REPORT

Town of Innisfil

Municipal Class Environmental Assessment Addendum 7th Line Storm Drainage Outlet

MAY 2020

Associated Engineering

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Version	Date Issued	Recipient	Comments
Rev. 1	March 17, 2020	Town of Innisfil	Issued for client review
Rev. 2	April 9, 2020	Town of Innisfil	Issued for final client review
Rev. 3	May 13, 2020	Town of Innisfil	Issued as Final Report

EXECUTIVE SUMMARY

Background

Within the Town of Innisfil (the Town), Watercourse No. 5, also known as Banks Creek, meanders adjacent to 7th Line then crosses to the south side of the road where it intersects with St. Johns Road, before converging with Lake Simcoe. The section of Banks Creek downstream of St. Johns Road has a history of significant flooding during storm events, causing erosion along the watercourse and impact to private properties. The Town has also expressed concerns regarding access to the watercourse for maintenance.

In response, the Town initiated a Municipal Class Environmental Assessment (MCEA) Study in 2005 to evaluate alternative solutions and identify a preferred solution to improve the drainage capacity of Banks Creek from St. Johns Road to Lake Simcoe. The study limits for the MCEA Study extended from 7th Line, approximately 150m west of St. Johns Road, to Lake Simcoe (**Figure E-1**). This comprised approximately 490 metres of Banks Creek. The MCEA was undertaken in compliance with Schedule 'B' of the Municipal Class Environmental Assessment process (Municipal Engineers Association, June 2000).

Figure E-1: Watercourse No. 5 (Banks Creek), Town of Innisfil

The results were documented in a Summary Report completed in March 2007. The MCEA process recommended that the preferred solution include the replacement of the existing cast in place concrete box culvert structure at Cross Street with a concrete arch span structure, which would provide a significant reduction in flooding during the more frequent storms, of up to the 5-year event.

Rationale for the MCEA Addendum

The preferred solution recommended in the 2007 MCEA had not been implemented within 10 years. Consequently, in accordance with the guidance document for Municipal Class Environmental Assessments (Municipal Engineers Association (MEA), October 2000, as amended 2007, 2011 & 2015), Section A.4.3.,

"If the period of time from (i) filing of the Notice of Completion of Environmental Study Report (ESR) in the public record or (ii) the MOE's denial of a Part II Order request(s), to the proposed commencement of construction for the project ***exceeds ten (10) years****, the proponent shall review the planning and design process and the current environmental setting to ensure that the project and the mitigation measures are still valid given the current planning context. The review shall be recorded in an addendum to the ESR which shall be placed on the public record."*

In addition, to support the detailed design phase, additional technical investigations were completed, including geotechnical investigation, natural environment assessment and hydraulic and hydrologic assessments of the watercourse and proposed culvert structure. At the outcome of these investigations, it was determined that the preferred solution is no longer applicable for various reasons including:

- The benefit-cost ratio of culvert replacement is low;
- The new culvert structure would only provide minimal floodplain benefits, particularly during high water levels in Lake Simcoe and high-intensity storm events;
- The existing structure still has adequate service life remaining (approximately 20 years);
- There were significant data gaps in terms of historical flooding issues and causes; and
- The preferred solution did not address the access issues identified by the Town.

MCEA Process – Addendum to Summary Report

The MCEA planning and design process allows for re-evaluation of the preferred solution and/or preferred design concept. The MCEA addendum process allows a proponent to:

- consider new data and solutions found through recent investigation; and
- submit a revised preferred solution or design concept to the public and agencies for review.

The original preferred solution was a Schedule B MCEA activity. Therefore, this MCEA Addendum reflects Schedule B requirements of the MEA MCEA process, focusing on amending Phase 2 (identifying a preferred solution), and Phase 5 (implementation).

This MCEA Addendum to the March 2007 Summary Report documents new information identified through additional investigations during the detailed design stage and describes how this information was considered in refining the preferred alternative solution. The Addendum should be reviewed in conjunction with the original Summary Report.

Notice of Addendum

The original Summary Report (March 2007) and the MCEA Addendum are being placed on the public record for a 30-day review period in accordance with the requirements of the Municipal Class Environmental Assessment process.

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1.1 Background

Within the Town of Innisfil (the Town), Watercourse No. 5, also known as Banks Creek, meanders adjacent to 7th Line then crosses to the south side of the road where it intersects with St. Johns Road, before converging with Lake Simcoe. The section of Banks Creek downstream of St. Johns Road has a history of significant flooding during storm events, causing erosion along the watercourse and impact to private properties. The Town has also expressed concerns regarding access to the watercourse for maintenance.

In response, the Town initiated a Municipal Class Environmental Assessment (MCEA) Study in 2005 to evaluate alternative solutions and identify a preferred solution to improve the drainage capacity of Banks Creek from St. Johns Road to Lake Simcoe. The study limits for the MCEA Study extended from 7th Line, approximately 150m west of St. Johns Road, to Lake Simcoe (**Figure 1-1**). This comprised approximately 490 metres of Banks Creek. The MCEA was undertaken in compliance with Schedule 'B' of the Municipal Class Environmental Assessment process (Municipal Engineers Association, June 2000).

Figure 1-1: Watercourse No. 5 (Banks Creek), Town of Innisfil

A Summary Report documenting the planning, public consultation and decision-making process followed to arrive at the preferred solution was completed in October 2006. After endorsement of the preferred solution by Town Council on November 1, 2006, the *7th Line Storm Drainage Outlet Schedule "B" Class Environmental Assessment Summary Report* was placed on the public record and was available for public review and comment for a 30-day period commencing January 3, 2007. Following the public review period, on February 16, 2007, the Ministry of the Environment (MOE)

was issued a memo notifying them of the completion of the MCEA process in accordance with the *Environmental Assessment Act*.

As detailed in the Summary Report, "increasing the conveyance capacity of the existing structure at Cross Street would be adopted as the preferred solution". Based on information available at the time and as documented in the Summary Report, the preferred solution included the replacement of the existing cast in place concrete box culvert structure at Cross Street with a concrete arch span structure, which would provide a significant reduction in flooding during the more frequent storms, of up to the 5-year event.

In 2018, the Town retained Associated Engineering (Ont.) Ltd. (AE) to prepare the detailed design and assist with construction administration for implementation of the preferred solution for the 7th Line Storm Drainage Outlet project.

1.1.1 Overview: 2007 Municipal Class Environmental Assessment

The original MCEA study identified and evaluated seven (7) alternative solutions and presented them to the public at a Public Information Centre (PIC) in January 2006. These alternatives included:

- No. 1 – Do Nothing;
- No. 2 – Construct a Piped Outlet to Lake Simcoe Along the 7th Line;
- No. 3 – Lower the Profile of the 7th Line Between St. Johns Road and the Lakeshore to provide an Overland Flow Route;
- No. 4 – Increase the Conveyance Capacity of the Structure at Cross Street;
- No. 5 – Turn Cross Street into a Cul-de-Sac and Remove Existing Structure Entirely;
- No. 6 – Create a Stormwater Detention Facility on Town Owned Lands; and
- No. 7 – Implement Measures Within Channel Limits.

The recommended solution presented at the PIC was No. 4 - Increase the Conveyance Capacity of the Structure at Cross Street. As a result of comments received at the PIC, the following additional alternatives were considered:

- No. 8 – Purchase the Affected Properties;
- No. 9 – Provide Stormwater Detention to control the 10-Year flows to 5-Year Levels at the Outlet to Lake Simcoe;
- No. 10 – Provide Stormwater Detention to control the 25-Year flows to 9.1m^3/s at the Outlet to Lake Simcoe; and
- No. 11 – Provide Stormwater Detention to control the 100-Year flows to 12.9m^3/s at the Outlet to Lake Simcoe.

Based on the responses received from the PIC and subsequent to the consideration of the additional alternatives, the original recommended solution of increasing the conveyance capacity of the existing structure at Cross Street was identified as the preferred solution. The existing culvert structure at Cross Street as well as the current road profile and the water level in Lake Simcoe were identified as restrictions, which contribute to the flooding of Banks Creek. Replacement of the existing structure with a concrete arch span structure would provide a significant reduction in flooding during the more frequent storms, of up to the 5-year event. The Summary Report identified that while there would be little reduction in flooding during the less frequent storms, given that it involves less extensive construction and is less expensive than other alternatives, the culvert replacement was a viable solution with an estimated cost of $400,000.

1.2 Class EA Addendum

The preferred solution recommended in the 2007 MCEA had not been implemented within 10 years. Consequently, in accordance with the guidance document for Municipal Class Environmental Assessments (Municipal Engineers Association (MEA), October 2000, as amended 2007, 2011 & 2015), Section A.4.3.,

"If the period of time from (i) filing of the Notice of Completion of Environmental Study Report (ESR) in the public record or (ii) the MOE's denial of a Part II Order request(s), to the proposed commencement of construction for the project ***exceeds ten (10) years****, the proponent shall review the planning and design process and the current environmental setting to ensure that the project and the mitigation measures are still valid given the current planning context. The review shall be recorded in an addendum to the ESR which shall be placed on the public record."*

In addition, to support the detailed design phase, additional technical investigations were completed, including geotechnical investigation, natural environment assessment and hydraulic and hydrologic assessments of the watercourse and proposed culvert structure. At the outcome of these investigations, it was determined that the preferred solution is no longer applicable for various reasons including:

- The benefit-cost ratio of culvert replacement is low;
- The new culvert structure would only provide minimal floodplain benefits, particularly during high water levels in Lake Simcoe and high-intensity storm events;
- The existing structure still has adequate service life remaining (approximately 20 years);
- There were significant data gaps in terms of historical flooding issues and causes; and
- The preferred solution did not address the access issues identified by the Town.

Based on these findings, and as per Section A.4.3. of the MEA guidance document,

"Due to unforeseen circumstances, it may not be feasible to implement the project in the manner outlined in the ESR. Any significant modification to the project or change in the environmental setting for the project which occurs after the filing of the ESR shall be reviewed by the proponent and an addendum to the ESR shall be written. The addendum shall describe the circumstances necessitating the change, the environmental implications of the change, and what, if anything can and will be done to mitigate any negative environmental impacts."

The MCEA planning and design process allows for the re-evaluation of the preferred solution. The MCEA Addendum process allows a proponent to consider new data and solutions found through recent investigations and submit a revised preferred solution to public and agency bodies for review. As the original MCEA Study was a Schedule B undertaking, this MCEA Addendum reflects Schedule B requirements, focusing on amending Phase 2 (identifying a preferred solution), and Phase 5 (implementation) of the MEA MCEA process. Phase 1 (identifying the problem) has not changed and is not considered in this Addendum. This Addendum should be reviewed in conjunction with the original Summary Report.

This MCEA Addendum will:

- Review and update the current environmental setting
- Identify additional alternative solutions
- Evaluate the additional alternatives relative to the alternative solutions in the original MCEA
- Identify and re-evaluate potential impacts
- Identify and re-evaluate mitigation measures to be deployed

- Consult with the public and review agencies
- Select a revised preferred alternative solution(s)

1.2.1 30-Day Review Period Part II Order

Following the issue of the Notice of Filing of Addendum, a 30-day period is provided to allow the Addendum to be reviewed by the public and review agencies. Only the proposed changes to the alternative solution identified in this MCEA Addendum are open for review.

