Prepared for:
Town of Innisfil

Stormwater Management Master Plan and Flooding Strategy: Municipal Class Environmental Assessment Draft Final Report

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Draft Final Report

Executive Summary

SWM-MP and Flooding Strategy

Municipal Class Environmental Assessment

Final Report

E.1 Introduction and Problem Identification

The Town of Innisfil's Stormwater Management Master Plan and Flooding Strategy (SWM-MP & FS) delivers a targeted approach to managing stormwater runoff and related infrastructure, and identifies a strategy to protect and enhance natural features, ecological function and biophysical integrity, and manage risks. The SWM-MP was completed as a Master Plan Environmental Assessment, an approved process under the Ontario Environmental Assessment Act.

Over the next 18 years the SWM-MP establishes stormwater management policies and guidelines, addresses stormwater infrastructure needs, identifies and prioritizes recommended works, and informs the overall asset management plan. The FS identifies and prioritizes areas of concern for flooding and creates a plan for cost-effective, environmentally sustainable, and innovative solutions. To reach this end, a comprehensive set of projects and programs has been recommended as part of the SWM-MP & FS Recommended Approach (**Section E-8**). The pace of implementation will ultimately be guided by the Town's capital budgeting and human resourcing capacity in the context of all organizational priorities. As a result, the implementation timeline as outlined in the SWM-MP & FS may be modified to reflect these priorities and resources.

The SWM-MP & FS has five (5) elements which are detailed in a series of technical documents which make up the core of the plan. The elements include:

1) **Municipal Pollution Prevention, Operations & Maintenance Practices**

This element focuses on pollution prevention and municipal practices that can help to prevent impacts before they occur.

2) **Private Property Strategies (Source Control Measures)**

This element focuses on increasing LID implementation on private property through volume control requirements for new development, infill development, and re-development.

3) **Stormwater Conveyance Infrastructure and Controls**

This element focuses on improving the way municipal roads manage runoff by constructing SWM controls, including LID controls as part of routine road reconstruction programs to reduce stormwater volume and pollutant loading.

4) **Stormwater Management Facilities**

This element focuses on maintaining and improving existing SWM facilities as well as constructing new stormwater management facilities in uncontrolled stormwater catchments.

5) **Flood Management and Watercourse Restoration**

This element focuses on managing urban flooding associated with storm sewer surcharging with focus on the predicted impacts of climate change.

The projects identified in the SWM-MP & FS will be undertaken per the Implementation Plan (**Section E-8**).

E.2 Study Purpose and Objectives

The purpose of the SWM-MP & FS is to update the Town of Innisfil 2016 SWM-MP and complete a flooding strategy, to serve as a decision support tool, as well as a methodology for the prioritization of works. The SWM-MP & FS also serves as a transparent community consultation process by which the Town can establish stormwater management guidelines and policies.

The SWM-MP & FS primarily addresses the existing urbanized areas of the Town and recommends remedial measures to improve overall environmental performance, increase efficiencies and reduce costs. The study focus is not new development; however, it does provide guidance in regards to future policies.

The objectives of the Town of Innisfil SWM-MP & FS consider water quality, water quantity, erosion control, flood control, natural environment, infrastructure, and policy and implementation, all in an integrated manner.

E.3 Class EA Process

The study was conducted in accordance with the requirements for Master Plans under Section 4, Approach #2 of the Municipal Engineers Association Municipal Class Environmental Assessment Act (October 2000, as amended in 2007, 2011, 2015, and 2023), which is an approved process under the Ontario Environmental Assessment Act. As part of the Class EA process, the evaluation of alternatives, assessment of the potential environmental effects and identification of mitigation measures for potential adverse impacts has been conducted and presented through public and agency consultations.

The SWM-MP & FS fulfills all of the Class EA requirements for Schedule B projects which can then proceed directly to detailed design and implementation (as required) and identifies any Schedule C projects for future studies.

Master plans, by definition, are long range plans which integrate infrastructure for existing and future land use with environmental assessment planning principles. In the case of the Town of Innisfil SWM-MP & FS, implementation is projected until 2041. The SWM-MP & FS concludes with a set of preferred alternatives which make up the recommended approach and, therefore, by its nature, the SWM-MP & FS will limit the scope of alternatives which can be considered at the implementation stage. It is proper to revisit Master Plans on a 5-year to 10-year basis to

ensure conditions (environmental, social, financial and technical) have remained unchanged. As such, if at the time of implementation, conditions have changed such that the preferred alternative cannot be implemented, an addendum may be prepared for the specific project. Amendments to the projects identified as part of the preferred alternatives can be made using the addendum procedures outlined in the Municipal Engineers Association Municipal Class Environmental Assessment Act (October 2000, as amended in 2007, 2011, 2015 & 2023) document and shall be posted for the required 30-day review period.

E-4 Public Consultation and Indigenous Consultation

A consultation plan was developed early in the study process, focusing on engagement approaches to obtain enhanced public input and improve participation of residents to secure feedback. The two (2) Public Open Houses and three (3) Neighbourhood Pop-ups offered opportunities for the community to stay up-to-date with the SWM-MP & FS process and to share how stormwater and flooding management could be improved in their neighbourhood, on their property, and in their community.

During the project, the Town consulted Beausoleil First Nation, Chippewas of Georgina Island, Chippewas of Mnjikaning First Nation (Rama), Chippewas of Nawash First Nation, Nation Huronne-Wendat, Saugeen First Nation, Saugeen Ojibway Nation, Metis Nation of Ontario, and Williams Treaty First Nation.

E-5 Existing Conditions

The Town of Innisfil covers approximately 262 km^2 of land. The Town is composed of 24 subwatersheds. Within Town boundaries there are approximately 267 km of watercourses, and the Town is characterized by a mixture of land uses. SWM facilities within the Town provide various levels of control to 1,250 ha (32.9 percent) of the 3,798 ha of built urban area in the Town of Innisfil. Of this area, approximately 43.5 ha (1.1 percent) is controlled for water quality and 1,207 ha (31.8 percent) are controlled for water quantity. Accordingly, there is approximately 2,548 ha (67 percent of urban area) that do not have either water quality or quantity control.

E-6 Technical Studies

Where relevant, a series of technical assessments were undertaken to confirm feasibility and provide direction as to which types of measures should be implemented. For those measures within each category which are subject to the Class EA process, the feasibility was determined through examination of the constraints and opportunities as physical, social, and environmental levels.

A series of technical reports have been prepared and included within the technical appendices of the SWM-MP & FS, which are listed below:

- Background Technical Memorandum (November 2023)
- Ditch Profile Analysis Results (July 2022)
- Catchments at Risk Report (March 2023)

- New End of Pipe Opportunities (March 2023)
- Identification of Preferred New End of Pipe Opportunities Alternatives and Conceptual Design (September 2023)
- Existing and Future Conditions Hydrology and Hydraulic Models Report (October 2023)
- Flood Mitigation Preferred Alternatives (November 2023)
- Culvert Assessment Summary (November 2023)
- Property Acquisition Technical Memo (July 2022)
- Operations and Maintenance Cost Estimates – Stormwater Quality Treatment (December 2022)

E-7 Evaluation of Alternatives

To select a preferred alternative for each of the five (5) categories of SWM measures identified previously, evaluation criteria were developed, an evaluation process was applied, and the preferred alternatives selected in fulfillment of the Class EA process. Each individual preferred alternative forms a component of the preferred SWM strategy or recommended approach. The following details the process undertaken per the Class EA process.

- **Municipal Pollution Prevention, Operations & Maintenance Practices**, is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.

- **Private Property Strategies (Source Control Measures)** fall outside of the Municipal Class EA process, since they are to be constructed on private property, often by the individual landowner as a retrofit or during development/ redevelopment (i.e. the Town is not the proponent). This precludes source control measures from the requirements of the Class EA process.

- **Stormwater Conveyance Infrastructure and Controls** is Exempt from the Municipal Class EA process based on the outcomes of the Archaeological Screening Process. If it is determined that the proposed project will have negative impacts on archaeological resources that cannot be appropriately mitigated, the project is not exempt, and must follow a Schedule B EA.
- **Stormwater Management Facilities** were evaluated using the following two (2) Class EA Schedules according to the project nature:

    - Sediment Removal for SWM Facilities is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.

    - Maintenance for SWM Facilities is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.

    - SWM Facility Retrofits is Exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.

- New SWM Facilities – preferred alternatives were selected for each of the identified locations using a series of evaluation criteria that were selected and include Physical/ Natural Environment, Social/ Cultural, Economic and Technical/Engineering criteria. A score was then established through a multidisciplinary evaluation process for each alternative design for each criterion established. This follows Schedule B of the Municipal Class EA process, and therefore can proceed directly to detailed design and implementation.

- **Flood Management and Watercourse Restoration** – To understand the capacity of existing watercourses, the environmental benefits, as well as technical and financial implications relating to riverine flooding within the Town, two reports were prepared. A Visual Otthymo (VO) model was developed for the LSRCA subwatersheds, and the Town provided a VO6 model for the NVCA subwatersheds. A HEC-RAS model was subsequently developed for the entire Town of Innisfil.

E-8 Recommended Approach and Implementation Plan

An Implementation Plan has been developed in order to:

- Prioritize all the works where there are opportunities to maintain and/or improve conditions through the elements of the recommended approach,
- Recommend funding allocation and develop an implementation schedule using existing funding sources, and
- Develop supporting policy.

The SWM-MP & FS Implementation Plan is a strategic approach which outlines how and when each specific program or projects of the recommended approach are to be completed to achieve the project goals and objectives. The Implementation Plan is subject to available budget, staff resources and professional judgement, regulatory clearances, and Council approval (where required). Through a collaborative effort with multiple Town departments and staff, an implementation schedule and budget forecast has been developed to guide future works from 2024 to 2041.

E-8.1 Policy Development

Eight (8) policy studies, updates, and/or development of new policies have been recommended to be prepared as part of the SWM-MP & FS process. These include:

1. **Work on Private Property (Target 2024)** – Where works are required on private property, this policy is to ensure the Town has appropriate land rights to access, construct, and maintain these works.

2. **Stormwater Fee Study (Target 2025)** – The Town does not currently have a dedicated funding stream for stormwater management. This study would determine what fee would allow for sustainable funding to be specifically collected and allocated for stormwater management projects.

3. **Cash-in-Lieu Study (Target 2025)** – This policy would require a development proponent to provide designated financial contribution towards the off-site stormwater management, in conformance with the recommended approaches of the SWM-MP & FS, elsewhere in the Town in-lieu of providing on-site stormwater management. The study would set out what the financial contribution should be.

4. **LID Policy and tracking Tool (Target 2027)** – It is recommended that the Town proceed with developing a LID policy and tracking tool. The policy should align with LSRCA stormwater management guidelines and the MECP LID guidelines as part of the CLI-ECA. LID controls for water quality and water balance should be considered in all new development, including site plans.

5. **Tile Drain Study (Target 2029)** – It is recommended that the Town partner with LSRCA and NVCA to determine the local impact of tile drainage on flood flows and develop policies to manage the impacts of tile drainage on downstream flooding, if necessary.

6. **Lake Simcoe Policies (Target 2024)** – New LiDAR that was flown for the Town showed that there are areas of the Town that would qualify to be part of the LSRCA regulated area, but are currently not. It is recommended that the Town share the LiDAR with the LSRCA with the recommendation that the LSRCA update its regulated area accordingly.

7. **Managing Future Development in, or Upstream of, Flood Risk Areas (Target 2025)** – The Town is recommended to develop a policy to ensure all construction / development within the regulatory flood risk area complies with all conservation authority requirements before issuing approval. Where downstream flooding has been identified, upstream developments should not only meet post to pre flows, but should provide overcontrol to reduce flood risk downstream. Cost sharing with the Town for this overcontrol would need to be determined on a case-by-case basis.

8. **Development Engineering Manual and Bylaw updates (Target 2024)** – It is recommended that the town update the Development Engineering Manual (DEM), including ROW cross-sections, and other policies, as needed, to account for the recommendations from the SWM-MP & FS as well as the other policy updates that are recommended.

E-8.2 Implementation Synergies with Town Plans and Policies

The recommended approach for Town-wide stormwater management and implementation on a priority subwatershed basis is not intended to be addressed in isolation as part of the SWM-MP & FS. The SWM-MP & FS was developed with full consideration for other Strategic Plans, Subwatershed Studies, Master Plans, Secondary Plans, Environmental Assessments and Policies. More specifically, the elements of the recommended approach represent potential synergies with other studies and plans and should be considered as such.

The SWM-MP & FS explicitly recommends that staff, as part of other Town initiatives, plans, studies and programs, leverage potential synergies as the opportunities are identified in order

to more efficiently achieve overall Town goals to improve the natural heritage system, construct new trails and cycle lanes, improve transit and build transit capacity, rehabilitate parks, and reconstruct roads, as well as improve stormwater management.

E-8.3 Recommended Approaches

The recommended approaches are described below**.** A plan was developed to implement the projects, programs, and policies that arise from these recommendations between 2024 to 2041.

E-8.3.1 Recommended Approach: Municipal Pollution Prevention, Operations & Maintenance Practices

The Recommended Plan for Municipal Pollution Prevention, Operations & Maintenance Practices involves monitoring sediment accumulation in OGS and LittaTrap units annually, and performing LID maintenance three times per year, removing sediment when needed. In addition, other operation and maintenance tasks currently completed by the Town, but not evaluated by the SWM-MP & FS, should be continued.

E-8.3.2 Recommended Approach: Private Property Strategies (Source Controls)

The Recommended Plan for Private Property Strategies is to develop a LID policy, approvals process, tracking system, and a process for oversight of private property LID best management practices (BMPs).

E-8.3.3 Recommended Approach: Stormwater Conveyance Infrastructure and Controls

The Recommended Plan for Stormwater Conveyance Infrastructure and Controls first involves cleanout of roadside ditches as a part of the Routine SWM Infrastructure Maintenance Program. The Town should initiate a storm sewer capacity study to identify undersized storm sewers, and also integrate LIDs into the road right of way as a part of the updates to the Town's DEM.

It is recommended that the Town adopt LID into its operations, including the development of a tracking tool and associated training, and operations and maintenance of municipally-owned LID features as a part of the Sediment Management Program.

E-8.3.4 Recommended Approach: Stormwater Management (SWM) Facilities

The Recommended Plan for Stormwater Management (SWM) Facilities includes six (6) primary components:

1. **Bathymetric and Topographic Surveys** – It is recommended that the Town continue to complete topographic and bathymetric surveys every five years.
2. **SWMF Sediment Removal** – It is recommended that the Town continue removing sediment from its SWM facilities, but at a greater frequency, to be completed as a part of the Town's broader Sediment Management Program.

3. **SWMF Maintenance** – In 2013 the Town identified maintenance requirements of the Town's SWMF, and these recommendations should be included as a part of the existing maintenance program. Further, it is recommended that the Town develop a tracking protocol to document performed and projected maintenance activities. This is to be completed as a part of the Town's broader Routine SWM Infrastructure Maintenance Program.

4. **SWMF Retrofits** – Retrofits improve or enhance the water quality, quantity and erosion control performance of existing stormwater management facilities and bring them in-line with current standards. Some facilities were not assessed for retrofit, as the catchments are not built out. Four retrofit types were identified:
    a. **Level of Service**: since the design level of service of these facilities doesn't meet the Town's current standards, it is recommended that these facilities be retrofitted to meet the Town's current standards, or the maximum extent possible. This includes the following fifteen (15) facilities: 6-1, 6-2, 6-3, 7-1, 7-2, 7-3, 7-5, 7-6, 7-7, 7-10, 7-11, 7-16, 8-2, 8-4, and 13-1.
    b. **Dry to wet Retrofit**: Retrofitting dry ponds to wet ponds allows for the facility to provide water quality controls. The following six (6) facilities were recommended for dry to wet retrofit: 1-1, 4-1, 7-4, 9-1, 14-1, and 15-1.
    c. **Catchment Source and Conveyance Controls**:
        i. Four (4) of the Town's dry ponds have catchments too small to support wet pond retrofits, so source and conveyance controls are recommended for water quality improvement in the following catchments: 5-2, 8-6, 8-10, and 8-11
        ii. SWMF 7-9 is an online channel facility, with multiple water quality facilities, but not all of its catchment receives water quality, so source and conveyance controls are recommended
        iii. SWMF 10-1 was retrofitted in 2019 but did not achieve Enhanced water quality treatment, so source and conveyance controls are recommended within the catchment

5. **SWMF Studies for Existing Facilities** – There are recommended additional investigations to be completed for 19 SWM facilities, including topographic and bathymetric surveys, modelling, monitoring, and quantity control retrofit feasibility studies, as required.

6. **New SWMF** – It is recommended to construct three (3) new SWM facilities, with two (2) of these being completed as park enhancements.

E-8.3.5 Recommended Approach: Flood Management and Watercourse Restoration

The Recommended Plan for Flood Management and Watercourse Restoration includes nine (9) primary components:

1. **Model Calibration** – There is a watercourse monitoring program that is recommended to allow for the full calibration of the model.

2. **High Priority Flood Risk Areas** – A total of 20 priority flood risk areas were identified along the Town's watercourses, not including flood risks associated with Lake Simcoe, which are recommended to be addressed through a Shoreline Flooding Management Program. Alternatives were developed for each area, with the preferred alternatives summarized in **Table E-1**.

3. **Other Culvert Replacements** – An assessment was completed, with 111 culvers being recommended for replacement to improve conveyance capacity, and 5 culverts recommended for replacement due to poor condition. Culverts have varying ownership and replacement is recommended to be an ongoing Culvert Replacement and Upgrade Program.

4. **Flood Control Operations and Maintenance –** The Town is currently responsible for operations and maintenance activities related to flooding effects. It is anticipated that flood mitigation options should reduce the demand for these activities.

5. **Private Property Drainage Program** – It is recommended for the Town to develop a Private Property Drainage Program that focuses on investigating and relieving these drainage issues. Minor complaints can be addressed internally and significant complaints may need to be addressed through a design process with an external consultant.

6. **Local Drainage Studies** – The Belle Aire Creek Road Drainage Study is recommended to investigate flooding in the area of Belle Aire Beach Road, Balsam Road, Spruce Road, and Reid Avenue. This study will be completed as a feasibility study, not an Environmental Assessment, and should focus on identifying flooding sources and identify potential solutions. The Kellough and Lawson Street Drainage Study should be conducted to determine the extent of drainage issues and to identify if a Permit to Take Water would be required.

7. **Rain Gauge Study** – The general recommendation is to have rain gauges provide coverage at a 3 km radius. This study would help identify locations where new rain gauges can be installed that will help the Town evaluate future rain events and better understand which events trigger flooding at particular locations.

8. **Shoreline Flooding Management Plan** – It is recommended for the Town to complete Shoreline Flooding Management Plan to identify alternatives to mitigate flood risks associated with Lake Simcoe water levels. This can include, but is not limited to: Lake level monitoring, evacuation plans, communication strategy, floodproofing guidelines, and emergency response for mobile pumping operations.

9. **Municipal Drainage Works** – The Second Concession Drain and the South Innisfil Drain Branch B are two drains that were found to have significant discrepancies based on the new LiDAR. It is recommended that the Town continue to manage municipal drain maintenance and consider abandoning drains that may no longer need to be municipal drains.

10. **Innisfil Heights Master Drainage Study** - A Master Drainage Study for Innisfil Heights is recommended to determine the preferred approach for managing stormwater and preventing flooding from future development in this area.

Table E-1: Preferred Alternatives for Priority Flood Risk Sites

Area ID	Location Name	Preferred Alternative	Considerations
1	Bridle Path Culvert	Bridle Path Culvert Replacement and Road Regrading	Private Property
2	Pinegrove Avenue Culvert	Pinegrove Avenue Culvert Replacement and Road Regrading	Municipal Drain – Section 78 Report Required
3	Main Street and 25th Sideroad	Improve Channel Conveyance Capacity and Raise Elevation of 25th Sideroad	Private Property
4	Sandy Cove Acres	Lockhart Road Culvert Replacement	
5	Cook Street and 25th Sideroad	Culvert Replacement at 25th Sideroad	
6	Trinity Street and Kildare Avenue	Upstream Flood Control Facility Combined with Potential Culvert Replacement	Land Acquisition Required
7	25th Sideroad, Wallace Avenue and Ralph Street Culverts	Upstream Flood Control Facility	
8	Tall Tree Lane and Buchanan Street Culverts	Culvert Replacement at Tall Tree Lane and Buchanan Street	
9	Plum Drive Culvert	Culvert Replacement	
10	St. John's Road Culvert (North of Anna Maria Drive)	Culvert Replacement and Realignment	
11	St. John's Road Culvert (7th Line)	Culvert Upgrade at St. John's Road and 7th Line	
12	Belle Aire Creek	Refer to separate EA for Belle Aire Creek	
13	Carson Creek Outlet	Engineered Berm and Regrading	Municipal Drain – coordinate improvement with ongoing Section 78 Report
14			

Area ID	Location Name	Preferred Alternative	Considerations
	Ferrier Avenue, Gilmore Avenue, and Corner Avenue Culverts	Culvert Replacements at Ferrier Avenue, Gilmore Avenue and Corner Avenue with Local Channel Improvement	Municipal Drain – coordinate improvement with ongoing Section 78 Report
15	Killarney Beach Road (West of 20th Sideroad)	Culvert Maintenance and Local Channel Improvement	Municipal Drain – coordinate improvement with ongoing Section 78 Report
16	White Birch Creek Outlet	Upstream Flood Control Facility	Land Acquisition Required
17	10th Line and Railway Crossing	Municipal Drain and Valley Corridor Improvement	Municipal Drain - Section 74 Maintenance for 10th Line and Railway Crossings on Hewitts Creek Drain
18	Innisfil Beach Road (east of Yonge Street)	Raise Private Road	Private Property Section 4 Petition for New Branch of Hewitts Creek Drain under Drainage Act
19	Innisfil Beach Road (west of Yonge Street)	Culvert Replacement and Regrade the Road	County Road Section 4 Petition for New Branch of 8th Line Municipal Drain under Drainage Act
20	Highway 400 Culvert (north of 7th Line)	Future Development Regrading	Private Property

E-8.4 Monitoring Plan

In order to ensure the goals and objectives of the SWM-MP & FS are accomplished over time, a focused stormwater monitoring program has also been established as part of the Implementation Plan. The stormwater monitoring program has been phased to permit Town staff to build capacity within the municipality, align with the Consolidated Linear Infrastructure Environmental Compliance Approval, vet the proposed monitoring program with partner agencies and permit the alignment of future budgets with the revised program needs. The monitoring program will start establishing baseline monitoring results (existing conditions) using three (3) autosamplers and working up to a total of seven (7) autosamplers to be rotated between subwatersheds. Water level monitoring in 10 wet SWM facilities will be initiated on a rotational basis.

The watercourse monitoring program is recommended to include water quality sampling, water quantity monitoring, temperature monitoring invertebrate community sampling, fish community sampling, and compliance monitoring.

Other Monitoring Obligations
In addition, the stormwater monitoring program is recommended to include previous monitoring obligations including but not limited to ECA compliance monitoring for stormwater management facilities and other permit compliance, as directed by the NVCA, LSRCA, MNRF, DFO, or MECP, to be identified on a case-by- case basis.

E-8.5 Staffing

In order to achieve the goals of the SWM-MP, it is recommended that additional Capital and Operating staff be considered. Tasks may include:

- Develop RFPs and manage stormwater management pond rehabilitation projects;
- Develop RFPs and manage design and construction of new stormwater management facilities;
- Develop RFPs and manage flood mitigation projects;
- Develop RFPs and manage all future studies;
- Further refine the hydraulic modelling to identify constraints in SWM infrastructure;
- Operate and maintain the Town's VO model;
- Review, approve, and inspect LID facilities on private property; and
- Provide design, operations, and maintenance support for LID facilities within the municipal ROW projects and create new design standards and specifications.

E-8.6 Cost Estimates

Estimated capital costs estimates for each element are detailed in **Table E-2**.

E-8.7 Implementation Schedule and Budget Forecast

The implementation schedule and budget forecast consider three (3) implementation periods:

1) Immediate Term Implementation Priorities (2024–2028) - $65.8 million
2) Medium Term Implementation Priorities (2029-2033) - $47.69 million
3) Long Term Implementation Priorities (2034–2041) - $106.01 million

The implementation schedule and budget forecast illustrate the specific program or project elements of the recommended approach as well as the recommended year within which the element is to be completed as well as the estimated costs. **Figure E-1** presents the geographic locations of the project recommendations.

The implementation schedule and associated costs does not include the replacement of all undersized culverts in the Town's network. It only includes those identified for upsizing as part of the high priority flood risk locations, plus an additional $1 million of culvert upgrades annually.

Table E-2: Recommended Approach – Summary of Cost Estimates†

Recommended Approach Element	Cost Estimate ($)
1) Municipal Pollution Prevention, Management, Operations & Maintenance Practices	
a. OGS Maintenance	$671,400
b. LittaTraps	$42,840
c. Low Impact Development	$462,000
d. Other Established/ Existing Town Practices	$9,298,620
2) Private Property Strategies (Source Controls):	
a. LID Policy and Tracking Tool Development	$100,000
3) Stormwater Conveyance Infrastructure and Controls	
a. Storm Sewer Model	$125,000
b. Storm Sewer Replacement and Upgrade Program	$13,000,000
c. Ditch Clean-outs	$18,588,000
d. Low Impact Development in the ROW	$6,750,000
4) Stormwater Management (SWM) Facilities	
a. SWM Facility Studies	$779,000
b. Bathymetric and Topographic Surveys	$576,000
c. Sediment Removals	$11,331,000
d. SWMF Maintenance	$414,000
e. SWMF Retrofits	$15,131,000
f. New SWM Facilities	$5,436,000
5) Flood Management and Watercourse Restoration (Preliminary Estimated Cost Implications based on Uncalibrated Model)	
a. Monitoring and VO Model Calibration	$150,000
b. Shoreline Flooding Management Plan	$150,000
c. High Priority Flood Risk Area Mitigation	$109,320,000
d. Rain Gauge Study	$5,000
e. Local Drainage Studies	$205,000
f. Additional Culvert Inspections	$100,000
g. Culvert Replacements	$18,000,000
h. Flood Control Operations and Maintenance	$470,000
i. Municipal Drain Maintenance	$720,000
j. Municipal Drain Reporting and Abandonment	$4,096,795
k. Private Property Drainage Program	$1,800,000
l. Innisfil Heights Master Drainage Study	$150,000
Implementation	
a. Work on Private Property Policy	$10,000
b. Stormwater Fee Study	$150,000
c. Cash-in-Lieu Study	$100,000
d. Tile Drain Study	$100,000
e. SWM-MP Update	$1,050,000

Recommended Approach Element	Cost Estimate ($)
f. SWM Monitoring Program g. Update DEM and ROW Cross-Sections h. Flood Risk Mapping and Development Policy	$840,000 $125,000 $50,000
Total	$220.6 million
Total Yearly Expenditure‡	**$12.3 million**
‡ expenditure time frame is 2024-2041 † Class 'C' cost estimate. Note: all values in 2023 CDN dollars	

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Subwatershed
- Road Centreline
- Watercourses
- Areas with Flooding Issues
- Flooding Issues Due to Lake Level
- Area Under the Influence of Lake Simcoe
- Regulatory Water Level (219.50m)
- Normal Water Level (219.15m)
- Proposed SWM Facility

SWMF Recommendations:

- Dry to Wet Retrofit
- Sediment Removal
- Quantity Control Feasibility Study
- Dry to Wet Retrofit, Quantity Control Feasibility Study
- Sediment Removal, Quantity Control Feasibility Study
- Sediment Removal, Water Quality Enhancement Retrofit, Quantity Control Feasibility Study
- Water Quality Enhancement Retrofit, Quantity Control Feasibility Study
- None

Watercourse Crossings:

- Conveyance Criteria Not Met
- Conveyance Criteria Met

Municipal Drains:

- Consider Abandonment of Municipal Drain – Prokopchuk Municipal Drain
- Consider Abandonment of Municipal Drain – Rouiston Drain
- New Municipal Drain Report Required – Second Concession Drain
- New Municipal Drain Report Required – South Innisfil Drain Branch B
- Section 4 Petition for New Municipal Drain Branch

LOCATOR MAP

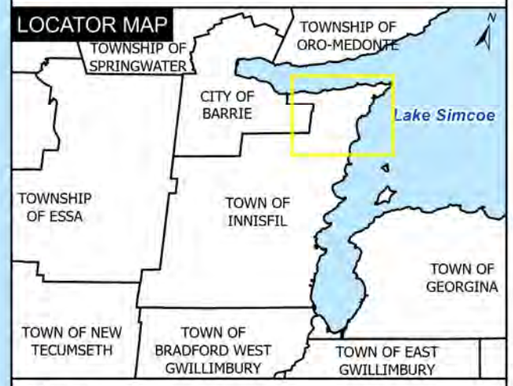

Figure E.1

Key Findings & Recommendations

Date: 2023-11-15
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, LSRCA, NVCA, OMNRF
Created by: A.V.

0 430 860 1,290
Meters

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Aquafor Beech Limited

Innisfil

Legend

- Municipal Borders
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SWMF Recommendations:

- Dry to Wet Retrofit
- Sediment Removal
- Quantity Control Feasibility Study
- Dry to Wet Retrofit, Quantity Control Feasibility Study
- Sediment Removal, Quantity Control Feasibility Study
- Sediment Removal, Water Quality Enhancement Retrofit, Quantity Control Feasibility Study
- Water Quality Enhancement Retrofit, Quantity Control Feasibility Study
- None

Watercourse Crossings:

- Conveyance Criteria Not Met
- Conveyance Criteria Met

Municipal Drains:

- Consider Abandonment of Municipal Drain – Prokopchuk Municipal Drain
- Consider Abandonment of Municipal Drain – Roulston Drain
- New Municipal Drain Report Required – Second Concession Drain
- New Municipal Drain Report Required – South Innisfil Drain Branch B
- Section 4 Petition for New Municipal Drain Branch

LOCATOR MAP

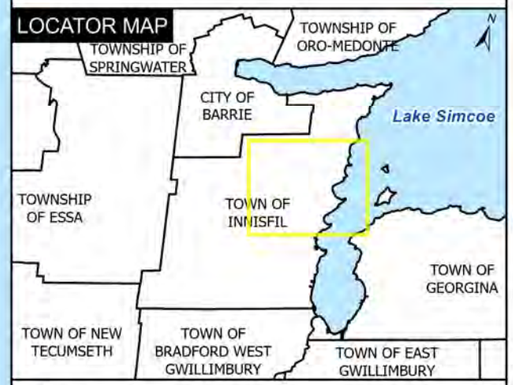

Figure E.1

Key Findings & Recommendations

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Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, LSRCA, NVCA, OMNRF
Created by: A.V.

0 490 980 1,470
Meters

N

Aquafor Beech Limited

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Subwatershed
- Road Centreline
- Watercourses
- Areas with Flooding Issues
- Flooding Issues Due to Lake Level
- Area Under the Influence of Lake Simcoe
- Regulatory Water Level (219.50m)
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- Dry to Wet Retrofit, Quantity Control Feasibility Study
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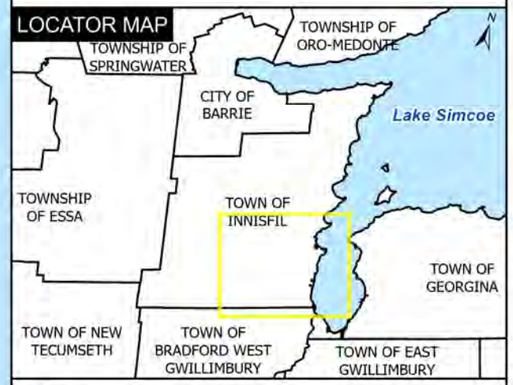

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Data Source: Town of Innisfil, LSRCA, NVCA, OMNRF
Created by: A.V.

0 540 1,080 1,620
Meters

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Aquafor Beech Limited

ALCONA
LEFROY
CHURCHILL
GILFORD
FENNEL'S CORNER
TOWN OF BRADFORD WEST GWILLIMBURY
TOWN OF GEORGINA
Lake Simcoe
Cedar Creek
Belle Aire Creek
Carson Creek
Innisfil Creek
Wilson Creek
White Birch Creek
Gilford Creek
Upper March Creek
5TH LINE
4TH LINE
3RD LINE
2ND LINE
14TH LINE
COUNTY RD 89
KILLARNEY BEACH RD
SHORE ACRES DR
EWART ST
YONGE ST
SIDERD 10
SIDERD 20
Area 12
Area 13
Area 14
Area 15
Area 16
NVCA_22
NVCA_72
NVCA_49
NVCA_6
NVCA_23
NVCA_44
NVCA_45
NVCA_93
LSRCA_135
LSRCA_136
LSRCA_10_2
LSRCA_167
LSRCA_137
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LSRCA_130
LSRCA_140
LSRCA_122
LSRCA_124
LSRCA_123
LSRCA_121
4-1
4-2
4-3
3-1
3-2
3-3
5-2
15-1

CITY OF BARRIE

LOCKHART RD

LSRCA_105

Sandy Cove Creek

SANDY COVE

SIDERD 20

10-2

STROUD

10-1

VICTORIA ST

EOPO#4

10-4

Area 17

LSRCA_83

LSRCA_11

10TH LINE

Mooselanka Creek

9-2

9-3

Hewitts Creek

South Sandy Cove Catchment 2

LSRCA_37

YONGE ST

Alcona North Urban Catchment 1

LSRCA_40

9TH LINE

LSRCA_12

LSRCA_13

LSRCA_39

Lovers Creek

Leonard's Creek

8-12

8-4

LSRCA_35

8-7

LSRCA_38

8-9

8-10

8-3

ALCONA

8-13

8-6

Area 19

LSRCA_84

LSRCA_27

LSRCA_29

7-15

INNISFIL BEACH RD

LSRCA_34

LSRCA_22

LSRCA_3

LSRCA_4

LSRCA_2

LSRCA_31

7-6

7-10

7-11

7-7

LSRCA_1

Bon Secours Creek

7-9

7-12

7-16

7-14

7-13

Banks Creek

Alcona Urban Catchment

7-17

7-1

LSRCA_10

7-3

LSRCA_9

LSRCA_8

LSRCA_7_2

7-2

Innisfil

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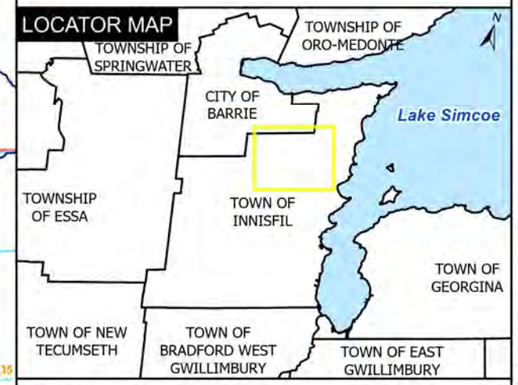

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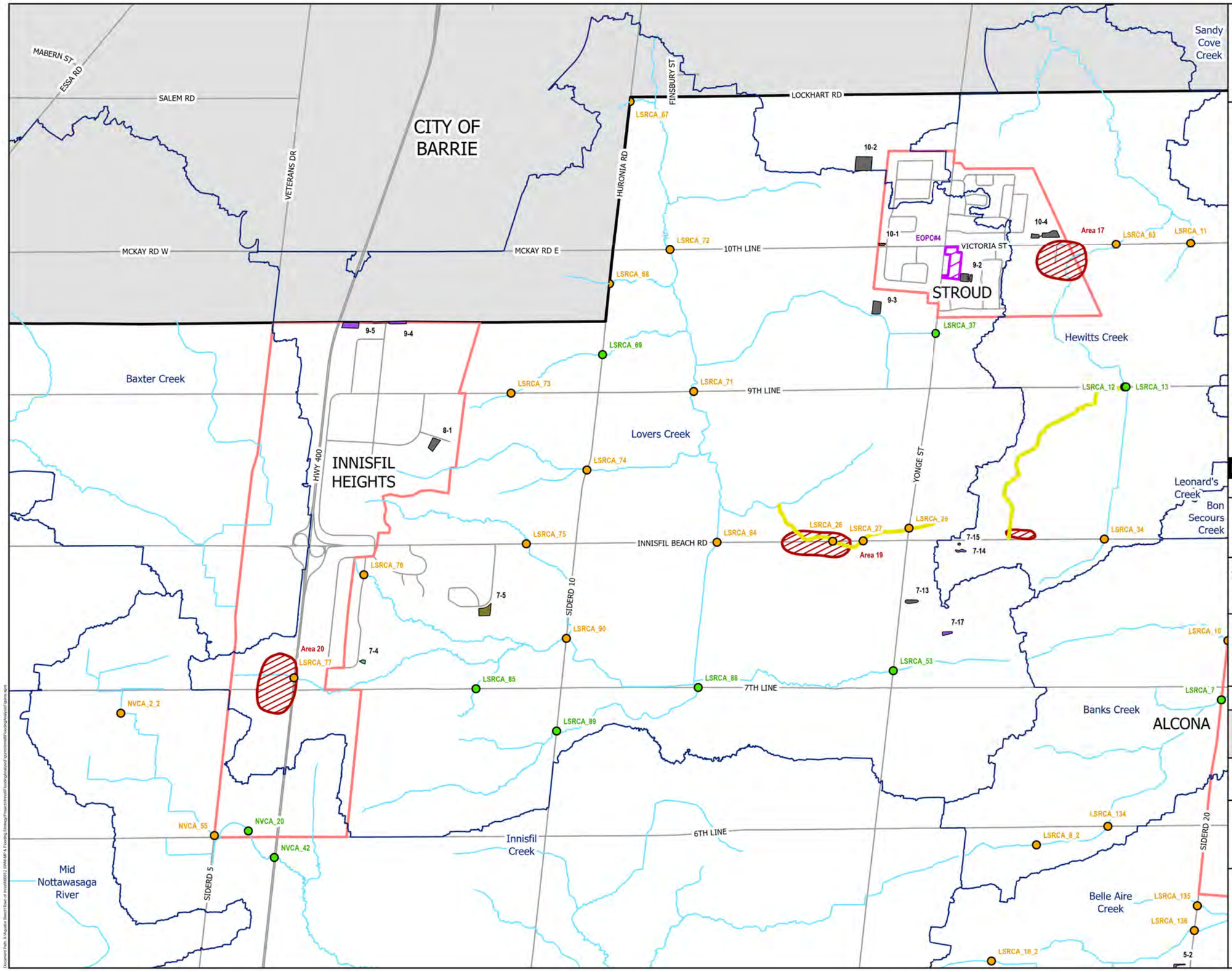
Aquafor Beech Limited



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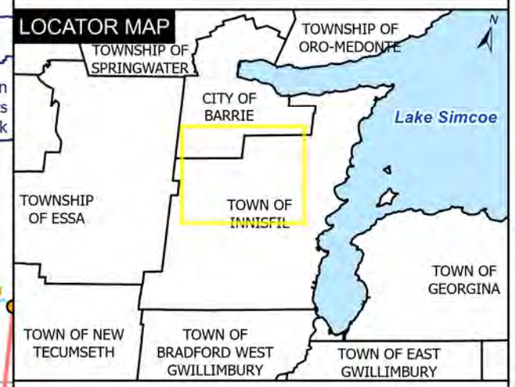

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0 500 1,000 1,500
Meters

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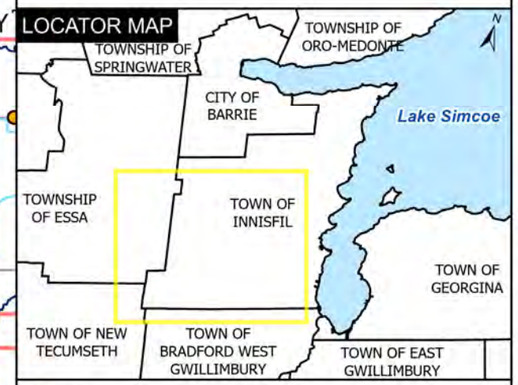

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Created by: A.V.

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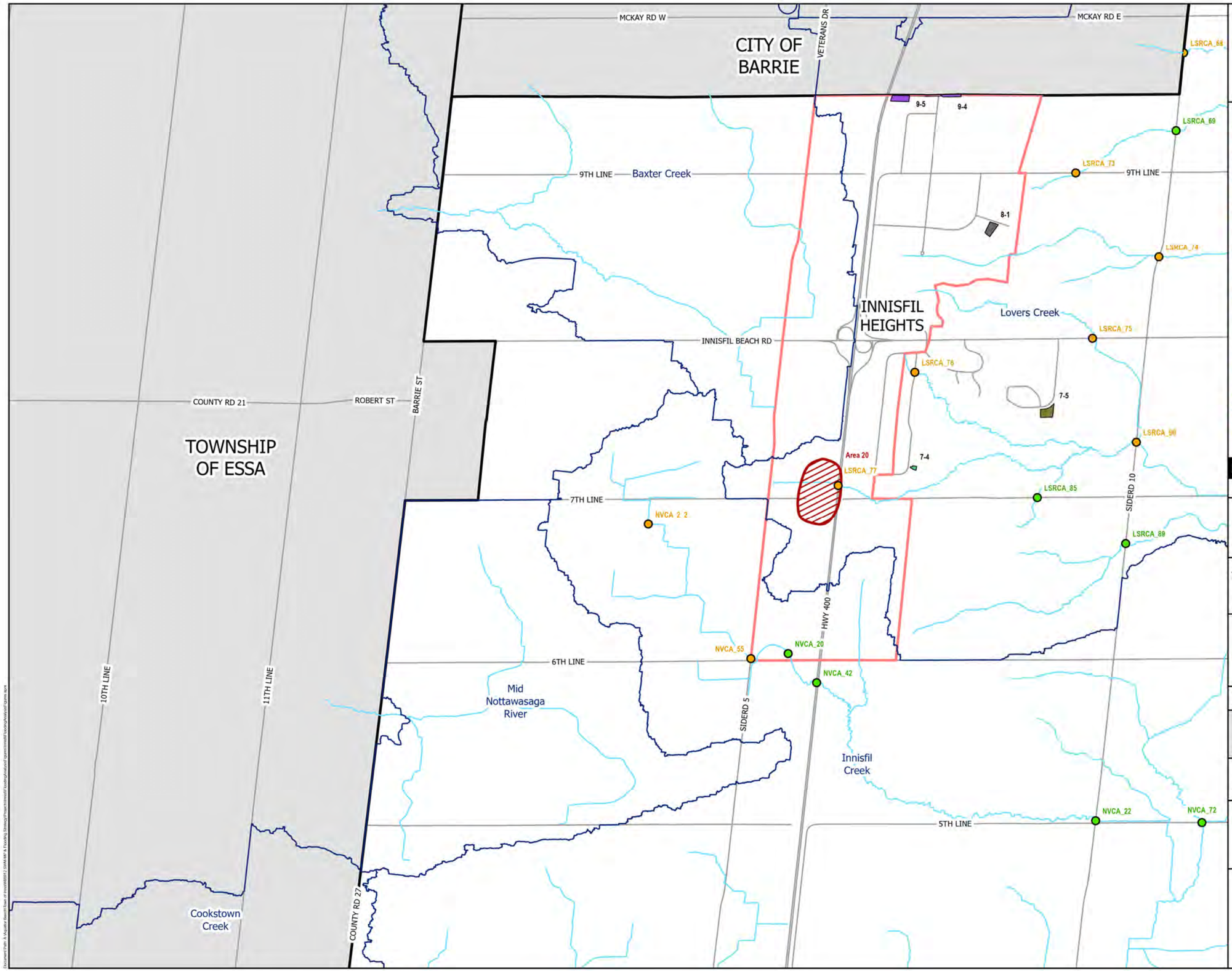
Aquafor Beech Limited



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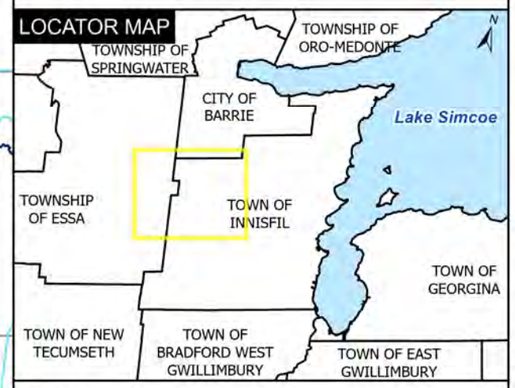

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0 475 950 1,425
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Aquafor Beech Limited

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List of Terms, Definitions and Acronyms

AEM	Adaptive Environmental Management
ANSI	Area of Natural and Scientific Interest
AMA	Adaptive Management Approach
BMP	Best Management Practice
DFO	Department of Fisheries and Oceans
EA	Environmental Assessment
ECA	Environmental Compliance Approval
EMC	Event Mean Concentration
EOP	End-of-Pipe
ESPA	Environmentally Sensitive Policy Area
GI	Green 'Stormwater' Infrastructure
GIS	Geographical Information Systems
ICA	Issue Contributing Area
LID	Low Impact Development
LOS	Level of Service
LSRCA	Lake Simcoe Region Conservation Authority
MCEA	Municipal Class Environmental Assessment
NHS	Natural Heritage System
MNRF	Ministry of Natural Resources and Forestry
MECP	Ministry of the Environment, Conservation and Parks
MTCS	Ministry of Tourism, Culture and Sport
NPS	Urban Non-point Source
NVCA	Nottawasaga Valley Conservation Authority
OGS	Oil and Grit Separator
OWRA	*Ontario Water Resources Act*
OP	Official Plan
PICP	Permeable Interlock Concrete Paver
PPS	Provincial Policy Statement
PWQO	Provincial Water Quality Objectives
SARA	*Species at Risk Act*
SPP	Source Protection Plan
SWM	Stormwater Management
SWM-MP	Stormwater Master Plan
SWMPDM	Stormwater Planning and Design Manual (MECP 2003)
SWS	Subwatershed Study
WHPA	Well Head Protection Area
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

The following report has been prepared by Aquafor Beech Limited.

Report prepared by: Alison Gingrich Regehr, MASc., P.Eng.

Report reviewed by:

Chris Denich, MSc., P.Eng.

1 Introduction

The Town of Innisfil Stormwater Management Master Plan and Flooding Strategy (SWM-MP & FS) Environmental Assessment (EA) is a strategic document that provides direction for the management of stormwater runoff and related infrastructure. The SWM-MP & FS identifies a preferred strategy to protect and enhance natural features, ecological function and biophysical integrity, and appropriately manage risks through the identification of preferred approaches and the establishment of environmental targets.

- The Stormwater Management Master Plan (SWM-MP) component establishes the stormwater management policies and guidelines for the next 18 years, addresses stormwater infrastructure needs, identifies and prioritizes recommended works, informs the overall asset management plan for the Town of Innisfil.
- The flooding Strategy (FS) component will identify and prioritize areas of concern for flooding and create a plan for cost-effective, environmentally sustainable and innovative solutions.

1.1 Study Purpose

The purpose of the current Stormwater Management Master Plan Update and Flooding Strategy (SWM-MP & FS) is to improve and minimize the negative impacts of flooding and stormwater movement, improve safety, preserve local character, and protect the natural environment. Through the completion of the Stormwater Management Master Plan Update and Flooding Strategy following the Municipal Class Environmental Assessment (EA) process, it is the intent that the Town will remain compliant with the Lake Simcoe Protection Act and to account for Town growth over the next 20 years. The SWM-MP also serves as a transparent community consultation process by which the Town can establish stormwater management guidelines and policies.

It is the intent of the SWM-MP & FS to develop a preferred stormwater management and flooding strategy (Recommended Approach) for the Town of Innisfil following a Master Planning approach. The study addresses primarily the existing urbanized areas of the Town and recommends remedial measures to improve overall environmental performance, increase efficiencies and reduce costs. The study focus is not new development; however, it does provide guidance in regards to future policies and identified intensification areas. It is understood that new development must follow the established processes and requiring approval under the Planning Act.

When approved, the SWM-MP will provide direction for resource requirements and identified works relating to the following five (5) stormwater management program elements:

1. Municipal Pollution Prevention, Operations & Maintenance Practices,
2. Source Control Measures,
3. Stormwater Conveyance Infrastructure and Control Measures,
4. Stormwater Management Facilities,

5. Flood Management and Watercourse Restoration.

1.1.1 Study Context - SWM Master Plan

This study has been completed as a Master Plan, a new approach to completing municipal stormwater master plans under *Section 4, Approach #2 of the Municipal Engineers Association Municipal Class Environmental Assessment Act (October 2000, as amended in 2007, 2011, 2015 and 2023)*. The SWM-MP & FS has been completed in keeping with the Ontario Water Resources Act (OWRA) O.Reg 525/98 which is designed to conserve, protect and manage Ontario's water resources for efficient and sustainable use relating to both groundwater and surface water throughout the province, as well as the *Guidelines for the Development and Implementation of Comprehensive Stormwater Management Master Plans in the Lake Simcoe Watershed* (LSRCA, 2011).

1.1.2 Study Context – Flooding Strategy

Like many Canadian municipalities, flooding within the Town has become a great concern for the municipality. Annual flooding events are occurring throughout the Town; responding to these events is resource intensive for Town staff. As such, the Flooding Strategy will assist the Town with the identification of flood prone areas, while providing a framework for the prioritization of areas concerned with flooding based on a multi-faceted risk assessment. Strategies for cost effective, environmentally sustainable, and innovative mitigation of flooding will be proposed and incorporated into the Town's short, medium, and long-term capital budget planning, with an overview of tasks included below.

1.2 Study Goals & Objectives

The SWM-MP & FS integrates water resources in the context of stormwater, within a holistic approach to the natural environment and associated wildlife habitats, existing and future policies, land planning, concepts of open space and trails, operation and maintenance, asset management, climate change and community engagement.

1.2.1 Study Goals

The goals of Town of Innisfil SWM-MP & FS have been developed in keeping with the goals and objectives of the key guiding documents listed above and in compliance with existing guidance, acts and regulations. The study goals include:

- Direct infill and redevelopment requirements in regard to stormwater management criteria tied to the preferred Master Plan strategies,
- Fill gaps in existing subwatershed studies and stormwater master plans,
- Maintain existing funding and forecast future funding requirements to implement the preferred strategies,
- Develop an integrated Town-wide approach for water quality, water quantity, erosion control, flood control, preservation of hydrologic processes through water budgets, and the preservation and enhancement of the natural environment,

- Inventory and address stormwater infrastructure issues as part of the Town's overall asset management program,
- Direct future SWM monitoring in compliance with the plan's goals, targets and objectives which acknowledges the adaptive environmental management (AEM) process,
- Develop an implementation plan to direct the safe and effective management of stormwater runoff from the Town's urban areas in addition to mitigating flood issues, while improving the ecosystem health and ecological sustainability of the receiving watersheds. The implementation plan is designed to direct future actions, identify responsible parties, outline costs and environmental benefits and clearly define the operation and maintenance requirements and costs,

1.2.2 Study Objectives

The Town of Innisfil SWM-MP & FS considers flood and erosion control, groundwater and surface water quality management, natural heritage environment management and infrastructure, all in an integrated manner. In addition, the SWM-MP & FS integrates existing policies, regulations, acts and guidelines, and where appropriate, develops new policies to aid in implementation. The objectives of the Town of Innisfil SWM-MP & FS include the following:

Water Quality

- Maintain or improve surface water and groundwater quality.
- Minimize sediment loading to surface water and groundwater.
- Maintain or enhance the quality of drinking water sources.
- Maintain existing thermal watercourse regimes
- Design and optimize a comprehensive water quality monitoring program.

Water Quantity

- Preserve and re-establish the natural hydrologic process to protect, restore and replenish surface water and groundwater resources.
- Minimize the threat to life and property from flooding and climate change.
- Maintain or enhance groundwater supplies through infiltration while minimizing the risks from future land uses and activities.

Erosion Control

- Reduce the impacts of excessive erosion on aquatic and terrestrial habitat and property.

Flood Control

- Review, update, and confirm hydrologic and hydraulic modeling
- Identify flood problems and flood relief opportunities
- Prioritize flood relief projects and develop preferred solutions

Natural Environment

- Protect, enhance and restore natural features and functions such as wetlands, riparian and ecological corridors, as well as identified linkages.
- Improve warmwater, coolwater and coldwater fisheries where feasible.

Infrastructure

- Provide a level of service for stormwater management which is consistent with municipal and agency standards. Develop ways to optimize infrastructure wherever feasible.
- Encourage the implementation of innovative solutions including Low Impact Development (LID) and Green 'Stormwater' Infrastructure (GI) to mitigate stormwater runoff as part of the development of sustainable infrastructure solutions.
- Develop a strategy to gain access to infrastructure which serves a communal function.
- Improve stormwater infrastructure resiliency and adaptation related to climate change.
- Direct future works and studies related to Municipal Drains within the Town.

Policy and Implementation

- Reflect existing acts, policies and regulation.
- Integration of Asset Management Plans for Stormwater which includes long-range financial forecast and planning direction for many of the specific policy items and recommendations.
- Create SWM Policies to support implementation of the Recommended Approach.

1.3 Background

In 2016, the Town of Innisfil completed a Comprehensive Stormwater Management Master Plan to improve existing drainage infrastructure and define a strategy to establish guidelines to manage stormwater quality and quantity, and reduce phosphorus loadings. An update to the 2016 CSWM-MP is now required, as the Town has completed many of the recommendations from 2016; there have been changes in key policies, acts, and regulation standards; substantial new development is being proposed in the Town; and to maintain compliance with the Lake Simcoe Protection Plan.

The field of stormwater management has evolved over the decades (**Figure 1.1**). It now includes broader environmental objectives and targets for not only water quality, quantity and erosion control, but a greater focus on water budget (infiltration) considerations, as well as the protection of aquatic and terrestrial habitats and groundwater resources. In addition, climate change resiliency, adaptation and mitigation must now be considered as part of stormwater design and implementation. As much of the Town was developed prior to the development of these modern stormwater guidelines, these areas may not provide adequate control of water quality, quantity or erosion, and may be less resilient to the effects of climate change.

