

Date: 2023-04-29

Subject: Churchville Ice Jam and Flood Risk Management

Contact: Michael Heralall, Director, Environment & Development Engineering
Michael.heralall@brampton.ca

Report Number: Planning, Bld & Growth Mgt-2023-403

Recommendations:

1. THAT the report titled **Churchville Ice Jam and Flood Risk Management** to the Committee of Council meeting of May 24, 2023 be received.

Overview:

- The Churchville neighbourhood is located in the floodplain of the Credit River and has a long history of flooding. Flood controls were installed after the 1987 flood, including berms, flood walls and backflow prevention valves.
- An ice jam in the Credit River in the Churchville neighbourhood occurred from February 17th to 23rd, 2022. The ice jam caused water levels in the Credit River to rise significantly and resulted in 15 to 20 homes being flooded and the voluntary evacuation of approximately 50 homes.
- The response during this flood by the City of Brampton and Credit Valley Conservation (CVC) was immediate and commensurate, especially given the changing weather conditions. There were no injuries amongst residents, City staff and contractors working on site.
- The flooding in February 2022 appears to have had three major causes: 1) the legacy of floodplain policies in Churchville; 2) ice break-up and jamming at a sharp bend in the Credit River; and 3) failure of two storm sewer outfalls that go through the existing berms.
- These storm sewer outfalls failed because gates installed to prevent water from the Credit River flowing into the storm sewer system when river levels are high did not close properly. Water flowing into the storm sewer system from the river also caused manhole covers to pop off.

- **Following the flood event, City staff have undertaken multiple actions to restore the affected areas, increase monitoring and inspections, and implement immediate improvements to the drainage system.**
- **City staff have replaced the flap gates with new backflow prevention valves and the manhole covers have been replaced and bolted.**
- **City staff are undertaking additional inspections and studies starting in 2023, including a condition assessment of the flood walls and berms, and a Municipal Class Environmental Assessment (EA) to look at long term mitigation actions for reducing flood risk in Churchville.**
- **Potential options that will be examined through the EA include increasing the conveyance capacity of the local drainage system, creating flood storage locations in low-lying areas, and eliminating points of failure at manholes.**
- **While flood risk can be mitigated by improving operations and upgrading the existing flood controls, infrastructure alone cannot protect the people and properties from all extreme rainfall, snowmelt and ice jam events because this neighbourhood is located within the Credit River floodplain. As such, flood prevention and recovery awareness and education in addition to evacuation and emergency response will continue to be essential elements of flood risk management in Churchville.**

Background:

The Churchville neighbourhood is located on the Credit River between Steeles Avenue West and Highway 407. The low-lying neighbourhood has a long history of flooding, including at least 34 floods between 1922 and 2022, which were primarily caused by ice jams. The flood in 1987 led to the Churchville Flood Control Project which installed berms, flood walls and backflow prevention valves (Figure 1) to mitigate future flood risk from the Credit River. The total length of the berms and flood walls is approximately 875 m, of which 340 m are located on private property. The City has no easements across these private properties.

The drainage system has also been modified since the original Flood Control Project. In 2006, a new storm sewer was installed on Victoria Street to drain a new subdivision from the north down to the Credit River. Catchbasins on Victoria Street were connected to this new sewer and flap gates were installed to prevent high water levels from the Credit River backing up into the new sewer onto Victoria Street. In 2010, Peel Region replaced the storm sewer and flap gate northeast of the Churchville Road bridge during a sanitary sewer project.

An ice jam event occurred in the Churchville neighbourhood from February 17th to 23rd, 2022. Approximately 35 to 45 mm of rain fell overnight on February 16th over frozen ground, but during a warming period where snow was already melting. This resulted in 50 to 60 mm of runoff across the Credit River watershed. River ice quickly broke up and began to move downstream. An ice jam formed in the elbow of the Credit River downstream of the Churchville Road bridge. Rising water levels backed up through multiple storm sewer systems and may have also overtopped the berm. Approximately 15 to 20 homes were flooded, and 50 homes were asked to voluntarily evacuate. The ice remained stuck until February 23rd, 2022.