In the event that a person or party has concerns or objections to the information provided, the proponent and the person or party raising the concern shall endeavour to come to a resolution. If the issue cannot be resolved, the person or party raising the objection may write to the Minister of the Environment, Conservation and Parks or delegate to request a Part II Order. A request for a Part II Order must be copied by the requester to the proponent at the same time that it is submitted to the Minister or delegate.

A Part II Order can be requested after the proponent issues the Notice of Filing of Addendum and within the specified review period outlined in the Notice (30 calendar days from issuance of Notice). As of July 1, 2018, a person or party wishing to request a Part II Order must use a Part II Order Request Form which can be found on the Forms Repository website (http://www.forms.ssb.gov.on.ca/) by searching "Part II Order" or "012-2206E" (the form ID number). The form will require you to provide the following information:

- Your name and address;
- Project name;
- Proponent name;
- Specific reasons why the request is being made - concerns and issues;
- Why a higher level of environmental assessment would address your concerns;
- Information about efforts to date to discuss and resolve concerns with the proponent;
- The outcome you are seeking from the Minister; and
- Other matters relevant to the request.

Unless you state otherwise in your request, any personal information you provide will become part of the public record and will be released, if requested, to any person.

In your request, you must:

- focus on potential environmental effects of the project or the MCEA process;
- not focus on decisions outside the MCEA process (e.g., land-use planning decisions made under the planning Act or issues related to municipal decision-making about the process); and
- not raise issues unrelated to the project.

Once completed, the form is to be sent to the Minister of the Environment, Conservation and Parks, the Director of Environmental Assessment and Permissions Branch and the Proponent at:

Minister
Ministry of the Environment, Conservation and Parks
Floor 11
77 Wellesley St. West
Toronto, ON M7A 2T5
Minister.mecp@ontario.ca

Director, Environmental Assessment and Permissions Branch
Ministry of the Environment, Conservation and Parks
135 St. Clair Ave. West, 1st Floor
Toronto, ON M4V 1P5
enviropermissions@ontario.ca

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Capital Project Manager
Town of Innisfil
2101 Innisfil Beach Road
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aleal@innisfil.ca

PHASE I: CONFIRMATION OF PROBLEMS & OPPORTUNITIES

2 PROBLEM AND OPPORTUNITY STATEMENT

Problem and Opportunity statements in MCEA's outline the problem and/or opportunity that the subject project is intended to address. The considerations in the remainder of the MCEA should seek to justify the advantage and disadvantages of each alternative in the context of the problem and opportunity statement.

For the purposes of the MCEA Addendum, the original problem statement is being left as-is. The original Problem Statement stated:

"*The Town of Innisfil is undertaking a Class Environmental Assessment to consider alternatives for improving the storm drainage capacity of Watercourse No. 5 from the intersection of St. Johns Road and the 7th Line to Lake Simcoe as this section of the watercourse experiences flooding during storm events. This capacity condition existed prior to the development of the newer subdivisions on the north and south side of the 7th Line.*

The Municipality does not own the lands which this portion of the watercourse traverses, nor does the Municipality have access easements."

PHASE II: ALTERNATIVE SOLUTIONS

3 EXISTING CONDITIONS

The study area currently supports a residential area and a tributary of Banks Creek which runs east into Lake Simcoe. Due to the presence of the watercourse, associated Regulated Lands within the jurisdiction of the Lake Simcoe Region Conservation Authority (LSRCA) exist (**Figure 3-1**).

Figure 3-1: Lake Simcoe Region Conservation Authority Regulated Lands

In order to characterize the study area, several policies were reviewed as well as subject-specific assessments were completed. Relevant policies that were reviewed include:

- The Town of Innisfil Official Plan (2018)
- The Town of Innisfil Comprehensive Stormwater Management Master Plan (2016)
- Official Plan of the County of Simcoe (2016)
- South Georgian Bay Lake Simcoe Region's Source Protection Plan (amended 2019)
- Lake Simcoe Protection Plan (2009)
- Provincial Policy Statement

The study area is within the Alcona Settlement Area (Schedule A and B1 of the Town's Official Plan) and is within the Banks Creek catchment (Figure 8 of the Town's Stormwater Management Master Plan). Based on the 2016 Stormwater Management Master Plan, there are five (5) existing stormwater management (SWM) ponds upstream of the study area, as shown in **Figure 3-2**, including:

- Previn Court SWM wet pond built in 2002;
- Tepco-North SWM wet pond built in 2005;
- Wallace Mills North SWM wet pond built in 2002;
- Wallace Mills South SWM wet pond built in 1998; and
- ORSI Bayshore Estates SWM wet pond built in 1999.

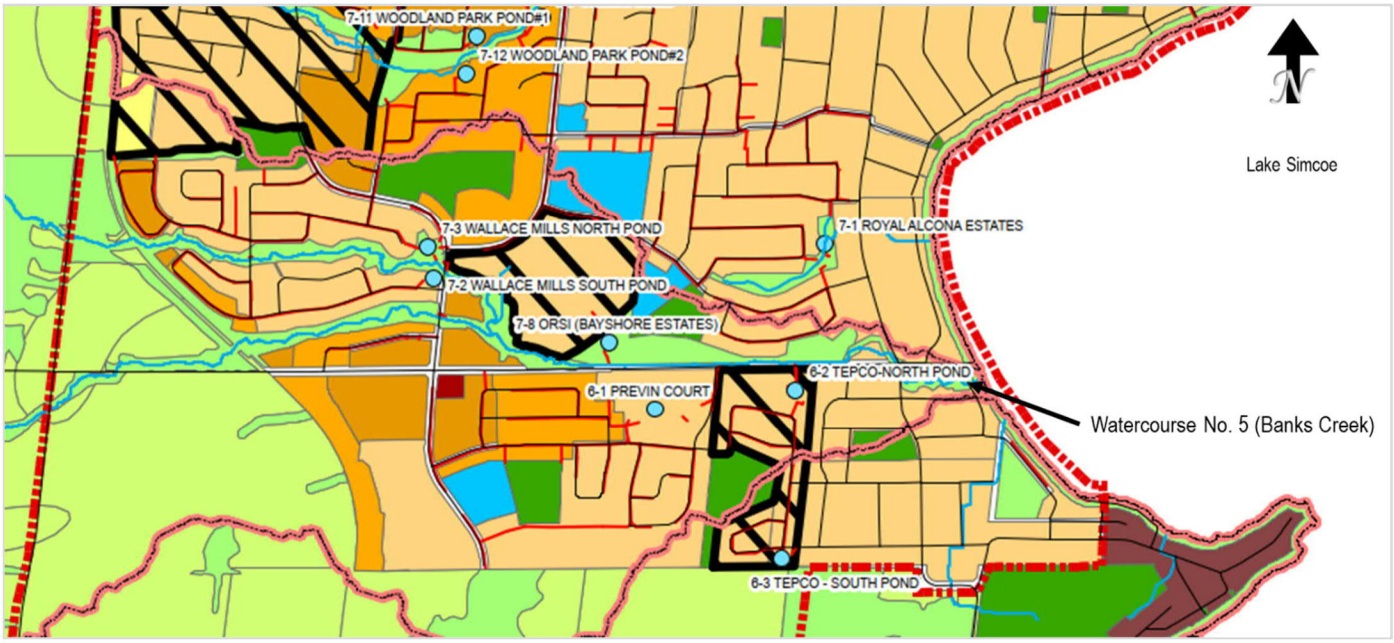


Figure 3-2: Stormwater Management Ponds Upstream of Study Area (from Figure 7A of Town's Stormwater Management Master Plan, 2016)

As documented in the Innisfil Creeks Subwatershed Plan, Banks Creek is a coldwater system, which is almost entirely urbanized in the lower section (LSRCA, 2018). The system is protected under the Federal *Fisheries Act*.

The Innisfil Mobility Orbit

In November 2019, the Innisfil Town Council approved a Staff Report recommending the endorsement of the Mobility Orbit Vision (Orbit) for the Town of Innisfil. Orbit is an innovative vision of providing urban benefits within a rural community. A Metrolinx GO Station is anticipated in Innisfil at 6th Line some time between 2022 and 2025. Orbit is a proposed community concept to be built around the GO Station in the area of the 6th Line and east of 20th Sideroad (**Figure 3-3**).

Currently, the Town is undertaking a Master Plan for the Orbit community. Although the study area of this EA Addendum is outside of the Orbit area, upstream areas, such as 7th Line, will likely be impacted by the Orbit development.

Figure 3-3: Innisfil Mobility Orbit Vision - Proposed Layout

3.1 Land Use and Property Ownership

The study area is within the Town of Innisfil's Alcona Urban Settlement area. Land use surrounding Banks Creek within the study area is designated as Residential Low Density One, which recognizes primarily existing low density residential development and seeks to maintain its character (2018 Town of Innisfil Official Plan).

Currently, the Banks Creek watercourse within the study area is owned by the Crown. Under Crown ownership, responsibility regarding operations and maintenance of the watercourse is absolved. The Town is in the process of having the watercourse downgraded to Town ownership. Once the Town has ownership of the watercourse, they will be responsible for the operations and maintenance of the watercourse.

The surrounding residential lots have ownership to water's edge including existing retaining wall structures along the banks of the watercourse (**Figure 3-4).** However, as can be seen in **Figure 3-5**, overtime the watercourse has meandered outside of the original property limits; therefore, in addition to the Town not having ownership of the watercourse presently, there are portions of the watercourse which have meandered onto private property and provide no maintenance access for the Town.

