The Corporation of the Municipality of Huron Shores
Ontario, Canada

Flood Risk Assessment Report

For

Huron Shores Flood Risk Assessment

H366743-0000-228-230-0003
Rev. 0
May 6, 2022

The Corporation of the Municipality of Huron Shores
Ontario, Canada

Flood Risk Assessment Report

For

Huron Shores Flood Risk Assessment

H366743-0000-228-230-0003
Rev. 0
May 6, 2022

Report

Flood Risk Assessment

H366743-0000-228-230-0003

2022-05-06	0	Final	B. Heppner	A. Breland, S. Lawal	A. Breland	As Required
DATE	REV.	STATUS	PREPARED BY	CHECKED BY	APPROVED BY	APPROVED BY
				Discipline Lead	Functional Manager	Choose Approver

Table of Contents

List of Tables

List of Figures

List of Appendices

1. Introduction

The Corporation of the Municipality of Huron Shores (Huron Shores) is seeking consulting services to provide a comprehensive flood risk assessment for high risk areas throughout the watersheds located in the Municipality of Huron Shores (the municipality). This will assist Huron Shores to determine areas of concern, communicating flood risk to the public, aid in future updates to the Official Plan, Zoning, and other relative Municipal By-laws, and assist with emergency management. Combined, these actions will improve Huron Shores' resilience to future flood events and help to reduce flood risk and damage.

The project is a Stream 1 Risk Assessment under the National Disaster Mitigation Program (NDMP) and the end product of the project will provide recommendations for Stream 2 studies and investigations for the reduction of flooding risks in the areas of concern.

Most importantly, the project will provide the information required for completion of the Risk Assessment Information Template (RAIT) that is necessary for Stream 2 funding applications under the NDMP, and Hatch Ltd. (Hatch) will assist Huron Shores in completing the forms required for future funding applications under the NDMP.

In the 1980s and 1990s under the Flood Damage Reduction Program (FDRP), a number of communities in the province with a known history of flooding were mapped and the 1:100-yr return period flood risk zones were designated. Since their creation, these flood risk zone maps have been incorporated into a wide range of land-use policies by provincial and municipal governments, including transportation, land-use development, regulations, and municipal plans. Since the 1990s, little has been done to update the flood mapping for the growing communities.

Current floodplain mapping along the watercourses within the municipality's jurisdiction is limited. The watershed of the lower Mississagi River and Thessalon River covers 4432 km^2 and is home to approximately 1661 people; the municipality covers an area of approximately 533 km^2 on the mainland. The municipality relies on dated maps produced through the Ontario Flood Damage Reduction Program, circa 1980s, with very limited geographic area mapped.

1.1 Scope

The purpose of this Project is to undertake a high-level risk assessment and hazard identification to address the flood risks in areas that are most flood vulnerable within the municipality, including the developed lakes and waterfront areas. The project study areas shall include all areas identified as Environmental Protection Area (Flood Prone Area) in the Huron Shores Official Plan Land-Use Schedules, as well as the Thessalon River, Bolton River, Mississagi River, Potomac River, Harris Creek, and Pickerel Creek. Figure 1-1 presents a map of the study area of this project.

The Project will include gathering historical flooding information, acquisition of elevation data, determination of populations potential exposure, preliminary assessment of potential flooding and prioritization of flood mapping activities for the areas listed as a priority for Huron Shores.

Furthermore, the Project will

- determine the most at-risk areas of concern and identify locations that will likely be affected by flooding
- determine how often flooding is likely to occur
- prioritize areas of concern for future flood hazard mapping
- recognize critical infrastructure that is most prone to be damaged in a flood
- inform Huron Shores of potential flooding risks to reduce potential future flooding impacts by regulating existing development and implementing structural and non-structural measures for new development
- provide a better understanding of the location of areas that are prone to flooding which will allow Huron Shores to improve emergency response planning and reduce risk to life safety, property and other economic damages and environmental impacts that a flood will have on the community
- provide existing property owners and residents with flood information to help them develop their own personal emergency preparedness plans
- assist the community in ensuring that area planning and development responds appropriately to Ontario's changing climate and, where/when possible, allow for appropriate management to mitigate floods across the municipality
- reduce the financial liabilities for the government by understanding the risk to critical infrastructure and mitigating that risk to reduce the potential reconstruction cost that would be shared by the government.

Hatch will also explore and recommend public works inspections and maintenance tasks that will aid Huron Shore's in managing the floodplain, and help improve the municipality's resilience to future flood events and help to reduce flood risk and damage.

Earthstar Geographics

Little Thessalon River
Thessalon River
Birch Lake
Basswood Lake
Little Basswood Lake
Cranberry Lake
Brownlee Lake
Mississagi River
Clear Lake
Warnock Lake
Bright Lake
Bolton River
Pickerel Creek
Potomac River
Little Dean Lake
Dean Lake
Pahpashcah Creek
Lake Huron

HIGHWAY 554
HIGHWAY 546
HIGHWAY 129
HIGHWAY 17
LAKESIDE DRIVE
RIVER STREET

C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig1-1_StudiedWaterbodies.aprx

LEGEND

- Huron Shores Municipal Boundary
- Waterbody Boundary (Study Areas)

DATA SOURCES
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Includes information used under the Open Government License - Ontario

0 2 4 8 km

1:110,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Flood Risk Assessment - Studied Waterbodies
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	1-1

HATCH

2. Background and Data Collection

This study's primary focus is to understand the current flood risk in the municipality. Therefore, data collection and review are a significant portion of the study. Hydrologic data was collected based on available reports, Water Survey of Canada flow and level data and dam watershed characteristics were reviewed to estimate the intensity of flooding that may occur. Additionally, topographic data and bathymetric data were collected in order to assess the impact that large flood events have on each body of water included in the study. Due to the variability of information available, each location required specific calculations using the most relevant and reliable data set.

2.1 Watershed Characteristics

The hydrologic assessment is concerned with providing the required hydrologic data for the risk assessment flood-prone areas on the lakes and rivers within the municipality. The main watersheds studied in this project are the Mississagi River watershed and the Thessalon River watershed (see Figure 2-1).

2.1.1 Mississagi River Watershed

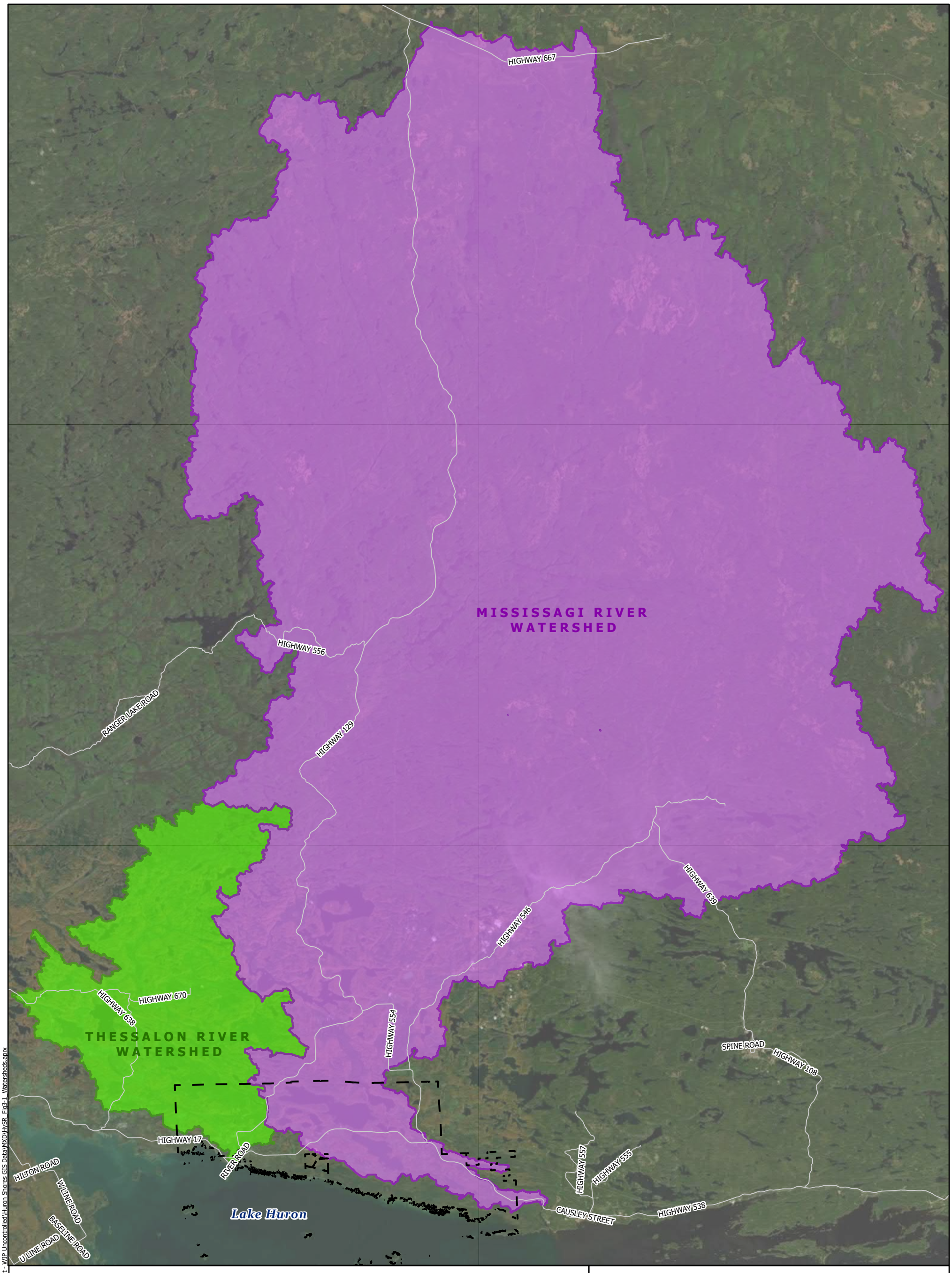
The Mississagi River watershed is located in northeastern Ontario, spanning from the municipality in the south to Strom township in the north. The majority of the watershed is located in Algoma District with an upstream section situated in the District of Sudbury. The watershed has a total drainage area of 9216 km^2 and is regulated by storages in Rocky Island Lake, Aubrey Falls Lake, Tunnel Lake and Red Rock Lake. Power is generated at Aubrey Falls generating station (GS), Wells-Rayner GS and Red Rock Lake GS. All three stations have relatively small seasonal storage and rely on the water stored at Rocky Island dam as the main water supply, supplemented by local basin inflows.

The 28-km reach under study, located between Red Rock Dam and Mississagi Falls, has a watershed where flows are modulated by the Mississagi River dams and Big Basswood Dam.

The Mississagi River watershed is a very sparsely urbanized watershed, with anthropic activities mainly concentrated in downstream areas, and characterized by a large lakes and wetlands system. Most of the land use is woodland while the rest is mainly clear open water.

2.1.2 Thessalon River Watershed

The Thessalon River watershed is located in northeastern Ontario, extending from the river mouth in the town of Thessalon in the south, north through the municipality, up to Kane township, located within Algoma District. The watershed has a total drainage area of 943 km^2 and is regulated by the Rydal Bank Dam located upstream of Huron Shores boundary, and the Little Rapids Dam at the Little Thessalon tributary. The Little Thessalon tributary is regulated by a series of cascade reservoirs, beginning by the Shaw Lake Dam at the upstream of the sub-basin, followed by the McCreight's Dam and the Little Rapids Dam.



LEGEND

- Major Road
- Huron Shores Municipal Boundary
- Mississagi River Watershed
- Thessalon River Watershed

DATA SOURCES
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Waterbodies, Municipal Boundaries - Land Information Ontario
3. Watershed Boundaries - OFAT

0 5 10 20 km

1:470,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Mississagi River and Thessalon River Watershed Delineations
CLIENT:	Municipality of Huron Shores
DWG BY: J. Snelgrove	**FIG NO.:** 2-1
DATE: March 30, 2022	HATCH

C:\Users\snel9701\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\HySR_Fig2-1_Watersheds.aprx

The Thessalon River reach under study is located 7.5 km downstream the Rydal Bank Dam and flows 16.4 km southeast to Lake Huron.

Similar to the Mississagi River basin, the Thessalon River watershed is a sparsely urbanized watershed with anthropic activities mainly concentrated in the downstream area and particularly in the town of Thessalon. The high majority of the land is occupied by woodland and the rest is clear open water and rural land use.

2.1.3 Major Lakes System

As presented before, the Mississagi River watershed contains many lakes and wetlands, which helps to mitigate flooding. There are 10 lakes of interest in the municipality, called the Major Lakes.

As presented in Figure 2-2, the majority of the lake system flows toward Bright Lake, with a major outlet located on the Bolton River, before flowing into the Mississagi River. The other part of the system is comprised of Dean Lake and its unnamed smaller lake, sometimes called Little Dean Lake by residents. This part of the system flows into a small creek which is a tributary of the Bolton River. The critical streams relevant to flooding are Harris Creek, which connects Basswood Lake to Bright Lake, and Pickerel Creek, which allows water flowing out of Little Basswood Lake and Brownlee Lake to drain southeast to Bright Lake.

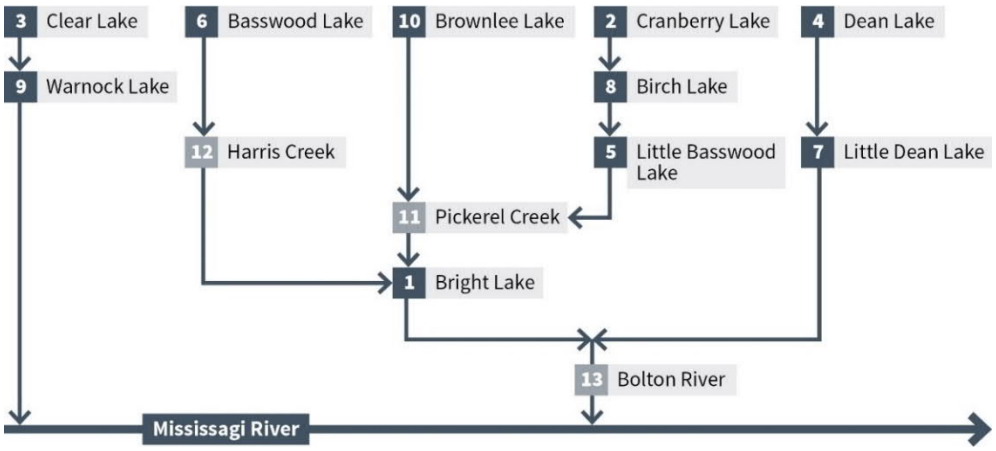


Figure 2-2: Major Lakes System

2.2 LiDAR Collection

On October 28, 2021, a light detection and ranging (LiDAR) topographic survey of the municipality was completed by Airborne Imaging. Tulloch Engineering completed post-processing of the LiDAR data and provided a processed LiDAR point cloud and digital elevation model (DEM) to Hatch for use in this assessment.

The survey was conducted using a Riegl VQ-1560ii laser scanner with a laser pulse repetition rate of 700 kHz. This sensor was mounted on board a Piper Navajo aircraft, and the survey was flown at 1800 m above ground level and 160-kts airspeed. The final LiDAR data reflects

an average point density of approximately 5.4 points per square metre. The total surveyed area of approximately 538.81 km^2 encompasses the entire study area and is shown in Figure 2-3.

2.3 Bathymetry Collection

Bathymetry was collected in October and November 2021 via a boat-mounted, single frequency sonar sensor paired with a survey-grade global positioning system (GPS) rover by Tulloch Engineering. The bathymetric survey data includes a continuous centerline and cross-sections of the rivers collected. The bathymetric survey included the southernmost reaches of the Thessalon River, from the Ansonia Rapids to Lake Huron, and the Mississagi River from Red Rock Dam downstream to Lake Huron. The bathymetric survey area is shown in Figure 2-4.

2.4 Critical Infrastructure

Critical infrastructure is broken down into 10 categories by The Government of Canada: health, food, finance, water, information and communication technology, safety, energy and utilities, manufacturing, government, and transportation. Critical infrastructure in this study focused mainly on identifying possible disruption to water supply, waste treatment plants, hospitals, major highways, etc. In addition to critical infrastructure, the locations of all cemeteries within the municipality were identified. For the present study, evaluation of critical infrastructure was limited to determining whether the infrastructure was within or outside of the flood risk area.

A photo map of the critical infrastructure identified is available in Appendix A.2. Critical infrastructure that falls within the flood risk area are listed in Section 5.5.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\BSR_Fig5-2_LiDARStudyArea.mxd

Thessalon River

Basswood Lake

Bright Lake

Dean Lake

Mississagi River

Lake Huron

Thessalon

Dayton

Iron Bridge

LEGEND

- City
- LiDAR Coverage Area
- Waterbody

DATA SOURCES
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains data used under the Open Government License - Ontario
3. USA Borders, USA Waterbodies - US Census Bureau

0 2 4 8 km

1:115,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Approximate LiDAR Study Area
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	2-3

HATCH

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\BSR_Fig5-1_BathymetryStudyArea.mxd

Thessalon River

Basswood Lake

Bright Lake

Dean Lake

Mississagi River

Lake Huron

LEGEND

- Huron Shores Municipal Boundary
- Waterbody

Bathymetry Collection Area

- Cross Section
- Centreline

DATA SOURCES
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario
3. USA Borders, USA Waterbodies - US Census Bureau

0 2.5 5 10 km

1:135,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Bathymetry Study Area
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	2-4

HATCH

3. Hydrology Assessment

3.1 Methodology

Hydrology assessment was performed to determine the flows required for the flood risk assessment for the Municipality of Huron Shores. A flow regionalization method has been used to estimate inflows to ungauged lakes with a single station frequency analysis of similar watershed gauged stations. The lakes and stations under study were separated into two homogeneous hydrological regions, Region 1 and Region 2, based on drainage area.

The multiple regression used for the estimation of flows was based on “Canada/Ontario Flood Damage Reduction Program - Regional Flood Frequency Analysis for Ontario Streams” by Moin & Shaw (1985), a methodology widely recognized. Depending on the hydrological region, a set of two or three parameters was considered in the multiple regression; the drainage area (DA, in km^2), the lakes and wetlands area proportion (WL, in % of total area), and the urban land-use area proportion (UL, in % of total area) of the watersheds.

The selected design return period for the establishment of flood risk areas is 100 years. A 100-yr flow estimate for the Mississagi River below Red Rock Falls has been made using a single station frequency analysis of Mississagi Falls gauge (02CC008). For Thessalon River, the 100-yr simulated flood flows of the Ministry of Natural Resources and Forestry (MNRF) Rydal Bank and Little Rapids dams were used for this study.

3.2 Flow Estimates

The flow estimates summarized in this section were calculated as part of the hydrologic assessment. The full methodology and data used in the calculations are described in full in the Hydrology Interim Report (H366743-0000-228-230-0002). Table 3-1, Table 3-2 and Table 3-3 present the main results for the hydrology assessment.

Table 3-1: Estimated 100-Yr River Flows

Location	100-Yr Flood Flow (m^3/s)	Estimation Methodology
Mississagi River at Red Rock Falls	1020	Single Station Frequency Analysis
Thessalon River at Rydal Bank Dam	318.4	MNRF Simulated Design Outflow
Little Thessalon River at Little Rapids Dam	87.9	MNRF Simulated Design Outflow

Table 3-2: Estimated 100-Yr Lake Inflows

Lake Name	100-Yr Flood Inflow (m^3/s)	Hydrologic Region	
		Name	Drainage Area Limits
Cranberry Lake	3.9	1	1 to 25 km^2
Clear Lake	1.8		
Dean Lake	3.2		
Little Basswood Lake	7.4		
N/A (Little Dean Lake)	3.6		
Warnock Lake	2.3		
Brownlee Lake	2.3		
Birch Lake	6.4		
Bright Lake	54.9	2	85 to 190 km^2
Basswood Lake	27.2		

Table 3-3: Lake Huron 100-Yr Level

100-Yr Flood Level (m)	Reference
177.8	Great Lakes – St. Lawrence River System and Large Inland Lakes TECHNICAL GUIDES FOR FLOODING, EROSION AND DYNAMIC BEACHES in support of Natural Hazards Policies 3.1 of the Provincial Policy Statement (1997) of the Planning Act

4. Hydraulic Assessment

This hydraulic study has been divided into three categories of water body to accommodate the different types of data available for the required assessment: Major River, Minor River and Lakes. The Thessalon and Mississagi rivers have been deemed Major Rivers as they pose a known flood risk to the community and were initially identified as requiring floodplain mapping. Bathymetric data was collected for hydraulic modeling of these two rivers. The Bolton River, Harris Creek, Pickerel Creek, Pahpashcah Creek, Potomac River, and Little Thessalon River were identified as minor rivers that may also require floodplain mapping. These smaller rivers were not included in the bathymetric survey but estimated river geometry for flood risk areas were established using the LiDAR data. LiDAR was also used to establish the discharge rating curves for each of the lakes in the study.

4.1 Major River Hydraulics

Both the Thessalon River and Mississagi River have known flooding risks to the community. Thus, bathymetric data was collected for these rivers to provide data for hydraulic modeling of the rivers and provide detailed estimation of the flood risk areas for both rivers.

4.1.1 Thessalon River

The Thessalon River enters the municipality through the western municipal boundary and flows southeast toward the town of Thessalon. Figure 4-1 illustrates the characteristics of the river channel at the western boundary of the municipality. The river exits the municipality at the boundary with the town of Thessalon, where it continues south to Lake Huron. The river channel consists of a mix of bedrock and sediment. Figure 4-2 illustrates an example of the bedrock hydraulic controls present at many locations along the length of the river. Figure 4-3 presents an example of the erosion of the sedimentary banks of the Thessalon River. Erosion is progressing outwards along bends of the river. This erosion can become problematic to property owners as the river encroaches on their property. Bridges over the Thessalon River are small single-span bridges with no piers. An example of the typical bridges on the Thessalon River is provided in Figure 4-4, which is the River Road Bridge.

Bathymetric cross-sections were collected for the Thessalon River. These cross-sections along with the LiDAR data was used to create a hydraulic model of the river. This model extends from the western municipal boundary to Lake Huron. Model simulations were run using the estimated 100-yr flows in order to determine the flood risk area. The schematic layout of the river hydraulic model and surveyed cross-sections is provided in Figure 4-5.

Figure 4-1: Thessalon River Upstream Municipal Boundary

Figure 4-2: Bedrock Hydraulic Control

Figure 4-3: Erosion of Thessalon Riverbank Near Junction with Little Thessalon River

Figure 4-4: River Road Bridge on Thessalon River

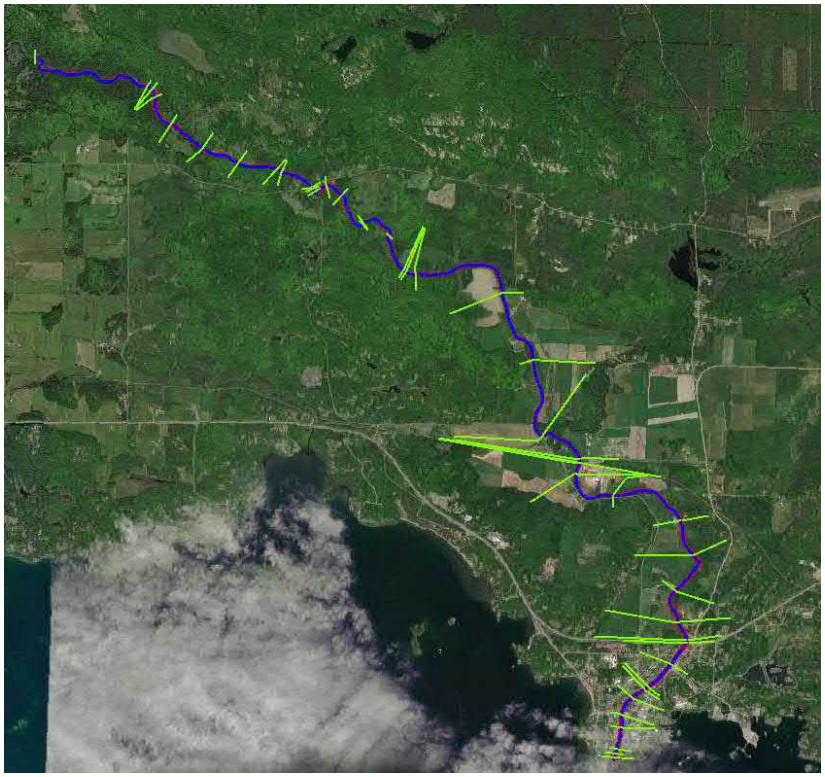


Figure 4-5: Thessalon River Hydraulic Model Schematic and Cross-Section Layout

The following bridges have been surveyed and included in the hydraulic model of the Thessalon River:

- Ansonia Road Bridge
- River Road Bridge
- Sherwood Road Bridge
- Rail Bridge
- Trans-Canada Highway 17 Bridge (outside of the municipality boundary)
- Government Road Bridge (outside of the municipality boundary)
- Frances Street Bridge (outside of the municipality boundary).

The Thessalon River HEC-RAS hydraulic model was calibrated using the edge of water line collected during bathymetric collection. Though there was no flood data to calibrate to, a sensitivity analysis was conducted using typical Manning's n roughness coefficient of the overbank. The sensitivity range of overbank Manning's n was from 0.065 to 0.05 estimate, and the difference in flood level estimates at the top of the reach was around 5 cm. The Manning's n of the overbank area was set at a conservative value of 0.065 based on the field

investigation. It was concluded that this was sufficient for the purposes of establishing a conservative flood risk area.

4.1.2 Mississagi River

The Mississagi River enters the municipality downstream of Red Rock Dam, the last in a series of generating stations along the Upper Mississagi River. These hydro generation stations are operated by the Mississagi Power Trust, a subsidiary of Evolugen by Brookfield Renewable Power. The dams in the upper Mississagi basin regulate the flow on the river and reduce the overall risk of flooding. Rocky Island Dam, the most upstream dam on the Mississagi, retains the majority of the spring runoff for future power generation on an annual basis. Figure 4-6 illustrates the location of the dams and hydro stations in relation to the Huron Shores study area.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Aubrey Falls Generating Station

Rocky Island Reservoir Control Structure

Mount Lake Dam

Rottier Lake Dam

Rawhide Lake Dam

Rayner Generating Station

Wells Generating Station

Red Rock Falls Generating Station

Big Basswood Dam

Lake Huron

LEGEND

- Huron Shores Municipal Boundary
- Mississagi Falls
- Regulation Structure

Mississagi River Watershed

- Red Rock Basin
- Mississagi Falls Basin

DATA SOURCES
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario
3. Watershed Boundaries - OFAT

0 5 10 20 km

1:500,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Regulation Structures in the Mississagi River Watershed
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	4-6

HATCH

The Mississagi River continues through the community of Iron Bridge and eventually leaves the municipal boundaries near Blind River. Figure 4-7 illustrates the general characteristics of the river as seen from Dean Bridge about halfway between Iron Bridge and Blind River. Dean Bridge has historical value to the community and was built prior to and survived the flood of record in 1979.

Figure 4-7: Mississagi River from Dean Bridge

Figure 4-8 illustrates the model river and cross-section layout. The following bridges have been included in the hydraulic model of the Mississagi River:

- Iron Bridge
- Dean Lake Bridge.

The Mississagi River HEC-RAS hydraulic model was calibrated using the edge of water line collected during bathymetric collection. Though there was no flood data to calibrate to, a sensitivity analysis was conducted using typical Manning's n roughness coefficient of the overbank. The sensitivity range of overbank Manning's n was from 0.06 to 0.045 estimate, and the difference in flood level estimates at the top of the reach was around 5 cm. The Manning's n of the overbank area was set at a conservative value of 0.06 based on the field investigation. It was concluded that this was sufficient for the purposes of establishing a conservative flood risk area.

Figure 4-8: Mississagi River Model River and Cross-Section Layout

4.2 Minor River Hydraulics

Several smaller rivers were studied to determine their extent of floodplain mapping required and a conservative estimate for flood risk area. At this point, no bathymetric or calibration data was available for the minor rivers. Based on the location-specific topography and data availability, different approaches and level of analysis were conducted on each river reach. This section describes the available data and methodology used to assess the risk of flooding for each river reach.

4.2.1 Bolton River

The Bolton River runs between Bright Lake and the Mississagi River. Bathymetric cross-sections were not available for this study, and therefore, assumed cross-sections were created to model the river. The assumed cross-sections were based on field observation during the field investigation in October 2021. This methodology allows for a useful estimate of the flood risk areas but needs to be updated when bathymetric cross-sections are collected to ensure the accuracy of the hydraulic model for floodplain mapping. Additionally, road crossings geometry would also be required to complete floodplain mapping in this area. Figure 4-9 and Figure 4-10 present the general characteristics of the river. This river has a mild slope, and the river channel is mostly sedimentary and vegetated. Figure 4-11 illustrates the layout of the Bolton River model from Bright Lake to the Mississagi River.

Figure 4-9: Bolton River near Bright Lake

Figure 4-10: Bolton River from Bolton River Road

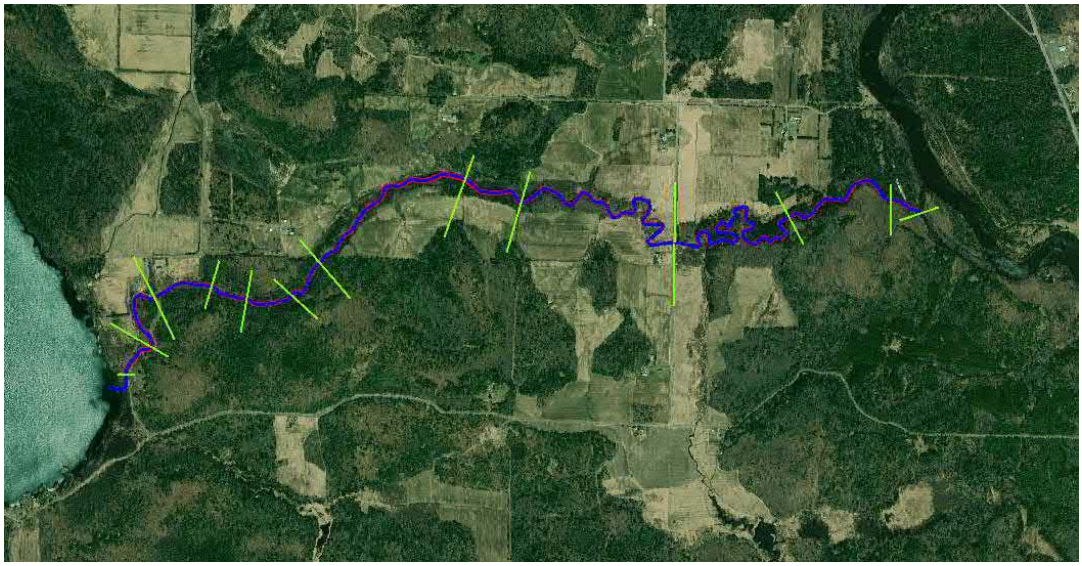


Figure 4-11: Bolton River Model River and Cross-Section Layout

4.2.2 Harris Creek

Harris Creek is a short section of river downstream of Basswood Dam connecting Basswood Lake to Bright Lake. Harris Creek has a steep slope, and the channel is predominantly made of bedrock. Figure 4-12 and Figure 4-13 illustrates the slopes and smooth bedrock riverbed of the creek. In Figure 4-14, the large rectangular culvert under Highway 17 is visible. Figure 4-15 illustrates the extent and layout of the HEC-RAS hydraulic model.

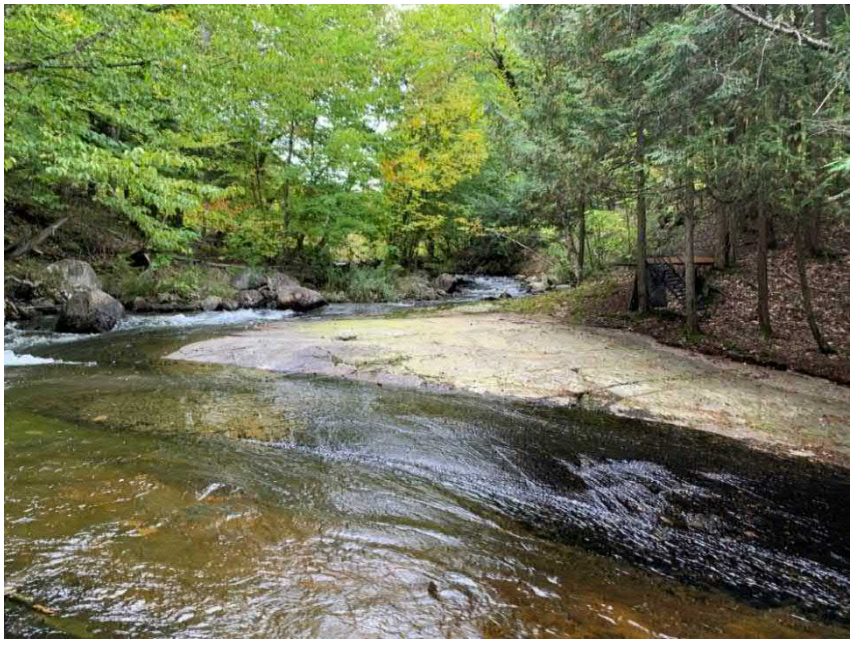


Figure 4-12: Harris Creek Bedrock Channel

Figure 4-13: Harris Creek Upstream of Highway 17

Figure 4-14: Harris Creek Upstream of Highway 17 Culvert

Figure 4-15: Harris Creek Model River and Cross-Section Layout

4.2.3 Pickerel Creek

Pickerel Creek connects Brownlee Lake and Little Basswood Lake to Bright Lake, through a series of channels and marshes. Marshland surrounds Highway 17 at the crossing of Pickerel Creek as shown in Figure 4-16. This area is particularly vulnerable to flooding. Though there was no bathymetric data, LiDAR provided enough data to create a coarse model of the creek. Figure 4-17 presents the layout of the hydraulic model for Pickerel Creek. This methodology allows for a useful estimate of the flood risk areas but needs to be updated when bathymetric cross-sections are collected to ensure the accuracy of the model for floodplain mapping. Additionally, road crossings geometry would also be required to complete floodplain mapping in this area.

Figure 4-16: Pickerel Creek Crossing Highway 17 (Google Street View)

Figure 4-17: Pickerel Creek Model River and Cross-Section Layout

4.2.4 Pahpashcah Creek

Based on the LiDAR, it appears that Pahpashcah Creek may have once been part of an ancient reach of the Mississagi River, but the river has moved to its current location. The creek is mostly flat and flows into the Mississagi River further downstream; though under extreme flooding of the Mississagi River, it may reverse direction. Figure 4-18 shows the overgrown state of the creek as seen from a private road just upstream of the confluence with the Mississagi River. Figure 4-19 illustrates the river and cross-section layout of the Pahpashcah Creek HEC-RAS hydraulic model.

Figure 4-18: Pahpashcah Creek Overgrowth

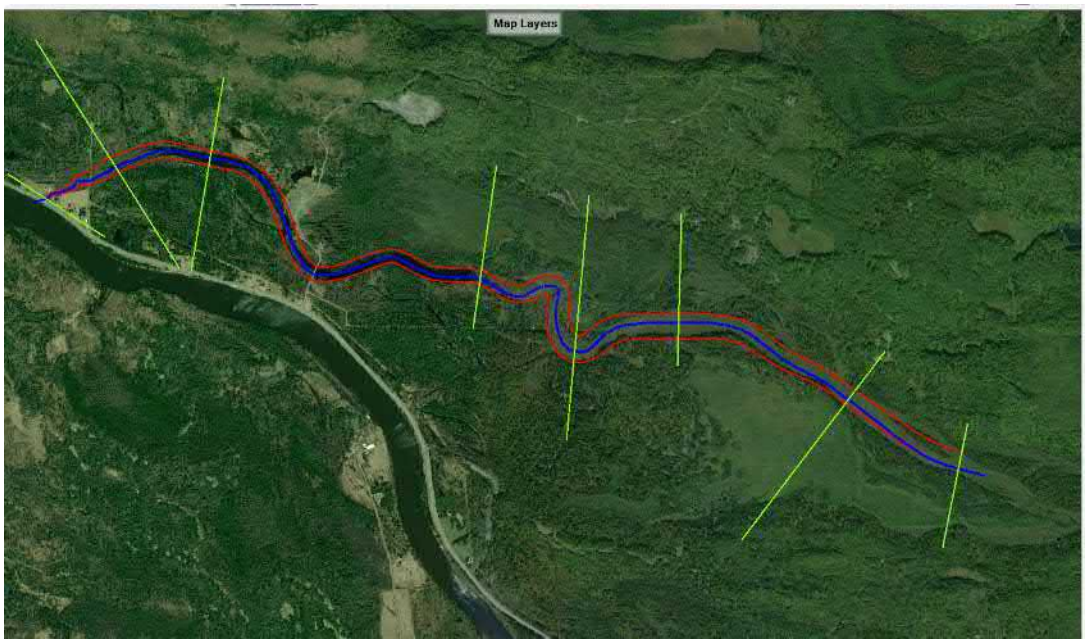


Figure 4-19: Pahpashcah Creek Model River and Cross-Section Layout

4.2.5 Potomac River

The Potomac River crosses the northeast corner of the municipality for approximately 6 km. This section of river is unpopulated and hard to access. The natural floodplain has been identified using LiDAR data, but no hydraulic modeling was conducted. Additional work will be required to establish the extent of flooding for a regulatory event, because bathymetric data was not collected for this reach as part of this project, and the hydraulic control points are beyond the limits of the municipality. Figure 4-20 presents the LiDAR data collected for Potomac River. The flood risk area identified in Section 5 is based on the floodplain visible in the LiDAR data.

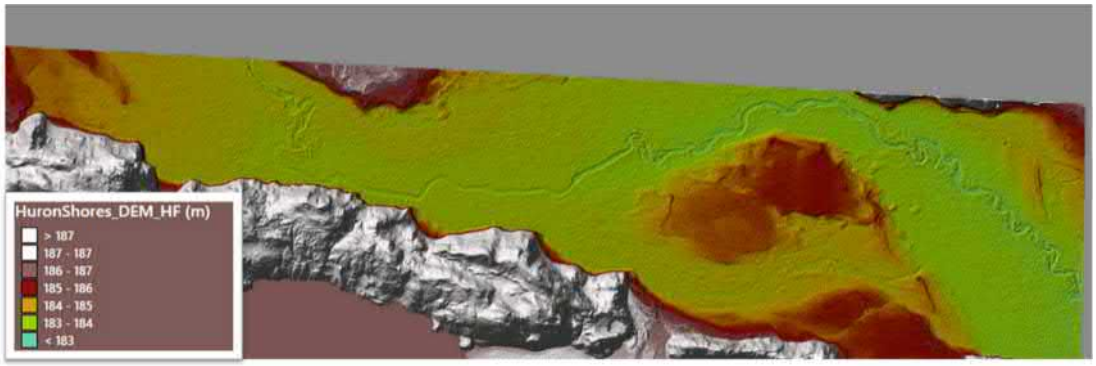


Figure 4-20: LiDAR Collection of Potomac River

4.2.6 Little Thessalon River

Shaw Dam is approximately 200 m inside the northern boundary of the municipality. During the public information session, several community members expressed concern for possible flooding downstream of Shaw Dam. Gerald Sanders provided a photo of the dam seen in Figure 4-21. The river runs from the northern boundary of the municipality to the confluence with the Thessalon River between Nestorville Road and Sherwood Road. Figure 4-22 illustrates outflow of the dam provided by Gerald Sanders. The natural floodplain has been identified using LiDAR data, but no hydraulic modeling was conducted. Additional work will be required to establish the extent of flooding for a regulatory event, because bathymetric data was not collected for this reach as part of this project.

Figure 4-21: Shaw Pond - November 2, 2020 (provided by Gerald Sanders)

Figure 4-22: Shaw Dam - November 1, 2021 (provided by Gerald Sanders)

Little Thessalon River can be split into three reaches: the upper reach from Shaw Dam Lake to McCreight's Pond, mid-reach from McCreight's Pond to Little Rapids, and the lower reach from Little Rapids to the confluence with the Thessalon River. Figure 4-23, Figure 4-24 and Figure 4-25 presents a snapshot of the LiDAR data collected for each of the reaches of Little Thessalon River.

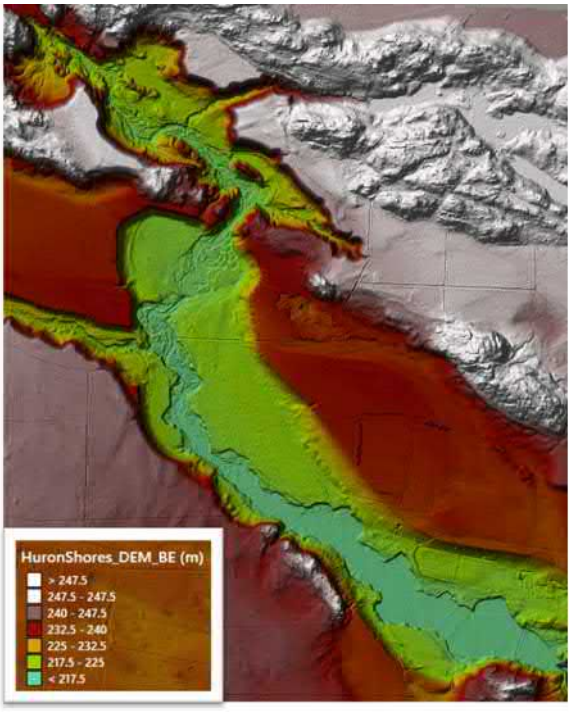


Figure 4-23: LiDAR Collection of Upper Little Thessalon River

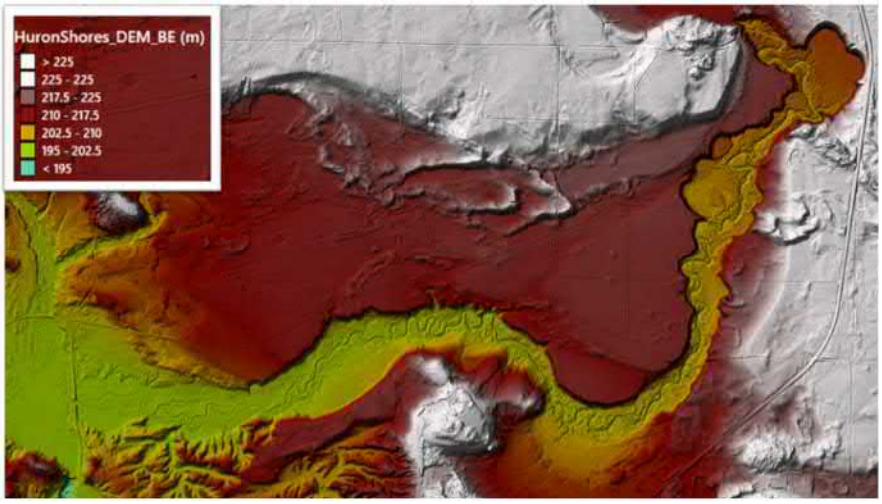


Figure 4-24: LiDAR Collection of Middle Little Thessalon River

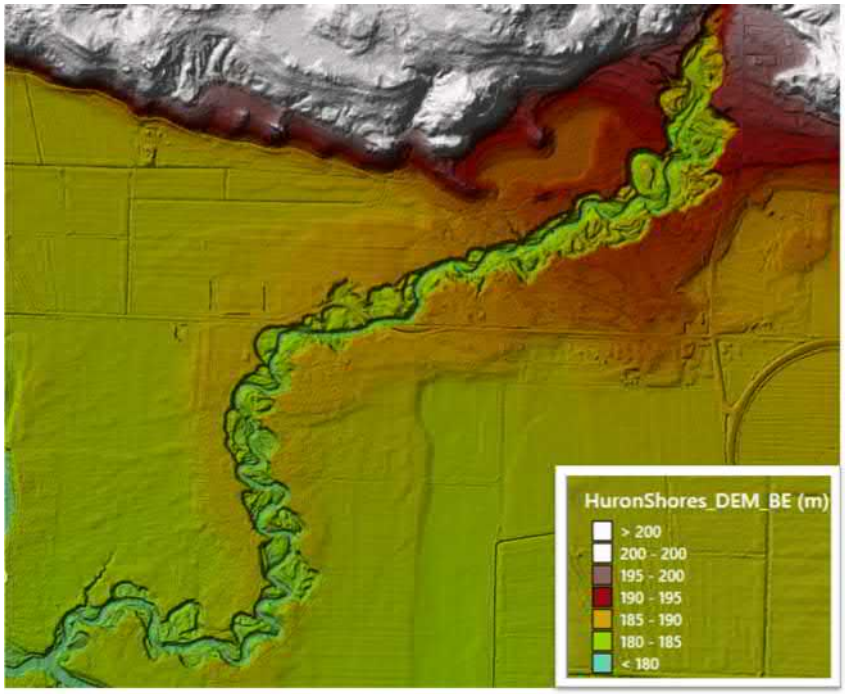


Figure 4-25: LiDAR Collection of Lower Little Thessalon River

4.3 Lake Outlet Hydraulics

Lake levels are controlled by the relationship between inflow, storage volume and outlet geometry. For this study, a simplified methodology was used to establish conservative estimates for lake flood levels. This methodology used estimates of lake inflows determined as part of the hydrology study summarized in Section 3.1 and described in full in the Hydrology Interim Report (H366743-0000-228-230-0002), as well as outlet geometry collected in the field investigation and LiDAR data. This section describes the outlet geometry and the methodology used to determine the lake levels at each location studied.

4.3.1 Basswood Lake

Basswood Lake is controlled at the outlet by Big Basswood Lake Dam operated by MNRF. This dam has the Timmins Storm identified as its regulatory event with an outflow of 14.3 m^3/s and a headwater level of 208.63 m. The dam spills into Harris Creek as shown in Figure 4-26.

Figure 4-26: Basswood Lake Outlet Dam (Looking Upstream)

4.3.2 Birch Lake

The outlet of Birch Lake is crossed by a low-lying road crossing. This crossing was captured in the LiDAR and was used to create an outlet model of the reach below the lake. Based on this information, an outlet rating curve was created to estimate lake levels associated with the predicted inflows. The outlet was also captured by drone imagery shown in Figure 4-27. Figure 4-28 illustrates the LiDAR collected at the outlet of Birch Lake. Using the LiDAR data to establish the elevation of the crossing, a rating curve was created to determine the lake level for a range of outflows. Table 4-1 summarizes the rating curve as determined from hydraulic modeling of the outlet.

Figure 4-27: Birch Lake Outlet

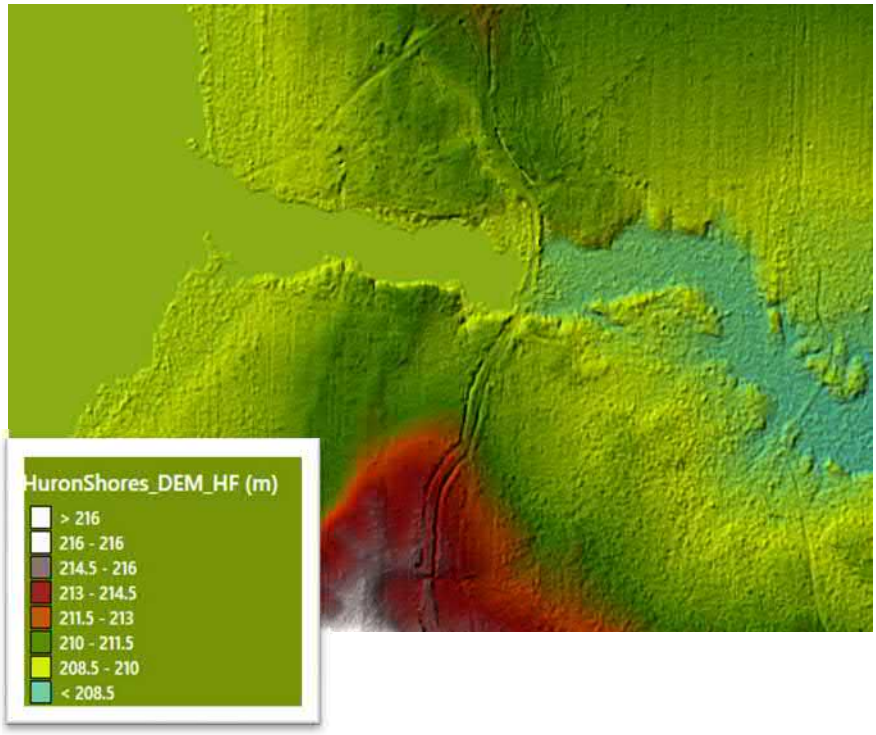


Figure 4-28: Birch Lake Outlet LiDAR

Table 4-1: Birch Lake Estimated Outlet Rating Curve

Discharge (m^3/s)	Lake Surface Elevation (m)
0	207.97
1	208.17
2	208.25
3	208.29
4	208.32
5	208.34
10	208.42
15	208.47
20	208.52
40	208.66
60	208.78

4.3.3 Bright Lake

Bright Lake drains through Bolton River to the Mississagi River. The model created for the Bolton River outlet rating curve for Bright Lake was used to estimate the lake level associated with the predicted inflows. The outlet of the lake is presented in Figure 4-29. Figure 4-30 was taken on the Bolton River downstream of Bight Lake at the Bolton River Road crossing showing the approximate depth of flow beneath the crossing. Figure 4-31 illustrates the LiDAR data collected at the outlet of Bright Lake. Using the LiDAR data and an assumed bathymetric cross-section for Bolton River, a rating curve was created to determine the lake level for a range of outflows. Table 4-2 summarizes the rating curve as determined from hydraulic modeling of the outlet.

