



**Six Mile Creek Flooding Project
Schedule B Municipal Class Environmental Assessment
Project File Report**

Prepared for: **Town of Fort Erie**

Prepared by: **Montrose Environmental Solutions Canada Inc.**

Version 1.0
April 2026
Guelph, Ontario

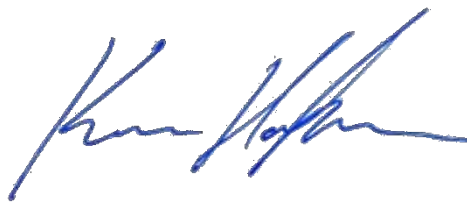
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Prepared for the Town of Fort Erie, April 2026



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1 Introduction

The Six Mile Creek watershed is in the Town of Fort Erie and originates north of Highway 3, southeast of Teal Road and Bertie Street, and travels adjacent to several residential neighbourhoods on the east side of Centralia Avenue North before flowing into Lake Erie. The Town of Fort Erie is undertaking a Schedule B Municipal Class Environmental Assessment (EA) for a portion of the Six Mile Creek watershed adjacent to Lake Erie. This community is locally known as Thunder Bay and for decades has experienced localized flooding along Shirley Road (Photo 1) and Bethune Avenue, with flooding occurring as recently as April 2024. The area is vulnerable to both chronic coastal and riverine flooding; coastal flooding is caused by high water levels in Lake Erie, whereas riverine flooding is caused by high stream flows in Six Mile Creek.



Photo 1 Recent Flooding along Shirley Road near Six Mile Creek (Provided by the Town, 2022)

The objective of this EA is to:

- determine the causes of the coastal and riverine flooding;
- review performance of existing drainage infrastructure;
- identify drainage improvements to reduce the potential for flooding; and,

- suggest an accompanying financial strategy for the preferred solution.

The project is being carried out in accordance with the requirements of the *Environmental Assessment Act* and follows the process for a Municipal Class EA Schedule B. The Municipal Class EA process provides a comprehensive decision-making framework to ensure that relevant engineering, environmental and cultural heritage features are considered when developing improvement alternatives. The process involves meaningful engagement with Indigenous communities, various stakeholders, public agencies, and the general public.

1.1 Study Area

The study area representing the coastal and riverine flood-related issues in the community of Thunder Bay is generally bounded by Friendship Trail to the north, Neva Road to the west, Colony Road alignment to the east (500 m west of Windmill Point Road North), and Lake Erie to the south (Figure 1.1). The area is largely rural, with the primary land uses of swamp, treed and undifferentiated/agricultural; remaining portions are allocated to urban and rural residential land uses.

Technical studies completed for the EA include:

- Natural Heritage
- Archaeology
- Cultural Heritage
- Hydrology and Hydraulics
- Hydrogeology

These technical studies may have additional area beyond the study area, according to requirements of adequate context for each study. Areas of interest beyond the study area are outlined in each of the technical studies completed as part of this EA.

1.2 Problem and Opportunity Statement

In the beginning phases of the EA process, the following problem and opportunity statement was developed. The statement summarizes the basis for completing the EA and was presented to the public at Public Information Centre No. 2.

“There are flood vulnerable areas along Six Mile Creek within the Community of Thunder Bay. This EA is being undertaken to define a flood risk reduction solution that addresses coastal and riverine flooding currently affecting private property and improves the level of service of municipal infrastructure.”



Buildings

Roads

Parcels

Six Mile Creek

Study area

1:4,500

NAD83(CSRS) / UTM zone 17N

0

100

200 m

References: Data obtained from OSM, Town of Fort Erie, and MES Canada

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MONTROSE

ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Study Area

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. Mckay

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Figure: 1.1

1.3 Ontario's Environmental Assessment Act

The project is subject to the provisions of Ontario's Environmental Assessment Act. The Act requires that, for any major public sector project that has the potential for significant environmental effects, an environmental assessment be undertaken prior to implementation to determine the ecological, cultural, economic, and social impact of the project.

The Act exists to “provide for the protection, conservation, and wise management of Ontario's environment.” The Act mandates clear terms of reference, focused assessment hearings, ongoing consultation with all parties involved including public consultation and, if necessary, referral to mediation for decision. Environmental assessment is a key part of the planning process and must be completed before decisions are made to proceed on a project.

To comply with the requirements of the Act, two types of EA processes can be applied to projects:

- **Individual EA:** This process includes developing a project-specific terms of reference that are submitted for review and approval to the Minister of the Environment. This process is typically applied to large, unique or complex projects that do not have precedents that demonstrate a predictable and manageable environmental impact.
- **Class EA:** This process applies to routine projects that have predictable and manageable environmental effects and follow a terms of reference that has been previously approved for certain types of projects.

The Six Mile Creek project follows the Class EA process.

1.4 Municipal Class Environmental Assessment

This Class EA for the Six Mile Creek study area follows the Municipal Class EA process as outlined in the *Municipal Class Environmental Assessment Manual* (Government of Ontario 2024), under the *Ontario Environmental Assessment Act*, Revised Statutes of Ontario (R.S.O.) 1990, Chapter E.18, as amended. The Municipal Class EA process shown in Figure 1.2 allows for strategic planning of multiple integrated systems that impact the environment (defined as the natural, social, cultural, built, and economic environments). The consultation process for this project complies with the *Code of Practice for Consultation in Ontario's Environmental Assessment Process* (MOE 2014).

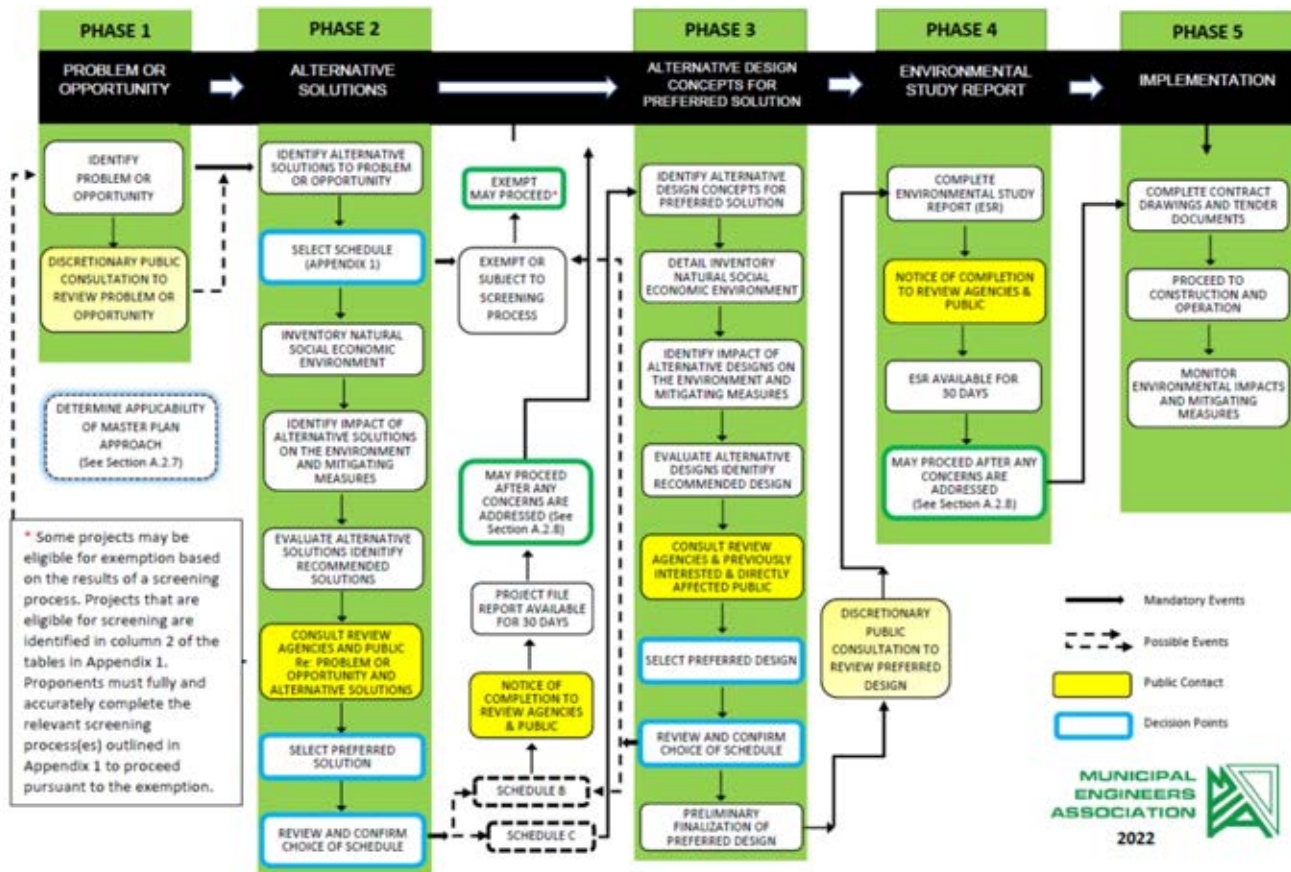


Figure 1.2 Municipal Class Environmental Assessment Process (Government of Ontario 2024)

The Ontario MEA “Municipal Class Environmental Assessment” document (2024) provides municipalities with a five-phase planning procedure, approved under the Environmental assessment Act, to plan and undertake all municipal sewage, water, stormwater management, and transportation projects that occur frequently, are limited in scale, and have a predictable range of environmental impacts and applicable mitigation measures.

In Ontario, infrastructure projects that require works for the purposes of flood or erosion control are subject to the Municipal Class EA process and must follow a series of mandatory steps as outlined in the Municipal Class EA document. The Class EA document identifies five project phases as summarized below.

- **Phase 1 – Problem or Opportunity:** Identify the problems or opportunities to be addressed and the needs and justification.
- **Phase 2 – Alternative Solutions:** Identify alternative solutions to the problems or opportunities by taking into consideration the existing environment and establish the preferred solution considering public and agency review and input.

- **Phase 3 – Alternative Design Concepts for the Preferred Solution:** Examine alternative methods of implementing the preferred solution based upon the existing environment, public and agency input, anticipated environmental effects and methods of minimizing negative effects and maximizing positive effects.
- **Phase 4 – Environmental Study Report:** Document in an Environmental Study Report (ESR), a summary of the rationale, planning, design, and consultation process for the project as established through Phases 1 to 3 above and make such documentation available for scrutiny by review agencies and the public.
- **Phase 5 – Implementation:** Complete contract drawings and documents, proceed to construction and operation, and monitor construction for adherence to environmental provisions and commitments. Also, where special conditions dictate, monitor the operation of the completed facilities.

Depending on the anticipated level of environmental impact; and for some projects, the anticipated construction costs, the project does not necessarily have to undertake all the phases. The Class EA defines three types of projects, referred to as Exempt (Schedule A), Schedule B, or Schedule C, which determine the required process. Projects are categorized according to their environmental significance and their effects on the surrounding environment. Planning methodologies are described within the Class EA and are different according to Class type, such as the following:

- **Exempt:** Projects are limited in scale, have minimal adverse environmental effects, and include a number of municipal maintenance and operational activities. Some projects are exempt based on the results of an archaeological screening process or because of emergency response. These projects are pre-approved and may proceed to implementation without following the full Class EA planning process.
- **Schedule B:** These projects have the potential for some adverse environmental effects. The proponent is required to undertake a screening process (Phases 1 and 2), involving mandatory contact with directly affected public, Indigenous communities, and with relevant review agencies to ensure that they are aware of the project and that their comments are addressed. At the end of Phase 2, a project report (Project File Report) documenting the planning process followed through Phases 1 and 2 shall be finalized and made available for public and agency review. If the screening process raises a concern which cannot be resolved, a request may be made to the Ontario Ministry of the Environment, Conservation and Parks (MECP) for an order (Section 16 order) requiring a higher level of study or that conditions be imposed only on the grounds that the requested order may prevent, mitigate, or remedy adverse impacts on constitutionally protected Aboriginal and

treaty rights. Alternatively, the proponent may elect voluntarily to plan the project as a Schedule C undertaking. If the Minister does not make a Section 16 order, then the proponent may proceed to implementation (Phase 5).

- **Schedule C:** These projects have the potential for significant adverse environmental effects and must proceed under the full planning and documentation (Phases 1 to 5) procedures specified in the Class EA document. Schedule C projects require that an Environmental Study Report (ESR) be prepared and filed for review by the public and review agencies. If concerns are raised that cannot be resolved, a Section 16 order may be requested.

1.4.1 Municipal Class Environmental Assessment Updates

The Municipal Class EA process is undergoing continuous updates as the Province of Ontario modifies the Environmental Assessment Act and its associated regulations. Substantial updates occurred in 2023, with some additional updates in February of 2024. The most recent updates (February 2024) include the enactment of several new regulations which place additional project types on the exempt projects list. The 2024 updates include the enactment of:

- O. Reg. 50/24 – Part II.3 Projects – Designations and Exemptions
- O. Reg. 51/24 – Exemptions from the Act and From Part II.1 of the Act

1.4.2 O. Reg. 53/24 – General and Transitional Matters Schedule Selection

Schedule B was considered applicable for this study. This approach requires Phases 1 and 2 of the Municipal Class EA process to be addressed to satisfy the requirements for Schedule ‘B’ projects before proceeding with implementation (Phase 5). Completing Phases 1 and 2 of the Municipal Class EA process will confirm whether a Schedule ‘B’ study is sufficient to address the flood concerns within the study area. Figure 1.3 illustrates the process followed in the planning and design of projects covered by Phases 1 and 2.

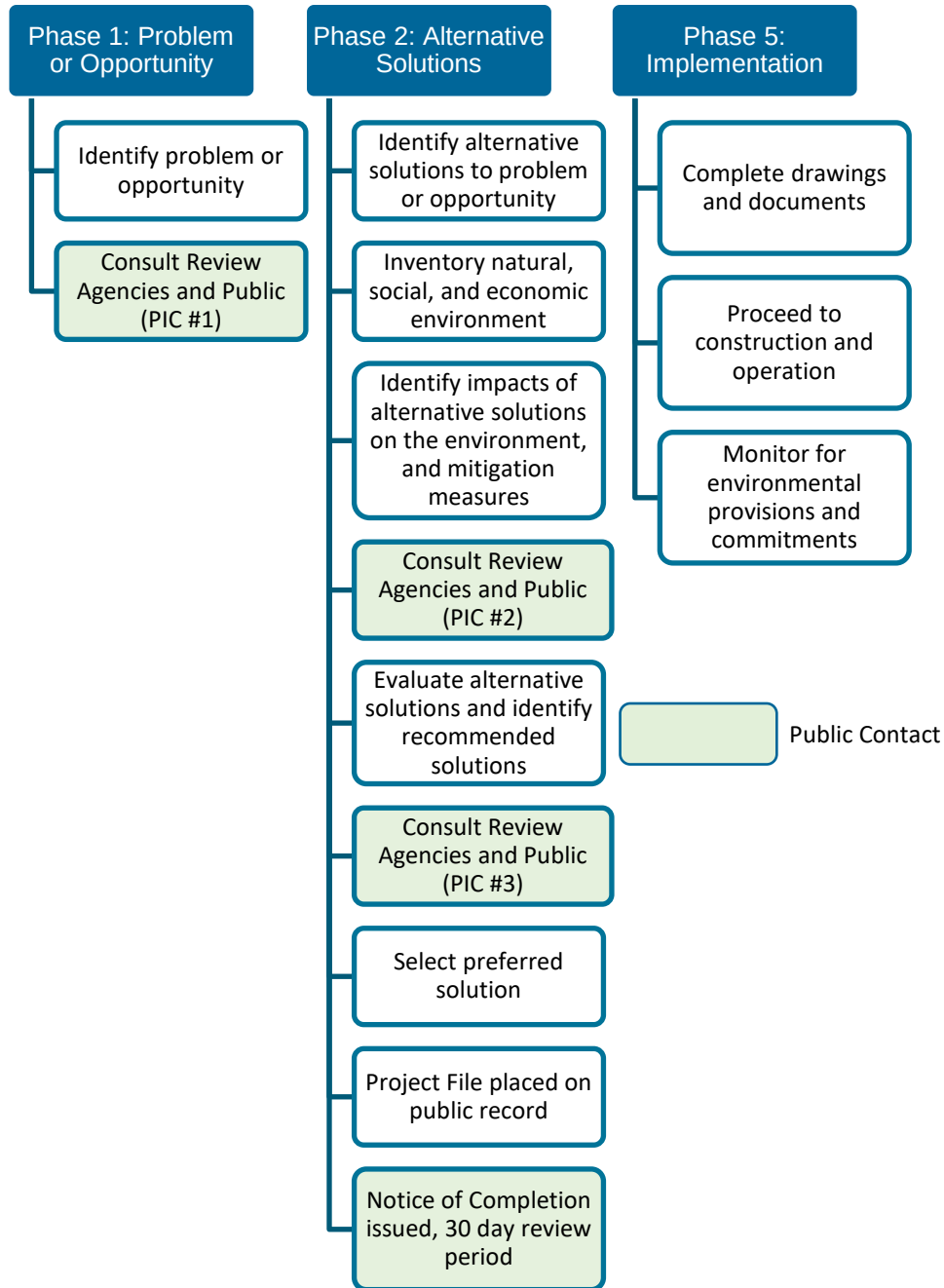


Figure 1.3 Class EA Process – Schedule B

2 Planning and Policy

2.1 Planning Act

The Planning Act is Ontario's legislative framework for land use planning. It establishes how land use decisions are made and ensures that local planning aligns with provincial interests. The Act promotes sustainable development, economic growth, and environmental protection while requiring that all planning decisions be consistent with the Provincial Policy Statement (PPS) and conform to provincial plans. Its purpose is to balance provincial priorities with municipal autonomy, creating a fair and transparent process for managing growth and development.

Under the Act, the province sets the overall policy direction by issuing the PPS, preparing provincial plans, and safeguarding interests such as housing, infrastructure, and resource protection. It also provides guidance, approves certain planning matters, and can intervene through tools like Minister's Zoning Orders. In contrast, municipalities are responsible for implementing these policies locally through official plans, zoning bylaws, and development approvals. They shape community growth while ensuring compliance with provincial requirements. This division of responsibilities allows the province to maintain strategic oversight while municipalities manage detailed, community-specific planning.

2.1.1 Provincial Policy Statement

The main provincial planning policy applicable to this EA is the Provincial Policy Statement (MMAH 2024). The PPS provides policy direction on matters of provincial interest related to land use planning and development, with the intention to protect resources, public health and safety, and the quality of the natural and built environment. The PPS contains policies that protect Ontario's natural heritage and water resources. These policies have been referenced in later portions of this EA report and been incorporated into the evaluation process of alternative solutions, including the preferred solution.