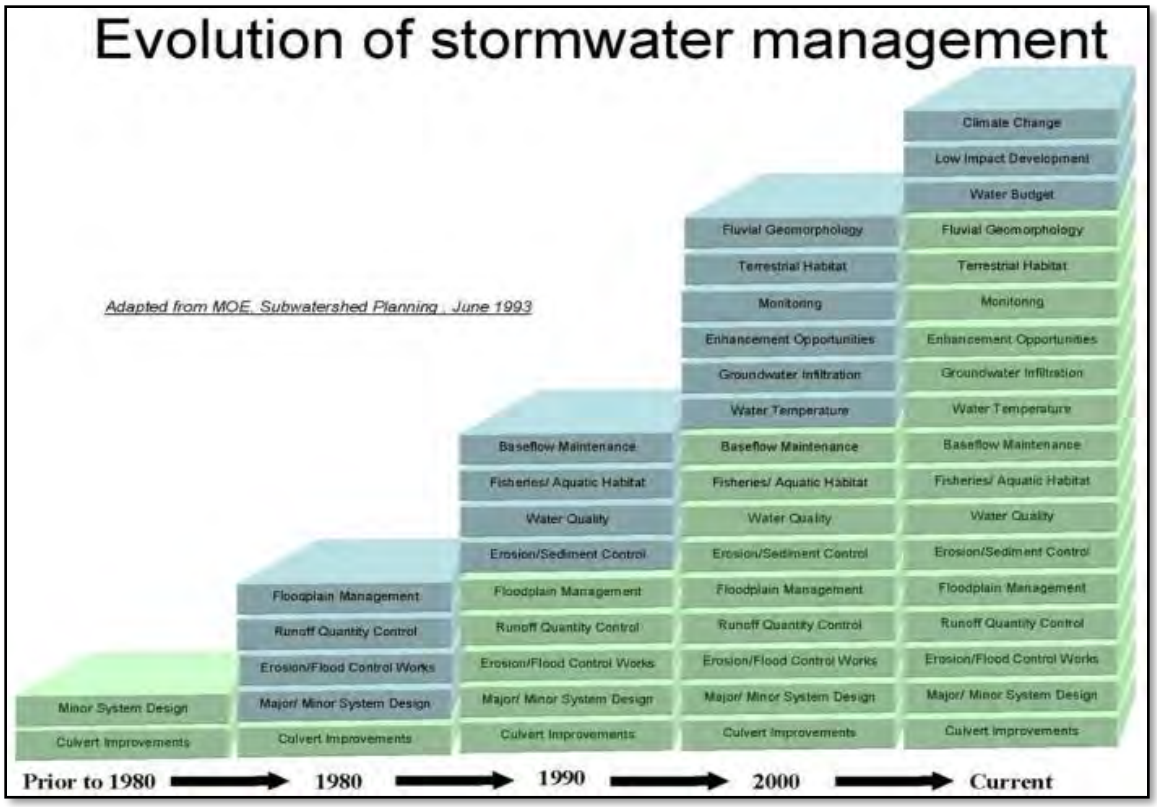


Figure 1.1: Evolution of Stormwater Management

1.4 Report Organization

Section 1 – Provides an introduction to the study, the study purpose, goals, objectives as well as an overview of the Class Environmental Assessment Process.

Section 2 – Describes the Problem statement, opportunity and constraints.

Section 3 – Summarizes key Federal, Provincial, Regional and Local legislations, policies, and guidelines for the management of water resources and stormwater management.

Section 4 – Summarizes the existing environmental conditions and stormwater assets within the Town of Innisfil based on available information extracted from background reports, GIS mapping and databases.

Section 5 – Details the various management options relating to each of the five (5) elements included with the SWM-MP & FS and the development of the long list of alternatives.

Section 6 – Summarizes the study approach, analysis and recommendations relating to the SWM-MP & FS program element: Municipal Pollution Prevention, Operations & Maintenance Practices.

Section 7 – Summarizes the study approach, analysis and recommendations relating to the SWM-MP & FS program element: Stormwater Conveyance Infrastructure and Control Measures.

Section 8 – Summarizes the study approach, analysis and recommendations relating to the SWM-MP & FS program element: Stormwater Management Facilities (end-of-pipe controls – existing, planned and proposed).

Section 9 – Summarizes the study approach, analysis and recommendations for the SWM-MP & FS program element: Flood Management and Watercourse Restoration.

Section 10 – Describes the evaluation criteria, evaluation process and selection of the preferred alternatives; the study recommendations; and the implementation plan.

Section 11 Summarizes the overarching recommendations from the SWM-MP & FS.

1.5 The Class Environmental Assessment Process

An approved Class Environmental Assessment (Class EA) document describes the process that a proponent must follow for a class or group of undertakings in order to satisfy the requirements of the *Environmental Assessment Act*, represents a method of obtaining an approval under the

Environmental Assessment Act and provides an alternative to carrying out individual environmental assessments for each separate undertaking or project within the class.

The *Environmental Assessment Act* was legislated by the Province of Ontario in 1980 to ensure that an Environmental Assessment is conducted prior to the onset of development and development related (servicing) projects. Depending on the individual Class Environmental Assessments (Class EA) or Master Plan to be completed, there are different processes that municipalities must follow in order to meet Ontario's Environmental Assessment requirements.

These processes are defined within the Municipal Engineers Association (MEA) Class Environmental (Class EA) (2000, as amended 2007, 2011, 2015 and 2023).

Class EAs (see **Section 1.5.1**) or Master Plan (see **Section 1.5.2**) are prepared for approval by the minister of the environment and are approved planning document that defines: projects, groups of projects and / or activities and the environmental assessment (EA) process which the proponent commits to for each project undertaking. Provided the process is followed, projects and activities included do not require formal review and approval under the *Environmental Assessment Act*. In this fashion the process expedites the environmental assessment of smaller recurring projects.

The Environmental Assessment process to be followed is illustrated in **Figure 1.2**, and may involve up to five phases of assessment. These phases include:

- **Phase 1**: Establish the Problem or Opportunity
- **Phase 2**: Identify and Assess Alternative Solutions to the Problem, and Select a Preferred Alternative
- **Phase 3**: Identify and Assess Alternative Design Concepts for the Preferred Solution, and Select a Preferred Design Concept
- **Phase 4**: Prepare an Environmental Study Report
- **Phase 5**: Proceed with Design and Implementation

Public, First Nations and agency consultation is also an important and necessary component of the five phases.

In partial fulfillment of Ontario's Environmental Assessment requirements, the process must satisfy at least the first two (2) phases of the Class Environmental Assessment process. Depending on the type of study to be completed, Phases 3 and 4 may also be required.

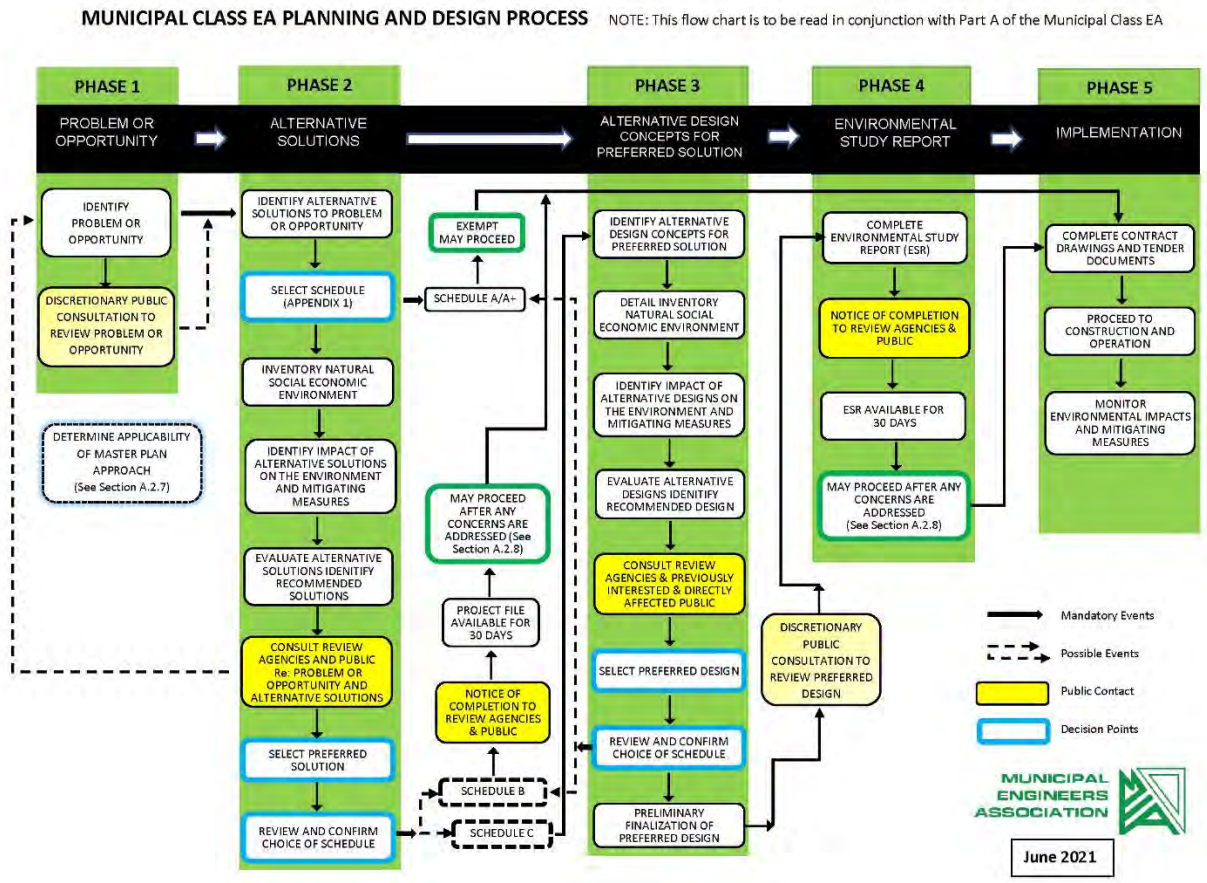


Figure 1.2: MEA Flow Chart

1.5.1 Class Environmental Assessment (Class EA)

The Municipal Engineers Association's Class EA document classifies individual projects as Schedule A, A+, B or C depending on their level of environmental impact and public concern. Any project identified must be classified as to their level of complexity and potential level of environmental impact, which will in turn decide which Schedule process needs to be followed.

- **Schedule 'A'** projects are generally routine maintenance and upgrade projects; they do not have the potential for significant environmental impacts or need public input. Schedule 'A' projects are pre-approved without any further public consultation.

- **Schedule 'A+'** was introduced in 2007 by the Municipal Engineers Association. These projects are pre-approved; however, the public is to be advised prior to the project implementation. Per Appendix 1 – Project Schedules of the Municipal Class Environmental Assessment (2000, as amended in 2007, 2011, 2015 and 2023), wastewater management projects that are intended to "modify, retrofit, or improve a retention/detention facility including outfall or infiltration systems for the purpose of

stormwater quality control" including "biological treatment through the establishment of constructed wetlands" are pre-approved under Schedule A^+ of the MEA.

- **Schedule 'B'** projects have more environmental impact and do have public implications. Examples would be stormwater ponds, river crossings, expansion of water or sewage plants up to or beyond their rated capacity, new or expanded outfalls and intakes, and the like. Schedule 'B' projects require completion of Phases 1 and 2 of the Class EA process.

- **Schedule 'C'** projects have the most major public and environmental impacts. Examples would be storage tanks and tunnels with disinfection, anything involving chemical treatment or expansion beyond a water or sewage plants rated capacity. Schedule 'C' projects require completion of Phases 1 through 4 of the Class EA process, before proceeding to Phase 5 implementation.

1.5.2 Master Plans

Master Plans are one form of Class EA document representing long range plans with environmental assessment planning principles. Master Plans provide a strategy for implementing a large number of projects of a similar nature where differences being primarily due to site specific conditions. The following characteristics distinguish the Master Planning Process from other processes:

a) The scope of Master Plans is broad and usually includes an analysis of the system in order to outline a framework for future works. Master Plans are not typically undertaken to address a single site-specific problem.

b) Master Plans typically recommend a set of works which are distributed geographically throughout the study area and which are to be implemented over an extended period of time. Master Plans provide the context for the implementation of the specific projects which make up the plan and satisfy, as a minimum, Phases 1 and 2 of the Class EA process (**Figure 1.2**). Notwithstanding that these works may be implemented as separate projects, collectively these works are part of a larger management system. Master Plan studies in essence conclude with a set of preferred alternatives and, therefore, by their nature, Master Plans will limit the scope of alternatives which can be considered at the implementation stage.

The Municipal Engineers Association (MEA) Class Environmental Class EA document also identifies four different approaches to completing Master Plans corresponding to different levels of assessment. Regardless of the approach selected, all Master Plans must follow at least the first two phases of the Class Environmental Assessment process (**Figure 1.3**).

- **Approach 1**, the most common approach, is to follow Phases 1 and 2 as defined above, then use the Master Plan as a basis for future investigations of site-specific Schedule 'B' and 'C' projects. Any Schedule 'B' and 'C' projects that need specific Phase 2 work and

Phase 3 and 4 work, usually have this Phase 2, 3 and 4 deferred until the actual project is implemented.

- **Approach 2** is to complete all of the work necessary for Schedule 'B' site specific projects at the time they are identified. Using this approach, a municipality would identify everything it needed in the first five years and would complete all the site-specific work required, including public consultation to meet Class EA requirements. The Master Plan in such cases has to be completed with enough detail so that the public in site-specific locations can be reasonably informed, and so that the approving government Agencies (Conservation Authorities, Ministry of Natural Resources and Forestry, Federal Department of Fisheries and Oceans, Transportation Canada, etc.) can be satisfied, in principle, that their concerns will be addressed before construction commences.

- **Approach 3** is to complete the requirements of Schedule 'B' and Schedule 'C' at the Master Plan stage.

- **Approach 4** is to integrate approvals under the EA and Planning Acts. For example, the preparation of new or amended Official Plans could be undertaken simultaneously with Master Plans for water, wastewater and transportation, and approval for both sought through the same process.

1.5.3 Town of Innisfil Stormwater Management Master Plan and Flooding Strategy

The Town of Innisfil SWM-MP & FS was conducted in accordance with the requirements for Master Plans under Appendix 4, Approach #2 of the Municipal Engineers Association Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011, 2015 and 2023). As part of the Class EA process evaluation of alternatives, assessment of the potential environmental effects and identification of mitigation measures for potential adverse impacts has been conducted and presented through public and agency consultations.

This SWM-MP & FS fulfills all of the Class EA requirements for Schedule A, A+, and B projects which can then proceed directly to detailed design and implementation (as required) and identifies any Schedule C projects for future studies.

Master plans by definition are long range plans. In the case of the Town of Innisfil SWM-MP & FS, implementation is projected to occur over a period of 20 years.

This SWM-MP & FS concludes with a set of preferred alternatives which make up the Preferred SWM Approach (i.e. Recommended Approach). It is proper to revisit Master Plans on a 5-year basis to ensure conditions (environmental, social, financial and technical) have remained unchanged. As such, if at the time of implementation, conditions have changed such that the preferred alternative cannot be implemented, an addendum may be prepared for the specific project. Amendments to the projects identified as part of the preferred alternatives can be made using the addendum procedures outlined in the Municipal Engineers Association

Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011, 2015 and 2023) document and shall be posted for the required 30-day review period.

Prior to implementation, additional public consultation shall be undertaken in support of further work carried out in the future for specific Schedule B projects. In addition, integration across departments is fundamental to a modern approach to stormwater management and is essential for the Town of Innisfil in the implementation of the SWM-MP & FS in order to meet the project goals and objectives. In this regard, potential synergies with other Town Strategic Plans, Subwatershed Studies, Master Plans, Secondary Plans, Environmental Assessments and Policies are considered essential.

1.6 Study Process

The study process that has been followed in this study is illustrated in **Figure 1.3.** The study has been broken down into three (3) stages. Stages 1 and 2 represent the completion of the SWM-MP & FS Municipal Class Environmental Assessment per the Municipal Class Environmental Assessment Master Planning process, as described By the Municipal Engineers Association (2000, as amended 2007, 2011, 2015 and 2023). The third stage is the Implementation Plan, which is under a separate cover.

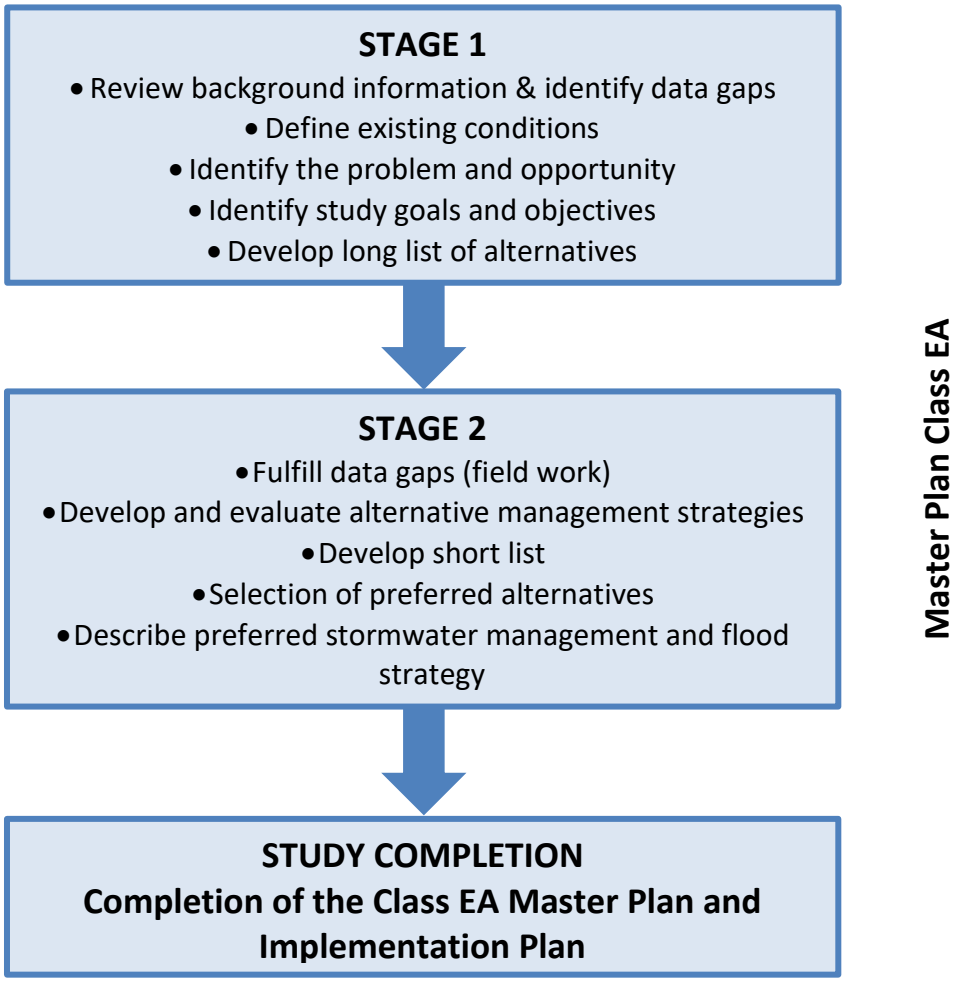


Figure 1.3: Town of Innisfil SWM-MP & FS Study Process

1.7 Public Consultation

This section summarizes the Public Consultation component of the study per the Consultation Plan. Recognizing the mandatory requirements for Public Consultation under the Municipal Class EA process, the Consultation Plan ensured all mandatory requirements were met while providing a more innovative approach that provides for enhanced public input and ultimately lays the foundation for improved participation of residents to secure feedback. It was the intent of the SWM-MP & FS to move public consultation beyond a process of presentation and feedback to a community visioning opportunity and a chance to create excitement, secure valuable insights and ideas and encourage public support.

In advance of Public Open houses, key messaging was developed and advanced advertising was undertaken via newspaper, website, and social media. Public open houses were held online. To ensure full transparency and public involvement, the public consultation completed for the SWM-MP & FS included:

1. **Notice of Study Commencement** (Notice was issued on August 18, 2021, and September 1, 2021, with notice to Council during the October 27, 2021 meeting)

2. **Public Open Houses**

   Public Open House No. 1 - was held as a virtual online meeting on Wednesday March 2, 2022 from 6:30 to 8:00 pm.

   Public Open House No. 2 – was held as an in-person meeting on Wednesday October 25, 2023 from 4:30 to 6:30 pm.

3. **Neighbourhood Pop-ups** – three in-person neighbourhood pop-ups were held on February 9, 2023 (Lefroy), February 13, 2023 (Town Hall), and February 28, 2023 (Cookstown). Each pop-up was held between 4:30 and 8:30 pm.

4. **Project Team**

A core project team was established which consisted of Town staff from various departments.

5. **Stakeholders**

A group of local stakeholders, community groups, agencies, and various levels of government were invited to participate in the Master Plan process through the formation of a Technical Advisory Committee. This group included:

- Nottawasaga Valley Conservation Authority (NVCA)
- Lake Simcoe Region Conservation Authority (LSRCA)
- InnServices Utilities, InnPower
- Simcoe County, City of Barrie, Town of Bradford West Gwillimbury, Town of New Tecumseth, Essa Township

6. **Indigenous Consultation**

Notices were provided to the following: Beausoleil First Nation, Chippewas of Georgina Island, Chippewas of Mnjikaning First Nation (Rama), Chippewas of Nawash First Nation, Nation Huronne-Wendat, Saugeen First Nation, Saugeen Ojibway Nation, Metis Nation of Ontario, and Williams Treaty First Nation.

A complete record of public consultation is included as **Appendix L.**

2 Problem Statement and Opportunity Identification

2.1 General

In 2016, the Town of Innisfil completed a Comprehensive Stormwater Management Master Plan to improve existing drainage infrastructure and define a strategy to establish guidelines to manage stormwater quality and quantity, and reduce phosphorus loadings. An update to the

2016 CSWM-MP is now required, as the Town has completed many of the recommendations from 2016; there have been changes in key policies, acts, and regulation standards; substantial new development is being proposed in the Town; and to maintain compliance with the Lake Simcoe Protection Plan. In addition, the Town has experienced numerous flooding events, and is therefore working towards developing a strategy to mitigate this flooding. An updated Stormwater Master Plan and Flooding Strategy (SWM-MP & FS) is thus being completed, following a Master Planning approach in accordance with the *Environmental Assessment Act as outlined by the Municipal Engineer's Association Municipal Class Environmental Assessment (MEA), October 2000, as amended in 2007, 2011, 2015 and 2023.*

2.2 Problem Statement

Areas of urban land use may degrade the environment in many ways. Degradation may occur at the onset as lands are stripped during the construction process. This may result in localized and /or broad-scale flooding, pollutants such as excessive sediment loads being discharged to the receiving bodies of water.

Sediment loading typically decreases as development of an area is completed, but different pollutants from the urban area can emerge at this stage. Common sources of pollutants include heavy metals from automobiles and air emissions, nutrients from fertilizers, bacterial contamination from animal wastes within stormwater runoff and toxic contaminants from a variety of residential, commercial and industrial sources.

The pollutants from developed urban areas, when conveyed to the receiving bodies of water, impact the environment in many ways. The particulate (settleable) and dissolved contaminants stress aquatic ecosystems by depleting oxygen, raising ambient water temperature, covering habitat or through the bioaccumulation or bioconcentration of contaminants in the tissues of various aquatic species. Similar to urban areas, rural areas may also degrade the environment as a result of increased bacterial, nutrient and suspended solids loadings from farms, golf courses and nurseries.

Urban development within the lands draining to streams also results in a transformation of the hydrologic characteristics within subwatersheds. Large amounts of previously permeable soils, which allowed rainwater to soak into the ground, are covered with impervious materials such as concrete and asphalt. Rainfall events that previously contributed little or no runoff to streams now cause flow to occur in the channels. Consequently, the amount of water draining to streams increases significantly in volume.

Commensurate with the increase in the volume of runoff is a decrease in the time it takes for the runoff to reach the channels. Ditches and storm sewers were constructed to rapidly convey the rainwater to streams resulting in higher peak flow rates in the receiving channels and result in flooding. While erosion and flooding are natural and necessary processes that can potentially occur in all watercourses, exacerbation of the erosion and flooding in urban areas may lead to increased risks to public health and safety. Where creeks have been channelized and confined as a result of historic development practices and encroachments, frequent flooding and erosion problems arise, particularly as they relate to undermined culverts at road crossings, failure of

roadway embankments, deterioration of historic erosion protection measures, and loss of private property.

The common geomorphic response to urban runoff and increased peak stream flows is channel enlargement through channel widening and deepening as erosion and sediment transport rates are accelerated. These urban impacts from increased stream flow (also known as "hydromodification") may in turn put infrastructure as well as structures and property at risk. With property and infrastructure within the stream corridors—and in some cases a long history of river engineering—generations of erosion and flood mitigation measures tend to deteriorate within a few decades and result in further degradation of natural stream functions.

As a result of existing land uses, together with proposed changes in land use within the urban core, a number of potential environmental problems have been identified. These include:

- Degraded surface water and groundwater quality
- Thermal enrichment of surface water
- Increased sediment loads to surface water
- Adverse effects on human and animal health
- Loss and degradation of fish and wildlife habitat, natural features and processes
- Increased flooding and erosion
- Disruption of the pre-development hydrologic process (reduction in groundwater recharge and stream baseflow)
- Urban flooding (overwhelming of the municipal storm sewer system and local watercourses)

3 Policy Framework & Technical Direction

As a component of the SWM-MP & FS, a Stormwater Policy Review was completed to identify existing policies, guidelines, and legislation that relate to stormwater management in the Town of Innisfil.

In Canada, environmental issues including stormwater planning and management are predominantly regulated through a multi-level legislative framework. Under the legislative framework for stormwater planning and management within the Town of Innisfil, there are several jurisdiction levels that interact and apply based on many factors including geographical scale, and administration role. These jurisdiction levels include:

- Local – County, Watershed or Municipal
- Provincial
- Federal

The reviewed documents are listed in **Table 3.1** below and are summarized in **Appendix A**.

Appendix A summarizes the relevant multi-level legislative framework in order to guide and direct future stormwater management activities in the Town of Innisfil. It also is intended to inform this SWM-MP & FS to ensure future municipal policy development is in full compliance with the necessary policies, statutes, regulations, plans and guidelines.

Table 3.1: Summary of Reviewed Federal, Provincial, Regional and Local Policies, Guidelines & Legislation

Federal Legislation	
• The Fisheries Act (1985, Amended 2019) • The Canada Water Act (1985, Amended 2014) • The Canadian Environmental Protection Act (1999, Amended 2021) • The Impact Assessment Act (2019) • The Migratory Birds Convention Act (1994, Amended 2017) • The Species at Risk Act (2002, Amended 2019) • The Canadian Navigable Waters Act (1985, Amended 2019)	
Provincial Legislation, Policies and Guidelines	
Ministry of the Environment, Conservation and Parks (MECP)	• Water Management Policies, Guidelines and Provincial Water Quality Objectives (PWQO) - The Blue Book (1994, Reprinted 1999) • Water Resources Act (1990, Amended 2021) • Consolidated Linear Infrastructure Environmental Compliance Approval (2022) • Clean Water Act (2006, Amended 2021) • Environmental Protection Act (1990, Amended 2021) • Environmental Assessment Act (1990, Amended 2021) • Lake Simcoe Protection Plan (2009) • Water Opportunities Act (2010, Amended 2019) • Management of Excess Soil – A Guide for Best Management Practices (2014, Updated 2021) • Environmental Bill of Rights (1993, Amended 2020) • Great Lakes Protection Act (2015, Amended 2021)
Ministry of Natural Resources & Forestry (MNRF)	• Lakes and Rivers Improvement Act (1990, Amended 2019) • Endangered Species Act (2007, Amended 2019)
Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA)	• Drainage Act (1990, Amended 2021) • Nutrient Management Act (2002, Amended 2021)
Ministry of Municipal Affairs and Housing (MMAH)	• Planning Act (2010, Amended 2021) & the Provincial Policy Statement (2020) • The Municipal Act (2001, Amended 2021)
Ministry of Infrastructure	• The Places to Grow Act (2005, Amended 2012)

	• Policy Review of Municipal Stormwater Management in the Light of Climate Change (2011, Updated 2019)
Local Legislation, Policies, Guidelines, Strategies, and Plans	
• Ontario Regulation 179/06 and 172/06 (1990, Amended 2013) • Technical Guidelines for Stormwater Management Submissions (LSRCA, 2022) • Comprehensive Stormwater Management Master Plan Guidelines (LSRCA, 2011) • LSPP Phosphorus Reduction Strategy (2010, Updated 2011) • Phosphorus Offsetting Policy (LSRCA, 2018, Amended 2021) • Ecological Offsetting Policy (LSRCA, 2017, Amended 2021) • Water Balance Recharge Policy for the Lake Simcoe Protection Plan (2018, Amended 2021) • NVCA Stormwater Technical Guide (2013) • Managing New Urban Development in Phosphorus-Sensitive Watersheds (2014) • NVCA Planning and Regulation Guidelines (2009) • Nottawasaga Valley Integrated Watershed Management Plan (2019) • South Georgian Bay Lake Simcoe Source Protection Plan (2014, Amended 2021) • County of Simcoe Official Plan (2016) • Simcoe County Transportation Master Plan (2008, Updated 2014) • Town of Innisfil Official Plan (2018) • Town of Innisfil Transportation Master Plan Update (2018) • Town of Innisfil Engineering Design Standards and Specifications Manual (2021) • Innisfil Creeks Subwatershed Plan (2012) • Barrie Creeks, Lovers Creek, and Hewitt's Creek Subwatershed Plan (2012)	

3.1 Cultural Heritage

The Ontario Ministry of Tourism, Culture and Sport (MTCS) mandates the conservation of Ontario's cultural heritage, including:

- Archaeological resources, including land-based and marine,
- Built heritage resources, including bridges and monuments, and
- Cultural heritage landscapes.

The MTCS notes that, while some cultural heritage resources may have already been formally identified, others may be identified through screening and evaluation. Furthermore, Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and the MTCS suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. The MTCS notes that Municipal Heritage Committees, historical societies and other local heritage organizations may also have knowledge that contributes to the identification of cultural heritage resources.

Under the Municipal Class Environmental Assessment (EA) process, the proponent is required to determine a project's potential impact on cultural heritage resources. The MTCS notes that developing and reviewing inventories of known and potential cultural heritage resources within the study area can identify specific resources that may play a significant role in guiding the evaluation of alternatives for subsequent project-driven EAs and/or on implementation.

3.1.1 Cultural Heritage: SWM-MP & FS Implementation

Given that a Master Plan, such as the subject SWM-MP & FS, is a high-level planning document, whose study area is the entirety of the Town of Innisfil, it is not practical to carry out technical heritage studies for such a broad geographic scope the way an EA proponent would when the "study area" is the footprint of a single proposed undertaking. However, as part of subsequent EAs to the SWM-MP & FS and /or prior to implementation, the more detailed processes stipulated by the archaeology and cultural heritage landscape shall be applied to the individual projects. In other words, consideration based on such heritage screenings or technical studies as are required must be applied prior implementation and the approaches modified as required.

Prior to the implementation of individual projects which comprise the preferred stormwater management strategy of this SWM-MP & FS, the Town shall review each site-specific project for the potential to impact known or potential cultural heritage resources and complete heritage screenings or technical studies in compliance with the heritage policies of the Innisfil Official Plan as well as other policies and procedures using the resources below relating to:

- Archaeological resources, including land-based and marine,
- Built heritage resources, including bridges and monuments, and
- Cultural heritage landscapes.

3.1.2 Cultural Heritage Resources

Archeological Resources

The Town of Innisfil does not map archaeological resources, as this is the responsibility of the Province and the County of Simcoe. However, the County does not release the specific locations of archaeological sites due to privacy and security concerns. Prior to the implementation of individual projects which comprise the preferred stormwater management strategy, the Town shall complete a Stage 1 Archaeological Assessment. The Archaeological Assessment shall evaluate the potential for archaeological resources within or adjacent to the proposed site by completing the following:

- A review of pertinent provincial and federal government files, as well as other published and unpublished literature
- Evaluating the property's archaeological potential
- Reviewing site-sensitive factors
- Conducting a property inspection of the project area

Heritage Conservation Districts

The Town of Innisfil has designated the Cookstown Heritage Conservation District, as the 14-block area surrounding the intersection of Queen Street and King Street in Cookstown possesses distinct heritage qualities and characteristics. Prior to the implementation of individual projects which comprise the preferred stormwater management strategy, the Town shall review each site-specific project for the potential to impact the known Heritage Conservation District.

The MTCS Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes should be completed to help determine whether the project may impact cultural heritage resources.

Built Heritage

The Town of Innisfil maintains a formal inventory of built heritage resources, including properties designated under Section 29 of the Ontario Heritage Act, and properties of cultural heritage value or interest. Prior to the implementation of individual projects which comprise the preferred stormwater management strategy, the Town shall complete a Stage 1 Built Heritage Assessment. The Built Heritage Assessment shall evaluate the potential for Built Heritage resources within or adjacent to the proposed site by completing the following:

- A review of pertinent provincial and federal government files, as well as other published and unpublished literature
- Evaluating the property's built heritage potential
- Reviewing site-sensitive factors
- Conducting a property inspection of the project area

The MTCS Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes should be completed to help determine whether the project may impact cultural heritage resources. The Built Heritage Assessment can be often be combined with the Cultural Heritage Landscapes Assessment.

4 Study Area Existing Conditions

In order to understand the existing environmental, surface and groundwater conditions as well as the relevant water, wastewater and stormwater conditions and assets within the Town of Innisfil a report entitled "**Stormwater Management Master Plan and Flooding Strategy: Background Technical Memorandum (April 2022)"** was prepared. This supporting technical document to the SWM-MP & FS is included as **Appendix A.**

The following section provides a summary of the existing environmental and stormwater asset conditions in the Town of Innisfil. The summary is based on available information extracted from background reports such as watershed studies and monitoring programs, GIS mapping and Town databases.

4.1 Summary of Background Documents

In preparation of the existing conditions, the following background studies were reviewed and summarized wherever relevant information existed:

Town of Innisfil

1. Town of Innisfil Stormwater Management Master Plan – Part 1 (Hatch Mott MachDonald, 2012)
2. Town of Innisfil Comprehensive Stormwater Management Master Plan (C.C. Tatham & Associates, 2016)
3. South Alcona Flood Reduction NDMP Project Environmental Study Report (Greenland Consulting Engineers, 2020)
4. Town of Innisfil 7th Line Storm Drainage Outlet Schedule "B" Class Environmental Assessment (Ainley Group, 2007)
5. Town of Innisfil Municipal Class Environmental Assessment Addendum 7th Line Storm Drainage Outlet (Associated Engineering, 2020)
6. Final Engineer's Report for South Innisfil Creek Drain 2019 Improvement (R.J. Burnside, 2019)
7. Town of Innisfil Road Needs Study Report (D.M. Wills, 2018)
8. Town of Innisfil Asset Management Plan (AECOM, 2014)
9. The Orbit: Innisfil – Rural Re-Imagined (Partisans and Innisfil, 2019)
10. Leonard's Beach Secondary Plan (Alcona North) (2013)

Agency

1. Lake Simcoe Protection Plan (MECP, 2009)
2. Guidelines for the Development and Implementation of Comprehensive Stormwater Management Master Plans in the Lake Simcoe Watershed (LSRCA, 2011)
3. Protecting People and Property: Ontario's Flooding Strategy (MNDMNRF, 2020)
4. South Georgian Bay Lake Simcoe Source Protection Plan (LSRCA, NVCA & SSEA, 2015; Amended 2019)

5. Approved Assessment Report: Lakes Simcoe and Couchiching-Black River Source Protection Area Part 1 (2015)

Subwatershed Studies

1. Innisfil Creeks Subwatershed Plan (LSRCA, 2012)
2. Barrie Creeks, Lovers Creek, and Hewitt's Creek Subwatershed Plan (LSRCA, 2012)
3. Barrie Creeks, Lovers Creek, Hewitt's Creek, and Innisfil Creeks Subwatershed Plans Implementation Plan: 2013-2017 (LSRCA, 2012)
4. Lake Simcoe Subwatershed Plans Implementation Report (LSRCA, 2018)
5. Nottawasaga Valley Conservation Authority Watershed Management Plan (NVCA, 2005)
6. NVCA Integrated Watershed Management Plan (2019)
7. Innisfil Creek Subwatershed Plan (NVCA, 2006)

In addition to the above, various development plans were reviewed as required.

4.2 Existing Conditions Executive Summary

The Town is located on the west shore of Lake Simcoe, approximately 85 km north of Toronto. With nine (9) distinct settlement areas, Innisfil is known as a "community of communities", combining rural charm with the amenities of a vibrant, small-town municipality.

The Town is located within the Lake Simcoe Watershed on the east and Nottawasaga Valley Watershed on the west. The Lake Simcoe Watershed consists of the 3,400 km^2 surrounding Lake Simcoe, and contains 20 municipalities with over 400,000 residents. The Nottawasaga Valley Watershed is approximately 3,700 km^2, consisting of the Nottawasaga River subwatershed, in addition to others draining directly to Georgian Bay. The Nottawasaga Valley Watershed contains 18 municipalities with a population of approximately 197,800 people. Watersheds are listed **Table 4.1** and shown on **Figure 4.1**.

Table 4.1: Watersheds in the Town of Innisfil

Watershed	Subwatershed	Drainage Area (ha)*	Stream Length (km)*
Lake Simcoe	Upper Lovers Creek	3,454.9	47.84
Lake Simcoe	Upper Hewitts Creek	1,054.3	12.06
Lake Simcoe	Innisfil – Strathallan North	10,265.2	129.41
Lake Simcoe	Innisfil – East		
Lake Simcoe	Sandy Cove Creek		
Lake Simcoe	Mooselanka Creek		
Lake Simcoe	Leonard's Creek		
Lake Simcoe	Bon Secours Creek		
Lake Simcoe	Banks Creek		
Lake Simcoe	Belle Aire Creek		
Lake Simcoe	Carson Creek		
Lake Simcoe	Wilson Creek		
Lake Simcoe	White Birch Creek		
Lake Simcoe	Gilford Creek		
Nottawasaga	Innisfil Creek	9,606.3	160.78
Nottawasaga	Cookstown Creek		
Nottawasaga	Bear Creek†	1,625.7	16.11
Total		**26,060.6**	**266.9**

* within Town boundaries

† includes Baxter Creek and Mid Nottawasaga River

TOWNSHIP OF SPRINGWATER
CITY OF BARRIE
TOWNSHIP OF ESSA
TOWN OF NEW TECUMSETH
TOWN OF BRADFORD WEST GWILLIMBURY
TOWN OF GEORGINA
BIG BAY POINT
SANDY COVE
STROUD
INNISFIL HEIGHTS
ALCONA
LEFROY
GILFORD
COOKSTOWN
FENNEL'S CORNER
HWY 89/400 COMMERCIAL AREA
Lake Simcoe
Bear Creek
Lovers Creek
Wilson Creek
Cookstown Creek
Innisfil Creek
Maskinonge (Jersey) River
COUNTY RD 90
30TH SIDERD
25TH SIDERD
9TH LINE
8TH LINE
COUNTY RD 56
COUNTY RD 21
10TH LINE
11TH LINE
15TH LINE
14TH LINE
13TH LINE
6TH LINE
5TH LINE
4TH LINE
3RD LINE
2ND LINE
7TH LINE
DUNLOP ST W
TIFFIN ST
ANNE ST S
BURTON AVE
BALDWIN LANE
SUMMERSET DR
ARDAGH RD
LITTLE AVE
PATTERSON RD
FAIRVIEW RD
BAYVIEW DR
FERNDALE DR S
MAPLETON AVE
MARSELLUS DR
ESSA RD
TOWNLINE RD
HURONIA RD
COX MILL RD
HURST DR
GOLDEN MEADOW RD
DEAN AVE
PRINCE WILLIAM WAY
THE QUEENSWAY
BIG BAY POINT RD
MAPLEVIEW DR W
MAPLEVIEW DR E
MAPLEVIEW DR
PATRICK DR
MABERN ST
SALEM RD
VETERANS DR
FINSBURY ST
LOCKHART RD
SIDERD 20
SIDERD 25
MCKAY RD W
MCKAY RD E
VICTORIA ST
INNISFIL BEACH RD
YONGE ST
SAINT JOHNS RD
SIDERD 5
SIDERD 10
HWY 400
COUNTY RD 27
EWART ST
METRO RD N
CIVIC CENTRE RD
BASELINE RD
BOYERS RD
OLD HOMESTEAD RD
CHURCH ST
MORTON AVE
GLENWOODS AVE
WOODBINE AVE
WARDEN AVE
QUEEN ST
KING ST N
KING ST S
HWY 89
COUNTY RD 89
SHORE ACRES DR
ROBERT ST
BARRIE ST

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody

Subwatershed:

- Bear Creek - Nottawasaga River
- Innisfil Creek
- Hewitts Creek
- Lake Simcoe
- Lovers Creek
- West Holland

LOCATOR MAP

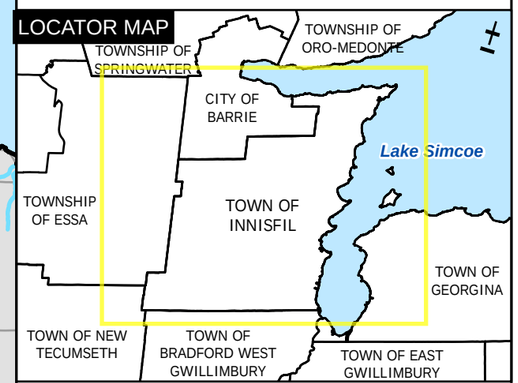


Figure 4.1

Study Area and Subwatersheds

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, LSRCA, OMNRF
Created by: A.V.

0 1 2 3 4
Kilometers

Aquafor Beech Limited

The following section describes and summarizes environmental and infrastructural existing conditions within the Town. The existing conditions inventory and analysis covers the following topics:

- Land-Use
- Physiography
- Geology
- Surficial Soils and Infiltration Potential
- Hydrogeology
- Hydrology
- Fluvial Geomorphology
- Aquatic Ecology
- Natural Heritage
- Stormwater Management Infrastructure
- Water Supply
- Wastewater

4.2.1 Land-Use

The Town is characterized by a mixture of land-uses. Generally, the lands outside the settlement areas are agriculture, key natural heritage features (KNHF), or key hydrological features (KHF). The settlement areas are generally residential and commercial, with employment lands located in Innisfil Heights.

Existing land uses within the Town of Innisfil per the 2018 Official Plan are summarized in **Figure 4.2**. Mapping showing the distribution of land-use in the Town can be found in **Appendix A**.

At the time of the completion of the Town's Official Plan in 2018, no settlement area boundary expansions were identified, as intensification was determined to be sufficient. However, the Official Plan noted that future settlement boundary expansion should prioritize the areas subject to the Alcona South and Alcona North Secondary Plans together with the lands abutting the future GO station.

The Town intends to achieve a minimum intensification target of 33 percent of all new residential units occurring annually within the delineated built-up areas. The Strategic Growth Areas of Alcona, Cookstown, Lefroy-Belle Ewart, and Sandy Cove will be prioritized for intensification, in addition to the Major Transit Station Area (i.e., Orbit) within Alcona.

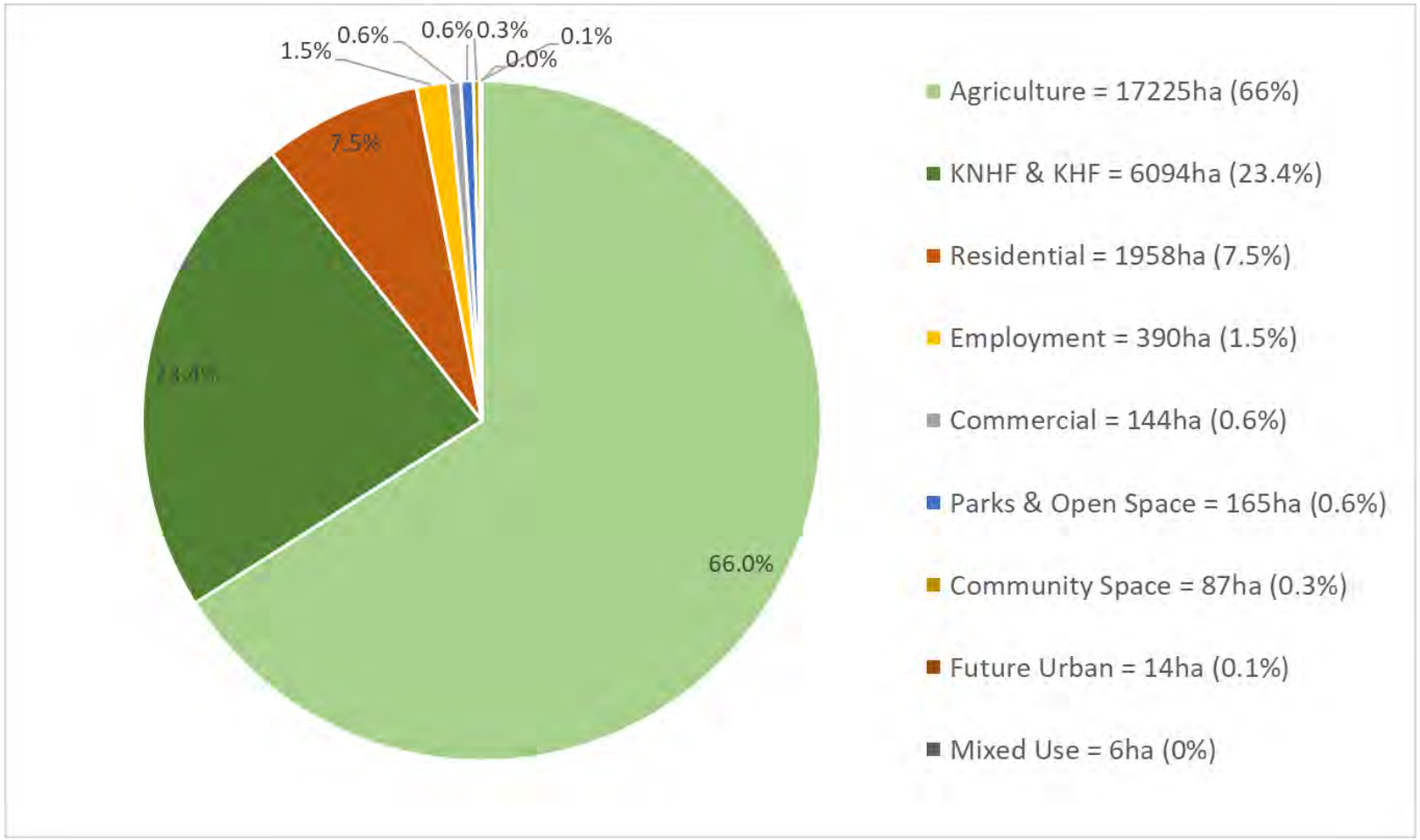


Figure 4.2: Existing Land Uses Per the Official Plan (OP)

4.2.2 Physiography

Physiography, also commonly referred to as physical geography, is the study of the physical features of the earth's surface and the classification, mapping and grouping of landforms based on their geologic structures and age. The following information was extracted and summarized from existing sources including, but are not limited to those listed in **Section 4.1**.

The Town of Innisfil is composed of two major landforms, including the Peterborough Drumlin Field and the Simcoe Lowlands (Chapman and Putnam, 1984). The Peterborough Drumlin Field consists of a calcareous till overlaying limestone bedrock. Drumlins, eskers, and gravel ridges are present throughout the area, with clay layers generally present between drumlins. Drumlins are generally 20m to 75m in width and 100m to 450m in length. The Simcoe Lowlands consist of both clay plains and sand plains originating from the glacial Lake Algonquin. The Simcoe Lowlands tend to be associated with current river systems.

4.2.3 Geology

Bedrock geology primarily consists of the Middle Ordovician Simcoe Group, generally consisting of carbonates and shales. This overlies the Precambrian basement rock of the Canadian Shield. There are four formations associated with the Simcoe Group, but only the Verulam and Lindsay Formations are found within the Town. The Innisfil Bedrock Channel passes through the Town from Kempenfelt Bay to the southwest through the Nottawasaga Valley watershed.

The sediments overlaying the bedrock within the Town were deposited during the Quaternary Period. These sediments vary in thickness across the Town; for example, within the Innisfil Creeks subwatershed, thickness ranges from 39m to 186m.

4.2.4 Surficial Soils & Infiltration Potential

The surficial geology in the Town generally consists of till interspersed with various glaciolacustrine sediments. Infiltration rates throughout the Town therefore depend on the texture of the sediments. Some coarse-grained deposits would allow for extensive infiltration and recharge. They also represent recharge zones for the watershed's major aquifers. Infiltration potential within the Town in the context of this SWM-MP & FS will have to be balanced against the protection of groundwater resources and Source Protection Plan (SPP) Policies including Issue Contributing Areas (ICA).

4.2.5 Hydrogeology

Hydrogeology is the science that deals with the movement and distribution of groundwater. Geological materials make up the solid medium that controls the storage, movement and chemical evolution of groundwater. Groundwater interacts with surface water through recharge and discharge. In general, rainwater infiltrates and is stored underground in sand and gravel deposits, called aquifers, which may supply drinking water to local wells or supply baseflow to adjacent streams.