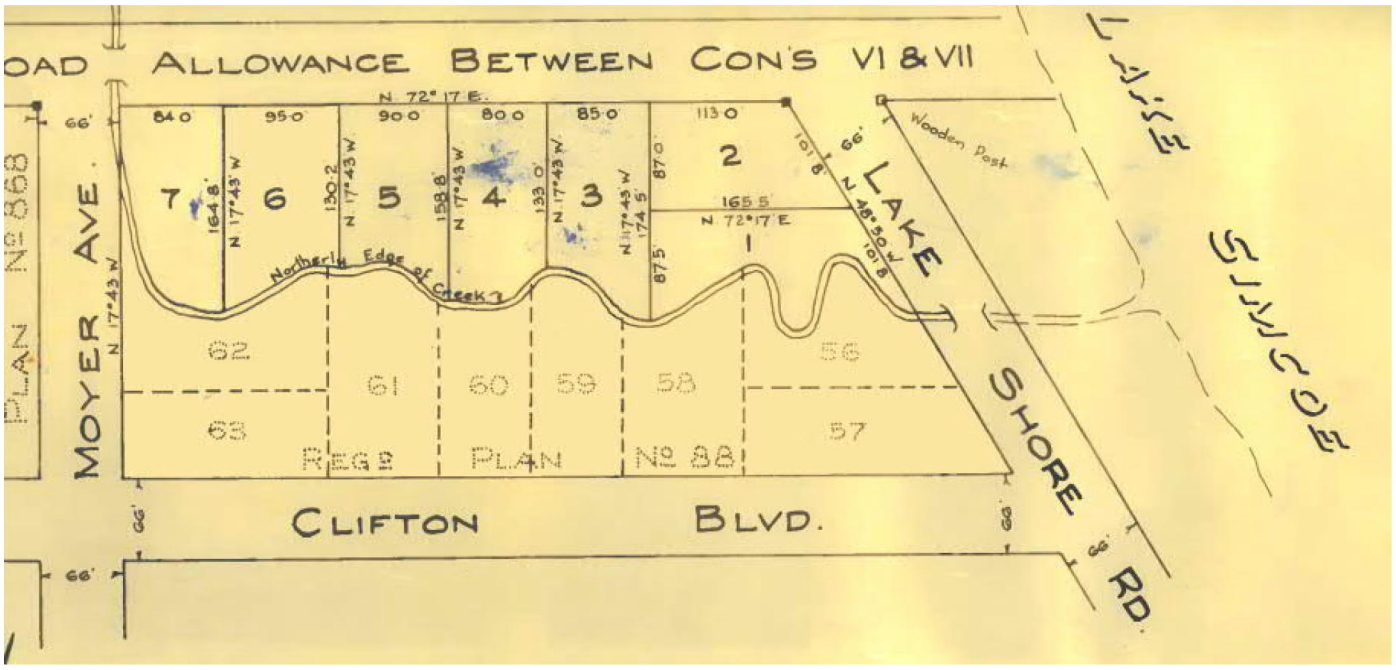


Figure 3-4: Property Limits along Banks Creek (1950 survey)

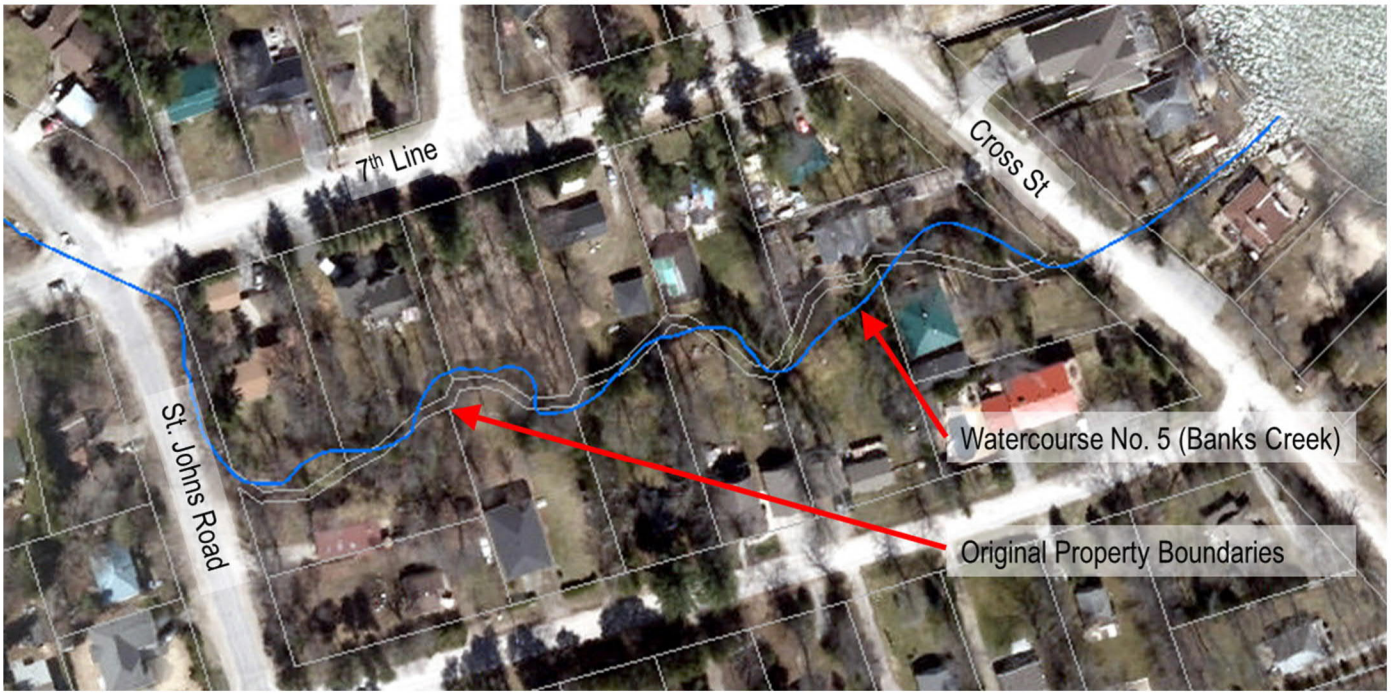


Figure 3-5: Property Limits along Banks Creek (current conditions)

3.2 Existing Cross Street Culvert Structure

The existing culvert structure at Cross Street (RC2506) is a single cell cast-in-place concrete box culvert (**Figure 3-6**). The year of construction is unknown, however, existing engineering drawings of the 900mm diameter sewer installation on Cross Street in 1986 show the existing culvert in place. An OSIM (Ontario Structural Inspection Manual) Inspection and Report was completed in 2017 for the structure. The report indicates that, based on inspection and condition of the culvert, that replacement of the culvert should occur in approximately 18 years. The culvert was identified as being in good condition with a BCI (Bridge Condition Index) of 73.5 (a BCI of 100 represents a new structure). The inspection identified only typical concrete defects such as scaling, small spalls and cracking.

Figure 3-6: Existing Cross Street Culvert Structure

3.3 Hydraulic and Hydrology Assessment

An hydraulic and hydrologic analysis was completed which confirmed that the existing culvert structure at Cross Street is undersized for the design event. The existing Cross Street culvert structure (RC2506) is a single cell cast-in-place concrete box culvert with a hydraulic opening of approximately 4.5m by 1.5m (6.75m^2). The analysis further indicated that the increase in conveyance capacity offered by a new structure (the original preferred solution of the 2007 MCEA) would not translate to significant reductions in floodplain extent or depths. For further details related to the following discussion refer to the technical memos (*Technical Memo #1 – Hydrology and Hydraulics Memo* and *Technical Memo #2 – Cost Benefit*) provided in **Appendix A**.

The study area is within the Great Lakes – St. Lawrence primary watershed and part of the Black River – Lake Simcoe tertiary watershed (**Figure 3-7**).

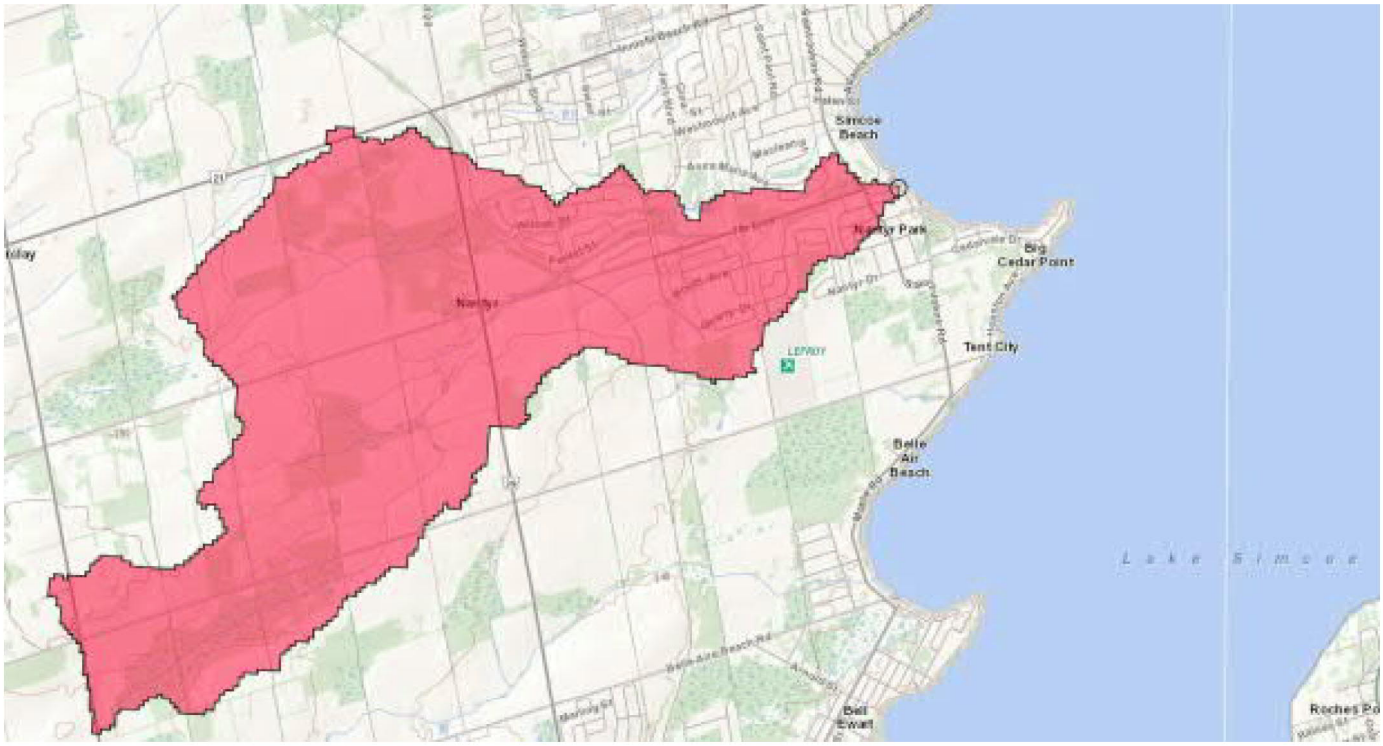


Figure 3-7: Study Area Watershed

Lake Simcoe

Banks Creek outlets to Lake Simcoe, which is a regulated waterbody part of the Trent-Severn Waterway. Water levels in the lake are managed to strike a balance between flood prevention, recreational use, and fish and wildlife habitats. Typically, Lake Simcoe water levels vary by about 0.4 to 0.5 metres during any given year. The highest levels usually occur between April and June and the lowest levels typically occur in late fall and winter. The Waterway and its tributary lakes and rivers are controlled by Parks Canada in collaboration with Ministry of Natural Resources and Forestry (MNRF), local conservation authorities (CAs), and hydro producers.

3.3.1 Hydrology

Three (3) non-hydrographic statistical hydrological estimation methods (Northern Ontario Hydrology Method; Modified Index Flood Method; and Primary Multiple Regression Model) were used to estimate flow rates for the culvert location and compare with results of three (3) previous hydrological studies (previous hydrology report (as part of the previous MCEA completed in 2007); flows as per LSRCA HEC-RAS model; and flows as per Alcona South Master Drainage Plan (C.C. Tatham & Associates, 2018)). The use of three (3) methods helps provide confidence in the results and offers a comparative, conservative flow estimation for design purposes.

