

Section III – Items for the Information of the Board

TO: Chair and Members of the Board of Directors
Friday, June 25, 2021 Meeting

FROM: Sameer Dhalla, Director, Development and Engineering Services

RE: **FLOOD EMERGENCY MANAGEMENT ANNUAL UPDATE**
Overview of TRCA activities in flood forecasting and warning, flood response planning, municipal emergency management and associated outreach activities.

KEY ISSUE

Summary of current non-structural flood risk management initiatives, highlights of flood events experienced in the past year, and an overview of flood response planning activities occurring in collaboration with municipal partner staff.

RECOMMENDATION

WHEREAS TRCA staff provided an overview of the Flood Risk Management program at the Board of Directors meeting #6/19 held on June 21, 2019, and were directed to provide an annual summary of flood risk management work that has been completed;

AND WHEREAS the last Flood Risk Management annual summary was provided to TRCA Board of Directors on September 25, 2020.

IT IS RECOMMENDED THAT this report be received as the 2021 Flood Emergency Management update.

BACKGROUND

Almost 5 million people live within the 9 watersheds and Lake Ontario waterfront that make up Toronto and Region Conservation Authority's (TRCA) jurisdiction. Many of the catchments in TRCA's jurisdiction are small, steep, and highly urbanized. Intense rainfall thus quickly accumulates in rivers and streams, leaving little time before flooding occurs.

Flooding in TRCA's jurisdiction can happen at any time of year; fall storms can draw on tropical moisture from Atlantic hurricanes, mid-winter thaws present the risk of ice jams, spring warm-ups melt the seasonal snowpack, and summer brings the risk of thunderstorms. These summer storms present a particular challenge because they are highly unpredictable from a meteorological perspective. The potential energy and moisture for a serious convective storm may exist on many summer days, but determining exactly where, and if, they will form, remains challenging. Ice jam flooding is also very difficult to predict as jams can occur anywhere along a watercourse and there is little to do to protect against them.

While land-use planning has effectively reduced risk in greenfield areas, many neighborhoods were historically settled near rivers prior to flood plain management. Examples include old downtowns in Brampton, Bolton, Unionville, and Stouffville. In other places, water may spill from altered watercourses and floodplains extend into populated areas. Across TRCA's jurisdiction, there are dozens of such Flood Vulnerable Clusters (FVC's), or areas where there is a high concentration of buildings in the floodplain.

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TRCA undertakes a wide variety of programs to fulfil our Strategic Plan objectives to reduce flood risks and protect communities. These programs span the full spectrum of the emergency management cycle: from land-use planning to prevent exposure to hazards, to capital flood mitigation projects, to the many non-structural initiatives in the preparedness, response, and recovery phases that work to reduce the threat to public safety in areas of existing flood risk. Initiatives that fall specifically within the Flood Emergency Management portfolio include flood emergency planning with municipal partners, personal preparedness education and outreach, and the Flood Forecasting and Warning (FFW) program. TRCA's flood risk management activities are at an advanced level and continue to incorporate state of the art technologies in real-time gauging, hydrology and hydraulic modeling and multi-mode communications. Many of the recommendations of the 2020 Ontario Flooding Strategy refer to flood risk reduction activities that have long been in-place at TRCA. During flood events, the information provided by TRCA plays a critical role assisting municipal partners in making decisions for emergency response.

RATIONALE

As outlined in the Ontario Flooding Strategy, the roles and responsibilities for ensuring public safety during flood events are shared between various levels of government, conservation authorities, and individuals. Municipalities have the primary role in undertaking emergency response actions, including road closures and evacuations, and are legislated, through the Provincial Emergency Management and Civil Protection Act, to develop emergency plans and conduct training exercises to support preparedness.

In areas where a Conservation Authority exists, they hold the delegated responsibility from the Ministry of Natural Resources and Forestry (MNRF) to operate a Flood Forecasting and Warning program in accordance with the *Provincial Flood Forecasting and Warning Guidelines*. The FFW program is designed to:

- Support municipal flood emergency planning,
- Monitor weather and watershed conditions daily and maintain a local data collection network,
- Issue flood messages to municipalities, applicable agencies, media and the public in order to advise of potential flooding when appropriate,
- Operate TRCA dams and flood control structures to reduce the effects of flooding when appropriate,
- Maintain communications with municipalities and the MNRF Surface Water Monitoring Centre during a flood event.