Groundwater recharge can potentially occur in any location where groundwater levels are below or have relief from surface water sources. Recharge areas, where water infiltrates into

the groundwater system, are usually areas of highly permeable soils such as sands and gravels. Significant Groundwater Recharge Areas (SGRA) consist of porous soils which permit water to easily infiltrate to an aquifer which supplies drinking water. SGRAs are distributed throughout the Town and are most closely associated with sandy and gravelly soils. This is typical, as the rate at which recharge occurs is dependent on the nature of the overburden material, where highest rates of recharge occur on coarse-grained moraine deposits with disconnected drainage. Significant recharge areas are illustrated on **Figure 4.3.**

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Significant Groundwater Recharge Area

BIG BAY POINT

BIG BAY POINT RD

13TH LINE

SANDRINGHAM DR

PRINCE WILLIAM WAY

THE QUEENSWAY

CITY OF BARRIE

MAPLEVIEW DR E

MAPLEVIEW DR

SIDERD 20

SANDY COVE

LOCKHART RD

SIDERD 25

10TH LINE

VICTORIA ST

STROUD

ALCONA

Lake Simcoe

LOCATOR MAP

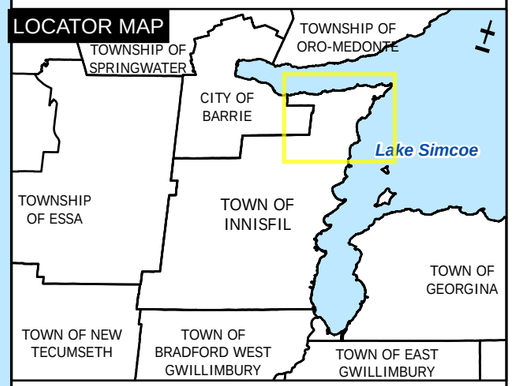


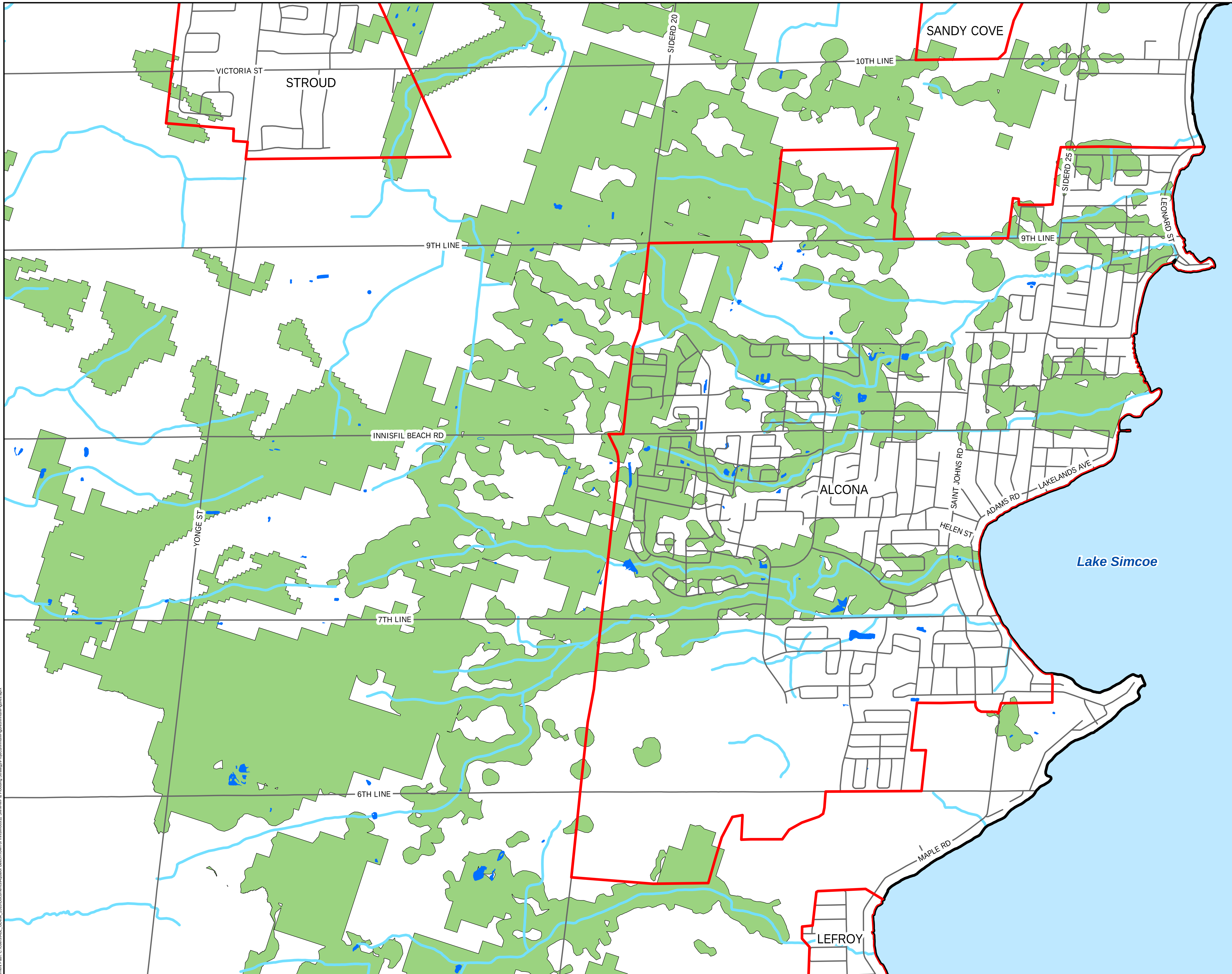
Figure 4.3

Significant Recharge Areas

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.5 1 1.5
Kilometers

Aquafor Beech Limited



Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Significant Groundwater Recharge Area

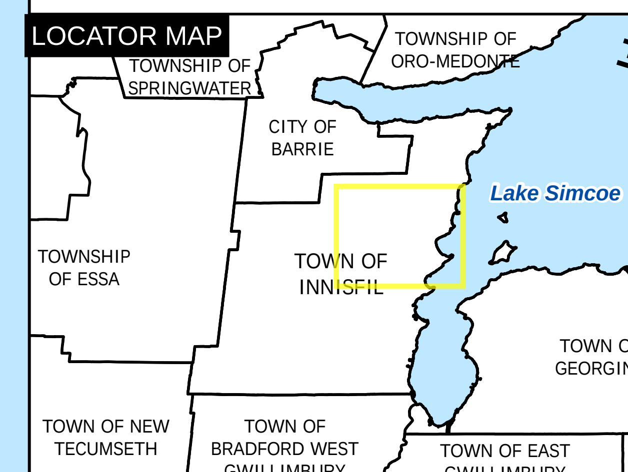


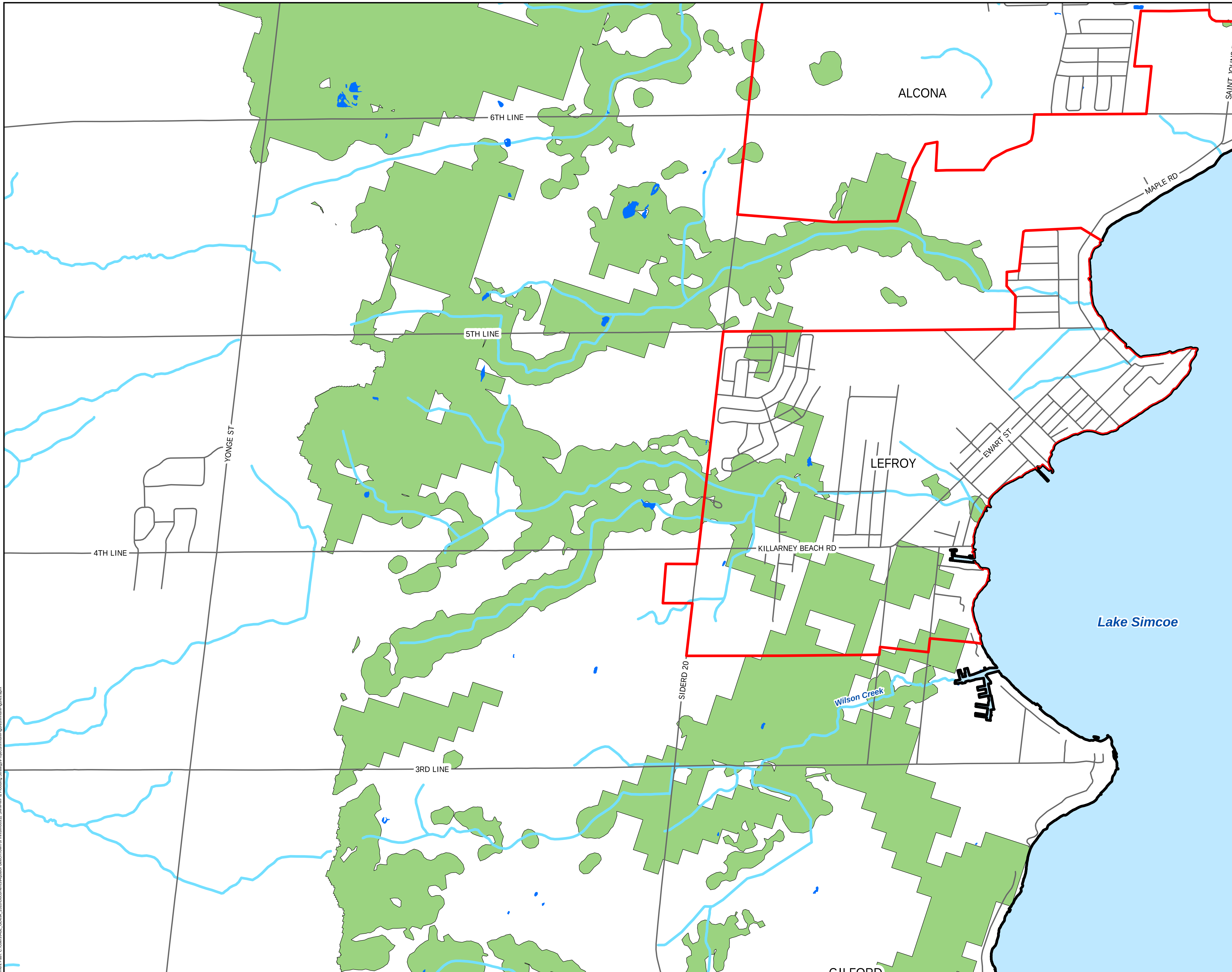
Figure 4.3

Significant Recharge Areas

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.5 1 1.5
Kilometers

Aquafor Beech Limited



Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Significant Groundwater Recharge Area

LOCATOR MAP

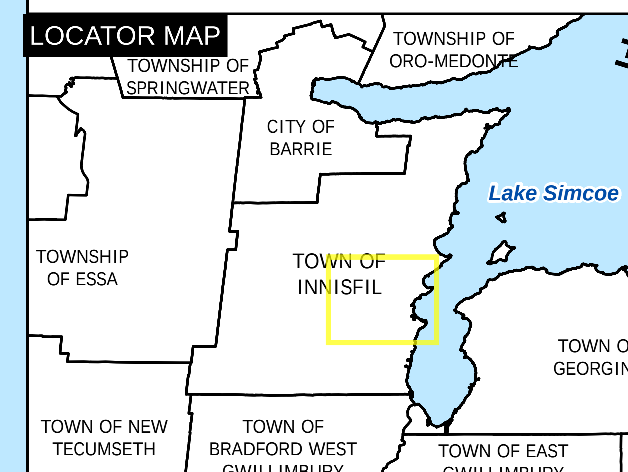


Figure 4.3

Significant Recharge Areas

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.4 0.8 1.2
Kilometers

Aquafor Beech Limited

2ND LINE

SHORE ACRES DR

SIDERD 20

14TH LINE

GILFORD

Lake Simcoe

TOWN OF BRADFORD WEST GWILLIMBURY

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Significant Groundwater Recharge Area

LOCATOR MAP

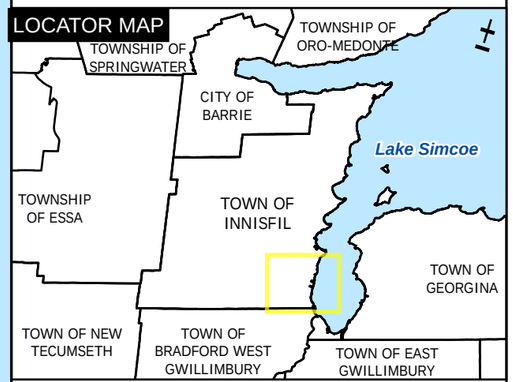


Figure 4.3

Significant Recharge Areas

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.35 0.7 1.05
Kilometers

Aquafor Beech Limited

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Significant Groundwater Recharge Area

HWY 400
4TH LINE
3RD LINE
2ND LINE
14TH LINE
SIDERD 10
SIDERD 20
YONGE ST
KILLARNEY BEACH RD
EWART ST
SHORE ACRES DR
COUNTY RD 89
LEFROY
GILFORD
FENNEL'S CORNER
HWY 89/400 COMMERCIAL AREA
Innisfil Creek
Wilson Creek
Lake Simcoe
TOWN OF BRADFORD WEST GWILLIMBURY

LOCATOR MAP

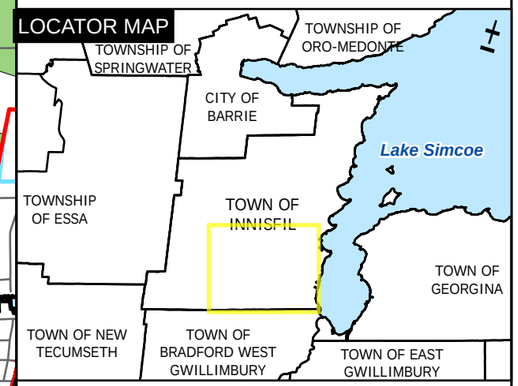


Figure 4.3

Significant Recharge Areas

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.55 1.1 1.65
Kilometers

Aquafor Beech Limited

CITY OF BARRIE

FINSBURY ST

LOCKHART RD

HURONIA RD

SIDERD 20

MCKAY RD E

VICTORIA ST

STROUD

10TH LINE

Lovers Creek

9TH LINE

9TH LINE

SIDERD 10

YONGE ST

INNISFIL BEACH RD

ALCONA

7TH LINE

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Significant Groundwater Recharge Area

LOCATOR MAP

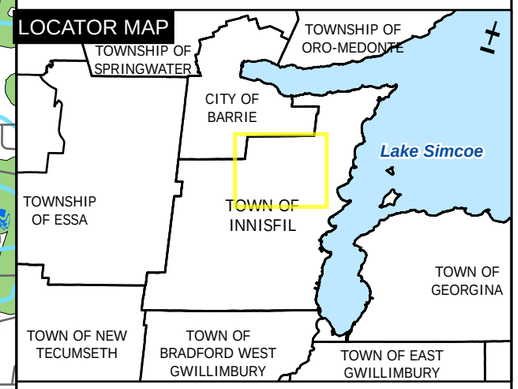


Figure 4.3

Significant Recharge Areas

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.45 0.9 1.35
Kilometers

Aquafor Beech Limited

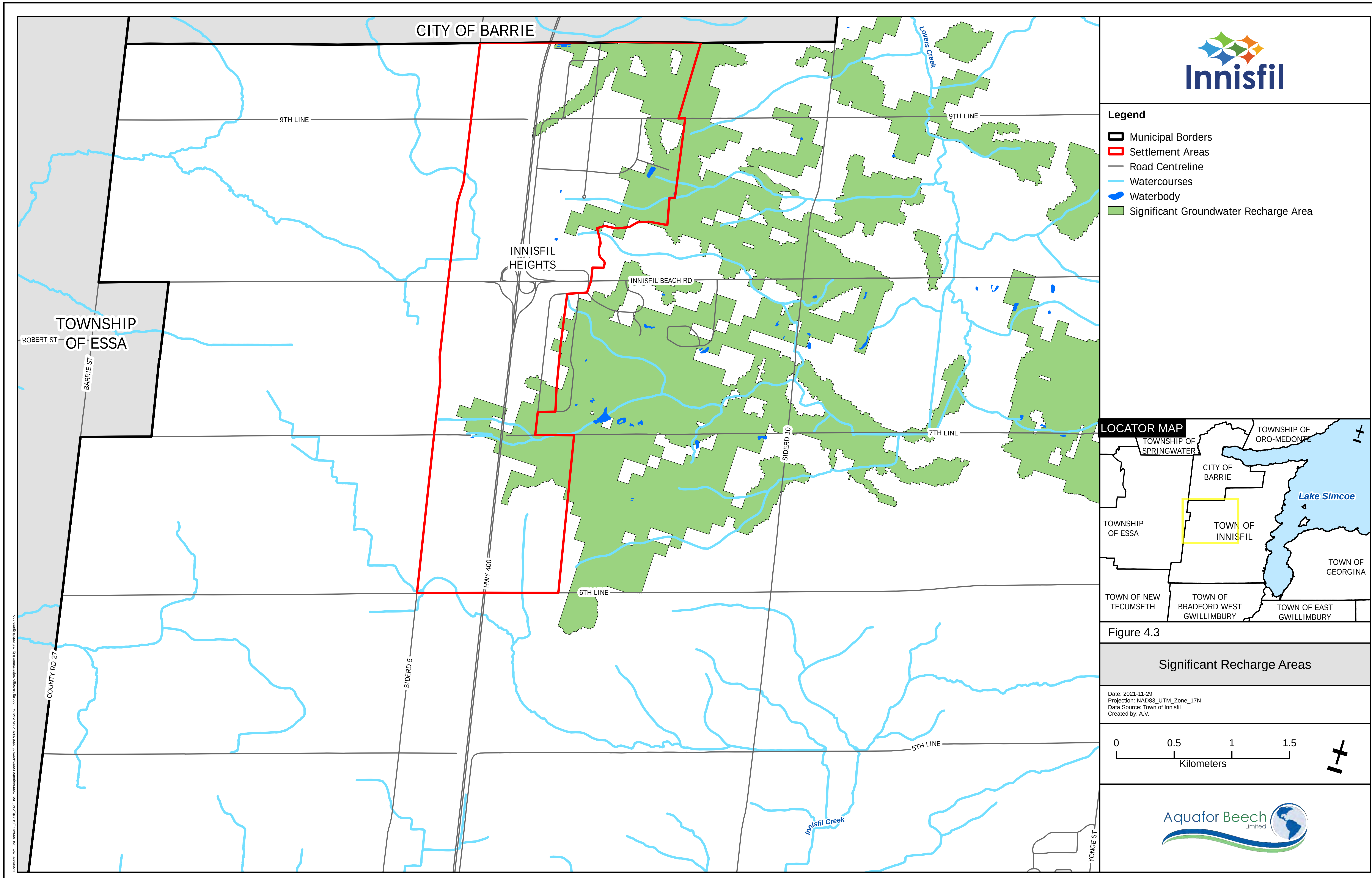


Figure 4.3

Significant Recharge Areas

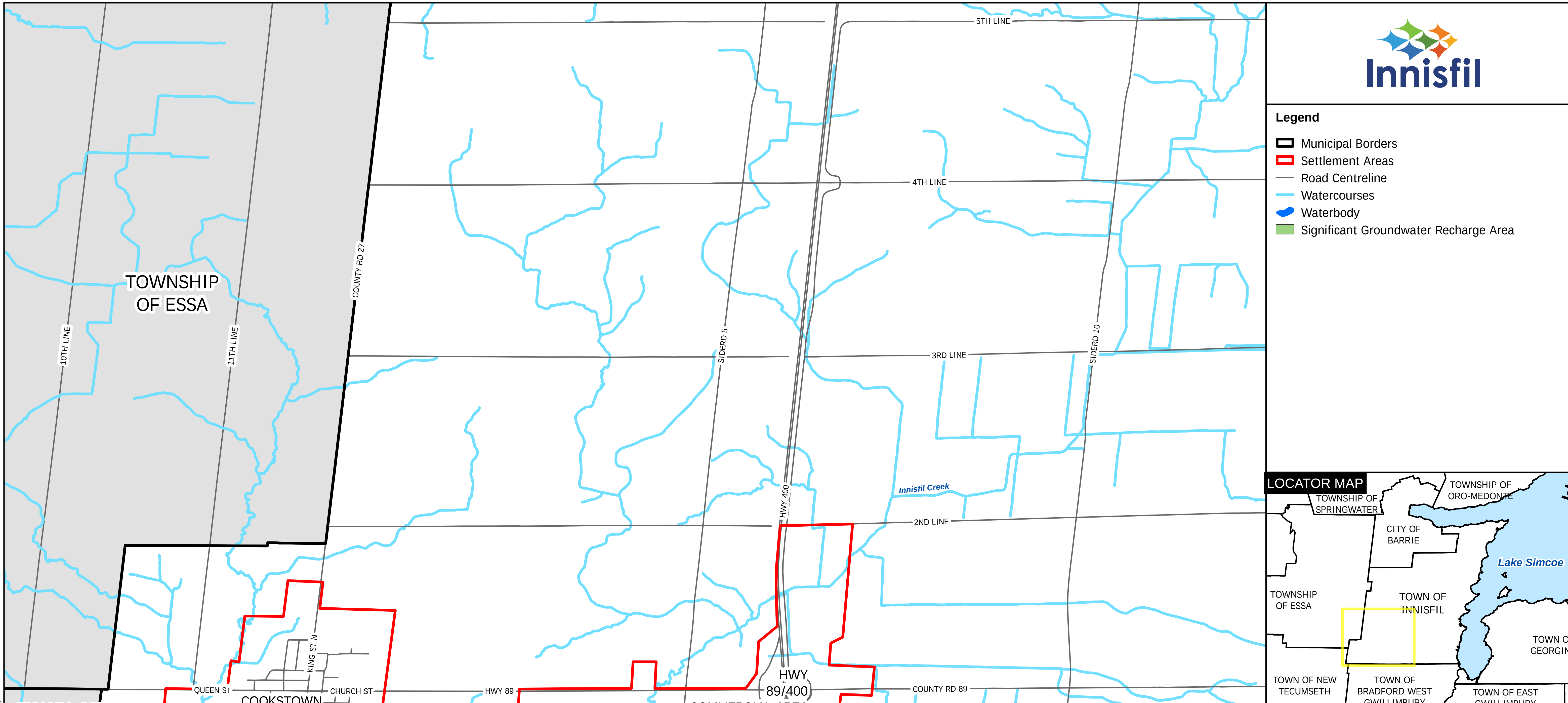


Figure 4.3

Significant Recharge Areas

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.55 1.1 1.65
Kilometers

Aquafor Beech Limited

4.2.6 Hydrology

The Town of Innisfil surface water system consists of numerous watercourses discharging into Lake Simcoe plus several watercourses that ultimately discharge into the Nottawasaga River. Lovers Creek, Hewitt's Creek, and Innisfil Creek are the most prominent creeks within the Town.

Aquafor re-delineated the Town's subwatersheds, identifying 24 distinct subwatersheds in addition to the lands that drain directly into Lake Simcoe. subwatersheds include:

1. Alcona North Urban Catchment 1
2. Alcona Urban Catchment
3. Banks Creek
4. Baxter Creek
5. Belle Aire Creek
6. Bon Secours Creek
7. Carson Creek
8. Cedar Creek
9. Cookstown Creek
10. Gilford Creek
11. Innisfil Creek
12. Leonard's Creek
13. Mid Nottawasaga River
14. Mooselanka Creek
15. Moyer Creek
16. Sandy Cove Creek
17. South Sandy Cove Catchment
18. South Sandy Cove Catchment 2
19. Strathallan Woods Catchment
20. Upper Hewitts Creek
21. Upper Lovers Creek
22. Upper March Creek
23. White Birch Creek
24. Wilson Creek

A very small portion of the West Holland subwatershed is also within the Town, but since the municipal boundary with Bradford West Gwillimbury generally aligns with the subwatershed boundary, it has not been included.

Note that Baxter Creek and Mid-Notawasaga River are sometimes represented collectively as Bear Creek.

As the outlet of many subwatersheds is directly into Lake Simcoe, flows within the creeks are impacted by water levels in Lake Simcoe. High water levels in the lake will result in a backwater effect within these creeks.

4.2.6.1 Flow Control

The Ontario Dam Inventory operated by the MNDMNRF identifies two flow control structures within the Town of Innisfil, as summarized in **Table 4.2**. Both dams maintain a small pond, and it is assumed that neither dam was designed for flow regulation purposes, but for aesthetic.

Table 4.2: Flow Control Structures

Dam Name	Subwatershed	Ownership
Innisfil Creek Tributary: 7847	Innisfil Creek	Private
354 Centennial Park Dam	Lovers Creek	Municipal

4.2.6.2 Flow Monitoring

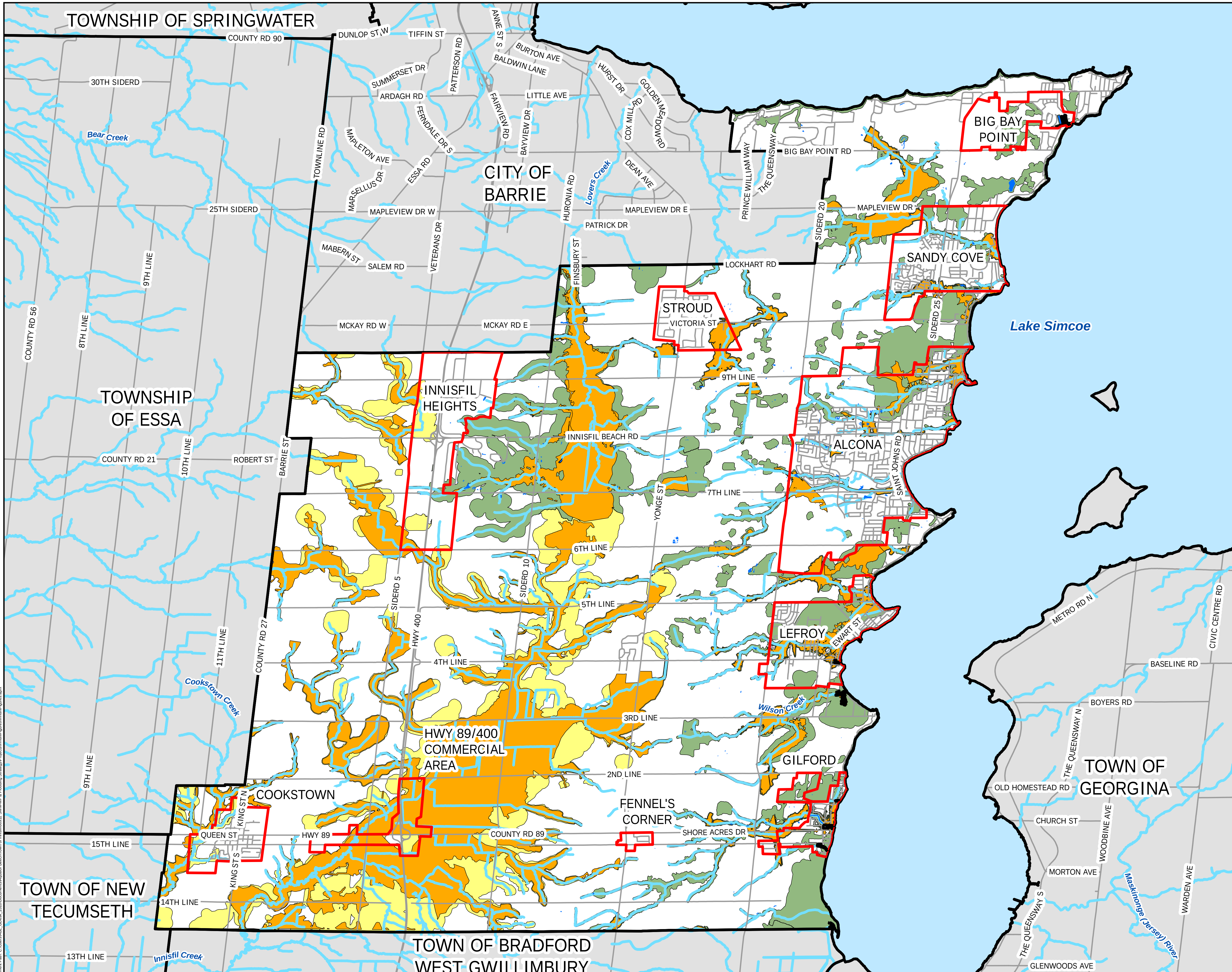
LSRCA does not operate any streamflow gauging stations within the Town of Innisfil, but does operate stations near the mouth of Lovers Creek and Hewitt's Creek; both watercourses originate in the town. These stations include:

1. LS0111: Lovers Creek – Hurst Drive
2. LS0202: Hewitt's Creek – Camelot Sq

No NVCA streamflow gauging stations are currently operational within the Town. One stream gauge in South Innisfil Creek at 5 Sideroad is currently non-operational, but will ultimately be fixed and re-installed.

4.2.6.3 Hydraulics

Within the Town of Innisfil, several hydraulic studies have been conducted to delineate the limits of flooding. Floodplain mapping coverage is illustrated in **Figure 4.4**.


TOWNSHIP OF SPRINGWATER
COUNTY RD 90
DUNLOP ST W
TIFFIN ST
ANNE ST S
BURTON AVE
BALDWIN LANE
HURST DR
GOLDEN MEADOW RD
30TH SIDERD
SUMMERSET DR
PATTERSON RD
ARDAGH RD
LITTLE AVE
FAIRVIEW RD
BAYVIEW DR
COX MILL RD
FERNDALE DR S
MAPLETON AVE
Bear Creek
TOWNLINE RD
ESSA RD
MARSELLUS DR
CITY OF BARRIE
HURONIA RD
Lovers Creek
DEAN AVE
BIG BAY POINT RD
PRINCE WILLIAM WAY
THE QUEENSWAY
BIG BAY POINT
25TH SIDERD
MAPLEVIEW DR W
MAPLEVIEW DR E
PATRICK DR
SIDERD 20
MAPLEVIEW DR
SANDY COVE
MABERN ST
SALEM RD
VETERANS DR
FINSBURY ST
LOCKHART RD
9TH LINE
STROUD
VICTORIA ST
SIDERD 25
Lake Simcoe
COUNTY RD 56
8TH LINE
MCKAY RD W
MCKAY RD E
9TH LINE
INNISFIL HEIGHTS
TOWNSHIP OF ESSA
INNISFIL BEACH RD
ALCONA
COUNTY RD 21
10TH LINE
ROBERT ST
BARRIE ST
YONGE ST
7TH LINE
SAINT JOHNS RD
6TH LINE
SIDERD 10
SIDERD 5
5TH LINE
METRO RD N
CIVIC CENTRE RD
HWY 400
LEFROY
EWART ST
11TH LINE
COUNTY RD 27
4TH LINE
BASELINE RD
Cookstown Creek
Wilson Creek
3RD LINE
BOYERS RD
HWY 89/400 COMMERCIAL AREA
GILFORD
THE QUEENSWAY N
TOWN OF GEORGINA
9TH LINE
2ND LINE
OLD HOMESTEAD RD
COOKSTOWN
KING ST N
FENNEL'S CORNER
CHURCH ST
WOODBINE AVE
QUEEN ST
HWY 89
COUNTY RD 89
SHORE ACRES DR
15TH LINE
KING ST S
MORTON AVE
TOWN OF NEW TECUMSETH
14TH LINE
Maskinonge (Jersey) River
WARDEN AVE
THE QUEENSWAY S
13TH LINE
Innisfil Creek
TOWN OF BRADFORD WEST GWILLIMBURY
GLENWOODS AVE

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Floodplain
- NVCA Regulation Area
- LSRCA Regulation Area

LOCATOR MAP

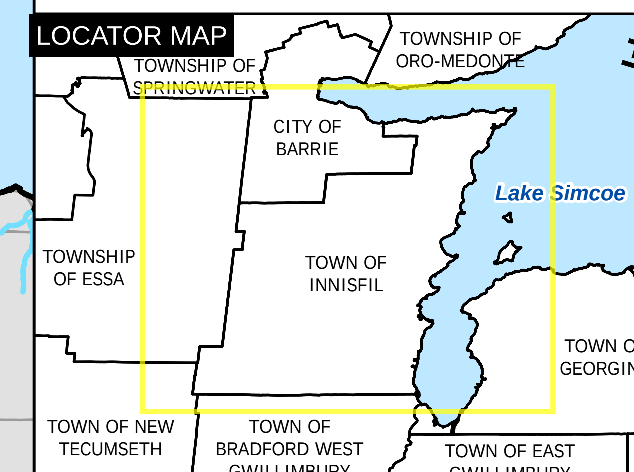


Figure 4.4

Floodplain and Regulated Area

Date: 2021-12-01
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, LSRCA, OMNRF
Created by: A.V.

0 1 2 3 4
Kilometers

Aquafor Beech Limited

4.2.7 Fluvial Geomorphology

With regards to the Town of Innisfil, over 366km of stream systems extend through 18 distinct subwatersheds or catchment areas, 14 of which drain into Lake Simcoe, while the remaining four ultimately drain to Georgian Bay through the Nottawasaga River.

As part of the 2016 CSWM-MP, a stream channel characterization and erosion susceptibility analysis was completed for nine watercourses, including Hewitt's Creek, Sandy Cove Creek, Sandy Cove Creek Tributary, Cooks Bay Tributary (Sandy Cove), Mooselanka Creek, Carson Creek, Cooks Bay Tributary B (Gilford), White Birch Tributary, and Cooks Bay Tributary C (Gilford). These watercourses were selected as they will receive stormwater discharge from future proposed development.

A summary of the erosion threshold analysis is presented in **Table 4.3**. This includes the unit-area flow rate to be maintained for erosion control at each of the locations. The CSWM-MP included the 25mm and 2-year (approx. 40mm) storms to be controlled, to conservatively address all frequent flows. Creeks that are entrenched required control during higher return period storm events.

Table 4.3: Erosion Threshold Analysis Summary (CSWM-MP, 2016)

Location	Unit Area Flow Rate Target (L/s/ha)	Entrenched (Y or N)	Storm Events to Control
Hewitt's Creek (10th Line, Stroud)	1.08	Y	25 mm 2-year to 25-year
Sandy Cove Creek (Woodlands Ave., Sandy Cove Acres)	0.7	N	25 mm 2-year
Sandy Cove Creek Tributary (Main St., Sandy Cove Acres)	5.14	Y	25 mm 2-year to 25-year
Cooks Bay Tributary (Mooselanka Rd., Sandy Cove Acres)	9.23	N	25 mm 2-year
Mooselanka Creek (25th SR, Sandy Cove Acres)	1.60	Y (partial)	25 mm 2-year to 10-year
Carson Creek (Ewart St. Lefroy)	0.85	Y	25 mm 2-year to 25-year
Cooks Bay Tributary (Parkview Drive, Gilford)	11.17	N	25 mm 2-year
White Birch Creek Tributary	6.21	N	25 mm 2-year

Location	Unit Area Flow Rate Target (L/s/ha)	Entrenched (Y or N)	Storm Events to Control
(Harbourview Golf, Gilford)			
Cooks Bay Tributary (Shore Acres Rd. & Nelly Rd., Gilford)	4.29	Y (partial)	25 mm 2-year to10-year

4.2.8 Aquatic Ecology

There is a direct linkage between fisheries habitat and groundwater discharge, in that some wetlands and watercourses are sustained by local groundwater discharge. Available subwatershed studies were reviewed to determine stream thermal classification (**Table 4.4** and **Table 4.5**). The LSRCA studies reported the stream's thermal classification as well as temperature spot ratings. Where the spot ratings differ from the thermal classification, this indicates thermal degradation within the creek. Thermal classification mapping from the applicable subwatershed studies can be found in **Appendix A.**

Table 4.4: Stream Thermal Classification (LSRCA)

Subwatershed	Thermal Classification	Temperature Spot-Readings in Innisfil	Source
Upper Lovers Creek	Cold Water	Cold: 3 Cool: 4 Warm: 3	LSRCA, 2012b
Upper Hewitt's Creek	Cold Water	Cold: 1 Cool: 2 Warm: 0	LSRCA, 2012b
Innisfil – Strathallan North	Cold Water	Cold: 0 Cool: 1 Warm: 0	LSRCA, 2012a
Innisfil – East	Cold Water	NA	LSRCA, 2012a
Sandy Cove Creek	Cold Water	Cold: 1 Cool: 1 Warm: 3	LSRCA, 2012a
Mooselanka Creek	Cold Water	Cold: 1 Cool: 0 Warm: 0	LSRCA, 2012a
Leonard's Creek	Cold Water (upstream) Warm Water (downstream)	Cold: 1 Cool: 4 Warm: 0	LSRCA, 2012a

Subwatershed	Thermal Classification	Temperature Spot-Readings in Innisfil	Source
Bon Secours Creek	Warm Water	NA	LSRCA, 2012a
Banks Creek	Cold Water	NA	LSRCA, 2012a
Belle Aire Creek	Cold Water	Cold: 0 Cool: 2 Warm: 2	LSRCA, 2012a
Carson Creek	Cold Water (upstream) Warm Water (downstream)	Cold: 1 Cool: 0 Warm: 0	LSRCA, 2012a
Wilson Creek	Cold Water	Cold: 0 Cool: 1 Warm: 1	LSRCA, 2012a
White Birch Creek	Cold Water (upstream) Warm Water (downstream)	Cold: 1 Cool: 3 Warm: 1	LSRCA, 2012a
Gilford Creek	Warm Water	Cold: 0 Cool: 1 Warm: 0	LSRCA, 2012a

Table 4.5: Stream Thermal Classification (NVCA)

Subwatershed	Instream Temperature Regime	Fisheries Habitat Type	Source
Innisfil Creek	Cool Water (tributaries) Warm Water (main channel)	Cold Water (upstream) Warm Water (downstream)	NVCA, 2006
Cookstown Creek	Cool Water and Warm Water (interspersed)	Cool Water	NVCA, 2006
Bear Creek	NA	NA	NA

4.2.9 Natural Heritage System

The Town's Official Plan (OP) provides a framework to guide the development of lands so that ecological processes, functions and significant natural features are protected, maintained, restored, and enhanced management, and stewardship of the environment. The Town's NHS consists of:

- Key Natural Heritage Features (KNHF);
- Key Hydrologic Features (KHF); and
- Linkages.

Additionally, a small part of the Town of Innisfil is located within the Greenbelt, where it is classified as Protected Countryside or Holland Marsh. The Greenbelt has been mapped within the Town's NHS.

Under the Town's Official Plan, development and site alteration within the NHS is generally prohibited; development and site alteration on adjacent lands is not permitted unless it is demonstrated that there will be no negative impacts to the natural heritage feature or its function.

4.2.10 Stormwater Management Infrastructure

Municipal stormwater management infrastructure includes all SWM facilities (dry ponds, wet ponds, wetlands, and hybrid facilities), oil & grit separators and holding tanks, low impact development, and storm pipe/ditch networks and associated appurtenances, such as manholes, catch basins, leads, and outfalls responsible for the capture, conveyance, and control (water quality and quantity) of stormwater runoff.

4.2.10.1 Stormwater Management Facilities

According to the Town's data sources, a total of 60 SWM facilities exist within the Town of Innisfil, with one additional proposed facility. Of the 60 existing facilities, 42 have been assumed by the Town.

Figure 4.5 shows the location of the existing stormwater management facilities within the Town of Innisfil, including the contributing drainage area for each of the existing facilities. Within **Appendix A, Table 3.6** summarizes the existing SWM facilities including their ownership status, type, drainage areas, installation year and basic design features.

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- SWM Catchment

Assumed SWM Facility:

- Dry
- Wet
- Wet (Forebay with Dry Main Cell)
- Wet (Infiltration)
- Wet (Online Channel)
- Wet (Wetland)
- Wetland

Unassumed SWM Facility:

- Dry
- Wet
- Wet (Wetland)

LOCATOR MAP

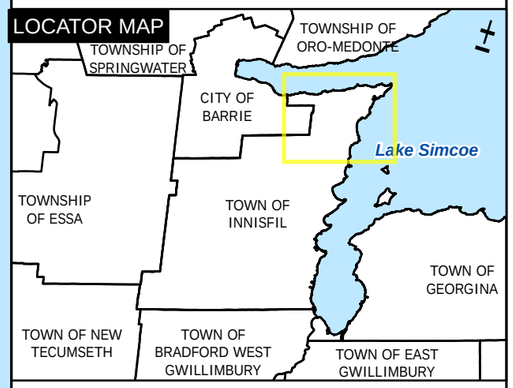


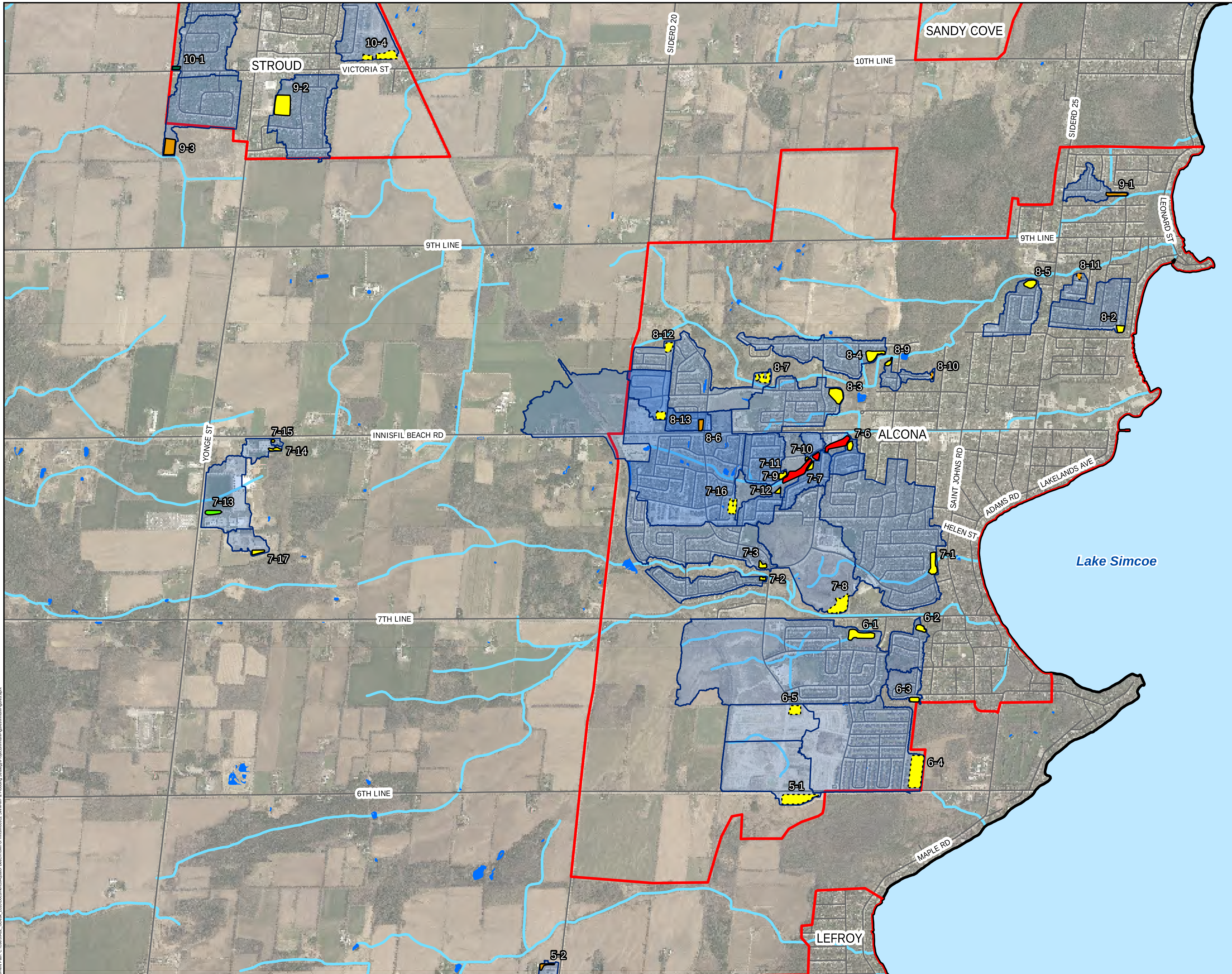
Figure 4.5

Existing Stormwater Management Facilities

Date: 2022-03-30
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.5 1 1.5
Kilometers

Aquafor Beech Limited



Innisfil

Legend

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- Wet (Online Channel)
- Wet (Wetland)
- Wetland

Unassumed SWM Facility:

- Dry
- Wet
- Wet (Wetland)

LOCATOR MAP

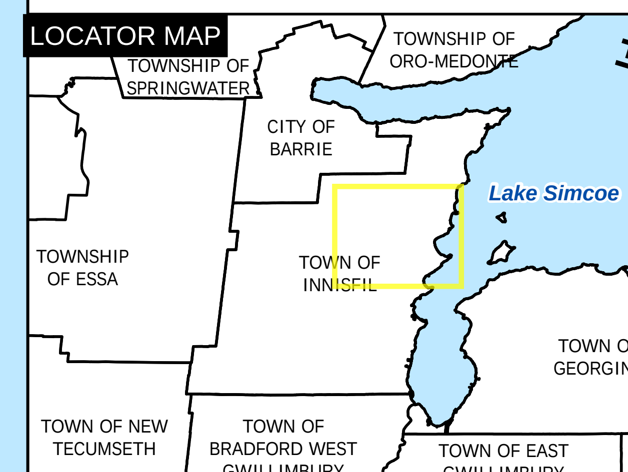


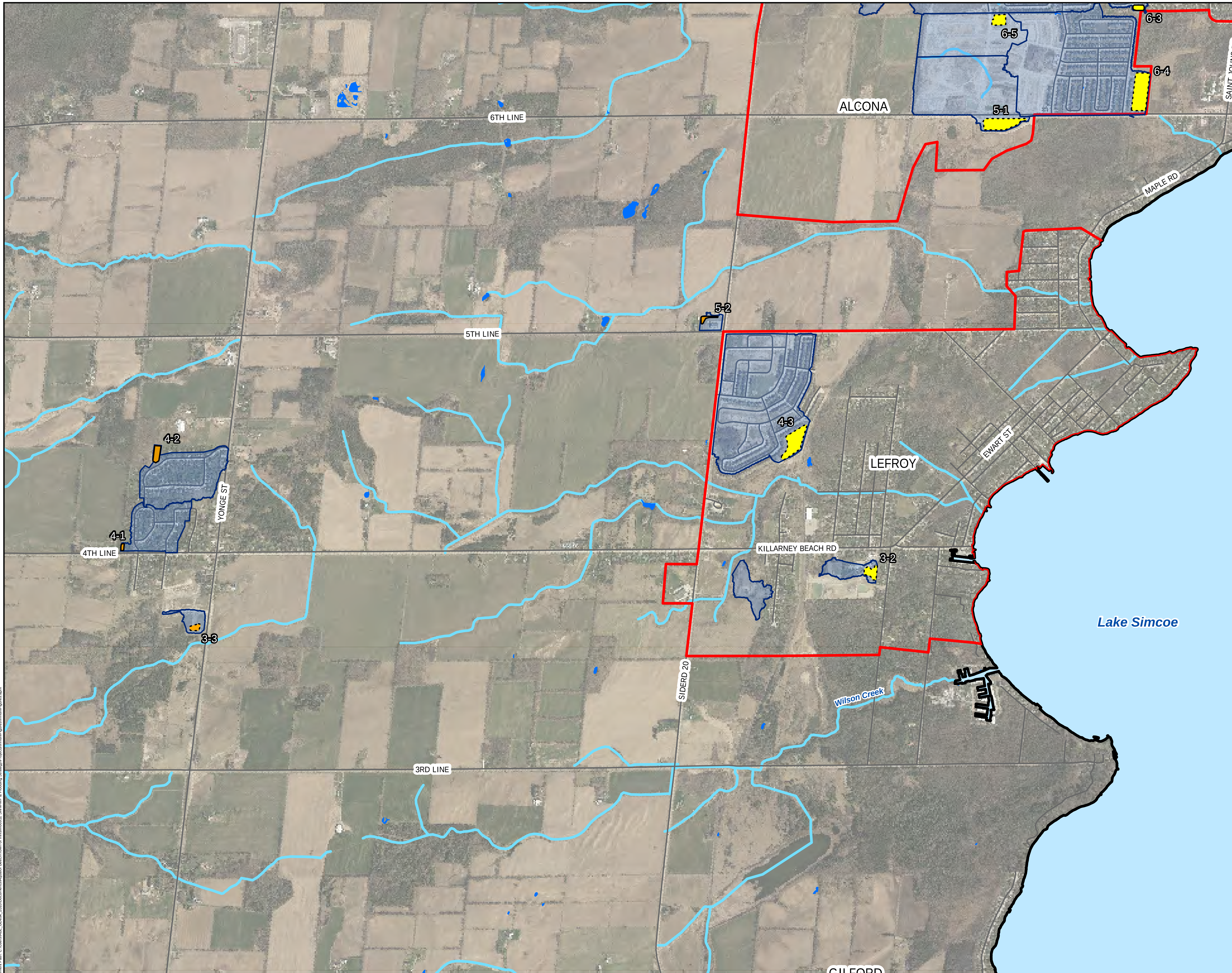
Figure 4.5

Existing Stormwater Management Facilities

Date: 2022-03-30
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.5 1 1.5
Kilometers

Aquafor Beech Limited



Innisfil

Legend

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- Watercourses
- Waterbody
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- Wet (Online Channel)
- Wet (Wetland)
- Wetland

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- Wet
- Wet (Wetland)

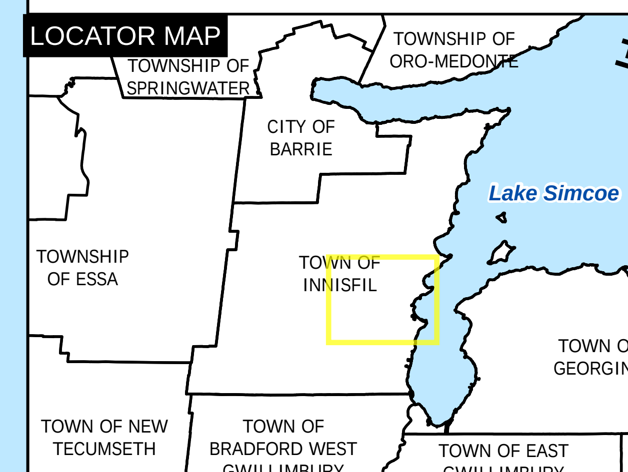


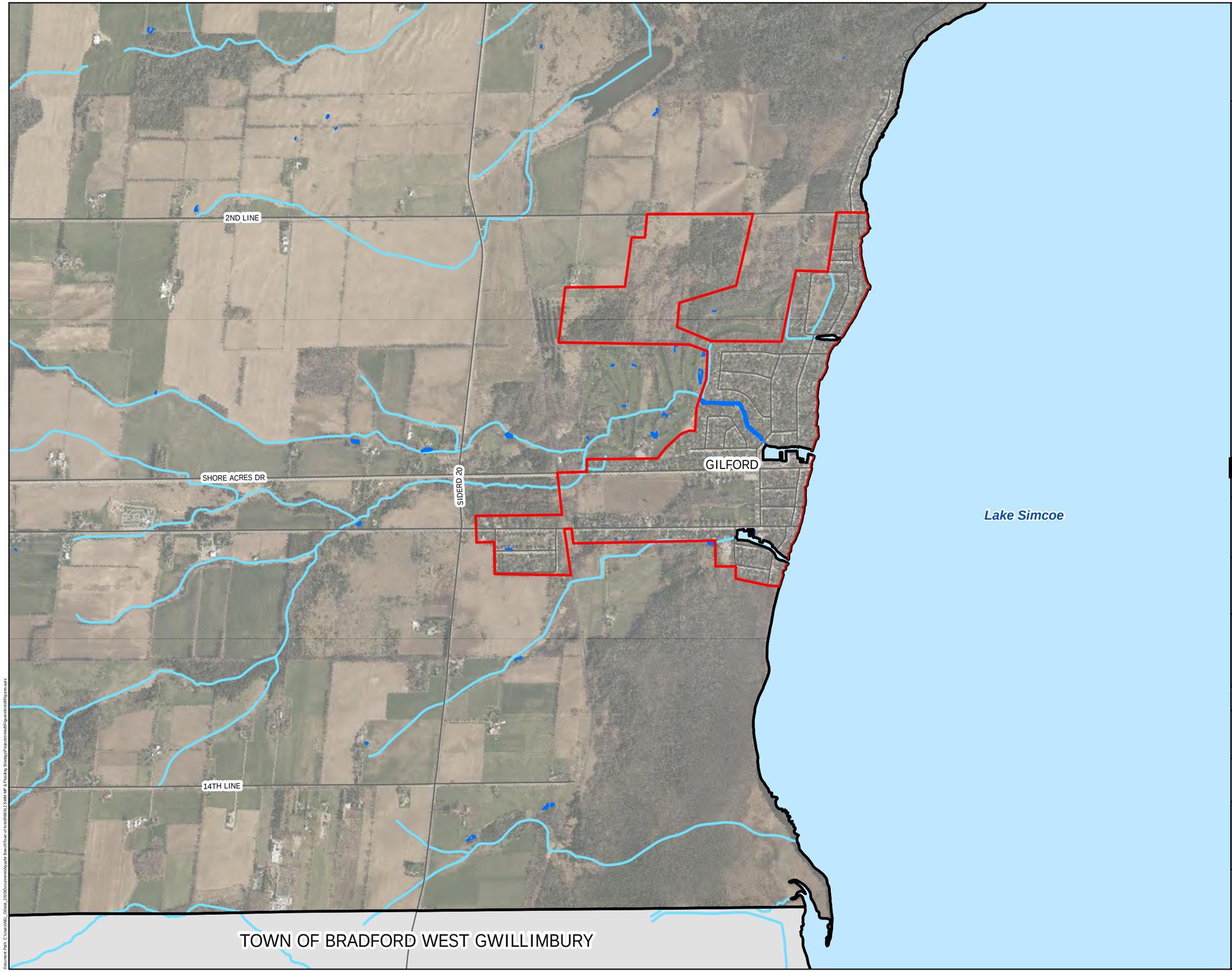
Figure 4.5

Existing Stormwater Management Facilities

Date: 2022-03-30
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.4 0.8 1.2
Kilometers

Aquafor Beech Limited



Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- SWM Catchment

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- Wet (Infiltration)
- Wet (Online Channel)
- Wet (Wetland)
- Wetland

Unassumed SWM Facility:

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- Wet
- Wet (Wetland)

LOCATOR MAP

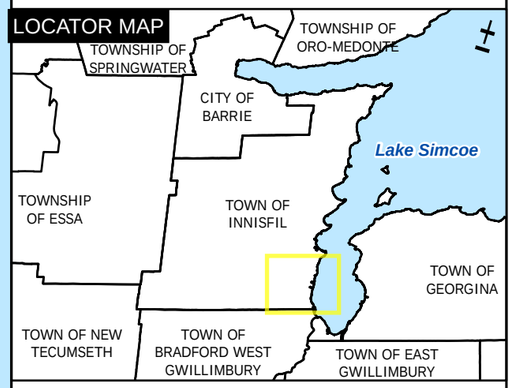


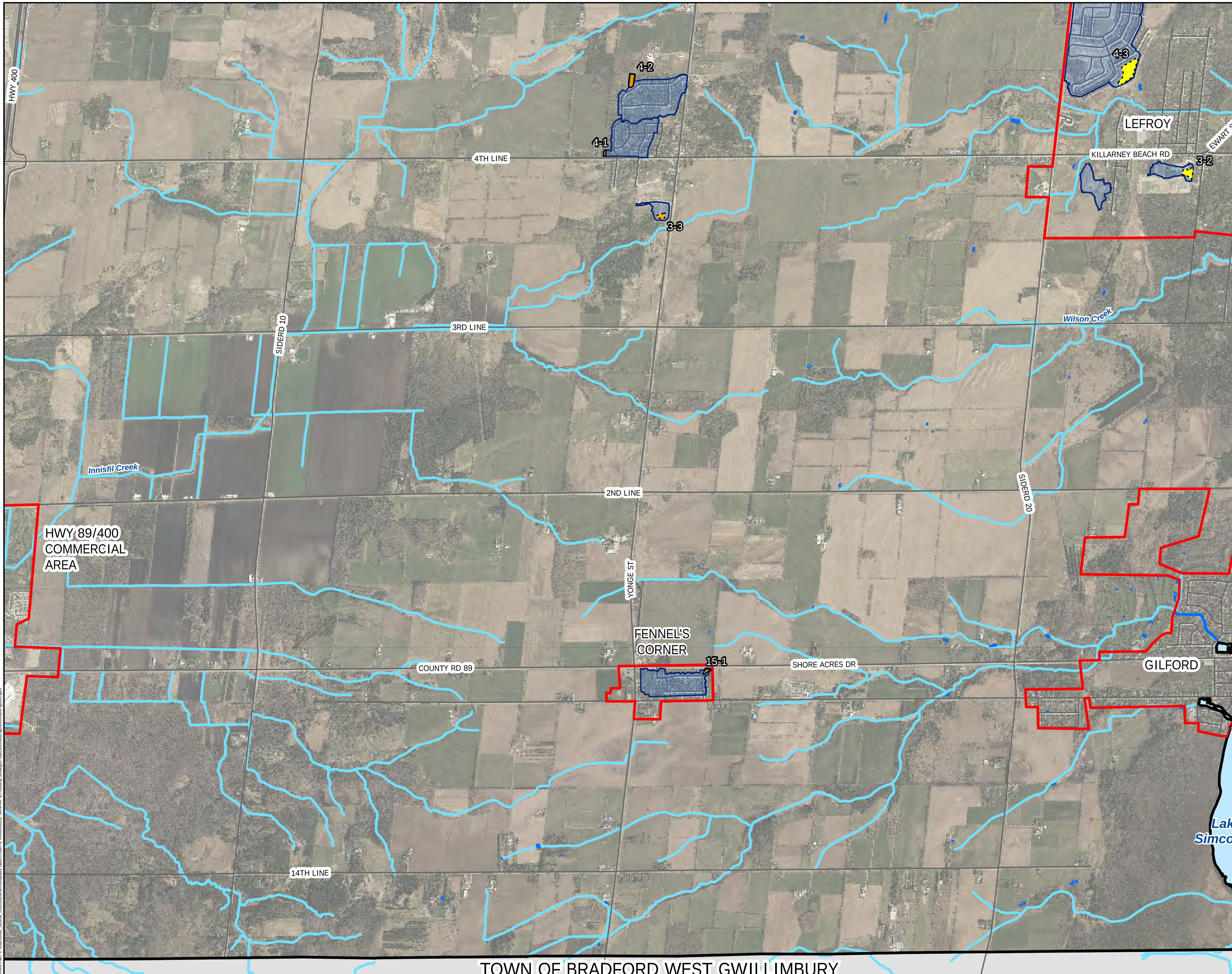
Figure 4.5

Existing Stormwater Management Facilities

Date: 2022-03-30
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.35 0.7 1.05
Kilometers

Aquafor Beech Limited



Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- SWM Catchment

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- Wet (Infiltration)
- Wet (Online Channel)
- Wet (Wetland)
- Wetland

Unassumed SWM Facility:

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- Wet
- Wet (Wetland)

LOCATOR MAP

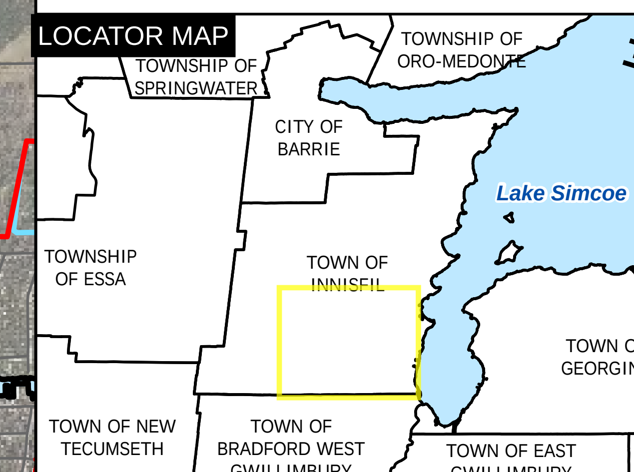


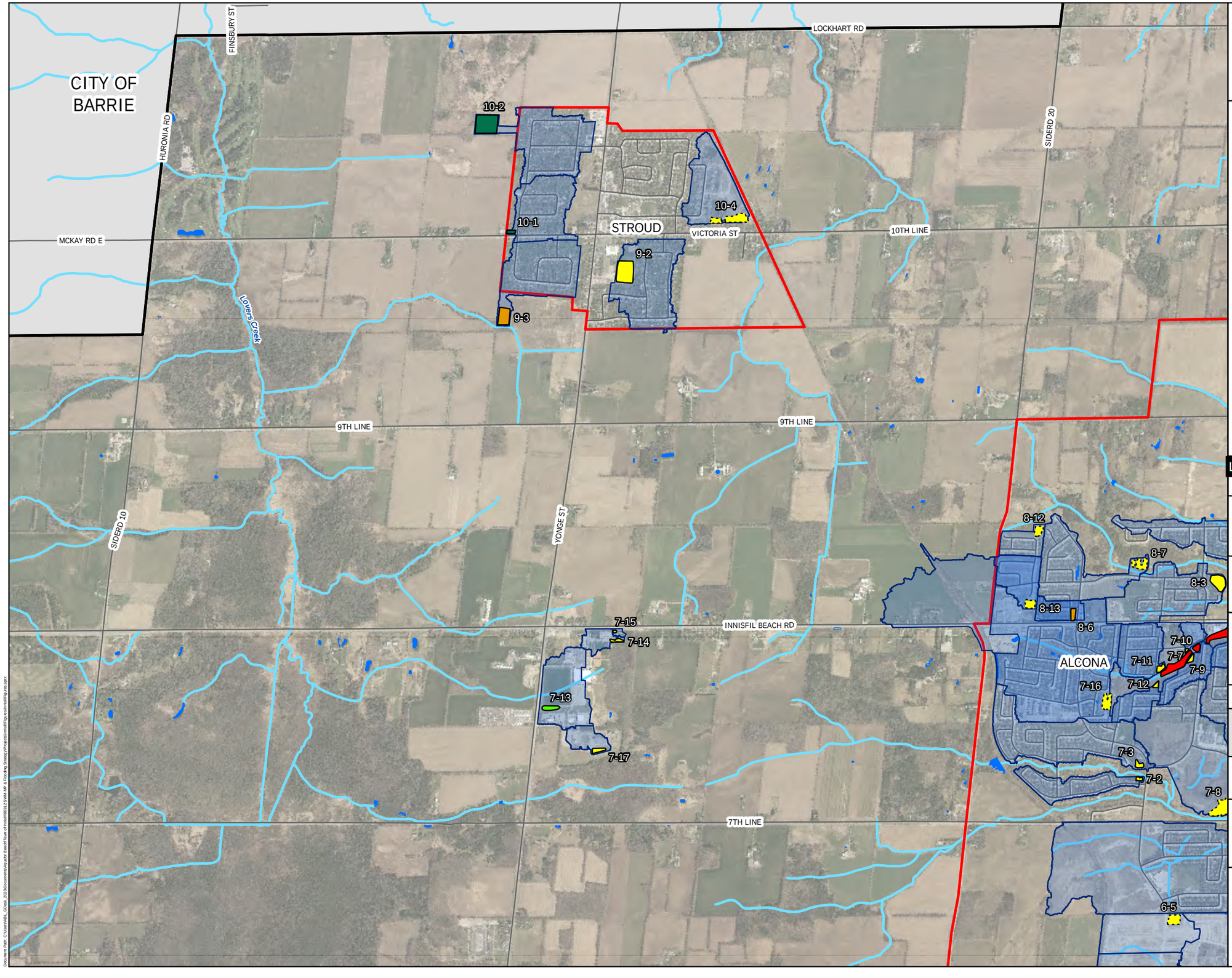
Figure 4.5

Existing Stormwater Management Facilities

Date: 2022-03-30
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.55 1.1 1.65
Kilometers

Aquafor Beech Limited



Innisfil

Legend

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- Watercourses
- Waterbody
- SWM Catchment

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- Wet (Infiltration)
- Wet (Online Channel)
- Wet (Wetland)
- Wetland

Unassumed SWM Facility:

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- Wet
- Wet (Wetland)

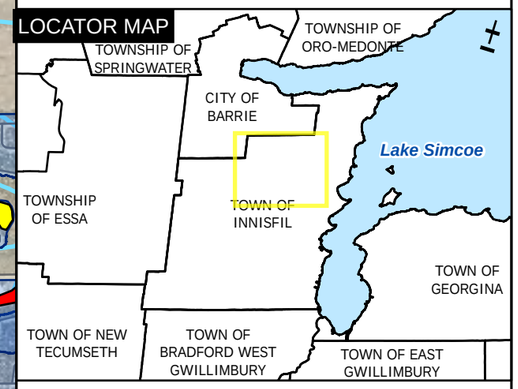


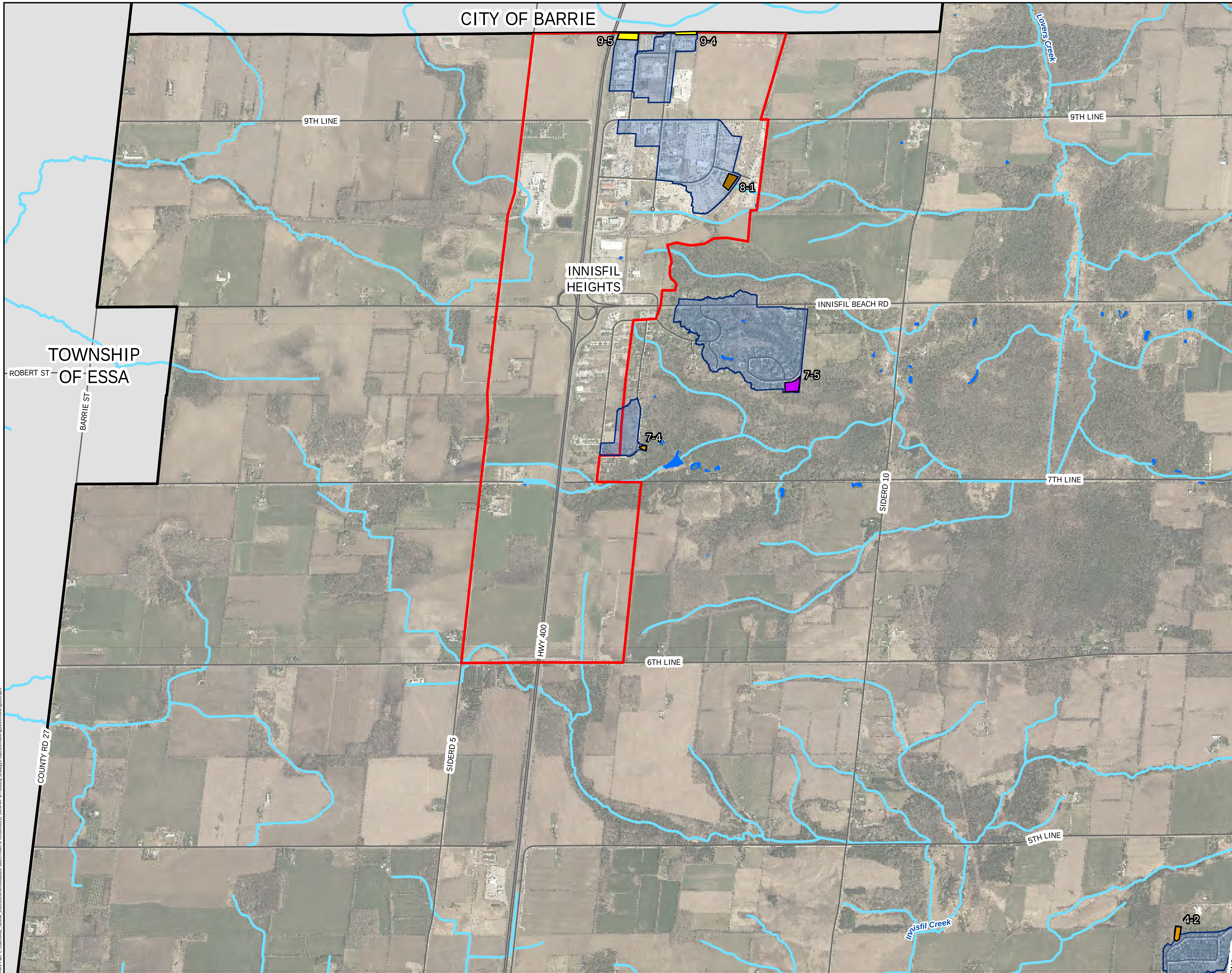
Figure 4.5

Existing Stormwater Management Facilities

Date: 2022-03-30
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.45 0.9 1.35
Kilometers

Aquafor Beech Limited



Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- SWM Catchment

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- Wet (Wetland)
- Wetland

Unassumed SWM Facility:

- Dry
- Wet
- Wet (Wetland)

LOCATOR MAP

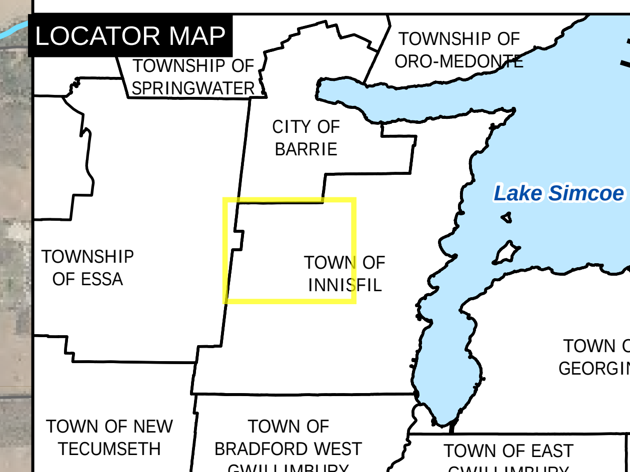


Figure 4.5

Existing Stormwater Management Facilities

Date: 2022-03-30
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.5 1 1.5
Kilometers

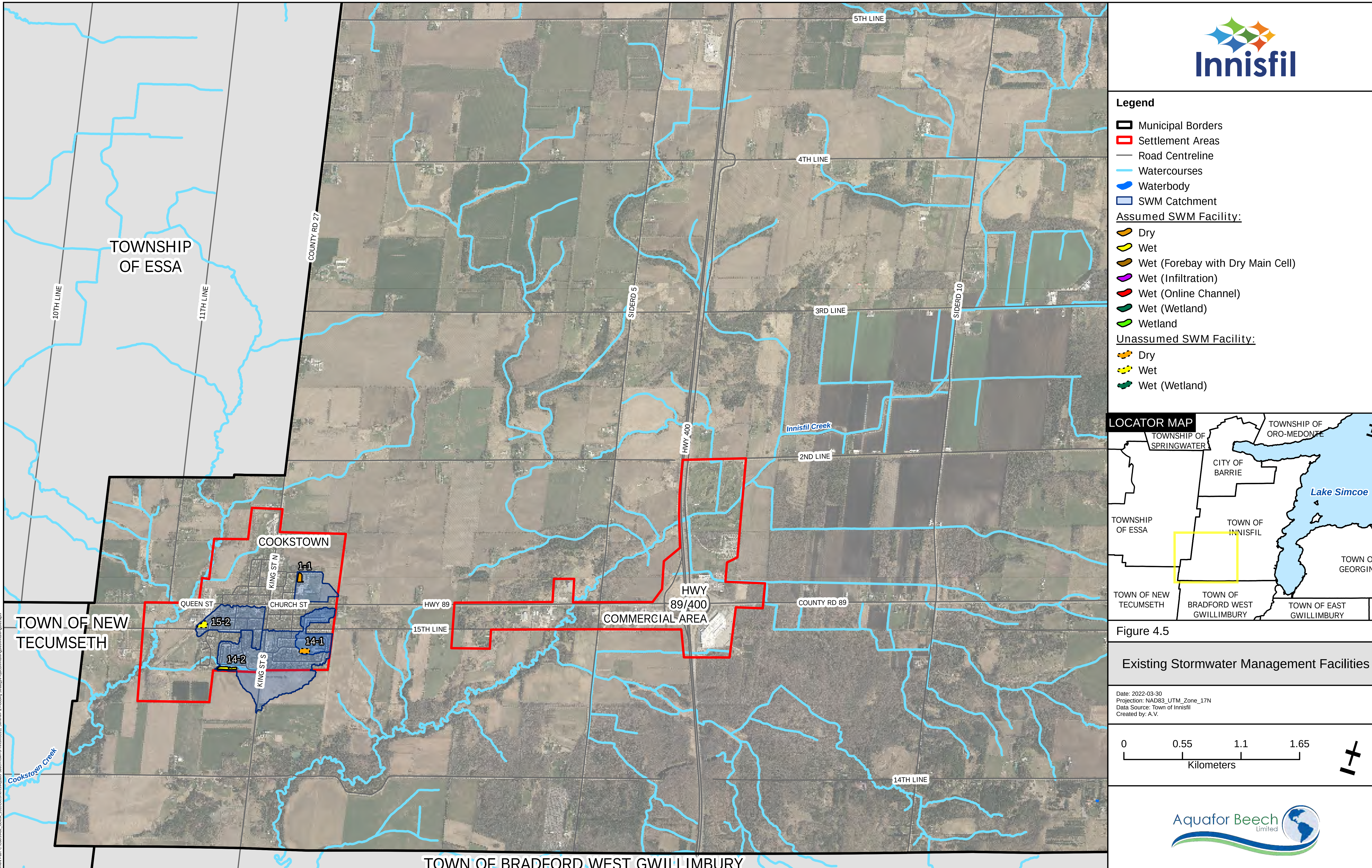


Figure 4.5

Existing Stormwater Management Facilities

4.2.10.2 Oil Grit Separators (OGS)

A total of 24 OGS units have been identified within the Town. Of these units, 5 have been assumed by the Town, 3 are un-assumed, and 16 are private.

The 7 OGS units with known catchment areas (5 assumed, 2 un-assumed) provide water quality treatment to approximately 31.25ha. An additional 17 OGS units provide water quality treatment to an unknown area. The Town generally inspects their assumed OGS units on an annual basis, flagging them for sediment removal as needed. Based on the annual inspections, OGS cleanout frequency ranges from an average of every 1.5 years (OGS-00003) to every 6 years (OGS-00002). Within **Appendix A**, **Table 3.8** summarizes the existing OGS ownership status, type, drainage areas, installation year and basic design features (make/model).

4.2.10.3 Low Impact Development

The Town's GIS database includes 6 low impact development (LID) features, consisting of a bioretention cell at the Lefroy Fire Hall, the Town Campus, Innisfil Beach Park, and Big Bay Point, with two bioswales also at Big Bay Point. No additional information was available for operations and maintenance activities.

4.2.11 Water Supply

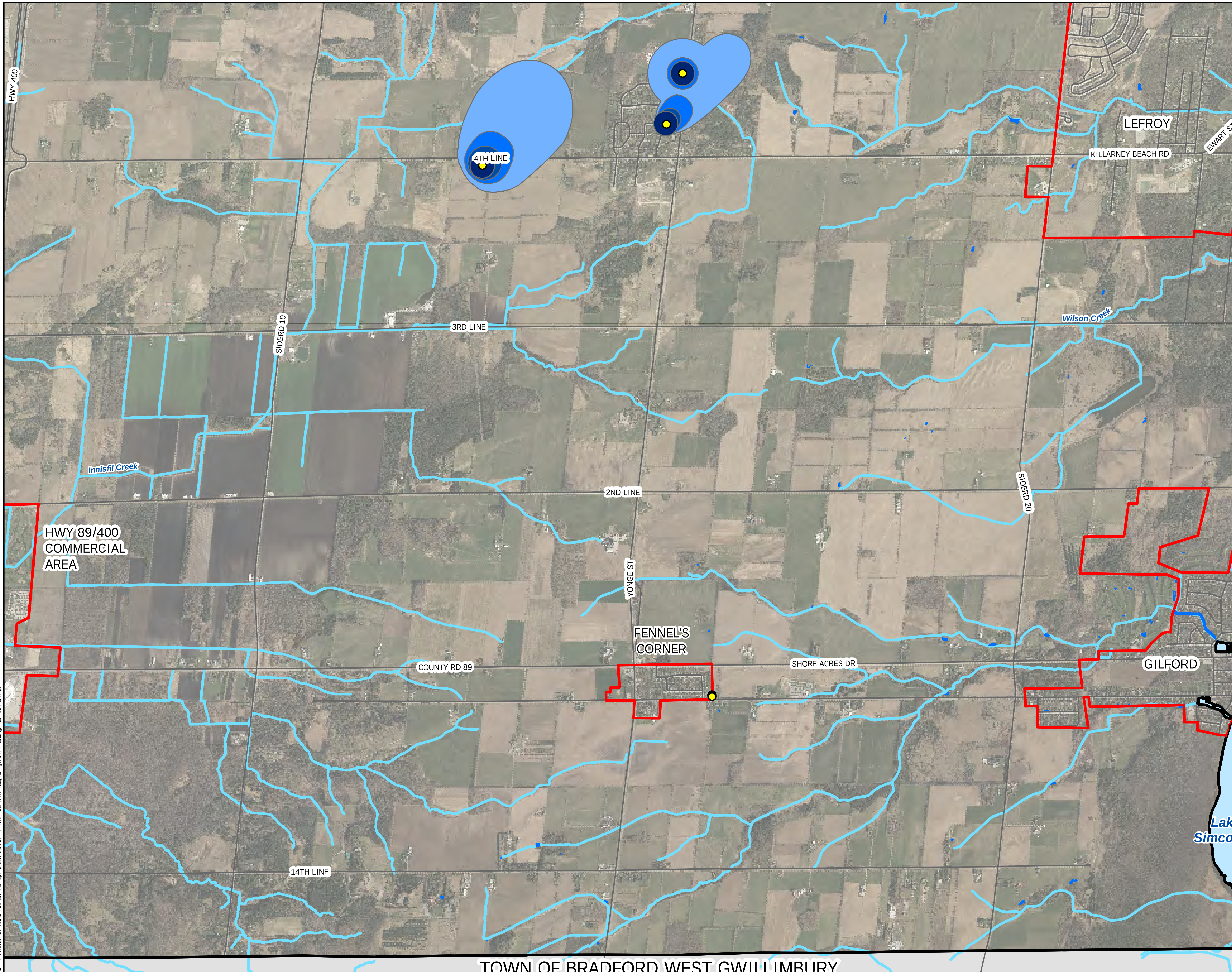
All nine settlement areas within the Town of Innisfil are serviced by municipal water systems, with the remaining areas serviced by individual private water supplies. The Lakeshore Water Treatment Plant (WTP) on Lake Simcoe provides water to Alcona, Sandy Cove and Friday Harbour Resort, Lefroy-Belle Ewart, Gilford, Fennel's Corners, and Cookstown. Municipal groundwater systems service Stroud, Churchill, and Innisfil Heights. Wellheads and associated Wellhead Protection Areas within or partially within the Town are illustrated on **Figure 4.6**, while Intake Protection Zones are illustrated on **Figure 4.7.**

The Ontario Clean Water Act, 2006, defines a Drinking Water Threat as "an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water, and includes an activity or condition that is prescribed by the regulation as a drinking water threat."

No issues have been identified regarding any of the drinking water sources within the Town of Innisfil; as such, no Issue Contributing Areas have been identified.

Salt use continues to be a potential threat to drinking water due to winter salt usage. As such, the 2019 and 2020 Drinking Water System Annual Reports were reviewed for the Churchill, Innisfil Heights, Innisfil Lake, and Stroud Drinking Water Systems to determine if there are elevated sodium or chloride concentrations. While chloride was not reported, sodium exceedances were noted in 2016 (most recent sampling date) in all four drinking water systems. No indication is provided regarding the source of the sodium, although the Approved Assessment Report: Lake Simcoe and Couchiching-Black River Source Protection Area, Part 1: Lake Simcoe Watershed (South Georgian Bay-Lake Simcoe Source Protection Committee, 2015) indicates that high sodium levels can be due to winter salt application as well as the use of water softener salt.

Innisfil



Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Road Centreline
- Watercourses
- Waterbody
- Water Well

Wellhead Protection Area:

- A
- B
- C
- D
- C1

LOCATOR MAP

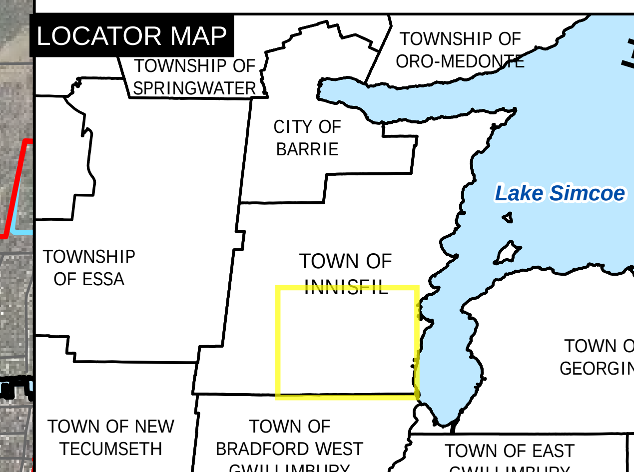


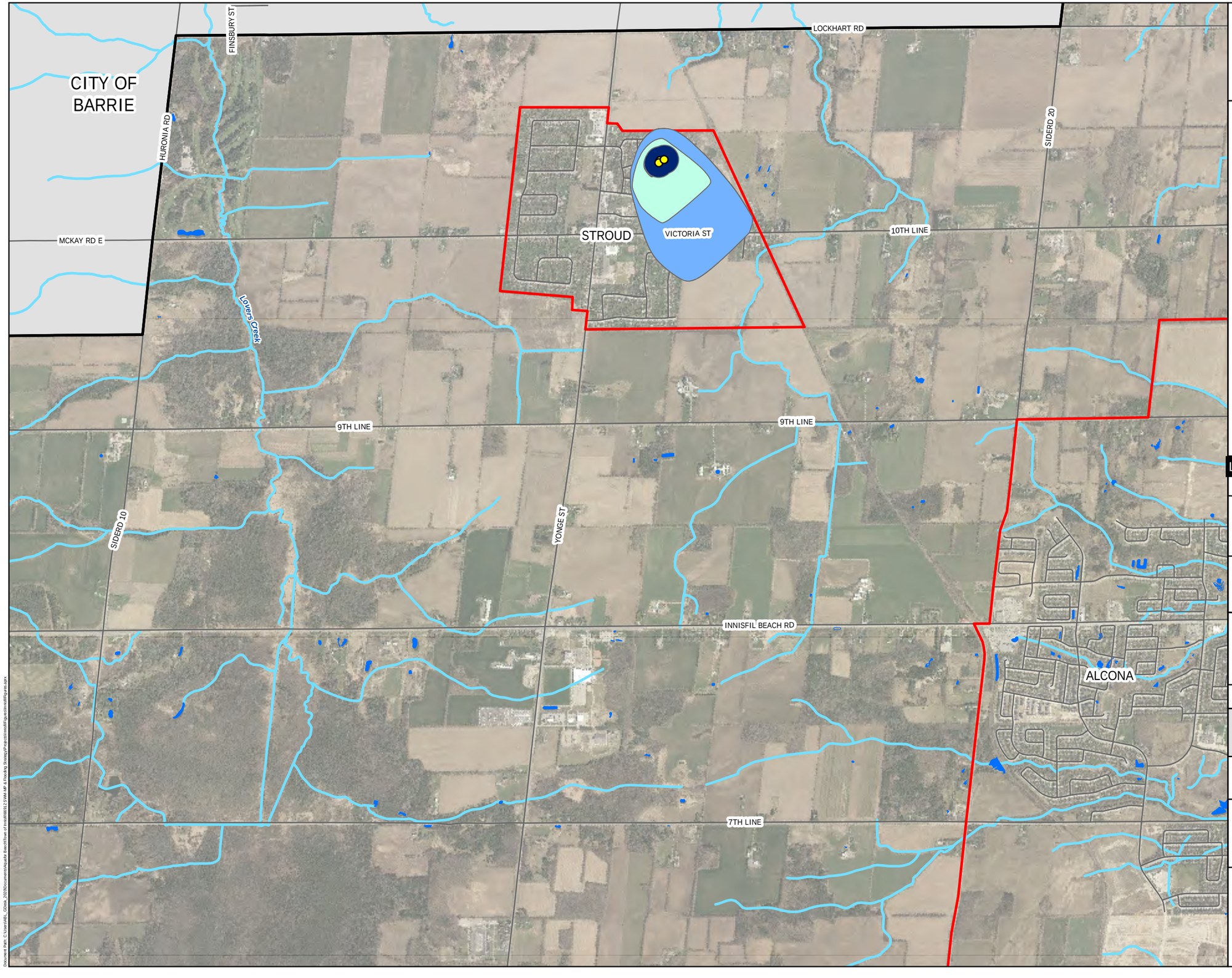
Figure 4.6

Wellhead Protection Zones (1 of 3)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.55 1.1 1.65
Kilometers

Aquafor Beech Limited



Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Road Centreline
- Watercourses
- Waterbody
- Water Well

Wellhead Protection Area:

- A
- B
- C
- D
- C1

LOCATOR MAP

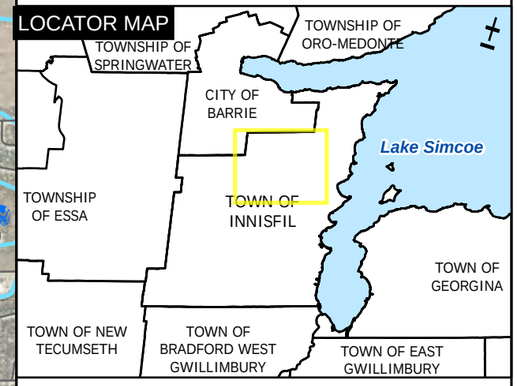


Figure 4.6

Wellhead Protection Zones (2 of 3)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.45 0.9 1.35
Kilometers

Aquafor Beech Limited

CITY OF BARRIE

TOWNSHIP OF ESSA

INNISFIL HEIGHTS

9TH LINE

INNISFIL BEACH RD

7TH LINE

6TH LINE

5TH LINE

ROBERT ST

BARRIE ST

COUNTY RD 27

SIDERD 5

HWY 400

SIDERD 10

YONGE ST

Lovers Creek

Innisfil Creek

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Road Centreline
- Watercourses
- Waterbody
- Water Well

Wellhead Protection Area:

- A
- B
- C
- D
- C1

LOCATOR MAP

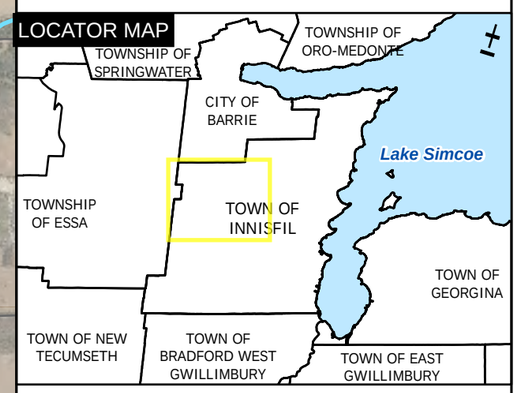


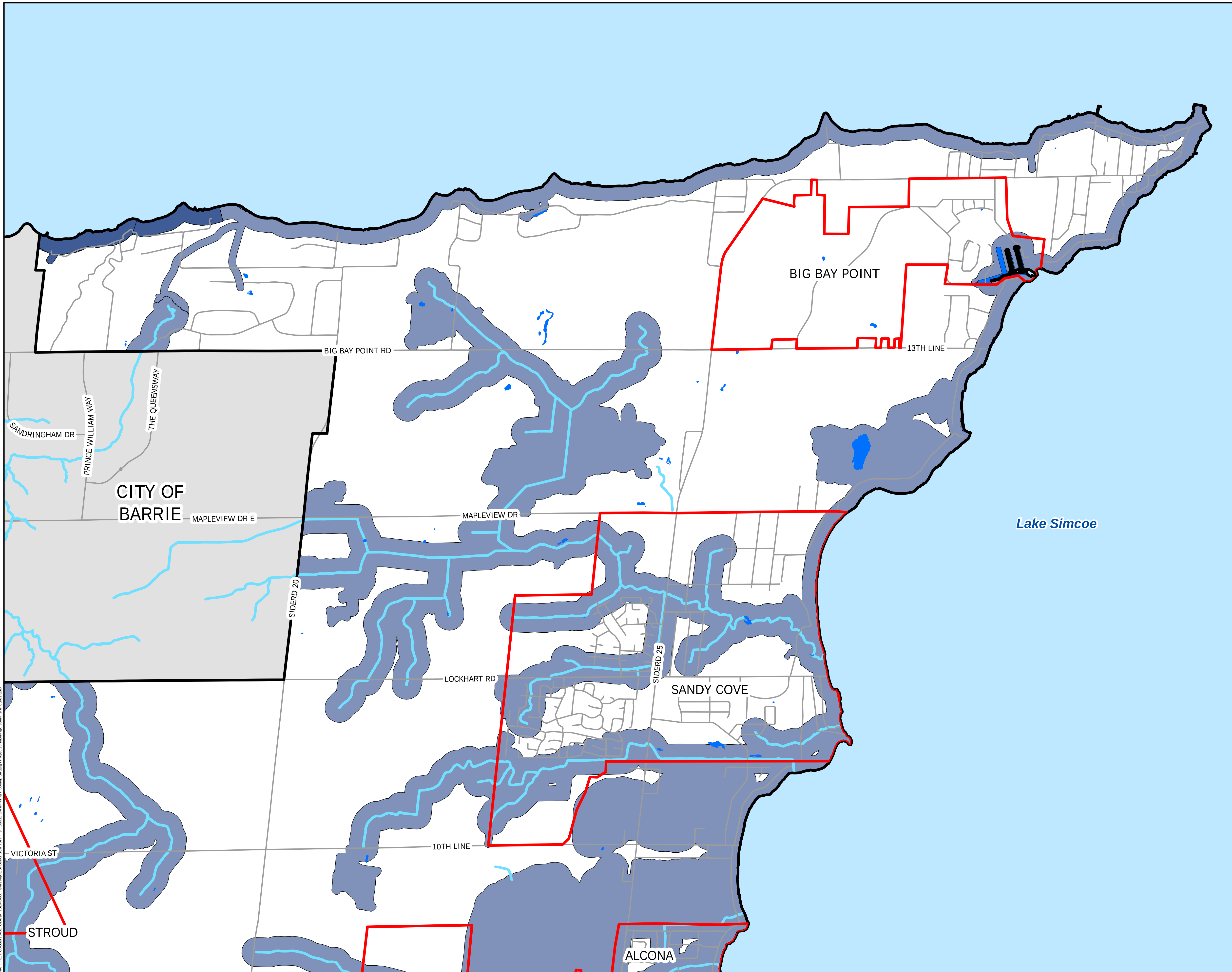
Figure 4.6

Wellhead Protection Zones (3 of 3)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil
Created by: A.V.

0 0.5 1 1.5
Kilometers

Aquafor Beech Limited



Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Intake Protection Zone

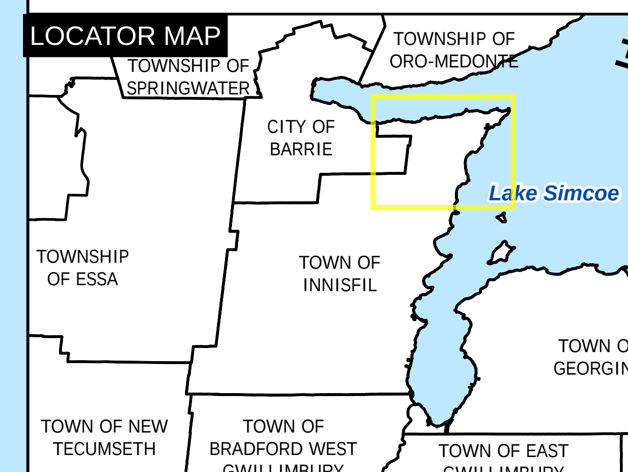


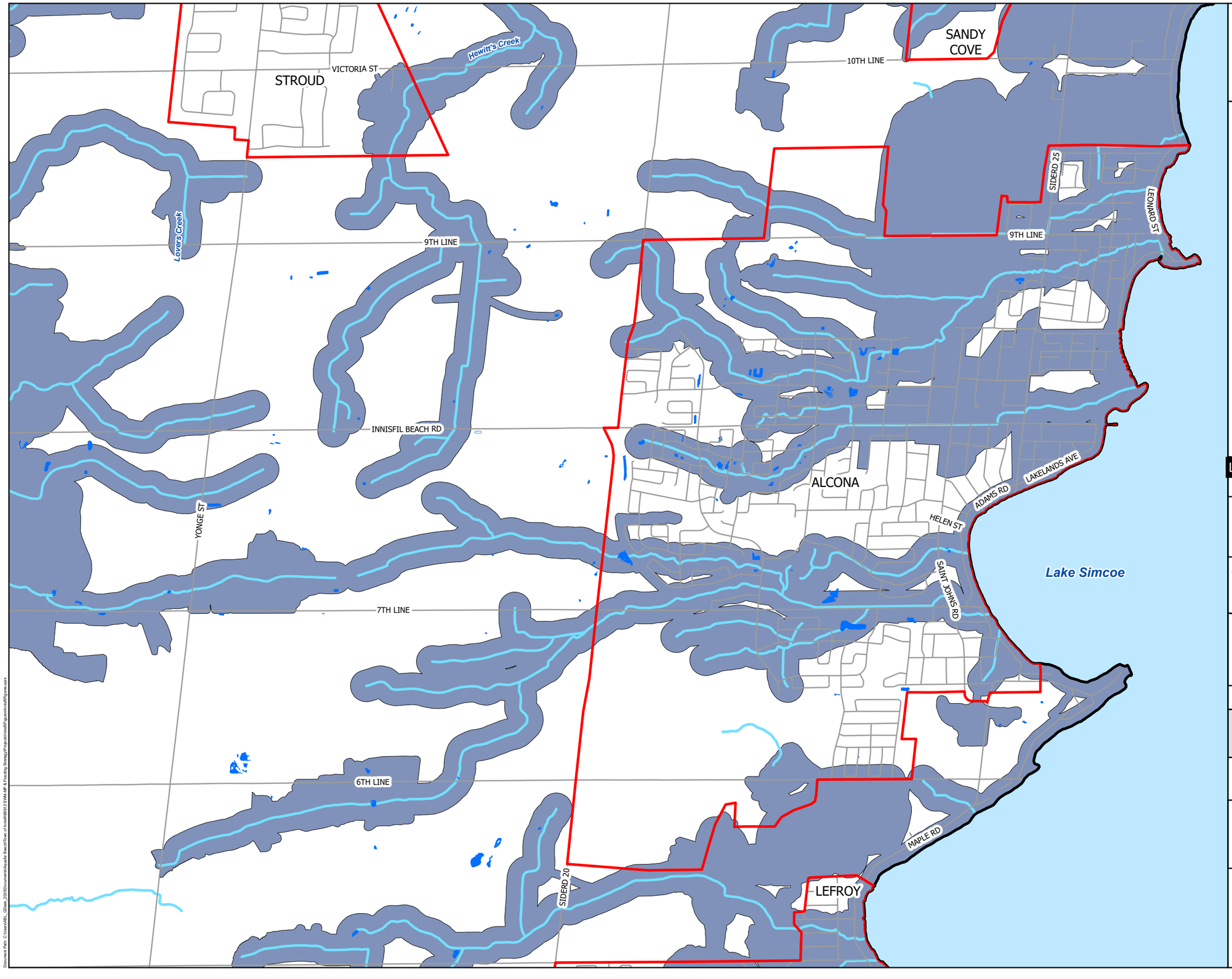
Figure 4.7

Intake Protection Zones (1 of 8)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, OMNRF
Created by: A.V.

0 0.5 1 1.5
Kilometers

Aquafor Beech Limited



Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Intake Protection Zone

LOCATOR MAP

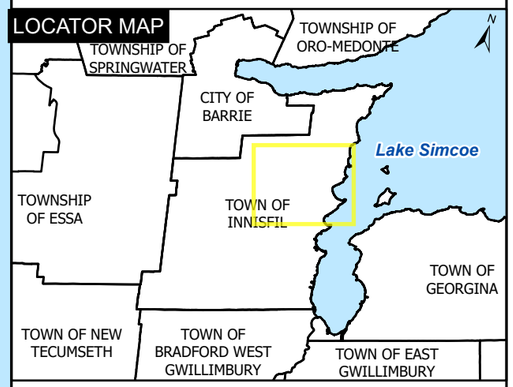


Figure 4.7

Intake Protection Zones (2 of 8)

Date: 2022-10-11
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, OMNRF
Created by: A.V.

0 0.5 1 1.5
Kilometers

N

Aquafor Beech Limited

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Intake Protection Zone

LOCATOR MAP

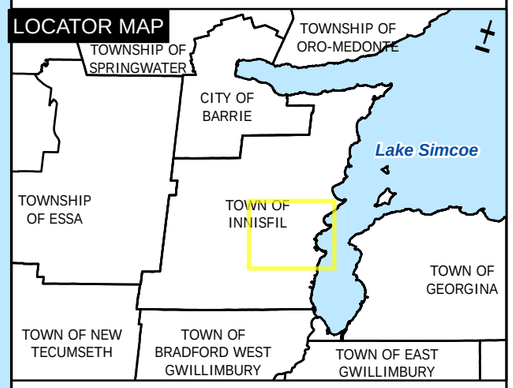


Figure 4.7

Intake Protection Zones (3 of 8)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, OMNRF
Created by: A.V.

0 0.4 0.8 1.2
Kilometers

Aquafor Beech Limited

Document Path: C:\Users\AVB_Office_2020\Documents\Aquafor Beech\Town of Innisfil\999312-SWM eIP & Flooding Strategy\Projects\mxd\Figure\Intake\IntakeFigure.aprx

2ND LINE

SHORE ACRES DR

SIDERD 20

GILFORD

14TH LINE

Lake Simcoe

TOWN OF BRADFORD WEST GWILLIMBURY

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Intake Protection Zone

LOCATOR MAP

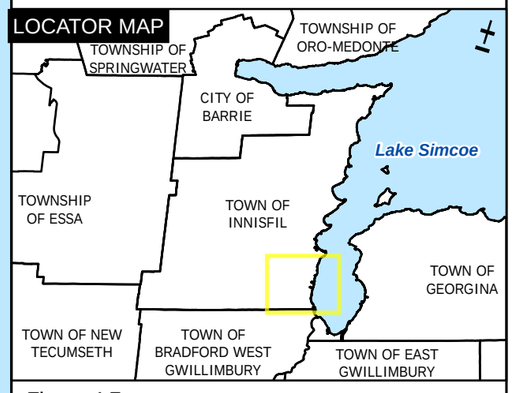


Figure 4.7

Intake Protection Zones (4 of 8)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, OMNRF
Created by: A.V.

0 0.35 0.7 1.05
Kilometers

Aquafor Beech Limited

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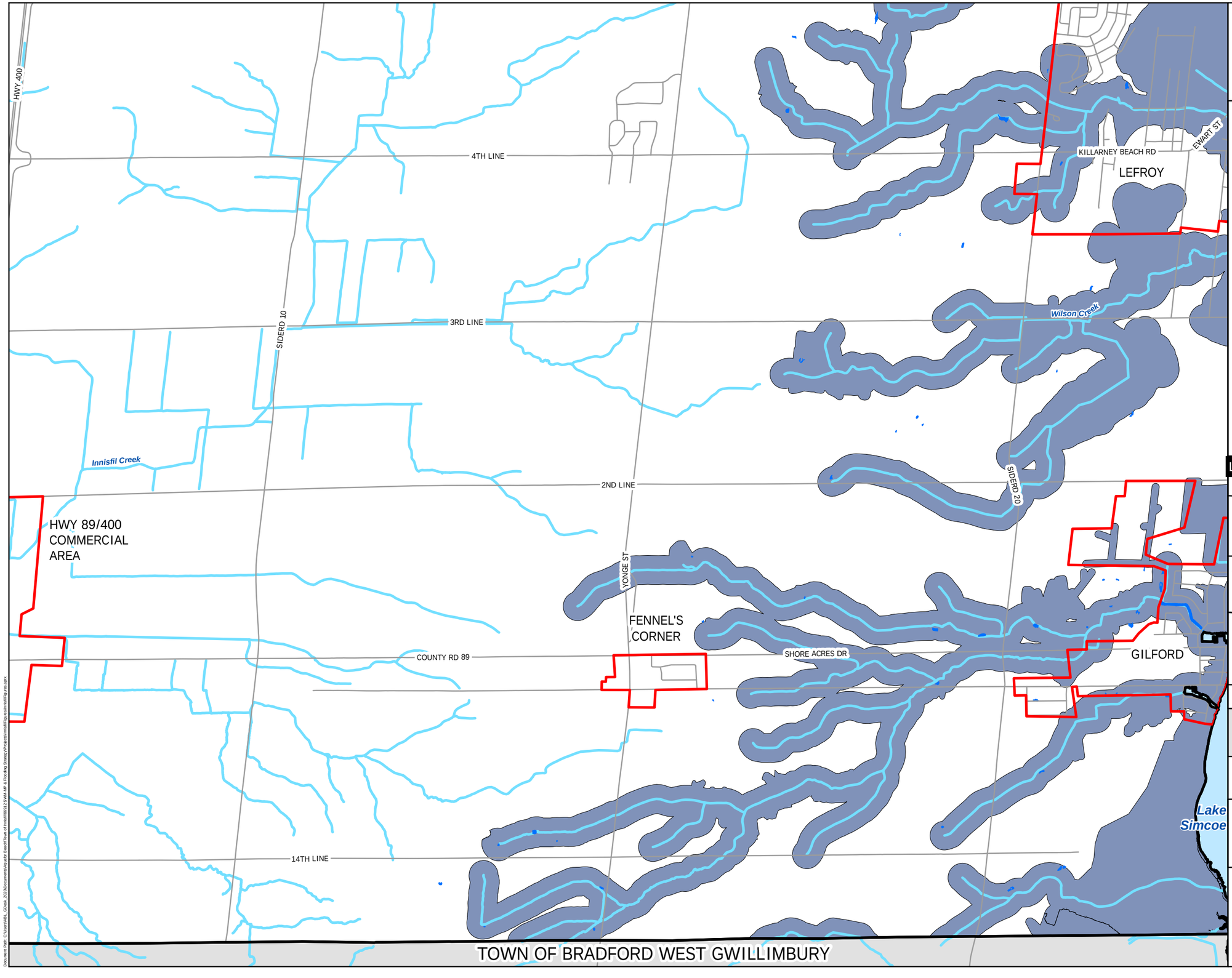

Innisfil

Legend

- Municipal Borders
- Settlement Areas
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LOCATOR MAP

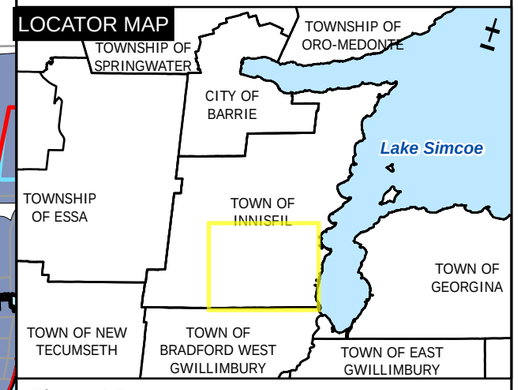


Figure 4.7

Intake Protection Zones (5 of 8)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, OMNRF
Created by: A.V.

0 0.55 1.1 1.65
Kilometers

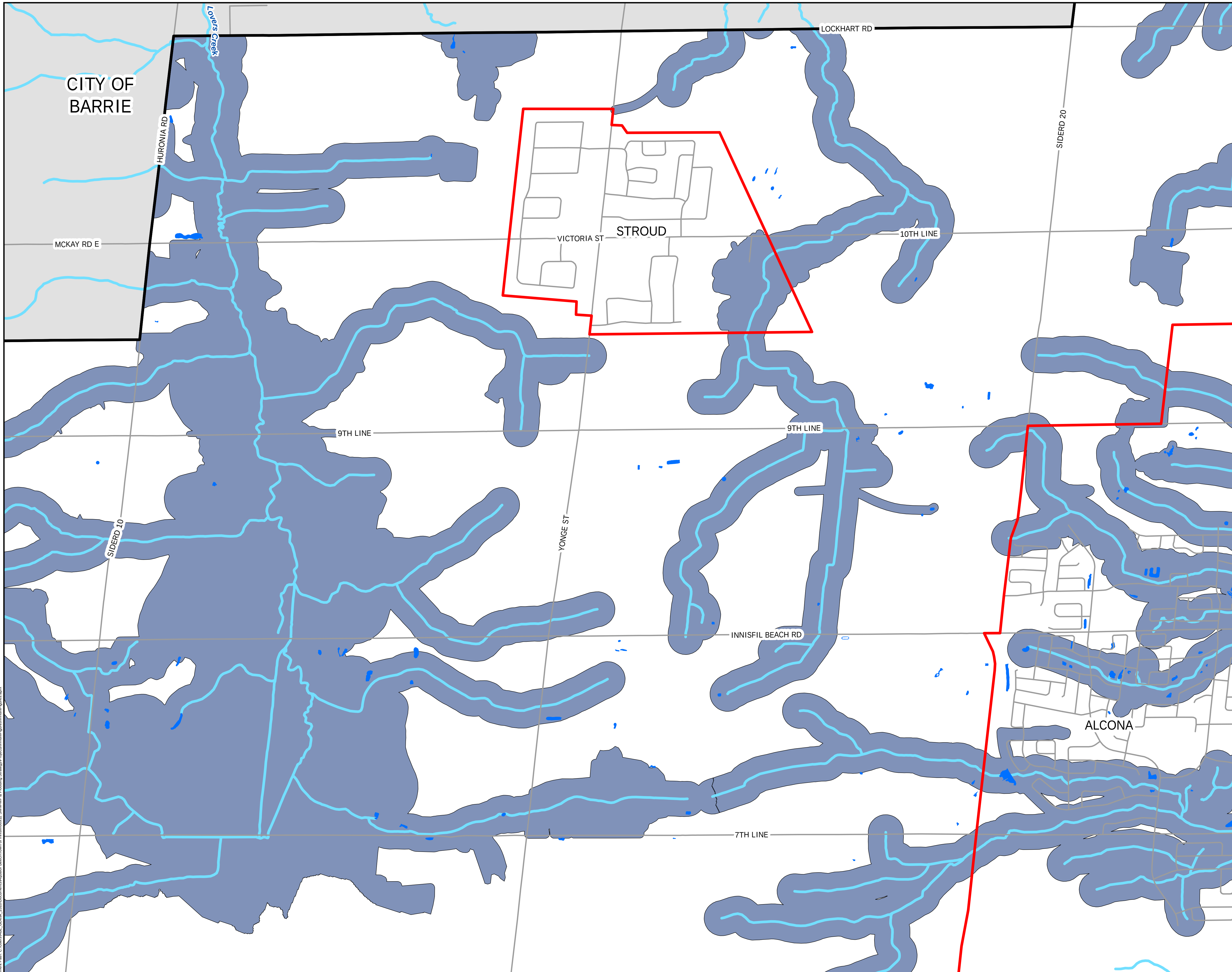
Aquafor Beech Limited

Document Path: C:\Users\AVEL_Office_2019\Documents\Aquafor Beech\Town of Innisfil\R012-21\MXD\F 4 Flooding Strategy\Projects\Innisfil\Figure\Innisfil\Figure.mxd

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Intake Protection Zone



LOCATOR MAP

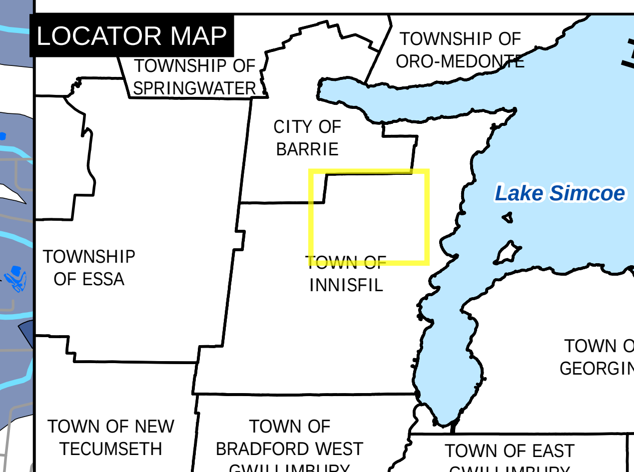


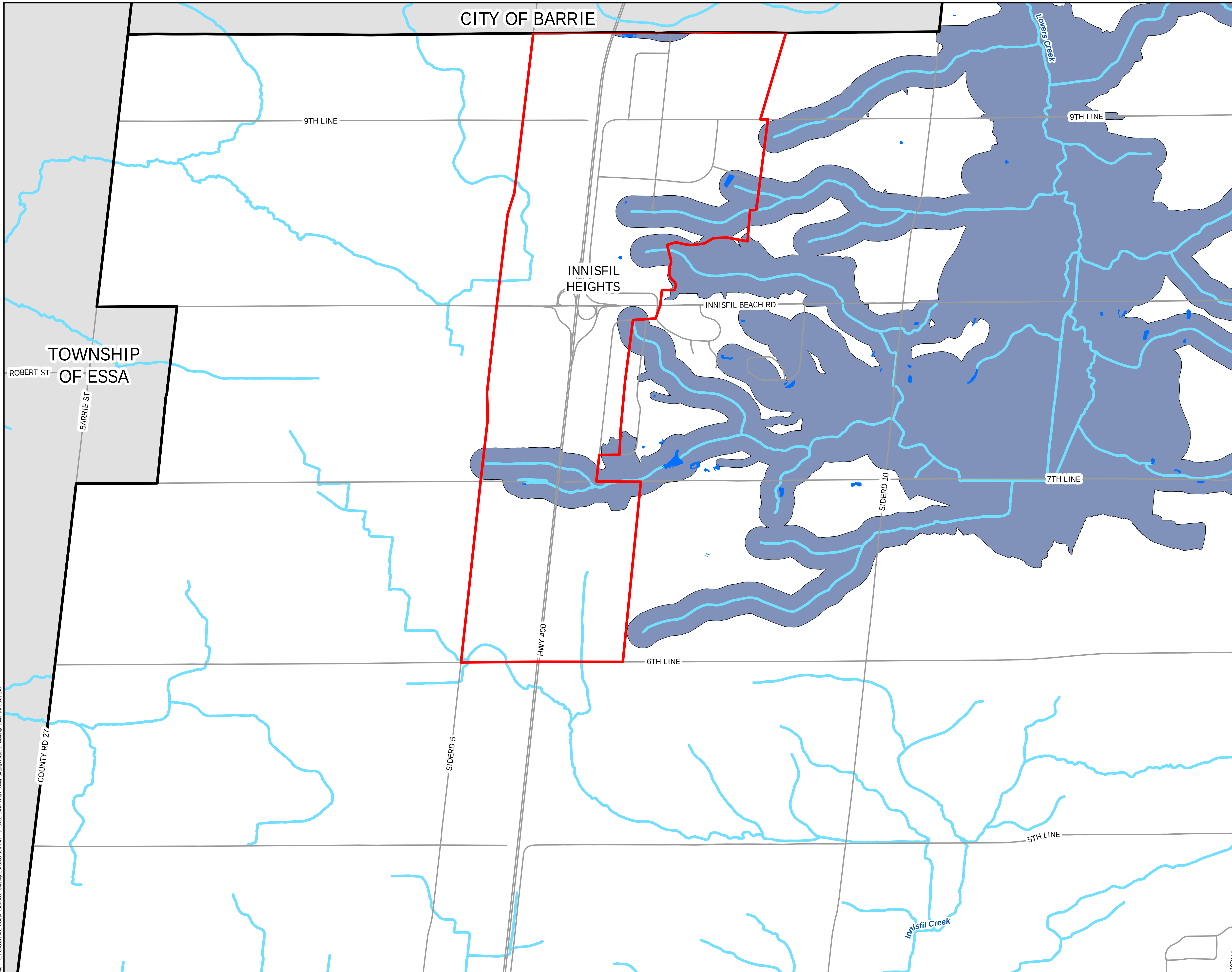
Figure 4.7

Intake Protection Zones (6 of 8)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, OMNRF
Created by: A.V.