The 15 to 20 flooded homes in the Churchville neighbourhood are located within the floodplain of the Credit River as shown in Figure 2. There are 550 properties in Brampton that are wholly or partially located within the floodplain of the Credit River and its tributaries.

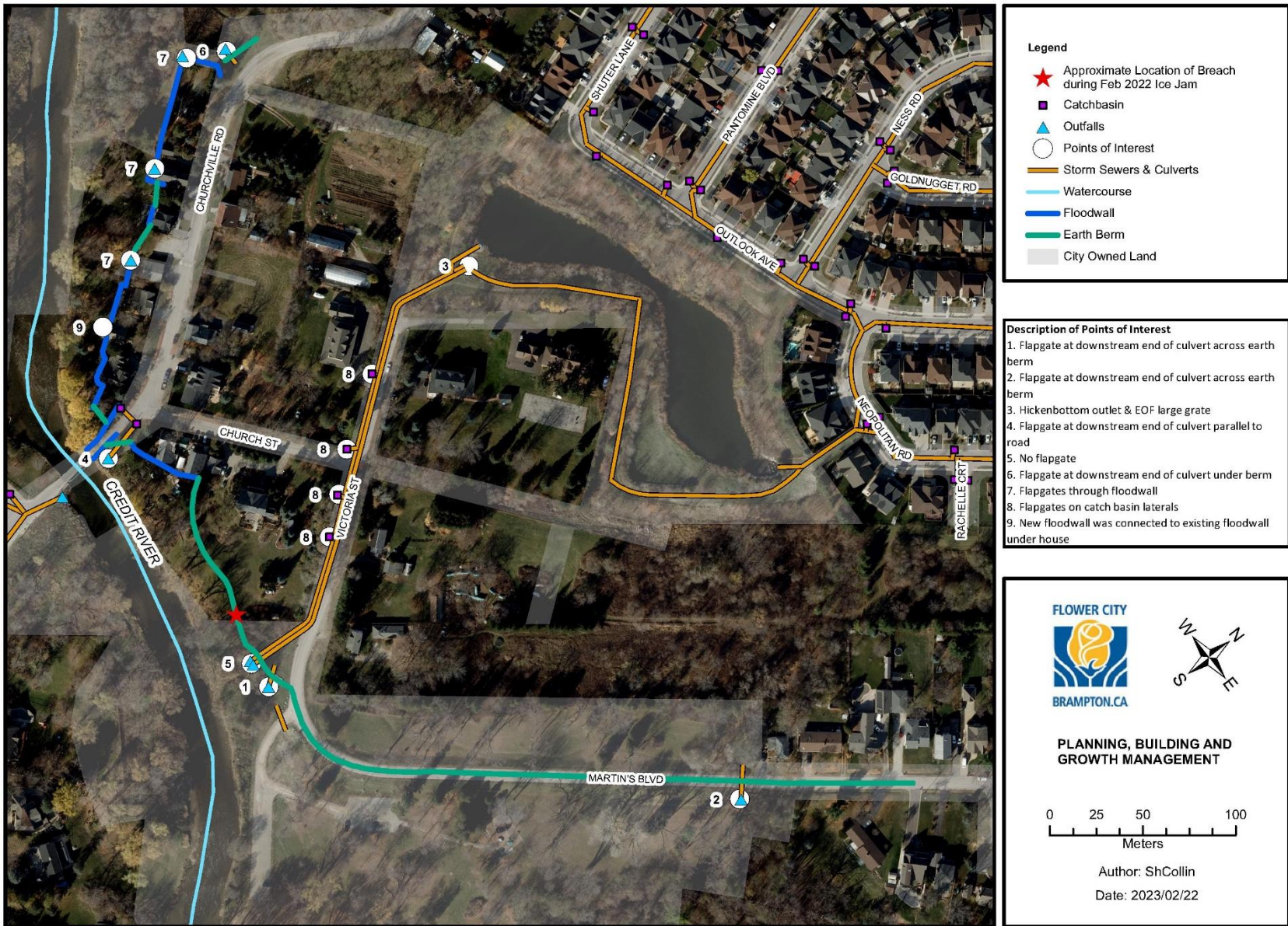


Figure 1. Churchville Flood Control Project Infrastructure




Legend


- Watercourse
- Regulatory Floodline (Unofficial)
- Regulatory Floodplain (Unofficial)

Note: The Regulatory floodline (unofficial) was plotted using the results from the official Credit River HEC-RAS model (EWRG, 2008) and newer LiDAR elevation data.