The results of these analyses are shown in **Table 3-1** and are compared with the flows provided in the previous hydrology report (as part of the previous MCEA), flows as estimated in the Alcona South Master Drainage Plan, as well as the flows already in the existing LSRCA HEC-RAS model. The most conservative 10-Year flow estimate was selected.

Table 3-1: Hydrology Analyses Summary

	Flow Estimations (m^3/s)					
	Hydrological Estimation Methods			Other Existing Hydrological Estimates		
Return Period	NOHM	MIFM	Moin & Shaw PMR	Previous Hydrology Report	LSRCA HEC-RAS model	Conservative Estimate (m^3/s)
2-Year	2.4	6.9	2.8	n/a	n/a	6.9
10-Year	3.9	11.5	6.3	n/a	11.2	11.5
100-Year	5.6	17.2	12.0	16.0	16.6	17.2
Regional	n/a	n/a	n/a	n/a	68.3	68.3

Climate Change Considerations

The magnitude and frequency of extreme events is increasing across Canada, and around the world, having a formidable impact on our infrastructure, environment, and our communities. Therefore, as part of this work, a climate change sensitivity analysis was completed using the MTO IDF Curve Tool. This analysis revealed that rainfall intensities may increase 6% (based on the 10-Year, 2-hour rainfall intensity) by 2070 (50-Years from an assumed completion date of 2020) to approximate the design service period. If we were to conservatively extrapolate that a 6% increase in intensity reflects an 6% increase in runoff volumes, then the conservative 10-Year climate change influenced design flow estimate would be 12.2 m^3/s. This is the climate change influenced flow estimate used in the hydraulic and cost-benefit analysis.

3.3.2 Ice Monitoring

Banks Creek outlets to Lake Simcoe, which is a large waterbody that freezes during the winter. Ice can be a major contributor to flooding conditions, particularly at waterway constrictions such as bridges and culverts. There is the potential for ice to develop in and around the culvert during ice formation processes and the culvert may also be affected by ice flows and jams during springtime ice breakup. Icing conditions and the impact of ice was not considered as part of the original MCEA for the replacement of the Cross Street culvert and ice-related flooding data was not available for consideration by the study team. Therefore, upon recommendation from the study team, the Town undertook an ice monitoring program during the winter of 2018-2019.

Ice impacts and hydraulic restrictions due to ice formation were monitored in the Spring of 2019 by the Town of Innisfil Public Works Department. During this time, the Town took photos and visually monitored the formation and breakup of ice. To supplement the qualitative analysis completed by the Town, a compilation of maximum and minimum temperatures (recorded at nearby Environment Canada Shanty Bay station) and corresponding field data (photos) collected during this period is provided in **Figure 3-8** to help characterize ice break up characteristics.

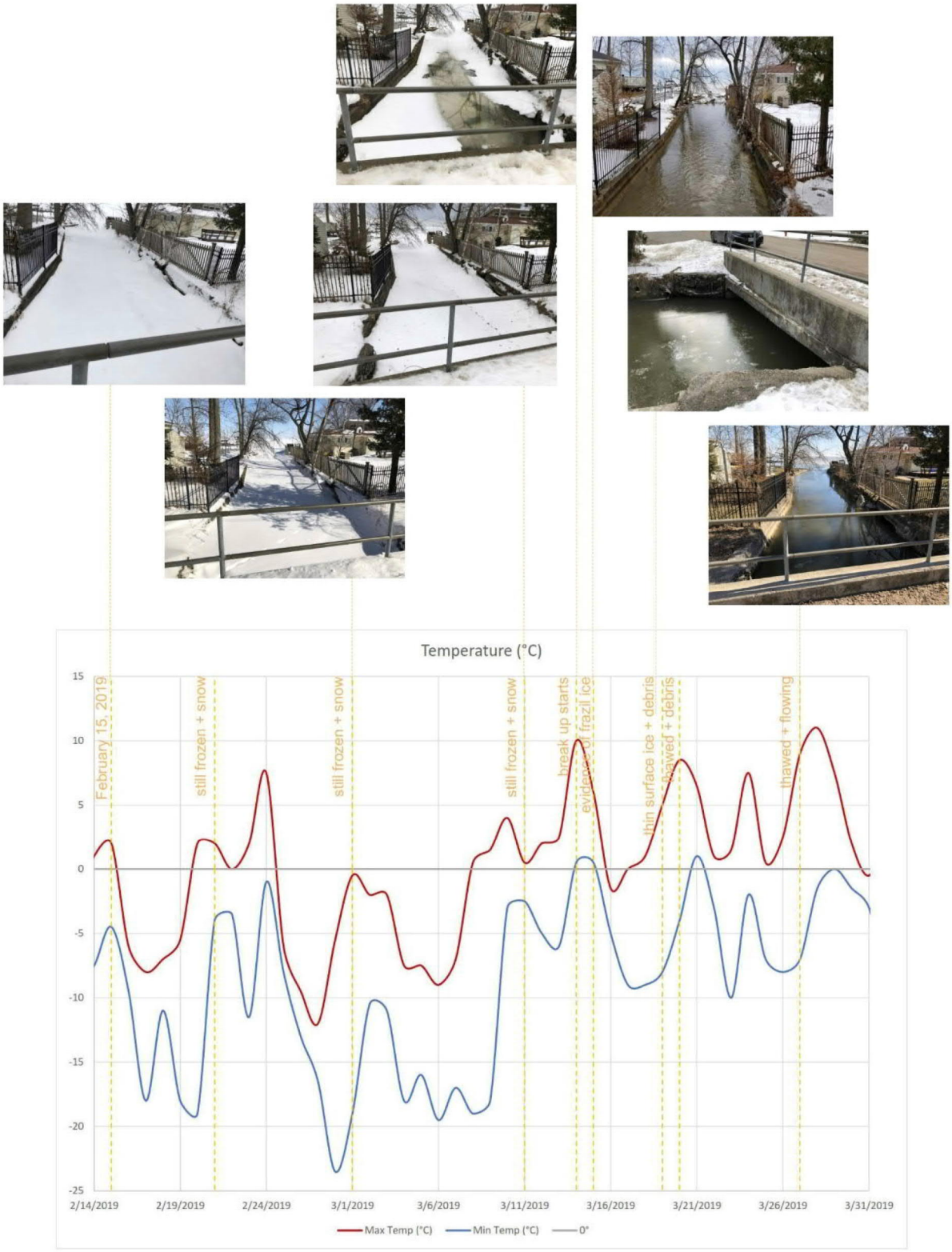


Figure 3-8: Ice Break up in Spring 2019
(temperature data from Environment Canada; photos from Town of Innisfil)

Based on the available information, it appears that Lake Simcoe froze to the Cross Street culvert and remained frozen for most of the winter season. During the springtime, the surface ice broke up and thawed within the span of a couple of days. During this time, visual inspections were completed, and photos were collected. No flow data was recorded during the monitoring period, and no measurements were made. During the monitoring period border and frazil ice were observed, but no ice jams occurred during breakup. However, even though an ice jam was not observed during the Town's spring 2019 ice observations, doesn't mean that ice jams do not happen, and does not mean they will not occur in the future.

Estimating the effects of such jams on a flood of a given magnitude is not a simple problem. Significant field reconnaissance is required as guidelines (such as the OMNR's Technical Guide to Flood Hazard Limit; the MTO Drainage Management Manual; and New Brunswick's River Ice Manual) recommend estimates should be based on field data and the history of jams at a specific site, considering local factors. As such, one (1) year's worth of qualitative data is not sufficient to make a definitive assessment as to whether ice is a significant contributor to the flooding at Cross Street culvert. Post monitoring, it was agreed upon by the study team and the Town that icing conditions would not be further considered in the hydraulic analysis.

3.3.3 Hydraulics

Using the conservative flow estimates from the hydrologic analysis, hydraulic analysis was completed using both HY-8 culvert analysis software (preliminary); and HEC-RAS. Hydraulic analysis was completed for the existing culvert and three (3) proposed design alternatives using HY-8 hydraulic modeling software. The three (3) alternatives were as follows:

- Three (3) 2000 diameter circular CSP culverts with headwall and wingwalls;
- Twin (2) 2800 x 1900 CSP pipe arch culverts with headwall and wingwalls; and
- Single (1) 6000 x 1900 closed bottom concrete box culvert with headwall and wingwalls.

The analysis was run considering both inlet and outlet-controlled conditions. Based on the analysis, none of the proposed alternatives would be able to meet Relief Flow criteria considering the Hazel storm. Designing to this level of service would not be practical and therefore, relief flow was considered as the 100-Year storm. From the HY-8 hydraulics analysis, it was determined that a closed bottom concrete box culvert was the preferred alternative due to enhanced hydraulics, debris, fish, and ice passage. This alternative was then compared to the performance of the existing culvert using a HEC-RAS model, which is described in more detail in the technical memos provided in **Appendix A**.

3.3.4 Benefits Analysis

A high-level benefits analysis was performed to estimate the value which could be provided by replacing the existing structure. Benefit was assessed as the amount of direct damages averted (difference between existing damages and proposed damages) to properties immediately upstream and downstream of the structure. Inundation maps were generated per the results of the HEC-RAS simulations; building elevations for the parcels immediately upstream and downstream of the culvert were per the findings of a topographical survey completed; and since no local stage-damage curves were available, curves were obtained from the flooding module of the HAZUS (Federal Emergency Management Agency (FEMA)) model. The assumptions made, and results of the benefit analysis are provided in *Technical Memo #2* provided in **Appendix A**.

A larger culvert at Cross Street would provide additional conveyance capacity, would provide improved hydraulics for the passage of debris and ice, and could help this crossing meet design criteria. However, based on the hydraulic and hydrology analyses and the benefits analysis, during high and extreme water levels in Lake Simcoe, the floodplain benefits provided by the increased capacity of a larger culvert structure would be minimal.

The damages averted were estimated to be approximately $4,000 for the design storm. The preliminary Class C cost estimate for replacing the structure (not including required property acquisitions or easements) is estimated to be about $802,500. Therefore, the benefit-cost ratio is low (a ratio of approximately 1:200) indicating that the new culvert would not likely provide a high cost-benefit for reduction of flood damages. Important to note, however, is that the current benefits estimate is event-based and not based on design life (or remaining design life) and does not factor in other considerations such as: inconveniences, indirect losses, expected level of service, or other impacts including those listed in *Technical Memo #2* (**Appendix A**). Due to low cost-benefit ratio, if the Town decides to proceed with the preferred solution of culvert replacement, it is recommended to wait until the lifespan of the culvert has been reached and re-evaluate the culvert replacement option at that time.

3.3.5 Recommendations

Based on the above analyses, the following is recommended:

- The Town implement a winter ice monitoring program to continue to monitor winter freeze and break-up patterns at the Cross Street culvert location to confirm whether flooding is due to ice impacts;
- The Town maintain a detailed record of localized flooding complaints which may include, but is not limited to: complainant name, address, date of event, depth of water, damages (if available);
- The analysis reveals that the replacement of Cross Street culvert with a larger (6000 x 1900) structure would not provide high cost-benefit to the Town and would only provide minimal improvements to reduce flooding impacts to houses immediately upstream and downstream of the structure for the design storm. This analysis, however, did not consider indirect damages (such as emergency response or traffic disruptions) or intangible impacts (such as inconvenience to homeowners or issues associated with accessibility). With this in mind, the Town may wish to consider additional alternatives which may offer a higher cost-benefit ratio to alleviate flooding of the nearby properties.

