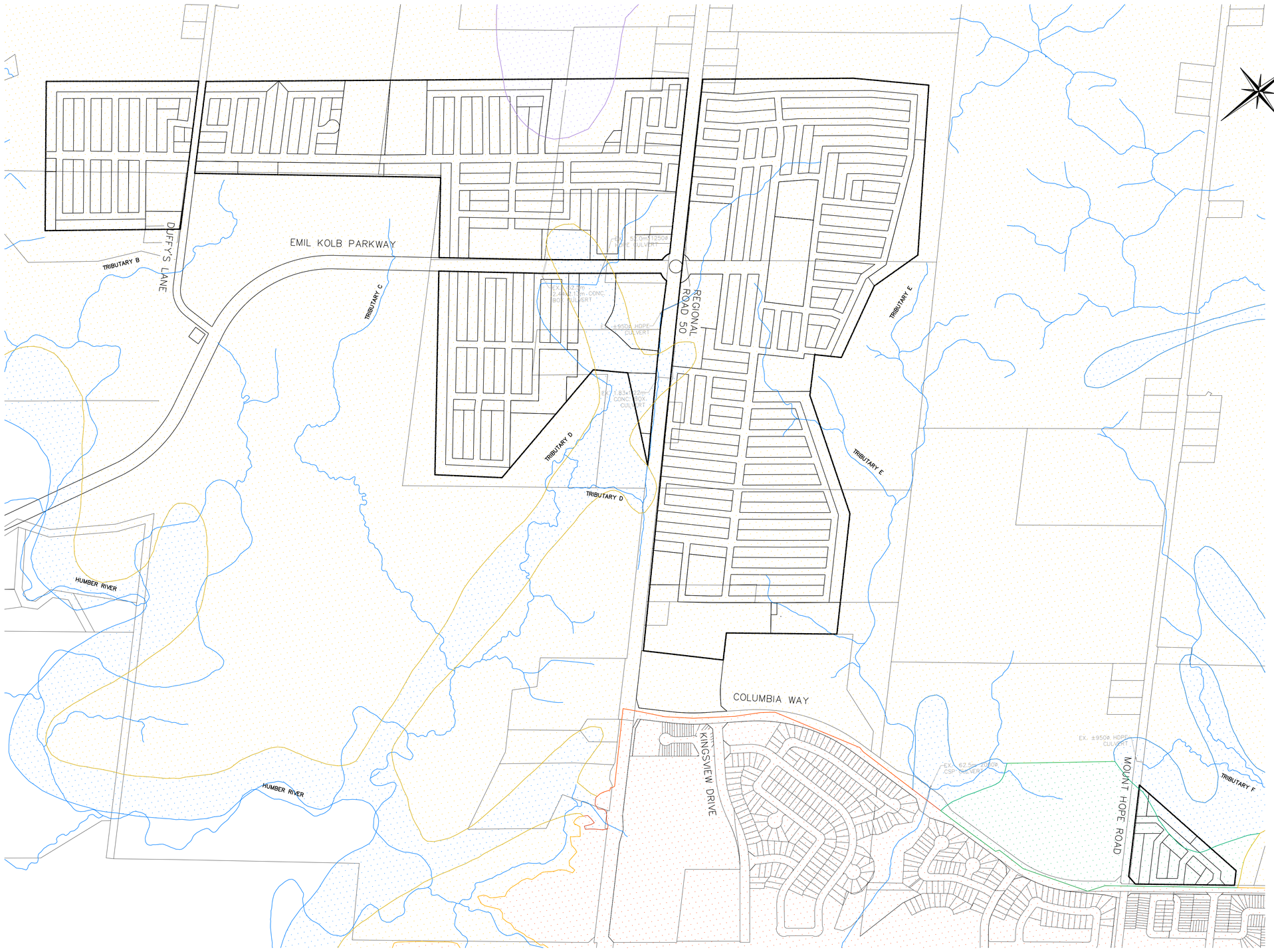
2. **Hydrologic Model of Humber River Watershed**

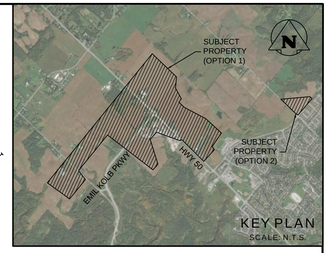
3. **Shapefile of Subwatershed Drainage Areas or Subcatchments**
4. **Shapefile of Existing Land Use Conditions**
5. **Any Available Contour/Topographic Data**
6. **Shapefile of Floodplain and Associated Maps**
7. **Stormwater Management Ponds and Infrastructure**
8. **Shapefile of Erosion/Hazardous Areas**

Please let me know if you require any more information. Feel free to email me back or call me directly at (807) 356-4282.

Thank you and have a great day,

APPENDIX E – FIGURES





KEY PLAN
SCALE: N.T.S.

LEGEND

- 198.00 — EXISTING MAJOR CONTOURS
- 198.50 — EXISTING MINOR CONTOURS
- x199.11 — EXISTING ELEVATION
- PROPERTY BOUNDARY
- BOTTOM LAND
- BUILT–UP AREA
- KING CLAY LOAM
- MONOGHAN CLAY LOAM
- PONTYPOOL SANDY LOAM

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EXISTING GROUND CONTOURS DERIVED FROM AERIAL SURVEY BY DRONE SURVEY CANADA (JULY 2021). ADDITIONAL CONTOUR DATA ADAPTED FROM THE ONTARIO DIGITAL TERRAIN MODEL (LIDAR–DERIVED) LAND INFORMATION ONTARIO (LIO) DATASET (MINISTRY OF NATURAL RESOURCES AND FORESTRY, 2017).

No.	ISSUE	DATE: MM/DD/YYYY
A	ISSUED FOR COORDINATION	12/03/2021

Engineer

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project

BOLTON NORTH HILL
TOWN OF CALEDON

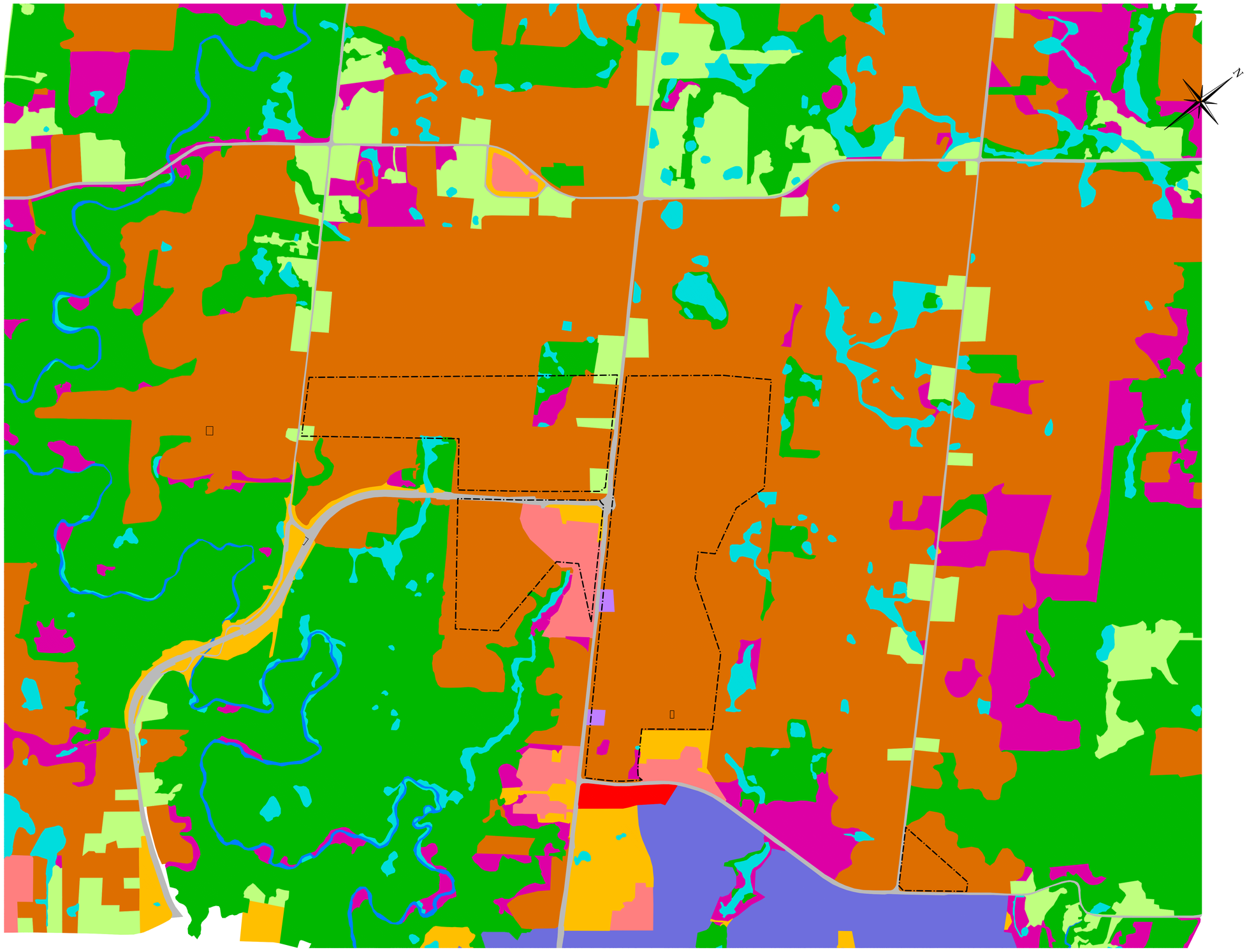
Drawing

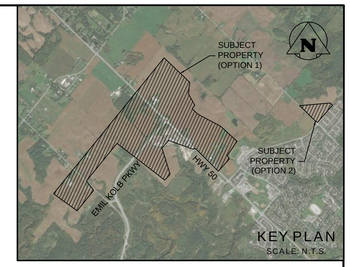
SOIL MAPPING PLAN

CROZIER CONSULTING ENGINEERS
2800 High Point Drive
Suite 100
Milton, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	Design By	Project	
E.D.	T.G.		708–3446
Check By	Check By	Scale	Figure
T.G.	S.C.	1:5000	SOIL–1