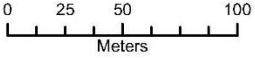
Source: Credit Valley Conservation Authority 2023



FLOWER CITY
BRAMPTON.CA



PLANNING, BUILDING AND GROWTH MANAGEMENT



Meters

Author: ShCollin
Date: 2023/04/06

Figure 2. Credit River Floodplain in Churchville Neighbourhood

Current Situation:

On March 2, 2022, City Council passed the resolution C056-2022, which directed staff to report back to Council with a post-mortem of the event, an assessment, and a potential strategy for the improvement of the infrastructure in Churchville.

Response during Ice Jam

The response during this flood by the City of Brampton and CVC was immediate and commensurate, especially given the changing weather conditions throughout the event and the inherent challenges associated with ice management. There were no injuries amongst residents, City staff and contractors working on the site.

CVC compiled the following lessons learned regarding ice jams:

1. *Prediction:* It is impossible to predict when or where an ice jam will occur. CVC staff can reasonably predict when weather conditions are ideal for river ice break-up; however, what the ice will do after breakup cannot be predicted. Ongoing field monitoring of conditions using flow gauges and by patrol staff is important.
2. *Intervention & Blasting:* The best time to blast, an ice jam is right after the jam has formed because there will be sufficient flow behind the jam to clear the jam. However, unstable ice jams are unsafe for workers. Furthermore, blasting contractors have a specialized skillset and are not prevalent throughout the GTA. CVC used to perform river ice blasting as recently as the 1990s but no longer undertakes this work as a result of past changes to their mandate and budgets. The lag time for any qualified contractors to arrive on site means that the ideal blasting window is usually passed before any blasting work can start.

It is important to note that blasting ice jams can send the problem downstream if the broken up ice creates another jam. In the case of the February 2022 event, staff were mindful of this risk to Highway 407 and the City of Mississauga. City staff elected not to blast this ice jam but it was considered as a “last resort” option.

3. *Release without Intervention:* If an ice jam develops and no mitigation efforts are applied, the following scenarios can unfold:
 - a) Ice jams can release by themselves.
 - b) Ice jams can release when a large influx of flows come from upstream.
 - c) Ice jams can become grounded/stuck when the water levels decline. This can persist for several days or weeks depending on conditions.
 - d) Ice jams can melt away. The water temperature appears to have a larger influence on the rate of melt compared to air temperature.

Debriefing

City staff and CVC debriefed the February 2022 event to assess the severity and causes of flooding. The flooding appeared to have three major causes:

1. *Legacy floodplain policies in Churchville*

Previous policies allowed development within the floodplain in Churchville. Today there are approximately 50 buildings in the floodplain while at least 34 floods have occurred since 1922. High water from the Credit River will always look to occupy the lowest ground nearby, including the Churchville neighbourhood.

2. *Ice break-up and jamming in the river elbow*

Peak flows along most of the Credit River during the February 2022 event were equivalent to approximately a 1-in-10-year flood (1:10-year flood). A 1:10-year flood would normally (in the absence of ice jams) cause only minor flooding along the Credit River in low-lying areas. Peak water levels in Churchville were higher than the 1:100-year flood during the event because of the ice jam at the first elbow downstream of the Churchville Road bridge.

3. *Failure of two storm sewer outfalls through the existing berms*

Outfall failures at locations 4 and 5 (Figure 1) allowed flooding in the Credit River to back up into the roads and properties behind the berms and floodwalls.