The PPS recognizes the complex relationships between economic, environmental, and social factors in planning and embodies good planning principles. It includes enhanced policies on key issues that affect our communities, such as:

- creating healthy and active communities by facilitating active transportation and community connectivity
- maintaining or restoring the diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems; and recognizing linkages between and among natural heritage features and areas, surface water features, and groundwater features

- restricting development and site alteration in, or adjacent to, significant wetlands, woodlands, valleylands, wildlife habitat, and Areas of Natural and Scientific Interest (ANSI) in Southern Ontario (Ecoregions 6E and 7E), unless it has been demonstrated that there will be no negative effects on the natural features or their ecological functions
- restricting development and site alteration in habitat of endangered or threatened species, except in accordance with provincial and federal requirements
- restricting development and site alteration in or near sensitive surface or groundwater features such that their features and related hydrological functions will be protected, improved, or restored
- conserving heritage and significant cultural heritage landscapes

The PPS focuses growth within settlement areas away from significant or sensitive resources and areas that may pose a risk to public health and safety. Furthermore, it recognizes that the wise use and management of resources may involve directing, promoting, or sustaining growth. It states that land uses must be carefully managed to accommodate appropriate development to meet the full range of current and future needs while achieving efficient development patterns.

The PPS highlights the importance of protecting the overall health and safety of the population and directs development away from areas of natural and human-made hazards. It includes policies to protect the population from hazards such as flooding and encourages the consideration of the potential effects of climate change that may increase the risk associated with natural hazards. The policies generally direct development to occur outside of areas that are identified as hazardous lands. The PPS does, however, provide for the implementation of Special Policy Areas, which allows for the continued viability of existing uses that were historically present within flood plains.

In addition to natural heritage and water resources-focused policies, the EA complies with the following climate-focused PPS components:

- ensuring that necessary infrastructure and public service facilities are or will be available to meet current and projected needs
- preparing for the regional and local impacts of a changing climate
- ensure that these systems are provided in a manner that prepares for the impacts of a changing climate; is feasible and financially viable over their lifecycle; and protects human health and safety, and the natural environment

2.1.2 Ontario Heritage Act

The Ontario Heritage Act (OHA, 2025) provides the legislative framework for identifying and protecting cultural heritage and archaeological resources in Ontario. It sets requirements for conserving archaeological sites and empowers municipalities to recognize and safeguard built heritage resources (BHRs) and cultural heritage landscapes (CHLs) through tools such as property listing, designation, and heritage conservation districts. Regional planning policies complement the OHA by promoting heritage conservation as an urban design objective. These policies also require engagement with Indigenous communities and support measures like cultural asset mapping, heritage impact assessments, and collaboration with agencies to ensure significant heritage resources are conserved for community benefit.

Applicability to Project: The OHA applies to all cultural heritage and archaeological resources identified within the study area.

2.1.3 Endangered Species Act

The *Endangered Species Act* (ESA) provides conservation and protection of species in Ontario. Species listed as endangered or threatened under the ESA are afforded legal protection from harm and harassment. The ESA also prohibits damage or destruction of habitat of endangered or threatened species. Habitat protection for a species can be general or subject to the specific provisions of a habitat regulation as set out in O. Reg. 832/21.

Applicability to Project: The ESA applies to all SAR within provincially regulated lands. Any impacts to these species, or their habitats protected under the ESA, would require a permit.

2.2 Federal Legislation

Where SAR or natural heritage features are present, additional federal legislation applies including:

- **Species at Risk Act:** The *Species at Risk Act* (SARA) incorporates a number of prohibitions to protect SAR, providing recovery strategies for extirpated, endangered, or threatened species, as well as managing species of special concern (Government of Canada 2025). On private or provincially owned lands, only aquatic species listed as endangered, threatened, or extirpated and migratory birds listed on Schedule 1 are protected under SARA, unless ordered by the Governor in Council, or for those species that have critical habitat identified. Should a species also be listed under SARA and the ESA, where the ESA provides equal or greater protection, the ESA takes precedence.

Applicability to Project: *The SARA applies to all SAR identified within the study area.*

- Fisheries Act: The *Fisheries Act* outlines the framework for the management and regulation of fisheries and the conservation and protection of fish and fish habitat within the fishing zones of Canada, all waters in the territorial sea of Canada, and all internal waters of Canada.

Applicability to Project: *Any activities that may impact a watercourse or waterbody (including Lake Erie and Six Mile Creek and its tributaries), would require a Request for Review (RFR) from the DFO.*

- Migratory Birds Convention Act: The *Migratory Birds Convention Act* (MBCA) affords protection to birds listed under Article 1 of the MBCA. General prohibitions protect migratory birds, their nests, and their eggs, and prohibits the deposition of harmful substances in waters and other areas frequented by them.

Applicability to Project: *All vegetation removal shall occur outside of the migratory bird nesting window of April 1 to August 31 of any given year to avoid disturbing active nests.*

Additional details on these policies and relevance to the study area are provided in Appendix C.

2.3 Regional Planning Context

2.3.1 Niagara Region Official Plan (Niagara Region 2022)

Niagara Region's Official Plan was adopted by Council on June 23, 2022 and approved on November 4, 2022. The policies of this Official Plan manage where and how the region will grow to create a sustainable community until the year 2051. As of March 31, 2025, the Niagara Official Plan is no longer a Regional Plan. It is now an official plan of the 12 local municipalities in Niagara.

Applicability to Project: The study area is located within the Niagara Region. Under the Niagara Official Plan, activities that create or maintain infrastructure authorized under an EA are exempt from development prohibitions in key natural heritage features, provincial natural heritage systems, and key hydrologic features.

2.3.2 Conservation Authorities Act – Niagara Peninsula Conservation Authority

Under the *Conservation Authorities Act* (1990, amended 2024), and Ontario Regulation 41/24: Prohibited Activities, Exemptions and Permits, the Niagara Peninsula Conservation Authority (NPCA) regulates development within and adjacent to regulated areas. This includes hazardous lands, wetlands, river or stream valleys; within areas that are adjacent to the shoreline of the Great Lakes; inland lakes subject to flooding, erosion, or dynamic beach hazards; as well as any activities that interfere with an existing watercourse or wetland.

The province has a set of policies and performance standards to support land use planning in areas susceptible to flooding hazards. The riverine flooding hazard limit within NPCA's jurisdiction is defined as the "greatest flood extent associated with the 1 in 100-year storm event." Flooding hazard along Lake Erie is based on the 100-year flood level ("the sum of the mean lake level and storm surge with a combined probability of a 100-year return period" (NPCA 2024). In general, development and site alternation are not permitted within the hazard mapping limits. In relation to this study, the policy related to the reconstruction of existing building and structure is relevant:

- "Buildings destroyed by flood and/or erosion forces will not be permitted to be reconstructed at the same location unless it can be conclusively demonstrated that the Great Lakes Hazards can be adequately mitigated to the satisfaction of the NPCA."
- Under O. Reg. 41/24, the NPCA may require that a landowner (including the Town of Fort Erie) obtain a permit prior to undertaking any development (as defined under the act) within a regulated area.

Applicability to Project: The study area contains features that are regulated by the NPCA including but not limited to a watercourse (Six Mile Creek), a great lake (Lake Erie), and hazardous lands (floodplain, and dynamic beach hazards). Permission from the NPCA would be required, in the form of a permit, prior to conducting any works within the regulated areas.

2.4 Town of Fort Erie Official Plan

The Official Plan for the Town of Fort Erie was adopted by Council on August 25, 2025. The Official Plan focus on maintaining the unique character of the Town of Fort Erie; while addressing social and community needs, developing strong, liveable and healthy communities, preserving agricultural lands, and providing residents with a high-quality living environment that protects, conserves, enhances, and restores natural features.

Applicability to Project: The study area is located within the Town of Fort Erie. Under the Official Plan for the Town of Fort Erie, essential public uses including public infrastructure are permitted in all land use designations, provided that there are no reasonable and feasible alternative locations, and that the use can be made compatible with its surroundings.

2.5 Other Policy and Guidelines

Many existing flood-related policies and criteria must be considered in the screening of alternative solutions for the Project. Relevant policies and guidelines used in this EA include:

- the provincial flooding hazard standards (MNR 2002)

- Ministry of Environmental – Stormwater Management Planning and Design Manual (MOE 2003)
- Town of Fort Erie Subdivision Control Guidelines for Development of New Subdivisions 2021
- Consideration of Climate Change in Environmental Assessments in Ontario (MOECC 2017)
- the PPS (MMAH 2024) related to climate change

2.5.1 Provincial Flooding Hazard Standards

The Technical Guide classifies alternative solutions as passive or active, dry or wet, and temporary or permanent. A key consideration in the Technical Guide is that flood mitigation measures be passive, dry, and permanent for lands to be considered outside of the flood hazard area.

“Active floodproofing requires some action, i.e., closing watertight doors or sandbagging for the measure to be effective. Advance flood warning is almost always required in order to make the flood protection operational.

Passive floodproofing measures are defined as those that are in place and do not require flood warning or any other action to put the flood protection into effect. These include construction of development at or above the flood standard, or the use of continuous berms or floodwall.

The objective of dry floodproofing is to keep a development and its contents completely dry. Such can be carried out by elevating the development above the level of the flood standard or by designing walls to be watertight and installing watertight doors and seals to withstand the forces of flood waters.

Wet floodproofing is undertaken in expectation of possible flooding. Its use is generally limited to certain specific non-residential/non-habitable structures (e.g., arena, stadium, parking garage). The intent of wet floodproofing is to maintain structural integrity by avoiding external unbalanced forces.” (p. A25 MNR 2002)

Permanent floodproofing measures are those that are resistant to time and extreme conditions with limited monitoring or maintenance. These measures are in place regardless of neglect and will withstand the pressures of flooding, including failure due to piping, blowout, and hydrostatic force. Increased conveyance is an example of a permanent floodproofing measure.

Temporary floodproofing measures are those at risk of failure due to structural neglect or the extreme conditions that occur during a flooding event. “Dykes and flood walls are not regarded as permanent flood control structures and the land behind the dykes and flood walls should continue to require protection to the revised (increased) flood standard.” (p. 16 MNR 2002).

Applicability to Project: The approaches to flood mitigation within the study area considers the information provided in the technical guidelines in the development and evaluation of alternatives.

2.5.2 Climate Change

The guide “Considering Climate Change in the Environmental Assessments Process” was finalized in October 2017 (MOECC 2017). This guide was considered in the development and evaluation of alternatives. Two approaches for consideration and addressing climate change in project planning include:

- Reducing a project’s effect on climate change (climate change mitigation)
- Increasing the project’s and local ecosystem’s resilience to climate change (climate change adaptation)

The Ontario PPS recognizes that climate change may lead to increased flooding and it allows for Municipalities and Ministries to choose the most suitable approach to address this problem. The Province of Ontario has recognized the need to examine current floodplain management methodologies in light of climate change. The PPS (MMAH 2024) has articulated this need at the policy level.

Applicability to Project: The focus of this project is flood mitigation and thus providing climate change resiliency to flooding is the primary target. A flood remediation measure may be considered more favourable if it provides a greater resilience to these unanticipated future conditions. One of the key opportunities to be achieved through this project is to reduce flood risk. This will also provide resiliency to climate change for more frequent flood events.

2.5.3 Clean Water Act – Source Water Protection

Section A.2.10.6 of the Municipal Class EA (Government of Ontario 2024) document directs proponents, including the Town of Fort Erie, to consider Source Water Protection (SWP) in the context of the *Clean Water Act* (CWA). Projects proposed within a vulnerable area are required to consider policies in the applicable Source Protection Plan (SPP), including their impact with respect to the project. A watershed based SPP contains policies to reduce existing and future threats to drinking water in order to safeguard human health through addressing activities that have the potential to impact municipal drinking water systems. The Town of Fort Erie is located within the Niagara Peninsula Source Protection Region and Source Protection Area (Ontario Source Protection Information Atlas; MECP 2025). The Niagara Peninsula Source Protection Plan (e.d. October 1, 2014) contains policies that address current and potential threats to municipal drinking water supply.

There are three types of vulnerable areas covered by the SPP:

- Intake protection zones (IPZs) – An IPZ is the area around a surface body of water where water is drawn in and conveyed for municipal drinking water.
- Wellhead protection areas (WHPAs) – WHPAs are areas of land around a municipal well where land use activities have the greatest potential to affect the quality of water flowing into the well.
- Issue Contributing Areas (ICAs) – An ICA is an area within a vulnerable area where activities could contribute to water quality issues.

The study area is located within the Surface Water Intake Protection Zone 2 (IPZ-2) for the Town of Fort Erie's Rosehill Water Treatment Plan (WTP). The IPZ-2 has an assigned vulnerability score of 5.6 out of 10. Due to the low vulnerability score, there are no potential significant threats within the IPZ-2 for the Rosehill WTP.

Applicability to Project: Construction in areas identified in the SPP require a screening and/or permit from NPCA.

3 Public and Agency Consultation

Meaningful involvement of the community including residents, agencies, stakeholders, Indigenous communities, and others who may be affected is a cornerstone of the Class EA process. The consultation component of the Class EA study is designed to foster transparency, inclusivity, and informed decision-making by:

- helping stakeholders and the public understand the study's scope, methodology, and objectives.
- inviting participation in the development and evaluation of project alternatives.
- gathering feedback and insights at critical milestones throughout the Class EA process.

More specifically, the consultation effort aims to:

- raise awareness of the project and ensure opportunities for engagement throughout the planning stages.
- encourage constructive input from public and agency stakeholders before key decisions are made.

The following sections summarize the consultation activities carried out as part of this Class EA. Information was made available to the public at <https://letstalk.forterie.ca/>, and feedback was collected via comment sheets at the PIC, online survey forms and emails. Notices, presentation material from the PICs and associated comments, feedback and discussions are provided in Appendix A.

3.1 Project Notices

3.1.1 Notice of Commencement

A notice of commencement was issued on November 23, 2023, via mail or email to review agencies, Indigenous communities, and individual properties within the study area. The notice was also published in the Fort Erie Observer and advertised on the Town of Fort Erie website at the address <https://letstalk.forterie.ca/six-mile-creek-flooding-project>. The notice presented an overview of the project, EA process, and study area.

3.1.2 Notice of Public Information Centres 1, 2, and 3

Notice of Public Information Centre (PIC) was included in the Notice of Commencement described above. Notice of PIC's 2 and 3 were issued via mail or email to review agencies, Indigenous communities, and individual properties within the study area. The notices were also published in the Fort Erie Observer and advertised on the Town of Fort Erie website at the address <https://letstalk.forterie.ca/six-mile-creek-flooding-project>. Details of the PICs are provided in the sections below.

3.1.3 Notice of Completion

To complete the Schedule B EA process, a Notice of Completion will be issued to Indigenous communities, review agencies, and the public and a period of at least 30 calendar days shall be allowed for comment and input. Following the adoption of this report by City Council, a Notice of Completion will be posted online, and mailed to the stakeholder list advising that the project had been filed for the 30-day review period. The notice will invite interested parties to submit comments to the City within 30 calendar days of posting.

3.2 Public Information Centre No. 1

A PIC was held on December 14, 2023, 5:00 p.m. to 7:00 p.m. at the Crystal Ridge Library and provided the first opportunity for the public to provide input on the project. The PIC provided the project team an opportunity to compile information on flooding issues and concerns in the Six Mile Creek area based on local resident insight. The public input received at this PIC and through the comment sheets was used to inform the following:

- Approach for coastal and riverine flood modelling
- To what degree flooding is caused by high water levels in Lake Ontario (coastal) and to what degree flooding is caused by high flows in Six Mile Creek (riverine)
- Potential alternatives and the assessment approach of those alternatives
- Development of the implementation strategy

3.3 Public Information Centre No. 2

A second PIC was held on June 24, 2024 5:00 pm to 7:00 pm at the Crystal Ridge Library and provided an opportunity for the project team to provide an update on the Class EA process since the last PIC. Information shared during this PIC included findings from the lake level analysis, hydrologic and hydraulic modelling of Six Mile Creek as well as the supporting technical studies (ecology, archaeology, cultural heritage, hydrogeology). The PIC also presented the alternative solutions and the evaluation criteria that would be used to assess and select the preferred solution.

3.4 Public Information Centre No. 3

A third PIC was held on May 6, 2025, 5:00 pm to 7:00 pm at the Crystal Ridge Library and provided an opportunity for the project team to provide updates and findings from the assessment of alternatives developed in the EA process since the last PIC. Information presented during this PIC included:

- Existing environmental characteristics impacting the selection of a preferred flooding mitigation alternative
- Hydraulic and hydrologic conditions in Lake Erie and Six Mike Creek impacting the level of service provided by alternatives
- The preliminary evaluation of alternatives.

Feedback was received on the alternative assessment and was used to select a preferred solution.

3.5 Stakeholder Meetings and Agency Consultation

Stakeholders and various agencies that were engaged in the planning and development of the alternatives included MECP, NPCA and different Town departments. A list of the groups consulted as well as feedback are provided in Appendix A.

3.6 First Nations and Indigenous Consultation

The Notice of Commencement and Notice of PIC #1, PIC #2 and PIC #3 were emailed to, Haudenosaunee Development Institute (HDI), Mississaugas of the Credit First Nation (MCFN), and Six Nations of the Grand River (SNGR). Acknowledgement of the notices were received from HDI, and SNGR.

3.7 Comments Received

Comments received during the PICs were integrated into the project including the development of alternative solutions, criteria and evaluation. Comments received and associated responses are provided in Appendix A.

A draft of this Project File report was provided to SNGR, MCRN, MECP, and NPCA for a pre-review period prior to filing. Comments were received from NPCA and their feedback was incorporated into the report. The comments received from NPCA and associated responses are provided in Appendix A.

4 Existing Conditions

The EA focused on surface flooding. Accordingly, the existing conditions within the study area emphasize the hydrologic and hydraulic characteristics of Six Mile Creek and Lake Erie, along with the features that may influence the development of alternative solutions, evaluation criteria, and overall assessment. To establish these existing conditions, the following studies were undertaken:

- Hydrotechnical assessment: analysis of Six Mile Creek flows and Lake Erie water levels including hydraulic model updates based on local survey and updated topography.
- Hydrogeological summary: review of available background studies and desktop information to determine the groundwater conditions within and surrounding the study area.
- Natural heritage assessment: desktop assessment to establish the ecological conditions within the study area including aquatic habitat, terrestrial environment, vegetation, and SAR.
- Cultural heritage: A desktop and field-based study to determine cultural resources and landscapes within the study area.

- Archaeological assessment: A Stage 1 Archaeological Assessment to determine potential for archaeological resources prior to ground disturbance activities.

Together, these studies provide the foundation for evaluating potential alternatives and inform the subsequent discussion of solutions and their implications for the study area.

4.1 Social and Economic Environment

The 25 ha study area encompasses a low-density residential area known as “Thunder Bay” in the Town of Fort Erie. The area includes several residential streetscapes (both permanent and seasonal), infrastructure features such as the Thunder Bay Road bridge, and various landscape features including Six Mile Creek, and Friendship Trail.

While many homes in the Thunder Bay community, particularly along the Lake Erie shoreline (Colony Road) are seasonal use, the homes that experience the most frequent flooding from Six Mile Creek in the study area are primary dwellings and are utilized year-round. The majority of these are small bungalows (single dwelling homes) are located along Shirley Road, Neva Road and Bethune Avenue. There are also several vacant land properties in the study area, most of which are assumed to be “non-buildable” based on current land use designations and regulated area mapping.