N:\700\708-Bolton NH Landowners Grp\3446-Bolton North Hill\CAD\Civil_Sheets\Figures\3446_SOIL.dwg, SOIL, 2021-12-06 10:13:50 AM, edodd





LEGEND

- PROPERTY BOUNDARY
- AGRICULTURAL LAND
- COMMERCIAL
- FOREST
- HIGH-DENSITY RESIDENTIAL
- INDUSTRIAL/INSTITUIONAL
- MEADOW
- MEDIUM-DENSITY RESIDENTIAL
- RECREATIONAL / OPEN SPACE
- RIVERINE
- ROADS
- RURAL RESIDENTIAL
- WETLANDS

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EXISTING GROUND CONTOURS DERIVED FROM AERIAL SURVEY BY DRONE SURVEY CANADA (JULY 2021). ADDITIONAL CONTOUR DATA ADAPTED FROM THE ONTARIO DIGITAL TERRAIN MODEL (LIDAR-DERIVED) LAND INFORMATION ONTARIO (LIO) DATASET (MINISTRY OF NATURAL RESOURCES AND FORESTRY, 2017).

No.	ISSUE	DATE: MM/DD/YYYY
A	ISSUED FOR COORDINATION	12/03/2021

Engineer

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project

BOLTON NORTH HILL
TOWN OF CALEDON

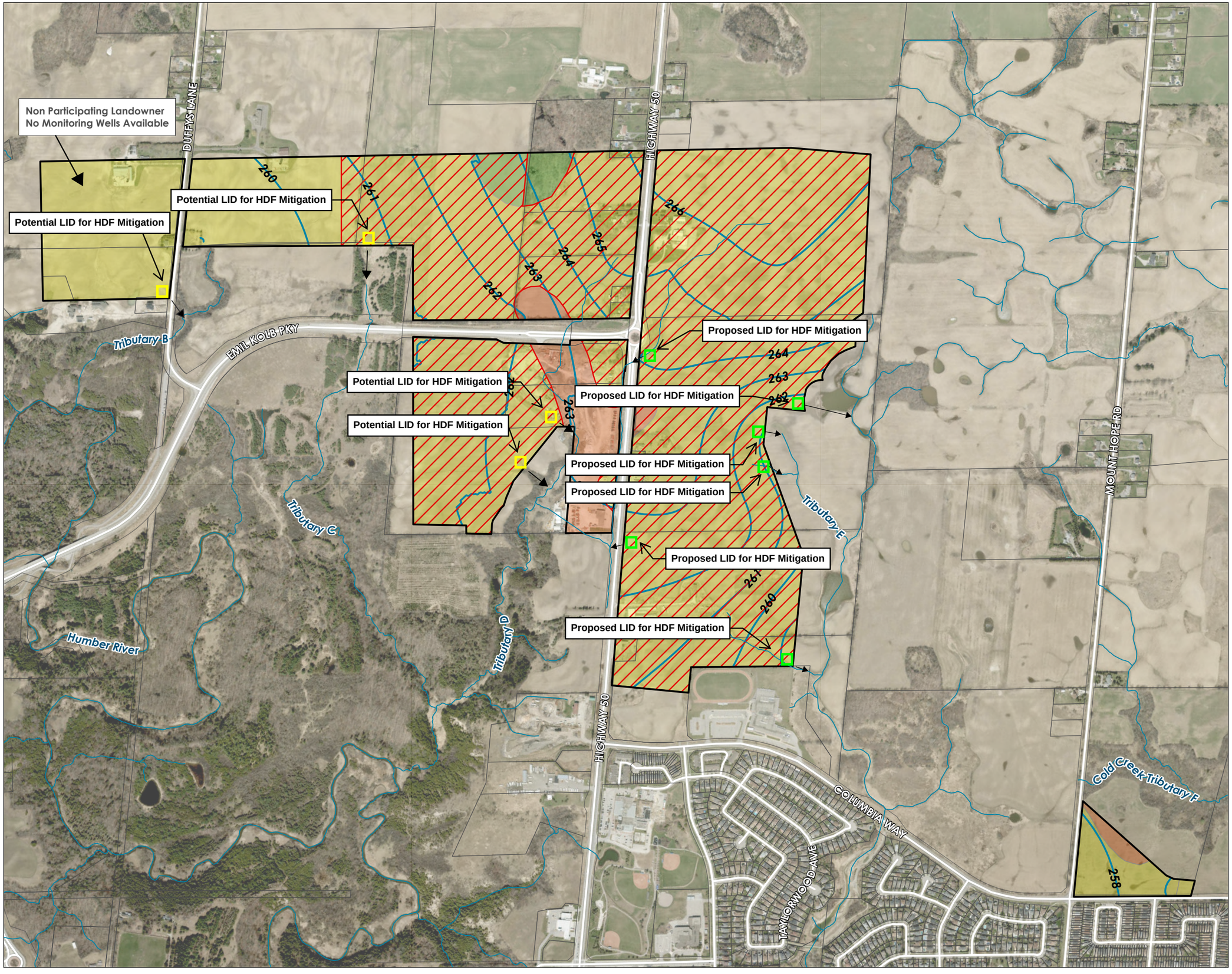
Drawing

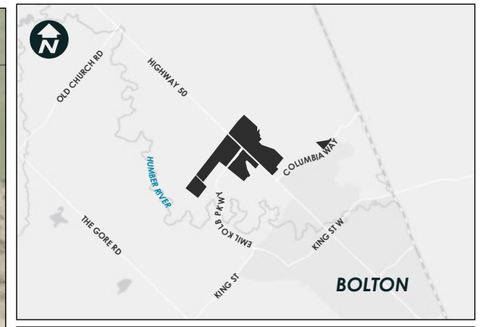
EXISTING LANDUSE
CONDITIONS

CROZIER
CONSULTING ENGINEERS
2800 High Point Drive
Suite 100
Milton, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	Design By	Project	
E.D.	T.G.		708-3446
Check By	Check By	Scale	Figure
T.G.	S.C.	1: 5000	LAND-1

N:\700-799 Bolton NH Landowners Grp\3446 Bolton North Hill\CAD\Civil_Sheets\Figures\3446_LANDUSE.dwg, LANDUSE, 2021-12-06 10:14:14 AM, sdedd





LEGEND

- STUDY AREA
- WATERCOURSE
- PROPERTY PARCEL
- INTERPRETED GROUNDWATER CONTOUR (MASL) (1M)
- SOILS CONDUCIVE TO INFILTRATION
- SOILS NOT CONDUCIVE TO INFILTRATION
- SOILS POTENTIALLY CONDUCIVE TO INFILTRATION
- AREAS SUITABLE TO LIDS BASED ON 1M MINIMUM SEPARATION TO GROUNDWATER AND SOIL TYPE
- **POTENTIAL LID FOR HDF MITIGATION**
- **PROPOSED L LID FOR HDF MITIGATION**

