Aquafor Beech Limited

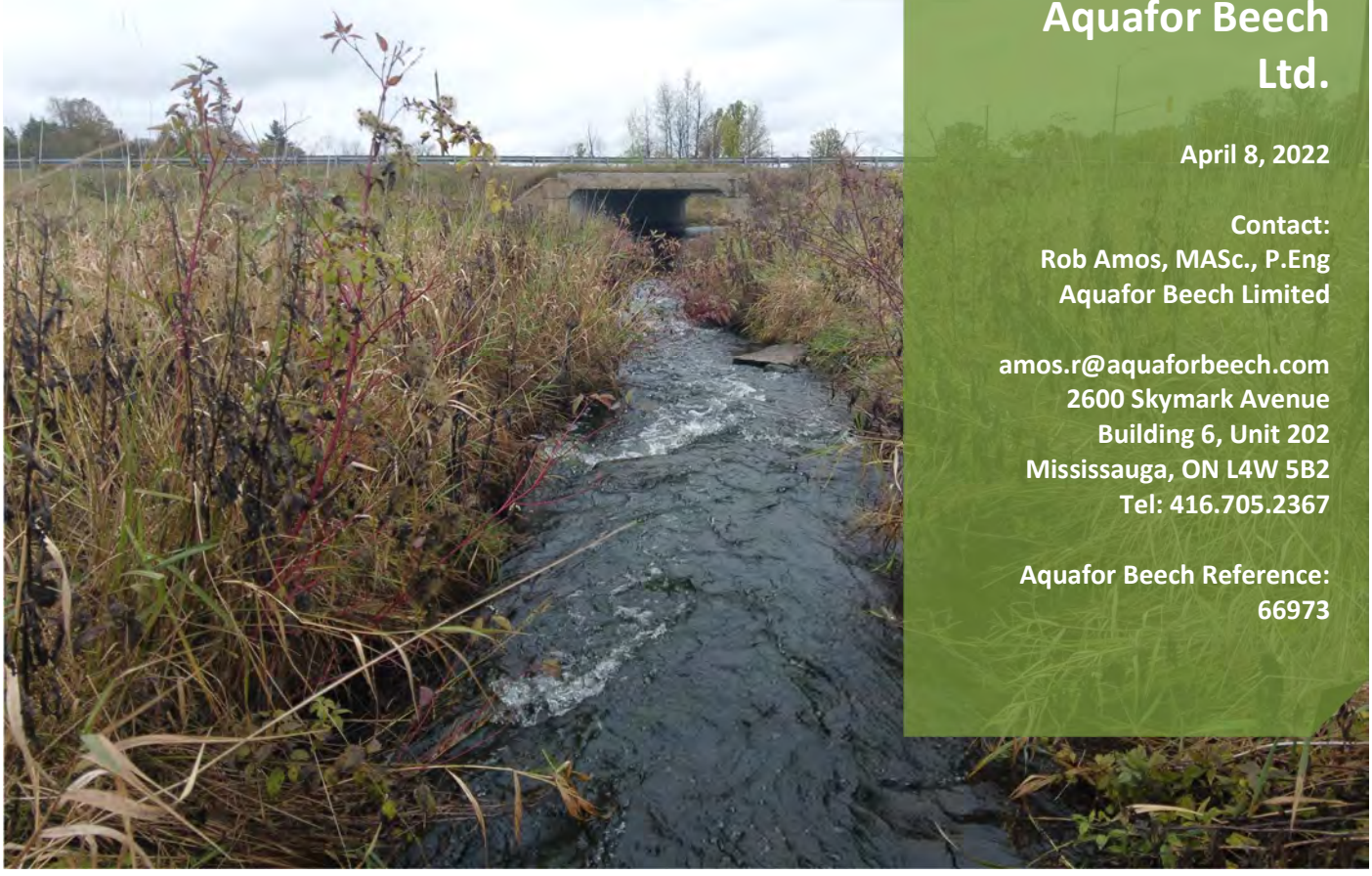
Prepared for:

Quinte Conservation

Attention: Mark Boone, P.Geo
Hydrogeologist
Tel: 613.968.3434 x 120
E: mboone@quinteconservation.ca
2061 Old Highway 2
RR2, Belleville, ON
K8N 4Z2

Floodplain Mapping – Deer Creek, Village of Madoc, Municipality of Centre Hastings

Hydraulic Modelling Report - Draft



Submitted by:

Aquafor Beech Ltd.

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Contact:
Rob Amos, MASc., P.Eng
Aquafor Beech Limited

amos.r@aquaforbeech.com
2600 Skymark Avenue
Building 6, Unit 202
Mississauga, ON L4W 5B2
Tel: 416.705.2367

Aquafor Beech Reference:
66973

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Quinte Conservation Authority:

Mark Boone – Project Manager / Hydrogeologist

Paul McCoy – Planning & Regulations Manager

Dave Eastcott – Water Resources Technician

Curtis Vance – GIS / IT Systems Supervisor

Aquafor Beech Limited:

Prepared by:

Julie Michel, MSc. (Fr)
Water Resources Specialist
Aquafor Beech Ltd

Alex Verville, BSc.
Geospatial & Mapping Technologist
Aquafor Beech Ltd

Reviewed by:

Rob Amos, MASc., P.Eng.,
Project Manager
Aquafor Beech Ltd

David Maunder, MSc., P.Eng.,
Senior Project Advisor
Aquafor Beech Ltd

EXECUTIVE SUMMARY

Deer Creek watershed is a sub-catchment of the Moira River watershed and drains a total area of over 77 km2 which has diverse land conditions, development, history, and extraordinary natural resources. The watershed is under Quinte Conservation's jurisdiction. Most of the headwaters are from Dummer Moraines located northwest of Madoc boundary, and a minor portion of the headwater is from south of Algonquin Highlands. Deer Creek is running north to south, passes through the Village of Madoc and discharges into the Moira Lake

Quinte Conservation (QC) retained Aquafor Beech Limited (Aquafor) to complete a comprehensive floodplain mapping of Deer Creek within the Village of Madoc. An up-to date hydrologic model using HEC-HMS software was developed to estimate peak flows throughout Deer Creek watershed, and a HEC-RAS hydraulic model using the most recent data was as well developed to in turn generate regulatory floodplain mapping of Deer Creek and performed a flood hazard assessment.

Quinte Conservation partnered with the Government of Canada and the Province of Ontario as part of the National Disaster Mitigation Program (NDMP) to help address the increasing dangers and costs associated with flooding. The "Floodplain Mapping of Deer Creek" was as defined, with a focus on delineate the Regulatory flood line and identifying any flood-susceptible buildings and roadway and quantify the depth and frequency.

In total six (6) flow nodes were estimated by the hydrologic modelling at subwatershed outlet, and three (3) additional flow nodes were derived to estimate streamflows at different locations all along the watercourse and have been used in the hydraulic model. Over 8.8 km length of watercourses and 160 cross-sections were simulated in the HEC-RAS model with 14 bridge and culvert crossings including weir and berm structures.

The hydraulic modelling approach was consistent with the HEC-RAS Hydraulic Reference Manual (2016), and Technical Guidelines for Flood Hazard Mapping (OMNR 2002 and EWRG 2017). LiDAR provided by the QC was used as the primary geometry source, which was augmented with detailed field measurements and topographic surveying of select crossing structures. Boundary conditions are based on the known Moira Lake regulatory water surface elevations.

Results of the model included a detailed floodplain mapping for the regulatory event (100-year storm return period). Consistent with the varied ranges of landuse and topography of the Deer Creek watershed, results include areas of residential and roadway flooding where risks are considered significant, alongside other areas where flood flows are entirely contained to the riparian valley setting. A comparison of flood susceptible buildings and roadway susceptible experiencing flood a range of flood flow (from 2-year through 100-year return periods) was performed.

The ongoing effects of climate change were also considered and flood lines under this scenario were also analyzed. Climate change has the potential to alter rainfall patterns resulting in an increase in extreme weather events, which will further reduce the conveyance capacity of undersized crossings and will increase the flood line extend.

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1 INTRODUCTION

1.1 Study Area

Quinte Conservation (QC) retained in 2021 Aquafor Beech Limited (Aquafor) to complete the update floodplain mapping for Deer Creek watershed within the Municipality of Centre Hastings, including the Village of Madoc.

Deer Creek watershed is a sub-catchment of the Moira River watershed and drains a total area of over 77 km2 which has diverse land conditions, development, history, and extraordinary natural resources. The watershed is under Quinte Conservation's jurisdiction. Most of the headwaters are from Dummer Moraines located northwest of Madoc boundary, and a minor portion of the headwater is from south of Algonquin Highlands. Deer Creek is running north to south, passes through the Village of Madoc and discharges into the Moira Lake as illustrated in Figure 1.1.

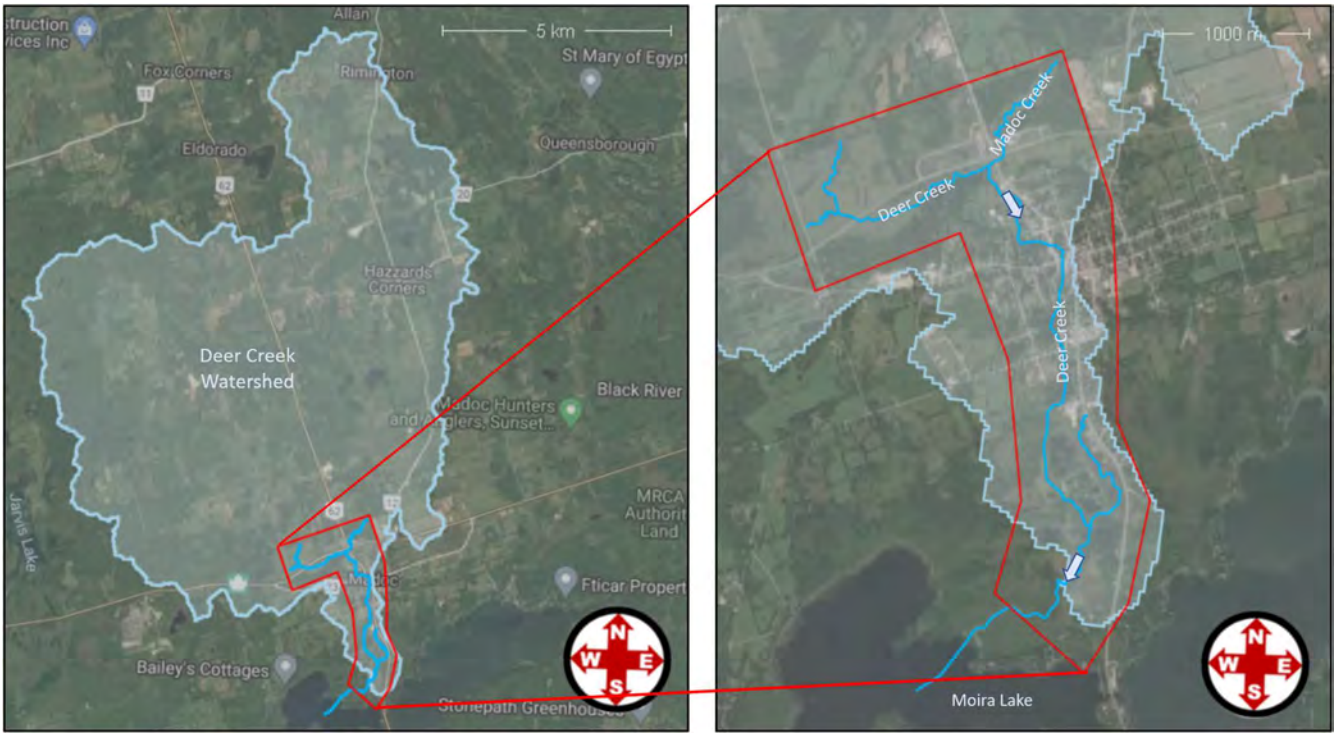


Figure 1.1: Deer Creek Watershed (left) and Deer Creek Floodplain Mapping Study Area (right)

Specific to the study area, a total of 8.8 kilometers of modeled watercourses run through the Village of Madoc, including main branch and tributaries of the Deer Creek. The watershed within the study area extends is bounded by the Moira Lake to the south, O'Hara Road to the west, and Durham Street to the west. The north section of the study area extends up to the Hw7 taking into account natural area with potential development. Agricultural, rural and natural lands are predominantly found within the study area with an urbanized land uses starting to take over approaching the centre of the Village of Madoc. In turn, the hydrology and flows received by the watercourses vary smoothly throughout the study area, which is reflected in the model setup and floodplain mapping as a result.

1.2 Study Objective

The purpose of this study is to establish updated Regulatory floodplain mapping for the Deer Creek watershed within the Village of Madoc, through detailed hydrological and hydraulic modelling, and related analyses of any flood hazards. The 100-year flood profile is used by Quinte Conservation to regulate development within the floodplain, to protect developed areas through structural land acquisition measures, and to identify properties at risk within the study area. The present report details the methodology and results of the hydraulic modelling.

The hydraulic modelling undertaken as part of this project has developed one integral 1D HEC-RAS model covering Deer Creek in the defined study area, with the updated topographic information (2022 LiDAR DEM), road networks, bridges, culverts, and land development. In total, seven (7) reaches, 160 cross-sections and 14 hydraulic structures were modelled.

Key objectives of this study are as follows:

- Review all available background information provided by Quinte Conservation;
- Perform data gap analysis to identify existing model deficiencies and missing road crossing information;
- Field inventory of all watercourses crossing structures and complete field surveys for structures without background information, in order to define appropriate modelling approach for each structure;
- Field inventory of all watercourses hydraulic crossing structures and complete field surveys for structures without background information, in order to define appropriate modelling approach for each structure;
- Develop a unique and accurate georeferenced 1D hydraulic model using both HEC-RAS and GeoHECRAS platforms throughout the study area,
- Develop the model geometry based upon the 2022 LiDAR DEM (Coordinate system NAD83 - UTM Zone 18N, vertical coordinate system CGVD2013), provided by Quinte Conservation;
- Incorporate the flood flow estimates based upon Aquafor Deer Creek Hydrological Study;
- Generate riverine flood lines for the 100-year storm and climate change scenario based on the flows computed by the HEC-HMS hydrologic model developed by Aquafor for the purpose of this study,
- Assess the impact of the regulatory flood lines on the buildings and facilities, and;
- Identify flooding extents and areas of potential spills.

1.3 NDMP Context

The National Disaster Mitigation Program (NDMP) Stream 2 (Flood Mapping), is the Federal Government's commitment to building safer and more resilient communities by addressing rising flood risks and costs and building the foundation for future informed mitigation investments that could reduce, or even negate, the effects of flood events. In recognition of increasing disaster risks and costs in Saskatchewan, Manitoba and Quebec in 2011, the Federal Government earmarked a total of $200 million over five years to establish the NDMP, with $183.8 million allocated for cost-shared projects with provinces and territories. The remaining NDMP funds are used to fund specific targeted investments, including developing specific tools, research activities, and public awareness activities at the national level. The NDMP fills a critical gap in Canada's ability to effectively mitigate, prepare for, respond to and recover from, flood-related events by understanding flood risks in Canada, and investing in foundational flood mitigation activities (e.g., risk assessments and flood mapping). Through these activities, there are multiple goals to: reduce the impacts of natural disasters on Canadians; aid governments, communities and individuals to understand the likely impacts of a range of emergency flooding scenarios upon community assets, values and functions; mitigate flood risks; and further discussions regarding residential flood insurance. Stream 2 (Flood Mapping) is intended to develop flood

mapping to identify structures, people and assets that are within the flood zone and most likely to be impacted by a flood event (i.e., 100-year, Hurricane Hazel, Timmins or future climate events) and to update the Municipality's risk assessment. The objective of Stream 2 of the NDMP is to permit a community such as the Village of Madoc to more accurately determine its flood related vulnerabilities and risks and to undertake mitigation measures, which is the most effective of the four components of Emergency Management (EM).

The overall outcome of the NDMP study will map the regulatory flood lines and will performed the flood hazard assessment, identifying the buildings and roads flood frequency. A key element of any sound mitigation program is an understanding of both the potential risk of an event occurring (frequency and probability), as well as the potential impacts should the risk be realized. In this way, emergency management planners can begin to make proactive, risk-based decisions regarding the potential events that might impact their communities and prioritize measures to improve their safety and resilience.

2 BACKGROUND REVIEW AND SITE RECONNAISSANCE

2.1 Background Data Review

At onset of the study, Aquafor collected and complied all pertinent background information from Quinte Conservation, Including:

- High resolution 2022 LiDAR and associated air photos;
- Existing Water Management Study for Deer Creek undertaken by Moira River Conservation Authority (Garatech 1987);
- Existing QC approved Regulatory Floodplain Maps (from Garatech 1987);
- GIS data layers for land use, watercourse centreline, roads, and buildings;
- Existing drawing records of bridge and culvert structures;

As requested, Aquafor has incorporated into the hydraulic model, the new topographic information from 2022 LIDAR and streamflow rates estimated by Aquafor after developing the Deer Creek watershed hydrological model.

2.2 LiDAR Acquisition Features

The Quinte Conservation's LiDAR elevation surface from January 2022 was used as the primary source for the general geometry of the model. The provided LiDAR was on geodetic control to NAD83 CSRS and vertical datum to CGVD2013. The point density of the LiDAR used was 8.5points by m^2 and it has a fundamental horizontal and vertical accuracy of 95% (0.25m horizontal and 0.1m vertical accuracy). To build the hydraulic model, Aquafor used the hydro-flattened DEM version of the LiDAR and as well as the 1m and 0.5m contours provided by Quinte Conservation.

2.3 Structure Review and Inventory

Crossing structures within the study area were first identified and indexed by Aquafor based upon the preliminary review of the GIS mapping and air photos. The proposed watercourse centerline was mapped, and public crossings were identified as structures to be included within the hydraulic model. Working together with QC, a total of 12 crossing structures were considered hydraulically significant and have been included in the model. Aquafor then conducted site visits and a detailed field survey using a GPS for 11 of the 12 identified structures. The survey included structure type and material, location and size of openings and headwalls/wingwalls, depth of embedment, culvert entrance types, etc. A summary of all field inventories as

Structure Inventory Sheets is compiled in Appendix A. The hydraulic structure crossing Queen Victoria Street West (Structure # 6) was modeled as per the detailed design drawing as the new bridge was under construction during the field investigation. Additionally, the berm (structure # 13) located parallel to the left bank of Deer Creek near Madoc Skate Park and the weir (structure # 14) located downstream the Russel Street Bridge # 7 were surveyed as well, and therefore considering in the model. Figure 2.1 illustrates the general location of each hydraulic structure incorporated in the model.

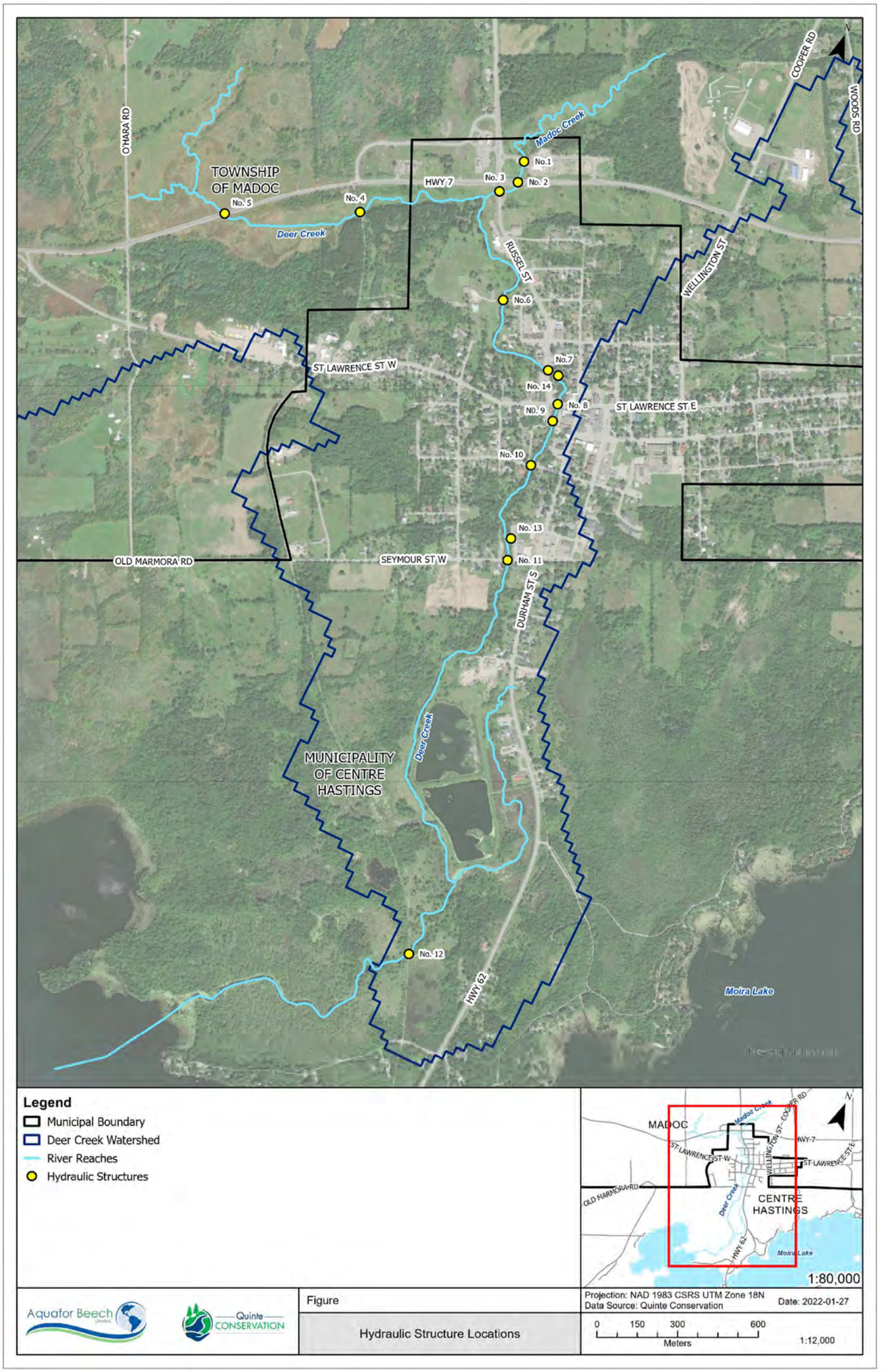


Figure 2.1. Hydraulic crossing structures within the study area

2.4 Field Survey

Aquafor identified data gaps within the LiDAR provided regarding the low flow channel characteristics. Therefore, in addition of the detailed hydraulic structure survey, Aquafor has undertaken a detailed topographic survey for river cross-section at different locations to complete the hydraulic modeling geometry. In total 69 river cross-sections all along the study area were surveyed including bounding cross-sections at each crossing structures (two up and downstream). The topographic elevation survey of the river cross-sections informs of the location and elevation for thalweg, water edge, bottom and top of bank, bottom and top of slope, and on the overbank topography within the floodplain.

3 HYDRAULIC MODEL DEVELOPMENT

3.1 Model Software and Platform

This updated Humber River 1D hydraulic model was built using a combination of the HEC-RAS software and the GeoHECRAS platform which integrate HEC modelling directly with various GIS tools and data sources (AutoCAD drawings, elevations files, survey files, and geodatabase). Preliminary floodplain mapping was also generated using GeoHECRAS from HEC-RAS results and elevation surface data.

3.2 Channel Network and Cross-Sections

The watercourse network to be mapped was determined by Aquafor in primary during the hydrology assessment and then was redefined using the 2022 LiDAR using GeoHECRAS software. Within a HEC-RAS hydraulic model, the term “River” refers to a watercourse made of multiple “Reaches”. In total 8.8 km of river divided on seven (7) reaches with a singular nomenclature are simulated in the hydraulic model as presented in Table 3-1.

Table 3-1. HEC-RAS River and Reach Nomenclature

HEC-RAS River Name	HEC-RAS Reach Name	Total Channel Length (m)
Madoc Creek	Main_01	1333.5
Deer Creek	Main_4	340.5
Deer Creek	Main_3	1362.8
Deer Creek	Main_2	3668.0
Deer Creek	Main_1	478.7
Deer Ck Trib_2	Main_Trib_2	673.3
Deer CK Trib_1	Main_Trib_1	951.0
Total Length		**8807.7**

A base model was assembled using the 2022 LiDAR surface elevation using GeoHECRAS. In addition of the watercourse network, this spatial data was used to define channel cross-sections, and overbank locations for the most part of the study area. At select locations where more detailed survey information was obtained by field investigation, cross-sections were refined with the detailed topographic survey data (69 cross-sections surveyed).

Cross-sections were spaced to account for changes in channel geometry, meanders, bridge/culvert/weir structures, and to account for the narrowest sections of the creeks. Also, they are close enough to ensure

accurate computation of the energy losses. As per standard modeling procedures, cross-sections were extended across the entire floodplain and oriented perpendicular to the anticipated flow lines.

3.3 Low Flow Channel

The low flow channel was then redefined throughout the base model at select locations where more detailed survey information was obtained by Aquafor. Cross-sections were refined with the detailed topographic survey data accounting for all low flow channel characteristics such as bed channel elevation, water edge, bottom and top of banks, and slopes.

The channel invert elevations were then refined for all cross-sections throughout the entire model to match defined invert elevations at the bridge/culvert crossing structures and at the bed channel of the surveyed river cross-sections, thus keeping the general slope between two surveyed bed channels. Figure 3.1 is an example of the corrected low flow channel based on the topographic survey data.

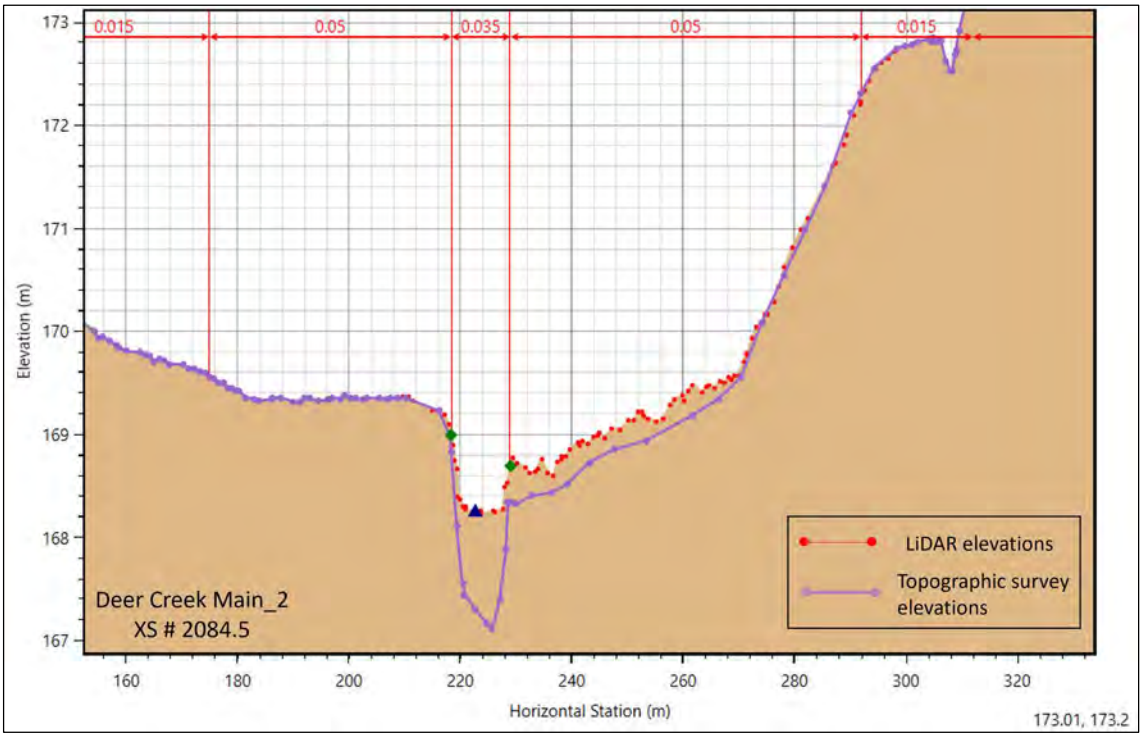


Figure 3.1. River Cross-section geometry corrected using topographic survey

3.4 Hydraulic Structures (Bridge, Culvert & Weir Structures)

Hydraulic structures included in this study are mostly bridges and culverts, however, a weir and a berm were as well included. Four cross-sections (i.e., two up and downstream of each structure) were coded at each crossing structure to define streambed and floodplain geometry at close proximity of the structure, as well as to account for expansion and contraction of the flow at these structures.

The spacing of these cross-sections was consistent with the HEC reference manual, estimated using the recommended flow expansion and contraction. In general, the locations for the upstream cross-sections were selected by assuming a typical flow contraction ratio of 1:1, while the downstream cross-section locations were selected based on expansion ratios that were typically in the range of 2:1 (Figure 3.2).

Structure parameters were then coded consistent with the approaches defined in Figure 3.2, including the structure material, opening dimensions, invert elevations, skew angles, depth of embedment, etc. Road profiles were mostly defined using LiDAR DEM and cross referenced with background information. In addition, the height of railing was added to the road profile for certain bridges, where the railing or fencing was anticipated to act as a blockage under high flows. A 100% blockage was coded in the model to be conservative.

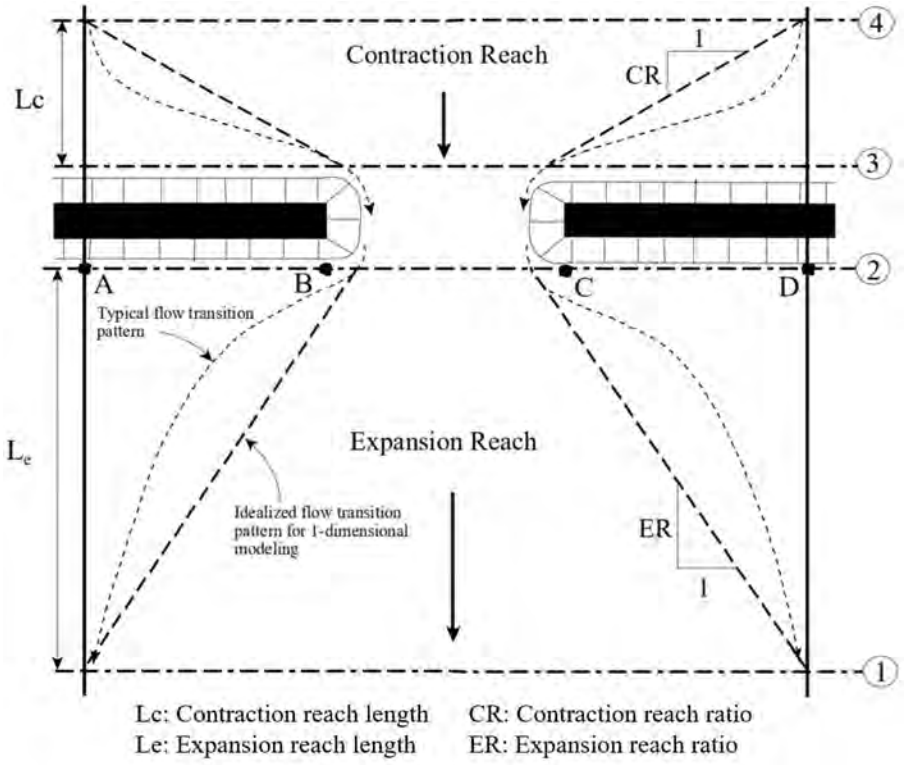


Figure 3.2. Cross-sections location at crossing structures (US Army Corps of Engineer, 2016)

3.5 Ineffective Flow Area and Levees

The ineffective flow area option was applied in the model to restrict the flow area to the width of the structure opening until the structure is overtopped and weir flow begins over the road structure. Ineffective flow areas were coded in accordance with HEC-RAS Hydraulic Reference Manual (USACE 2016) where stations were placed each side of the structure opening at a 1:1 ratio in upstream and 2:1 ratio in downstream of the distance between the bounding cross-sections and structure faces. The ineffective flow elevations upstream were set to the lowest point of the top-of-road (minimum weir elevation) and downstream to the average between the soffit and minimum top-of-road. Refinements were made after the initial run where surface water elevations were confined by the ineffective flow areas.

Some levees have been added to the model at some roads and other topographic high points in order that the estimated water surface elevation remains concentrated in the main streambed until the flood flow reaches the levee elevation and spreads within the floodplain depressions.

3.6 Energy Loss Coefficients

3.6.1 *Roughness Parameterization*

Manning's roughness coefficients were assigned to each cross-section based on a modified version of the Ontario Landcover where additional road network, quarry and impervious data was integrated into the layer. Verification of the Land Use repartition was performed by observing in available aerial photography. Deer Creek within the study area flows through a mix of land uses, mostly natural coverage, which typically have wide range of Manning roughness values. These values were defined as shown in Table 3-2 and according to the Technical Guidelines For Flood Hazard Mapping (EWRG, 2017) and the MTO Drainage Management Manual (Design Chart 2.01, 1997). A map illustrating the different land uses within the study area is following in Figure 3.3.

Table 3-2. Manning Roughness Values Used in HEC-RAS Model

Class	Manning's Roughness Value
Agriculture and Undifferentiated Rural Land Use	0.08
Bedrock	0.014
Bog	0.095
Clear Open Water	0.035
Coniferous Treed	0.07
Deciduous Treed	0.07
Fen	0.095
IMPERVIOUS	0.013
Mixed Treed	0.06
OPEN SPACE	0.045
QUARRY	0.1
RESIDENTIAL LOT	0.045
ROAD	0.015
Sparse Treed	0.05
Watercourse	0.035

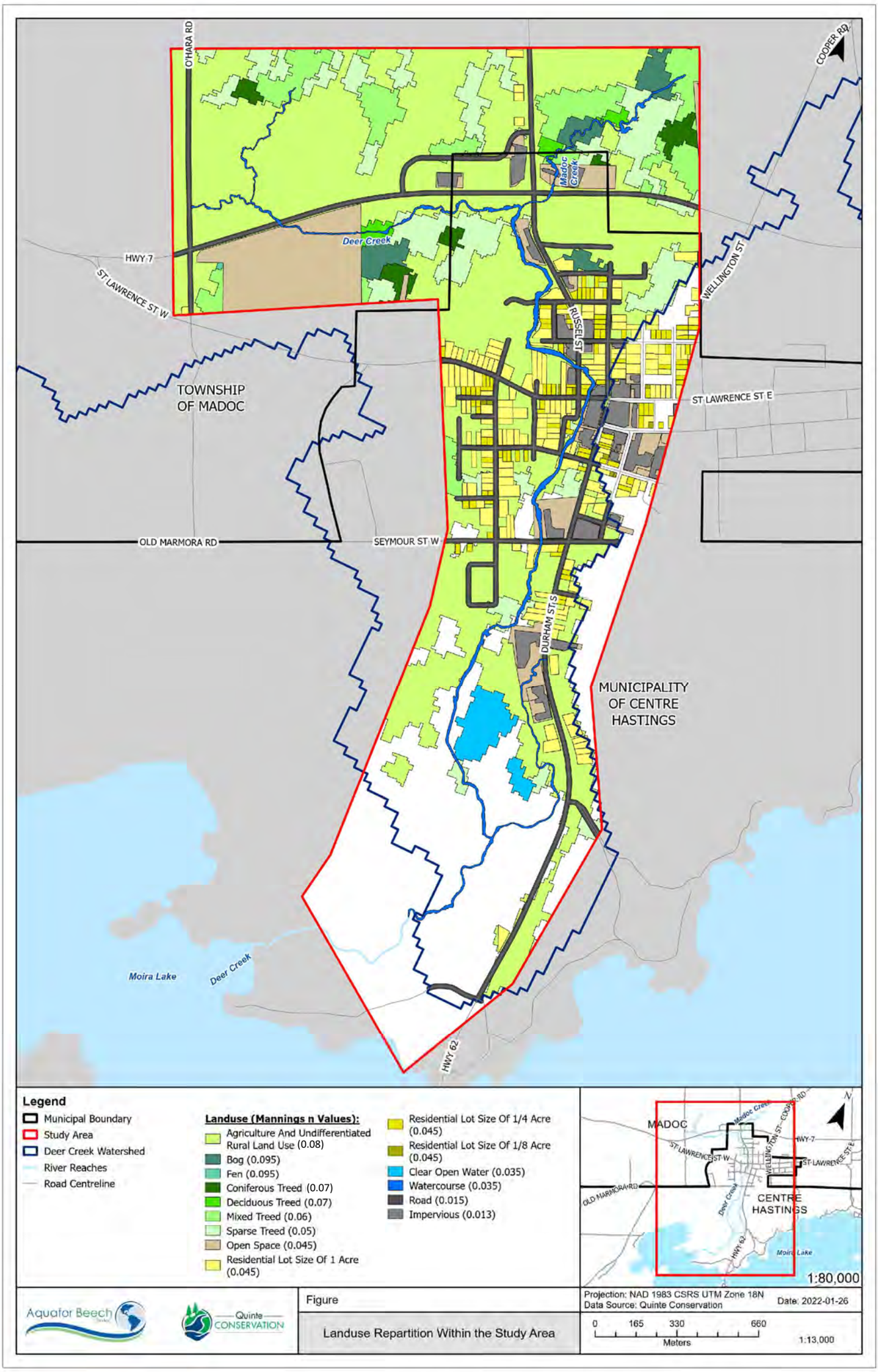


Figure 3.3. Hydraulic Land use repartition within the Village of Madoc

3.6.2 *Contraction and Expansion Loss Coefficients*

Contraction and expansion coefficients were coded in the model to evaluate transition loss due to changes of flow between cross-sections. These coefficients were applied differently between regular cross-sections and structure cross-sections following the recommended values, as summarized in Table 3-3. Contraction and expansion coefficients were applied two cross-sections upstream and one cross-section downstream of each bridge or culvert structure.