Over the past few years there has been a notable increase in residential construction within the Town of Fort Erie (The Town of Fort Erie 2025a). Fort Erie has the highest number of development applications with the Municipality of Niagara, with the community of Thunder Bay being an area where the highest number of new residential building permits were issued in 2024 (The Town of Fort Erie 2025b). While the focus of the growth and development is not within the study area, increased development in the surrounding area could influence the need for more informal public uses as well as reliable access and egress along roadways. As flooding in the area affects both private property as well as municipal roadways, the EA solution should focus on supporting responsible long-term growth and development.

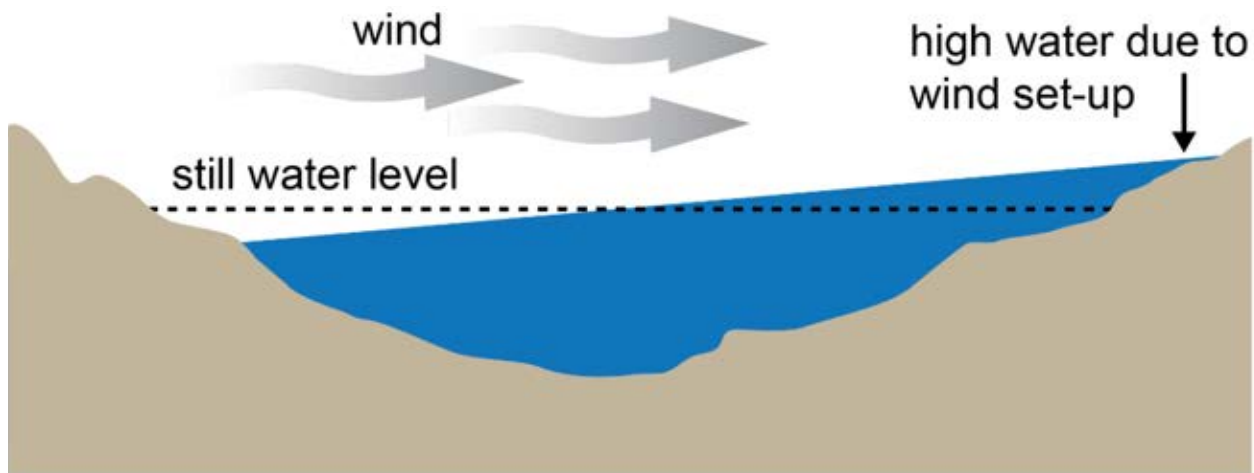
4.2 Hydrotechnical Environment

Many of the residents along Shirley Road and Neva Road are located within the Regulated flood limits, which include both Regulatory flood hazard limits from Six Mile Creek and shoreline extents for Lake Erie (Figure 4.1). The following sections detail the context and mechanisms for flooding in the area.

4.2.1 Background

For decades, the study area in the community of Thunder Bay has experienced several major storms leading to localized private property flooding, as well as flooding along Shirley Road, Neva Road and Bethune Avenue. Town staff have reported that high water levels in the creek have resulted in closures of Shirley Road nine-times since February 2019. Recently, elevated lake level and wind gusts caused significant flooding on October 31, 2019, November 15, 2020, and December 2022 during Winter Storm Elliot (suspected cause was southwest wind gusts of 70 km/hour).

Although the study area is located within the documented NPCA 100-year riverine floodplain, it is suspected that the localized flooding occurs primarily due to seiche effect or storm surge (see Figure 4.1) from Lake Erie.



Wind setup is a local rise in water level caused by wind.

Figure 4.1 Example of the Seiche / Storm Surge Effect on Lake Erie (NPS 2018)

A key component of the study was to determine the main cause of flooding in the area. The combination of riverine flooding from Six Mile Creek and lake-level induced flooding from Lake Erie, often referred to as compound flooding, poses unique challenges for risk assessment and resilience planning. Compound flooding events occur when high river levels driven by local precipitation coincides with high lake levels, which are driven by wind induced storm surge and seasonal fluctuations in lake level. Determining if the flooding issues are a result of riverine flows, lake water levels or a combination thereof, focuses the assessment and helps determine practical solutions that can be implemented.



Buildings

Roads

Parcels

Six Mile Creek

Study area

Regulated Floodplain Extent

1:4,500

NAD83(CSRS) / UTM zone 17N

0

100

200 m

References: Data obtained from OSM, Town of Fort Erie, and MES Canada

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MONTROSE

ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Regulated Floodplain
Extend in the Study Area

Date: December, 2025	Project No: 36481	Submitter: J. Arce-Rodriguez	Reviewer: A. Mckay
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Figure:
4.2

4.2.2 Six Mile Creek

The study area is bound within the 18 km² drainage area of the Six Mile Creek watershed (Figure 4.3). Six Mile Creek generally flows from the north to south and from the west to east within the study area. While there appears to have been some local changes to land use within the study area, much of the land use within the upstream portion of the watershed has remained unaltered since the 1950s, leading to the understanding that the increase in recent flooding is not a result of an increase in urban development.

The study area is largely rural, with the primary land uses of swamp, treed and undifferentiated/agricultural; remaining portions are allocated to urban and rural residential land uses. Soils in the residential areas are largely disturbed and “unmapped” within the Soil Survey Complex. Soils surrounding Six Mile Creek and the adjacent wetland are classified as alluvium, which is described as a loose mix of clay, silt, sand and gravel sediments that are associated with floodplains. There is a small pocket between the residential area and the wetland that has been mapped as “Maplewood Soil – Red Phase” which is described as a loamy texture over silty clay (Kingston and Presant 1989).



Buildings

Roads

Six Mile Creek

Regulated Floodplain

Study Area

Six Mile Creek Watershed (NPCA)

1:30,000

NAD83(CSRS) / UTM zone 17N

07001,400 m

References: Town of Fort Erie, Ontario GeoHub, LIO
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MONTROSE

ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Six Mile Creek Watershed

Date:December, 2025

Project No:36481

Submitter:J. Arce-Rodriguez

Reviewer:A. McKay

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Figure:4.3

There are no flow monitoring gauges on Six Mile Creek. Return period flows for the creek have been estimated using the NPCA’s SWMHYMO model developed for the area by Philips Engineering Ltd. in 2008. An overview of the peak flows derived from the 2 through 100-year events for the main branch of Six Mile Creek is outlined in Table 4.1.

Table 4.1 Return Period Flows for Six Mile Creek

Return Period	2-year	5-year	10-year	25-year	50-year	100-year
Flow m ³ /s	4.82	13.15	20.10	30.46	38.81	47.40

The hydraulic conditions for the study area were derived by updating an existing conditions hydraulic model provided by NPCA on at the onset of the project. The NPCA model was updated to current conditions based on a 2024 survey, terrain models and aerial imagery. A detailed summary of the updates, and comparison to the NPCA model is provided in Appendix B.

A hydraulic analysis of the Six Mile Creek was performed using the update existing conditions HEC-RAS model with data from the return period flows (Table 1), assuming a median lake level of 173.6 meters above sea level (masl) CVGD2013. The analysis found that average lot levels of the Shirley Road properties (176 masl CVGD2013) are within the 50-year riverine flood extent. Therefore, it would be expected that these properties would only flood from river flows (Six Mile Creek) once per 50-years on average. Figure 4.4 shows the result of the hydraulic analysis for the Six Mile Creek 2-year through 100-year return periods flows.

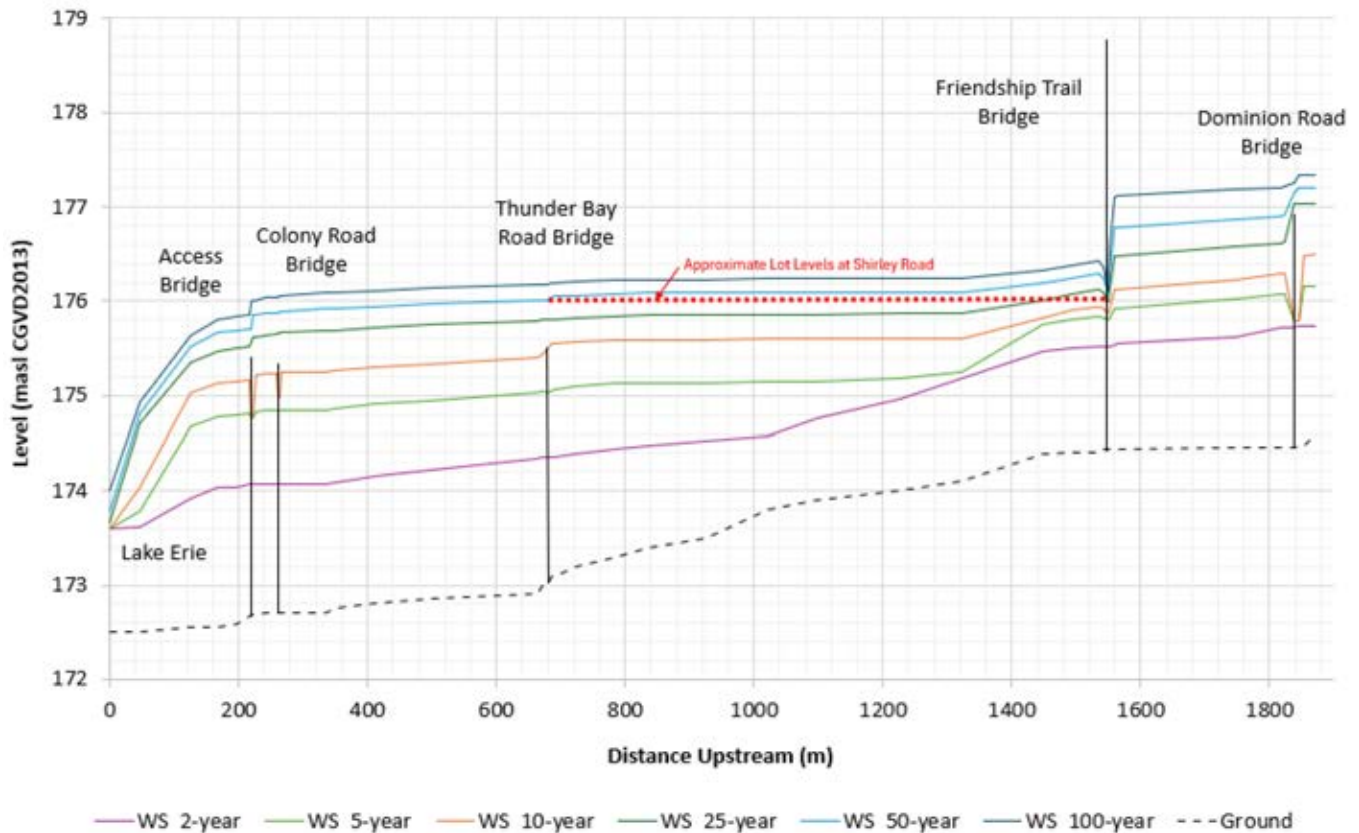


Figure 4.4 Riverine Flood Levels (2-year through 100-year peak flows, median lake level)

4.2.3 Lake Levels

Lake Erie's geography makes it highly susceptible to a phenomenon called storm surge (or seiche). Due to its shallow depth and east-west orientation, strong southwest winds can push large volumes of water to the eastern end of the lake. This effect can raise water levels by up to 2.4 m in the Fort Erie area in extreme cases. The storm surge effect leads to flooding in low-lying areas or near watercourse outlets, with the water oscillating in these areas for hours or even days.

A historical analysis shows that the lake levels above 176 masl (the approximate lot levels of Shirley Road) have occurred approximately 1 to 2 times per decade. However, lake levels above 176 m have occurred 4 times in the past 5 years (see Figure 4.5).

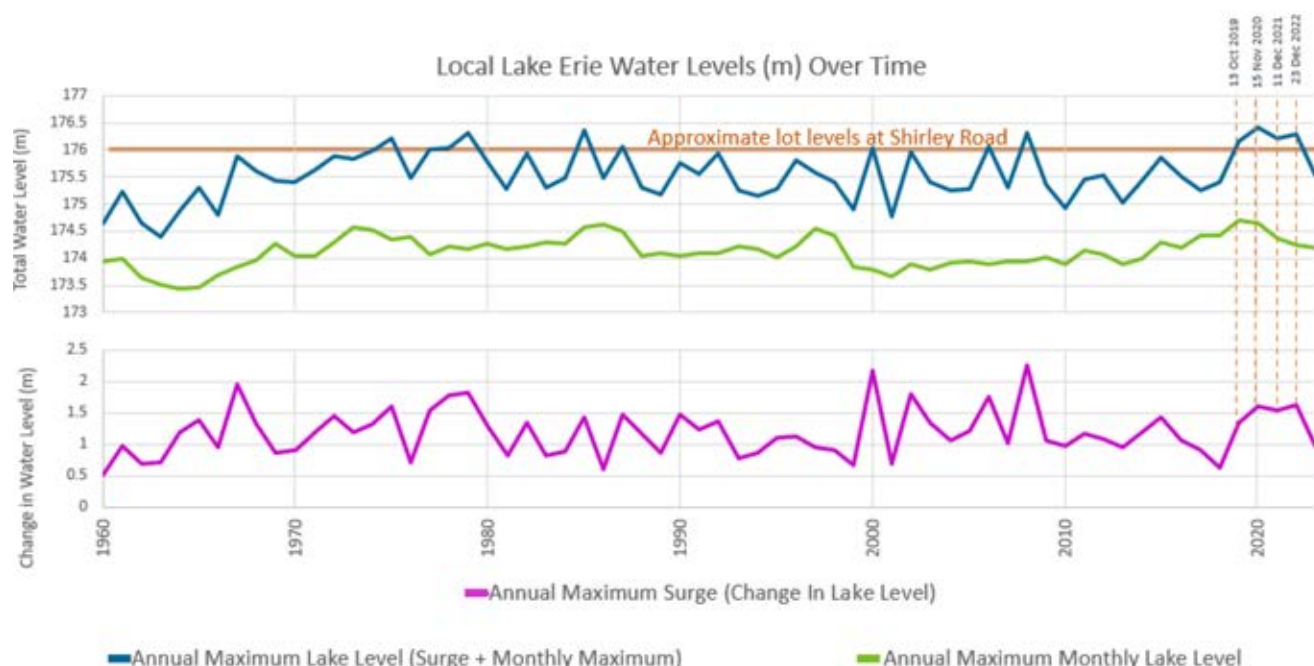


Figure 4.5 Lake Erie Water Levels Over Time

A probability analysis was completed to derive the return period frequency of the combined lake level/storm surge level for Lake Erie. Details of the analysis are provided in Appendix B. A summary of return period storm surge lake levels for Fort Erie is outlined in Table 4.2.

Table 4.2 Return Period Storm Surge Lake Levels for Fort Erie (masl)

Return Period	2-year	5-year	10-year	25-year	50-year	100-year
Combined Lake Level & Surge	175.58	175.98	176.18	176.33	176.47	176.56

Datum is CGVD 2013

A hydraulic analysis of Six Mile Creek was performed using the updated existing conditions HEC.RAS model with data from the return period storm surge lake levels based on a combined lake level/storm surge analysis (Table 4.2). The analysis determined that return period surge lake levels produce higher water levels upstream than the equivalent riverine flood levels. Shirley Road properties are at approximately the 5-year storm surge water levels (Figures 4.6). Therefore, they would flood from storm surge lake levels once per 5-years on average.

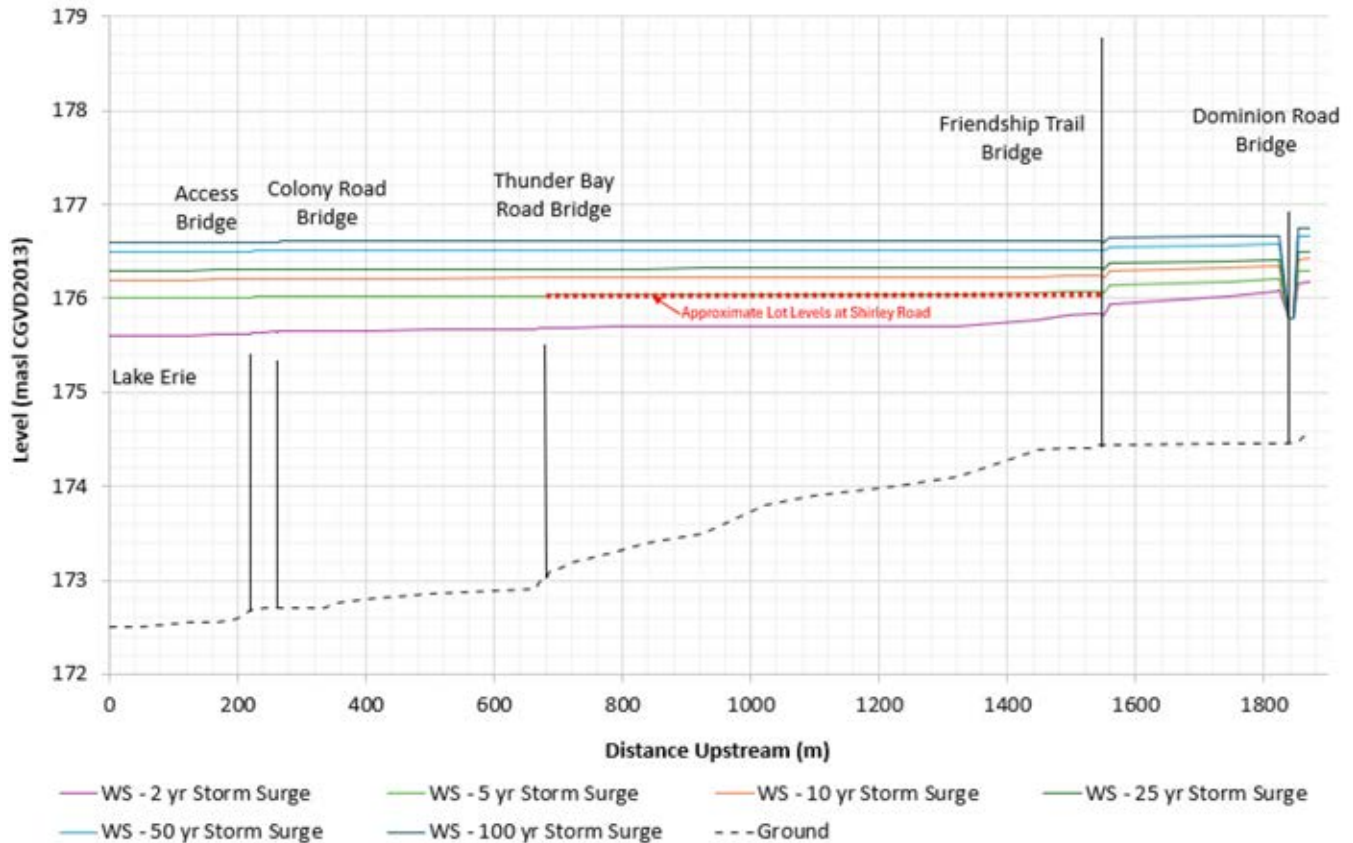


Figure 4.6 Lake Flood Levels (2-year through 100-year Storm Surge Lake Level, 5-year Creek Flow)

4.2.4 Flood Mechanism

4.2.4.1 Seasonal Flood Analysis

In southern Ontario, the largest rainfall events tend to be a result of summer convective thunderstorms, which occur in July and August. However, in the months November to March, freshet and rain-on-snow events can also cause high riverine flood events, particularly in rural watersheds (such as the Six Mile Creek watershed).