0 0.45 0.9 1.35
Kilometers

Aquafor Beech Limited



Legend
- Municipal Borders
- Settlement Areas
- Road Centreline
- Watercourses
- Waterbody
- Intake Protection Zone

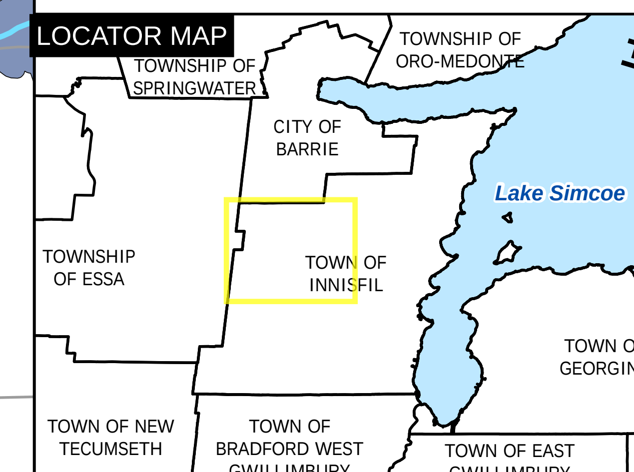
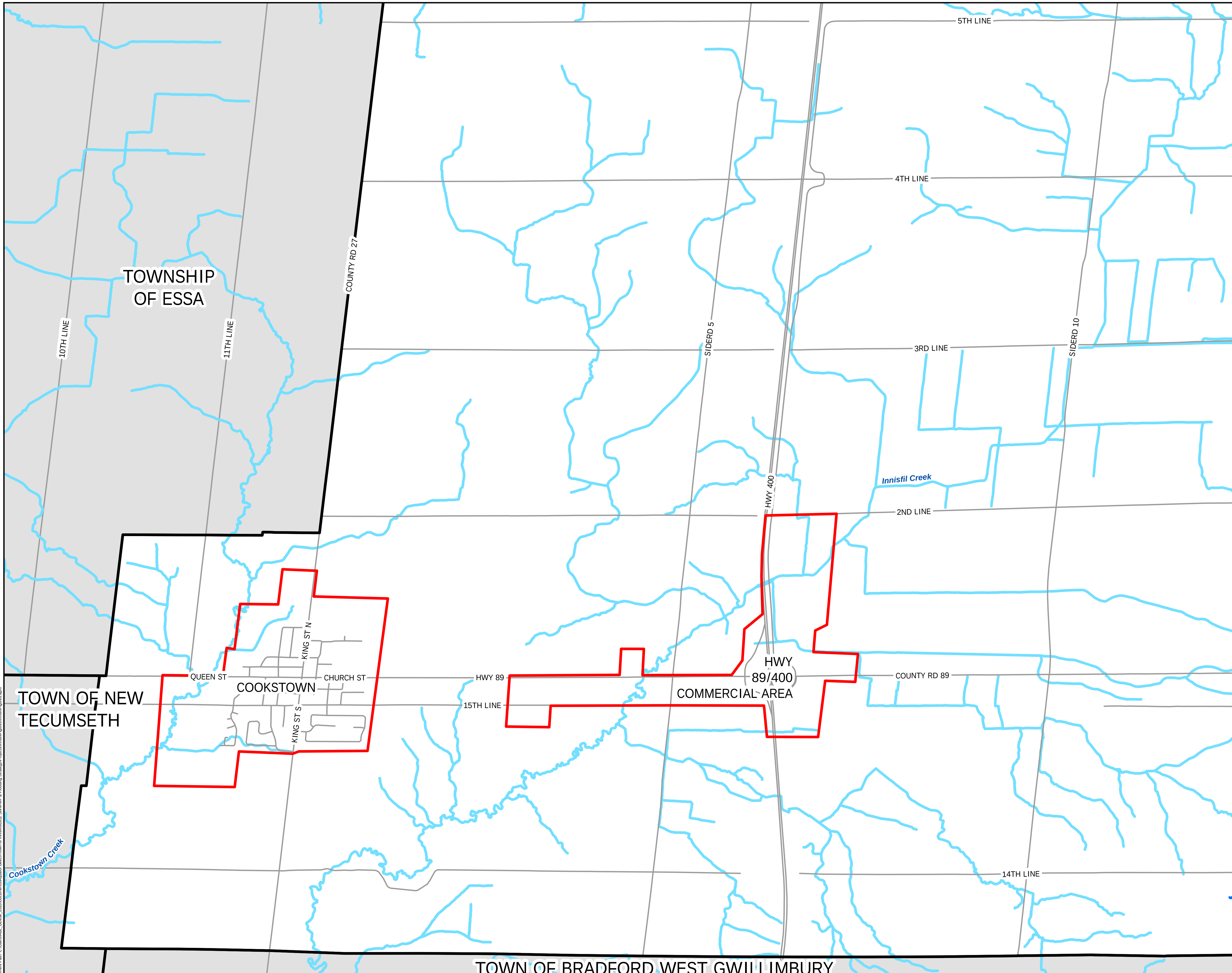


Figure 4.7

Intake Protection Zones (7 of 8)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, OMNRF
Created by: A.V.

0 0.5 1 1.5
Kilometers



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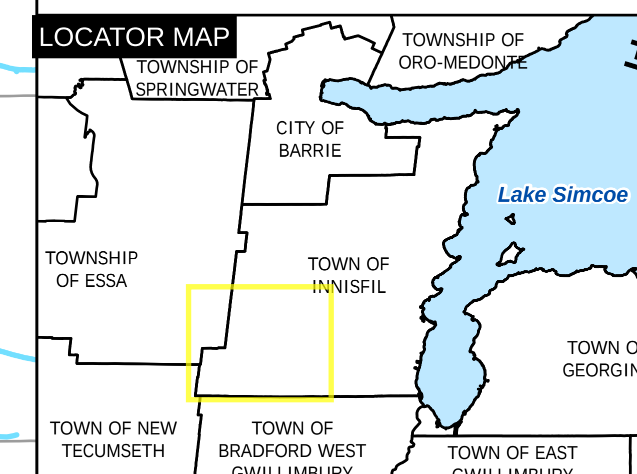


Figure 4.7

Intake Protection Zones (8 of 8)

Date: 2021-11-29
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, OMNRF
Created by: A.V.

0 0.55 1.1 1.65
Kilometers

4.2.12 Wastewater

The Town of Innisfil provides sanitary sewers and wastewater treatment to Alcona, Lefroy-Belle Ewart, Cookstown, and Sandy Cove and Friday Harbour Resort. All other Innisfil residents rely on individual septic systems. The municipal wastewater system consists of two WPCPs, including Cookstown and Lakeshore, nine sewage pumping stations, and the associated sanitary sewers and forcemains. The Lakeshore WPCP discharges to Lake Simcoe, while the Cookstown WPCP discharges to Innisfil Creek.

5 Development of Alternatives

The approach for developing and evaluating alternatives is consistent with the requirements of the planning process for Master Planning projects as outlined by the Municipal Engineer's Association Municipal Class Environmental Assessment (MEA), October 2000, as amended in 2007, 2011, 2015 and 2023. That is, any problems or opportunities identified during the Master Planning process will have alternatives prepared to address them and a preferred alternative, strategic or approach selected for each deficiency.

The EA involves reviewing Phase 1 work (i.e. Identification of the Problem) and undertaking Phase 2 (i.e. Establishing Existing Conditions, Identification of a Long List of Alternatives, Development and Assessment of Alternative Management Strategies and Selection of a Preferred Strategy). Consultation with stakeholders is also a necessary and important component of this process.

When looking to address the problem statement and any identified deficiency, there are five (5) categories of practices and options that can be used to:

- Improve surface water and groundwater quality,
- Prevent thermal enrichment of surface water,
- Decrease sediment loads to surface water,
- Reduce adverse effects on human and animal health,
- Prevent the loss and degradation of fish and wildlife habitat, natural features and processes
- Reduce flooding and erosion
- Prevent disruption of the pre-development hydrologic process (reduction in groundwater recharge and stream baseflow)
- Reduce the occurrence of Urban flooding (overwhelming of the municipal storm sewer system)

The following sections describe each of the five (5) categories of options which comprise the long list of alternatives as part of the SWM-MP & FS. The long list of alternatives represents a series of approaches, strategies, practices or actions that can be applied to address the identified problem statement and satisfy the study goals and objectives. The five (5) categories are:

1. Municipal Pollution Prevention, Operations & Maintenance Practices,
2. Source Control Measures
3. Stormwater Conveyance Infrastructure and Control Measures
4. End-of-Pipe Measures (SWM Facilities), and
5. Flood Management and Watercourse Restoration

When a problem is identified, the first step undertaken in the development and evaluation of alternative management strategies and the ultimate selection of a recommended approach, is the development of a long list of alternatives. The long list of alternatives must be all encompassing, and consistent with the study principle, goals and objectives. Furthermore, the development of the long list of alternatives must consider both existing and proposed conditions within the study area.

The long list also considered agency and provincial direction, specifically the use of a Treatment Train Approach to stormwater management as prescribed in the Stormwater Planning and Design Guide (MECP, 2003) and the draft Low Impact Development Stormwater Management Guidance Manual (MECP, 2022).

5.1 Municipal Pollution Prevention, Operations & Maintenance Practices

Municipal Pollution Prevention Measures, Management and Operational Practices are methods that have the intent to improve operation and maintenance of privately and publicly owned land, buildings, and infrastructure that will reduce pollution generation. Certain municipal and regional programs such road salt management, street sweeping and parks maintenance activities (elimination of the broad use of herbicides and pesticides) are known to improve water quality.

Applying Municipal Pollution Prevention Measures, Management and Operational Practices measures often include changing behavior, altering current practices and providing educational programs. These measures and practices are not site-specific and can be generally applied over a subwatershed or municipal boundary to prevent sources of pollution from entering the drainage system. Several Municipal Pollution Prevention Measure, Management and Operational Practices are described below.

Pollution Prevention Plans - Promote pollution prevention techniques that are applied in collaboration with the NVCA, LSRCA, and the MECP to minimize the potential for spills and contaminated runoff from entering the storm drainage network, and ultimately to local watercourses, Lake Simcoe, and/or groundwater.

Control of De-icers - Sensible and conservative use of de-icing compounds, e.g. reducing de-icing chemical application rates to minimum amounts necessary to perform the job and use of alternative de-icing materials (to sodium chloride) that can be more effective and can be used in lesser amounts. This includes the development and use of Salt Management Plans and applicator training modelled after such programs as the Region of Waterloo's Smart About Salt™ program. The LSRCA salt management working group is another local resource on the use of winter salt.

Control of Pesticides and Fertilizers – Can include alternatives for pest and weed control, including the use of beneficial insects, companion plantings, alternative spray compounds and non-toxic substances. In regard to existing laws:

- Per O.Reg 63/09 and the *Pesticides Act* (R.S.O 1990, C. P.11), it is illegal in Ontario to use Class 9 pesticides to kill weeds and insects on lawns, vegetable and ornamental gardens, patios, driveways, parks and schoolyards. Class 9 pesticides ingredients include 2,4-D, Diazinon and glyphosate. Class 9 pesticides are banned for cosmetic purposes because they may pose an unnecessary risk to human health, particularly children's health.
- A provincial fertilizer ban currently does not exist, however several nutrient limited watersheds in North America, including the Lake Simcoe watershed, have implemented or are considering fertilizer bans for non-agricultural purposes.

Enforcement of By-Laws - Prevents impact to the quality of water resources through enforcement of municipal by-law such as: Town of Innisfil property standards, weed control, and garbage. They can also include: Debris and Anti-Litter policies to prohibit, for example, the illegal dumping of refuse and debris; Storm Sewer By-Laws to prevent the discharge of harmful substances to municipal and private storm sewer systems which ends up in our creeks and rivers; and Erosion and Sediment Control By-laws to prevent sediment from entering a body of water.

Household Hazardous Waste Collection & Used Oil Recycling - Collection of deleterious chemicals such that they are disposed of in a manner that does not threaten stormwater quality and the environment. Used oil recycling is a responsible alternative to improper disposal practices. Arrangement must be made for collection and delivering wasted oil to a recycling facility.

Safer Alternative Products – Promotes the use of less harmful and environmentally damaging products which can reduce the amount of toxic and deleterious substances entering stormwater and reaching receiving waters.

Materials Storage Controls - Concerns material delivery and storage for municipal and commercial operations. This can include reducing the storage of hazardous materials on site, storing materials in designated areas, installing secondary containment, conducting regular inspections and training employees and subcontractors.

Pool Drainage - Drawdown of pools prior to winter may release a large volume of water, chlorine and salt (with the increase in the use of salt water pools) that may be toxic to aquatic life. Actions can include providing advice or requiring pool drainage to be undertaken in an environmentally acceptable ways (e.g. emptying pool at least 3 days after the last chemical application).

Municipal Management & Operational Practices

The following details municipal management and operation practices.

Storm Sewer Flushing - a storm drain is “flushed” with water to suspend and remove deposited materials. Flushing helps ensure pipes convey design flows and removes pollutants from the storm sewer system. The Town began a storm sewer flushing program in 2020, with the intent to flush storm sewers every 5 years.

Ditch Rehabilitation – Over time, ditches accumulate sediment and lose capacity to convey the design flows. Removing sediment and excess vegetation restores the ditches to be able to convey design flows. Approximately 5km of ditches are rehabilitated annually by the Town using a complaint-based system.

Catch Basin Cleaning – catch basin and stormwater inlet maintenance is typically done on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system and restore the catch basin’s sediment-trapping capacity. Maintenance program can reduce loadings to existing stormwater management ponds and surface water. The Town of Innisfil currently undertakes catch basin cleaning on an annual basis.

Sediment Removal – involves the regular removal of sediment from municipal stormwater infrastructure such as oil and grit separators (OGS) and SWM facilities. The Town of Innisfil is obligated to perform regular inspection and maintenance, including sediment removals, of all Town-owned OGS and SWM facilities, per the conditions of the respective MECP Environmental Compliance Approval (ECA). The Town currently removes sediment from OGS units on an as-needed basis. SWM facilities are cleaned out through the Capital Program.

Street Sweeping – Regular street sweeping can reduce the build-up of pollutants on street surfaces and prevent mobilization during rainfall events. The Town of Innisfil currently has a street sweeping program, completed annually.

Erosion and Sediment Control - For construction sites where erosion and sedimentation rates are usually very high, this approach aims at the prevention of erosion and containment of sediment from leaving the site boundary. The Town of Innisfil currently has an erosion and sediment controls program as part of the normal development process.

Leaf Pick-up and Removal – Reduces the discharge of nutrients and pollutants to stormwater from street surfaces by leaf clearing and removal during the fall and/or spring periods. This municipal action reduces the nutrient load in the storm sewers, stormwater ponds, and the creek system, which enhances overall water quality. Simcoe County currently has a leaf collection program, but leaves must be placed in containers for pickup.

Cross Connection Control Program - Preventing unwarranted physical connections to the storm drain system from the sanitary and floor drains through regulation, regular inspection, testing and education.

Public Education - Informs the public about pollution prevention and stormwater management issues, solutions, regulations and related financial incentives using methods appropriate to the target audience and the specific issue. This approach involves the public in remedial actions to achieve cost savings though volunteerism, and increase political support.

Business Education and Awareness - promotes education of the business and industrial community as to the impact of pollution on the environment and the runoff pathways of pollution in an industrialized watershed. This approach fosters an environment where expertise and information can be shared on pollution prevention at source.

Yellow Fish Road Program - Stenciling of storm drain system with warnings/advisories and graphic icons discourages the illegal dumping of unwanted materials.

Snow Plowing and Storage – The Town is responsible for removing snow when accumulated snow exceeds the onsite storage capacity of road rights-of-way and municipal properties. Snow can be contaminated with salt, oil, grease, and heavy metals so it must be handled and stored in ways that protect water sources.

5.1.1 Summary

The Municipal Pollution Prevention Measures, Management and Operational Practices listed above have been included here to promote better housekeeping. Many measures and practices

listed above are part of existing municipal programs by the Town of Innisfil and/or are preventative rather than treatment measures and therefore are not considered further for the purposes of the Class Environmental process followed in this report.

Specific measure and practices which are discussed further within the SWM-MP & FS include:

- Sediment removal (OGS and SWM facilities);
- Public awareness and business awareness and education (discussed as a component of source controls); and
- Erosion and sediment control.

5.2 Source Control Measures

Source control measures are small-scale stormwater management techniques located at the beginning of a drainage system where stormwater is captured and treated on-site or close to where the rainfall lands. Due to the relatively small area treated by an individual measure, source controls must be well distributed to treat stormwater runoff effectively.

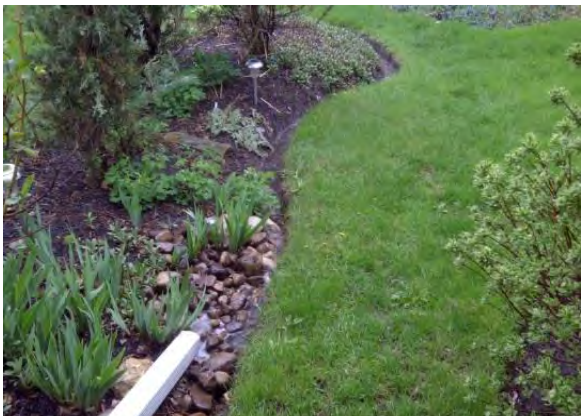
These measures are generally installed on private property within residential, commercial, industrial and institutional land uses, but can also be installed within municipal lands such as parks, trails, municipal buildings and facilities. Source control measures provide treatment for the stormwater generated by roof, driveway, landscape and parking areas.

Source control measures remove pollutants from stormwater through a variety of mechanisms, including mechanical filtration, biological uptake, adsorption, infiltration and settling. These measures can exhibit a wide variability in their ability to remove pollutants, generally ranging between 60% and 80% in efficiency depending on the particular measure and the type of pollutant being analyzed.

Despite the emphasis on source control in most recent stormwater policy and guidelines documents, systematic implementation of these measures throughout a municipality has not yet fully occurred in Canada. The implementation of a variety of source control measures has however become more common in the last decade as is exemplified in the Cities of Kitchener and Waterloo through the establishment of a SWM Utility and associated Credit program. Acceptance and promotion of this approach to stormwater management offers considerable promise in achieving the goals and objectives of the SWM-MP & FS.

Source control measures include:

Disconnection of Roof Leader - Roof leader (eavestrough) connections from residential and commercial buildings can vary within different areas of the Town depending on when the site was constructed and the standards of the day. Typically, if connected, the roof leaders flow into the municipal storm sewer system, however it is also possible that the roof leader is connected to the sanitary sewer system which is no longer permitted. These conditions, known as 'directly connected', promote a significant inflow of stormwater runoff directly into these systems during a rainfall event.



Disconnected roof leader

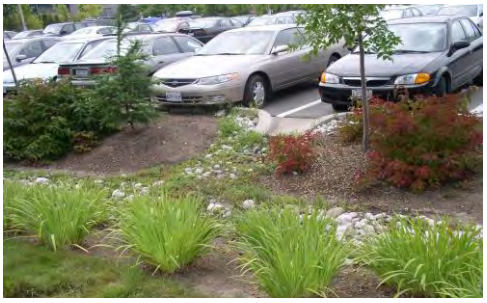
A relatively simple source control measure is to disconnect the roof leader from the municipal sewer so that the relatively clean rooftop drainage can be treated on a permeable ground surface and/or used as a resource for on-site purposes. The simplest forms of roof leader disconnection are to the lawn, to a depressed area in the lawn or to another SWM practice such as a rain barrel. More advanced systems direct the roof leader to absorptive or naturalized gardens and bioretention techniques as discussed below.

Absorptive Landscapes - In residential and commercial land uses, absorptive landscape areas can be placed in the front or back of building where they will capture 'disconnected' rooftop and yard drainage and in doing so will prevent relatively clean stormwater from entering the conventional stormwater infrastructure system and mixing with more contaminated stormwater. Absorptive landscapes are an alternative to conventional turf areas and can be planted with a variety of perennials, grasses, trees and shrubs.

Bioretention Areas - Bioretention areas (also commonly referred to as rain gardens) are a specialized form of the more generic engineered sand filter class of stormwater control. Bioretention facilities capture, temporarily store, and treat stormwater runoff by passing it through an engineered filter media. The primary component of a bioretention practice is the filter media bed, composed of a mixture of sand, soil, and organic material as filtering medium.

Bioretention cell in a residential area

Bioretention can be applied in most soils or topography, since underdrains which collect and return filtered water to the surface or sub-surface system may be used when full infiltration into native soils is not feasible. Snow storage can be provided by bioretention, especially those located adjacent to parking lots. Plant material must be salt-tolerant, perennial, and tolerant of periodic inundation. In commercial land uses, bioretention areas can be used at the base of buildings, in parking lot islands, or at the edge of a parking lot where stormwater is directed. Bioretention areas are relatively inexpensive to build, easy to maintain, and can add aesthetic value to a site, without consuming large amounts of valuable land area. Bioretention is often popular in developments with a higher urban design standard as it can meet local landscaping requirements and provide improved site aesthetics.



Bioretention cell in a commercial parking area

Reduced Lot Grading - The grading in manicured yards or other green space areas can be reduced from the standard 2% or can incorporate micro-grading (creation of small depressions or circuitous drainage pathways) to encourage infiltration.

Permeable Pavements – Driveways, parking lots, trails and sidewalks can be designed using permeable pavements to allow rain water to drain through the pavement and into the ground. Common materials include permeable interlocking concrete pavers (PICP), porous concrete and permeable asphalt as well as grass-pavers and permeable grid systems.

Permeable driveway

PICP parking lot

Soakaway Pits/Infiltration Trenches - These techniques provide for infiltration of roof drainage into the ground by directing the rain water from roof leaders to an underground infiltration trench referred to as a ‘soakaway pit’. These underground units are typically filled with clear stone or pre-manufactured drainage materials (generally plastic grids or arched systems which increase the available storage).

Infiltration trench

Soakaway pit

Green Rooftop Technology - Are constructed on top of buildings to reduce runoff volume (via increased evapotranspiration), improve water quality and reduce energy usage. Green roofs are most applicable to the industrial and commercial land uses due to the prevalence of large flat roof areas. Generally, retrofitting green roofs onto an existing building is uncommon as it can be expensive and require structural reinforcements.

Green roofs treat stormwater landing on rooftops in commercial areas

Oil & Grit Separators (OGS) – OGS units are used to trap and retain oil and/or sediment in detention chambers. These units are located either at the beginning of a storm sewer (pre-treatment or source control) or at the end of a storm sewer (end-of-pipe control).

Rainwater Harvesting (RWH) Rainwater harvesting (RWH) is the practice of intercepting, diverting and storing rainfall in an above- or below-ground storage tank for future use. The captured rainwater is then pumped into the building where it can be used for non-potable water uses such as to serve toilets, to be used in building cooling processes or for outdoor irrigation applications such as underground sprinkler systems for landscaped elements. This capture and re-use of rainwater can, in turn, significantly reduce stormwater runoff volumes and pollutant loads.

Rainwater Harvesting (Employment Building) St. Paul, Minnesota

Soil Amendments – Compost amendments are tilled or mixed into existing soils thereby enhancing or restoring soil properties by reversing the loss of organic matter and compaction. They also are used to make Hydrologic Group C and D soils suitable for on-site source controls such as downspout disconnection, filter strips, and grass channels. Soil amendments benefits include increased infiltration, stormwater storage in the soil matrix, survival rate of new plantings, root growth and stabilization against erosion, improved overall plant health and decreased need for irrigation and fertilization of landscaping. Amended soils are suitable for any pervious area where soils have been or will be compacted by the grading and construction process. While soil amendments will never be used solely to meet stormwater management objectives, they are effective in reducing the overall runoff volume, will contribute to a lower peak discharge, and can help reduce the size of total runoff storage needed.

Park soil amendments

Tree Conservation and Urban Canopy - Tree conservation at development sites should be given priority as a technique to maintain a natural hydrologic regime. Similarly, the urban tree canopy plays an important role in managing stormwater. A mature tree canopy can reduce stormwater runoff volume, peak flows, improve water quality, generate organic soils, absorb greenhouse gases, create wildlife habitat, and provide shading to mitigate temperature increases at development sites.

Tree conservation accompanied by soakaway pit design

5.3 Stormwater Conveyance Infrastructure and Control Measures

Traditional conveyance systems are typically comprised of curbs, gutters, buried concrete (or other) piping systems, and/or ditches that carry stormwater away from a development area to a water body generally along the road network. Conveyance control measures are measures that are designed to treat stormwater as it travels overland or through ditches or pipes to the downstream outlet. In appropriate applications, alternative conveyance control measures can be used to improve water quality conditions at lower cost to the municipality. Because the municipal right-of-way (ROW) account for a significant share of a community's impervious surfaces, conveyance control measures present an important opportunity to improve downstream water quality conditions (e.g. sediment, nutrient, bacteria, oil/grit, thermal impact reduction, etc.), promote groundwater recharge and minimize watercourse erosion.

5.3.1 Traditional Conveyance Approaches

Traditional conveyance measures are well understood, are regularly applied within the Town of Innisfil and are part of the existing Town standards. Approaches for traditional conveyance measures include:

System Storage (in-line/off-line sewers) – involves the construction of off-line sewers parallel to the existing storm sewer to provide additional storage and flood relief. Effective in regulating/moderating peak flows at locations where the capacity of a storm sewer is inadequate. This approach allows some flexibility regarding location of construction, which is generally less extensive than a full storm sewer replacement. Operations and maintenance requirements are less than for underground storage tanks. This approach does not require open space for implementation but does require favorable hydraulic conditions of the existing sewer for optimal operation and minimal maintenance.

Inlet Control Devices – are used to control flow into the storm sewer during peak flow events. They are designed to allow a specified flow volume out of an individual catch basin at a specified head and cause the excess stormwater to be temporarily stored above ground. This approach is effective in controlling the storm water entering the storm system provided an adequate major system exists.

Ditch and Culvert Upgrades – undersized ditches may result in spills, while undersized culverts result in water back-ups, both of which may cause flooding. Upgrading ditches and culverts allow them to convey greater flows, thereby reducing surface flooding.

Pipe Upgrade (pipe replacement/ twinning) – highly effective in preventing surcharge of existing sewer system, however often represents the highest capital cost due to significant construction requirements.

Internal Diversion – this approach focuses on balancing flows within the existing storm sewer system by utilizing spare capacity in other parts of system to accommodate more intensive storms. Internal diversion typically requires minimal construction.

5.3.2 Conveyance Controls

Non-traditional conveyance control such as Low Impact Development (LID) measures can provide stormwater treatment for the collected drainage concentrated within the ROW of a municipal road (or regional road). LID conveyance controls are linear stormwater transport systems that are generally located within the road right-of-way (ROW) of private and public roads where they encourage infiltration of water into the ground, improve water quality and reduce runoff. The suitability of LID conveyance controls depends on many environmental and planning considerations, including soil conditions, ROW size and characteristics, and implementation considerations.

LID conveyance control measures, however have had limited application in the Town. LID conveyance controls are described in the following sections which include:

Bioretention - As a stormwater filtration and infiltration practice, bioretention temporarily stores, treats and infiltrates runoff. The primary component of the practice is the bioretention soil media. This component is comprised of a specific ratio of sand, fines and organic material. Another important element of bioretention practices is vegetation, which can be either grass or a more elaborate planting arrangement. Depending on the native soil infiltration rate and site

constraints, bioretention practices may be designed without an underdrain for full infiltration or with an underdrain for partial infiltration. Bioretention can be further separated into:

- Bioretention Bump Outs (Curb Extensions)
- Boulevard Bioretention
- Bioretention Planters

Bioswales - Bioswales are vegetated open channels designed to convey, filter, and attenuate stormwater runoff. Applying the same technology as bioretention units, bioswales also promote infiltration to the native soil reducing stormwater contributions to the municipal storm sewer. A unique feature of bioswales when compared to conventional vegetated swales is the bioretention soil media, granular storage layer, and optional underdrain components (which can replace a traditional storm sewer). Depending on the desired neighbourhood aesthetic, bioswales can be vegetated with grass to blend in with the traditional streetscape or can be planted with a wide variety of shrubs, grasses and flowers for a garden-like visual.

Bioswale

Perforated Pipe - Perforated pipe systems are long infiltration trenches that are designed for both conveyance and infiltration of stormwater runoff. These stormwater conveyance systems are composed of perforated pipes installed in gently sloping granular stone beds lined with geotextile fabric that allows infiltration of runoff into the gravel bed and underlying native soil. Perforated pipe systems can be used in place of conventional storm sewer pipes where topography, water table depth, and runoff quality conditions are suitable. Perforated pipe systems can be installed as a single larger diameter perforated pipe beneath the roadway surface or as two (2) parallel smaller diameter perforated pipes beneath a shallow swale beneath the boulevard area. With most perforated pipe designs, the streetscape remains largely the same as conventional curb-and-gutter. Due to their simple design, perforated pipe systems require very little maintenance and have a proven track record in Ontario.

Perforated pipe

Permeable Pavements - Permeable pavement includes pervious concrete, porous asphalt and permeable interlocking concrete pavers (PICP). Permeable pavement can be used in place of conventional asphalt or concrete pavement. These alternatives contain pore spaces or joints that allow stormwater to pass through to a stone base for infiltration into underlying native soil or temporarily detained.

PICP lay-by and sidewalk, Mississauga, ON

For best results in ROW applications, permeable pavement should be limited to areas subject to light vehicle traffic, including parking lay-bys, shoulders, cycle paths, sidewalks and pedestrian areas as well as laneways. Use in heavy traffic areas is not recommended—these materials currently don't wear as well as conventional asphalt or concrete.

Vegetated and Enhanced Swales - Vegetated and enhanced swales have long been used for conveyance, particularly as roadway drainage. More recently, their benefits as a stormwater best management practice have been recognized. Vegetated and enhanced swales are closer in hydrologic properties to natural zero order channels than drainage systems composed of curb and gutter, inlets, and pipes. Grass channels allow infiltration, discharge at a lower rate, and reduce pollutant loads. Swales are most frequently applied for drainage alongside roads, highways, and parking lots however they are also well suited for use in conjunction with drive-lanes and rooftop drainage as well as within pervious surfaces, such as parks and landscaped areas.

Vegetated Swale – Seattle, WA

Proprietary Stormwater Quality Treatment Devices - Proprietary stormwater quality treatment devices cover a broad range of technologies that can be used to treat runoff from the municipal ROW. These devices are typically prefabricated enclosures into which proprietary technologies are added to treat stormwater runoff. Some of the treatment approaches include:

- Hydrodynamic systems, commonly called oil grit separators (OGS) devices;
- Media filters;
- Membrane filters; and
- Selected modular tree pits and bioretention units etc.

The pollutant removal characteristics of proprietary stormwater treatment devices can vary widely. Like all best management practices, their performance depends upon regular inspection and maintenance.

5.4 End-of-Pipe Measures (SWM Facilities)

End-of-pipe measures are the most commonly used stormwater management measure in most municipalities. These measures provide treatment for the collected drainage at the end of conveyance system prior to the discharge of stormwater to a watercourse. End-of-pipe measures are typically implemented in urbanizing areas as a requirement of development. Typical end-of-pipe measures used to treat stormwater include stormwater ponds (dry or wet), wetlands, hybrid facilities and/or subsurface storage facilities.

In end-of-pipe measures which have wet component, a permanent pool of water provides the water quality treatment. This permanent pool promotes the settling of sediments and pollutants to the bottom of the facility as stormwater travels through the facility. Provided the facility is functioning properly and is well maintained, sediments and pollutants will not be transported downstream of the facility. To optimize pollutant removal capacities, design engineers usually aim to maximize the distance that stormwater must travel through these facilities so that a larger percentage of the suspended solids will fall out of suspension. In general, a larger volume of water utilized for water quality storage will enhance performance; however, suspended solids removal performance becomes asymptotic with increasing design storage (there is a limit to storage beyond which there are negligible increases in suspended solids settling).

It is ideal if end-of-pipe measures are designed as large centralized facilities that treat the collected drainage from as much upstream development area as is realistically possible. This will reduce construction, operations and maintenance costs. It should be noted that this approach is not always feasible in existing urban areas.

End-of-pipe (SWM facilities) measures include:

Wet Ponds - The facilities comprise the most common form of end-of-pipe stormwater management facilities. Wet ponds contain a permanent pool of water and store a specific volume of water to provide water quality treatment and also address issues related to erosion and flooding.

Wet ponds are not limited in the size of the contributing catchment and can control drainage areas ranging from 10ha to over 100ha.

Wet stormwater quality pond

Constructed Wetlands – Typically comprise one of the least common end-of-pipe facilities in most municipalities due to the large land requirements. These facilities may be effective in improving water quality and reducing downstream erosion potential, but their role in water quantity control is limited because of their limited storage volume and shallow water depth. As compared with other end-of-pipe systems, construction costs for wetland systems are typically higher. Limited by the size of the catchment they can service, wetlands are common for small drainage areas, typically less than 10ha.

Constructed wetlands

Hybrid Wet Ponds / Wetlands - A system design using a combination of wet ponds and constructed wetlands. Hybrid facilities require a wet pond to be constructed in series with a wetland. The required permanent pool volume is approximately 50% for each element respective element. Hybrid facilities combine the best performance attributes of each technique; the wetland component provides improved water quality performance and the wet pond provides the added water quantity and erosion control benefits. Hybrid facilities typically require additional land to construct to accommodate the shallow wetland features.

Hybrid wet pond/ wetland

Dry Ponds - Stormwater dry ponds, which are dry except during rainfall events, are designed for erosion and flood control. These facilities may not provide water quality control. Dry facilities are often retrofitted so that a permanent pool of water is incorporated into the design to provide water quality treatment.

Dry stormwater pond

Subsurface Storage Facilities – Subsurface storage facilities capture and store stormwater collected from surrounding impervious areas. Storm sewers direct runoff to subsurface vaults or systems of large-diameter interconnected storage pipes or chambers. Stored water is then released directly through an outlet pipe back into the storm sewer network or to natural waters at rates designed to reduce peak water flows during storms or to mimic pre-development conditions. In some cases, stored water can be allowed to infiltrate to recharge groundwater (if soil types are suitable and the groundwater table is located sufficiently below the water storage units). Underground stormwater storage facilities can provide water quality benefits when designed with a permanent water volume or when pre-treatment or baffle designs are incorporated.

Subsurface HDPE arched chamber system

Subsurface concrete arched chamber system

The addition of pre-treatment features at the system inlet can facilitate improvements to water quality by removing floatables, skimming of oils and grease and trap some level of sediments through deposition. Pre-treatment is most important if runoff is intended to be infiltrated, otherwise rapid clogging of the system could occur. Pre-treatment features can be designed and built into the system or commercially available, prefabricated units can be incorporated within the system during initial planning and design. Subsurface storage facilities can also significantly improve water quantity and erosion control.

Oil and Grit Separators (OGS) - Discussed previously in **Section 4.2.10.2**, when located upstream of a storm sewer outfall at the terminus of the storm sewer network, OGS units can be considered an end-of-pipe treatment facility. These mechanical devices are used for the capture of spills and removal of coarse sediment from stormwater. OGS units are intended to remove floatables (debris, gasoline, oil, grease, light petroleum products and other floating liquids) from stormwater runoff. These systems are typically used for contributing drainage area less than four (4) ha but can accommodate larger drainage areas when used off-line, in parallel or in series. Generally, these devices are used for commercial and industrial land use but can also be used for redevelopment and infill areas (where available space is constrained, and traditional forms of water quality treatment cannot be implemented).

5.5 Flood Management and Watercourse Restoration

The alternatives listed are mainly concerned with flood mitigation, although other environmental benefits may result from their implementation, including improving water quality and stream health and stability. Combinations of flood mitigation alternative may be implemented where benefits are additive and doing so may feasibly reduce flood risk.

Recommendations for reducing flood risk have been divided into two categories, including structural alternatives and non-structural alternatives:

Structural Alternatives

- Stormwater flood storage
- Channel realignment
- Watercourse capacity upgrades
- Culvert capacity upgrades
- Flood proofing
- Diversions
- Local remedial measures

Non-Structural Alternatives

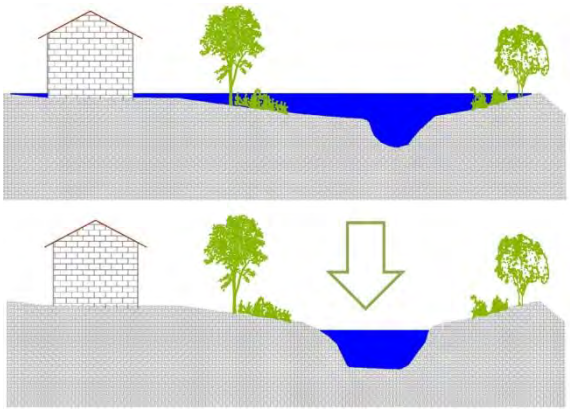
- Land acquisition
- Regulation
- Emergency programs

5.5.1 Structural Alternatives

Stormwater Flood Storage - these measures include wet and dry stormwater ponds and subsurface storage facilities, as presented in **Section 5.4**, as well as LID source and conveyance controls (**Section 5.2** and **5.3**). Implementation of LID measures should be investigated as opportunities arise within the Town; however, implementation throughout the watershed is not a feasible alternative to reduce flooding in the short term, and as such will not be identified specifically as a preferred alternative.

Mechanical Lift (pump) Stations – these measures include the locating and construction of permanent mechanical lift (pump) stations within low-lying areas of the Town, particularly those: that are below normal and/of high water of Lake Simcoe and without a gravity/ free outlet to the lake; where the Town is currently mobilizing moveable pumps during heavy rainfall events and where other structural alternatives are not feasible.

Watercourse Capacity Upgrade – This includes measures that are designed and implemented based on engineering-based flood mitigation measures that would increase the conveyance capacity of watercourses, thus reducing the flow of water beyond the channel banks during storm events. The measures are generally applied on a stream reach basis and include stream rehabilitation using natural or engineered channel design principles and naturalization of stream riparian zones using native materials. They may also include individual approaches such as streambank re-grading, gradient controls and floodplain contouring to address specific flooding problems. Riparian plantings and open space re-vegetation can be implemented concurrently to improve the function of stream corridors. In addition to reducing overbank flood flows, these approaches improve water quality, slow runoff, moderate stream temperatures, reduce erosion and improve aquatic and terrestrial habitat conditions. These programs are often integrated with components for aquatic habitat enhancement such as spawning habitat creation, refuge pool construction, undercut bank structures, boulder placements, half log cover structures and flow deflectors.



Watercourse Capacity Enlargement

Culvert Capacity Upgrade – This measure involves increasing the size of an existing culvert to increase conveyance capacity. Increasing conveyance capacity can reduce the frequency with which the crossing structure is overtopped by floodwaters, and reduce upstream flooding conditions. The number of culvert barrels should be minimized while retaining the total flow capacity to reduce the frequency of culvert and creek blockages due to transport of debris. In areas where full replacement of a culvert is infeasible, a relief culvert may be installed adjacent to the exist culvert at a higher elevation to convey flood flows.

Conceptual Example of Culvert Capacity Upgrade

Flood Proofing – Landowners can apply structural treatments to their buildings to reduce or eliminate the possibility of flood damage to the structure and its contents. Residential buildings should be dry-flood proofed to prevent flooding up to and including the Regulatory event, and prevent structural movement as a result of flood flows. Buildings can be flood proofed by sealing or filling low openings which are flood susceptible. Additional flood proofing strategies may involve local berming or flood walls.

Sealed Glass Block Basement Windows to Provide Flood Proofing

Diversions – Diversion channels or tunnels can be constructed to divert flows above levels that cause flooding to an adjacent watershed or watercourse. In order to divert waters to an adjacent watercourse, the diversion must not introduce additional flood risk to the receiving watercourse and the receiving watercourse must be relatively close and of a suitable elevation. Feasibility of diversion channels within developed lands may be limited by existing infrastructure and development, high capital costs and high ecological impacts.

Concrete Lined Diversion Channel

Local Remedial Measures - These measures, if properly implemented, can be highly effective in reducing urban flooding and can provide a high level of protection for individual properties. They are typically recommended for isolated cases of urban flooding. They include but are not limited to:

- Backflow Prevention with or without Sump Pump – is an effective solution for individual properties to prevent basement flooding due to sewer surcharge. They require installation within individual properties and also require sporadic maintenance by home owners. Implementation can require financial assistance.

- Sump Pump for Foundation Drains – involves the disconnection of foundation drains from the sewer system to prevent hydrostatic pressure due to sewer surcharge. Also reduces inflow and infiltration (I/I) in cases of drain connections to sanitary sewer. They require installation within individual properties and also require electrical backup supply to work under power failure.
- Lot Regrading – effective in reducing local flooding and high inflow and infiltration (I/I) to foundation drains. Care must be taken due to the potential increase in overland flow and potential flooding to adjacent properties.
- Rain Barrel – reduces storm runoff by promoting re-use of roof runoff (also thus reduces municipal water consumption). Requires co-operation of home owner, so implementation may require financial assistance.

5.5.2 Non-Structural Alternatives

Land Acquisition – When structural alternatives cannot be implemented (due to technical, financial and/or regulatory considerations), flood susceptible properties may be purchased by the Town, NVCA, or LSRCA as they come up for sale to remove private lands from hazard zones (erosion and flooding), and for securement of natural features, including negotiations with landowners through easement, severance/consent, or expropriation processes. A cost benefit analysis must be conducted prior to any land purchase, severance/consent, or expropriation processes.

Regulation – As per NVCA and LSRCA mandates, land use in floodplains are regulated to restrict development or re-development, and ensure that creek and floodplain alternations do not negatively impact flooding conditions. The LSRCA and NVCA are enabled to regulate development, interference with wetlands and alterations to shorelines and watercourses under O. Reg. 179/06 and O.Reg. 172/06, respectively. This alternative may be valid to prevent creation of additional flood risks, and potentially reduce or remove existing risks, but should be undertaken concurrently with structural flood damage reduction alternatives to maximize benefits.

Emergency Programs – Emergency action programs may include evacuation of people to safety during flood events, reduction of flood damages by transport of flood susceptible items to a location away from flood waters, and temporary measures (e.g. sandbagging, pumping) to prevent flood waters from reaching areas where flood damage would occur. Homeowners, small, owner-operated businesses and farms, and not-for-profit organizations may apply for Disaster Recovery Assistance for Ontarians through the Province of Ontario to recover costs associated with floods causing widespread and costly damage; however, financial help is capped and subject to deductibles. Flood related disaster relief and assistance has also been provided through the federal, provincial and municipal governments in the past. Although these programs may provide reduction in damages, there is no guarantee of relief or assistance, and they do not remove risk and should therefore be considered as a last resort over other mitigation alternatives.

6 Technical Assessment: Municipal Pollution Prevention, Operations and Maintenance Practices

Municipal Pollution Prevention, Operations and Maintenance Practices are important to ensure pollutants are prevented from impacting the environment and to ensure stormwater infrastructure maintain their effectiveness.

The SWM-MP explored approaches to manage pollutants and sediment within the Town's stormwater management infrastructure in the most cost-effective manner. The following studies and resulting recommended works are Exempt from the Municipal Class EA process, and therefore, are pre-approved.

6.1 Existing Practices

The Town should continue the use and implementation of existing programs including, but not limited to:

- Control of de-icers;
- By-law enforcement;
- Household hazardous waste collection & used oil recycling;
- Use of safer alternative products;
- Materials storage controls;
- Storm sewer flushing;
- Street sweeping;
- Sediment removal;
- Ditch rehabilitation;
- Erosion and sediment control;
- Leaf Pick-up and Removal;
- Public and business education; and
- Snow Plowing and Storage.

Other practices, not investigated by the SWM-MP, but which could be implemented by the Town include:

- Pollution prevention plans;
- Managing pool drainage;
- Fertilizer bans for non-agricultural purposes; and
- Cross Connection Control Program;
- Yellow Fish Road Program; and
- Town-wide catch basin cleanouts on a regular schedule (e.g., every 5 years).

6.2 Sediment Removal from OGS Units

The Town generally inspects their assumed OGS units on an annual basis, flagging them for sediment removal as needed. Based on the annual inspections, OGS cleanout frequency ranges from an average of every 1.5 years (OGS-00003) to every 6 years (OGS-00002). It is

recommended that the Town budget for cleaning out three (3) OGS units per year, not counting any new OGS units which may be recommended as part of the SWM-MP.

7 Technical Assessment: Stormwater Conveyance Infrastructure and Control Measures

In order to investigate the opportunities and constraints of right-of-way (ROW) retrofits and determine an integration strategy within the Town of Innisfil, one report was prepared in support of the SWM-MP, including:

- **Ditch Profile Analysis (July 2022) - Appendix B**

Targeting roads for municipal SWM improvements is an important method of mitigating the stormwater impact of urban development. Throughout most of the Town, including in rural and urban areas, ditches are used to convey stormwater to its discharge point. Maintaining ditch capacity is therefore important to mitigate nuisance flooding within the road ROW. Some of the Town's watercourses are within the ROW and appear to be roadside ditches, but are actually watercourses. These watercourses were not evaluated through the ditch profile analysis, but through the hydrologic and hydraulic modeling in **Section 9.1**.

Many urban areas have urbanized storm sewer systems instead of ditches, but storm sewer capacity was not evaluated through this SWM-MP. Opportunities for implementation of low impact development (LID) in the municipal ROW were not specifically evaluated through this SWM-MP. However, given the context of the LSRCA's requirements to "show that every possible effort has been made to follow the L.I.D. approach by incorporating lot level and conveyance controls" (LSRCA, 2022) and the CLI ECA requirements for volume control, it is recommended that the Town develop a LID implementation policy.

7.1 Ditch Analysis

7.1.1 Urban Ditches

Urban ditches are those present in settlement areas or urban land use types (e.g., residential, commercial, industrial). These ditches have not been assigned a clean-out prioritization, as clean-outs are to be undertaken based on complaints from residents and businesses and/or as identified through the recommended Private Property Drainage Program or as part of the Local Drainage Studies and Subsequent Works projects. However, it can be expected that older urban ditches will be more likely to require clean-outs than newer ditches.

7.1.2 Rural Ditches

A GIS analysis was completed to identify ditch segments throughout the Town where sediment removal is required. The length of segments requiring sediment removal was divided by the total ditch feature length to determine what percentage of that ditch required cleanout. Ditches were then ranked based on this percentage, where the highest percentage corresponds to the highest priority for cleanout. Each overall rank was then reclassified into one of four prioritization categories, including high priority, medium priority, low priority, and not requiring clean-out (**Table 7.1**). Mapping presenting the prioritization of the ditch cleanouts can be found in **Appendix B.**

Table 7.1: Rural Ditch Prioritization and Ownership

Priority	Road Owner	Ditch Length (km)
High Priority	County	24.63
High Priority	**Town**	48.42
High Priority	Private	0.41
High Priority	Province	2.09
Medium Priority	County	19.74
Medium Priority	**Town**	49.79
Medium Priority	Private	0.12
Medium Priority	Province	2.80
Low Priority	County	18.13
Low Priority	**Town**	55.26
Low Priority	Private	0.36
Low Priority	Province	2.00
No cleanout required	County	6.09
No cleanout required	**Town**	8.77
No cleanout required	Province	0.39

8 Technical Assessment: Stormwater Management Facilities (End-of-Pipe Controls)

Stormwater management (SWM) facilities are an important component of the Town of Innisfil's current stormwater infrastructure. The management of existing facilities and the construction of new SWM facilities remains a central course of action to ensure stormwater infrastructure maintain their effectiveness and that pollutants are prevented from impacting the environment.

In order to assess conditions of existing SWM facilities and identify opportunities for new SWM facilities a series of three (3) technical reports have been prepared in support of the SWM-MP. These technical reports are included within the SWM-MP appendices and are summarized in the following sections and include:

- **Catchments at Risk Report (March 2023) (Appendix C)**
- **New End-of-Pipe Opportunities Report (March 2023) (Appendix D)**
- **Identification of Preferred New End-of-Pipe Opportunities Alternatives and Conceptual Design (September 2023) (Appendix E)**

Based on the analysis undertaken in the above reports and described in **Sections 8.2** through **8.5**, there are four (4) general approaches to improving the Town of Innisfil's end-of-pipe stormwater treatment network, these are:

1. Complete required maintenance works for facilities, where noted.
2. Remove sediment from existing facilities that have water quality and water quality control significantly impacted by sediment accumulation and maintain the facility in a state of good repair in keep with the legislative requirement of the Town's Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA).
3. Retrofit existing ponds to improve water quality treatment where feasible.
4. Construct new SWM facilities in underserviced urban areas of opportunity which are typically associated with public parks/trails and vacant lands.

In addition, SWM catchment areas can be enhanced with conveyance and source controls to mitigate the impact of infill development and intensification on existing end-of-pipe facilities and the natural environment, although these have not been specifically investigated.

Note: the management of sediment within Town-owned OGS units is discussed in **Section 6.1.**

8.1 Maintenance Needs

The SWM-MP did not complete maintenance inspections of the Town's SWM facilities. Maintenance inspections were last completed in 2012 as part of the previous CSWM-MP. It is therefore recommended that the Town complete maintenance inspections of all SWM facilities, not including sediment removal requirements which were completed during 2020 and 2021 bathymetry surveys. Maintenance inspections will help the Town to identify issues such as:

- Accessibility for maintenance;

- Inlet and outlet structure condition;
- Emergency overflow weir or spillway conditions;
- Facility grading;
- Conditions of upstream sources and downstream receivers;
- Public access and associated hazards;
- Vegetation including invasive species;
- Fence or gate condition;
- Stormwater pond facility signage conditions where applicable;
- Potential water quality concerns where applicable; and
- Wildlife nuisances.

8.2 Sediment Removal for Ponds

In order to ensure long-term operational effectiveness of SWM facilities, it is crucial to remove accumulated sediment periodically per the legislative requirements and conditions of the CLI ECA. The maintenance frequency depends on several aspects, such as type of facility, design storage volume, characteristics of the catchment area, and municipal practices. Sediment accumulation compromises the effective storage volume and the long-term efficiency of suspended solids retention.

Managing pollutants and sediment within the Town's SWM facilities are exempt from the Municipal Class EA process, and therefore, are pre-approved.

AECOM completed a two-year survey of thirty-two (32) of the Town's SWM facilities from 2020-2021 (AECOM, 2021, **Appendix C**). This investigation found that eight (8) SWM facilities did not meet the desired level of efficiency, and therefore recommended sediment removal, including for 7-1, 7-2, 7-3, 7-6, 7-7, 7-11, 7-12, and 8-2. Additional SWM facilities were recommended for sediment removal in 2022 (8-4 and 7-10), 2023 (6-3), and 2024 (6-2 and 5-2).

Additional facilities beyond those surveyed in 2020 and 2021 may require sediment removal; however, without the completion of additional bathymetric studies these additional facilities cannot be identified.

8.3 Stormwater Facilities Catchment Analysis

In order to understand the impact of changes to the area and impervious percentage of stormwater catchment areas within the Town of Innisfil, a report titled "**Catchments at Risk Report (March 2023)"** was prepared. This supporting technical document to the SWM-MP is included as **Appendix C.**

Infill development and redevelopment of areas within the Town's Settlement Areas can have a negative impact on the performance of end-of-pipe storm water management (SWM) facilities. SWM facilities are designed based on the surface area of the catchment, catchment impervious percentage and the required level of water quality and water quantity control. New development and/or redevelopment within an urban catchment can increase the impervious percentage resulting in greater volumes of both runoff and pollutants suspended in the water

column. Expanding the area draining to a SWM facility beyond the original catchment delineation can have a similar effect.

According to the Town's database, a total of 61 SWM facilities exist within the Town of Innisfil. These SWM facilities provide water quality and/or water quantity control. The Town provided information for each facility based on the data submitted as part of their Consolidated Linear Infrastructure ECA (CLI ECA) submission. Where necessary, this information was supplemented from the design brief, initial ECA, the 2016 Consolidated Stormwater Management Master Plan, or the 2020 Stormwater Management Facility Sediment Survey and Assessment.

Where information was available, the SWM facilities were evaluated to determine whether changes to catchment parameters (area and imperviousness) put the SWM facility at risk of no longer achieving design objectives.

SWM facility catchment analysis has indicted that changes to the catchment areas including directing unplanned subcatchments to SWM facilities and increases in the imperviousness of the catchment areas has resulted in some SWM facilities no longer being able to provide the designed level of quality control.

Changes to SWM facility catchment areas also have the potential to impact how SWM facilities function during flood events. Most SWM facilities including dry ponds (designed without a permanent pool for water quality) are designed to temporarily detain runoff during flood events and release without exacerbating flooding and erosion on downstream lands. Increases in impervious surfaces and/or catchment areas draining to SWM facilities can overwhelm these facilities with larger volumes and higher peak flowrates entering the facility. Due to the unique stage-storage-discharge relationship at each SWM facility, it is not feasible at this level of study to identify the flood volume deficit for each SWM facility. It is however, likely that those facilities with the highest combined risk score are the most susceptible to failing their flood control requirements, and should be subject to a subsequent study.

The SWM facility catchment analysis has indicted that changes to the catchment areas including directing unplanned subcatchments to SWM facilities and increases in the imperviousness of the catchment areas has resulted in some SWM facilities no longer being able to provide the design level of quality control. Nineteen (19) facilities have been recommended for additional study and/or retrofit (**Appendix C).**

8.4 SWM Facility Retrofits

As described in **Section 8.1**, nineteen (19) SWM facilities require additional study to confirm level of service and/or efficiency of facilities at high risk of failure. The additional studies are summarized in **Appendix C**.

As many facilities were designed before modern SWM standards, or are now undersized due to changes in the catchment, it is recommended that these facilities be scheduled for retrofit. Multiple purposes of retrofit exist, including:

- Water quality enhancement retrofits to provide Enhanced water quality treatment (16 facilities).
- Retrofit dry ponds to wet ponds (6 facilities).
- Additional studies were recommended for 19 facilities to determine whether retrofitting to upgrade quantity control was feasible.
- 23 facilities do not have a SWM report, so it is recommended that a SWM report be reverse-engineered for each of these facilities.

Specific recommendations for each facility, including additional studies, maintenance, sediment removal, and/or retrofit are included in **Appendix C**.

8.5 New SWM Facilities

A significant portion of the Town of Innisfil was developed prior to the development of current stormwater management (SWM) criteria. As such, there are areas within the town where uncontrolled and untreated stormwater runoff is directly discharged to the receiving watercourses, as well as areas that discharge directly into Lake Simcoe. Industry experience has shown that these uncontrolled discharges are responsible for a significant portion of the contaminant loadings to receiving waterbodies as well as increasing the potential for downstream erosion and flooding.

The end-of-pipe facility opportunities study (**Appendix D**) was initiated to provide a framework for a long-term strategy to implement stormwater quality and quantity control within the existing urbanized areas of the Town of Innisfil. The SWM-MP explored and assessed the feasibility of constructing new stormwater management facilities as part of park rehabilitations and/or other areas in the town, including vacant lands.