To fulfill these objectives, TRCA works closely with partner municipalities, including staff from the respective emergency management offices, emergency services personnel who act as the Community Emergency Management Coordinators (CEMC's) and with meteorological agencies such as the Ontario Storm Prediction Centre (OSPC) operated by Environment Canada and Climate Change (ECCC). To support effective flood response during an event, and to support municipal partners in fulfilling their emergency management responsibilities, TRCA staff also participate in the development of flood emergency response plans, training, and emergency management exercises.

One of the core mandates of TRCA is to provide services to partner municipalities to reduce flood risk and protect people and property from riverine flooding. This mandate has been tested many times with both forecasted and un-forecasted storm events as well as with hard to predict

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floods caused by ice jams. Recent storm examples include a jurisdictional winter rain on snow event in early January 2020, a localized intense thunderstorm on July 8, 2020 and a flood caused by an ice jam in the community of Bolton in March of 2019. Additionally, there have been two high lake level events since 2017 impacting all the shorelines of Lake Ontario.

In past Flood Risk Management annual updates, a summary of notable flood events over the past year was provided. However, since the last update to TRCA Board members, there have been no significant flooding events for TRCA from September 2020 to May 2021. This highlights the irregularities and variabilities of local weather patterns both on a seasonal and annual level. Instead, this report will focus on the work that continues to improve TRCA's Flood Risk Management and Flood Forecasting and Warning program. The following sections will summarize specifically how TRCA is working to improve upon its Flood Forecasting and Warning program, expanding and enhancing its flood operations, enriching flood outreach and communication, as well as assisting municipalities with emergency planning.

Flood Forecasting and Warning Program

The FFW program is staffed by a complement of Flood Duty Officers (FDOs), Chief Flood Duty Officers (CFDOs), Dam Operators, and technical staff who are on-call 24 hours a day, 7 days a week. During flood events, core staff from Engineering Services, specifically, the Flood Infrastructure & Hydrometrics, Flood Risk Management and Water Resources teams, play critical roles in providing technical expertise and advice to municipal partners, thus assisting them in making decisions and taking actions for emergency response. TRCA is continually looking for opportunities to improve current processes related to the Flood Forecasting and Warning program.

Communications through flood messages to municipal partners, stakeholders and the public remain a priority area for the program. In 2021, several improvements to the Flood Message notification system and process have been implemented, with more improvements to be completed by the end of 2021. These include the addition of standardized shoreline flood message categories for Lake Ontario, as per Ministry of Natural Resources and Forestry (MNRF) guidelines, and improvements to facilitate a faster dissemination of flood warning messages and shortened response action by affected municipalities.

As communicated to the Board through the 2020 program update, in 2018 TRCA evaluated and identified a well-established flood forecasting and warning decision support system, the Deltares Flood Early Warning System (FEWS). The system meets the unique requirements of TRCA's jurisdiction (both rural and urban environments) and can integrate numerous weather forecasts, radar products, stream and precipitation monitoring systems, and various hydrology and hydraulic modelling platforms. TRCA Flood Risk Management team is currently taking a phased approach to develop and implement FEWS as the daily flood assessment tool for Flood Duty Officers. Staff are working to advance the complex configuration of the system developed as a pilot model. This will include data consolidation of weather forecast models as well as TRCA and other partner monitoring data, and a report output for the daily flood assessment for TRCA's jurisdiction.

In 2018, Federal and Provincial emergency management officials introduced Alert Ready messages for mobile devices, and TRCA established an agreement with the Provincial Emergency Operations Centre (PEOC) to push Alert Ready messages to residents during activation of the G. Ross Lord Dam Emergency Preparedness Plan. TRCA has recently become an authorized agency who can request the issuance of these alerts (for the above specified

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scenario) directly with the Provincial Office of the Fire Marshall and Emergency Management (OFMEM), thus saving valuable time for emergency communications.