A frequency analysis was completed to determine the seasonal patterns of rainfall against the occurrences of flooding in nearby gauged watershed (Twenty Mile Creek, Twelve Mile Creek and Welland River). Figure 4.6 shows that the highest recorded river flows happen between November and March, and not during the typical periods of high rainfall/convective thunderstorm events (July and August). This leads to the conclusion that high water levels in Six Mile Creek are typically driven by rain-on-snow events through the winter/early spring. Figure 4.7 also shows the occurrence of peak storm surge events, which typically occur in October through February. This temporal correlation shows that

there is potential for high river flow from Six Mile Creek to coincide with high surge levels in Lake Erie, leading to the potential for compound flooding.

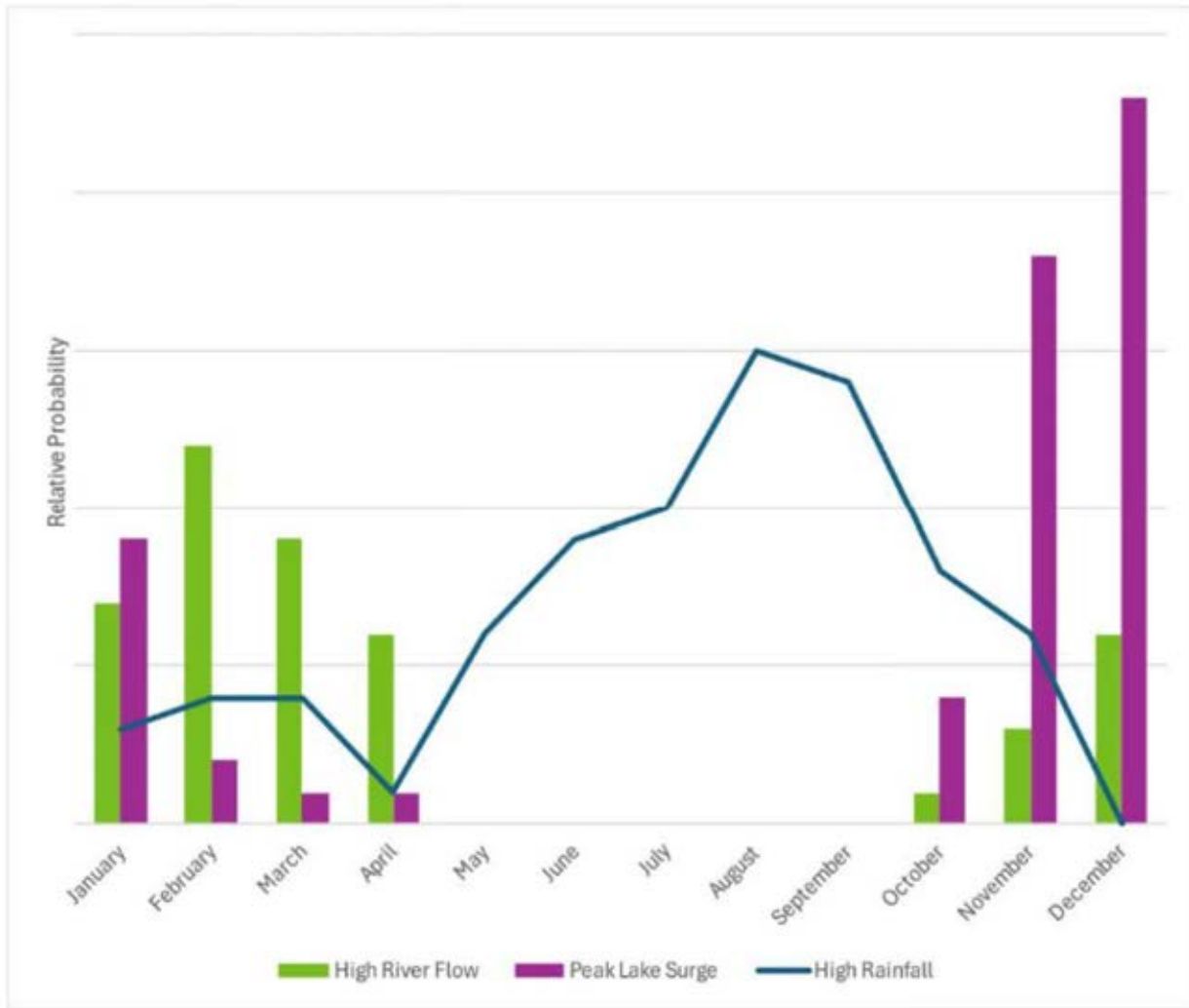


Figure 4.7 Flooding Seasonality vs Rainfall

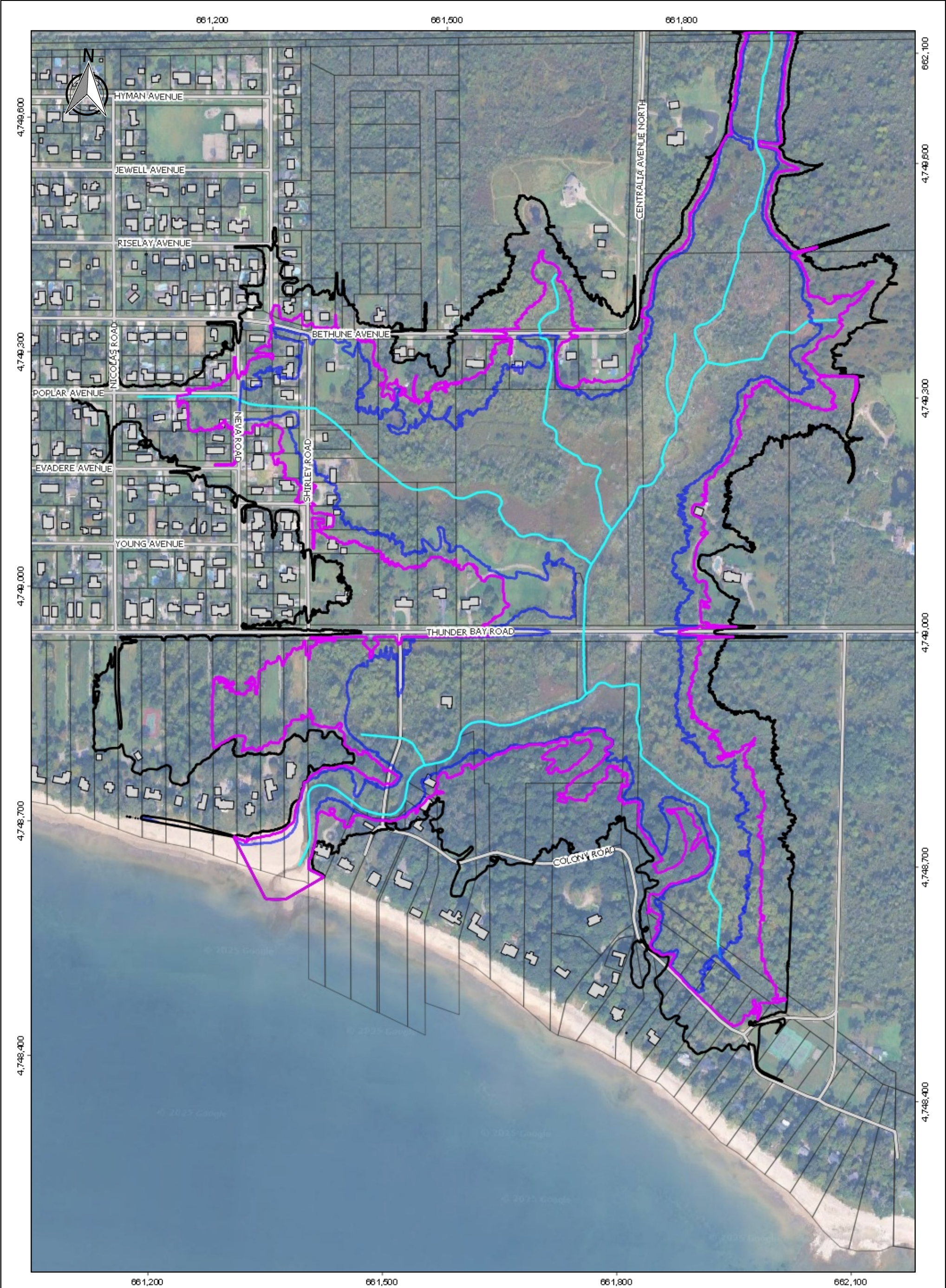
4.2.4.2 Compound Flooding Analysis

The seasonal occurrence of riverine floods and storm surge events during the winter months suggests that there may be instances where compound flooding has occurred in Six Mile Creek. A statistical analysis looked at days where rainfall greater than 20 mm was recorded against daily maximum storm surge lake levels. Over a period of 60 years, there was only one instance on November 14, 1974, where a coincident event could have taken place (58 mm of rainfall and 1.7 m storm surge) but generally large rainfall/melt events and peak storm surges were independent. This suggests that coinciding events are possible but are quite rare/weakly correlated. Further, no significant rain fell in the Six Mile Creek watershed when the Town of For Erie reported flooding incidents between 2019 and 2023.

Therefore, the analysis indicates the main cause of flooding in the study area is lake induced storm surges, not river flows. Figure 4.8 outlines the resulting flood inundation lines associated with the 2-year, 5-year and 100-year return period storm surge lake levels.

4.2.4.3 Localized Flooding

Through public consultation, it was noted that additional flooding may be occurring in the Thunder Bay community northwest of Shirley Road. Residents reported flooding coming from the west side of the road even when water levels in Six Mile Creek, located to the east, were lower. This suggests that local drainage issues, such as undersized storm sewer infrastructure or altered overland flow paths, are causing additional flooding issues. It is understood that the Town may already be investigating these urban drainage concerns; however, further assessment should be undertaken to ensure that any existing issues are addressed and do not exacerbate flooding in the area independent of Six Mile Creek storm-surge events.



Six Mile Creek

Buildings

Parcels

Roads

Lake Level Storm Surge

2-year

5-year

100-year

1:4,500

NAD83(CSRS) / UTM zone 17N

0

100

200 m

References: Data obtained from OSM, Town of Fort Erie, and MES Canada

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MONTROSE

ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Flood Inundation Extents for the

2-, 5- and 100-year Storm Surge

Date:

December, 2025

Project No:

36481

Submitter:

J. Arce-Rodriguez

Reviewer:

A. Mckay

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Figure:

4.8

4.3 Hydrogeology

The Philip Engineering 2008 Fort Erie Creeks – Watershed Plan details the hydrogeology within the study area. In general, the study area lies within the Onondaga Formation and consists of a thin overburden/shallow bedrock environment. Surficial geology consists of overburden lithology that is glaciolacustrine clay-dominant, which is characterized by low permeability. Generally, the water table and groundwater flow follows topography, which is consistent with the surface water flow direction of north to south of Six Mile Creek.

The 2008 watershed study suggested that there could be strong upward groundwater gradients (groundwater discharge) in the area of Thunder Bay Road and Prospect Point Road (west of the study area) as well as Dominion Road and Buffalo Heights (east of the study area). These upward gradients could be driven by the local bedrock topography. Conversely, portions of the area have been identified as a Significant Groundwater Recharge Area (groundwater recharge is greater than 53 mm/year), with annual groundwater recharge estimated at 50-100 mm/year (NPCA 2013).

There are no major surficial aquifers in the area. There is likely an unconfined aquifer where overburden is less than 5 m thick (NPCA 2013). The study area does contain portions identified as a highly vulnerable aquifer (largely along the shoreline of Lake Erie where more sands and gravel layers are found) (NPCA 2012). The NPCA Groundwater Study did identify a septic system problem area within the southern portion of the Six Mile Creek watershed. The thin overburden layer does not provide sufficient filtration/containment of potential contaminants from surface water features.

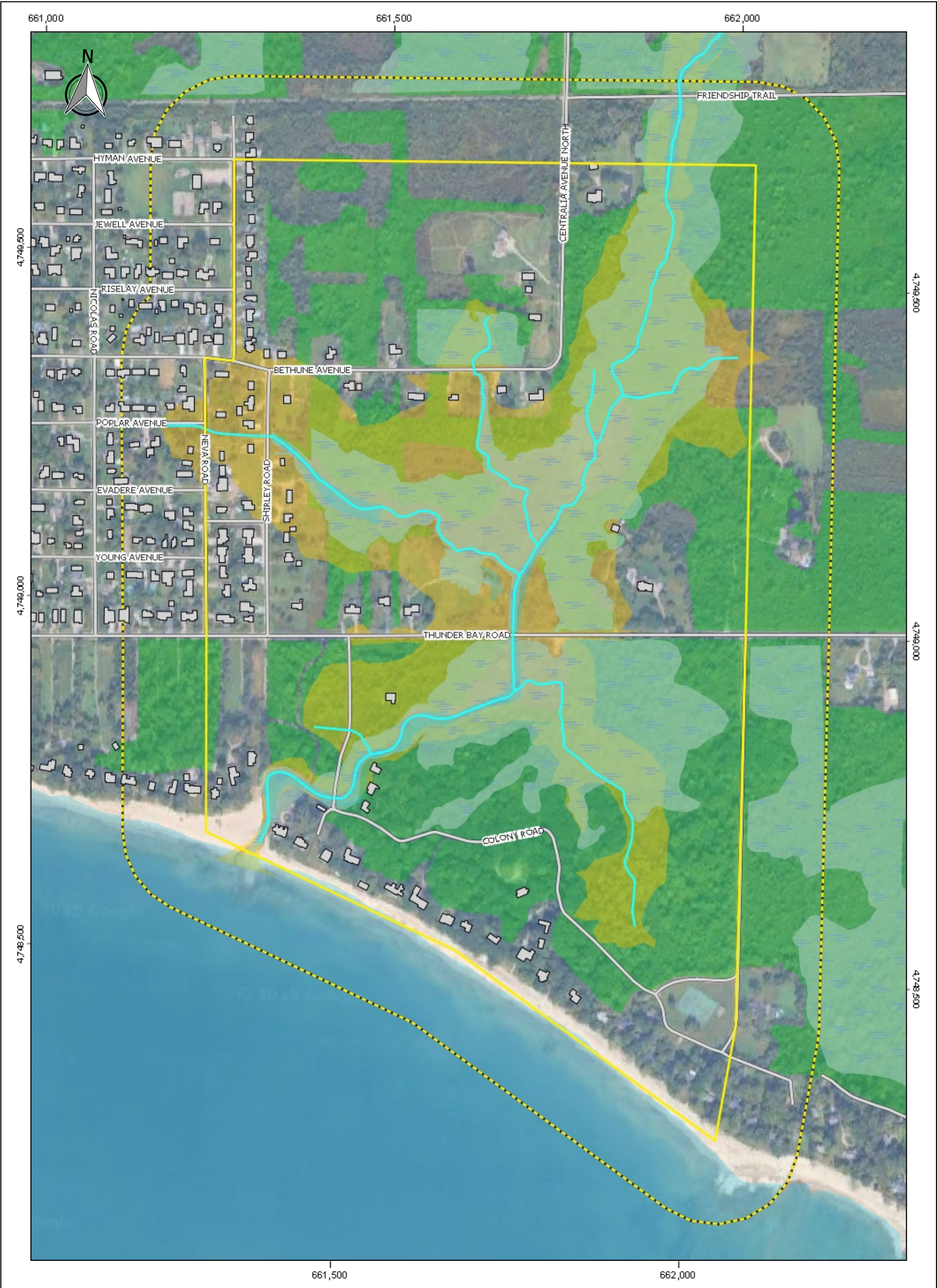
4.4 Natural Heritage and Ecology

The natural environment within the study area includes a diverse array of features such as provincially significant wetlands, significant woodlands, valleylands, environmentally sensitive areas (ESAs), and watercourses (Figure 4.8). The Six Mile Wetland Complex, a key feature, spans 226 hectares and includes 19 individual wetlands with deciduous swamp and marsh vegetation. It supports several provincially significant species and contributes to groundwater recharge and nutrient trapping. Additionally, the area contains significant woodlands over 2 hectares in size, valleylands associated with Six Mile Creek, and ESAs like Wavecrest Bush, which is a large wetland complex extending from Lake Erie northward.

Surface water quality monitoring has been ongoing in Six Mile Creek at Thunder Bay Road since 2007. Water quality in Six Mile Creek is a concern, with the NPCA's 2023 Watershed Report Card rating it poorly due to high levels of phosphorus, E. coli, and chloride. The creek is a warm water system that supports critical stream fish habitat. Aquatic species at risk such as American Eel, Eastern Sand Darter, and Lake Sturgeon may use both Lake Erie and Six Mile Creek during their lifecycles. While no fish barriers were identified, the presence of similar species upstream and downstream suggests fish passage is possible throughout the creek.

Ecological Land Classification (ELC) identified 14 vegetation communities within the study area, including deciduous forest, mixed forest, marshes, and a rare Sea Rocket Sand Open Beach community. This rare community is sensitive to pedestrian traffic and shoreline disturbances. The area also supports a range of Species at Risk (SAR) and Species of Conservation Concern (SCC), with 13 SAR and 8 SCC having moderate to high potential of occurrence. These include bird species such as Bobolink, Red-headed Woodpecker, as well as Butternut trees, and Fowler's Toad, among others. Their presence underscores the ecological sensitivity of the area and the need for careful planning and mitigation in any proposed flood management solutions.

The Natural Heritage Report is provided in Appendix C.



Buildings

Roads

Six Mile Creek

Subject Lands

Study Area (120 m Adjacent Lands)

Regulation Limit (NPCA)

Waterbody (LIO)

Wetland (LIO)

Wooded Area (Ontario GEOHub)

1:5,000

NAD83(CSRS) / UTM zone 17N

0

100

200 m

References: Town of Fort Erie, Ontario GeoHub, LIO

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MONTROSE

ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Natural Heritage Features

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. McKay

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Figure: 4.9

4.5 Cultural Heritage

A cultural heritage screening for the study area reviewed 90 properties, structures, and landscapes, and identified 71 for further review. After a detailed assessment, four Built Heritage Resources (BHRs) and one Cultural Heritage Landscape (CHL) were found to have potential Cultural Heritage Value or Interest (CHVI) under Ontario Regulation 9/06. Throughout the EA process, Indigenous communities, municipal staff, and heritage organizations were consulted, but no additional heritage concerns were raised.

The identified CHL is the Lake Erie shoreline, which holds cultural and historical significance for Indigenous communities and the broader Fort Erie community. It is valued for its natural beauty, historical associations with early settlement and cottage development, and its role in shaping the area's tourism and public realm. The CHL includes features such as the Centralia Waterfront Window, a public trail offering views of the lake, and deep-set residential lots along Colony Road that reflect early 20th-century development patterns.

The four BHRs include:

- **2912 Bethune Avenue:** A c.1906 two-storey vernacular house, notable as one of the earliest surviving residences in the area.
- **Thunder Bay Road Bridge (Figure 4.10):** A c.1930 rigid-frame concrete bridge, significant for its engineering style and its role in connecting the community during a period of residential expansion.
- **2923 Colony Road:** An early 20th-century Colonial Revival-style house, representing early lakefront residential development.
- **2877 Colony Road:** A Classical Revival-style house from the early 20th century, also part of the shoreline cottage development era.