Furthermore, the current regulatory floodplain limits extend to cover a large area; therefore, it may be prudent to enforce minimum building elevations for habitable living areas.

3.4 Natural Environment

Palmer Environmental Consulting Group Inc. (PECG) completed a natural environment assessment of the study area, primarily in the vicinity of the Cross Street culvert structure. PECG completed an aquatic assessment of Banks Creek, an assessment of potential Species at Risk (SAR) habitat, and a tree inventory. The technical memo prepared summarizing the ecological information of the study area is included in **Appendix B**.

Preliminary consultation with LSRCA and Ministry of Natural Resources and Forestry (MNRF) was completed to gather information regarding permitting requirements, potential species at risk and background information on flora and fauna. As well, a site visit in July 2018 was conducted to survey the flora and vegetation communities, characterize the aquatic habitat, conduct a tree inventory and screen for potential SAR presence and habitat opportunities.

Aquatic Habitat Assessment
The downstream portion of Banks Creek (between Cross Street and Lake Simcoe) exhibits a straightened pattern, reflecting a history of channel modification (straightening), and is constrained by a concrete channel. The tributary exhibits low to moderate flow velocities with a channel width of approximately 4.5 m. The Creek has an entrenched confinement and lacks islands but features a 10 m long culvert (Cross Street). The substrate is primarily muck with low visibility. There is a lack of in-stream vegetation and woody debris present within the watercourse. The riparian banks are well vegetated with manicured grasses, shrubs and trees and provide trace amounts of cover with overhanging vegetation. Fish barriers were not observed in the immediate vicinity of the culvert structure.

Upstream of Cross Street, Banks Creek exhibits the same velocity, substrate and channel characteristics. Portions of the hardened channel have broken away, providing a limited amount of in-stream shade. The riparian vegetation is also similar but provides more canopy cover with 40% overhanging vegetation. Small fish were also observed approximately 20 m upstream of the culvert. The surrounding land use upstream and downstream of the Banks Creek tributary is residential, contributing a low impact to the channelized watercourse given the presence of a well-vegetated riparian buffer.

From data available from Land Information Ontario (LIO), there are records of twelve (12) fish species in Banks Creek. All fish species present are native and common to Ontario. In addition, there are records of 29 fish species in Lake Simcoe, most of which are native and common to Ontario. There are no known SAR fish present.

Data available from LIO marks the thermal regime of Banks Creek as “Unknown”. To determine the in-water work timing window, the spawning periods for fish species within Banks Creek were considered. Most species within Banks Creek are spring/summer spawners, expect for Brook Trout, which is a fall spawner. Direction received from MNRF indicated that timing restrictions for both seasons must be combined. Therefore, for Banks Creek, the in-water work timing window is **July 15 to October 1** of a given year.

Wildlife
During the July 2018 field survey, only limited observations of wildlife were made. Occasional songbirds were observed and heard, however no nesting structures were observed in the trees inventories for the project. Within Banks Creek, several small fish were observed, which demonstrates that Banks Creek is an active fish habitat and mitigation must be implemented for the project.

Species at Risk Assessment
Background review regarding SAR revealed records for Henslow’s Sparrow (*Ammodramus henslowii*), an Endangered bird species, in the vicinity of the study area. Through site review, correspondence with MNRF, and site-specific surveys, it was confirmed that there are no other SAR or potential habitat that is likely to occur on or directly adjacent to the study area.

Tree Inventory
The tree inventory comprised 31 individual trees, including 29 native and 2 non-native trees. There were no SAR trees observed; however, two types of Ash species (*Fraxinus Americana* and *Fraxinus pennsylvanica*) that are at high risk of infestation were observed.

3.5 Geotechnical Investigation

A geotechnical investigation was completed by GeoPro Consulting Ltd. for the original preferred solution of replacing the culvert structure at Cross Street. Subsequently, the preferred solution was determined to be inadequate. However, a summary of the geotechnical investigation is provided below to help characterize the study area. The complete Geotechnical Investigation Report is included in **Appendix C**.

Subsurface Characteristics

Two (2) boreholes were advanced on Cross Street, in the vicinity of the culvert structure at Banks Creek, to depths ranging from 6.6m to 9.1m below the existing ground surface. Below the pavement structure, base and subbase materials, probable fill materials consisting of silty fine sand, sand and gravelly sand were encountered. Sand and fine sand deposits were encountered below the probable fill materials. The fill materials and very loose to loose silty/sandy soils shall be considered extremely easy to disturb causing settlement. In accordance with the Occupational Health and Safety Act, the existing fills and native soils are classified as Type 3 soils above groundwater table and Type 4 below the groundwater table.

Groundwater Conditions

The groundwater conditions were observed in both boreholes on the date of drilling (June 2 and 22, 2018) as well as on July 16, 2018. Groundwater levels are summarized in **Table 3-2**.

Table 3-2: Groundwater Levels Observed

BH No.	Water Level Upon Completion of Drilling (mBGS)	Water Level on July 16, 2018 (mBGS)
BH1	0.8	1.05
BH2	0.9	0.96

*mBGS = meters below ground surface

Depending on the preferred solution, if construction works are required along Banks Creek, a hydrogeological investigation may be required due to the extensive silty/sandy soils and the proximity to Lake Simcoe to support the application for a Permit to Take Water (PTTW).

Soil Analytics

Three (3) soil samples were analyzed for the parameters of metals and inorganics, Petroleum Hydrocarbons (F1 to F4) (PHCs), Volatile Organic Compounds (VOCs) and Polycyclic Aromatic Hydrocarbons (PAHs), under Ontario Regulation 153/04. No exceedances were found for Metals and Inorganics, VOCs and PAHs. However, exceedance of MECP Table 1, Table 2 or Table 3 Standards was noted for PHCs F2. As such the following disposal option is recommended:

- The soils generated at the Site at the same tested sample depth from BH2 may be disposed at a licensed landfill site; however, additional chemical testing under O. Reg. 347/90 may be required by the landfill site.

4 ALTERNATIVE SOLUTIONS

To address the Problem encompassing the flooding, capacity and access issues that were identified as part of the original MCEA, a range of reasonable and feasible 'solutions' were identified as alternative ways to address the

Problem. Considering the analyses and assessments completed, as discussed in Section 3, and information provided by the public, as discussed in Section 7, several new alternatives as well as alternatives previously included in the original 2007 MCEA were identified by the study team to be considered as part of this Addendum.

Table 4-1 presents a comparison of the new and carried forward alternative solutions. The comparison takes into consideration the evaluation criteria from the original MCEA Study including:

- Flood reduction – the extent to which the alternative would aid in the reduction of flooding downstream of St. Johns Road;
- Cost – the cost to implement the alternative;
- Property impacts – the extent to which the adjacent private properties would be affected by the implementation of the alternative as well as the ability of the alternative to provide Town access to the watercourse; and
- Extent of construction – the amount of construction/re-construction that the alternative would require.

Table 4-1: Proposed Alternative Solutions

	Alternatives					
Evaluation Considerations	**Alternative #1:** Do Nothing	**Alternative #2:** Increase the Conveyance Capacity of the Cross Street Structure	**Alternative #3:** Turn Cross Street into a Cul-de-Sac and Remove Existing Structure Entirely	**Alternative #4:** Purchase Affected Properties	**Alternative #5:** Annual Watercourse Monitoring Program	**Alternative #6:** Restrict Upstream Flows
Alternative Description	• Take no action to address the issues within the Study Area	• Replace the existing culvert structure at Cross Street with a larger structure while still maintaining the existing road profile • Replacement structure would be closed bottom (6mx1.9m) concrete box culvert *This is the original preferred solution (2007 MCEA)*	• Remove the existing culvert structure at Cross Street to eliminate the restriction along Banks Creek • Cross Street would become cul-de-sac or dead end on both sides of the watercourse • Could consider installing pedestrian only structure across watercourse to maintain pedestrian/cyclist access along Cross Street	• Purchase the adjacent private properties that are directly impacted by the flooding of Banks Creek	• Implement a monitoring program which would monitor flooding and ice jamming occurrences along Bank Creek • The program would allow data to be collected to provide a more robust understanding of the issues and help determine appropriate interventions	• Restrict the upstream flows into Banks Creek prior to the intersection of 7th Line and St. Johns Road • Restriction to flows may include modifying existing upstream SWM ponds, building a new SWM pond, incorporating additional storage along 7th Line
Flood Reduction	• Flooding issues will continue to persist • Lack of capacity within Banks Creek remains	• Culvert designed for 10-year storm flow • Increases capacity of structure at Cross Street from 6.75m^2 to 11.4m^2 resulting in decrease of flooding ranging from 0.05m (downstream of culvert) to 0.62m (at culvert) during the 10-year storm • Although reduces flooding does not eliminate flooding, even for frequent storm events; will continue to impact private property • Does not reduce flooding for larger storm events, when lake levels are high or because of ice jams	• Removes restriction at Cross Street to increase capacity for flow and eliminate/minimize ice jamming at structure • Will still experience flooding when flow volume exceeds watercourse capacity (10-Year storm event)	• Does not reduce the flooding issues along Banks Creek; however, purchasing private properties adjacent to watercourse eliminates direct impact and cost flooding has to private property • Provides opportunity to implement remedial works on purchased properties to increase capacity of watercourse and/or reduce flooding	• Flooding issues will continue to persist • Due to the lack of data associated with historical flooding and ice jamming issues within the study area, the program would allow the Town to better assess the issues into the future to implement a suitable solution	• Flooding in the immediate vicinity of the culvert during the 5-year storm event, would be moderate (without consideration for ice-induced flooding) • To eliminate flooding in the immediate vicinity of the culvert for the 10-year storm event, would require a 40% reduction in upstream flows • Capacity of Banks Creek would remain unchanged
Cost	• No cost	• $802,500 (not including property acquisition or easement costs) • Existing structure still has remaining service life and value which will be lost if replaced with new structure	• $300,000 (includes cost of structure removal, roadway upgrades) • $250,000 for installation of pedestrian crossing (if desired)	• Assume four (4) properties would require purchasing (2 adjacent properties upstream of Cross Street culvert and 2 adjacent properties downstream of Cross Street culvert) • Estimate $1M for each of the properties downstream	• Approximate cost associated with equipment procurement and administration of program by Town staff is $25,000 annually • Does not include any costs associated with interventions	• $650,000 (approximate costs for implementing upstream flow restrictions by means of a new storm pond); however, note that these costs may be reduced by implementing other flow control alternatives (utilizing available storage or retrofitting existing

