



## 2016 Flood Forecasting and Warning Program

For more information:

[www.quinteconservation.ca](http://www.quinteconservation.ca)

(613) 968-3434 or (613) 354-3312

RR 2, 2061 Old Highway 2 • Belleville, ON • K8N 4Z2

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*There is a map at the back of this booklet showing high risk flood areas.*

**With special thanks to the GTA Conservation Authorities Flood Group  
for providing some of the information in this booklet.**

# 1.0 INTRODUCTION

Quinte Conservation acts in an advisory capacity only, providing continuous monitoring of flood conditions.

Quinte Conservation is not responsible for flood fighting other than in the operation of its own dams.

During a flooding situation, Quinte Conservation's office will be staffed appropriately to monitor water levels and weather conditions on a 24-hour basis if required.

The responsibility for dealing with flood contingency planning in Ontario is shared by municipalities, Conservation Authorities and the Ministry of Natural Resources (MNR), on behalf of the province. As with all emergencies, municipalities have the primary responsibility for the welfare of residents, and should incorporate flood emergency response into municipal emergency planning. The MNR and the Conservation Authorities are primarily responsible for operating a forecasting and warning system, and the province may coordinate a response in support of municipal action.

Quinte Conservation has developed a Flood Forecasting and Warning Service for its municipalities and residents within their watershed and the shoreline of Lake Ontario. The purpose of this service is to reduce risk to life and damage to property by providing local agencies and the public with notice, information and advice so that they can respond to potential flooding and flood emergencies.

This Flood Forecasting and Warning Program is intended for all public officials and agency staff likely to play a role in the prevention, mitigation, preparedness, response and recovery pertaining to flood events. This version of the Program provides general information on the Quinte Conservation Forecasting and Warning System, as well as specific information and contacts for municipalities within its jurisdiction.

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## 1.1 EMERGENCY MANAGEMENT AND CIVIL PROTECTION ACT

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Ontario's Emergency Management and Civil Protection Act (EMCPA, 2006) sets out requirements for the development, implementation and maintenance of municipal and ministry emergency management programs. These comprehensive emergency management programs are based on the five principles of emergency management: prevention, mitigation, preparedness, response, and recovery. The province describes six "pillars of preparedness"; each an essential component of an emergency management program, including:

1. Emergency Plans
2. Emergency Operations Centre
3. Training
4. Exercises
5. Emergency Information
6. Public Education

The province has assigned the emergency response responsibility for flooding to the MNR, which includes flood forecasting and warning as well as flood control operations. Where a Conservation Authority exists, the province relies on the Conservation Authority to assist them in their assigned responsibilities for flooding.

Quinte Conservation's Flood Forecasting and Warning Program provides vital service to our municipal partners to ensure that the flood aspects of these components are met.

## 2.0 ROLES AND RESPONSIBILITIES OF AGENCIES

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### 2.1 MUNICIPAL ROLE

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Under the Emergency Management and Civil Protection Act (Ontario Regulation 380/04), municipalities have the primary responsibility and authority for response to flooding and flood emergencies, and also for the welfare of residents and protection of property. In order to fulfill this responsibility, municipalities should ensure that emergency plans are kept current and tested on a regular basis.

Upon receiving a Flood Watch or Flood Warning municipalities shall:

1. Notify appropriate municipal officials, departments and agencies in accordance with their municipal emergency plan.
2. Determine the appropriate response to a flood threat and, if warranted, deploy municipal resources to protect life and property.
3. If required, declare a flood emergency and implement their emergency response plan.
4. Request provincial assistance under the Emergency Management and Civil Protection Act, if municipal resources are inadequate to respond to the emergency.
5. Maintain liaison with Conservation Authority Flood Coordinators.

#### 2.1.1 Sandbags

Each Municipality that traditionally experiences spring flooding must have its own supply of sandbags; however, Quinte Conservation has a stock of 40,000 sandbags for emergency use should its member municipalities run short. Please note that over 2,000 sandbags are required to construct a dyke 4 feet high by 100 feet long.

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## 2.2 CONSERVATION AUTHORITY ROLE

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Conservation Authorities have several areas of responsibility for flooding and flood emergencies:

1. Support municipal flood emergency planning by providing technical advice pertaining to flood risk (e.g., hydrology, hydraulics, flood vulnerable areas, etc.) and engaging in flood mitigation projects to reduce flood risk prior to flood events.
2. Maintain a local network, collect data, and monitor watershed and weather conditions daily in order to provide timely warning of anticipated or actual flood condition. Provide updated forecasts and other supporting technical data pertaining to flood conditions under their jurisdiction during an event.
3. Issue flood messages to municipalities and other appropriate agencies, including the media and the public, to advise of potential flooding when appropriate.
4. Operate Conservation Authority dams and flood control structures to reduce the effects of flooding when appropriate.
5. Maintain communications with municipalities and the Surface Water Monitoring Centre of the MNR during a flood event.