Figure 4-29: Bright Lake Outlet

Figure 4-30: Bolton River Road Crossing of Bolton River

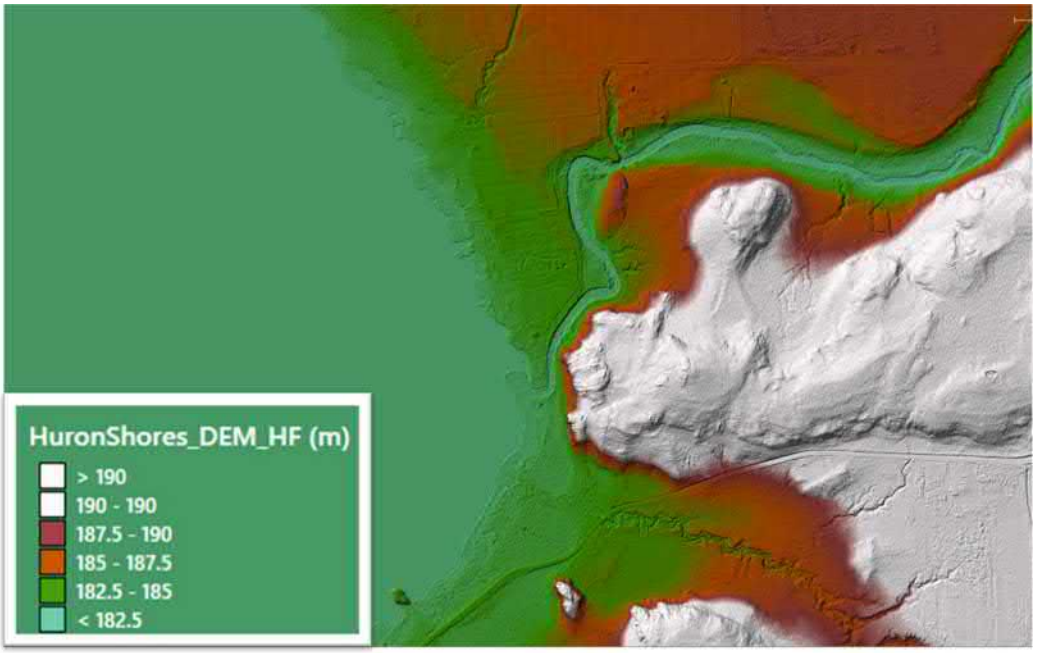


Figure 4-31: Bright Lake Outlet LiDAR

Table 4-2: Bright Lake Estimated Outlet Rating Curve

Discharge (m^3/s)	Lake Surface Elevation (m)
0	179.79
10	181.49
20	182.05
30	182.43
40	182.74
50	183.02
60	183.27
70	183.50
80	183.70
90	183.85
100	183.97

4.3.4 Brownlee Lake

Brownlee Lake outlet is controlled by a beaver dam. Downstream of the beaver dam, there is a section of marshland (Figure 4-32) which turns into a forested stream (Figure 4-33) before crossing under Brownlee Road (Figure 4-34) and eventually to Little Basswood Lake. Figure 4-35 illustrates the LiDAR data collected at the outlet of Brownlee Lake. Using the LiDAR data to establish the elevation of the beaver dam, a rating curve was created to determine the lake level for a range of outflows. Table 4-3 summarizes the rating curve as determined from hydraulic modeling of the outlet.

Figure 4-32: Marshland Downstream of Brownlee Lake Outlet

Figure 4-33: Forested Stream Downstream of Brownlee Lake Outlet

Figure 4-34: Brownlee Lake Outlet/Pickerel Creek at Brownlee Road

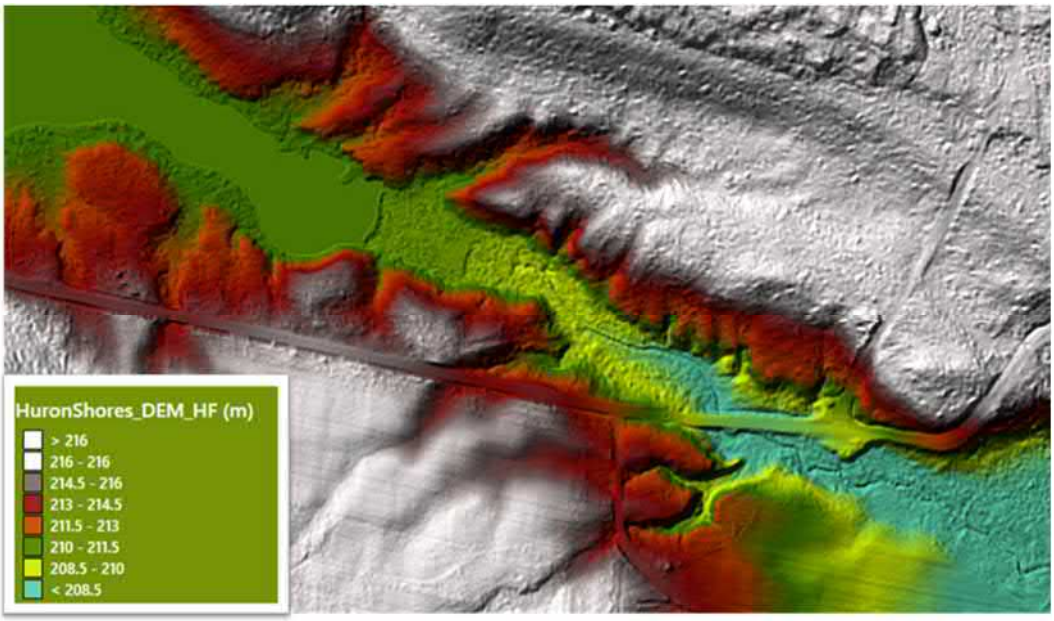


Figure 4-35: Brownlee Lake Outlet LiDAR

Table 4-3: Brownlee Lake Estimated Outflow Rating Curve

Discharge (m^3/s)	Lake Surface Elevation (m)
0	209.67
1	209.84
2	209.88
3	209.90
4	209.92
5	209.93
10	210.01
15	210.07
20	210.11
40	210.29
60	210.44

4.3.5 Clear Lake

Clear Lake initially appeared to be self-contained, but an outlet was visible in the LiDAR data. Though publicly available watershed maps indicate that Clear Lake drains into Basswood Lake, it in fact drains into Warnock Lake through a tiny outlet channel obscured by vegetation. An outlet model was created to establish the outlet rating curve to determine an estimated lake level. There is an 18-m drop between Clear Lake and Warnock Lake; Figure 4-36 shows the channel profile along the length of that drop. Figure 4-37 illustrates the LiDAR data collected at the outlet of Clear Lake. Using the LiDAR data to establish the elevation of the outlet, a rating curve was created to determine the lake level for a range of outflows. Table 4-4 summarizes the rating curve as determined from hydraulic modeling of the outlet.

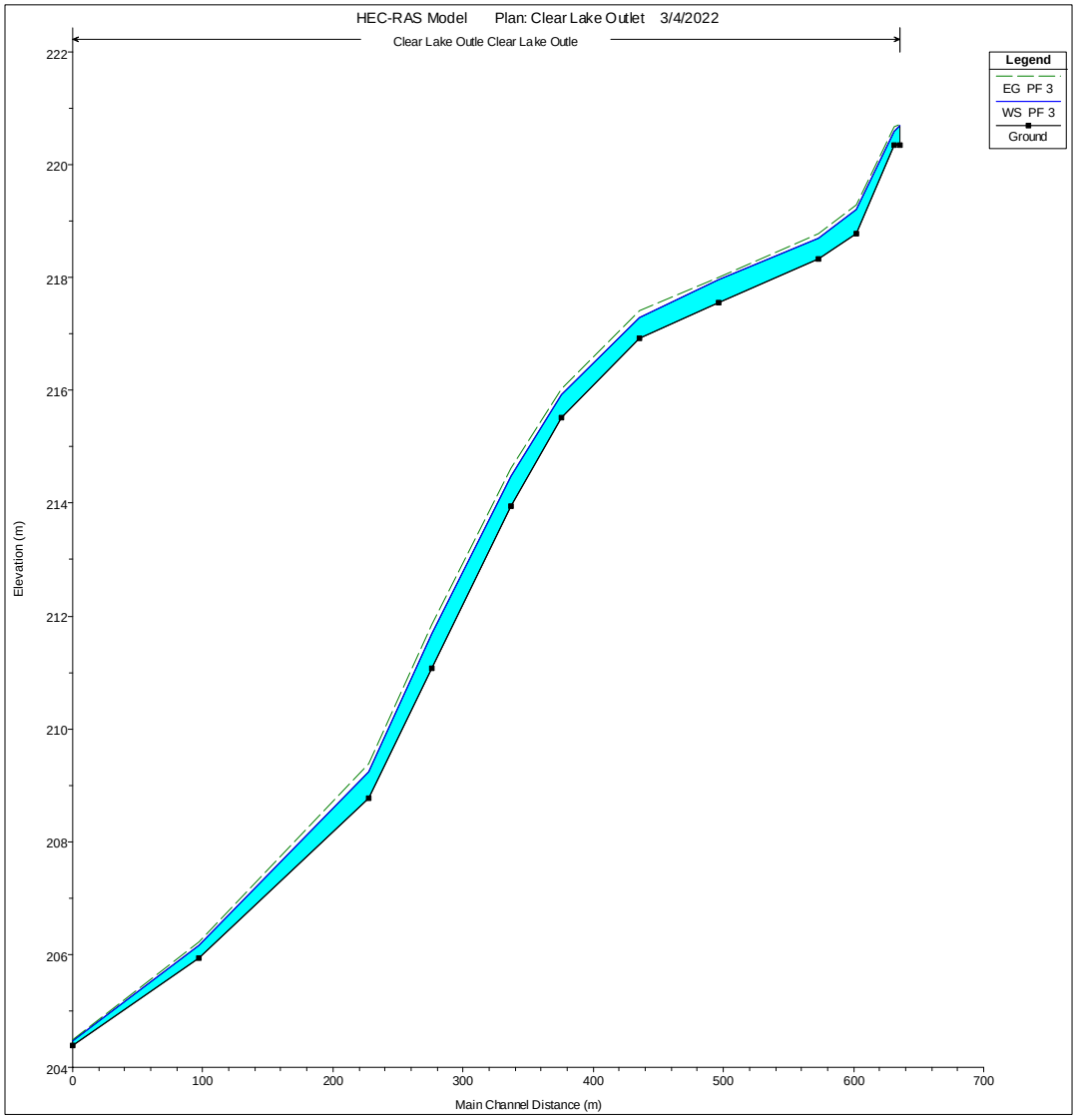


Figure 4-36: Clear Lake Outlet Model Profile

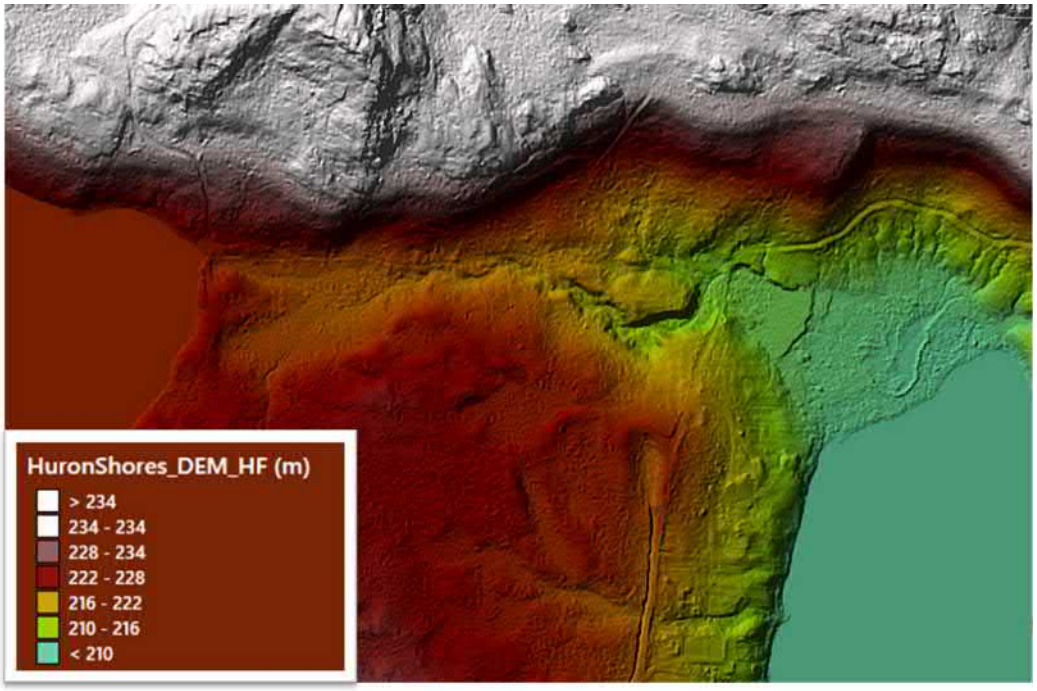


Figure 4-37: Clear Lake Outlet LiDAR

Table 4-4: Clear Lake Estimated Outflow Rating Curve

Discharge (m^3/s)	Lake Surface Elevation (m)
0	220.36
1	220.58
2	220.65
3	220.70
4	220.74
5	220.78
10	220.91
15	221.01
20	221.09
40	221.34
60	221.53

4.3.6 Cranberry Lake

Cranberry Lake outlet is controlled by a beaver dam, presented in Figure 4-38. This beaver dam regulates lake levels. This dam was identified in the LiDAR data and a model was created to establish a rating curve for the outlet. From this rating curve, an estimated lake

level was determined. Figure 4-39 illustrates the LiDAR data collected at the outlet of Cranberry Lake. Using the LiDAR data to establish the elevation of the beaver dam, a rating curve was created to determine the lake level for a range of outflows. Table 4-5 summarizes the rating curve as determined from hydraulic modeling of the outlet.

Figure 4-38: Cranberry Lake Outlet Beaver Dam

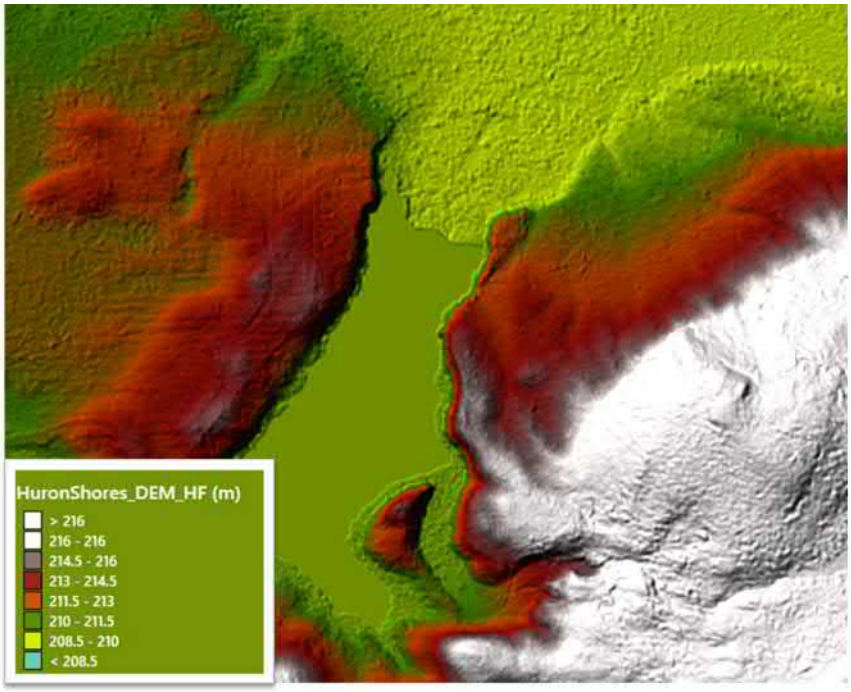


Figure 4-39: Cranberry Lake Outlet LiDAR

Table 4-5: Cranberry Lake Estimated Outflow Rating Curve

Discharge (m^3/s)	Lake Surface Elevation (m)
0	209.21
1	209.30
2	209.33
3	209.34
4	209.36
5	209.36
10	209.41
15	209.44
20	209.48
40	209.59
60	209.68

4.3.7 Dean Lake

Dean Lake outlet is controlled by a beaver dam, presented in Figure 4-40. This dam regulates lake levels, and the local residents have reinforced the dam with steal rebar. In the past, the dam has breached and lowered the lake level reducing the recreational use of the lake. Figure 4-40 shows a piece of the rebar installed by residents, and Figure 4-41 shows the channel downstream of the dam toward Little Dean Lake. Figure 4-42 illustrates the LiDAR data collected at the outlet of Dean Lake. Using the LiDAR data to establish the elevation of the beaver dam, a rating curve was created to determine the lake level for a range of outflows. Table 4-6 summarizes the rating curve as determined from hydraulic modeling of the outlet.

Figure 4-40: Dean Lake Outlet Reinforced Beaver Dam

Figure 4-41: Dean Lake Outlet Beaver Dam and Downstream Channel

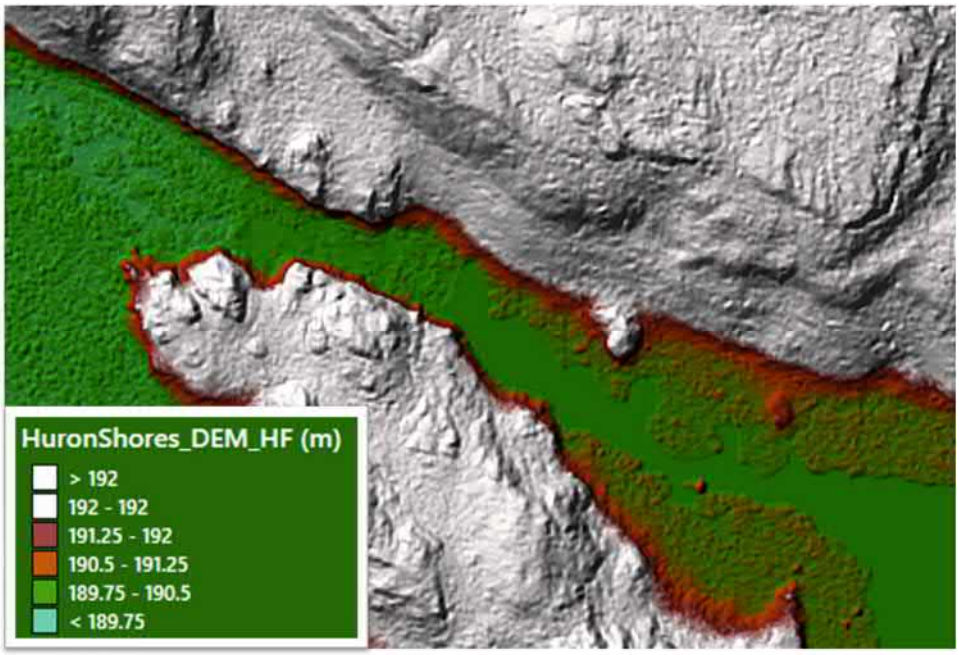


Figure 4-42: Dean Lake Outlet LiDAR

Table 4-6: Dean Lake Estimated Outflow Rating Curve

Discharge (m^3/s)	Lake Surface Elevation (m)
0	189.81
1	190.00
2	190.07
3	190.13
4	190.18
5	190.22
10	190.39
15	190.53
20	190.65
40	190.98
60	191.28

4.3.8 Little Basswood Lake

Little Basswood Lake outlet is controlled by a roadway through the marshland of Pickerel Creek. There is a small makeshift bridge across Pickerel Creek shown in Figure 4-43. The opening to this bridge is mostly blocked by the logs used for construction. There did not appear to be a difference in water level from the upstream to downstream sides of the bridge. Based on estimated opening geometry and LiDAR data, a coarse model of Pickerel Creek was developed, described in Section 4.2.3. This model was used to establish the estimated lake level for Little Basswood Lake. Table 4-7 summarizes the rating curve as determined from hydraulic modeling of the outlet.

Figure 4-43: Little Basswood Lake Outlet to Pickerel Creek

Table 4-7: Little Basswood Lake Estimated Outflow Rating Curve

Discharge (m^3/s)	Lake Surface Elevation (m)
0	205.23
1	205.52
2	205.62
3	205.73
4	205.97
5	206.07
10	206.24
15	206.46
20	206.83
40	207.15
60	207.33

4.3.9 Little Dean Lake

Though Little Dean Lake outlet was not accessible during the field investigation, the outlet is visible in the LiDAR data. Local residents advised that, similar to Dean Lake, the outlet of Little Dean Lake was controlled by a beaver dam. Figure 4-44 illustrates the LiDAR data collected at the outlet of Little Dean Lake. Using the LiDAR data to establish the elevation of

the beaver dam, a rating curve was created to determine the lake level for a range of outflows. Table 4-8 summarizes the rating curve as determined from hydraulic modeling of the outlet.

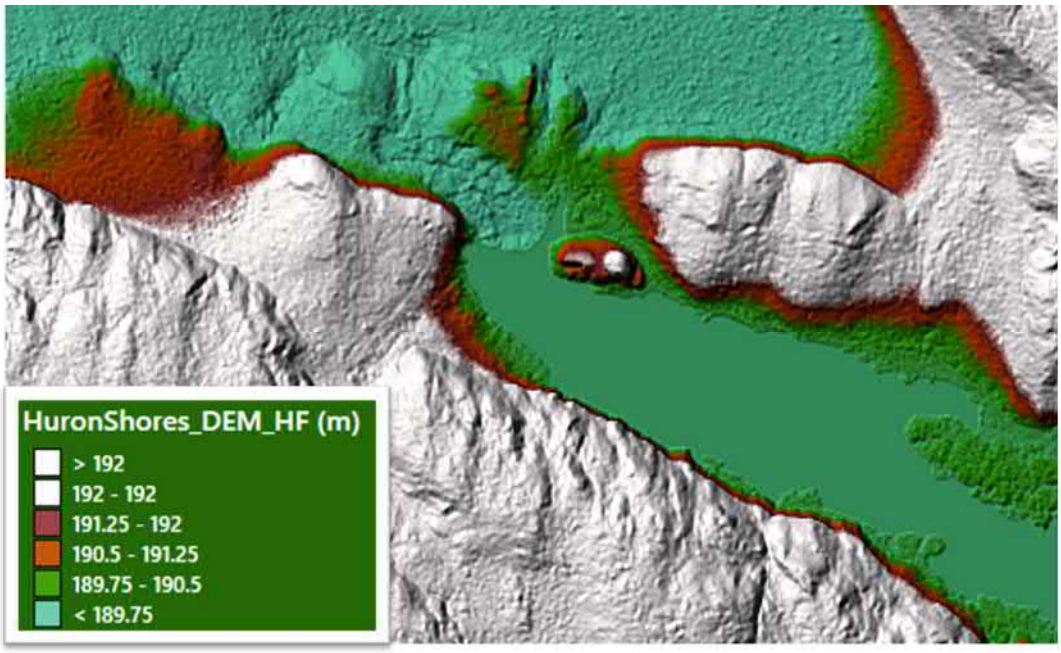


Figure 4-44: Little Dean Lake Outlet LiDAR

Table 4-8: Little Dean Lake Estimated Outflow Rating Curve

Discharge (m^3/s)	Lake Surface Elevation (m)
0	189.13
1	189.26
2	189.29
3	189.31
4	189.33
5	189.35
10	189.41
15	189.48
20	189.54
40	189.78
60	189.99

4.3.10 Warnock Lake

Warnock Lake spills over a 20-m waterfall. Using the LiDAR data to establish the elevation of the outlet, a rating curve was created to determine the lake level for a range of outflows. Figure 4-45 presents the LiDAR data collected for the Warnock Lake outlet, and Figure 4-46 illustrates the channel profile along the length of that drop. Table 4-9 summarizes the rating curve as determined from hydraulic modeling of the outlet.

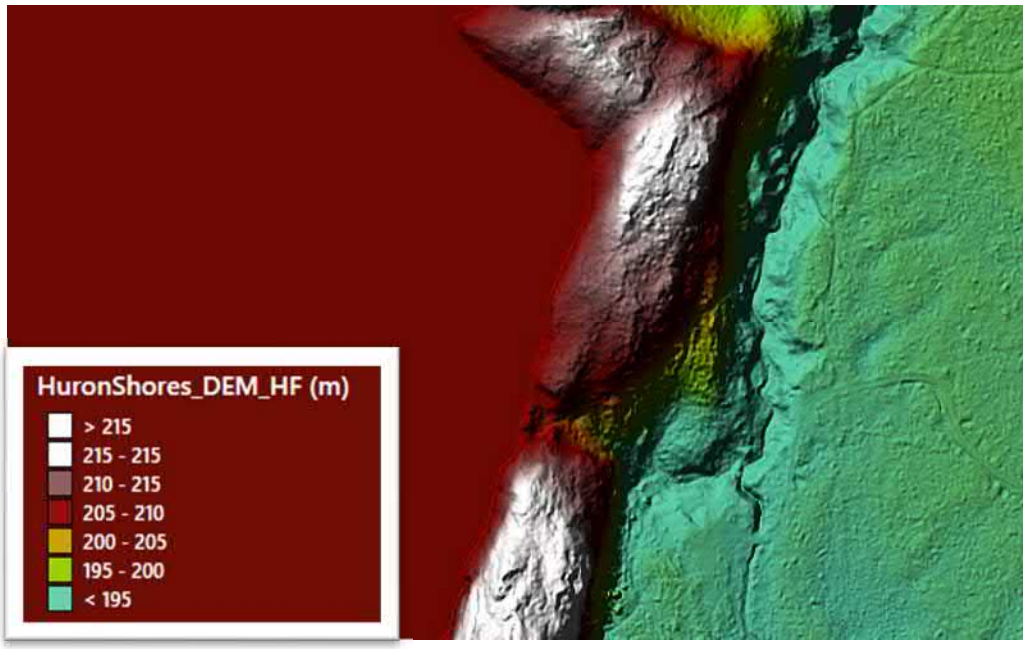


Figure 4-45: Warnock Lake Outlet LiDAR

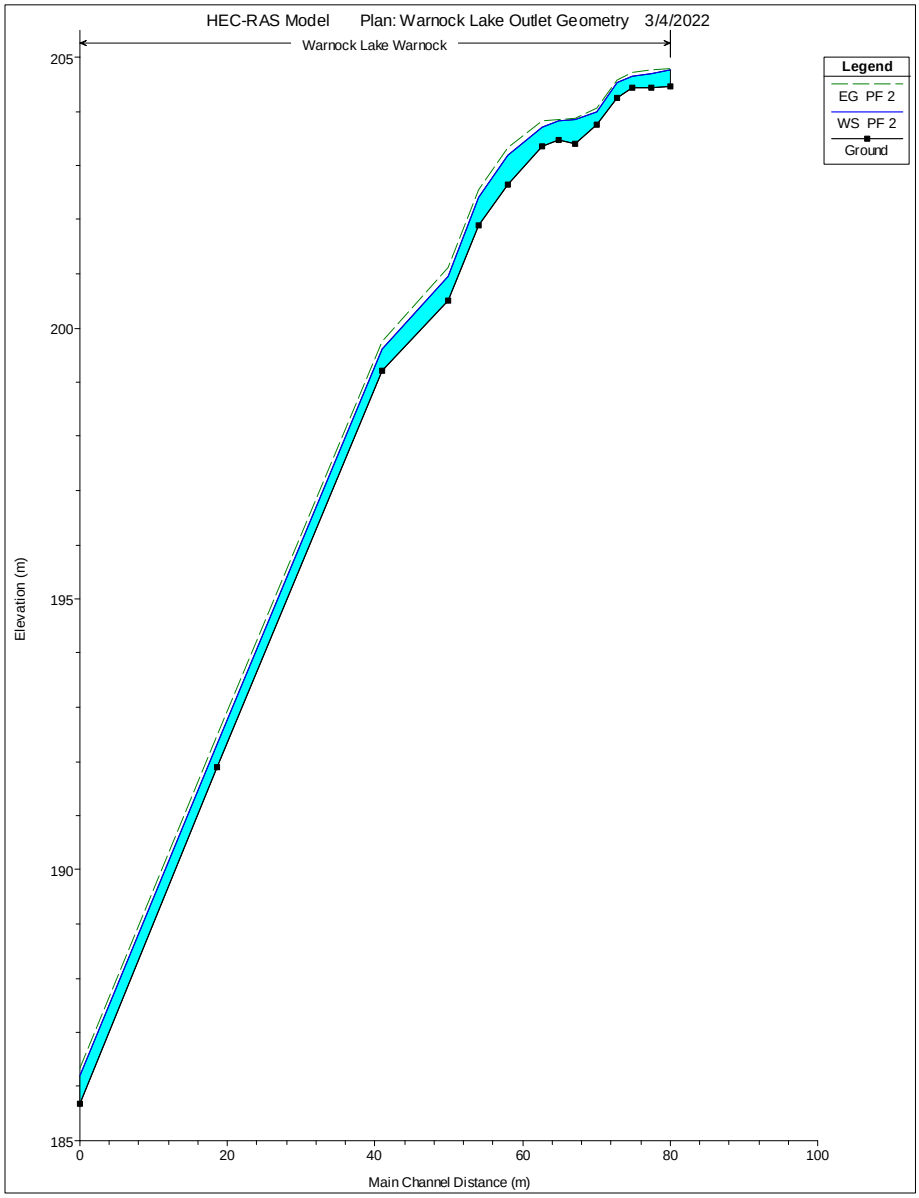


Figure 4-46: Warnock Lake Outlet Model Profile

Table 4-9: Warnock Lake Estimated Outflow Rating Curve

Discharge (m^3/s)	Lake Surface Elevation (m)
0	204.45
1	204.69
2	204.78
3	204.85
5	204.97
10	205.20
15	205.36
20	205.49
40	205.80
60	205.98
80	206.17

4.4 Lake Level Estimates

Due to the coarseness of the modeling and data available for the lake outlets, a range of elevations were produced to encompass potential flood risks for each lake. Table 4-10 presents the lake level estimates determined from the hydraulic modeling of the lake outlets. The Low Range in the table below presents the estimate lake elevation based on the flow data determined in the hydrology assessment. The High Range elevation estimates present a conservative estimate for potential flood levels on more extreme hydrologic conditions. This methodology was used as to establish the sensitivity of the lake to more extreme hydrologic conditions. Bright Lake and Little Basswood Lake levels are the most sensitive to an increase in flow as they have the larger drainage area and a shallow sloped outlet through Bolton River and Pickerel Creek, respectively. It is unlikely for the Bright Lake to ever reach an elevation listed in the High Range with a potential variability of 0.48 cm. Birch Lake, Brownlee Lake, Clear Lake, Cranberry Lake, Dean Lake, Little Dean Lake and Warnock Lake levels are less sensitive to increases in flow as they are less susceptible to backwater effects due to the geometry of their outlets.

Table 4-10: 100-Yr Lake Level Estimates

Lake	Predicted 100-Yr Inflow (m^3/s)	Elevation Estimates (m)	
		Low Range	High Range
Basswood Lake	27.2	208.63	208.75
Birch Lake	6.2	208.29	208.42
Bright Lake	54.9	183.02	183.50
Brownlee Lake	2.3	208.75	209.01
Clear Lake	1.7	220.58	220.78
Cranberry Lake	3.6	209.34	209.41
Dean Lake	3.1	190.13	190.39
Little Basswood Lake	7.2	206.07	206.46
Little Dean Lake	3.5	189.31	189.41
Warnock Lake	2.3	204.78	204.97

5. Qualitative Risk Assessment

5.1 Major River

5.1.1 Thessalon River

Infrastructure, residences and industrial buildings have been identified using arial imagery within the Thessalon River risk area. In the upper reach of the river, the river is steep and the floodplain is confined to a relatively small area surrounding the river. This area is mostly forested. However, beginning at Ansonia Road Bridge downstream to Thessalon, the topography of the floodplain becomes flatter, particularly downstream at Little Thessalon tributary. Several residences and infrastructure become inundated under the modeled 100-yr flood conditions. Figure 5-1 shows the most critical at-risk area of the Thessalon River floodplain within the municipality.

The following roads could be overtopped during a 100-yr flood event on the Thessalon River:

- Ansonia Road
- River Road
- Nestorville Road
- Sherwood Road.

The results of the model show that all the bridges present a risk of overtopping at a 100-yr flood event. This poses a risk not only to the structure of these bridges, but also limits the capacity of the river and increases upstream water levels and potentially increasing the consequences of flooding. This finding underscores the importance of further studying these structures in order to better understand and quantify their impact on flood-prone areas.

There are more than 44 buildings within the flood risk area of the Thessalon River within the municipality. Among them, the Midway Lumber Mills at the left floodplain of the Thessalon River which would present a risk of economic losses to the community.

Problematic erosion and scour have been documented for the Thessalon River from both public consultation and field survey. As observed in the field, the river has a bottom that is predominantly bedrock making the streambed control the vertical elevation and prevent the river from eroding deeper. The river is being forced to widen and meander sideways at specific points which is causing the observed shoreline erosion problems. It is, therefore, essential to consider the erosion problem in the flood risk assessment as that calls into question the integrity of the foundations of the dwellings and structures located near the riverbanks. This erosion is likely to continue and may cause significant financial and environmental consequences to riverfront properties.

Taking into account all of the economic, environmental, societal and infrastructural impacts, Thessalon River is identified as a high priority for floodplain mapping and erosion mitigation studies.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

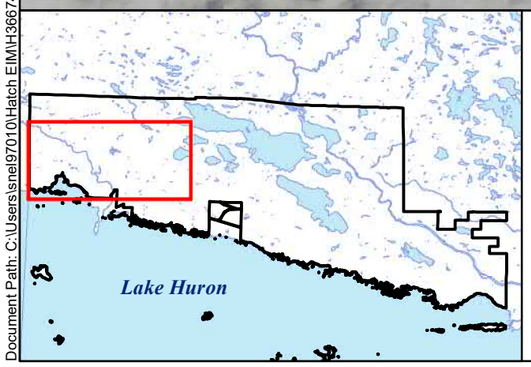
Document Path: C:\Users\snelj97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig\X-X_RiskAreas_ThessalonRiver.mxd

ROAD TOWER
SHAW ROAD
TOWER ROAD
BASSWOOD LAKE ROAD
HOPPER ROAD
ANSONIA ROAD
MCCREIGHTS ROAD
Cranberry Lake Outlet
WINDMILL ROAD
SCHEUERMANN HIGHWAY
Public Works Garage
MAGLEAN ROAD
Forest Lawn Cemetery
Little Rapids Hall
COLLVER ROAD
HIGHWAY 129
Heritage Park Museum
Fire Department, Station 1
INGRAM ROAD
WALKER ROAD
HIGHWAY 17
NESTORVILLE ROAD
RIVER ROAD
SHERWOOD ROAD
STATION ROAD
TRUNK ROAD
HURON SHORE
FELTHAM ROAD
GOVERNMENT ROAD
GREEN LANE
Lake Huron

2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Critical Infrastructure
- Lake Outlet
- Flood Risk Area
- Waterbody
- Huron Shores Municipal Boundary

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.5 1 2 km
1:37,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Thessalon River Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-1

HATCH

5.1.2 Mississagi River

Mississagi River flood risk areas have infrastructure, residences and industrial buildings that have been identified using arial imagery. The first 6 km upstream of the Mississagi Falls is being flooded, but as the land is mainly woodland, the societal and economic impacts are less concerning. However, further downstream, the residential area around Iron Bridge shows that several residences and infrastructure start to be impacted by the water uprising. Among them, there are roads, industrial buildings and residences.

The following list of roads are shown to be at risk of flooding along the Mississagi River:

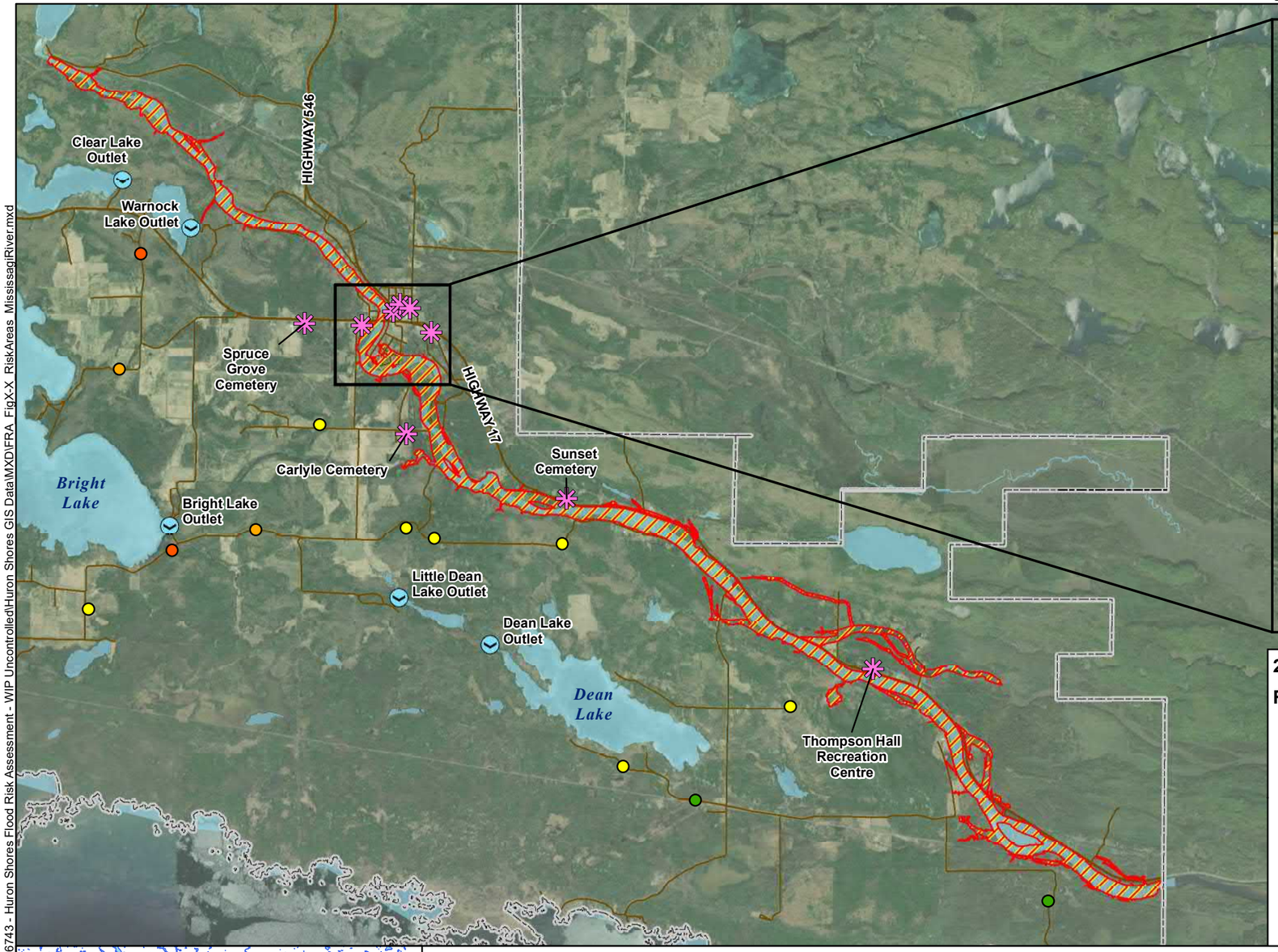
- Highway 17 (Trans-Canada Highway)
- Chevis Road
- Dean Lake Road
- Old Mine Road
- Hartt Road
- Mississagi Crescent
- Eaket Drive
- Riverview Drive
- Short Street.

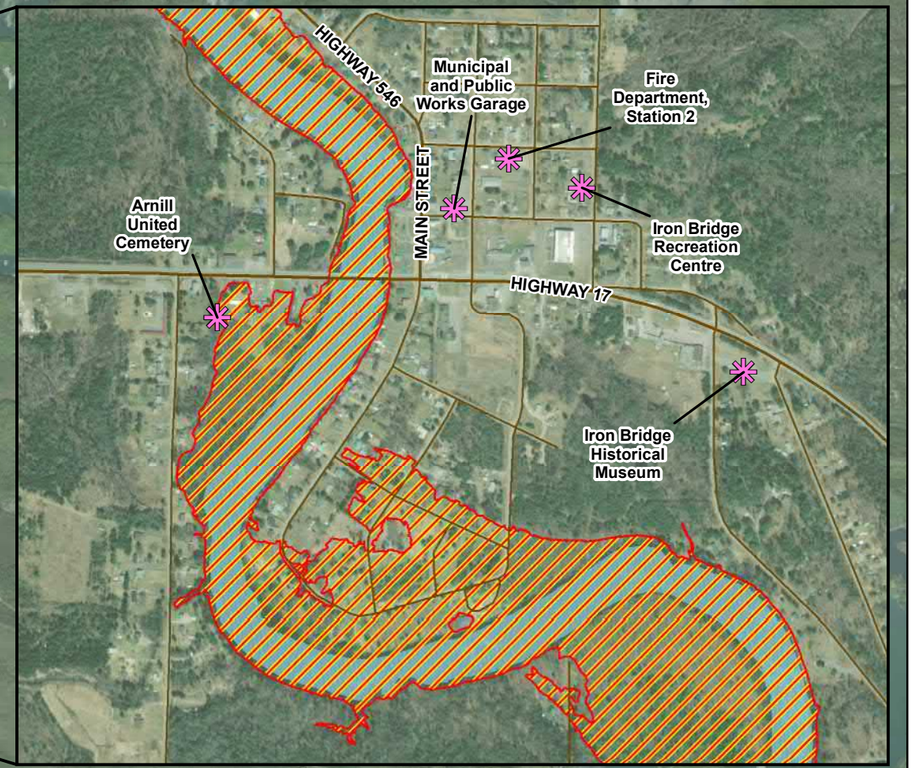
The results of the model show that the modeled bridges do not present a risk of overtopping at a 100-yr flood event. There is around 90 cm of clearance at the entrance of Dean Lake Bridge and 114 cm between the top soffit and the 100-yr level at the upstream entrance of Iron Bridge.

Figure 5-2 shows the most critical at-risk area in the Mississagi River floodplain within the municipality.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Document Path: C:\Users\snelj9701\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig\X-X_RiskAreas_MississagiRiver.mxd

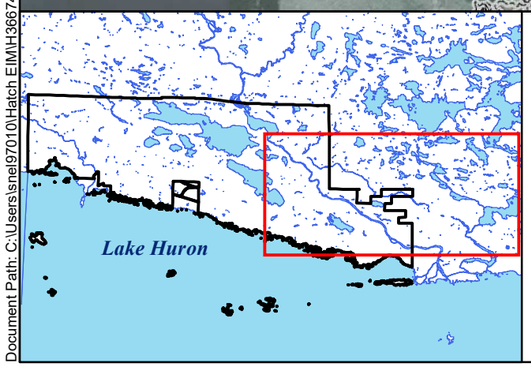




2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Critical Infrastructure
- Lake Outlet
- Flood Risk Area
- Waterbody
- Huron Shores Municipal Boundary

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 1.25 2.5 5 km

1:72,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Mississagi River Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-2

HATCH

There are more than 33 residential and commercial buildings in the flood risk area of the Mississagi River within the municipality. Among them, there is the Arnill United Cemetery which has been identified as an area of importance to the community. It is also important to note that the Iron Bridge Centennial Park is also in the flood risk area, identifying societal and environmental consequences for the municipality.

Also, erosion and scour problems have been documented for the Mississagi River by public data. It has been noted that works were carried out in the 1980s following the major flood event of 1979, where the Mississagi River had its bottom and shorelines protected by a riprap lining. However, some citizens suggest scour issues could impact the integrity of the foundations of their homes following bank erosion during flood events, despite the presence of the protecting lining.

It is, therefore, essential to consider the potential shoreline erosion problem in the future flood risk mitigation assessments to address the questions on the integrity of the foundations of the dwellings and structures located near the riverbanks.

Taking into account all of the potential economic, environmental, societal and infrastructural impacts, Mississagi River is identified as a high priority for floodplain mapping and erosion mitigation studies.

5.2 Minor Rivers

This section describes the flood risk areas associated with each of the minor rivers included in this study. Figures of each flood risk area are presented at the end of the section.

5.2.1 Bolton River

The Bolton River flood risk area has several residences that have been identified using arial imagery. Dayton Road may also be inundated during a large flood event. This area is recommended for floodplain mapping. The update of the hydraulic model with bathymetric data and bridge data will facilitate the mapping of Bright Lake which has also been identified as a high priority for floodplain mapping. Figure 5-3 illustrates the flood risk area of Bolton River.

5.2.2 Harris Creek

Harris Creek does not pose a significant flooding risk to the municipality. The creek is short and incredibly steep with sufficient culvert capacity at Highway 17 (Trans-Canada Highway) to pass expected flood peaks. Figure 5-4 illustrates the flood risk area of Harris Creek.

5.2.3 Pickerel Creek

Pickerel Creek is a string of wetlands connected by short steep sections of creek. Pickerel Creek poses a flood risk to the municipality, specifically to transportation access along Highway 17 (Trans-Canada Highway). A large flood on Pickerel Creek could close Highway 17 (Trans-Canada Highway). This area needs particular care in mapping and mitigation of risks. The capacity of the culverts under the highway at Pickerel Creek should be investigated to determine if the capacity is sufficient. There are roads and residences that fall withing the flood risk area. TWP Line Road, which was included in the 2013 flood response areas, is particularly at risk to flooding. It is recommended that a floodplain mapping of the regulatory flood is conducted for Pickerel Creek. Figure 5-5 illustrates the flood risk area of Pickerel Creek.

5.2.4 Pahpashcah Creek

There is a property with a residence and several buildings at the confluence of Pahpashcah Creek and Mississagi River which is in both the Pahpashcah Creek and Mississagi River risk area. Floodplain mapping of the Mississagi River would be sufficient to determine the risk to that property. The remainder of the Pahpashcah Creek risk area is unpopulated. Due to the remoteness of Pahpashcah Creek and the area of concern will be covered by mapping of the Mississagi River, it is not recommended to do floodplain mapping for Pahpashcah Creek. Figure 5-6 illustrates the flood risk area of Pahpashcah Creek.

5.2.5 Potomac River

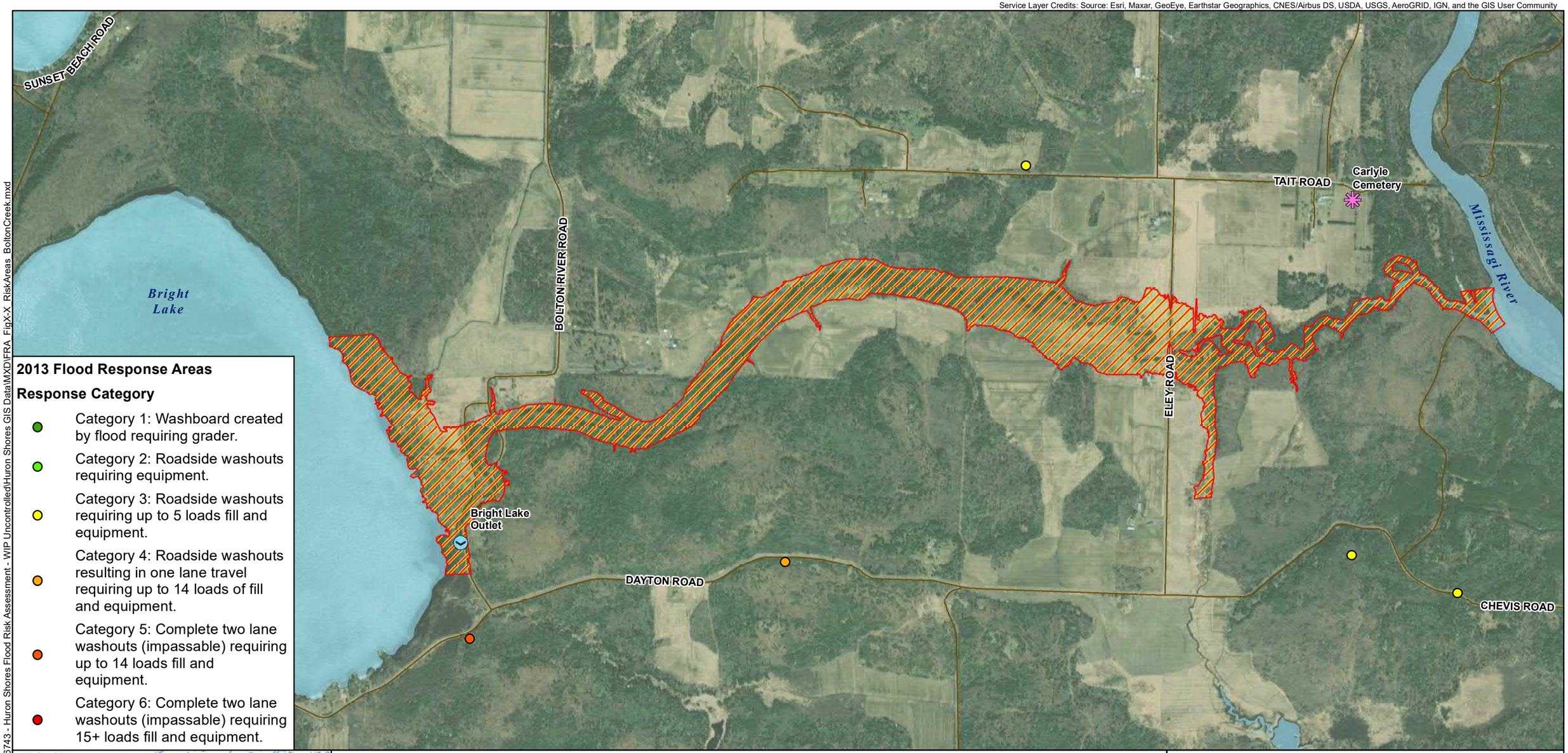
The area surrounding Potomac River is undeveloped. Although there are no identified residences withing the flood risk area, there is potential for flooding of approximately 1.5 km of Potomac Valley Road in the northwest corner of the municipality. There are alternative routes in the region that would provide access if this section of road were inundated. Given the remoteness of the location, lack of residential or public buildings and alternative routes

available for access, Potomac Creek is currently not recommended for floodplain mapping. Figure 5-7 illustrates the flood risk area of Potomac Creek.

5.2.6 Little Thessalon River

Little Thessalon River can be split into three reaches; the upper reach, from Shaw Dam Lake to McCreight's Pond, mid-reach from McCreight's Pond to Little Rapids and the lower reach from Little Rapids to the confluence with the Thessalon River. Figure 5-8 illustrates the flood risk area in each of the three reaches of Little Thessalon River. The Little Thessalon River has been recommended for floodplain mapping as it is an area of concern for the public and poses a risk to the community of Little Rapids.