A small part of the flood protection berm was overtopped at the location shown in Figure 1 but this was a minimal contribution to flooding compared to the sewer backup and surcharging.

Post-flood Restoration

City staff restored the park, roads, swales, and bridge throughout the neighbourhood after the ice jam event. Additional details on the restoration work undertaken after the ice jam and additional work since then are provided in the attached table.

Condition of Flood Control Infrastructure

City staff and contractors inspected the storm sewers, culverts, flap gates, and ditches after the ice jam to identify maintenance needs. The failures at locations 4 and 5 in Figure 1 appear to have occurred due to jammed flap gates and bolts securing manhole lids being sheared off. City staff have replaced the flap gates with new backflow prevention valves that are less prone to clogging or jamming. In addition, the manhole lids have been replaced and bolted. Storm sewers and culverts have also been flushed which will help reduce the risk of clogging the valves. City staff have repaired the culvert at location 2 in Figure 1.

In addition, annual operational programs moving forward will include more frequent:

- Inspection and hand-removal of debris at outfalls;
- CCTV inspection of storm sewers;
- Flushing culverts, storm sewers, and catchbasin leads; and
- Mowing vegetation at outfalls.

Next Steps

In addition to ongoing operational improvements, as well as the installation of improved flap gates to replace previous ones, the City will be looking at approaches to reduce flood risk for the long term.

This includes:

Structural Assessment of Existing Flood Protection

The City has retained a qualified consultant to inspect the existing floodwalls and berms, assess their structural condition, and identify any improvements needed to restore full functionality and integrity. Inspections are expected to be completed by Q3 2023. Approximately 40% of the berms and floodwalls are across private property, as shown in Figure 3. Given the absence of any easements to allow the City to enter onto private property to access these segments of the berms and floodwalls, City staff have contacted these property owners requesting permission to access their property.

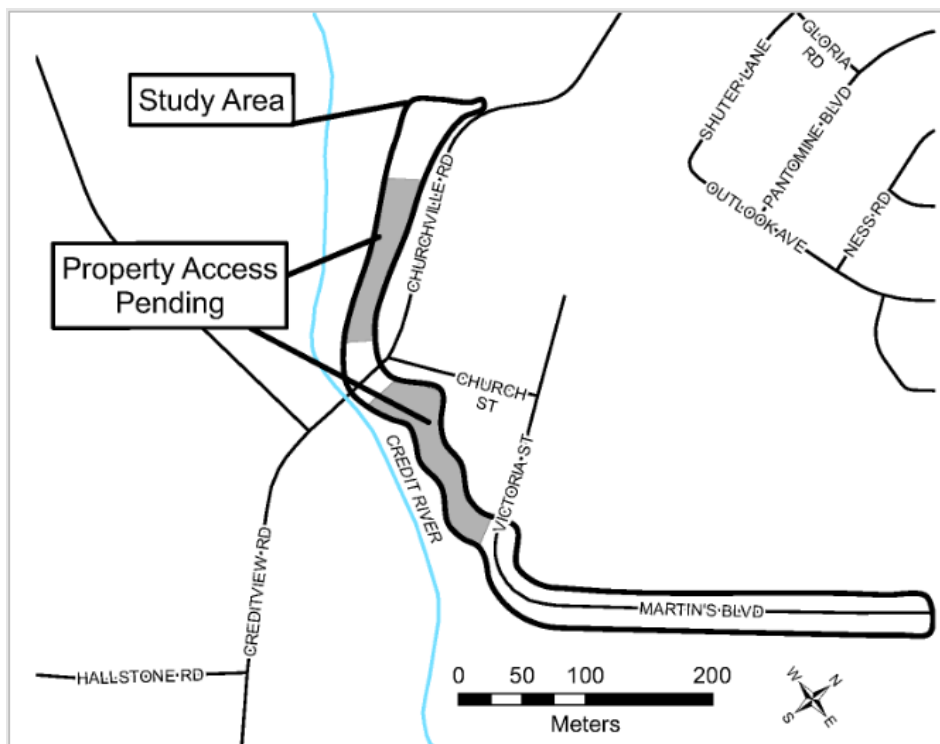


Figure 3. Property Access Needed for Private Berm and Floodwall Condition Assessment