Table 3-3. Contraction and Expansion Loss Coefficients Used in HEC-RAS Model

	Contraction Coefficient	Expansion Coefficient
Regular Cross-sections	0.1	0.3
Structure Cross-sections	0.3	0.5

3.7 Conveyance Obstructions (Buildings)

Buildings located within the study area were modeled as conveyance obstructions when defining areas of the cross-section that are permanently blocked out. Aquafor acquired building footprint data through the Open Street Map 3D building feature layer available on GeoHECRAS and created a standalone shapefile representing buildings as polygons with a height of 10m automatically assigned for each identified building. Information from this GIS shapefile was extracted to define obstructions, including dimensions and elevations. Figure 3.4 shows the building locations within the Deer Creek hydraulic model domain.

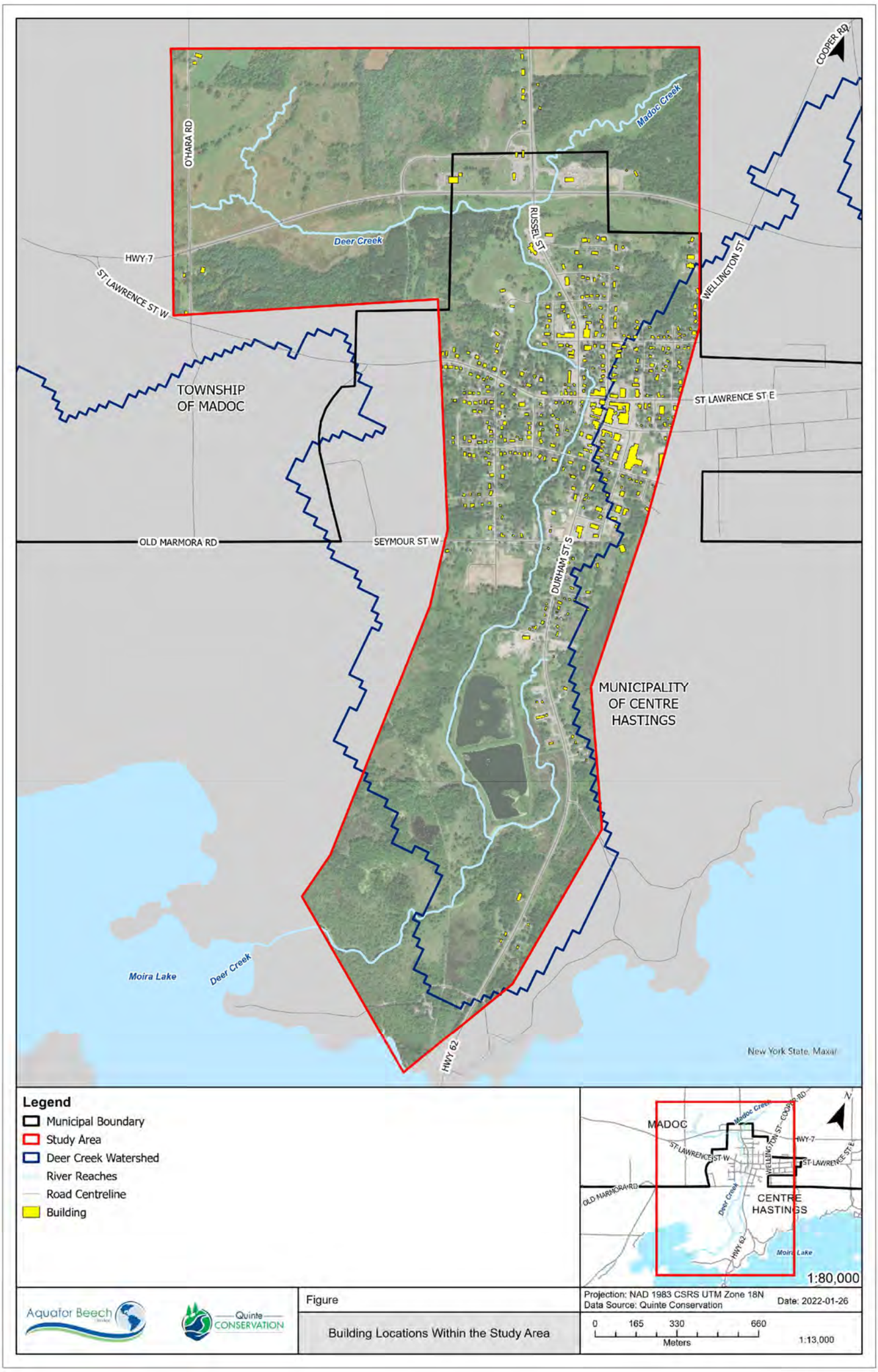


Figure 3.4. Building location within the Village of Madoc

3.8 Modelling of Reaches Within Wetland Areas

In wetland areas where there is limited topographic relief for low flow channel shape, several tributaries are connected during flood flow events and no longer function as separate channels. As the main purpose of the hydraulic model is for floodplain mapping including 100-year storm event, these tributaries in wetland areas were not discretely modelled in the HEC-RAS modelling. Several upstream reaches such as Madoc Creek Reach Main_01, Deer Creek Reach Main_ 3 and Main_4, and Deer Creek Trib_2 Reach Main_Trib_2 would fall completely within the regional extent as a single floodplain. Due to the topography of these wetland areas (considered as Marshes), the smaller tributaries are typically contained within the backwater condition stemming from the downstream junction or are impacted by the flow from the adjacent main branch within the wetland. As a result, cross-sections were drawn wide along the main channel to incorporate the flow area of the adjacent smaller tributaries to best represent the hydraulic function under high flow conditions. However, the flows from the smaller not modelled tributaries were accounted for the total flow crossing those specific wetland areas (application of the downstream junction flow node).

3.9 Development of Steady-State Flow Rate

3.9.1 *Flow Rate and Boundary Conditions*

The outlet conditions of the Deer Creek watershed are controlled by the water level in Moira Lake. For the purpose of the hydraulic model, the downstream boundary condition was set to 156.2m (CGVD2013), the 100-year water level of Moira Lake, as directed by Quinte Conservation. This water level was used for all modelled storm events. Normal depth boundary conditions were also applied at the upstream end of each reach for mixed flow calculations.

The Regulatory peak flows used to inform the hydraulic model are based on the 100-year peak flows and climate change scenario. Peak flows were estimated in the Deer Creek hydrology study using HEC-HMS software conducted by Aquafor. The flow rates used for the hydraulic purpose reflects the computed HEC-HMS flows for future land use conditions and under the average past soil moisture conditions scenario. The flow node locations in the HEC-RAS model are consistent with the outlet of catchment defined in the HEC-HSM model. However, intermediate flow rates were interpolated for three specific reaches located at the headwater catchments (Deer Creek Main_4, Deer Ck Trib_2 Main_Trib_2 and Deer CK Trib_1 Mai_Trib_1).

To estimate the flow for those three specific reaches, Aquafor used the Pro-Rating Method based on the HEC-HMS downstream flow rate. The simplified version of the Modified Index Flood Method referenced in the MTO Drainage Management Manual used in this study is defined as follows:

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

Where:
Q2 is the flow to be estimated (m^3/s)
Q1 is the known downstream flow (m^3/s)
A2 is the drainage area at the outlet for the desired flow node (km^2)
A1 is the drainage area of the downstream catchment outlet (km^2)

The location of all flow nodes is provided in Figure 3.5 and the calculation of the estimated headwater flows is provided in the Table 3-4. Flows for design storm events ranging from the 2-year through 50-year storms estimated during Aquafor hydrologic assessment were also run in the HEC-RAS hydraulic model. Flow rate was applied in the most upstream cross-section for each reach as presented in Table 3-5.

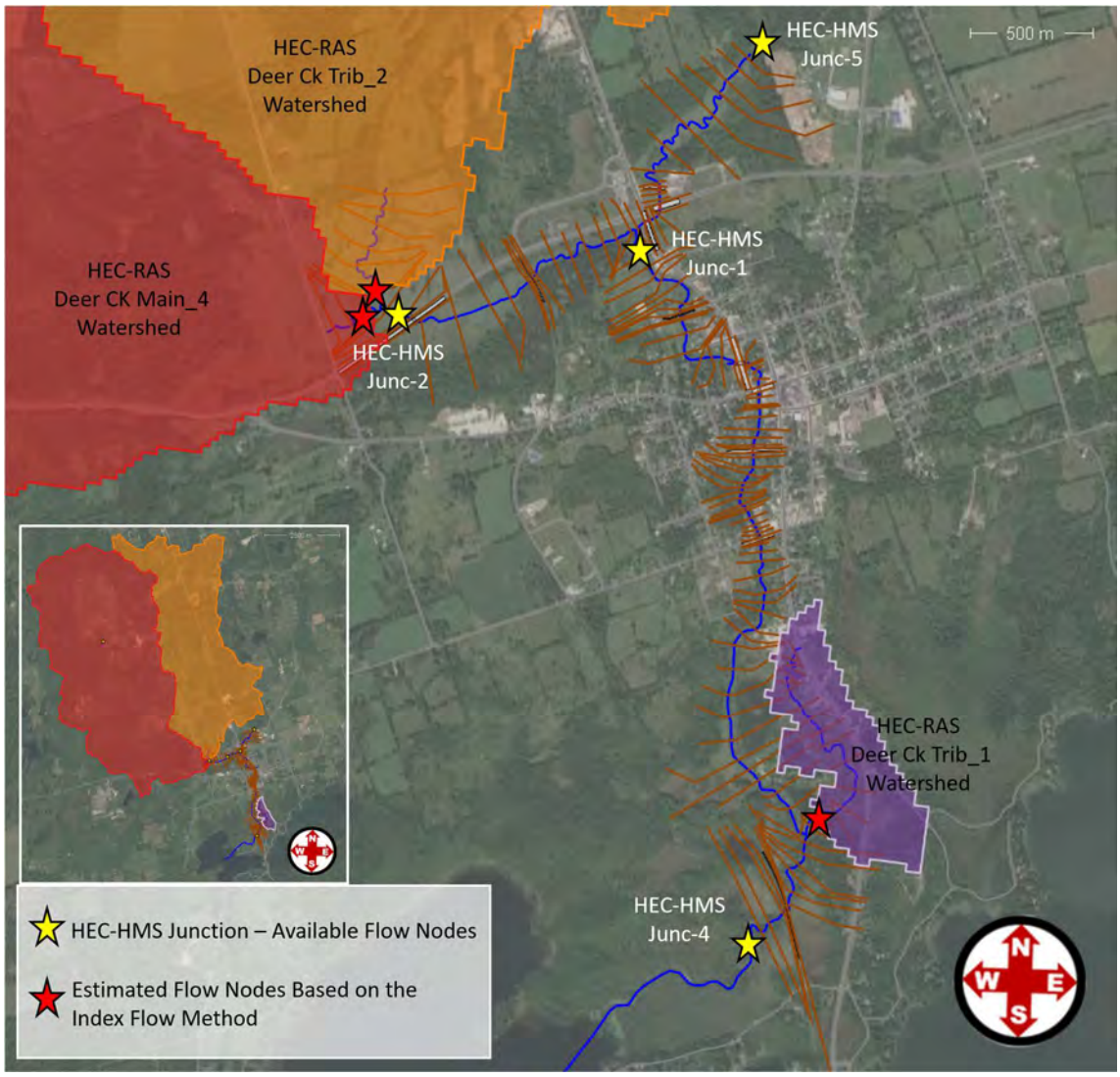


Figure 3.5. Flow node locations and sources for HEC-RAS hydraulic use

Table 3-4. Calculated flow rates using Index Flow Method

HEC-RAS Reach	100-year Q1 (m^3/s)	A1 (km^2)	A2 (km^2)	Calculated 100-year Q2 (m^3/s)
Deer Creek Trib_1, Reach Main Trib_1	75.5	77.024	0.33	**1.20**
Deer Creek Trib_2, Reach Main Trib_2	50	44.54	16.88	**24.15**
Deer Cree, Reach Main_4	50	44.54	27.66	**1.26**

Table 3-5. HEC-RAS flows entered in the model for design storm from the 2-year to the 100-year events

HEC-RAS Location		Flow Storm Event (m^3/s)					
River Reach	**Cross-section ID**	**100-year**	**50-year**	**25-year**	**5-year**	**2-year**	**100-year Climate Change**
Madoc Creek Mian_01	1905.4	31.9	26.2	20.8	9.6	3.9	38.2
Deer Creek Trib_2 Main_Trib_2	1548.8	24.15	19.95	15.99	7.73	2.61	28.89
Deer Creek Main_4	1239.4	34.98	28.89	23.16	11.19	3.78	41.83
Deer Creek Main_3	2100.3	50	41.3	33.1	16	5.4	59.8
Deer Creek Main_2	2646.3	75.3	61.9	49.2	23.4	8.7	90.2
Deer Creek Main_1	430	75.6	62	49.3	23.4	8.7	90.7
Deer Creek Trib_1 Main Trib_1	1671.1	1.27	1.04	0.83	0.39	0.15	1.52

3.9.2 *Sensitivity Analysis on Boundary Conditions*

A sensitivity analysis was performed on the boundary conditions, the Moira Lake known water surface elevations (WSE), to determine how the modelling results may be affected by the controlled changes. Two modelling scenarios were analyzed with the same geometry and flood flows but with different downstream initial water surface elevation conditions, as follows:

- Deer Creek Reach Main_1, River Station 430: WSE + 0.3m for all flood flows
- Deer Creek Reach Main_1, River Station 430: WSE - 0.3m for all flood flows

The computed water levels for each tested scenario were compared with the baseline model outputs to evaluate the extent and magnitude of the impact of the downstream boundary elevations on the model. More specifically, the furthest affected cross-sections and the differences in computed water surface elevations (WSE) of all affected cross-sections were identified and summarized in Table 3-6 and Table 3-7 for each condition.

A review of the comparison tables suggests that the changes of boundary conditions have considerable impacts on the computed water surface elevations for the 100-year flood flows up to maximum distance of 1.3km (XS # 828.7) upstream along the Main branch and of 1.7km (XS # 1671.1) upstream along the Deer Creek Tributary 1. That said, the updated model is sensitive to the boundary conditions for those identified area, as well as the estimated flood limits for the 100-year flood event.

Table 3-6. Sensitivity Analysis on Boundary Conditions for Deer Creek Main Channel - Known Moira Lake WSE vs. +/-0.3m

Reach	Cross-section ID	Distance from Downstream Cross Section (m) *	100-year Flow	[1] Regulatory Moira Lake WSE (m)	[2] +0.3m Moira Lake WSE (m)	[3] -0.3m Moira Lake WES (m)	[2] - [1] Difference (m)	[3] - [1] Difference (m)
Deer Creek Main_2	1070.6	2577.23	75.3	162.06	162.06	162.06	0	0
Deer Creek Main_2	1049.4	2556.03	75.3	162.03	162.03	162.03	0	0
Deer Creek Main_2	1030.9	2537.53	75.3	162.02	162.02	162.02	0	0
Deer Creek Main_2	1015	2521.61	75.3	162.01	162.01	162.01	0	0
Deer Creek Main_2	1007	Bridge # 11						
Deer Creek Main_2	997.8	2504.46	75.3	161.74	161.74	161.74	0	0
Deer Creek Main_2	997	2493.58	75.3	161.47	161.47	161.47	0	0
Deer Creek Main_2	995	2461.58	75.3	161.02	161.02	161.02	0	0
Deer Creek Main_2	991.6	2422.99	75.3	161.2	161.2	161.2	0	0
Deer Creek Main_2	986.4	2356.47	75.3	160.37	160.37	160.37	0	0
Deer Creek Main_2	983*	2337.37	75.3	160.2	160.2	160.2	0	0
Deer Creek Main_2	982*	2318.27	75.3	159.97	159.97	159.97	0	0
Deer Creek Main_2	981*	2299.17	75.3	159.71	159.71	159.71	0	0
Deer Creek Main_2	980.6	2280.07	75.3	159.28	159.28	159.28	0	0
Deer Creek Main_2	977.6	2240.65	75.3	158.72	158.72	158.72	0	0
Deer Creek Main_2	974.6	2200.94	75.3	158.55	158.55	158.55	0	0
Deer Creek Main_2	968.4	2119.03	75.3	158.45	158.45	158.45	0	0
Deer Creek Main_2	950.7	1900.68	75.3	158.14	158.14	158.14	0	0
Deer Creek Main_2	939.8	1641.99	75.3	158.02	158.02	158.02	0	0
Deer Creek Main_2	**828.7**	**1343.02**	**75.3**	**157.83**	**157.83**	**157.83**	**0**	**0**
Deer Creek Main_2	720.9	1235.14	75.3	157.42	157.41	157.41	-0.01	-0.01
Deer Creek Main_2	630.2	1144.92	75.3	157.33	157.33	157.32	0	-0.01
Deer Creek Main_2	529.5	1044.23	75.3	157.21	157.19	157.19	-0.02	-0.02
Deer Creek Main_2	441.8	954.55	75.3	157.24	157.23	157.23	-0.01	-0.01
Deer Creek Main_2	382.3	896.1	75.3	157.24	157.23	157.22	-0.01	-0.02

Reach	Cross-section ID	Distance from Downstream Cross Section (m) *	100-year Flow	[1] Regulatory Moira Lake WSE (m)	[2] +0.3m Moira Lake WSE (m)	[3] -0.3m Moira Lake WES (m)	[2] - [1] Difference (m)	[3] - [1] Difference (m)
Deer Creek Main_2	322.5	836.27	75.3	157.24	157.23	157.22	-0.01	-0.02
Deer Creek Main_2	219.2	731.52	75.3	156.59	156.61	156.61	0.02	0.02
Deer Creek Main_2	136.9	649.25	75.3	156.33	156.54	156.27	0.21	-0.06
Deer Creek Main_2	25	537.35	75.3	156.28	156.53	156.13		
Deer Creek Main_1	430	478.67	75.6	156.23	156.51	156.01	0.28	-0.22
Deer Creek Main_1	381.6	430.94	75.6	156.22	156.51	155.98	0.29	-0.24
Deer Creek Main_1	329.7	378.69	75.6	156.22	156.51	155.97	0.29	-0.25
Deer Creek Main_1	286.2	334.96	75.6	156.22	156.5	155.96	0.28	-0.26
Deer Creek Main_1	151	229.4	75.6	156.21	156.5	155.95	0.29	-0.26
Deer Creek Main_1	128.3	171.88	75.6	156.21	156.5	155.95	0.29	-0.26
Deer Creek Main_1	103.6	149.12	75.6	156.2	156.5	155.93	0.3	-0.27
Deer Creek Main_1	102	Bridge # 12						
Deer Creek Main_1	91.7	137.23	75.6	156.2	156.5	155.9	0.3	-0.3
Deer Creek Main_1	81.5	124.41	75.6	156.2	156.5	155.9	0.3	-0.3
Deer Creek Main_1	52.5	52.3	75.6	156.2	156.5	155.9	0.3	-0.3
Deer Creek Main_1	1	0	75.6	156.2	156.5	155.9	0.3	-0.3

* Distance between the most upstream affected cross-section and the downstream boundary cross-section

Table 3-7. Sensitivity Analysis on Boundary Conditions for Deer Creek Tributary 1- Known Moira Lake WSE vs. +/-0.3m

Reach	Cross-section ID	Distance from Downstream Cross Section (m) *	100-year Flow	[1] Regulatory Moira Lake WSE (m)	[2] +0.3m Moira Lake WSE (m)	[3] -0.3m Moira Lake WES (m)	[2] - [1] Difference (m)	[3] - [1] Difference (m)
Deer CK Trib_1	1671.1	1429.69	1.27	156.67	156.61	156.63	-0.06	-0.04
Deer CK Trib_1	1639.5	1398.14	1.27	156.43	156.54	156.46	0.11	0.03

Reach	Cross-section ID	Distance from Downstream Cross Section (m) *	100-year Flow	[1] Regulatory Moira Lake WSE (m)	[2] +0.3m Moira Lake WSE (m)	[3] -0.3m Moira Lake WES (m)	[2] - [1] Difference (m)	[3] - [1] Difference (m)
Deer CK Trib_1	1547.7	1306.38	1.27	156.29	156.53	156.19	0.24	-0.1
Deer CK Trib_1	1485.7	1244.34	1.27	156.28	156.53	156.14	0.25	-0.14
Deer CK Trib_1	1419	1175.57	1.27	156.28	156.53	156.13	0.25	-0.15
Deer CK Trib_1	1358.8	1113.33	1.27	156.28	156.53	156.13	0.25	-0.15
Deer CK Trib_1	1193.1	947.63	1.27	156.28	156.53	156.13	0.25	-0.15
Deer CK Trib_1	1058.5	812.98	1.27	156.28	156.53	156.13	0.25	-0.15
Deer CK Trib_1	965.6	720.05	1.27	156.28	156.53	156.13	0.25	-0.15
Deer CK Trib_1	929.8	684.31	1.27	156.28	156.53	156.13	0.25	-0.15
Deer CK Trib_1	881.6	636.1	1.27	156.28	156.53	156.12	0.25	-0.16
Deer CK Trib_1	841	594.65	1.27	156.28	156.53	156.12	0.25	-0.16
Deer CK Trib_1	802.6	553.48	1.27	156.28	156.53	156.12	0.25	-0.16
Deer Creek, Main _1	430	478.67	75.6	156.23	156.51	156.01	0.28	-0.22
Deer Creek, Main _1	381.6	430.94	75.6	156.22	156.51	155.98	0.29	-0.24
Deer Creek, Main _1	329.7	378.69	75.6	156.22	156.51	155.97	0.29	-0.25
Deer Creek, Main _1	286.2	334.96	75.6	156.22	156.5	155.96	0.28	-0.26
Deer Creek, Main _1	151	229.4	75.6	156.21	156.5	155.95	0.29	-0.26
Deer Creek, Main _1	128.3	171.88	75.6	156.21	156.5	155.95	0.29	-0.26
Deer Creek, Main _1	103.6	149.12	75.6	156.2	156.5	155.93	0.3	-0.27
Deer Creek, Main _1	102	Bridge # 12						
Deer Creek, Main _1	91.7	137.23	75.6	156.2	156.5	155.9	0.3	-0.3
Deer Creek, Main _1	81.5	124.41	75.6	156.2	156.5	155.9	0.3	-0.3
Deer Creek, Main _1	52.5	52.3	75.6	156.2	156.5	155.9	0.3	-0.3
Deer Creek, Main _1	1	0	75.6	156.2	156.5	155.9	0.3	-0.3

* Distance between the most upstream affected cross-section and the downstream boundary cross-section

3.9.3 *Model Improvement (Errors, Warnings and Notes)*

Improvement of the model commenced with a thorough review of all warnings and notes from the computations. Care was taken to extend cross-sections to an elevation sufficient to contain the flow, wherever feasible, in an effort to prevent the model from assuming artificial vertical extensions. This required extension of the cross-sections, at many locations, to a topographic high point that represents the location where spill out of the channel would begin, possibly into an adjacent tributary system. In some locations, roadside berms may also be located on the topographic high point followed by parallel swale features. In these situations, levees were inserted into the model to constraint the flow within the main channel before spilling out (e.g., On Deer Creek, Reach Main_1 at the XS # 103.6).

In addition, difference of the resultant water surface elevations between consecutive cross-sections were reviewed to enhance model output. Locations where changes in water surface elevations are greater than 0.5m without a substantial change in the bed elevation were identified and interpolated cross-sections (represented with an asterisk (*) were therefore added at a maximum spacing of 25m to reduce abrupt changes. One location was concerned by the addition of interpolated cross-sections as mentioned below:

- On Deer Creek Reach Main_2 between cross-sections # 986.4 and # 980.6

HEC RAS model defaulting to critical depths is also a common issue when the steady flow equations cannot be solved with a subcritical profile. In this case, the model assumes the water flowing at the critical depth, which can mask surcharges and lead to underestimated flood limits. If such issue was observed, within the model it has been addressed on a case-by-case basis, typically by adding additional cross-sections adjacent to the offending sections, adjusting location or orientation of cross-sections.

4 HYDRAULIC MODEL VERIFICATION

The flood lines from preliminary model results of the 100-year storm event was mapped for comparison purposes with the existing Regulatory Floodplain (Garatech 1987) for model verification. While we recognize that this comparison does not prove the validity of either result dataset, the comparison is used to understand the differences between the models and to identify areas requiring detailed review during the hydraulic model refinement tasks. It was noted that the Regulatory flood boundaries from these two models are not directly comparable due to the following:

- differences in topography (1980s mapping vs. 2022 LiDAR)
- different hydrology models (HYMO vs HEC-HMS)
- different watershed boundary
- difference in flows (Aquafor updated modelled flows are generally smaller for the average past soil moisture scenario)
- different hydraulic models (HEC-2 vs. HEC-RAS)
- different hydraulic structure crossing consideration
- differences in the reaches and reach extents mapped between the new and the existing flood lines.

There was an acceptable agreement between the 100-year flood extents from Garatech 1987 and the preliminary Aquafor HEC-RAS results. As the HEC-RAS model results were subsequently refined, this exercise was not repeated, and mapping included in this report is based on the final HEC-RAS modelling as refined throughout the project.

5 MODEL RESULTS AND REGULATORY FLOODPLAIN MAPPING

The updated GeoHECRAS hydraulic model for the Deer Creek within the Village of Madoc was applied to establish water surface profiles for 100-year storm and climate change scenarios under the average past soil moisture conditions (refer to the Aquafor hydrologic report). As such, the model results are appropriate for use for the Regulatory floodplain mapping. The model was executed using the subcritical flow regime. Model output results for the all reaches are presented in Appendix B.

5.1 Backwater Effect Analysis

A backwatering analysis for the 100-year storm event was performed by Aquafor to identify the upstream flooded area under backwater effect from a downstream crossing. The analysis was conducted for each storm event. The comments and profile plots for individual crossings are provided in Table 5-1 to Table 5-13.

In total 6 hydraulic crossing structures (structure No. #2, #3, #5, #9, #10, and #14) are responsible for backwatering, thus influencing the upstream water level and the flood line boundaries.

Table 5-1. Profile plot analysis of the crossing # 12

Crossing No. # 12
The crossing itself does not create backwater, however, all the downstream study area, including bridge # 12, is under the influence of the Moira Lake level, creating backwatering in the channel until Cross-section # 286.2 on Deer Creek Main_1.

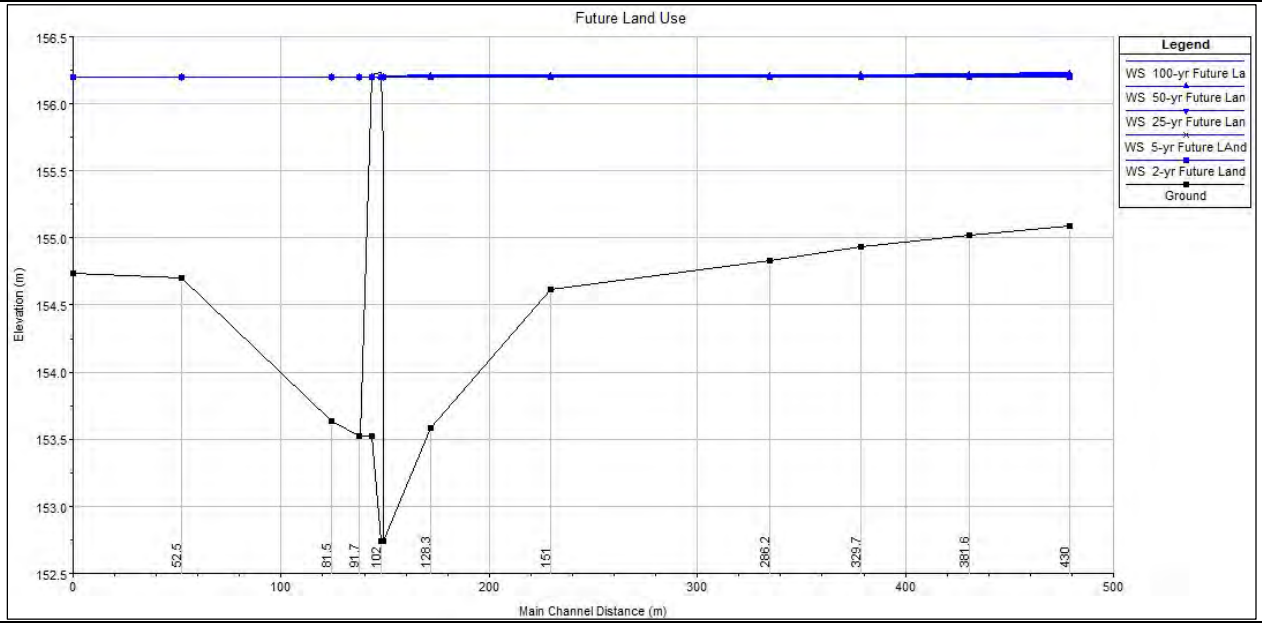


Table 5-2. Profile plot analysis of the crossing # 11

Crossing No. # 11 (at Seymour Street)
No backwater effect observed.

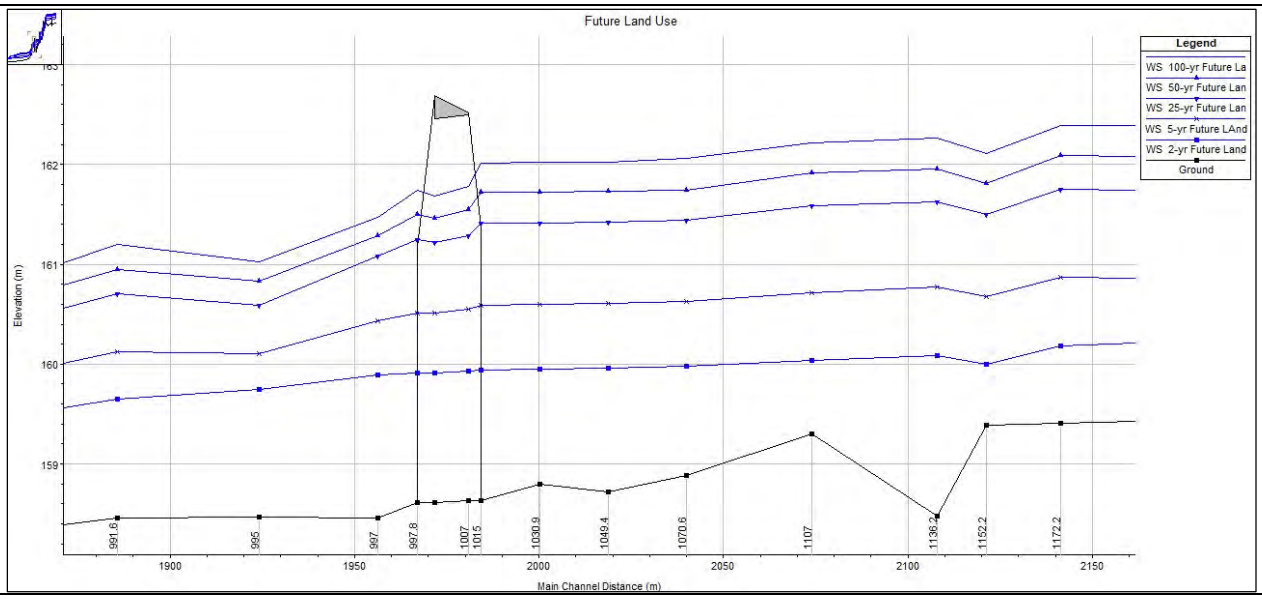


Table 5-3. Profile plot analysis of the crossing # 10

Crossing No. # 10 (at Livingstone Avenue West)
Crossing creates a backwater effect for the storms up to 25-year return period impacting the water level until cross-section # 1557.2 on Deer Creek Main_2 for the 100-year event and cross-section 1505 for the for the 50-year and 25-year storms.

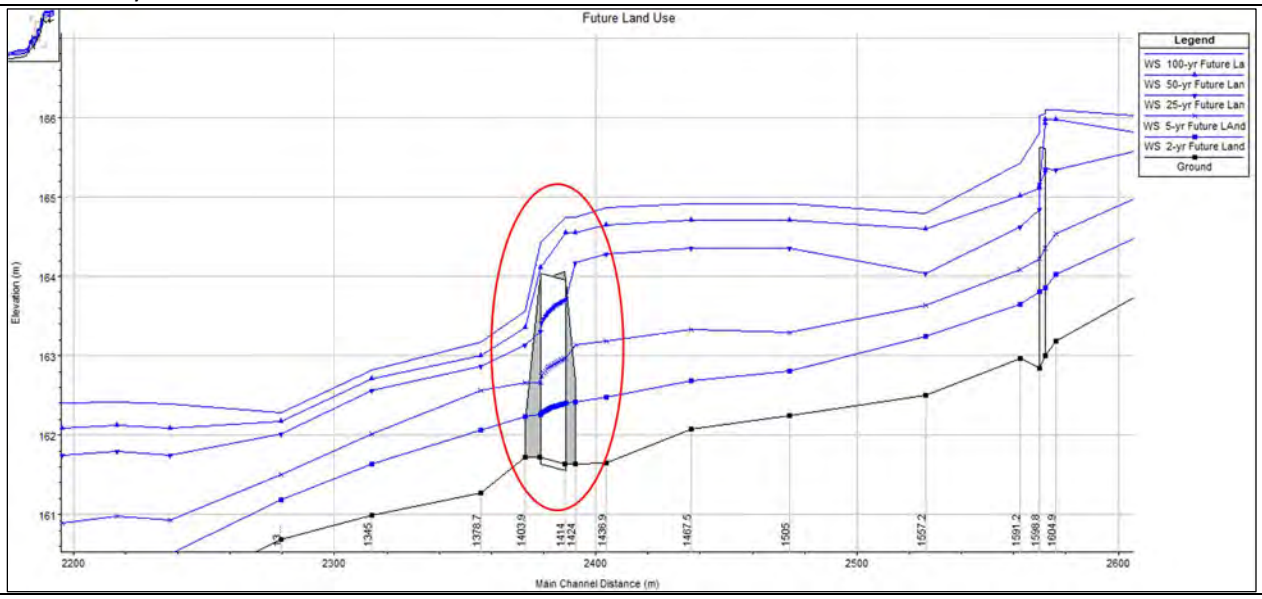


Table 5-4. Profile plot analysis of the crossing # 9

Crossing No. # 9 (pedestrian bridge)
The pedestrian bridge located between Champlain Street and Madoc Village Square Market creates backwatering for the 100-year storm. This impact goes back to cross-section # 1636.3 on Deer Creek Main_2.

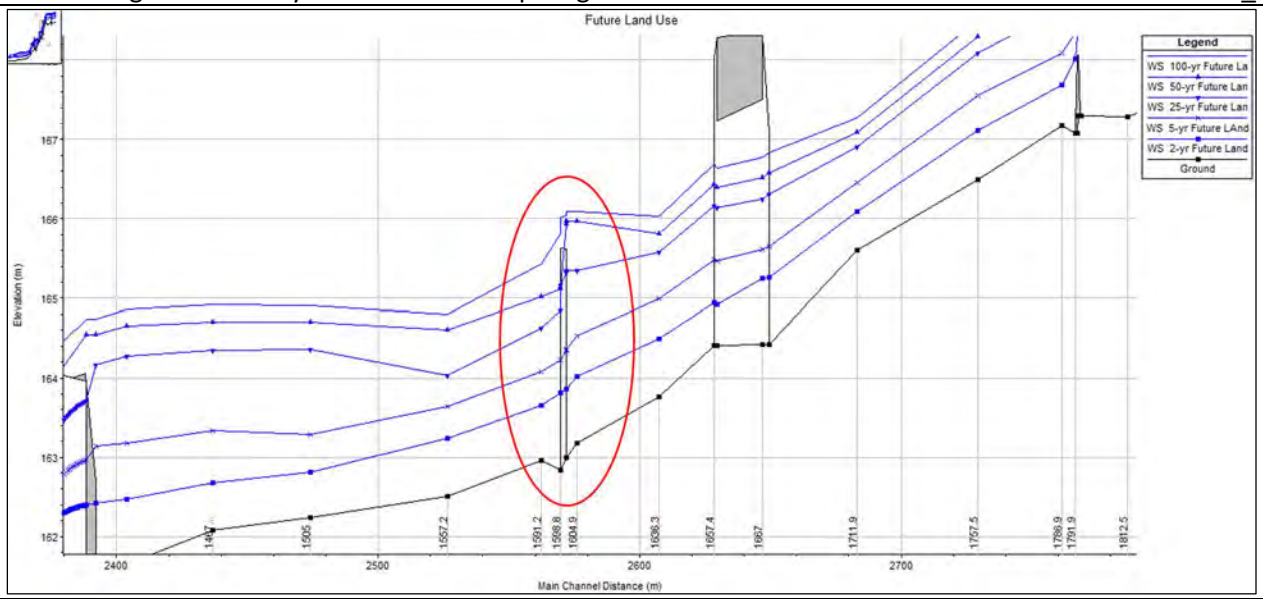


Table 5-5. Profile plot analysis of the crossing # 8

Crossing No. # 8 (at Saint Lawrence Street West)
No backwater effect observed.