The principal objective was to identify locations where new end-of-pipe SWM facilities could be implemented within existing urban areas of the town without stormwater control to increase the proportion of SWM controlled drainage areas in the town to improve:

- Water quality control (primary objective);
- Water quantity control (secondary objective);
- Erosion control (secondary objective).

As such a list of potential sites which represent opportunities for new end-of-pipe SWM facilities was. Sites were identified and assessed using a four (4) phase process, including:

- Phase 1 – Geographic Information Systems (GIS)/Land Assessment
- Phase 2 – Field Reconnaissance and Impact Assessment
- Phase 3 – Performance Assessment
- Phase 4 – Consultation with Town Staff

Three (3) SWM opportunities (**Table 8.1**) were confirmed by Town staff. As two of these are located on Town property with other park or recreation purposes, SWMF design and construction should be completed as part of overall parcel rehabilitation and enhancement.

The following study and resulting recommended works have been completed following Schedule B of the Municipal Class EA process and therefore can proceed directly to detailed design and implementation.

Table 8.1: Feasible SWM Facility Opportunities

Site ID	Location Name	Recommended Facility Type
1	24 King Street North	Surface Facility
4	Stroud Community Centre	Surface Facility
7	Aspen Street Park	Surface Facility

9 Technical Assessment: Flood Management and Watercourse Restoration

In order to understand and assess the capacity of the existing watercourses, the environmental benefits, as well as technical and financial implications relating to riverine flooding within the Town of Innisfil, two reports were prepared. These technical reports are included as appendices and are summarized in the following sections and include:

- **Existing and Future Conditions Hydrology and Hydraulic Models (October 2023) (Appendix F)**
- **Flood Mitigation Preferred Alternatives (October 2023) (Appendix G)**

As part of the SWM-MP & FS, a Visual Otthymo (VO6) model was developed for the LSRCA subwatersheds within the Town of Innisfil, while the Town provided a VO6 model for the NVCA watersheds. A HEC-RAS model was subsequently developed for the entire Town of Innisfil to evaluate flood risk due to riverine flooding.

9.1 Hydrologic and Hydraulic Analysis

The model will help Town staff anticipate needs regarding channel or culvert capacity upgrades or capital improvements, as well as to provide direction as to where spare capacity for future development may exist. Along with the existing conditions assessment, the Town's existing infrastructure was compared against a future development scenario, with land use forecast to 2041.

The hydrologic model selected for application in this study was VO6. VO6 was selected since the Town already had several VO models; and as it is the standard modelling platform for the LSRCA. As a point of alignment and to ensure an ease in future studies, review and approvals, it was preferable to have common modelling software platform.

The development of the model, detailed description of scenarios, and figures discussing the results of the scenarios, is detailed in **Appendix F.**

Results are based on an un-calibrated model and therefore results may be conservative. Additional monitoring and calibration is recommended as part of a future study.

The results were assessed in terms of number of private properties impacted by flood risk lines, number of structures impacted by flood risk lines, and culvert capacity based on the MTO design flow criteria for bridges and culverts.

The results show that many of the Town's culverts are undersized with 65% of the analyzed culverts unable to convey the design flow. In addition, future development demonstrates an increased risk of flooding, with up to a 31% increase in impacted buildings during the 100-year event. A total of 20 priority locations with high flood risk were subsequently identified to help mitigate the flood risk effects. These locations were selected based on the following criteria:

- Identification of the flooded properties for 2-yr through 100-yr and Regional Events
- Identification of the flooded buildings for 2-yr through 100-yr and Regional Events

- Identification of the areas with specific interest for future developments
- Identification of the impassable road network and private access
- Frequency of impact by flooding (i.e., 2 year vs. 50 year)

The study and resulting recommended works have been completed following Schedule B of the Municipal Class EA process and therefore can proceed directly to detailed design and implementation.

Table 9.1: Summary of Preferred Alternatives

Area ID	Location Name	Preferred Alternative
1	Bridle Path Culvert	Bridle Path Culvert Replacement and Road Regrading
2	Pinegrove Avenue Culvert	Pinegrove Avenue Culvert Replacement and Road Regrading
3	Main Street and 25th Sideroad	Improve Channel Conveyance Capacity and Raise Elevation of 25th Sideroad
4	Sandy Cove Acres	Lockhart Road Culvert Replacement
5	Cook Street and 25th Sideroad	Culvert Replacement at 25th Sideroad
6	Trinity Street and Kildare Avenue	Upstream Flood Control Facility Combined with Potential Culvert Replacement
7	25th Sideroad, Wallace Avenue and Ralph Street Culverts	Upstream Flood Control Facility
8	Tall Tree Lane and Buchanan Street Culverts	Culvert Replacement at Tall Tree Lane and Buchanan Street
9	Plum Drive Culvert	Culvert Replacement
10	St. John's Road Culvert (North of Anna Maria Drive)	Culvert Replacement and Realignment
11	St. John's Road Culvert (7th Line)	Culvert Upgrade at St. John's Road and 7th Line
12	Belle Aire Creek	Refer to separate EA for Belle Aire Creek
13	Carson Creek Outlet	Engineered Berm and Regrading

Area ID	Location Name	Preferred Alternative
14	Ferrier Avenue, Gilmore Avenue, and Corner Avenue Culverts	Culvert Replacements at Ferrier Avenue, Gilmore Avenue and Corner Avenue with Local Channel Improvement
15	Killarney Beach Road (West of 20th Sideroad)	Culvert Maintenance and Local Channel Improvement
16	White Birch Creek Outlet	Upstream Flood Control Facility
17	10th Line and Railway Crossing	Municipal Drain and Valley Corridor Improvement
18	Innisfil Beach Road (east of Yonge Street)	Raise Private Road
19	Innisfil Beach Road (west of Yonge Street)	Culvert Replacement and Regrade the Road
20	Highway 400 Culvert (north of 7th Line)	Future Development Regrading

9.2 Culvert Condition Assessment

A condition assessment was completed for the Town's culvert crossings using a hierarchical approach regarding the available information, as follows:

1. If the hydraulic model identified that the crossing needed replacement due to insufficient capacity, its condition was not assessed. These culverts have been recommended for upgrade to reduce flooding impacts.
2. If an OSIM report was available for the structure, it was reviewed to determine the condition of the structure. The Town's 2020 OSIM reports were reviewed for this purpose.
3. Any culverts that did not require replacement to improve capacity or did not have an OSIM report were assessed for their condition when the structures were surveyed for the hydraulic model.

A three-level condition assessment was used:

- Good: like new
- Fair: old but in reasonable condition, functional
- Poor: crumpled, deformed, very rusted, blocked, impaired-function

Crossings with a poor assessment are recommended for replacement or rehabilitation. Based on the results of the assessment, 111 culverts are recommended for replacement to improve

conveyance capacity, and 5 culverts are recommended for replacement due to poor condition. **Table 9.2** summarizes the results of the assessment, while the full results are available in **Appendix H.**

A total of 80 culverts were not assessed, either due to their location on private property that didn't grant access; an inability to access the culvert due to high water, construction, lack of safe access; or staff were unable to locate the culvert.

Table 9.2: Culvert Condition Results

	Total Assessed	Good	Fair	Poor	N/A	Recommend Replacement
Hydraulic Model Review	111	-	-	-	-	111
OSIM Review	12	4	8	0	0	0
Culvert Review	106	15	82	5	4	5

9.3 Municipal Drains

Many of the Town's watercourses have been converted to municipal drains, and as such, are subject to the Drainage Act. These municipal drains are summarized in **Table 9.3**. The Town's municipal drains were reviewed in the context of the updated LiDAR that was flown as part of the SWM-MP & FS. Historic municipal drain watersheds were overlaid with catchments produced by watershed delineation software using LiDAR data. In general, the watersheds were comparable, although several discrepancies between historic drain watersheds and delineated watersheds were evaluated on a case-by-case basis. Where historic drain watersheds were larger than delineated watersheds, the historic watersheds were appended to delineated catchments to ensure existing conveyance connectivity was properly modelled.

The comparison was made using GIS software to determine the accuracy of the historic municipal drain watershed. The discrepancies in historic watershed and the LiDAR were used to ensure accuracy in the modelling and determine the need for Section 78 reports under the Drainage Act to correct the watershed and assessment schedules. Where a new report is required, this is summarized in **Table 9.3**.

To estimate the Town's share of the ongoing municipal drain maintenance program, four years of drain maintenance records were reviewed, which indicated average cleanout rates ranging from $15/m to $32/m. The Town has 74.5 km of municipal drains, 73.4 km of which are open drains, while the remaining 1.1 km is a closed drain. Functional municipal drains require regular maintenance, and regular maintenance requires up-to-date assessment schedules for cost-recovery.

9.4 Private Property Acquisition

Throughout the Town of Innisfil, flood impacts from watercourses and Lake Simcoe impact private property and structures. Property acquisition can sometimes be undertaken to mitigate flooding risks, whereby the municipality purchases private property at risk of flooding. Using the LSRCA and NVCA floodplains, the Town's parcel and building geodatabases, and local property costs throughout Innisfil, Aquafor estimated the cost to the Town to purchase properties at risk of flooding (**Appendix J)**. For the Town to purchase all properties with buildings that intersect or are within the floodplain, the estimated costs would be $1.91 billion. This cost increases to an estimated $3.49 billion to purchase all property parcels that intersect or are within the floodplain. As such, it was recommended that the Town first pursue technical solutions through the SWM-MP & FS to mitigate flood risk without purchasing private properties. Technical solutions to the highest priority flood locations were therefore evaluated, as described in **Section 10.6.2** and **Appendix G**. When structural alternatives cannot be implemented (due to technical, financial and/or regulatory considerations), flood susceptible properties may be purchased by the Town, NVCA, or LSRCA as they come up for sale to remove private lands from hazard zones (erosion and flooding), and for securement of natural features, including negotiations with landowners through easement, severance/consent, or expropriation processes. A cost benefit analysis must be conducted prior to any land purchase, severance/consent, or expropriation processes.

Table 9.3: Municipal Drain Summary

ID	Drain Name	Drain Length (m)	WS Area (ha)	Status
D-01	8th Line Municipal Drain	6,335	3,130	Maintained in 2008 (Main Drain)
D-02	Branch "B" 8th Line Municipal Drain	2,759	400	Maintained in 1995 (Branch B)
D-03	Hewitt's Creek Drainage Work	4,720	600	Maintained in 2019 (Entire Drain) S.65 Report
D-04	Second Concession Drain	6,491	280	New Section 78 Report Required
D-05	Carson Village Drain	4,253	640	New report ongoing (Burnside)
D-06	Hnydczak Drain- Innisfil Section	1,812	1,240	Maintained in 2018 (Entire Drain)
D-07	Hnydczak Drain	3,563		Maintained in 2018 (Entire Drain)
D-08	Big Bay Point and Redfern Drains-Big Bay Point Drain	3,930		Maintained in 2012 (Entire Drain)
D-09	Big Bay Point and Redfern Drains-Redfern Drain	2,387	1,360	Maintained in 2012 (Entire Drain)
D-10	Redfern Drainage Works	2,145	121	Maintained in 2012 (Innisfil Section Only)
D-11	Pine Grove Municipal Drain	540	36	Tree removal in 2018
D-12	Ninth Line Drain Improvements	685	180	No major maintenance since 1991 (Improvement)
D-13	Lawson Drainage Works, Repair and Improvement, 2008	4,297	571	County replaced crossing on Main Drain (5 Sideroad in 2021)
D-15	Wilson Drain	4,467	370	Maintained in 2017/2018 (Entire Drain)
D-16	Sturgess Municipal Drain	1,564	63	Maintained in 2017 (Entire Drain)
D-17	Kell-Campbell Municipal Drain	3,206	480	Maintained in 2017 (Entire Drain)
D-18	South Innisfil Creek Drain	14,306	7,660	Construction ongoing (Phase 1 Complete

ID	Drain Name	Drain Length (m)	WS Area (ha)	Status
D-19	Prokopchuk Municipal Drain	1,215	170	Consider abandonment under Section 84
D-20	Kell Drainage Works	197	110	Maintained in 2020 (Entire Drain)
D-21	Roulston Drain	1,672	100	Consider abandonment under Section 84
D-22	Little Cedar Point Municipal Drain	282	14	Maintained in 2020 (Collector No. 1)
D-23	South Innisfil Drain Branch B	2,131	130	New Section 78 Report Required
D-24	Hughes Drain	1568	126	No record of maintenance since Drain was assumed by the Town from BWG.

10 Evaluation of Alternatives, Recommended Approach and Implementation Plan

The Implementation Plan has been prepared to provide guidance with respect to key next steps, future study considerations, facilitators and contributors, costs and funding considerations, operations and maintenance, integration with other studies, and the prioritization of works within the Town of Innisfil.

Integration across Town departments is the cornerstone of a modern approach to stormwater management and will be essential for the Town of Innisfil in the implementation of the SWM-MP & FS in order to maintain and improve the condition and health of the Town's subwatersheds. This Implementation Plan has been developed as such.

Recommended projects, as described in the subsections below, have also been consolidated into one figure, as presented in **Figure 10.1**.

Innisfil

Legend

- Municipal Borders
- Settlement Areas
- Subwatershed
- Road Centreline
- Watercourses
- Areas with Flooding Issues
- Flooding Issues Due to Lake Level
- Area Under the Influence of Lake Simcoe
- Regulatory Water Level (219.50m)
- Normal Water Level (219.15m)
- Proposed SWM Facility

SWMF Recommendations:

- Dry to Wet Retrofit
- Sediment Removal
- Quantity Control Feasibility Study
- Dry to Wet Retrofit, Quantity Control Feasibility Study
- Sediment Removal, Quantity Control Feasibility Study
- Sediment Removal, Water Quality Enhancement Retrofit, Quantity Control Feasibility Study
- Water Quality Enhancement Retrofit, Quantity Control Feasibility Study
- None

Watercourse Crossings:

- Conveyance Criteria Not Met
- Conveyance Criteria Met

Municipal Drains:

- Consider Abandonment of Municipal Drain – Prokopchuk Municipal Drain
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- New Municipal Drain Report Required – Second Concession Drain
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LOCATOR MAP

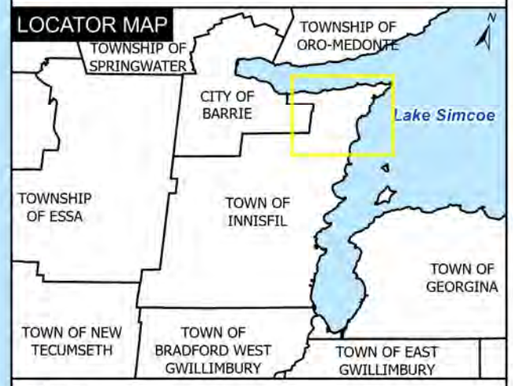

Figure 10.1

Key Findings & Recommendations

Date: 2023-11-15
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, LSRCA, NVCA, OMNRF
Created by: A.V.

0 430 860 1,290
Meters

N

Aquafor Beech Limited

Area 1
LSRCA_104
13-1
13-2
13-3
Strathallan Woods Catchment
LSRCA_106
BIG BAY POINT
BIG BAY POINT RD
LSRCA_101
LSRCA_103
13TH LINE
THE QUEENSWAY
SIDERD 25
CITY OF BARRIE
MAPLEVIEW DR E
LSRCA_98
MAPLEVIEW DR
LSRCA_93
Sandy Cove Creek
LSRCA_3_2
Area 2
EOPO#7
SIDERD 20
LSRCA_119
LSRCA_109
LSRCA_120
LSRCA_118
Area 3
LSRCA_4_2
LSRCA_117
LSRCA_95
LSRCA_116
LSRCA_105
LOCKHART RD
10-7
SANDY COVE
Area 4
Area 5
LSRCA_115
LSRCA_114
10-6
10-5
10-3
Lake Simcoe
Mooselanka Creek
South Sandy Cove Catchment
Area 9
LSRCA_111
LSRCA_112
Hewitts Creek
LSRCA_11
10TH LINE
South Sandy Cove Catchment 2
Alcona North Urban Catchment 1
ALCONA

Innisfil

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- Water Quality Enhancement Retrofit, Quantity Control Feasibility Study
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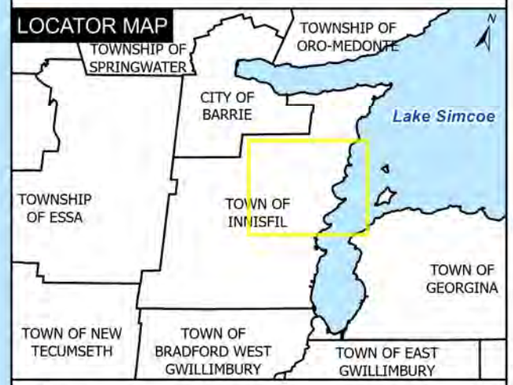

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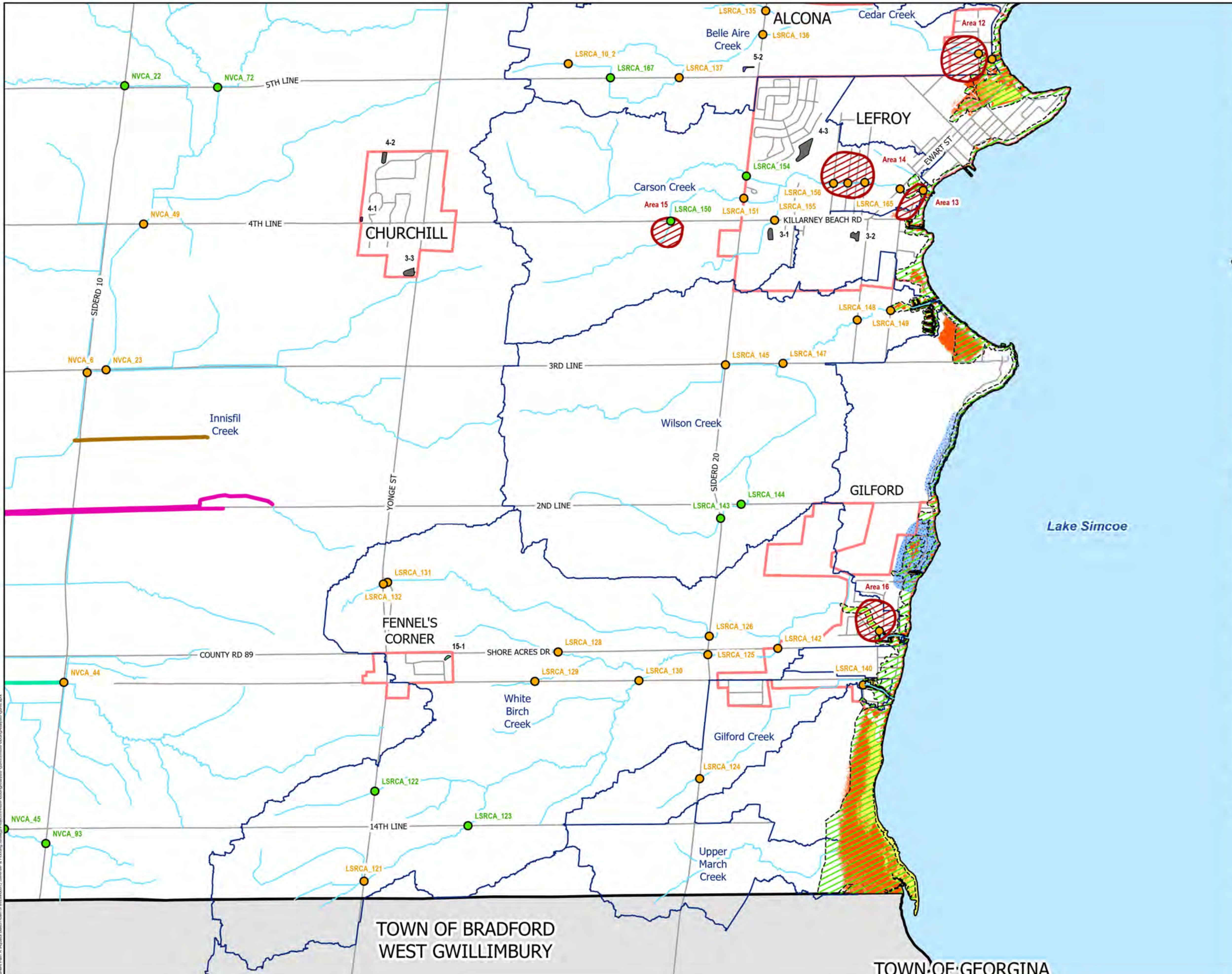
Key Findings & Recommendations

Date: 2023-11-15
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, LSRCA, NVCA, OMNRF
Created by: A.V.

0 490 980 1,470
Meters

N

Aquafor Beech Limited



Innisfil

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Data Source: Town of Innisfil, LSRCA, NVCA, OMNRF
Created by: A.V.

0 540 1,080 1,620
Meters

N

Aquafor Beech Limited

CITY OF BARRIE

LOCKHART RD

LSRCA_105

Sandy Cove Creek

SANDY COVE

SIDERD 20

10-2

STROUD

10-1

VICTORIA ST

EOPO#4

10-4

Area 17

LSRCA_83

LSRCA_11

10TH LINE

Mooselanka Creek

9-2

9-3

Hewitts Creek

South Sandy Cove Catchment 2

LSRCA_37

YONGE ST

Alcona North Urban Catchment 1

LSRCA_40

9TH LINE

LSRCA_12

LSRCA_13

LSRCA_39

Lovers Creek

Leonard's Creek

8-12

8-4

LSRCA_35

8-7

LSRCA_38

8-9

8-10

8-3

ALCONA

8-13

8-6

Area 19

LSRCA_84

LSRCA_27

LSRCA_29

7-15

INNISFIL BEACH RD

LSRCA_34

LSRCA_22

LSRCA_3

LSRCA_4

LSRCA_2

LSRCA_31

7-6

7-10

7-11

7-7

Bon Secours Creek

LSRCA_1

7-9

7-12

7-16

7-14

7-13

Banks Creek

Alcona Urban Catchment

7-17

LSRCA_10

LSRCA_8

7-3

LSRCA_9

7-1

LSRCA_7_2

7-2

Innisfil

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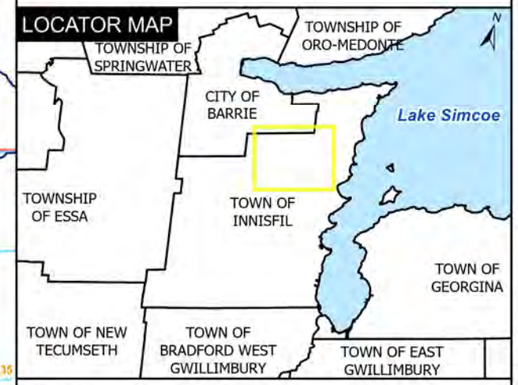

Figure 10.1

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Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, LSRCA, NVCA, OMNRF
Created by: A.V.

0 340 680 1,020
Meters

N

Aquafor Beech Limited

Innisfil

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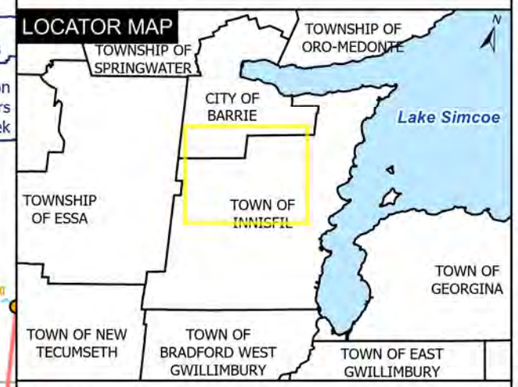

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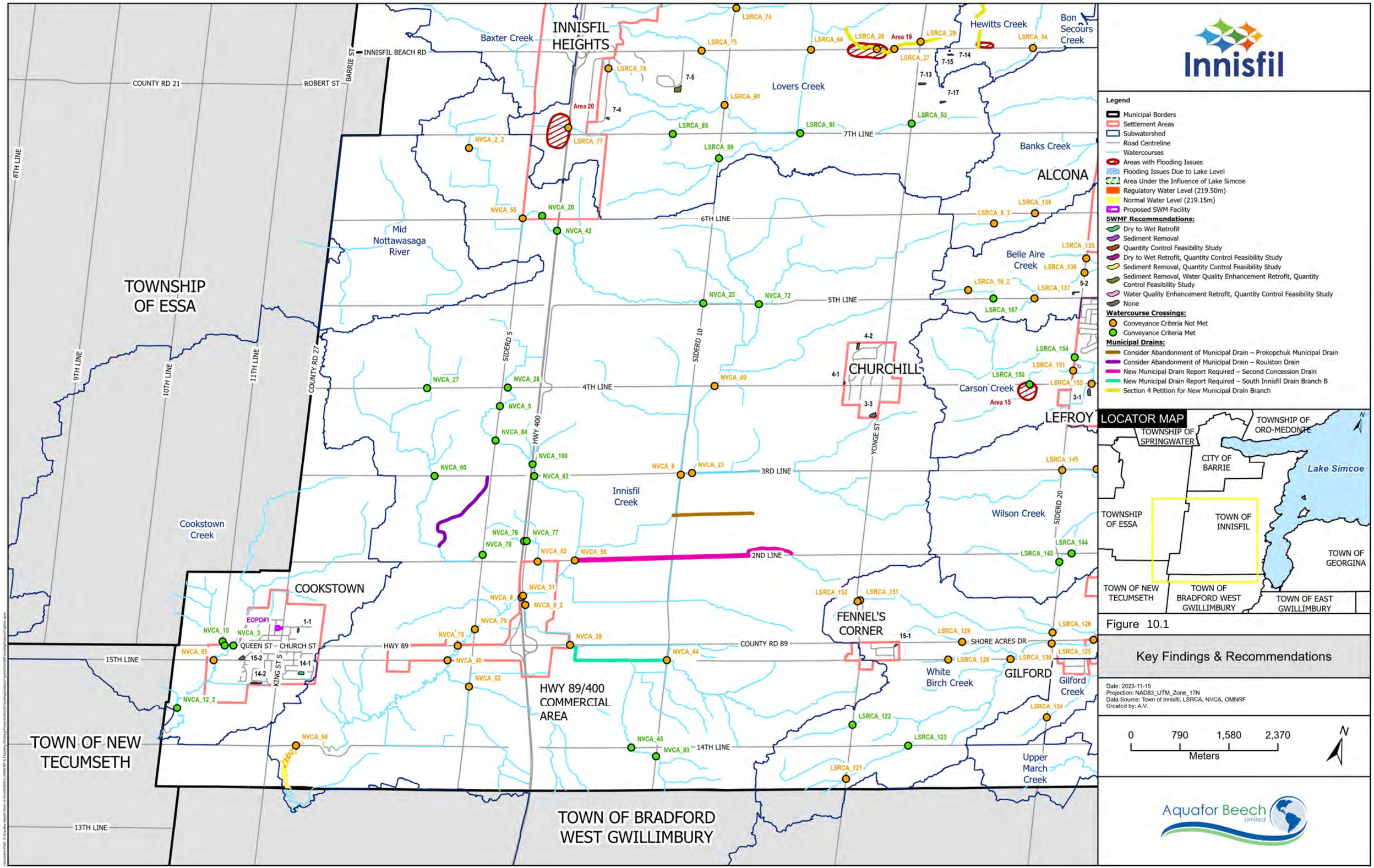
Created by: A.V.

0 500 1,000 1,500
Meters

N

Aquafor Beech Limited



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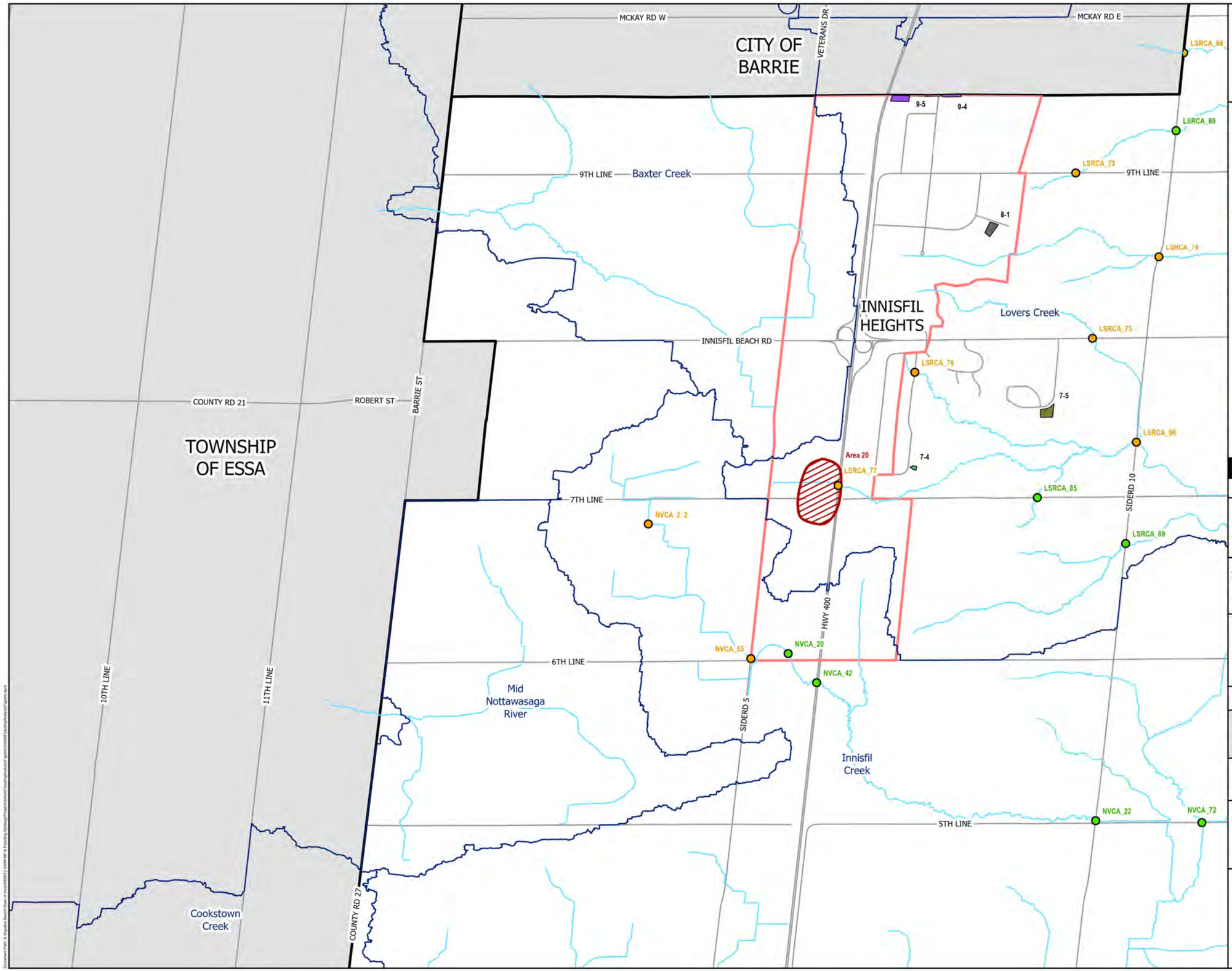
0 790 1,580 2,370
Meters

N

Aquafor Beech Limited



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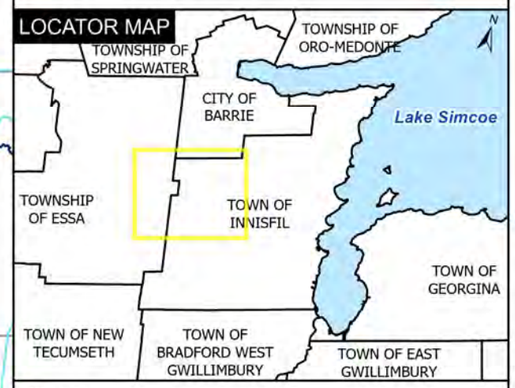

Figure 10.1

Key Findings & Recommendations

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Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, LSRCA, NVCA, OMNRF
Created by: A.V.

0 475 950 1,425
Meters

N

Aquafor Beech Limited

10.1 Evaluation of Alternatives

Section 5 of this SWM-MP & FS details the development of a long list of alternative measures, while **Sections 6** through to **Section 0** describe the feasibility of the five (5) stormwater and flooding management program elements in the context of the different opportunities/constraints within the Town. The following section describes the evaluation criteria, evaluation process and selection of the preferred alternatives which will form the recommended approach in fulfillment of the Class Environmental Assessment process (Class EA).

The SWM-MP & FS was conducted in accordance with the requirements for Master Plans under **Appendix 4, Approach #2** of the *Municipal Engineers Association Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011, 2015 & 2023)*, which is an approved process under the *Ontario Environmental Assessment Act*. As part of the Class EA process evaluation of alternatives, assessment of the potential environmental effects, analysis of problems or opportunities, and identification of mitigation measures for potential adverse impacts has been conducted and presented through public and agency consultations. The SWM-MP & FS fulfills all of the Class EA requirements for Schedule B projects which can then proceed directly to detailed design and implementation and identifies any Schedule C projects for future studies. Schedule C projects would have to fulfill Phases 3 and 4 prior to filing an Environmental Study Report (ESR) for public review.

A key component of the SWM-MP is to define and describe each type of proposed measure, followed by an evaluation in the context of identified evaluation criteria in order to develop a preferred strategy. A summary of the five (5) stormwater and flood management program elements and the relevant Class EA Schedule associated is detailed below.

1. **Municipal Pollution Prevention, Operations & Maintenance Practices**, is exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.

2. **Source Control Measures** fall outside of the Class EA process since they are to be constructed on private property, by the individual land owner as a retrofit or during development/ redevelopment (i.e. the Town is not the proponent).

3. **Stormwater Conveyance Infrastructure and Control Measures)** is exempt from the Municipal Class EA process based on the outcomes of the Archaeological Screening Process. If it is determined that the proposed project will have negative impacts on archaeological resources that cannot be appropriately mitigated, the project is not exempt, and must follow a Schedule B EA. Archaeological screening was not completed as part of the SWM-MP, and will therefore need to be completed as each project is brought to design.

4. **Stormwater Management Facilities** were evaluated using according to the project nature:

a. **Maintenance for SWM Facilities** is exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
b. **Sediment Removal for SWM Facilities** is exempt from the Municipal Class EA process, and therefore, is pre-approved. As such, detailed evaluations were not required.
c. **SWM Facility Retrofits** are exempt from the Municipal Class EA process, and therefore, are pre-approved. As such, detailed evaluations were not required.
d. **New SWM Facilities** follows Schedule B of the Municipal Class EA process, and therefore can proceed directly to detailed design and implementation. Selection of the preferred alternative in fulfillment of Phase 2 of the Class EA process is detailed in **Section 10.5.6.1.**

5. **Flood Management and Watercourse Restoration** – follows Schedule B of the Municipal Class EA process, and therefore can proceed directly to detailed design and implementation. Selection of the preferred alternative in fulfillment of Phase 2 of the Class EA process is detailed in **Section 10.6.2.1.**

10.2 Pollution Prevention/ Municipal Management/Operational Practices

Municipal Pollution Prevention, Management and Operational Practices are important to ensure pollutants are prevented from impacting the environment and to ensure existing stormwater infrastructure maintain their effectiveness. The SWM-MP explored approaches to manage pollutants and sediment within the Town's stormwater management infrastructure in the most cost-effective manner. The study and resulting recommended approaches are Exempt from the Municipal Class EA process, and therefore, are pre-approved.

The technical assessment completed as part of Innisfil SWM-MP & FS focuses on Sediment Removal from Oil and Grit Separators. OGS units use hydrodynamic separation to remove sediment and hydrocarbons from urban runoff. These units require regular inspection and maintenance in order to function as designed. The SWM-MP & FS explored approaches to manage pollutants and sediment within the Town's OGS units, LittaTraps, and LIDs in the most cost-effective manner as described in "**Operations and Maintenance Cost Estimates – Stormwater Quality Treatment"** (**Appendix K).**

10.2.1 OGS Units

The Town is responsible for the operation and maintenance of five (5) OGS units per the conditions of the respective MECP Environmental Compliance Approval (ECA), with new ones potentially added as part of road reconstruction or SWMF retrofit projects where technically feasible. Ultimately, all of the units will require maintenance service at some point as a condition of the Environmental Compliance Approval for their installation.

The Town inspects each OGS unit on an annual basis and records sediment depth. Based on the measured depth, cleanouts are triggered. On average, OGS units are cleaned out every two years.

10.2.1.1 Recommended Approach

The SWM-MP & FS has recommended an OGS Maintenance Program a part of the Town's broader Sediment Management Program. The program is an ongoing element of the SWM-MP & FS to remove sediment from 3 units per year.

10.2.1.2 Cost and Timeframe

At a 2-year cleanout rate, 3 OGS units should be cleaned out on an annual basis. Based on the capacity of the Town's OGS units, an average of 31.5 m^3 of sediment would be removed annually. Assuming an average sediment density of 1.8 ton/m^3 and a removal cost of $499/ton, this would cost the Town $28,300 per year as an operational expenditure. An additional $9,000 per year was added to the cost estimate to account for an additional unit, as directed by the Town.

10.2.1.3 Funding

The Town currently allocates approximately $25,000 per year for OGS maintenance from the Town's general revenue.

10.2.2 LittaTraps

As part of the retrofit of SWMF 4-2, LittaTraps are being installed in each catchbasin throughout the catchment to achieve Enhanced water quality benefits. A total of 34 LittaTraps will be installed, each requiring annual maintenance.

10.2.2.1 Recommended Approach

The SWM-MP & FS recommends a LittaTrap Maintenance Program a part of the Town's broader Sediment Management Program. The program is an ongoing element of the SWM-MP & FS to complete annual maintenance for the 34 LittaTraps.

10.2.2.2 Cost and Timeframe

Annual maintenance of LittaTraps is assumed at $70/unit/year for a total of $2380 per year as an operational expenditure.

10.2.2.3 Funding

The Town has not currently allocated any funding directly towards the LittaTraps maintenance. This would be an additional charge to the Town's general revenue.

10.2.3 Low Impact Development

The Town owns and operates six Low Impact Development (LID) features, including four (4) bioretention facilities and two (2) bioswales. Three maintenance visits per year are assumed.

10.2.3.1 Recommended Approach

The SWM-MP & FS recommends a Low Impact Development Maintenance Program a part of the Town's broader Sediment Management Program. The program is an ongoing element of the SWM-MP & FS to complete annual maintenance for the Town's LID facilities.

10.2.3.2 Cost and Timeframe

Vegetated LID annual maintenance costs are estimated at $3.12/m^2. With a total of 1279m^2 of area, operations and maintenance costs for these six LID features are estimated at $4000/year.

10.2.3.3 Funding

The Town has not currently allocated any funding directly towards the LID maintenance. This would be an additional charge to the Town's general revenue.

10.2.4 Other Operation and Maintenance Activities

The Town currently completes other operation and maintenance tasks that have not been evaluated as part of the SWM-MP & FS, but which should continue, include:

- Curb/gutter and catch basin maintenance
- SWM sewer system maintenance
- Bridge and culvert maintenance
- West Nile Virus maintenance
- Invasive species maintenance
- Stormwater CCTV inspections
- Other stormwater management maintenance

10.2.4.1 Recommended Approach

The SWM-MP & FS recommends the Town continue to complete the above-listed operation and maintenance tasks, a part of a Routine SWM Infrastructure Maintenance Program. The program is an ongoing element of the SWM-MP & FS to complete annual maintenance.

10.2.4.2 Cost and Timeframe

Other operation and maintenance tasks currently carried out by the Town that have not been evaluated as part of the SWM-MP & FS were costed based on the Town's 2023 budget, and have been carried forward as annual costs, including:

- Curb/gutter and catch basin maintenance - $46,500
- SWM sewer system maintenance - $16,000
- Bridge and culvert maintenance - $39,300
- West Nile Virus maintenance - $1,500
- Invasive species maintenance - $15,000
- Stormwater CCTV inspections - $259,000
- Other stormwater management maintenance - $139,290

10.2.4.3 Funding

All funds for these programs are coming from the Town's general revenue.

10.2.5 Recommendations

It is recommended that the Town continue and optimize all existing practices that they currently implement, as outlined in the long list of alternatives in **Section 5.1** and in the summary of existing practices in **Section 6.1**. The Town will monitor sediment accumulation in

each OGS unit and LittaTrap on an annual basis, and perform LID maintenance three times per year, and will remove sediment as needed.

As several of the practices recommended for pollution prevention and municipal management and operation practices are not currently included in the Town's budget forecast, it is recommended that the Town investigate an alternative, stable funding source instead of relying on allocations from general revenue (see **Section 10.9.2**).

10.3 Private Property Strategies (Source Controls)

Source control measures fall outside of the Municipal Class EA process, since they are to be constructed on private property, often by the individual land owner as a retrofit or during development/ redevelopment (i.e. the Town is not the proponent).

10.3.1 Recommended Approach

The SWM-MP & FS recommends the Town develop a LID Policy, an approvals process, a tracking system, and a process for providing oversight of private property LID best management practices (BMPs).

10.3.2 Key Next Steps

There are multiple external design guides that provide detailed guidance for the design, construction, inspection, operations, and maintenance of LID features. It is recommended the Town endorse its preferred documents, and update the DEM and other policies accordingly.

Town staff will need to review LID submissions, including design and operations and maintenance, to ensure they adhere to Town standards. The Town's existing approvals process can be modified to include these reviews and approvals. A LID tracking system should be developed at the same time that the approvals process is updated to ensure that applications include sufficient detail for the Town to track. The Town will need to develop protocols for providing oversight of private property LID features, to ensure LID features are properly designed, constructed, and maintained.

10.3.3 Approvals, Policy, By-law or Design Standards Consideration

The LID approvals process, tracking system, and protocols for oversight of private property LID features should be developed, and then formalized into a LID Policy (combined with the municipal ROW recommendations outlined in **Section 10.4.2.6**).

It is recommended that a review of the Town of Innisfil Property Standards Bylaw 075-02 and other applicably bylaws be conducted to ensure wording allows for the use of plant growth in LID facilities and unconventional grading which permit the 'temporary ponding' of water.

10.3.4 Cost

The development of a LID Policy and Tracking Tool, and associated training of Town staff to operate the tool, is estimated to cost $100,000. Any other tasks are assumed to be completed internally, and will not have any additional costs.

10.3.5 Timeframe

The tracking tool development and staff training is scheduled to occur in 2027.

10.3.6 Integration

Operating a program for LID implementation on private property will require collaboration between various Town departments to ensure a smooth operation of the program.

10.3.7 Operation and Maintenance

The approval and subsequent O&M activities of LID BMPs on private property has repeatedly been identified as a common concern for Ontario municipalities. While this concern is valid, many Ontario and neighboring U.S. municipalities have developed solutions to mitigate the risks of O&M non-compliance, facility failure, ability for the City to maintain in the event of non-compliance and associated cost recovery mechanisms.

Table 10.1 provides a summary of the various municipal tools and approaches that can be employed related to O&M of LID BMPs on private property. Each of the municipal tools can be applied through municipal by-laws, subdivision agreements, site plan approvals or other such legal mechanism as described below. In many cases, multiple mechanism and/ or approaches can be applied to a specific project or group of projects. It is recommended that the mechanisms and approaches listed within **Table 10.1** be included, modified and / or adapted by the Town of Innisfil responsible for approval based on the local context and existing legal framework.

Table 10.1: Summary of Municipal Tools and Approaches relating to O&M Activities of LIDs BMPs on Private Property

Mechanism/ Requirement	Outcome	Applied Through
O&M Financial Responsibility • All costs for constructing and maintaining the SWM Facility/LID or structure shall be the responsibility of the owner.	• Designates responsibility and costs	• Approvals (subdivision agreement, site plan or other) • By-law
Easements - Legal Right to Enter and Inspect • An easement shall be placed over the private facility/LID including an easement for access from the nearest vehicular entrance off of the municipal right-of-way and extending to the facility, and shall be dedicated to the Town. This easement (if required) shall be such that it grants the Town with the right-to enter and inspect the facility. The easement shall include access to any controls structure(s). If easements over parts of the property are not feasible, then the LID should be constructed over the area that can acquire an easement. To be of legal standing, the easement must be shown on the property survey and recorded in the title.	• Ensures the Town retains the legal ability to enter and inspect.	• Approvals (subdivision agreement, site plan or other) • By-law
Minimization of Post Construction O&M - Inspection Prior to Occupancy • The proponent's consulting engineer shall supervise and certify the installation prior to occupancy of the affected lot, block or building to the satisfaction of the Town.	• Minimizes O&M activities related to improper construction or installation. • Incentivizes proper construction practices.	• Approvals (subdivision agreement, site plan or other)
Definition of O&M Activities Subject to ECA • Where a LID BMP is subject to the Ontario Water Resources Act provincial approvals for SWM facilities and BMPs and require an Environmental Compliance Approval (ECA), the maintenance activity requirements and facility function should be measured against the property specific ECA or CLI ECA.	• Defines O&M activities to be completed and enforced	• ECA

Mechanism/ Requirement	Outcome	Applied Through
Definition of O&M Activities Not Subject to ECA • Where a LID BMPs is not subject to the Ontario Water Resources Act provincial approvals for SWM facilities and BMPs and do not require an ECA from the MECP, the maintenance activity requirements and facility function should be measured against the O&M manual contained within the required design brief.	• Defines O&M activities to be completed and enforced	• Approvals (subdivision agreement, site plan or other)
Annual O&M Reporting & Inspection • An annual report shall be submitted by the property owner to the Town verifying that the required maintenance activities as defined with the O&M manual (design brief) and /or ECA has been completed and the facility(ies) are functional and meet the designed performance target. The Town shall reserve the right to inspect all such facility(ies) at its discretion provided 48 hours notice is given prior to inspection. For private residential LIDs located on an easement, the Town may choose to accept inspection and reporting duties to ensure continued operation.	• Documents O&M activities on private property • Town reserves the verify maintenance has occurred	• Approvals (subdivision agreement, site plan or other) • By-law • SWM Utility or SWM Rate Structure if applicable.
Mechanism for Assurance of O&M • For commercial properties, annual O&M and associated reporting requirements as specified, must be received and approved prior to the renewal of 1) SWM change rebates/ credits, 2) Business licenses, 3) Fire Inspection/ Certifications, 4) Public Health Inspections/ Certificates to other.	• Links submission of O&M activities to non-stormwater management related renewals and approvals • Utilizes existing mechanisms to ensure compliance	• SWM Utility or SWM Rate Structure if applicable. • By-law

Mechanism/ Requirement	Outcome	Applied Through
O&M Non-Compliance when Subject to ECA • Should repairs or maintenance to any LID feature be abandoned by the property owner, the Town shall maintain the right to enter and perform the necessary maintenance as described within the ECA, O&M Manual and/or Design Brief. The Town shall be obligated, at its discretion, to notify the MECP of non-compliance and shall work with local enforcement officers to enforce the conditions of the ECA. Should the Town be forced to undertake the prescribed maintenance activities, all costs shall be recovered through the provisions of the Property Standards By-law or other and collected through property tax.	• Utilizes existing compliance mechanism to enforce O&M • Permits the Town to recover costs for maintenance activities through existing or amended by-laws	• MECP Environmental Compliance Approval (ECA) • By-law
O&M Non-Compliance when Not Subject to ECA • Should repairs or maintenance to any LID feature be abandoned by the property owner, the Town shall maintain the right to enter and perform the necessary maintenance as described within O&M manual contained within the required design brief. Should the Town be forced to undertake the prescribed maintenance activities, all costs shall be recovered through the provisions of the Property Standards By-law or other and collected through property tax.	• Permits the Town to recover costs for maintenance activities through existing or amended by-laws	• By-law

Mechanism/ Requirement	Outcome	Applied Through
Minimization of Post Construction O&M - Contingency Areas or Practices • The proponent shall prepare a detailed engineering design for stormwater management facilities including a required amount of contingency stormwater management facilities as specified and shall place such areas under a Town easement. The easement(s) over the contingency facilities may be released, in whole or in part, and may occur concurrently with the issuance of building permit(s) for each identified block, lot or building. Release of contingency blocks may be subject to verification through appropriate monitoring as approved and confirmed by the respective approval authority.	• Minimizes O&M activities related to improper construction or installation. • Incentivizes proper construction practices. • Ensures compliance with SWM targets in sensitive environments • Allows for a performance verification mechanism	• Approvals (subdivision agreement, site plan or other)
Minimization of Post Construction O&M – Letter of Credit/ Construction Phasing • The proponent shall provide a letter of credit based on 60% of the estimated cost of approved facilities and any contingency facilities to the satisfaction of the respective approval authority. The letter of credit will be reduced to 15% once 90% of the catchment area is stabilized (meaning buildings are constructed and lots/blocks are sodded or vegetated), and the submission of the first report for post-construction monitoring. The balance of the letter of credit will be reduced after the "post-construction" monitoring program has expired (two years after 90% of the catchment area is stabilized.	• Minimizes O&M activities related to improper construction or installation. • Incentivizes proper construction practices. • Ensures compliance with SWM targets in sensitive environments • Allows for a performance verification mechanism	• Approvals (subdivision agreement, site plan or other)

Mechanism/ Requirement	Outcome	Applied Through
Notice of O&M Responsibility - Notification to Buyers • The proponent agrees to include a statement in all Offers of Purchase and Sales Agreements that advises of lot level facilities requirements and the requirement to maintain such facilities including the any all maintenance requirements. Offers of Purchase and Sales Agreement with builders shall obligate the builder to notify purchasers of the exact location, size and intent of lot level facilities. The wording of the statement shall be to the satisfaction of the respective approval authority.	• Notifies perspective buyers of the presence of the private facilities • Serves to outline maintenance requirements, Town contacts and / or resources.	• Approvals (subdivision agreement, site plan or other)
Registration of O&M Agreement • The proponent shall enter willingly and without reservation into a maintenance agreement that is recorded with the property title that identifies the responsible party and the applicable lot(s) and specifies right-of-entry for maintenance and inspections by Town staff or their contractors.	• Ensures the Town retains the legal ability to enter and inspect. • Legally establishes O&M requirements on the property title.	• Approvals (subdivision agreement, site plan or other)

10.3.8 Recommendations

It is recommended that the Town develop a **LID Policy**, an approvals process, a tracking system, and a process for providing oversight of private property LID best management practices (BMPs).

None of the components of the recommended approach for private property source controls are currently included in the Town's budget forecast. As such, it is recommended that the Town investigate an alternative, stable funding source instead of relying on allocations from general revenue (see **Section 10.9.2**).

10.4 Stormwater Conveyance Infrastructure and Controls

The incorporation of a cost-effective right-of-way (ROW) retrofit approach using a combination of traditional SWM infrastructure and Low Impact Development (LID) approaches as part of road projects presents a significant opportunity to improve SWM control (water quality, water quantity, erosion mitigation, water balance) within the Town of Innisfil.

10.4.1 Ditch Clean-outs

The Town owns 171km of urban ditches and 162km of rural ditches, which convey runoff and are therefore an integral part of the Town's stormwater conveyance infrastructure. Ditches require periodic maintenance to clean out accumulation of sediment and other debris. It was assumed that the clean-out of urban ditches would be complaint-driven by residents and businesses, while rural ditch clean-out was estimated based on sediment accumulation. Ditches are also owned by the County, Province and private landowners, so it is recommended that the Town coordinate with these owners to ensure ditch clean-outs are occurring as needed.

10.4.1.1 Recommended Approach

The SWM-MP & FS recommends the Town implement a systematic approach to ditch cleanouts, where rural ditches are cleaned out on a rotational basis, while urban ditches are cleaned out based on receipt of complaints. Ditch clean-outs will form part of the Town's Routine SWM Infrastructure Maintenance Program.

10.4.1.2 Cost and Timeframe

The Town advised in 2022 that municipal drain cleanouts typically cost $40 per linear metre to remove, haul, and dispose of sediment; however, this cost does not include the costs associated with O.Reg. 406/19 compliance, nor does it include traffic controls. Aquafor assumed $100 per linear metre (2022 dollars) to account for O.Reg. 406/19, traffic controls, and additional fuel charges. Accounting for 4% inflation, this was increased to $104 per linear metre in 2023 dollars.

As urban ditch clean-outs are expected to be driven by complaints, an estimate of 5km per year (3% of the total urban ditch length) was assumed for costing purposes, based on recent cleanout extents. This results in a 34-year time period to clean out all of the Town's urban ditches. A 30-year timeline to clean out the Town's rural ditches was assumed.

Table 10.2: Ditch Cleanout Costs

	Cleanout Year	Rural Ditches			Urban Ditches		Total Annual Cost (millions)
		Ditch Length (m)	Total Cost (millions)	Annual Cost	Annual Ditch Length (m)	Annual Cost	
High Priority	2023-2032	48,418	$5.04	$504,000	5,000	$520,000	$1.02
Medium Priority	2033-2042	49,790	$5.18	$518,000	5,000	$520,000	$1.04
Low Priority	2043-2052	55,262	$5.75	$575,000	5,000	$520,000	$1.10

10.4.1.3 Prioritization

It was assumed that urban ditch cleanouts would be driven by complaints from residents and businesses. However, it is expected that older ditches will be more likely to require clean-outs than newer ditches. Rural ditches were prioritized into four categories (high, medium, and low priority, and no cleanout required). It was assumed that each priority level would take 10 years to clean out, thereby removing sediment from all of the Town's rural ditches over the next 30 years. Within Innisfil, the County, Province, and private landowners also own ditches, which have been prioritized by the same approach as the Town's ditches.

Table 10.3: Rural Ditch Prioritization

Road Owner	Priority	Ditch Length (km)
Town	**High Priority**	**48.42**
	Medium Priority	**49.79**
	Low Priority	**55.26**
	No cleanout required	**8.77**
County	High Priority	24.63
	Medium Priority	19.74
	Low Priority	18.13
	No cleanout required	6.09
Province	High Priority	2.09
	Medium Priority	2.80
	Low Priority	2.00
	No cleanout required	0.39
Private	High Priority	0.41
	Medium Priority	0.12
	Low Priority	0.36

10.4.1.4 Funding

The Town currently allocates approximately $70,000 per year from general revenue for ditch clean-outs. This funding is inadequate to maintain ditch capacity throughout the Town.