Figure 4.10 Thunder Bay Road Bridge (left) and Lake Erie Shoreline (right)

4.6 Archaeological

The Stage 1 Archaeological Assessment reviewed the context of the study area to determine the potential for archaeological resources prior to any ground-disturbing activities. The background review identified several indicators of archaeological potential, including proximity to water sources (Lake Erie and Six Mile Creek), historic transportation routes (such as the Grand Trunk Railway), and 19th-century homesteads. Additionally, the Town of Fort Erie's Archaeological Master Plan designates parts of the area as having archaeological potential. Although no registered archaeological sites were found within the project area itself, 15 sites were identified within a 1 km radius, including Indigenous campsites and a multi-component site with both Indigenous and Euro-Canadian artifacts.

A property inspection conducted in November 2024 confirmed that 12.6% of the area had been extensively disturbed by residential development and infrastructure, while 0.9% was classified as low-lying and wet, lacking land-based archaeological potential. However, most of the area (81.9%)—including manicured grasslands, woodlots, and beach zones—was found to retain archaeological potential and will require Stage 2 test pit surveys. Additionally, 4.6% of the area, specifically within Six Mile Creek, may require marine archaeological assessment if in-water work is planned.

4.7 Infrastructure and Utilities

4.7.1 Roads and Bridges

Roadways within the study area include local roads - Neva Road, Shirley Road, and Bethune Avenue. Thunder Bay Road is classified as a collector (owned by the Town of Fort Erie) and Colony Road is private. Shirley Road was recently raised between 127 and 137 Shirley Road in 2022 to an elevation of 175.6 masl in an attempt to help address localized flooding. There are no sidewalks or paved shoulders along the roadways in the study area, but there is a recommendation within Fort Erie's Official Plan to implement bicycle lanes along Thunder Bay Road (Figure 4.11).



Figure 4.11 Thunder Bay Road

There are four existing bridge crossings along Six Mile Creek within the study area. These bridge structures are summarized in Table 4.3.

Table 4.3 Bridge Sizes and Conveyance Capacities

Crossing	Bridge Span ¹	River Conveyance Capacity (when Lake Erie is at a median water level) ²
Friendship Trail	7.6 m	10-year flow
Thunder Bay Road	11.0 m	10-year flow
Colony Road	15.0 m	5-year flow
Private laneway off Thunder Bay Road	15.0 m	100-year flow

Notes:

1. Based on information provided by the 2024 Survey
2. Based on the updated HEC-RAS model (Appendix B)

There are two stormwater conveyance features that drain into the western tributary of Six Mile Creek, from Shirley Road. There is an open channel feature which originates at Neva Road and drains west through Shirley Road via a recently installed 1,200 mm by 900 mm box culvert complete with a flap gate to prevent backwater flooding. While the intent of the structure was to help prevent flooding, the flapgate is prone to clogging with channel debris and is heavy, which likely results in roadway overtopping before full flap gate opening during storm surge events.

Just south of the culverts there is a 675 mm concrete storm sewer outlet which drains a portion of the Thunder Bay neighbourhood. The outlet is currently submerged which limits its capacity to drain during storm events.

4.7.2 Utilities

The study area also contains both private and public utilities that need to be considered in the alternative solutions. Utilities include:

- stormwater mains
- sanitary sewers (there is a sewage pump station just west of Shirley Road within the regulated area)
- watermains
- hydro utilities, gas and cable

5 Development of Alternative Solutions

5.1 High-Level Screening

Alternative solutions were derived by considering the technical, social, economic and environmental setting. Flooding in the study area is primarily caused by backwater effects from high lake levels at the Six Mile Creek outlet. Traditional riverine flood mitigation measures are often ineffective for lake/coastal flooding. Typical solutions like channel widening, or deepening will not fix this flooding issue, as water levels are controlled by the elevated lake level at the downstream boundary. Similarly, culvert or bridge upgrades (unless also fitted with backwater prevention mechanisms) offer negligible relief, since flow conveyance capacity is not the driving factor.

Potentially effective measures to address lake level induced flooding include installing control structures (such as weirs, gates, or pumping systems), or temporary flood barriers to protect low-lying areas when high lake levels occur. Non-structural strategies such as property acquisition and floodproofing are also viable, especially when lake level fluctuations are long in duration or frequent.

A high-level screening process reviewed the technical feasibility of potential alternative solutions (i.e., whether the alternative solution could mitigate the flooding issue). The following options and their ultimate outcomes are summarized in Table 5.1. Solutions were categorized into structural (modifying the area with physical protection) or non-structural (reducing exposure of vulnerability).

Table 5.1 High-Level Alternative Solutions Screening

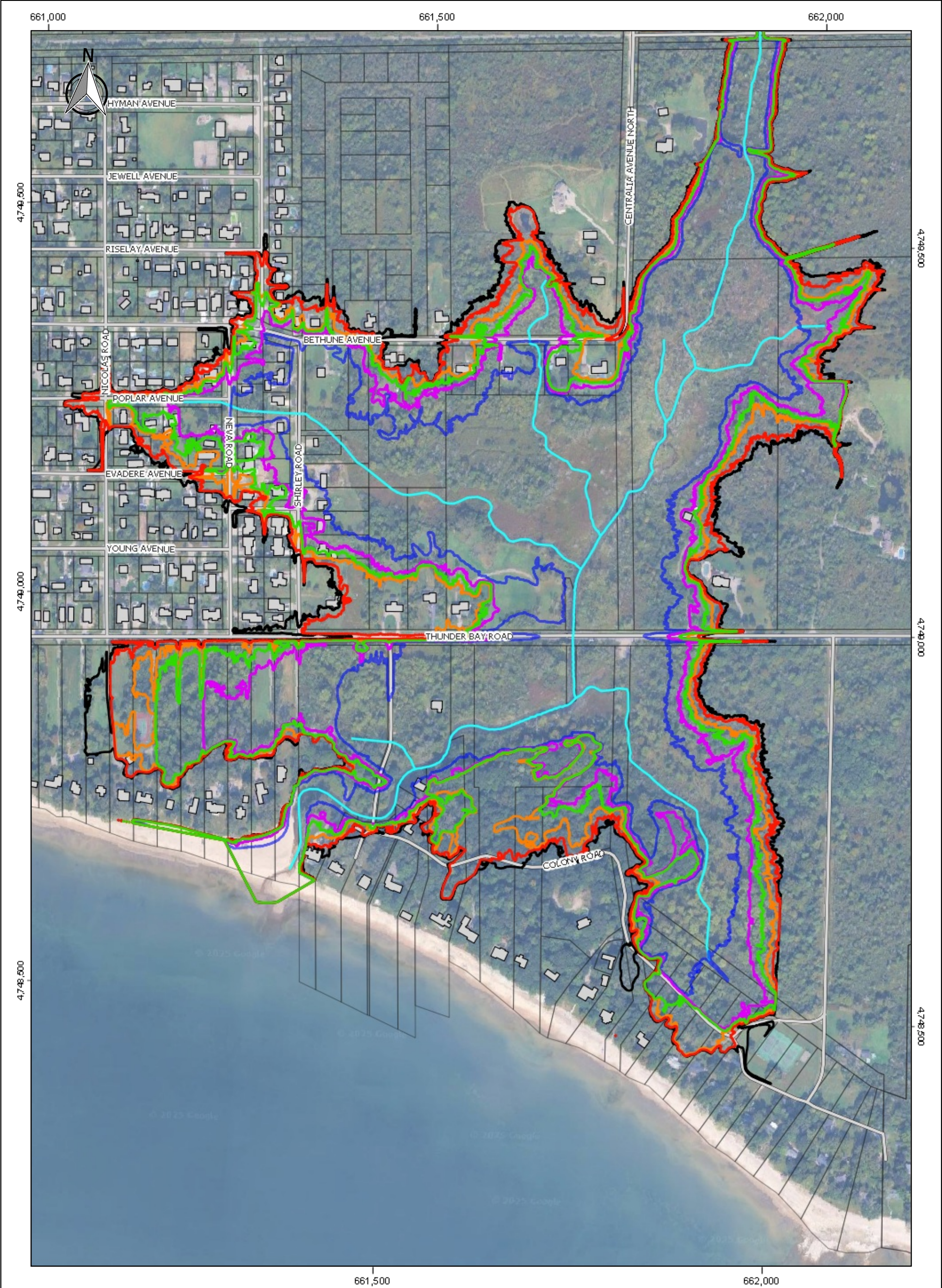
Potential Solution	Description	Screening	Further Evaluation
Structural Measures			
Conveyance Capacity	- Widening or lowering of Six Mile Creek - Increasing bridge or culvert sizes	Not effective – will not mitigate flooding from lake backwater	X
Flood Storage	- Upstream detention (SWM facilities) - Offline storage facilities	Not effective – will not mitigate flooding from lake backwater	X
Flood Barrier	Levees, berms, flood walls	Potentially effective – carried forward to short-listed alternatives	✓
Pumping	Pumping station to remove water behind structures when closed	Potentially effective – in conjunction with other measures - carried forward to short-listed alternatives	✓
Controlled Outlet	Weirs or gates at outlet	Potentially effective – carried forward to short-listed alternatives	✓
Non-Structural Measures			
Property Acquisition	Purchasing properties within the flood extents	Potentially effective – carried forward to short-listed alternatives	✓
Flood proofing	Sump pumps, raising finished floors, perimeter berms, foundation waterproofing	Potentially effective – carried forward to short-listed alternatives	✓

Several variations of each potentially effective high-level alternative solution were screened for feasibility in conjunction with the level of service analysis described below.

5.2 Level of Service Analysis

While removing the regulatory flood extents completely for the community of Thunder Bay would be the most beneficial, it ultimately is not practical due to the low-lying topography and proximity to the lake. Alternative solutions that remove the flooding extent entirely from properties (both lake and riverine flooding) would be too costly or too complex to construct.

The level of service needs to consider the flooding mechanism (lake levels), the frequency of occurrence (return period), protection of houses / buildings (as opposed to the entire property, or non-developed properties) as well as costs and constructability. Figure 5.1 shows inundations extents of the 2 through 100-year lake surge events, along with the regulatory riverine flood extent.



Six Mile Creek

Buildings

Parcels

Roads

Storm Surge Flood Extent

2-year

5-year

10-year

25-year

50-year

100-year

1:4,500

NAD83(CSRS) / UTM zone 17N

0

100

200 m

References: Town of Fort Erie, Ontario GeoHub, LIO

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ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Flood Extents 2- through 100-year

Storm Surge

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. McKay

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Figure: 5.1

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Based on discussions with agencies and stakeholders, a 5-year level of service related to lake surge flooding was selected to facilitate the alternative solutions development and evaluation process. This selection aligns with Town's design standards where lake flood risk within the study area would be consistent with the rest of Town design criteria: "storm sewers and ditches shall [convey] the runoff from the 5-year storm event with minimal inconvenience to activities of property owners and damage to properties (Town of Fort Erie Subdivision Control Guidelines for Development of New Subdivisions 2021)." Additional considerations for selecting the 5-year level of service include:

- Properties experiencing frequent storm surge induced flooding – the properties that experience the most frequent flooding are located with the 5-year storm surge flood extent.
- Feasible construction – barriers or control structures that address a higher level of service would be challenging or complicated to construct.
- Environmental impacts – a higher level of service would require larger and more extensive construction, potentially impacting the adjacent sensitive wetland and natural heritage features.
- Cost-effectiveness – larger or more complex flood mitigation solutions will come at a higher capital cost to implement as well as maintain.

All alternative solutions presented below achieve a reduction in flood risk within the 5-year storm surge flood extent for residential properties along Shirely Road, Neva Road and Bethune Ave. The alternative solutions provide protection of residential dwelling structures, but do not eliminate the risk of property flooding.

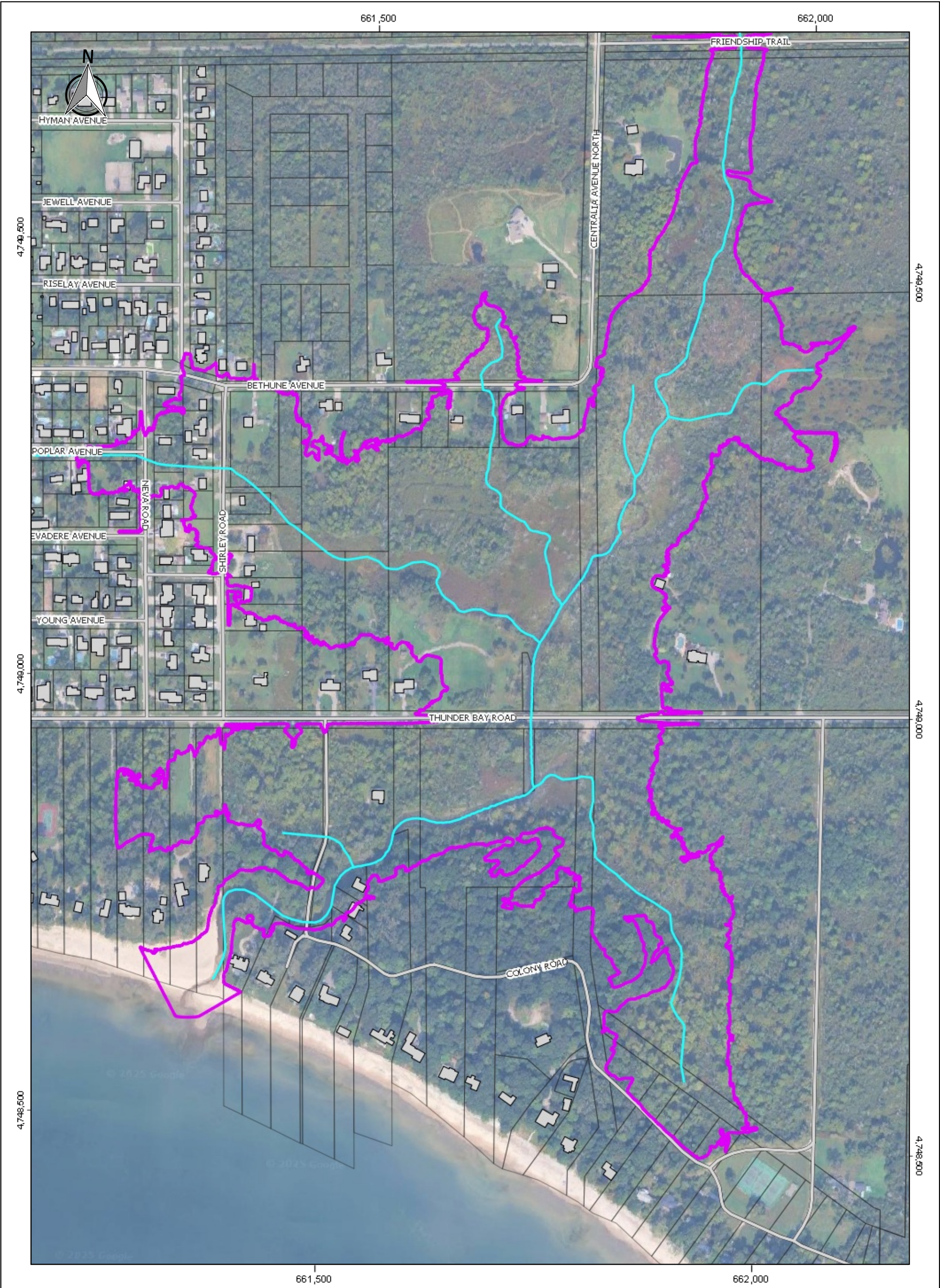
Three properties south of Thunder Bay Road may have residential dwellings within the 5-year storm surge flood extent. Access to these properties was not granted prior to undertaking the required surveys, and therefore the structure elevations could not be confirmed. As such, these three properties have not been formally included in the evaluation of alternative solutions.

5.3 Alternative Solutions for Flood Protection

5.3.1 Do Nothing Alternative

The 'do nothing' alternative shown in Figure 5.2 must be considered as part of the EA process. In this alternative, no new infrastructure is built, there are no changes or improvements to existing infrastructure leading to no changes in flood risk to public and private properties.

The 'do nothing' alternative provides a baseline for comparison of other alternatives.



Six Mile Creek

Buildings

Parcels

Roads

5-year Storm Surge Flood Extent

This figure must be used in conjunction with the attached memorandum and is subject to the same limitations and conditions stated in the memorandum.

1:4,000

NAD83(CSRS) / UTM zone 17N

0100200 m

References: Town of Fort Erie, Ontario GeoHub, LIO

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ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Do Nothing Alternative

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. McKay

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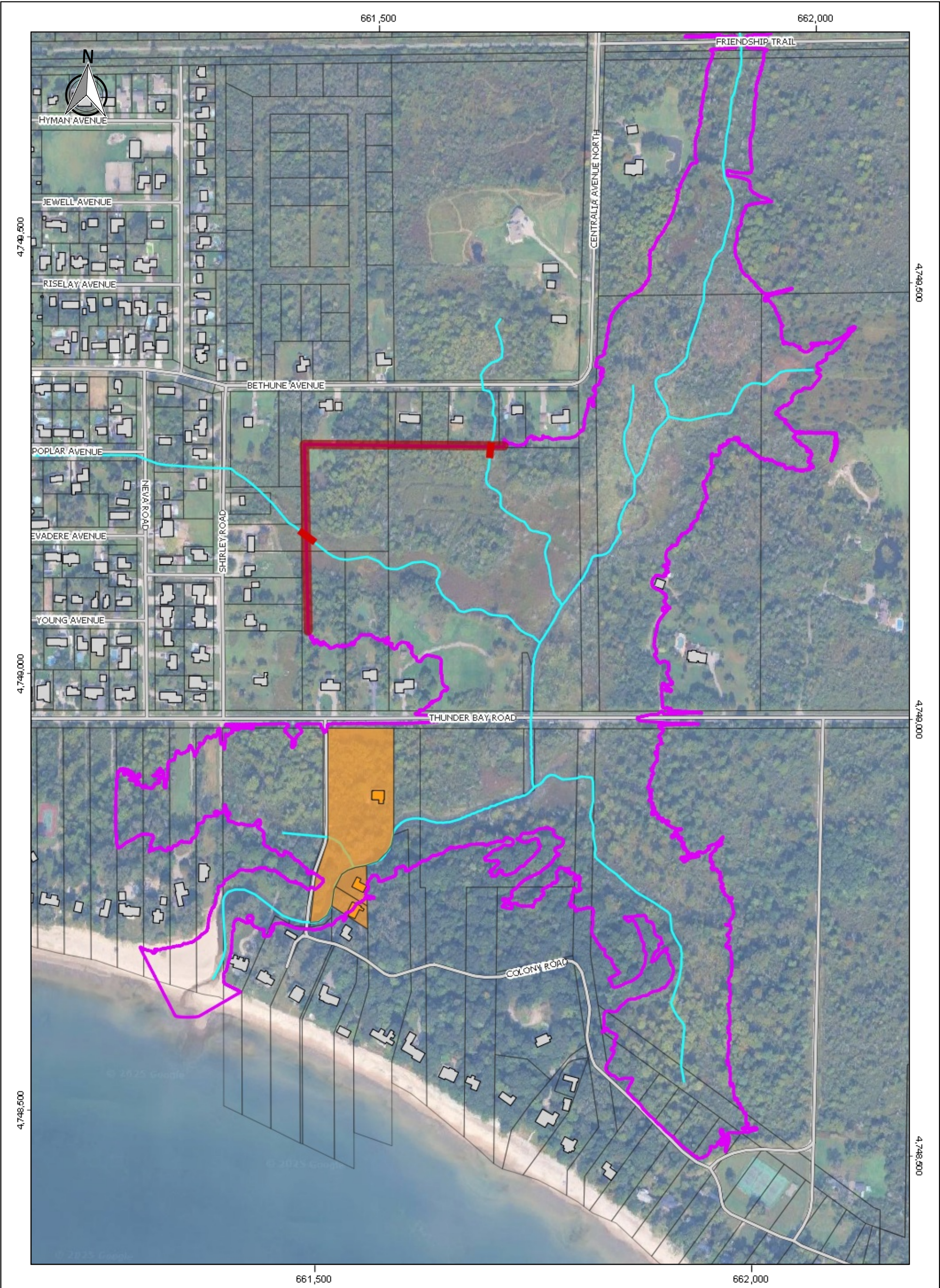
Figure: 5.2

5.3.2 Alternative Solution 1: Landform Barrier

Alternative 1 (Figure 5.3) creates a landform barrier (or dyke) along rear property lines adjacent to the wetland protecting residents along Shirley Road and Bethune Avenue from lake surge induced flooding up to the desired level of service.