	Alternatives					
				• Estimate $500k for each of the properties upstream • Does not include costs associated with remedial work on properties to reduce flooding		upstream ponds; or flow diversions)
Property Impacts	• Flooding will continue to impact adjacent private properties • Town access issues not addressed	• Short-term: adjacent property owners will be impacted during construction works • Long-term: adjacent property owners will see minimal improvement to flooding for all events larger than the 10-year storm event; due to relatively low elevations of private properties in relation to the lake level, flooding will not be eliminated • Town access issues not addressed with replacement alone; would need to acquire property and/or easements to provide maintenance access	• Short-term: adjacent property owners will be impacted during construction works • Long-term: adjacent property owners will see some reduction in flooding occurrences on private property; due to relatively low elevations of private properties in relation to the lake level, flooding will not be eliminated • Removal of vehicle crossing will impact access to four (4) private properties along Cross Street • Town access issues not addressed unless property is acquired and/or easements are granted	• By purchasing adjacent impacted properties would eliminate private property impacts associated with flooding • Four (4) lots would become public lands which would provide floodplain relief for watercourse and provide access for the Town to complete maintenance works • Opportunity to convert portion(s) of the lots to open greenspace	• Adjacent property owners will continue to be impacted by flooding of Banks Creek watercourse • Town access issues not addressed	• Adjacent property owners will not be impacted by construction works • Long-term: as restrictions to upstream flows are implemented adjacent property owners will have reduced flooding on private property; however, due to relatively low elevations of private properties in relation to the lake level, flooding will likely not be eliminated for events > 25-Years. • Town access issues not addressed unless property is acquired and/or easements are granted
Extent of Construction	• None	• Construction impact area would be immediate vicinity of culvert structure and approaches along Cross Street • Construction length would be approximately 3 months	• Construction impact area would be Cross Street from 7th Line to Clifton Boulevard • Construction length would be approximately 1 month	• No construction works required to purchase property • Once properties are purchased, Town can choose to implement remedial works which would require construction	• None	• No construction works in immediate vicinity of Study Area • Construction works would be required upstream to implement flow restrictions and could include SWM pond modifications, SWM pond construction, installation of additional storage pipe(s) along 7th Line
Summary	While there is no cost associated with this solution, it does not address the flooding, capacity and access issues within the study area.	This solution will only provide minimal improvements to reduce flooding impacts to surrounding properties. A new culvert would not eliminate the flooding issue. Since the existing culvert still has remaining service life and the cost-benefit of replacement now is low, it is not recommended to replace the structure now in an attempt to mitigate flooding.	This solution will provide similar flooding improvements as Alternative 2; however, would remove restriction created by culvert structure to mitigate flooding resulting from ice jamming. The cost of removal and replacement with pedestrian structure is less than Alternative 2; however, has transportation implications.	While this solution is costly with an estimated cost of $3M to purchase properties, it does provide a solution to reduce the amount of private properties impacted from flooding. With land owned by Town, it provides an opportunity to explore mitigation measures such as additional storage, widening of watercourse, and providing community greenspace.	Although this solution does not address flooding issues immediately, it provides the ability for the Town to develop a detailed record of flooding occurrences along Banks Creek, including address, date of event, depth of water, extent of damages, cause of flooding, etc. This information will better assist the Town in mitigating flooding into the future.	This solution will help address the issue of flooding and lack of capacity along Banks Creek by reducing the upstream flow entering the watercourse. Additional storage and SWM pond upgrades would be required to reduce the amount of flows entering Banks Creek at/downstream of 7th Line and St Johns Road.
	Not Recommended	***Recommended in Future***	***Not Recommended***	***Not Recommended***	***Recommended***	***Recommended***

5 REVISED PREFERRED SOLUTION

Based on the summary provided in **Table 4-1,** the recommended preferred solution is a combination of three alternative solutions generated, including:

- Alternative #2 – Increase the conveyance capacity of the Cross Street structure
- Alternative #5 – Annual watercourse monitoring program
- Alternative #6 – Restrict upstream flows

Additional information for each of the recommended solutions is provided below.

5.1 Alternative #2 – Increase the Conveyance Capacity of the Cross Street Structure

Alternative #2, the replacement of the Cross Street culvert, was the preferred solution from the 2007 MCEA study. During various investigations and assessments conducted at project onset for the culvert replacement, it was determined that culvert replacement alone would not eliminate the occurrence of flooding within the study area (refer to Sections 1.2 and 3) at this time.

It is recommended that at the end of the culvert's service life (roughly 18 to 20 years) when the culvert requires replacement, the replacement structure is enlarged to provide additional conveyance capacity for the watercourse. This increased capacity will help alleviate some flooding during more frequent storm events and will help with the potential ice jamming that is occurring at the structure.

Based on existing conditions, a closed bottom concrete box culvert (6m x 1.9m) would be a suitable replacement structure to provide an additional capacity of 4.65m^2 at the Cross Street crossing. It is recommended that at the time of replacement a review and update of the hydraulic and hydrology assessment be completed to ensure that the identified replacement structure is suitable for current conditions (i.e.: consideration of climate change and increased storm events). The estimated present-day value of replacement is $802,500. Preliminary design drawings of the future culvert replacement are provided in **Appendix D**.

5.2 Alternative #5 – Annual Watercourse Monitoring Program

During the MCEA process, it was evident that the Town had insufficient data regarding the historic and existing flooding issues along Banks Creek within the study area. Without clear data of flooding incidents, including dates, cause of flooding, extent of flooding, etc. the project team was required to make assumptions of the existing hydraulic and hydrologic conditions that was causing the flooding. As discussed in Section 3.3.2, with AE direction, the Town completed one season of ice monitoring along the watercourse, as it was suggested that ice jamming may be one of the causes of flooding.

Due to the lack of flooding data, it is recommended that the Town develop and administer an annual watercourse monitoring program to gain a detailed record of flooding occurrences along Banks Creek to better assist the Town in mitigating flooding into the future. Monitoring the watercourse will allow the Town to obtain accurate, site-specific data which will develop engineering and hydrological knowledge to facilitate smart operational and public security decisions. The monitoring program should include:

- Monitoring of winter ice formation and breakup conditions along Banks Creek; and
- Monitoring of watercourse conditions during and after storm events.

As part of the annual monitoring program, it is recommended that the Town communicate to local residents the implementation of the program and encourage residents to contact the Town during flooding and icing events that impact private property. Encouraging the reporting of flooding and icing events will allow the Town to maintain better records of issues associated with the watercourse and develop a more thorough understanding of the on-going issues associated with Banks Creek. A database should be maintained of all received notifications.

Winter Ice Monitoring

Understanding and quantifying ice processes will help identify and assess hydraulic conditions, impact on aquatic and riparian habitats and potential damage to watercourse and floodplain structures that are not appropriately designed or located. Monitoring of winter ice formation and breakup conditions along Banks Creek, in particular between St. Johns Road and Lake Simcoe, will better inform the Town on the occurrence, frequency and impacts icing conditions are having on the watercourse and adjacent properties. A basic scope of work would include:

- Set up of camera equipment at key locations along watercourse and daily site photos;
- Bi-weekly site visits by Town representative(s) to collect ice measurements and record observations of ice buildup and/or breakup and ice type (frazil ice, surface/border ice and aufeis ice); and
- Data recording of observations and measurements in central database for reference and use moving forward.

It is recommended that the winter ice monitoring begins each year in late November or early December until ice breakup in the spring months. Key information that should be collected during the winter ice monitoring program include:

- Date of observation(s);
- Temperature;
- Presence of ice;
- If present, type of ice (frazil, surface/border, aufeis);
- Thickness of ice;
- Water level of watercourse:
    - qualitative measurement – low, medium, high
    - quantitative measurement – depth of water, distance from surface of water to top of bank; and
- Photos and/or video of watercourse to supplement above observation data.

Storm Event Monitoring

Storm event monitoring is recommended along Banks Creek, in particular between St. Johns Road and Lake Simcoe, to better inform the Town on the occurrence, frequency and impacts flooding of Banks Creek due to storm events has on the surrounding area. The objective of the program would be to monitor and record information pertaining to how storm events impact Banks Creek watercourse. The program would run year-round and would create a central database documenting storm events during all seasons.

It is recommended that the Town install camera equipment and flow monitors at key locations along the watercourse for continuous monitoring of the watercourse. This equipment could be used for both the storm event monitoring and the winter ice monitoring (as discussed above) programs. Key information that should be collected for each storm event by Town staff include:

- Date of event;
- Description of storm event (quantity of rainfall, duration of storm event, classification of storm);
- Water level of Lake Simcoe;

- Observation of watercourse during event (water flow, water level);
- Observation of watercourse proceeding event (water flow, water level);
- In the event of flooding:
    - description of extent of flooding (depth, area)
    - length of time until water level recedes to within watercourse banks
    - impact to private property (damage to structures, damage to yards)
    - impact to public property (flooding overtopping roadway, ditches overflowing, etc.)
- Description of any mitigating measures taken by the Town;
- Record of any complaints and claims made with relation to storm event; and
- Photos and/or video of watercourse to supplement above observation data.

5.3 Alternative #6 – Restrict Upstream Flows

It is identified in the Town's Official Plan that due to historic development in the floodplain in the existing shoreline and settlement areas along Lake Simcoe and Cooks Bay, releasing of water from upstream stormwater management ponds can lead to flooding downstream through the existing communities (Official Plan, Section 16.2.2). As discussed in Section 3, there are five (5) existing stormwater management (SWM) ponds upstream of the study area including:

- Previn Court SWM wet pond built in 2002;
- Tepco-North SWM wet pond built in 2005;
- Wallace Mills North SWM wet pond built in 2002;
- Wallace Mills South SWM wet pond built in 1998; and
- ORSI Bayshore Estates SWM wet pond built in 1999.

In addition, review of the MCEA Environmental Study Report (ESR) for the 7th Line Improvements (completed in 2019), indicates stormwater from 7th Line (between 20th Side Road and St. Johns Road) currently is untreated and discharges overland directly to Banks Creek. Banks Creek runs along the north side of 7th Line in the form of a roadside ditch which then crosses under the intersection of St. Johns Road and 7th Line through a large CSP culvert (**Figure 5-1**) and flows downstream to Lake Simcoe through the study area.

Figure 5-1: Existing CSP Culvert at St. Johns Road and 7th Line

Restricting upstream flows, including flows from SWM ponds and roadway runoff, will reduce the volume of flow conveyed along Banks Creek, between St. Johns Road and Lake Simcoe, resulting in the reduction of flooding occurrences. It is estimated that to eliminate flooding in Banks Creek during the 10-year storm event, a 40% reduction in upstream flows would be required. Restriction of upstream flows may be achieved through:

- Construction of a new SWM pond;
- Improvements of upstream SWM ponds;
- Improvements to 7th Line drainage (as per the 7th Line MCEA completed and Addendum to be completed); and
- Implementation of additional storm runoff storage along 7th Line.