### 2.2.1 Data Collection and Assessment

In order to forecast a flood and to provide as much advance notice as possible, Quinte Conservation staff collects data from five different sources:

1. Weather forecasts and runoff conditions from the Surface Water Monitoring Centre (MNR), CFB Trenton and various weather websites. All information is updated daily.
2. Quinte Conservation stream gauges located throughout the watershed; water level, temperature and precipitation amounts are collected hourly.

3. Quinte Conservation staff perform snow measurements twice each month; snow depth and water content are measured.
4. In areas prone to frazil ice flooding (Moirra River Watershed) ice measurements are taken. The ice sheet, as well as the depth and viscosity of frazil ice below the ice sheet are measured. Daily visual assessment of rivers and lakes by Quinte Conservation staff plus the observation of staff gauges (generally a metre stick attached to bridges used by staff to monitor water levels). This activity includes documenting the extent of any flood damages.
5. Snow depth and water content measured in our network of gauges.

Quinte Conservation's Flood Forecasting System enables staff to predict the amount of runoff from a rainfall or snow melt event as well as the approximate time when the peak water levels will be experienced. Remote gauging stations monitor rainfall; snow accumulation is monitored by direct measurement. Water level gauges also provide us with real time river flows. By comparison to documented events, staff can predict the time to peak for each river. Also, by monitoring upper stream gauges, we can make a prediction of the peak amount of runoff that will be experienced downstream.

Quinte Conservation also uses a computer model to predict the amount of runoff that could result based on watershed conditions at the time using predicted rainfall depths. This computer model provides early awareness to staff of the potential for flooding conditions.

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## 2.3 PROVINCIAL ROLE (SURFACE WATER MONITORING CENTRE)

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1. Operate and maintain a provincial forecasting and warning system to alert MNR District Offices and Conservation Authorities of potential meteorological events that could create a flood hazard.
2. Maintain communications with MNR District Offices and Conservation Authorities regarding the status of provincial flood potential.



3. Receive messages from Conservation Authorities, MNR District Offices and other agencies and provide analysis and information that is used to guide the MNRs response to a flood.
4. Assists the MNR Districts where Conservation Authorities do not exist in the preparation of river response forecasts, daily planning cycle, and the monitoring of local storm conditions.

## 3.0 FLOOD MESSAGES

A flood is defined as a situation where water levels in a watercourse exceed the channel banks. Quinte Conservation operates a 24-hour flood forecasting and warning program that monitors weather forecasts and watershed conditions. This information is used to assess the potential for flooding. When spring melt or severe storms are anticipated, Quinte Conservation estimates the severity, location, and timing of possible flooding, and provides these forecasts to local agencies.

Quinte Conservation uses an array of technologies to disseminate flood messages. Quinte Conservation issues messages using email including Constant Contact email, Twitter, Facebook, media releases and website technologies. During a power or internet outage at the Quinte Conservation office a facsimile will be used. Messages are sent to designated individuals within municipalities and other local agencies. These individuals, in turn, are responsible for relaying the message to relevant individuals and departments within their organizations, and activating their role as defined by their organization's Emergency Response Plan.

In order to improve the understanding of flood messages sent by Quinte Conservation, flood messages may include the following terminology to describe the magnitude of anticipated flooding.

**No Flooding:** Water levels remain within channel banks.

**Nuisance Flooding:** Flooding of low lying lands. However, road access remains available and no structures will be flooded.

**Minor Flooding:** Potential for some structural flooding and sections of road access may be impassable. No evacuation is required.

**Major Flooding:** Potential for significant basement flooding, some 1st floor flooding, and significant road access cuts. Evacuation possibly required.

**Severe Flooding:** Potential for many structures to be flooded, major disruption of roads and services. Evacuation is required due to risk to life and major damages to residential, industrial, commercial and/or agricultural sites. The event may produce negative environmental impacts caused by spills of

hazardous substances such as sewage, oils, chemicals, etc., that pose a threat to public safety and/or to the ecosystem.

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## 3.1 TYPES OF FLOOD MESSAGES

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When conditions warrant, Quinte Conservation will communicate with local agencies using one of the following types of messages:

### 3.1.1 Water Safety Statement



A Water Safety Statement indicates that high flows, unsafe banks, melting ice or other factors could be dangerous for users such as anglers, boaters, swimmers, children or pets. Flooding is not expected.

### 3.1.2 Flood Outlook Statement



A Flood Outlook Statement gives early notice of the potential for flooding based on weather forecasts calling for heavy rain, snow melt, high wind or other conditions that could lead to high runoff, cause ice jams, lakeshore flooding or erosion.

### 3.1.3 Flood Watch



This level notifies that the potential for flooding exists within specific watercourses and municipalities. Municipalities, emergency services and individual landowners in flood-prone areas should prepare.