The elevation of the landform is at the 5-year storm surge level (176 masl) plus 0.3 m of freeboard (additional height for resiliency). The barrier would extend approximately 425 m, at a height averaging 0.8 m (max height of 1.8 m), impacting 2,400 m² of area (rear properties and adjacent wetland/woodlands). Culverts with passive backflow prevention devices will be required through the barrier at each tributary (along Shirley Road and Bethune Avenue). Pending the exact location of the landform, an easement through the properties yard may be required for construction and maintenance access.

Three property dwellings south of Thunder Bay Road may fall within the 5-year storm surge extent. These properties could be purchased to fully eliminate flood risk.



Six Mile Creek

Buildings

Parcels

Roads

5-year Storm Surge Flood Extent

Alternative 1

Culvert

Landform Barrier

Optional Property Purchase

1:4,000

NAD83(CSRS) / UTM zone 17N

0

100

200 m

References: Town of Fort Erie, Ontario GeoHub, LIO
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ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Alternative 1:

Landform Barrier

Date:

December, 2025

Project No:

36481

Submitter:

J. Arce-Rodriguez

Reviewer:

A. McKay

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Figure:

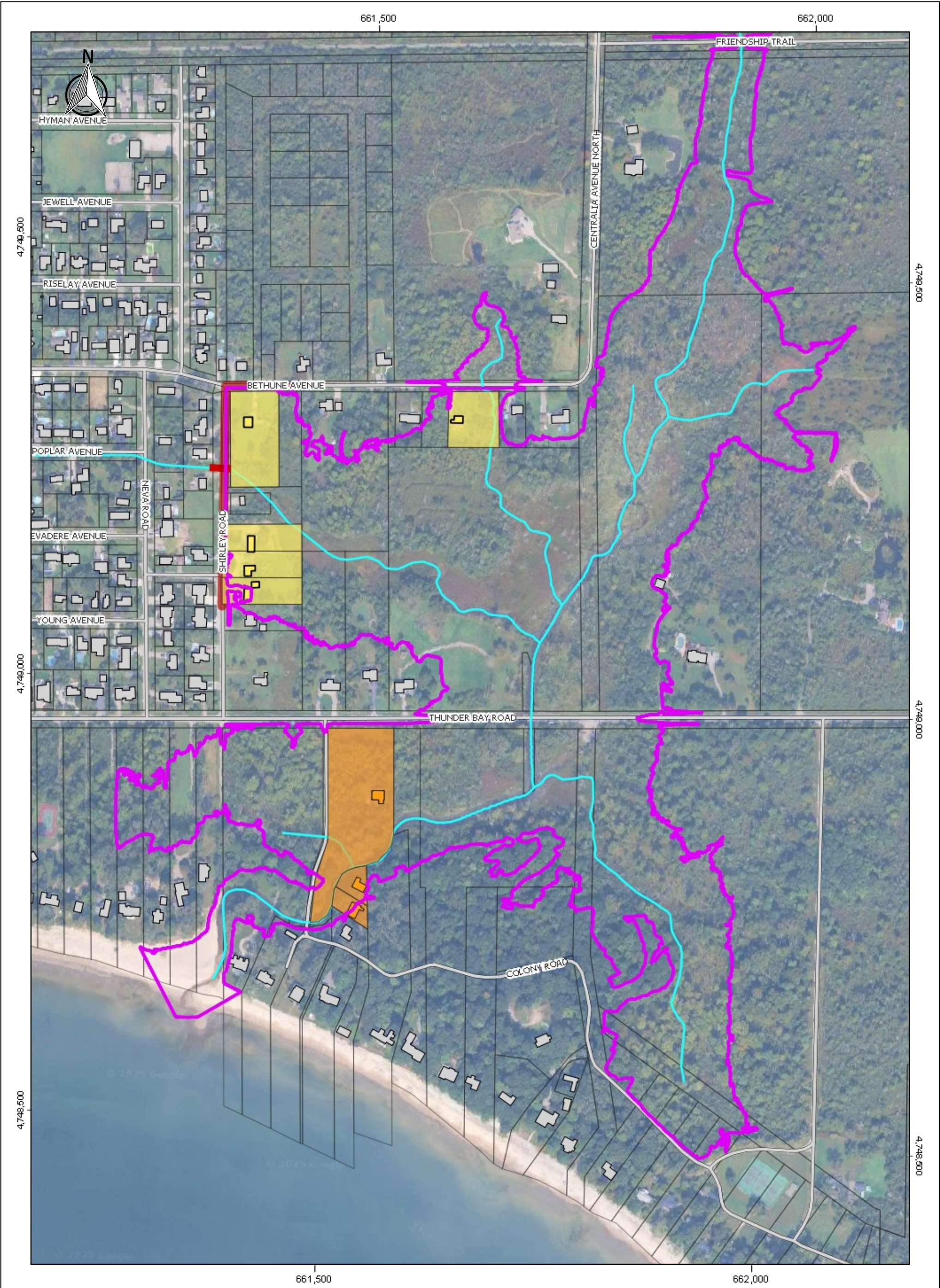
5.3

5.3.3 Alternative Solution 2: Road Right-Of-Way Barrier with Property Purchase

Alternative 2 (Figure 5.4) creates a landform barrier by raising the elevation for sections of the municipal roadway, protecting residents west of Shirley Road from lake surge induced flooding up to the desired level of service. The crown elevation of the road would be raised an average of 0.6 m equal to 5-year storm surge level plus freeboard. The barrier would extend approximately 300 m with the footprint being largely contained within the road right-of-way.

Residential properties with dwellings/structures falling within the 5-year storm surge extent, east of Shirley Road and south of Bethune Avenue, could be purchased to eliminate flood risk. Three properties south of Thunder Bay Road may fall within the 5-year storm surge area, and could optionally be purchased to fully eliminate flood risk.

Culverts with passive backflow prevention devices will be required through the barrier at the tributary from Shirley Road. This alternative makes use of existing road infrastructure to form a flood barrier removing the need to construct barriers outside the existing municipal corridor.



Six Mile Creek

Buildings

Roads

Parcels

5-year Storm Surge Flood Extent

Alternative 2

Culvert

Road Re-Profiling

Property Purchase

Optional Property Purchase

1:4,000

NAD83(CSRS) / UTM zone 17N

0

100

200 m

References: Town of Fort Erie, Ontario GeoHub, LIO
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Town of Fort Erie

Six Mile Creek Flooding Project

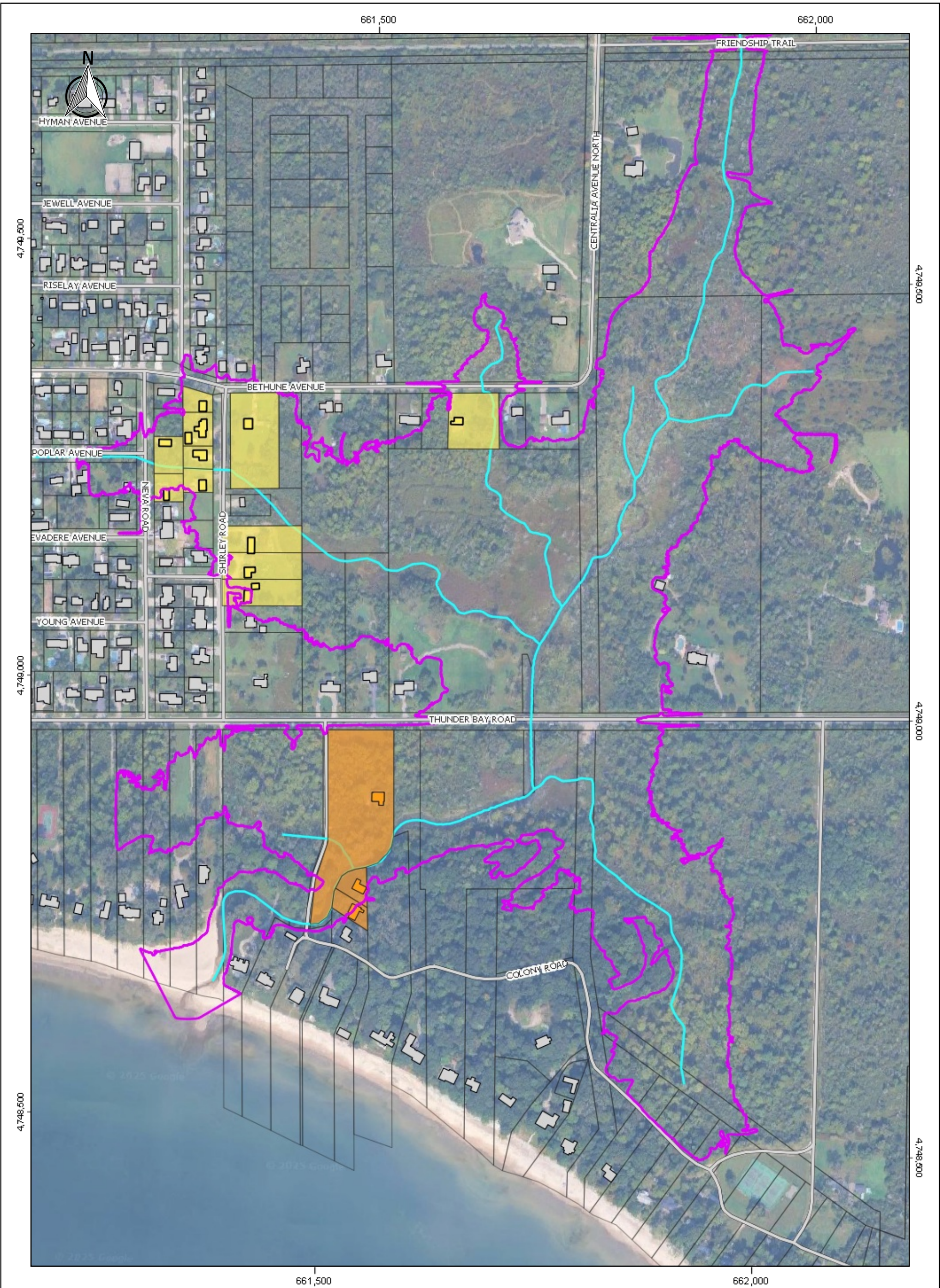
Alternative 2: Road Right-of-Way with Property Purchase

Date:	December, 2025	Project No:	36481	Submitter:	J. Arce-Rodriguez	Reviewer:	A. McKay
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5.3.4 Alternative Solution 3: Property Purchase

Alternative 3 (Figure 5.5) involves the potential purchase of all properties with residential buildings along Shirley Road, Neva Road and Bethune Avenue falling within the 5-year storm surge area to eliminate lake surge induced flood risk at homes up to the desired level of service. Property purchase values are based on high-level estimates based on development / risk within a floodplain. Individual residents could accept flooding risk thereby negating the need for property purchase (similar to a 'do nothing' scenario).

Not included in the analysis but shown as optional to purchase to fully eliminate flood risk up to the desired level of service, are the three properties south of Thunder Bay Road.



Six Mile Creek

Buildings

Parcels

Roads

5-year Storm Surge Flood Extent

Property Purchase

Optional Property Purchase

This figure must be used in conjunction with the attached memorandum and is subject to the same limitations and conditions stated in the memorandum.

1:4,000

NAD83(CSRS) / UTM zone 17N

0

100

200 m

Town of Fort Erie

Six Mile Creek Flooding Project

Alternative 3:

Property Purchase

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. McKay

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Figure: 5.5

References: Town of Fort Erie, Ontario GeoHub, LIO

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5.3.5 Alternative Solution 4: Thunder Bay Road Barrier and Backflow Prevention System

Alternative 4 (Figure 5.6) creates a landform barrier by raising the elevation of a section of Thunder Bay Road and incorporating a backflow prevention system into the municipal roadway and bridge structure, protecting residents north of Thunder Bay Road from lake storm surge induced flooding up to the desired level of service.

Three properties with dwellings may fall within the 5-year storm surge area, south of Thunder Bay Road, and could be purchased to eliminate flood risk up to the desired level of service.

This alternative would require the Thunder Bay Road crown elevation, currently at 175.7 masl be raised to equal to 5-year storm surge level plus freeboard (176.3 masl). The road raise would extend for approximately 300 m, as shown in Figure 5.6 below.

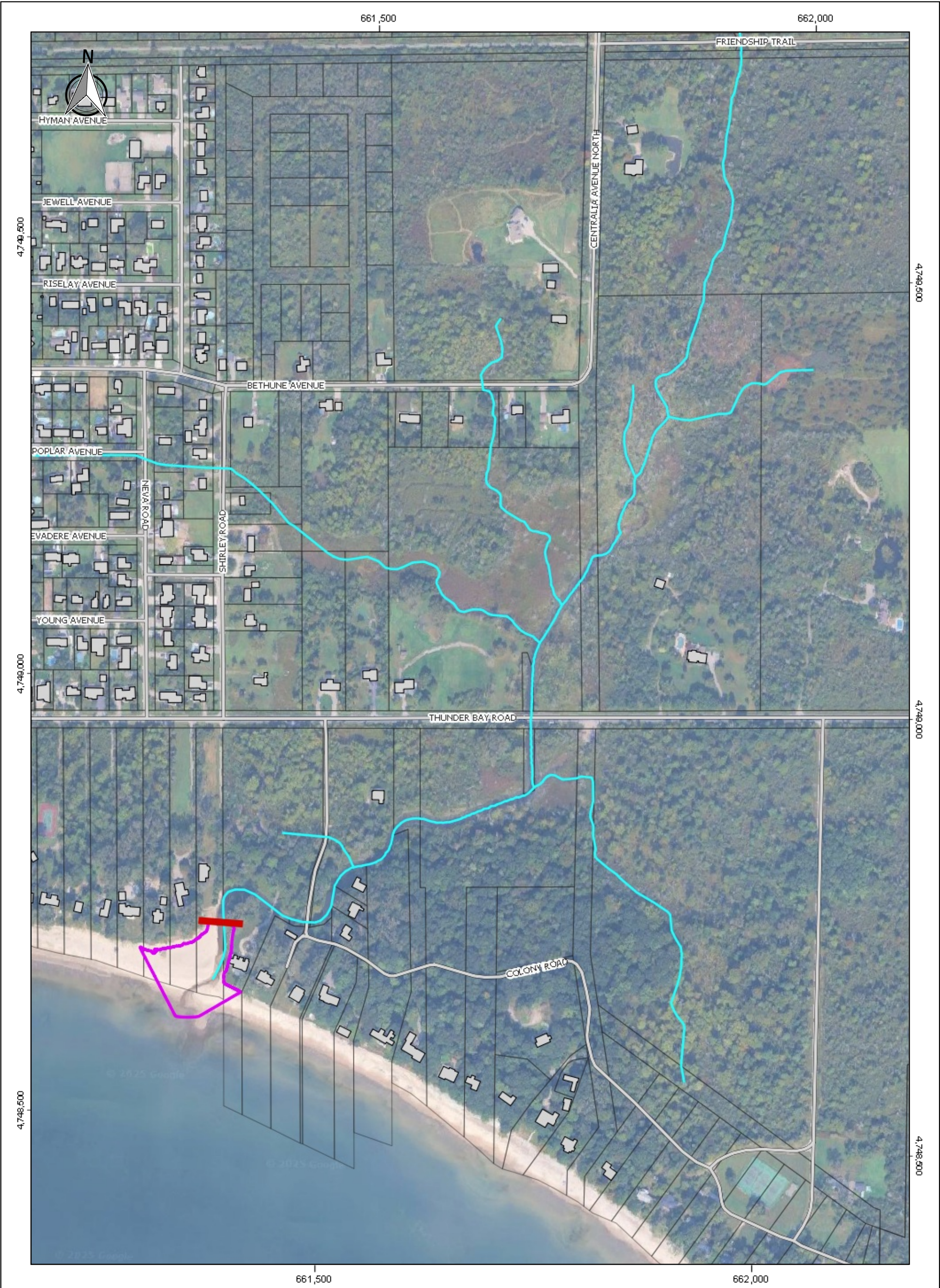
This alternative makes use of existing municipal infrastructure but would require the existing bridge to likely be retrofitted to match the raised road profile. A pump station is necessary for this alternative to relieve upland flooding during concurrent storm surge and rainfall events.

5.3.6 Alternative Solution 5: Lake Front Barrier and Backflow Prevention System

Alternative 5 (Figure 5.7) creates a landform barrier (or dyke) along the Lake Erie shoreline protecting residents along Six Mile Creek from lake storm surge induced flooding up to the desired level of service.

The proposed landform barrier elevation would equal the 5-year storm surge level freeboard. This alternative would require an easement to construct and contain the barrier structure, which would impact property owners adjacent to the proposed works. An access road would also be required for maintenance/operations.

A pump station is required for this alternative to relieve upland flooding during potential concurrent storm surge and rainfall events.



Six Mile Creek

Buildings

Parcels

Roads

5-year Storm Surge Flood Extent

Alternative 5

Barrier

This figure must be used in conjunction with the attached memorandum and is subject to the same limitations and conditions stated in the memorandum.

1:4,000

NAD83(CSRS) / UTM zone 17N

0100200 m

References: Town of Fort Erie, Ontario GeoHub, LIO

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ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Alternative 5: Lake Front Barrier and Backflow Prevention System

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. McKay

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Figure: 5.7

6 Evaluation of Alternative Solutions

The alternative solutions presented in Section 5 are subject to a structured evaluation process based on criteria and methodologies specifically developed for this EA. The selection of evaluation criteria, their respective weightings, and the approach used to rank alternatives are informed by the unique context of the study area. The evaluation framework incorporates applicable planning and policy directives (Section 2), input received from public and stakeholder engagement activities (Section 3), and characterization of existing environmental, social, and technical conditions (Section 4).