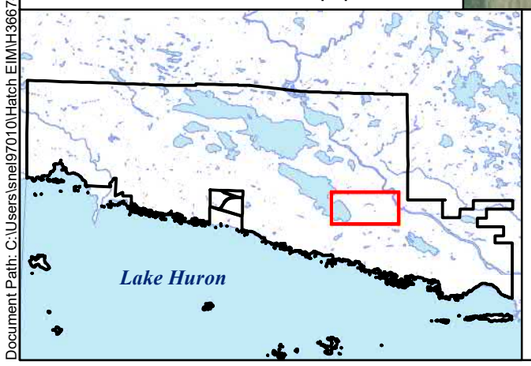
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Critical Infrastructure
- Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.25 0.5 1 km

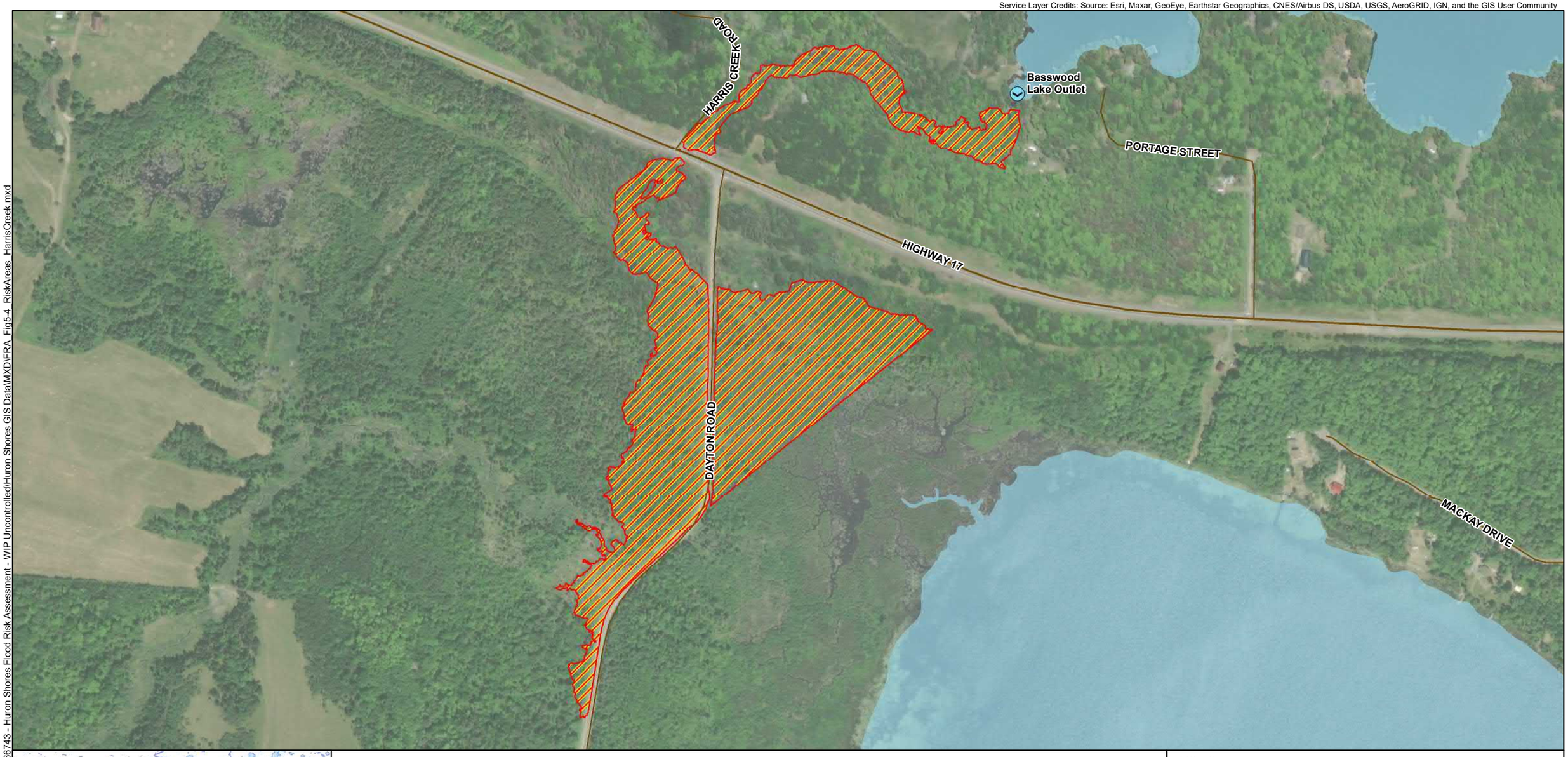
1:15,000

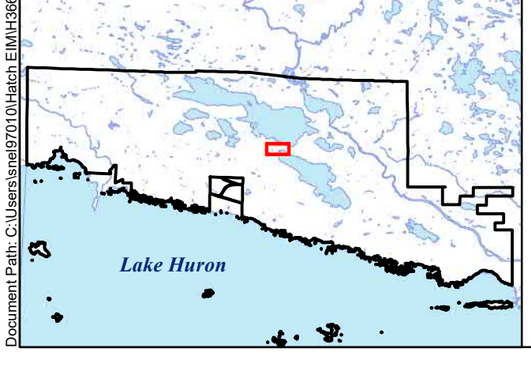
N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Bolton River Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY: J. Snelgrove	FIG NO.: 5-3
DATE: March 30, 2022	HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig5-3_RiskAreas_BoltonCreek.mxd

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community





LEGEND

- Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 75 150 300 m

1:5,000

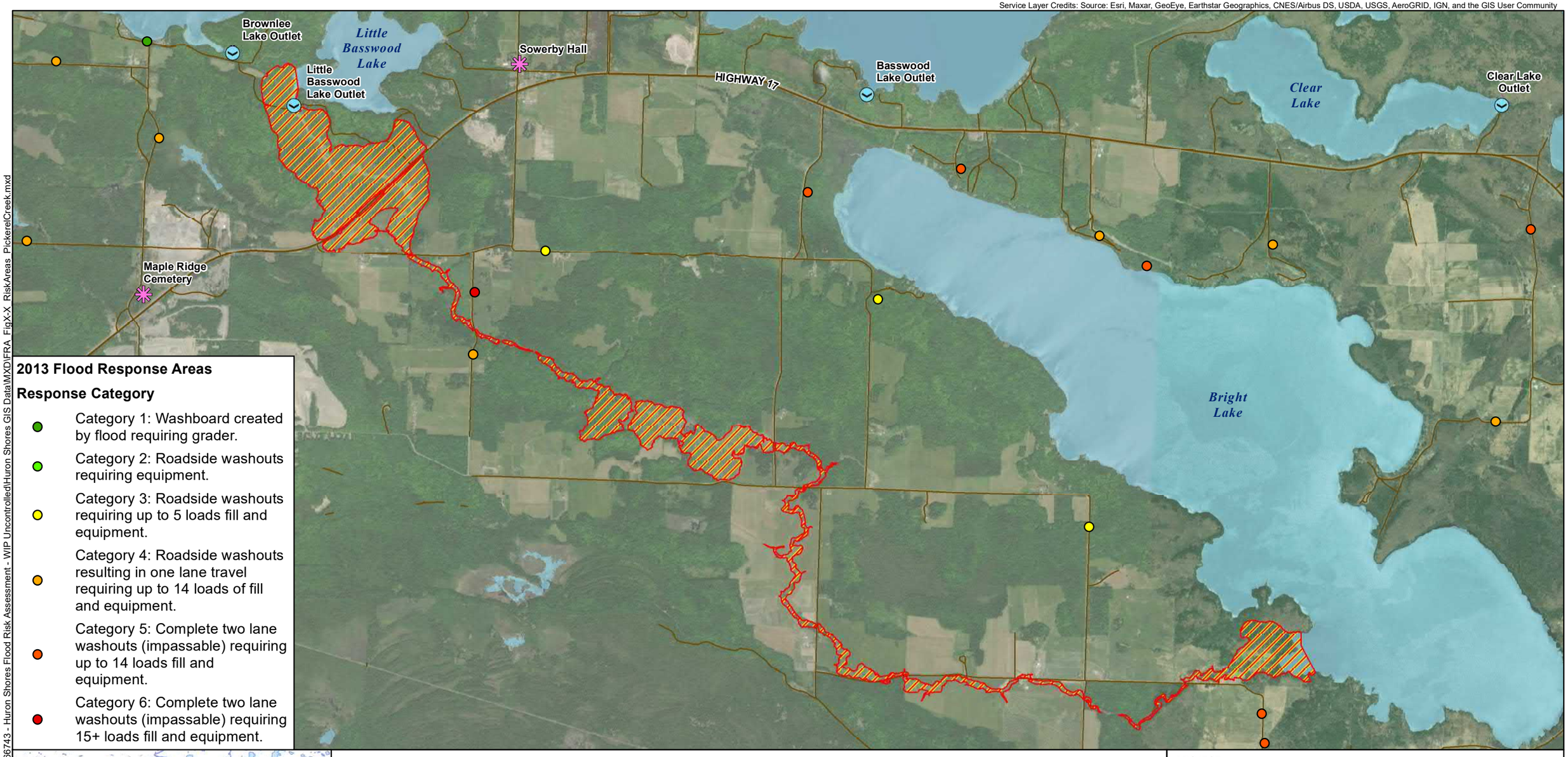
N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Harris Creek Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-4

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig5-4_RiskAreas_HarrisCreek.mxd

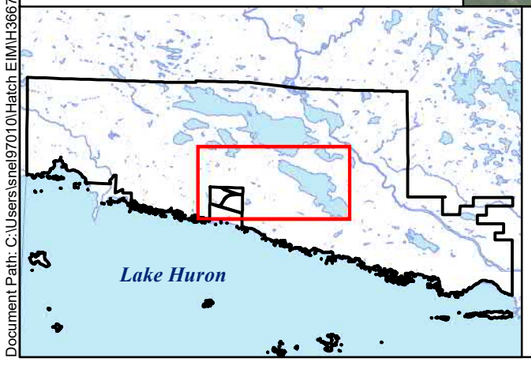
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Critical Infrastructure
- Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.5 1 2 km

1:34,000

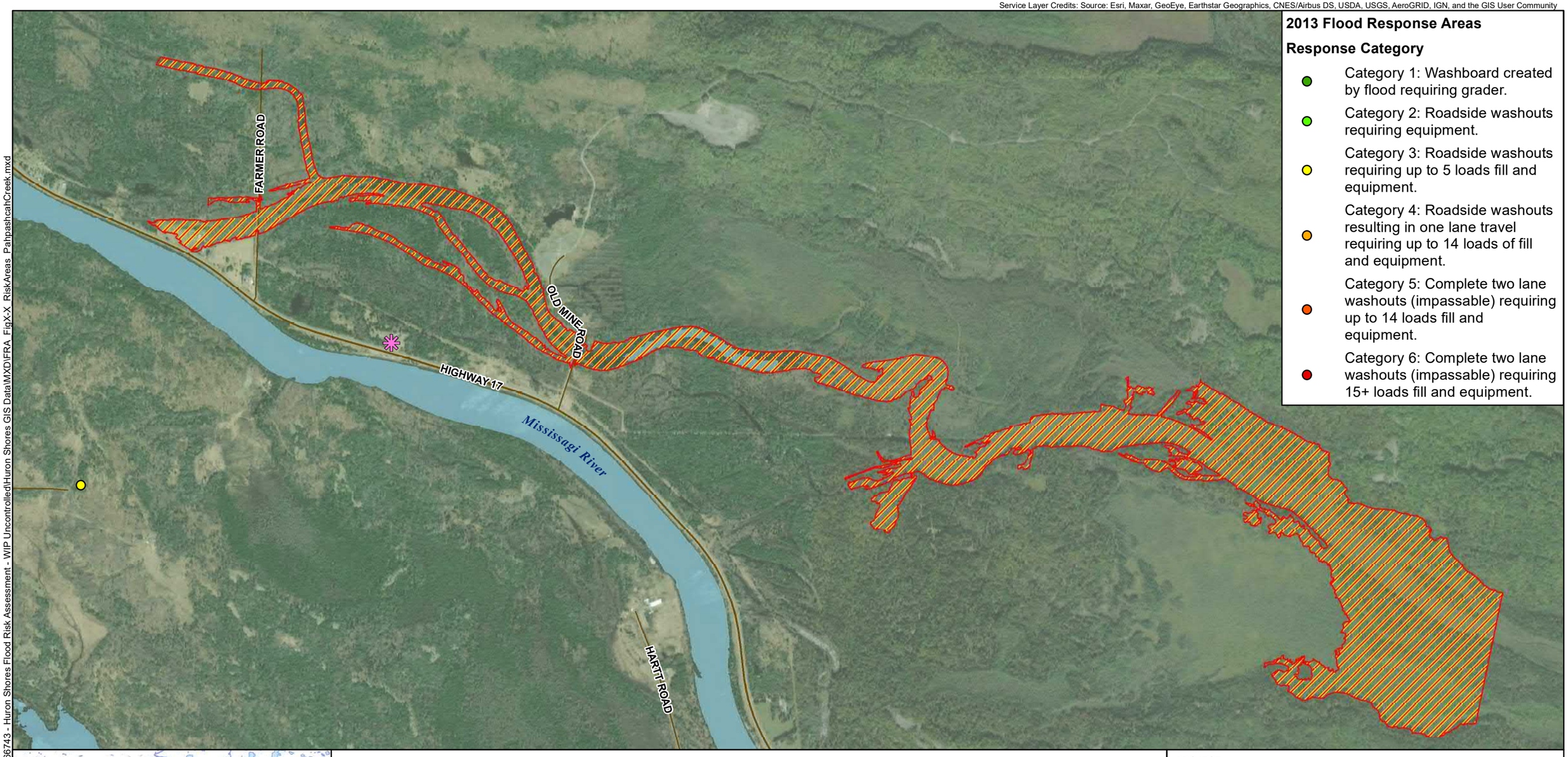
N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Pickerel Creek Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-5

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig5-5_RiskAreas_PickerelCreek.mxd

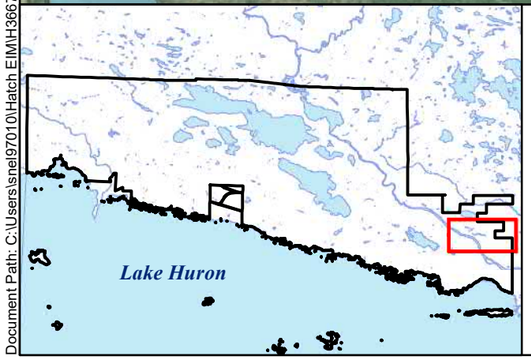
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Critical Infrastructure
- Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.25 0.5 1 km

1:15,000

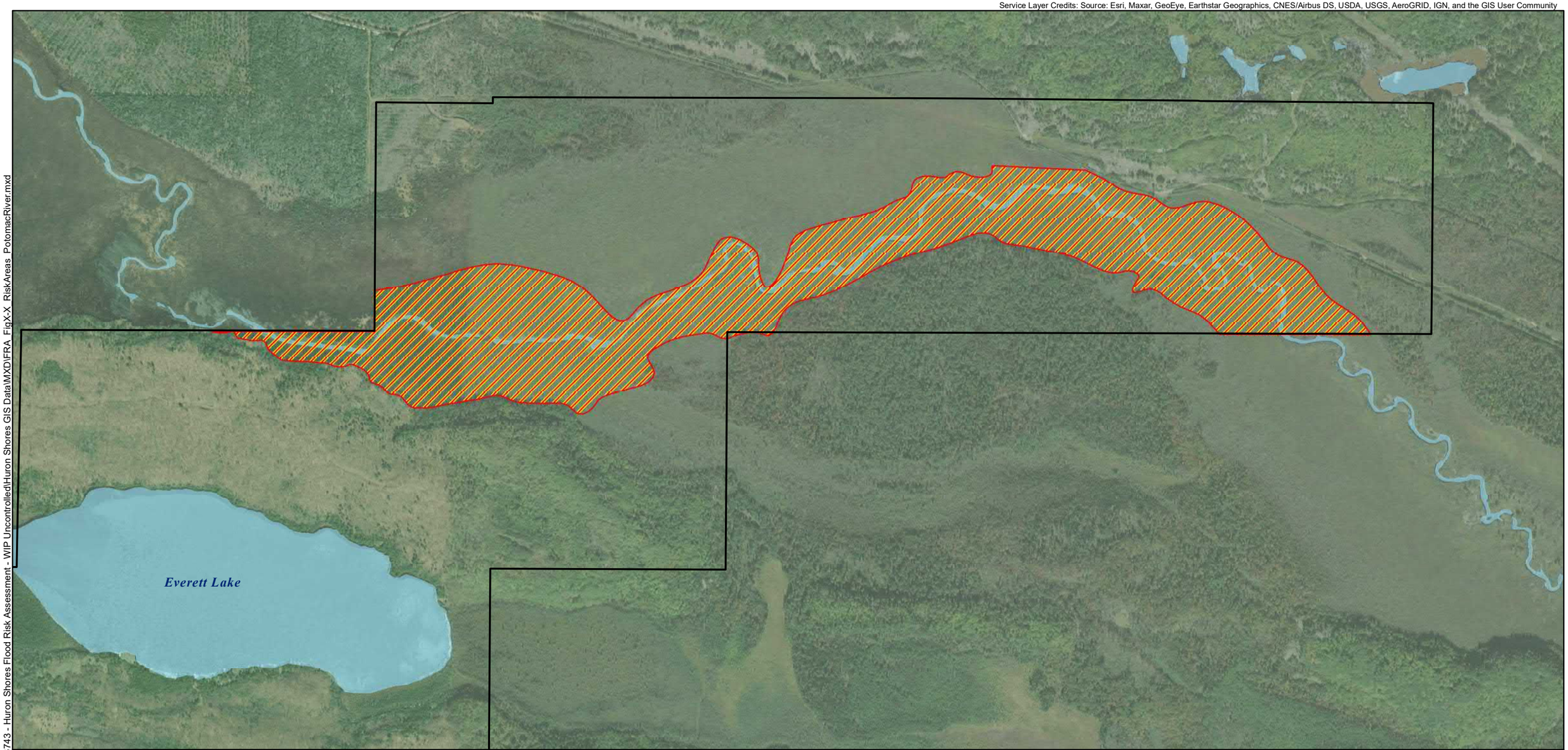
N

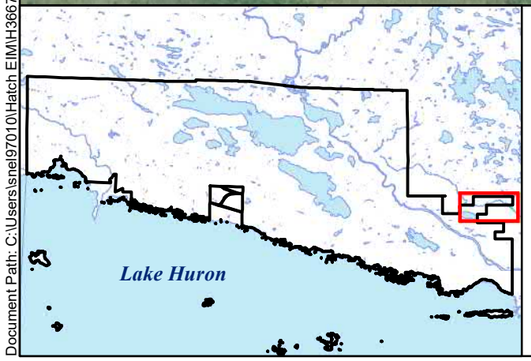
PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Pahpashcah Creek Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-6

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_FigX-X_RiskAreas_PahpashcahCreek.mxd

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community





LEGEND

- Lake Outlet
- Flood Risk Arear
- Waterbody
- Huron Shores Municipal Boundary

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 175 350 700 m

1:13,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Potomac River Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-7

HATCH

Document Path: C:\Users\snelj97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig5-7_RiskAreas_PotomacRiver.mxd

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_FigX-X_RiskAreas_LittleThessalonRiver.mxd

Public Works Garage
THOMAS STREET
MAY STREET
LITTLE RAPIDS ROAD
Forest Lawn Cemetery
Little Rapids Hall
COLLVER ROAD
HIGHWAY 129
Fire Department, Station 1
Heritage Park Museum
ROAD TOWER
TOWER ROAD
SHAW ROAD
MACLEAN ROAD
MCCREIGHTS ROAD
HIGHWAY 129
WINDMILL ROAD
BASSWOOD L
Basswood Lake
Birch Lake
Cranberry Lake
SCHEUERMANN HIGHWAY
HIGHWAY 17
MCFADDEN DRIVE
NESTORVILLE ROAD
RIVER ROAD
STATION ROAD
WALKER ROAD
INGRAM ROAD
PINE RIDGE ROAD
VINE ROAD

2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.

Lake Huron

LEGEND

- Critical Infrastructure
- Flood Risk Area
- Waterbody
- Huron Shores Municipal Boundary

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.5 1 2 km
1:40,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Little Thessalon River Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY: J. Snelgrove	FIG NO.: 5-8
DATE: March 30, 2022	HATCH

5.3 Lakes

This section describes the flood risk areas associated with each of the lakes included in this study. Figures of each flood risk area are presented at the end of the section.

5.3.1 Basswood Lake

The level of Basswood Lake is controlled by the outlet dam. This lake outlet has the capacity to pass the regulatory flood event without significant overland flooding around the lake. There are no residences identified within the flood risk area. Figure 5-9 illustrates the flood risk area surrounding Basswood Lake. Additional study of this lake and floodplain mapping are not recommended beyond the risk area at this time.

5.3.2 Birch Lake

Birch Lake has wetlands on both the east and west sides of the lake that may become inundated by a large flood event. These areas do not have any identified residences and are unlikely to become populated due to limited road access. One property on the northeast side of the lake may lose access during a large flood event, but the building is sufficiently elevated as not to be at risk of flooding. Birch Lake Resort, rental properties and residences, along the north shore of Birch Lake are also unlikely to be affected by flood levels. Basswood Lake Road is well above expected flood levels around Birch Lake. Figure 5-10 illustrates the flood risk area surrounding Birch Lake. Additional modeling and delineation of the regulatory flood level is not recommended beyond the risk area at this time.

5.3.3 Bright Lake

Bright Lake has the largest predicted inflow of any of the lakes in this study. In 2013, there were flood response areas that fall within the lake flood risk area. It is likely that the flooding seen in 2013 was caused by high lake levels. There are roads and residences that fall within the flood risk area. It is recommended that a floodplain mapping of the regulatory flood is conducted for Bright Lake. Figure 5-11 illustrates the flood risk area surrounding Bright Lake as well as the 2013 flood response area around the lake.

5.3.4 Brownlee Lake

Brownlee Lake has wetlands on the west side of the lake that may become inundated by a large flood event. These areas do not have identified residences and are unlikely to become populated due to limited road access. Figure 5-12 illustrates the flood risk area surrounding Brownlee Lake. Additional modeling and delineation of the regulatory flood level is not recommended beyond the risk area at this time.

5.3.5 Clear Lake

Clear Lake has a very small drainage area and an outlet with sufficient capacity. It is unlikely that Clear Lake could get above the risk area outlined in Figure 5-13. There is one property near the risk area on the west side of Clear Lake, but the property is above the most conservative estimate flood level. Additional modeling and delineation of the regulatory flood level is not recommended beyond the risk area at this time.

5.3.6 Cranberry Lake

Cranberry Lake has wetlands on both the southeast and west sides of the lake that may become inundated by a large flood event. These areas do not have identified residences and are unlikely to become populated. One property on the southwest side of the lake is close to the flood risk area, but is well above any expected lake levels and will not lose access due to high lake levels. Windmill Campground north of Cranberry Lake is unlikely to be significantly flooded or lose road access during a large flood event. Figure 5-14 illustrates the flood risk area surrounding Cranberry Lake. Additional modeling and delineation of the regulatory flood level is not recommended beyond the risk area at this time.

5.3.7 Dean Lake

The shores of Dean Lake are populated along Lakeview Road, Lavigne Road, and Woodside Road, but there are only two buildings identified in the flood risk area. The buildings appear to be a residence from areal imagery, but confirmation is required. Due to the population surrounding Dean Lake and the potential for further development, it is recommended that floodplain mapping be completed. The areas defined by floodplain mapping can be used to ensure that areas at risk to flooding are not developed further. Figure 5-15 illustrates the flood risk area surrounding Dean Lake. Additional modeling and delineation of the regulatory flood level is not recommended beyond the risk area at this time.

5.3.8 Little Basswood Lake

Little Basswood Public Beach and Eden Camp Resort are within the flood risk area for Little Basswood Lake. Residences along Basswood Lake Road are on the edge of the flood risk area. Due to the current uncertainty of the capacity of Pickerel Creek, it is recommended that this lake be included in a floodplain mapping study along with Pickerel Creek.

Additionally, Little Basswood Lake has a wetland to the north of the lake that may become inundated by a large flood event, but this area does not have any identified residences and is unlikely to become populated. Figure 5-16 illustrates the flood risk area surrounding Little Basswood Lake. Additional modeling and delineation of the regulatory flood level is not recommended beyond the risk area at this time.

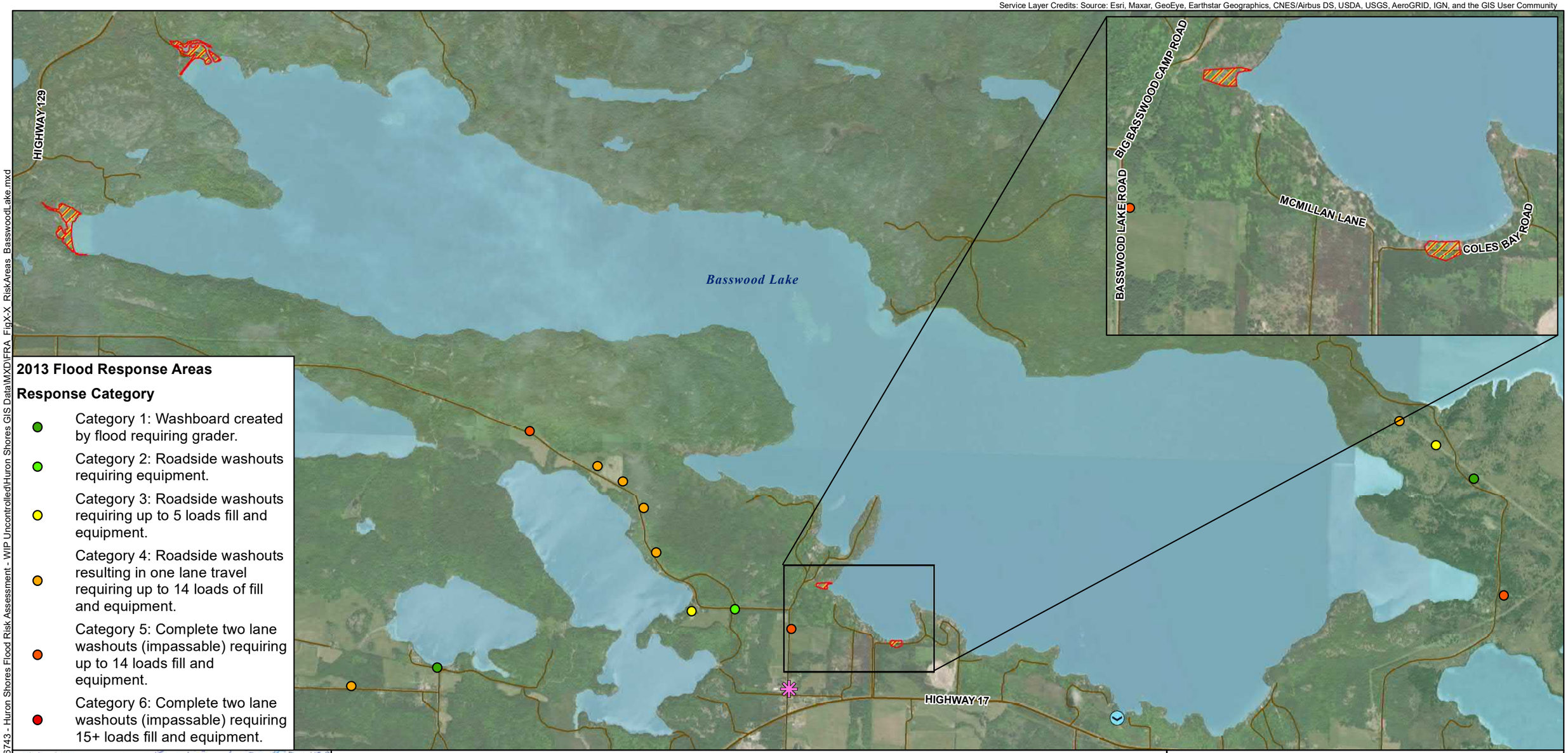
5.3.9 Little Dean Lake

Little Dean Lake is surrounded by wetlands that become inundated during a large flood event. There are currently no residences within the flood risk area and the area is unlikely to be populated due to the lack of road access. Although the flood risk area is large compared to the normal lake area, this lake does not currently pose a risk to life property or infrastructure. Figure 5-17 illustrates the flood risk area surrounding Little Dean Lake. Additional modeling and delineation of the regulatory flood level is not recommended beyond the risk area at this time.

5.3.10 Warnock Lake

Warnock Lake has a very small drainage area and an outlet with sufficient capacity. It is unlikely that Warnock Lake could get above the risk area outlined in Figure 5-18. Additional modeling and delineation of the regulatory flood level is not recommended beyond the risk area at this time.

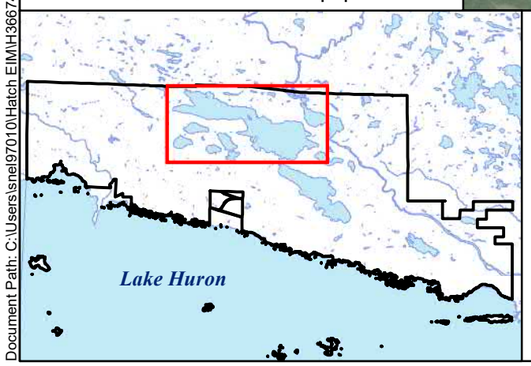
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Critical Infrastructure
- Basswood Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.5 1 2 km

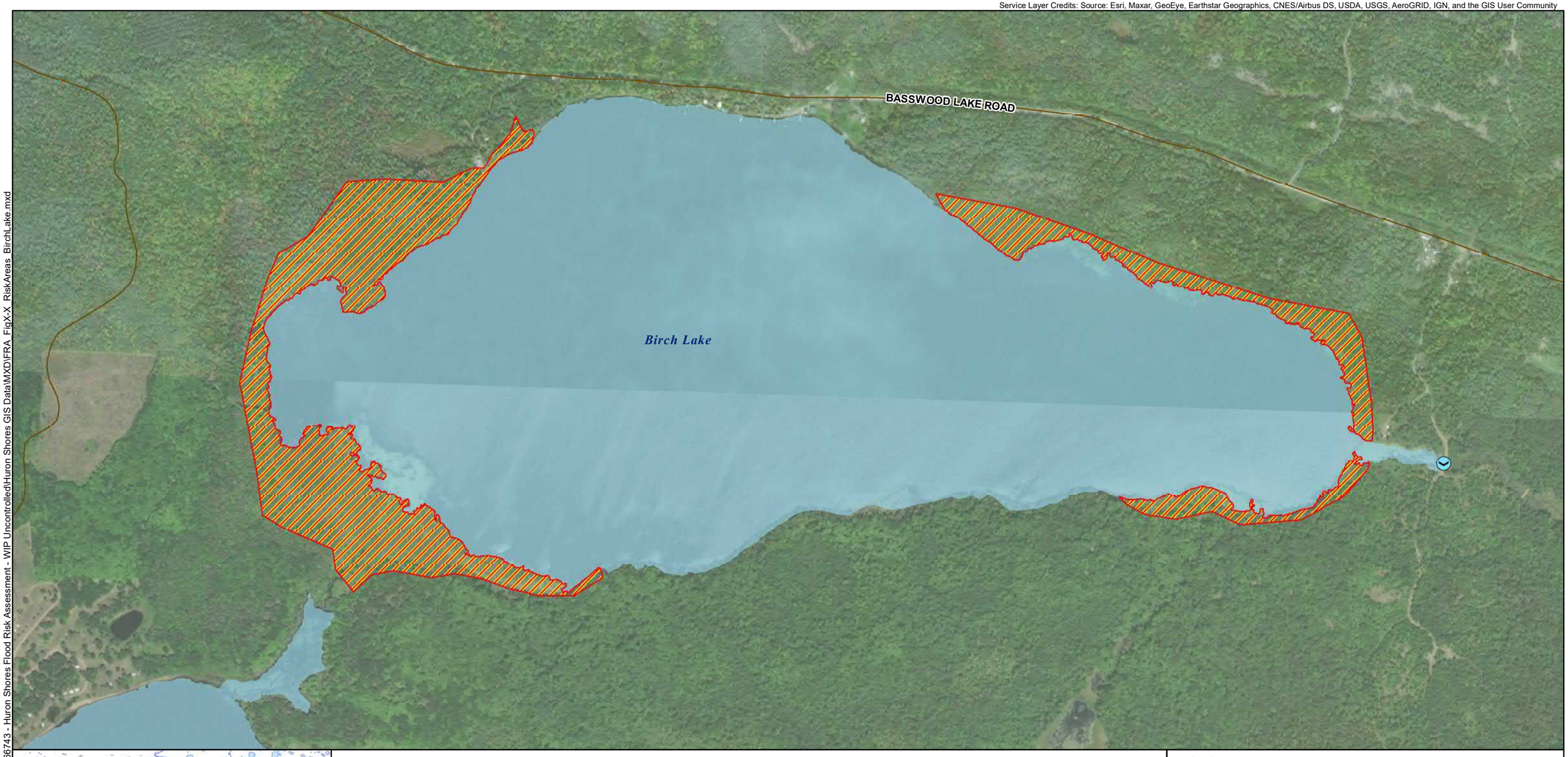
1:36,000

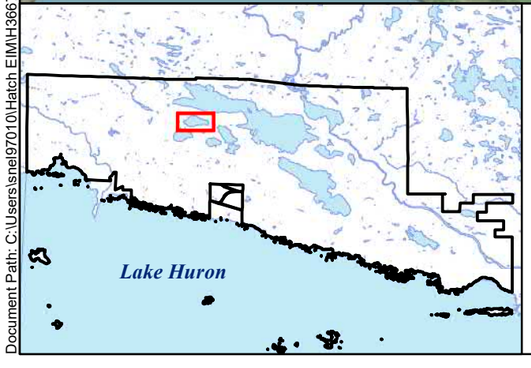
N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Basswood Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY: J. Snelgrove	FIG NO.: 5-9
DATE: March 30, 2022	HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_FigX-X_RiskAreas_BasswoodLake.mxd

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community





LEGEND

- Birch Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 125 250 500 m

1:8,000

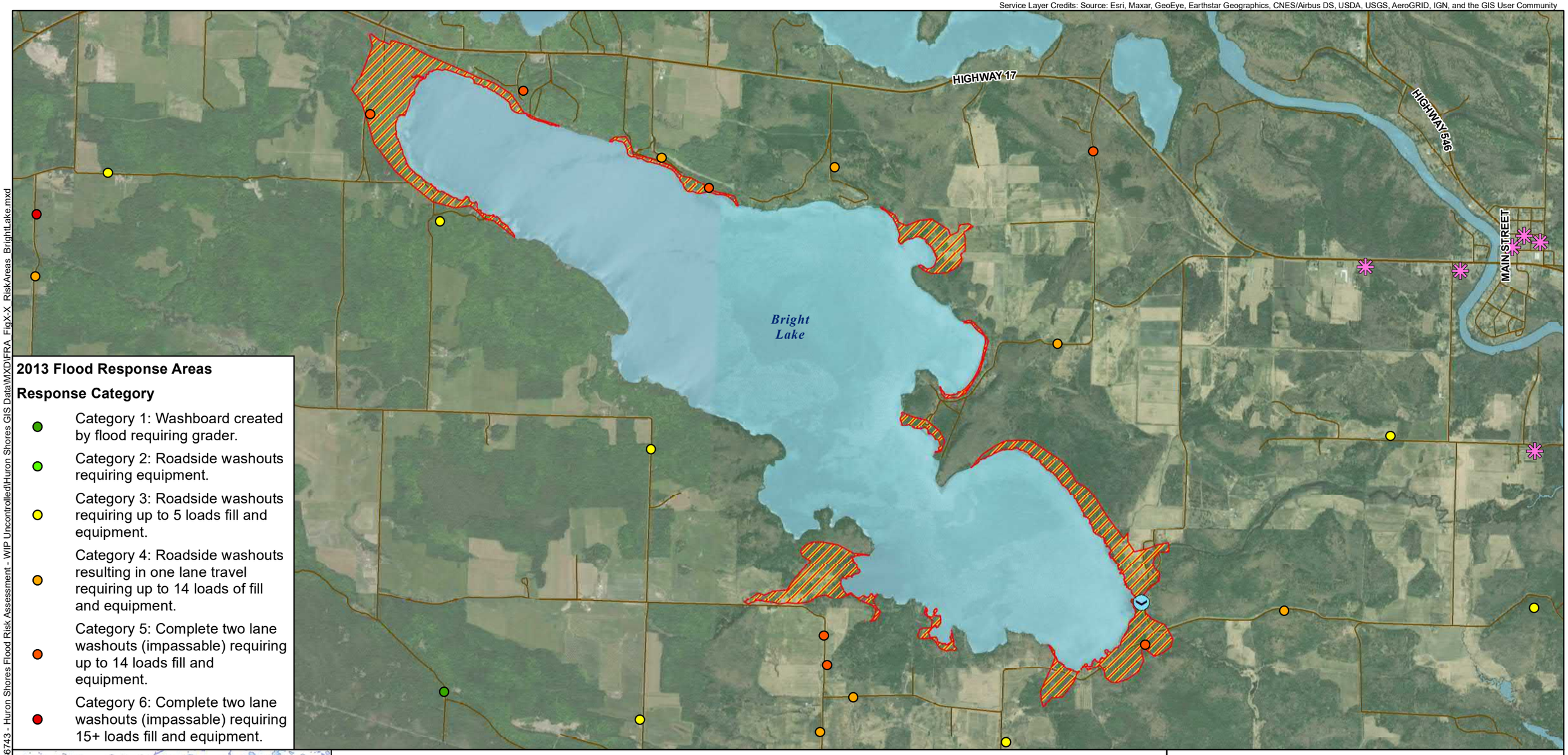
N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Birch Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-10

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig X-X_RiskAreas_BirchLake.mxd

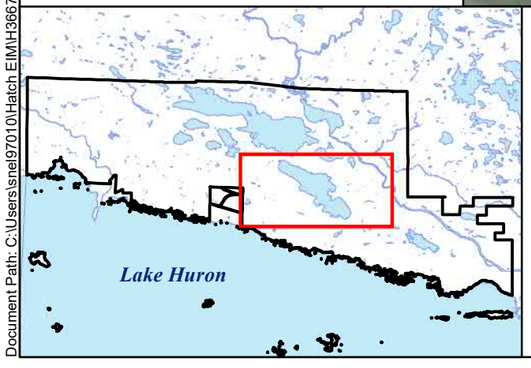
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Critical Infrastructure
- Bright Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.5 1 2 km

1:34,000

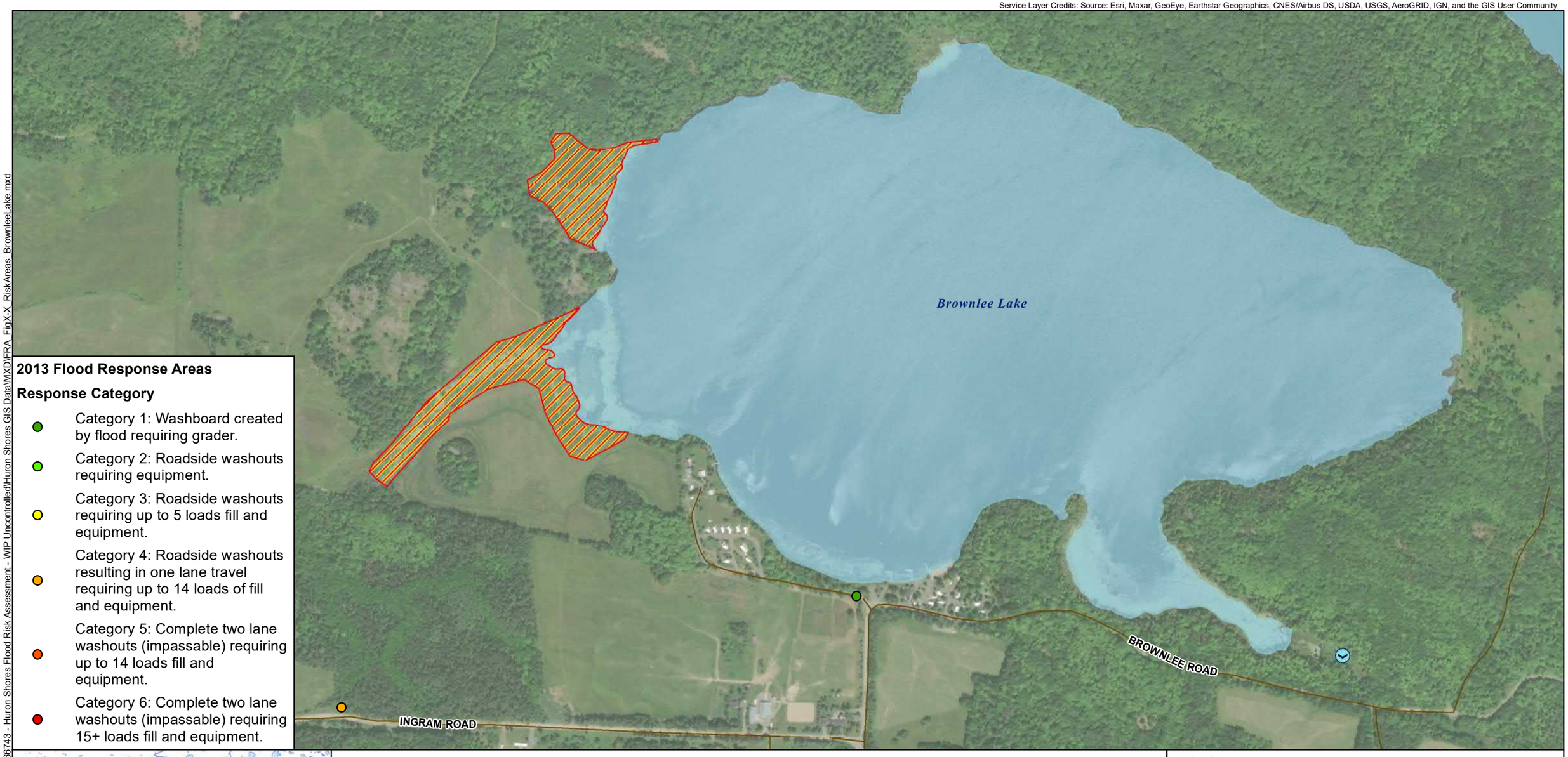
N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Bright Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY: J. Snelgrove	FIG NO.: 5-11
DATE: March 30, 2022	HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_FigX-X_RiskAreas_BrightLake.mxd

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

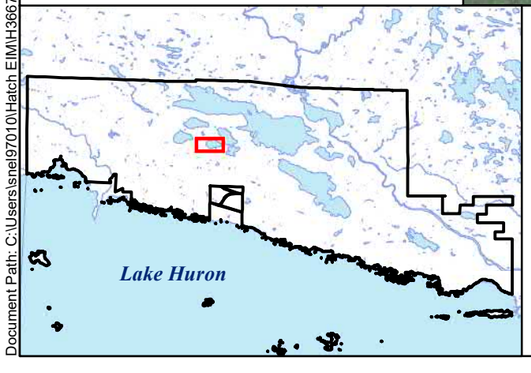
Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_FigX-X_RiskAreas_BrownleeLake.mxd



2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Brownlee Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

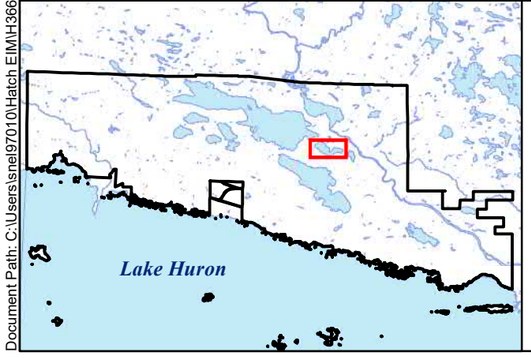
0 200 400 m
1:6,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Brownlee Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-12

HATCH

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



LEGEND

- Clear Lake Outlet
- Waterbody
- Flood Risk Area

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

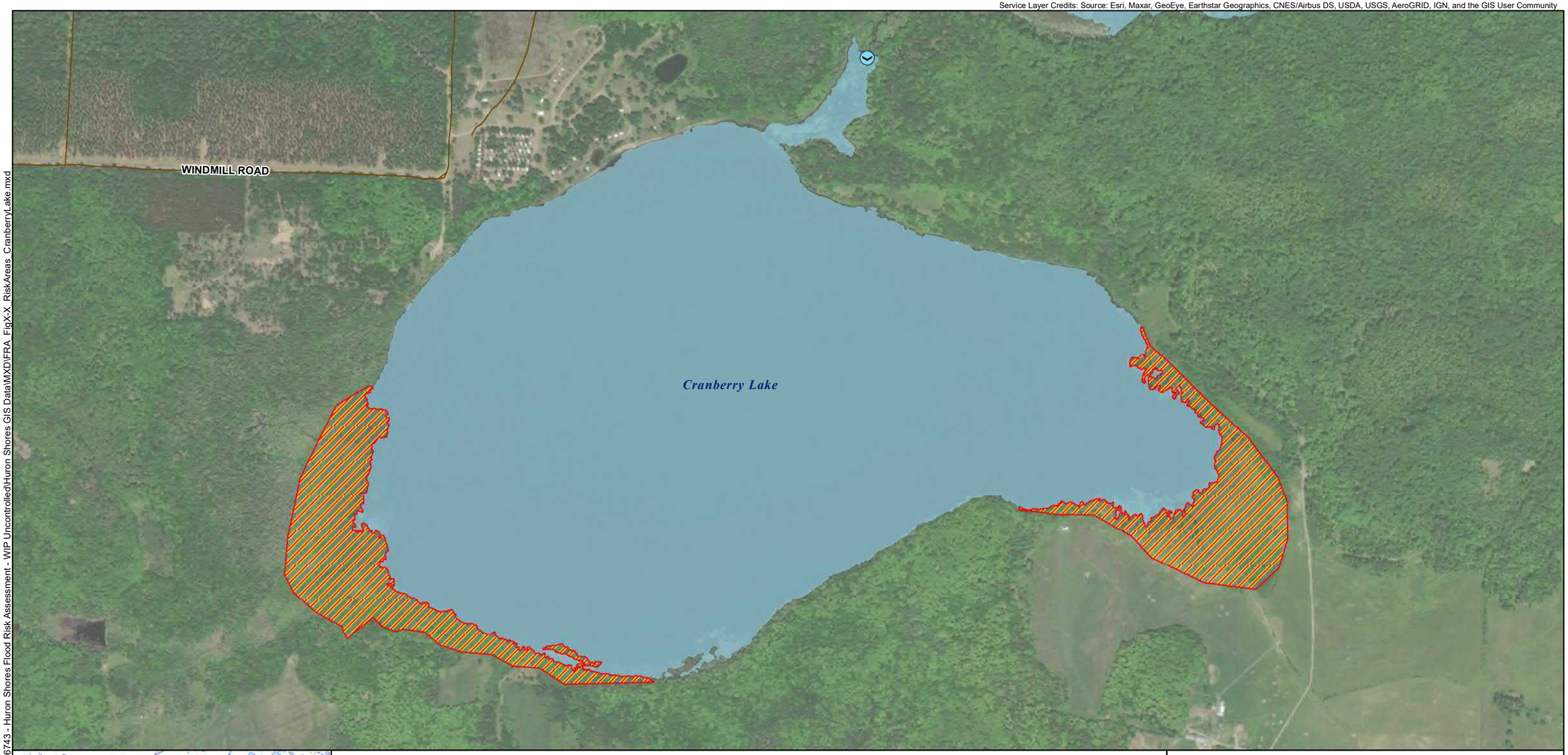
0 250 500 m
1:8,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Clear Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-13

HATCH

Document Path: C:\Users\snel9701\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig5-13_RiskAreas_ClearLake.mxd



LEGEND

- Cranberry Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

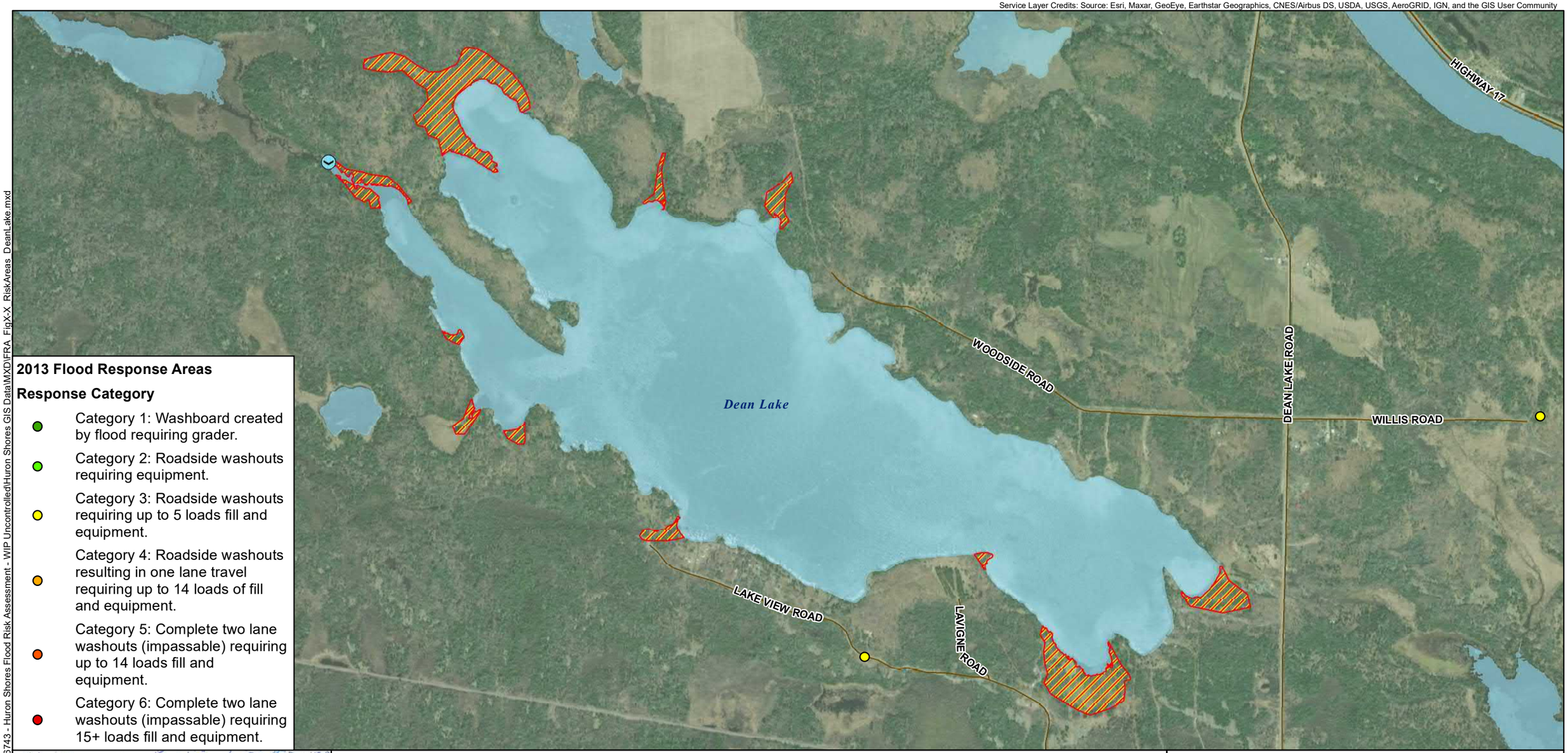
0 250 500 m
1:8,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Cranberry Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-14

HATCH

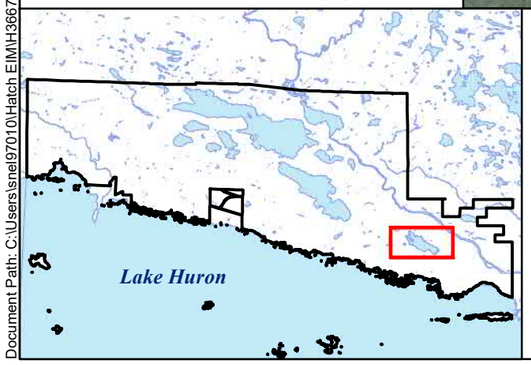
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Dean Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 400 800 m
1:14,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Dean Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-15

HATCH

Document Path: C:\Users\snel9701\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_FigX-X_RiskAreas_DeanLake.mxd

BASSWOOD LAKE ROAD

FRAIRS BAY ROAD

Little Basswood Lake

MCMILLAN LANE

COLES BAY ROAD

CAVANAGH DRIVE

BROWNLEE ROAD

Sowerby Hall

HENDRY STREET

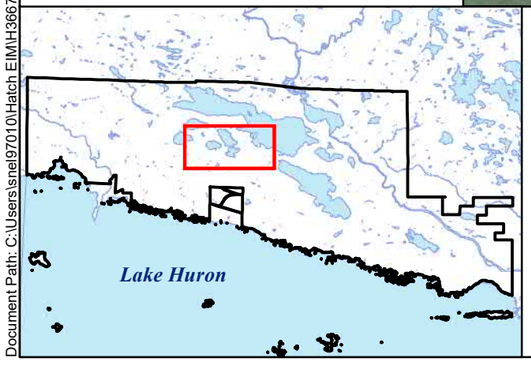
HIGHWAY 17

SOWERBY ROAD

2013 Flood Response Areas

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Critical Infrastructure
- Little Basswood Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