Hydrometrics Program, Gauging Network and Flood Monitoring Website

TRCA's Hydrometrics Program is responsible for obtaining water quantity data to support flood forecasting and warning, floodplain mapping, dam operations, watershed studies, climate studies and infrastructure design.

TRCA's real-time gauging network, together with the updated real-time gauging website, are essential tools for TRCA's Flood Forecasting and Warning program, in which the Hydrometric Program plays a critical role. Hydrometrics refers to the measurement of different components of the hydrologic cycle that includes how water moves through the atmosphere and watershed. Flood forecasting and warning systems at TRCA mainly use precipitation data (rain and snow), and water level and flow data (reservoirs and streams) for evaluating real time flood risk. TRCA operates, maintains, and monitors several different types of hydrometric networks, as outlined below.

1. **Real-time stream and reservoir gauges:** Real-time stream and reservoir gauges measure water elevation and flow and send the data to TRCA's flood monitoring website (trcagauging.ca) every 15 minutes. These gauges can be alarmed and will send alerts to TRCA staff when specified thresholds are exceeded.
2. **Real-time precipitation gauges:** Real-time precipitation gauges measure rain every 5 minutes and send the data to TRCA's flood monitoring website (trcagauging.ca). These gauges can be alarmed and will send alerts to TRCA staff when thresholds are exceeded.
3. **Remote (stand-alone) stream gauges:** Remote stream gauges do not provide real-time data. Data is recorded on-site and must be manually downloaded by TRCA's Flood Infrastructure and Hydrometrics staff. Data is downloaded monthly. Data from remote stations is used for floodplain mapping, hydraulic/hydrologic modelling, watershed plans, climate studies, infrastructure design, and post-flood event analysis. There are currently 28 remote stream gauges in the network.
4. **Remote precipitation gauges:** Remote precipitation gauges do not provide real-time data. Data is recorded on-site and must be manually downloaded by TRCA's Flood Infrastructure and Hydrometrics staff. Data is downloaded monthly. Data from remote stations is used for floodplain mapping, hydraulic/hydrologic modelling, watershed plans, climate studies, infrastructure design, and post-flood event analysis. There are currently 11 remote precipitation gauges in the network.
5. **Climate stations:** Climate stations include gauges that collect wind, temperature, humidity, soil moisture and other environmental data. Climate stations also include snow courses where Flood Infrastructure and Hydrometrics staff measure snow pack at various locations in TRCA's jurisdiction. Climate data assists TRCA staff in predicting rain and snow run-off that can help predict flood potential.

Type of Gauge / Location	York Region	Peel Region	City of Toronto	Durham Region	Total per Type
Real-time Stream gauges	4	7	9	1	21
Real-time Precipitation Gauges	10	6	8	4	28
Remote Stream Gauges	3	6	7	12	28

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Remote Precipitation Gauges	2	3	2	4	11
Climate Stations	4	1	0	2	7
Total per Region	23	23	26	23	95

The real-time gauging network is set-up to report directly to the Flood Monitoring website and database and is used to inform Flood Duty staff of real-time watershed and weather conditions. The real-time network is currently comprised of 21 stream gauges, including five at dam reservoirs, as well as 28 rain gauges (11 of which do not operate in the winter). In 2020, five new field monitoring stations were installed, of which three feed directly into the Flood Monitoring website. Additionally, one rain gauge in the City of Toronto, within the Highland Creek watershed, was upgraded in September 2020 to operate and collect data during winter months. Furthermore, a live camera feed view has been recently added at one stream gauge location in the Lower Humber River at Old Mill Rd bridge, in the City of Toronto. Camera views were previously available at two other stream gauge locations (Don River at Todmorden and Black Creek at Alliance) and at three TRCA dam locations (Claireville Dam, G. Ross Lord Dam and Milne Dam). Four additional real-time stream gauges have been proposed to be installed in 2021/2022, pending budget approvals. They are proposed to be located in the watersheds of Duffins Creek in Ajax, Highland Creek in Toronto, Don River in Markham and in the East Humber River in Richmond Hill.