0 150 300 600 Metres

Source: Peel Region, Maxar, Esri, HERE, Garmin, USGS, EPA, NPS, NRCan

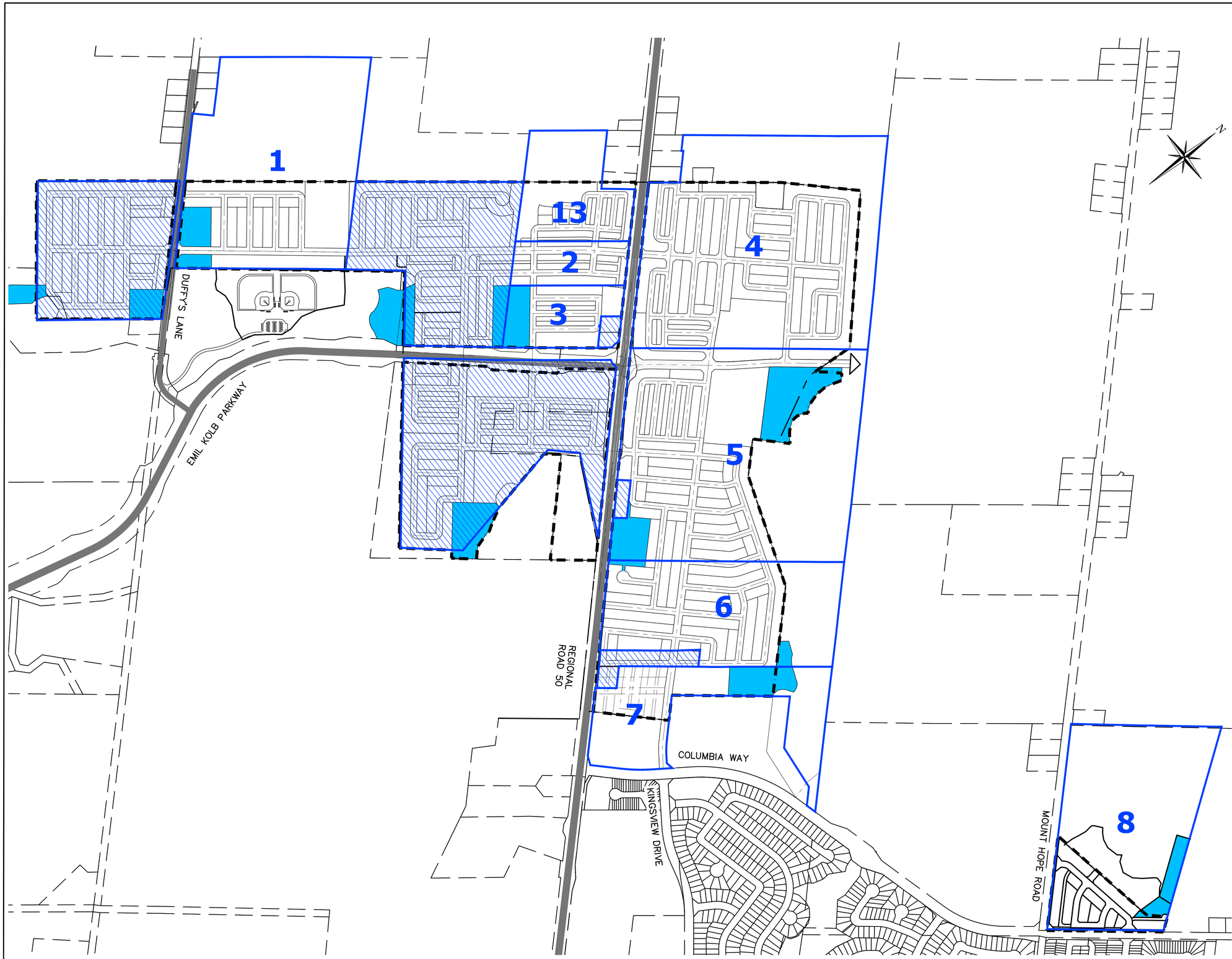
BOLTON NORTH HILL SUBWATERSHED STUDY

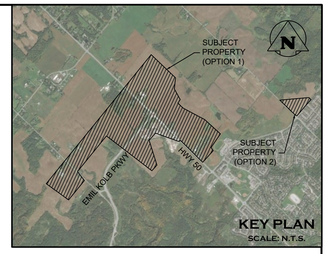
AREAS CONDUCIVE TO INFILTRATION & POTENTIAL LID LOCATIONS

CROZIER

DRAWN:	DESIGN:	PROJECT NO.	
J.M / D.M	A.W	708 - 3446	
DATE:	PROJECTION:	SCALE:	
2025-03-11	EPSG:26917	1:10,000	Fig 28

APPENDIX F – DRAWINGS





LEGEND

1 — PROPERTY BOUNDARY AND BOLTON NORTH HILL OWNERSHIP ID

NON-PARTICIPANT PROPERTY

PROPERTY BOUNDARY

NOTES

ALL OF THESE PROPERTIES, INCLUDING WHAT IS TRADITIONALLY REFERRED TO AS THE OPTION 1 LANDS (PARECELS 1–7, 13) AND OPTION 2 LANDS (PARCEL 8) ARE INCLUDED IN THE PHASE 1 DEVELOPMENT PLANS PER THE TOWN OF CALEDON'S OFFICIAL PLAN AMENDMENT TO ADDRESS GROWTH MANAGEMENT AND PHASING.

PLAN PREPARED BY BOUSFIELDS INC. DATED FEBRUARY 2026

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EXISTING GROUND CONTOURS DERIVED FROM AERIAL SURVEY BY DRONE SURVEY CANADA (JULY 2021). ADDITIONAL CONTOUR DATA ADAPTED FROM THE ONTARIO DIGITAL TERRAIN MODEL (LIDAR-DERIVED) LAND INFORMATION ONTARIO (LIO) DATASET (MINISTRY OF NATURAL RESOURCES AND FORESTRY, 2017).

No.	ISSUE	DATE: MM/DD/YYYY
1	ISSUED FOR FIRST SUBMISSION	12/17/2021
2	ISSUED FOR SECOND SUBMISSION	02/18/2025
3	ISSUED FOR THIRD SUBMISSION	02/27/2026

Engineer

Engineer

PRELIMINARY

NOT TO BE USED FOR CONSTRUCTION

Project

BOLTON NORTH HILL
TOWN OF CALEDON

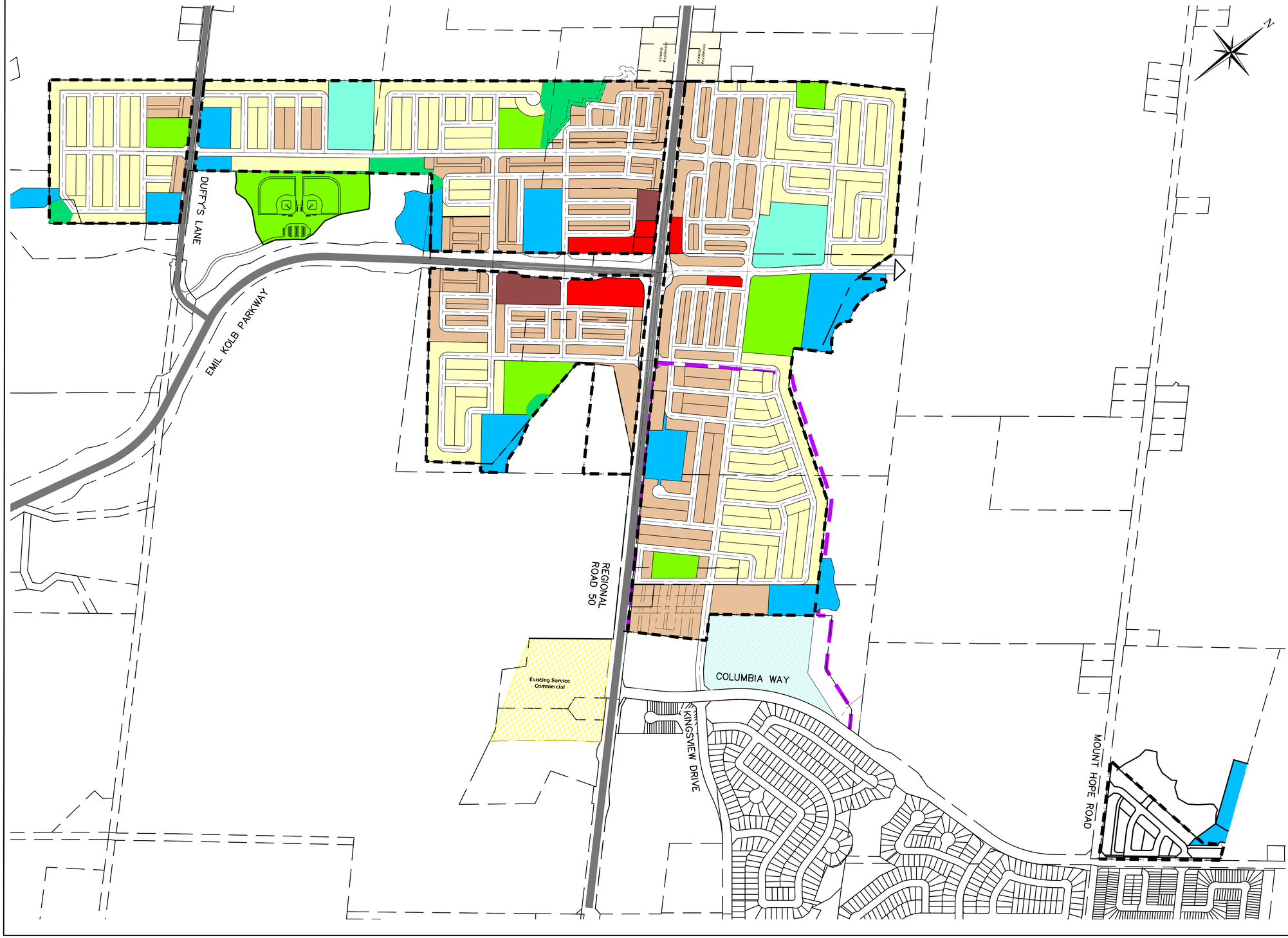
Drawing

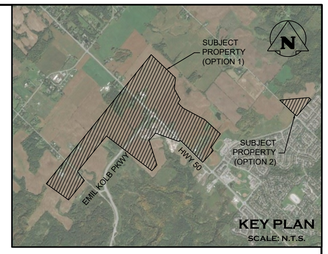
LANDOWNERSHIP MAP

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
S.v.N./J.B.	S.v.N./J.L.		708-3446
Check By	Check By	Scale	Drawing
J.L./J.B.	T.G.	1:6000	C701

N:\700\708-Bolton NH Landowners Grp\3446-Bolton North Hill\CAD\Civil_Sheets\Figures\3446_C701 - LANDOWNERSHIP MAP.dwg, 2026-02-27 4:11:57 PM, AutoCAD PDF (General Documentation).pc3





LEGEND

- PROPERTY BOUNDARY
- LOW DENSITY SINGLES
- MEDIUM DENSITY (TOWNS)
- MEDIUM/HIGH DENSITY
- MIXED USE
- SCHOOLS
- PARKS
- OPEN SPACE
- STORM WATER PONDS
- ROUNDING OUT AREA
- EXISTING SEPARATE SECONDARY SCHOOL
- EXISTING RESIDENTIAL
- ROPA 30 BOUNDARY

PLAN PREPARED BY BOUSFIELDS INC. DATED JANUARY 27, 2025

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No.	ISSUE	DATE: MM/DD/YYYY
1	ISSUED FOR FIRST SUBMISSION	12/17/2021
2	ISSUED FOR SECOND SUBMISSION	02/18/2025
3	ISSUED FOR THIRD SUBMISSION	02/27/2026