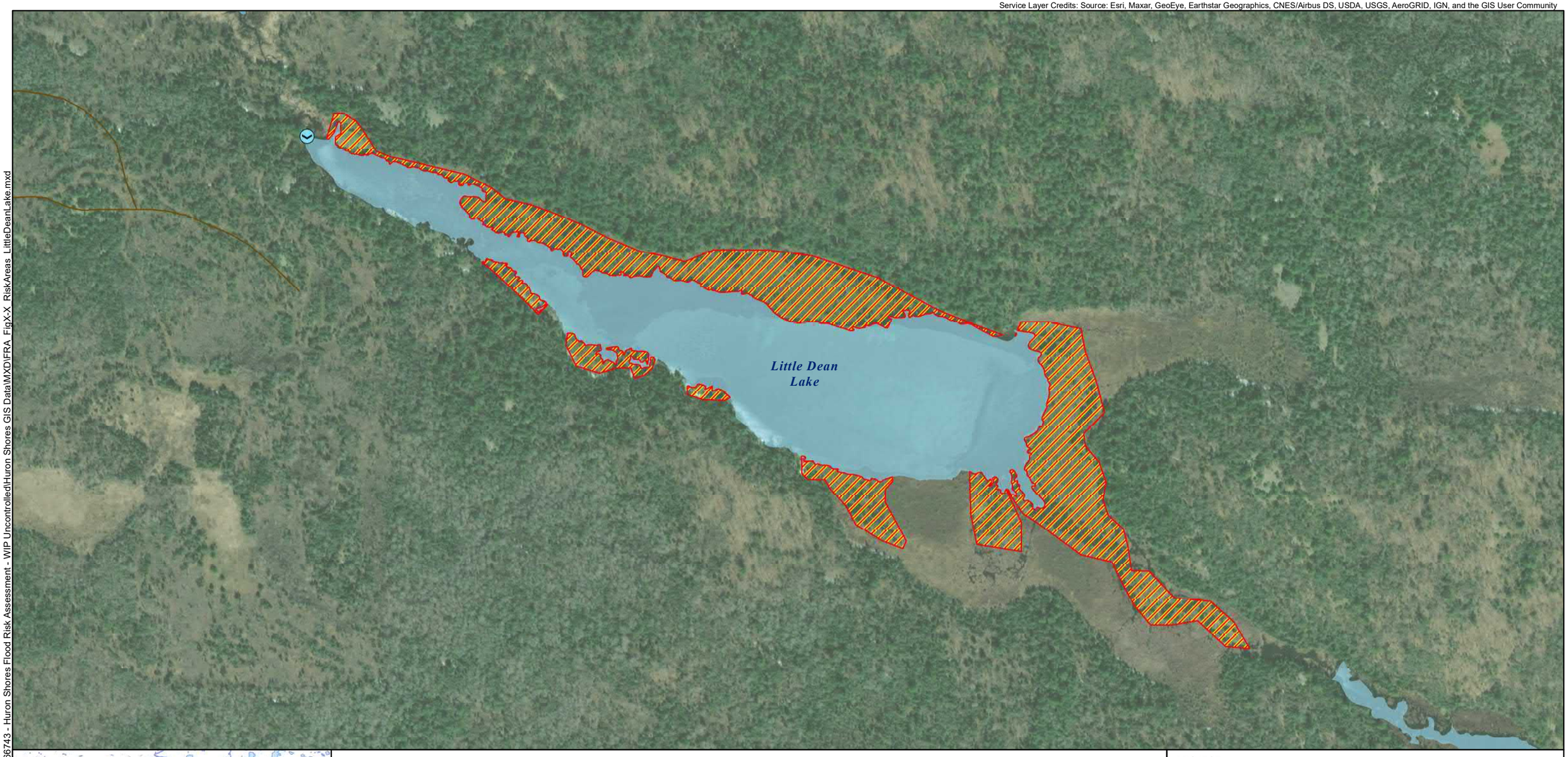
0 0.5 1 km
1:20,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Little Basswood Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-16

HATCH

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



LEGEND

- Little Dean Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

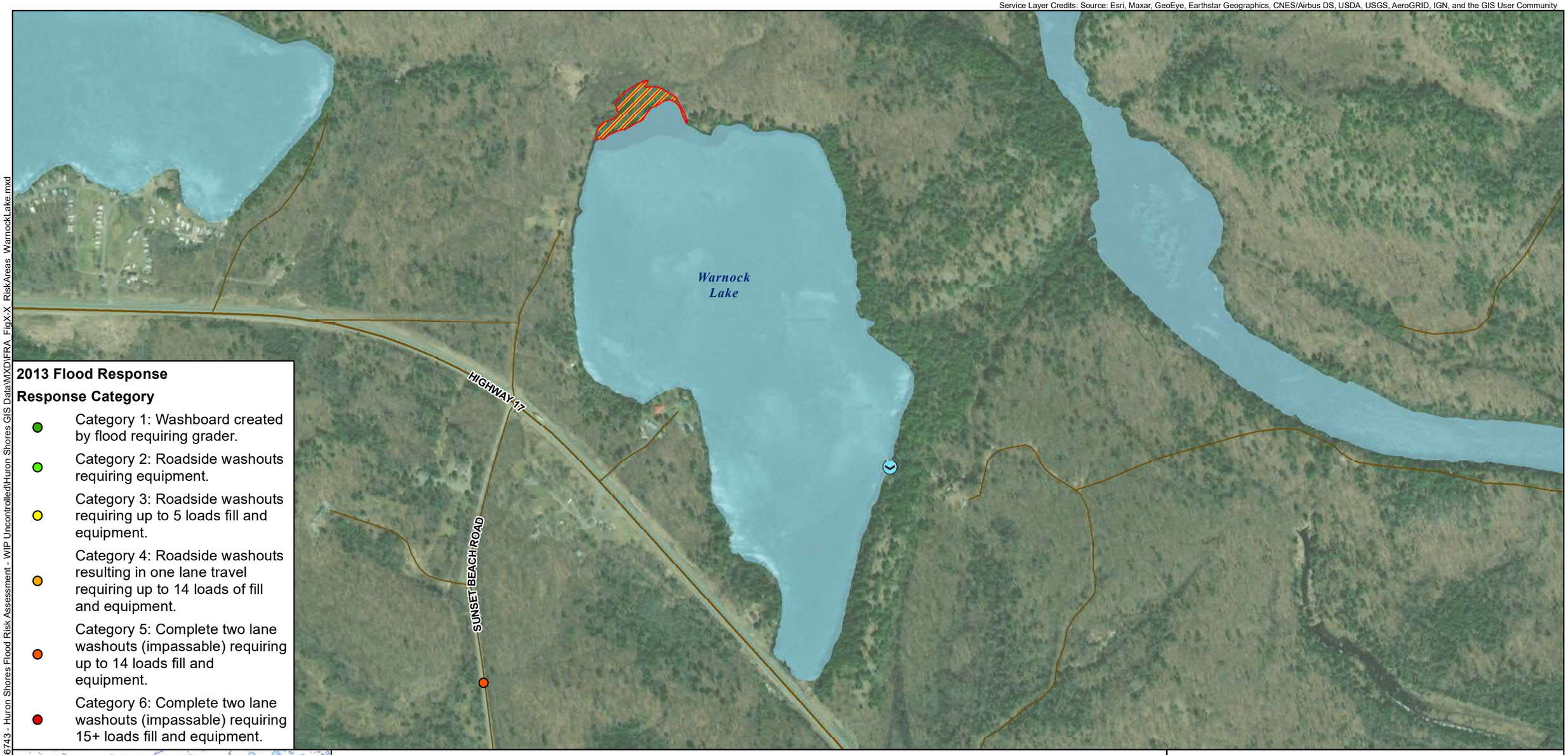
0 150 300 m
1:5,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Little Dean Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-17

HATCH

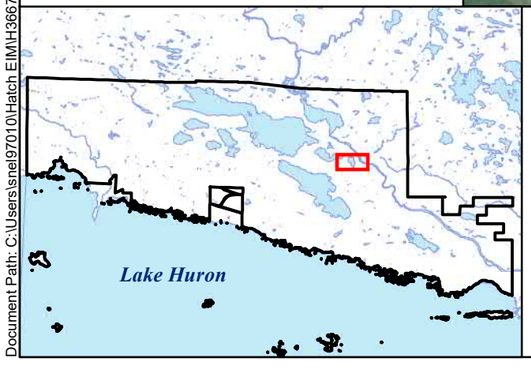
Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_FigX-X_RiskAreas_LittleDeanLake.mxd



2013 Flood Response

Response Category

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.



LEGEND

- Warnock Lake Outlet
- Flood Risk Area
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 200 400 m
1:7,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Warnock Lake Identified Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-18

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_FigX-X_RiskAreas_WarnockLake.mxd

5.4 2013 Flood Response Areas

Each of the 2013 flood response areas identified by Huron Shores was examined against the LiDAR data to determine a potential cause of flooding. Many of the flood response areas were located near road culverts. It is likely that these areas were inundated due to localized flooding from undersized or plugged culverts. Figure 5-19 illustrates the response area provided by Huron Shores compared to the likely cause of flooding. The original map provided by Huron Shores was at a municipal-wide scale and, therefore, there was some interpretation required to determine the specific cause of flooding. Only a couple of locations were determined to be caused by the bodies of water included in this study.

As shown in Figure 5-19, the following list of roads were affected by the spring flood in 2013:

- Ansonia Road
- Baker Road
- Basswood Lake Road
- Brownlee Road
- Chevis Road
- Cullis Road
- Dayton Road
- De Moyne Avenue
- Feltham Road
- Genesee & Wyoming Canada Inc. Railway
- Hopper Road
- Horan Road
- Ingram Road
- Lake Huron Road
- Lakeview Road
- Little Rapids Road
- Maclean Road
- Melwel Road
- Meyers Road
- Mississagi Bay Road
- Morest Road
- N Livingstone Road
- Pine Ridge Road
- River Road
- Round Barn Road
- Scheuermann Highway
- Station Road
- Sunset Beach Road
- Tait Road West
- Twp Line Road
- Walker Lane
- Walker Road
- Willis Road
- Unnamed road north of Ansonia Road

5.5 Critical Infrastructure

Critical infrastructure is broken down into 10 categories by The Government of Canada: health, food, finance, water, information and communication technology, safety, energy and utilities, manufacturing, government, and transportation. Critical infrastructure in this study focused mainly on identifying possible disruption to water supply and waste treatment plants, hospitals, major highways, etc. For the present study, evaluation of critical infrastructure was limited to determining whether the infrastructure was within or outside of the flood risk area. The location of critical infrastructure in relation to the flood risk areas determined by this study is presented in Figure 5-20.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Document Path: C:\Users\snelj97010\Hatch EIMH366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig5-19_SuspectedCauses2013Flood.mxd

2013 Flood Response Areas

- Category 1: Washboard created by flood requiring grader.
- Category 2: Roadside washouts requiring equipment.
- Category 3: Roadside washouts requiring up to 5 loads fill and equipment.
- Category 4: Roadside washouts resulting in one lane travel requiring up to 14 loads of fill and equipment.
- Category 5: Complete two lane washouts (impassable) requiring up to 14 loads fill and equipment.
- Category 6: Complete two lane washouts (impassable) requiring 15+ loads fill and equipment.

Ansonia Rd
Hopper Rd
Maclean Rd
Genesee & Wyoming Canada Inc. Railway
Scheuermann Hwy
Little Rapids Rd
River Rd
Station Rd
Feltham Rd
HIGHWAY 129
Walker Rd
Ingram Rd
Pine Ridge Rd
Round Barn Rd
Basswood Lake Rd
Brownlee Rd
Twp Line Rd
Cullis Rd
Walker Ln
North Livingstone Rd
Basswood Lake
Melwel Rd
HIGHWAY 546
Meyers Rd
Morest Rd
HIGHWAY 17
De Moyne Ave
Bright Lake
Tait Rd W
Sunset Beach Rd
Horan Rd
Baker Rd
Chevis Rd
Willis Rd
Lakeview Rd
Mississagi Bay Rd
Lake Huron
Dayton Rd

LEGEND

- Suspected Cause of Flooding
- Huron Shores Municipal Boundary
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

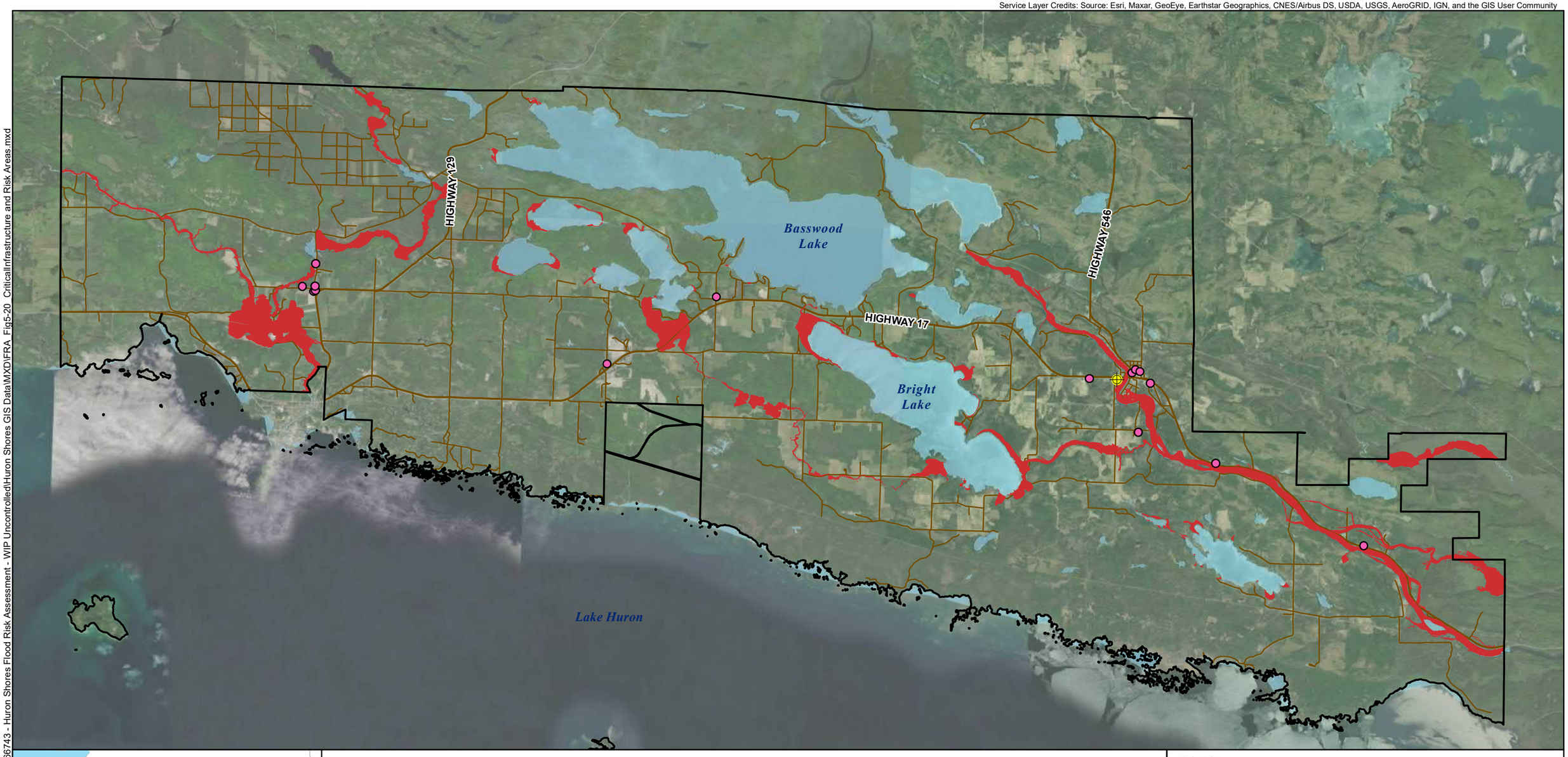
0 2 4 8 km
1:117,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	2013 Flood Response Areas and Suspected Causes of Flooding
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-19

HATCH

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



LEGEND

- Critical Infrastructure - At
- Critical Infrastructure - Not at Risk
- Flood Risk Area
- Huron Shores Municipal Boundary
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 2 4 8 km

1:117,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Critical Infrastructure and Flood Risk Areas
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-20

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\FRA_Fig5-20_CriticalInfrastructure and Risk Areas.mxd

5.6 Erosion Risk

In the case of the Mississagi River, it is important to recall that the work carried out in the 1980s following the major flood event of 1979 was performed in order to protect the river bottom with riprap lining. Nonetheless, some residents have observed erosion issues that may impact the integrity of the foundations of their homes following bank erosion during flood events, despite the presence of riprap.

The downstream area of the Thessalon River is characterized by flat topography. Most meandering rivers have both an erodible bottom and banks that allow the river to erode both vertically and horizontally. The Thessalon River, however, has a bottom that is predominantly bedrock. The bedrock streambed limits the vertical elevation, preventing the river from eroding deeper. As a result, the river is being forced to erode exclusively horizontally, widening the river and causing the observed shoreline erosion problems.

Given this particular geomorphological situation, the river will continue to widen to regain its equilibrium. The inability to erode vertically also limits the change in slope over time. In the case of a river with an erodible bottom, the natural geomorphological dynamics tend the river towards a flatter slope over time, with an accumulation of sediments eroding from upstream to downstream. In the case of the Thessalon River, the slope will remain essentially the same over time. The provided images of some affected locations demonstrate the seriousness of the problem. The erosion locations identified in the public data and during the field survey are depicted in Figure 5-21, including photographs where possible.

Taking all this information into account, it is essential to consider the erosion problem in the flood risk assessment and future mitigation plans, with particular attention to the situation of the Thessalon River. This is necessary, as the erosion is causing loss of land and could eventually endanger the integrity of the foundations of residences, structures and roads located near the riverbanks; thus potentially cause significant financial consequences on shoreline property in the municipality over time.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Thessalon River

Thessalon

Big Basswood Lake

Bright Lake

Dayton

Iron Bridge

Mississagi River

Dean Lake

Lake Huron

LEGEND

- Location with Known Erosion
- Road Network
- Huron Shores Municipal Boundary
- Waterbody

DATA SOURCES
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 1.5 3 6 km

1:110,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	Areas of Known Erosion
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 30, 2022
FIG NO.:	5-21

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\BSR_Fig4-1_ErosionLocations.mxd

6. Recommendations

6.1 Floodplain Mapping

For each of the listed proposed mapping locations, a RAIT form has been included as part of Appendix D.

Proposed Mapping Locations

- Thessalon River
- Mississagi River
- Bright Lake
- Pickerel Creek
- Bolton River
- Little Thessalon River

6.2 Inspection of Beaver Dams

Since many of the lakes in the municipality are controlled at the outlet by beaver dams, it is important that the dams be inspected. The dams provided regulation at the outlet to maintain water levels for recreational use of the lakes but they can also become a hazard to residences downstream. If the dams were to breach, a flood wave caused by the release may endanger downstream residences or cause damage to infrastructure. Additionally, the recreational use of the upstream lake would be diminished because of the lowered water levels until the dam is reestablished. Some community members have reinforced the dam at the outlet of Dean Lake in order to prevent this from occurring. Huron Shores should be aware of all the risks associated with the presence of beaver dams in their watershed.

6.3 Inspection and Maintenance of Culverts

In addition to floodplain mapping, it is also recommended that each of the culverts suspected of causing flooding during the 2013 event be inspected. The majority of flood response areas in 2013 were likely caused by insufficient local drainage capacity rather than large waterbody flooding. Maintenance and replacement of undersized culverts with sufficient capacity would likely resolve the issues observed in 2013. Figure 5-19 presents the location of the culverts identified as causes of the 2013 flood response areas. Section 5.4 lists the roadways associated with the culverts.

6.4 Erosion Study of the Thessalon River

A river-morphology and erosion study of the Thessalon River is needed to fully understand the issues of erosion and potential solutions for maintaining the current river geometry.

Appendix A
Photo Maps

A.1 Thessalon Photo Map

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

User Name: SNEL97010

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\AppX_PhotoMaps_TessalonRiver.mxd

N

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53

HIGHWAY 17

HIGHWAY 129

Georgian Bay

LAKESIDE DRIVE

FRANCES STREET

HURON STREET

RIVER ROAD

LEGEND

- Observation Location

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17N

0 175 350 700 Metres

1:19,000

Project:	**Huron Shores Flood Risk Analysis**	
Figure Title:	**Thessalon River - Field Photos Key**	
Survey Date:	**October 7, 2021**	
Prepared By:	HATCH	**Figure: A1**

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
1	 	
2	 	Rapids looking upstream
3	 	Potential Cross-Section

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
4	 	Depth approx. 1.9 m
5	  	Potential Cross-Section

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
6	   	Potential Cross-Section
7	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
8	  	
9	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
		
10	 	
11	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
12	 	
13	 	Bridge looking downstream
14	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
15	   	Bridge looking upstream; range finder = 6.9 m + 16.6 m
16	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
17	   	Possible cross-section due to large mass wasting on right bank
18	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
		
19	  	Road bridge looking downstream

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
20	 	
21	 	Road bridge looking upstream; range finder = 43 ft + 34 ft
22	 	Train bridge looking downstream

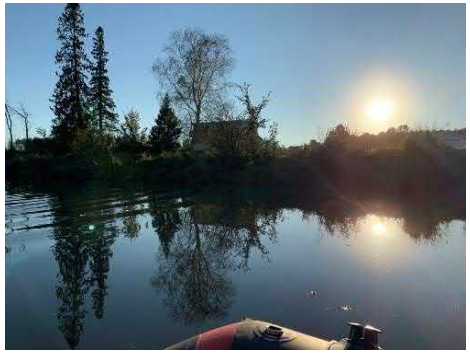
Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
23	 	Bridge - range finder = 61 ft-8 in. + 38 ft-7 in.
24	  	Bridge looking upstream

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
25	  	
26	 	

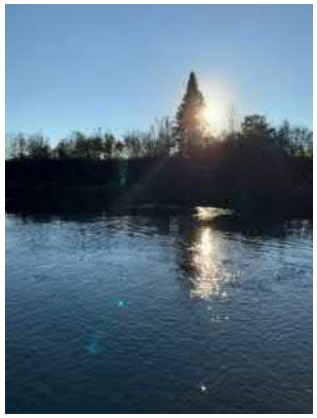
Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
		
27	   	Potential riprap on right bank, erosion control measures

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
28	 	
29	 	
30	 	Potential Cross-Section

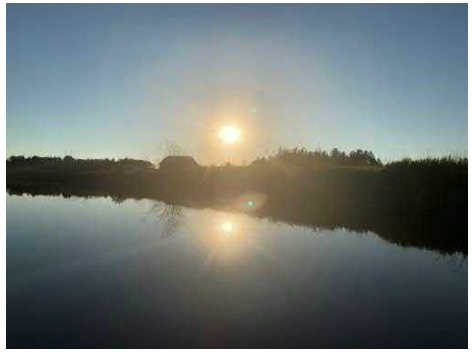
Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
		
31	  	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
32	 	
33	 	
34	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
		
35	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
36		
37		

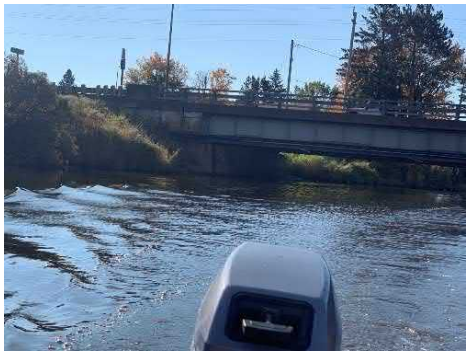
Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
38	 	
39	 	
40	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
41	  	Photos of bedrock left shoreline, grassy shore right shoreline
42	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
43	 	
44	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
45	 	
46	 	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
47	   	
48		

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
49	 	
50	  	

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
51	  	
52		

Thessalon River – Field Observations		
Location ID	**Photos**	**Field Notes**
53	  	

A.2 Critical Infrastructure Photo Map

LEGEND

- Critical Infrastructure

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17N

0 1 2 4 km

1:85,000

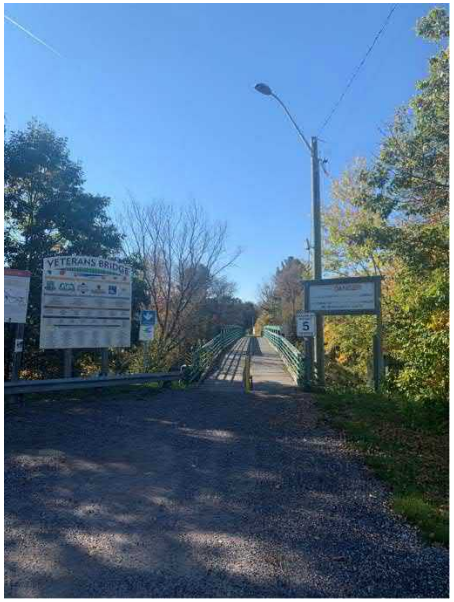
Project:	**Huron Shores Flood Risk Analysis**
Figure Title:	**Critical Infrastructure - Field Photos Key**
Survey Date:	**October 7, 2021**
Prepared By: HATCH	**Figure: A2**

Critical Infrastructure – Field Photos	
Location	**Photos**
Public Works Garage	
Little Rapids Cemetery	

Critical Infrastructure – Field Photos	
Location	**Photos**
Fire Department, Station #1	
Little Rapids Hall	

Critical Infrastructure – Field Photos	
Location	**Photos**
Heritage Park Museum	
Forest Lawn Cemetery	

Critical Infrastructure – Field Photos	
Location	**Photos**
Maple Ridge Cemetery	
Sowerby Hall	

Critical Infrastructure – Field Photos	
Location	**Photos**
Municipal and Public Works Garage	
Mississagi River Crossing Veterans Pedestrian Bridge	

Critical Infrastructure – Field Photos	
Location	**Photos**
Spruce Grove Cemetery	
Arnill United Cemetery	

Critical Infrastructure – Field Photos	
Location	**Photos**
Mississagi River Crossing Highway 17	
Carlyle Cemetery	

Critical Infrastructure – Field Photos	
Location	**Photos**
Fire Department Station #2	
Iron Bridge Recreation Centre	 

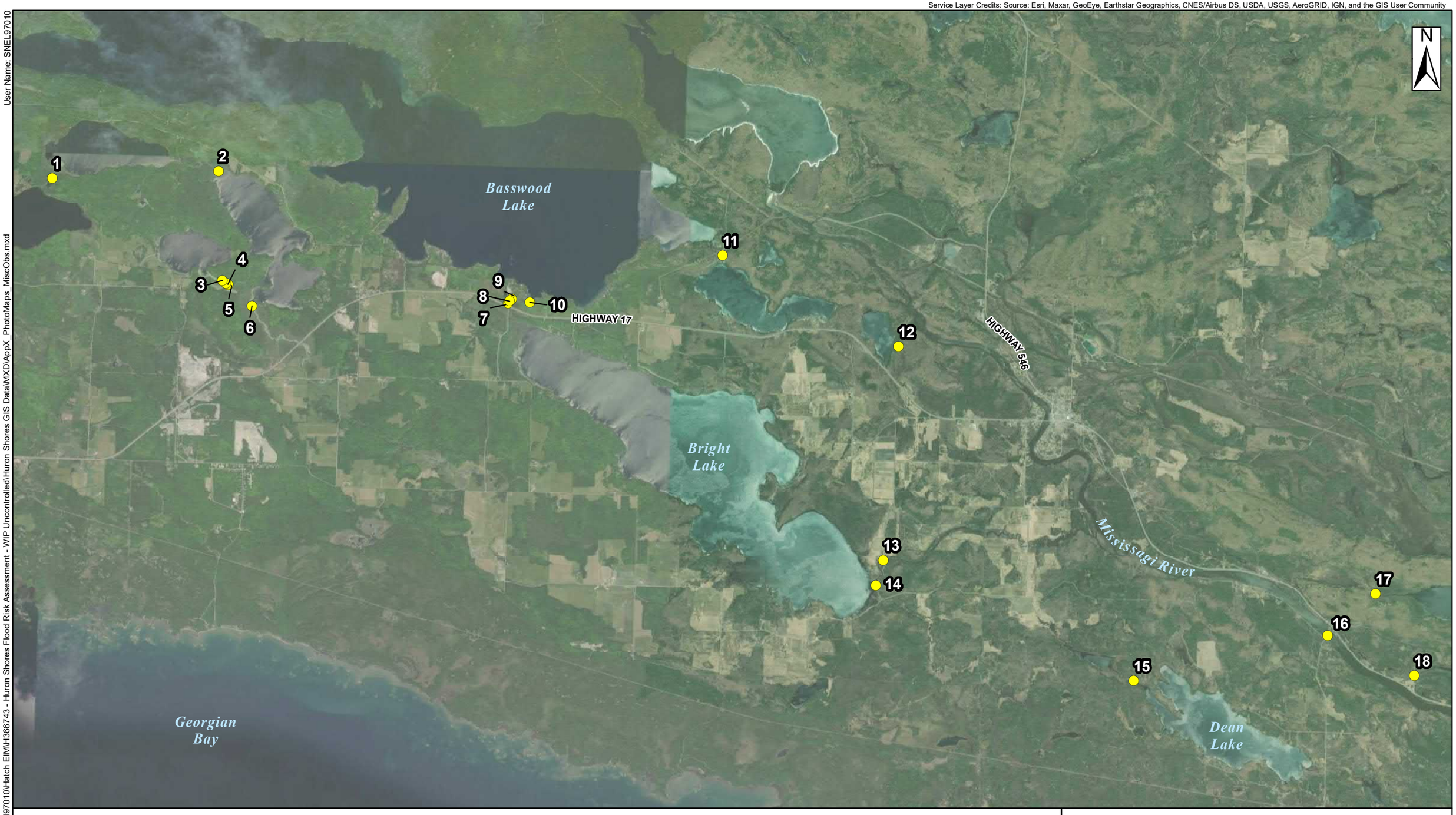
Critical Infrastructure – Field Photos	
Location	**Photos**
Iron Bridge Historical Museum	
Iron Bridge Canada Post	

Critical Infrastructure – Field Photos	
Location	**Photos**
Sunset Cemetery	
Mississagi River Crossing Dean Lake Bridge	

Critical Infrastructure – Field Photos	
Location	**Photos**
Thompson Hall Recreation Centre	 

A.3 Hydraulic Feature Photo Map

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



LEGEND

- Photo Location

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17N

0 0.75 1.5 3 km

1:65,000

Project:	**Huron Shores Flood Risk Analysis**
Figure Title:	**Huron Shores Observations - Field Photos Key**
Survey Date:	**September 28 to October 8, 2021**
Prepared By: HATCH	**Figure: A3**

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
1	  	Beaver dam, approx. 1-m head, small flow over, active at time of survey (October 1, 10:00 a.m.)

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
2	 	Inlet, could not access Birch Lake
3	  	Outlet from north lake, beaver dam, east end of lake is all wetland/ marshland

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
4		Looking upstream
5	 	Creek underpasses road at culvert, flow direction indistinguishable

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
6	   	

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
7	  	Harris Creek north of Highway 17
8	  	

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
9	   	

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
10		
11		No culvert under road, Clear Lake appears offline

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
12	 	Waterfall behind property D on Dobson Drive, outlet for Warnock Lake
13	  	Bolton River crossing

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
14	    	

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
15	    	Beaver dam all the way across river; approx. 80-cm head

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
16		Misissagi River from Dean Lake Bridge
17		River crosses the road (road currently fully washed out)

Miscellaneous Observations – Field Photos		
Location ID	**Photos**	**Field Notes**
18	    	Known flooding, culvert under road

Appendix B
Public Information Meeting
Complete Transcript

Huron Shores Flood Risk Assessment - Public Information Session #1

Virtual Session; February 17th, 2022, 6:00PM EST

Bethany Heppner (Presenter) 6:00 PM:

Hi everyone. Welcome. We are just about to get started. We've started recording just so that we have a full recording of this whole meeting to be posted later. I'm so glad that all of you could join me for this presentation.

I will be presenting information on behalf of the Municipality about the current flood risk assessment going on in your community. I'm just going to give it one more minute for a few more people to filter in. It still seems like people are just getting here. Alright, I think it's time we get started.

Hello, my name is Bethany Heppner. I'm a hydrotechnical engineer with Hatch in Niagara Falls, and I am presenting this on behalf of Natashia Roberts, the Deputy Clerk of Huron Shores. She is also here if you guys have any specific questions for her. But let's cover a little bit of housekeeping in the meantime.

How to use Microsoft Teams. This might be the first time for some of you using Teams. You'll notice that for the moment all of your cameras and microphones have been disabled. That is just until we get through the presentation. There will be a question period where you will be able to speak freely and I'm going to go over the process for question and answers at the end of this presentation.

There will be two options. You can either submit a question typed into the chat, or you'll be able to raise your hand and I can unmute you and you can ask your question in person.

And if you have additional questions that you think of after this meeting, you have up to the 24th of February to submit those questions to Natashia Roberts and her email address is on the screen right now and it's also available on the Huron Shores website.

So the first option - if you want to submit a text question, you have the option to open the chat in this little button here, highlighted in red, and type into the conversation. We will be going through them at the end of the meeting and answering all those questions in turn.

Alternatively, if you want, you can also raise your hand, which is the little hand button, and when you do that, I will call on you by name and I will give you the option to unmute your own microphone, which will be this little mute/unmute button and then I'll be able to answer your question after you ask it. Awesome. And then once you're done, you can also lower your hand just so that you don't get called on again.

For all of your information, this meeting is being recorded and will be available to listen to again. Once it's finished, if you know anyone who's missed this meeting and wants to know about the content of it, it will be made available.

Let's get right into what we are here to talk about today.

Obviously, Hatch always starts with Manifesto Moment to share what we do and why we do it. Before we get into the Project specific things, I'm going to go through the introduction. We're going to talk a little bit about where the funding from this Project comes from and how it is defined. We will talk about the area that we're looking at, all the data that we've been collecting over the past few

months; some watershed characteristics and then next steps and what you should expect coming out of this Project: what are the deliverables, what you're going to see and what your community is going to have coming out of this Project.

Obviously, everything in this [presentation] is an ongoing Project, so just be aware that it should be relied upon at your own risk only. Nothing here is finalized yet and it's still all in the works, so use this information for your own knowledge, but it's not necessarily to be relied upon. You should wait until the report comes out.

One more person showing up. Nope.

Alright so at Hatch, we start every meeting with a Manifesto Moment just to let you guys know a little bit about us. We are an engineering firm and we provide engineering services, but we are really focused on "positive change", making the world better; trying to in this case really "achieve no harm", which is one of our key values. We're looking to provide you with the best information for you and your community to protect itself against flooding. So that's what this whole thing is, is we are going to start looking at the risk of flooding in your Municipality and what we can do to reduce that risk.

So why are we talking about flooding? It is the most costly natural disaster in Canada in terms of property damage. There is extreme flooding in many places in Canada and it's becoming more and more common and understanding the causes of those floods and why they are happening is key to preventing damage in the future. Knowing what is possible and how likely is it is really important.

So we're going to get into Ontario's approach to flood management. This is just general information that the province has produced about the cycle of flooding and right now, we are in the process of understanding the possible impacts of flooding and being prepared and having an emergency plan. So all of this is to give you information to then prepare for flooding events. This is exclusively a study at where we are looking at what could happen.

Next up: why is it so important? The number one priority is to understand flooding. It's to define where it could happen, develop appropriate land use options, and all of that is really the long-term goal of this Project. This is the upfront study that we're doing, to eventually be able to define limits of flooding, create maps, and develop appropriate land use planning. Really understanding the hazard- What is out there and and why? How can the water move? Where does it go? Why?

This Project is partially funded by the National Disaster Mitigation Program, which was first brought out a few years ago, and this is part of the sixth intake of that funding program. It provides funding to communities and allows them to better understand the risks of disaster within their own communities. In this program, we are currently in stream one which is the flood risk assessment. It is the very first step that you must complete to continue in this program and to continue getting funding from the government.

In this specific case we are doing a flood risk assessment and that flood risk assessment is to do a watershed analysis to determine which areas are prone to flooding and then prioritize them for mapping, so we won't be producing floodplain maps in this project. I know lots of you are looking for the official maps, with the [flood] line on it. That's the next step of this funding. So, we are in the

process of collecting all of the information required for that and making a prioritized list of areas that need mapping. We're going to do a small bit of mapping as a conservative indicator of risk potential and that is one of the limitations of this program. It's not something that we can just do, it is a rule that that is the limit that you can take this stream one in the natural disaster mitigation program.

This program is designed to help communities identify, on large water courses, what areas have potential to be flooded. And it is what areas are critical, what needs to be prioritized, and what maps need to be produced to help residents and communities plan appropriately. So the majority of this Project is in data collection. Obviously, I've already said, we will not be producing regulatory maps as part of this Project. That absolutely is the next step for the next project in this area.

Let's break right into what we are covering in this Project. Here you'll see a beautiful map of your municipality, and labelled here are two rivers, the Thessalon and the Mississagi, which are included in this study, and we will be determining the areas along those rivers that need to be mapped. In addition to that, we are also looking at all of the lakes labeled on this map. So for each one of those lakes we will be determining whether or not there is a risk of flooding and which areas are of concern.

I told you at the majority of this is data collection. Let's talk about that data. So first off, your municipality provided to us this map of flood response areas in the 2013 event. I'm sure lots of you are aware of all the incidents of flooding in your community in 2013. So as part of this project we are going to determine which ones of those sites were caused by overland flooding of any of these bodies of water that were listed on the last map. We're going to look at this and figure out how many of those were caused by those bodies of water and then filter out the ones that were caused by, say, an infrastructure issue, rather than in increase in too much volume of water. You wouldn't expect, say, the culvert under your driveway to be able to pass a 100 year flood. That's not what we're looking at in this Project. We're looking at the large bodies of water and their capability to absorb a large regulatory event like a 1 in 100 year [flood] or a Timmins storm event without causing damage to the community or the people that live around it. And again, I want to focus on the main focus of this is to reduce the risk to life and reduce the risk to property damage. I mean obviously that is the long-term goal. We're going to use this information to make changes, but this is just studying the current state of the watershed.

There have been a few historic floods. We got a chance to go out to the community and talked to people who were around in 1979 when the Mississagi flooded with the highest recorded flows on that waterway. There was another event in 2002 as well on the Mississagi River, and obviously what happened in 2013 with all that localized flooding, in addition to all of your waterways being overrun.

As part of our data collection, the wonderful Jaimie Snelgrove and I spent two weeks in your community. We visited each of the lakes and boated the rivers. It was to assess the physical characteristics of the watershed as well as determine how each of the lakes is controlled. As many of you probably know, quite a few of the lakes in your area are controlled by beaver dams. So Jaimie and I canoed out and catalogued them so that we can determine the levels and what kind of risk there is to flooding in those lakes.

We also spent some time out there identifying and documenting all of your critical infrastructure. As part of this project, we are going to identify any critical infrastructure that is at risk of flooding. Critical infrastructure is defined as anything that is essential to the health, safety and economic well-being of your community. This is the list that we put together with your local municipality of things that are critical to the function of your community, so we will be identifying if anything on the list on the screen is at risk of flooding. Additionally, we were asked to also look at all of your memorials and museums. We know they're very important to the community and so we will also be determining whether any of these sites are at risk of flooding as well.

LiDAR! This is really the most valuable product that your community will be getting out of this Project. It was flown in the fall of last year and has just been processed. We actually just received the LiDAR package a few days ago. It is a comprehensive and detailed large scale elevation data. So, your municipality can use this for all future construction planning projects, and it is incredibly valuable data. I am so happy that we've been able to get this in under this Project because this will really facilitate the creation of those maps- and not only flood maps, all sorts of other projects that your community has in the future. This is invaluable data; it is just beautiful. Here you see a sample of what that data is going to look like. It is here coloured by elevation. So, they fly over in a plane after the leaves have fallen, before the snow falls, and we get a really clear picture of what the ground looks like. We were able to, within the project budget, to get the entire municipality covered in LiDAR. This information will be available to your municipality, and you'll be able to do anything with it. I'm so happy that you guys are going to have this data to work with in the future. Obviously, all the sites that we were looking at in this study are included, but any additional sites that you are going to want to look at in the future, we will already have the LiDAR coverage to do that work. It's going to save, long term in your community, lots of money having this data in house.

In addition to the LiDAR, we also conducted an underwater survey of the Thessalon and the Mississagi River, including a centreline as well as cross sections around every 500 meters. In addition to that, something called hydraulic control points, which are, say, like a set of falls or rapids where there is a known contraction in the river. It helps with hydraulic modelling, it's important when doing floodplain mapping which is going to be the next step of this Project. And again, this data is incredibly valuable, and you will be able to use it over and over. We collected some really great information about your watershed.

Here is the image of the cross sections that we've collected. So, you'll see starting right at Red Rock all the way down to the outlet of the Mississagi River. And then there the Thessalon River as well, starting just outside of the municipal boundary through Thessalon all the way to the outlet.

We're going to dive into your specific watershed characteristics.

On the screen here you will see just how large the Mississagi watershed is. You can see your municipality here, down at the very bottom of it, but all of the water from the entire purple basin comes through Iron Bridge. You can see here that the Mississagi watershed is over 10 times the size of the Thesslon watershed. The difference in basin size does have an effect on its response to flooding. In a large basin, it takes a long time for the water to get from the top of the basin to the bottom. And so, you see floods happening, they take a little bit longer, the time is longer, the time to

peak. And also, if there is storage within the watershed, those peaks also decrease. So instead of being a sharp, quick increase in water levels and flows, it's longer and drawn out over several days. And so, you'll see there will be a slight difference in in how those watersheds react to large snowmelt events, large rainfall events. I can confirm that the Mississagi River watershed is mostly driven by snowmelt in that northern part of the basin while the Thessalon River watershed could be more affected by something like a thunderstorm, which has a smaller area but potential for higher inputs.

Now, if we're going to dive a little bit deeper into the Mississagi River watershed, here is your municipality right at the bottom of that huge, huge watershed. And then in here, we've divided the basin into 2 sub basins: the Red Rock Basin, which comes through the Red Rock Generating Station just upstream of Iron Bridge, and then the Mississagi Falls Basin which encompasses all of the watershed that is below that point and that goes through Mississagi Falls out by Blind River.

And then we are also internally dividing that watershed up into each individual lake as well. So, each of the lakes that we are studying, we are looking at the individual inputs to those lakes. But here you can seet, especially if I flip back one, this local watershed is just a very, very small portion of the watershed as a whole. So, the water that you see going through the Mississagi River is everything above, whereas if we are looking at just these individual lakes, it'll just be the area in green here that is contributing to those lakes.

If we flip over to the Thessalon River watershed, here we see a few different inputs coming in. Obviously, upstream of your community, there's the entire upper basin, then we've got the downstream basin here, which includes the stretch of river that runs through your municipality that's included in this study, as well as the Little Rapids Dam basin, which is everything that flows from above Little Rapids dam into the Thessalon River eventually.

So, what are the next steps to this Project? I think we have a pretty brief description of what is in your watershed, but I want you to know what to expect from this study.

The project is going to be complete on March 31st, 2022, which is about six weeks from now. It will include a technical report, a list of all the identified areas, as well as a Risk Assessment Information Template for each of the sites identified. And that is really the key to this Project, because that is what needs to be submitted to the federal government for funding for floodplain mapping. So, the end deliverable for this project is the ability to then map all of those areas. And because we've done all of the upfront data collection, it's going to be a lot easier to produce those maps than it would be if starting from scratch.

In addition to that, we will also be giving a presentation to your Council. Once everything is finalized, we will also have a final public meeting where we discussed the results of this Project and you'll be getting all of the hydraulic models, all of the studies that we've done, as well as the big ticket items like the LiDAR and then bathymetry, which are going to cut what is required for floodplain mapping drastically.

We’re going to open up to questions and comments. One note before we get started- I can't answer any questions that are related to your local government bylaws or insurance. I am a technical person,

so please try to keep your questions focused on the scope of this Project. I'm going open it up to questions if anyone wants to raise their hand and ask a question, I will allow you to speak.

Huron Shores Flood Risk Assessment - Public Information Session #1 – Q&A Session Transcript

Virtual Session; February 17th, 2022, 6:00PM EST

Bethany Heppner (Presenter) 6:27 PM: Hi there, George Bilodeau, you can now unmute yourself and speak if you would like.

Georges Bilodeau (Guest) 6:28 PM: Thank you. Very good presentation. I enjoyed it and some good details coming forward. One question having to do with north of the Little Rapids Dam, there's another dam call a Shaw Dam.

Bethany Heppner (Presenter) 6:29 PM: Okay.

Georges Bilodeau (Guest) 6:29 PM: You didn't identify it. I know it's critical at this moment because the MNR are considering changes to that dam as there's a little reservoir above it. But the question is, the size of the reservoir I guess would be in, in the ministries files, and what would happen if they removed the Shaw Dam or something happens to Shaw Dam? Because presently it's in a critical state of disrepair, and then needs to be examined and I didn't see that in your presentation.

Bethany Heppner (Presenter) 6:29 PM: Yeah.

Georges Bilodeau (Guest) 6:29 PM: Other than that I enjoyed it, and I'm looking forward to the next steps to this study and good work. Thank you.

Bethany Heppner (Presenter) 6:29 PM: Excellent. Thank you so much. Yeah. So, I've just noted your comment there and we will add it to the questions of the report and come up with a little something for it. I think to answer your question briefly here, we are currently only looking at the Thessalon River, and I know it's an input to the Thessalon River, so we will look to see if it has an effect. I'm thinking that at these high-level floods that we're looking at, I'd have to obviously check the reservoir size and see if it would have an effect. I'm not… I don't think it's going to have a huge effect on the total inputs to the Thessalon River, but we will have a look at that watershed and see what's up with that. Thank you.

Does anyone else have a question or comment?

Hi there. I will allow your mic. Please go ahead and unmute yourself if you would like to ask a question.

Sorry, Teresa Richardson.

You have to unmute your own mic, unfortunately.

Teresa Richardson (Guest) 6:31 PM – In Meeting Chat: sorry I can't find the mic

Bethany Heppner (Presenter) 6:31PM: I'm going to move on to Corey Edwards and let's see if you can unmute yourself and ask a question.

Corrie Edwards (Guest) 6:31 PM: I do have a question. Our watershed has actually four generating stations, regulatory generating stations, that also can play a large party in our watershed here.

Bethany Heppner (Presenter) 6:32 PM: Absolutely.

Corrie Edwards (Guest) 6:32 PM: We never heard too much of that mentioned as well.

Bethany Heppner (Presenter) 6:32 PM: Yeah, we are absolutely taking that into account when establishing the flows that we are running through our models, absolutely that is fully taken into account. We have a great understanding of those dams. I've actually worked on them myself and we are absolutely taking that into account. We are aware of the role that those dams play in your watershed. Great question.

Corrie Edwards (Guest) 6:32 PM: Thank you very much.

Natashia Roberts (Guest) 6:32 PM – In Meeting Chat: Teresa, you can write your question in the chat as well

Bethany Heppner (Presenter) 6:32 PM: Yeah, Teresa, I did see that Natashia mentioned you could type your question into the chat if you would like.

Teresa Richardson (Guest) 6:33 PM – In Meeting Chat: Thanks Natashia. Approximately how long does each step take.

Bethany Heppner (Presenter) 6:33 PM: Oh, how long does each step take up? I mean, like each of the stages of funding for this program? This Project – Natashia, when did we apply for funding for this project initially?

Teresa Richardson (Guest) 6:33 PM – In Meeting Chat: yes

Bethany Heppner (Presenter) 6:33 PM: I think it was last December, so it would have been… sorry, 2020. In December of 2020, Natashia?

Natashia Roberts (Guest) 6:33 PM: Correct. Yeah, that's correct.

Bethany Heppner (Presenter) 6:33 PM: Yeah. So we originally applied in December of 2020. I helped Natashia apply for that funding, and so it's going to depend on when the next intake into this program is. We are already into the 6th intake of this program and it's been incredibly popular. So, depending on when the government opens up the next intake for this, we're absolutely going to help your community apply for that next stage of funding.

Again, limited by what the federal government is doing, as always.

Natashia Roberts (Guest) 6:33 PM – In Meeting Chat: Teresa, please give me a call on Tuesday and we can chat!

Jaimie Snelgrove (Moderator) 6:33 PM – In Meeting Chat: Hi Teresa! If you would prefer to speak into your microphone, the unmute button is located in the bottom third of your screen.

Bethany Heppner (Presenter) 6:33 PM: Does anyone else have a question?

Wayne (Guest) 6:34 PM – In Meeting Chat: Can you explain what this will mean for the residents of Huron Shores when this study is complete?

Bethany Heppner (Presenter) 6:34 PM: Oh, here, Wayne. Can you explain what this means for the residents of here Huron Shores, when the study is complete?

What this is going to do is make you aware of what is currently already the state of your watershed. So, what it is going to do is allow you to make the best decisions you can with the best information possible. I know that it's a scary thought to think about new maps coming out, and maybe that line changing, but it's all about having the correct information moving forward, allowing you to know what kind of risk you're putting yourself in or other people in your community and identifying those risks is the first step in that reduction of harm.

Teresa Richardson (Guest) 6:34 PM – In Meeting Chat: So do we all get to see the March 31 data

Sandra Leach (Guest) 6:34 PM – In Meeting Chat: when will we know about how this affects land use planning in an affected area

Natashia Roberts (Guest) 6:33 PM – In Meeting Chat: Hi Sandra, give me a call on Tuesday and we can chat!

Bethany Heppner (Presenter) 6:35 PM: When will we know how this effects land use and planning? So that is going to be for your municipality to determine. This Project is not going to have an effect on your local planning. Natashia, do you want to speak to this at all?

Ah, there we go, Natashia.

Natashia Roberts (Guest) 6:35 PM: Hey, I was just letting Sandra know that she could give me a call.

Bethany Heppner (Presenter) 6:35 PM: Okay.

Natashia Roberts (Guest) 6:35 PM: Ideally, the results of this program or the program will allow us to have some up-to-date flood risk data in our OP that we're currently reviewing, and then the subsequent zoning bylaws. So we're hoping that the results give us something to work with, at least within these planning and zoning bylaws that are due for review so we can start kind of permitting development according to the results, whatever they shall be.

Teresa Richardson (Guest) 6:36 PM – In Meeting Chat: do we all get to see the March 31 data

Bethany Heppner (Presenter) 6:36 PM: Oh man, we've still got so much time. But open for questions. If anyone would like to ask a question, I am here to answer.

Natashia Roberts (Guest) 6:37 PM – In Meeting Chat: Yes, we will have the reports available and ideally posted on our website.

Teresa Richardson (Guest) 6:37 PM – In Meeting Chat: Thanks

Bethany Heppner (Presenter) 6:37 PM: Ah, Rob. I have allowed your microphone Rob and Catherine. You can unmute yourself and ask a question if you'd like. Rob, you have to unmute yourself if you would like to ask a question.