### 3.1.4 Flood Warning



A Flood Warning means flooding is imminent or already occurring in specific watercourses or municipalities. Municipalities and individuals should take action to deal with flood conditions. This may include road closures and evacuations.

## 4.0 FLOOD RESPONSE PROCEDURES

As previously mentioned, during an actual flood event the primary responsibility for the welfare of residents and protection of property rests with the municipality. Upon receiving a flood message, municipalities should monitor their local conditions and determine the appropriate action, which may include activating their Emergency Response Plan.

Where a flood emergency is beyond the capacity of a municipality, provincial assistance can be requested in accordance with the municipality's Emergency Response Plan.

During a flood, Quinte Conservation will continue to provide updated information as well as technical advice on flood mitigation.

During the emergency, Quinte Conservation staff will continue to advise the Surface Water Monitoring Centre (MNR) of the status of the situation. The Centre will be responsible for updating and relaying information related to the emergency to the Ministry's District Offices.

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### 4.1 COMMUNICATIONS AND OPERATIONS RELATED TO MUNICIPAL EMERGENCY OPERATIONS CENTRES

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The Province of Ontario, through its Emergency Management and Civil Protection Act legislation, requires all municipalities to have valid emergency response plans and procedures in place. One component of this requirement is the need to have a defined Emergency Operations Centre (EOC) where municipal activities can be undertaken in the event of an emergency. Under normal flooding operations where there is no need to activate the EOC, Quinte Conservation will provide information as requested by their local municipalities. Quinte Conservation will present one or more members of staff at the EOC (if resources permit) where staff will coordinate flood related information and advice.

## 5.0 WHERE TO ORDER SAND BAGS

### **Burtex Industries**

Arthur Saunders  
66 Bartor Road  
Weston, ON  
M9M 2G5  
P: 1-800-268-0908  
C: 416-315-2396  
F: 416-740-2261  
E: farrell@bellnet.ca  
<http://www.burtexburlap.com/>

### **Polytarp Products**

Irving Kohl  
350 Wildcat Road  
Toronto, ON  
M3J 2N5  
P: 1-800-606-2231 x 280  
P: 416-633-2231 x 280  
F: 416-633-1685  
E: ikohl@polytarp.com  
<http://www.polytarp.com/>

### **Vince Products Inc. / Harnois Shelters**

Vivianne Dion  
507 Route 158  
St-Thomas, QC  
J0K 3L0  
P: 866-661-6646 x 203  
F: 450-755-6878  
E: s.assistant@abrisharnois.com  
<http://www.abrisharnois.com/en/>

# 6.0 QUINTE CONSERVATION CONTACT INFORMATION

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## 6.1 FLOOD COORDINATORS

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### **Terry Murphy – General Manager**

E: tmurphy@quinteconservation.ca

P: 613-968-3434 ext. 103

C: 613-391-4040

### **Christine McClure – Water Resources Manager**

E: cmclure@quinteconservation.ca

P: 613-968-3434 ext. 130

C: 613-848-1286

### **Paul McCoy – Planning and Regulations Manager**

E: pmccoy@quinteconservation.ca

P: 613-968-3434 ext. 108

C: 613-967-7236

*Back up phone / facsimile if main line out of service (613) 968-4949*

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## 6.2 MCLEOD DAM OPERATOR

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### **Tom Sweet – Dam Operator**

E: tsweet10@cogeco.ca

C: 613-847-1317

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## 6.3 FLOOD COMMUNICATIONS

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**Jennifer May-Anderson – Communications Manager**

E: [jmayanderson@quinteconservation.ca](mailto:jmayanderson@quinteconservation.ca)