6.1 Criteria and Methodology

Each alternative solution identified in Section 5, was evaluated according to the following typical EA criteria:

- technical performance:
- economic impact
- environmental impact
- social impact

Montrose considered each alternative's potential for benefits and negative impacts towards each category. Details of the criteria considered within each category were presented in PIC 2 (June 24, 2024) and are provided below. Figure 6.1 provides a visual representation of the considerations / criteria within the four categories.



Figure 6.1 Evaluation Criteria

6.1.1 Natural Environment

The Natural Environment focuses on impacts to the natural heritage and ecological conditions of the area. Overall criteria for evaluating natural environment impacts include:

- water quality risks
- terrestrial habitat / wildlife impacts
- vegetation restoration
- aquatic habitat / fish impacts
- climate change resiliency

The natural environment analysis is broken into both aquatic and terrestrial criteria. The aquatic environment includes consideration for fish and fish habitat, surface water quality, and groundwater quality. The study area includes a large ecologically significant and complex water feature, which elevates the environmental consideration. The long-term impacts towards water features, including the wetland and watercourses, as well as short-term impacts during construction, and impacts of operation and maintenance are considered.

The terrestrial environment includes both vegetation and wildlife communities in and around the study area. Wetland ecology, wildlife habitat, and tree/vegetation health are considered with respect to the short-term and long-term impacts of the proposed alternatives.

Climate change resilience is also considered when assessing the natural environment. The impacts of severe weather towards the study area, such as flooding, are assessed with consideration of a changing climate. The evaluation also favours proactive mitigation, prioritizing alternatives which maintain or reduce the known climate change contributors.

6.1.2 Socio-Cultural Environment

The cultural and social environment focuses on impacts to people and places of social and cultural relevance. Overall criteria for evaluating potential socio-cultural impacts include:

- property owner acceptance
- cultural heritage
- recreation and greenspace
- public safety and disruption

Locations of social and cultural significance including archaeological sites, built heritage, private properties, greenspaces, and recreational facilities were assessed for both positive and negative impacts. Consideration was also given to effects on residents' social wellbeing and safety (during construction as well as future flood events). Additionally, intangible factors such as noise from construction, traffic disruptions, and temporary closures of public amenities were evaluated for their influence on the broader social environment.

6.1.3 Economic Environment

Economic environment looks at factors that will influence the overall cost of the alternative solutions (including the 'do nothing'). Overall criteria for evaluating the economic environment include:

- capital costs
- maintenance / lifecycle costs (for public infrastructure)

- flooding damages
- potential funding sources

Economic impacts consider the relative capital costs of projects, operation and maintenance costs, costs of potential flooding damages, and funding sources in the evaluation of alternatives. Costs of a project are weighed against benefits, such as cost savings from the prevention of flooding damages, to provide a wholistic evaluation.

6.1.4 Technical Environment

The Technical Environment focuses on the alternative solution's ability to be constructed and meet the project objectives. Overall criteria for evaluating solutions' technical performance include:

- flood risk
- constructability / feasibility
- approvability (ease of permitting and approvals)
- functionality

Flood risk was a critical criterion evaluated for each alternative solution. The assessment focused on the effectiveness of long-term overall flood hazard mitigation within the study area, considering interaction between Six Mile Creek, the local wetland and Lake Erie. In some instances, the alternative solutions may mitigate the risk of flooding from the storm surge, while increasing the flood risk during riverine flooding. The alternative solution that had the most potential to reduce the overall flood risk was ranked the highest.

For this project, the functionality looked at the relative potential of the alternatives to provide a holistic approach for addressing flood risk and reducing environmental and socio-cultural impacts. Flexibility to accommodate future needs such as those arising from climate change, or other regional developments were also considered as part of the functionality assessment.

The technical environment also includes the approvability, and constructability or feasibility of each alternative. The approvability includes considerations for municipal planning policies, coordination with existing and future designated land uses, and the potential requirements for agency and utility permits. The constructability and feasibility of an alternative also considers things such as physical constraints such as topography or dimensions, construction duration, utility conflicts, channel function during construction, soil conditions and groundwater control.

6.2 Criteria Scoring and Weighting

The alternatives were evaluated using the above categories and associated criteria. Table 6.1 shows the criteria and category weightings for this project. Given the project purpose to reduce long-term flooding risk to residential property and homes in the study area, some of the criteria such as property owner acceptance are weighted more heavily. An evaluation criteria bias, highlighting the importance of climate resiliency and flood protection, has been applied.

Scoring is applied based on values of 1 through 5, 1 being the worst (or least preferred) and 5 being the best (or most preferred).

Table 6.1 Alternative Evaluation Matrix – Category and Criteria Weighting

Natural Environment	Criteria Weighting	Maximum Criteria Score
Water Quality Risk	1	5
Terrestrial Habitat, Wildlife Impacts	1	5
Vegetation Restoration	1	5
Aquatic Habitat, Fish Impacts	1	5
Climate Change Resiliency	2	10
Socio-Cultural Environment	Criteria Weighting	Maximum Criteria Score
Property, Owner Acceptance	2	10
Cultural Heritage Impacts	2	10
Recreation and Greenspace	1	5
Safety and Disruption	1	5
Economic Environment	Criteria Weighting	Maximum Criteria Score
Capital Costs	2	10
Maintenance and Lifecycle Costs	1	5
Flooding Damages	2	10
Funding Sources	1	5
Technical Environment	Criteria Weighting	Maximum Criteria Score
Flood Risk	3	15
Constructability/Feasibility	1	5
Approvability	1	5
Functionality	1	5

6.3 Evaluation

Table 6.4 summarizes the criteria ranking within each category. Double and single red arrows pointing downwards are least and low preferred options with scores of 1 and 2 respectively, black arrows pointing horizontally are scores of 3 which are moderately preferred, and one and two green arrows pointing upwards are more and most preferred with scores of 4 and 5.

A detailed summary of each alternative is provided in the sections below. A detailed description of the categories and ranking criteria are provided in Appendix F.

Table 6.2 Individual Criteria Rankings for Each Alternative Solution

Criteria	Criteria Description	Do Nothing	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
		Do Nothing	Floodplain Landform Flood Barrier	Road ROW Flood Barrier w/Property Purchase	Property Purchase	Thunder Bay Road Flood Barrier w/Backflow Prevention	Lakefront Flood Barrier w/Backflow Prevention
Natural Environment							
Water Quality Risks	Relative potential to mitigate water quality impacts, erosion and sedimentation during constructure was well as sedimentation pos-implementation of the backwater prevention systems.	↑↑	↓	↔	↑↑	↓	↓↓
Terrestrial Habitat, Wildlife Impacts	Relative potential to limit disturbance to trees and terrestrial habitat with footprint impacts for permanent works or construction access.	↑↑	↓↓	↑	↑↑	↔	↓
Vegetation Restoration	Relative potential to restore native vegetation and trees with relative amount of productive land to be restored	↓↓	↑	↓↓	↑↑	↓	↔
Aquatic Habitat, Fish Impacts (Risks)	Relative potential risks to fish and aquatic habitat due to construction activities, including downstream environments by limiting fish passage impacts.	↑↑	↔	↑	↑↑	↓	↓↓
Climate Change Resiliency	Relative potential to provide additional hydrological and ecological resiliency (including drought resistance), through physical, hydrological, and ecological redundancy for buffering extreme events and seasonal climate shifts	↓↓	↑↑	↔	↑	↓↓	↓
Socio-Economic Environment							
Property Owner Acceptance	Relative potential to private and public land owners needs, including public relations acceptability and improved protection against flooding potential (meeting project goals and objectives)	↓↓	↑↑	↑	↔	↓	↓↓
Cultural Heritage Impacts	Relative potential to limit archaeological and build heritage impacts, including consideration for cultural landscapes and significant features.	↑↑	↔	↑	↑↑	↓	↓↓
Recreation and Greenspace	Relative potential to provide recreational amenities, trails, and navigability for physical connectivity through the study area; criteria assumes that greater levels of intervention provide declining potential due to reduced access to natural features.	↓↓	↑	↔	↔	↔	↔
Public Safety & Disruption	Relative potential to address public safety related to access/egress during flooding events. Relative potential to address disruption to traffic, businesses and residents during and after construction	↓↓	↑↑	↔	↓↓	↓	↔

Criteria		Criteria Description	Do Nothing	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			Do Nothing	Floodplain Landform Flood Barrier	Road ROW Flood Barrier w/Property Purchase	Property Purchase	Thunder Bay Road Flood Barrier w/Backflow Prevention	Lakefront Flood Barrier w/Backflow Prevention
Economic Environment								
Capital Costs	Relative potential capital costs for engineering, construction and restoration (approximate order of magnitude costs for total solution ±\$#M provided for relative scale only)		↑↑	↑	↔	↓	↓↓↓	↓↓↓
Maintenance / Lifecycle Costs	Relative potential public infrastructure maintenance and lifecycle costs; criteria assumes higher costs associated with higher complexity of engineering solution and capital costs.		↑↑	↑	↓	↑↑	↓↓↓	↓
Flooding Damages	Relative potential flood damages costs for private/public property owners (approximate order of magnitude costs for total solution ±\$#M provided for relative scale only)		↓↓↓	↑	↔	↑↑	↔	↑
Funding Sources	Relative potential to obtain Municipal/Provincial funding through Canada Community Building Fund, DMAF, Green Municipal Fund and Ontario Municipal Partnership Fund.		↓↓↓	↑↑	↑↑	↓↓↓	↓	↑↑
Technical Environment								
Flood Risk	Relative potential to mitigate long-term flood hazard risks within the study area based on floodplain and hydraulic conveyance capacity, including changes to storage characteristics of waterway.		↓↓↓	↑	↑	↑↑	↓	↑
Constructability / Feasibility	Relative potential feasibility in terms of complexity and ease of implementation, especially based on technical challenges for geotechnical, hydraulic, geomorphological, ecological, and construction staging design.		↑↑	↑	↑	↑↑	↓	↓↓↓
Approvability	Relative potential for regulatory approval, consistency with municipal planning policies and accommodation of existing and future designated land use.		↓↓↓	↔	↑↑	↓↓↓	↓↓↓	↓
Functionality	Relative potential to fulfill project goals and objectives, specifically the potential to provide a holistic approach for addressing flood risk, erosion risk and accommodating future needs; criteria scoring assumes that the highest functionality is provided by a balance between flood protection and environmental impacts.		↓↓↓	↑	↔	↔	↓	↓
Overall			4 th 	1 st Most Preferred 	2 nd 	3 rd 	6 th Least Preferred 	5 th 

6.3.1 Do Nothing Alternative

The 'do nothing' alternative shown in Figure 5.2 must be considered as part of the EA process. In this alternative, no new infrastructure is built, there are no changes or improvements to existing infrastructure leading to no changes in flood risk to public and private properties.

Natural Environment (ranks 4th): The natural environment criteria for the do nothing shows mixed results. The alternative scores the lowest for climate change resiliency as there is no improvements made to the current flooding conditions and there is no infrastructure in place to protect against future events. It also scores low for vegetation restoration as there is no potential to improve native vegetation or trees. The do nothing alternative ranks highest in the criteria of water quality, terrestrial habitat, aquatic habitat and wildlife impacts as there is no construction or permanent infrastructure that could potentially impact the existing natural heritage features in the study area.

Socio-Cultural Environment (ranks 4th): The socio-cultural criteria score low for most criteria in the do-nothing approach. Property owners are not likely to support this option as the flooding is left to continue without any implemented solution. There is no improvement to public access or recreational amenities in the area. Public safety and disruption scores low as the access and egress issues that occur during flood events are left to continue, and people are regularly flooded out of their homes. The do nothing scores high for cultural heritage /archaeology impacts as there are no construction activities or built infrastructure that could affect cultural landscapes or significant features. The Thunder Road bridge and 2912 Bethune Avenue are cultural features that are impacted by existing flooding but only during events greater than the 5-year storm surge.

Economic Environment (ranks 4th): The 'do nothing' alternative scores highest for capital and maintenance / life cycle costs as there is no initial spending or operational spending required to maintain new infrastructure. Conversely, the do nothing alternative scores lowest for flooding damages (as the current flooding frequency, and consequential damages are left to continue). There would also be no funding sources available to support the resulting flood damages as no improvements or investments have been made.

Technical Environment (ranks 6th- lowest): The do nothing is the most constructable/feasible option as there is no infrastructure to be built or investments to be made. The do nothing ranks low for the remaining technical criteria; functionality it does not fulfill the project goals/objectives, and approvability is low as it does not align with the goals of current planning policies. Do nothing scores the lowest for flood risk as there is no improvement made to the current flooding conditions and there is no infrastructure in place to protect against future flood events. Figure 5.2 depicts the existing 5-year storm surge flood extents and the affected infrastructure and properties.

6.3.2 Alternative Solution 1: Landform Barrier

Alternative 1 creates a landform barrier (or dyke) along rear property lines adjacent to the wetland protecting residents along Shirley Road and Bethune Avenue from lake surge induced flooding up to the 5-year storm surge with an additional 0.3 m of freeboard. The alternative requires removal of vegetation, and the placement of fill within the rear yards (private property) to form a barrier. Culverts sized to the 100-year upstream peak flow would need to be installed along the two watercourses draining toward Six Mile Creek. The culverts (2 x 1,200 mm diameters downstream of Shirley Road and 1 x 750 mm downstream of Bethune Avenue) would need to be fitted with passive backflow prevention devices to stop lake surge from entering through the culverts and pushing further upstream.



Sources: (US Army Corps of Engineers, <https://www.nws.usace.army.mil/Missions/Civil-Works/Engineering/Levee-Safety/>; EWN 2025, <https://ewn.ercd.dren.mil/research/project/design-and-assessment-guidance-for-vegetation-on-riverside-levees-with-ecosystem-and-engineering-benefits/>)

Figure 6.2 Examples of Landform Barriers

The exact placement/location of the landform barrier will be determined in subsequent design phases, once more details investigations (e.g., geotechnical, wetland staking) can be completed. If the berm is located within private properties, easements along each of the affected properties will be required.

Natural Environment (ranks 2nd): The Landform Barrier has mixed results in the environmental criteria. It scores moderately for water quality risks due to risks during constructions as well as potential changes in conveyance and storage characteristics that may lead to an increase in sedimentation within the tributary upstream of the barrier. It has the lowest score for terrestrial habitat impacts, indicating significant disturbance to local vegetation from construction. However, it offers high potential for vegetation restoration as the barrier can be restored to a naturalized condition with high value plantings. There is potential for moderate impacts to aquatic habitat, as the backflow preventer can disrupt fish passage along the tributary. The climate change resiliency of this alternative is ranked highest, as there is flexibility and adaptability in constructing a natural landform barrier; the freeboard also provides some additional flood protection resiliency as it prevents flooding up to the 176.3 masl level (approximately the 25-year storm surge level).

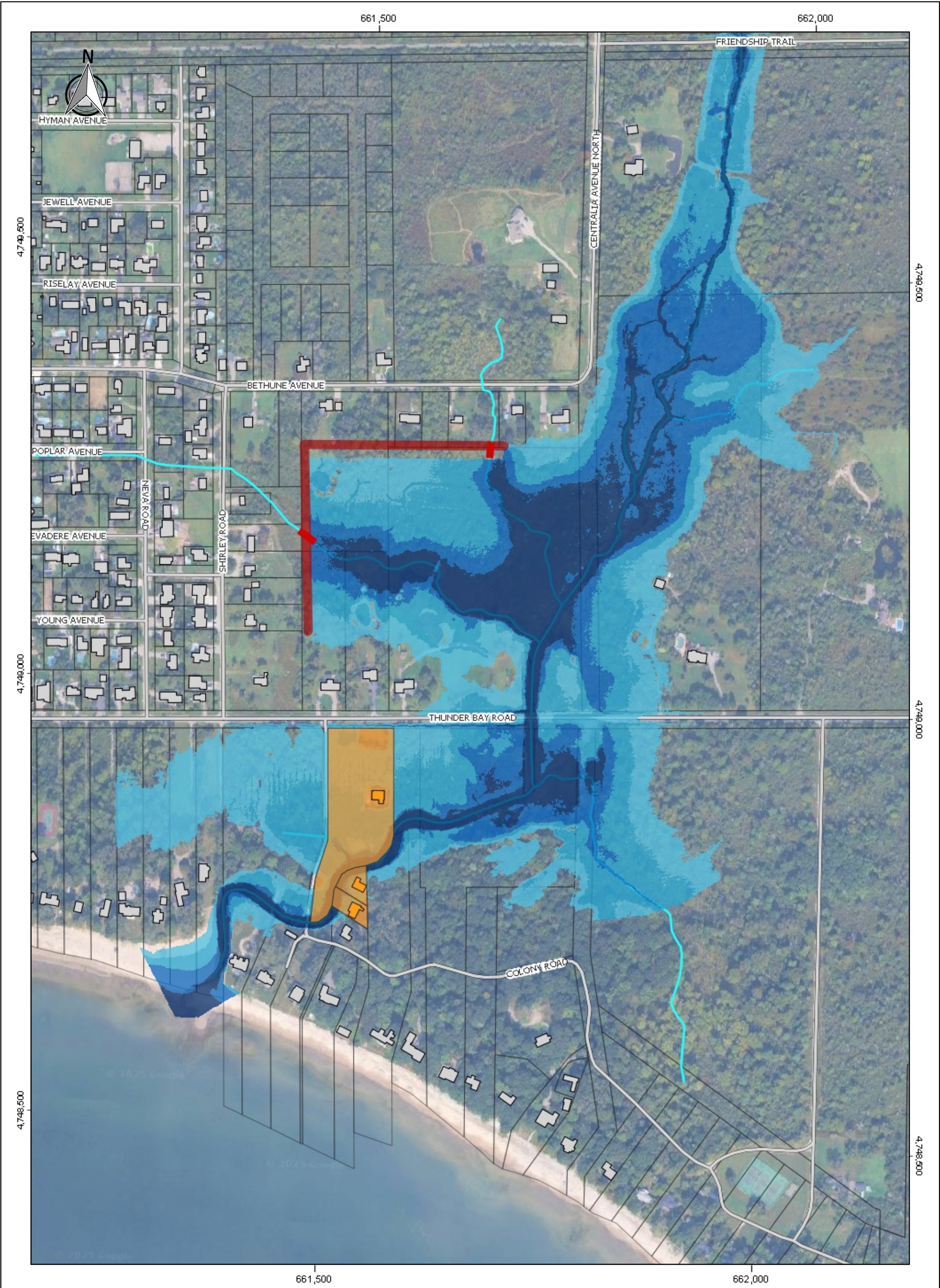
Socio-Cultural Environment (ranks 1st – most preferred): This alternative scores highest for property owner acceptance, public safety, and disruption mitigation, reflecting positive support from property owners as it reduces flood risk to residents without property purchase / re-location. It also performs moderately well in terms of recreation and greenspace, providing some informal connections to nearby naturalized areas. Cultural heritage impacts are moderate, there is some archaeological risk from construction disturbance as some of the proposed landform is within non-developed areas, which has been identified as having archaeologic potential and will require a Stage 2 assessment, however there is no impacts to the identified BHRs.