Construction of a new SWM pond upstream of St. Johns Road would provide additional storage capacity and restrict flows along Banks Creek, between St. Johns Road and Lake Simcoe. Initial analysis suggests that a 4,000m^3 SWM pond would provide flow attenuation to alleviate flooding during the 10-year storm event. The new SWM pond is assumed to be a wetland construction in the existing conservation lands in the north-west corner of St. Johns Road and 7th Line. The design of the additional storage would be sympathetic to the local environment and strive to maintain the natural aesthetics of the conservation land. An approximate cost for this construction is $650,000. The size and construction cost of the new SWM pond could be reduced with the implementation of additional works as discussed below.

It is recommended the Town evaluate the five (5) existing upstream SWM ponds to determine if they are meeting their respective design objectives. Detailed analysis of each facility should be completed to determine the storage volume and attenuation required with consideration for climate change impacts and the most current SWM guidelines. Hydrologic monitoring at each site should include measurements of rainfall, runoff (influent and effluent) and water levels. Data analysis for each site should include calculations of volumetric flow balances, peak flow attenuation, hydraulic detention and residence time, outlet flow duration, peak to peak lag times and runoff coefficients. These design characteristics should then be compared with guidelines provided in the MOE *Stormwater Management Planning and Design (SWMP) Manual* (1994/2003). Based on the analysis, recommendations can be made for improvements to each facility to reduce peak flows thereby helping to control flooding and erosion of the downstream watercourse, Banks Creek.

Recommended solutions for the 7th Line Improvements (as identified in the ESR completed in 2019 by Ainley Group), included reconstructing the roadway to an urbanized cross-section with curb and gutter and storm sewer. The implementation of Low Impact Development (LID) features were proposed in the form of infiltration galleries to provide for the infiltration of the first 25mm flush and provide the required storm runoff storage and attenuation for the increased impervious area. Also, to suit the road improvements, it was proposed to realign and naturalize 910m of Banks Creek (existing roadside ditch on north side of 7th Line) northward.

Since the completion of the ESR in 2019, the Town has chosen to pause the design and implementation of the recommended solutions and re-open the MCEA to consider the affects the proposed Orbit development (as discussed in Section 3) will have along 7th Line. Also, through discussions with Town representatives it was determined that implementation of LIDs along 7th Line was infeasible due to the existing high groundwater conditions. However, improvements along 7th Line will occur in the short-term horizon, and it is recommended that any proposed improvements do not negatively impact the downstream portion of Banks Creek and that the recommendations made in this Addendum Report be considered during their development, as well as the development of the Orbit Master

Plan. During the re-evaluation of 7th Line improvements a review of opportunities to provide additional storm runoff storage along 7th Line should be completed. Inclusion of in-line storage pipes is considered a potential option.

5.4 Additional Considerations

In addition to the preferred solutions identified and discussed above, the following are recommended to be considered and implemented, if deemed feasible, for the study area:

- Acquire ownership of Banks Creek, from St. Johns Road to Cross Street culvert, from the Crown;
- Negotiate with private property owners along Banks Creek to acquire land easements along the watercourse to facilitate Town access for maintenance works;
- Advise private property owners that the structural integrity of the existing retaining walls shall be maintained to prevent collapse into the creek; and
- If short-term monitoring identifies ice as a major contributor to flooding conditions at the Cross Street culvert, implement a pilot project of installing external energy dissipaters to control the formation and break up of ice at the culvert structure. For example, bubbler de-icing systems have had success in preventing ice formation on dock piers and have applications in de-icing water intakes in the Great Lakes.

5.5 Project Timelines

It is recommended to implement the preferred solution(s) immediately upon approval of the MCEA Addendum, where feasible. Approximate timelines for each preferred solution include:

- Replacement of Cross Street culvert – delay design and construction until the end of its service life (approximately 15 to 20 years); complete annual reviews and condition assessments of the culvert structure to monitor service life.
- Annual Monitoring Program – coordinate and initiate program within one (1) to two (2) months upon approval of MCEA including purchase monitoring equipment, create database and identify administration procedures; monitoring to be on-going as discussed in Section 5.2.
- Restricting Upstream Flows –retain consultant to complete detailed assessment of five (5) SWM ponds and develop improvement plan and design of new SWM pond.
- Property Acquisition – continue acquisition process with Crown to downgrade ownership to Town; begin discussions with private property owners immediately upon approval of MCEA to coordinate land easements.

5.6 Approval Requirements

Since the recommended solution(s) do not involve construction works in the immediate future, no permits or approvals will be required. During future design and construction of the Cross Street culvert replacement, retaining wall replacements and/or SWM facility implementation and improvements anticipated permits and approvals will need to be acquired from the following agencies:

- Lake Simcoe Region Conservation Authority
- Department of Fisheries and Oceans
- Town of Innisfil for any temporary exemptions to the noise control by-law (By-law No. 122-16)
- Town of Innisfil for tree permitting
- Ministry of Environmental, Conservation and Parks (MECP) for Permit to Take Water, ECA

6 MITIGATION MEASURES

In advance of design and construction of the preferred solutions, including culvert replacement and improvement works to upstream facilities, the following mitigation and enhancement measures have been identified to minimize the potential impacts to the environment during the implementation of the proposed works.

Timing of Works

The following environmental timing windows should be followed during construction:

- Vegetation removal to be avoided between **April 1 and August 31** to conform with the *Migratory Birds Convention Act* and the Migratory Birds Regulations, specifically any trees that require removal to implement the project;
- The MNRF have outlined that for this section of Banks Creek, the in-water work timing window is **July 15 to October 1st** of a given year.

Erosion and Sediment Control

During construction, there is risk of potential erosion and siltation impacts that could release sediment into the watercourse. This impact would degrade the water quality of the creek and affect the habitat of wildlife. Therefore, an erosion and sediment control plan will be developed to help mitigate this risk. Possible measures include, but not limited to, the use of biodegradable erosion control media, siltation fences or biodegradable 'logs', check and coffer dams, mud mats, etc. All in-water work will be completed in isolation of flowing water through the use of streamflow by-pass methods such as a flume, dam-and-pump and/or diversion channel. These activities will be confirmed during the detailed design phase of the project before implementation and will be reviewed and approved by LSRCA as part of its permit process.

Fish Salvage

If construction requires in-water works, the relocation of fish from the work area would be required. The incorporation of this activity into the construction schedule would be required.

Tree Replacement Plantings

To conform to the Town of Innisfil Tree Official Plan (Section 10.1.34), trees identified for removal during project planning should be compensated for via replacement plantings. Tree replacement plantings are recommended at a 2:1 ratio, which is required for street trees. The locations of replacement plantings would be recommended in an Arborist Report, and should be planted at or near the locations of removals. Other locations may be suggested at the discretion of the Town.

Air Quality, Dust and Noise

There will be construction noise generated during any remediation works within the watercourse due to the required use of heavy machinery and other construction equipment. Measures will be taken to manage construction noise including maintaining equipment to prevent unnecessary noise. Any initial noise complaint will trigger verification that noise control measures are in effect. If persistent noise complaints occur, alternative noise control measures will be considered.

Impacts of air quality during project construction are not considered to be significant. Although dust impacts from heavy construction equipment may impact air quality, this is not a recurring activity as it will be limited to the

construction period. Contract provisions will minimize impacts to adjacent properties during construction. Therefore, the impacts from construction on air quality are not considered significant.

Provisions to minimize air quality impacts during construction include removal of construction-caused debris and dust through regular cleaning and maintenance of construction sites and access roads; dust suppression using non-chloride dust suppressants on unpaved areas, subject to the area being free of sensitive plant, water, or other ecosystems that may be affected by dust suppression chemicals; and prompt cleaning of paved streets/roads where tracking of soil, mud or dust has occurred.

6.1 Climate Change Considerations

Climate change concerns relate to the increased concentration of greenhouse gases in the atmosphere which can result in a rise in the global mean surface temperature. Increased temperatures worldwide are creating changes in climate that is resulting in extreme weather events. The rise of greenhouse gas emissions is influencing climate patterns, hydrology, ecosystems, and ocean chemistry. As per the new regulations set out by the Ministry of the Environment, Conservation and Parks (MECP) in December 2017, climate change shall be considered during the Class EA Process. The environmental assessment of proposed undertakings is to consider how a project might impact climate change and how climate change may impact a project.

There are two approaches to address climate change. These are 1) reducing a project's impact on climate change (climate change mitigation) and 2) increasing the local ecosystem's resilience to climate change (climate change adaptation). However, before a mitigation or adaptation strategy can be established, the potential for the project to impact climate change and the potential impact that climate change may have on a project must be considered. The current undertaking is a small-scale project not anticipated to impact climate change. Climate change does, however, have the potential to result in increased storm events that can lead to increased flooding. Further discussions regarding climate change impacts are discussed in Section 3.3.1.

7 CONSULTATION

One of the essential components of the MCEA process is public, agency and First Nations participation. This MCEA Addendum involved notifying all potentially affected members of the public and review agencies. In addition, the First Nations and Aboriginal communities that were not specifically consulted during the MCEA were included in the distribution list for this Addendum. Comments received throughout the Addendum process are provided in **Appendix F**.

7.1 Notice of Class Environmental Assessment Addendum

A Notice of Class Environmental Assessment Addendum was prepared and issued on November 15, 2019. The Notice was published on the Town of Innisfil website (https://innisfil.ca/7th-line-storm-drainage-outlet-cross-street/) and hand delivered to local residents. Cover letters including the Notice were mailed directly to agencies, First Nations, and known interested stakeholders.

A summary list of the stakeholder register, Notice of Class Environmental Assessment Addendum and a sample copy of the cover letter are provided in **Appendix E**. Received comments and project team responses are summarized in **Table 7-1** below and provided in **Appendix F**.

Table 7-1: Summary of Public and Stakeholder Comments

Stakeholder	Comments Received

Chunmei Liu
Environmental Resource Planner
MECP
	• Provided recommendation on First Nations to contact as part of the project:
	  ○ Chippewas of Georgina Island
	  ○ Chippewas of Rama First Nation (Chippewas of Mnjikaning)
	  ○ Beausoleil First Nation
	  ○ Huron-Wendat Nation (if there is potential for the project to impact archeological resources)
	  ○ Métis Nation of Ontario, MNO Georgian Bay Métis Council

Dan Minkin MTCS	• Requested a copy of the original EA to understand what has been done for the cultural heritage environment to date • Assist in preparing preliminary comments and advice
Local Resident	• Worried about future water coming from subdivisions upstream • Worried amount of water will continue to increase • Suggests pedestrian bridge to connect roads; remove culvert
Local Resident	• Expressed frustration that nothing has been done • Dealing with ever increasing flooding situation that is causing damage to their property
Local Resident	• Initial complaint in June 2017 that the replacement of the culvert at the intersection of 7th Line and St. Johns has directed runoff to his property causing erosion • Issue with flooding and erosion to private properties is ongoing and needs to be addressed by the Town • Stormwater running directly to Lake because marsh and green space was removed for development • Development has continued with no recourse for stormwater generated from these developments • The Town must address this issue by implementing infrastructural drainage plans without delay
Local Resident	• Concerned that issue with flooding is the upstream flow that is coming from Previn SWM pond • High flows from upstream are causing erosion and flooding issues • The SWM pond at Previn is likely undersized • Is an option to install pipe from 7th Line straight to Lake Simcoe? • Replacement of culvert at 7th Line and St. Johns (~3 years ago) did not help flooding issues • Similar flooding issues along Simcoe Boulevard • Noted that 2 properties on either side of outlet to Lake Simcoe on Cross Street were for sale. • South property has recently sold.
Local Resident	• 2 winters previous had flooding ○ Not severe but 12-18 inches of high water; could see water marks on cottage • Is not a permanent resident; seasonal cottage • Last Spring had very high water; however, no damage from flooding

Stakeholder	Comments Received
	• A few winters ago had ice jamming at the culvert; Town crew had to come out and break up ice several times to alleviate flooding • Neighbour across the street is permanent resident and told him that several times the water has been so high it has flowed over the road and culvert structure • Has a retaining wall with a tree abutting the wall and causing damage and reducing freeboard under regular conditions • Inquired about ownership of creek • Recommended removing culvert and having pedestrian bridge only – free flow condition

7.1.1 Letter to Residents and On-line Survey

As part of the MCEA Addendum the study team aimed to collect data from local residents concerning their experience with flooding associated with the Banks Creek watercourse. To solicit this information, an online questionnaire was developed and made available for residents within the study area to complete. A letter was mailed to residents within the study area introducing the MCEA Addendum and providing details of the online questionnaire (**Appendix F**). Letters were mailed by the Town of Innisfil to the identified properties in **Figure 7-1**.