P: 613-968-3434 ext. 125

C: 613-847-1764

## 7.0 DATA COLLECTION SITES

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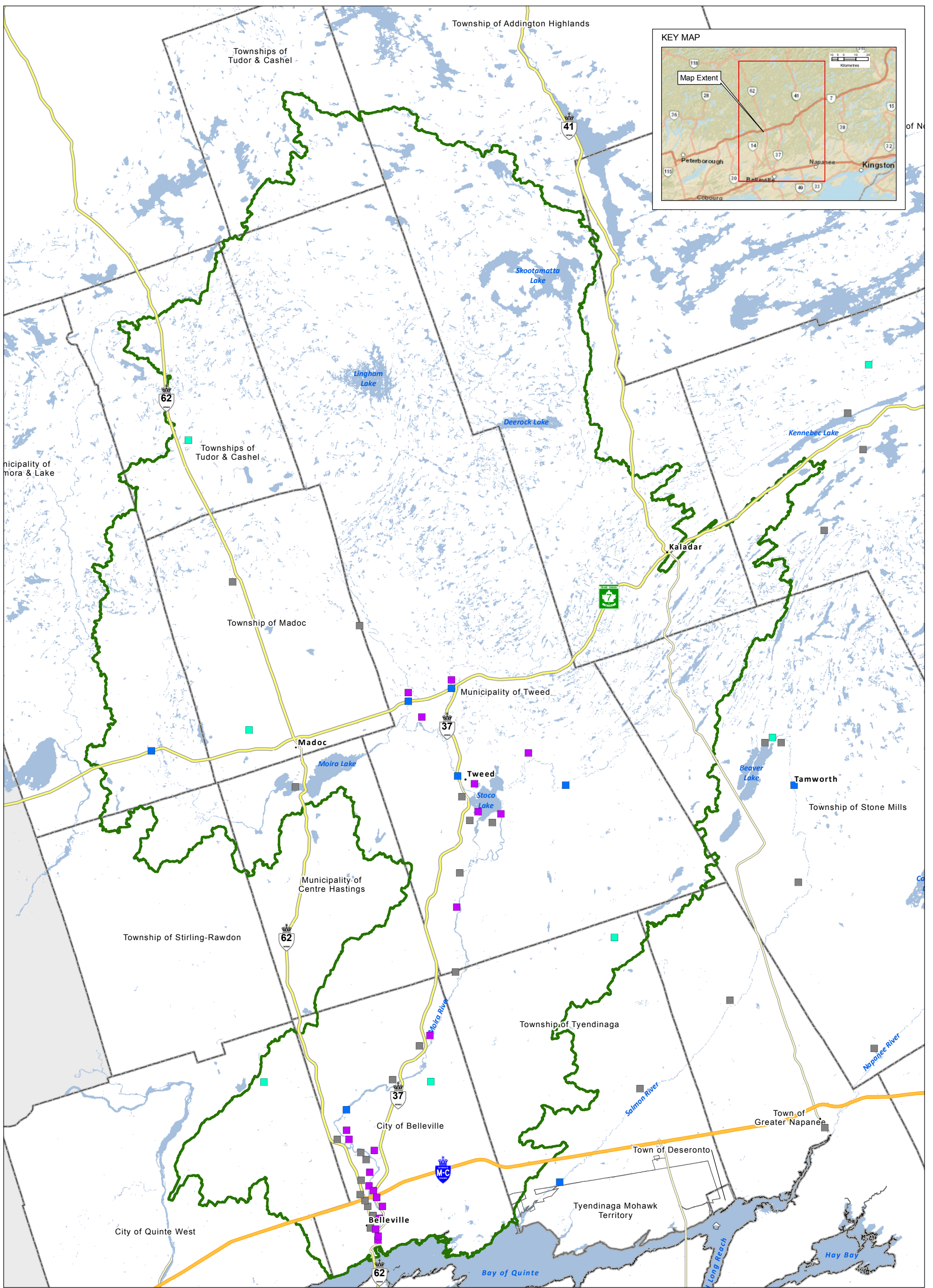
7.1 MOIRA RIVER WATERSHED

7.2 NAPANEE RIVER WATERSHED

7.3 PRINCE EDWARD COUNTY WATERSHED

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PROGRAM:	2016 Flood Forecasting and Warning Program	
TITLE:	Data Collection Sites - Moira River Watershed -	
SCALE:	1:275,000	
SHEET:	1 of 1	
DRAWING:	C.V.	
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Moira River, Napanee Region and Prince Edward Region Watersheds, RR # 2, 2061 Old Highway # 2, Belleville, Ontario, K8N 4Z2. www.quinteconservation.ca, 613-968-3434. Produced by Quinte Conservation 17/12/2015 under license with the Ontario Ministry of Natural Resources. Copyright Quinte Conservation and the Queen's Printer for Ontario, 2015. Data is projected in NAD 83 UTM Zone 18N. Digital Mapping Sources: Base Map - Ontario Ministry of Natural Resources Imagery - SCOP 2012 Ontario Ministry of Natural Resources Imagery - DRAPÉ 2014 Ontario Ministry of Natural Resources Key Map - ArcGIS Online Services. Disclaimer: This map is for illustrative purposes only. Quinte Conservation makes no warranties and assumes no liability whatsoever regarding the truth, accuracy, currency, or completeness of this map and its associated data.


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2	Approved for distribution	17/12/15
1	Draft for comment / review	16/12/15