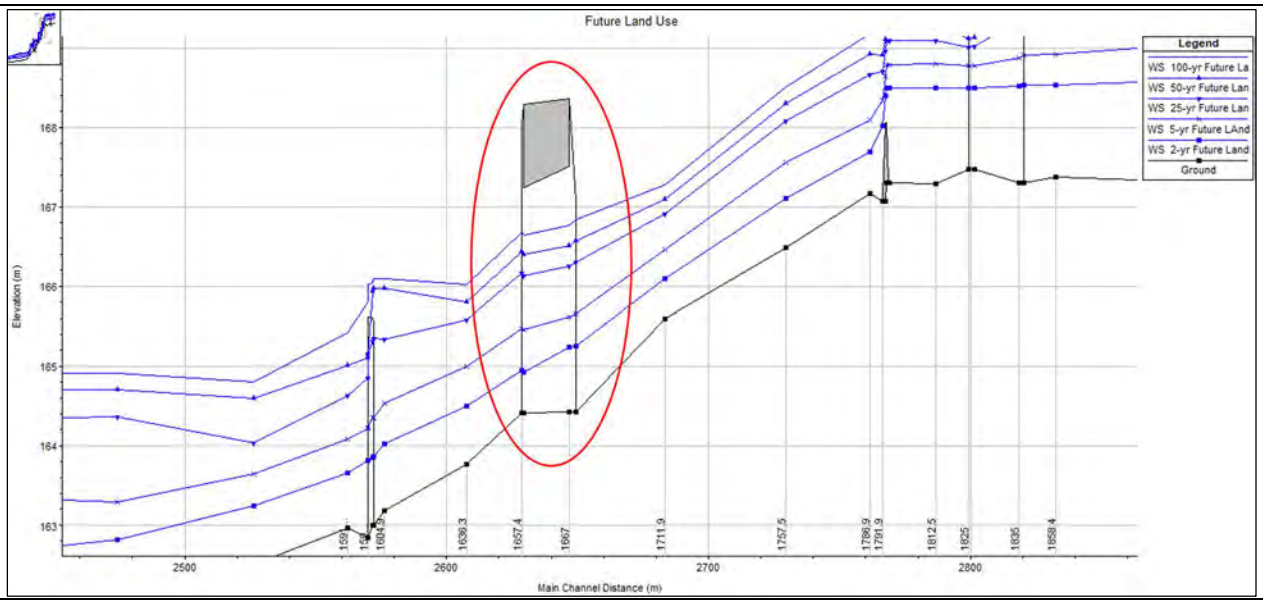


Table 5-6. Profile plot analysis of the Weir Structure # 14

Crossing No. # 14
The weir structure and the upstream relatively flat bed channel slope encourage backwatering for all storm returns. This impact goes back to the upstream bridge # 7 located on Russel Street.

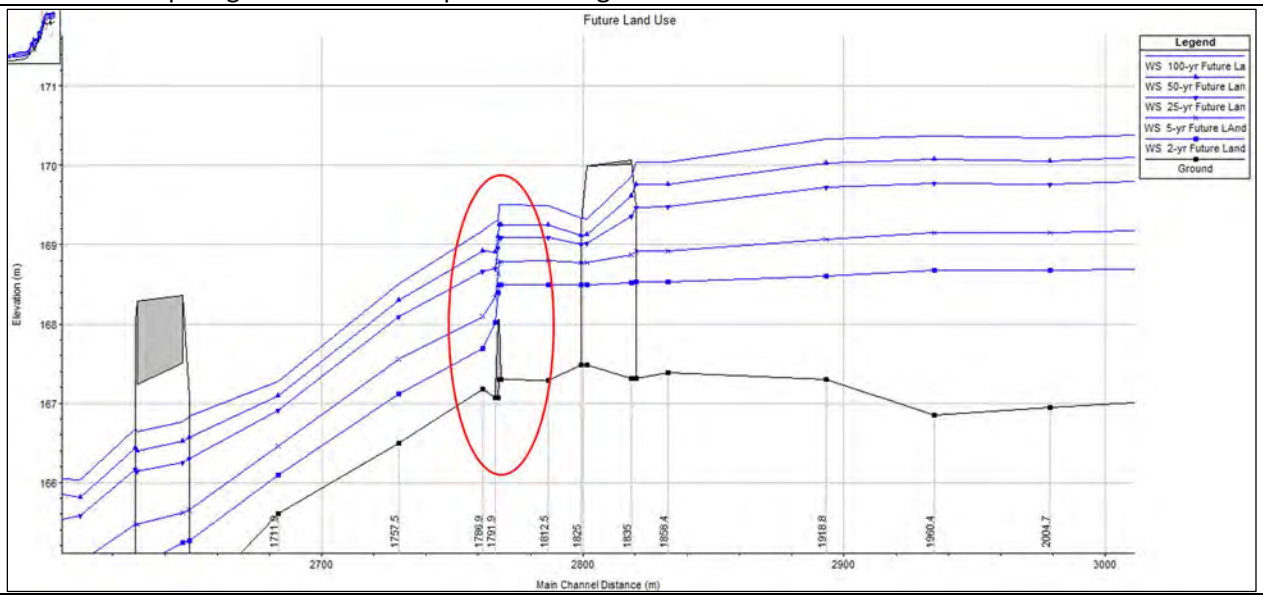


Table 5-7. Profile plot analysis of the crossing # 7

Crossing No. # 7 (at Russel Street)
No backwater effect observed.

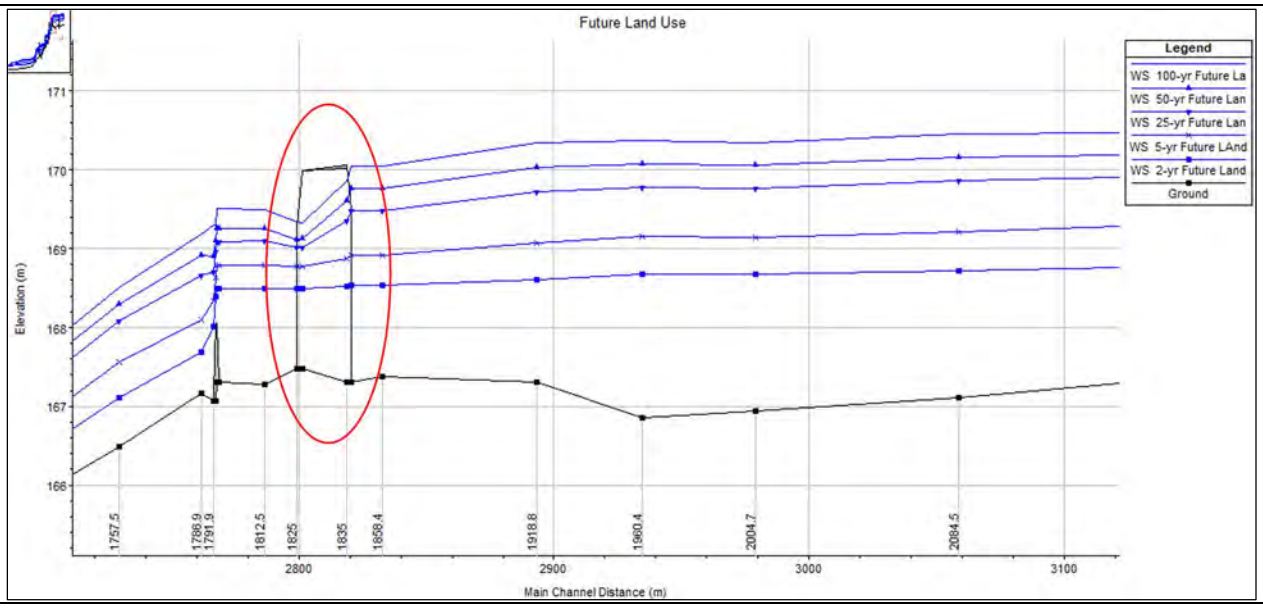


Table 5-8. Profile plot analysis of the crossing # 6

Crossing No. # 6 (at Queen Victoria Street West)
Upstream the crossing the bed channel slope is very smooth, however, there is no backwater effect observed.

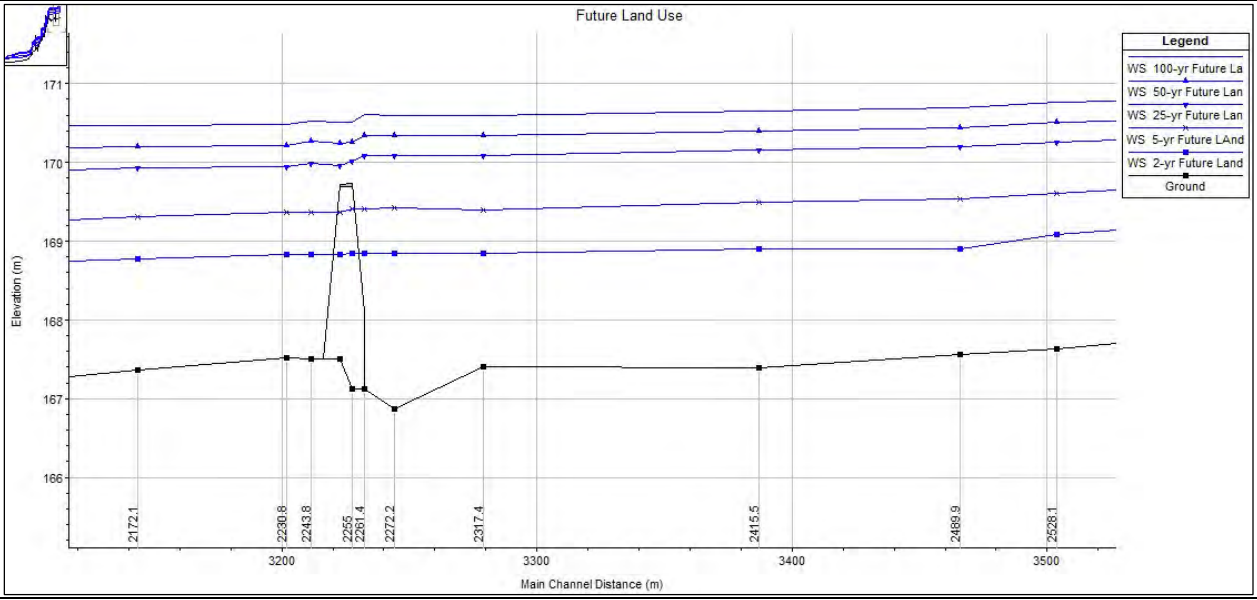


Table 5-9. Profile plot analysis of the crossing # 4

Crossing No. # 4
No backwater effect observed.

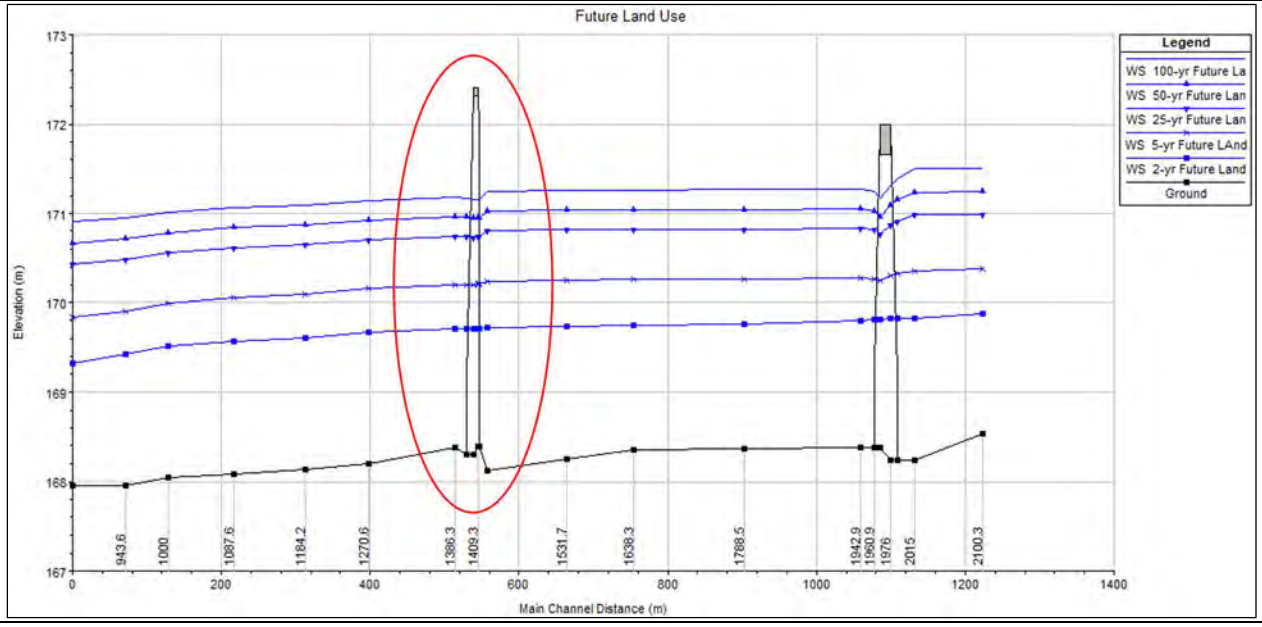
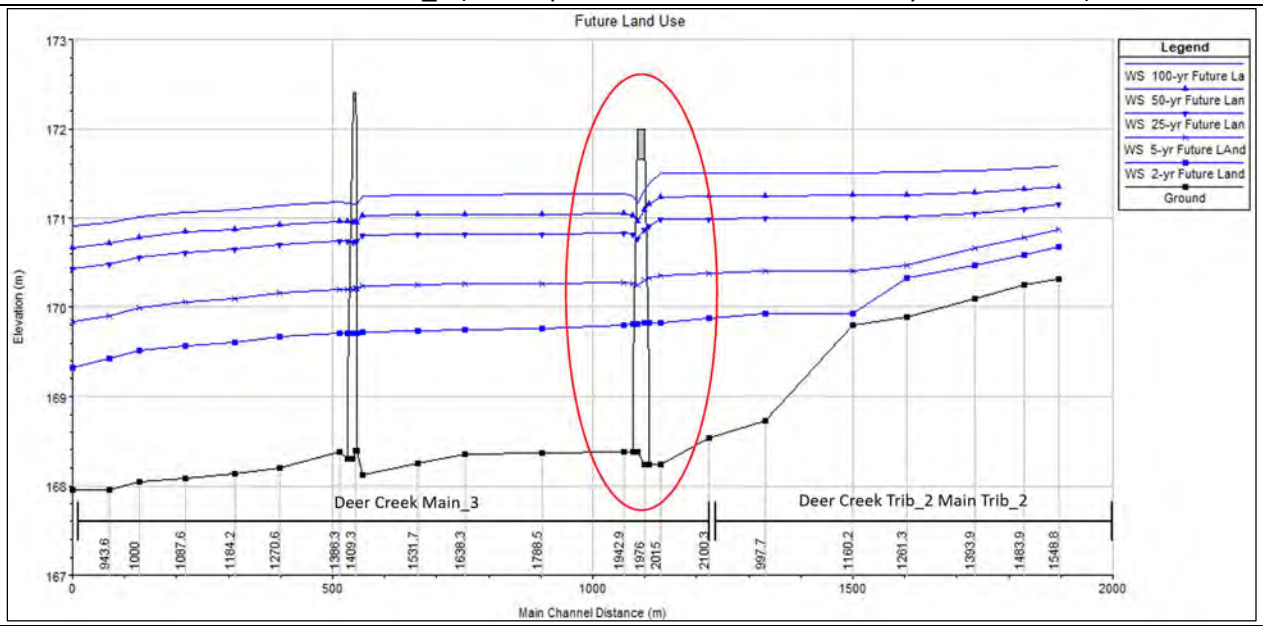


Table 5-10. Profile plot analysis of the crossing # 5

Crossing No. # 5 (at the Hwy 7)
The crossing located on the Hwy 7 creates backwatering for the storms up to 25-year event. This impact goes back after the upstream confluence to cross-section # 1261.3 on Deer Creek Trib_2 mainTrib_2 and cross-section # 1239.4 on Deer Creek Main_4 (most upstream cross-section in the hydraulic model).



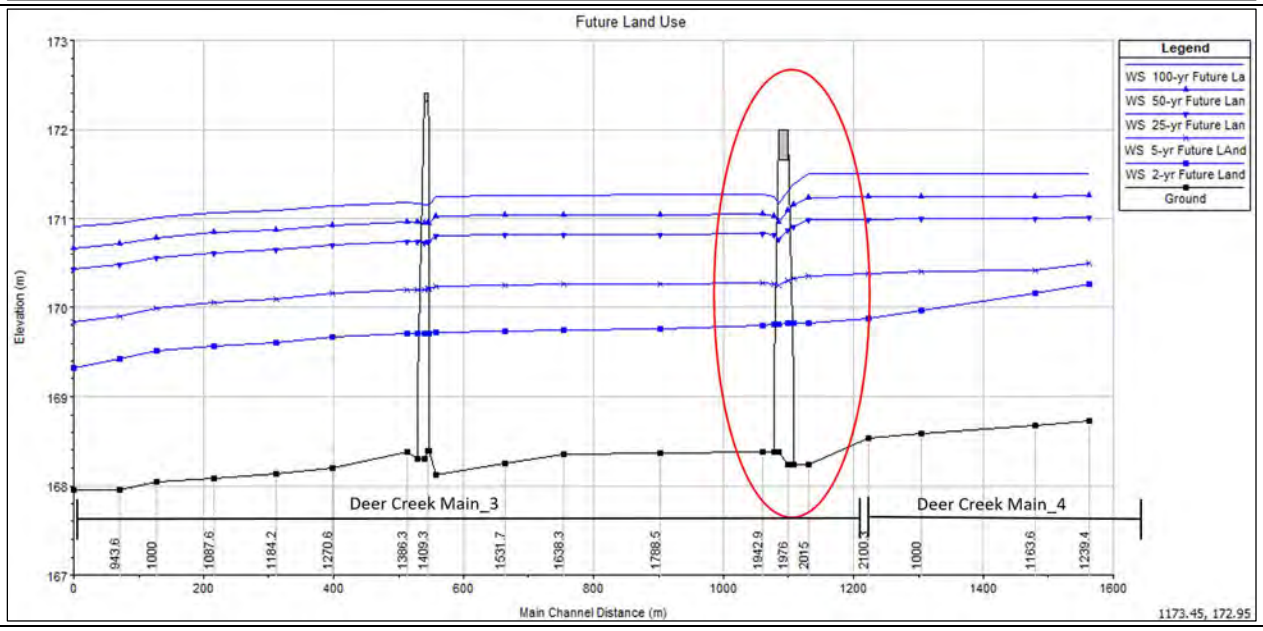


Table 5-11. Profile plot analysis of the crossing # 3

Crossing No. # 3 (at Russel Street)
The crossing is responsible for backwatering. This impact goes up to the next upstream crossing structure (structure # 2).

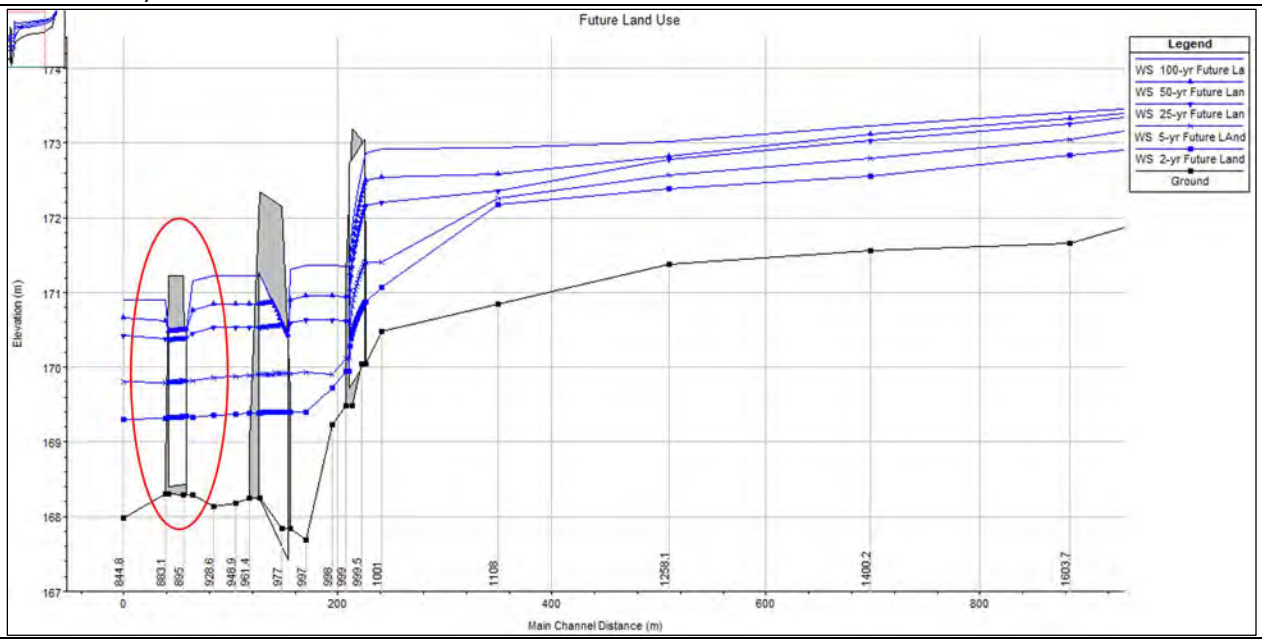


Table 5-12. Profile plot analysis of the crossing # 2

Crossing No. # 2 (at the Hwy 7)
As for the crossing #3, the crossing # 2 is responsible for backwatering. This impact goes up to the next upstream crossing structure (structure # 1).

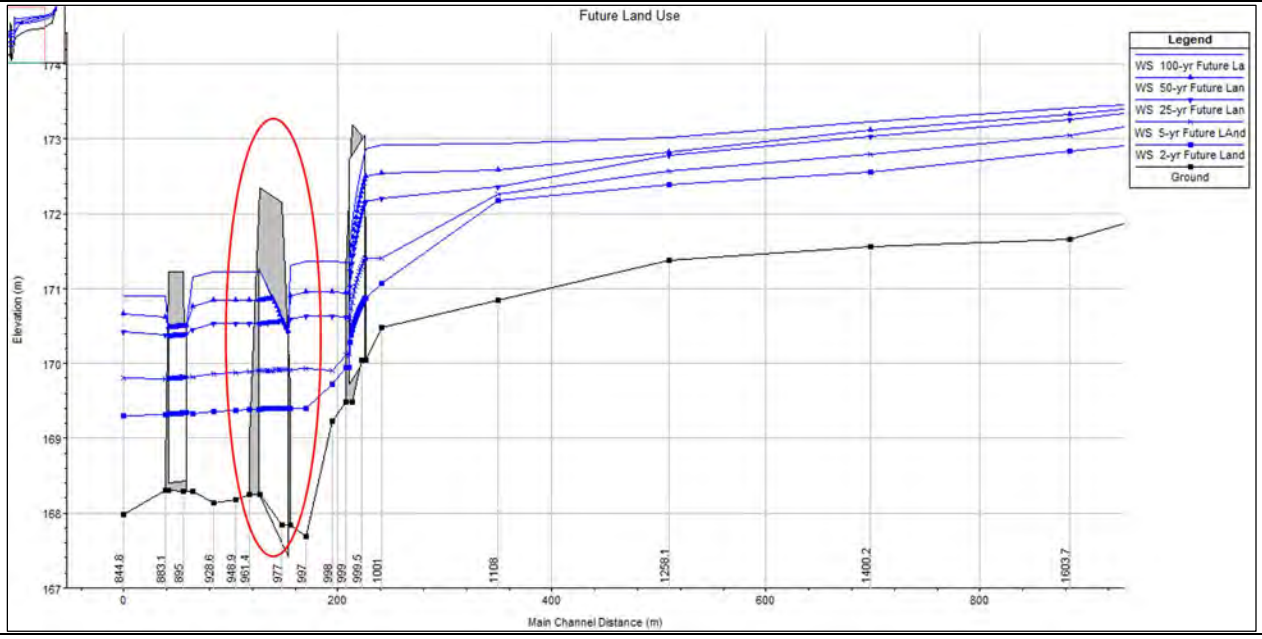
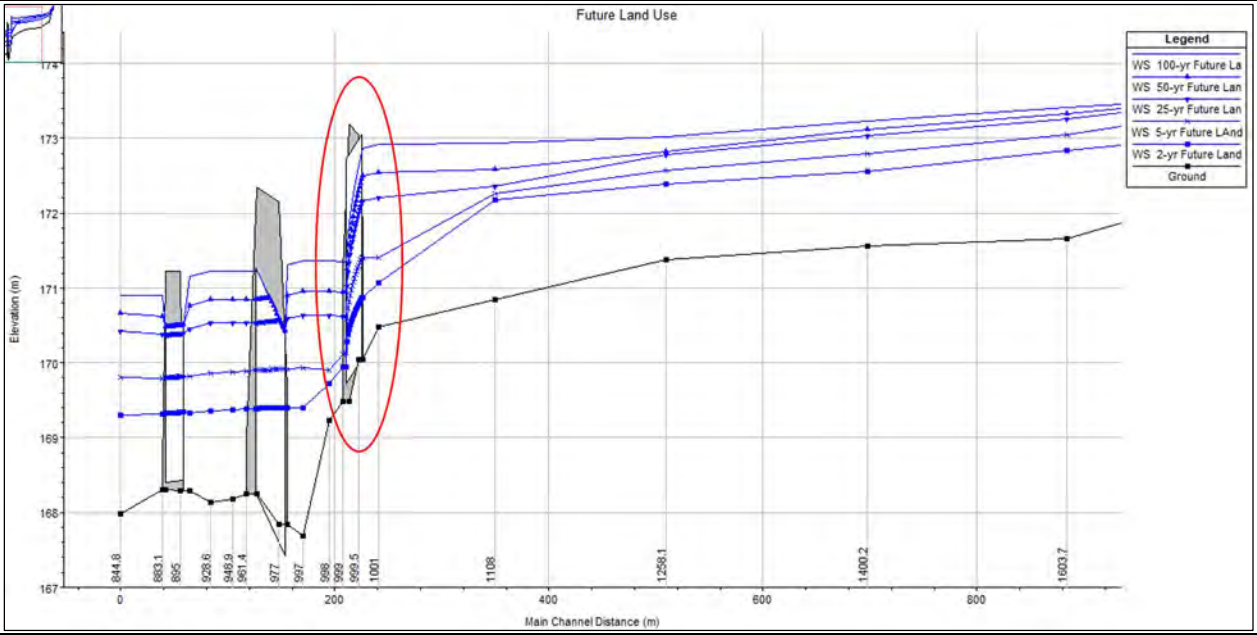


Table 5-13. Profile plot analysis of the crossing # 1

Crossing No. # 1 (Macdonald entrance)
No backwater effect observed.



5.2 Influence of Moira Lake Level

As referred in section 5.1 for crossing structure # 12, the downstream of the study area is under the influence of the Moira Lake level, creating backwatering in the channel until cross-section # 286.2 on Deer Creek Main_1, and thereby influencing the floodplain extent. Indeed, the downstream study area is reflected by a large marsh area dominated by flat terrain and high-density herbaceous species. Their locations are mostly found at the edge of lakes and streams as is the case here. The delineation of the regulatory flood lines is not primarily due to the Deer Creek flood condition but by the Moira Lake flood condition/level for the Regulatory event as shown in the overlapped flood lines of Moira Lake (Quinte Conservation) and those of Deer Creek (Aquafor) in Figure 5.1.

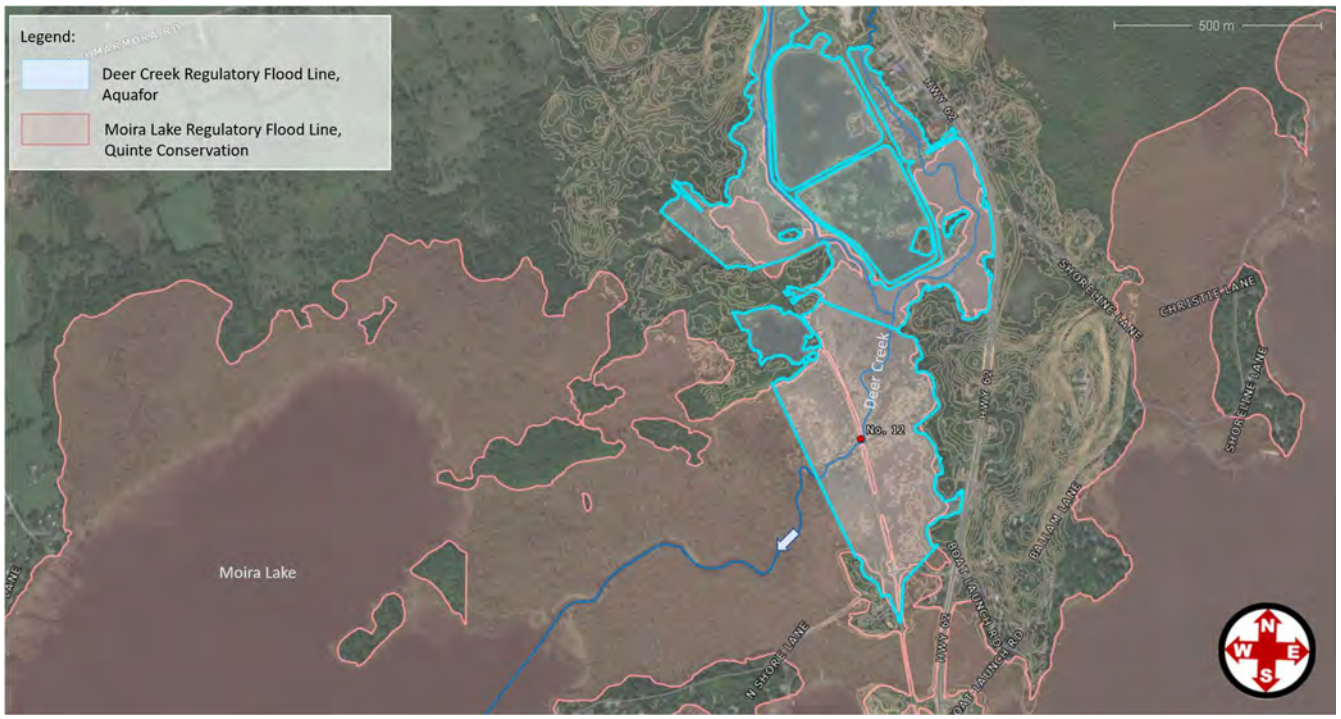


Figure 5.1. Downstream study area and the impact of Moira Lake level on the flood lines

5.3 Existing Berm at Madoc Skate Park

The existing berm parallel of Deer Creek at Madoc Skate Park is modeled with levees all along. The 100-year water level would not reach the top of the berm and would stay within the bank full of the creek as illustrated in Figure 5.2. However, because Aquafor could not verify the engineering of the landform constructed (no background data provided), and no maintenance program is currently performed, the capacity of the berm to keep the flood flow within the channel and protect the depression area located behind the structure out of flooding was not considered in the Regulatory flood line delineation analysis. Indeed, delineation protocol of flood hazards within Ontario are defined within the Ministry of Natural Resources and Forestry - Technical Guide – River and Stream Systems: Flooding Hazard Limit (2002). Special flood hazard conditions are addressed within this document, in which Dykes and berms are defined, along with technical requirements for hazard delineation. A key excerpt from the document is included below.

> *"Where a dyke has been properly designed and constructed to the flood standard, and a suitable maintenance program is in place, the area behind the dyke can be considered as flood fringe. As such, new development would still be required to be floodproofed to the flood standard. The floodway would be considered to be contained within the dyke area. If new development in the flood fringe cannot be floodproofed to the flood standard, then special policy area status may be requested, subject to the appropriate requirements."*

The assessment of the berm conditions for potential modes of failure could not be performed, hence, the depression area behind the berm was included in the final regulatory flood lines extend.

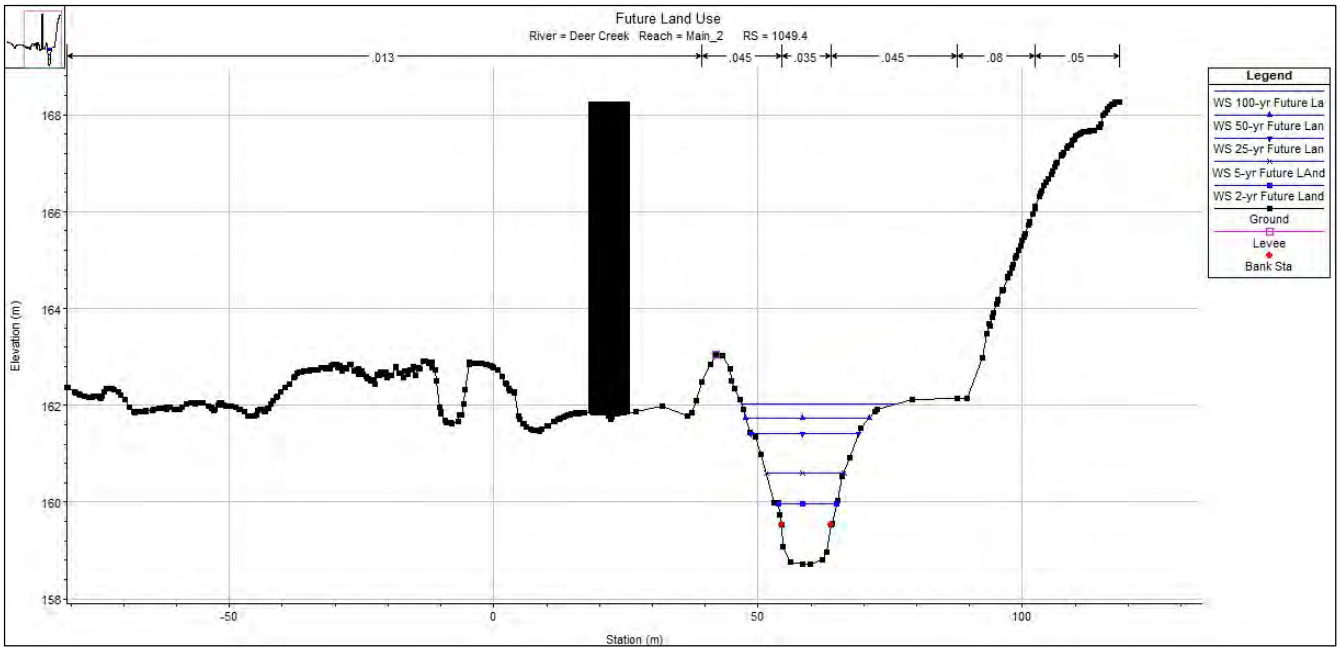


Figure 5.2. River Ross-section Profile at the berm (Structure # 13) Location

5.4 Floodplain Mapping

The model simulation results based on the 100-year average past soil moisture conditions and current Landuse is thereafter applied onto the LiDAR (hydro-flattened DEM), provided by Quinte Conservation, to generate the respective flood line extents. Regulatory flood lines were mapped based on the predicted water surface elevation and engineering judgement. Detailed floodplain mapping is illustrated in Appendix C, while Figure 5.3 is an overview of the regulatory floodplain mapping. The following are notable components of the flood hazard mapping exercise:

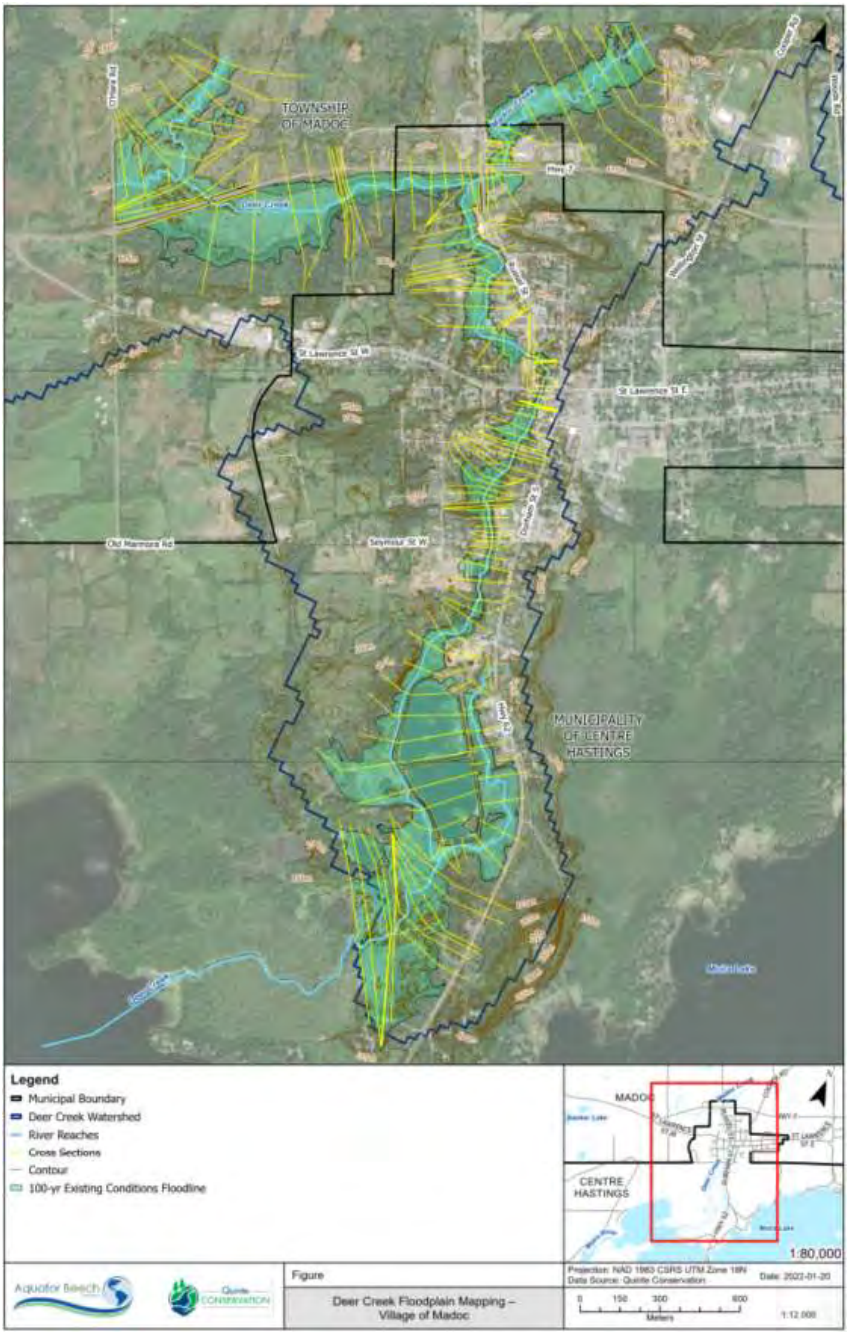


Figure 5.3. Overview of the Regulatory Deer Creek floodplain mapping

- The hydraulic model was built using a combination of topographic data (LiDAR and Survey) both with CGVD2013 vertical datum.