10.4.1.5 Approvals, Policy, By-law or Design Standards Consideration

It is recommended that the Town require the implementation of robust erosion and sediment controls during all ditch cleanouts. At a minimum, this should include the installation of erosion control matting (e.g., straw netting, coir cloth) and immediate stabilization following construction.

10.4.2 Low Impact Development

10.4.2.1 Recommended Approach

The SWM-MP & FS recommends that the Town develop a LID Policy and tracking system, update ROW cross-sections with LIDs, and update the DEM with updated LID direction. The Town should also develop a LID in the ROW Program to facilitate the implementation of LID in road reconstruction projects.

10.4.2.2 Key Next Steps

The Town recently received its CLI ECA from the Province, which includes expectations regarding low impact development infiltration and filtration measures. It is recommended that the Town update its road right-of-way cross-sections to include source and/or conveyance controls in compliance with the Town's CLI ECA. This can include the development of preferred cross-sections for Town streets which include LID features, and how LID features will fit with the other infrastructure included in the ROW.

There are multiple external design guides that provide detailed guidance for the design, construction, inspection, operations, and maintenance of LID features. It is recommended the Town endorse their preferred documents, and update the Development Engineering Manual accordingly.

The LID tracking system developed to track source control features on private property should also include tracking of municipal conveyance control features.

In order to ensure the Town assumes only LID practices that are viable in the short and long-term, the Town's maintenance period for all ROW LID approaches should be reviewed in the context of standard Town of Innisfil tender and special provisions. Of importance are the requirement for extended contractor maintenance periods and enhanced guarantees. The Town should also develop and/or review LID design, inspection, and assumption protocols.

10.4.2.3 Cost and Timeframe

There is an increase in road replacement costs when LID features are incorporated into the design. Other southern Ontario municipalities have found that construction of conveyance controls during road reconstruction projects increases the capital cost of the road work by approximately 3%. LID in the road right-of-way was therefore estimated at an additional 3% of

the annual Capital Roads Program (assumed to be approximately $15 million per year based on the Town's capital budget forecast) for an annual LID cost of $450,000.

Maintenance of conveyance controls was assumed conservatively at $10/linear meter annually for vegetated practices. It was assumed that the length of conveyance controls to be maintained would increase at a rate of 500m/year, starting in 2030 with 500m to be maintained. Annual maintenance costs therefore increased from $4000 in 2024 to $64,000 in 2041. It was assumed that sediment removal from conveyance controls will only be required after 25 years, and will cost $250/linear metre at 500 metres per year.

Development of updated ROW cross-sections to incorporate LIDs, and other applicable updates to the DEM are estimated to cost $125,000 and should be prioritized to occur in 2024.

10.4.2.4 Prioritization

Implementation of conveyance controls within the municipal ROW is opportunistic in that they are incorporated into planned road reconstruction projects. Conveyance controls will be integrated into road works at the detailed design stage for all capital roads projects such that the project can incorporate new SWM infrastructure to achieve SWM objectives. All conveyance control projects incorporated into roads will be implemented as components of capital roads projects through the Town's general budget, or partially through Development Charges if the road works are growth-driven. Routine re-assessment of the roads scheduled for reconstruction allows for prioritization of which streets to target for the installation of conveyance controls.

10.4.2.5 Funding

The Town currently allocates funding for road reconstruction and the associated stormwater works from general revenue. Any costs associated with LID implementation are included in these funds.

10.4.2.6 Approvals, Policy, By-law or Design Standards Consideration

The Town's processes for the design, assumption, operations and maintenance should be developed, and then formalized into a LID Policy (combined with the private property recommendations outlined in **Section 10.3**). The LID Policy should also account for the Town's approach to comply with the CLI ECA.

Per the 2023 amendments to the *Municipal Class Environmental Assessment (MEA) Act (October 2000, as amended in 2007, 2011, 2015 & 2023)*, the MEA Archaeological Screening Process must be to completed in order to "establish new or modify, retrofit or improve LID features within an existing road allowance or an existing utility corridor" without completing a Schedule B Environmental Assessment (EA). The outcomes of the screening will identify whether the project is exempt, or whether a Schedule B EA is required.

10.4.3 Storm Sewers

10.4.3.1 Recommended Approach

An evaluation of storm sewer capacity was not included as part of the SWM-MP & FS. It is recommended that a storm sewer model be developed for all storm sewers throughout Innisfil to determine where there are capacity limitations within the Town's storm sewers. This model can be developed as part of the next Stormwater Management Master Plan Update.

10.4.3.2 Cost and Timeframe

The next SWM-MP Update is scheduled for 2028, at which point it is recommended a storm sewer model be developed as part of this study. The development, calibration and validation of the storm sewer model is anticipated to cost $125,000, including completing of the necessary storm sewer monitoring to enable calibration and validation. It is anticipated that many of the Town's older storm sewers will be undersized, so a budgetary placeholder for storm sewer upgrades has been included in the budget at a rate of $1 million per year starting in 2029.

10.4.3.3 Funding

The Town does not currently fund storm sewer upgrades unless they are part of a road reconstruction project.

10.4.4 Integration

Public transportation, active transportation, and street trees are all components of the municipal ROW. Road reconstruction projects, including those that incorporate LID features into the ROW, should be designed with consideration of these systems. In addition, several watercourses are within the municipal ROW and generally present the appearance of ditches. These watercourses should be considered separately from the Town's ditch network.

10.4.5 Recommendations

- It is recommended that the Town initiate a systematic cleanout of roadside ditches to maintain capacity to convey flows as part of the **Routine SWM Infrastructure Maintenance Program**.

- It is recommended that the Town initiate a **storm sewer capacity study** as part of the 2028 SWM-MP update to identify areas where storm sewers may be undersized.

- It is recommended that LID integration into the road right of way (ROW) be included as part of the Town's standard cross-sections. This can include LID features, and how LID features will fit with the other infrastructure included in the ROW of local, collector, and arterial streets. This should be incorporated into an **update of the Town's DEM**.

- It is recommended that the Town incorporate LID into its operations, including:
    - Development of a **tracking tool**;
    - Municipal training in use of tracking tool, and LID design, construction, operations, and maintenance;
    - Operations and maintenance of municipally-owned LID features as part of the **Sediment Management Program**.

- It is recommended that the Town ensure proper oversight during construction and warranty periods by trained and experienced professionals in LID design and construction.
- It is recommended that the Town proceed with 'multiple objectives' at the detailed design stage for each capital roads project such that the project can incorporate new SWM infrastructure to achieve SWM objectives as well as achieving objectives relating to Urban Forestry, transit, cycling, trails etc.
- It is recommended that the Town review the maintenance period for all ROW LID in the context of standard Town of Innisfil tender and special provisions, specifically the requirement for extended contractor maintenance periods and enhanced guarantees.
- As the current level of funding for ditch cleanouts is inadequate, and the Town does not currently directly fund LID implementation or storm sewer upgrades, it is recommended that the Town investigate an alternative, stable funding source instead of relying on allocations from general revenue (see **Section 10.9.2**).

10.5 Stormwater Management Facilities

Stormwater management (SWM) facilities are an important component of the Town's stormwater infrastructure. The management of existing facilities and the construction of new SWM facilities is critical to ensure stormwater infrastructure maintain their effectiveness and that pollutants are prevented from impacting the environment.

10.5.1 Bathymetric and Topographic Surveys

The Town currently completes bathymetric and topographic surveys of each assumed facility on a five-year basis, to be completed the year prior to the update of the SWM-MP.

10.5.1.1 Recommended Approach

The SWM-MP & FS recommends that the Town continue to complete topographic and bathymetric surveys on a 5-year basis. This is to be completed as part of the Town's broader Sediment Management Program.

10.5.1.2 Cost

The cost of the bathymetric and topographic surveys is estimated at approximately $4,000 per facility when all of the Town's facilities are surveyed at once. It is assumed that the number of facilities owned by the Town will increase per **Table 10.4**, and that only facilities with a permanent pool will be surveyed.

Table 10.4: Bathymetric and Topographic Survey Assumptions and Costs

Year	Number of Facilities	Cost
2027	46	$184,000
2032	48	$192,000
2037	50	$200,000

10.5.1.3 Funding

The Town has currently allocated $322,525 for the next surveys to be completed in 2030, which is more than enough to cover the estimated costs.

10.5.1.4 Timeframe

Based on the completion of the current SWM-MP & FS in 2023, the next one is recommended to be completed in 2028; as such, the bathymetric and topographic surveys should be completed in 2027.

10.5.2 SWMF Sediment Removal

In order to ensure long-term operational effectiveness of SWM facilities, it is crucial to remove accumulated sediment periodically per the conditions of the respective MECP Environmental Compliance Approval (ECA). The Town last completed a bathymetry study of 32 of its SWM facilities in 2020 and 2021, which recommended a schedule for sediment removal based on the results of the surveys, although none have yet been completed.

10.5.2.1 Recommended Approach

The SWM-MP & FS recommends that the Town continue completing sediment removal from its SWM facilities, but at a greater frequency to maintain compliance. This is to be completed as part of the Town's broader Sediment Management Program.

10.5.2.2 Approvals, Policy, By-law or Design Standards Consideration

Public consultation is not required for sediment removal projects; instead, public notice will be issued prior to these activities. In cases where facilities are within habitat of Species at Risk, MECP permitting under the Endangered Species Act will be required.

10.5.2.3 Cost

The overall cost of sediment removal from the identified priority SWM facilities is summarized in **Table 10.5**. The Town estimated that sediment removal cost approximately $210/m^3 of sediment removed if the sediment quality was found to meet Table 1. If the material is to be taken to a landfill, costs were approximately $350/m^3 to remove, haul, and dispose of sediment. Costs were increased by 30% to account environmental chemical testing for compliance with the Excess Soil Regulations (O.Reg. 406/19) and for increased fuel costs/ surcharges. It is assumed that a bathymetric and topographic survey would already have been completed, otherwise an additional $10,000 per facility would be included to complete the survey prior to sediment removal. It was assumed that by 2031, the Town will have completed cleanouts of the backlog of facilities, and will thereafter complete 4 cleanouts per year, to be

prioritized based on the results of future bathymetric surveys. These were assumed to cost $150,000 per facility to clean out.

Table 10.5: Sediment Removals

Pond #	Pond Name	Pond Type	Recommended Cleanout	Sediment Removal Cost (Meets Table 1) †	Sediment Removal Cost (Landfill) †
5-2	Lefroy Fire Station	Dry	2024	$137,000	$228,000
6-2	Tepco North	Wet	2024	$182,000	$304,000
6-3	Tepco South	Wet	Due (forebay); 2023 (main cell)	$131,000	$218,000
7-1	Royal Alcona	Wet	Due	$214,000	$356,000
7-2	Wallace Mills Ph.2 (South)	Wet	Due	$94,000	$157,000
7-3	Wallace Mills Ph.1 (North)	Wet	Due	$428,000	$714,000
7-5	Innisbrook Estates (IH)	Wet (Infiltration)	Due	$67,000	$112,000
7-6	Innisbrook Developments	Wet	Due	$61,000	$102,000
7-7	Green Acres Subdivision (South)	Wet	Due	$90,000	$149,000
7-9	Green Acres Subdivision North (BMP 4C2)	Wet (Online Channel)	Due	$243,000	$405,000
7-10	Green Acres Subdivision (West)	Wet	2022	$14,000	$24,000
7-11	Woodland Park North	Wet	Due	$146,000	$244,000
7-12	Woodland Park South	Wet	Due	$108,000	$180,000
7-14	Innisfil Admin Building Back	Wet	Due	$30,000	$50,000
7-17	Sand Salt	Wet	Due	$38,000	$64,000
8-2	Taylorwoods	Wet	Due	$29,000	$49,000

Pond #	Pond Name	Pond Type	Recommended Cleanout	Sediment Removal Cost (Meets Table 1) †	Sediment Removal Cost (Landfill) †
8-3	Crossroads Ph.1	Wet	2024 (forebay); 2049 (main cell)	$76,000	$127,000
8-4	Crossroads #2	Wet	2022	$257,000	$428,000
8-9	Crossroads	Wet	Due (forebay); 2029 (main cell)	$52,000	$87,000
9-4	Doral Business Park East	Wet	Due (forebay)	$18,000	$31,000
9-5	Doral Business Park West	Wet	Due (forebay); 2037 (main cell)	$29,000	$48,000
13-1	Kempenfelt Bayside Estates	Wet	Due	$32,000	$54,000
			Total	**$2,476,000**	**$4,131,000**

† Class "C" Cost estimate, all values in 2023 CDN dollars. Rounded to the nearest $1,000. Lower costs assume that the sediment removed from the facility meets Table 1 quality of the Excess Soil Standards. If the sediment does not meet these standards, it is assumed to be disposed of in landfill at a higher cost.

10.5.2.4 Funding

The Town currently allocates approximately $700,000 per year from general revenue for SWM pond cleanouts and retrofits. This allocation would be sufficient for SWM pond cleanouts alone, but not for the Town to complete retrofits as well as the required pond cleanouts.

10.5.2.5 Timeframe

High priority sediment removals are scheduled to begin in 2024 and continue to 2029. As the Town builds capacity, it is recommended that sediment removal be completed for four (4) facilities annually, beginning in 2030.

10.5.2.6 Prioritization

Sediment removal projects were prioritized based on the recommended dates for sediment removal as provided by AECOM (2021). Where too many facilities were recommended to complete within one year, facilities were subsequently prioritized based on the reduction in performance due to sediment accumulation.

10.5.3 SWMF Maintenance

10.5.3.1 Recommended Approach

Maintenance requirements of the Town's SWMF were identified in 2013. The Town already maintains a budget for SWMF maintenance; as such, the maintenance recommendations from

2013 are to be included as part of the existing maintenance program. It is further recommended that the Town develop a tracking protocol to document when recommended maintenance activities have been completed. This is to be completed as part of the Town's broader Routine SWM Infrastructure Maintenance Program.

10.5.3.2 Cost and Funding

Maintenance costs were only carried forward for SWMF 9-4 to address an erosion issue. A cost of $10,000 was applied. As the Town already maintains a budget line for SWMF maintenance, no additional costs were allocated for these works, as it is assumed these works will be implemented through the existing budget.

10.5.3.3 Timeframe

SWMF maintenance is already an existing Town program, and should therefore be continued throughout the entire implementation period.

10.5.4 SWMF Retrofits

Retrofits improve or enhance the water quality, quantity and erosion control performance of existing stormwater management facilities and bring them in-line with current standards.

10.5.4.1 Recommended Approach

Since there was not sufficient information for all facilities to determine retrofit need, additional investigations will be required to determine need for retrofit. The final list of facilities to be retrofitted may therefore change pending the results of these investigations. Facilities currently recommended for retrofits are listed below and presented in **Figure 10.1**:

- Level of Service: since the design level of service of these facilities doesn't meet the Town's current standards, it is recommended that these facilities be retrofitted to meet the Town's current standards, or the maximum extent possible. This includes the following fifteen (15) facilities: 6-1, 6-2, 6-3, 7-1, 7-2, 7-3, 7-5, 7-6, 7-7, 7-10, 7-11, 7-16, 8-2, 8-4, and 13-1.
- Dry to Wet Retrofit: Retrofitting dry ponds to wet ponds allows for the facility to provide water quality controls. The following six (6) facilities were recommended for dry to wet retrofit: 1-1, 4-1, 7-4, 9-1, 14-1, and 15-1.
- Catchment Source and Conveyance Controls:
    - Four (4) of the Town's dry ponds have catchments too small to support wet pond retrofits. As such, source and conveyance controls to improve water quality are recommended within the following four (4) catchments: 5-2, 8-6, 8-10, and 8-11.
    - SWMF 7-9 is an online channel facility, with multiple water quality facilities within its catchment. However, not all of its catchment receives water quality treatment; as such, source and conveyance controls are recommended within these untreated catchment areas.
    - SWMF 10-1 was retrofitted in 2019 to the maximum extent possible, although it did not achieve Enhanced water quality treatment. As such, source and conveyance controls within its catchment are recommended.

- SWMF 13-2 was proposed for retrofit, but the benefits of retrofit were subsequently deemed to minimal. When road reconstruction occurs within its catchment, source and conveyance controls should be considered.

The following facilities were not assessed for retrofit, as the catchments are not built out: 3-1, 3-2, 3-3, 4-3, 5-1, 6-4, 6-5, 8-13, 9-4, 10-6, and 10-7.

10.5.4.2 Approvals, Policy, By-law or Design Standards Consideration

The study and resulting recommended retrofit works are exempt from the Municipal Class EA process and therefore can proceed directly to detailed design and implementation.

Permits from the MECP may required where projects may impact Species at Risk. Under the Endangered Species Act, the MECP can grant permits or other authorizations for activities that would otherwise not be allowed, with conditions that are aimed at protecting and recovering species at risk.

Fisheries and Oceans Canada (DFO) administers development requirements relating to aquatic habitat under the Fisheries Act. This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery. A self-assessment will need to be undertaken for all pond retrofits and new park projects involving works in wetlands and watercourses.

A permit under Ontario Regulation 179/06 or 172/06 - Development, Interference with Wetlands and Alterations to Shoreline Watercourse will be required through the LSRCA or NVCA for any facilities within regulations limits, impacts a wetland or requires the establishment of an outlet. Permits for the maintenance of SWM facility blocks are not generally required from LSRCA or NVCA.

10.5.4.3 Cost

Appendix C includes a list of each SWMF, the retrofit recommendations, and the associated cost. The total retrofit cost estimate is $15.1 million.

10.5.4.4 Funding

The Town currently allocates approximately $700,000 per year from general revenue for SWM pond cleanouts and retrofits. This allocation would be sufficient for SWM pond cleanouts alone, but not for the Town to complete retrofits as well as the required pond cleanouts.

10.5.4.5 Timeframe

SWMF retrofits are scheduled to begin in 2025 and continue through 2041. One (1) or two (2) facilities will be retrofitted each year.

10.5.4.6 Prioritization

In general, the sequencing of the remaining SWM facility retrofits was prioritized based on facility age, with older facilities being retrofitted first (**Table 10.6**). Prioritization was occasionally modified to prevent high-cost facilities from being retrofitted in subsequent years.

Table 10.6: SWMF Retrofit Prioritization

Years	SWMF
2025-2026	4-1
2026-2027	9-1, 8-4
2027-2028	15-1
2028-2029	8-2
2029-2030	7-4
2030-2031	7-2
2031-2032	7-3
2032-2033	7-5, 7-6
2033-2034	6-1
2034-2035	7-7, 7-10
2035-2036	13-1, 1-1
2036-2037	6-2, 6-3
2037-2038	7-11
2038-2039	7-1
2039-2040	7-16
2040-2041	7-17, 14-1

10.5.5 SWMF Studies for Existing Facilities

10.5.5.1 Future Studies

To address deficiencies in information about various SWM facilities, it was recommended that additional investigations be completed, as recommended for each facility (**Appendix C**). These Level of Service investigations include topographic and bathymetric surveys (if not completed recently), modeling, monitoring, and quantity control retrofit feasibility studies, as required for each of the 19 facilities for which this study is recommended.

In addition, many of the Town's SWM facilities do not have a design report on file. A study is therefore recommended to reverse engineer these design reports for the 23 facilities for which a report is missing.

10.5.5.2 Recommended Approach

The SWM-MP & FS recommends that the Town combine the Level of Service studies and the Reverse Engineering of Design Reports studies to improve the efficiency of the studies. The implementation schedule refers to these studies as "SWM Facility Study."

10.5.5.3 Cost and Timeframe

To reduce redundancies, it has been assumed that the Quantity Control Level of Service Study and the Reverse Engineering Design Reports will be completed concurrently. The total cost of these combined studies will be $779,000. However, the studies have been broken into two

phases throughout the implementation period, for a cost of $388,000 and $391,000 for the two phases, respectively. Higher priority facilities should be investigated in earlier phases. The study phases will occur in 2024 and 2032.

10.5.5.4 Prioritization

The SWMF studies will be completed in two phases. It is recommended that the two phases include the facilities as outlined in **Table 10.7**.

Table 10.7: SWM Facility Study Prioritization

Study Phase	SWM Pond #	Quantity Control Study	Modelling	Reverse Engineer Report
Phase 1	9-3		yes	yes
	4-1	yes		yes
	9-1		yes	yes
	15-1		yes	yes
	8-4	yes		yes
	8-9		yes	yes
	8-2	yes		
	7-2	yes		
	8-5		yes	yes
	6-1	yes		
	7-3	yes		
	7-5	yes		yes
	7-6	yes		yes
	7-7	yes		yes
	7-9	yes		yes
Phase 2	7-10	yes		yes
	13-1	yes		yes
	6-2	yes		
	6-3	yes		
	7-11	yes		yes
	7-12		yes	yes
	7-1	yes		
	8-6	yes		
	7-14		yes	yes
	7-15		yes	yes
	1-1		yes	yes
	7-17	yes		yes
	8-10		yes	yes
	8-11		yes	yes
	8-3		yes	yes
	10-1	yes		yes

10.5.6 New SWMF

New end-of-pipe SWM facilities are to be constructed in parks and vacant lots within existing urban areas of the Town without SWM controls to increase the proportion of SWM controlled drainage areas in Innisfil and improve water quality control, water quantity control, and erosion control.

10.5.6.1 Evaluation of New Pond Opportunities

As discussed in **Section 8.5,** three (3) SWM opportunities were identified as feasible for the construction of new stormwater management facilities as part of park rehabilitations based on the four (4) phase technical assessment.

For each of the SWM opportunity sites, five (5) alternative solutions were evaluated using baseline information collected as part of the technical evaluation process and a list of evaluation criteria. These alternatives are described below with specifics dependant on each particular site:

- **Alternative 1: Do Nothing** – This alternative involves leaving the site as it is, and not pursuing any SWM improvements at the location.
- **Alternative 2: Wet Pond** – This alternative involves the construction of a stormwater quality control pond at each site.
- **Alternative 3: Constructed Wetland** – This alternative would involve the construction of a large constructed wetland.
- **Alternative 4: Hybrid SWM Facility** – This alternative would involve the construction of a facility that consists of a wet pond element and a wetland element, connected in series.
- **Alternative 5: Subsurface Storage Facility** – This alternative would involve the construction of an underground facility that captures, stores, and releases stormwater.

Scoring of the criteria produced a preferred alternative based on the highest score, which was then developed into a conceptual design. A description of the evaluation criteria and the evaluation of alternatives can be found in **Appendix E**.

10.5.6.2 Recommended Approach

The SWM-MP & FS recommends the construction of three (3) new SWM facilities, two (2) of which may be completed as part of park enhancements. The locations for these SWM opportunities are illustrated within **Figure 10.1**.

10.5.6.3 Approvals, Policy, By-law or Design Standards Consideration

The study and resulting recommended works for new SWM facilities have been completed following Schedule B of the Municipal Class EA process and therefore can proceed directly to detailed design and implementation. It is strongly recommended that the Town utilize neighbourhood design charrettes or other collaborative public engagement approaches at the earliest possible stage of planning for SWM in public parks. Early and on-going participation of residents in the design and planning of SWM projects on public lands results in projects that

reflect the values and aesthetics of local neighbourhoods and builds support amongst area residents and businesses.

MECP Environmental Compliance Approval (ECA) per Section 53 of the Ontario Water Resources Act / Application for Approval of Municipal and Private Sewage works will be required prior to the construction of new SWM facilities. Where existing facilities are to be retrofitted, the City will need to update the Consolidated Linear Infrastructure ECA.

Permits from the MECP may also be required where projects may impact Species at Risk. Under the Endangered Species Act, the MECP can grant permits or other authorizations for activities that would otherwise not be allowed, with conditions that are aimed at protecting and recovering species at risk.

Fisheries and Oceans Canada (DFO) administers development requirements relating to aquatic habitat under the Fisheries Act. This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery. A self-assessment will need to be undertaken for all pond retrofits and new park projects involving works in wetlands and watercourses.

A permit under Ontario Regulation 179/06 or 172/06 - Development, Interference with Wetlands and Alterations to Shoreline Watercourse will be required through the LSRCA or NVCA for any facilities within regulations limits, impacts a wetland or requires the establishment of an outlet. Permits for the maintenance of SWM facility blocks are not generally required from LSRCA or NVCA.

Prior to the implementation of an individual project, the Town shall review each site-specific project for the potential to impact known or potential cultural heritage resources and complete heritage screenings or technical studies in compliance with the heritage policies of the Innisfil Official Plan as well as other policies and procedures using the resources below relating to:

- Archaeological resources, including land-based and marine,
- Built heritage resources, including bridges and monuments, and
- Cultural heritage landscapes.

10.5.6.4 Cost

The implementation of three (3) proposed SWM facility opportunities is estimated to cost approximately $4.7 to $5.5 million, including engineering design, construction, and park rehabilitation. This cost also includes a land purchase for 24 King Street North, Cookstown, using an average land purchase price within the Town of Innisfil. Implementation costs for the proposed SWM facility opportunities are summarized in **Table 10.8**.

Table 10.8: New SWM Facility Costs

Site ID	Location Name	EA Schedule	Recommended Facility Type	Cost ($) (millions)†
1	24 King Street North	B	Surface Facility	$1.9 – 2.2
4	Stroud Community Centre	B	Surface Forebay	$2.0 – 2.2
5	Aspen Street Park	B	Surface Facility	$0.8 – 1.1
			Total	**$4.7 – 5.5**

† Class 'C' cost estimate, all values in 2023 CDN dollars, including design, construction, park rehabilitation, and land purchase for 24 King Street North.

10.5.6.5 Funding

The Town has not currently allocated any funding from general revenue for the development of new stormwater facilities. Federal funding to support the new SWM facilities may be available through the Disaster Mitigation and Adaptation Fund, but the Town would still be required to fund a portion of the projects.

10.5.6.6 Timeframe

New facility design and construction will begin in 2029, and will continue until 2034.

10.5.6.7 Prioritization

New facilities were prioritized based on the proportion of the applicable subwatershed that currently receives water quality treatment.

10.5.7 Integration

SWM facilities are often in or adjacent to public open spaces such as parks and trail networks. As a result, there is a potential synergy with parks rehabilitation and enhancements within many SWM facility projects. It has been shown through previous Master Plans for other Ontario municipalities that 'broader community benefits' are required when implementing new SWM facilities in established neighbourhoods in order to gain community support and ensure the project success.

The retrofit of existing SWM facilities and design of new SWM facilities should respect the objectives of the **Land and Lake Plan** (2023) which establishes a vision for activities that affect open space planning, parks operations and forestry, and recreation services, and will develop the action plans needed to achieve the vision. It will be crucial to recognize the opportunity for stormwater retrofits that parks can present. Stormwater management can be incorporated into existing and future parks via subsurface stormwater chambers, bioswales and bioretention facilities, and dry stormwater management facilities.

Additional municipal programs that provide opportunities for integration with the stormwater management facility strategy are:

- Asset Management Plan (2019)
- Belle Aire Creek Diversion and Wetland Creation (2020)

- Orbit Potential and Innovation Plan (under development)

10.5.8 Recommendations

- It is recommended that the Town continue to complete sediment removal from SWM facilities as needed as part of the **Sediment Management Program**. Nineteen facilities are currently overdue for cleanout. After these facilities have been cleaned out, it is recommended the Town clean out an average of four (4) facilities per year;

- It is recommended that the Town incorporate the maintenance recommendations from 2013 as part of the **Routine SWM Infrastructure Maintenance Program**. It is further recommended that the Town develop a tracking protocol to document when recommended maintenance activities have been completed;

- It is recommended that the Town complete the recommended **SWM Facility Studies** - SWM facility Level of Service and Reverse Engineering studies;

- It is recommended that the Town complete the recommended **SWM facility retrofits** and the construction of **new SWM facilities**;

- It is recommended that the Town utilize neighbourhood design charrettes at the earliest possible stage of planning for SWM in public parks. Early and on-going participation of residents in the design and planning of SWM projects on public lands results in projects that reflect the values and aesthetics of local neighbourhoods and builds support amongst area residents and businesses;

- In light of the risks associated with increases in SWM catchments areas, it is recommended that the Town prohibit the expansion of SWM facility catchment boundaries beyond the limits described in original designs. Where it is feasible for retrofits to meet Enhanced quality control for the new catchment area, SWM facility catchment areas may be expanded.

- It is recommended that the Town investigate an alternative, stable funding source instead of relying on allocations from general revenue (see **Section 10.9.2**), as there is insufficient fund allocated towards the Town's SWM facilities in the current budget.

10.6 Flood Management and Watercourse Restoration

10.6.1 Model Calibration

A watercourse monitoring program is recommended to enable full calibration of the VO model. **Appendix F (Existing and Future Conditions Hydrology and Hydraulic Models, October 2023)** includes a recommended monitoring program that is targeted towards the model calibration.

10.6.1.1 Cost

The model developed as part of the SWM-MP & FS is uncalibrated. Monitoring, calibration, and validation is expected to cost $150,000 over two years.

10.6.1.2 Prioritization and Timeframe

Monitoring, and model calibration and validation will occur in 2024 and 2025.

10.6.2 High Priority Flood Risk Areas

A total of 20 priority flood risk areas were identified along the Town's watercourses, not including flood risks associated with Lake Simcoe. It is recommended that the Town complete a Shoreline Flooding Management Plan to mitigate flood risks associated with Lake Simcoe water levels.

10.6.2.1 Evaluation of Flood Management Alternatives

As previously detailed in **Section 0**, twenty (20) flood risk sites were identified through the modeling process. Recommendations for reducing flood risk have been divided into two (2) categories, including structural alternatives and non-structural alternatives. In addition, a Do Nothing alternative must always be considered.

Structural Alternatives

- Stormwater flood storage
- Channel realignment
- Watercourse capacity upgrades
- Regrading, engineered berms and/or elevation changes
- Culvert capacity upgrades
- Flood proofing
- Diversions
- Local remedial measures

Non-Structural Alternatives

- Land or easement acquisition (including Temporary and Permanent Easement Requirements)
- Regulation (e.g., zoning, bylaws, engineering standards, etc.)
- Emergency programs

A preliminary screening of the above alternatives was completed to identify which alternatives, or combination of alternatives, would be appropriate for each of the flood risk locations. Alternatives which would not be feasible at a location were therefore removed from the detailed evaluation of alternatives, such that the detailed evaluation only included alternatives that would be feasible and applicable.

Scoring of the evaluation criteria produced a preferred alternative based on the highest score, which was then developed into a conceptual design. Cost estimates for engineering services (i.e., design, background studies such as geotechnical investigations) and construction costs for each of the preferred alternatives was estimated for each of the preferred alternatives for each site.

A description of the evaluation criteria and the evaluation of alternatives can be found in **Appendix G**.

10.6.2.2 Recommended Approach

The **Flood Mitigation Preferred Alternatives Report (Appendix G)** identifies 20 priority flood risk locations throughout the Town, including the evaluation of the preliminary alternatives, the selection of the preferred solution, and the development of the preliminary conceptual designs. Flood risk sites, including cost estimates, are identified in **Table 10.9**, and graphically in **Figure 10.1**. Where culvert upgrades were proposed as the preferred alternative, preliminary culvert sizing and road regrading were identified to enable the culvert to convey the design flow for the specific crossing. Flooding is still anticipated to continue during events larger than the design storm, unless the detailed design process is further able to refine the design to further contain the flows. During detailed design, the proposed design can be refined to vary the dimensions of the culvert, number of barrels, road elevation, extents of channel restoration and/or enlargements, easement requirements, etc. based on the detailed surveys that will be completed as part of pre-design stages. As well, pre-consultation with the LSRCA or NVCA, as applicable, is recommended to confirm what will be accepted at this location.

Technical solutions may be combined with property acquisition pending the results of a cost benefit analysis. During detailed design, if the design is found to be non-feasible from a technical or agency approval perspective, then it is recommended that the Town use the allocated budget for this project to acquire adjacent property with an elevated flood risk, pending the results of the aforementioned cost benefit analysis.

The identification of flood risk locations and the associated preferred alternatives was completed with an uncalibrated model. It is recommended that the Town undertake monitoring of select watercourses in order to calibrate the model developed as part of this study. Once calibration is complete, the identification of the top 20 flood risk locations should be confirmed.

10.6.2.3 Policy, By-law or Design Standards Consideration

Expected permitting requirements for each flood mitigation site have been summarized in **Table 10.9**.

MECP permits will only be required where projects may impact Species at Risk. Under the Endangered Species Act, the MECP can grant different types of permits or other authorizations for activities that would otherwise not be allowed, with conditions that are aimed at protecting and recovering Species at Risk.

DFO administers development requirements relating to aquatic habitat under the Fisheries Act. This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery. DFO approval will be required for works at most sites.

MNRF permits may be required under the Ontario Fish and Wildlife Conservation Act, where fish and wildlife collection and relocation will be required.

A permit under Ontario Regulation 179/06 - Development, Interference with Wetlands and Alterations to Shoreline Watercourse will be required through the LSRCA for in-water works.

Prior to the implementation of an individual project, the Town shall review each site-specific project for the potential to impact known or potential cultural heritage resources and complete heritage screenings or technical studies in compliance with the heritage policies of the Innisfil Official Plan as well as other policies and procedures using the resources below relating to:

- Archaeological resources, including land-based and marine,
- Built heritage resources, including bridges and monuments, and
- Cultural heritage landscapes.

Some of the watercourses within Innisfil are located on private property, and therefore any flood mitigation works will require work on private property. It is recommended that the Town develop a policy for works on private property that will apply to these projects (**Section 10.9.1**).

10.6.2.4 Cost

The implementation costs associated with each site are identified in **Table 10.9.** This includes 20% for design and engineering, and a 20% contingency. Estimated land purchase costs were also included for the two flood control facilities, and design and engineering was only estimated at 10% for these projects. Areas 2 and 17 are on municipal drains that require new Section 78 reports; the Town's portion for these reports has been included in the cost. Area 18, although adjacent to a County Road, is not on County property, and is therefore to be completed by the Town. As Area 18 is on a branch of an existing municipal drain, it is recommended that the Town complete a Section 4 petition for a new branch of the existing municipal drain, the cost of which has also been included.

Area 19 involves a culvert on a Simcoe County road; the completion of this project has not been attributed to the Town, and is instead allocated to the County ($1.6 million). However, since Area 19 is on a branch of an existing municipal drain, it is recommended that the Town complete a Section 4 petition for a new branch of the existing municipal drain. These costs have been attributed to the Town ($100,000).

The remaining projects are either on private property ($6.0 million) or Town property ($103.8 million). The SWM-MP & FS has assumed that the Town will carry the cost and responsibility of completing the works on private property; however, once the Town has developed a policy for works on private property, these costs may no longer be born by the Town depending on the policy. The SWM-MP & FS has assumed that the Town will carry the cost and responsibility of completing the works on municipal drains.

10.6.2.5 Funding

The Town has allocated approximately $900,000 per year for drainage improvements to various road, as well as about $200,000 per year for bridge and/or culvert rehabilitations. This allocation is insufficient to fully fund the flood mitigation works associated with the high priority flood risk areas. It is also anticipated that the Town may be able to acquire grants, such as the Disaster Mitigation and Adaptation Fund.

Where projects are to be completed on municipal drains, the Town may consider apportioning the cost of works to the properties on the drains. However, to be conservative, it has been

assumed that the Town will carry the cost and responsibility of completing the works on municipal drains.

10.6.2.6 Prioritization and Timeline

Flood mitigation projects for the high priority flood risk areas were prioritized based on the storm event that triggers flooding:

- Priority 1: 2-year event triggers flooding
- Priority 2: 5-year event triggers flooding
- Priority 3: 10-year event triggers flooding
- Priority 4: 25-year triggers flooding
- Priority 5: 50-year or higher triggers flooding

The Implementation Plan assumes flood mitigation works will continue from 2025 to 2041. As the Town has already scheduled some road upgrades at locations where works are recommended, these projects should be completed concurrently. These include:

- Area 5 – Although this is a Priority 2 location, the Town is upgrading 25th Sideroad over the next five years; as such, this project is recommended to occur when the 25th Sideroad upgrades occur, assumed to be in 2025 based on current phasing.
- Area 11 – The Town is proceeding with works to upgrade 7th Line and to realign Banks Creek so that it is no longer the roadside ditch and can be returned to a coldwater regime. To achieve efficiencies, it is recommended that the culvert be replaced at the same time that 7th Line is reconstructed, assumed to be in 2026.
- Area 2 – Since the Town is completing works on Pinegrove Avenue in 2024, works on Area 2 have been postponed to be one of the final Priority 1 areas addressed, and is scheduled for 2031.

Table 10.9: Preferred Alternatives for Priority Flood Risk Sites

Area ID	Location Name	Preferred Alternative	EA Schedule	Considerations	Permitting†	Cost
1	Bridle Path Culvert	Bridle Path Culvert Replacement and Road Regrading	Schedule B Completed	Private Property	LSRCA, DFO, MNRF, MECP-SAR	$1,740,000
2	Pinegrove Avenue Culvert	Pinegrove Avenue Culvert Replacement and Road Regrading	Schedule B Completed	Municipal Drain – Section 78 Report Required	LSRCA, DFO, MNRF, MECP-SAR	$2,769,000
3	Main Street and 25th Sideroad	Improve Channel Conveyance Capacity and Raise Elevation of 25th Sideroad	Schedule B Completed	Private Property	LSRCA, DFO, MNRF, MECP-SAR	$3,187,000
4	Sandy Cove Acres	Lockhart Road Culvert Replacement	Schedule B Completed		LSRCA, DFO, MNRF, MECP-SAR	$2,426,000
5	Cook Street and 25th Sideroad	Culvert Replacement at 25th Sideroad	Schedule B Completed		LSRCA, DFO, MNRF, MECP-SAR	$1,002,000
6	Trinity Street and Kildare Avenue	Upstream Flood Control Facility Combined with Potential Culvert Replacement	Schedule B Completed	Land Acquisition Required	LSRCA, DFO, MNRF, MECP-SAR, MECP-ECA	$24,200,000
7	25th Sideroad, Wallace Avenue and Ralph Street Culverts	Upstream Flood Control Facility	Schedule B Completed			

Area ID	Location Name	Preferred Alternative	EA Schedule	Considerations	Permitting†	Cost
8	Tall Tree Lane and Buchanan Street Culverts	Culvert Replacement at Tall Tree Lane and Buchanan Street	Schedule B Completed		LSRCA, DFO, MNRF, MECP-SAR	$4,752,000
			Schedule B Completed		LSRCA, DFO, MNRF, MECP-SAR	$5,040,000
9	Plum Drive Culvert	Culvert Replacement	Schedule B Completed		LSRCA, DFO, MNRF, MECP-SAR	$812,000
10	St. John's Road Culvert (North of Anna Maria Drive)	Culvert Replacement and Realignment	Schedule B Completed		LSRCA, DFO, MNRF, MECP-SAR	$1,928,000
11	St. John's Road Culvert (7th Line)	Culvert Upgrade at St. John's Road and 7th Line	Schedule B Completed		LSRCA, DFO, MNRF, MECP-SAR	$2,695,000
12	Belle Aire Creek	Refer to separate EA for Belle Aire Creek	Schedule B Completed		-	-
13	Carson Creek Outlet	Engineered Berm and Regrading	Schedule B Completed	Municipal Drain – coordinate improvement with ongoing Section 78 Report	LSRCA	$504,000
14	Ferrier Avenue, Gilmore Avenue, and	Culvert Replacements at Ferrier Avenue, Gilmore Avenue and Corner	Schedule B Completed	Municipal Drain – coordinate improvement with ongoing Section 78 Report	LSRCA, DFO, MNRF, MECP-SAR	$2,249,000
						$2,010,000
						$2,016,000

Area ID	Location Name	Preferred Alternative	EA Schedule	Considerations	Permitting†	Cost
	Corner Avenue Culverts	Avenue with Local Channel Improvement				
15	Killarney Beach Road (West of 20th Sideroad)	Culvert Maintenance and Local Channel Improvement	Schedule B Completed	Municipal Drain – coordinate improvement with ongoing Section 78 Report	LSRCA, DFO, MNRF, MECP-SAR	$1,008,000
16	White Birch Creek Outlet	Upstream Flood Control Facility	Schedule B Completed	Land Acquisition Required	LSRCA, DFO, MNRF, MECP-SAR, MECP- ECA	$48,400,000
17	10th Line and Railway Crossing	Municipal Drain and Valley Corridor Improvement	Schedule B Completed	Municipal Drain - Section 74 Maintenance for 10th Line and Railway Crossings on Hewitts Creek Drain	LSRCA, DFO, MNRF, MECP-SAR	$1,984,000
18	Innisfil Beach Road (east of Yonge Street)	Raise Private Road	Schedule B Completed	Private Property Section 4 Petition for New Branch of Hewitts Creek Drain under Drainage Act	LSRCA	$446,000
19	Innisfil Beach Road (west of Yonge Street)	Culvert Replacement and Regrade the Road	Schedule B Completed	County Road Section 4 Petition for New Branch of 8th Line Municipal Drain under Drainage Act	LSRCA, DFO, MNRF, MECP-SAR	$2,057,000
20	Highway 400 Culvert (north of 7th Line)	Future Development Regrading	Schedule B Completed	Private Property	LSRCA	$600,000
					Total	**$111,415,000**

Area ID	Location Name	Preferred Alternative	EA Schedule	Considerations	Permitting†	Cost

† DFO – Fisheries and Oceans Canada
LSRCA – Lake Simcoe Region Conservation Authority
MECP-SAR – Ministry of the Environment, Conservation and Parks Species at Risk
MNRF – Ministry of Natural Resources and Forestry

10.6.3 Other Culvert Replacements

As described in **Section 9.2**, culverts conveying watercourses were evaluated based on their condition and/or conveyance capacity. A total of 80 culverts were not assessed, either due to their location on private property that didn't grant access; an inability to access the culvert due to high water, construction, or lack of safe access; or staff were unable to locate the culvert.

10.6.3.1 Recommended Approach

Based on the results of the assessment, 111 culverts are recommended for replacement to improve conveyance capacity, and 5 culverts are recommended for replacement due to poor condition. Culverts which are undersized and/or in poor condition should be replaced as needed. Of the 111 culverts recommended for replacement, 18 are owned by the County, 2 by the Province, 2 are private, and 2 are unassumed. For these 24 culverts, it is recommended that the Town collaborate with the appropriate owner to ensure the culverts are upgraded as required. Culvert replacement is recommended to be an ongoing Culvert Replacement and Upgrade Program.

10.6.3.2 Future Studies

A total of 80 culverts were not inspected due to their location on private property that didn't grant access; an inability to access the culvert due to high water, construction, or lack of safe access; or staff were unable to locate the culvert. It is recommended that the Town inspect these culverts to confirm their presence/absence and to confirm their condition and capacity. Based on the results of this inspection, additional culverts may be recommended for replacement. This study may be completed internally or externally, and should include model updates for these 80 culverts. However, the Town should confirm access to the culverts prior to the hiring of an external consultant, if the Town prefers for an external entity to complete the study.

10.6.3.3 Policy, By-law or Design Standards Consideration

All culvert replacements should be evaluated to determine the permitting requirements, similar to those described above for the high priority flood risk areas.

10.6.3.4 Cost

Detailed modeling was not completed to size the recommended culvert replacement, as this is typically done at the detailed design stage in concert with the roadway design. A high-level cost estimate was determined for the Town's culverts assuming that each culvert would be increased by two sizes. The smallest culvert upsize was priced at $8,827.8 per linear metre, while the largest (anything above 3000 x 2400mm box culvert) was priced at $30,030.40 per linear metre. To replace the 71 culverts owned by the Town, and not already included in the high priority flood risk areas, will cost approximately $46.5 million. The SWM-MP & FS has allocated $1 million annually for culvert replacements, for a total of $18 million over the implementation period. This results in some culverts not being upgraded until after 2041.

The cost associated with inspecting, surveying, and modeling the additional 80 culverts will cost approximately $100,000.

10.6.3.5 Funding

The Town has allocated approximately $900,000 per year for drainage improvements to various road, as well as about $200,000 per year for bridge and/or culvert rehabilitations. This allocation is insufficient to fully fund the culvert replacements.

10.6.3.6 Timeframe

It is recommended that the required culvert replacements begin after the high priority flood mitigation works are completed. However, for scheduling and budgetary purposes, it has been assumed that one downstream culvert will need to be replaced for every culvert replaced as part of the high priority flood risk areas; as such, these culvert replacements will begin in 2025.

It is recommended that the study of the additional 80 culverts occur in 2028.

10.6.4 Flood Control Operations and Maintenance

Due to the frequency of flooding in various parts of the Town, it is understood that operations and maintenance activities by Town staff are required to mitigate the effects of flooding. This can include pumping of water to reduce water levels, thawing frozen culverts, etc. Once the flood mitigation options have been constructed, it is expected that the operation and maintenance efforts can be reduced, but until then, they should be maintained.

10.6.4.1 Cost

Flood control operations and maintenance has been estimated at $30,000 per year starting in 2024. It was reduced to $20,000 per year in 2035, assuming that the completed flood mitigation works will have started taking effect by then.

10.6.4.2 Funding

While flood control operations and maintenance is typically included in the Town's operations budget, it was removed from the 2023 budget allocations from general revenue.

10.6.5 Private Property Drainage Program

The Town frequently receives complaints from the public about flooding on private property that is not caused by watercourses.

10.6.5.1 Recommended Approach

It is recommended that the Town develop a Private Property Drainage Program with a focus on investigating and relieving these drainage issues. **Figure 10.2** summarizes the proposed process for proceeding to address these complaints. Minor complaints can be addressed internally, while more significant complaints may need to be addressed through a design process with an external consultant.

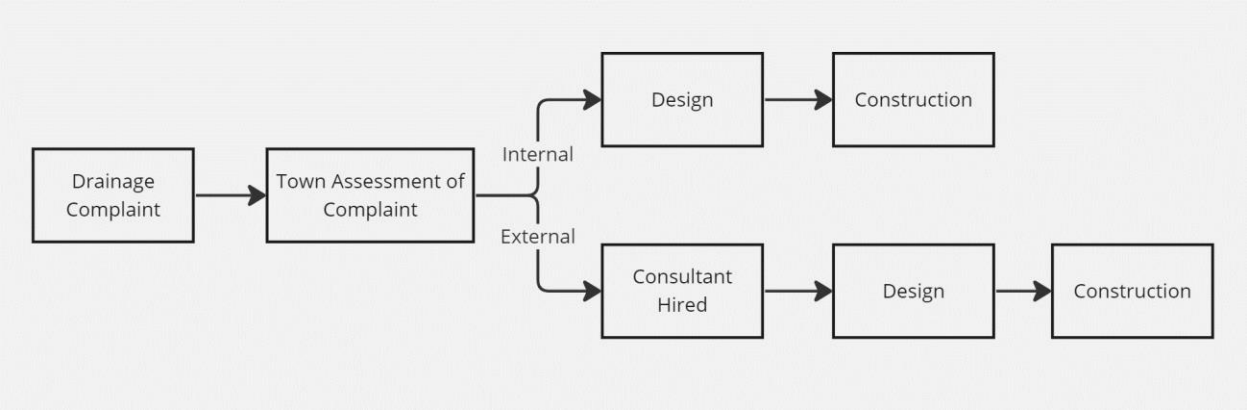


Figure 10.2: Process for Private Property Drainage Program

10.6.5.2 Policy, By-law or Design Standards Consideration

A new policy describing the conditions under which the Town will complete works on private property will need to be developed. This policy is discussed in more detail in **Section 10.9.1.**

10.6.5.3 Cost

It is recommended the Town allocate $100,000 annually to address drainage problems on private property which are not caused by watercourses. These costs can be used for internal or external design and construction.

10.6.5.4 Funding

The Town does not currently allocate any funding towards drainage problems on private property.

10.6.5.1 Timeframe

It is recommended that the Town develop the Private Property Drainage Program in 2024.

10.6.6 Local Drainage Studies

10.6.6.1 Recommended Approach

Belle Aire Creek Road Drainage Study - Based on feedback from the public, it was noted that flooding at the east end of Belle Aire Beach Road does not seem to be exclusively associated with Belle Aire Creek, and may stem from Belle Aire Beach Road ditches, Lake Simcoe water levels, or other localized sources. A local drainage study of this area is therefore recommended, with specific focus on Belle Aire Beach Road, Balsam Road, Spruce Road, Reid Avenue, and culverts LSRCA_135, LSRCA_136 and LSRCA_137. This study should be conducted as a feasibility study, not an Environmental Assessment, and should focus on identifying the source of flooding along Belle Aire Beach Road, Balsam Road, Spruce Road, and Reid Avenue, and should also include consideration of a Mechanical Lift (pump) Station at the east end of Belle Aire Beach Road to help alleviate flooding issues.

Kellough and Lawson Street Drainage Study - Ongoing flood issues have previously been noted at Kellough Street and Lawson Streets. A 2022 study by Azimuth Environmental investigated the drainage and hydrogeological conditions of this area. Azimuth concluded that the drainage

issues experienced in this area is likely due to encroachment of the properties and basements into a shallow water table, exacerbated by limited infiltration rates of the silt and clay till soils in the area. A proposed solution including weeping tiles installed in the rear yards, connected to either the sumps for the houses along Kellough Street with discharge towards the front of the lots onto the streets or connected to the municipal storm sewer network along Lawson Street. Additional study would be required to determine the extent of the drainage issues and to identify whether a Permit to Take Water would be required.

10.6.6.2 Cost

Class C cost estimates associated with local drainage studies are summarized in **Table 10.10**. Construction costs can only be estimated once preliminary studies and/or design are complete.

Table 10.10: Estimated Cost Summary and Schedule of Local Drainage Studies

Study	Project Task*	Cost Estimate
Belle Aire Beach Road	Feasibility Study	$125,000
Kellough Street and Lawson Streets	Feasibility Study	$75,000
	Total	**$200,000**

*Construction costs can only be estimated once preliminary studies and/or design are complete.

10.6.6.3 Prioritization and Timeframe

The Belle Aire Beach Road study is recommended in 2026, while the Kellough and Lawson Streets study is recommended in 2027. Depending on the outcomes of the feasibility study, design and construction may follow.

10.6.7 Rain Gauge Study

On June 27, 2023, the Town experienced a significant rain event that caused flooding throughout the town, including in areas that don't typically flood. The LSRCA rain gauge within Innisfil shows that the return period for this storm was between a 2-year and 5-year rain event. However, as there is only one rain gauge, it is possible that more rain fell elsewhere in the Town, and was therefore not recorded.

10.6.7.1 Recommended Approach

It is generally recommended to have rain gauges provide coverage at a 3 km radius. As such, a rain gauge study is recommended to identify locations where new rain gauges may be installed. This will help the Town to evaluate future rain events and better understand which events trigger flooding at various locations throughout Innisfil.

10.6.7.2 Cost

A rain gauge study is estimated to cost approximately $5,000.

10.6.7.1 Timeframe

It is recommended that the rain gauge study occur in 2028, and can be completed as part of the next SWM-MP.

10.6.8 Shoreline Flooding Management Plan

Regular flooding in some areas of the Town is caused by the effect of water levels in Lake Simcoe. Alternatives to address these flooding concerns were not addressed as part of the SWM-MP & FS.

10.6.8.1 Recommended Approach

It is therefore recommended that the Town complete a Shoreline Flooding Management Plan to identify alternatives to mitigate flood risks associated with Lake Simcoe water levels. This could include, but not be limited to:

- Lake level monitoring
- Evacuation plans
- Communication strategy
- Floodproofing guidelines
- Emergency response for mobile pumping operations

10.6.8.2 Cost

The Shoreline Flooding Management Plan is expected to cost approximately $150,000.

10.6.8.3 Prioritization and Timeframe

It is recommended that the Shoreline Flooding Management Plan be completed in 2026.

10.6.9 Municipal Drain Works

The Town has 74.5 km of municipal drains. The Town bears some responsibility for the operations and maintenance of these municipal drains.

10.6.9.1 Recommended Approach

Reporting Under the Drainage Act

The discrepancies in historic watershed and the LiDAR were used to ensure accuracy in the modelling and determine the need for Section 78 reports under the Drainage Act to correct the watershed and assessment schedules. Two drains were found to have significant discrepancies based on the new LiDAR; as such, new Section 78 reports are recommended for:

1. the Second Concession Drain and
2. the South Innisfil Drain Branch B.

One of the recommended High Priority Flood Risk mitigation projects is to be completed by Simcoe County on watercourses that are municipal drains elsewhere in the watercourse (Area 19). It is recommended that Simcoe County complete this project, but that the Town complete the Section 4 petition for a new municipal drain branch of 8th Line Drain.

In addition, it is recommended that the Town complete a Section 4 petition for a new municipal drain branch of Hewitt's Creek Drain as part of the recommended works to address flooding at Area 18.

Drainage Superintendent Program
It is recommended that the Town continue to manage the maintenance of municipal drains within the Town, including maintenance cleanouts and beaver dam removals. The Town has indicated that Prokopchuk Drain and Roulston Drain may no longer need to be municipal drains; as such, it is recommended that the Town consider abandoning these drains under Section 84.

10.6.9.2 Cost

Reporting Under the Drainage Act
The Town's portion for the new Section 78 reports is estimated to be $120,000 for the Second Concession Drain, and $10,000 for the South Innisfil Drain Branch B. The Town's portion for the Section 4 petitions is estimated to be $140,000 for the 8th Line Drain branch, and $100,000 for the Hewitt's Creek branch.

Drainage Superintendent Program
The Town's portion of annual maintenance costs for municipal drains is estimated at $30,000 per year, while beaver dam removals is estimated at $10,000 per year. The Town has already allocated $433,600 for the abandonment of Roulston Drain in 2024.

10.6.9.3 Funding

The Town currently allocates $15,700 for municipal drain maintenance, which is not sufficient to meet the recommended maintenance and beaver dam removal requirements.

10.6.9.4 Timeframe

The following timeframes are recommended for the recommended works:

- Section 78 report for Second Concession Drain - 2027
- Section 78 report for South Innisfil Drain Branch 'B' - 2025
- Abandonment of Prokopchuk Municipal Drain under Section 84 - 2029
- Abandonment of Roulston Drain under Section 84 – 2024
- Section 4 Petition for New Branch of Hewitts Creek Drain - 2032
- Section 4 Petition for New Branch of 8th Line Municipal Drain - 2030

10.6.10 Innisfil Heights Master Drainage Study

10.6.10.1 Recommended Approach

Innisfil Heights will be undergoing future development; as such, the completion of a Master Drainage Study for this area is recommended. A Master Drainage Study would review and refine the hydrologic and hydraulic models, including more detailed future conditions modeling, and selection of preferred stormwater management alternatives. This study could be completed as an Environmental Assessment if the Town will construct SWMF. However, if the landowners will construct the SWMF and convey them to the Town upon assumption; or, if each site constructs its own SWMF on private property, then the study does not need to be an Environmental Assessment.