**LEGEND / NOTES**

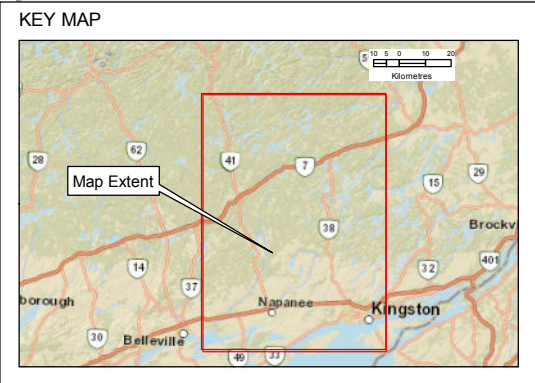
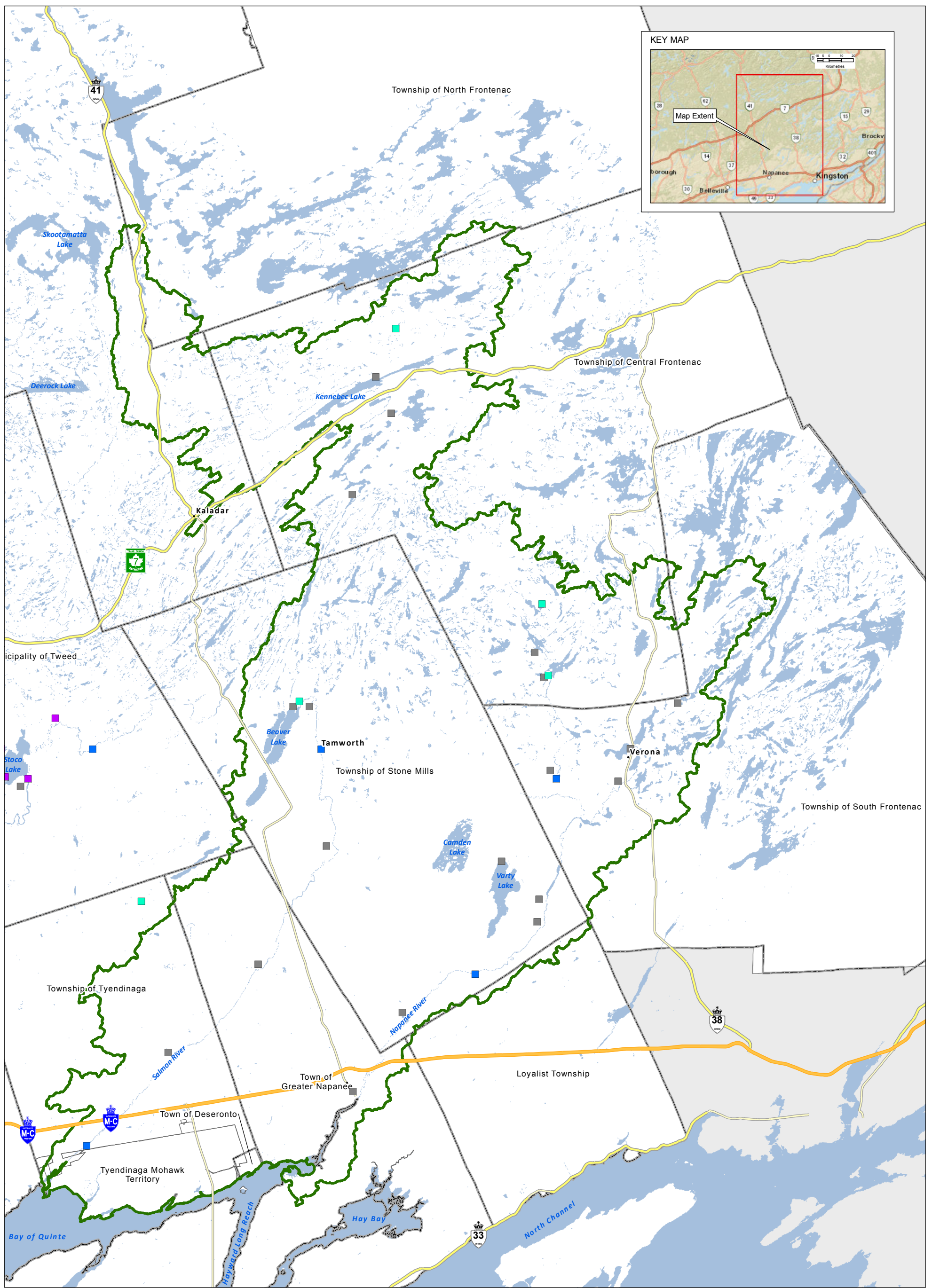
- Ice Monitoring Site
- Snow Sampling Site
- Staff Gauge
- Stream Gauge
- Moira River Watershed
- Municipal Boundary