Rob Lecuyer & Catherine Green (Guest) 6:37 PM: There you go.

Bethany Heppner (Presenter) 6:37 PM: Perfect.

Rob Lecuyer & Catherine Green (Guest) 6:37 PM: So how long is it gonna take? How long of a time frame is it before we get flood elevations set so for some of us can go ahead with building in areas that we're not supposed to be able to build in at the moment.

Bethany Heppner (Presenter) 6:37 PM: So that is going to depend on when that floodplain mapping project can be started. Unfortunately, it's not part of this project, but we will be able to identify the areas-

Rob Lecuyer & Catherine Green (Guest) 6:37 PM: I'm sorry.

Bethany Heppner (Presenter) 6:38 PM: -that are that are at risk, but not giving you those exact levels for regulatory events unfortunately, but this will answer the question about which areas those are required in.

Rob Lecuyer & Catherine Green (Guest) 6:38 PM: So we're basically no further ahead than we were before.

Bethany Heppner (Presenter) 6:38 PM: Well, no, you guys are a lot further ahead because, you have all the data in hand to do that project. Like I said, the majority of this project was data collection. There was a lot of information that was required and now that we have all of that information, those next steps are going to run a lot quicker. If you hadn't collected the LiDAR and bathymetry as part of this, you would have had to do it in the next stream, and you'd have to wait for the season to be right to get that information.

Rob Lecuyer & Catherine Green (Guest) 6:38 PM: Now, how does this differ from the elevation readings that we had prior from Halliday Reports going forward with… with the elevations coming up?

Bethany Heppner (Presenter) 6:39 PM: Sorry, which reports? I just missed that.

Rob Lecuyer & Catherine Green (Guest) 6:39 PM: Yeah, the Halliday Report.

Bethany Heppner (Presenter) 6:39 PM: Halliday Report.

Rob Lecuyer & Catherine Green (Guest) 6:39 PM: That, yeah, the one that was on the Mississagi River prior to.

Natashia Roberts (Guest) 6:39 PM: Hi, Bethany.

Bethany Heppner (Presenter) 6:39 PM: I'm not sure how this is going to directly compare. Obviously, we're going to be using a lot better data sources to produce that so, I don't know if it's going to be higher or lower, but it is definitely going to be more accurate.

Rob Lecuyer & Catherine Green (Guest) 6:39 PM: Okay, but you don't have a time frame on it?

Bethany Heppner (Presenter) 6:39 PM: No. Unfortunately, that is going to be up to your municipality when that next project gets rolling.

Rob Lecuyer & Catherine Green (Guest) 6:39 PM: So that's another project on top of the one that we're… that's at hand now, then.

Bethany Heppner (Presenter) 6:39 PM: Yes. Yeah. And that's just the limitation of the government funding that was used for this Project, is that we are required to do this step first. So, we did as much as we possibly could under stream one, but we were told by the federal government that we could not produce those maps as part of this Project. It's going to have to be a second project.

Rob Lecuyer & Catherine Green (Guest) 6:40 PM: OK. I guess we're just all kind of stagnant then.

Bethany Heppner (Presenter) 6:40 PM: Yeah, and we've done everything we can to get you to that point where it's going to be really quick to get those maps out. I would say we've done 90% of what needs to be done to produce those maps, but that last 10% is going to have to be under a different contract.

Rob Lecuyer & Catherine Green (Guest) 6:40 PM: How long will it take? Assuming that you had the funding instantaneously, how long would it take Hatch to complete that aspect of the project?

Bethany Heppner (Presenter) 6:40 PM: We could have that aspect of the project, once this Project is complete, within a few months.

Rob Lecuyer & Catherine Green (Guest) 6:40 PM: Oh. Okay, well…

Bethany Heppner (Presenter) 6:40 PM: Yeah. It would be a really quick turnaround. I mean and absolutely we would love to do that portion of the project with you, but it'll be up to the municipality who they get to do that work.

Rob Lecuyer & Catherine Green (Guest) 6:41 PM: Okay, that's fair.

Bethany Heppner (Presenter) 6:41 PM: Yeah. We're right there, but yeah can't produce the maps under this because the scope had to be narrowed to not include maps to be eligible for the federal funding that you received for this.

Rob Lecuyer & Catherine Green (Guest) 6:41 PM: Thank you.

Bethany Heppner (Presenter) 6:42 PM: Ah, Wayne. Hello. You should be able to unmute yourself now.

Wayne (Guest) 6:42 PM: Yeah, I'm just wondering, why wasn't the Bolton River and the Potomac River, were they included in this this plan?

Bethany Heppner (Presenter) 6:42 PM: So not at this time. Obviously-

Wayne (Guest) 6:42 PM: Because they are two major rivers that are going through Iron Bridge that I think have more effect than the Mississagi River. To be honest with you.

Bethany Heppner (Presenter) 6:42 PM: Yeah.

Wayne (Guest) 6:42 PM: And what is this? What does this do for the residents of this town? We… this costs us so much money in real estate and we… I lost so much money in housing that we couldn't sell or we couldn't build onto and… so what does that mean for the residents of Iron Bridge, that we've been going through for so many years fighting for this? I've moved out of the flood zone now-

Bethany Heppner (Presenter) 6:42 PM: Yeah.

Wayne (Guest) 6:43 PM: - I'm thinking, I've gotta move again? Like what does this entail?

Bethany Heppner (Presenter) 6:43 PM: So. I understand that there is a lot… that this is very important to your community. Obviously, knowing where the flood lines are are important, but I think it's also important to note that whether or not they're drawn on a map, that's where the water is going to go if it floods. And knowing that is better than not knowing it. Because the environment, the weather, doesn't care if we've established that that is the line where you can and can't build. It's going to happen either way, so it's important for your community members to know what the risks are.

Yeah, open to any other questions if anyone's got anything.

Wayne, did you have another question or is your hand just still up? Sorry. Right.

Wayne (Guest) 6:45 PM: I'm just, you know, when the flood happened '76 I was here.

Bethany Heppner (Presenter) 6:45 PM: Okay.

Wayne (Guest) 6:45 PM: Yeah. So anyways, so Minister Paletti blamed Ontario Hydro for this. So then the Hydro come in, and they fixed that problem.

Bethany Heppner (Presenter) 6:45 PM: Mm-hm.

Wayne (Guest) 6:45 PM: I know, I lived down there, right on the, the shores of the river. They actually fixed that problem, and we didn't have that problem when you went- there was a little bit of flooding, but it was nothing like '76. My house never had a drop water, and I lived on Riverview right on the corner there, there was there was no flooding.

Bethany Heppner (Presenter) 6:45 PM: Mm-hm.

Wayne (Guest) 6:46 PM: I never had any more flooding after that. They spent thousands and thousands of dollars rafting the river.

Bethany Heppner (Presenter) 6:46 PM: Yeah.

Wayne (Guest) 6:46 PM: I'm just tired of losing the value of my properties.

Bethany Heppner (Presenter) 6:46 PM: Yeah, absolutely. And I think what this Project is going to do is give you the information ahead of time. It's about knowing what the risks are rather than just finding out when you lose your property. I think it's important to know ahead of time what that risk to property loss is rather than finding out when the flood happens. It's better to do a simulation and find out what could happen, rather than waiting for it to actually happen and then losing property.

Natashia.

Natashia Roberts (Guest) 6:46 PM: Uh, I just want to know, Bethany, when you were out on the field, I know that we went through kind of the problem areas that we have identified in our OP land schedules.

Bethany Heppner (Presenter) 6:47 PM: Yep.

Natashia Roberts (Guest) 6:47 PM: Were there any that you saw, okay, there's an area identified here that might not be problematic going forward. Any that were like, blatantly obvious?

Bethany Heppner (Presenter) 6:47 PM: I mean, there were a few. We did talk to some community members on some lakes that have said that those lakes have never flooded above their regular level.

And I think that's going to be really important in knowing that we don't have to- or the community doesn't have to- commit to mapping those areas that are just not at risk of flooding, right? So, we'll find the areas that are at risk and then only proceed with those forward rather than diving right in, doing a bunch of work that might not be necessary. So yes, there were some areas where it was, specifically we spoke to some people who have confirmed that they've lived there, you know, 30 plus years, and have never seen water levels rise beyond normal.

Natashia Roberts (Guest)6:48 PM: Right. So there are some areas that we may be able to just totally removed from our...

Bethany Heppner (Presenter) 6:48 PM: Priority list? Absolutely. Yeah. Yeah. That's what this whole study is about is to refine that list so you know exactly which areas you want to continue looking at and that you need to produce maps for because not every body of water has the same risk to flooding.

Natashia Roberts (Guest) 6:48 PM: Okay.

Bethany Heppner (Presenter) 6:48 PM: And by risk, I mean both likelihood and consequence, right? If you've got a big open field with nothing on it and something like a major flood happens, and the water recedes, and the land is just how it used to be, that's not a big deal. But if a lot of people live there, that becomes a serious issue. So, it's a combination of both areas that have a high likelihood of flooding and also are, say, an area of interest for the community- all of your critical infrastructure sites, where everyone lives as well as all those memorial sites that are important to your community. If a swamp floods regularly and no one lives there, that's okay! But you don't want your town flooding, and you want to know that ahead of time.

Oh. Teresa. Hello. You should be able to unmute yourself and ask a question.

Teresa Richardson (Guest) 6:50 PM – In Meeting Chat: Does it make sense if when the big flood hit that your property wasn't affected or considered in the flood zone and then when the new assessment came in 2018 all of a sudden your considered in the flood zone.

Bethany Heppner (Presenter) 6:50 PM: Oh, in the chat. So it says, "does it make sense if when the big flood hits, your property wasn't affected or considered in the flood zone, then when the new assessment came in 2018, all of a sudden you're considered a flood zone?" I think my comment on that would be we are specifically looking at floods that are a very rare occurrence. And so... that means that the majority of people will have never seen them in their lifetime. So, just because you didn't get flooded in a particular flood, it doesn't mean that you aren't at risk to flooding for the regulatory event. They tend to be the 1 in 100- well, they *are* the 1-in-100-year flooding event or higher, based on a couple of different designs, storms, very technical. But it means that, realistically, the majority of people will never see a flood like that in their lifetime. That's not quite how 1-in-100-year works, but it just means that that particular event is different than the one that occurred previously. Does that make sense? Not all storms are created equal?

Teresa Richardson (Guest) 6:50 PM – In Meeting Chat: Yes

Bethany Heppner (Presenter) 6:51 PM: Okay, thank you. Still open for questions if anyone is interested. I can do this all night.

GERALD SANDERS (Guest) 6:52 PM – In Meeting Chat: the flooding of 2013 would be classified as a 100 year flood?

Teresa Richardson (Guest) 6:52 PM – In Meeting Chat: So what your saying is that even though we might not ever get flooded we might still be labeled in the flood zone and can never build

Snelgrove, Jaimie (Moderator) 6:52 PM: Hey, Bethany, you just have a couple new questions in the chat.

Bethany Heppner (Presenter) 6:52 PM: Ah, thank you. Perfect. Uh Gerald.. the flooding in 2013. I don't think the flooding in 2013 was a 1-in-100-year event, but it's going to depend on the specific sub-watershed. So, it may have been a 100-year event on a specific lake or system, but it definitely was not on the Mississagi. I can confirm that the 2013 was quite a bit lower than a 1-in-100-year event on the Mississagi system, but on an individual lake, it may have been the worst that that individual sub-basin had ever seen. Does that make sense?

GERALD SANDERS (Guest) 6:53 PM – In Meeting Chat: Thessalon river drain area

Bethany Heppner (Presenter) 6:53 PM: Thessalon drainage area. Yeah. So, I don't have the numbers in front of me about the 2013 event, but I think it was a little bit lower than a 1-in-100-year event. It didn't quite meet that level, and that's just because you've had larger events in the past. I'm speaking of 2002 was a larger event than 2013, and that 1979 flood was larger. That being said, it doesn't mean that it wasn't the worst, specifically in like local flooding. Especially if you had issues with rain on snow, or plugged culverts, it can cause localized flooding that isn't actually caused by the watershed at large, it's caused by a specific restriction. And in general for this project we're looking at stuff that's, you know, risk to life. So large floods, obviously, road closures are an issue, and we are cataloging them and looking into them, but I don't think, in general, the 2013 event wasn't quite at that 1-in-100-year level.

GERALD SANDERS (Guest) 6:53 PM – In Meeting Chat: thanks

Bethany Heppner (Presenter) 6:54 PM: …might not ever get a flood… you might still be… So, yeah. You might never get a flood, but- so the 1-in-100-year event means that there is a 1% chance of it happening every year. And obviously, by the time you get to 100 years, you'd assume that that will have happened once. But probability is an interesting thing, because if you have a 30-year mortgage on your house, and you plan on living there for 30 years, that means there is a 1-in-3 chance you're going to lose your property to flooding if you are inside that line, and I think that is a much better way of looking at it, in terms of how long people own property for. Do you want to build a house where there's a 1-in-3 chance over a 30-year mortgage that you might lose your house to flooding? That's a better indicator than calling it "the 1-in-100-year event."

That was for you, Teresa. And Gerald.

Teresa Richardson (Guest) 6:52 PM – In Meeting Chat: That is definitely something I would want to know if I was a new building, but not if I'm already existing.

Wayne (Guest) 6:56 PM – In Meeting Chat: So do we as residents of Huron Shores have any say in the mapping or not?

Bethany Heppner (Presenter) 6:56 PM: Things are kind of winding down here, unless there's another question. I am going to stick around right till 8:00 [PM] to answer any other questions, and then all of the questions and answers will be included in the report. So if you guys want to drop off and read the rest of the questions, that's great. I see two more here, though that I'm going to answer.

Definitely something I would wanna know. Thanks Teresa.

What do you mean by say in the maps, Wayne? Are you saying that you don't…?

Wayne (Guest) 6:56 PM – In Meeting Chat: Any input

Wayne (Guest) 6:56 PM – In Meeting Chat: input

Natashia Roberts (Guest) 6:57 PM – In Meeting Chat: Hi Wayne, can you call me on Tuesday so we can chat?

Bethany Heppner (Presenter) 6:57 PM: Any input. So, the maps are purely based on physical science. They are based on the terrain data which you've seen we're collecting for the entire community as well as statistical analysis and government regulation. So, there is guidelines from the government in how this mapping is done and how regulatory flood hazard maps are produced, and you have to follow those guidelines in producing them. I'm not sure there's a lot of input that isn't scientifically based. And then Natashia said here that she's available for a chat on Tuesday, Wayne.

Wayne (Guest) 6:57 PM – In Meeting Chat: Ok thank you

Bethany Heppner (Presenter) 6:57 PM: But does that answer your question?

Wayne (Guest) 6:57 PM – In Meeting Chat: Yes thank you

Bethany Heppner (Presenter) 6:57 PM: Keith, you should now have the ability to unmute yourself. Perfect.

Keith Sayers (Guest) 6:58 PM: Yes, in regards to Wayne's question. And I'm, you know, I'm thinking I know where he's coming from, and what I'm getting at is traditional local knowledge. Talking to some of the local folks that's been around, you know, for some time that's seen, you know, that somehow the river had, you know, acted over the course of the last 60, 50, maybe even, you know, 80 years.

Bethany Heppner (Presenter) 6:58 PM: Yeah.

Keith Sayers (Guest) 6:59 PM: Because, you know, it is important, because you know, you say "science". Well, science is good, but traditional knowledge, local knowledge, I think is probably much better.

Sandra Leach (Guest) 6:59 PM – In Meeting Chat: The fact that we didn't have a major flood event since 1979 along Mississagi River and the fact that the river was rip rapped and allows for flow, perhaps the flood line can be reduced.

Wayne (Guest) 6:59 PM – In Meeting Chat: Absolutely Keith. The locals do have knowledge

Bethany Heppner (Presenter) 6:59 PM: Absolutely, and actually the slide where I had the history of the basin, with the '79, that was actually originally titled "Oral History of the Community" because we did go out there and talk to people who experienced that flood. Absolutely local knowledge is important, and

that's why you're seeing that map of the 2013 stuff- that is information that the community provided to us about flooding that happened in 2013 and it is what we are starting this Project with. We're looking at those sites, we're looking at which one of them could have been caused by something small, something large. We are actively engaging the community in this, that is why you guys are here today. If you have comments about flooding, we would love to hear them. Yeah, we are absolutely soliciting information from the community members.

Keith Sayers (Guest) 6:59 PM: Okay, thank you.

Bethany Heppner (Presenter) 6:59 PM: And some of the interviews that we conducted while we were there will be included in our final report.

Yeah, I agree. You guys have lots of local knowledge. We went out there and talked to so many people about the water in your community, about the lakes and the rivers and what they've seen for the time that they've lived there.

Snelgrove, Jaimie (Moderator) 7:00 PM: You do have an additional comment in the chat Bethany, from Sandra.

Bethany Heppner (Presenter) 7:00 PM: Oh, Sandra. Yeah, about that you guys haven't had a real major flood since '79. That in large part is due to the regulation in the basin from those hydro stations. There's a giant reservoir at the very top of the basin that holds the majority of the water that would otherwise come down the Mississagi in one big peak. They save it, and run it when the flows are a little bit lower so that they can keep that constant generation throughout the summer. So, the stations there actually really protect the community downstream.

(Guest) 7:01 PM – In Meeting Chat: In addition to the data you collected, do remedial works (like trap rock along Mississagi banks) get factored into determining the final mapping/flood plain?

Keith Sayers (Guest) 7:01 PM – In Meeting Chat: some engineers I know and often consult with has informed me that the rip rap supported a change in flood levels

Bethany Heppner (Presenter) 7:02 PM: So the rip rap would prevent erosion, but wouldn't necessarily change the… it will change, say, the roughness of the river, and a few other things, but really what the rip rap is doing is preventing erosion and preventing the river from moving sideways and eating property as it moves. But the rip rap itself won't really change the placement of those lines. It has more to do with the level of the river rather than the effects that it's having on the banks.

Yeah, like rip rap, absolutely, a large amount of rip rap can change flood levels as it changes the roughness of the river. So, an addition of rip rap can change how a river works. And that has to do… like internally in our modeling, we do consider that.

I see we are just waiting on a question from Brittany.

Brittany Hollingsworth (Guest) 7:04 PM – In Meeting Chat: Does your report include likelihood of flooding based on the various areas with the municipality? i.e. this zone indicates 1/100 chance, or 1/10 etc

Bethany Heppner (Presenter) 7:04 PM: There we go. So, the… in a flood hazard mapping study, which would be the next study of this, you would pick one event for a reach that is the regulatory event. So, it's

likely the 1-in-100, but it can often be other major storm events that are larger than the 1-in-100, and what happens is there will actually be a few lines on the map. There will be the furthest flooding extent and then the hazard zone. So often times the hazard zone poses a risk to life where the inundation zone shows how far the water actually stretches to. But they are always done for something like the 1-in-100-year or above. So, there would never be a variation down to say that 1-in-10. Instead it would be… we're always looking at, there's a few different floods, but it will be either the 1-in-100 or the Timmins storm in a community like Huron Shores, and that is based on local weather conditions and what is possible in that specific region.

Wayne (Guest) 7:05 PM – In Meeting Chat: When the work was done on the river it help to stop the riverbank erosion and it helped to dredge the river deeper. It has increased the gpm flow in the river.

Bethany Heppner (Presenter) 7:05 PM: Yeah, Wayne, that is absolutely true. Adding the rip rap to the sides reduces the spread of erosion horizontally and can lead to a deepening of the river. But it's not always the case. So, a specific example of that is on the Thessalon, where the majority of the riverbed has already eroded to bedrock. So, there's really no way for it to go down, and that's why it's moving sideways.

Brittany Hollingsworth (Guest) 7:06 PM – In Meeting Chat: Thanks! … further as a comment, I certainly understand people's concerns about reduced property value, but on the other hand, as a buyer, I'd certainly want to be aware if I'm looking to get a mortgage and buy a home or property that may be on floodzone, even if the event is unlikely

Bethany Heppner (Presenter) 7:06 PM: Brittany, obviously there are implications to being aware of flooding areas, but those risks exist, whether or not we are aware of them. So, becoming aware of them doesn't change what is there.

Wayne (Guest) 7:07 PM – In Meeting Chat: That's not the case with the Mississagi River though

Bethany Heppner (Presenter) 7:07 PM: Yeah. Wayne you're right, it's not the case with the Mississagi where it is generally a soft bottom. There is a lot of environmental effects of doing something like rip rapping or dredging the river to reduce flooding. So, I think the first step is to know what the risk of flooding is, whether or not something that drastic is warranted before we go dumping a bunch of rocks inside of the river, or dredging it and disturbing the ecosystem, we should know what's at risk because the answer- I mean, unlikely, but- the answer could be nothing! There are some areas that we're looking at here that are unlikely to have any real risk to the community as far as flooding and it's not… it's important to know that before digging into mitigation. Obviously, mitigation for flooding is the long-term goal, but understanding what those floods are is first.

Wayne (Guest) 7:07 PM – In Meeting Chat: But that work was already done by Hydro after the flood of 70

Bethany Heppner (Presenter) 7:07 PM: Yeah, I understand that that work was done by Hydro in '79. And I understand that it worked then, but I'm just talking future mitigation. We're currently looking at the watershed as it is now, so including that rip rap and all that work that had been done previously, that'll all be in there.

Rob Lecuyer & Catherine Green (Guest) 7:08 PM – In Meeting Chat: It is certainly true that the 1/84-yr flood at 1979 as described in the Halliday report precedes when significant riprap was done by the power dam corporation in the 1980's and any permits and severances issued since then reference the 1979 data, which may well be worst case

Bethany Heppner (Presenter) 7:07 PM: Hi Rob, I'm just reading your comment. From our records, '79 has been the worst case as far as flows on the Mississagi.

Sandra Leach (Guest) 7:09 PM – In Meeting Chat: Our flooding documents are very outdated so updated information is necessary I believe.

Bethany Heppner (Presenter) 7:09 PM: Thanks Sandra were working at updating them as best as we can.

Brittany Hollingsworth (Guest) 7:10 PM – In Meeting Chat: I came in a bit late to the presentation so sorry if I missed this, but can you speak a bit about climate change and the potential impact on future flood risks? Is that something being considered as well ?

Bethany Heppner (Presenter) 7:10 PM: Ah, I did not speak about climate change at the beginning of the study. So, as part of this Project, we are looking at the watershed as is and what it looks like now, with all the information that we have available. It is absolutely an option to include some contingencies for climate change in the floodplain mapping stage. It is encouraged as part of the funding to do a quick study to see how climate change may change the hydrology or the rainfall patterns and the snow melt patterns of a watershed. It is not part of this study, but it is definitely something that can be done in the future. In general, in similar studies, usually we'll have a look at the long-term trends, and also look at other climate change studies that have been done in the region and then try and identify a percentage increase or decrease to flows to be expected. So, it's not necessarily considered in this study, but it is definitely a part of floodplain mapping in general.

GERALD SANDERS (Guest) 7:11 PM – In Meeting Chat: I understand that the flood of 1979 was a failure of a timber dam on the White River.

Bethany Heppner (Presenter) 7:11 PM: Gerald mentioned a failure of a dam on White River during the '79 flood. I'm gonna have to dig into that a little bit, but that is a great information. I will definitely add that to my list for this evening.

Brittany Hollingsworth (Guest) 7:12 PM – In Meeting Chat: thanks! :D

GERALD SANDERS (Guest) 7:12 PM – In Meeting Chat: is there any documentation on this event

Keith Sayers (Guest) 7:12 PM – In Meeting Chat: I believe he is correct along with a dam at Mount Lake

Sandra Leach (Guest) 7:12 PM – In Meeting Chat: Has the funding been established for the mapping yet?

Keith Sayers (Guest) 7:12 PM – In Meeting Chat: local knowledge!!

Bethany Heppner (Presenter) 7:12 PM: So, Sandra, the municipality has not yet applied for funding for the mapping. I'm not sure what you guys have done internally, but as part of this study, we are helping you prepare the materials that you will need to apply for future federal government funding.

Corrie Edwards (Guest) 7:13 PM – In Meeting Chat: I thought that dam was on Rocky Island

Bethany Heppner (Presenter) 7:13 PM: Also seeing comments here about the event, the timber dam failure on White River, and he said a dam on Mount Lake, and Corrie Edwards here has commented that they thought that the dam was on Rocky Island. I'm going to look into all of those and try and sleuth out an answer for you guys and provide something in the report.

Yeah, we have lost a few people and obviously, everything said here will be recorded, so you can jump back if there's anything else.

Sandra Leach (Guest) 7:14 PM – In Meeting Chat: Is there a grant program available yet for this part of the project seeing as this is a priority of the government?

Bethany Heppner (Presenter) 7:14 PM: Sandra, is there a grant program available yet for this part of the project, seeing as it's a priority for the government? I haven't seen anything for an additional intake of the NDMP funding specifically. Natashia, do you have anything to say about that?

Natashia Roberts (Guest) 7:15 PM: I haven't seen anything either, Bethany, but I'm hopeful that that's kind of where the direction will go, so we can do an intake seven under that phase two.

Bethany Heppner (Presenter) 7:15 PM: Yeah, and because so much of the work was done up front in this, it should be a lot easier to get that that funding with the majority of the data already collected to do that project. And depending on the cost, it might be something as well that the municipality might be able to do, but again, that's… it's something that to look into long-term.

Teresa Richardson (Guest) 7:16 PM – In Meeting Chat: So what happens if we don't get the funding

Bethany Heppner (Presenter) 7:16 PM: Yeah, so the question, what happens if we don't get funding? I think with all the information that you have here, it is likely that you'll need a lot less money to do that next step. So, we did the majority of it, you know, with the federal government footing the bill, and then will really reduce the cost of that next step. So, whether or not you're able to secure additional funding, you should be able to continue this project I'm hoping, but obviously that's an internal funding thing with your municipality.

Scott/Sandie Dagg (Guest) 7:16 PM – In Meeting Chat: When do you anticipate the municipality will be in a position to issue a building permit on Mississagi Crescent

Bethany Heppner (Presenter) 7:16 PM: Natashia, this is a question about building permits for you. In the chat from Scott and Sandy.

Natashia Roberts (Guest) 7:17 PM: Mm-hm, at this point we don't have an answer for Scott, but we can take it offline and have those discussions. We hope to know more once this Project is done, it wraps up at the end of March. But yeah, I'll reach out to Scott and Sandy offline.

Bethany Heppner (Presenter) 7:17 PM: Thanks.

Sandra Leach (Guest) 7:17 PM – In Meeting Chat: When did you say the next step will be presented?

Bethany Heppner (Presenter) 7:17 PM: Oh, so the rest of this Project- we'll be having another public information session in April. So, after this project has wrapped up at the end of March, we'll be hosting

another one of these sessions where we'll be looking specifically at all the areas that have been identified.

Sandra Leach (Guest) 7:17 PM – In Meeting Chat: Thank you.

Bethany Heppner (Presenter) 7:18 PM: So in April we'll have a Council meeting, we'll have meetings with your municipal staff, as well as another public information session. So, there will be 3 meetings depending on who you are, if you're the public or council or member of staff, and we'll be going through all of the results then. Anyone have anything else to quiz me on?

Teresa Richardson (Guest) 7:19 PM – In Meeting Chat: Thank you for your time.

Bethany Heppner (Presenter) 7:19 PM: Thanks Teresa. Have a good night. Obviously open for any more questions, but I'm not anticipating a ton more at this point. You guys can feel free to check out that recording if you need to drop off, and I am going to stay right till 8:00 [PM].

GERALD SANDERS (Guest) 7:20 PM – In Meeting Chat: not at this time, I will give Natashia a call on Tuesday

Bethany Heppner (Presenter) 7:20 PM: Great. Thanks Gerald.

Natashia Roberts (Guest) 7:20 PM – In Meeting Chat: Thanks Gerald. Talk Tuesday!

Corrie Edwards (Guest) 7:20 PM – In Meeting Chat: Thank you!

GERALD SANDERS (Guest) 7:20 PM – In Meeting Chat: thanks for your hard work on this important issue

Keith Sayers (Guest) 7:20 PM – In Meeting Chat: thanks for the update

Rob Lecuyer & Catherine Green (Guest) 7:21 PM – In Meeting Chat: Thanks for the status so far.

Bethany Heppner (Presenter) 7:21 PM: Thank you so much everyone for your time tonight. I really appreciate you coming out and voicing your opinion asking questions. Lots of great questions tonight. Just as we're finishing up, if you guys have any other questions or comments, you can email Natashia at natashia@huronshores.ca with anything else, and anything submitted before February 24th, we will be able to answer and include in the report.

Thanks everyone.

Appendix C
Photos Provided by Gerald Sanders

Appendix C: Photos Provided by Gerald Sanders

McCreight's Dam – May 1, 2020

McCreight's Dam – May 1, 2020

Shaw Dam – November 2, 2020

Shaw Dam – November 1, 2021

Shaw Pond – November 2, 2020

Little Rapids Dam – October 25, 2020

Appendix D
RAIT Forms

Public Safety Canada | Sécurité publique Canada

Ottawa, Canada
K1A 0P8

National Disaster Mitigation Program (NDMP)
Risk Assessment Information Template

Risk Event Details			
Start and End Date	Provide the start and end dates of the selected event, based on historical data.	Start Date: 06/09/2013	End Date: 13/09/2013
Severity of the Risk Event	Provide details about the risk, including: • Speed of onset and duration of event; • Level and type of damaged caused; • Insurable and non-insurable losses; and • Other details, as appropriate.	Bolton River, a tributary within the Mississagi River watershed. The significant 5-day precipitation event recorded at Sault Ste. Marie in early September 2013 totaled 90 mm of rain over 5 days, with 42 mm occurring on September 6. This event occurred across the northern shores of Lake Huron and resulted in historically high flood flows on September 10 in small river sub-basins from Sault Ste. Marie to Iron Bridge. This fall 2013 event caused flood damages across the Huron Shores municipality in direct physical damages to private and public property. An estimate of 1:100-yr flood risks has been studied (see attached Flood Risk Assessment report). The risk assessment indicates that a 1:100-yr flood will cause significant direct and indirect flood damages such as property loss, disruption in residential living conditions, loss of business, and disruption of major transportation routes.	
Response During the Risk Event	Provide details on how the defined geographic area continued its essential operations while responding to the event.	After OPP reports of flooded roads and washouts on September 10, emergency crews were activated. All roads were closed the morning of the event in order to assess conditions. Patrols revealed some 82 road washouts. A State of Emergency was declared at 11:15 a.m. on September 10, 2013. Public Information lines were available to answer calls for service. The media played a role in providing updates and advising of road closures/openings.	
Recovery Method for the Risk Event	Provide details on how the defined geographic area recovered.	Cleaning up after the flood included cleaning, repairing, and inspecting municipal roads; the event caused 365 hours of overtime. A total of 18 residences, 5 farms, 1 business and 2 non-profit organizations were impacted, and took flood damaged debris to the landfill. All but 3 roads had been temporarily repaired by September 16, 2013 to allow for traffic flow.	
Recovery Costs Related to the Risk Event	Provide details on the costs, in dollars, associated with implementing recovery strategies following the event.	Total road repairs were estimated at $1.14 million at the time of the event. There were also municipal repairs for a couple of years following the event that were not tracked. The Municipality applied for financial assistance, in the amount of $325,803.41 under the Ontario Disaster Relief Program. All private claims were handled by a joint Disaster Relief Committee established under the Ontario Disaster Relief Program. The Committee handled private claims for all municipalities impacted across the North Shore and was overseen by the Township of Macdonald, Meredith and Aberdeen Additional.	

Recovery Time Related to the Risk Event	Provide details on the recovery time needed to return to normal operations following the event.	As per above, all but 3 roads were passable by September 16, 2013, but road issues appeared for years following the event. Emergency was terminated on September 23, 2013 as conditions, other than those road issues previously mentioned, had returned to pre-event status.

National Disaster Mitigation Program
Risk Assessment Information Template

Risk Event Identification and Overview	
Provide a qualitative description of the defined geographic area, including: • Watershed/community/region name(s); • Province/Territory; • Area type (i.e., city, township, watershed, organization, etc.); • Population size; • Population variances (e.g., significant change in population between summer and winter months); • Main economic areas of interest; • Special consideration areas (e.g., historical, cultural and natural resource areas); and an • Estimate of the annual operating budget of the area.	- The Municipality of Huron Shores, Ontario within the Thessalon and Mississagi River watersheds. Focus is on identified risk areas within both watersheds. - Huron Shores is the result of the 1999 amalgamation of the former Village of Iron Bridge, the Townships of Thessalon, Thompson and Day and Bright Additional, and the unincorporated geographic townships of Bright and Gladstone. - The Municipality has a permanent population of approximately 1,860 (2021 census). - There is a substantial influx of residents (cottagers and tourists) in the summer months. - The area has a long history of farming and logging as well as aggregate extraction. The Municipality celebrates its rich pioneer history with annual heritage days, fall fairs and civic festivals. - There are protected natural areas and major open spaces within the sub-watershed, including the Mississagi Delta Provincial Nature Reserve, marking the mouth of the largest river flowing into Lake Huron. - Areas of economic interest within the Mississagi River watershed include the commercial district of Iron Bridge. - Annual operating budget for the entire Municipality of Huron Shores is $7.1 million for 2021.
Methodolgies, processes and analyses	
Provide the year in which the following processes/analyses were last completed and state the methodology(ies) used: • Hazard identification; • Vulnerability analysis; • Likelihood assessment; • Impact assessment; • Risk assessment; • Resiliency assessment; and/or • Climate change impact and/or adaptation assessment. *Note: It is recognized that many of the processes/analyses mentioned above may be included within one methodology.*	- A Flood Risk Assessment report was completed for the Municipality of Huron Shores in March 2022. - There were four steps completed: Background Review, Hydrology Assessment, Hydraulics Assessment, Hazard Identification and Risk Assessment. - Hazard Identification involved identification of the hazards through hydraulic modeling of flood levels that could impact the community. All hazards associated with the 1:100-yr flood were reviewed. - Risk Assessment examined the level of risk for each hazard. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance, and critical infrastructure was examined.

National Disaster Mitigation Program
Risk Assessment Information Template

Hazard Mapping	
To complete this section: • Obtain a map of the area that clearly indicates general land uses, neighbourhoods, landmarks, etc. For clarity throughout this exercise, it may be beneficial to omit any non-essential information from the map intended for use. Controlled photographs (e.g. aerial photography) can be used in place of or in addition to existing maps to avoid the cost of producing new maps. • Place a grid over the maps/photographs of the area and assign row and column identifiers. This will help identify the specific area(s) that may be impacted, as well as additional information on the characteristics within and affecting the area. • Identify where and how flood hazards may affect the defined geographic area. • Identify the mapped areas that are most likely to be impacted by the identified flood hazard. Map(s)/photograph(s) can also be used, where appropriate, to visually represent the information/prioritization being provided as part of this template.	
Hazard identification and prioritization	
List known or likely flood hazards to the defined geographic area in order of proposed priority. For example: (1) dyke breach overland flooding; (2) urban storm surge flooding ; and so on.	(1) Rain events causing riverine flooding and erosion. (2) Riverine flooding causing inundation of residential property and potential loss of life. (3) Riverine flooding causing washouts of municipal roads and bridges. (4) Erosion of shorelines causing loss of residential and agricultural lands.
Provide a rationale for each prioritization and the key information sources supporting this rationale.	- Based on the Flood Risk Assessment, see attached. - Floodplain mapping is not available for any area of Bolton River. - Significant rain events will produce high water levels on Bolton River.
Risk Event Title	
Identify the name/title of the risk. An example of a risk event name or title is: "A one-in-one hundred year flood following an extreme rain event."	A one-in-one hundred year (1:100-yr) flood event following a severe rainfall-on-snow event. A one-in-one hundred year (1:100-yr) flood event following a severe summer or fall rainfall event.
Type of Flood Hazard	
Identify the type of flood hazard being described (e.g., riverine flooding, coastal inundation, urban run-off, etc.)	Riverine flooding. Shoreline erosion.

National Disaster Mitigation Program
Risk Assessment Information Template

Secondary hazards	
Describe any secondary effects resulting from the risk event (e.g., flooding that occurs following a hurricane).	Erosion of shorelines and loss of residential and agricultural land. Environmental impacts from erosion of shorelines (loss of trees, loss of water fowl and amphibian nesting areas).
Primary and secondary organizations for response	
Identify the primary organization(s) with a mandate related to a key element of a natural disaster emergency, and any supporting organization(s) that provide general or specialized assistance in response to a natural disaster emergency.	(1) Emergency Management Ontario (2) Municipality of Huron Shores

Risk Event Description	
Description of risk event, including risk statement and cause(s) of the event	
Provide a baseline description of the risk event, including: • Risk statement; • Context of the risk event; • Nature and scale of the risk event; • Lead-up to the risk event, including underlying cause and trigger/stimulus of the risk event; and • Any factors that could affect future events. *Note: The description entered here must be plausible in that factual information would support such a risk event.*	Risk Statement - Significant rainfall-on-snow event or significant summer/fall rainfall event, resulting in riverine flooding, loss of some critical infrastructure (bridges) for no less than one week. Context - The estimated 1:100-yr flood event that has been assessed through a hydrology study. Scale - The 1:100-yr flood event would have a broad effect across the entire Municipality and likely impact, either directly or indirectly, the entire population of the Municipality. Spring Lead-up - Accumulation of a large winter snowpack, combined with warm spring temperatures and a significant rainfall prior to the flood event. Summer/Fall Lead-up - A significant 3-day to 5-day rainfall prior to the flood event. Factors - Climate change will increase the probability of more severe rainfall storm events and the likelihood of significant short duration rainfall.

National Disaster Mitigation Program
Risk Assessment Information Template

Location	
Provide details regarding the area impacted by the risk event such as: • Province(s)/territory(ies); • Region(s) or watershed(s); • Municipality(ies); • Community(ies); and so on.	The areas within the Municipality of Huron Shores along the rivers and creeks in the watersheds of the Thessalon River and Mississagi River. Bolton River is a tributary of the Mississagi River with agricultural and residential lands along the shores.
Natural environment considerations	
Document relevant physical or environmental characteristics of the defined geographic area.	- This is a rural area. - Bolton River is surrounded by residential, rural, and agricultural land uses. - The river functions as a warm water fishery.
Meteorological conditions	
Identify the relevant meteorological conditions that may influence the outcome of the risk event.	- The fall 2013 flood event was caused by a significant 5-day rainfall event. - A significant rain-on-snow event would cause similar damages.

National Disaster Mitigation Program
Risk Assessment Information Template

Seasonal conditions	
Identify the relevant seasonal changes that may influence the outcome of the risk assessment of a particular risk event.	- Annual flood threats in the spring based on rainfall and ice conditions. - Significant summer/fall rainfall events are increasing in frequency and magnitude, and are causing larger than historical spring floods on small river basins. - Climate change is impacting seasonal changes, making certain events more likely, such as significant summer/fall rain events.
Nature and vulnerability	
Document key elements related to the affected population, including: • Population density; • Vulnerable populations (identify these on the hazard map from step 7); • Degree of urbanization; • Key local infrastructure in the defined geographic area; • Economic and political considerations; and • Other elements, as deemed pertinent to the defined geographic area.	- The Municipality of Huron Shores has a population density of 4.1 people per square kilometre. The area surrounding Bolton River is primarily very low density but has some areas of low density near the outlet of Bright Lake. - See Map attached for an indication of vulnerable populations. - There are two rural municipal roads (Bolton River Road and Eley Road) and local roads within the predicted floodplain areas. - Flooding would result in a loss of access over the roads.

National Disaster Mitigation Program
Risk Assessment Information Template

Asset inventory	
Identify the asset inventory of the defined geographic area, including: • Critical assets; • Cultural or historical assets; • Commercial assets; and • Other area assets, as applicable to the defined geographic area. Key asset-related information should also be provided, including: • Location on the hazard map (from step 7); • Size; • Structure replacement cost; • Content value; • Displacement costs; • Importance rating and rationale; • Vulnerability rating and reason; and • Average daily cost to operate. A total estimated value of physical assets in the area should also be provided.	- The main critical assets in the subject area include municipal roads and bridges. - Cultural or historical assets are not known in the area. - Commercial assets include agricultural operations and potentially rental cottages. - Other assets include residential properties and potentially boat houses. - The included Map provides a broader look at the assets. - Limited information is available related to the asset information. - The value associated with these assets was not readily available but could be produced with a more detailed assessment of risk after the floodplain maps are produced.
Other assumptions, variability and/or relevant information	
Identify any assumptions made in describing the risk event; define details regarding any areas of uncertainty or unpredictability around the risk event; and supply any supplemental information, as applicable.	A hydrology study was performed to assess the magnitude of the flood risk event (1:100-yr flood). The event is described in the attached reports.
Existing Risk Treatment Measures	
Identify existing risk treatment measures that are currently in place within the defined geographic area to mitigate the risk event, and describe the sufficiency of these risk treatment measures.	The Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) is responsible for flood forecasting and warning throughout the watershed. However, it is unlikely that any specific details would be provided for Bolton River since it is not monitored and is a minor tributary to Mississagi River. A flood warning program would greatly benefit from updated mapping to help identify specific flood inundation zones and identify which areas pose the greatest hazard.

National Disaster Mitigation Program
Risk Assessment Information Template

Likelihood Assessment		
Return Period		
Identify the time period during which the risk event might occur. For example, the risk event described is expected to occur once every X number of years. Applicants are asked to provide the X value for the risk event.	The one-in-one hundred year (1:100-yr) flood event is expected to have a less than 1% Annual Exceedance Probability (AEP).	
Period of interest		
Applicants are asked to determine and identify the likelihood rating (i.e. period of interest) for the risk event described by using the likelihood rating scale within the table below.		
Likelihood Rating	**Definition**	
5	The event is expected and may be triggered by conditions expected over a 30 year period.	5
4	The event is expected and may be triggered by conditions expected over a 30 - 50 year period.	
3	The event is expected and may be triggered by conditions expected over a 50 - 500 year period.	
2	The event is expected and may be triggered by conditions expected over a 500 - 5000 year period.	
1	The event is possible and may be triggered by conditions exceeding a period of 5000 years.	
Provide any other relevant information, notes or comments relating to the likelihood assessment, as applicable.	While the event has an Annual Exceedance Probability (AEP) of 1%, if we assume a 30-yr period, a 1% AEP has a 26% chance of occurring. For this reason, a likelihood rating of 5 was selected. This is supported by historical events around the Great Lakes, including the fall 2013 event in the Huron Shores municipality, as well as the Muskoka River watershed where the 1:100-yr flood has occurred two times in the last 7 years.	

National Disaster Mitigation Program
Risk Assessment Information Template

Impacts/Consequences Assessment

There are 12 impacts categories within 5 impact classes rated on a scale of 1 (least impacts) to 5 (greatest impact). Conduct an assessment of the impacts associated with the risk event, and assign one risk rating for each category. Additional information may be provided for each of the categories in the supplemental fields provided.

A) People and societal impacts

	Risk Rating	Definition	Assigned risk rating
Fatalities	5	Could result in more than 50 fatalities	4
	4	Could result in 10 - 49 fatalities	
	3	Could result in 5 - 9 fatalities	
	2	Could result in 1 - 4 fatalities	
	1	Not likely to result in fatalities	
Supplemental information (optional)	As per attached Flood Risk Assessment and Bolton River Flood Risk Map indicating buildings at risk of flooding, of which some are permanent and summer residences.		
Injuries	5	Injuries, illness and/or psychological disablements cannot be addressed by local, regional, or provincial/territorial healthcare resources; federal support or intervention is required	1
	4	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources; provincial/territorial healthcare support or intervention is required.	
	3	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources additional healthcare support or intervention is required from other regions, and supplementary support could be required from the province/territory	
	2	Injuries, illnesses and/or psychological disablements cannot be addressed by local resources through local facilities; healthcare support is required from other areas such as an adjacent area(ies)/municipality(ies) within the region	
	1	Any injuries, illnesses, and/or psychological disablements can be addressed by local resources through local facilities; available resources can meet the demand for care	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

		Risk Rating	Definition	Assigned risk rating
Displacement	Percentage of displaced individuals	5	> 15% of total local population	1
		4	10 - 14.9% of total local population	
		3	5 - 9.9% of total local population	
		2	2 - 4.9% of total local population	
		1	0 - 1.9% of total local population	
	Duration of displacement	5	> 26 weeks (6 months)	4
		4	4 weeks - 26 weeks (6 months)	
		3	1 week - 4 weeks	
		2	72 hours - 168 hours (1 week)	
		1	Less than 72 hours	
Supplemental information (optional)		As per Flood Risk Assessment, based on entire municipality. Actual ratio within defined geographic area would be higher. A more detailed risk assessment would be required to accurately assign rating.		
B) Environmental impacts				
		5	> 75% of flora or fauna impacted or 1 or more ecosystems significantly impaired; Air quality has significantly deteriorated; Water quality is significantly lower than normal or water level is > 3 meters above highest natural level; Soil quality or quantity is significantly lower (i.e., significant soil loss, evidence of lethal soil contamination) than normal; > 15% of local area is affected	3
		4	40 - 74.9% of flora or fauna impacted or 1 or more ecosystems considerably impaired; Air quality has considerably deteriorated; Water quality is considerably lower than normal or water level is 2 - 2.9 meters above highest natural level; Soil quality or quantity is moderately lower than normal; 10 - 14.9% of local area is affected	
		3	10 - 39.9% of flora or fauna impacted or 1 1 or more ecosystems moderately impaired; Air quality has moderately deteriorated; Water quality is moderately lower than normal or water level is 1 - 2 meters above highest natural level; Soil quality is moderately lower than normal; 6 - 9.9 % of area affected	

National Disaster Mitigation Program
Risk Assessment Information Template

	2	< 10 % of flora or fauna impacted or little or no impact to any ecosystems; Little to no impact to air quality and/or soil quality or quantity; Water quality is slightly lower than normal, or water level is less than 0.9 meters above highest natural level and increased for less than 24 hours; 3 - 5.9 % of local area is affected	
	1	Little to no impact to flora or fauna, any ecosystems, air quality, water quality or quantity, or to soil quality or quantity; 0 - 2.9 % of local area is affected	
Supplemental information (optional)			

C) Local economic impacts

	Risk Rating	**Definition**	**Assigned risk rating**
	5	> 15 % of local economy impacted	2
	4	10 - 14.9 % of local economy impacted	
	3	6 - 9.9 % of local economy impacted	
	2	3 - 5.9 % of local economy impacted	
	1	0 - 2.9 % of local economy impacted	
Supplemental information (optional)	Based on land flooded in the local Bolton River area.		

National Disaster Mitigation Program
Risk Assessment Information Template

D) Local infrastructure impacts			
	Risk Rating	**Definition**	**Assigned risk rating**
Transportation	5	Local activity stopped for more than 72 hours; > 20% of local population affected; lost access to local area and/or delivery of crucial service or product; or having an international level impact	5
	4	Local activity stopped for 48 - 71 hours; 10 - 19.9% of local population affected; significantly reduced access to local area and/or delivery of crucial service or product; or having a national level impact	
	3	Local activity stopped for 25 - 47 hours; 5 - 9.9% of local population affected; moderately reduced access to local area and/or delivery of crucial service or product; or having a provincial/territorial level impact	
	2	Local activity stopped for 13 - 24 hours; 2 - 4.9% of local population affected; minor reduction in access to local area and/or delivery of crucial service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	
Supplemental information (optional)	Two municipal roads and local access roads flooded as per attached Risk Maps.		
Energy and Utilities	5	Duration of impacts > 72 hours; > 20% of local population without service or product; or having an international level impact	1
	4	Duration of impact 48 - 71 hours; 10 - 19.9% of local population without service or product; or having a national impact	
	3	Duration of impact 25 - 47 hours; 5 - 9.9% of local population without service or product; or having a provincial/territorial level impact	
	2	Duration of impact 13 - 24 hours; 2 - 4.9% of local population without service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Information and Communications Technology	5	Service unavailable for > 72 hours; > 20 % of local population without service; or having an international level impact	1
	4	Service unavailable for 48 - 71 hours; 10 - 19.9 % of local population without service; or having a national level impact	
	3	Service unavailable for 25 - 47 hours; 5 - 9.9 % of local population without service; or having a provincial/territorial level impact	
	2	Service unavailable for 13 - 24 hours; 2 - 4.9 % of local population without service; or having a regional level impact	
	1	Service unavailable for 0 - 12 hours; 0 - 1.9 % of local population without service	
Supplemental information (optional)			
Health, Food, and Water	5	Inability to access potable water, food, sanitation services, or healthcare services for > 72 hours; non - essential services cancelled; > 20 % of local population impacted; or having an international level impact	1
	4	Inability to access potable water, food, sanitation services, or healthcare services for 48 - 72 hours; major delays for nonessential services; 10 - 19.9 % of local population impacted; or having a national level impact	
	3	Inability to access potable water, food, sanitation services, or healthcare services for 25 - 48 hours; moderate delays for nonessential services; 5 - 9.9 % of local population impacted; or having a provincial/territorial level impact	
	2	Inability to access potable water, food, sanitation services, or healthcare services for 13 - 24 hours; minor delays for nonessential; 2 - 4.9 % of local population impacted; or having a regional level impact	
	1	Inability to access potable water, food, sanitation services, or healthcare services for 0 - 12 hours; 0 - 1.9 % of local population impacted	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Safety and Security	5	> 20 % of local population impacted; loss of intelligence or defence assets or systems for > 72 hours; or having an international level impact	1
	4	10 - 19.9 % of local population impacted; loss of intelligence or defence assets or systems for 48 – 71 hours; or having a national level impact	
	3	5 - 9.9 % of local population impacted; loss of intelligence or defence assets or systems for 25 – 47 hours; or having a provincial/territorial level impact	
	2	2 - 4.9 % of local population impacted; loss of intelligence or defence assets or systems for 13 – 24 hours; or having a regional level impact	
	1	0 - 1.9 % of local population impacted; loss of intelligence or defence assets or systems for 0 – 12 hours	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

E) Public sensitivity impacts			
	Risk Rating	Definition	Assigned risk rating
	5	Sustained, long term loss in reputation/public perception of public institutions and/or sustained, long term loss of trust and confidence in public institutions; or having an international level impact	3
	4	Significant loss in reputation/public perception of public institutions and/or significant loss of trust and confidence in public institutions; significant resistance; or having a national level impact	
	3	Some loss in reputation/public perception of public institutions and/or some loss of trust and confidence in public institutions; escalating resistance	
	2	Isolated/minor, recoverable set - back in reputation, public perception, trust, and/or confidence of public institutions	
	1	No impact on reputation, public perception, trust, and/or confidence of public institutions	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

Confidence Assessment

Based on the table below, indicate the level of confidence regarding the information entered in the risk assessment information template in the "Confidence Level Assigned" column.
Confidence levels are language - based and range from A to E (A=most confident to E=least confident).