Figure 7-1: Distribution of Letter for Online Questionnaire

The online survey consisted of seven (7) questions (**Figure 7-2**) asking for information regarding flooding and ice jamming along Banks Creek and at the Cross Street culvert structure. A total of three (3) responses were received and are summarized in **Table 7-2**.

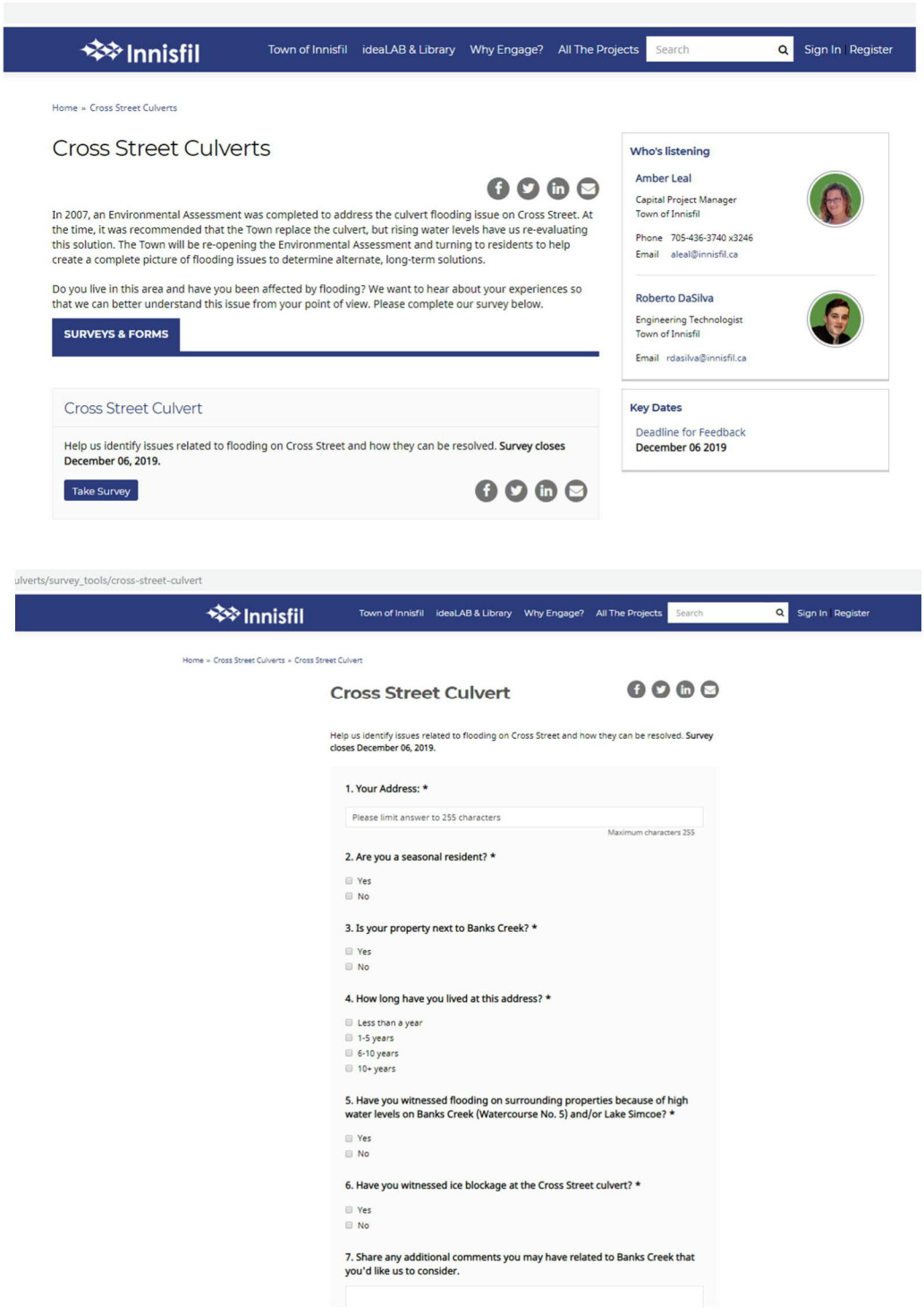


Figure 7-2: On-line Questionnaire Screenshots (Town of Innisfil website)

Table 7-2: Summary of Questionnaire Responses

Questions	Respondent #1	Respondent #2	Respondent #3
Q1: Address	Not provided to preserve privacy	Not provided to preserve privacy	Not provided to preserve privacy
Q2: Are you a seasonal resident?	No	Yes	No
Q3: Is your property close to Banks Creek? • How many flooding incidents have you experienced and approximately when did they occur? • How did the flooding impact your yard or structures in your yard? • Did you seek compensation to address flooding damages? • Would you allow Town Staff access to your property for maintenance purposes? • Please provide any additional comments related to the flooding that you have experienced.	Property is adjacent to Banks Creek Flooding incidents: • Spring water levels often break over the bank and come up front lawn (~1/2 of property – 15-20m from street where water stops) • Takes 4-6 weeks for water to recede back into creek • Spring 2018 due to large ice blocks under bridge on house side of bridge the water came up another 5m towards the house • If Town hadn't cleared ice jam after complaints it likely would have flood the garage • Neighbour had water right up to their house (sits closer to the road) Flooding impact: • Front lawn always very wet for weeks mid-late spring • Bank along edge is degrading and every year holes between cement edging/stone cages and the lawn gets larger	Property adjacent to Banks Creek Flooding incidents: • At least 3 occasions where flooding affected property and buildings • Most serious 2-3 years ago when ice jams under Cross Street backed up on the in-land part of the road and overflowed onto my property • Affect was flood water of 18-24" over the property and flooding in basement • Impact has been increased as result of refresh of ditch at St. Johns and Cross Street flood waters from the lake overflowing onto the property from early spring through the summer • This past summer saw lake water at record levels affecting waters for 4-6 months • Creek retaining wall on property has sunk to the point flood waters encroach on the cottage lot and foundation of the cottage	Property is not next to Banks Creek

	• In 2018 with larger flooding had to pull everything off floor of garage because of concern of damage – Town came to clear ice jam Did not seek compensation Would consider providing Town access for maintenance	Flooding impact: • Impacting concrete retention wall with the height of lake and creek waters Did not seek compensation Would consider providing Town access for maintenance Additional comments regarding flooding: • Who owns property at water's edge of the creek and who is responsible for maintenance? • A number of residents were in favour of pedestrian walk over the creek • Were told this would have negative impact on emergency vehicles • What alternatives remain on table?	
Q4: How long have you lived at this address?	+ 10 years	+10 years	+10 years
Q5: Have you witnessed flooding on surrounding properties because of high water levels on Banks Creek and/or Lake Simcoe?	Yes, see previous answers	Yes	Yes
Q6: Have you witnessed flooding on properties due to ice blockage?	Yes	Yes	No

Q7: Share any additional comments you may have related to Banks Creek that you'd like us to consider.	• Ice jams are frequent in the spring and cause flooding • 2018 a particularly bad year • Attempts to dislodge ice jams were unsuccessful • Town had to come with backhoe to help clear jam • Seems every year water levels during spring thaw are higher and last longer and flooding creeps further up my property	Current setup of bridge encourages illegal parking and pedestrian traffic which eventually will result in a serious accident as cars speed across the bridge with cars illegally parked both sides of the bridge	• Each spring my front property and my neighbour on corner of Cross and Kennedy are covered with several inches of water • Ditch in front of properties is filled with so much water that doesn't drain anywhere so it overflows on our properties • Suggest the following: each and every driveway should have a culvert, ditches should be checked regularly so there are no debris obstructing the flow of water, the water should freely run in either direction either towards Banks Creek or under and along Kennedy Road to another creek that connects to Lake Simcoe

7.2 Notice of Filing of Addendum

A Notice of Filing of Addendum will be published in the local newspaper and posted on the Town's website to provide the public with at least 30 calendar days to provide final public comment under the provisions of the MCEA process.

The Notice will identify the change in the preferred solution and identify where the Addendum Report will be available for public review. Comments from the public, stakeholders and agencies will be solicited in the Notice. A copy of the Notice of Filing of Addendum and sample cover letter are provided in **Appendix E**.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

Through preliminary investigations and assessments, the preferred solution as identified in the original 2017 MCEA Report was determined to not adequately address the identified problems of flooding, lack of capacity and access issues along Banks Creek. As a result, the Project Team and Town of Innisfil determined modification of the 2007 preferred solution was required. This Addendum describes the circumstances which precipitated the changes to the preferred solution, additional alternatives for consideration, the revised preferred solutions, measures to mitigate potential negative environmental impacts and the consultation process.

8.2 Recommendations

It is recommended that the Town of Innisfil move forward with the implementation of the preferred solutions to address the flooding along Banks Creek. This includes delaying the culvert replacement at Cross Street until the service life of the structure has reached its end, implementing an annual monitoring program of Banks Creek to collect information regarding the flooding issues, and complete a review of upstream facilities and implement improvements to restrict/reduce the upstream flows along Banks Creek.

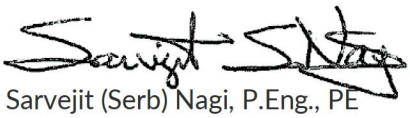
9 CLOSURE

This report was prepared for the Town of Innisfil to satisfy the requirements of the Municipal Class EA process and *Environmental Assessment Act* and to set the stage for implementation of the preferred solutions for the study area discussed herein.

The services provided by Associated Engineering (Ont.) Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering (Ont.) Ltd.

Andrea LaPlante, P.Eng.
Environmental Assessment Coordinator



Sarvejit (Serb) Nagi, P.Eng., PE
Project Manager

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