- The hydraulic model was run under subcritical flow for all storm events.

- The starting water elevation is the Moira Lake water surface elevation for the 100-year event (156.2m CGVD2013).

- Where the automatically generated inundation extent gets cut off, the inundation boundary was filled in by projecting out to the appropriate contour elevation.

- Island were manually filled and isolated area were removed of water as appropriate.

- Smoothing of flood lines and full manual inspection of 100-year flood lines were performed.

- A spill area analysis was performed, and no spills were identified.

6 FLOOD HAZARD ASSESSMENT

6.1 Overtopping Conditions of Crossing Structures

Pedestrian and vehicle access can be limited when a road crossing is overtopped and inundated. As per the Technical Guide – River and Stream System: Flooding Hazard Limit (OMNR 2002), the impassable road is the road with the overtopping water depth equal or greater than 0.3m. A road can be overtopped but then it becomes impassable only if the threshold defined above is reached or passed. In order to define the road elevation at the crossing location, the updated Regulatory Floodplain Mapping and water surface profiles were reviewed and the lowest point elevation of the road is taken into account (as defined in the existing HEC-RAS models) to calculate the depth of water overtopping the road.

Pedestrian bridges are typically expected to be overtopped more frequently, however, they do not require replacement and maintenance as the result of flooding quite as often.

Under the Regulatory flood (100-year storm event), a total of 4 crossing structures are estimated to be impassable. To provide additional insight into the road overtopping condition, Table 6-1 classes, for each structure by storm event and using a code color, the 3 defined categories:

- Road not overtopped – highlighted in green
- Road overtopped but passable (water depth <0.3m) - highlighted in orange
- Road impassable (water depth ≥ 0.3m) - highlighted in red

Table 6-1. Overtopping Conditions analysis for all crossing structures listing by storm event the roads not overtopped (green), the roads overtopped but passable (orange) and the roads impassable (red)

River	Reach	Structure ID	Structure Type	Upstream Bounding XS	Road Elev. (m)	Difference between WES and Road Elevation (m)				
						2-year	5-year	25-year	50-year	100-year
Deer Creek	Main_1	12	Bridge	103.6	155.4	0.8	0.8	0.8	0.8	0.8
Deer Creek	Main_2	11	Bridge	1015	162.69	-2.75	-2.1	-1.28	-0.97	-0.68
Deer Creek	Main_2	10	Box Culvert	1414	164.32	-1.9	-1.19	-0.15	0.23	0.42
Deer Creek	Main_2	9	Pedestrian Bridge	1600.8	165.59	-1.73	-1.23	-0.24	0.38	0.5
Deer Creek	Main_2	8	Bridge	1678.3	168.42	-3.16	-2.77	-2.12	-1.85	-1.58
Deer Creek	Main_2	7	Bridge	1846.2	170.89	-2.36	-1.97	-1.42	-1.13	-0.85
Deer Creek	Main_2	6	Bridge	2261.4	169.73	-0.88	-0.32	0.36	0.61	0.87
Deer Creek	Main_3	5	Bridge	1992	172	-2.17	-1.67	-1.08	-0.85	-0.61
Deer Creek	Main_3	4	Bridge	1414.7	172.41	-2.69	-2.2	-1.67	-1.46	-1.25

River	Reach	Structure ID	Structure Type	Upstream Bounding XS	Road Elev. (m)	Difference between WES and Road Elevation (m)				
						2-year	5-year	25-year	50-year	100-year
Madoc Creek	Main_01	3	Box Culvert	908.2	171.23	-1.9	-1.41	-0.77	-0.47	-0.08
Madoc Creek	Main_01	2	Box Culvert	986.9	172.15	-2.75	-2.24	-1.56	-1.25	-0.85
Madoc Creek	Main_01	1	Arch Culvert	1000	173.04	-2.17	-1.63	-0.87	-0.54	-0.18

6.2 Flooded Building Assessment

The impact of the flood lines on the private and public facilities has been analyzed using the building feature layer shapefile (same as used for conveyance obstruction application) and GIS tools. The number of buildings impacted by the Deer Creek flood flow within the study area has been identified for the 100-year storm event (regulatory event). In total 15 buildings are impacted by the 100-year storm because they are partially or totally within the floodplain. The map in Appendix D provides the location of those impacted buildings.

7 CLIMATE CHANGE ESTIMATED IMPACT

The impact of climate change on peak flows were evaluated for the Future Land Use scenario under the 100-year event, using the Coupled Model Intercomparison Project Phase 6 (CMIP6) global climate model and assuming a moderate warming scenario (SSP2-4.5). The IDF curve based on historical data and the projected IDF curve under the SSP2-45 climate change scenario were extracted for Madoc using the IDF_CC Tool 6.0 (Western University, 2021). By comparing these IDF curves, it was determined that moderate climate change is expected to increase the 100-year rainfall volume by 9.6%. Using Deer Creek Watershed HEC-HMS model developed by Aquafor, the climate change scenario increased 100-year peak flows by approximately 20%.

The impact of the climate change on the flood line for the 100-year event was analysed and climate change flood lines were mapped as illustrated in Appendix E. Detailed water surface elevations at each reiver cross-section are provided in the map and as well in Appendix B.

8 UNCERTAINTIES, LIMITS AND RECOMMENDATIONS

Aquafor undertook different measures to reduce uncertainty and increase confidence in the HEC-RAS hydraulic model's ability to predict water surface elevations. Those included the use of estimated flow rates from the approved HEC-HMS hydrologic model and approved scenario (average past soil moisture conditions), the use of appropriate hydraulic parameters based on technical guidelines, reviewing errors, warnings and notes in the model, and completing a visual verification of the preliminary model results screening the regulatory flood lines delineation.

Detailed reach investigations of the low flow channel were not conducted all along the creek due to the scale of the study area and site access and safety conditions. River cross-section was only surveyed within the channel at certain locations (69 cross-sections surveyed). Aquafor could correct the bed channel elevation (as explained in section 3.3 Low Flow Channel) but did not correct the entire low flow channel shape. Moreover, for the river

cross-sections not surveyed (56% of the cross-sections), the low flow channel geometry was extracted using the LiDAR and then the bed channel was corrected based on the slope between two cross-sections surveyed.

It is noted that the hydraulic model has foremost been developed for the purposes of flood hazard mapping. The development of the model was focused on generating water surface elevations for the Regulatory flood event (100-year storm). The hydraulic model results for smaller return period storm events have higher degree of uncertainty. The hydraulic model and the results presented within this report for storms less than the Regulatory event will provide only general guidance for infrastructure planning and/or flood estimation purposes. Additional detailed studies (i.e., low flow channel, placement of levees, etc.), may be required to ensure adequate accuracy of modelling results for lesser storm events.

9 CONCLUSION

This updated HEC-RAS hydraulic model was built taking into account the most recent data in possession of the Quinte Conservation Madoc and is compliant with the Technical Guidelines (OMNR 2002 and EWRG 2017). This study will thus allow the Conservation Authority to recognize in detail the behavior of the riverine system of Deer Creek crossing the Village of Madoc for the important storm events.

The following points are key conclusions drawn from this study:

- The hydraulic model includes a total of 7 (seven) river reaches, covering a total length of 8.8 km;
- The model includes a total of 14 hydraulic structures including bridges, culverts, weirs; and berm;
- The model includes a total of 7 (seven) flow nodes (4 from HEC-HMC hydrologic model and 3 from Index Flow Method);
- Survey investigations were conducted by Aquafor Beech Limited in October and November 2021, and for structures and 69 river cross-sections were surveyed (44% of total cross-sections);
- Structure Inventory Sheet were developed for each of the hydraulic structure;
- Quinte Conservation 2022 LiDAR (Hydro-flattened DEM) with vertical coordinate system CGVD2013, was applied to define river cross-sections, stream centerline, overbank locations and generate flood lines;
- Flows imputed in the hydraulic model were from Aquafor's HEC-HMS hydrologic model and are relevant for storm returns ranging from the 2-year to the 100-year events and climate change scenario.
- Manning roughness values based upon landuse were assigned in the model according to the MTO Standard Coefficient (MTO Drainage Management Manual - Design Chart 2.01) and Technical Guidelines for Flood Hazard Mapping (EWRG, 2017);
- Steady flow model simulations and subcritical flow regime were simulated to generate model results.
- Floodplain mapping for the 100-year storm event (Regulatory event) were defined;
- Impact of the climate change on the flood line extent was analyzed
- Overtopping conditions at each crossing structure have been conducted, listing the flood-prone roads and then impassable roads, and
- Impact of the 100-year storm has been performed, highlighting buildings partially and completely flooded within the study area.

The study concluded with the development of 1-D HEC-RAS hydraulic model for the Deer Creek crossing the Village of Madoc. Aquafor has confidence in the hydraulic model to reasonably predict water surface elevations for the Regulatory event (100-year storm) and thus, on the Regulatory Floodplain Mapping.

10 REFERENCES

Garatech Inc. (1987). *Water management study Deer Creek: Village of Madoc. Brampton, ON: Garatech Inc.*

Environmental Water Resources Group Ltd. (2017). *Technical guidelines for flood hazard mapping.*

Ministry of Transportation of Ontario (MTO). 1997. *MTO Drainage Management Manual.* Drainage and Hydrology Section, Transportation Engineering Branch, Quality and Standards Division. October 1997

Ontario Ministry of Natural Resources (OMNR). 2002. *Technical Guide - River and Stream Systems: Flooding Hazard Limit.* Peterborough, Ontario

US Army Corps of Engineers (February 2016). HEC-RAS River Analysis System – Hydraulic Reference Manual (Ver.5.0).

Appendix A - Structure Inventory Sheets

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 1

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/25/2021	Structure Type (Culvert/Bridge): Arch Culvert		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Corrugated Steel Pipe		Approx. Velocity (m/s):
Subcatchment Area: Madoc Creek	Height (m) x Width (m) or Diameter (m): 3.9m H x 12m W		Upstream Erosion (Y/N): No
Tributary Name: Madoc Creek	Length (m): 14m		Downstream Erosion (Y/N): No
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 170.042	U/S Obvert Elev. (m):173.944	Additional Information:
Cross Section Range:	D/S Invert Elev. (m): 169.725	D/S Obvert Elev. (m): 173.931	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall): Headwall		Natural riffle step 4-5m upstream culvert (abrupt slope change).
Location (Road Name/Intersection): Private Mcdonald Entrance, corner of Hwy 62 and Hwy7.	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m): 1.12m		
	Depth of Siltation (mm): No Siltation		

Site Photograph and Additional Field Notes

Site Sketch:

Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel

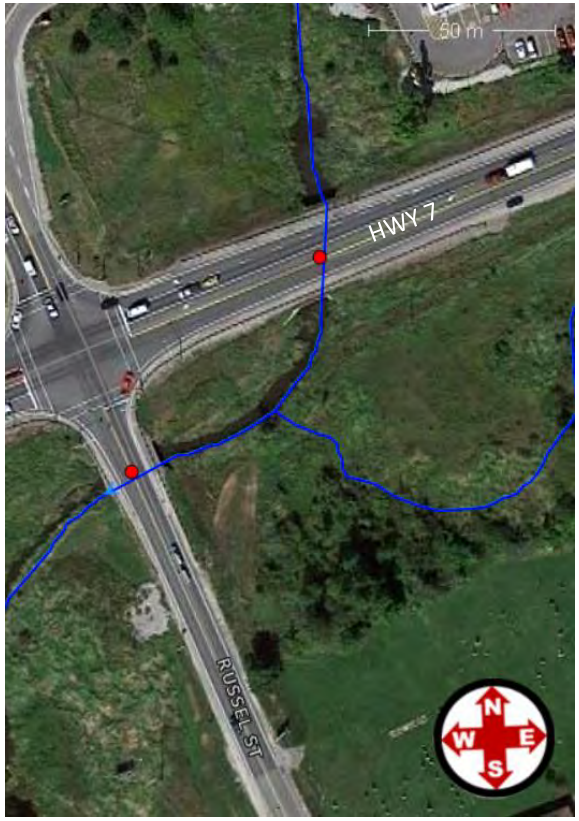
Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc – Structure # 2

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/25/2021	Structure Type (Culvert/Bridge): Box Culvert Chamfered with Wingwall		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Concrete		Approx. Velocity (m/s):
Subcatchment Area: Madoc Creek	Height (m) x Width (m) or Diameter (m): 3m H x 8.2m W		Upstream Erosion (Y/N): No
Tributary Name: Madoc Creek	Length (m): 27m		Downstream Erosion (Y/N): No
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 167.427	U/S Obvert Elev. (m):171.382	Additional Information:
Cross Section Range:	D/S Invert Elev. (m): 168.264	D/S Obvert Elev. (m): 171.304	Sedimentation bar with presence of vegetation is formed downstream culvert dividing the channel.
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall): Headwall and Wingwall		
Location (Road Name/Intersection): Hwy 7 located east of Hwy 62	Skew Angle of Crossing (Degrees): downstream skew angle for low flow channel		
	Height from Obvert to Top of Road (m): 1.2m		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:



Upstream Bridge Face

Upstream Channel (view from upstream arch culvert)

Downstream Bridge Face

Downstream Channel

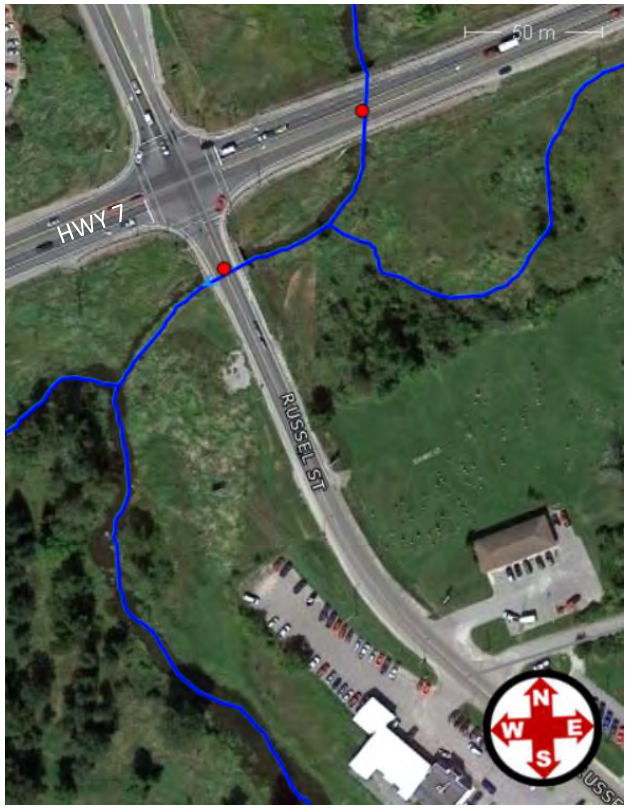
Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 3

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/25/2021	Structure Type (Culvert/Bridge): Box Culvert Chamfered with Wingwalls		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Concrete		Approx. Velocity (m/s):
Subcatchment Area: Madoc Creek	Height (m) x Width (m) or Diameter (m): 2.07m H x 7.5m W		Upstream Erosion (Y/N): No
Tributary Name: Madoc Creek	Length (m): 16.05m		Downstream Erosion (Y/N):No
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 168.431	U/S Obvert Elev. (m):170.504	Additional Information:
Cross Section Range:	D/S Invert Elev. (m): 168.404	D/S Obvert Elev. (m): 170.477	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall): Headwall and Wingwalls		
Location (Road Name/Intersection): On Russel Street, south of Hwy 7	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m): 1.4m		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:



Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel

Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 4

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/25/2021	Structure Type (Culvert/Bridge): Pedestrian Bridge		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Wood and Steel		Approx. Velocity (m/s):
Subcatchment Area No:	Height (m) x Width (m) or Diameter (m): 3.9 m H x 6m W		Upstream Erosion (Y/N): No
Tributary Name: Deer Creek	Length (m): 32.5m		Downstream Erosion (Y/N):No
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 168.389	U/S Obvert Elev. (m):172.322	Additional Information:
Cross Section Range:	D/S Invert Elev. (m): 168.301	D/S Obvert Elev. (m): 172.312	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall):		
Location (Road Name/Intersection): Pedestrian Bridge at the Trail Crossing	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m): 1.2m		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:

Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel

Description Photos:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 5

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/26/2021	Structure Type (Culvert/Bridge): Culvert with Headwall		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Concrete with Headwall		Approx. Velocity (m/s):
Subcatchment Area: Deer Creek	Height (m) x Width (m) or Diameter (m): 2.6m H x 10.5m W		Upstream Erosion (Y/N): No
Tributary Name: Deer Creek	Length (m): 14m		Downstream Erosion (Y/N): No
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 168.239	U/S Obvert Elev. (m):171.655	Additional Information:
Cross Section Range:	D/S Invert Elev. (m): 169.007	D/S Obvert Elev. (m): 171.663	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall): Headwall		
Location (Road Name/Intersection): Hwy 7	Skew Angle of Crossing (Degrees): Yes only downstream		
	Height from Obvert to Top of Road (m): 0.8m / Top of railing: 1.5m		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch

Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel

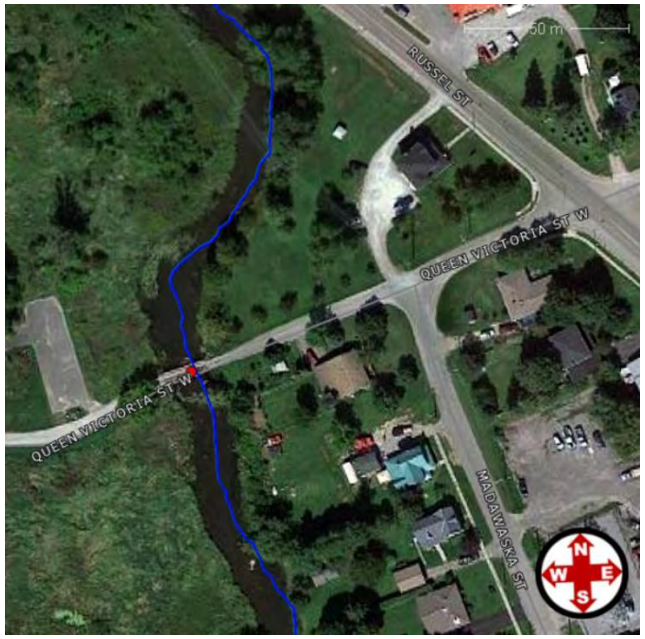
Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 6

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 2021-11-25	Structure Type (Culvert/Bridge): Bridge		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Steel Plate		Approx. Velocity (m/s):
Subcatchment Area No:	Height (m) x Width (m) or Diameter (m): 2.57 x 18.5		Upstream Erosion (Y/N): No
Tributary Name: Deer Creek	Length (m): 18.5		Downstream Erosion (Y/N):No
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 167.124	U/S Obvert Elev. (m):169.694	Additional Information:
Cross Section Range:	D/S Invert Elev. (m): 167.86	D/S Obvert Elev. (m): 169.759	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall):		
Location (Road Name/Intersection): Queen Victoria St West	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m): 0.85		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:



Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel

Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 7

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/26/2021	Structure Type (Culvert/Bridge): Bridge with Headwall		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Concrete		Approx. Velocity (m/s):
Subcatchment Area:	Height (m) x Width (m) or Diameter (m): 2.5m H x 12.5m W		Upstream Erosion (Y/N): No
Tributary Name: Deer Creek	Length (m): 17.30m		Downstream Erosion (Y/N): No
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 167.306	U/S Obvert Elev. (m):170.021	Additional Information: The bridge is located 30m upstream of the weir structure.
Cross Section Range:	D/S Invert Elev. (m): 167.477	D/S Obvert Elev. (m): 169.989	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall): Headwall		
Location (Road Name/Intersection): Russel Street	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m): 1.1 m		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

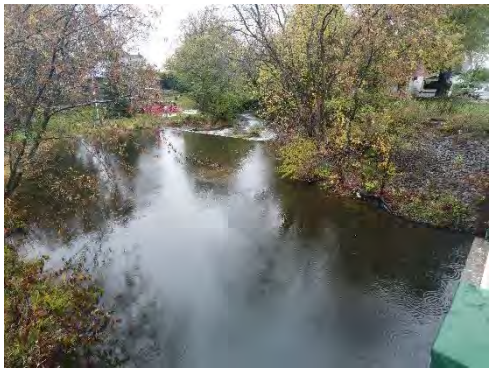
Site Sketch:

Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel



Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 8

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/27/2021	Structure Type (Culvert/Bridge): Bridge		Flow Present (Y/N):
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Concrete		Approx. Velocity (m/s):
Subcatchment Area No:	Height (m) x Width (m) or Diameter (m): 2.82m H x 11.20m W		Upstream Erosion (Y/N): Yes
Tributary Name: Deer Creek	Length (m): 17.5m		Downstream Erosion (Y/N): Yes
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 164.422	U/S Obvert Elev. (m):167.505	Additional Information: No access from the upstream of the structure.
Cross Section Range:	D/S Invert Elev. (m): 164.414	D/S Obvert Elev. (m): 167.236	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall):		
Location (Road Name/Intersection): Saint Lawrence Street West	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m):		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:

Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel

Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 9

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/26/2021	Structure Type (Culvert/Bridge): Pedestrian Bridge		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): wood and steel		Approx. Velocity (m/s):
Subcatchment Area No:	Height (m) x Width (m) or Diameter (m): 2.61m H x 13.3		Upstream Erosion (Y/N): Yes
Tributary Name: Deer Creek	Length (m): 2 m		Downstream Erosion (Y/N): Minor
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 163.00	U/S Obvert Elev. (m):165.609	Additional Information: Major erosion upstream and minor erosion downstream. Two riffle steps were observed, one located downstream, the other located upstream.
Cross Section Range:	D/S Invert Elev. (m): 162.84	D/S Obvert Elev. (m): 165.624	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall):		
Location (Road Name/Intersection): Pedestrian bridge between Champlain St and public parking at Madoc Village Square Market	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m): 0.45		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:

Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel

Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 10

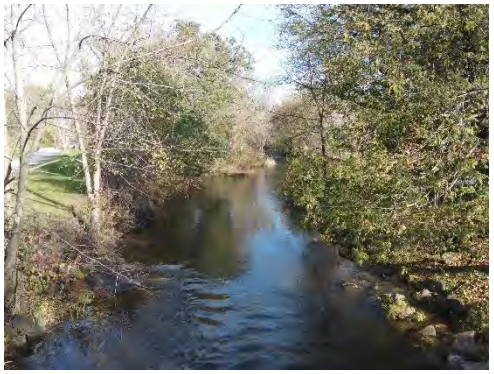
Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/27/2021	Structure Type (Culvert/Bridge): Box Culvert Chamfered		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Concrete		Approx. Velocity (m/s):
Subcatchment Area No:	Height (m) x Width (m) or Diameter (m): 2.4m H x 7.3m W		Upstream Erosion (Y/N): No
Tributary Name: Deer Creek	Length (m): 9.7		Downstream Erosion (Y/N): No
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 161.553	U/S Obvert Elev. (m):164.049	Additional Information: two riffle steps were observed downstream of the culvert.
Cross Section Range:	D/S Invert Elev. (m): 161.635	D/S Obvert Elev. (m): 164.064	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall): Wingwalls		
Location (Road Name/Intersection): Livingstone Ave W	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m): 0.5m		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:

Upstream Bridge Face

Upstream Channel



Downstream Bridge Face

Downstream Channel

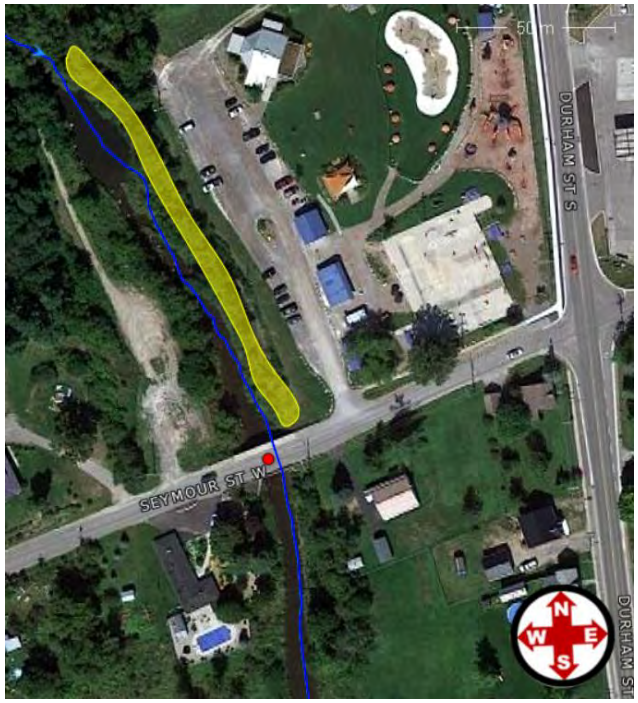
Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 11

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/27/2021	Structure Type (Culvert/Bridge): Bridge		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Concrete		Approx. Velocity (m/s):
Subcatchment Area No:	Height (m) x Width (m) or Diameter (m): 3.63m x 10m		Upstream Erosion (Y/N): No
Tributary Name: Deer Creek	Length (m): 9.10		Downstream Erosion (Y/N): No
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 158.969	U/S Obvert Elev. (m):162.50	Additional Information:
Cross Section Range:	D/S Invert Elev. (m): 159.173	D/S Obvert Elev. (m): 162.46	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall): Wingwalls		
Location (Road Name/Intersection): Seymour St West	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m): 0.78		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:

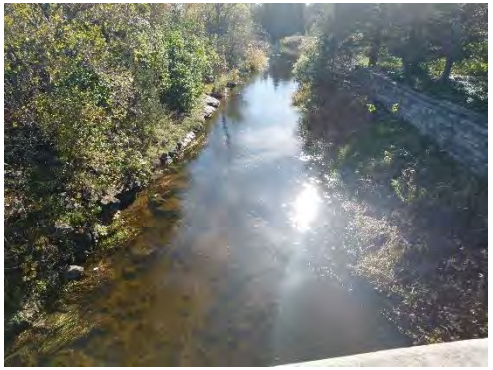


Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel



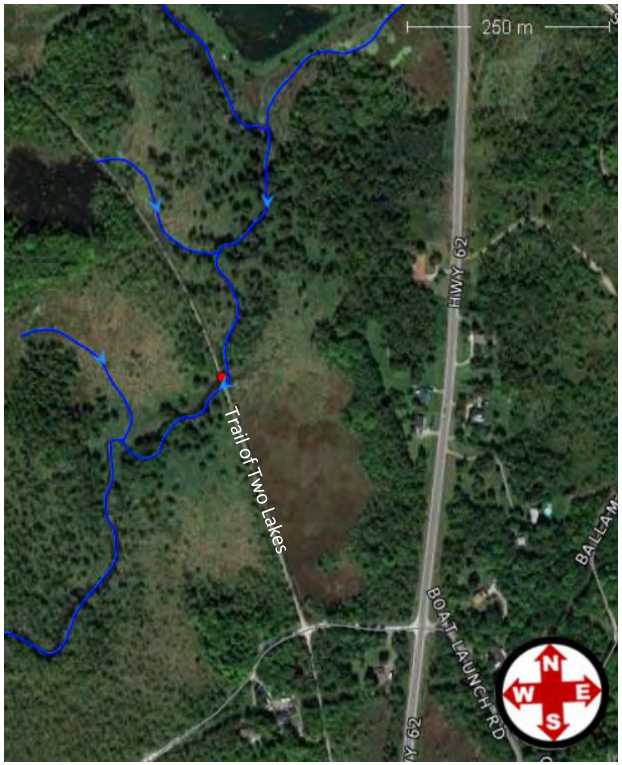
Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 12

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 2021-11-26	Structure Type (Culvert/Bridge): Bridge		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No): Yes	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Steel and Wood		Approx. Velocity (m/s): Yes
Subcatchment Area No:	Height (m) x Width (m) or Diameter (m): 3.3m x 10.25m		Upstream Erosion (Y/N): No
Tributary Name: Deer Creek	Length (m): 4.4m		Downstream Erosion (Y/N): NO
Floodplain Map Sheet No.:	U/S Invert Elev. (m): 153.077	U/S Obvert Elev. (m):156.23	Additional Information:
Cross Section Range:	D/S Invert Elev. (m): 153.53	D/S Obvert Elev. (m): 156.22	
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall):		
Location (Road Name/Intersection): Trail of Two Lakes near the HWY 62	Skew Angle of Crossing (Degrees): Yes		
	Height from Obvert to Top of Road (m): 0.74m		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:



Upstream Bridge Face

Upstream Channel

Downstream Bridge Face

Downstream Channel

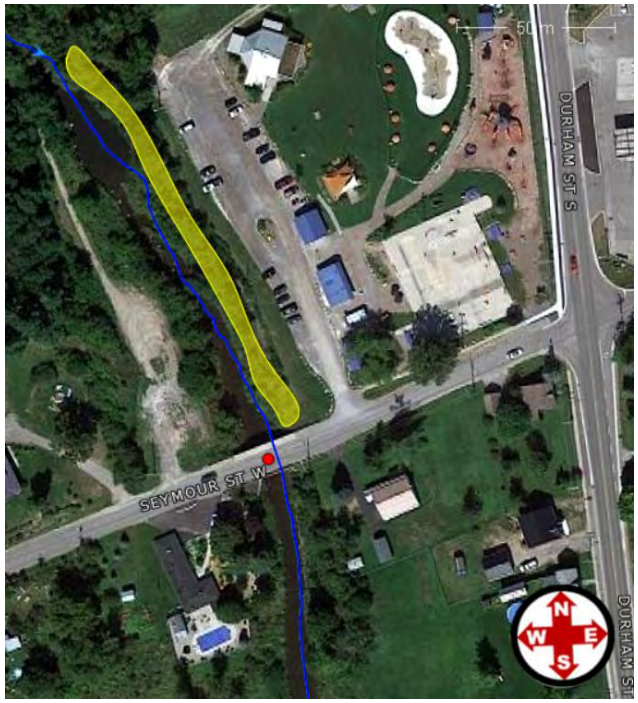
Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 13

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/27/2021	Structure Type (Culvert/Bridge): Berm parallel to the Creek (left bank)		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No):	Approx. Depth (mm):
Watershed Name: Deer Creek	Material : Earth Berm		Approx. Velocity (m/s):
Subcatchment Area No:	Height (m) x Width (m) approximate 1.35m H x 10m W		Upstream Erosion (Y/N): No
Tributary Name: Deer Creek	Length (m): 125m		Downstream Erosion (Y/N): No
Floodplain Map Sheet No.:	Top Elev (m): 163.05		Additional Information:
Cross Section Range:	Bottom Elev. (m): 161.78		
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall):		
Location (Road Name/Intersection): Seymour St West – Parallel to the left bank of the creek.	Skew Angle of Crossing (Degrees): No		
	Height from Obvert to Top of Road (m):		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:



Middle of Berm

Middle of Berm

South end of Berm

North end of Berm

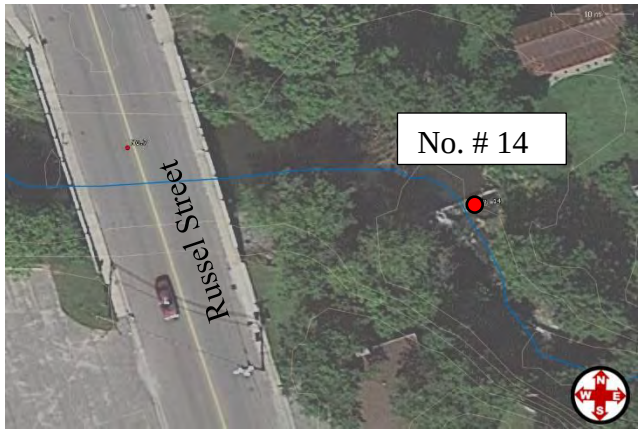
Description of Photograph:

HYDRAULIC STRUCTURE INVENTORY SHEET – Deer Creek Within Village of Madoc - Structure # 14

Watershed and Location Information	Structure Configuration and Dimensions		Current Flow Information
Date (mm/dd/yy): 10/26/2021	Structure Type (Culvert/Bridge): Weir Structure (Drop structure)		Flow Present (Y/N): Yes
Field Crew: TS & JM	Number of Cells: 1	Open Footing (Yes/No):	Approx. Depth (mm):
Watershed Name: Deer Creek	Material (Concrete/Steel): Concrete		Approx. Velocity (m/s):
Subcatchment Area:	Height (m) x Width (m) or Diameter (m): approximate 0.82m H x 0.3m W		Upstream Erosion (Y/N): No
Tributary Name: Deer Creek	Length (m): 18.6m		Downstream Erosion (Y/N): No
Floodplain Map Sheet No.:	Lower Weir Elev. (m): 168.06 Top Weir Elev.(m): 168.18		Additional Information: The weir structure is located 30m downstream of the bridge # 7.
Cross Section Range:	Bottom Creek Elev. (m): 167.30		
Municipality: Centre Hastings	Inlet Type (Projecting/Mitered/Headwall):		
Location (Road Name/Intersection): Russel Street	Skew Angle of Crossing (Degrees):		
	Height from Obvert to Top of Road (m):		
	Depth of Siltation (mm):		

Site Photograph and Additional Field Notes

Site Sketch:



Upstream of the Weir, Looking Downstream

Upstream Channel, Looking Downstraem

Downstream of the Weir, Looking Upstream

Downstream Channel, Looking Downstream

Description of Photograph:

Appendix B – HEC-RAS Model Output Results

HEC-RAS Profile: 100-yr Future La

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)	
Madoc Creek	Main_01	1905.4	100-yr Future La	Future Land Use	31.90	174.04	174.80	174.56	174.82	0.002951	1.20	58.90	153.97	0.46
Madoc Creek	Main_01	1905.4	100-yr Climate C	Climate Change	38.20	174.04	174.84	174.62	174.87	0.003070	1.28	65.37	154.55	0.48
Madoc Creek	Main_01	1905.4	100-yr Future La	+0.3m Average&Future Landuse	31.90	174.04	174.80	174.56	174.82	0.002954	1.20	58.88	153.97	0.46
Madoc Creek	Main_01	1905.4	100-yr Future La	-0.3m Average&Future Landuse	31.90	174.04	174.80	174.56	174.82	0.002954	1.20	58.88	153.97	0.46
Madoc Creek	Main_01	1843.4	100-yr Future La	Future Land Use	31.90	174.01	174.26	174.26	174.36	0.051433	1.95	23.62	124.86	1.53
Madoc Creek	Main_01	1843.4	100-yr Climate C	Climate Change	38.20	174.01	174.29	174.29	174.40	0.047699	2.09	27.16	126.87	1.51
Madoc Creek	Main_01	1843.4	100-yr Future La	+0.3m Average&Future Landuse	31.90	174.01	174.26	174.26	174.36	0.051433	1.95	23.62	124.86	1.53
Madoc Creek	Main_01	1843.4	100-yr Future La	-0.3m Average&Future Landuse	31.90	174.01	174.26	174.26	174.36	0.051433	1.95	23.62	124.86	1.53
Madoc Creek	Main_01	1771.6	100-yr Future La	Future Land Use	31.90	172.44	173.83		173.86	0.001528	1.25	68.52	167.94	0.36
Madoc Creek	Main_01	1771.6	100-yr Climate C	Climate Change	38.20	172.44	173.87		173.91	0.001713	1.35	75.52	175.40	0.38
Madoc Creek	Main_01	1771.6	100-yr Future La	+0.3m Average&Future Landuse	31.90	172.44	173.82		173.86	0.001553	1.26	68.08	167.79	0.36
Madoc Creek	Main_01	1771.6	100-yr Future La	-0.3m Average&Future Landuse	31.90	172.44	173.82		173.86	0.001553	1.26	68.08	167.79	0.36
Madoc Creek	Main_01	1714.9	100-yr Future La	Future Land Use	31.90	172.19	173.53	173.53	173.67	0.010379	2.28	28.05	118.87	0.85
Madoc Creek	Main_01	1714.9	100-yr Climate C	Climate Change	38.20	172.19	173.60	173.59	173.71	0.008349	2.17	36.73	141.63	0.78
Madoc Creek	Main_01	1714.9	100-yr Future La	+0.3m Average&Future Landuse	31.90	172.19	173.54	173.54	173.67	0.009680	2.22	28.94	121.55	0.83
Madoc Creek	Main_01	1714.9	100-yr Future La	-0.3m Average&Future Landuse	31.90	172.19	173.54	173.54	173.67	0.009680	2.22	28.94	121.55	0.83
Madoc Creek	Main_01	1603.7	100-yr Future La	Future Land Use	31.90	171.66	173.41		173.42	0.000631	0.86	85.39	155.31	0.23
Madoc Creek	Main_01	1603.7	100-yr Climate C	Climate Change	38.20	171.66	173.52		173.54	0.000519	0.82	104.25	159.50	0.21
Madoc Creek	Main_01	1603.7	100-yr Future La	+0.3m Average&Future Landuse	31.90	171.66	173.41		173.42	0.000631	0.86	85.39	155.31	0.23
Madoc Creek	Main_01	1603.7	100-yr Future La	-0.3m Average&Future Landuse	31.90	171.66	173.41		173.42	0.000631	0.86	85.39	155.31	0.23
Madoc Creek	Main_01	1400.2	100-yr Future La	Future Land Use	31.90	171.56	173.22		173.26	0.002920	1.32	58.67	139.94	0.46
Madoc Creek	Main_01	1400.2	100-yr Climate C	Climate Change	38.20	171.56	173.41		173.43	0.001527	1.09	85.36	149.91	0.34
Madoc Creek	Main_01	1400.2	100-yr Future La	+0.3m Average&Future Landuse	31.90	171.56	173.22		173.26	0.002920	1.32	58.67	139.94	0.46
Madoc Creek	Main_01	1400.2	100-yr Future La	-0.3m Average&Future Landuse	31.90	171.56	173.22		173.26	0.002920	1.32	58.67	139.94	0.46
Madoc Creek	Main_01	1258.1	100-yr Future La	Future Land Use	31.90	171.37	173.02		173.04	0.000935	1.05	86.05	140.02	0.28
Madoc Creek	Main_01	1258.1	100-yr Climate C	Climate Change	38.20	171.37	173.32		173.33	0.000393	0.77	130.65	158.57	0.18
Madoc Creek	Main_01	1258.1	100-yr Future La	+0.3m Average&Future Landuse	31.90	171.37	173.02		173.04	0.000935	1.05	86.05	140.02	0.28
Madoc Creek	Main_01	1258.1	100-yr Future La	-0.3m Average&Future Landuse	31.90	171.37	173.02		173.04	0.000935	1.05	86.05	140.02	0.28
Madoc Creek	Main_01	1108	100-yr Future La	Future Land Use	31.90	170.84	172.94		172.95	0.000573	0.62	105.65	157.22	0.19
Madoc Creek	Main_01	1108	100-yr Climate C	Climate Change	38.20	170.84	173.29		173.29	0.000212	0.45	162.96	167.81	0.12
Madoc Creek	Main_01	1108	100-yr Future La	+0.3m Average&Future Landuse	31.90	170.84	172.94		172.95	0.000573	0.62	105.65	157.22	0.19
Madoc Creek	Main_01	1108	100-yr Future La	-0.3m Average&Future Landuse	31.90	170.84	172.94		172.95	0.000573	0.62	105.65	157.22	0.19
Madoc Creek	Main_01	1001	100-yr Future La	Future Land Use	31.90	170.48	172.92		172.92	0.000159	0.60	87.58	67.92	0.13
Madoc Creek	Main_01	1001	100-yr Climate C	Climate Change	38.20	170.48	173.27		173.28	0.000116	0.57	115.55	98.48	0.11
Madoc Creek	Main_01	1001	100-yr Future La	+0.3m Average&Future Landuse	31.90	170.48	172.92		172.92	0.000159	0.60	87.58	67.92	0.13
Madoc Creek	Main_01	1001	100-yr Future La	-0.3m Average&Future Landuse	31.90	170.48	172.92		172.92	0.000159	0.60	87.58	67.92	0.13
Madoc Creek	Main_01	1000	100-yr Future La	Future Land Use	31.90	170.04	172.86	171.23	172.91	0.000340	0.95	33.91	39.50	0.19
Madoc Creek	Main_01	1000	100-yr Climate C	Climate Change	38.20	170.04	173.24	171.34	173.27	0.000229	0.86	58.13	61.06	0.16
Madoc Creek	Main_01	1000	100-yr Future La	+0.3m Average&Future Landuse	31.90	170.04	172.86	171.23	172.91	0.000340	0.95	33.91	39.50	0.19
Madoc Creek	Main_01	1000	100-yr Future La	-0.3m Average&Future Landuse	31.90	170.04	172.86	171.23	172.91	0.000340	0.95	33.91	39.50	0.19
Madoc Creek	Main_01	999.5			Culvert									
Madoc Creek	Main_01	999	100-yr Future La	Future Land Use	31.90	169.48	171.35	170.45	171.39	0.000705	1.08	37.74	28.33	0.26
Madoc Creek	Main_01	999	100-yr Climate C	Climate Change	38.20	169.48	171.64	170.52	171.68	0.000565	1.07	45.08	29.22	0.24
Madoc Creek	Main_01	999	100-yr Future La	+0.3m Average&Future Landuse	31.90	169.48	171.35	170.45	171.39	0.000705	1.08	37.74	28.33	0.26
Madoc Creek	Main_01	999	100-yr Future La	-0.3m Average&Future Landuse	31.90	169.48	171.35	170.45	171.39	0.000705	1.08	37.74	28.33	0.26
Madoc Creek	Main_01	998	100-yr Future La	Future Land Use	31.90	169.24	171.36		171.37	0.000146	0.55	94.22	71.31	0.12
Madoc Creek	Main_01	998	100-yr Climate C	Climate Change	38.20	169.24	171.66		171.66	0.000118	0.54	116.20	79.23	0.11
Madoc Creek	Main_01	998	100-yr Future La	+0.3m Average&Future Landuse	31.90	169.24	171.36		171.37	0.000146	0.55	94.22	71.31	0.12
Madoc Creek	Main_01	998	100-yr Future La	-0.3m Average&Future Landuse	31.90	169.24	171.36		171.37	0.000146	0.55	94.22	71.31	0.12
Madoc Creek	Main_01	997	100-yr Future La	Future Land Use	31.90	167.69	171.36		171.37	0.000057	0.46	142.65	97.73	0.08
Madoc Creek	Main_01	997	100-yr Climate C	Climate Change	38.20	167.69	171.65		171.66	0.000052	0.46	171.56	99.83	0.08
Madoc Creek	Main_01	997	100-yr Future La	+0.3m Average&Future Landuse	31.90	167.69	171.36		171.37	0.000057	0.46	142.65	97.73	0.08
Madoc Creek	Main_01	997	100-yr Future La	-0.3m Average&Future Landuse	31.90	167.69	171.36		171.37	0.000057	0.46	142.65	97.73	0.08
Madoc Creek	Main_01	986.9	100-yr Future La	Future Land Use	31.90	167.85	171.30	169.36	171.35	0.000321	1.02	34.38	119.65	0.19
Madoc Creek	Main_01	986.9	100-yr Climate C	Climate Change	38.20	167.85	171.58	169.49	171.64	0.000339	1.11	37.79	161.98	0.20
Madoc Creek	Main_01	986.9	100-yr Future La	+0.3m Average&Future Landuse	31.90	167.85	171.30	169.36	171.35	0.000321	1.02	34.38	119.65	0.19
Madoc Creek	Main_01	986.9	100-yr Future La	-0.3m Average&Future Landuse	31.90	167.85	171.30	169.36	171.35	0.000321	1.02	34.38	119.65	0.19
Madoc Creek	Main_01	977			Culvert									
Madoc Creek	Main_01	961.4	100-yr Future La	Future Land Use	31.90	168.25	171.22	169.69	171.25	0.000361	0.96	57.79	111.27	0.19
Madoc Creek	Main_01	961.4	100-yr Climate C	Climate Change	38.20	168.25	171.46	169.83	171.50	0.000353	1.01	67.01	142.63	0.19
Madoc Creek	Main_01	961.4	100-yr Future La	+0.3m Average&Future Landuse	31.90	168.25	171.22	169.69	171.25	0.000361	0.96	57.79	111.27	0.19
Madoc Creek	Main_01	961.4	100-yr Future La	-0.3m Average&Future Landuse	31.90	168.25	171.22	169.69	171.25	0.000361	0.96	57.79	111.27	0.19
Madoc Creek	Main_01	948.9	100-yr Future La	Future Land Use	31.90	168.18	171.23		171.24	0.000198	0.76	126.88	109.90	0.14
Madoc Creek	Main_01	948.9	100-yr Climate C	Climate Change	38.20	168.18	171.47		171.48	0.000169	0.74	154.58	114.56	0.13
Madoc Creek	Main_01	948.9	100-yr Future La	+0.3m Average&Future Landuse	31.90	168.18	171.23		171.24	0.000198	0.76	126.88	109.90	0.14
Madoc Creek	Main_01	948.9	100-yr Future La	-0.3m Average&Future Landuse	31.90	168.18	171.23		171.24	0.000198	0.76	126.88	109.90	0.14
Madoc Creek	Main_01	928.6	100-yr Future La	Future Land Use	31.90	168.14	171.22		171.23	0.000133	0.61	153.12	112.63	0.11
Madoc Creek	Main_01	928.6	100-yr Climate C	Climate Change	38.20	168.14	171.47		171.48	0.000118	0.61	181.14	115.84	0.11
Madoc Creek	Main_01	928.6	100-yr Future La	+0.3m Average&Future Landuse	31.90	168.14	171.22		171.23	0.000133	0.61	153.12	112.63	0.11
Madoc Creek	Main_01	928.6	100-yr Future La	-0.3m Average&Future Landuse	31.90	168.14	171.22		171.23	0.000133	0.61	153.12	112.63	0.11
Madoc Creek	Main_01	908.2	100-yr Future La	Future Land Use	31.90	168.30	171.15	169.86	171.21	0.000719	1.39	40.27	119.18	0.27
Madoc Creek	Main_01	908.2	100-yr Climate C	Climate Change	38.20	168.30	171.47	169.98	171.47	0.000133	0.64	173.10	135.32	0.12
Madoc Creek	Main_01	908.2	100-yr Future La	+0.3m Average&Future Landuse	31.90	168.30	171.15	169.86	171.21	0.000719	1.39	40.27	119.18	0.27
Madoc Creek	Main_01	908.2	100-yr Future La	-0.3m Average&Future Landuse	31.90	168.30	171.15	169.86	171.21	0.000719	1.39	40.27	119.18	0.27
Madoc Creek	Main_01	895			Culvert									
Madoc Creek	Main_01	883.1	100-yr Future La	Future Land Use	31.90	168.30	170.90	169.92	170.90	0.000076	0.43	188.09	154.88	0.09
Madoc Creek	Main_01	883.1	100-yr Climate C	Climate Change	38.20	168.30	171.18	170.04	171.18	0.000060	0.41	231.22	156.73	0.08
Madoc Creek	Main_01	883.1	100-yr Future La	+0.3m Average&Future Landuse	31.90	168.30	170.90	169.92	170.90	0.000076	0.43	188.08	154.88	0.09
Madoc Creek	Main_01	883.1	100-yr Future La	-0.3m Average&Future Landuse	31.90	168.30	170.90	169.92	170.90	0.000076	0.43	188.08	154.88	0.09
Madoc Creek	Main_01	844.8	100-yr Future La	Future Land Use	31.90	167.98	170.90		170.90	0.000047	0.35	187.44	128.01	0.07
Madoc Creek	Main_01	844.8	100-yr Climate C	Climate Change	38.20	167.98	171.18		171.18	0.000039	0.34	224.60	137.06	0.06

HEC-RAS Profile: 100-yr Future La (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)	
Madoc Creek	Main_01	844.8	100-yr Future La	+0.3m Average&Future Landuse	31.90	167.98	170.90		170.90	0.000047	0.35	187.44	128.00	0.07
Madoc Creek	Main_01	844.8	100-yr Future La	-0.3m Average&Future Landuse	31.90	167.98	170.90		170.90	0.000047	0.35	187.44	128.00	0.07
Deer Creek	Main_4	1239.4	100-yr Future La	Future Land Use	34.98	168.72	171.51		171.51	0.000068	0.36	291.22	279.45	0.08
Deer Creek	Main_4	1239.4	100-yr Climate C	Climate Change	41.83	168.72	171.79		171.79	0.000045	0.32	370.67	288.38	0.06
Deer Creek	Main_4	1239.4	100-yr Future La	+0.3m Average&Future Landuse	34.98	168.72	171.51		171.51	0.000068	0.36	291.22	279.45	0.08
Deer Creek	Main_4	1239.4	100-yr Future La	-0.3m Average&Future Landuse	34.98	168.72	171.51		171.51	0.000068	0.36	291.22	279.45	0.08
Deer Creek	Main_4	1163.6	100-yr Future La	Future Land Use	34.98	168.68	171.51		171.51	0.000050	0.27	348.94	336.35	0.06
Deer Creek	Main_4	1163.6	100-yr Climate C	Climate Change	41.83	168.68	171.79		171.79	0.000034	0.25	445.05	347.99	0.05
Deer Creek	Main_4	1163.6	100-yr Future La	+0.3m Average&Future Landuse	34.98	168.68	171.51		171.51	0.000050	0.27	348.94	336.35	0.06
Deer Creek	Main_4	1163.6	100-yr Future La	-0.3m Average&Future Landuse	34.98	168.68	171.51		171.51	0.000050	0.27	348.94	336.35	0.06
Deer Creek	Main_4	1000	100-yr Future La	Future Land Use	34.98	168.59	171.51		171.51	0.000015	0.16	581.63	463.25	0.03
Deer Creek	Main_4	1000	100-yr Climate C	Climate Change	41.83	168.59	171.79		171.79	0.000012	0.15	715.93	484.74	0.03
Deer Creek	Main_4	1000	100-yr Future La	+0.3m Average&Future Landuse	34.98	168.59	171.51		171.51	0.000015	0.16	581.63	463.25	0.03
Deer Creek	Main_4	1000	100-yr Future La	-0.3m Average&Future Landuse	34.98	168.59	171.51		171.51	0.000015	0.16	581.63	463.25	0.03
Deer Creek	Main_3	2100.3	100-yr Future La	Future Land Use	50.00	168.54	171.50		171.50	0.000042	0.32	454.15	340.07	0.06
Deer Creek	Main_3	2100.3	100-yr Climate C	Climate Change	59.80	168.54	171.78		171.79	0.000033	0.31	553.17	360.38	0.06
Deer Creek	Main_3	2100.3	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.54	171.50		171.50	0.000042	0.32	454.15	340.07	0.06
Deer Creek	Main_3	2100.3	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.54	171.50		171.50	0.000042	0.32	454.15	340.07	0.06
Deer Creek	Main_3	2015	100-yr Future La	Future Land Use	50.00	168.24	171.50		171.50	0.000029	0.29	559.77	409.34	0.05
Deer Creek	Main_3	2015	100-yr Climate C	Climate Change	59.80	168.24	171.78		171.78	0.000023	0.27	675.96	414.00	0.05
Deer Creek	Main_3	2015	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.24	171.50		171.50	0.000029	0.29	559.77	409.34	0.05
Deer Creek	Main_3	2015	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.24	171.50		171.50	0.000029	0.29	559.77	409.34	0.05
Deer Creek	Main_3	1992	100-yr Future La	Future Land Use	50.00	168.24	171.39	169.57	171.47	0.000466	1.26	39.57	491.97	0.24
Deer Creek	Main_3	1992	100-yr Climate C	Climate Change	59.80	168.24	171.65	169.71	171.75	0.000502	1.39	43.08	524.71	0.25
Deer Creek	Main_3	1992	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.24	171.39	169.57	171.47	0.000466	1.26	39.57	491.97	0.24
Deer Creek	Main_3	1992	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.24	171.39	169.57	171.47	0.000466	1.26	39.57	491.97	0.24
Deer Creek	Main_3	1976			Bridge									
Deer Creek	Main_3	1960.9	100-yr Future La	Future Land Use	50.00	168.38	171.25	170.15	171.29	0.000569	1.17	75.47	477.31	0.24
Deer Creek	Main_3	1960.9	100-yr Climate C	Climate Change	59.80	168.38	171.49	170.24	171.54	0.000553	1.23	85.74	490.39	0.24
Deer Creek	Main_3	1960.9	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.38	171.25	170.15	171.29	0.000569	1.17	75.47	477.31	0.24
Deer Creek	Main_3	1960.9	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.38	171.25	170.15	171.29	0.000569	1.17	75.47	477.31	0.24
Deer Creek	Main_3	1942.9	100-yr Future La	Future Land Use	50.00	168.38	171.27		171.27	0.000018	0.22	490.25	368.55	0.04
Deer Creek	Main_3	1942.9	100-yr Climate C	Climate Change	59.80	168.38	171.51		171.51	0.000016	0.21	580.85	374.39	0.04
Deer Creek	Main_3	1942.9	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.38	171.27		171.27	0.000018	0.22	490.25	368.55	0.04
Deer Creek	Main_3	1942.9	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.38	171.27		171.27	0.000018	0.22	490.25	368.55	0.04
Deer Creek	Main_3	1788.5	100-yr Future La	Future Land Use	50.00	168.37	171.27		171.27	0.000019	0.17	397.41	272.85	0.04
Deer Creek	Main_3	1788.5	100-yr Climate C	Climate Change	59.80	168.37	171.51		171.51	0.000017	0.17	465.74	285.67	0.04
Deer Creek	Main_3	1788.5	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.37	171.27		171.27	0.000019	0.17	397.41	272.85	0.04
Deer Creek	Main_3	1788.5	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.37	171.27		171.27	0.000019	0.17	397.41	272.85	0.04
Deer Creek	Main_3	1638.3	100-yr Future La	Future Land Use	50.00	168.36	171.26		171.26	0.000024	0.23	369.49	269.63	0.05
Deer Creek	Main_3	1638.3	100-yr Climate C	Climate Change	59.80	168.36	171.51		171.51	0.000021	0.23	436.78	278.15	0.04
Deer Creek	Main_3	1638.3	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.36	171.26		171.26	0.000024	0.23	369.49	269.63	0.05
Deer Creek	Main_3	1638.3	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.36	171.26		171.26	0.000024	0.23	369.49	269.63	0.05
Deer Creek	Main_3	1531.7	100-yr Future La	Future Land Use	50.00	168.26	171.26		171.26	0.000062	0.33	367.59	255.89	0.07
Deer Creek	Main_3	1531.7	100-yr Climate C	Climate Change	59.80	168.26	171.50		171.51	0.000055	0.33	431.30	263.85	0.07
Deer Creek	Main_3	1531.7	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.26	171.26		171.26	0.000062	0.33	367.59	255.89	0.07
Deer Creek	Main_3	1531.7	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.26	171.26		171.26	0.000062	0.33	367.59	255.89	0.07
Deer Creek	Main_3	1428.6	100-yr Future La	Future Land Use	50.00	168.13	171.25		171.25	0.000100	0.54	185.80	159.45	0.10
Deer Creek	Main_3	1428.6	100-yr Climate C	Climate Change	59.80	168.13	171.49		171.50	0.000090	0.54	227.98	178.14	0.10
Deer Creek	Main_3	1428.6	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.13	171.25		171.25	0.000100	0.54	185.80	159.45	0.10
Deer Creek	Main_3	1428.6	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.13	171.25		171.25	0.000100	0.54	185.80	159.45	0.10
Deer Creek	Main_3	1414.7	100-yr Future La	Future Land Use	50.00	168.39	171.16	169.92	171.23	0.000685	1.29	48.75	25.89	0.26
Deer Creek	Main_3	1414.7	100-yr Climate C	Climate Change	59.80	168.39	171.39	170.04	171.47	0.000698	1.38	54.90	26.75	0.27
Deer Creek	Main_3	1414.7	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.39	171.16	169.92	171.23	0.000685	1.29	48.75	25.89	0.26
Deer Creek	Main_3	1414.7	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.39	171.16	169.92	171.23	0.000685	1.29	48.75	25.89	0.26
Deer Creek	Main_3	1409.3			Bridge									
Deer Creek	Main_3	1399.2	100-yr Future La	Future Land Use	50.00	168.30	171.17	169.94	171.20	0.000316	0.96	89.72	122.50	0.19
Deer Creek	Main_3	1399.2	100-yr Climate C	Climate Change	59.80	168.30	171.41	170.04	171.44	0.000291	0.98	105.12	140.30	0.18
Deer Creek	Main_3	1399.2	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.30	171.17	169.94	171.20	0.000316	0.96	89.72	122.50	0.19
Deer Creek	Main_3	1399.2	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.30	171.17	169.94	171.20	0.000316	0.96	89.72	122.50	0.19
Deer Creek	Main_3	1386.3	100-yr Future La	Future Land Use	50.00	168.38	171.18		171.19	0.000189	0.71	142.87	112.71	0.14
Deer Creek	Main_3	1386.3	100-yr Climate C	Climate Change	59.80	168.38	171.42		171.43	0.000181	0.74	172.38	133.25	0.14
Deer Creek	Main_3	1386.3	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.38	171.18		171.19	0.000189	0.71	142.87	112.71	0.14
Deer Creek	Main_3	1386.3	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.38	171.18		171.19	0.000189	0.71	142.87	112.71	0.14
Deer Creek	Main_3	1270.6	100-yr Future La	Future Land Use	50.00	168.20	171.14		171.16	0.000386	0.88	121.90	104.54	0.19
Deer Creek	Main_3	1270.6	100-yr Climate C	Climate Change	59.80	168.20	171.38		171.40	0.000335	0.88	148.65	118.56	0.18
Deer Creek	Main_3	1270.6	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.20	171.14		171.16	0.000386	0.88	121.90	104.54	0.19
Deer Creek	Main_3	1270.6	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.20	171.14		171.16	0.000386	0.88	121.90	104.54	0.19
Deer Creek	Main_3	1184.2	100-yr Future La	Future Land Use	50.00	168.14	171.09		171.12	0.000476	0.99	108.91	87.19	0.21
Deer Creek	Main_3	1184.2	100-yr Climate C	Climate Change	59.80	168.14	171.34		171.37	0.000416	1.00	131.31	93.01	0.20
Deer Creek	Main_3	1184.2	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.14	171.09		171.12	0.000476	0.99	108.91	87.19	0.21
Deer Creek	Main_3	1184.2	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.14	171.09		171.12	0.000476	0.99	108.91	87.19	0.21
Deer Creek	Main_3	1087.6	100-yr Future La	Future Land Use	50.00	168.09	171.06		171.09	0.000318	0.83	109.05	79.72	0.18
Deer Creek	Main_3	1087.6	100-yr Climate C	Climate Change	59.80	168.09	171.31		171.34	0.000287	0.85	129.43	83.26	0.17
Deer Creek	Main_3	1087.6	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.09	171.06		171.09	0.000318	0.83	109.05	79.72	0.18
Deer Creek	Main_3	1087.6	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.09	171.06		171.09	0.000318	0.83	109.05	79.72	0.18
Deer Creek	Main_3	1000	100-yr Future La	Future Land Use	50.00	168.05	171.01		171.05	0.000536	1.07	96.16	85.40	0.23
Deer Creek	Main_3	1000	100-yr Climate C	Climate Change	59.80	168.05	171.27		171.31	0.000451	1.05	119.75	95.92	0.22
Deer Creek	Main_3	1000	100-yr Future La	+0.3m Average&Future Landuse	50.00	168.05	171.01		171.05	0.000536	1.07	96.16	85.40	0.23
Deer Creek	Main_3	1000	100-yr Future La	-0.3m Average&Future Landuse	50.00	168.05	171.01		171.05	0.000536	1.07	96.16	85.40	0.23
Deer Creek	Main_3	943.6	100-yr Future La	Future Land Use	50.00	167.95	170.95		171.01	0.000994	1.44	79.78	71.92	0.31

HEC-RAS Profile: 100-yr Future La (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)	
Deer Creek	Main_3	943.6	100-yr Climate C	Climate Change	59.80	167.95	171.22		171.27	0.000809	1.40	101.40	88.97	0.28
Deer Creek	Main_3	943.6	100-yr Future La	+0.3m Average&Future Landuse	50.00	167.95	170.95		171.01	0.000994	1.44	79.78	71.92	0.31
Deer Creek	Main_3	943.6	100-yr Future La	-0.3m Average&Future Landuse	50.00	167.95	170.95		171.01	0.000994	1.44	79.78	71.92	0.31
Deer Creek	Main_3	875.9	100-yr Future La	Future Land Use	50.00	167.96	170.91		170.95	0.000639	1.15	89.87	91.54	0.25
Deer Creek	Main_3	875.9	100-yr Climate C	Climate Change	59.80	167.96	171.19		171.23	0.000513	1.11	117.34	102.10	0.23
Deer Creek	Main_3	875.9	100-yr Future La	+0.3m Average&Future Landuse	50.00	167.96	170.91		170.95	0.000639	1.15	89.87	91.54	0.25
Deer Creek	Main_3	875.9	100-yr Future La	-0.3m Average&Future Landuse	50.00	167.96	170.91		170.95	0.000639	1.15	89.87	91.54	0.25
Deer Creek	Main_2	2646.3	100-yr Future La	Future Land Use	75.30	167.83	170.82		170.87	0.000534	1.28	86.03	45.50	0.25
Deer Creek	Main_2	2646.3	100-yr Climate C	Climate Change	90.20	167.83	171.10		171.15	0.000521	1.34	102.69	75.31	0.25
Deer Creek	Main_2	2646.3	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.83	170.82		170.87	0.000534	1.28	86.03	45.50	0.25
Deer Creek	Main_2	2646.3	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.83	170.82		170.87	0.000534	1.28	86.03	45.50	0.25
Deer Creek	Main_2	2555.3	100-yr Future La	Future Land Use	75.30	167.76	170.79		170.83	0.000737	1.32	88.86	70.37	0.28
Deer Creek	Main_2	2555.3	100-yr Climate C	Climate Change	90.20	167.76	171.07		171.12	0.000637	1.33	109.92	77.15	0.26
Deer Creek	Main_2	2555.3	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.76	170.79		170.83	0.000737	1.32	88.86	70.37	0.28
Deer Creek	Main_2	2555.3	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.76	170.79		170.83	0.000737	1.32	88.86	70.37	0.28
Deer Creek	Main_2	2528.1	100-yr Future La	Future Land Use	75.30	167.63	170.77		170.80	0.000519	1.08	150.73	143.58	0.23
Deer Creek	Main_2	2528.1	100-yr Climate C	Climate Change	90.20	167.63	171.06		171.09	0.000394	1.02	193.13	147.51	0.20
Deer Creek	Main_2	2528.1	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.63	170.77		170.80	0.000519	1.08	150.73	143.58	0.23
Deer Creek	Main_2	2528.1	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.63	170.77		170.80	0.000519	1.08	150.73	143.58	0.23
Deer Creek	Main_2	2489.9	100-yr Future La	Future Land Use	75.30	167.56	170.69		170.77	0.000920	1.44	80.33	60.78	0.31
Deer Creek	Main_2	2489.9	100-yr Climate C	Climate Change	90.20	167.56	170.97		171.06	0.000893	1.53	99.80	74.18	0.31
Deer Creek	Main_2	2489.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.56	170.69		170.77	0.000920	1.44	80.33	60.78	0.31
Deer Creek	Main_2	2489.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.56	170.69		170.77	0.000920	1.44	80.33	60.78	0.31
Deer Creek	Main_2	2415.5	100-yr Future La	Future Land Use	75.30	167.39	170.65		170.71	0.000515	1.27	106.27	86.36	0.24
Deer Creek	Main_2	2415.5	100-yr Climate C	Climate Change	90.20	167.39	170.93		171.00	0.000484	1.31	136.48	127.91	0.24
Deer Creek	Main_2	2415.5	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.39	170.65		170.71	0.000515	1.27	106.27	86.36	0.24
Deer Creek	Main_2	2415.5	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.39	170.65		170.71	0.000515	1.27	106.27	86.36	0.24
Deer Creek	Main_2	2317.4	100-yr Future La	Future Land Use	75.30	167.41	170.60		170.66	0.000621	1.42	142.29	119.54	0.27
Deer Creek	Main_2	2317.4	100-yr Climate C	Climate Change	90.20	167.41	170.90		170.95	0.000521	1.39	180.92	135.04	0.25
Deer Creek	Main_2	2317.4	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.41	170.60		170.66	0.000621	1.42	142.29	119.54	0.27
Deer Creek	Main_2	2317.4	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.41	170.60		170.66	0.000621	1.42	142.29	119.54	0.27
Deer Creek	Main_2	2272.2	100-yr Future La	Future Land Use	75.30	166.87	170.59		170.64	0.000299	1.08	119.30	75.22	0.19
Deer Creek	Main_2	2272.2	100-yr Climate C	Climate Change	90.20	166.87	170.89		170.93	0.000291	1.12	144.09	106.38	0.19
Deer Creek	Main_2	2272.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	166.87	170.59		170.64	0.000299	1.08	119.30	75.22	0.19
Deer Creek	Main_2	2272.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	166.87	170.59		170.64	0.000299	1.08	119.30	75.22	0.19
Deer Creek	Main_2	2261.4	100-yr Future La	Future Land Use	75.30	167.12	170.60	168.89	170.62	0.000111	0.63	115.72	81.00	0.11
Deer Creek	Main_2	2261.4	100-yr Climate C	Climate Change	90.20	167.12	170.90	169.05	170.92	0.000095	0.62	140.81	90.20	0.11
Deer Creek	Main_2	2261.4	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.12	170.60	168.89	170.62	0.000111	0.63	115.72	81.00	0.11
Deer Creek	Main_2	2261.4	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.12	170.60	168.89	170.62	0.000111	0.63	115.72	81.00	0.11
Deer Creek	Main_2	2255			Bridge									
Deer Creek	Main_2	2243.8	100-yr Future La	Future Land Use	75.30	167.50	170.53	169.38	170.55	0.000211	0.81	119.11	83.41	0.15
Deer Creek	Main_2	2243.8	100-yr Climate C	Climate Change	90.20	167.50	170.85	169.56	170.87	0.000162	0.76	146.02	88.09	0.14
Deer Creek	Main_2	2243.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.50	170.53	169.38	170.55	0.000211	0.81	119.11	83.41	0.15
Deer Creek	Main_2	2243.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.50	170.53	169.38	170.55	0.000211	0.81	119.11	83.41	0.15
Deer Creek	Main_2	2230.8	100-yr Future La	Future Land Use	75.30	167.52	170.48		170.54	0.000471	1.23	118.53	85.38	0.23
Deer Creek	Main_2	2230.8	100-yr Climate C	Climate Change	90.20	167.52	170.80		170.86	0.000410	1.23	146.25	89.48	0.22
Deer Creek	Main_2	2230.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.52	170.48		170.54	0.000471	1.23	118.53	85.38	0.23
Deer Creek	Main_2	2230.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.52	170.48		170.54	0.000471	1.23	118.53	85.38	0.23
Deer Creek	Main_2	2172.1	100-yr Future La	Future Land Use	75.30	167.36	170.47		170.51	0.000508	1.09	142.49	98.81	0.23
Deer Creek	Main_2	2172.1	100-yr Climate C	Climate Change	90.20	167.36	170.79		170.82	0.000409	1.07	175.55	116.02	0.21
Deer Creek	Main_2	2172.1	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.36	170.47		170.51	0.000508	1.09	142.49	98.81	0.23
Deer Creek	Main_2	2172.1	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.36	170.47		170.51	0.000508	1.09	142.49	98.81	0.23
Deer Creek	Main_2	2084.5	100-yr Future La	Future Land Use	75.30	167.12	170.45		170.47	0.000320	0.99	168.31	161.83	0.19
Deer Creek	Main_2	2084.5	100-yr Climate C	Climate Change	90.20	167.12	170.78		170.80	0.000193	0.83	224.55	173.35	0.15
Deer Creek	Main_2	2084.5	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.12	170.45		170.47	0.000320	0.99	168.31	161.83	0.19
Deer Creek	Main_2	2084.5	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.12	170.45		170.47	0.000320	0.99	168.31	161.83	0.19
Deer Creek	Main_2	2004.7	100-yr Future La	Future Land Use	75.30	166.94	170.35		170.43	0.000706	1.33	70.56	72.20	0.28
Deer Creek	Main_2	2004.7	100-yr Climate C	Climate Change	90.20	166.94	170.72		170.77	0.000450	1.17	101.75	94.00	0.23
Deer Creek	Main_2	2004.7	100-yr Future La	+0.3m Average&Future Landuse	75.30	166.94	170.35		170.43	0.000706	1.33	70.56	72.20	0.28
Deer Creek	Main_2	2004.7	100-yr Future La	-0.3m Average&Future Landuse	75.30	166.94	170.35		170.43	0.000706	1.33	70.56	72.20	0.28
Deer Creek	Main_2	1960.4	100-yr Future La	Future Land Use	75.30	166.85	170.37		170.40	0.000232	0.90	143.71	111.65	0.16
Deer Creek	Main_2	1960.4	100-yr Climate C	Climate Change	90.20	166.85	170.73		170.75	0.000183	0.86	188.53	141.21	0.15
Deer Creek	Main_2	1960.4	100-yr Future La	+0.3m Average&Future Landuse	75.30	166.85	170.37		170.40	0.000232	0.90	143.71	111.65	0.16
Deer Creek	Main_2	1960.4	100-yr Future La	-0.3m Average&Future Landuse	75.30	166.85	170.37		170.40	0.000232	0.90	143.71	111.65	0.16
Deer Creek	Main_2	1918.8	100-yr Future La	Future Land Use	75.30	167.30	170.34		170.38	0.000646	1.21	133.01	121.48	0.26
Deer Creek	Main_2	1918.8	100-yr Climate C	Climate Change	90.20	167.30	170.71		170.74	0.000439	1.11	182.28	141.44	0.22
Deer Creek	Main_2	1918.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.30	170.34		170.38	0.000646	1.21	133.01	121.48	0.26
Deer Creek	Main_2	1918.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.30	170.34		170.38	0.000646	1.21	133.01	121.48	0.26
Deer Creek	Main_2	1858.4	100-yr Future La	Future Land Use	75.30	167.38	170.04		170.30	0.002026	2.29	38.81	21.08	0.47
Deer Creek	Main_2	1858.4	100-yr Climate C	Climate Change	90.20	167.38	170.41		170.67	0.001757	2.34	46.80	22.51	0.45
Deer Creek	Main_2	1858.4	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.38	170.04		170.30	0.002026	2.29	38.81	21.08	0.47
Deer Creek	Main_2	1858.4	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.38	170.04		170.30	0.002026	2.29	38.81	21.08	0.47
Deer Creek	Main_2	1846.2	100-yr Future La	Future Land Use	75.30	167.31	170.04	169.02	170.25	0.001661	2.03	37.48	22.64	0.42
Deer Creek	Main_2	1846.2	100-yr Climate C	Climate Change	90.20	167.31	170.41	169.18	170.63	0.001475	2.10	43.33	26.77	0.40
Deer Creek	Main_2	1846.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.31	170.04	169.02	170.25	0.001661	2.03	37.48	22.64	0.42
Deer Creek	Main_2	1846.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.31	170.04	169.02	170.25	0.001661	2.03	37.48	22.64	0.42
Deer Creek	Main_2	1835			Bridge									
Deer Creek	Main_2	1825	100-yr Future La	Future Land Use	75.30	167.48	169.33	169.24	169.96	0.007912	3.55	23.24	25.07	0.87
Deer Creek	Main_2	1825	100-yr Climate C	Climate Change	90.20	167.48	169.60	169.45	170.24	0.006714	3.61	27.97	30.90	0.82
Deer Creek	Main_2	1825	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.48	169.33	169.24	169.96	0.007912	3.55	23.24	25.07	0.87
Deer Creek	Main_2	1825	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.48	169.33	169.24	169.96	0.007912	3.55	23.24	25.07	0.87