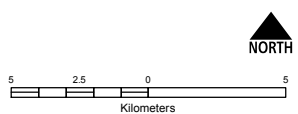
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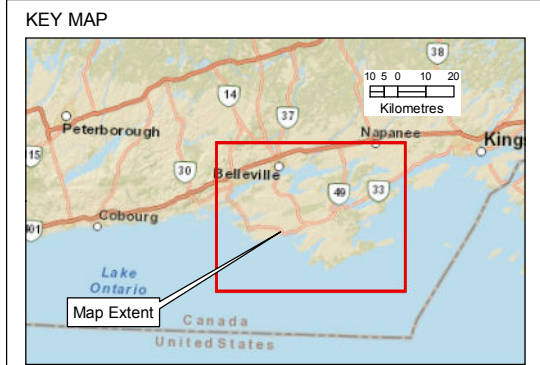
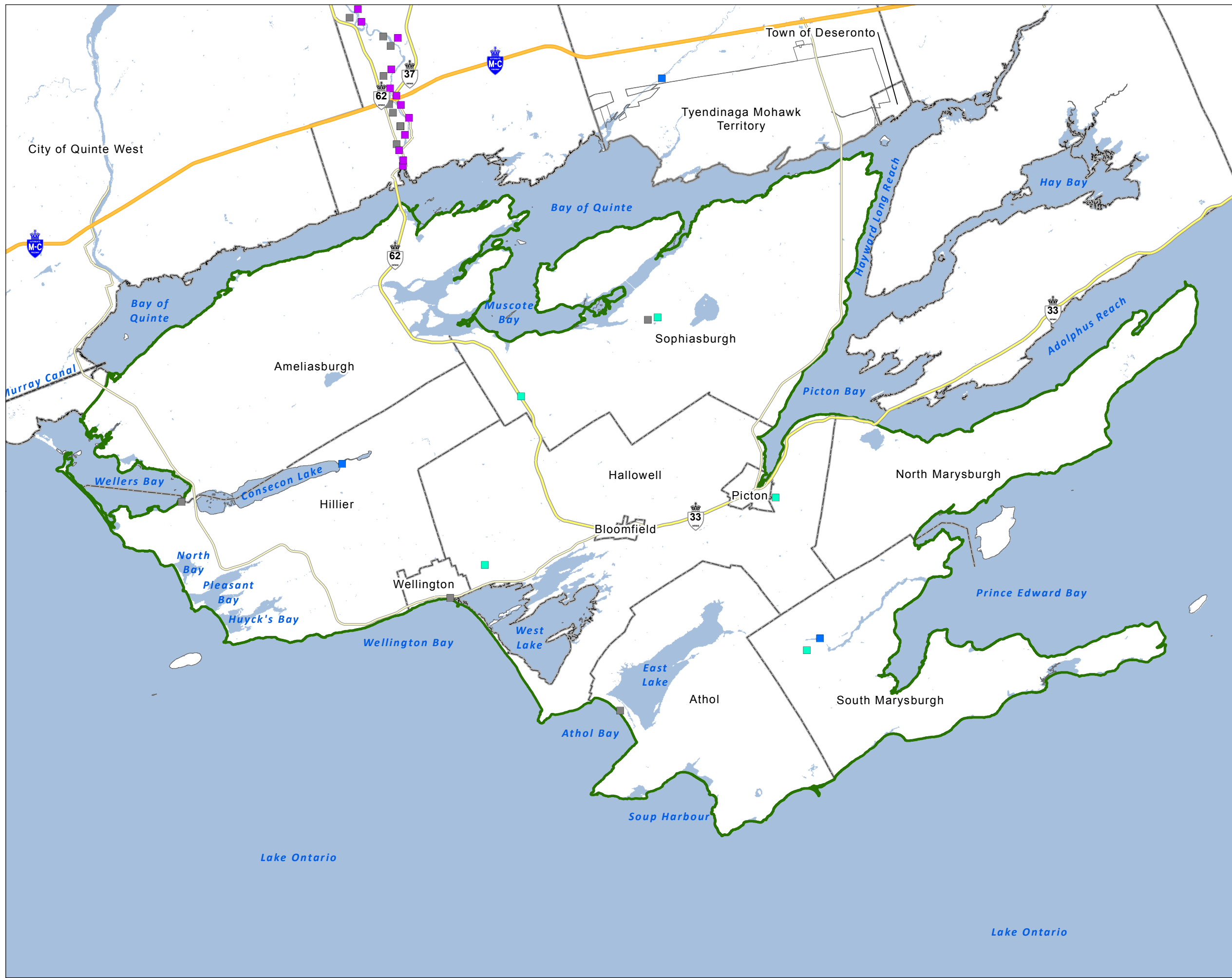


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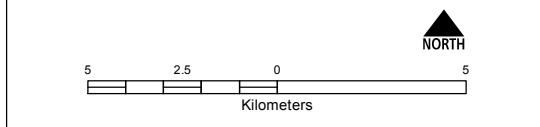