Confidence Level	Definition	Confidence Level Assigned
A	Very high degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of high - quality data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of existing/known mitigation measures	
B	High degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with some subject matter expertise (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of potential mitigation measures	

National Disaster Mitigation Program
Risk Assessment Information Template

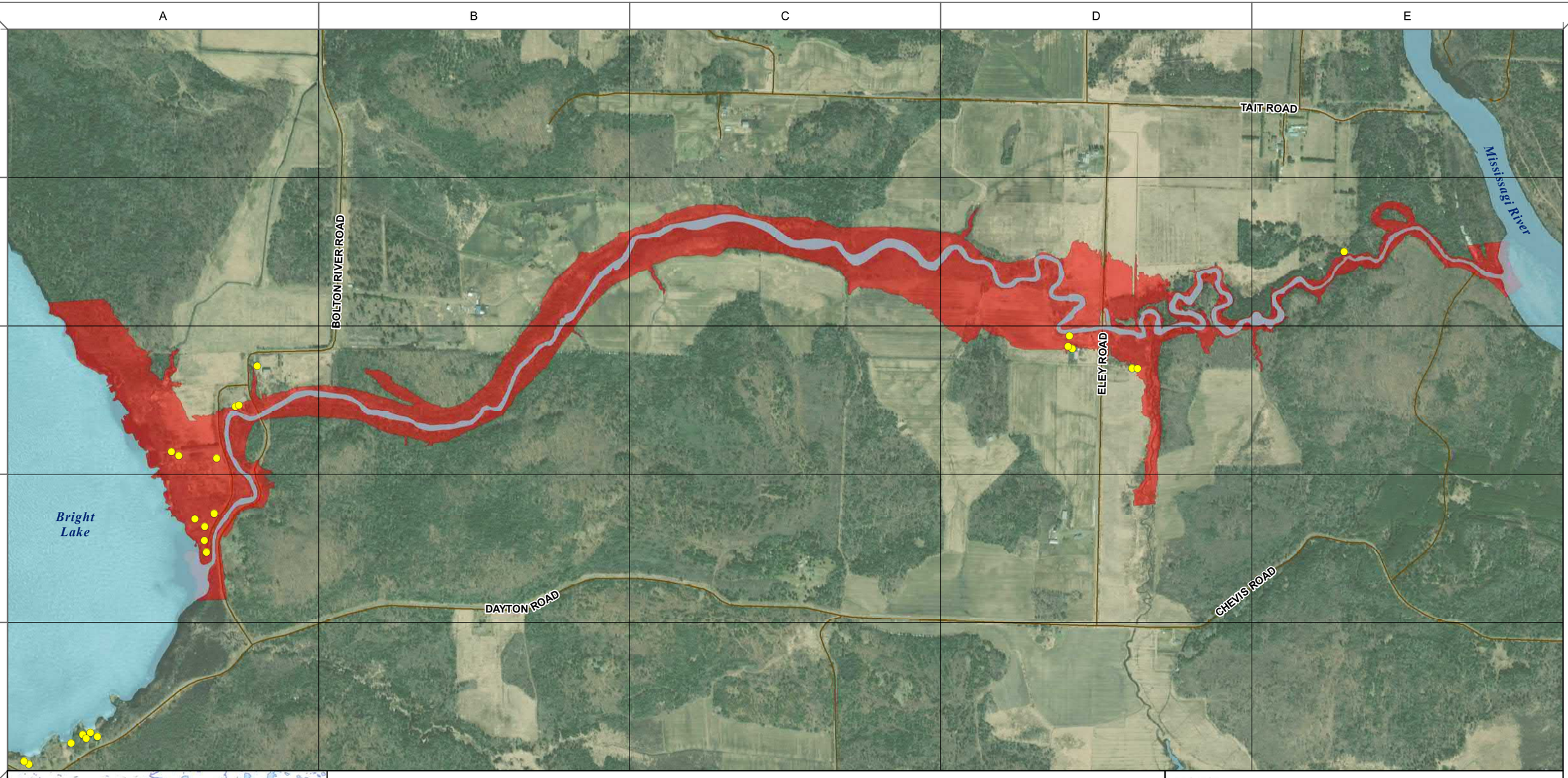
C	Moderate confidence Risk assessment used to inform the risk assessment information template was moderately evidence - based from a considerable amount of knowledge of the natural hazard risk event; leveraged a considerable quantity of data that was quantitative and/or qualitative in nature; leveraged a considerable amount of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a moderately sized multidisciplinary team, incorporating some subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a large number of potential mitigation measures	A
D	Low confidence Risk assessment used to inform the risk assessment information template was based on a relatively small amount of knowledge of the natural hazard risk event; leveraged a relatively small quantity of quantitative and/or qualitative data that was largely historical in nature; may have leveraged some geospatial information or information from other sources (i.e., databases, key risk and resilience methodologies); and the risk assessment and analysis processes were completed by a small team that may or may not have incorporated subject matter experts (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts considered a relatively small number of potential mitigation measures	
E	Very low confidence Risk assessment used to inform the risk assessment information template was not evidence - based; leveraged a small quantity of information and/or data relating to the natural risk hazard and risk event; primary qualitative information used with little to no quantitative data or information; and the risk assessment and analysis processes were completed by an individual or small group of individuals little subject matter expertise (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts did not consider existing or potential mitigation measures	

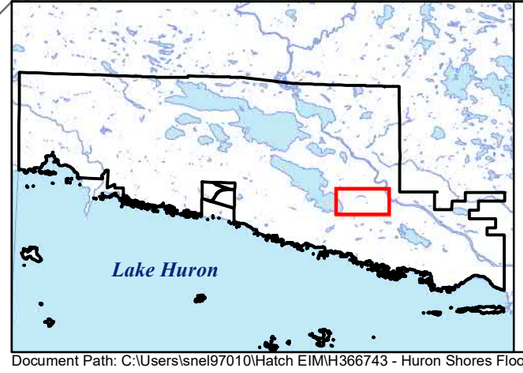
Rationale for level of confidence

Provide the rationale for the selected confidence level, including any references or sources to support the level assigned.	- The impacts of flooding were observed in 2013. - The predicted impact levels for a 1:100-yr flood event were based on a completed hazard identification and risk assessment.

National Disaster Mitigation Program
Risk Assessment Information Template

Key Information Sources	
Identify all supporting documentation and information sources for qualitative and quantitative data used to identify risk events, develop the risk event description, and assess impacts and likelihood. This ensures credibility and validity of risk information presented as well as enables referencing back to decision points at any point in time. Clearly identify unclassified and classified information.	*All information is unclassified "Flood Risk Assessment", completed by Hatch Ltd. in March 2022.
Description of the risk analysis team	
List and describe the type and level of experience of each individual who was involved with the completion of the risk assessment and risk analysis used to inform the information contained within this risk assessment information template.	Flood Risk Assessment was completed by Hatch Ltd. hydro-technical engineers Bethany Heppner, P.Eng., and Alfred Breland, P.Eng. Bethany has 5 years of experience directly related to hydrology and hydraulics, and Alfred Breland has 39 years of experience directly related to hydrology and hydraulics and the risks and concerns surrounding riverine flooding in rural and municipal areas.





LEGEND

- Buildings at Risk
- Flood Risk Area
- Huron Shores Municipal Boundary
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 175 350 700 m

1:12,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	RAIT Risk Area - Bolton River
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 29, 2022
FIG NO.:	1

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\RAIT_Maps\RAIT_Fig1_BoltonRiver.mxd

Public Safety Canada | Sécurité publique Canada

Ottawa, Canada
K1A 0P8

National Disaster Mitigation Program (NDMP)
Risk Assessment Information Template

Risk Event Details			
Start and End Date	Provide the start and end dates of the selected event, based on historical data.	Start Date: 06/09/2013	End Date: 13/09/2013
Severity of the Risk Event	Provide details about the risk, including: • Speed of onset and duration of event; • Level and type of damaged caused; • Insurable and non-insurable losses; and • Other details, as appropriate.	Bright Lake flows into the Bolton River, and is a small lake within the Mississagi River watershed. The significant 5-day precipitation event recorded at Sault Ste. Marie in early September 2013 totaled 90 mm of rain over 5 days, with 42 mm occurring on September 6. This event occurred across the northern shores of Lake Huron and resulted in historically high flood flows on September 10 in small river sub-basins from Sault Ste. Marie to Iron Bridge. This fall 2013 event caused flood damages across the Huron Shores municipality in direct physical damages to private and public property. An estimate of 1:100-yr flood risks has been studied (see attached Flood Risk Assessment report). The risk assessment indicates that a 1:100-yr flood will cause significant direct and indirect flood damages such as property loss, disruption in residential living conditions, loss of business, and disruption of major transportation routes.	
Response During the Risk Event	Provide details on how the defined geographic area continued its essential operations while responding to the event.	After OPP reports of flooded roads and washouts on September 10, emergency crews were activated. All roads were closed the morning of the event in order to assess conditions. Patrols revealed some 82 road washouts. A State of Emergency was declared at 11:15 a.m. on September 10, 2013. Public Information lines were available to answer calls for service. The media played a role in providing updates and advising of road closures/openings.	
Recovery Method for the Risk Event	Provide details on how the defined geographic area recovered.	Cleaning up after the flood included cleaning, repairing, and inspecting municipal roads; the event caused 365 hours of overtime. A total of 18 residences, 5 farms, 1 business and 2 non-profit organizations were impacted, and took flood damaged debris to the landfill. All but 3 roads had been temporarily repaired by September 16, 2013 to allow for traffic flow.	
Recovery Costs Related to the Risk Event	Provide details on the costs, in dollars, associated with implementing recovery strategies following the event.	Total road repairs were estimated at $1.14 million at the time of the event. There were also municipal repairs for a couple of years following the event that were not tracked. The Municipality applied for financial assistance, in the amount of $325,803.41 under the Ontario Disaster Relief Program. All private claims were handled by a joint Disaster Relief Committee established under the Ontario Disaster Relief Program. The Committee handled private claims for all municipalities impacted across the North Shore and was overseen by the Township of Macdonald, Meredith and Aberdeen Additional.	

Recovery Time Related to the Risk Event	Provide details on the recovery time needed to return to normal operations following the event.	As per above, all but 3 roads were passable by September 16, 2013, but road issues appeared for years following the event. Emergency was terminated on September 23, 2013 as conditions, other than those road issues previously mentioned, had returned to pre-event status.

National Disaster Mitigation Program
Risk Assessment Information Template

Risk Event Identification and Overview	
Provide a qualitative description of the defined geographic area, including: • Watershed/community/region name(s); • Province/Territory; • Area type (i.e., city, township, watershed, organization, etc.); • Population size; • Population variances (e.g., significant change in population between summer and winter months); • Main economic areas of interest; • Special consideration areas (e.g., historical, cultural and natural resource areas); and an • Estimate of the annual operating budget of the area.	- The Municipality of Huron Shores, Ontario within the Thessalon and Mississagi River watersheds. Focus is on identified risk areas within both watersheds. - Huron Shores is the result of the 1999 amalgamation of the former Village of Iron Bridge, the Townships of Thessalon, Thompson and Day and Bright Additional, and the unincorporated geographic townships of Bright and Gladstone. - The Municipality has a permanent population of approximately 1,860 (2021 census). - There is a substantial influx of residents (cottagers and tourists) in the summer months. - The area has a long history of farming and logging as well as aggregate extraction. The Municipality celebrates its rich pioneer history with annual heritage days, fall fairs and civic festivals. - There are protected natural areas and major open spaces within the sub-watershed, including the Mississagi Delta Provincial Nature Reserve, marking the mouth of the largest river flowing into Lake Huron. - Areas of economic interest within the Mississagi River watershed include the commercial district of Iron Bridge. - Annual operating budget for the entire Municipality of Huron Shores is $7.1 million for 2021.
Methodolgies, processes and analyses	
Provide the year in which the following processes/analyses were last completed and state the methodology(ies) used: • Hazard identification; • Vulnerability analysis; • Likelihood assessment; • Impact assessment; • Risk assessment; • Resiliency assessment; and/or • Climate change impact and/or adaptation assessment. *Note: It is recognized that many of the processes/analyses mentioned above may be included within one methodology.*	- A Flood Risk Assessment report was completed for the Municipality of Huron Shores in March 2022. - There were four steps completed: Background Review, Hydrology Assessment, Hydraulics Assessment, Hazard Identification and Risk Assessment. - Hazard Identification involved identification of the hazards through hydraulic modeling of flood levels that could impact the community. All hazards associated with the 1:100-yr flood were reviewed. - Risk Assessment examined the level of risk for each hazard. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance, and critical infrastructure was examined.

National Disaster Mitigation Program
Risk Assessment Information Template

Hazard Mapping	
To complete this section: • Obtain a map of the area that clearly indicates general land uses, neighbourhoods, landmarks, etc. For clarity throughout this exercise, it may be beneficial to omit any non-essential information from the map intended for use. Controlled photographs (e.g. aerial photography) can be used in place of or in addition to existing maps to avoid the cost of producing new maps. • Place a grid over the maps/photographs of the area and assign row and column identifiers. This will help identify the specific area(s) that may be impacted, as well as additional information on the characteristics within and affecting the area. • Identify where and how flood hazards may affect the defined geographic area. • Identify the mapped areas that are most likely to be impacted by the identified flood hazard. Map(s)/photograph(s) can also be used, where appropriate, to visually represent the information/prioritization being provided as part of this template.	
Hazard identification and prioritization	
List known or likely flood hazards to the defined geographic area in order of proposed priority. For example: (1) dyke breach overland flooding; (2) urban storm surge flooding ; and so on.	(1) Rain events causing riverine flooding and erosion. (2) Riverine flooding causing inundation of residential property and potential loss of life. (3) Riverine flooding causing washouts of municipal roads and bridges. (4) Erosion of shorelines causing loss of residential and agricultural lands.
Provide a rationale for each prioritization and the key information sources supporting this rationale.	- Based on the Flood Risk Assessment, see attached. - Floodplain mapping is not available for any area of Bright Lake. - Significant rain events will produce high water levels on Bright Lake.
Risk Event Title	
Identify the name/title of the risk. An example of a risk event name or title is: "A one-in-one hundred year flood following an extreme rain event."	A one-in-one hundred year (1:100-yr) flood event following a severe rainfall-on-snow event. A one-in-one hundred year (1:100-yr) flood event following a severe summer or fall rainfall event.
Type of Flood Hazard	
Identify the type of flood hazard being described (e.g., riverine flooding, coastal inundation, urban run-off, etc.)	Riverine flooding. Shoreline erosion.

National Disaster Mitigation Program
Risk Assessment Information Template

Secondary hazards	
Describe any secondary effects resulting from the risk event (e.g., flooding that occurs following a hurricane).	Erosion of shorelines and loss of residential and agricultural land. Environmental impacts from erosion of shorelines (loss of trees, loss of water fowl and amphibian nesting areas).
Primary and secondary organizations for response	
Identify the primary organization(s) with a mandate related to a key element of a natural disaster emergency, and any supporting organization(s) that provide general or specialized assistance in response to a natural disaster emergency.	(1) Emergency Management Ontario (2) Municipality of Huron Shores

Risk Event Description	
Description of risk event, including risk statement and cause(s) of the event	
Provide a baseline description of the risk event, including: • Risk statement; • Context of the risk event; • Nature and scale of the risk event; • Lead-up to the risk event, including underlying cause and trigger/stimulus of the risk event; and • Any factors that could affect future events. *Note: The description entered here must be plausible in that factual information would support such a risk event.*	Risk Statement - Significant rainfall-on-snow event or significant summer/fall rainfall event, resulting in riverine flooding, loss of some critical infrastructure (bridges) for no less than one week. Context - The estimated 1:100-yr flood event that has been assessed through a hydrology study. Scale - The 1:100-yr flood event would have a broad effect across the entire Municipality and likely impact, either directly or indirectly, the entire population of the Municipality. Spring Lead-up - Accumulation of a large winter snowpack, combined with warm spring temperatures and a significant rainfall prior to the flood event. Summer/Fall Lead-up - A significant 3-day to 5-day rainfall prior to the flood event. Factors - Climate change will increase the probability of more severe rainfall storm events and the likelihood of significant short duration rainfall.

National Disaster Mitigation Program
Risk Assessment Information Template

Location	
Provide details regarding the area impacted by the risk event such as: • Province(s)/territory(ies); • Region(s) or watershed(s); • Municipality(ies); • Community(ies); and so on.	The areas within the Municipality of Huron Shores along the lakes and rivers in the watersheds of the Thessalon River and Mississagi River. Bright Lake is at the head of the Bolton River, a tributary of the Mississagi River with agricultural and residential lands along the shores.
Natural environment considerations	
Document relevant physical or environmental characteristics of the defined geographic area.	- This is a rural area. - Bright Lake is surrounded by residential, rural, and agricultural land uses. - The river functions as a warm water fishery.
Meteorological conditions	
Identify the relevant meteorological conditions that may influence the outcome of the risk event.	- The fall 2013 flood event was caused by a significant 5-day rainfall event. - A significant rain-on-snow event would cause similar damages.

National Disaster Mitigation Program
Risk Assessment Information Template

Seasonal conditions	
Identify the relevant seasonal changes that may influence the outcome of the risk assessment of a particular risk event.	- Annual flood threats in the spring based on rainfall and ice conditions. - Significant summer/fall rainfall events are increasing in frequency and magnitude, and are causing larger than historical spring floods on small river basins. - Climate change is impacting seasonal changes, making certain events more likely, such as significant summer/fall rain events.
Nature and vulnerability	
Document key elements related to the affected population, including: • Population density; • Vulnerable populations (identify these on the hazard map from step 7); • Degree of urbanization; • Key local infrastructure in the defined geographic area; • Economic and political considerations; and • Other elements, as deemed pertinent to the defined geographic area.	- The Municipality of Huron Shores has a population density of 4.1 people per square kilometre. The area surrounding Bright Lake is primarily very low density but has some areas of low density near the outlet. - See Map attached for an indication of vulnerable populations. - There are rural municipal roads (Bolton River Road and Dayton Road) and local roads within the predicted floodplain areas. - Flooding would result in a loss of access over the roads.

National Disaster Mitigation Program
Risk Assessment Information Template

Asset inventory	
Identify the asset inventory of the defined geographic area, including: • Critical assets; • Cultural or historical assets; • Commercial assets; and • Other area assets, as applicable to the defined geographic area. Key asset-related information should also be provided, including: • Location on the hazard map (from step 7); • Size; • Structure replacement cost; • Content value; • Displacement costs; • Importance rating and rationale; • Vulnerability rating and reason; and • Average daily cost to operate. A total estimated value of physical assets in the area should also be provided.	- The main critical assets in the subject area include municipal roads and bridges. - Cultural or historical assets are not known in the area. - Commercial assets include agricultural operations and potentially rental cottages. - Other assets include residential properties and potentially boat houses. - The included Map provides a broader look at the assets. - Limited information is available related to the asset information. - The value associated with these assets was not readily available but could be produced with a more detailed assessment of risk after the floodplain maps are produced.
Other assumptions, variability and/or relevant information	
Identify any assumptions made in describing the risk event; define details regarding any areas of uncertainty or unpredictability around the risk event; and supply any supplemental information, as applicable.	A hydrology study was performed to assess the magnitude of the flood risk event (1:100-yr flood). The event is described in the attached reports.
Existing Risk Treatment Measures	
Identify existing risk treatment measures that are currently in place within the defined geographic area to mitigate the risk event, and describe the sufficiency of these risk treatment measures.	The Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) is responsible for flood forecasting and warning throughout the watershed. However, it is unlikely that any specific details would be provided for Bright Lake since it is not monitored and is on a minor tributary to Mississagi River. A flood warning program would greatly benefit from updated mapping to help identify specific flood inundation zones and identify which areas pose the greatest hazard.

National Disaster Mitigation Program
Risk Assessment Information Template

Likelihood Assessment	
Return Period	
Identify the time period during which the risk event might occur. For example, the risk event described is expected to occur once every X number of years. Applicants are asked to provide the X value for the risk event.	The one-in-one hundred year (1:100-yr) flood event is expected to have a less than 1% Annual Exceedance Probability (AEP).
Period of interest	
Applicants are asked to determine and identify the likelihood rating (i.e. period of interest) for the risk event described by using the likelihood rating scale within the table below.	

Likelihood Rating	**Definition**	
5	The event is expected and may be triggered by conditions expected over a 30 year period.	5
4	The event is expected and may be triggered by conditions expected over a 30 - 50 year period.	
3	The event is expected and may be triggered by conditions expected over a 50 - 500 year period.	
2	The event is expected and may be triggered by conditions expected over a 500 - 5000 year period.	
1	The event is possible and may be triggered by conditions exceeding a period of 5000 years.	

Provide any other relevant information, notes or comments relating to the likelihood assessment, as applicable.	While the event has an Annual Exceedance Probability (AEP) of 1%, if we assume a 30-yr period, a 1% AEP has a 26% chance of occurring. For this reason, a likelihood rating of 5 was selected. This is supported by historical events around the Great Lakes, including the fall 2013 event in the Huron Shores municipality, as well as the Muskoka River watershed where the 1:100-yr flood has occurred two times in the last 7 years.

National Disaster Mitigation Program
Risk Assessment Information Template

Impacts/Consequences Assessment

There are 12 impacts categories within 5 impact classes rated on a scale of 1 (least impacts) to 5 (greatest impact). Conduct an assessment of the impacts associated with the risk event, and assign one risk rating for each category. Additional information may be provided for each of the categories in the supplemental fields provided.

A) People and societal impacts

	Risk Rating	Definition	Assigned risk rating
Fatalities	5	Could result in more than 50 fatalities	4
	4	Could result in 10 - 49 fatalities	
	3	Could result in 5 - 9 fatalities	
	2	Could result in 1 - 4 fatalities	
	1	Not likely to result in fatalities	
Supplemental information (optional)	As per attached Flood Risk Assessment and Bright Lake Flood Risk Map indicating buildings at risk of flooding, of which some are permanent and summer residences.		
Injuries	5	Injuries, illness and/or psychological disablements cannot be addressed by local, regional, or provincial/territorial healthcare resources; federal support or intervention is required	1
	4	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources; provincial/territorial healthcare support or intervention is required.	
	3	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources additional healthcare support or intervention is required from other regions, and supplementary support could be required from the province/territory	
	2	Injuries, illnesses and/or psychological disablements cannot be addressed by local resources through local facilities; healthcare support is required from other areas such as an adjacent area(ies)/municipality(ies) within the region	
	1	Any injuries, illnesses, and/or psychological disablements can be addressed by local resources through local facilities; available resources can meet the demand for care	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

		Risk Rating	Definition	Assigned risk rating
Displacement	Percentage of displaced individuals	5	> 15% of total local population	1
		4	10 - 14.9% of total local population	
		3	5 - 9.9% of total local population	
		2	2 - 4.9% of total local population	
		1	0 - 1.9% of total local population	
	Duration of displacement	5	> 26 weeks (6 months)	4
		4	4 weeks - 26 weeks (6 months)	
		3	1 week - 4 weeks	
		2	72 hours - 168 hours (1 week)	
		1	Less than 72 hours	
Supplemental information (optional)		As per Flood Risk Assessment, based on entire municipality. Actual ratio within defined geographic area would be higher. A more detailed risk assessment would be required to accurately assign rating.		
B) Environmental impacts				
		5	> 75% of flora or fauna impacted or 1 or more ecosystems significantly impaired; Air quality has significantly deteriorated; Water quality is significantly lower than normal or water level is > 3 meters above highest natural level; Soil quality or quantity is significantly lower (i.e., significant soil loss, evidence of lethal soil contamination) than normal; > 15% of local area is affected	3
		4	40 - 74.9% of flora or fauna impacted or 1 or more ecosystems considerably impaired; Air quality has considerably deteriorated; Water quality is considerably lower than normal or water level is 2 - 2.9 meters above highest natural level; Soil quality or quantity is moderately lower than normal; 10 - 14.9% of local area is affected	
		3	10 - 39.9% of flora or fauna impacted or 1 1 or more ecosystems moderately impaired; Air quality has moderately deteriorated; Water quality is moderately lower than normal or water level is 1 - 2 meters above highest natural level; Soil quality is moderately lower than normal; 6 - 9.9 % of area affected	

National Disaster Mitigation Program
Risk Assessment Information Template

	2	< 10 % of flora or fauna impacted or little or no impact to any ecosystems; Little to no impact to air quality and/or soil quality or quantity; Water quality is slightly lower than normal, or water level is less than 0.9 meters above highest natural level and increased for less than 24 hours; 3 - 5.9 % of local area is affected	
	1	Little to no impact to flora or fauna, any ecosystems, air quality, water quality or quantity, or to soil quality or quantity; 0 - 2.9 % of local area is affected	
Supplemental information (optional)			

C) Local economic impacts

	Risk Rating	**Definition**	**Assigned risk rating**
	5	> 15 % of local economy impacted	2
	4	10 - 14.9 % of local economy impacted	
	3	6 - 9.9 % of local economy impacted	
	2	3 - 5.9 % of local economy impacted	
	1	0 - 2.9 % of local economy impacted	
Supplemental information (optional)	Based on land flooded in the local Bright Lake area.		

National Disaster Mitigation Program
Risk Assessment Information Template

D) Local infrastructure impacts			
	Risk Rating	**Definition**	**Assigned risk rating**
Transportation	5	Local activity stopped for more than 72 hours; > 20% of local population affected; lost access to local area and/or delivery of crucial service or product; or having an international level impact	5
	4	Local activity stopped for 48 - 71 hours; 10 - 19.9% of local population affected; significantly reduced access to local area and/or delivery of crucial service or product; or having a national level impact	
	3	Local activity stopped for 25 - 47 hours; 5 - 9.9% of local population affected; moderately reduced access to local area and/or delivery of crucial service or product; or having a provincial/territorial level impact	
	2	Local activity stopped for 13 - 24 hours; 2 - 4.9% of local population affected; minor reduction in access to local area and/or delivery of crucial service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	
Supplemental information (optional)	Two municipal roads and local access roads flooded as per attached Risk Maps.		
Energy and Utilities	5	Duration of impacts > 72 hours; > 20% of local population without service or product; or having an international level impact	1
	4	Duration of impact 48 - 71 hours; 10 - 19.9% of local population without service or product; or having a national impact	
	3	Duration of impact 25 - 47 hours; 5 - 9.9% of local population without service or product; or having a provincial/territorial level impact	
	2	Duration of impact 13 - 24 hours; 2 - 4.9% of local population without service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Information and Communications Technology	5	Service unavailable for > 72 hours; > 20 % of local population without service; or having an international level impact	1
	4	Service unavailable for 48 - 71 hours; 10 - 19.9 % of local population without service; or having a national level impact	
	3	Service unavailable for 25 - 47 hours; 5 - 9.9 % of local population without service; or having a provincial/territorial level impact	
	2	Service unavailable for 13 - 24 hours; 2 - 4.9 % of local population without service; or having a regional level impact	
	1	Service unavailable for 0 - 12 hours; 0 - 1.9 % of local population without service	
Supplemental information (optional)			
Health, Food, and Water	5	Inability to access potable water, food, sanitation services, or healthcare services for > 72 hours; non - essential services cancelled; > 20 % of local population impacted; or having an international level impact	1
	4	Inability to access potable water, food, sanitation services, or healthcare services for 48 - 72 hours; major delays for nonessential services; 10 - 19.9 % of local population impacted; or having a national level impact	
	3	Inability to access potable water, food, sanitation services, or healthcare services for 25 - 48 hours; moderate delays for nonessential services; 5 - 9.9 % of local population impacted; or having a provincial/territorial level impact	
	2	Inability to access potable water, food, sanitation services, or healthcare services for 13 - 24 hours; minor delays for nonessential; 2 - 4.9 % of local population impacted; or having a regional level impact	
	1	Inability to access potable water, food, sanitation services, or healthcare services for 0 - 12 hours; 0 - 1.9 % of local population impacted	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Safety and Security	5	> 20 % of local population impacted; loss of intelligence or defence assets or systems for > 72 hours; or having an international level impact	1
	4	10 - 19.9 % of local population impacted; loss of intelligence or defence assets or systems for 48 – 71 hours; or having a national level impact	
	3	5 - 9.9 % of local population impacted; loss of intelligence or defence assets or systems for 25 – 47 hours; or having a provincial/territorial level impact	
	2	2 - 4.9 % of local population impacted; loss of intelligence or defence assets or systems for 13 – 24 hours; or having a regional level impact	
	1	0 - 1.9 % of local population impacted; loss of intelligence or defence assets or systems for 0 – 12 hours	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

E) Public sensitivity impacts			
	Risk Rating	Definition	Assigned risk rating
	5	Sustained, long term loss in reputation/public perception of public institutions and/or sustained, long term loss of trust and confidence in public institutions; or having an international level impact	3
	4	Significant loss in reputation/public perception of public institutions and/or significant loss of trust and confidence in public institutions; significant resistance; or having a national level impact	
	3	Some loss in reputation/public perception of public institutions and/or some loss of trust and confidence in public institutions; escalating resistance	
	2	Isolated/minor, recoverable set - back in reputation, public perception, trust, and/or confidence of public institutions	
	1	No impact on reputation, public perception, trust, and/or confidence of public institutions	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

Confidence Assessment

Based on the table below, indicate the level of confidence regarding the information entered in the risk assessment information template in the "Confidence Level Assigned" column.
Confidence levels are language - based and range from A to E (A=most confident to E=least confident).

Confidence Level	Definition	Confidence Level Assigned
A	Very high degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of high - quality data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of existing/known mitigation measures	
B	High degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with some subject matter expertise (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of potential mitigation measures	

National Disaster Mitigation Program
Risk Assessment Information Template

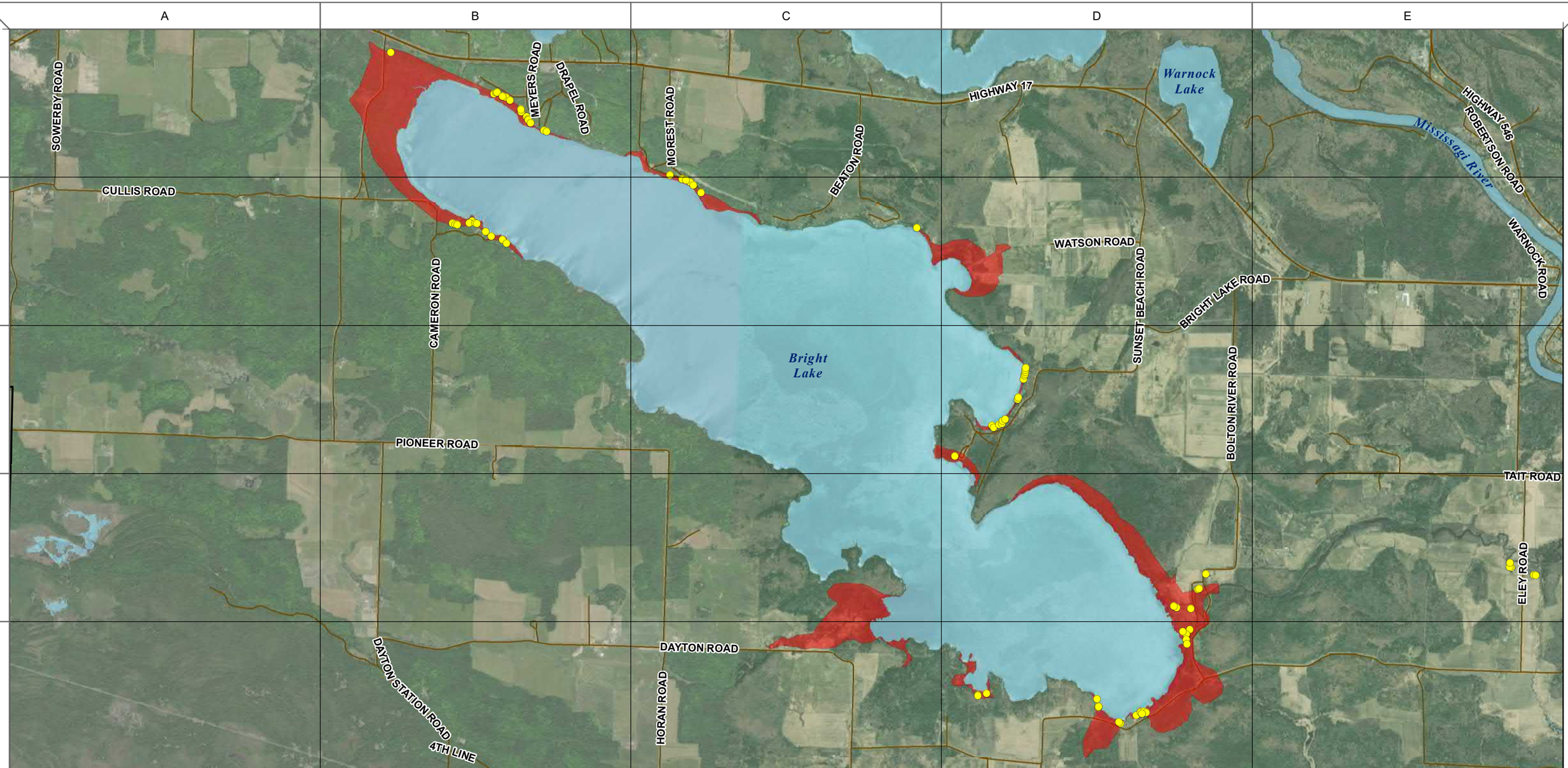
C	Moderate confidence Risk assessment used to inform the risk assessment information template was moderately evidence - based from a considerable amount of knowledge of the natural hazard risk event; leveraged a considerable quantity of data that was quantitative and/or qualitative in nature; leveraged a considerable amount of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a moderately sized multidisciplinary team, incorporating some subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a large number of potential mitigation measures	A
D	Low confidence Risk assessment used to inform the risk assessment information template was based on a relatively small amount of knowledge of the natural hazard risk event; leveraged a relatively small quantity of quantitative and/or qualitative data that was largely historical in nature; may have leveraged some geospatial information or information from other sources (i.e., databases, key risk and resilience methodologies); and the risk assessment and analysis processes were completed by a small team that may or may not have incorporated subject matter experts (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts considered a relatively small number of potential mitigation measures	
E	Very low confidence Risk assessment used to inform the risk assessment information template was not evidence - based; leveraged a small quantity of information and/or data relating to the natural risk hazard and risk event; primary qualitative information used with little to no quantitative data or information; and the risk assessment and analysis processes were completed by an individual or small group of individuals little subject matter expertise (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts did not consider existing or potential mitigation measures	

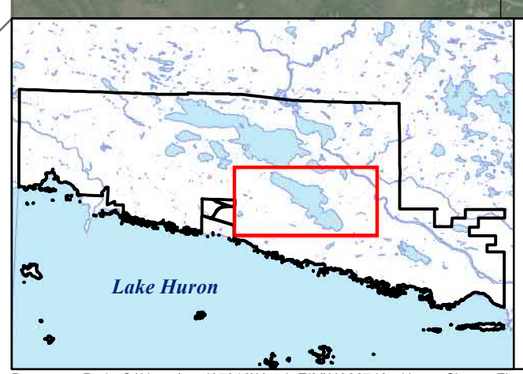
Rationale for level of confidence

Provide the rationale for the selected confidence level, including any references or sources to support the level assigned.	- The impacts of flooding were observed in 2013. - The predicted impact levels for a 1:100-yr flood event were based on a completed hazard identification and risk assessment.

National Disaster Mitigation Program
Risk Assessment Information Template

Key Information Sources	
Identify all supporting documentation and information sources for qualitative and quantitative data used to identify risk events, develop the risk event description, and assess impacts and likelihood. This ensures credibility and validity of risk information presented as well as enables referencing back to decision points at any point in time. Clearly identify unclassified and classified information.	*All information is unclassified "Flood Risk Assessment", completed by Hatch Ltd. in March 2022.
Description of the risk analysis team	
List and describe the type and level of experience of each individual who was involved with the completion of the risk assessment and risk analysis used to inform the information contained within this risk assessment information template.	Flood Risk Assessment was completed by Hatch Ltd. hydro-technical engineers Bethany Heppner, P.Eng., and Alfred Breland, P.Eng. Bethany has 5 years of experience directly related to hydrology and hydraulics, and Alfred Breland has 39 years of experience directly related to hydrology and hydraulics and the risks and concerns surrounding riverine flooding in rural and municipal areas.





LEGEND

- Buildings at Risk
- Flood Risk Area
- Huron Shores Municipal Boundary
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.5 1 2 km

1:32,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	RAIT Risk Area - Bright Lake
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 29, 2022
FIG NO.:	1

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\RAIT_Maps\RAIT_Fig1_BrightLake.mxd

Public Safety Canada | Sécurité publique Canada

Ottawa, Canada
K1A 0P8

National Disaster Mitigation Program (NDMP)
Risk Assessment Information Template

Risk Event Details			
Start and End Date	Provide the start and end dates of the selected event, based on historical data.	Start Date: 06/09/2013	End Date: 13/09/2013
Severity of the Risk Event	Provide details about the risk, including: • Speed of onset and duration of event; • Level and type of damaged caused; • Insurable and non-insurable losses; and • Other details, as appropriate.	Little Thessalon River is a tributary within the Thessalon River watershed. The significant 5-day precipitation event recorded at Sault Ste. Marie in early September 2013 totaled 90 mm of rain over 5 days, with 42 mm occurring on September 6. This event occurred across the northern shores of Lake Huron and resulted in historically high flood flows on September 10 in small river sub-basins from Sault Ste. Marie to Iron Bridge. This fall 2013 event caused flood damages across the Huron Shores municipality in direct physical damages to private and public property. An estimate of 1:100-yr flood risks has been studied (see attached Flood Risk Assessment report). The risk assessment indicates that a 1:100-yr flood will cause significant direct and indirect flood damages such as property loss, disruption in residential living conditions, loss of business, and disruption of major transportation routes.	
Response During the Risk Event	Provide details on how the defined geographic area continued its essential operations while responding to the event.	After OPP reports of flooded roads and washouts on September 10, emergency crews were activated. All roads were closed the morning of the event in order to assess conditions. Patrols revealed some 82 road washouts. A State of Emergency was declared at 11:15 a.m. on September 10, 2013. Public Information lines were available to answer calls for service. The media played a role in providing updates and advising of road closures/openings.	
Recovery Method for the Risk Event	Provide details on how the defined geographic area recovered.	Cleaning up after the flood included cleaning, repairing, and inspecting municipal roads; the event caused 365 hours of overtime. A total of 18 residences, 5 farms, 1 business and 2 non-profit organizations were impacted, and took flood damaged debris to the landfill. All but 3 roads had been temporarily repaired by September 16, 2013 to allow for traffic flow.	
Recovery Costs Related to the Risk Event	Provide details on the costs, in dollars, associated with implementing recovery strategies following the event.	Total road repairs were estimated at $1.14 million at the time of the event. There were also municipal repairs for a couple of years following the event that were not tracked. The Municipality applied for financial assistance, in the amount of $325,803.41 under the Ontario Disaster Relief Program. All private claims were handled by a joint Disaster Relief Committee established under the Ontario Disaster Relief Program. The Committee handled private claims for all municipalities impacted across the North Shore and was overseen by the Township of Macdonald, Meredith and Aberdeen Additional.	

Recovery Time Related to the Risk Event	Provide details on the recovery time needed to return to normal operations following the event.	As per above, all but 3 roads were passable by September 16, 2013, but road issues appeared for years following the event. Emergency was terminated on September 23, 2013 as conditions, other than those road issues previously mentioned, had returned to pre-event status.

National Disaster Mitigation Program
Risk Assessment Information Template

Risk Event Identification and Overview	
Provide a qualitative description of the defined geographic area, including: • Watershed/community/region name(s); • Province/Territory; • Area type (i.e., city, township, watershed, organization, etc.); • Population size; • Population variances (e.g., significant change in population between summer and winter months); • Main economic areas of interest; • Special consideration areas (e.g., historical, cultural and natural resource areas); and an • Estimate of the annual operating budget of the area.	- The Municipality of Huron Shores, Ontario within the Thessalon and Mississagi River watersheds. Focus is on identified risk areas within both watersheds. - Huron Shores is the result of the 1999 amalgamation of the former Village of Iron Bridge, the Townships of Thessalon, Thompson and Day and Bright Additional, and the unincorporated geographic townships of Bright and Gladstone. - The Municipality has a permanent population of approximately 1,860 (2021 census). - There is a substantial influx of residents (cottagers and tourists) in the summer months. - The area has a long history of farming and logging as well as aggregate extraction. The Municipality celebrates its rich pioneer history with annual heritage days, fall fairs and civic festivals. - There are protected natural areas and major open spaces within the sub-watershed, including the Mississagi Delta Provincial Nature Reserve, marking the mouth of the largest river flowing into Lake Huron. - Areas of economic interest within the Mississagi River watershed include the commercial district of Iron Bridge. - Annual operating budget for the entire Municipality of Huron Shores is $7.1 million for 2021.
Methodolgies, processes and analyses	
Provide the year in which the following processes/analyses were last completed and state the methodology(ies) used: • Hazard identification; • Vulnerability analysis; • Likelihood assessment; • Impact assessment; • Risk assessment; • Resiliency assessment; and/or • Climate change impact and/or adaptation assessment. *Note: It is recognized that many of the processes/analyses mentioned above may be included within one methodology.*	- A Flood Risk Assessment report was completed for the Municipality of Huron Shores in March 2022. - There were four steps completed: Background Review, Hydrology Assessment, Hydraulics Assessment, Hazard Identification and Risk Assessment. - Hazard Identification involved identification of the hazards through hydraulic modeling of flood levels that could impact the community. All hazards associated with the 1:100-yr flood were reviewed. - Risk Assessment examined the level of risk for each hazard. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance, and critical infrastructure was examined.

National Disaster Mitigation Program
Risk Assessment Information Template

Hazard Mapping	
To complete this section: • Obtain a map of the area that clearly indicates general land uses, neighbourhoods, landmarks, etc. For clarity throughout this exercise, it may be beneficial to omit any non-essential information from the map intended for use. Controlled photographs (e.g. aerial photography) can be used in place of or in addition to existing maps to avoid the cost of producing new maps. • Place a grid over the maps/photographs of the area and assign row and column identifiers. This will help identify the specific area(s) that may be impacted, as well as additional information on the characteristics within and affecting the area. • Identify where and how flood hazards may affect the defined geographic area. • Identify the mapped areas that are most likely to be impacted by the identified flood hazard. Map(s)/photograph(s) can also be used, where appropriate, to visually represent the information/prioritization being provided as part of this template.	
Hazard identification and prioritization	
List known or likely flood hazards to the defined geographic area in order of proposed priority. For example: (1) dyke breach overland flooding; (2) urban storm surge flooding ; and so on.	(1) Rain events causing riverine flooding and erosion. (2) Riverine flooding causing inundation of residential property and potential loss of life. (3) Riverine flooding causing washouts of municipal roads and bridges. (4) Erosion of shorelines causing loss of residential and agricultural lands.
Provide a rationale for each prioritization and the key information sources supporting this rationale.	- Based on the Flood Risk Assessment, see attached. - Floodplain mapping is not available for any area of Little Thessalon River. - Significant rain events will produce high water levels on Little Thessalon River.
Risk Event Title	
Identify the name/title of the risk. An example of a risk event name or title is: "A one-in-one hundred year flood following an extreme rain event."	A one-in-one hundred year (1:100-yr) flood event following a severe rainfall-on-snow event. A one-in-one hundred year (1:100-yr) flood event following a severe summer or fall rainfall event.
Type of Flood Hazard	
Identify the type of flood hazard being described (e.g., riverine flooding, coastal inundation, urban run-off, etc.)	Riverine flooding. Shoreline erosion.

National Disaster Mitigation Program
Risk Assessment Information Template

Secondary hazards	
Describe any secondary effects resulting from the risk event (e.g., flooding that occurs following a hurricane).	Erosion of shorelines and loss of residential and agricultural land. Environmental impacts from erosion of shorelines (loss of trees, loss of water fowl and amphibian nesting areas).
Primary and secondary organizations for response	
Identify the primary organization(s) with a mandate related to a key element of a natural disaster emergency, and any supporting organization(s) that provide general or specialized assistance in response to a natural disaster emergency.	(1) Emergency Management Ontario (2) Municipality of Huron Shores

Risk Event Description	
Description of risk event, including risk statement and cause(s) of the event	
Provide a baseline description of the risk event, including: • Risk statement; • Context of the risk event; • Nature and scale of the risk event; • Lead-up to the risk event, including underlying cause and trigger/stimulus of the risk event; and • Any factors that could affect future events. *Note: The description entered here must be plausible in that factual information would support such a risk event.*	Risk Statement - Significant rainfall-on-snow event or significant summer/fall rainfall event, resulting in riverine flooding, loss of some critical infrastructure (bridges) for no less than one week. Context - The estimated 1:100-yr flood event that has been assessed through a hydrology study. Scale - The 1:100-yr flood event would have a broad effect across the entire Municipality and likely impact, either directly or indirectly, the entire population of the Municipality. Spring Lead-up - Accumulation of a large winter snowpack, combined with warm spring temperatures and a significant rainfall prior to the flood event. Summer/Fall Lead-up - A significant 3-day to 5-day rainfall prior to the flood event. Factors - Climate change will increase the probability of more severe rainfall storm events and the likelihood of significant short duration rainfall.

National Disaster Mitigation Program
Risk Assessment Information Template

Location	
Provide details regarding the area impacted by the risk event such as: • Province(s)/territory(ies); • Region(s) or watershed(s); • Municipality(ies); • Community(ies); and so on.	The areas within the Municipality of Huron Shores along the lakes and rivers in the watersheds of the Thessalon River and Mississagi River. Little Thessalon River is a tributary of the Thessalon River with agricultural and residential lands along the shores.
Natural environment considerations	
Document relevant physical or environmental characteristics of the defined geographic area.	- This is a rural area. - Little Thessalon River is surrounded by residential, rural, and agricultural land uses. - The river functions as a warm water fishery.
Meteorological conditions	
Identify the relevant meteorological conditions that may influence the outcome of the risk event.	- The fall 2013 flood event was caused by a significant 5-day rainfall event. - A significant rain-on-snow event would cause similar damages.

Seasonal conditions	
Identify the relevant seasonal changes that may influence the outcome of the risk assessment of a particular risk event.	- Annual flood threats in the spring based on rainfall and ice conditions. - Significant summer/fall rainfall events are increasing in frequency and magnitude, and are causing larger than historical spring floods on small river basins. - Climate change is impacting seasonal changes, making certain events more likely, such as significant summer/fall rain events.
Nature and vulnerability	
Document key elements related to the affected population, including: • Population density; • Vulnerable populations (identify these on the hazard map from step 7); • Degree of urbanization; • Key local infrastructure in the defined geographic area; • Economic and political considerations; and • Other elements, as deemed pertinent to the defined geographic area.	- The Municipality of Huron Shores has a population density of 4.1 people per square kilometre. The area surrounding Little Thessalon River is primarily very low density. - See Map attached for an indication of vulnerable populations. - There are rural municipal roads (e.g., McCreights Road and Collver Road) and local roads (e.g., Yates Lane) within the predicted floodplain areas. - Flooding would result in a loss of access over the roads.

National Disaster Mitigation Program
Risk Assessment Information Template

Asset inventory	
Identify the asset inventory of the defined geographic area, including: • Critical assets; • Cultural or historical assets; • Commercial assets; and • Other area assets, as applicable to the defined geographic area. Key asset-related information should also be provided, including: • Location on the hazard map (from step 7); • Size; • Structure replacement cost; • Content value; • Displacement costs; • Importance rating and rationale; • Vulnerability rating and reason; and • Average daily cost to operate. A total estimated value of physical assets in the area should also be provided.	- The main critical assets in the subject area include municipal roads and bridges. - Cultural or historical assets are not known in the area. - Commercial assets include agricultural operations and potentially rental cottages. - Other assets include residential properties and potentially boat houses. - The included Map provides a broader look at the assets. - Limited information is available related to the asset information. - The value associated with these assets was not readily available but could be produced with a more detailed assessment of risk after the floodplain maps are produced.
Other assumptions, variability and/or relevant information	
Identify any assumptions made in describing the risk event; define details regarding any areas of uncertainty or unpredictability around the risk event; and supply any supplemental information, as applicable.	A hydrology study was performed to assess the magnitude of the flood risk event (1:100-yr flood). The event is described in the attached reports.
Existing Risk Treatment Measures	
Identify existing risk treatment measures that are currently in place within the defined geographic area to mitigate the risk event, and describe the sufficiency of these risk treatment measures.	The Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) is responsible for flood forecasting and warning throughout the watershed. However, it is unlikely that any specific details would be provided for Little Thessalon River since it is not monitored and is on a tributary to Thessalon River. A flood warning program would greatly benefit from updated mapping to help identify specific flood inundation zones and identify which areas pose the greatest hazard.

National Disaster Mitigation Program
Risk Assessment Information Template

Likelihood Assessment	
Return Period	
Identify the time period during which the risk event might occur. For example, the risk event described is expected to occur once every X number of years. Applicants are asked to provide the X value for the risk event.	The one-in-one hundred year (1:100-yr) flood event is expected to have a less than 1% Annual Exceedance Probability (AEP).
Period of interest	
Applicants are asked to determine and identify the likelihood rating (i.e. period of interest) for the risk event described by using the likelihood rating scale within the table below.	

Likelihood Rating	**Definition**	
5	The event is expected and may be triggered by conditions expected over a 30 year period.	5
4	The event is expected and may be triggered by conditions expected over a 30 - 50 year period.	
3	The event is expected and may be triggered by conditions expected over a 50 - 500 year period.	
2	The event is expected and may be triggered by conditions expected over a 500 - 5000 year period.	
1	The event is possible and may be triggered by conditions exceeding a period of 5000 years.	

Provide any other relevant information, notes or comments relating to the likelihood assessment, as applicable.	While the event has an Annual Exceedance Probability (AEP) of 1%, if we assume a 30-yr period, a 1% AEP has a 26% chance of occurring. For this reason, a likelihood rating of 5 was selected. This is supported by historical events around the Great Lakes, including the fall 2013 event in the Huron Shores municipality, as well as the Muskoka River watershed where the 1:100-yr flood has occurred two times in the last 7 years.

National Disaster Mitigation Program
Risk Assessment Information Template

Impacts/Consequences Assessment

There are 12 impacts categories within 5 impact classes rated on a scale of 1 (least impacts) to 5 (greatest impact). Conduct an assessment of the impacts associated with the risk event, and assign one risk rating for each category. Additional information may be provided for each of the categories in the supplemental fields provided.