TRCA will continue to identify feasible expansions to the real-time network to increase network density and improve warning times for flood messages. However, with the increased network density, comes increased cost of operations and maintenance requirements, which underscores the need for addressing funding gaps. Accordingly, the Hydrometrics Program is included in TRCA's 2021 Unfunded Priorities list.

As noted previously, TRCA uses a Flood Monitoring website (trcagauging.ca) to evaluate watershed conditions by accessing real-time stream flow, water level and precipitation information of watersheds in TRCA's jurisdiction. This information is used to assess the potential for flooding. In 2018, TRCA initiated a project to update, modernize and enhance the real-time flood monitoring and warning website both functionally and aesthetically. TRCA has recently moved to a newer and updated data acquisition system that obtains the monitoring data to populate the website display and this update required significant redesign of the back-end system of the flood monitoring website. The second phase of this update which will be completed by the end of 2021 will bring significant improvements to the source data quality, increase the reporting frequency, and create opportunities to intake third party data (like municipal partner data) into the current website.

TRCA is continuing to collaborate with the Region of Peel to support its Gauge-Adjusted-Radar-Rainfall (GARR) project, providing rain gauge data used in real-time calibration, and post-event validation, of radar-rainfall products. As it would be impossible to achieve rain gauge coverage everywhere, GARR products represent an important advancement in flood forecasting and warning and are utilized, where available, to assist Flood Forecast and Warning staff with storm event characterization. A rainfall alerting feature from the GARR system will also begin to be utilized in 2021 by TRCA Flood Forecast and Warning staff which will enhance their ability to characterize intense rainfall events. TRCA is also working with municipal partners, such as the City of Toronto and York Region, to import their rain gauge network information, with the aim of providing Flood Forecast and Warning staff with a consolidated real-time precipitation network.

Emergency Planning and Outreach

As outlined in previous annual updates, staff continue to work in partnership with municipalities to develop flood mitigation strategies for priority areas, including enhanced warning and emergency management tools, collaborative emergency planning and training opportunities, as well as communications strategies.

Site-specific Flood Response Planning (SSFRP)

TRCA has continued to work with municipal partners in developing Site Specific Flood Risk Packages (SSFRP's) for some of the highest ranked flood vulnerable clusters within TRCA's jurisdiction. These documents are informational packages, intended to be co-developed by TRCA and municipal/regional partners, to identify specific assets that may be at risk to flooding. Since municipalities have the primary responsibility for ensuring the welfare of residents, including the mandate for response actions such as evacuations, road closures, and procedures to safeguard infrastructure, TRCA's role is that of providing expertise and technical assistance regarding the riverine flood hazard to municipalities.

To date, ten final packages have been developed and have been shared and implemented with nine different municipalities within TRCA's jurisdiction and are listed below.

1. City of Mississauga, Dixie-Dundas FVC
2. Town of Caledon, Bolton Core FVC
3. City of Brampton, Spring Creek/Bramalea FVC
4. City of Toronto, Black Creek - includes Jane-Wilson and Rockcliffe-Smythe FVC's
5. City of Richmond Hill, Oak Ridges FVC
6. City of Vaughan, Woodbridge FVC
7. City of Markham, Unionville FVC (TRCA package only)
8. Town of Whitchurch-Stouffville, Downtown Stouffville FVC
9. Town of Ajax, Lower Carruthers FVC

The information in these packages can be used when responding to flood emergencies and assist municipal and agency staff to make decisions and conduct emergency response actions due to flooding. The SSFRPs do not represent formal response plans and is not meant to supersede any other Municipal, Regional, Provincial or Federal emergency processes, documents or provisions, but rather to complement them.

The process of developing the SSFRPs has also strengthened the working relationships with each of these municipal emergency management partners. Municipal emergency management and operational staff must be commended on their collaboration efforts with TRCA on the development of these critical informational packages, all while managing pandemic response activities while also balancing their tasks surrounding other hazards (like flooding), for most of 2020 and continuing into 2021.