Identification and Assessment of Further Flood Mitigation Measures

The City will begin a Municipal Class Environmental Assessment (MCEA) in Q2 2023 to evaluate engineering solutions for reducing flood risk in Churchville. Potential solutions may include but are not limited to retrofitting the Victoria Street storm sewer to seal and separate it from local drainage on Victoria Street. This assessment will engage residents, additional regulatory agencies (Province, CVC) and other stakeholders in floodplain management. These assessments typically take upwards of a year to be completed. Only

upon completion, and on the expectation that there are meaningful solutions identified, can the City move to implement those improvements through appropriate capital projects.

Development of Ice Management Plan

CVC will develop an Ice Management Plan in accordance with the changes to the *Conservation Authorities Act* in Bill 23. However, it is not possible to forecast an ice-jam event because the state of the science of river-ice is in its infancy.

Communications Portal

City staff will continue to provide updates on operations, maintenance and upcoming projects in Churchville through this new page on the City's website: www.brampton.ca/ChurchvilleIceJam.

Corporate Implications:

Financial Implications:

Staff estimate the total cost of the planned initiatives are \$345,000 (inclusive of 1.76% of non-recoverable HST). Sufficient funding exists in the following project to fund this initiative:

Capital Project	Budget Available
234941-003 - <i>Stormwater Asset Management -Capital Improvements</i>	\$350,000

Legal Implications:

Currently, the City does not have any easements present on properties within Churchville on which the berm and floodwalls are located. These flood protection infrastructure elements are located on a mix of public and private properties. Typically, infrastructure located on private property without easements taken by the City would be the responsibility of the property owner to ensure its continued integrity and function. The City will need to consider the question of whether to assume the maintenance obligations of infrastructure on private property as part of the long term plan for flood risk reduction in Churchville.

Term of Council Priorities:

The actions and initiatives described in this report supports Term of Council Priority to ensure Brampton is a Well-run City.

Conclusion:

Legacy floodplain policies, the ice jam and failures at two storm sewer outlets appear to have caused the flooding in Churchville in February 2022. Outlet controls intended to prevent water from the Credit River flowing into the local drainage system under high river levels failed and caused water to back up into the drainage system and on to the roads and properties behind the berms and floodwalls. City staff have replaced the flap gates with new backflow prevention valves and the manhole lids have been replaced and bolted.

The City is continuing to assess and implement operational improvements to ensure any issues are identified and dealt with as early as possible. Further, the City is conducting an assessment of the condition of the berms and floodwalls to establish its competence, identify any defects and repairs needed, and develop a strategy for managing these assets moving forward. The City will also commence a Municipal Class Environmental Assessment in 2023 to identify and evaluate potential engineering solutions for reducing flood risk in Churchville. Only upon completion, and on the expectation that there are meaningful solutions identified, can the City move to implement those improvements.

Infrastructure alone cannot protect people and properties from all extreme rainfall, snowmelt, and ice jam events in Churchville because the neighbourhood is located within the floodplain of the Credit River. As such, flood prevention and recovery awareness and education in addition to evacuation and other emergency response measures will continue to be essential components of a flood risk management and reduction plan for Churchville. The City is well prepared for these emergency measures with the leadership of Brampton Fire and Emergency Services (BFES) and the Brampton Emergency Management Office (BEMO) as well as support by Brampton Transit, Public Works, and Region of Peel. The flood forecasting and warning programs run by CVC and Toronto and Region Conservation Authority support the City in preparing for anticipated events.

Authored by:

Olivia Sparrow
Manager, Stormwater Programs

Reviewed by:

Michael Heralall
Director, Environment and Development
Engineering

Approved by:

Steve Ganesh, MCIP, RPP
Commissioner, Planning, Building &
Growth Management

Submitted by:

Marlon Kallideen
Chief Administrative Officer

Attachments:

Ice Jam Information Sheet
Actions by Staff