10.6.10.2 Cost

If the study is being completed as an EA, it expected to cost approximately $150,000; otherwise, it is expected to cost $90,000. For the purposes of this SWM-MP & FS budget, $150,000 has been allocated.

10.6.10.3 Timeframe

It is recommended that this study begin in 2024. If the study is being completed as an EA, it expected to take approximately 18 months; otherwise, it is expected to take 12 months.

10.6.11 Integration

The flood mitigation opportunities will ultimately need to consider how projects align with other Town priorities. Specific municipal programs that provide opportunities for integration with the Watercourse Improvement Program are:

- Transportation Master Plan (2022)

10.6.12 Recommendations

- It is recommended that the Town undertake monitoring of select watercourses in order to calibrate the storm sewer model developed as part of this study.
- It is recommended that the Town **calibrate the VO model** developed as part of this study. Calibration to 20% of peak flows and 20% of event volumes are recommended.
- It is recommended that the Town complete a **rain gauge study** to identify where additional rain gauges may be placed to improve data coverage across all of Innisfil.
- It is recommended that the Town implement the recommended **flood mitigation** alternatives for each of the identified flood risk areas.
- It is recommended that upcoming capital roads projects consider the outputs of the calibrated model when sizing culvert crossings and roadside ditches which are also watercourses.
- It is recommended that the Town **replace and upgrade culverts** that were identified as in poor condition or undersized.
- It is recommended that the Town continue to fund **flood control operations and maintenance** activities to address emergency flooding events.
- Where localized flooding issues have been identified, it is recommended that the Town proceed with **local drainage studies** to determine the cause and identify possible alternatives to resolve the issues. The first two areas recommended for study are Belle Aire Beach Road and Kellough and Lawson Streets.
- It is recommended that prior to moving forward with any flood mitigation works on private property, the Town develop **a policy for works on private property** (**Section 10.9.1**).
- It is recommended that the Town develop a **Private Property Drainage Program** to address flooding issues not caused by watercourses.
- It is recommended that the Town complete a **Shoreline Flooding Management Plan** to mitigate flood risks associated with Lake Simcoe water levels.
- It is recommended that the Town complete **municipal drain maintenance** (clean-outs) on a 10-year frequency, and remove beaver dams as needed.

- It is recommended that the Town initiate new Section 78 reports for the Second Concession Drain, and South Innisfil Drain Branch B.
- It is recommended that the Town abandon the Prokopchuk Municipal Drain and Roulston Drain under Section 84.
- It is recommended that the Town complete Section 4 petitions for new branches of existing municipal drains for 8th Line Municipal Drain and Hewitt's Creek Drain.
- The Town has not allocated adequate funds for the completion of the recommended programs and projects to address flood management and watercourse restoration. As such, it is recommended that the Town investigate an alternative, stable funding source instead of relying on allocations from general revenue (see **Section 10.9.2**).

10.7 Annual Stormwater Monitoring Plan

In order to ensure the goals and objectives of the SWM-MP & FS are accomplished over time, a focused stormwater monitoring program is recommended. Stormwater monitoring helps to identify any existing or emerging water quality and quantity issues, allowing the Town to identify when maintenance and/or infrastructure upgrades are required.

The proposed monitoring plan includes a transition away from monitoring SWMF (except for water levels) to monitoring larger outfalls throughout Innisfil. This proposed plan focuses on the receiving water bodies and their response to upstream SWM techniques, instead of on individual ponds. By monitoring outfalls, the baseline water quality can be identified, and changes in water quality can indicate issues in the upstream catchment that may warrant additional detailed investigations and remedial work. The proposed monitoring plan also considers the forthcoming MECP monitoring requirements as part of the CLI ECA.

In addition, the stormwater monitoring program is recommended to include previous monitoring obligations including but not limited to:

- ECA compliance monitoring. Once the CLI ECA Monitoring Program is implemented, the current ECA compliance monitoring is expected to shift to the CLI ECA monitoring program.
- Other permit compliance monitoring as directed by the GRCA, MNRF, DFO or MECP. To be identified on a case-by- case basis.

10.7.1 Consolidated Linear Infrastructure Environmental Compliance Approval

The Ministry of Environment, Conservation and Parks (MECP) recently implemented the Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA). The CLI ECA consolidates each municipality's SWM infrastructure into one ECA, and grants approval authority for new SWM infrastructure to the municipality provided specific conditions are achieved. In October 2022, the MECP released draft Stormwater Monitoring Guidance for the CLI ECA, which "provides technical and procedural guidance for design considerations and implementation of stormwater monitoring plans."

The draft Stormwater Monitoring Guidance outlines the development and implementation of a monitoring program which focuses on representative monitoring stations to monitor changes

to the overall health of a receiver over time. Monitoring the outlets of stormwater management facilities or infrastructure would only occur if the receiver shows water quality issues, and these outlets need to be monitored to determine the source of the issue.

The Town of Innisfil will need to prepare a Monitoring Plan in compliance with the Stormwater Monitoring Guidance. This monitoring plan must be developed and implemented either by the date of ECA approval or within twenty-four (24) months of the date of the publication of the Monitoring Guidance, whichever is later.

10.7.2 Proposed Monitoring Plan Overview

The proposed monitoring plan includes a transition away from water quality monitoring of SWMF to monitoring larger outfalls throughout Innisfil. Monitoring individual SWMF is very resource-intensive; full implementation across the Town will be cost-prohibitive. In addition, by only monitoring SWMF, the City does not obtain water quality information from the urban area that is not controlled through SWMF.

By monitoring outfalls, the baseline water quality can be identified, and changes in water quality can indicate issues in the upstream catchment that may warrant additional detailed investigations and remedial work. The proposed monitoring plan also considers the forthcoming MECP monitoring requirements as part of the CLI ECA.

The below sections outline a preliminary monitoring plan. It is recommended that the Town develop a detailed monitoring plan in 2024.

10.7.2.1 Flow Proportionate Sampling

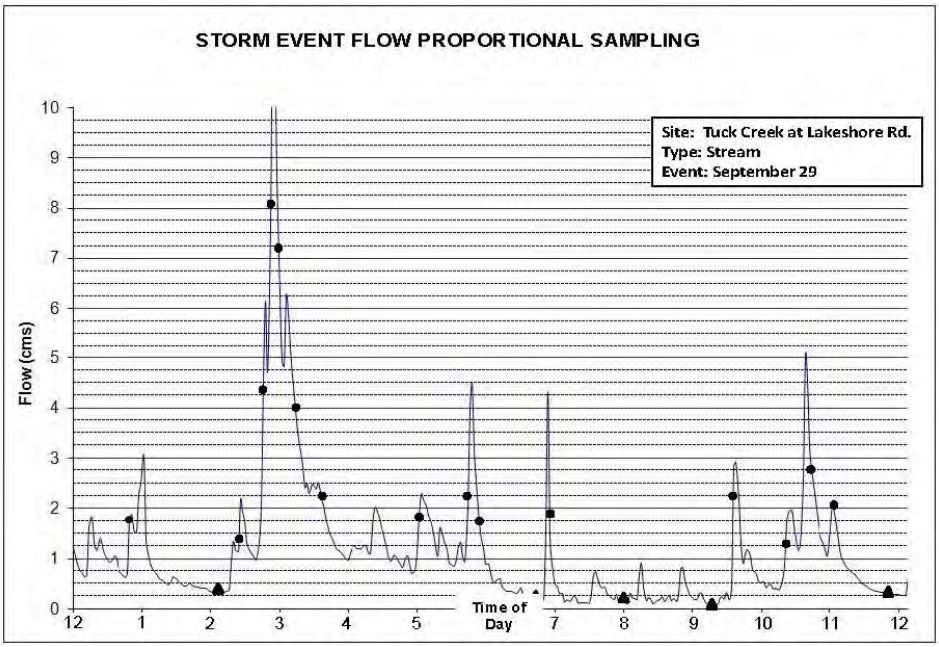
The use of flow proportionate samples taken for at least one benchmark site is typically required in order to thoroughly assess the variability of water quality through the course of the runoff events and over the course of several seasons and/or years. In this regard it is recommended that the Town consider the need to install automated flow and water quality sampling equipment.

The objective, as explained below, would be to collect ‘flow proportionate samples’ for at least eight events in order to more rigorously characterize the variability of water quality over the period of sampling.

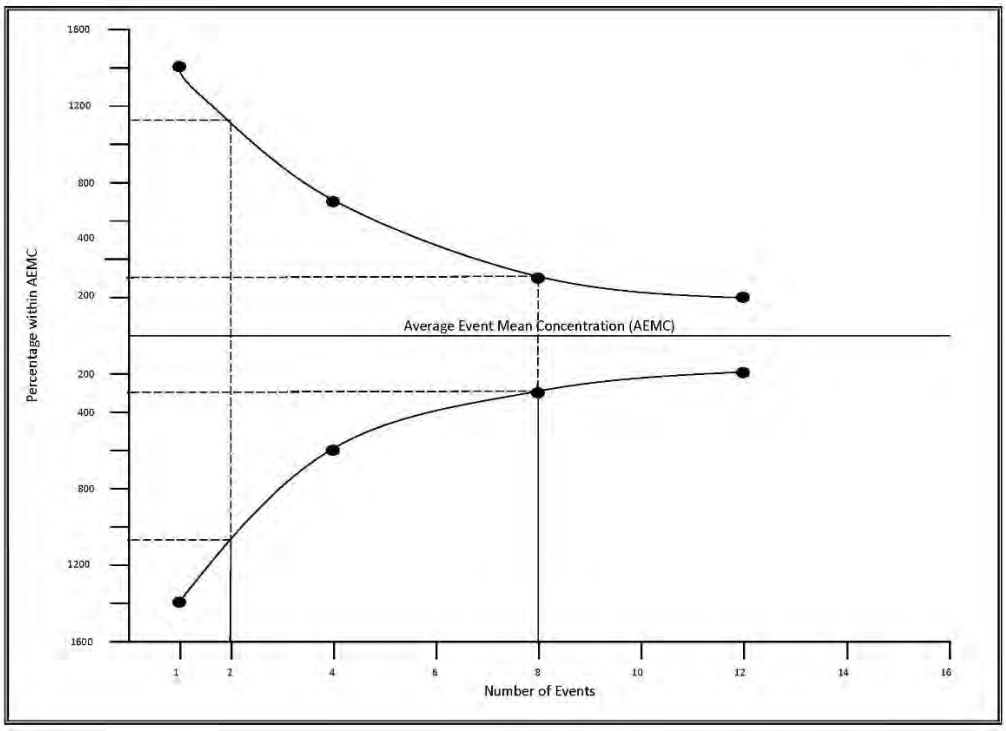
Event Mean Concentration (EMC) is the primary output of flow proportionate sampling. An EMC is the average concentration of a selected constituent over a unit time of flow, generally a wet-weather (storm) event. The EMC for a given event (or series of events) can be compared to a regulatory value (e.g., Provincial Water Quality Objective) and be used to calculate pollutant mass loadings into receiving waters and to judge the effectiveness of stormwater management measures.

There are a number of fundamentals for undertaking flow and water quality monitoring which are outlined below.

- **Variability of Pollutant Concentration during an Event:** Pollutant concentrations (see accompanying graph) vary considerably during an event. It is therefore important to gather flow proportionate samples in order to obtain an accurate representative of the average concentration during the event (Event Mean Concentration) as well as the pollutant loading.



- **Variability of Event Mean Concentration (EMC) from Event to Event:** The EMC will vary significantly from event to event. This is a result of a number of factors including rainfall patterns, inter event period and time of year. Therefore, as is shown on the accompanying graph, it is necessary to collect flow and water quality information from at least 8 events from storm sewer outfalls if mass loadings are to be reasonably defined.



- **Relationship between Nutrients and Total Suspended Solids:** Previous studies show a strong relationship between nutrient concentrations and Total Suspended Solids. Collection of nutrient data and TSS data is therefore valuable.
- **Influence of Land Uses:** Previous studies have shown that the concentrations from different land uses (i.e. industrial, commercial and residential) do not vary as much as is generally thought. Typically, EMC's from different land uses are within 10-20 percent.

10.7.2.2 Adaptive Environmental Management

The monitoring plan has been developed in keeping with the Adaptive Environmental Management (AEM) process which is "A systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective form - "active" environmental management - employs management programs that are designed to experimentally compare selected policies or practices, by evaluating alternative hypotheses about the system being managed."

Numerous definitions of the AEM exist in the literature, but the process can be described as a risk management strategy utilizing a "learning-by-doing" and "revising-as-appropriate" approach. The primary benefit of an AEM compared to the standard approach is the opportunity to modify the approach by introducing an adjustment step where monitoring program can be adjusted to better meet the needs of the subwatershed.

The primary benefit of an AEM compared to the standard approach is the opportunity to modify the approach by introducing an adjustment step where development and or its system (i.e. stormwater management) designs can be adjusted to better meet the needs of the

subwatershed. Adjustments to monitoring sites, parameters and protocols can be made over time, as gaps are identified, to optimize the program.

10.7.3 Recommended Program

The stormwater monitoring program has been phased to permit Town staff to build capacity within the municipality, vet the proposed monitoring program with partner agencies (e.g., the NVCA and LSRCA) and permit the alignment of future budgets with the revised program needs. The monitoring program will start establishing baseline monitoring results (existing conditions) using three (3) autosamplers, working up to a total of seven (7) autosamplers to be rotated between subwatersheds. Water level monitoring in 10 wet SWMF will be initiated on a rotational basis.

Other Monitoring Obligations

In addition, the stormwater monitoring program is recommended to include previous monitoring obligations including but not limited to:

- ECA compliance monitoring. Once the CLI ECA Monitoring Program is implemented, the current ECA compliance monitoring is expected to shift to the CLI ECA monitoring program.
- Other permit compliance monitoring as directed by the NVCA, LSRCA, MNRF, DFO or MECP. To be identified on a case-by- case basis.

Table 10.11 and **Table 10.12** summarize the proposed SWMF water level monitoring and watercourse monitoring schedule from 2024 to 2032, respectively. **Figure 10.3** illustrates the recommended watercourse monitoring locations.

Table 10.11: Recommended SWMF Water Level Monitoring Schedule

SWMF		2024	2025	2026	2027	2028	2029	2030	2031	2032
4-2	Coralwoods*									
6-1	Previn Court Stage 1									
6-2	Tepco North									
6-3	Tepco South									
7-1	Royal Alcona									
7-2	Wallace Mills Ph.2 (South)									
7-3	Wallace Mills Ph.1 (North)									
7-5	Innisbrook Estates (IH)									
7-6	Innisbrook Developments									
7-7	Green Acres Subdivision (South)									
7-9	Green Acres Subdivision North (BMP4C2)									
7-10	Green Acres Subdivision (West)									

SWMF		2024	2025	2026	2027	2028	2029	2030	2031	2032
7-11	Woodland Park North									
7-12	Woodland Park South									
7-13	South Rec Centre									
7-14	Innisfil Admin Building Back									
7-15	Innisfil Admin Building Front									
7-17	Sand Salt									
8-1	Trillium Industrial									
8-2	Taylorwoods									
8-3	Crossroads Ph.1									
8-4	Crossroads #2									
8-5	Skivereen									
8-9	Crossroads									
9-2	Southview									
9-3	Victoria Green*									
9-4	Doral Business Park East									
9-5	Doral Business Park West									
10-1	Brandy Lane/Village North									
10-2	Village North Dempster									
10-3	McKee									
13-1	Kempenfelt Bayside Estates									
13-3	South Shore Woods									
14-2	Cookshill South									

* undergoing retrofit from dry to wet facilities

Table 10.12: Recommended Monitoring Program Schedule

Subwatershed	Monitoring Site ID	2024 (3)	2025 (4)	2026 (5)	2027 (6)	2028 (6)	2029 (7)	2030 (7)	2031 (7)	2032 (7)
Lovers Creek	LoC									
Hewitts Creek	HC									
Strathallen Woods Catchment	SW									
Sandy Cove Creek	SCC									
Mooselanka Creek	MoC									
South Sandy Cove Catchment 1	SSC1									
South Sandy Cove Catchment 2	SSC2									
Alcona North Urban Catchment 1	AN1									
Leonard's Creek	LeC									
Bon Secours Creek	BSC									
Banks Creek	BaC									
Moyer Creek	MyC									
Cedar Creek	CeC									
Belle Aire Creek	BAC									
Carson Creek	CaC									
Wilson Creek	WC									
White Birch Creek	WBC									
Gilford Creek	GC									
Upper March Creek	UMC									
Lake Simcoe Catchments	LSC									
Innisfil Creek	IC									
Cookstown Creek	CoC									
Mid Nottawasaga River	MNR									
Baxter Creek	BxC									

	EMC - Flow Proportionate WQ Sampling, Dry Weather Sampling, Flow/Temperature Monitoring, Biological/Fisheries Sampling
	Grab samples recommended, as too many outfalls for EMC monitoring

Innisfil

Legend

- Municipal Borders
- Road Centreline
- Watercourses
- Settlement Areas
- Subwatershed
- Lake Simcoe Catchments - Grab Samples Recommended
- EMC Samples Recommended

LOCATOR MAP

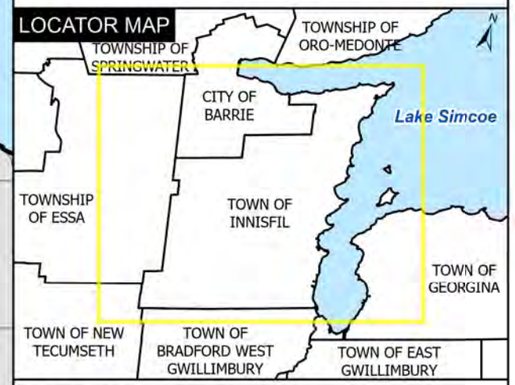


Figure 10.3

Recommended Monitoring Locations

Date: 2023-11-14
Projection: NAD83_UTM_Zone_17N
Data Source: Town of Innisfil, LSRCA, NVCA, OMNRF
Created by: A.V.

0 1,000 2,000 3,000
Meters

N

Aquafor Beech Limited

10.7.3.1 Watercourse Monitoring

The watercourse monitoring program is recommended to include the following:

- **Water Quality** - flow proportionate water quality sampling using automated water quality sampling procedures and equipment to develop Event Mean Concentrations (EMCs) using three (3) automated water quality sampling units to be purchased by the Town. In the subsequent years of the program, it is recommended that the Town purchase additional sampling units at the rate of up to 1 per year. It is recommended that water quality sampling include:
    - Flow proportionate water quality sampling for each station annually using automated water quality sampling procedures and equipment to develop EMCs. EMCs will provide the Town with the ability to better quantify in-stream water quality in regards to Provincial Water Quality Objectives (PWQO) for various representative pollutants. Station locations are recommended to rotate annually to ensure all subwatersheds are monitored. This recommendation would reduce the overall sampling effort (reduced number of analyzed samples) while providing improved data resolution and comparative analysis.
    - While grab sampling is generally not recommended as part of a long-term monitoring program, there are too many outfalls in some of the catchments that drain directly to lake Simcoe to enable representative sampling using an automated water quality sampler. Ongoing grab sampling is therefore recommended in these catchments as part of the multi-year sampling rotation schedule. It is recommended that 5 outfalls are sampled during each grab sampling event.
        - It is recommended that grab samples are collected during two wet weather events and two dry weather events each year that grab samples are collected. As per standard sampling protocols, wet samples are to be collected within 1 hour following the commencement of a significant storm event (typically greater than 15mm in the previous 24 hours). A dry event occurs after 72 hours without rain. Dry events are sampled to understand potential spills or infrastructure failure associated with the upstream SWM ponds and/or associated infrastructure.
    - Collected water quality samples shall be submitted to a private accredited laboratory for analysis.
- **Water Quantity** – continuous flow monitoring at each EMC station annually corresponding to the flow proportionate water quality sampling stations. Station locations are recommended to rotate annually. Monitoring efforts could be combined with the recommended flow monitoring for the calibration of the Town-wide VO model.

- **Temperature Monitoring** - continuous temperature monitoring for each station annually corresponding to the flow proportionate water quality sampling stations. Station locations are recommended to rotate annually.

- **Invertebrate Community Sampling** – Benthic macroinvertebrate monitoring should be completed on an annual basis for at each continuous flow monitoring station and dry weather sampling station (one location per subwatershed). The benthic community composition can change very quickly if habitat quality changes (benthics have limited mobility and a short life span), therefore monitoring is best conducted frequently. The results would continue to be compared to previous years, to track changes over time. Results provide a measure of how the benthic community has changed over time and are an excellent indication of in-stream conditions.

- **Fish Community Sampling -** For each sampling station, it is recommended that annual data be collected for a minimum of two (2) years to establish baseline conditions at each station. After baseline conditions have been established for all station, monitoring shall be can be conducted per the following:

    - Stations with no identified sensitive species – sampling may be conducted at a reduced frequency (bi-annual or longer). Station locations are recommended to rotate annually.

    - Stations where sensitive species have been identified, monitoring may be conducted at an increased frequency (annual basis). If sensitive species are found at a station where no sensitive species have been previously identified, monitoring should be conducted at an increased frequency for subsequent years.

- **Compliance Monitoring: Permit, Construction and ECA –** where possible, it is recommended that compliance monitoring be integrated into the annual stormwater monitoring program.

Subwatershed based monitoring will be undertaken at regular intervals to confirm and/or evaluate the effects of the recommended approaches and refine the Implementation Plan to ensure project and programs are delivering the greatest value-for-dollar for the residents of Innisfil. In 2032, it is recommended that subwatershed health be reassessed following the protocol outlined within the SWM-MP and that monitoring priorities be re-prioritized for 2033 based on implementation status of the recommended approaches and revised subwatershed health scores.

10.7.3.2 SWM Pond Water Level Monitoring

Water level monitoring of 10 wet SWM facilities per year will allow each of the Town's wet facilities to be monitored every two to three years. It is recommended that the results from this monitoring program be incorporated into the next SWM-MP to confirm prioritization of SWM retrofits and/or maintenance.

10.7.3.3 Monitoring Costs

Each EMC monitoring station is estimated to cost approximately $25,000. The first six years of the program will therefore incur the purchase costs for the stations until the Town has its full complement of seven monitoring stations by 2029. Annual costs for program implementation will increase as the number of monitoring sites increases, as presented in **Table 10.13**.

Table 10.13: Monitoring Program Cost Estimates

Year	EMC Station Purchase Cost	Watercourse Monitoring Program Cost	SWM Facility Water Level Monitoring	Total Annual Cost
2024	$75,000	$12,000	$10,000	$97,000
2025	$25,000	$16,000	$10,000	$51,000
2026	$25,000	$20,000	$10,000	$55,000
2027	$25,000	$24,000	$10,000	$59,000
2028	-	$24,000	$10,000	$34,000
2029	$25,000	$28,000	$10,000	$63,000
2030	-	$28,000	$10,000	$38,000
2031	-	$28,000	$10,000	$38,000
2032	-	$28,000	$10,000	$38,000

10.8 Staffing Recommendations

If the SWM-MP & FS is fully funded, it is recommended that additional Capital and Operating staff be considered. Tasks for these staff are expected to include, but not be limited to:

- Review and approve LID BMP designs on private property;
- Run the new Town LID tracking system using GIS software;
- Perform operations and maintenance for Town-owned and operated vegetated LIDs;
- Inspect private LID BMPs to ensure ongoing compliance;
- Provide design support for the implementation of LID techniques within the municipal ROW projects and create new design standards and specifications;
- Develop RFPs and manage stormwater management pond rehabilitation projects;
- Develop RFPs and manage design and construction of new stormwater management facilities;
- Develop RFPs and manage flood mitigation projects;
- Further refine the hydraulic modelling to identify constraints in SWM infrastructure; and
- Operate and maintain the Town's VO model.

10.9 Policy Recommendations

In general, the SWM-MP & FS, including its supporting technical reports and this Implementation Plan, shall provide the overarching policy direction for stormwater management with Town of Innisfil. Individual policy development is detailed below.

10.9.1 Work on Private Property

In consideration of the alternative solutions for the flood mitigation opportunities, many of the identified works cannot be completed or fully completed without addressing land rights and channel encroachment within the watercourse corridors.

Recommendation: It is recommended that creek-based works not be completed by the Town on private property unless permanent access can be guaranteed. As such, land rights will be a critical component of many of the identified projects, and thus permanent easements and/or property acquisition may be necessary to address the existing flood risk issues and to achieve the long-term environmental and economic benefits. The accompanying cost of land rights negotiations and acquisitions are not included in project cost estimates outlined in the current EA report, unless otherwise noted.

In cases where work is required on private land and the Town is unable to obtain easements or acquire the land for a reasonable amount, the Drainage Act provides a process option to complete the require work and obtain a legal outlet for area(s) requiring drainage, even when the downstream system crosses one or more private parcels or involves neighbouring municipalities.

The result, commonly referred to as a "municipal drain," is a communal drainage scheme whose design and cost-sharing is defined by an engineer's report with future maintenance completed by the Town's Drainage Superintendent, at the expense of upstream lands and roads. Under the *Drainage Act* the Town is authorized to enter onto private lands to construct and maintain municipal drains.

Drainage solutions can be implemented through Section 2, Section 4, Section 78, and Section 74 of the Act:

- Under specific circumstances, Section 2 of the Act can address drainage issues involving two or more parties through creation of a Mutual Agreement Drain. Mutual Agreement Drains require the parties to agree on the design, land access and cost sharing for initial construction and future maintenance. Mutual Agreement Drains are registered on the title of all involved properties to secure a legal outlet for upstream lands in the case of future ownership changes.

- Section 4 is used to initiate the Drainage Act process via a petition for new drainage works. Private landowners and road authorities can individually petition for drainage works. Once a petition is filed, the Town appoints an Engineer to determine the validity of the petition and prepare a report for construction and maintenance of the municipal drain. The Drainage Act process may be delayed if there are appeals from recalcitrant landowners opposed to the engineer's report. However, if the process was initiated through a valid petition and the engineer's report provides a cost-effective solution based on sound engineering and complies with applicable agency requirements, the new drainage works is eventually implemented in most cases.

- Section 78 of the Drainage Act improves existing municipal drains. A drain improvement project can be initiated by a private landowner or a road authority who requests improvement. Once a request is submitted, an Engineer is appointed to evaluate the existing drain and propose improvements.

- Section 74 of the Drainage Act provides for maintenance on a municipal drain, such as ditch cleanout, brushing, obstruction removal, and culvert replacement. There is no engineer appointment needed for a Section 74 maintenance project, and the work is coordinated by the Drainage Superintendent.

It is recommended that the Town develop this policy during 2024, and allocate $10,000 for the development of this policy.

10.9.2 Stormwater Fee Study

The Town currently does not have a dedicated funding stream for stormwater management. Funding for stormwater projects is allocated from the Town's general budget. Many municipalities in Ontario have moved towards a dedicated stormwater fee, the proceeds of which are dedicated to stormwater management projects. A stormwater fee is often correlated to the impervious area on a property, but the specific approach to implementing this fee can vary by municipality. Over the last several years, the Town of Innisfil has been allotting approximately $100/year in taxes per household for stormwater-related works. In contrast, stormwater fees from three other Ontario municipalities are summarized in **Table 10.14**.

Table 10.14: Municipal Stormwater Fees

Municipality	Small Residential	Medium Residential	Large Residential
Kitchener[1]	$134.88	$225.12	$295.95
Waterloo[2]	$123.36	$184.68	$252.12
Mississauga[3]	$81.76	$116.80	$140.16

The costs associated with the implementation of the SWM-MP & FS were presented in **Sections 10.1** to **10.7** and summarized in **Table 10.15**. At the current funding rate, the Town will not be able to adequately fund stormwater management and flooding mitigation projects and programs. At current funding levels (approximately $3.5 million per year), the implementation of all the SWM-MP & FS projects and programs ($226.6 million) as identified would span 65 years to 2089. The implementation of all the SWM-MP & FS projects and programs as identified within the 18-year timeframe of the Implementation Schedule would require an annual spending of approximately $12.6 million in dedicated SWM & FS funding. This is more

[1] https://www.kitchenerutilities.ca/en/rates/stormwater-rates.aspx#Stormwater-rates-table
[2] https://www.waterloo.ca/en/living/accounts-and-billing.aspx#Monthly-stormwater-rates
[3] https://www.mississauga.ca/services-and-programs/home-and-yard/stormwater/stormwater-charge/

than three times the amount currently allocated to stormwater management and flooding mitigation.

Recommendation: As such, it is recommended that the Town initiate a Stormwater Fee Study to determine a sustainable funding rate to implement the projects and programs arising from this SWM-MP & FS. It is recommended that this study occur in 2025, and that the Town allocate $150,000 towards this study. It is recommended that this study be combined with the Cash-in-Lieu Study (**Section 10.9.3**), to enable a holistic investigation into the Town's SWM funding.

10.9.3 Cash-in-Lieu Study

The Town of Innisfil does not currently have a cash-in-lieu program. This program would require a development proponent to provide a designated financial contribution at the current per hectare rate as defined by the Town, as amended from time to time, towards the off-site stormwater management, in conformance with the recommended approaches of the SWM-MP, elsewhere in the Town in lieu of providing on-site stormwater management should the Town's stormwater management requirements not be fully achieved.

Funds would be collected by the Town of Innisfil SWM Fee until such time as a suitable project or program is identified for partial or full funding. The Implementation Plan includes $100,000 in 2025 to complete a study to determine the logistics for how the Town would implement a cash-in-lieu program.

Recommendation: It is recommended that this study be combined with the SWM Fee Study (**Section 10.9.2**), to enable a holistic investigation into the Town's SWM funding.

10.9.4 Low Impact Development Policy

Recommendation: As discussed in **Sections 10.3** and **10.4,** it is recommended that the Town proceed with developing a LID policy and tracking tool. A budget of approximately $100,000 is recommended for the development of this policy and tool in 2027. This policy should include, but not be limited to:

- LID approvals process for private property;
- Assumption protocols for LID BMPs that will become part of the Town's SWM system;
- Town oversight of private property LID BMPs;
- Operations and maintenance processes for private property;
- Town operations and maintenance approach during design, construction, and post-construction for LID BMPs that are part of the Town SWM system; and
- Any updates/revisions to the Town's manuals and/or by-laws that arise from the above.

This policy should align with LSRCA stormwater management guidelines and the MECP LID guidelines as part of the CLI ECA. LID controls for water quality and water balance should be considered in all new development, including site plans.

10.9.5 Tile Drain Study

The headwaters for many watercourses within Innisfil are agricultural, while the built-up areas along Lake Simcoe are at the mouth of these watercourses where they discharge into Lake

Simcoe. As such, water levels within the watercourses where they enter urbanized areas are influenced by upstream agricultural practices, including tile drainage. Installation of tile drains has anecdotally increased watercourse flows downstream of the tiled field based on public feedback to the SWM-MP & FS; however, the literature on the impact of tiling on downstream flooding shows mixed results. Tiling may reduce peak flows from small to moderate rain events and have a negligible impact on large events (Scherer and Kandel, 2021); or it may cause increases in low flows, decreases in intermediate flows, and have a minimal impact on large events (Sloan et al., 2017).

Recommendation: It is recommended that the Town partner with LSRCA and NVCA to determine the local impact of tile drainage on flood flows, and if necessary, develop policies to manage the impacts of tile drainage on downstream flooding. This could include the requirement for gated tile drain systems where the outlet level of the drains can be manually altered through the season, to allow for early spring drainage to allow access of farm vehicles to the field, and then raising the outlet level during summer, fall, and winter months to allow storage of more water in the soil.

It is recommended that this study be completed in 2029, and that the Town allocate $100,000 for this study.

10.9.6 Lake Simcoe Policies

As part of the SWM-MP & FS, new LiDAR was flown for the Town. When comparing elevations obtained from the new LiDAR with the LSRCA regulated area along the Lake Simcoe shoreline, it was noted that there are likely areas of the Town that would qualify to be part of the LSRCA regulated area, but which currently are not.

Recommendation: It is therefore recommended that the Town share the LiDAR with the LSRCA with the recommendation that the LSRCA update its regulated area accordingly.

The SWM-MP & FS also identified several areas along the Lake Simcoe shoreline that are under the influence of the lake water levels, even if they are outside of the regulatory water level of 219.15m from 2-year to 50-year storms, and 219.5m for the 100-year storm and Regional event.

Recommendation: It is therefore recommended that any development applications within the area influenced by Lake Simcoe water levels be referred to the LSRCA, and that at a minimum, no new basements are allowed in these areas. Once the Shoreline Flooding Management Plan (**Section 10.6.8**) is completed, these recommendations may be updated.

10.9.7 Managing Future Development in Flood Risk Areas

It is recommended that the Town develop a formal GIS based planning level screening process using the greater of the flood risk mapping developed for the regulatory event (100-year or Regional) and the applicable NVCA or LSRCA regulatory mapping. This formal screening process should be used to filter **all** development applications to the Town, including subdivisions, site-plans, building permits, grading alterations and others as determined relevant by the Town.

Any properties (land-parcels) that intersect with identified the flood risk area will be required to comply with O.Reg. 179/06 (LSRCA jurisdiction) or O.Reg. 172/06 (NVCA jurisdiction), who collectively have established policies for development, construction and/or the placement of fill within the within the regulatory floodplain. It should be the Town's policy that unless the proponent meets all requirements outlined by the appropriate conservation authority and successfully obtains a permit under O.Reg. 179/06 (LSRCA jurisdiction) or O.Reg. 172/06 (NVCA jurisdiction) it is recommended that the Town not approve the application until such time as approval is obtained from the NVCA or LSRCA, as applicable.

Recommendation: It is recommended that the Town develop a policy to ensure all construction/ development within the regulatory flood risk area complies with all conservation authority requirements before issuing approval. $50,000 has been allocated to this task in 2025.

10.9.8 Development Engineering Manual and Bylaw Updates

The Town periodically updates its Development Engineering Manual (DEM) on an as-needed basis.

It is recommended that the Town also develop Storm Sewer By-Laws to prevent the discharge of harmful substances to municipal and private storm sewer systems which ends up in our creeks and rivers; and Erosion and Sediment Control By-laws to prevent sediment from entering a body of water.

Recommendation: It is recommended that the Town update the DEM, including ROW cross-sections, and other policies, as needed, to account for the recommendations arising from the SWM-MP & FS and the policy updates recommended above. $125,000 has been allocated to this task in 2024.

10.10 Cost Summary

A summary of the estimated implementation costs for each element of the recommended strategy is provided below and includes a summary of all assumptions. Class C costs estimates for each element of the Recommended Approach are detailed in **Table 10.15** below.

Table 10.15: Recommended Approach – Summary of Cost Estimates†

Recommended Approach Element	Cost Estimate ($)
6) Municipal Pollution Prevention, Management, Operations & Maintenance Practices	
a. OGS Maintenance	$671,400
b. LittaTraps	$42,840
c. Low Impact Development	$462,000
d. Other Established/ Existing Town Practices	$9,298,620
7) Private Property Strategies (Source Controls):	
a. LID Policy and Tracking Tool Development	$100,000
8) Stormwater Conveyance Infrastructure and Controls	

Recommended Approach Element	Cost Estimate ($)
a. Storm Sewer Model	$125,000
b. Storm Sewer Replacement and Upgrade Program	$13,000,000
c. Ditch Clean-outs	$18,588,000
d. Low Impact Development in the ROW	$6,750,000
9) Stormwater Management (SWM) Facilities	
a. SWM Facility Studies	$779,000
b. Bathymetric and Topographic Surveys	$576,000
c. Sediment Removals	$11,331,000
d. SWMF Maintenance	$414,000
e. SWMF Retrofits	$15,131,000
f. New SWM Facilities	$5,436,000
10) Flood Management and Watercourse Restoration (Preliminary Estimated Cost Implications based on Uncalibrated Model)	
a. Monitoring and VO Model Calibration	$150,000
b. Shoreline Flooding Management Plan	$150,000
c. High Priority Flood Risk Area Mitigation	$109,320,000
d. Rain Gauge Study	$5,000
e. Local Drainage Studies	$205,000
f. Additional Culvert Inspections	$100,000
g. Culvert Replacements	$18,000,000
h. Flood Control Operations and Maintenance	$470,000
i. Municipal Drain Maintenance	$720,000
j. Municipal Drain Reporting and Abandonment	$4,096,795
k. Private Property Drainage Program	$1,800,000
l. Innisfil Heights Master Drainage Study	$150,000
Implementation	
a. Work on Private Property Policy	$10,000
b. Stormwater Fee Study	$150,000
c. Cash-in-Lieu Study	$100,000
d. Tile Drain Study	$100,000
e. SWM-MP Update	$1,050,000
f. SWM Monitoring Program	$840,000
g. Update DEM and ROW Cross-Sections	$125,000
h. Flood Risk Mapping and Development Policy	$50,000
Total	$220.6 million
Total Yearly Expenditure‡	**$12.3 million**

‡ expenditure time frame is 2024-2041
† Class 'C' cost estimate. Note: all values in 2023 CDN dollars

10.11 Implementation Schedule and Budget

The implementation schedule and budget forecast illustrate the specific program or project elements of the recommended approach as well as the recommended year within which the element is to be completed as well as the estimated costs. **Table 10.16** summarizes the implementation schedule and budget forecast.

- **Program:** Within the proposed stormwater budget forecast, a program requires perpetual or long-term annual funding to sustain an acceptable level of service. Programs may have defined start dates and projected program periods; however, it is expected that these programs will continue until program components are integrated into new programs or replaced by more efficient strategies.
- **Project:** Within the proposed stormwater budget forecast, a project requires a short-term capital expenditure typically for construction. A goal of the stormwater budget forecast is to allocate start and completion dates for these projects that take into consideration budget opportunities and constraints as well as watershed prioritization.

The implementation schedule and associated costs have been distributed over the 18-year implementation period (2024-2041) in order to manage staff and equipment requirements, build municipal capacity, align with other municipal projects and programs and provide the Town with information required to acquire adequate funding. The culvert upgrade program has only been partially implemented during the specified implementation period, and will continue past 2024. Only $18 million in culvert upgrades was allocated, out of the estimated $46.5 million required.

Implementation of the remaining culvert upgrades will continue as part of the Town's ongoing Capital Roads Program beyond the 2041 implementation period.

The SWM-MP & FS is intended to provide a comprehensive vision for the Town which would address identified deficiencies within the existing system, provide direction for new development, and enable the Town to operate the SWM program at a sustainable level. The pace of implementation will ultimately be guided by the Town's capital budgeting and human resourcing capacity in the context of all organizational priorities. As a result, the implementation timeline as outlined in **Table 10.16** may be modified to reflect these priorities and resources.

Should implementation of the Recommended Approach per the Implementation Plan be significantly delayed, the Town risks impacts to infrastructure through flooding and/or erosion; and continued negative impacts to water quality in the Town's surface water features.

Table 10.16: SWM-MP FS Implementation Schedule and Budget Forecast

		Immediate Term Implementation Priorities										Medium Term Implementation Priorities				
		2024			2025			2026	2027	2028			2029	2030	2031	2032	2033
Projects/Studies																	
Town-Wide Studies and Policy Development		Phase 1 SWM Facility Study $388,000	Update DEM and ROW Cross-Sections $125,000	Work on Private Property Policy $10,000	SWM Fee Study $150,000	Flood Risk Mapping and Development Policy $50,000	Cash-in-Lieu Study $100,000	Shoreline Flooding Management Plan $150,000	LID Policy and Tracking Tool $100,000	Rain Gauge Study $5,000	80 Culvert Inspections $100,000	SWM-MP Update $350,000	Tile Drainage Study $100,000			Phase 2 SWM Facility Study $391,000	SWM-MP Update $350,000
SWM Facility Retrofits	**Design & Construction of SWMF Retrofits**				Design: 4-1 $74,000			Design: 9-1, 8-4 Construct: 4-1 $576,000	Design: 15-1 Construct: 9-1, 8-4 $665,000	Design: 8-2 Construct: 15-1 $451,000			Design: 7-4 Construct: 8-2 $492,000	Design: 7-2 Construct: 7-4 $376,000	Design: 7-3 Construct: 7-2 $657,000	Design: 7-5, 7-6 Construct: 7-3 $1,262,000	Design: 6-1 Construct: 7-5, 7-6 $884,000
New Stormwater Facilities	**Design and Construction of New Stormwater Facilities**												Design: 7 $92,000	Construct: 7 $958,000	Purchase Land & Design: 1 $967,000	Construct: 1 $1,184,000	Design: 4 $289,000
Modeling	**Model Updates and Development**	Monitoring and VO Model Calibration and Validation $75,000			$75,000					Storm Sewer Model $125,000							
Flood Mitigation	**Design & Construction of Flood Mitigation Projects**	Design: 5, 8 $1,799,000			Design: 11 Construct: 5, 8 $9,444,000			Design: 10 Construct: 11 $2,566,000	Design: 6, 7 Construct: 10 $3,806,000	Design: 4 Construct: 6, 7 $22,404,000			Design: 1, 20 Construct: 4 $2,412,000	Design: 9 Construct: 1, 20 $2,085,000	Design: 2 Construct: 9 $1,279,000	Design: 14 Construct: 2 $3,212,000	Design: 17 Construct: 14 $5,594,000
	Flood Control Operations and Maintenance	$30,000			$30,000			$30,000	$30,000	$30,000			$30,000	Flood Control Operations and Maintenance $30,000	$30,000	$30,000	$30,000
Local Drainage Studies					Town Campus Drainage Improvements $5,000			Belle Aire Beach Road Study $125,000	Kellough and Lawson Study $75,000								
Innisfil Heights Master Drainage Study		Innisfil Heights Master Drainage Study $150,000															
Programs																	
Sediment Management Program (SWMF, OGS, LID, LittaTraps)	**SWMF Bathymetric Surveys**								46 SWMF Surveys $184,000							48 SWMF Surveys $192,000	
	SWMF Maintenance	8-2, 7-1, 7-2 $562,000			7-3 $714,000			7-6, 7-17, 7-5, 7-9 $683,000	7-7, 7-12, 7-14, 13-1 $677,000	9-4, 6-3, 8-9, 9-5, 7-10, 6-2 $712,000			8-4, 5-2, 8-3 $783,000	$600,000	$600,000	$600,000	$600,000
	OGS Units Maintenance	$37,300			$37,300			$37,300	$37,300	$37,300			$37,300	OGS $37,300	$37,300	$37,300	$37,300
	Litta Traps Maintenance	$2,380			$2,380			$2,380	$2,380	$2,380			$2,380	LittaTrap $2,380	$2,380	$2,380	$2,380
	LID Maintenance	$4,000			$4,000			$4,000	$4,000	$4,000			$4,000	LID $9,000	$14,000	$19,000	$24,000
Routine SWM Infrastructure Maintenance Program	**SWMF Maintenance**	$23,000			$23,000			$23,000	$23,000	$23,000			$23,000	SWMF Maintenance $23,000	$23,000	$23,000	$23,000
	Ditch Clean-outs	$1,024,000			$1,024,000			$1,024,000	$1,024,000	$1,024,000			$1,024,000	Ditch Clean-Outs $1,024,000	$1,024,000	$1,024,000	$1,038,000
	Curb/Gutter, CB and SWM Sewer System Maintenance	$62,500			$62,500			$62,500	$62,500	$62,500			$62,500	Curb/Gutter, Catch Basins and SWM Sewer System Maintenance $62,500	$62,500	$62,500	$62,500
	Bridge and Culvert Maintenance	$39,300			$39,300			$39,300	$39,300	$39,300			$39,300	Bridge and Culvert Maintenance $39,300	$39,300	$39,300	$39,300
	West Nile Virus and Invasive Species Management	$16,500			$16,500			$16,500	$16,500	$16,500			$16,500	West Nile Virus and Invasive Species Management $16,500	$16,500	$16,500	$16,500
	Stormwater CCTV Inspections	$259,000			$259,000			$259,000	$259,000	$259,000			$259,000	Stormwater CCTV Inspections $259,000	$259,000	$259,000	$259,000
	Other SWM Maintenance	$139,290			$139,290			$139,290	$139,290	$139,290			$139,290	Other Stormwater Management Maintenance $139,290	$139,290	$139,290	$139,290
Municipal Drains Program	**Municipal Drains Maintenance**	$40,000			$40,000			$40,000	$40,000	$40,000			$40,000	Municipal Drains Maintenance and Beaver Dam Removal $40,000	$40,000	$40,000	$40,000
	Municipal Drain Reporting and Abandonment	Roulston Drain Abandonment $433,600			Section 78 Report - South Innisfil Drain Branch B $10,000			Municipal Drain Works $3,293,195	Section 78 Report - Second Concession Drain $120,000				Prokopchuk Drain Abandonment $0	Section 4 Petition for New Branch of 8th Line Municipal Drain $140,000		Section 4 Petition for New Branch of Hewitts Creek Drain $100,000	
Private Property Drainage Program		$100,000			$100,000			$100,000	$100,000	$100,000			$100,000	$100,000	$100,000	$100,000	$100,000
SWM Monitoring Program	**Monitoring Plan Development**	$25,000															
	Euipment and Monitoring	$97,000			$51,000			$55,000	$59,000	$34,000			$63,000	$38,000	$38,000	$38,000	$38,000
LID in ROW Program	**LID Construction in Capital Roads Program**								$450,000	$450,000			$450,000	$450,000	$450,000	$450,000	LID Construction in Capital Roads Pro $450,000
Culvert Replacement and Upgrade Program		$1,000,000			$1,000,000			$1,000,000	$1,000,000	$1,000,000			$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Storm Sewer Replacement and Upgrade Program													$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
ANNUAL TOTALS																	
Annual Total Expenses		**$6,441,870**			**$13,450,270**			**$10,225,465**	**$8,913,270**	**$27,408,270**			**$8,169,270**	**$8,429,270**	**$7,778,270**	**$11,221,270**	**$12,016,270**
Current Allocation		$2,729,302			$2,680,552			$6,008,650	$2,849,200	Not Allocated							
Projected Deficit		-$3,712,568			-$10,769,718			-$4,216,815	-$6,064,070								

Table 10.16: SWM-MP FS Implementation Schedule and Budget Forecast

	Long Term Implementation Priorities							
	2034	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**
Projects/Studies								
Town-Wide Studies and Policy Development					SWM-MP Update $350,000			
SWM Facility Retrofits	Design: 7-7, 7-10 Construct: 6-1 $1,897,000	Design: 13-1, 1-1 Construct: 7-7, 7-10 $700,000	Design: 6-2, 6-3 Construct: 13-1, 1-1 $700,000	Design: 7-11 Construct: 6-2, 6-3 $653,000	Design: 7-1 Construct: 7-11 $770,000	Design: 7-16 Construct: 7-1 $3,177,000	Design: 7-17, 14-1 Construct: 7-16 $1,056,000	Construct: 7-17, 14-1 $741,000
New Stormwater Facilities	Construct: 4 $1,946,000							
Modeling								
Flood Mitigation	Design: 18 Construct: 17 $1,678,000	Design: 13 Construct: 18 $372,000	Design: 3 Construct: 13 $951,000	Construct: 3 $2,656,000	Design: 16 $4,400,000	Construct: 16 $44,000,000	Design: 15 $168,000	Construct: 15 $840,000
	$30,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Local Drainage Studies								
Innisfil Heights Master Drainage Study								
Programs								
Sediment Management Program (SWMF, OGS, LID, LittaTraps)				50 SWMF Surveys $200,000				
	4 SWM facilities per year $600,000	$600,000	$600,000	$600,000	$600,000	$600,000	$600,000	$600,000
	$37,300	$37,300	$37,300	$37,300	$37,300	$37,300	$37,300	$37,300
	$2,380	$2,380	$2,380	$2,380	$2,380	$2,380	$2,380	$2,380
	$29,000	$34,000	$39,000	$44,000	$49,000	$54,000	$59,000	$64,000
Routine SWM Infrastructure Maintenance Program	$23,000	$23,000	$23,000	$23,000	$23,000	$23,000	$23,000	$23,000
	$1,038,000	$1,038,000	$1,038,000	$1,038,000	$1,038,000	$1,038,000	$1,038,000	$1,038,000
	$62,500	$62,500	$62,500	$62,500	$62,500	$62,500	$62,500	$62,500
	$39,300	$39,300	$39,300	$39,300	$39,300	$39,300	$39,300	$39,300
	$16,500	$16,500	$16,500	$16,500	$16,500	$16,500	$16,500	$16,500
	$259,000	$259,000	$259,000	$259,000	$259,000	$259,000	$259,000	$259,000
	$139,290	$139,290	$139,290	$139,290	$139,290	$139,290	$139,290	$139,290
Municipal Drains Program	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000
Private Property Drainage Program	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000
SWM Monitoring Program								
	$38,000	$38,000	$38,000	$38,000	$38,000	$38,000	$38,000	$38,000
LID in ROW Program	gram $450,000	$450,000	$450,000	$450,000	$450,000	$450,000	$450,000	$450,000
Culvert Replacement and Upgrade Program	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Storm Sewer Replacement and Upgrade Program	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
ANNUAL TOTALS								
Annual Total Expenses	**$10,425,270**	**$5,971,270**	**$6,555,270**	**$8,418,270**	**$10,434,270**	**$52,096,270**	**$6,148,270**	**$6,510,270**
Current Allocation	Not Allocated							
Projected Deficit								

11 Recommendations

The final study recommendations for consideration by the Town Innisfil are as follows:

1. That Council approve the Town of Innisfil Stormwater Management Master Plan and Flooding Strategy (SWM-MP & FS) Class Environmental Assessment Report together with the Recommended Approach.

2. That Town staff be directed to file the report with the Ministry of the Environment, Conservation and Parks for the 30-day public review period as required by the Environmental Assessment Act.

3. That the Town update its policies, manuals and guidelines, as appropriate, to align with the recommendations put forth in the SWM-MP & FS technical reports, specifically including the Development Engineering Manual and by-laws.

4. That the Town implement the Recommended Approach per the Implementation Plan for all Projects and Programs with an operational and maintenance strategy, resource requirements, and supporting policies and by-laws to permit the implementation of the Recommended Approach.

5. That the Town incorporate elements of the Recommended Approach into the forthcoming Multi-Year Budget.

6. That the Town use the cost estimates and recommendations from the SWM-MP & FS to support the development of a dedicated Stormwater Service Fee.

7. That the Town apply the Recommended Approach of the SWM-MP & FS as part of other Town initiatives, plans, studies and programs to leverage potential synergies as the opportunities are identified in order to more efficiently achieve overall Town goals to increase urban tree canopy, construct new trails and cycle lanes, improve transit and build transit capacity, rehabilitate parks, reconstruct roads as well as improve stormwater management. It is further recommended that the Town integrate source and conveyance control SWM practices in all road reconstruction projects, to mitigate the hydrologic and water quality impact of urbanization.

8. That the Town undertake comprehensive monitoring in order to fully calibrate the VO model developed as part of this Master Plan. The model calibration will permit the City to evaluate and select the preferred remedial approaches to improve the level of service. Monitoring should include at least 10 stream gauge monitoring stations distributed through the LSRCA and NVCA watersheds, and representing different land uses. Rain gauges should be installed as part of the study such that each monitoring station is within 2km of a rain gauge.

9. To ensure implementation of the Master Plan can proceed efficiently and per the Implementation Plan schedule, that the Town review staffing levels for Capital and Operations staff, with roles to be defined through benchmarking.

10. That the Town review existing watercourses on privately-owned property, evaluate easements associated with these watercourses, and develop a policy approach for works completed on private property to reduce the risks associated with watercourses on private property.

11. That the City refine existing stormwater monitoring approaches as part of the Implementation Plan to reflect the recommended strategy, including:
    a. Align monitoring approaches with the CLI ECA monitoring requirements;
    b. Complete a rain gauge study to identify locations for new long-term rain gauge(s);
    c. Stay current in the review of monitoring reports and data as required by subwatershed plans and other policies;
    d. Analyze and complete Phase 4 of the adaptive environmental management (AEM) feedback loop of subwatershed plans, environmental studies and other policies. The four (4) phase AEM approach requires Characterization (Phase 1), Impact Assessment (Phase 2), Implementation (Phase 3) as well as Monitoring and Refinement of the management strategy (Phase 4). The analyzed data from the follow-up monitoring is used to test the assumptions made during earlier studies phases to evaluate the performance of the selected management strategies and make necessary adjustments. When all four (4) phases of the AEM process are not completed the process cannot ensure project goals and objectives are being met.

12. That the Town consider a study for the development of a Cash-in-Lieu policy, whereby an equivalent fee is collected from proponents who have demonstrated that they cannot achieve the required stormwater targets.

13. That the Town initiate a Shoreline Flooding Management Plan to assess flooding caused by Lake Simcoe, and subsequently develop policy and technical alternatives to reduce the risk of flooding caused by Lake Simcoe water levels.

14. That the Town initiate a storm sewer capacity analysis study to identify risks of urban flooding due to storm sewer and road network capacity limitations.

15. That the Town review their ROW cross-sections in light of the new CLI ECA.

16. That the Town coordinate with the County and the Province regarding the upgrade of undersized culverts on County and Province roads.

12 References

AECOM. 2021. Town of Innisfil Stormwater Management Facility Sediment Survey and Assessment Year 1 (2020) and Year 2 (2021).

LSRCA. 2022. Technical Guidelines for Stormwater Management Submissions. https://www.lsrca.on.ca/Shared%20Documents/Technical-Guidelines-for-Stormwater-Management-Submissions.pdf

Scherer, T. and Kandel, H. (2021). Frequently Asked Questions About Subsurface (Tile) Drainage. *North Dakota State University Extension*. AE1690. https://www.ndsu.edu/agriculture/sites/default/files/2022-02/ae1690.pdf

Sloan, B.P., Mantilla, R., Fonley, M., and Basu, N.B. 2017. Hydrologic impacts of subsurface drainage from the field to watershed scale. *Hydrological Processes,* 31(17): 3017-3028.