Flood Risk Outreach

Ensuring Ontarians are aware of flood risks is one of five overarching objectives within the Ontario Flooding Strategy, and communications activities for this year include the development of new and updated digital content, informational videos, and pursuing partnerships for pro-active communications together with the Peel Climate Change Partnership, Conservation Ontario, and various municipal partners. Updates and creation of new digital content, including informational videos and factsheets, related to flood risk management and flood monitoring will be added to the trca.ca web content in order to provide the public with resources and information they may be seeking. In the realm of knowledge transfer, TRCA continues to play a

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role in facilitating the Provincial Flood Forecasting and Warning Committee workshop, which will be held virtually in the fall.

TRCA is continually communicating with municipal partners and improving processes through engagement and training. Flood Risk Management staff regularly attend and participate in working group meetings, preparedness workshops, outreach events, and collaborate on annual exercises with the various emergency management departments of our local partners. With the ongoing pandemic situation, participation in such activities in 2020/2021 was and continues to be limited. However, TRCA Flood Risk Management staff have continued to be engaged with partners and participate in events and meetings whenever possible. Some examples include, but not limited to, extensive collaboration on the Site Specific Flood Risk Packages, participating in Emergency Management Working Groups for the City of Toronto, presenting Riverine Flood Risk in York Region for the annual Hazard Identification and Risk Assessment (HIRA) review, collaboration on flood resiliency deliverables as part of the Peel Climate Change Partnership with Credit Valley Conservation (CVC) and regular communication with staff from the PEOC regarding Incident Management System training, and planning and implementation of Alert Ready Notification for Dam Emergency Preparedness Plans.

Staff continue to support collaborative initiatives with other CA's in the Greater Toronto Area (GTA) including the Peel Climate Change Partnership and the GTA Conservation Authority Flood Working Group. In early 2021, TRCA co-hosted an online virtual event, specifically for municipal partner staff, to review the role of CA's for flooding in the GTA. The Flood Forecasting and Warning Program Seminar (previously known as the Floods Happen Workshop) was co-hosted by TRCA, CVC, Halton Conservation and Kawartha Lakes Conservation. Two sessions were held over a two-day period which highlighted the roles and responsibilities of CA's, current monitoring advancements, emergency management planning projects as well as case studies focusing on ice jam and ice jam mitigation. TRCA also partnered with CVC, to create an Ice Jam Technical Guide intended as a resource for municipal operations staff or those who may have a responsibility to respond to the threat of ice jams.

TRCA also works to host other annual workshops such as the Provincial Flood Forecasting and Warning Committee workshop, in conjunction with the Ministry of Natural Resources and Forestry (MNRF) and Conservation Ontario. This annual workshop was a success in Fall 2020 where it was delivered as a virtual 5-session series of webinars. Over 200 attendees participated in the webinar sessions that occurred over several weeks between September to November. Conservation authority staff as well as MNRF, some federal water resource agencies as well as meteorological professionals were invited to review the latest flood events, policy changes and advancements in flood forecasting, monitoring and communications.

Conclusion

TRCA is consistently improving the flood management program, leveraging best-available technologies and processes to mitigate risk for priority areas. As the flood risk management program evolves to meet the challenges of our jurisdiction, the degree of technical support and expertise required to administer the various tools and technologies also increases. TRCA will continue to pursue both structural and non-structural measures to reduce the existing and substantial flood risk in our jurisdiction, leveraging updating flood mapping and modeling, incorporating new technologies, and enhancing emergency preparedness planning with municipal partners.

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Relationship to Building the Living City, the TRCA 2013-2022 Strategic Plan

This report supports the following strategy set forth in the TRCA 2013-2022 Strategic Plan:
Strategy 2 – Manage our regional water resources for current and future generations

FINANCIAL DETAILS

Funds for general FFW operations are available in operating account 115-60 (Flood Warning Program) and 115-62 (Flood Risk Management and Communications). Gauging is funded through capital account 107-01 (Flood Forecasting and Warning System).

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