Engineer

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project

BOLTON NORTH HILL
TOWN OF CALEDON

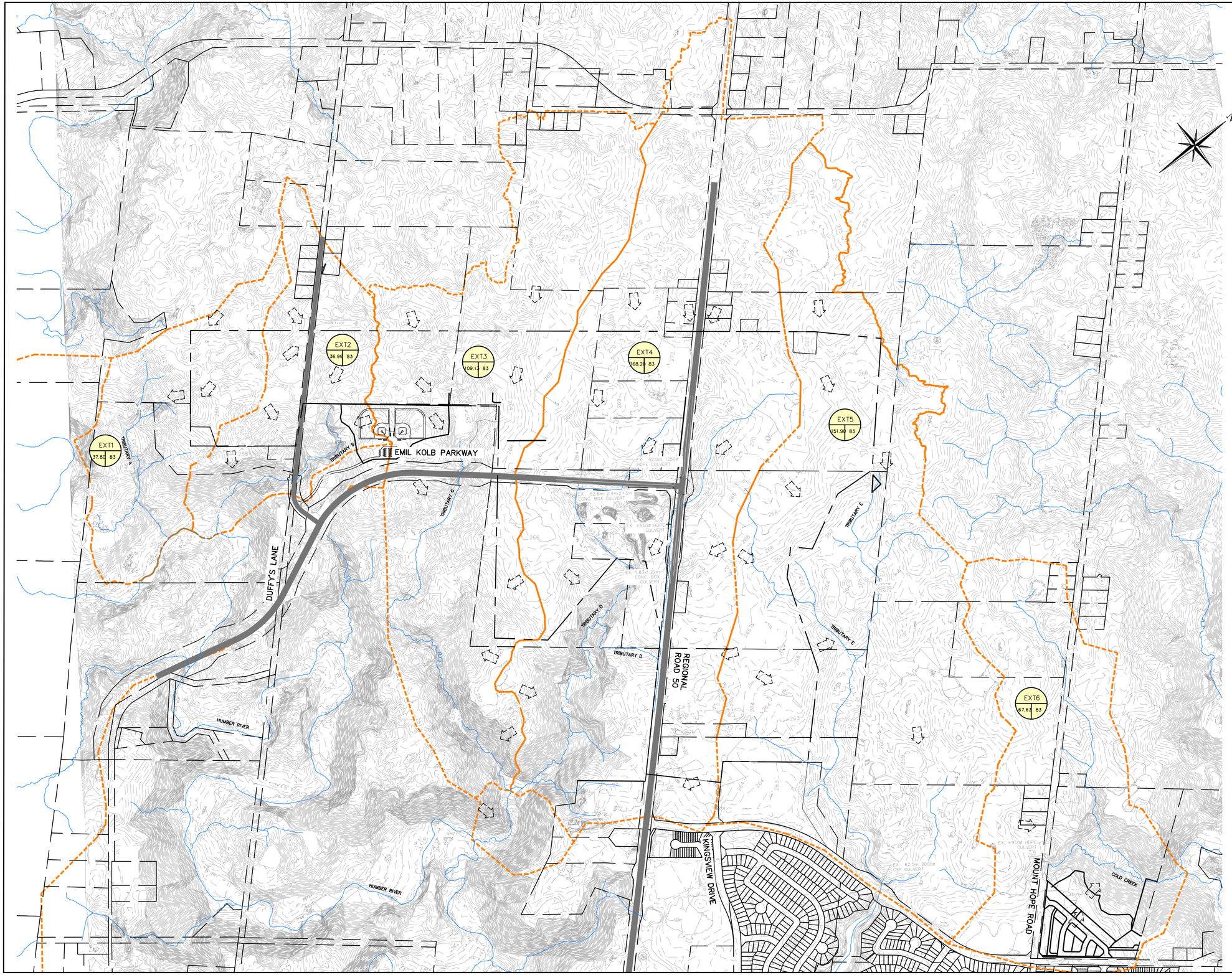
Drawing

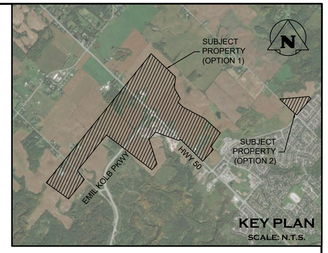
PRELIMINARY FRAMEWORK PLAN

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON. L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
S.v.N./J.B.	S.v.N./J.L.		708-3446
Check By	Check By	Scale	Drawing
J.L./J.B.	T.G.	1:6000	C702

N:\700\708-Bolton NH Landowners Grp\3446-Bolton North Hill\CAD\Civil_Sheets\Figures\3446_C702 - DP.dwg, 2026-02-27 4:13:24 PM, AutoCAD PDF (General Documentation).pc3





KEY PLAN
SCALE: N.T.S.

LEGEND

- EXISTING MAJOR CONTOURS (2.0m) (198.00)
- EXISTING MINOR CONTOURS (1.0m) (197.00)
- DRAINAGE AREA
- PROPERTY BOUNDARY
- EXISTING OVERLAND FLOW ARROW
- CATCHMENT ID
- CN NUMBER (PERVIOUS AREAS) % IMPERVIOUS (IMPERVIOUS AREAS)
- CATCHMENT AREA (ha)

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5. ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

EXISTING GROUND CONTOURS DERIVED FROM AERIAL SURVEY BY DRONE SURVEY CANADA (JULY 2021). ADDITIONAL CONTOUR DATA ADAPTED FROM THE ONTARIO DIGITAL TERRAIN MODEL (LIDAR-DERIVED) LAND INFORMATION ONTARIO (LIO) DATASET (MINISTRY OF NATURAL RESOURCES AND FORESTRY, 2017).

No.	ISSUE	DATE: MM/DD/YYYY
1	ISSUED FOR FIRST SUBMISSION	12/17/2021
2	ISSUED FOR SECOND SUBMISSION	02/18/2025
3	ISSUED FOR THIRD SUBMISSION	02/27/2026

Engineer

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project

BOLTON NORTH HILL
TOWN OF CALEDON

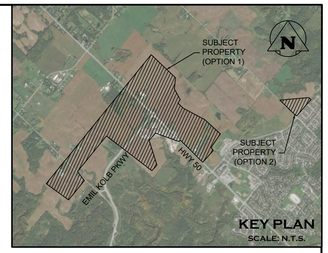
Drawing

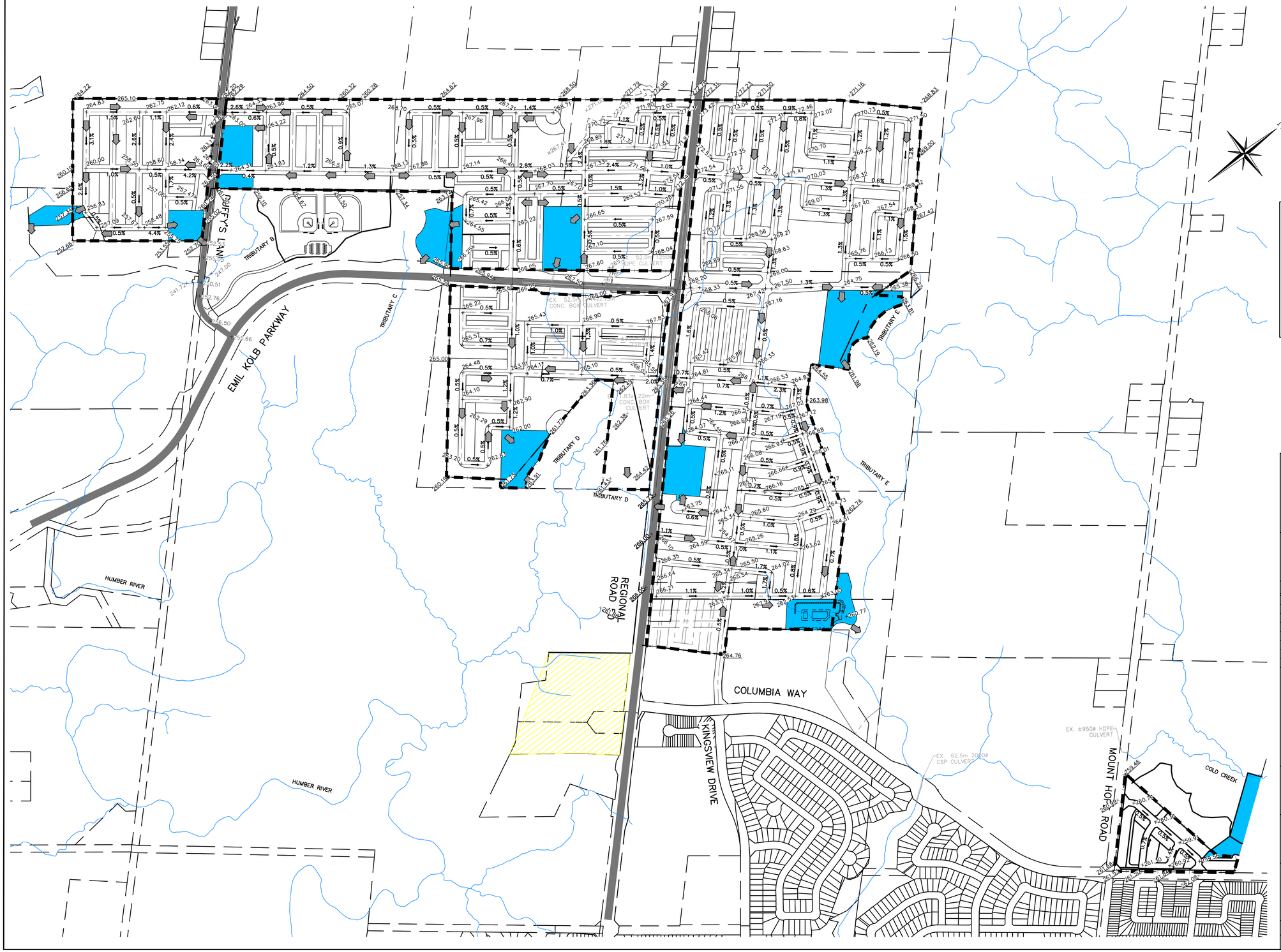
PRE-DEVELOPMENT STORM DRAINAGE PLAN

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	708-3446
S.V. / E.D.	E.D.		
Check By	Check By	Scale	Drawing
J.L. / J.B.	T.G.	1:6000	C703