HEC-RAS Profile: 100-yr Future La (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)	
Deer Creek	Main_2	1812.5	100-yr Future La	Future Land Use	75.30	167.28	169.49		169.71	0.002286	2.17	42.06	28.30	0.48
Deer Creek	Main_2	1812.5	100-yr Climate C	Climate Change	90.20	167.28	169.76		169.99	0.002047	2.23	49.96	29.08	0.46
Deer Creek	Main_2	1812.5	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.28	169.49		169.71	0.002286	2.17	42.06	28.30	0.48
Deer Creek	Main_2	1812.5	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.28	169.49		169.71	0.002286	2.17	42.06	28.30	0.48
Deer Creek	Main_2	1796.2	100-yr Future La	Future Land Use	75.30	167.30	169.51	168.70	169.65	0.001571	1.73	51.58	42.81	0.40
Deer Creek	Main_2	1796.2	100-yr Climate C	Climate Change	90.20	167.30	169.80	168.86	169.93	0.001279	1.71	64.38	45.42	0.37
Deer Creek	Main_2	1796.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.30	169.51	168.70	169.65	0.001571	1.73	51.58	42.81	0.40
Deer Creek	Main_2	1796.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.30	169.51	168.70	169.65	0.001571	1.73	51.58	42.81	0.40
Deer Creek	Main_2	1794			Inl Struct									
Deer Creek	Main_2	1791.9	100-yr Future La	Future Land Use	75.30	167.07	169.30		169.62	0.005001	2.63	34.32	36.31	0.68
Deer Creek	Main_2	1791.9	100-yr Climate C	Climate Change	90.20	167.07	169.66		169.91	0.003061	2.37	48.41	40.83	0.55
Deer Creek	Main_2	1791.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.07	169.30		169.62	0.005001	2.63	34.32	36.31	0.68
Deer Creek	Main_2	1791.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.07	169.30		169.62	0.005001	2.63	34.32	36.31	0.68
Deer Creek	Main_2	1786.9	100-yr Future La	Future Land Use	75.30	167.17	169.18		169.59	0.005013	2.87	28.35	24.07	0.68
Deer Creek	Main_2	1786.9	100-yr Climate C	Climate Change	90.20	167.17	169.48		169.88	0.004049	2.86	35.69	25.17	0.63
Deer Creek	Main_2	1786.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	167.17	169.18		169.59	0.005013	2.87	28.35	24.07	0.68
Deer Creek	Main_2	1786.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	167.17	169.18		169.59	0.005013	2.87	28.35	24.07	0.68
Deer Creek	Main_2	1757.5	100-yr Future La	Future Land Use	75.30	166.49	168.51	168.51	169.32	0.010772	4.00	19.21	12.77	0.99
Deer Creek	Main_2	1757.5	100-yr Climate C	Climate Change	90.20	166.49	168.72	168.72	169.63	0.010240	4.23	22.01	13.27	0.98
Deer Creek	Main_2	1757.5	100-yr Future La	+0.3m Average&Future Landuse	75.30	166.49	168.51	168.51	169.32	0.010772	4.00	19.21	12.77	0.99
Deer Creek	Main_2	1757.5	100-yr Future La	-0.3m Average&Future Landuse	75.30	166.49	168.51	168.51	169.32	0.010772	4.00	19.21	12.77	0.99
Deer Creek	Main_2	1711.9	100-yr Future La	Future Land Use	75.30	165.60	167.27	167.27	167.96	0.011831	3.67	20.51	15.06	1.00
Deer Creek	Main_2	1711.9	100-yr Climate C	Climate Change	90.20	165.60	167.45	167.45	168.22	0.011474	3.90	23.15	15.50	1.00
Deer Creek	Main_2	1711.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	165.60	167.27	167.27	167.96	0.011831	3.67	20.51	15.06	1.00
Deer Creek	Main_2	1711.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	165.60	167.27	167.27	167.96	0.011831	3.67	20.51	15.06	1.00
Deer Creek	Main_2	1678.3	100-yr Future La	Future Land Use	75.30	164.42	166.84	166.29	167.30	0.005685	3.02	24.92	11.43	0.65
Deer Creek	Main_2	1678.3	100-yr Climate C	Climate Change	90.20	164.42	167.08	166.50	167.62	0.006007	3.26	27.66	11.45	0.67
Deer Creek	Main_2	1678.3	100-yr Future La	+0.3m Average&Future Landuse	75.30	164.42	166.84	166.29	167.30	0.005685	3.02	24.92	11.43	0.65
Deer Creek	Main_2	1678.3	100-yr Future La	-0.3m Average&Future Landuse	75.30	164.42	166.84	166.29	167.30	0.005685	3.02	24.92	11.43	0.65
Deer Creek	Main_2	1667			Bridge									
Deer Creek	Main_2	1657.4	100-yr Future La	Future Land Use	75.30	164.41	166.68	166.13	167.11	0.004191	2.89	26.10	19.03	0.63
Deer Creek	Main_2	1657.4	100-yr Climate C	Climate Change	90.20	164.41	166.56	166.32	167.25	0.007284	3.67	24.64	18.45	0.83
Deer Creek	Main_2	1657.4	100-yr Future La	+0.3m Average&Future Landuse	75.30	164.41	166.68	166.13	167.11	0.004191	2.89	26.10	19.03	0.63
Deer Creek	Main_2	1657.4	100-yr Future La	-0.3m Average&Future Landuse	75.30	164.41	166.68	166.13	167.11	0.004191	2.89	26.10	19.03	0.63
Deer Creek	Main_2	1636.3	100-yr Future La	Future Land Use	75.30	163.76	166.03	166.03	166.85	0.011844	4.02	18.83	12.55	0.99
Deer Creek	Main_2	1636.3	100-yr Climate C	Climate Change	90.20	163.76	166.59	166.59	167.06	0.004932	3.15	32.19	35.79	0.67
Deer Creek	Main_2	1636.3	100-yr Future La	+0.3m Average&Future Landuse	75.30	163.76	166.03	166.03	166.85	0.011844	4.02	18.83	12.55	0.99
Deer Creek	Main_2	1636.3	100-yr Future La	-0.3m Average&Future Landuse	75.30	163.76	166.03	166.03	166.85	0.011844	4.02	18.83	12.55	0.99
Deer Creek	Main_2	1604.9	100-yr Future La	Future Land Use	75.30	163.18	166.09		166.21	0.001310	1.88	64.03	85.70	0.37
Deer Creek	Main_2	1604.9	100-yr Climate C	Climate Change	90.20	163.18	166.20		166.32	0.001347	1.95	72.97	88.09	0.38
Deer Creek	Main_2	1604.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	163.18	166.09		166.21	0.001310	1.88	64.03	85.70	0.37
Deer Creek	Main_2	1604.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	163.18	166.09		166.21	0.001310	1.88	64.03	85.70	0.37
Deer Creek	Main_2	1600.8	100-yr Future La	Future Land Use	75.30	163.00	166.09	165.74	166.20	0.001214	1.77	66.24	79.28	0.36
Deer Creek	Main_2	1600.8	100-yr Climate C	Climate Change	90.20	163.00	166.19	165.88	166.31	0.001289	1.87	74.27	81.84	0.37
Deer Creek	Main_2	1600.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	163.00	166.09	165.74	166.20	0.001214	1.77	66.24	79.28	0.36
Deer Creek	Main_2	1600.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	163.00	166.09	165.74	166.20	0.001214	1.77	66.24	79.28	0.36
Deer Creek	Main_2	1600			Bridge									
Deer Creek	Main_2	1598.8	100-yr Future La	Future Land Use	75.30	162.84	165.81	165.81	166.12	0.003101	2.92	46.14	68.21	0.57
Deer Creek	Main_2	1598.8	100-yr Climate C	Climate Change	90.20	162.84	165.93	165.93	166.24	0.003127	3.01	54.62	74.76	0.58
Deer Creek	Main_2	1598.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	162.84	165.81	165.81	166.12	0.003101	2.92	46.14	68.21	0.57
Deer Creek	Main_2	1598.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	162.84	165.81	165.81	166.12	0.003101	2.92	46.14	68.21	0.57
Deer Creek	Main_2	1591.2	100-yr Future La	Future Land Use	75.30	162.96	165.43	165.43	165.79	0.003874	2.92	38.77	59.39	0.63
Deer Creek	Main_2	1591.2	100-yr Climate C	Climate Change	90.20	162.96	165.55	165.55	165.91	0.003935	3.05	46.18	64.52	0.64
Deer Creek	Main_2	1591.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	162.96	165.43	165.43	165.79	0.003874	2.92	38.77	59.39	0.63
Deer Creek	Main_2	1591.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	162.96	165.43	165.43	165.79	0.003874	2.92	38.77	59.39	0.63
Deer Creek	Main_2	1557.2	100-yr Future La	Future Land Use	75.30	162.51	164.80	164.76	165.05	0.003177	2.58	49.64	74.71	0.56
Deer Creek	Main_2	1557.2	100-yr Climate C	Climate Change	90.20	162.51	164.89		165.15	0.003398	2.74	56.38	75.27	0.59
Deer Creek	Main_2	1557.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	162.51	164.80	164.76	165.05	0.003177	2.58	49.64	74.71	0.56
Deer Creek	Main_2	1557.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	162.51	164.80	164.76	165.05	0.003177	2.58	49.64	74.71	0.56
Deer Creek	Main_2	1505	100-yr Future La	Future Land Use	75.30	162.24	164.91		164.94	0.000279	0.89	107.03	87.27	0.18
Deer Creek	Main_2	1505	100-yr Climate C	Climate Change	90.20	162.24	165.01		165.04	0.000325	0.98	115.15	89.42	0.19
Deer Creek	Main_2	1505	100-yr Future La	+0.3m Average&Future Landuse	75.30	162.24	164.91		164.94	0.000279	0.89	107.03	87.27	0.18
Deer Creek	Main_2	1505	100-yr Future La	-0.3m Average&Future Landuse	75.30	162.24	164.91		164.94	0.000279	0.89	107.03	87.27	0.18
Deer Creek	Main_2	1467.5	100-yr Future La	Future Land Use	75.30	162.08	164.91		164.93	0.000170	0.72	166.84	146.76	0.14
Deer Creek	Main_2	1467.5	100-yr Climate C	Climate Change	90.20	162.08	165.01		165.03	0.000195	0.78	180.60	149.55	0.15
Deer Creek	Main_2	1467.5	100-yr Future La	+0.3m Average&Future Landuse	75.30	162.08	164.91		164.93	0.000170	0.72	166.84	146.76	0.14
Deer Creek	Main_2	1467.5	100-yr Future La	-0.3m Average&Future Landuse	75.30	162.08	164.91		164.93	0.000170	0.72	166.84	146.76	0.14
Deer Creek	Main_2	1436.9	100-yr Future La	Future Land Use	75.30	161.65	164.86	163.65	164.92	0.000457	1.18	75.77	62.99	0.22
Deer Creek	Main_2	1436.9	100-yr Climate C	Climate Change	90.20	161.65	164.94	163.99	165.01	0.000551	1.32	80.77	63.35	0.25
Deer Creek	Main_2	1436.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	161.65	164.86	163.65	164.92	0.000457	1.18	75.77	62.99	0.22
Deer Creek	Main_2	1436.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	161.65	164.86	163.65	164.92	0.000457	1.18	75.77	62.99	0.22
Deer Creek	Main_2	1424	100-yr Future La	Future Land Use	75.30	161.63	164.74	163.61	164.87	0.001020	1.65	46.82	33.27	0.33
Deer Creek	Main_2	1424	100-yr Climate C	Climate Change	90.20	161.63	164.76	163.83	164.94	0.001409	1.95	47.42	33.43	0.38
Deer Creek	Main_2	1424	100-yr Future La	+0.3m Average&Future Landuse	75.30	161.63	164.74	163.61	164.87	0.001020	1.65	46.82	33.27	0.33
Deer Creek	Main_2	1424	100-yr Future La	-0.3m Average&Future Landuse	75.30	161.63	164.74	163.61	164.87	0.001020	1.65	46.82	33.27	0.33
Deer Creek	Main_2	1414			Culvert									
Deer Creek	Main_2	1403.9	100-yr Future La	Future Land Use	75.30	161.72	163.56	163.56	164.32	0.012056	3.86	19.57	13.42	1.00
Deer Creek	Main_2	1403.9	100-yr Climate C	Climate Change	90.20	161.72	164.24	164.24	164.55	0.003678	2.67	40.88	65.43	0.58
Deer Creek	Main_2	1403.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	161.72	163.56	163.56	164.32	0.012056	3.86	19.57	13.42	1.00
Deer Creek	Main_2	1403.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	161.72	163.56	163.56	164.32	0.012056	3.86	19.57	13.42	1.00

HEC-RAS Profile: 100-yr Future La (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)	
Deer Creek	Main_2	1378.7	100-yr Future La	Future Land Use	75.30	161.27	163.17	163.17	163.79	0.009483	3.59	23.14	19.87	0.93
Deer Creek	Main_2	1378.7	100-yr Climate C	Climate Change	90.20	161.27	163.34	163.34	164.03	0.009201	3.80	26.55	20.28	0.93
Deer Creek	Main_2	1378.7	100-yr Future La	+0.3m Average&Future Landuse	75.30	161.27	163.17	163.17	163.79	0.009483	3.59	23.14	19.87	0.93
Deer Creek	Main_2	1378.7	100-yr Future La	-0.3m Average&Future Landuse	75.30	161.27	163.17	163.17	163.79	0.009483	3.59	23.14	19.87	0.93
Deer Creek	Main_2	1345	100-yr Future La	Future Land Use	75.30	160.99	162.82	162.82	163.30	0.008769	3.43	36.30	49.46	0.89
Deer Creek	Main_2	1345	100-yr Climate C	Climate Change	90.20	160.99	162.89	162.89	163.49	0.010286	3.84	40.35	55.86	0.97
Deer Creek	Main_2	1345	100-yr Future La	+0.3m Average&Future Landuse	75.30	160.99	162.82	162.82	163.30	0.008769	3.43	36.30	49.46	0.89
Deer Creek	Main_2	1345	100-yr Future La	-0.3m Average&Future Landuse	75.30	160.99	162.82	162.82	163.30	0.008769	3.43	36.30	49.46	0.89
Deer Creek	Main_2	1310.4	100-yr Future La	Future Land Use	75.30	160.69	162.28	162.28	162.72	0.007975	3.18	37.32	50.07	0.85
Deer Creek	Main_2	1310.4	100-yr Climate C	Climate Change	90.20	160.69	162.54	162.42	162.91	0.005711	3.01	50.61	54.55	0.74
Deer Creek	Main_2	1310.4	100-yr Future La	+0.3m Average&Future Landuse	75.30	160.69	162.28	162.28	162.72	0.007975	3.18	37.32	50.07	0.85
Deer Creek	Main_2	1310.4	100-yr Future La	-0.3m Average&Future Landuse	75.30	160.69	162.28	162.28	162.72	0.007975	3.18	37.32	50.07	0.85
Deer Creek	Main_2	1267.8	100-yr Future La	Future Land Use	75.30	160.01	162.39		162.45	0.000660	1.20	110.67	118.31	0.26
Deer Creek	Main_2	1267.8	100-yr Climate C	Climate Change	90.20	160.01	162.71		162.75	0.000494	1.14	152.38	138.09	0.23
Deer Creek	Main_2	1267.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	160.01	162.39		162.45	0.000660	1.20	110.67	118.31	0.26
Deer Creek	Main_2	1267.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	160.01	162.39		162.45	0.000660	1.20	110.67	118.31	0.26
Deer Creek	Main_2	1247.7	100-yr Future La	Future Land Use	75.30	159.82	162.42		162.43	0.000107	0.52	243.28	170.69	0.11
Deer Creek	Main_2	1247.7	100-yr Climate C	Climate Change	90.20	159.82	162.73		162.74	0.000089	0.51	297.09	173.53	0.10
Deer Creek	Main_2	1247.7	100-yr Future La	+0.3m Average&Future Landuse	75.30	159.82	162.42		162.43	0.000107	0.52	243.28	170.69	0.11
Deer Creek	Main_2	1247.7	100-yr Future La	-0.3m Average&Future Landuse	75.30	159.82	162.42		162.43	0.000107	0.52	243.28	170.69	0.11
Deer Creek	Main_2	1226.6	100-yr Future La	Future Land Use	75.30	159.58	162.40		162.42	0.000274	0.86	164.07	137.89	0.17
Deer Creek	Main_2	1226.6	100-yr Climate C	Climate Change	90.20	159.58	162.72		162.73	0.000204	0.80	208.30	141.24	0.15
Deer Creek	Main_2	1226.6	100-yr Future La	+0.3m Average&Future Landuse	75.30	159.58	162.40		162.42	0.000274	0.86	164.07	137.89	0.17
Deer Creek	Main_2	1226.6	100-yr Future La	-0.3m Average&Future Landuse	75.30	159.58	162.40		162.42	0.000274	0.86	164.07	137.89	0.17
Deer Creek	Main_2	1200.8	100-yr Future La	Future Land Use	75.30	159.44	162.39		162.41	0.000282	0.91	152.58	105.63	0.18
Deer Creek	Main_2	1200.8	100-yr Climate C	Climate Change	90.20	159.44	162.71		162.73	0.000230	0.89	186.40	107.48	0.16
Deer Creek	Main_2	1200.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	159.44	162.39		162.41	0.000282	0.91	152.58	105.63	0.18
Deer Creek	Main_2	1200.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	159.44	162.39		162.41	0.000282	0.91	152.58	105.63	0.18
Deer Creek	Main_2	1172.2	100-yr Future La	Future Land Use	75.30	159.40	162.39		162.40	0.000125	0.62	195.13	104.98	0.12
Deer Creek	Main_2	1172.2	100-yr Climate C	Climate Change	90.20	159.40	162.71		162.72	0.000112	0.63	228.54	106.82	0.11
Deer Creek	Main_2	1172.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	159.40	162.39		162.40	0.000125	0.62	195.13	104.98	0.12
Deer Creek	Main_2	1172.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	159.40	162.39		162.40	0.000125	0.62	195.13	104.98	0.12
Deer Creek	Main_2	1152.2	100-yr Future La	Future Land Use	75.30	159.39	162.11		162.37	0.002129	2.37	36.87	22.40	0.48
Deer Creek	Main_2	1152.2	100-yr Climate C	Climate Change	90.20	159.39	162.41		162.69	0.001947	2.45	43.84	23.19	0.46
Deer Creek	Main_2	1152.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	159.39	162.11		162.37	0.002129	2.37	36.87	22.40	0.48
Deer Creek	Main_2	1152.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	159.39	162.11		162.37	0.002129	2.37	36.87	22.40	0.48
Deer Creek	Main_2	1136.2	100-yr Future La	Future Land Use	75.30	158.48	162.26	160.04	162.29	0.000217	0.89	129.91	101.98	0.16
Deer Creek	Main_2	1136.2	100-yr Climate C	Climate Change	90.20	158.48	162.58	160.20	162.61	0.000187	0.88	163.37	108.63	0.15
Deer Creek	Main_2	1136.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.48	162.26	160.04	162.29	0.000217	0.89	129.91	101.98	0.16
Deer Creek	Main_2	1136.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.48	162.26	160.04	162.29	0.000217	0.89	129.91	101.98	0.16
Deer Creek	Main_2	1107	100-yr Future La	Future Land Use	75.30	159.30	162.22	160.74	162.28	0.000511	1.21	79.14	49.33	0.24
Deer Creek	Main_2	1107	100-yr Climate C	Climate Change	90.20	159.30	162.53	160.89	162.59	0.000456	1.23	94.93	51.10	0.23
Deer Creek	Main_2	1107	100-yr Future La	+0.3m Average&Future Landuse	75.30	159.30	162.22	160.74	162.28	0.000511	1.21	79.14	49.33	0.24
Deer Creek	Main_2	1107	100-yr Future La	-0.3m Average&Future Landuse	75.30	159.30	162.22	160.74	162.28	0.000511	1.21	79.14	49.33	0.24
Deer Creek	Main_2	1070.6	100-yr Future La	Future Land Use	75.30	158.88	162.06	160.80	162.24	0.001294	1.98	49.59	41.01	0.37
Deer Creek	Main_2	1070.6	100-yr Climate C	Climate Change	90.20	158.88	162.40	161.02	162.56	0.001093	1.96	63.69	43.39	0.35
Deer Creek	Main_2	1070.6	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.88	162.06	160.80	162.24	0.001294	1.98	49.59	41.01	0.37
Deer Creek	Main_2	1070.6	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.88	162.06	160.80	162.24	0.001294	1.98	49.59	41.01	0.37
Deer Creek	Main_2	1049.4	100-yr Future La	Future Land Use	75.30	158.72	162.03	160.72	162.21	0.001212	2.08	47.75	29.45	0.37
Deer Creek	Main_2	1049.4	100-yr Climate C	Climate Change	90.20	158.72	162.34	160.95	162.53	0.001164	2.17	60.07	44.49	0.37
Deer Creek	Main_2	1049.4	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.72	162.03	160.72	162.21	0.001212	2.08	47.75	29.45	0.37
Deer Creek	Main_2	1049.4	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.72	162.03	160.72	162.21	0.001212	2.08	47.75	29.45	0.37
Deer Creek	Main_2	1030.9	100-yr Future La	Future Land Use	75.30	158.80	162.02	160.61	162.19	0.001215	1.92	46.66	24.09	0.35
Deer Creek	Main_2	1030.9	100-yr Climate C	Climate Change	90.20	158.80	162.32	160.82	162.51	0.001201	2.03	54.35	26.07	0.35
Deer Creek	Main_2	1030.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.80	162.02	160.61	162.19	0.001215	1.92	46.66	24.09	0.35
Deer Creek	Main_2	1030.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.80	162.02	160.61	162.19	0.001215	1.92	46.66	24.09	0.35
Deer Creek	Main_2	1015	100-yr Future La	Future Land Use	75.30	158.63	162.01	160.52	162.16	0.000714	1.57	45.13	30.62	0.28
Deer Creek	Main_2	1015	100-yr Climate C	Climate Change	90.20	158.63	162.31	160.72	162.49	0.000707	1.66	50.22	95.53	0.29
Deer Creek	Main_2	1015	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.63	162.01	160.52	162.16	0.000714	1.57	45.13	30.62	0.28
Deer Creek	Main_2	1015	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.63	162.01	160.52	162.16	0.000714	1.57	45.13	30.62	0.28
Deer Creek	Main_2	1007			Bridge									
Deer Creek	Main_2	997.8	100-yr Future La	Future Land Use	75.30	158.61	161.74	160.75	161.98	0.001564	2.14	34.59	15.63	0.40
Deer Creek	Main_2	997.8	100-yr Climate C	Climate Change	90.20	158.61	161.98	160.94	162.27	0.001609	2.29	38.35	15.72	0.42
Deer Creek	Main_2	997.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.61	161.74	160.75	161.98	0.001564	2.14	34.59	15.63	0.40
Deer Creek	Main_2	997.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.61	161.74	160.75	161.98	0.001564	2.14	34.59	15.63	0.40
Deer Creek	Main_2	997	100-yr Future La	Future Land Use	75.30	158.45	161.47		161.90	0.003485	3.05	29.17	16.17	0.60
Deer Creek	Main_2	997	100-yr Climate C	Climate Change	90.20	158.45	161.65	161.09	162.17	0.003910	3.37	32.06	16.69	0.64
Deer Creek	Main_2	997	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.45	161.47		161.90	0.003485	3.05	29.17	16.17	0.60
Deer Creek	Main_2	997	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.45	161.47		161.90	0.003485	3.05	29.17	16.17	0.60
Deer Creek	Main_2	995	100-yr Future La	Future Land Use	75.30	158.47	161.02	161.02	161.71	0.008446	3.85	26.26	23.38	0.89
Deer Creek	Main_2	995	100-yr Climate C	Climate Change	90.20	158.47	161.21	161.21	161.97	0.008379	4.08	30.77	24.42	0.90
Deer Creek	Main_2	995	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.47	161.02	161.02	161.71	0.008446	3.85	26.26	23.38	0.89
Deer Creek	Main_2	995	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.47	161.02	161.02	161.71	0.008446	3.85	26.26	23.38	0.89
Deer Creek	Main_2	991.6	100-yr Future La	Future Land Use	75.30	158.46	161.20	160.42	161.25	0.000737	1.26	120.88	109.42	0.28
Deer Creek	Main_2	991.6	100-yr Climate C	Climate Change	90.20	158.46	161.46	160.55	161.50	0.000611	1.24	151.27	122.77	0.26
Deer Creek	Main_2	991.6	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.46	161.20	160.42	161.25	0.000737	1.26	120.88	109.42	0.28
Deer Creek	Main_2	991.6	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.46	161.20	160.42	161.25	0.000737	1.26	120.88	109.42	0.28
Deer Creek	Main_2	986.4	100-yr Future La	Future Land Use	75.30	158.15	160.37	160.37	161.06	0.011157	3.69	20.95	16.65	0.98
Deer Creek	Main_2	986.4	100-yr Climate C	Climate Change	90.20	158.15	160.55	160.55	161.32	0.010628	3.90	24.11	17.81	0.98
Deer Creek	Main_2	986.4	100-yr Future La	+0.3m Average&Future Landuse	75.30	158.15	160.37	160.37	161.06	0.011157	3.69	20.95	16.65	0.98
Deer Creek	Main_2	986.4	100-yr Future La	-0.3m Average&Future Landuse	75.30	158.15	160.37	160.37	161.06	0.011157	3.69	20.95	16.65	0.98
Deer Creek	Main_2	983*	100-yr Future La	Future Land Use	75.30	157.93	160.20	160.20	160.83	0.009687	3.56	23.52	29.25	0.93

HEC-RAS Profile: 100-yr Future La (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)	
Deer Creek	Main_2	983*	100-yr Climate C	Climate Change	90.20	157.93	160.40	160.40	161.05	0.008712	3.67	29.92	34.33	0.90
Deer Creek	Main_2	983*	100-yr Future La	+0.3m Average&Future Landuse	75.30	157.93	160.20	160.20	160.83	0.009687	3.56	23.52	29.25	0.93
Deer Creek	Main_2	983*	100-yr Future La	-0.3m Average&Future Landuse	75.30	157.93	160.20	160.20	160.83	0.009687	3.56	23.52	29.25	0.93
Deer Creek	Main_2	982*	100-yr Future La	Future Land Use	75.30	157.71	159.97	159.97	160.59	0.009748	3.58	24.60	22.76	0.94
Deer Creek	Main_2	982*	100-yr Climate C	Climate Change	90.20	157.71	160.14	160.14	160.83	0.009424	3.79	28.84	25.74	0.94
Deer Creek	Main_2	982*	100-yr Future La	+0.3m Average&Future Landuse	75.30	157.71	159.97	159.97	160.59	0.009748	3.58	24.60	22.76	0.94
Deer Creek	Main_2	982*	100-yr Future La	-0.3m Average&Future Landuse	75.30	157.71	159.97	159.97	160.59	0.009748	3.58	24.60	22.76	0.94
Deer Creek	Main_2	981*	100-yr Future La	Future Land Use	75.30	157.49	159.71	159.71	160.26	0.009697	3.49	28.99	28.94	0.93
Deer Creek	Main_2	981*	100-yr Climate C	Climate Change	90.20	157.49	159.87	159.87	160.47	0.009441	3.69	33.57	30.19	0.93
Deer Creek	Main_2	981*	100-yr Future La	+0.3m Average&Future Landuse	75.30	157.49	159.71	159.71	160.26	0.009697	3.49	28.99	28.94	0.93
Deer Creek	Main_2	981*	100-yr Future La	-0.3m Average&Future Landuse	75.30	157.49	159.71	159.71	160.26	0.009697	3.49	28.99	28.94	0.93
Deer Creek	Main_2	980.6	100-yr Future La	Future Land Use	75.30	157.27	159.28	159.28	159.80	0.013602	3.65	30.13	30.40	1.07
Deer Creek	Main_2	980.6	100-yr Climate C	Climate Change	90.20	157.27	159.41	159.41	160.00	0.013593	3.91	34.15	31.85	1.09
Deer Creek	Main_2	980.6	100-yr Future La	+0.3m Average&Future Landuse	75.30	157.27	159.28	159.28	159.80	0.013602	3.65	30.13	30.40	1.07
Deer Creek	Main_2	980.6	100-yr Future La	-0.3m Average&Future Landuse	75.30	157.27	159.28	159.28	159.80	0.013602	3.65	30.13	30.40	1.07
Deer Creek	Main_2	977.6	100-yr Future La	Future Land Use	75.30	156.95	158.72	158.56	159.03	0.009262	3.02	37.79	54.42	0.89
Deer Creek	Main_2	977.6	100-yr Climate C	Climate Change	90.20	156.95	158.87		159.16	0.007639	2.98	46.40	57.67	0.82
Deer Creek	Main_2	977.6	100-yr Future La	+0.3m Average&Future Landuse	75.30	156.95	158.72	158.56	159.03	0.009269	3.03	37.78	54.42	0.89
Deer Creek	Main_2	977.6	100-yr Future La	-0.3m Average&Future Landuse	75.30	156.95	158.72	158.56	159.03	0.009271	3.03	37.78	54.42	0.89
Deer Creek	Main_2	974.6	100-yr Future La	Future Land Use	75.30	156.73	158.55	158.22	158.76	0.003657	2.36	42.07	37.23	0.59
Deer Creek	Main_2	974.6	100-yr Climate C	Climate Change	90.20	156.73	158.67	158.33	158.92	0.003982	2.58	46.64	40.42	0.62
Deer Creek	Main_2	974.6	100-yr Future La	+0.3m Average&Future Landuse	75.30	156.73	158.55	158.22	158.76	0.003660	2.36	42.06	37.22	0.59
Deer Creek	Main_2	974.6	100-yr Future La	-0.3m Average&Future Landuse	75.30	156.73	158.55	158.22	158.76	0.003662	2.36	42.06	37.22	0.59
Deer Creek	Main_2	968.4	100-yr Future La	Future Land Use	75.30	156.30	158.45		158.54	0.001545	1.82	66.13	49.29	0.40
Deer Creek	Main_2	968.4	100-yr Climate C	Climate Change	90.20	156.30	158.55		158.67	0.001791	2.02	71.42	50.55	0.44
Deer Creek	Main_2	968.4	100-yr Future La	+0.3m Average&Future Landuse	75.30	156.30	158.45		158.54	0.001546	1.82	66.11	49.29	0.40
Deer Creek	Main_2	968.4	100-yr Future La	-0.3m Average&Future Landuse	75.30	156.30	158.45		158.54	0.001547	1.82	66.10	49.28	0.40
Deer Creek	Main_2	950.7	100-yr Future La	Future Land Use	75.30	155.90	158.14		158.22	0.001380	1.73	78.95	62.35	0.38
Deer Creek	Main_2	950.7	100-yr Climate C	Climate Change	90.20	155.90	158.13		158.26	0.001998	2.08	78.68	62.19	0.46
Deer Creek	Main_2	950.7	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.90	158.14		158.22	0.001383	1.74	78.88	62.31	0.38
Deer Creek	Main_2	950.7	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.90	158.14		158.22	0.001385	1.74	78.85	62.29	0.38
Deer Creek	Main_2	939.8	100-yr Future La	Future Land Use	75.30	155.45	158.02		158.04	0.000366	0.98	148.06	106.32	0.20
Deer Creek	Main_2	939.8	100-yr Climate C	Climate Change	90.20	155.45	157.93		157.96	0.000634	1.26	138.53	104.28	0.26
Deer Creek	Main_2	939.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.45	158.02		158.04	0.000367	0.98	147.91	106.29	0.20
Deer Creek	Main_2	939.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.45	158.02		158.04	0.000367	0.98	147.84	106.27	0.20
Deer Creek	Main_2	828.7	100-yr Future La	Future Land Use	75.30	155.47	157.83		157.88	0.000740	1.34	112.25	76.02	0.28
Deer Creek	Main_2	828.7	100-yr Climate C	Climate Change	90.20	155.47	157.51		157.64	0.002034	2.01	88.29	73.10	0.46
Deer Creek	Main_2	828.7	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.47	157.83		157.88	0.000743	1.34	112.09	75.99	0.28
Deer Creek	Main_2	828.7	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.47	157.83		157.88	0.000745	1.34	112.02	75.98	0.28
Deer Creek	Main_2	720.9	100-yr Future La	Future Land Use	75.30	155.35	157.42	156.99	157.71	0.003539	2.64	36.85	27.11	0.60
Deer Creek	Main_2	720.9	100-yr Climate C	Climate Change	90.20	155.35	157.56	157.16	157.56	0.000140	0.55	320.75	180.26	0.12
Deer Creek	Main_2	720.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.35	157.41	156.99	157.71	0.003573	2.65	36.72	27.05	0.61
Deer Creek	Main_2	720.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.35	157.41	156.99	157.70	0.003588	2.65	36.67	27.03	0.61
Deer Creek	Main_2	630.2	100-yr Future La	Future Land Use	75.30	155.27	157.33	156.76	157.44	0.001636	1.76	63.12	52.35	0.41
Deer Creek	Main_2	630.2	100-yr Climate C	Climate Change	90.20	155.27	157.37	156.87	157.52	0.002193	2.07	64.87	53.19	0.47
Deer Creek	Main_2	630.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.27	157.33	156.76	157.44	0.001664	1.77	62.73	52.26	0.41
Deer Creek	Main_2	630.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.27	157.32	156.76	157.43	0.001677	1.78	62.56	52.22	0.41
Deer Creek	Main_2	529.5	100-yr Future La	Future Land Use	75.30	155.32	157.21	156.61	157.28	0.001498	1.60	77.37	68.69	0.38
Deer Creek	Main_2	529.5	100-yr Climate C	Climate Change	90.20	155.32	157.17	156.73	157.28	0.002359	1.98	74.96	68.27	0.48
Deer Creek	Main_2	529.5	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.32	157.19	156.61	157.27	0.001543	1.62	76.60	68.55	0.39
Deer Creek	Main_2	529.5	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.32	157.19	156.61	157.26	0.001563	1.63	76.26	68.49	0.39
Deer Creek	Main_2	441.8	100-yr Future La	Future Land Use	75.30	155.34	157.24	155.90	157.24	0.000045	0.27	446.04	321.71	0.07
Deer Creek	Main_2	441.8	100-yr Climate C	Climate Change	90.20	155.34	157.22	155.95	157.23	0.000068	0.33	440.83	321.41	0.08
Deer Creek	Main_2	441.8	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.34	157.23	155.90	157.23	0.000047	0.27	442.66	321.51	0.07
Deer Creek	Main_2	441.8	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.34	157.23	155.90	157.23	0.000047	0.27	441.18	321.43	0.07
Deer Creek	Main_2	382.3	100-yr Future La	Future Land Use	75.30	155.25	157.24	156.32	157.24	0.000032	0.22	548.33	356.56	0.05
Deer Creek	Main_2	382.3	100-yr Climate C	Climate Change	90.20	155.25	157.22	156.32	157.22	0.000047	0.27	542.23	356.14	0.07
Deer Creek	Main_2	382.3	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.25	157.23	156.32	157.23	0.000032	0.22	544.56	356.30	0.05
Deer Creek	Main_2	382.3	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.25	157.22	156.32	157.22	0.000033	0.22	542.92	356.19	0.05
Deer Creek	Main_2	322.5	100-yr Future La	Future Land Use	75.30	155.18	157.24	156.69	157.24	0.000021	0.20	529.47	309.10	0.05
Deer Creek	Main_2	322.5	100-yr Climate C	Climate Change	90.20	155.18	156.77	156.77	157.17	0.010491	3.70	40.21	48.45	0.98
Deer Creek	Main_2	322.5	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.18	157.23	156.69	157.23	0.000021	0.20	526.19	308.53	0.05
Deer Creek	Main_2	322.5	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.18	157.22	156.69	157.22	0.000021	0.20	524.77	308.29	0.05
Deer Creek	Main_2	219.2	100-yr Future La	Future Land Use	75.30	155.20	156.59	156.58	156.89	0.008320	3.11	40.13	56.47	0.86
Deer Creek	Main_2	219.2	100-yr Climate C	Climate Change	90.20	155.20	156.67	156.67	157.01	0.008703	3.31	45.01	57.38	0.89
Deer Creek	Main_2	219.2	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.20	156.61	156.58	156.90	0.007797	3.03	41.09	56.62	0.84
Deer Creek	Main_2	219.2	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.20	156.61	156.58	156.90	0.007556	3.00	41.56	56.70	0.83
Deer Creek	Main_2	136.9	100-yr Future La	Future Land Use	75.30	155.16	156.33	156.14	156.42	0.004132	1.94	67.14	98.93	0.59
Deer Creek	Main_2	136.9	100-yr Climate C	Climate Change	90.20	155.16	156.38	156.19	156.49	0.004929	2.18	71.37	99.57	0.65
Deer Creek	Main_2	136.9	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.16	156.54	156.14	156.59	0.001839	1.46	87.90	102.73	0.41
Deer Creek	Main_2	136.9	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.16	156.27	156.14	156.38	0.005693	2.19	60.43	98.36	0.69
Deer Creek	Main_2	25	100-yr Future La	Future Land Use	75.30	155.18	156.28	155.77	156.29	0.000649	0.73	179.63	250.78	0.23
Deer Creek	Main_2	25	100-yr Climate C	Climate Change	90.20	155.18	156.31	155.80	156.32	0.000828	0.84	186.93	251.34	0.26
Deer Creek	Main_2	25	100-yr Future La	+0.3m Average&Future Landuse	75.30	155.18	156.53	155.77	156.53	0.000247	0.52	242.42	253.75	0.15
Deer Creek	Main_2	25	100-yr Future La	-0.3m Average&Future Landuse	75.30	155.18	156.13	155.77	156.14	0.001400	0.96	141.63	245.82	0.33
Deer Creek	Main_1	430	100-yr Future La	Future Land Use	75.60	155.09	156.23	155.72	156.25	0.000729	0.79	159.27	203.73	0.25
Deer Creek	Main_1	430	100-yr Climate C	Climate Change	90.70	155.09	156.25	155.76	156.27	0.000989	0.93	162.20	203.87	0.29
Deer Creek	Main_1	430	100-yr Future La	+0.3m Average&Future Landuse	75.60	155.09	156.51	155.72	156.52	0.000273	0.57	217.26	227.11	0.16
Deer Creek	Main_1	430	100-yr Future La	-0.3m Average&Future Landuse	75.60	155.09	156.01	155.72	156.04	0.002103	1.15	114.79	201.16	0.40
Deer Creek	Main_1	381.6	100-yr Future La	Future Land Use	75.60	155.02	156.22	155.48	156.23	0.000224	0.45	259.42	280.39	0.14
Deer Creek	Main_1	381.6	100-yr Climate C	Climate Change	90.70	155.02	156.23	155.51	156.24	0.000312	0.54	262.29	281.03	0.16
Deer Creek	Main_1	381.6	100-yr Future La	+0.3m Average&Future Landuse	75.60	155.02	156.51	155.48	156.51	0.000095	0.34	339.96	289.95	0.09
Deer Creek	Main_1	381.6	100-yr Future La	-0.3m Average&Future Landuse	75.60	155.02	155.98	155.48	155.99	0.000598	0.63	191.77	276.26	0.22