A) People and societal impacts

	Risk Rating	Definition	Assigned risk rating
Fatalities	5	Could result in more than 50 fatalities	4
	4	Could result in 10 - 49 fatalities	
	3	Could result in 5 - 9 fatalities	
	2	Could result in 1 - 4 fatalities	
	1	Not likely to result in fatalities	
Supplemental information (optional)	As per attached Flood Risk Assessment and Little Thessalon River Flood Risk Map indicating buildings at risk of flooding, of which some are permanent and summer residences.		
Injuries	5	Injuries, illness and/or psychological disablements cannot be addressed by local, regional, or provincial/territorial healthcare resources; federal support or intervention is required	1
	4	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources; provincial/territorial healthcare support or intervention is required.	
	3	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources additional healthcare support or intervention is required from other regions, and supplementary support could be required from the province/territory	
	2	Injuries, illnesses and/or psychological disablements cannot be addressed by local resources through local facilities; healthcare support is required from other areas such as an adjacent area(ies)/municipality(ies) within the region	
	1	Any injuries, illnesses, and/or psychological disablements can be addressed by local resources through local facilities; available resources can meet the demand for care	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

		Risk Rating	Definition	Assigned risk rating
Displacement	Percentage of displaced individuals	5	> 15% of total local population	1
		4	10 - 14.9% of total local population	
		3	5 - 9.9% of total local population	
		2	2 - 4.9% of total local population	
		1	0 - 1.9% of total local population	
	Duration of displacement	5	> 26 weeks (6 months)	4
		4	4 weeks - 26 weeks (6 months)	
		3	1 week - 4 weeks	
		2	72 hours - 168 hours (1 week)	
		1	Less than 72 hours	
Supplemental information (optional)		As per Flood Risk Assessment, based on entire municipality. Actual ratio within defined geographic area would be higher. A more detailed risk assessment would be required to accurately assign rating.		
B) Environmental impacts				
		5	> 75% of flora or fauna impacted or 1 or more ecosystems significantly impaired; Air quality has significantly deteriorated; Water quality is significantly lower than normal or water level is > 3 meters above highest natural level; Soil quality or quantity is significantly lower (i.e., significant soil loss, evidence of lethal soil contamination) than normal; > 15% of local area is affected	3
		4	40 - 74.9% of flora or fauna impacted or 1 or more ecosystems considerably impaired; Air quality has considerably deteriorated; Water quality is considerably lower than normal or water level is 2 - 2.9 meters above highest natural level; Soil quality or quantity is moderately lower than normal; 10 - 14.9% of local area is affected	
		3	10 - 39.9% of flora or fauna impacted or 1 1 or more ecosystems moderately impaired; Air quality has moderately deteriorated; Water quality is moderately lower than normal or water level is 1 - 2 meters above highest natural level; Soil quality is moderately lower than normal; 6 - 9.9 % of area affected	

National Disaster Mitigation Program
Risk Assessment Information Template

	2	< 10 % of flora or fauna impacted or little or no impact to any ecosystems; Little to no impact to air quality and/or soil quality or quantity; Water quality is slightly lower than normal, or water level is less than 0.9 meters above highest natural level and increased for less than 24 hours; 3 - 5.9 % of local area is affected	
	1	Little to no impact to flora or fauna, any ecosystems, air quality, water quality or quantity, or to soil quality or quantity; 0 - 2.9 % of local area is affected	
Supplemental information (optional)			

C) Local economic impacts

	Risk Rating	Definition	Assigned risk rating
	5	> 15 % of local economy impacted	2
	4	10 - 14.9 % of local economy impacted	
	3	6 - 9.9 % of local economy impacted	
	2	3 - 5.9 % of local economy impacted	
	1	0 - 2.9 % of local economy impacted	
Supplemental information (optional)	Based on land flooded in the local Little Thessalon River area.		

National Disaster Mitigation Program
Risk Assessment Information Template

D) Local infrastructure impacts			
	Risk Rating	**Definition**	**Assigned risk rating**
Transportation	5	Local activity stopped for more than 72 hours; > 20% of local population affected; lost access to local area and/or delivery of crucial service or product; or having an international level impact	5
	4	Local activity stopped for 48 - 71 hours; 10 - 19.9% of local population affected; significantly reduced access to local area and/or delivery of crucial service or product; or having a national level impact	
	3	Local activity stopped for 25 - 47 hours; 5 - 9.9% of local population affected; moderately reduced access to local area and/or delivery of crucial service or product; or having a provincial/territorial level impact	
	2	Local activity stopped for 13 - 24 hours; 2 - 4.9% of local population affected; minor reduction in access to local area and/or delivery of crucial service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	
Supplemental information (optional)	Two municipal roads and local access roads flooded as per attached Risk Maps.		
Energy and Utilities	5	Duration of impacts > 72 hours; > 20% of local population without service or product; or having an international level impact	1
	4	Duration of impact 48 - 71 hours; 10 - 19.9% of local population without service or product; or having a national impact	
	3	Duration of impact 25 - 47 hours; 5 - 9.9% of local population without service or product; or having a provincial/territorial level impact	
	2	Duration of impact 13 - 24 hours; 2 - 4.9% of local population without service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Information and Communications Technology	5	Service unavailable for > 72 hours; > 20 % of local population without service; or having an international level impact	1
	4	Service unavailable for 48 - 71 hours; 10 - 19.9 % of local population without service; or having a national level impact	
	3	Service unavailable for 25 - 47 hours; 5 - 9.9 % of local population without service; or having a provincial/territorial level impact	
	2	Service unavailable for 13 - 24 hours; 2 - 4.9 % of local population without service; or having a regional level impact	
	1	Service unavailable for 0 - 12 hours; 0 - 1.9 % of local population without service	
Supplemental information (optional)			
Health, Food, and Water	5	Inability to access potable water, food, sanitation services, or healthcare services for > 72 hours; non - essential services cancelled; > 20 % of local population impacted; or having an international level impact	1
	4	Inability to access potable water, food, sanitation services, or healthcare services for 48 - 72 hours; major delays for nonessential services; 10 - 19.9 % of local population impacted; or having a national level impact	
	3	Inability to access potable water, food, sanitation services, or healthcare services for 25 - 48 hours; moderate delays for nonessential services; 5 - 9.9 % of local population impacted; or having a provincial/territorial level impact	
	2	Inability to access potable water, food, sanitation services, or healthcare services for 13 - 24 hours; minor delays for nonessential; 2 - 4.9 % of local population impacted; or having a regional level impact	
	1	Inability to access potable water, food, sanitation services, or healthcare services for 0 - 12 hours; 0 - 1.9 % of local population impacted	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Safety and Security	5	> 20 % of local population impacted; loss of intelligence or defence assets or systems for > 72 hours; or having an international level impact	1
	4	10 - 19.9 % of local population impacted; loss of intelligence or defence assets or systems for 48 – 71 hours; or having a national level impact	
	3	5 - 9.9 % of local population impacted; loss of intelligence or defence assets or systems for 25 – 47 hours; or having a provincial/territorial level impact	
	2	2 - 4.9 % of local population impacted; loss of intelligence or defence assets or systems for 13 – 24 hours; or having a regional level impact	
	1	0 - 1.9 % of local population impacted; loss of intelligence or defence assets or systems for 0 – 12 hours	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

E) Public sensitivity impacts			
	Risk Rating	Definition	Assigned risk rating
	5	Sustained, long term loss in reputation/public perception of public institutions and/or sustained, long term loss of trust and confidence in public institutions; or having an international level impact	3
	4	Significant loss in reputation/public perception of public institutions and/or significant loss of trust and confidence in public institutions; significant resistance; or having a national level impact	
	3	Some loss in reputation/public perception of public institutions and/or some loss of trust and confidence in public institutions; escalating resistance	
	2	Isolated/minor, recoverable set - back in reputation, public perception, trust, and/or confidence of public institutions	
	1	No impact on reputation, public perception, trust, and/or confidence of public institutions	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

Confidence Assessment

Based on the table below, indicate the level of confidence regarding the information entered in the risk assessment information template in the "Confidence Level Assigned" column.
Confidence levels are language - based and range from A to E (A=most confident to E=least confident).

Confidence Level	Definition	Confidence Level Assigned
A	Very high degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of high - quality data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of existing/known mitigation measures	
B	High degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with some subject matter expertise (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of potential mitigation measures	

National Disaster Mitigation Program
Risk Assessment Information Template

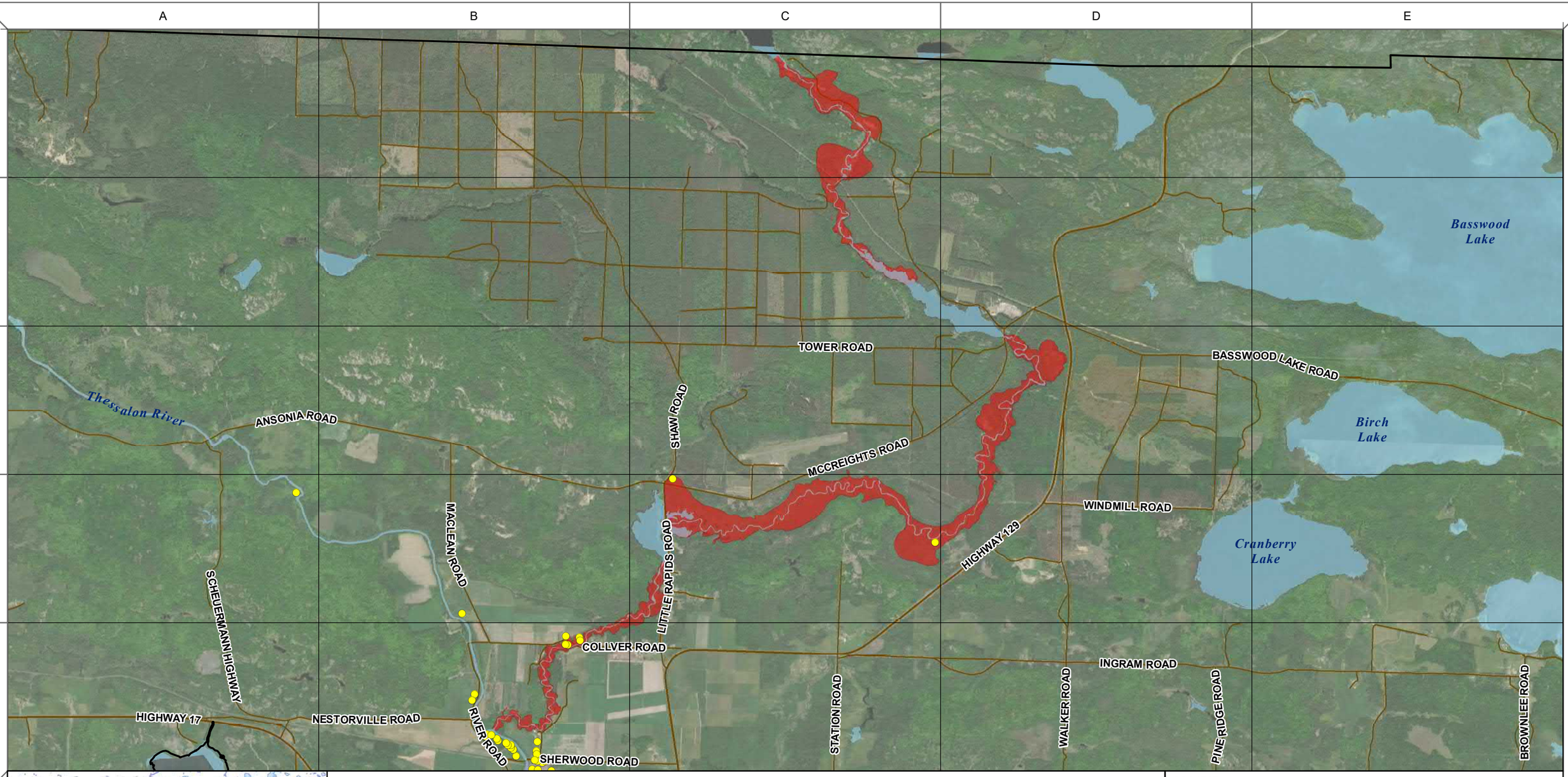
C	Moderate confidence Risk assessment used to inform the risk assessment information template was moderately evidence - based from a considerable amount of knowledge of the natural hazard risk event; leveraged a considerable quantity of data that was quantitative and/or qualitative in nature; leveraged a considerable amount of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a moderately sized multidisciplinary team, incorporating some subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a large number of potential mitigation measures	A
D	Low confidence Risk assessment used to inform the risk assessment information template was based on a relatively small amount of knowledge of the natural hazard risk event; leveraged a relatively small quantity of quantitative and/or qualitative data that was largely historical in nature; may have leveraged some geospatial information or information from other sources (i.e., databases, key risk and resilience methodologies); and the risk assessment and analysis processes were completed by a small team that may or may not have incorporated subject matter experts (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts considered a relatively small number of potential mitigation measures	
E	Very low confidence Risk assessment used to inform the risk assessment information template was not evidence - based; leveraged a small quantity of information and/or data relating to the natural risk hazard and risk event; primary qualitative information used with little to no quantitative data or information; and the risk assessment and analysis processes were completed by an individual or small group of individuals little subject matter expertise (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts did not consider existing or potential mitigation measures	

Rationale for level of confidence

Provide the rationale for the selected confidence level, including any references or sources to support the level assigned.	- The impacts of flooding were observed in 2013. - The predicted impact levels for a 1:100-yr flood event were based on a completed hazard identification and risk assessment.

National Disaster Mitigation Program
Risk Assessment Information Template

Key Information Sources	
Identify all supporting documentation and information sources for qualitative and quantitative data used to identify risk events, develop the risk event description, and assess impacts and likelihood. This ensures credibility and validity of risk information presented as well as enables referencing back to decision points at any point in time. Clearly identify unclassified and classified information.	*All information is unclassified "Flood Risk Assessment", completed by Hatch Ltd. in March 2022.
Description of the risk analysis team	
List and describe the type and level of experience of each individual who was involved with the completion of the risk assessment and risk analysis used to inform the information contained within this risk assessment information template.	Flood Risk Assessment was completed by Hatch Ltd. hydro-technical engineers Bethany Heppner, P.Eng., and Alfred Breland, P.Eng. Bethany has 5 years of experience directly related to hydrology and hydraulics, and Alfred Breland has 39 years of experience directly related to hydrology and hydraulics and the risks and concerns surrounding riverine flooding in rural and municipal areas.



LEGEND

- Buildings at Risk
- LittleThessalonRiver_RiskArea
- Huron Shores Municipal Boundary
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.5 1 2 km

1:40,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	RAIT Risk Area - Little Thessalon River
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 29, 2022
FIG NO.:	1

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\RAIT_Maps\RAIT_Fig1_LittleThessalonRiver.mxd

Public Safety Canada | Sécurité publique Canada

Ottawa, Canada
K1A 0P8

National Disaster Mitigation Program (NDMP)
Risk Assessment Information Template

Risk Event Details			
Start and End Date	Provide the start and end dates of the selected event, based on historical data.	Start Date: 26/04/1979	End Date: 04/05/1979
Severity of the Risk Event	Provide details about the risk, including: • Speed of onset and duration of event; • Level and type of damaged caused; • Insurable and non-insurable losses; and • Other details, as appropriate.	The risk area of the Mississagi River is located in the lower reach of the Mississagi River watershed, below Red Rock dam, primarily in the Town of Iron Bridge. The area was flooded in the 1979 spring flood flood event and has been assessed to be at high risk during a 1:100-yr flood event. An estimate of 1:100-yr flood risks has been studied (see attached Flood Risk Assessment report). The risk assessment indicates that a 1:100-yr flood will cause significant direct and indirect flood damages such as property loss, disruption in residential living conditions, loss of business, and disruption of major transportation routes.	
Response During the Risk Event	Provide details on how the defined geographic area continued its essential operations while responding to the event.	No details are available for the response to1979 spring risk event. Typically a State of Emergency would be declared, similar to the response to the September 2013 event in other parts of the Municipality. Public Information lines were available to answer calls for service. The media played a role in providing updates and advising of road closures/openings.	
Recovery Method for the Risk Event	Provide details on how the defined geographic area recovered.	No details are available for the recovery after the 1979 spring risk event. As an example of flood recovery in other areas of the municipality, the 2013 event, cleaning up after the flood included cleaning, repairing, and inspecting municipal roads; the event caused 365 hours of overtime. A total of 18 residences, 5 farms, 1 business and 2 non-profit organizations were impacted and took flood damaged debris to the landfill. All but 3 roads had been temporarily repaired by September 16, 2013 to allow for traffic flow.	
Recovery Costs Related to the Risk Event	Provide details on the costs, in dollars, associated with implementing recovery strategies following the event.	The 2013 event as an example, total road repairs were estimated at $1.14 million at the time of the event. There were also municipal repairs for a couple of years following the event that were not tracked. The Municipality applied for financial assistance, in the amount of $325,803.41 under the Ontario Disaster Relief Program. All private claims were handled by a joint Disaster Relief Committee established under the Ontario Disaster Relief Program. The area along the Mississagi River is more populated and has more municipality infrastructure. The costs of recovery from a flood event on the Mississagi would be much higher than the costs from the 2013 event.	

Recovery Time Related to the Risk Event	Provide details on the recovery time needed to return to normal operations following the event.	As per above, all but 3 roads were passable by September 16, 2013, but road issues appeared for years following the event. Emergency was terminated on September 23, 2013 as conditions, other than those road issues previously mentioned, had returned to pre-event status.

National Disaster Mitigation Program
Risk Assessment Information Template

Risk Event Identification and Overview	
Provide a qualitative description of the defined geographic area, including: • Watershed/community/region name(s); • Province/Territory; • Area type (i.e., city, township, watershed, organization, etc.); • Population size; • Population variances (e.g., significant change in population between summer and winter months); • Main economic areas of interest; • Special consideration areas (e.g., historical, cultural and natural resource areas); and an • Estimate of the annual operating budget of the area.	- The Municipality of Huron Shores, Ontario within the Thessalon and Mississagi River watersheds. Focus is on identified risk areas within both watersheds. - Huron Shores is the result of the 1999 amalgamation of the former Village of Iron Bridge, the Townships of Thessalon, Thompson and Day and Bright Additional, and the unincorporated geographic townships of Bright and Gladstone. - The Municipality has a permanent population of approximately 1,860 (2021 census). - There is a substantial influx of residents (cottagers and tourists) in the summer months. - The area has a long history of farming and logging as well as aggregate extraction. The Municipality celebrates its rich pioneer history with annual heritage days, fall fairs and civic festivals. - There are protected natural areas and major open spaces within the sub-watershed, including the Mississagi Delta Provincial Nature Reserve, marking the mouth of the largest river flowing into Lake Huron. - Areas of economic interest within the Mississagi River watershed include the commercial district of Iron Bridge. - Annual operating budget for the entire Municipality of Huron Shores is $7.1 million for 2021.
Methodolgies, processes and analyses	
Provide the year in which the following processes/analyses were last completed and state the methodology(ies) used: • Hazard identification; • Vulnerability analysis; • Likelihood assessment; • Impact assessment; • Risk assessment; • Resiliency assessment; and/or • Climate change impact and/or adaptation assessment. *Note: It is recognized that many of the processes/analyses mentioned above may be included within one methodology.*	- A Flood Risk Assessment report was completed for the Municipality of Huron Shores in March 2022. - There were four steps completed: Background Review, Hydrology Assessment, Hydraulics Assessment, Hazard Identification and Risk Assessment. - Hazard Identification involved identification of the hazards through hydraulic modeling of flood levels that could impact the community. All hazards associated with the 1:100-yr flood were reviewed. - Risk Assessment examined the level of risk for each hazard. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance, and critical infrastructure was examined.

National Disaster Mitigation Program
Risk Assessment Information Template

Hazard Mapping	
To complete this section: • Obtain a map of the area that clearly indicates general land uses, neighbourhoods, landmarks, etc. For clarity throughout this exercise, it may be beneficial to omit any non-essential information from the map intended for use. Controlled photographs (e.g. aerial photography) can be used in place of or in addition to existing maps to avoid the cost of producing new maps. • Place a grid over the maps/photographs of the area and assign row and column identifiers. This will help identify the specific area(s) that may be impacted, as well as additional information on the characteristics within and affecting the area. • Identify where and how flood hazards may affect the defined geographic area. • Identify the mapped areas that are most likely to be impacted by the identified flood hazard. Map(s)/photograph(s) can also be used, where appropriate, to visually represent the information/prioritization being provided as part of this template.	
Hazard identification and prioritization	
List known or likely flood hazards to the defined geographic area in order of proposed priority. For example: (1) dyke breach overland flooding; (2) urban storm surge flooding ; and so on.	(1) Rain events causing riverine flooding and erosion. (2) Riverine flooding causing inundation of residential property and potential loss of life. (3) Riverine flooding causing washouts of municipal roads and bridges. (4) Erosion of shorelines causing loss of residential and agricultural lands.
Provide a rationale for each prioritization and the key information sources supporting this rationale.	- Based on the Flood Risk Assessment, see attached. - Old floodplain mapping is available for the Mississagi River, but this needs to be updated. - Significant rain events will produce high water levels on Mississagi River.
Risk Event Title	
Identify the name/title of the risk. An example of a risk event name or title is: "A one-in-one hundred year flood following an extreme rain event."	A one-in-one hundred year (1:100-yr) flood event following a severe rainfall-on-snow event. A one-in-one hundred year (1:100-yr) flood event following a severe summer or fall rainfall event.
Type of Flood Hazard	
Identify the type of flood hazard being described (e.g., riverine flooding, coastal inundation, urban run-off, etc.)	Riverine flooding. Shoreline erosion.

National Disaster Mitigation Program
Risk Assessment Information Template

Secondary hazards	
Describe any secondary effects resulting from the risk event (e.g., flooding that occurs following a hurricane).	Erosion of shorelines and loss of residential and agricultural land. Environmental impacts from erosion of shorelines (loss of trees, loss of water fowl and amphibian nesting areas).
Primary and secondary organizations for response	
Identify the primary organization(s) with a mandate related to a key element of a natural disaster emergency, and any supporting organization(s) that provide general or specialized assistance in response to a natural disaster emergency.	(1) Emergency Management Ontario (2) Municipality of Huron Shores

Risk Event Description	
Description of risk event, including risk statement and cause(s) of the event	
Provide a baseline description of the risk event, including: • Risk statement; • Context of the risk event; • Nature and scale of the risk event; • Lead-up to the risk event, including underlying cause and trigger/stimulus of the risk event; and • Any factors that could affect future events. *Note: The description entered here must be plausible in that factual information would support such a risk event.*	Risk Statement - Significant rainfall-on-snow event or significant summer/fall rainfall event, resulting in riverine flooding, loss of some critical infrastructure (bridges) for no less than one week. Context - The estimated 1:100-yr flood event that has been assessed through a hydrology study. Scale - The 1:100-yr flood event would have a broad effect across the entire Municipality and likely impact, either directly or indirectly, the entire population of the Municipality. Spring Lead-up - Accumulation of a large winter snowpack, combined with warm spring temperatures and a significant rainfall prior to the flood event. Summer/Fall Lead-up - A significant 3-day to 5-day rainfall prior to the flood event. Factors - Climate change will increase the probability of more severe rainfall storm events and the likelihood of significant short duration rainfall.

National Disaster Mitigation Program
Risk Assessment Information Template

Location	
Provide details regarding the area impacted by the risk event such as: • Province(s)/territory(ies); • Region(s) or watershed(s); • Municipality(ies); • Community(ies); and so on.	The Town of Iron Bridge and the areas within the Municipality of Huron Shores along the rivers and creeks in the watershed of the Mississagi River. The Mississagi River has agricultural, municipal and rural lands along the shores.
Natural environment considerations	
Document relevant physical or environmental characteristics of the defined geographic area.	- This is a municipal and rural area. - Mississagi River is surrounded by residential, rural, and agricultural land uses. - The river functions as a warm water fishery.
Meteorological conditions	
Identify the relevant meteorological conditions that may influence the outcome of the risk event.	- The 1:100-yr flood event would be caused by a significant rainfall-on-snow event, similar to the 1979 event.

Seasonal conditions	
Identify the relevant seasonal changes that may influence the outcome of the risk assessment of a particular risk event.	- Annual flood threats in the spring based on rainfall and ice conditions. - Significant summer/fall rainfall events are increasing in frequency and magnitude, and are causing larger than historical spring floods on small river basins. - Climate change is impacting seasonal changes, making certain events more likely, such as significant summer/fall rain events.
Nature and vulnerability	
Document key elements related to the affected population, including: • Population density; • Vulnerable populations (identify these on the hazard map from step 7); • Degree of urbanization; • Key local infrastructure in the defined geographic area; • Economic and political considerations; and • Other elements, as deemed pertinent to the defined geographic area.	- The Municipality of Huron Shores has a population density of 4.1 people per square kilometre. The area surrounding Mississagi River is primarily very low density but has some areas of high density at Iron Bridge. - See Map attached for an indication of vulnerable populations. - There are rural municipal roads and local roads within the predicted floodplain areas. - Flooding would result in a loss of access over the roads.

National Disaster Mitigation Program
Risk Assessment Information Template

Asset inventory	
Identify the asset inventory of the defined geographic area, including: • Critical assets; • Cultural or historical assets; • Commercial assets; and • Other area assets, as applicable to the defined geographic area. Key asset-related information should also be provided, including: • Location on the hazard map (from step 7); • Size; • Structure replacement cost; • Content value; • Displacement costs; • Importance rating and rationale; • Vulnerability rating and reason; and • Average daily cost to operate. A total estimated value of physical assets in the area should also be provided.	- The main critical assets in the subject area include municipal roads and bridges. - Cultural or historical assets are not known in the area. - Commercial assets include agricultural operations and potentially rental cottages. - Other assets include residential properties and potentially boat houses. - The included Map provides a broader look at the assets. - Limited information is available related to the asset information. - The value associated with these assets was not readily available but could be produced with a more detailed assessment of risk after the floodplain maps are produced.
Other assumptions, variability and/or relevant information	
Identify any assumptions made in describing the risk event; define details regarding any areas of uncertainty or unpredictability around the risk event; and supply any supplemental information, as applicable.	A hydrology study was performed to assess the magnitude of the flood risk event (1:100-yr flood). The event is described in the attached reports.
Existing Risk Treatment Measures	
Identify existing risk treatment measures that are currently in place within the defined geographic area to mitigate the risk event, and describe the sufficiency of these risk treatment measures.	The Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) is responsible for flood forecasting and warning throughout the watershed. As well, the dams on the Mississagi River are monitored by Mississagi Power Trust (Brookfield Renewable). A flood warning program would greatly benefit from updated mapping to help identify specific flood inundation zones and identify which areas pose the greatest hazard.

National Disaster Mitigation Program
Risk Assessment Information Template

Likelihood Assessment	
Return Period	
Identify the time period during which the risk event might occur. For example, the risk event described is expected to occur once every X number of years. Applicants are asked to provide the X value for the risk event.	The one-in-one hundred year (1:100-yr) flood event is expected to have a less than 1% Annual Exceedance Probability (AEP).
Period of interest	
Applicants are asked to determine and identify the likelihood rating (i.e. period of interest) for the risk event described by using the likelihood rating scale within the table below.	

Likelihood Rating	**Definition**	
5	The event is expected and may be triggered by conditions expected over a 30 year period.	5
4	The event is expected and may be triggered by conditions expected over a 30 - 50 year period.	
3	The event is expected and may be triggered by conditions expected over a 50 - 500 year period.	
2	The event is expected and may be triggered by conditions expected over a 500 - 5000 year period.	
1	The event is possible and may be triggered by conditions exceeding a period of 5000 years.	

Provide any other relevant information, notes or comments relating to the likelihood assessment, as applicable.	While the event has an Annual Exceedance Probability (AEP) of 1%, if we assume a 30-yr period, a 1% AEP has a 26% chance of occurring. For this reason, a likelihood rating of 5 was selected. This is supported by historical events around the Great Lakes, including the fall 2013 event in the Huron Shores municipality, as well as the Muskoka River watershed where the 1:100-yr spring flood has occurred two times in the last 7 years.

National Disaster Mitigation Program
Risk Assessment Information Template

Impacts/Consequences Assessment

There are 12 impacts categories within 5 impact classes rated on a scale of 1 (least impacts) to 5 (greatest impact). Conduct an assessment of the impacts associated with the risk event, and assign one risk rating for each category. Additional information may be provided for each of the categories in the supplemental fields provided.

A) People and societal impacts

	Risk Rating	Definition	Assigned risk rating
Fatalities	5	Could result in more than 50 fatalities	4
	4	Could result in 10 - 49 fatalities	
	3	Could result in 5 - 9 fatalities	
	2	Could result in 1 - 4 fatalities	
	1	Not likely to result in fatalities	
Supplemental information (optional)	As per attached Flood Risk Assessment and Mississagi River Flood Risk Map indicating buildings at risk of flooding, of which some are permanent and summer residences.		
Injuries	5	Injuries, illness and/or psychological disablements cannot be addressed by local, regional, or provincial/territorial healthcare resources; federal support or intervention is required	3
	4	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources; provincial/territorial healthcare support or intervention is required.	
	3	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources additional healthcare support or intervention is required from other regions, and supplementary support could be required from the province/territory	
	2	Injuries, illnesses and/or psychological disablements cannot be addressed by local resources through local facilities; healthcare support is required from other areas such as an adjacent area(ies)/municipality(ies) within the region	
	1	Any injuries, illnesses, and/or psychological disablements can be addressed by local resources through local facilities; available resources can meet the demand for care	
Supplemental information (optional)	The risk area along the Mississagi River in Iron Bridge contains both housing for low income families and the elderly. These populations are at higher risk during a flood event. Since, there is limited healthcare available locally it is likely that supplementary support may be required.		

National Disaster Mitigation Program
Risk Assessment Information Template

		Risk Rating	Definition	Assigned risk rating
Displacement	Percentage of displaced individuals	5	> 15% of total local population	1
		4	10 - 14.9% of total local population	
		3	5 - 9.9% of total local population	
		2	2 - 4.9% of total local population	
		1	0 - 1.9% of total local population	
	Duration of displacement	5	> 26 weeks (6 months)	4
		4	4 weeks - 26 weeks (6 months)	
		3	1 week - 4 weeks	
		2	72 hours - 168 hours (1 week)	
		1	Less than 72 hours	
Supplemental information (optional)		As per Flood Risk Assessment, based on entire municipality. Actual ratio within defined geographic area would be higher. A more detailed risk assessment would be required to accurately assign rating.		
B) Environmental impacts				
		5	> 75% of flora or fauna impacted or 1 or more ecosystems significantly impaired; Air quality has significantly deteriorated; Water quality is significantly lower than normal or water level is > 3 meters above highest natural level; Soil quality or quantity is significantly lower (i.e., significant soil loss, evidence of lethal soil contamination) than normal; > 15% of local area is affected	3
		4	40 - 74.9% of flora or fauna impacted or 1 or more ecosystems considerably impaired; Air quality has considerably deteriorated; Water quality is considerably lower than normal or water level is 2 - 2.9 meters above highest natural level; Soil quality or quantity is moderately lower than normal; 10 - 14.9% of local area is affected	
		3	10 - 39.9% of flora or fauna impacted or 1 1 or more ecosystems moderately impaired; Air quality has moderately deteriorated; Water quality is moderately lower than normal or water level is 1 - 2 meters above highest natural level; Soil quality is moderately lower than normal; 6 - 9.9 % of area affected	

National Disaster Mitigation Program
Risk Assessment Information Template

	2	< 10 % of flora or fauna impacted or little or no impact to any ecosystems; Little to no impact to air quality and/or soil quality or quantity; Water quality is slightly lower than normal, or water level is less than 0.9 meters above highest natural level and increased for less than 24 hours; 3 - 5.9 % of local area is affected	
	1	Little to no impact to flora or fauna, any ecosystems, air quality, water quality or quantity, or to soil quality or quantity; 0 - 2.9 % of local area is affected	
Supplemental information (optional)			

C) Local economic impacts

	Risk Rating	Definition	Assigned risk rating
	5	> 15 % of local economy impacted	2
	4	10 - 14.9 % of local economy impacted	
	3	6 - 9.9 % of local economy impacted	
	2	3 - 5.9 % of local economy impacted	
	1	0 - 2.9 % of local economy impacted	
Supplemental information (optional)	Based on land flooded in the local Mississagi River area.		

National Disaster Mitigation Program
Risk Assessment Information Template

D) Local infrastructure impacts			
	Risk Rating	**Definition**	**Assigned risk rating**
Transportation	5	Local activity stopped for more than 72 hours; > 20% of local population affected; lost access to local area and/or delivery of crucial service or product; or having an international level impact	5
	4	Local activity stopped for 48 - 71 hours; 10 - 19.9% of local population affected; significantly reduced access to local area and/or delivery of crucial service or product; or having a national level impact	
	3	Local activity stopped for 25 - 47 hours; 5 - 9.9% of local population affected; moderately reduced access to local area and/or delivery of crucial service or product; or having a provincial/territorial level impact	
	2	Local activity stopped for 13 - 24 hours; 2 - 4.9% of local population affected; minor reduction in access to local area and/or delivery of crucial service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	
Supplemental information (optional)	Municipal roads and local access roads flooded as per attached Risk Maps.		
Energy and Utilities	5	Duration of impacts > 72 hours; > 20% of local population without service or product; or having an international level impact	1
	4	Duration of impact 48 - 71 hours; 10 - 19.9% of local population without service or product; or having a national impact	
	3	Duration of impact 25 - 47 hours; 5 - 9.9% of local population without service or product; or having a provincial/territorial level impact	
	2	Duration of impact 13 - 24 hours; 2 - 4.9% of local population without service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Information and Communications Technology	5	Service unavailable for > 72 hours; > 20 % of local population without service; or having an international level impact	1
	4	Service unavailable for 48 - 71 hours; 10 - 19.9 % of local population without service; or having a national level impact	
	3	Service unavailable for 25 - 47 hours; 5 - 9.9 % of local population without service; or having a provincial/territorial level impact	
	2	Service unavailable for 13 - 24 hours; 2 - 4.9 % of local population without service; or having a regional level impact	
	1	Service unavailable for 0 - 12 hours; 0 - 1.9 % of local population without service	
Supplemental information (optional)			
Health, Food, and Water	5	Inability to access potable water, food, sanitation services, or healthcare services for > 72 hours; non - essential services cancelled; > 20 % of local population impacted; or having an international level impact	1
	4	Inability to access potable water, food, sanitation services, or healthcare services for 48 - 72 hours; major delays for nonessential services; 10 - 19.9 % of local population impacted; or having a national level impact	
	3	Inability to access potable water, food, sanitation services, or healthcare services for 25 - 48 hours; moderate delays for nonessential services; 5 - 9.9 % of local population impacted; or having a provincial/territorial level impact	
	2	Inability to access potable water, food, sanitation services, or healthcare services for 13 - 24 hours; minor delays for nonessential; 2 - 4.9 % of local population impacted; or having a regional level impact	
	1	Inability to access potable water, food, sanitation services, or healthcare services for 0 - 12 hours; 0 - 1.9 % of local population impacted	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Safety and Security	5	> 20 % of local population impacted; loss of intelligence or defence assets or systems for > 72 hours; or having an international level impact	1
	4	10 - 19.9 % of local population impacted; loss of intelligence or defence assets or systems for 48 – 71 hours; or having a national level impact	
	3	5 - 9.9 % of local population impacted; loss of intelligence or defence assets or systems for 25 – 47 hours; or having a provincial/territorial level impact	
	2	2 - 4.9 % of local population impacted; loss of intelligence or defence assets or systems for 13 – 24 hours; or having a regional level impact	
	1	0 - 1.9 % of local population impacted; loss of intelligence or defence assets or systems for 0 – 12 hours	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

E) Public sensitivity impacts			
	Risk Rating	Definition	Assigned risk rating
	5	Sustained, long term loss in reputation/public perception of public institutions and/or sustained, long term loss of trust and confidence in public institutions; or having an international level impact	3
	4	Significant loss in reputation/public perception of public institutions and/or significant loss of trust and confidence in public institutions; significant resistance; or having a national level impact	
	3	Some loss in reputation/public perception of public institutions and/or some loss of trust and confidence in public institutions; escalating resistance	
	2	Isolated/minor, recoverable set - back in reputation, public perception, trust, and/or confidence of public institutions	
	1	No impact on reputation, public perception, trust, and/or confidence of public institutions	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

Confidence Assessment

Based on the table below, indicate the level of confidence regarding the information entered in the risk assessment information template in the "Confidence Level Assigned" column.
Confidence levels are language - based and range from A to E (A=most confident to E=least confident).

Confidence Level	Definition	Confidence Level Assigned
A	Very high degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of high - quality data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of existing/known mitigation measures	
B	High degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with some subject matter expertise (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of potential mitigation measures	

National Disaster Mitigation Program
Risk Assessment Information Template

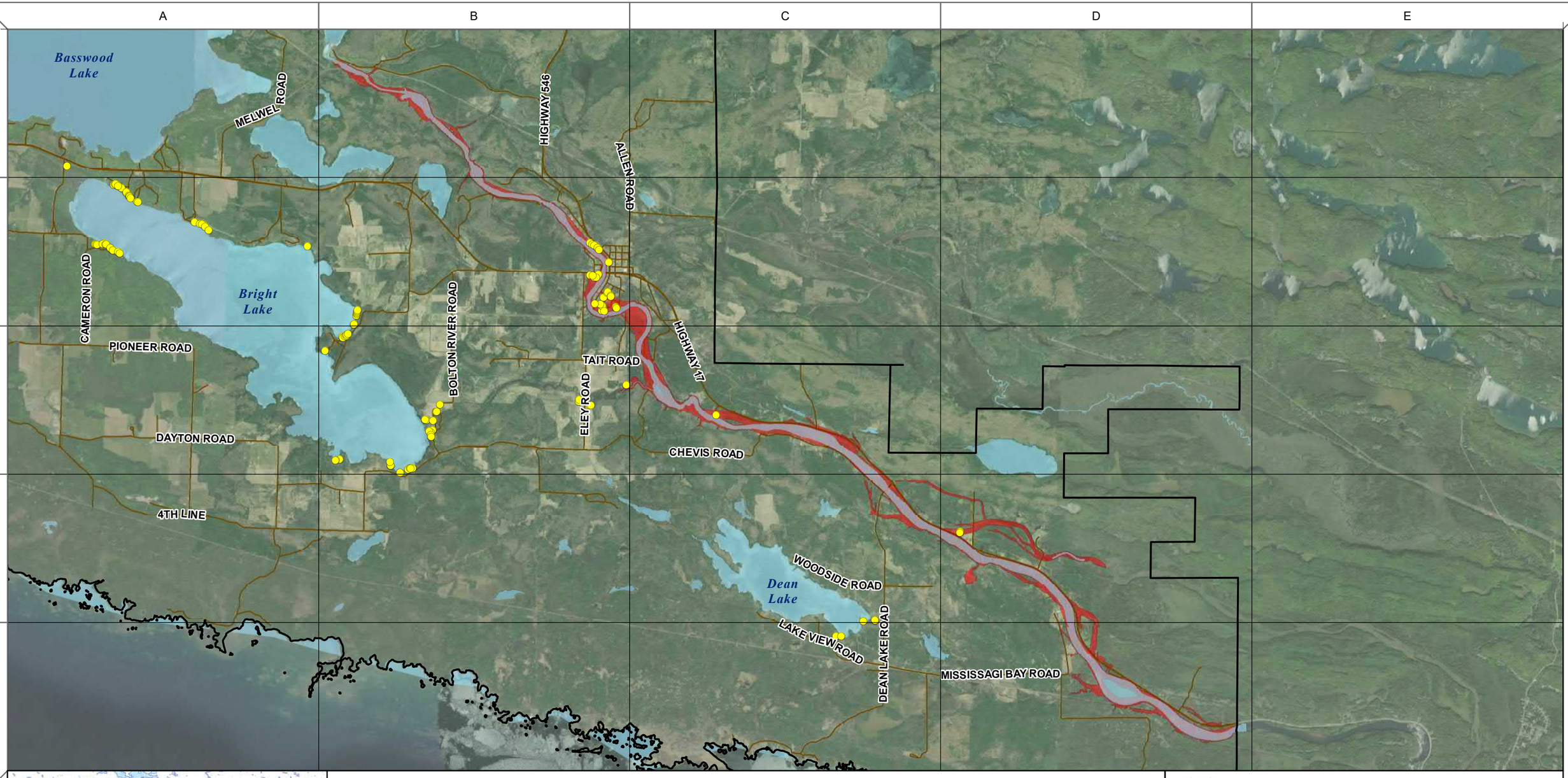
C	Moderate confidence Risk assessment used to inform the risk assessment information template was moderately evidence - based from a considerable amount of knowledge of the natural hazard risk event; leveraged a considerable quantity of data that was quantitative and/or qualitative in nature; leveraged a considerable amount of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a moderately sized multidisciplinary team, incorporating some subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a large number of potential mitigation measures	A
D	Low confidence Risk assessment used to inform the risk assessment information template was based on a relatively small amount of knowledge of the natural hazard risk event; leveraged a relatively small quantity of quantitative and/or qualitative data that was largely historical in nature; may have leveraged some geospatial information or information from other sources (i.e., databases, key risk and resilience methodologies); and the risk assessment and analysis processes were completed by a small team that may or may not have incorporated subject matter experts (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts considered a relatively small number of potential mitigation measures	
E	Very low confidence Risk assessment used to inform the risk assessment information template was not evidence - based; leveraged a small quantity of information and/or data relating to the natural risk hazard and risk event; primary qualitative information used with little to no quantitative data or information; and the risk assessment and analysis processes were completed by an individual or small group of individuals little subject matter expertise (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts did not consider existing or potential mitigation measures	

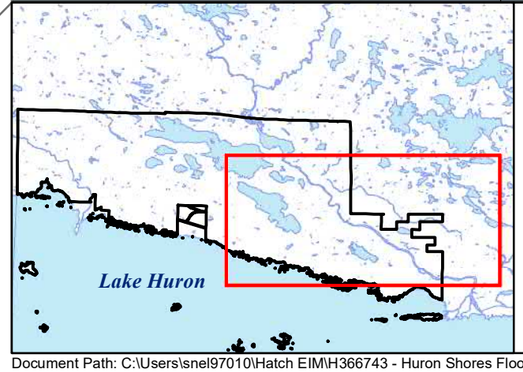
Rationale for level of confidence

Provide the rationale for the selected confidence level, including any references or sources to support the level assigned.	- The impacts of flooding were observed in 1979. - The predicted impact levels for a 1:100-yr flood event were based on a completed hazard identification and risk assessment.

National Disaster Mitigation Program
Risk Assessment Information Template

Key Information Sources	
Identify all supporting documentation and information sources for qualitative and quantitative data used to identify risk events, develop the risk event description, and assess impacts and likelihood. This ensures credibility and validity of risk information presented as well as enables referencing back to decision points at any point in time. Clearly identify unclassified and classified information.	*All information is unclassified "Flood Risk Assessment", completed by Hatch Ltd. in March 2022.
Description of the risk analysis team	
List and describe the type and level of experience of each individual who was involved with the completion of the risk assessment and risk analysis used to inform the information contained within this risk assessment information template.	Flood Risk Assessment was completed by Hatch Ltd. hydro-technical engineers Bethany Heppner, P.Eng., and Alfred Breland, P.Eng. Bethany has 5 years of experience directly related to hydrology and hydraulics, and Alfred Breland has 39 years of experience directly related to hydrology and hydraulics and the risks and concerns surrounding riverine flooding in rural and municipal areas.





LEGEND

- Buildings at Risk
- Flood Risk Area
- Huron Shores Municipal Boundary
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 1 2 4 km

1:70,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	RAIT Risk Area -Mississagi River
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 29, 2022
FIG NO.:	1

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\RAIT_Maps\RAIT_Fig1_MississagiRiver.mxd

Public Safety Canada | Sécurité publique Canada

Ottawa, Canada
K1A 0P8

National Disaster Mitigation Program (NDMP)
Risk Assessment Information Template

Risk Event Details			
Start and End Date	Provide the start and end dates of the selected event, based on historical data.	Start Date: 06/09/2013	End Date: 13/09/2013
Severity of the Risk Event	Provide details about the risk, including: • Speed of onset and duration of event; • Level and type of damaged caused; • Insurable and non-insurable losses; and • Other details, as appropriate.	Pickerel Creek, a tributary within the Mississagi River watershed. The significant 5-day precipitation event recorded at Sault Ste. Marie in early September 2013 totaled 90 mm of rain over 5 days, with 42 mm occurring on September 6. This event occurred across the northern shores of Lake Huron and resulted in historically high flood flows on September 10 in small river sub-basins from Sault Ste. Marie to Iron Bridge. This fall 2013 event caused flood damages across the Huron Shores municipality in direct physical damages to private and public property. An estimate of 1:100-yr flood risks has been studied (see attached Flood Risk Assessment report). The risk assessment indicates that a 1:100-yr flood will cause significant direct and indirect flood damages such as property loss, disruption in residential living conditions, loss of business, and disruption of major transportation routes.	
Response During the Risk Event	Provide details on how the defined geographic area continued its essential operations while responding to the event.	After OPP reports of flooded roads and washouts on September 10, emergency crews were activated. All roads were closed the morning of the event in order to assess conditions. Patrols revealed some 82 road washouts. A State of Emergency was declared at 11:15 a.m. on September 10, 2013. Public Information lines were available to answer calls for service. The media played a role in providing updates and advising of road closures/openings.	
Recovery Method for the Risk Event	Provide details on how the defined geographic area recovered.	Cleaning up after the flood included cleaning, repairing, and inspecting municipal roads; the event caused 365 hours of overtime. A total of 18 residences, 5 farms, 1 business and 2 non-profit organizations were impacted and took flood damaged debris to the landfill. All but 3 roads had been temporarily repaired by September 16, 2013 to allow for traffic flow.	
Recovery Costs Related to the Risk Event	Provide details on the costs, in dollars, associated with implementing recovery strategies following the event.	Total road repairs were estimated at $1.14 million at the time of the event. There were also municipal repairs for a couple of years following the event that were not tracked. The Municipality applied for financial assistance, in the amount of $325,803.41 under the Ontario Disaster Relief Program. All private claims were handled by a joint Disaster Relief Committee established under the Ontario Disaster Relief Program. The Committee handled private claims for all municipalities impacted across the North Shore and was overseen by the Township of Macdonald, Meredith and Aberdeen Additional.	

Recovery Time Related to the Risk Event	Provide details on the recovery time needed to return to normal operations following the event.	As per above, all but 3 roads were passable by September 16, 2013, but road issues appeared for years following the event. Emergency was terminated on September 23, 2013 as conditions, other than those road issues previously mentioned, had returned to pre-event status.

National Disaster Mitigation Program
Risk Assessment Information Template

Risk Event Identification and Overview	
Provide a qualitative description of the defined geographic area, including: • Watershed/community/region name(s); • Province/Territory; • Area type (i.e., city, township, watershed, organization, etc.); • Population size; • Population variances (e.g., significant change in population between summer and winter months); • Main economic areas of interest; • Special consideration areas (e.g., historical, cultural and natural resource areas); and an • Estimate of the annual operating budget of the area.	- The Municipality of Huron Shores, Ontario within the Thessalon and Mississagi River watersheds. Focus is on identified risk areas within both watersheds. - Huron Shores is the result of the 1999 amalgamation of the former Village of Iron Bridge, the Townships of Thessalon, Thompson and Day and Bright Additional, and the unincorporated geographic townships of Bright and Gladstone. - The Municipality has a permanent population of approximately 1,860 (2021 census). - There is a substantial influx of residents (cottagers and tourists) in the summer months. - The area has a long history of farming and logging as well as aggregate extraction. The Municipality celebrates its rich pioneer history with annual heritage days, fall fairs and civic festivals. - There are protected natural areas and major open spaces within the sub-watershed, including the Mississagi Delta Provincial Nature Reserve, marking the mouth of the largest river flowing into Lake Huron. - Areas of economic interest within the Mississagi River watershed include the commercial district of Iron Bridge. - Annual operating budget for the entire Municipality of Huron Shores is $7.1 million for 2021.
Methodolgies, processes and analyses	
Provide the year in which the following processes/analyses were last completed and state the methodology(ies) used: • Hazard identification; • Vulnerability analysis; • Likelihood assessment; • Impact assessment; • Risk assessment; • Resiliency assessment; and/or • Climate change impact and/or adaptation assessment. *Note: It is recognized that many of the processes/analyses mentioned above may be included within one methodology.*	- A Flood Risk Assessment report was completed for the Municipality of Huron Shores in March 2022. - There were four steps completed: Background Review, Hydrology Assessment, Hydraulics Assessment, Hazard Identification and Risk Assessment. - Hazard Identification involved identification of the hazards through hydraulic modeling of flood levels that could impact the community. All hazards associated with the 1:100-yr flood were reviewed. - Risk Assessment examined the level of risk for each hazard. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance, and critical infrastructure was examined.

National Disaster Mitigation Program
Risk Assessment Information Template

Hazard Mapping	
To complete this section: • Obtain a map of the area that clearly indicates general land uses, neighbourhoods, landmarks, etc. For clarity throughout this exercise, it may be beneficial to omit any non-essential information from the map intended for use. Controlled photographs (e.g. aerial photography) can be used in place of or in addition to existing maps to avoid the cost of producing new maps. • Place a grid over the maps/photographs of the area and assign row and column identifiers. This will help identify the specific area(s) that may be impacted, as well as additional information on the characteristics within and affecting the area. • Identify where and how flood hazards may affect the defined geographic area. • Identify the mapped areas that are most likely to be impacted by the identified flood hazard. Map(s)/photograph(s) can also be used, where appropriate, to visually represent the information/prioritization being provided as part of this template.	
Hazard identification and prioritization	
List known or likely flood hazards to the defined geographic area in order of proposed priority. For example: (1) dyke breach overland flooding; (2) urban storm surge flooding ; and so on.	(1) Rain events causing riverine flooding, erosion and highway/road washout. (2) Riverine flooding causing inundation of residential property and potential loss of life. (3) Riverine flooding causing washouts of the Trans-Canada Highway, municipal roads and bridges. (4) Erosion of shorelines causing loss of residential and agricultural lands.
Provide a rationale for each prioritization and the key information sources supporting this rationale.	- Based on the Flood Risk Assessment, see attached. - Floodplain mapping is not available for any area of Pickerel Creek. - Significant rain events will produce high water levels on Pickerel Creek.
Risk Event Title	
Identify the name/title of the risk. An example of a risk event name or title is: "A one-in-one hundred year flood following an extreme rain event."	A one-in-one hundred year (1:100-yr) flood event following a severe rainfall-on-snow event. A one-in-one hundred year (1:100-yr) flood event following a severe summer or fall rainfall event.
Type of Flood Hazard	
Identify the type of flood hazard being described (e.g., riverine flooding, coastal inundation, urban run-off, etc.)	Trans-Canada Highway washout. Riverine flooding. Shoreline erosion.

National Disaster Mitigation Program
Risk Assessment Information Template

Secondary hazards	
Describe any secondary effects resulting from the risk event (e.g., flooding that occurs following a hurricane).	Erosion of shorelines and loss of residential and agricultural land. Environmental impacts from erosion of shorelines (loss of trees, loss of water fowl and amphibian nesting areas).
Primary and secondary organizations for response	
Identify the primary organization(s) with a mandate related to a key element of a natural disaster emergency, and any supporting organization(s) that provide general or specialized assistance in response to a natural disaster emergency.	(1) Emergency Management Ontario (2) Municipality of Huron Shores

Risk Event Description	
Description of risk event, including risk statement and cause(s) of the event	
Provide a baseline description of the risk event, including: • Risk statement; • Context of the risk event; • Nature and scale of the risk event; • Lead-up to the risk event, including underlying cause and trigger/stimulus of the risk event; and • Any factors that could affect future events. *Note: The description entered here must be plausible in that factual information would support such a risk event.*	Risk Statement - Significant rainfall-on-snow event or significant summer/fall rainfall event, resulting in riverine flooding, loss of some critical infrastructure (bridges) for no less than one week. Context - The estimated 1:100-yr flood event that has been assessed through a hydrology study. Scale - The 1:100-yr flood event would have a broad effect across the entire Municipality and likely impact, either directly or indirectly, the entire population of the Municipality. Spring Lead-up - Accumulation of a large winter snowpack, combined with warm spring temperatures and a significant rainfall prior to the flood event. Summer/Fall Lead-up - A significant 3-day to 5-day rainfall prior to the flood event. Factors - Climate change will increase the probability of more severe rainfall storm events and the likelihood of significant short duration rainfall.