N:\700\708-Bolton NH Landowners Grp\3446-Bolton North Hill\CAD\Civil_Sheets\Figures\3446_C703 - DRN.dwg, 2026-02-27 4:14:30 PM, AutoCAD PDF (General Documentation).pc3





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3	ISSUED FOR THIRD SUBMISSION	02/27/2026

Engineer

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project

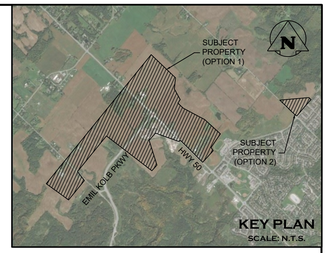
BOLTON NORTH HILL
TOWN OF CALEDON

Drawing

GENERAL GRADING

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON. L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
S.v.N./J.B.	S.v.N./J.L.		708-3446
Check By	Check By	Scale	Drawing
J.L./J.B.	T.G.	1:6000	C704



LEGEND

PROPERTY BOUNDARY

CUT / FILL ANALYSIS				
Number	Minimum Elevation	Maximum Elevation	Color	VOL (cum)
1	-12.3	-7.0		10809
2	-7.0	-5.0		13280
3	-5.0	-3.0		84724
4	-3.0	-1.0		547833
5	-1.0	0.0		805645
6	0.0	1.0		477569
7	1.0	3.0		461294
8	3.0	5.0		132203
9	5.0	7.0		41215
10	7.0	10.1		9622

ROPA 30 BOUNDARY

OPTION 1

OPTION 2

EARTHWORKS NOTES
- ASSUMED TOPSOIL STRIPPING DEPTH = 0.30m
- ASSUMED AVERAGE PRE-GRADE DEPTH = 0.80m
- OPTION 1 VOLUMES ARE INCLUSIVE OF ROPA 30 LAND

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EXISTING GROUND CONTOURS DERIVED FROM AERIAL SURVEY BY DRONE SURVEY CANADA (JULY 2021). ADDITIONAL CONTOUR DATA ADAPTED FROM THE ONTARIO DIGITAL TERRAIN MODEL (LIDAR-DERIVED) LAND INFORMATION ONTARIO (LIO) DATASET (MINISTRY OF NATURAL RESOURCES AND FORESTRY, 2017).

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Engineer

Engineer

PRELIMINARY

NOT TO BE USED FOR CONSTRUCTION

Project

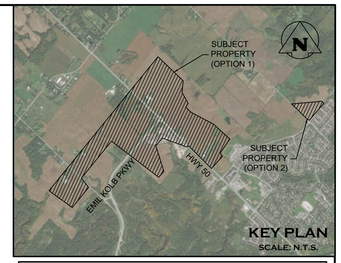
BOLTON NORTH HILL
TOWN OF CALEDON

Drawing

PRELIMINARY
EARTHWORKS MAP

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
S.V.N./J.B.	S.V.N./J.L.		708-3446
Check By	Check By	Scale	Drawing
J.L./J.B.	T.G.	1:6000	C705



LEGEND

- EXISTING MAJOR CONTOURS (2.0m)
- EXISTING MINOR CONTOURS (1.0m)
- PROPERTY BOUNDARY
- INTERNAL DRAINAGE AREA
- EXTERNAL DRAINAGE AREA
- WATERCOURSE (FROM TRCA MODEL)
- PROPOSED STORM SEWER
- CATCHMENT ID
- CN NUMBER (PERVIOUS AREAS)
- % IMPERVIOUS (IMPERVIOUS AREAS)
- CATCHMENT AREA (ha)
- PROPOSED OVERLAND FLOW DIRECTION

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Engineer

Engineer

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Project

BOLTON NORTH HILL
TOWN OF CALEDON

Drawing

PRELIMINARY POST DEVELOPMENT STORM DRAINAGE PLAN

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON. L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
S.v.N./J.B.	S.v.N./J.L.		708-3446
Check By	Check By	Scale	Drawing
J.L./J.B.	T.G.	1:6000	C706

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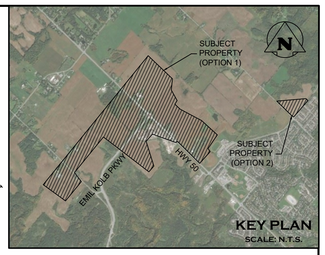
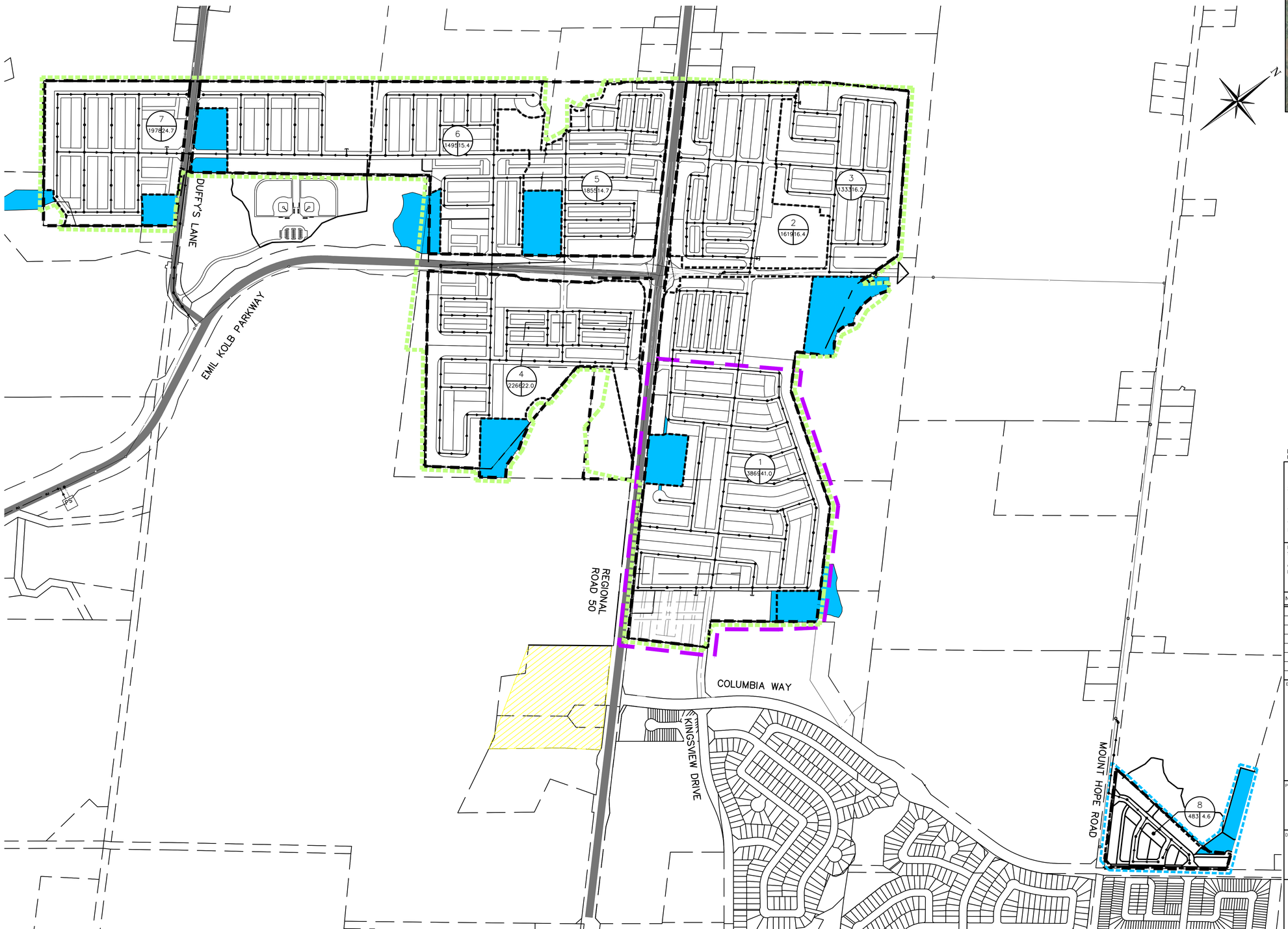


KEY PLAN
SCALE: N.T.S.



LEGEND

- PROPOSED SANITARY SEWER
- PROPOSED 150mmø FORCEMAIN
- PS — PROPOSED PUMP STATION
- PROPOSED SANITARY CATCHMENT
- PROPOSED LOT LINES
- PROPERTY LIMITS
- REGION SANITARY SEWER
- EXISTING SANITARY SEWER
- 1 / 320 | 3.8 — CATCHMENT AREA ID; AREA (ha); POPULATION
- ROPA 30 BOUNDARY
- OPTION 1
- OPTION 2

NOTE: ALL SANITARY PIPES ARE 250mmø @ 0.5% UNLESS STATED OTHERWISE

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Engineer

Engineer

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Project

BOLTON NORTH HILL
TOWN OF CALEDON

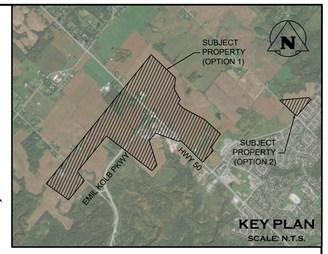
Drawing

PRELIMINARY INTERNAL
SANITARY DRAINAGE PLAN

CROZIER CONSULTING ENGINEERS
2800 High Point Drive
Suite 100
Milton, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	Design By	Project	
S.v.N./J.B.	S.v.N./J.L.		708-3446
Check By	Check By	Scale	Drawing
J.L./J.B.	T.G.	1:6000	C707

N:\700\708-Bolton NH Landowners Grp\3446-Bolton North Hill\CAD\Civil_Sheets\Figures\3446_C707 - SAN.dwg, 2026-02-27 4:08:37 PM, DWG To PDF.pc3



LEGEND

- PROPOSED GRAVITY SEWER TRUNK ON EMIL KOLB PKWY
- EX. SANITARY SEWER UPGRADE TO 300mm
- EX. SANITARY SEWER UPGRADE TO 450mm
- EX. SANITARY SEWER WITH NO UPGRADE
- PROPOSED FORCEMAIN
- PROPOSED LOT LINES
- PROPERTY LIMITS
- PROPOSED SANITARY CATCHMENT
- 3 — AREA I.D.; 173ha — LAND AREA (ha)
- B.R.E.S. OPTION LANDS
- B.R.E.S. ROUNDING OUT AREAS
- EX. SANITARY PUMPING STATION
- EX. SANITARY SEWER
- PROPOSED SANITARY TRUNK SEWER BY OTHERS

TO LIMIT THE EXTENT OF DISTURBANCE IN THE EXISTING SYSTEM SOUTH OF COLUMBIA WAY, THE CAPACITY ANALYSIS WAS LIMITED TO INDIVIDUAL LEGS OF SEWER, RATHER THAN UPGRADING THE ENTIRE SYSTEM DOWNSTREAM.