HEC-RAS Profile: 100-yr Future La (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)	
Deer Creek	Main_1	329.7	100-yr Future La	Future Land Use	75.60	154.93	156.22		156.22	0.000099	0.33	378.56	384.62	0.09
Deer Creek	Main_1	329.7	100-yr Climate C	Climate Change	90.70	154.93	156.23		156.23	0.000139	0.39	381.86	385.04	0.11
Deer Creek	Main_1	329.7	100-yr Future La	+0.3m Average&Future Landuse	75.60	154.93	156.51		156.51	0.000043	0.25	489.11	389.15	0.06
Deer Creek	Main_1	329.7	100-yr Future La	-0.3m Average&Future Landuse	75.60	154.93	155.97		155.97	0.000255	0.45	282.85	379.18	0.14
Deer Creek	Main_1	286.2	100-yr Future La	Future Land Use	75.60	154.83	156.22		156.22	0.000071	0.29	420.76	388.51	0.08
Deer Creek	Main_1	286.2	100-yr Climate C	Climate Change	90.70	154.83	156.22		156.23	0.000099	0.35	423.52	388.59	0.10
Deer Creek	Main_1	286.2	100-yr Future La	+0.3m Average&Future Landuse	75.60	154.83	156.50		156.50	0.000033	0.22	532.99	392.42	0.06
Deer Creek	Main_1	286.2	100-yr Future La	-0.3m Average&Future Landuse	75.60	154.83	155.96		155.96	0.000168	0.39	321.92	382.26	0.12
Deer Creek	Main_1	151	100-yr Future La	Future Land Use	75.60	154.62	156.21		156.21	0.000060	0.28	451.03	407.43	0.07
Deer Creek	Main_1	151	100-yr Climate C	Climate Change	90.70	154.62	156.22		156.22	0.000085	0.33	453.48	407.61	0.09
Deer Creek	Main_1	151	100-yr Future La	+0.3m Average&Future Landuse	75.60	154.62	156.50		156.50	0.000028	0.22	569.92	420.83	0.05
Deer Creek	Main_1	151	100-yr Future La	-0.3m Average&Future Landuse	75.60	154.62	155.95		155.96	0.000143	0.38	345.74	402.84	0.11
Deer Creek	Main_1	128.3	100-yr Future La	Future Land Use	75.60	153.58	156.21		156.21	0.000043	0.29	549.21	531.70	0.06
Deer Creek	Main_1	128.3	100-yr Climate C	Climate Change	90.70	153.58	156.22		156.22	0.000061	0.34	552.21	531.78	0.08
Deer Creek	Main_1	128.3	100-yr Future La	+0.3m Average&Future Landuse	75.60	153.58	156.50		156.50	0.000020	0.21	705.43	553.65	0.04
Deer Creek	Main_1	128.3	100-yr Future La	-0.3m Average&Future Landuse	75.60	153.58	155.95		155.95	0.000107	0.41	411.17	520.92	0.10
Deer Creek	Main_1	103.6	100-yr Future La	Future Land Use	75.60	152.74	156.20	155.14	156.21	0.000082	0.46	355.91	334.69	0.09
Deer Creek	Main_1	103.6	100-yr Climate C	Climate Change	90.70	152.74	156.21	155.41	156.21	0.000117	0.55	356.59	334.85	0.11
Deer Creek	Main_1	103.6	100-yr Future La	+0.3m Average&Future Landuse	75.60	152.74	156.50	155.14	156.50	0.000005	0.12	1297.89	1007.90	0.02
Deer Creek	Main_1	103.6	100-yr Future La	-0.3m Average&Future Landuse	75.60	152.74	155.93	155.14	155.94	0.000191	0.65	267.43	317.00	0.14
Deer Creek	Main_1	102			Bridge									
Deer Creek	Main_1	91.7	100-yr Future La	Future Land Use	75.60	153.53	156.20	155.21	156.20	0.000012	0.17	869.79	668.56	0.04
Deer Creek	Main_1	91.7	100-yr Climate C	Climate Change	90.70	153.53	156.20	155.32	156.20	0.000017	0.20	870.32	668.59	0.04
Deer Creek	Main_1	91.7	100-yr Future La	+0.3m Average&Future Landuse	75.60	153.53	156.50	155.21	156.50	0.000006	0.13	1072.36	684.39	0.03
Deer Creek	Main_1	91.7	100-yr Future La	-0.3m Average&Future Landuse	75.60	153.53	155.90	155.21	155.90	0.000032	0.26	595.92	547.05	0.06
Deer Creek	Main_1	81.5	100-yr Future La	Future Land Use	75.60	153.63	156.20	154.98	156.20	0.000011	0.16	866.30	653.46	0.03
Deer Creek	Main_1	81.5	100-yr Climate C	Climate Change	90.70	153.63	156.20	155.01	156.20	0.000016	0.20	866.79	653.52	0.04
Deer Creek	Main_1	81.5	100-yr Future La	+0.3m Average&Future Landuse	75.60	153.63	156.50	154.98	156.50	0.000005	0.12	1189.60	825.40	0.02
Deer Creek	Main_1	81.5	100-yr Future La	-0.3m Average&Future Landuse	75.60	153.63	155.90	154.98	155.90	0.000026	0.22	674.09	637.26	0.05
Deer Creek	Main_1	52.5	100-yr Future La	Future Land Use	75.60	154.70	156.20	154.96	156.20	0.000012	0.13	799.13	615.67	0.03
Deer Creek	Main_1	52.5	100-yr Climate C	Climate Change	90.70	154.70	156.20	154.99	156.20	0.000018	0.15	799.39	615.67	0.04
Deer Creek	Main_1	52.5	100-yr Future La	+0.3m Average&Future Landuse	75.60	154.70	156.50	154.96	156.50	0.000006	0.10	985.00	627.88	0.02
Deer Creek	Main_1	52.5	100-yr Future La	-0.3m Average&Future Landuse	75.60	154.70	155.90	154.96	155.90	0.000030	0.17	615.73	611.54	0.05
Deer Creek	Main_1	1	100-yr Future La	Future Land Use	75.60	154.74	156.20	154.96	156.20	0.000021	0.16	622.52	465.84	0.04
Deer Creek	Main_1	1	100-yr Climate C	Climate Change	90.70	154.74	156.20	154.98	156.20	0.000030	0.20	622.52	465.84	0.05
Deer Creek	Main_1	1	100-yr Future La	+0.3m Average&Future Landuse	75.60	154.74	156.50	154.96	156.50	0.000011	0.13	763.04	471.27	0.03
Deer Creek	Main_1	1	100-yr Future La	-0.3m Average&Future Landuse	75.60	154.74	155.90	154.96	155.90	0.000047	0.21	483.41	460.81	0.06
Deer Ck Trib_2	Main_Trib_2	1548.8	100-yr Future La	Future Land Use	24.15	170.31	171.57		171.58	0.000258	0.48	81.90	89.79	0.15
Deer Ck Trib_2	Main_Trib_2	1548.8	100-yr Climate C	Climate Change	28.89	170.31	171.83		171.84	0.000172	0.45	105.91	96.11	0.12
Deer Ck Trib_2	Main_Trib_2	1548.8	100-yr Future La	+0.3m Average&Future Landuse	24.15	170.31	171.57		171.58	0.000258	0.48	81.90	89.79	0.15
Deer Ck Trib_2	Main_Trib_2	1548.8	100-yr Future La	-0.3m Average&Future Landuse	24.15	170.31	171.57		171.58	0.000258	0.48	81.90	89.79	0.15
Deer Ck Trib_2	Main_Trib_2	1483.9	100-yr Future La	Future Land Use	24.15	170.25	171.55		171.56	0.000433	0.66	74.99	73.57	0.19
Deer Ck Trib_2	Main_Trib_2	1483.9	100-yr Climate C	Climate Change	28.89	170.25	171.82		171.82	0.000302	0.63	94.87	76.61	0.17
Deer Ck Trib_2	Main_Trib_2	1483.9	100-yr Future La	+0.3m Average&Future Landuse	24.15	170.25	171.55		171.56	0.000433	0.66	74.99	73.57	0.19
Deer Ck Trib_2	Main_Trib_2	1483.9	100-yr Future La	-0.3m Average&Future Landuse	24.15	170.25	171.55		171.56	0.000433	0.66	74.99	73.57	0.19
Deer Ck Trib_2	Main_Trib_2	1393.9	100-yr Future La	Future Land Use	24.15	170.10	171.53		171.53	0.000224	0.51	98.59	117.39	0.14
Deer Ck Trib_2	Main_Trib_2	1393.9	100-yr Climate C	Climate Change	28.89	170.10	171.80		171.81	0.000153	0.48	133.66	135.32	0.12
Deer Ck Trib_2	Main_Trib_2	1393.9	100-yr Future La	+0.3m Average&Future Landuse	24.15	170.10	171.53		171.53	0.000224	0.51	98.59	117.39	0.14
Deer Ck Trib_2	Main_Trib_2	1393.9	100-yr Future La	-0.3m Average&Future Landuse	24.15	170.10	171.53		171.53	0.000224	0.51	98.59	117.39	0.14
Deer Ck Trib_2	Main_Trib_2	1261.3	100-yr Future La	Future Land Use	24.15	169.89	171.51		171.51	0.000142	0.44	147.43	195.17	0.12
Deer Ck Trib_2	Main_Trib_2	1261.3	100-yr Climate C	Climate Change	28.89	169.89	171.79		171.79	0.000090	0.39	205.11	216.02	0.09
Deer Ck Trib_2	Main_Trib_2	1261.3	100-yr Future La	+0.3m Average&Future Landuse	24.15	169.89	171.51		171.51	0.000142	0.44	147.43	195.17	0.12
Deer Ck Trib_2	Main_Trib_2	1261.3	100-yr Future La	-0.3m Average&Future Landuse	24.15	169.89	171.51		171.51	0.000142	0.44	147.43	195.17	0.12
Deer Ck Trib_2	Main_Trib_2	1160.2	100-yr Future La	Future Land Use	24.15	169.79	171.51		171.51	0.000029	0.20	297.72	238.11	0.05
Deer Ck Trib_2	Main_Trib_2	1160.2	100-yr Climate C	Climate Change	28.89	169.79	171.79		171.79	0.000022	0.20	365.05	242.41	0.05
Deer Ck Trib_2	Main_Trib_2	1160.2	100-yr Future La	+0.3m Average&Future Landuse	24.15	169.79	171.51		171.51	0.000029	0.20	297.72	238.11	0.05
Deer Ck Trib_2	Main_Trib_2	1160.2	100-yr Future La	-0.3m Average&Future Landuse	24.15	169.79	171.51		171.51	0.000029	0.20	297.72	238.11	0.05
Deer Ck Trib_2	Main_Trib_2	997.7	100-yr Future La	Future Land Use	24.15	168.73	171.51		171.51	0.000014	0.17	368.34	243.74	0.03
Deer Ck Trib_2	Main_Trib_2	997.7	100-yr Climate C	Climate Change	28.89	168.73	171.79		171.79	0.000012	0.17	438.22	254.25	0.03
Deer Ck Trib_2	Main_Trib_2	997.7	100-yr Future La	+0.3m Average&Future Landuse	24.15	168.73	171.51		171.51	0.000014	0.17	368.34	243.74	0.03
Deer Ck Trib_2	Main_Trib_2	997.7	100-yr Future La	-0.3m Average&Future Landuse	24.15	168.73	171.51		171.51	0.000014	0.17	368.34	243.74	0.03
Deer CK Trib_1	Main_Trib_1	1671.1	100-yr Future La	Future Land Use	1.27	156.56	156.67		156.68	0.016370	0.57	2.89	29.08	0.73
Deer CK Trib_1	Main_Trib_1	1671.1	100-yr Climate C	Climate Change	1.52	156.56	156.68		156.70	0.017548	0.63	3.19	30.52	0.77
Deer CK Trib_1	Main_Trib_1	1671.1	100-yr Future La	+0.3m Average&Future Landuse	1.27	156.56	156.61	156.61	156.65	0.137276	1.10	1.42	19.93	1.92
Deer CK Trib_1	Main_Trib_1	1671.1	100-yr Future La	-0.3m Average&Future Landuse	1.27	156.56	156.63	156.61	156.66	0.059892	0.88	1.86	21.92	1.33
Deer CK Trib_1	Main_Trib_1	1639.5	100-yr Future La	Future Land Use	1.27	156.22	156.43		156.43	0.003969	0.41	4.14	31.07	0.37
Deer CK Trib_1	Main_Trib_1	1639.5	100-yr Climate C	Climate Change	1.52	156.22	156.45		156.45	0.003675	0.43	4.73	31.23	0.37
Deer CK Trib_1	Main_Trib_1	1639.5	100-yr Future La	+0.3m Average&Future Landuse	1.27	156.22	156.54		156.55	0.000542	0.24	7.92	35.54	0.15
Deer CK Trib_1	Main_Trib_1	1639.5	100-yr Future La	-0.3m Average&Future Landuse	1.27	156.22	156.46		156.47	0.001834	0.33	5.24	31.36	0.27
Deer CK Trib_1	Main_Trib_1	1547.7	100-yr Future La	Future Land Use	1.27	155.98	156.29		156.30	0.000829	0.33	8.62	45.63	0.21
Deer CK Trib_1	Main_Trib_1	1547.7	100-yr Climate C	Climate Change	1.52	155.98	156.32		156.33	0.000739	0.34	10.07	46.28	0.20
Deer CK Trib_1	Main_Trib_1	1547.7	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.98	156.53		156.53	0.000060	0.14	19.83	47.72	0.06
Deer CK Trib_1	Main_Trib_1	1547.7	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.98	156.19		156.20	0.005817	0.64	4.32	38.96	0.51
Deer CK Trib_1	Main_Trib_1	1485.7	100-yr Future La	Future Land Use	1.27	155.74	156.28		156.29	0.000067	0.13	20.85	64.47	0.06
Deer CK Trib_1	Main_Trib_1	1485.7	100-yr Climate C	Climate Change	1.52	155.74	156.32		156.32	0.000072	0.15	22.86	64.64	0.07
Deer CK Trib_1	Main_Trib_1	1485.7	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.74	156.53		156.53	0.000011	0.07	36.89	65.77	0.03
Deer CK Trib_1	Main_Trib_1	1485.7	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.74	156.14		156.14	0.000353	0.24	11.99	60.93	0.14
Deer CK Trib_1	Main_Trib_1	1419	100-yr Future La	Future Land Use	1.27	155.73	156.28		156.28	0.000042	0.12	24.30	63.29	0.05
Deer CK Trib_1	Main_Trib_1	1419	100-yr Climate C	Climate Change	1.52	155.73	156.31		156.31	0.000048	0.13	26.30	67.45	0.06
Deer CK Trib_1	Main_Trib_1	1419	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.73	156.53		156.53	0.000009	0.07	42.98	83.34	0.03
Deer CK Trib_1	Main_Trib_1	1419	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.73	156.13		156.13	0.000186	0.19	14.86	59.27	0.10

HEC-RAS Profile: 100-yr Future La (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)	
Deer CK Trib_1	Main_Trib_1	1358.8	100-yr Future La	Future Land Use	1.27	155.56	156.28		156.28	0.000002	0.03	98.48	149.86	0.01
Deer CK Trib_1	Main_Trib_1	1358.8	100-yr Climate C	Climate Change	1.52	155.56	156.31		156.31	0.000002	0.03	103.07	150.08	0.01
Deer CK Trib_1	Main_Trib_1	1358.8	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.56	156.53		156.53	0.000001	0.02	136.12	153.05	0.01
Deer CK Trib_1	Main_Trib_1	1358.8	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.56	156.13		156.13	0.000004	0.04	75.33	148.56	0.02
Deer CK Trib_1	Main_Trib_1	1193.1	100-yr Future La	Future Land Use	1.27	155.30	156.28		156.28	0.000001	0.03	87.64	144.08	0.01
Deer CK Trib_1	Main_Trib_1	1193.1	100-yr Climate C	Climate Change	1.52	155.30	156.31		156.31	0.000001	0.03	92.05	144.45	0.01
Deer CK Trib_1	Main_Trib_1	1193.1	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.30	156.53		156.53	0.000000	0.02	123.86	146.29	0.01
Deer CK Trib_1	Main_Trib_1	1193.1	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.30	156.13		156.13	0.000003	0.04	65.39	142.00	0.01
Deer CK Trib_1	Main_Trib_1	1058.5	100-yr Future La	Future Land Use	1.27	155.39	156.28	155.40	156.28	0.000001	0.03	65.71	110.85	0.01
Deer CK Trib_1	Main_Trib_1	1058.5	100-yr Climate C	Climate Change	1.52	155.39	156.31	155.41	156.31	0.000002	0.03	69.13	112.36	0.01
Deer CK Trib_1	Main_Trib_1	1058.5	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.39	156.53	155.40	156.53	0.000000	0.02	108.68	139.85	0.01
Deer CK Trib_1	Main_Trib_1	1058.5	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.39	156.13	155.40	156.13	0.000003	0.04	49.79	92.26	0.01
Deer CK Trib_1	Main_Trib_1	965.6	100-yr Future La	Future Land Use	1.27	155.21	156.28	155.33	156.28	0.000000	0.02	111.22	135.70	0.01
Deer CK Trib_1	Main_Trib_1	965.6	100-yr Climate C	Climate Change	1.52	155.21	156.31	155.34	156.31	0.000000	0.02	115.37	136.18	0.01
Deer CK Trib_1	Main_Trib_1	965.6	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.21	156.53	155.33	156.53	0.000000	0.01	145.67	140.21	0.00
Deer CK Trib_1	Main_Trib_1	965.6	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.21	156.13	155.33	156.13	0.000001	0.02	90.32	132.90	0.01
Deer CK Trib_1	Main_Trib_1	929.8	100-yr Future La	Future Land Use	1.27	155.21	156.28		156.28	0.000003	0.04	41.55	67.62	0.01
Deer CK Trib_1	Main_Trib_1	929.8	100-yr Climate C	Climate Change	1.52	155.21	156.31		156.31	0.000004	0.05	43.67	71.59	0.02
Deer CK Trib_1	Main_Trib_1	929.8	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.21	156.53		156.53	0.000001	0.03	62.04	93.21	0.01
Deer CK Trib_1	Main_Trib_1	929.8	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.21	156.13		156.13	0.000006	0.05	31.90	57.93	0.02
Deer CK Trib_1	Main_Trib_1	881.6	100-yr Future La	Future Land Use	1.27	155.25	156.28	155.49	156.28	0.000010	0.09	24.10	38.79	0.03
Deer CK Trib_1	Main_Trib_1	881.6	100-yr Climate C	Climate Change	1.52	155.25	156.31	155.51	156.31	0.000013	0.10	25.29	39.16	0.03
Deer CK Trib_1	Main_Trib_1	881.6	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.25	156.53	155.49	156.53	0.000004	0.06	34.30	44.89	0.02
Deer CK Trib_1	Main_Trib_1	881.6	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.25	156.12	155.49	156.12	0.000023	0.12	18.22	36.62	0.04
Deer CK Trib_1	Main_Trib_1	841	100-yr Future La	Future Land Use	1.27	155.25	156.28	155.47	156.28	0.000004	0.05	39.84	55.57	0.02
Deer CK Trib_1	Main_Trib_1	841	100-yr Climate C	Climate Change	1.52	155.25	156.31	155.49	156.31	0.000005	0.06	41.53	56.01	0.02
Deer CK Trib_1	Main_Trib_1	841	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.25	156.53	155.47	156.53	0.000001	0.04	54.10	58.33	0.01
Deer CK Trib_1	Main_Trib_1	841	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.25	156.12	155.47	156.12	0.000008	0.06	31.33	53.62	0.02
Deer CK Trib_1	Main_Trib_1	802.6	100-yr Future La	Future Land Use	1.27	155.17	156.28	155.29	156.28	0.000002	0.04	48.51	65.04	0.01
Deer CK Trib_1	Main_Trib_1	802.6	100-yr Climate C	Climate Change	1.52	155.17	156.31	155.30	156.31	0.000002	0.05	50.49	65.49	0.01
Deer CK Trib_1	Main_Trib_1	802.6	100-yr Future La	+0.3m Average&Future Landuse	1.27	155.17	156.53	155.29	156.53	0.000001	0.03	65.50	72.46	0.01
Deer CK Trib_1	Main_Trib_1	802.6	100-yr Future La	-0.3m Average&Future Landuse	1.27	155.17	156.12	155.29	156.12	0.000003	0.05	38.61	62.46	0.02

Appendix C – Regulatory Floodplain Mapping

TOWNSHIP OF MADOC

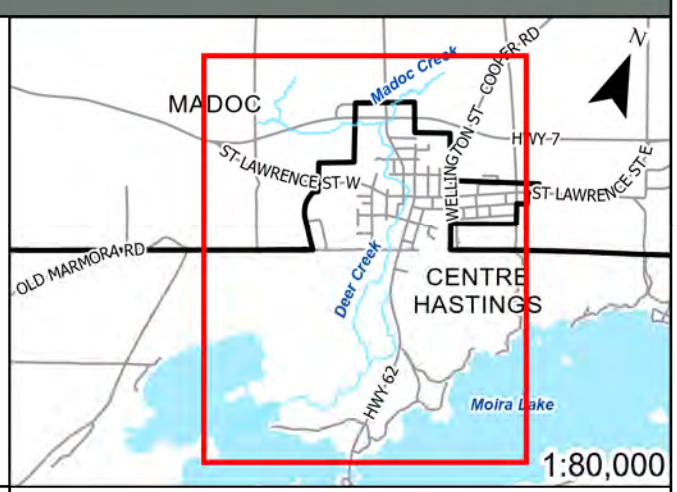
MUNICIPALITY OF CENTRE HASTINGS

O'Hara Rd
Hwy 62
Cooper Rd
Woods Rd
Hwy 7
Wellington St
St Lawrence St W
St Lawrence St E
Old Marmora Rd
Seymour St W
Durham St S
Deer Creek
Moira Lake

New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
- 100 Year Floodline
- Flood Hazard modification upon engineer confirmation of berm landform



Aquafor Beech Limited

Quinte CONSERVATION

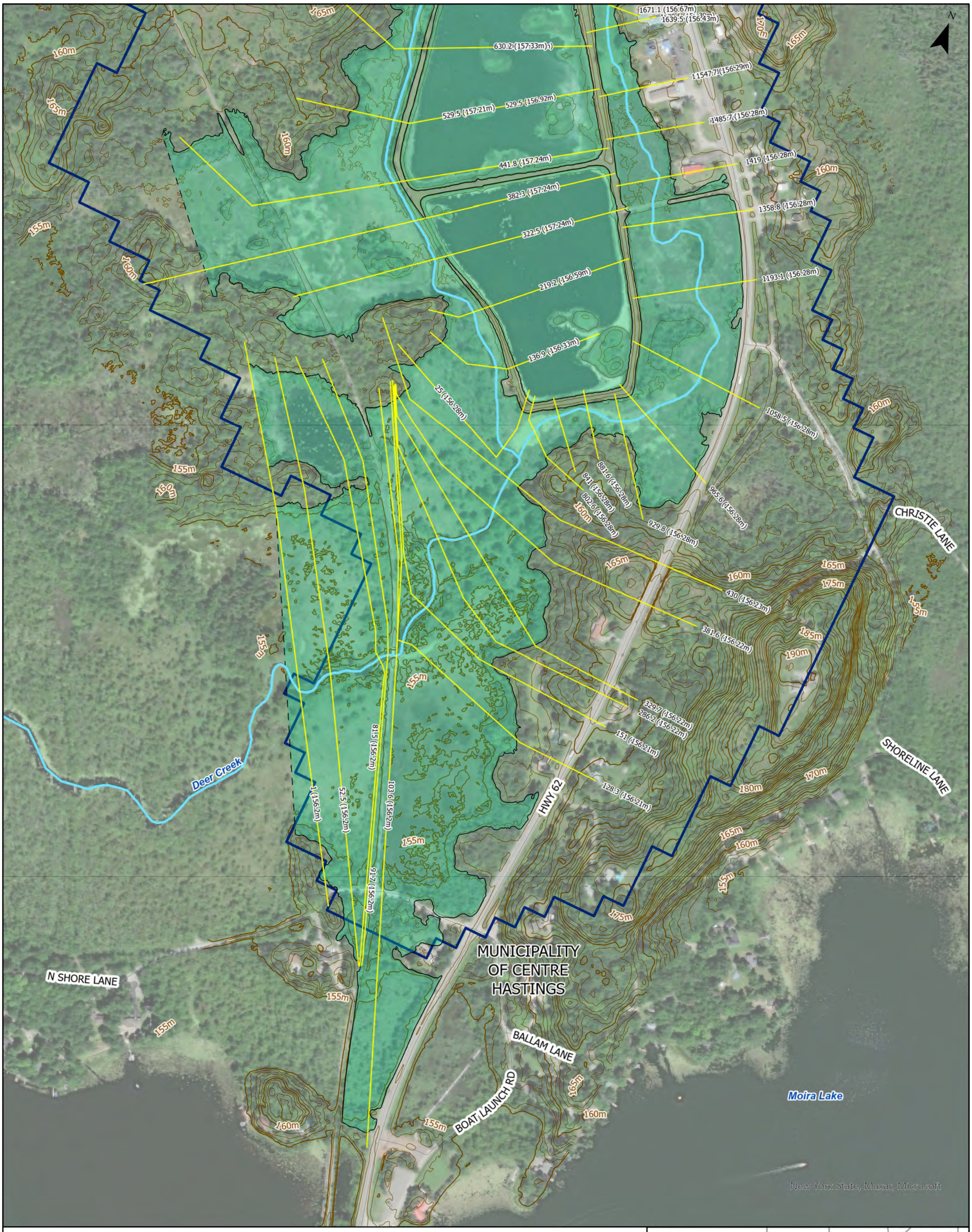
Figure

Deer Creek Floodplain Mapping - Village of Madoc

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

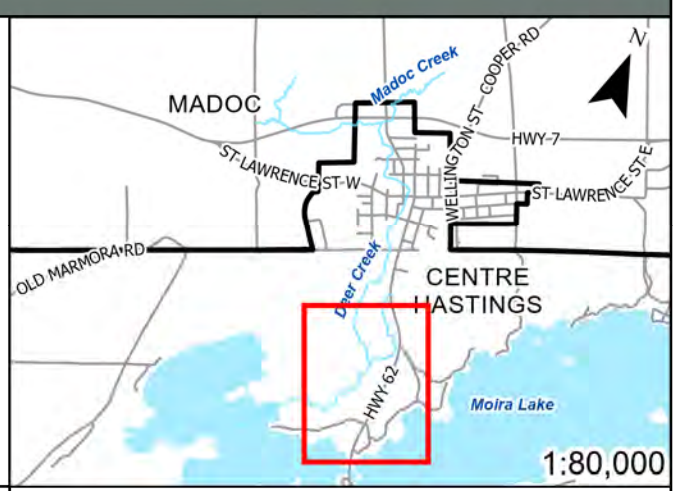
0 165 330 660
Meters

1:13,000



Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
  - Label Example: 986.4 (160.37m)
  - Cross-section # (100-Year Storm SWE)
- 100 Year Floodline
- Flood Hazard modification upon engineer confirmation of berm landform



Aquafor Beech Limited

Quinte CONSERVATION

Figure

Deer Creek Floodplain Mapping – Village of Madoc (1 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

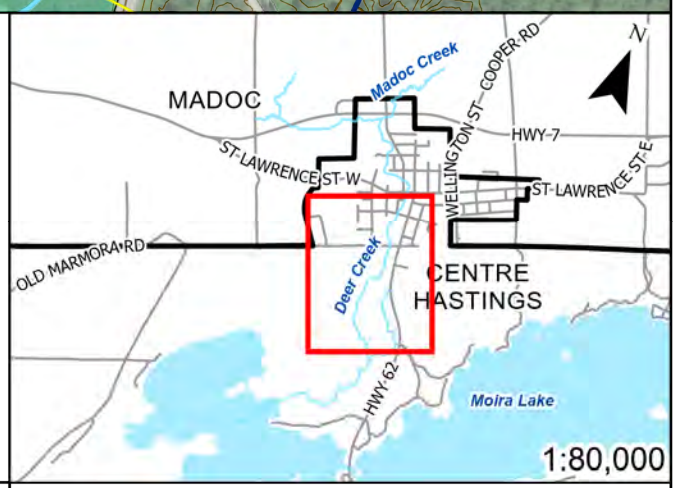
0 50 100 200
Meters

1:5,000

WISHART ST
ELGIN ST
FRANCIS ST
LIVINGSTONE AVE W
LIVINGSTONE AVE E
BURNSIDE ST
BALDWIN ST
COLBORNE ST
HILL AVE
ROLLINS ST
TOWNSHIP OF MADOC
SEYMOUR ST W
SEYMOUR ST E
DANCON AVE
MUNICIPALITY OF CENTRE HASTINGS
DURHAM ST S
HWY 62
Deer Creek
1636.3 (166.03m)
161600.8 (166.09m)
11557.2 (164.8m)
1505 (164.91m)
1467.5 (164.91m)
1436.9 (164.62m)
1424 (164.5m)
1436.9 (164.86m)
1424 (164.74m)
1403.9 (163.56m)
1378.7 (163.17m)
1403.9 (163.48m)
1378.7 (163.1m)
1345 (162.76m)
1345 (162.82m)
1310.4 (162.28m)
1267.8 (162.39m)
1247.7 (162.42m)
1226.6 (162.4m)
1200.8 (162.39m)
1172.2 (162.39m)
1152.2 (162.11m)
1136.2 (162.26m)
1136.2 (162.1m)
1107 (162.05m)
1107 (162.22m)
1070.6 (162.06m)
1070.6 (161.87m)
1049.4 (162.03m)
1049.4 (161.85m)
1030.9 (162.02m)
1030.9 (161.84m)
1015 (162.01m)
1015 (161.84m)
997.8 (161.56m)
997.8 (161.74m)
997 (161.47m)
995 (161.02m)
991.6 (161.2m)
986.4 (160.37m)
983* (160.2m)
982* (159.97m)
981* (159.71m)
980.6 (159.28m)
977.6 (158.72m)
9974.6 (158.55m)
968.4 (157.87m)
950.7 (157.77m)
939.8 (157.77m)
968.4 (158.45m)
950.7 (158.14m)
939.8 (158.02m)
828.7 (157.83m)
828.7 (157.71m)
720.9 (157.42m)
720.9 (157.31m)
1802.3 (158.48m)
1731 (157.84m)
1671.1 (156.67m)
1639.5 (156.43m)
630.2 (157.33m)
11547.7 (156.29m)
529.5 (157.21m)
529.5 (156.92m)
1485.7 (156.28m)
441.8 (157.24m)
1419 (156.28m)
382.3 (157.24m)
1358.8 (156.28m)
322.5 (157.24m)
219.2 (156.59m)
1193.1 (156.28m)
136.9 (156.33m)
© New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
  - Label Example: 986.4 (160.37m)
  - Cross-section # (100-Year Storm SWE)
- 100 Year Floodline
- Flood Hazard modification upon engineer confirmation of berm landform



Aquafor Beech Limited

Quinte CONSERVATION

Figure

Deer Creek Floodplain Mapping – Village of Madoc (2 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

0 50 100 200
Meters

1:5,000

TOWNSHIP OF MADOC

MUNICIPALITY OF CENTRE HASTINGS

BONJOUR BLVD

HWY 7

HWY 62

Madoc Creek

Deer Creek

RUSSEL ST

GLADSTONE ST W

GLADSTONE ST E

DURHAM ST N

PRINCE ALBERT ST E

DAVIDSON ST

NELSON ST

ST LAWRENCE ST W

ST LAWRENCE ST E

WHYTOCK AVE

ROLLINS ST

MARMORA ST

WISHART ST

ST PETERS ST S

CHURCH ST

ELGIN ST

FRANCIS ST

LIVINGSTONE AVE W

LIVINGSTONE AVE E

BALDWIN ST

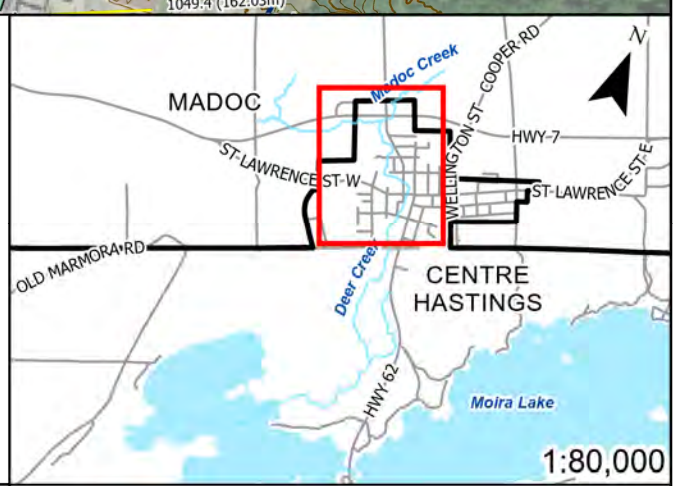
BURNSIDE ST

COLBORNE ST

New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
  - Label Example: 986.4 (160.37m)
  - Cross-section # (100-Year Storm SWE)
- 100 Year Floodline
- Flood Hazard modification upon engineer confirmation of berm landform



Aquafor Beech Limited

Quinte CONSERVATION

Figure

Deer Creek Floodplain Mapping – Village of Madoc (3 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

0 50 100 200
Meters

1:5,000

TOWNSHIP OF MADOC

MUNICIPALITY OF CENTRE HASTINGS

O'HARA RD

ATKINSON RD

HILL AVE

BONJOUR BLVD

HWY 7

ST LAWRENCE ST W

Deer Creek

1548.8 (171.57m)

1548.8 (171.49m)

1483.9 (171.55m)

1483.9 (171.47m)

1393.9 (171.53m)

1261.3 (171.51m)

1160.2 (171.51m)

9997.7 (171.51m)

2100.3 (171.5m)

2015 (171.5m)

1992 (171.39m)

1961960.9 (171.25m)

1942.9 (171.27m)

1788.5 (171.27m)

1639.6 (171.51m)

1000 (171.51m)

1239.4 (171.51m)

1239.4 (171.44m)

1163.6 (171.44m)

1000 (171.44m)

1992 (171.38m)

1788.5 (171.15m)

1638.3 (171.26m)

1531.7 (171.26m)