<p><b>Quinte CONSERVATION</b></p>	<b>PROGRAM:</b> 2016 Flood Forecasting and Warning Program			<b>LEGEND / NOTES</b> Ice Monitoring Site Snow Sampling Site Staff Gauge Stream Gauge Napanee Region Watershed Municipal Boundary		
	<b>TITLE:</b> Data Collection Sites - Napanee Region Watershed -					
	<b>SCALE:</b> 1:275,000	<small>Mura River, Napanee Region and Prince Edward Region Watersheds, RR # 2, 2061 Old Highway # 2, Belleville, Ontario, K8N 4Z2. www.quinteconservation.ca. 613.968.3434. Produced by Quinte Conservation 17/12/2015 under license with the Ontario Ministry of Natural Resources. Copyright Quinte Conservation and the Queen's Printer for Ontario, 2015. Data is projected in NAD 83 UTM Zone 18N. Digital Mapping Sources: Base Map - Ontario Ministry of Natural Resources Imagery - SCOP 2012 Ontario Ministry of Natural Resources Imagery - GRAPE 2014 Ontario Ministry of Natural Resources Key Map - ArcGIS Online Services Disclaimer: This map is for illustrative purposes only. Quinte Conservation makes no warranties and assumes no liability whatsoever regarding the truth, accuracy, currency, or completeness of this map and its associated data.</small>		2	Approved for distribution	17/12/15
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- LEGEND / NOTES**
- Snow Sampling Site
  - Ice Monitoring Site
  - Staff Gauge
  - Stream Gauge
  - Prince Edward Region Watershed
  - Municipal / Ward Boundary



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**PROGRAM:** 2016 Flood Forecasting and Warning Program

**TITLE:** Data Collection Sites - Prince Edward Region Watershed -

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# 8.0 EXTREME EVENTS IN QUINTE

Quinte Conservation staff have reviewed the flow records from several stream flow stations in the Quinte area. The records range from 100 years of record for the Moira River to 56 years for Salmon River. Typically flood events occur in the spring and all the largest events are spring runoff events. River flow peaks are driven by a combination of snow melt and spring rains.

## 8.1 MOIRA RIVER

In Moira River at Foxboro the following years rank the highest for flood flows.

Year	Date	Peak Daily (cms)
1981	26-Feb	364
1936	31-Mar	351
1976	3-Apr	343
2014	17-Apr	341
1948	25-Mar	314
1928	9-Apr	311
1980	24-Mar	306
1917	30-Mar	294
1947	10-Apr	292
1952	8-Apr	292
1960	9-Apr	286
1987	8-Apr	286
2008	15-Apr	285

The most common date for the peak to arrive is April 9th. In an average year the peak arrives on April 1 (this is affected by the fall events). The median

date for the peak spring runoff event is April 5th. Peaks occurring within one standard deviation of the mean fall between March 18th and April 30th.

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## 8.2 SALMON RIVER

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In the Salmon River at Shannonville the following years rank the highest for flood flows (cms).

Year	Date	Peak Daily (cms)
1981	21-Feb	106
1960	4-Apr	104
2014	9-Apr	99
1959	3-Apr	88.1
1976	28-Mar	86.4
1974	5-Apr	80.1
1993	31-Mar	78.3
1971	14-Apr	77.9
2005	4-Apr	76.8
1982	4-Apr	76.2
1973	18-Mar	75
2008	13-Apr	74.7

The most common date for the peak to arrive is April 4th. In an average year the peak arrives on March 20th (this is affected by the fall events). The median for the peak spring event is April 2nd. Peaks occurring within one standard deviation from the mean fall between March 7th and April 16th.

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## 8.3 NAPANEE RIVER

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This gauge was moved to Camden East in 1974. Previous records exist from 1916 to 1974 for the former location in Napanee. Statistics were not performed on the earlier gauge.

Year	Date	Peak Daily (cms)
<b>2014</b>	15-Apr	80
<b>1976</b>	1-Apr	76.5
<b>1981</b>	24-Feb	66.2
<b>2008</b>	14-Apr	59.3
<b>1993</b>	11-Apr	53.6
<b>1978</b>	13-Apr	53.5
<b>1982</b>	4-Apr	52.4
<b>1974</b>	7-Apr	51
<b>1997</b>	8-Apr	50.6
<b>1980</b>	25-Mar	49.7
<b>2005</b>	6-Apr	47.3

The most common date for the peak to arrive is April 14th. In an average year the peak arrives on March 19th (this date is affected by the fall events). The median for the peak spring event is April 3rd. The mean of the spring events occurs on March 24th. Peaks occurring within one standard deviation from the mean fall between February 21st and April 5th.

## 9.0 HIGH RISK AREAS FOR MUNICIPALITIES

Flooding can occur from a number of factors, or combinations thereof, such as heavy snowfall combined with late or rapid snowmelts, deep frost and/or excessive rainy weather, or ice jams. Municipalities should prepare flood warning plans for each flood prone area. The major flood prone areas are as follows:

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### 9.1 MOIRA RIVER WATERSHED

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- Moira River at Bannockburn; Village of Tweed; East Channel Outlet; Latta; Plainfield; Foxboro; and the City of Belleville
- Skootamatta River at Actinolite
- Deer Creek in the Village of Madoc
- Stoco Lake
- Moira Lake

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### 9.2 NAPANEE REGION WATERSHED

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- Napanee River at Yarker; Camden East; Petworth Bridge; Newburgh; and Strathcona
- Salmon River at Waddingham Valley; Croydon; Teskey Road Bridge; Kingsford; and Arden
- White Lake (Sheffield Twp.)
- Verona (Rock) Lake
- Big Clear Lake
- Varty Lake
- Hambly Lake
- Howes Lake
- Thirteen Island Lake