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Engineer | Engineer

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Project

BOLTON NORTH HILL
TOWN OF CALEDON

Drawing

PRELIMINARY EXTERNAL SANITARY SERVICING PLAN

CROZIER CONSULTING ENGINEERS
2800 High Point Drive
Suite 100
Milton, ON. L9T 6P4
905-875-0026 T
905-875-4915 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	Design By	Project	
S.v.N./J.B.	S.v.N./J.L.		708-3446
Check By	Check By	Scale	Drawing
J.L./J.B.	T.G.	1:10000	C708

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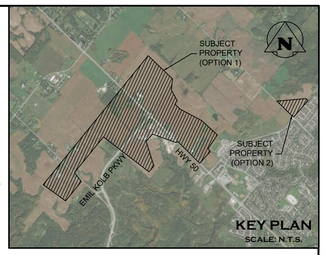

KEY PLAN
SCALE: N.T.S.

ELEVATED WATER TANK
(LOCATION TO BE CONFIRMED THROUGH COMPLETION OF ENVIRONMENTAL ASSESSMENT)

DUFFY'S LANE

PROPOSED 600ø WATERMAIN

EMIL KOLB PARKWAY

PROPOSED 600ø WATERMAIN

PROPOSED 400ø WATERMAIN

PROPOSED 400ø WATERMAIN

WATERMAIN TRUNK CONTINUES SOUTH ON EMIL KOLB PKWY WITH CONNECTION TO THE OPTION 3 LANDS TRUNK ON KING STREET

PROPOSED 400ø WATERMAIN

REGIONAL ROAD 50

PROPOSED 400ø WATERMAIN

COLUMBIA WAY

EX. 400ø WATERMAIN

KINGSVIEW DRIVE

EX. 400ø WATERMAIN

EX. 400ø WATERMAIN

PROPOSED 400ø WATERMAIN

DECOMMISSIONING OF EX. 300ø WATERMAIN TO BE CONFIRMED THROUGH COMPLETION OF ENVIRONMENTAL ASSESSMENT

EX. 300ø WATERMAIN

PROPOSED 400ø WATERMAIN

MOUNT HOPE ROAD

EX. 300ø WATERMAIN

EX. 300ø WATERMAIN

PROPOSED 400ø WATERMAIN

LEGEND

- PROPOSED SUB-TRUNK WATERMAIN
- PROPOSED 400ø WATERMAIN
- PROPOSED 600ø WATERMAIN
- EXISTING WATERMAIN
- PROPOSED ELEVATED TANK
- PROPOSED CONNECTION TO EXISTING
- PROPOSED CONNECTION
- PROPOSED LOT LINES
- PROPERTY LIMITS

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Engineer

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project

BOLTON NORTH HILL
TOWN OF CALEDON

Drawing

PRELIMINARY WATER DISTRIBUTION PLAN

CROZIER CONSULTING ENGINEERS
2800 High Point Drive
Suite 100
Milton, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	Design By	Project	
S.v.N./J.B.	S.v.N./J.L.		708-3446
Check By	Check By	Scale	Drawing
J.L./J.B.	T.G.	1:6000	C709

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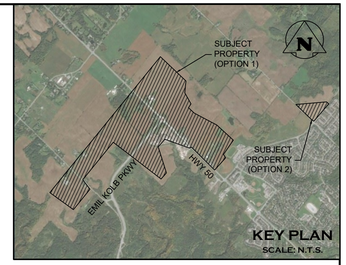

KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY BOUNDARY
- PROP. REGIONAL FLOODLINE
- EX. REGIONAL FLOODLINE
- PROP. REGIONAL FLOODLINE BUFFER (10m)
- EX. REGIONAL FLOODLINE BUFFER (10 m)
- TRCA WATERCOURSE
- EXISTING REGIONAL FLOODLINE – CHANNEL TO BE REALIGNED AND CONVERTED TO STORM SEWER UNDER THE PROPOSED CONDITION

CROSS–SECTION ID: 1830.512 — 268.49 EXISTING REGIONAL WSEL / 268.44 PROPOSED REGIONAL WSEL

AN ASTERISK (*) BEFORE THE CROSS–SECTION ID INDICATES A CROSS–SECTION FROM THE ENGINEERED TRCA MODEL. THE WATER SURFACE ELEVATION HAS NOT CHANGED FROM EXISTING TO PROPOSED CONDITIONS.

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4. DO NOT SCALE THE DRAWINGS.
5. CONTOURS GENERATED FROM HIGH–RESOLUTION DIGITAL ELEVATION MODEL PROVIDED BY NATURAL RESOURCES CANADA (OCTOBER 2023).
6. ELEVATIONS REFLECT THE CANADIAN GEODETIC VERTICAL DATUM OF 2013 (CGVD2013) COORDINATE REFERENCE SYSTEM.

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Engineer

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project

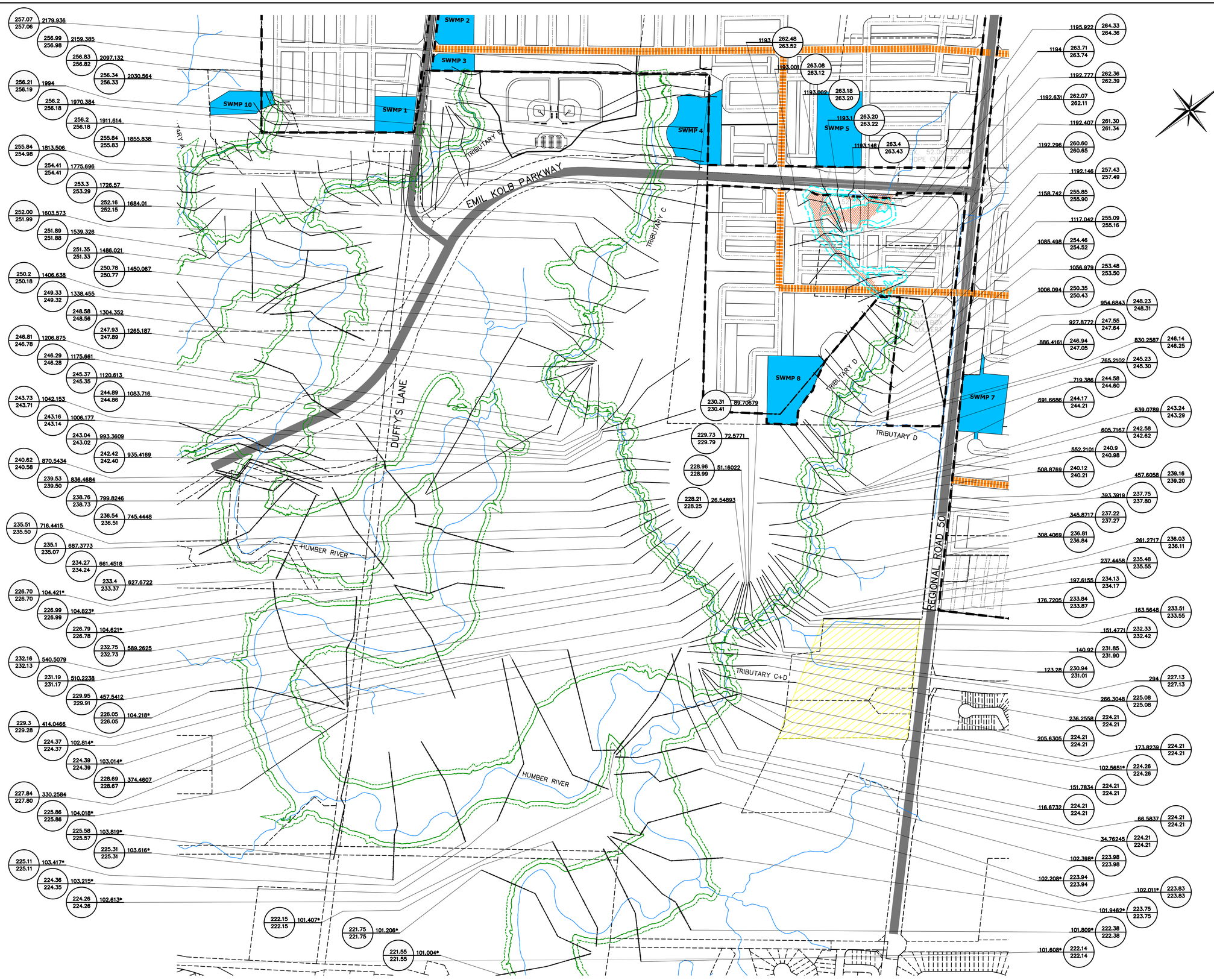
BOLTON NORTH HILL
TOWN OF CALEDON

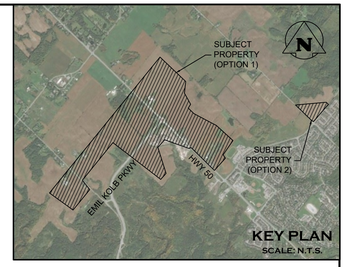
Drawing

REGIONAL STORM
FLOODPLAIN MAPPING

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON. L9T 6P4
905 875-0026 T
905 875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
A.O.	J.W.		708–3446
Check By	Check By	Scale	Drawing
J.L.	T.G.	1: 4000	C710–FP1