National Disaster Mitigation Program
Risk Assessment Information Template

Location	
Provide details regarding the area impacted by the risk event such as: • Province(s)/territory(ies); • Region(s) or watershed(s); • Municipality(ies); • Community(ies); and so on.	The areas within the Municipality of Huron Shores along the rivers and creeks in the watersheds of the Thessalon River and Mississagi River. Pickerel Creek is a tributary of the Mississagi River with agricultural and residential lands along the shores.
Natural environment considerations	
Document relevant physical or environmental characteristics of the defined geographic area.	- This is a rural area. - Pickerel Creek is surrounded by residential, rural, and agricultural land uses. - The river functions as a warm water fishery.
Meteorological conditions	
Identify the relevant meteorological conditions that may influence the outcome of the risk event.	- The fall 2013 flood event was caused by a significant 5-day rainfall event. - A significant rain-on-snow event would cause similar damages.

Seasonal conditions	
Identify the relevant seasonal changes that may influence the outcome of the risk assessment of a particular risk event.	- Annual flood threats in the spring based on rainfall and ice conditions. - Significant summer/fall rainfall events are increasing in frequency and magnitude, and are causing larger than historical spring floods on small river basins. - Climate change is impacting seasonal changes, making certain events more likely, such as significant summer/fall rain events.
Nature and vulnerability	
Document key elements related to the affected population, including: • Population density; • Vulnerable populations (identify these on the hazard map from step 7); • Degree of urbanization; • Key local infrastructure in the defined geographic area; • Economic and political considerations; and • Other elements, as deemed pertinent to the defined geographic area.	- The Municipality of Huron Shores has a population density of 4.1 people per square kilometre. The area surrounding Pickerel Creek is primarily very low population density. - See Map attached for an indication of vulnerable populations. - Highway 17 (Trans-Canada Highway), several rural municipal roads and local roads are within the predicted floodplain areas. - Flooding would result in a loss of access over the Trans-Canada Highway and municipal roads.

National Disaster Mitigation Program
Risk Assessment Information Template

Asset inventory	
Identify the asset inventory of the defined geographic area, including: • Critical assets; • Cultural or historical assets; • Commercial assets; and • Other area assets, as applicable to the defined geographic area. Key asset-related information should also be provided, including: • Location on the hazard map (from step 7); • Size; • Structure replacement cost; • Content value; • Displacement costs; • Importance rating and rationale; • Vulnerability rating and reason; and • Average daily cost to operate. A total estimated value of physical assets in the area should also be provided.	- The main critical assets in the subject area include municipal roads and bridges. - Cultural or historical assets are not known in the area. - Commercial assets include agricultural operations and potentially rental cottages. - Other assets include residential properties and potentially boat houses. - The included Map provides a broader look at the assets. - Limited information is available related to the asset information. - The value associated with these assets was not readily available but could be produced with a more detailed assessment of risk after the floodplain maps are produced.
Other assumptions, variability and/or relevant information	
Identify any assumptions made in describing the risk event; define details regarding any areas of uncertainty or unpredictability around the risk event; and supply any supplemental information, as applicable.	A hydrology study was performed to assess the magnitude of the flood risk event (1:100-yr flood). The event is described in the attached reports.
Existing Risk Treatment Measures	
Identify existing risk treatment measures that are currently in place within the defined geographic area to mitigate the risk event, and describe the sufficiency of these risk treatment measures.	The Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) is responsible for flood forecasting and warning throughout the watershed. However, it is unlikely that any specific details would be provided for Pickerel Creek since it is not monitored and is a minor tributary to Mississagi River. A flood warning program would greatly benefit from updated mapping to help identify specific flood inundation zones and identify which areas pose the greatest hazard.

National Disaster Mitigation Program
Risk Assessment Information Template

Likelihood Assessment	
Return Period	
Identify the time period during which the risk event might occur. For example, the risk event described is expected to occur once every X number of years. Applicants are asked to provide the X value for the risk event.	The one-in-one hundred year (1:100-yr) flood event is expected to have a less than 1% Annual Exceedance Probability (AEP).
Period of interest	
Applicants are asked to determine and identify the likelihood rating (i.e. period of interest) for the risk event described by using the likelihood rating scale within the table below.	

Likelihood Rating	**Definition**	
5	The event is expected and may be triggered by conditions expected over a 30 year period.	5
4	The event is expected and may be triggered by conditions expected over a 30 - 50 year period.	
3	The event is expected and may be triggered by conditions expected over a 50 - 500 year period.	
2	The event is expected and may be triggered by conditions expected over a 500 - 5000 year period.	
1	The event is possible and may be triggered by conditions exceeding a period of 5000 years.	

Provide any other relevant information, notes or comments relating to the likelihood assessment, as applicable.	While the event has an Annual Exceedance Probability (AEP) of 1%, if we assume a 30-yr period, a 1% AEP has a 26% chance of occurring. For this reason, a likelihood rating of 5 was selected. This is supported by historical events around the Great Lakes, including the fall 2013 event in the Huron Shores municipality, as well as the Muskoka River watershed where the 1:100-yr flood has occurred two times in the last 7 years.

National Disaster Mitigation Program
Risk Assessment Information Template

Impacts/Consequences Assessment

There are 12 impacts categories within 5 impact classes rated on a scale of 1 (least impacts) to 5 (greatest impact). Conduct an assessment of the impacts associated with the risk event, and assign one risk rating for each category. Additional information may be provided for each of the categories in the supplemental fields provided.

A) People and societal impacts

	Risk Rating	Definition	Assigned risk rating
Fatalities	5	Could result in more than 50 fatalities	4
	4	Could result in 10 - 49 fatalities	
	3	Could result in 5 - 9 fatalities	
	2	Could result in 1 - 4 fatalities	
	1	Not likely to result in fatalities	
Supplemental information (optional)	As per attached Flood Risk Assessment and Pickerel Creek Flood Risk Map indicating buildings at risk of flooding, of which some are permanent and summer residences.		
Injuries	5	Injuries, illness and/or psychological disablements cannot be addressed by local, regional, or provincial/territorial healthcare resources; federal support or intervention is required	1
	4	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources; provincial/territorial healthcare support or intervention is required.	
	3	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources additional healthcare support or intervention is required from other regions, and supplementary support could be required from the province/territory	
	2	Injuries, illnesses and/or psychological disablements cannot be addressed by local resources through local facilities; healthcare support is required from other areas such as an adjacent area(ies)/municipality(ies) within the region	
	1	Any injuries, illnesses, and/or psychological disablements can be addressed by local resources through local facilities; available resources can meet the demand for care	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

		Risk Rating	Definition	Assigned risk rating
Displacement	Percentage of displaced individuals	5	> 15% of total local population	1
		4	10 - 14.9% of total local population	
		3	5 - 9.9% of total local population	
		2	2 - 4.9% of total local population	
		1	0 - 1.9% of total local population	
	Duration of displacement	5	> 26 weeks (6 months)	4
		4	4 weeks - 26 weeks (6 months)	
		3	1 week - 4 weeks	
		2	72 hours - 168 hours (1 week)	
		1	Less than 72 hours	
Supplemental information (optional)		As per Flood Risk Assessment, based on entire municipality. Actual ratio within defined geographic area would be higher. A more detailed risk assessment would be required to accurately assign rating.		
B) Environmental impacts				
		5	> 75% of flora or fauna impacted or 1 or more ecosystems significantly impaired; Air quality has significantly deteriorated; Water quality is significantly lower than normal or water level is > 3 meters above highest natural level; Soil quality or quantity is significantly lower (i.e., significant soil loss, evidence of lethal soil contamination) than normal; > 15% of local area is affected	3
		4	40 - 74.9% of flora or fauna impacted or 1 or more ecosystems considerably impaired; Air quality has considerably deteriorated; Water quality is considerably lower than normal or water level is 2 - 2.9 meters above highest natural level; Soil quality or quantity is moderately lower than normal; 10 - 14.9% of local area is affected	
		3	10 - 39.9% of flora or fauna impacted or 1 1 or more ecosystems moderately impaired; Air quality has moderately deteriorated; Water quality is moderately lower than normal or water level is 1 - 2 meters above highest natural level; Soil quality is moderately lower than normal; 6 - 9.9 % of area affected	

National Disaster Mitigation Program
Risk Assessment Information Template

	2	< 10 % of flora or fauna impacted or little or no impact to any ecosystems; Little to no impact to air quality and/or soil quality or quantity; Water quality is slightly lower than normal, or water level is less than 0.9 meters above highest natural level and increased for less than 24 hours; 3 - 5.9 % of local area is affected	
	1	Little to no impact to flora or fauna, any ecosystems, air quality, water quality or quantity, or to soil quality or quantity; 0 - 2.9 % of local area is affected	
Supplemental information (optional)			

C) Local economic impacts

	Risk Rating	**Definition**	**Assigned risk rating**
	5	> 15 % of local economy impacted	2
	4	10 - 14.9 % of local economy impacted	
	3	6 - 9.9 % of local economy impacted	
	2	3 - 5.9 % of local economy impacted	
	1	0 - 2.9 % of local economy impacted	
Supplemental information (optional)	Based on land flooded in the local Pickerel Creek area.		

National Disaster Mitigation Program
Risk Assessment Information Template

D) Local infrastructure impacts			
	Risk Rating	**Definition**	**Assigned risk rating**
Transportation	5	Local activity stopped for more than 72 hours; > 20% of local population affected; lost access to local area and/or delivery of crucial service or product; or having an international level impact	5
	4	Local activity stopped for 48 - 71 hours; 10 - 19.9% of local population affected; significantly reduced access to local area and/or delivery of crucial service or product; or having a national level impact	
	3	Local activity stopped for 25 - 47 hours; 5 - 9.9% of local population affected; moderately reduced access to local area and/or delivery of crucial service or product; or having a provincial/territorial level impact	
	2	Local activity stopped for 13 - 24 hours; 2 - 4.9% of local population affected; minor reduction in access to local area and/or delivery of crucial service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	
Supplemental information (optional)	Trans-Canada Highway, municipal roads and local access roads flooded as per attached Risk Maps.		
Energy and Utilities	5	Duration of impacts > 72 hours; > 20% of local population without service or product; or having an international level impact	1
	4	Duration of impact 48 - 71 hours; 10 - 19.9% of local population without service or product; or having a national impact	
	3	Duration of impact 25 - 47 hours; 5 - 9.9% of local population without service or product; or having a provincial/territorial level impact	
	2	Duration of impact 13 - 24 hours; 2 - 4.9% of local population without service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Information and Communications Technology	5	Service unavailable for > 72 hours; > 20 % of local population without service; or having an international level impact	1
	4	Service unavailable for 48 - 71 hours; 10 - 19.9 % of local population without service; or having a national level impact	
	3	Service unavailable for 25 - 47 hours; 5 - 9.9 % of local population without service; or having a provincial/territorial level impact	
	2	Service unavailable for 13 - 24 hours; 2 - 4.9 % of local population without service; or having a regional level impact	
	1	Service unavailable for 0 - 12 hours; 0 - 1.9 % of local population without service	
Supplemental information (optional)			
Health, Food, and Water	5	Inability to access potable water, food, sanitation services, or healthcare services for > 72 hours; non - essential services cancelled; > 20 % of local population impacted; or having an international level impact	1
	4	Inability to access potable water, food, sanitation services, or healthcare services for 48 - 72 hours; major delays for nonessential services; 10 - 19.9 % of local population impacted; or having a national level impact	
	3	Inability to access potable water, food, sanitation services, or healthcare services for 25 - 48 hours; moderate delays for nonessential services; 5 - 9.9 % of local population impacted; or having a provincial/territorial level impact	
	2	Inability to access potable water, food, sanitation services, or healthcare services for 13 - 24 hours; minor delays for nonessential; 2 - 4.9 % of local population impacted; or having a regional level impact	
	1	Inability to access potable water, food, sanitation services, or healthcare services for 0 - 12 hours; 0 - 1.9 % of local population impacted	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Safety and Security	5	> 20 % of local population impacted; loss of intelligence or defence assets or systems for > 72 hours; or having an international level impact	1
	4	10 - 19.9 % of local population impacted; loss of intelligence or defence assets or systems for 48 – 71 hours; or having a national level impact	
	3	5 - 9.9 % of local population impacted; loss of intelligence or defence assets or systems for 25 – 47 hours; or having a provincial/territorial level impact	
	2	2 - 4.9 % of local population impacted; loss of intelligence or defence assets or systems for 13 – 24 hours; or having a regional level impact	
	1	0 - 1.9 % of local population impacted; loss of intelligence or defence assets or systems for 0 – 12 hours	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

E) Public sensitivity impacts			
	Risk Rating	Definition	Assigned risk rating
	5	Sustained, long term loss in reputation/public perception of public institutions and/or sustained, long term loss of trust and confidence in public institutions; or having an international level impact	3
	4	Significant loss in reputation/public perception of public institutions and/or significant loss of trust and confidence in public institutions; significant resistance; or having a national level impact	
	3	Some loss in reputation/public perception of public institutions and/or some loss of trust and confidence in public institutions; escalating resistance	
	2	Isolated/minor, recoverable set - back in reputation, public perception, trust, and/or confidence of public institutions	
	1	No impact on reputation, public perception, trust, and/or confidence of public institutions	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

Confidence Assessment

Based on the table below, indicate the level of confidence regarding the information entered in the risk assessment information template in the "Confidence Level Assigned" column. Confidence levels are language - based and range from A to E (A=most confident to E=least confident).

Confidence Level	Definition	Confidence Level Assigned
A	Very high degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of high - quality data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of existing/known mitigation measures	
B	High degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with some subject matter expertise (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of potential mitigation measures	

National Disaster Mitigation Program
Risk Assessment Information Template

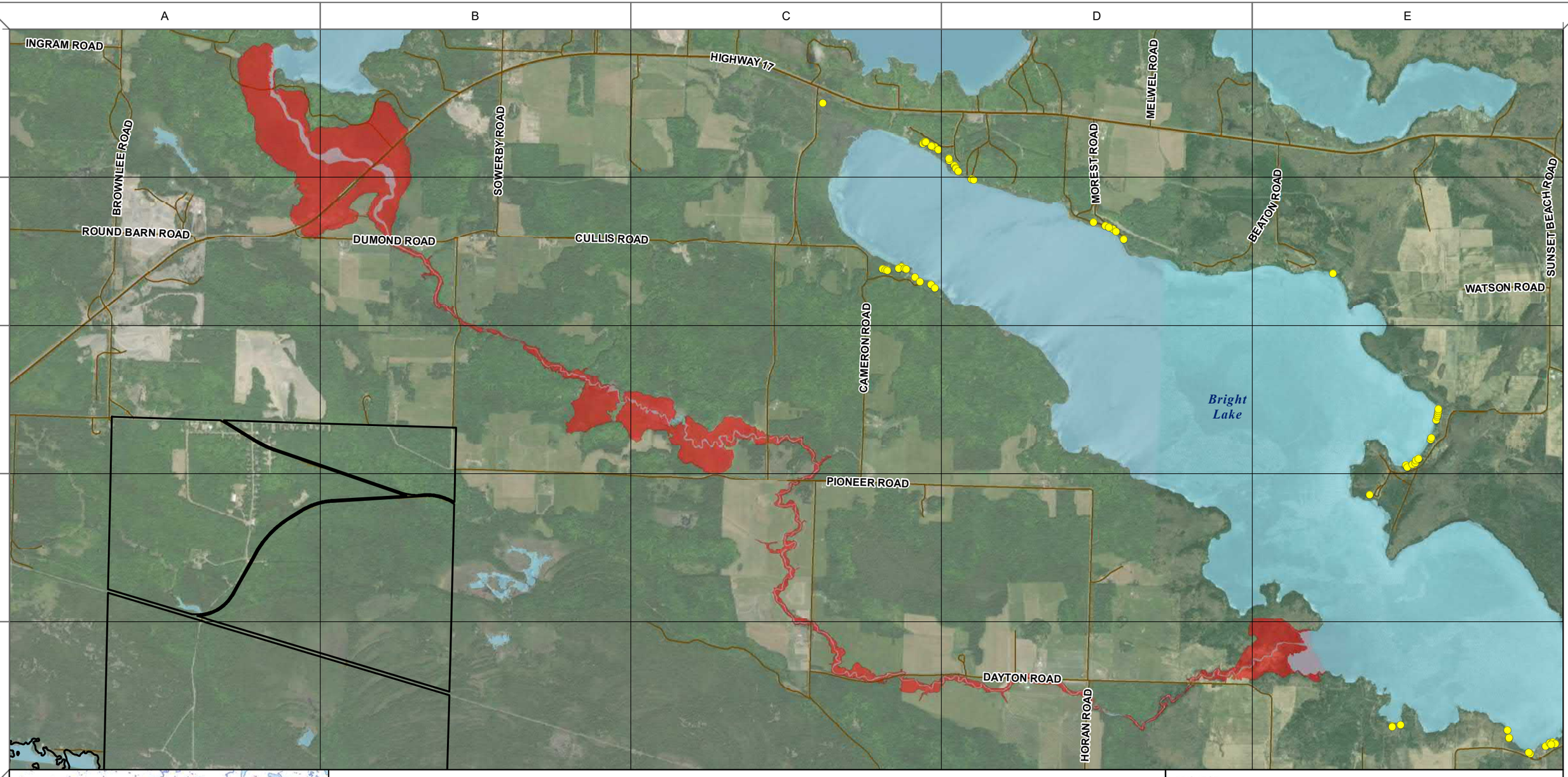
C	Moderate confidence Risk assessment used to inform the risk assessment information template was moderately evidence - based from a considerable amount of knowledge of the natural hazard risk event; leveraged a considerable quantity of data that was quantitative and/or qualitative in nature; leveraged a considerable amount of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a moderately sized multidisciplinary team, incorporating some subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a large number of potential mitigation measures	A
D	Low confidence Risk assessment used to inform the risk assessment information template was based on a relatively small amount of knowledge of the natural hazard risk event; leveraged a relatively small quantity of quantitative and/or qualitative data that was largely historical in nature; may have leveraged some geospatial information or information from other sources (i.e., databases, key risk and resilience methodologies); and the risk assessment and analysis processes were completed by a small team that may or may not have incorporated subject matter experts (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts considered a relatively small number of potential mitigation measures	
E	Very low confidence Risk assessment used to inform the risk assessment information template was not evidence - based; leveraged a small quantity of information and/or data relating to the natural risk hazard and risk event; primary qualitative information used with little to no quantitative data or information; and the risk assessment and analysis processes were completed by an individual or small group of individuals little subject matter expertise (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts did not consider existing or potential mitigation measures	

Rationale for level of confidence

Provide the rationale for the selected confidence level, including any references or sources to support the level assigned.	- The impacts of flooding were observed in 2013. - The predicted impact levels for a 1:100-yr flood event were based on a completed hazard identification and risk assessment.

National Disaster Mitigation Program
Risk Assessment Information Template

Key Information Sources	
Identify all supporting documentation and information sources for qualitative and quantitative data used to identify risk events, develop the risk event description, and assess impacts and likelihood. This ensures credibility and validity of risk information presented as well as enables referencing back to decision points at any point in time. Clearly identify unclassified and classified information.	*All information is unclassified "Flood Risk Assessment", completed by Hatch Ltd. in March 2022.
Description of the risk analysis team	
List and describe the type and level of experience of each individual who was involved with the completion of the risk assessment and risk analysis used to inform the information contained within this risk assessment information template.	Flood Risk Assessment was completed by Hatch Ltd. hydro-technical engineers Bethany Heppner, P.Eng., and Alfred Breland, P.Eng. Bethany has 5 years of experience directly related to hydrology and hydraulics, and Alfred Breland has 39 years of experience directly related to hydrology and hydraulics and the risks and concerns surrounding riverine flooding in rural and municipal areas.



LEGEND

- Buildings at Risk
- Flood Risk Area
- Huron Shores Municipal Boundary
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.5 1 2 km

1:33,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	RAIT Risk Area - Pickerel Creek
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 29, 2022
FIG NO.:	1

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\RAIT_Maps\RAIT_Fig1_PickerelCreek.mxd

Public Safety Canada | Sécurité publique Canada

Ottawa, Canada
K1A 0P8

National Disaster Mitigation Program (NDMP)
Risk Assessment Information Template

Risk Event Details			
Start and End Date	Provide the start and end dates of the selected event, based on historical data.	Start Date: 06/09/2013	End Date: 13/09/2013
Severity of the Risk Event	Provide details about the risk, including: • Speed of onset and duration of event; • Level and type of damaged caused; • Insurable and non-insurable losses; and • Other details, as appropriate.	Thessalon River, a tributary within the Thessalon River watershed. The significant 5-day precipitation event recorded at Sault Ste. Marie in early September 2013 totaled 90 mm of rain over 5 days, with 42 mm occurring on September 6. This event occurred across the northern shores of Lake Huron and resulted in historically high flood flows on September 10 in small river sub-basins from Sault Ste. Marie to Iron Bridge. This fall 2013 event caused flood damages across the Huron Shores municipality in direct physical damages to private and public property. An estimate of 1:100-yr flood risks has been studied (see attached Flood Risk Assessment report). The risk assessment indicates that a 1:100-yr flood will cause significant direct and indirect flood damages such as property loss, disruption in residential living conditions, loss of business, and disruption of major transportation routes.	
Response During the Risk Event	Provide details on how the defined geographic area continued its essential operations while responding to the event.	After OPP reports of flooded roads and washouts on September 10, emergency crews were activated. All roads were closed the morning of the event in order to assess conditions. Patrols revealed some 82 road washouts. A State of Emergency was declared at 11:15 a.m. on September 10, 2013. Public Information lines were available to answer calls for service. The media played a role in providing updates and advising of road closures/openings.	
Recovery Method for the Risk Event	Provide details on how the defined geographic area recovered.	Cleaning up after the flood included cleaning, repairing, and inspecting municipal roads; the event caused 365 hours of overtime. A total of 18 residences, 5 farms, 1 business and 2 non-profit organizations were impacted and took flood damaged debris to the landfill. All but 3 roads had been temporarily repaired by September 16, 2013 to allow for traffic flow.	
Recovery Costs Related to the Risk Event	Provide details on the costs, in dollars, associated with implementing recovery strategies following the event.	Total road repairs were estimated at $1.14 million at the time of the event. There were also municipal repairs for a couple of years following the event that were not tracked. The Municipality applied for financial assistance, in the amount of $325,803.41 under the Ontario Disaster Relief Program. All private claims were handled by a joint Disaster Relief Committee established under the Ontario Disaster Relief Program. The Committee handled private claims for all municipalities impacted across the North Shore and was overseen by the Township of Macdonald, Meredith and Aberdeen Additional.	

Recovery Time Related to the Risk Event	Provide details on the recovery time needed to return to normal operations following the event.	As per above, all but 3 roads were passable by September 16, 2013, but road issues appeared for years following the event. Emergency was terminated on September 23, 2013 as conditions, other than those road issues previously mentioned, had returned to pre-event status.

National Disaster Mitigation Program
Risk Assessment Information Template

Risk Event Identification and Overview	
Provide a qualitative description of the defined geographic area, including: • Watershed/community/region name(s); • Province/Territory; • Area type (i.e., city, township, watershed, organization, etc.); • Population size; • Population variances (e.g., significant change in population between summer and winter months); • Main economic areas of interest; • Special consideration areas (e.g., historical, cultural and natural resource areas); and an • Estimate of the annual operating budget of the area.	- The Municipality of Huron Shores, Ontario within the Thessalon and Mississagi River watersheds. Focus is on identified risk areas within both watersheds. - Huron Shores is the result of the 1999 amalgamation of the former Village of Iron Bridge, the Townships of Thessalon, Thompson and Day and Bright Additional, and the unincorporated geographic townships of Bright and Gladstone. - The Municipality has a permanent population of approximately 1,860 (2021 census). - There is a substantial influx of residents (cottagers and tourists) in the summer months. - The area has a long history of farming and logging as well as aggregate extraction. The Municipality celebrates its rich pioneer history with annual heritage days, fall fairs and civic festivals. - There are protected natural areas and major open spaces within the sub-watershed, including the Mississagi Delta Provincial Nature Reserve, marking the mouth of the largest river flowing into Lake Huron. - Areas of economic interest within the Mississagi River watershed include the commercial district of Iron Bridge. - Annual operating budget for the entire Municipality of Huron Shores is $7.1 million for 2021.
Methodolgies, processes and analyses	
Provide the year in which the following processes/analyses were last completed and state the methodology(ies) used: • Hazard identification; • Vulnerability analysis; • Likelihood assessment; • Impact assessment; • Risk assessment; • Resiliency assessment; and/or • Climate change impact and/or adaptation assessment. *Note: It is recognized that many of the processes/analyses mentioned above may be included within one methodology.*	- A Flood Risk Assessment report was completed for the Municipality of Huron Shores in March 2022. - There were four steps completed: Background Review, Hydrology Assessment, Hydraulics Assessment, Hazard Identification and Risk Assessment. - Hazard Identification involved identification of the hazards through hydraulic modeling of flood levels that could impact the community. All hazards associated with the 1:100-yr flood were reviewed. - Risk Assessment examined the level of risk for each hazard. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance, and critical infrastructure was examined.

National Disaster Mitigation Program
Risk Assessment Information Template

Hazard Mapping	
To complete this section: • Obtain a map of the area that clearly indicates general land uses, neighbourhoods, landmarks, etc. For clarity throughout this exercise, it may be beneficial to omit any non-essential information from the map intended for use. Controlled photographs (e.g. aerial photography) can be used in place of or in addition to existing maps to avoid the cost of producing new maps. • Place a grid over the maps/photographs of the area and assign row and column identifiers. This will help identify the specific area(s) that may be impacted, as well as additional information on the characteristics within and affecting the area. • Identify where and how flood hazards may affect the defined geographic area. • Identify the mapped areas that are most likely to be impacted by the identified flood hazard. Map(s)/photograph(s) can also be used, where appropriate, to visually represent the information/prioritization being provided as part of this template.	
Hazard identification and prioritization	
List known or likely flood hazards to the defined geographic area in order of proposed priority. For example: (1) dyke breach overland flooding; (2) urban storm surge flooding ; and so on.	(1) Rain events causing riverine flooding and erosion. (2) Riverine flooding causing inundation of residential property and potential loss of life. (3) Riverine flooding causing washouts of municipal roads and bridges. (4) Erosion of shorelines causing loss of residential and agricultural lands.
Provide a rationale for each prioritization and the key information sources supporting this rationale.	- Based on the Flood Risk Assessment, see attached. - Floodplain mapping is not available for any area of Thessalon River. - Significant rain events will produce high water levels on Thessalon River.
Risk Event Title	
Identify the name/title of the risk. An example of a risk event name or title is: "A one-in-one hundred year flood following an extreme rain event."	A one-in-one hundred year (1:100-yr) flood event following a severe rainfall-on-snow event. A one-in-one hundred year (1:100-yr) flood event following a severe summer or fall rainfall event.
Type of Flood Hazard	
Identify the type of flood hazard being described (e.g., riverine flooding, coastal inundation, urban run-off, etc.)	Riverine flooding. Shoreline erosion.

National Disaster Mitigation Program
Risk Assessment Information Template

Secondary hazards	
Describe any secondary effects resulting from the risk event (e.g., flooding that occurs following a hurricane).	Erosion of shorelines and loss of residential and agricultural land. Environmental impacts from erosion of shorelines (loss of trees, loss of water fowl and amphibian nesting areas).
Primary and secondary organizations for response	
Identify the primary organization(s) with a mandate related to a key element of a natural disaster emergency, and any supporting organization(s) that provide general or specialized assistance in response to a natural disaster emergency.	(1) Emergency Management Ontario (2) Municipality of Huron Shores

Risk Event Description	
Description of risk event, including risk statement and cause(s) of the event	
Provide a baseline description of the risk event, including: • Risk statement; • Context of the risk event; • Nature and scale of the risk event; • Lead-up to the risk event, including underlying cause and trigger/stimulus of the risk event; and • Any factors that could affect future events. *Note: The description entered here must be plausible in that factual information would support such a risk event.*	Risk Statement - Significant rainfall-on-snow event or significant summer/fall rainfall event, resulting in riverine flooding, loss of some critical infrastructure (bridges) for no less than one week. Context - The estimated 1:100-yr flood event that has been assessed through a hydrology study. Scale - The 1:100-yr flood event would have a broad effect across the entire Municipality and likely impact, either directly or indirectly, the entire population of the Municipality. Spring Lead-up - Accumulation of a large winter snowpack, combined with warm spring temperatures and a significant rainfall prior to the flood event. Summer/Fall Lead-up - A significant 3-day to 5-day rainfall prior to the flood event. Factors - Climate change will increase the probability of more severe rainfall storm events and the likelihood of significant short duration rainfall.

National Disaster Mitigation Program
Risk Assessment Information Template

Location	
Provide details regarding the area impacted by the risk event such as: • Province(s)/territory(ies); • Region(s) or watershed(s); • Municipality(ies); • Community(ies); and so on.	The areas within the Municipality of Huron Shores along the rivers and creeks in the watersheds of the Thessalon River and Mississagi River. Thessalon River is the main river in the Thessalon River watershed with agricultural and residential lands along the shores.
Natural environment considerations	
Document relevant physical or environmental characteristics of the defined geographic area.	- This is a rural area. - Thessalon River is surrounded by residential, rural, and agricultural land uses. - The river functions as a warm water fishery.
Meteorological conditions	
Identify the relevant meteorological conditions that may influence the outcome of the risk event.	- The fall 2013 flood event was caused by a significant 5-day rainfall event. - A significant rain-on-snow event would cause similar damages.

National Disaster Mitigation Program
Risk Assessment Information Template

Seasonal conditions	
Identify the relevant seasonal changes that may influence the outcome of the risk assessment of a particular risk event.	- Annual flood threats in the spring based on rainfall and ice conditions. - Significant summer/fall rainfall events are increasing in frequency and magnitude, and are causing larger than historical spring floods on small river basins. - Climate change is impacting seasonal changes, making certain events more likely, such as significant summer/fall rain events.
Nature and vulnerability	
Document key elements related to the affected population, including: • Population density; • Vulnerable populations (identify these on the hazard map from step 7); • Degree of urbanization; • Key local infrastructure in the defined geographic area; • Economic and political considerations; and • Other elements, as deemed pertinent to the defined geographic area.	- The Municipality of Huron Shores has a population density of 4.1 people per square kilometre. The area surrounding Thessalon River is primarily very low density but has some areas of low density approaching Lake Huron. - See Map attached for an indication of vulnerable populations. - There are rural municipal roads (Collver Road, River Road and Sherwood Road) and local roads within the predicted floodplain areas. - Flooding would result in a loss of access over the roads.

National Disaster Mitigation Program
Risk Assessment Information Template

Asset inventory	
Identify the asset inventory of the defined geographic area, including: • Critical assets; • Cultural or historical assets; • Commercial assets; and • Other area assets, as applicable to the defined geographic area. Key asset-related information should also be provided, including: • Location on the hazard map (from step 7); • Size; • Structure replacement cost; • Content value; • Displacement costs; • Importance rating and rationale; • Vulnerability rating and reason; and • Average daily cost to operate. A total estimated value of physical assets in the area should also be provided.	- The main critical assets in the subject area include municipal roads and bridges. - Cultural or historical assets are not known in the area. - Commercial assets include agricultural operations and potentially rental cottages. - Other assets include residential properties and potentially boat houses. - The included Map provides a broader look at the assets. - Limited information is available related to the asset information. - The value associated with these assets was not readily available but could be produced with a more detailed assessment of risk after the floodplain maps are produced.
Other assumptions, variability and/or relevant information	
Identify any assumptions made in describing the risk event; define details regarding any areas of uncertainty or unpredictability around the risk event; and supply any supplemental information, as applicable.	A hydrology study was performed to assess the magnitude of the flood risk event (1:100-yr flood). The event is described in the attached reports.
Existing Risk Treatment Measures	
Identify existing risk treatment measures that are currently in place within the defined geographic area to mitigate the risk event, and describe the sufficiency of these risk treatment measures.	The Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) is responsible for flood forecasting and warning throughout the watershed. However, it is unlikely that any specific details would be provided for Thessalon River since it is not monitored. A flood warning program would greatly benefit from updated mapping to help identify specific flood inundation zones and identify which areas pose the greatest hazard.

National Disaster Mitigation Program
Risk Assessment Information Template

Likelihood Assessment	
Return Period	
Identify the time period during which the risk event might occur. For example, the risk event described is expected to occur once every X number of years. Applicants are asked to provide the X value for the risk event.	The one-in-one hundred year (1:100-yr) flood event is expected to have a less than 1% Annual Exceedance Probability (AEP).
Period of interest	
Applicants are asked to determine and identify the likelihood rating (i.e. period of interest) for the risk event described by using the likelihood rating scale within the table below.	

Likelihood Rating	**Definition**	
5	The event is expected and may be triggered by conditions expected over a 30 year period.	5
4	The event is expected and may be triggered by conditions expected over a 30 - 50 year period.	
3	The event is expected and may be triggered by conditions expected over a 50 - 500 year period.	
2	The event is expected and may be triggered by conditions expected over a 500 - 5000 year period.	
1	The event is possible and may be triggered by conditions exceeding a period of 5000 years.	

Provide any other relevant information, notes or comments relating to the likelihood assessment, as applicable.	While the event has an Annual Exceedance Probability (AEP) of 1%, if we assume a 30-yr period, a 1% AEP has a 26% chance of occurring. For this reason, a likelihood rating of 5 was selected. This is supported by historical events around the Great Lakes, including the fall 2013 event in the Huron Shores municipality, as well as the Muskoka River watershed where the 1:100-yr flood has occurred two times in the last 7 years.

National Disaster Mitigation Program
Risk Assessment Information Template

Impacts/Consequences Assessment

There are 12 impacts categories within 5 impact classes rated on a scale of 1 (least impacts) to 5 (greatest impact). Conduct an assessment of the impacts associated with the risk event, and assign one risk rating for each category. Additional information may be provided for each of the categories in the supplemental fields provided.

A) People and societal impacts

	Risk Rating	Definition	Assigned risk rating
Fatalities	5	Could result in more than 50 fatalities	4
	4	Could result in 10 - 49 fatalities	
	3	Could result in 5 - 9 fatalities	
	2	Could result in 1 - 4 fatalities	
	1	Not likely to result in fatalities	
Supplemental information (optional)	As per attached Flood Risk Assessment and Thessalon River Flood Risk Map indicating buildings at risk of flooding, of which some are permanent and summer residences.		
Injuries	5	Injuries, illness and/or psychological disablements cannot be addressed by local, regional, or provincial/territorial healthcare resources; federal support or intervention is required	1
	4	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources; provincial/territorial healthcare support or intervention is required.	
	3	Injuries, illnesses and/or psychological disablements cannot be addressed by local or regional healthcare resources additional healthcare support or intervention is required from other regions, and supplementary support could be required from the province/territory	
	2	Injuries, illnesses and/or psychological disablements cannot be addressed by local resources through local facilities; healthcare support is required from other areas such as an adjacent area(ies)/municipality(ies) within the region	
	1	Any injuries, illnesses, and/or psychological disablements can be addressed by local resources through local facilities; available resources can meet the demand for care	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

		Risk Rating	Definition	Assigned risk rating
Displacement	Percentage of displaced individuals	5	> 15% of total local population	1
		4	10 - 14.9% of total local population	
		3	5 - 9.9% of total local population	
		2	2 - 4.9% of total local population	
		1	0 - 1.9% of total local population	
	Duration of displacement	5	> 26 weeks (6 months)	4
		4	4 weeks - 26 weeks (6 months)	
		3	1 week - 4 weeks	
		2	72 hours - 168 hours (1 week)	
		1	Less than 72 hours	
Supplemental information (optional)		As per Flood Risk Assessment, based on entire municipality. Actual ratio within defined geographic area would be higher. A more detailed risk assessment would be required to accurately assign rating.		
B) Environmental impacts				
		5	> 75% of flora or fauna impacted or 1 or more ecosystems significantly impaired; Air quality has significantly deteriorated; Water quality is significantly lower than normal or water level is > 3 meters above highest natural level; Soil quality or quantity is significantly lower (i.e., significant soil loss, evidence of lethal soil contamination) than normal; > 15% of local area is affected	3
		4	40 - 74.9% of flora or fauna impacted or 1 or more ecosystems considerably impaired; Air quality has considerably deteriorated; Water quality is considerably lower than normal or water level is 2 - 2.9 meters above highest natural level; Soil quality or quantity is moderately lower than normal; 10 - 14.9% of local area is affected	
		3	10 - 39.9% of flora or fauna impacted or 1 1 or more ecosystems moderately impaired; Air quality has moderately deteriorated; Water quality is moderately lower than normal or water level is 1 - 2 meters above highest natural level; Soil quality is moderately lower than normal; 6 - 9.9 % of area affected	

National Disaster Mitigation Program
Risk Assessment Information Template

	2	< 10 % of flora or fauna impacted or little or no impact to any ecosystems; Little to no impact to air quality and/or soil quality or quantity; Water quality is slightly lower than normal, or water level is less than 0.9 meters above highest natural level and increased for less than 24 hours; 3 - 5.9 % of local area is affected	
	1	Little to no impact to flora or fauna, any ecosystems, air quality, water quality or quantity, or to soil quality or quantity; 0 - 2.9 % of local area is affected	
Supplemental information (optional)			

C) Local economic impacts

	Risk Rating	Definition	Assigned risk rating
	5	> 15 % of local economy impacted	2
	4	10 - 14.9 % of local economy impacted	
	3	6 - 9.9 % of local economy impacted	
	2	3 - 5.9 % of local economy impacted	
	1	0 - 2.9 % of local economy impacted	
Supplemental information (optional)	Based on land flooded in the local Thessalon River area.		

National Disaster Mitigation Program
Risk Assessment Information Template

D) Local infrastructure impacts			
	Risk Rating	**Definition**	**Assigned risk rating**
Transportation	5	Local activity stopped for more than 72 hours; > 20% of local population affected; lost access to local area and/or delivery of crucial service or product; or having an international level impact	5
	4	Local activity stopped for 48 - 71 hours; 10 - 19.9% of local population affected; significantly reduced access to local area and/or delivery of crucial service or product; or having a national level impact	
	3	Local activity stopped for 25 - 47 hours; 5 - 9.9% of local population affected; moderately reduced access to local area and/or delivery of crucial service or product; or having a provincial/territorial level impact	
	2	Local activity stopped for 13 - 24 hours; 2 - 4.9% of local population affected; minor reduction in access to local area and/or delivery of crucial service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	
Supplemental information (optional)	Municipal roads and local access roads flooded as per attached Risk Maps.		
Energy and Utilities	5	Duration of impacts > 72 hours; > 20% of local population without service or product; or having an international level impact	1
	4	Duration of impact 48 - 71 hours; 10 - 19.9% of local population without service or product; or having a national impact	
	3	Duration of impact 25 - 47 hours; 5 - 9.9% of local population without service or product; or having a provincial/territorial level impact	
	2	Duration of impact 13 - 24 hours; 2 - 4.9% of local population without service or product; or having a regional level impact	
	1	Local activity stopped for 0 - 12 hours; 0 - 1.9% of local population affected; little to no reduction in access to local area and/or delivery of crucial service or product	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Information and Communications Technology	5	Service unavailable for > 72 hours; > 20 % of local population without service; or having an international level impact	1
	4	Service unavailable for 48 - 71 hours; 10 - 19.9 % of local population without service; or having a national level impact	
	3	Service unavailable for 25 - 47 hours; 5 - 9.9 % of local population without service; or having a provincial/territorial level impact	
	2	Service unavailable for 13 - 24 hours; 2 - 4.9 % of local population without service; or having a regional level impact	
	1	Service unavailable for 0 - 12 hours; 0 - 1.9 % of local population without service	
Supplemental information (optional)			
Health, Food, and Water	5	Inability to access potable water, food, sanitation services, or healthcare services for > 72 hours; non - essential services cancelled; > 20 % of local population impacted; or having an international level impact	1
	4	Inability to access potable water, food, sanitation services, or healthcare services for 48 - 72 hours; major delays for nonessential services; 10 - 19.9 % of local population impacted; or having a national level impact	
	3	Inability to access potable water, food, sanitation services, or healthcare services for 25 - 48 hours; moderate delays for nonessential services; 5 - 9.9 % of local population impacted; or having a provincial/territorial level impact	
	2	Inability to access potable water, food, sanitation services, or healthcare services for 13 - 24 hours; minor delays for nonessential; 2 - 4.9 % of local population impacted; or having a regional level impact	
	1	Inability to access potable water, food, sanitation services, or healthcare services for 0 - 12 hours; 0 - 1.9 % of local population impacted	

National Disaster Mitigation Program
Risk Assessment Information Template

Supplemental information (optional)			
Safety and Security	5	> 20 % of local population impacted; loss of intelligence or defence assets or systems for > 72 hours; or having an international level impact	1
	4	10 - 19.9 % of local population impacted; loss of intelligence or defence assets or systems for 48 – 71 hours; or having a national level impact	
	3	5 - 9.9 % of local population impacted; loss of intelligence or defence assets or systems for 25 – 47 hours; or having a provincial/territorial level impact	
	2	2 - 4.9 % of local population impacted; loss of intelligence or defence assets or systems for 13 – 24 hours; or having a regional level impact	
	1	0 - 1.9 % of local population impacted; loss of intelligence or defence assets or systems for 0 – 12 hours	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

E) Public sensitivity impacts			
	Risk Rating	Definition	Assigned risk rating
	5	Sustained, long term loss in reputation/public perception of public institutions and/or sustained, long term loss of trust and confidence in public institutions; or having an international level impact	3
	4	Significant loss in reputation/public perception of public institutions and/or significant loss of trust and confidence in public institutions; significant resistance; or having a national level impact	
	3	Some loss in reputation/public perception of public institutions and/or some loss of trust and confidence in public institutions; escalating resistance	
	2	Isolated/minor, recoverable set - back in reputation, public perception, trust, and/or confidence of public institutions	
	1	No impact on reputation, public perception, trust, and/or confidence of public institutions	
Supplemental information (optional)			

National Disaster Mitigation Program
Risk Assessment Information Template

Confidence Assessment

Based on the table below, indicate the level of confidence regarding the information entered in the risk assessment information template in the "Confidence Level Assigned" column.
Confidence levels are language - based and range from A to E (A=most confident to E=least confident).

Confidence Level	Definition	Confidence Level Assigned
A	Very high degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of high - quality data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of existing/known mitigation measures	
B	High degree of confidence Risk assessment used to inform the risk assessment information template was evidence - based on a thorough knowledge of the natural hazard risk event; leveraged a significant quantity of data that was quantitative and qualitative in nature; leveraged a wide variety of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a multidisciplinary team with some subject matter expertise (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a significant number of potential mitigation measures	

National Disaster Mitigation Program
Risk Assessment Information Template

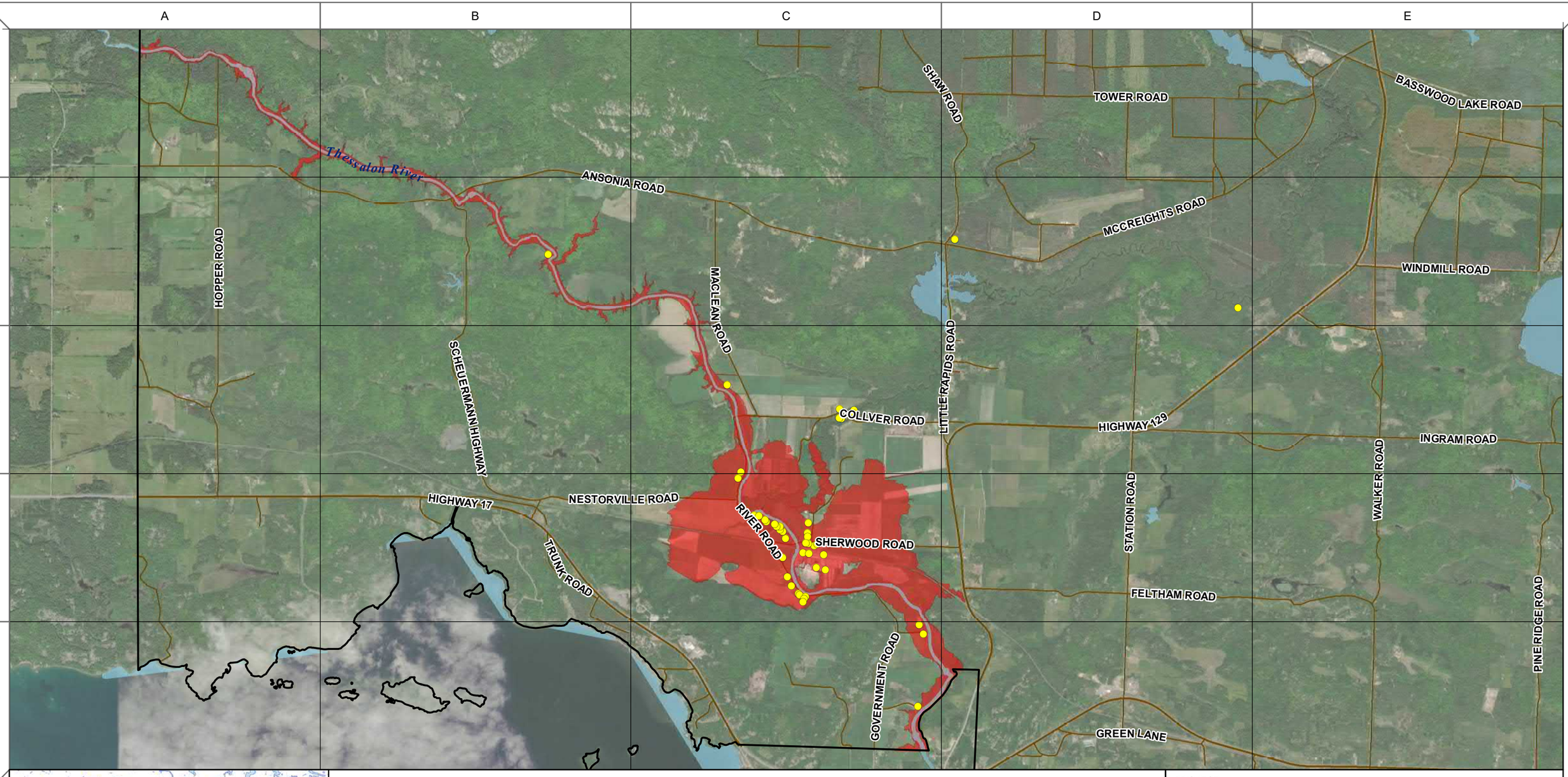
C	Moderate confidence Risk assessment used to inform the risk assessment information template was moderately evidence - based from a considerable amount of knowledge of the natural hazard risk event; leveraged a considerable quantity of data that was quantitative and/or qualitative in nature; leveraged a considerable amount of data and information including from historical records, geospatial and other information sources; and the risk assessment and analysis processes were completed by a moderately sized multidisciplinary team, incorporating some subject matter experts (i.e., a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences) Assessment of impacts considered a large number of potential mitigation measures	A
D	Low confidence Risk assessment used to inform the risk assessment information template was based on a relatively small amount of knowledge of the natural hazard risk event; leveraged a relatively small quantity of quantitative and/or qualitative data that was largely historical in nature; may have leveraged some geospatial information or information from other sources (i.e., databases, key risk and resilience methodologies); and the risk assessment and analysis processes were completed by a small team that may or may not have incorporated subject matter experts (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts considered a relatively small number of potential mitigation measures	
E	Very low confidence Risk assessment used to inform the risk assessment information template was not evidence - based; leveraged a small quantity of information and/or data relating to the natural risk hazard and risk event; primary qualitative information used with little to no quantitative data or information; and the risk assessment and analysis processes were completed by an individual or small group of individuals little subject matter expertise (i.e., did not include a wide array of experts and knowledgeable individuals on the specific natural hazard and its consequences). Assessment of impacts did not consider existing or potential mitigation measures	

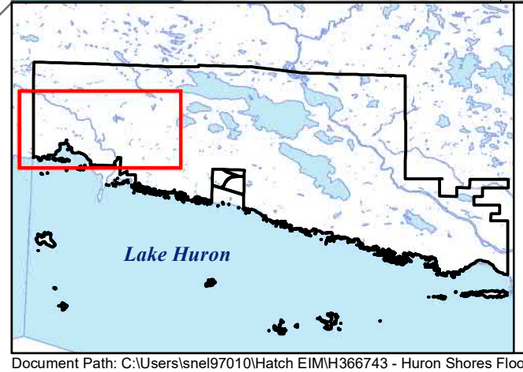
Rationale for level of confidence

Provide the rationale for the selected confidence level, including any references or sources to support the level assigned.	- The impacts of flooding were observed in 2013. - The predicted impact levels for a 1:100-yr flood event were based on a completed hazard identification and risk assessment.

National Disaster Mitigation Program
Risk Assessment Information Template

Key Information Sources	
Identify all supporting documentation and information sources for qualitative and quantitative data used to identify risk events, develop the risk event description, and assess impacts and likelihood. This ensures credibility and validity of risk information presented as well as enables referencing back to decision points at any point in time. Clearly identify unclassified and classified information.	*All information is unclassified "Flood Risk Assessment", completed by Hatch Ltd. in March 2022.
Description of the risk analysis team	
List and describe the type and level of experience of each individual who was involved with the completion of the risk assessment and risk analysis used to inform the information contained within this risk assessment information template.	Flood Risk Assessment was completed by Hatch Ltd. hydro-technical engineers Bethany Heppner, P.Eng., and Alfred Breland, P.Eng. Bethany has 5 years of experience directly related to hydrology and hydraulics, and Alfred Breland has 39 years of experience directly related to hydrology and hydraulics and the risks and concerns surrounding riverine flooding in rural and municipal areas.





LEGEND

- Buildings at Risk
- Flood Risk Area
- Huron Shores Municipal Boundary
- Waterbody

Road Class

- Main Road
- Road Network

NOTES:
1. Spatial Reference: NAD 1983 UTM Zone 17
2. Contains information used under the Open Government License - Ontario

0 0.5 1 2 km

1:37,000

N

PROJECT:	District of Huron Shores - Flood Risk Assessment
FIGURE TITLE:	RAIT Risk Area - Thessalon River
CLIENT:	Municipality of Huron Shores
DWG BY:	J. Snelgrove
DATE:	March 29, 2022
FIG NO.:	1

HATCH

Document Path: C:\Users\snel97010\Hatch EIM\H366743 - Huron Shores Flood Risk Assessment - WIP Uncontrolled\Huron Shores GIS Data\MXD\RAIT_Maps\RAIT_Fig1_ThessalonRiver.mxd

Suite 300, 4342 Queen Street
Niagara Falls, Ontario, Canada L2E 7J7
Tel: +1 (905) 374 5200

Suite 300, 4342 Queen Street
Niagara Falls, Ontario, Canada L2E 7J7
Tel: +1 (905) 374 5200