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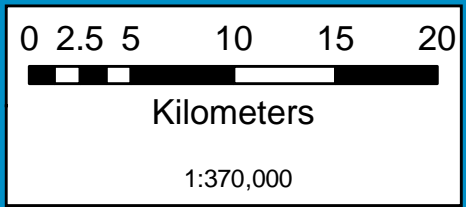
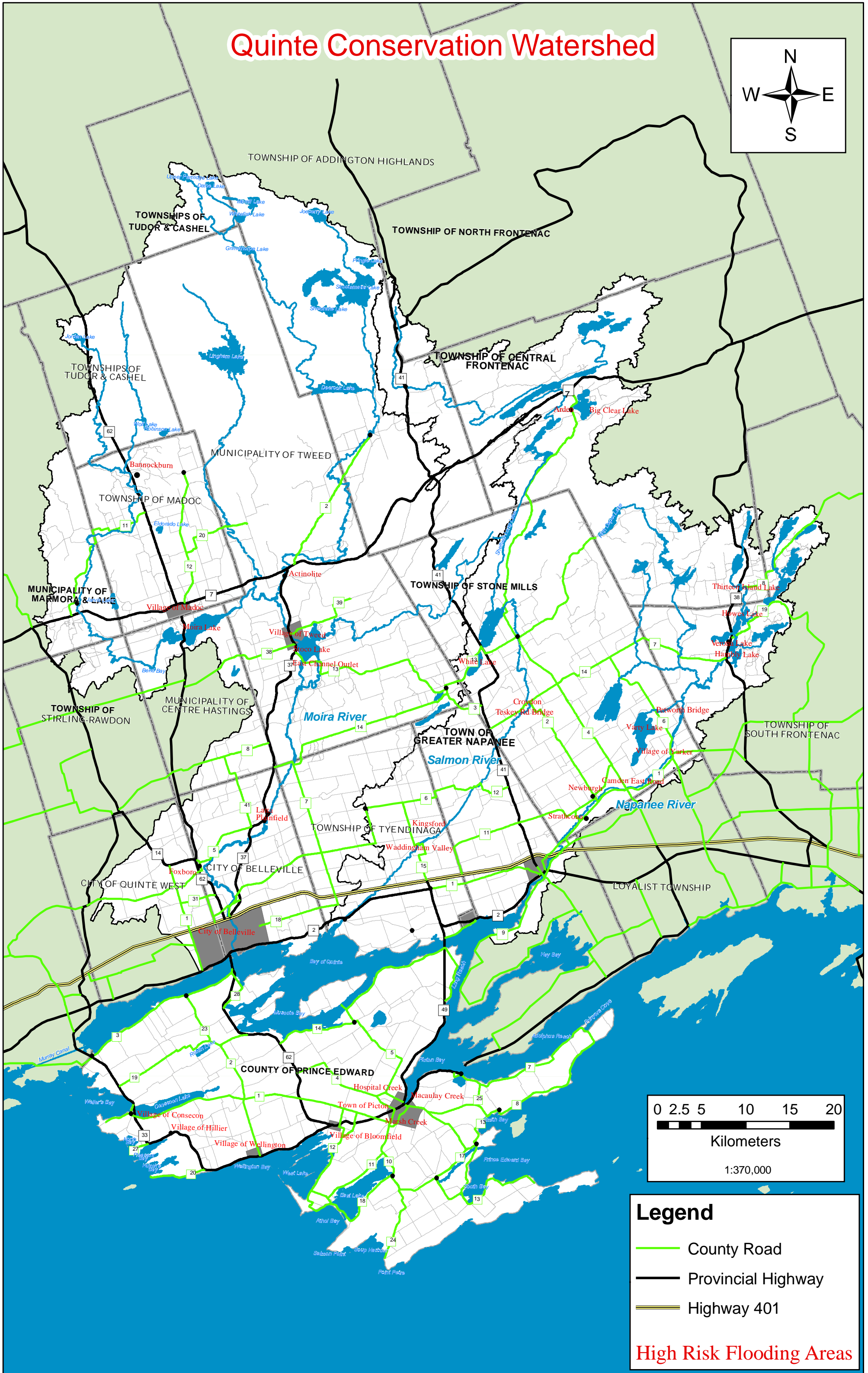
## 9.3 PRINCE EDWARD REGION WATERSHED

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- Macaulay Creek/Marsh Creek/Hospital Creek all within the town of Picton
- Bloomfield Creek in Bloomfield
- Lane Creek in Wellington
- Slab Creek in Hillier
- Consecon Creek in Consecon



# Quinte Conservation Watershed



**Legend**

- County Road
- Provincial Highway
- Highway 401

**High Risk Flooding Areas**