1428.6 (171.13m)

1414.7 (171.01m)

1399.2 (171.02m)

1386.3 (171.03m)

1270.6 (171.14m)

1184.2 (171.09m)

1087.6 (171.06m)

1428.6 (171.25m)

1414.7 (171.16m)

1399.2 (171.17m)

1386.3 (171.18m)

185m

180m

175m

170m

New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
  - Label Example: 986.4 (160.37m)
    - Cross-section # (100-Year Storm SWE)
- 100 Year Floodline
- Flood Hazard modification upon engineer confirmation of berm landform

Aquafor Beech Limited

Quinte CONSERVATION

Figure

Deer Creek Floodplain Mapping – Village of Madoc (4 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013

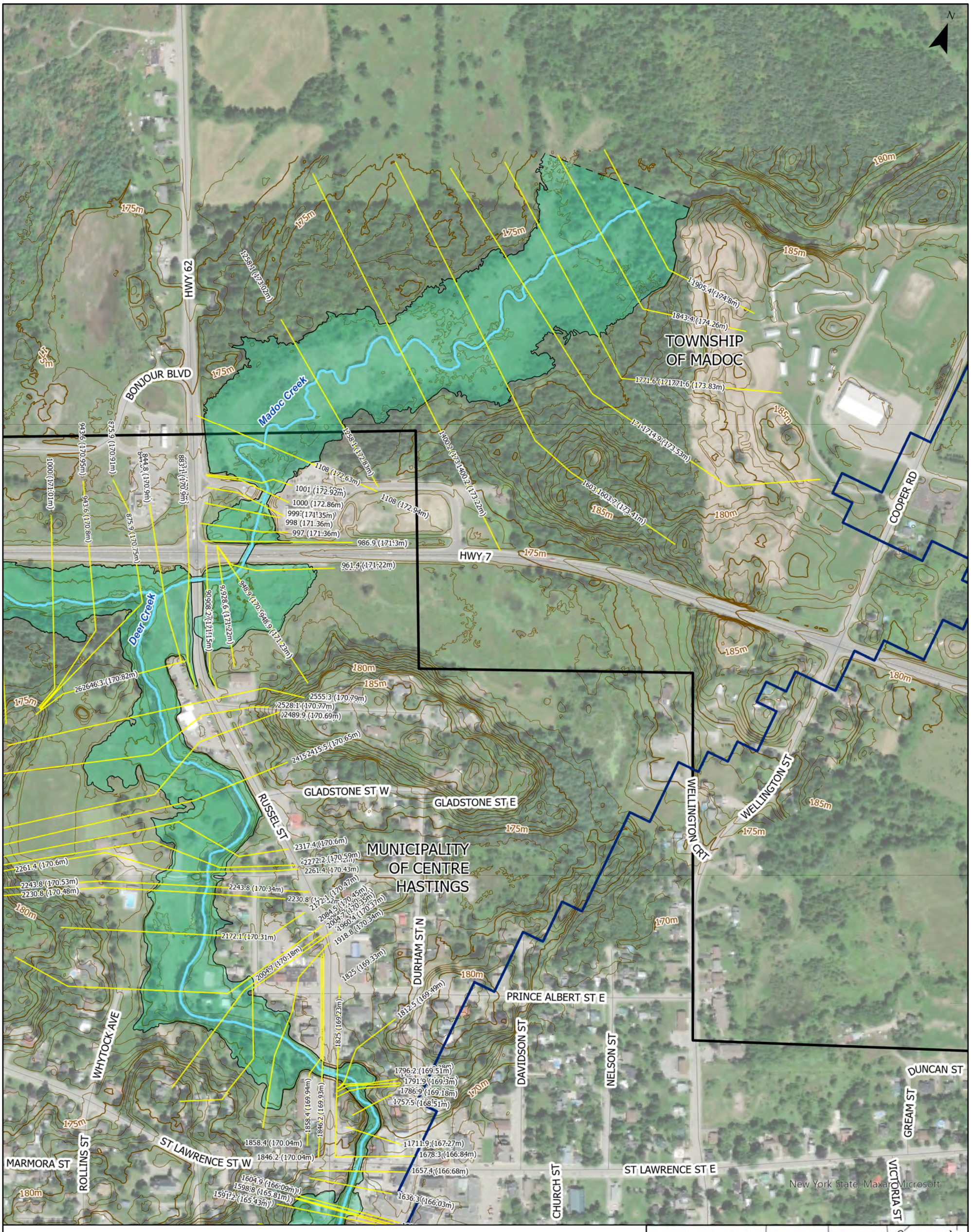
Data Source: Quinte Conservation

Date: 2022-04-13

0 50 100 200

Meters

1:5,000



Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
  - Label Example: 986.4 (160.37m)
    - Cross-section # (100-Year Storm SWE)
- 100 Year Floodline
- Flood Hazard modification upon engineer confirmation of berm landform

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Quinte CONSERVATION

Figure

Deer Creek Floodplain Mapping – Village of Madoc (5 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

0 50 100 200
Meters

1:5,000

Appendix D - Flooded Buildings Location Within the Floodplain

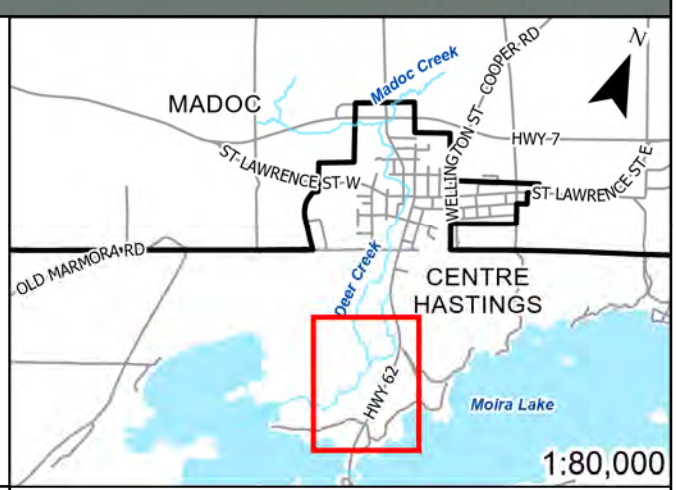
CHRISTIE LANE
SHORELINE LANE
MUNICIPALITY OF CENTRE HASTINGS
HWY 62
Deer Creek
BALLAM LANE
N SHORE LANE
Moira Lake
BOAT LAUNCH RD
New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- 100 Year Floodline

Buildings Within Floodplain:

- Within Floodplain
- Partially Within Floodplain
- Not Within Floodplain



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Quinte CONSERVATION

Figure

Flooded Buildings Located Within the Floodplain (1 of 5)

Projection: NAD 1983 CSRS UTM Zone 18N
Data Source: Quinte Conservation

Date: 2022-02-15

0 50 100 200
Meters

1:4,250

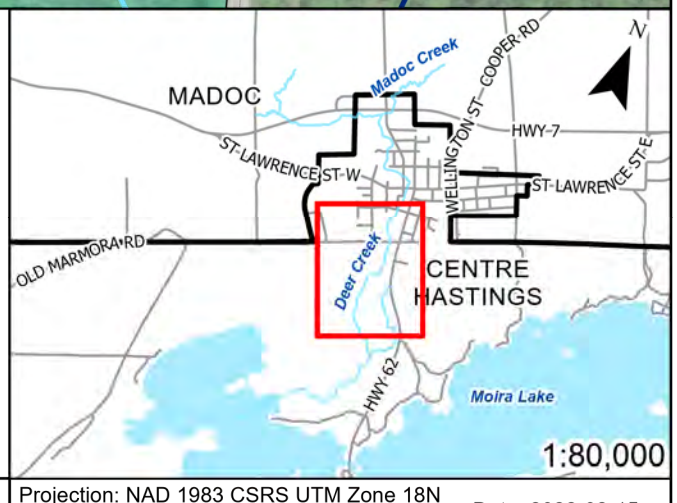
LIVINGSTONE AVE W
FRANCIS ST
BURNSIDE ST
COLBORNE ST
ROLLINS ST
SEYMOUR ST W
DANCON AVE
MUNICIPALITY OF CENTRE HASTINGS
Deer Creek
LIVINGSTONE AVE E
BALDWIN ST
FURNACE ST
DURHAM ST S
SEYMOUR ST E
MAUD ST
HWY 62
N
New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- 100 Year Floodline

Buildings Within Floodplain:

- Within Floodplain
- Partially Within Floodplain
- Not Within Floodplain



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Quinte CONSERVATION

Figure

Flooded Buildings Located Within the Floodplain (2 of 5)

Projection: NAD 1983 CSRS UTM Zone 18N
Data Source: Quinte Conservation

Date: 2022-02-15

0 50 100 200
Meters

1:4,250

BONJOUR BLVD
HWY 62
TOWNSHIP OF MADOC
HWY 7
Madoc Creek
DUFFERIN ST
GLADSTONE ST W
GLADSTONE ST E
RUSSEL ST
QUEEN VICTORIA ST W
MADAWASKA ST
DURHAM ST N
MUNICIPALITY OF CENTRE HASTINGS
PRINCE ALBERT ST W
PRINCE ALBERT ST E
DAVIDSON ST
WHYTOCK AVE
ROLLINS ST
MARMORA ST
ST LAWRENCE ST W
ST LAWRENCE ST E
ST PETERS ST S
CHAMPLAIN ST
Deer Creek
CHURCH ST
WISHART ST
ELGIN ST
FRANCIS ST
LIVINGSTONE AVE W
LIVINGSTONE AVE E
DURHAM ST S
BALDWIN ST
MACNAB ST
New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- 100 Year Floodline

Buildings Within Floodplain:

- Within Floodplain
- Partially Within Floodplain
- Not Within Floodplain

Aquafor Beech Limited

Quinte CONSERVATION

Figure

Flooded Buildings Located Within the Floodplain (3 of 5)

Projection: NAD 1983 CSRS UTM Zone 18N
Data Source: Quinte Conservation

Date: 2022-02-15

0 50 100 200
Meters

1:4,250

O'HARA RD

TOWNSHIP
OF MADOC

BONJOUR BLVD

HWY 7

Deer Creek

MUNICIPALITY
OF CENTRE
HASTINGS

ST LAWRENCE ST W

ATKINSON RD

HILL AVE

New York State, Maxar, Microsoft

N

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- 100 Year Floodline

Buildings Within Floodplain:

- Within Floodplain
- Partially Within Floodplain
- Not Within Floodplain

Aquafor Beech Limited

Quinte CONSERVATION

Figure

Flooded Buildings Located Within the Floodplain
(4 of 5)

Projection: NAD 1983 CSRS UTM Zone 18N
Data Source: Quinte Conservation

Date: 2022-02-15

0 50 100 200
Meters

1:4,250

TOWNSHIP OF MADOC

MUNICIPALITY OF CENTRE HASTINGS

BONJOUR BLVD
HWY 62
Madoc Creek
HWY 7
COOPER RD
DUFFERIN ST
GLADSTONE ST W
GLADSTONE ST E
RUSSEL ST
WELLINGTON CRT
WELLINGTON ST
QUEEN VICTORIA ST W
MADAWASKA ST
DURHAM ST N
PRINCE ALBERT ST W
PRINCE ALBERT ST E
DAVIDSON ST
NELSON ST
WHYTOCK AVE
Deer Creek

New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- 100 Year Floodline

Buildings Within Floodplain:

- Within Floodplain
- Partially Within Floodplain
- Not Within Floodplain

Aquafor Beech Limited

Quinte CONSERVATION

Figure

Flooded Buildings Located Within the Floodplain (5 of 5)

Projection: NAD 1983 CSRS UTM Zone 18N
Data Source: Quinte Conservation

Date: 2022-02-15

0 50 100 200
Meters

1:4,250

Appendix E – Climate Change Flood Lines

TOWNSHIP OF MADOC

MUNICIPALITY OF CENTRE HASTINGS

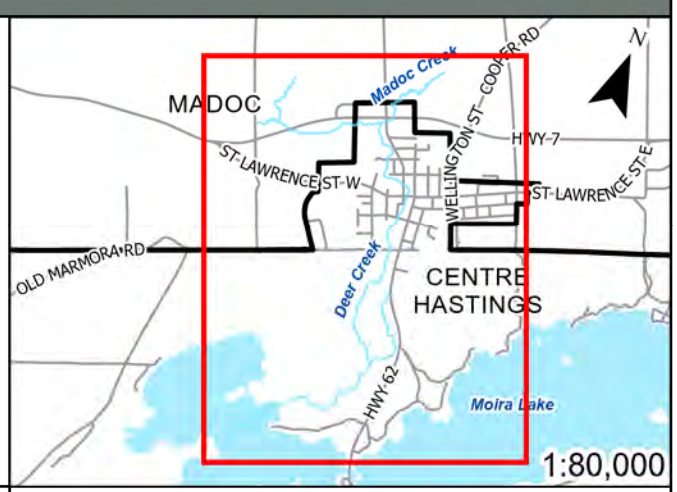
O'Hara Rd
Hwy 7
Madoc Creek
Cooper Rd
Woods Rd
Wellington St
Russel St
St Lawrence St W
St Lawrence St E
Old Marmora Rd
Seymour St W
Durham St S
HWY 62
Deer Creek
Moira Lake

185m 180m 175m 170m 165m 160m 155m

New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
- 100 Year Floodline
- 100 Year Floodline Under Climate Change Scenario
- Flood hazard modification upon engineer confirmation of berm landform
- Flood hazard modification upon engineer confirmation of berm landform under climate change scenario



Aquafor Beech Limited

Quinte CONSERVATION

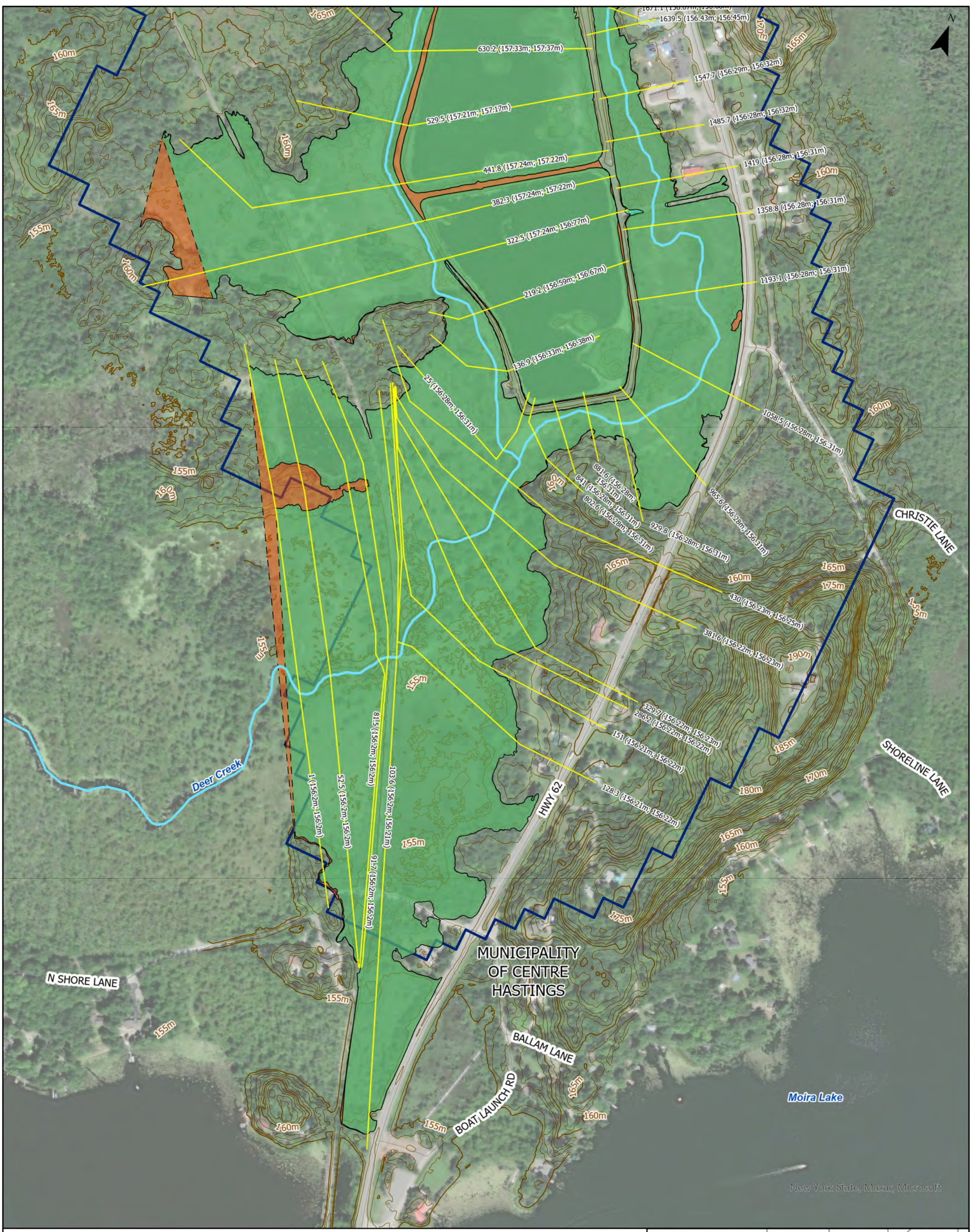
Figure

Deer Creek Flood Lines Comparison

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

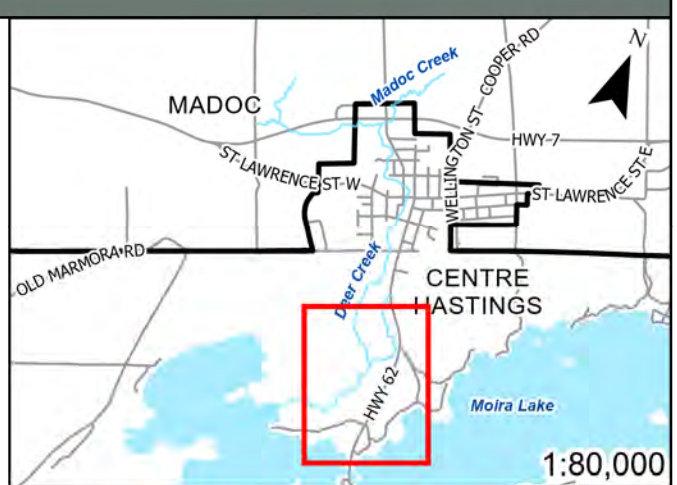
0 165 330 660
Meters

1:13,000



Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
  - Label Example: 986.4 (160.37m; 160.55m)
  - Cross-section # (100-Year Storm WSE; 100-Year Storm WSE Under Climate Change)
- 100 Year Floodline
- 100 Year Floodline Under Climate Change Scenario
- Flood hazard modification upon engineer confirmation of berm landform
- Flood hazard modification upon engineer confirmation of berm landform under climate change scenario



Aquafor Beech Limited

Quinte CONSERVATION

Figure

Deer Creek Flood Lines Comparison (1 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

0 50 100 200
Meters

1:5,000

WISHART ST
ELGIN ST
FRANCIS ST
LIVINGSTONE AVE W
BURNSIDE ST
COLBORNE ST
HILL AVE
ROLLINS ST
MACNAB ST
SEYMOUR ST W
SEYMOUR ST E
DANCON AVE
DURHAM ST S
HWY 62
Deer Creek
TOWNSHIP OF MADOC
MUNICIPALITY OF CENTRE HASTINGS
N
1636.3 (166.03m; 166.59m)
1600.8 (166.09m; 166.19m)
1557.2 (164.8m; 164.89m)
1505 (164.91m; 165.01m)
1467.5 (164.91m; 165.01m)
1436.9 (164.86m; 164.94m)
1424 (164.74m; 164.76m)
1403.9 (163.56m; 164.24m)
1378.7 (163.17m; 163.34m)
1345 (162.82m; 162.89m)
1310.4 (162.28m; 162.54m)
1267.8 (162.39m; 162.71m)
1247.7 (162.42m; 162.73m)
1226.6 (162.4m; 162.72m)
1200.8 (162.39m; 162.71m)
1172.2 (162.39m; 162.71m)
1152.2 (162.11m; 162.41m)
1136.2 (162.26m; 162.58m)
1107 (162.22m; 162.53m)
1070.6 (162.06m; 162.4m)
1049.4 (162.03m; 162.34m)
1030.9 (162.02m; 162.32m)
1015 (162.01m; 162.31m)
997.8 (161.74m; 161.98m)
997 (161.47m; 161.65m)
995 (161.02m; 161.21m)
991.6 (161.2m; 161.46m)
986.4 (160.37m; 160.55m)
983* (160.2m; 160.4m)
982* (159.97m; 160.14m)
981* (159.71m; 159.87m)
980.6 (159.28m; 159.41m)
977.6 (158.72m; 158.87m)
974.6 (158.55m; 158.66m)
968.4 (158.45m; 158.55m)
950.7 (158.14m; 158.13m)
939.8 (158.02m; 157.93m)
828.7 (157.83m; 157.51m)
720.9 (157.42m; 157.56m)
1671.1 (156.67m; 156.68m)
1639.5 (156.43m; 156.45m)
630.2 (157.33m; 157.37m)
1547.7 (156.29m; 156.32m)
529.5 (157.21m; 157.17m)
1485.7 (156.28m; 156.32m)
441.8 (157.24m; 157.22m)
1419 (156.28m; 156.31m)
382.3 (157.24m; 157.22m)
1358.8 (156.28m; 156.31m)
322.5 (157.24m; 156.77m)
219.2 (156.59m; 156.67m)
1193.1 (156.28m; 156.31m)
136.9 (156.33m; 156.38m)
25 (156.3
175m
170m
165m
160m
155m
180m
New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
  - Label Example: 986.4 (160.37m; 160.55m)
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Aquafor Beech Limited

Quinte CONSERVATION

Figure

Deer Creek Flood Lines Comparison (2 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

0 50 100 200
Meters

1:5,000

TOWNSHIP OF MADOC

MUNICIPALITY OF CENTRE HASTINGS

BONJOUR BLVD

HWY 7

HWY 62

Madoc Creek

Deer Creek

GLADSTONE ST W

GLADSTONE ST E

RUSSEL ST

DURHAM ST N

PRINCE ALBERT ST E

DAVIDSON ST

NELSON ST

ST LAWRENCE ST W

ST LAWRENCE ST E

WHYTOCK AVE

ROLLINS ST

MARMORA ST

WISHART ST

FRANCIS ST

LIVINGSTONE AVE W

LIVINGSTONE AVE E

CHURCH ST

ELGIN ST

BURNSIDE ST

COLBORNE ST

1531.7 (171.26m; 171.5m)
1270.6 (171.38m; 171.14m)
1184.2 (171.34m; 171.09m)
1087.6 (171.31m; 171.06m)
1000 (171.27m; 171.01m)
943.6 (171.22m; 170.95m)
875.9 (171.19m; 170.91m)
844.8 (171.18m; 170.9m)
883.1 (171.18m; 170.9m)
1001 (172.92m; 173.27m)
1000 (172.86m; 173.24m)
999 (171.35m; 171.64m)
998 (171.36m; 171.66m)
997 (171.36m; 171.65m)
1108 (172.94m; 173.29m)
986.9 (171.3m; 171.58m)
961.4 (171.22m; 171.46m)
928.6 (171.22m; 171.47m)
908.2 (171.15m; 171.42m)
948.9 (171.23m; 171.47m)
1400.2 (173.22m; 173.41m)
1603.7 (173.41m; 17
2646.3 (170.82m; 171.1m)
2555.3 (170.79m; 171.07m)
2528.1 (170.77m; 171.06m)
2489.9 (170.69m; 170.97m)
2415.5 (170.65m; 170.93m)
1386.3 (171.18m; 171.42m)
1428.6 (171.25m; 171.49m)
1414.7 (171.16m; 171.39m)
1399.2 (171.17m; 171.41m)
2317.4 (170.6m; 170.9m)
2272.2 (170.59m; 170.89m)
2261.4 (170.6m; 170.9m)
2243.8 (170.53m; 170.85m)
2230.8 (170.48m; 170.8m)
2172.1 (170.47m; 170.79m)
2084.5 (170.45m; 170.78m)
2004.7 (170.35m; 170.72m)
1960.4 (170.57m; 170.73m)
1918.8 (170.34m; 170.71m)
1825 (169.33m; 169.6m)
1812.5 (169.49m; 169.76m)
1796.2 (169.51m; 169.8m)
1791.9 (169.3m; 169.66m)
1786.9 (169.18m; 169.48m)
1757.5 (168.51m; 168.72m)
1858.4 (170.04m; 170.41m)
1846.2 (170.04m; 170.41m)
1711.9 (167.27m; 167.45m)
1678.3 (166.84m; 167.08m)
1657.4 (166.68m; 166.56m)
1604.9 (166.09m; 166.2m)
1598.8 (165.81m; 165.93m)
1591.2 (165.43m; 165.55m)
1636.3 (166.03m; 166.59m)
1600.8 (166.09m; 166.19m)
1557.2 (164.8m; 164.89m)
1505 (164.91m; 165.01m)
1467.5 (164.91m; 165.01m)
1436.9 (164.86m; 164.94m)
1424 (164.74m; 164.76m)
1403.9 (163.56m; 164.24m)
1378.7 (163.17m; 163.34m)
1345 (162.82m; 162.89m)
1310.4 (162.28m; 162.54m)
1267.8 (162.39m; 162.71m)
1247.7 (162.42m; 162.73m)
1226.6 (162.4m; 162.72m)
1200.8 (162.39m; 162.71m)
1172.2 (162.39m; 162.71m)
1152.2 (162.11m; 162.41m)
1136.2 (162.26m; 162.58m)
1107 (162.22m; 162.53m)
1070.6 (162.06m; 162.4m)
1049.4 (162.03m; 162.34m)

175m
180m
185m
170m
165m

New York State, Maxar, Microsoft

Legend

- Municipal Boundary
- Deer Creek Watershed
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  - Label Example: 986.4 (160.37m; 160.55m)
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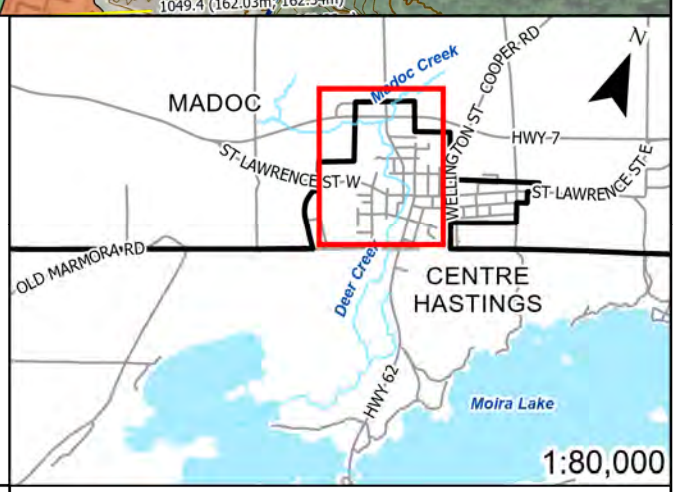
- Flood hazard modification upon engineer confirmation of berm landform under climate change scenario



Aquafor Beech Limited

Quinte CONSERVATION

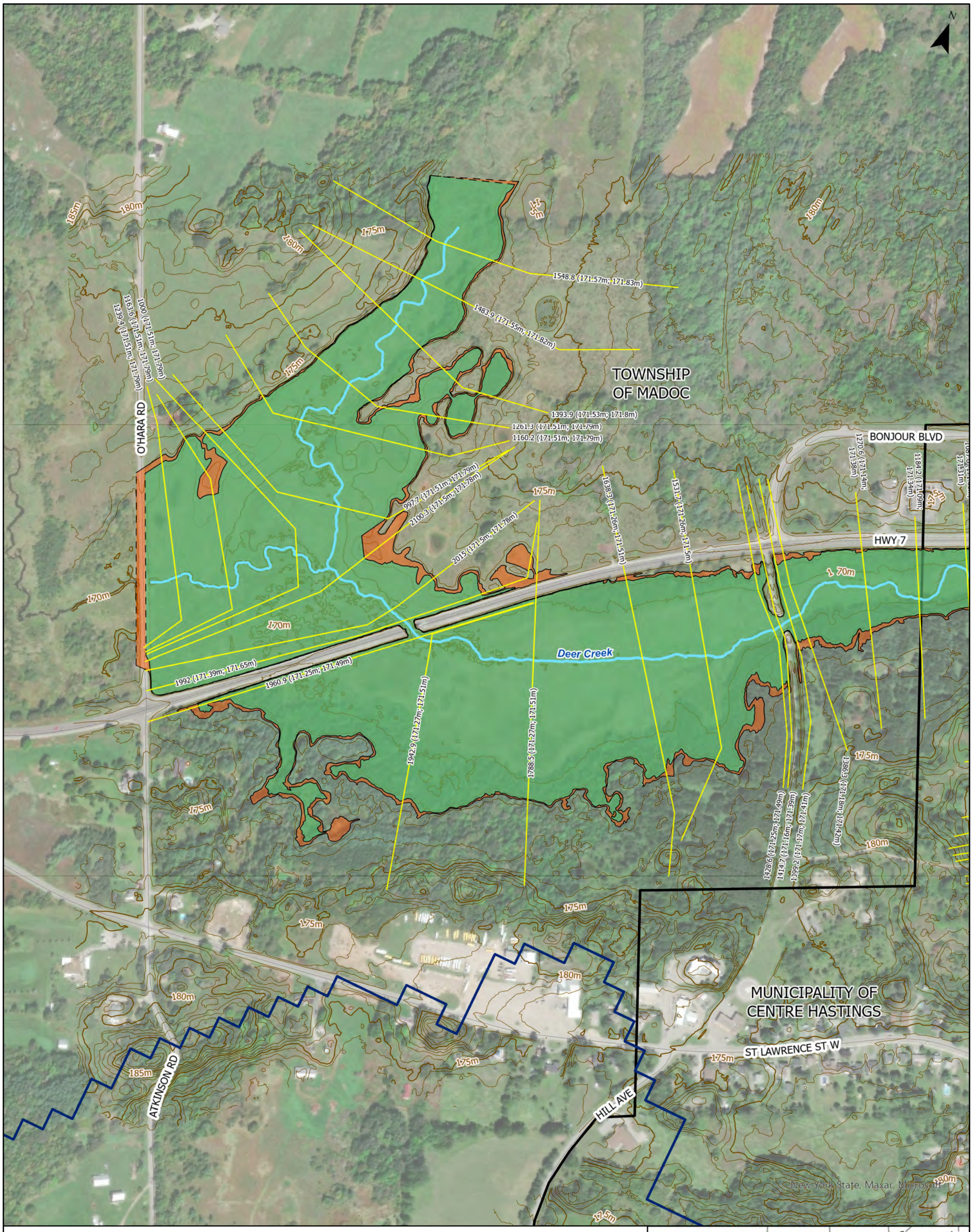
Figure

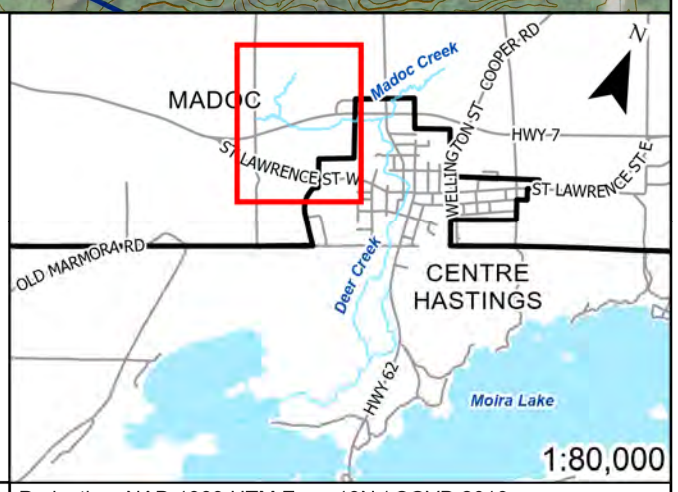
Deer Creek Flood Lines Comparison (3 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

0 50 100 200
Meters

1:5,000





Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
  - Label Example: 986.4 (160.37m; 160.55m)
  - Cross-section # (100-Year Storm WSE; 100-Year Storm WSE Under Climate Change)
- 100 Year Floodline
- 100 Year Floodline Under Climate Change Scenario
- Flood hazard modification upon engineer confirmation of berm landform
- Flood hazard modification upon engineer confirmation of berm landform under climate change scenario

Aquafor Beech Limited

Quinte CONSERVATION

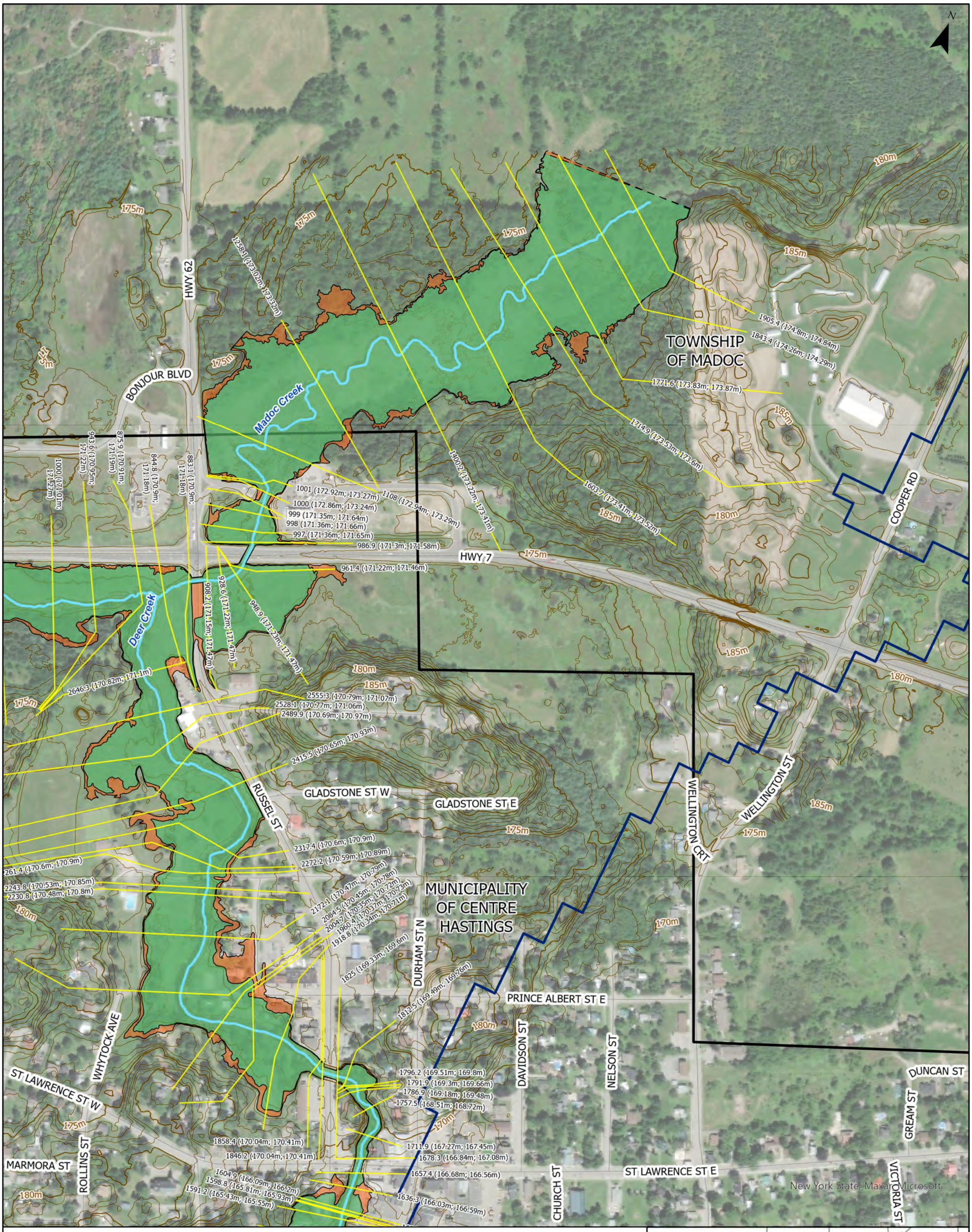
Figure

Deer Creek Flood Lines Comparison (4 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

0 50 100 200
Meters

1:5,000



Legend

- Municipal Boundary
- Deer Creek Watershed
- River Reaches
- Contour
- Cross Sections
  - Label Example: 986.4 (160.37m; 160.55m)
  - Cross-section # (100-Year Storm WSE; 100-Year Storm WSE Under Climate Change)
- 100 Year Floodline
- 100 Year Floodline Under Climate Change Scenario
- Flood hazard modification upon engineer confirmation of berm landform
- Flood hazard modification upon engineer confirmation of berm landform under climate change scenario

Aquafor Beech Limited

Quinte CONSERVATION

Figure

Deer Creek Flood Lines Comparison (5 of 5)

Projection: NAD 1983 UTM Zone 18N / CGVD 2013
Data Source: Quinte Conservation Date: 2022-04-13

0 50 100 200
Meters

1:5,000