LEGEND

- PROPERTY BOUNDARY
- PROP. REGIONAL FLOODLINE
- EX. REGIONAL FLOODLINE
- PROP. REGIONAL FLOODLINE BUFFER (10m)
- EX. REGIONAL FLOODLINE BUFFER (10 m)
- TRCA WATERCOURSE
- EXISTING REGIONAL FLOODLINE – CHANNEL TO BE REALIGNED AND CONVERTED TO STORM SEWER UNDER THE PROPOSED CONDITION

CROSS-SECTION ID — 1830.512 — 268.49 / 268.44 — EXISTING REGIONAL WSEL / PROPOSED REGIONAL WSEL

AN ASTERISK (*) BEFORE THE CROSS-SECTION ID INDICATES A CROSS-SECTION FROM THE ENGINEERED TRCA MODEL. THE WATER SURFACE ELEVATION HAS NOT CHANGED FROM EXISTING TO PROPOSED CONDITIONS.

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6. ELEVATIONS REFLECT THE CANADIAN GEODETIC VERTICAL DATUM OF 2013 (CGVD2013) COORDINATE REFERENCE SYSTEM.

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1	ISSUED FOR FIRST SUBMISSION	12/17/2021
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3	ISSUED FOR THIRD SUBMISSION	02/27/2026

Engineer

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project

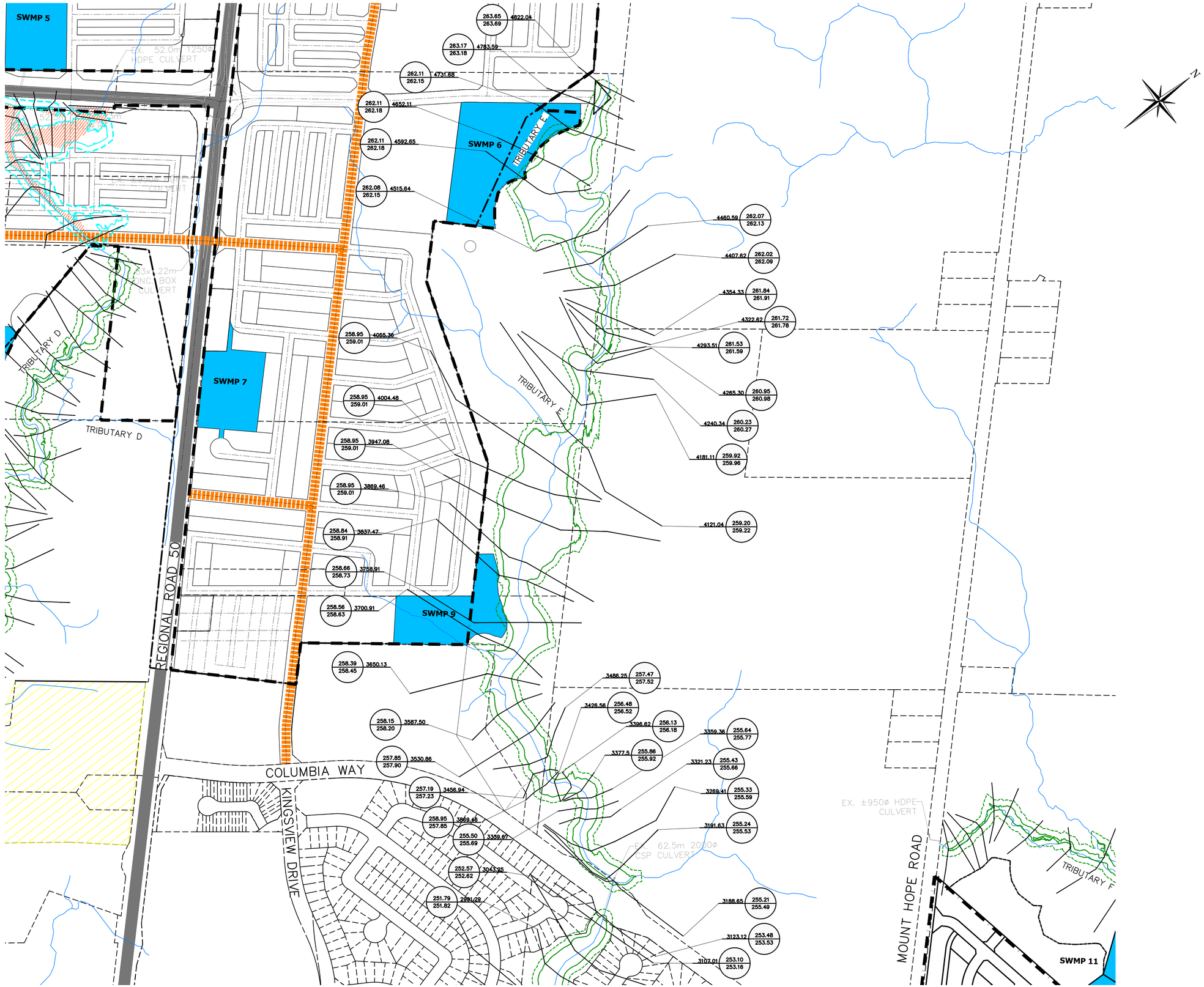
BOLTON NORTH HILL
TOWN OF CALEDON

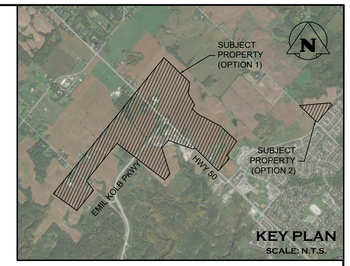
Drawing

REGIONAL STORM
FLOODPLAIN MAPPING

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON. L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	A.O.	Design By	J.W.	Project	708-3446
Check By	J.L.	Check By	T.G.	Scale 1: 4000	Drawing C710-FP2





LEGEND

- PROPERTY BOUNDARY
- PROP. REGIONAL FLOODLINE
- EX. REGIONAL FLOODLINE
- PROP. REGIONAL FLOODLINE BUFFER (10m)
- EX. REGIONAL FLOODLINE BUFFER (10 m)
- TRCA WATERCOURSE
- EXISTING REGIONAL FLOODLINE – CHANNEL TO BE REALIGNED AND CONVERTED TO STORM SEWER UNDER THE PROPOSED CONDITION

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Engineer

Engineer

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Project

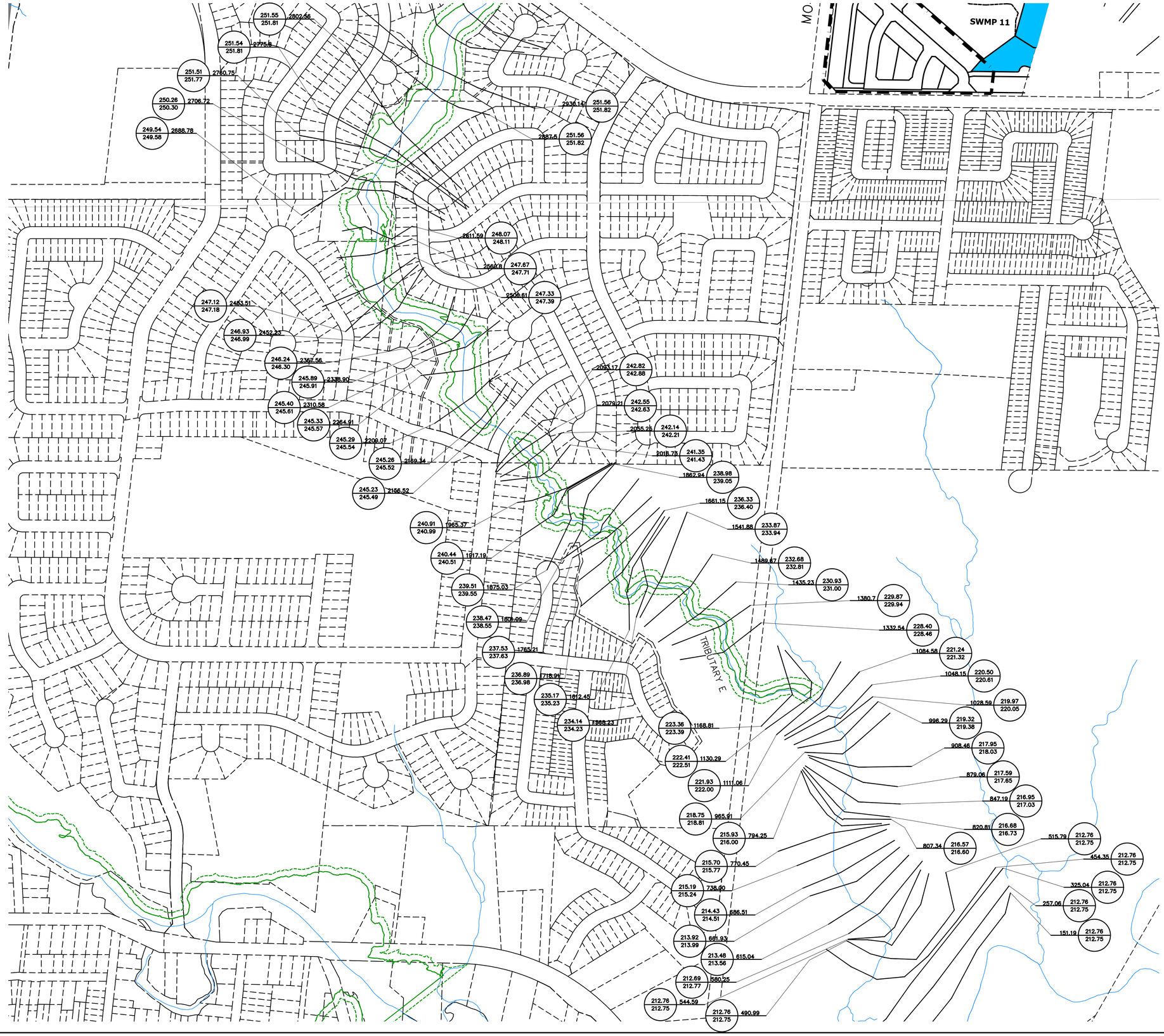
BOLTON NORTH HILL
TOWN OF CALEDON

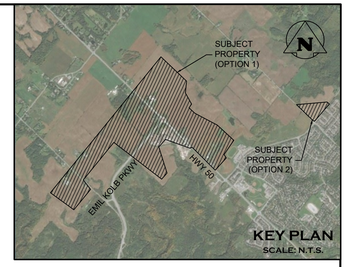
Drawing

REGIONAL STORM
FLOODPLAIN MAPPING

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON. L9T 6P4
905 875 0026 T
905 875 4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project
A.O.	J.W.	708-3446
Check By	Check By	Scale / Drawing
J.L.	T.C.	1: 3000 / C710-FP3





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Engineer

Engineer

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Project

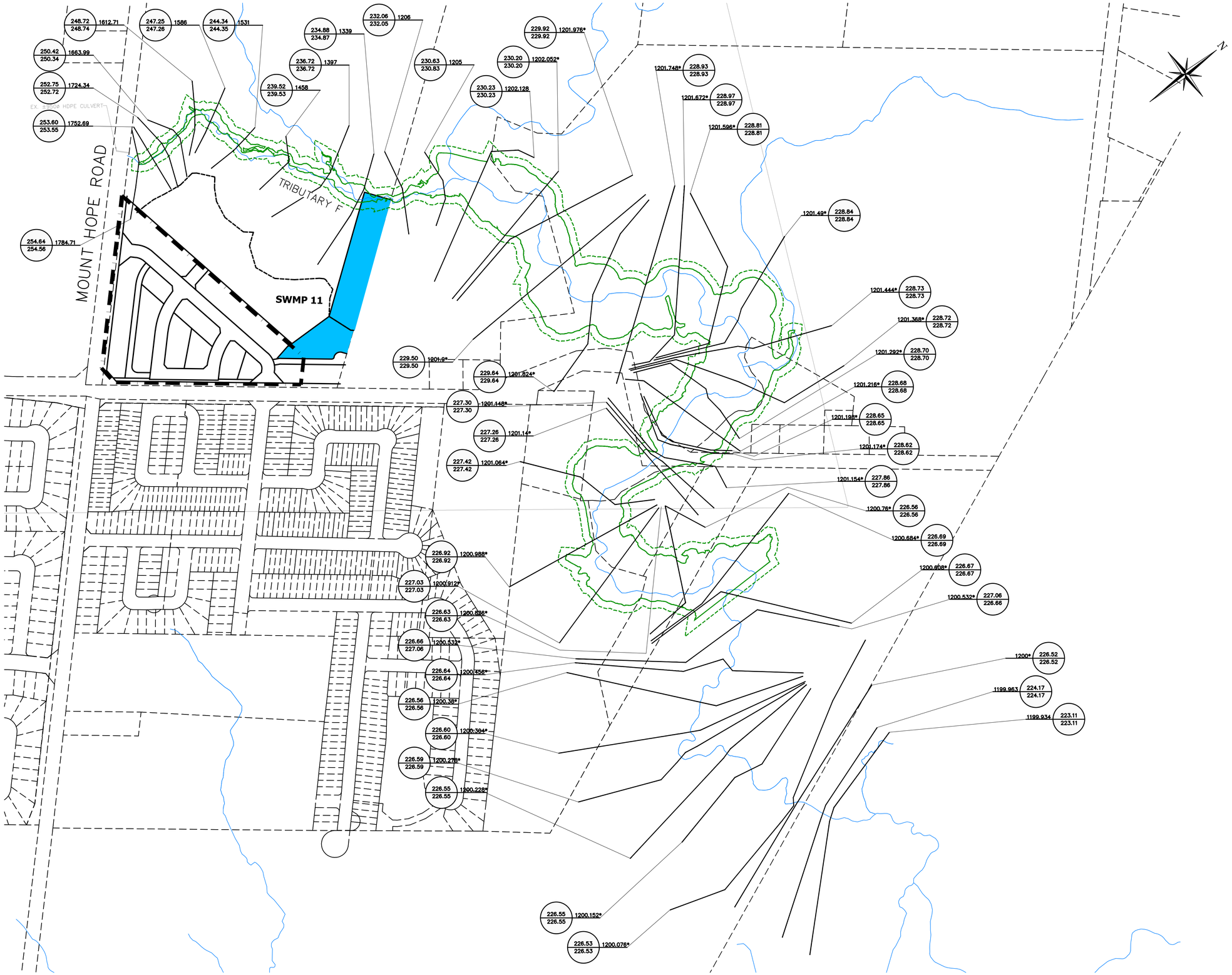
BOLTON NORTH HILL
TOWN OF CALEDON

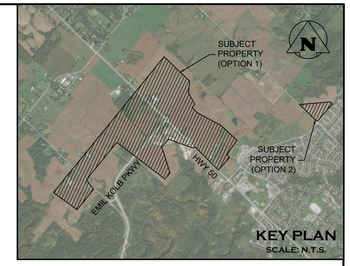
Drawing

REGIONAL STORM
FLOODPLAIN MAPPING

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905 875-0026 T
905 875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
A.O.	J.W.		708-3446
Check By	Check By	Scale	Drawing
J.L.	T.G.	1: 3000	C710-FP4





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Engineer

Engineer

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Project

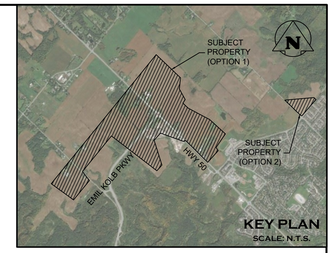
BOLTON NORTH HILL
TOWN OF CALEDON

Drawing

REGIONAL STORM
FLOODPLAIN MAPPING

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON. L9T 6P4
905 875 0026 T
905 875 4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
A.O.	J.W.		708–3446
Check By	Check By	Scale	Drawing
J.L.	T.C.	1: 2500	C710–FP5



DIVERTED CATCHMENT AREA SUMMARY TABLE

TRIBUTARY	AREA ADDED TO TRIBUTARY (ha)	AREA REMOVED FROM TRIBUTARY (ha)	NET CHANGE (ha)
A	0.94	1.47	-0.53
B	5.15	0.94	4.21
C	2.23	6.56	-4.33
D	8.90	9.35	-0.45
E	7.12	6.02	1.10
COLD CREEK	0.00	0.00	NO CHANGE

LEGEND

- EXISTING MAJOR CONTOURS (198.00)
- EXISTING MINOR CONTOURS (198.50)
- EXISTING ELEVATION (×199.11)
- PRE-DEVELOPMENT DRAINAGE AREA
- POST-DEVELOPMENT DRAINAGE AREA
- DIVERTED CATCHMENT AREA

1.47ha AREA DIVERTED FROM TRIBUTARY A TO TRIBUTARY B

3.68ha AREA DIVERTED FROM TRIBUTARY C TO TRIBUTARY B

3.44ha AREA DIVERTED FROM TRIBUTARY D TO TRIBUTARY E

0.94ha AREA DIVERTED FROM TRIBUTARY B TO TRIBUTARY A

2.23ha AREA DIVERTED FROM TRIBUTARY D TO TRIBUTARY C

6.02ha AREA DIVERTED FROM TRIBUTARY E TO TRIBUTARY D

HALF OF 5.77ha AREA (2.88 TOTAL) DIVERTED FROM TRIBUTARY C TO TRIBUTARY D

3.68ha AREA DIVERTED FROM TRIBUTARY D TO TRIBUTARY E

DUFFY'S LANE
EMIL KOLB PARKWAY
REGIONAL ROAD 50
COLUMBIA WAY
KINGSVIEW DRIVE
MOUNT HOPE ROAD
HUMBER RIVER
HUMBER RIVER
COLD CREEK
TRIBUTARY A
TRIBUTARY B
TRIBUTARY C
TRIBUTARY D
TRIBUTARY E
EX. ±1.83x2.2m CONCRETE BOX CULVERT
EX. ±950ø HDPE CULVERT
EX. 62.5m 2400ø CSP CULVERT

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EXISTING GROUND CONTOURS DERIVED FROM AERIAL SURVEY BY DRONE SURVEY CANADA (JULY 2021). ADDITIONAL CONTOUR DATA ADAPTED FROM THE ONTARIO DIGITAL TERRAIN MODEL (LIDAR-DERIVED) LAND INFORMATION ONTARIO (LIO) DATASET (MINISTRY OF NATURAL RESOURCES AND FORESTRY, 2017).

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Engineer | Engineer

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Project
BOLTON NORTH HILL
TOWN OF CALEDON

Drawing
STORMWATER DRAINAGE DIVERSION PLAN

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
S.v.N./J.B.	S.v.N./J.L.		708-3446
Check By	Check By	Scale	Drawing
J.L./J.B.	T.G.	1:6000	C711