Economic Environment (ranks 1st – most preferred): The landform barrier ranks highest in the economic environment category. It has lower capital costs than the other flood mitigation alternatives and low maintenance/lifecycle costs because of the naturalized condition. The alternative also scores high for funding potential, suggesting strong eligibility for municipal and provincial grants. Flood damages score is high, indicating effective mitigation to most of the flood prone areas (except for the properties south of Thunder Bay Road which could be purchased to fully eliminate the flood risk in the identified level of service).

Technical Environment (ranks 3rd): Technically, this alternative ranks moderate to high. It scores high for flood risk reduction as most properties are mitigated against flooding within the selected level of service. The hydraulic modelling (Appendix B) also shows no increase to Regulatory riverine flood risk from the constructed landform barrier. Figure 6.2 shows the level of flood protection resulting from the landform barrier during the 5-year storm surge event.

The landform barrier scores high for constructability; it is an earthen berm to be constructed in a natural area, at a proposed average height of 0.8 m. Regulatory approval is likely; there could be some additional hurdles as the landform barrier is proposed on the riparian edge of the PSW. The Town will need to demonstrate that the construction of the barrier will have no long-term impacts to the wetland function during the next phase of design. It is functionality scored high as it shows good alignment with project goals.

Summary (ranks 1st - highest): Alternative 1 offers a strong balance of social acceptance, economic efficiency, and technical feasibility, with moderate environmental impacts. Its primary strengths are cost-effectiveness and property protection, while its main weaknesses relate to terrestrial habitat disturbance during construction (which can be mitigated with revegetation) and regulatory complexity due to the location within the natural area.



Six Mile Creek

Buildings

Parcels

Roads

Alternative 1

Culvert

Landform Barrier

Optional Property Purchase

5 year Storm Surge Depth (m)

<= 0.00

0.00 - 0.50

0.50 - 1.00

1.00 - 1.50

1.50 - 2.00

> 2.00

1:4,000

NAD83(CSRS) / UTM zone 17N

0

100

200 m

References: Town of Fort Erie, Ontario GeoHub, LIO
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MONTROSE

ENVIRONMENTAL

Town of Fort Erie

Six Mile Creek Flooding Project

Alternative 1: Resulting Flood Depths During 5-year Storm Surge

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. McKay

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Figure: 6.3

6.3.3 Alternative Solution 2: Road Right-Of-Way Barrier with Property Purchase

Alternative 2 raises the elevation of the municipal roadway to create a barrier, protecting residents on the west side of Shirley Road from lake surge-induced flooding. Culverts sized to the 100-year upstream peak flow would need to be installed along the tributary draining toward Six Mile Creek. The culverts (2 x 1,200 mm diameters downstream of Shirley Road) require backflow prevention devices to stop flow backwater from entering upstream during a storm surge event. This alternative makes use of existing road infrastructure and corridor to form flood barriers removing the need to construct barriers outside the existing municipal corridor.

The ROW barrier does not alleviate flooding from all properties along Shirley Road. There are five residential properties with buildings falling within the 5-year storm surge area, east of Shirley Road and south of Bethune Avenue. These properties would need to be purchased to eliminate flood risk for the desired level of service.

Three properties south of Thunder Bay Road are optional for purchase and have not been included in the analysis.

Natural Environment (ranks 3rd): The ROW barrier alternative scores well for aquatic habitat impacts, with some moderate risks during construction, and minimal impact once in operation. Terrestrial habitat impacts are lower than Alternative 1, as the footprint is largely within the road corridor. Vegetation restoration potential is limited, as the ROW doesn't provide much opportunity for terrestrial enhancements. The ROW barrier with associated freeboard does provide some climate change resiliency for the properties west and north of the barriers, as well as Shirley and Bethune Avenue roadways themselves. Water quality impacts are similar to Alternative 1, but with some additional benefit as the barrier would have less disturbance to the watercourse during construction and it is located further upstream, outside of the wetland area.

Socio-Cultural Environment (ranks 3rd): Alternative 2 ranks moderately in the socio-cultural category. It provides strong property owner acceptance, as it combines flood protection with potential strategic property purchases (although it ranks lower than alternative 1 as more properties would need to be purchased). Public safety and disruption scores are moderate, as construction within the road may temporarily affect traffic. Recreation and greenspace opportunities are moderate as the road corridor can provide access and integrate formal trails. Cultural heritage impacts are low as the construction footprint would be contained within already disturbed areas, but there could be some indirect impacts during construction to BHR at 2912 Bethune Avenue.

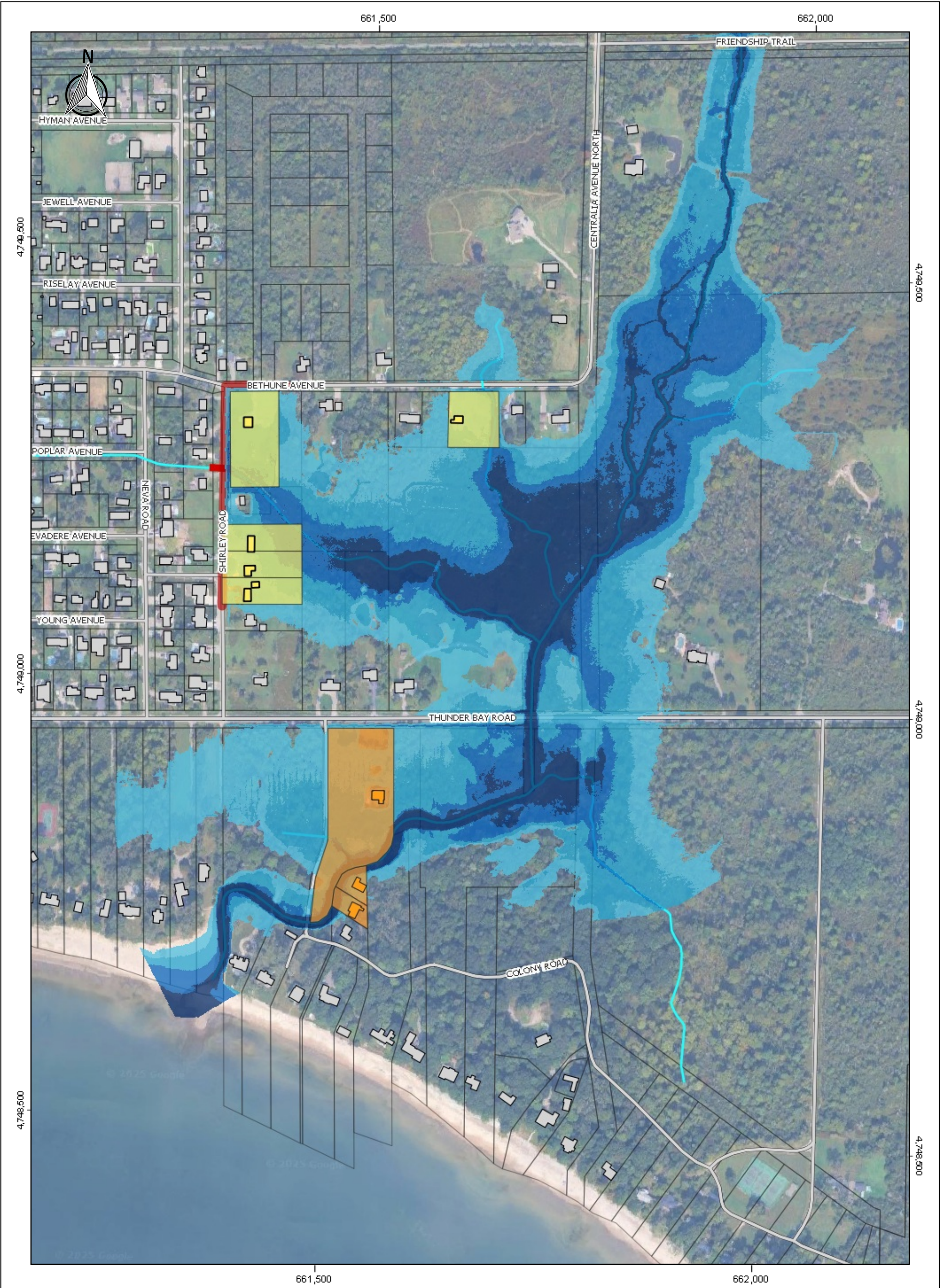
Economic Environment (ranks 3rd): Economically, Alternative 2 is moderately favourable. Capital costs are higher than Alternative 1 due to road elevation works and property purchases. Maintenance costs

are moderate/low as the integrity of the road, culverts and backflow prevention systems will need to be inspected and maintained regularly. The flood damage reduction is moderate and will depend on if the properties that are still experiencing flood are purchased. Funding potential is high as the solution aligns with infrastructure improvement programs.

Technical Environment (ranks 1st – highest): Alternative 2 is highly feasible. It ranks high for constructability as it leverages the existing road infrastructure, although some driveways may need to be modified to accommodate the road raise. Functionality scores high as it meets most of the project objectives (with property purchase). Approvability is higher than Alternative 1, requiring coordination with municipal planning but posing fewer environmental/ecologically challenges than Alternative 1.

Flood risk reduction scores high as most properties are mitigated against flooding within the selected level of service (if properties are purchased). The hydraulic modelling (Appendix B) shows no increase to Regulatory riverine flood risk from a ROW barrier. Figure 6.4 shows the level of flood protection resulting from the landform barrier during the 5-year storm surge event.

Summary (ranks 3rd): Alternative 2 offers the best technical performance with moderate / high socio-cultural, environmental and economic performance. Its strengths lie in integration with existing infrastructure, and limited ecological impacts, while weakness includes moderate flood damage costs (as there are still 8 properties along Shirley Road and Bethune Avenue that would need to be purchased to eliminate the flood risk).



Six Mile Creek

Buildings

Parcels

Roads

Alternative 2

Culvert

Road Re-profiling

Property Purchase

Optional Property Purchase

5 year Storm Surge Depth (m)

<= 0.00

0.00 - 0.50

0.50 - 1.00

1.00 - 1.50

1.50 - 2.00

> 2.00

1:4,000

NAD83(CSRS) / UTM zone 17N

0

100

200 m

References: Town of Fort Erie, Ontario GeoHub, LIO

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Town of Fort Erie

Six Mile Creek Flooding Project

Alternative 2: Resulting Flood Depths during the 5-Year Storm Surge

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. McKay

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Figure: 6.4

6.3.4 Alternative Solution 3: Property Purchase

Alternative 3 involves purchasing all 11 properties within the 5-year storm surge flood extents along Shirley Road, Bethune Avenue and Neva Road to eliminate lake induced flood risk. This approach offers a non-infrastructure solution by removing vulnerable assets from the floodplain.

Estimated costs for acquiring the 11 properties were developed at a high level and were based on drive-by inspections and market value estimates for each individual property. These figures were then consolidated into a total cost estimate to inform the evaluation. While the costs presented (Appendix G) represent the cumulative expense of purchasing all 11 properties, acquisitions will only proceed where property owners agree to the Town's offer. Residents may choose to remain in their homes and accept the associated flood risk, consistent with the "do nothing" scenario.

There are three homes south of Thunder Bay Road with building structure that may be within the 5-year storm surge flood extent. These properties were not included in the solution for purchase but could be purchased to eliminate the flood risk to the desired level of service.

Natural Environment (ranks 1st): The property purchase alternative ranks highest environmentally. With no construction footprint, it avoids impacts to terrestrial and aquatic habitats and maintains water quality. Vegetation restoration potential is highest, as purchased lands can be restored to natural conditions. Climate change resiliency is high, as there are no properties at continued risk within the flooded area and natural buffers are preserved. However, Shirley Road and Bethune Avenue are still a risk during a storm surge and there is no built infrastructure that can be modified to protect against future flood events.

Socio-Cultural Environment (ranks 3rd): Socially, Alternative 3 ranks moderately. Property owner acceptance is moderate to low. The feedback during the PICs indicates that some residents are in favour of property purchase while others may be resistant. Public safety improves only if all properties are vacated, and disruption is high in the short-term while residents move out. Access and egress on Shirley Road, Neva Road and Bethune Avenue will still be affected during storm surge events. Recreation and greenspace opportunities are minimal unless lands are converted for public use. Cultural heritage is scored high as there are no potential impacts to cultural landscapes or significant features in this alternative.

Economic Environment (ranks 2nd): Economically, Alternative 3 has high costs upfront due to property acquisition but eliminates long-term flood damage and maintenance costs. Even with all the property purchases along Shirley Road, Neva Road, and Bethune Avenue, it is still less costly than Alternatives 4 and 5 (Appendix G). With this Alternative, there is no opportunity for external funding sources as no new infrastructure is being built, so funding will need to come from the Town.

Technical Environment (ranks 2nd): Technically, this alternative ranks highest for feasibility and constructability as it avoids complex engineering. There is a complete flood risk reduction (if all properties within the identified level of service are purchased). Functionality is strong in terms of risk elimination but does not provide any infrastructure improvements, Shirley Road, Neva Road and Bethune Avenue are still impacted. Approvability is low as it will require all landowners to agree to purchase, and does not align with municipal planning policies (PPS), which would look to increase population and growth within the Town of Fort Erie.

Summary (ranks 2nd): Alternative 3 excels environmentally and technically but faces social challenges and high upfront costs. Its strengths are ecological restoration and risk elimination, while weaknesses include low regulatory and public acceptance. Figure 5.5 shows the required and optional property purchases.

6.3.5 Alternative Solution 4: Thunder Bay Road Barrier and Backflow Prevention System

Alternative 4 raises the elevation of Thunder Bay Road and incorporates a backflow prevention system (gates), protecting residents north of the road from surge flooding. The gates would have to be operated by the Town during storm surge events and closed once the event subsides. A pump station is required to manage upland flooding.

The road would be raised approximately 0.6 m from the existing elevation; the existing bridge will likely need to be retrofitted and some costs to complete this has been included in the evaluation. For this alternative evaluation it is assumed that the conveyance (opening of the bridge) would remain the same.

Three properties south of Thunder Bay Road could be purchased to eliminate flood risk.

6.3.5.1 Flood Risk Analysis

Raising Thunder Bay Road introduces a significant impact during a 100-year regulatory riverine flood (assuming median lake level condition). The existing, lower road elevation is overtopped during riverine events greater than the 10-year peak flow, and provides a secondary overflow path for floodwaters. Raising the road removes this path, causing water to back up and increases upstream flood elevations, as shown in the flood profile in Figure 6.5 and 6.6. To mitigate this adverse impact, a significant enlargement of the bridge opening is required.

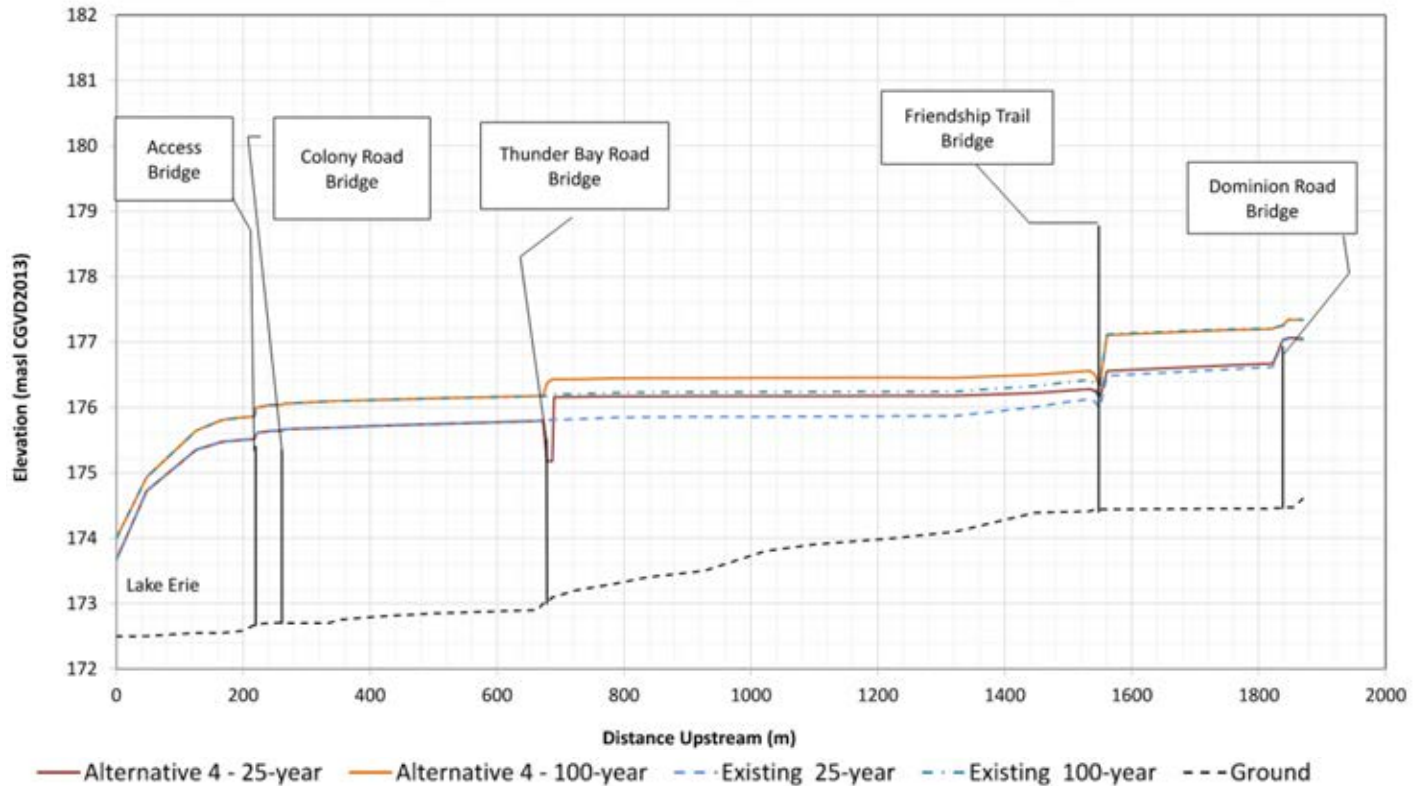


Figure 6.5 HEC-RAS Model Profile Water Levels – 100-year (Regulatory) and 25-year with Median Lake Level (raised profile, but no enlargement of Thunder Bay Road Bridge Opening)

6.3.5.2 Criteria Evaluation

Natural Environment (ranks 6th - lowest): This alternative ranks lowest environmentally. Although it has minimal terrestrial impacts (the road raise would largely be contained to the ROW), it has potential to impact aquatic habitat, and water quality risk due to the backflow prevention system which could act as a long-term or short-term barrier depending on how it is construction. Vegetation restoration potential is limited as there is not much opportunity within the ROW for terrestrial improvements. There is poor resiliency to climate change as the road raise would increase water levels upstream during larger riverine storm events (greater than the 10-year and including the Regulatory).

Socio-Cultural Environment (ranks 5th): Socially, Alternative 4 ranks the lowest. While some property owners may accept this alternative as it would alleviate flood risk during the lake induced flood events, riverine flood events (greater than the 25-year) would increase, creating a larger regulated floodplain and more properties and owners being affected. The solution is not preferred from a cultural heritage standpoint as it would likely require some modification to the Thunder Bay Road Bridge (a BHR). Public safety risks are moderate, the solution would improve access/egress during storm surge events, but reduce access/egress during riverine events. Disruption during construction would be high as Thunder

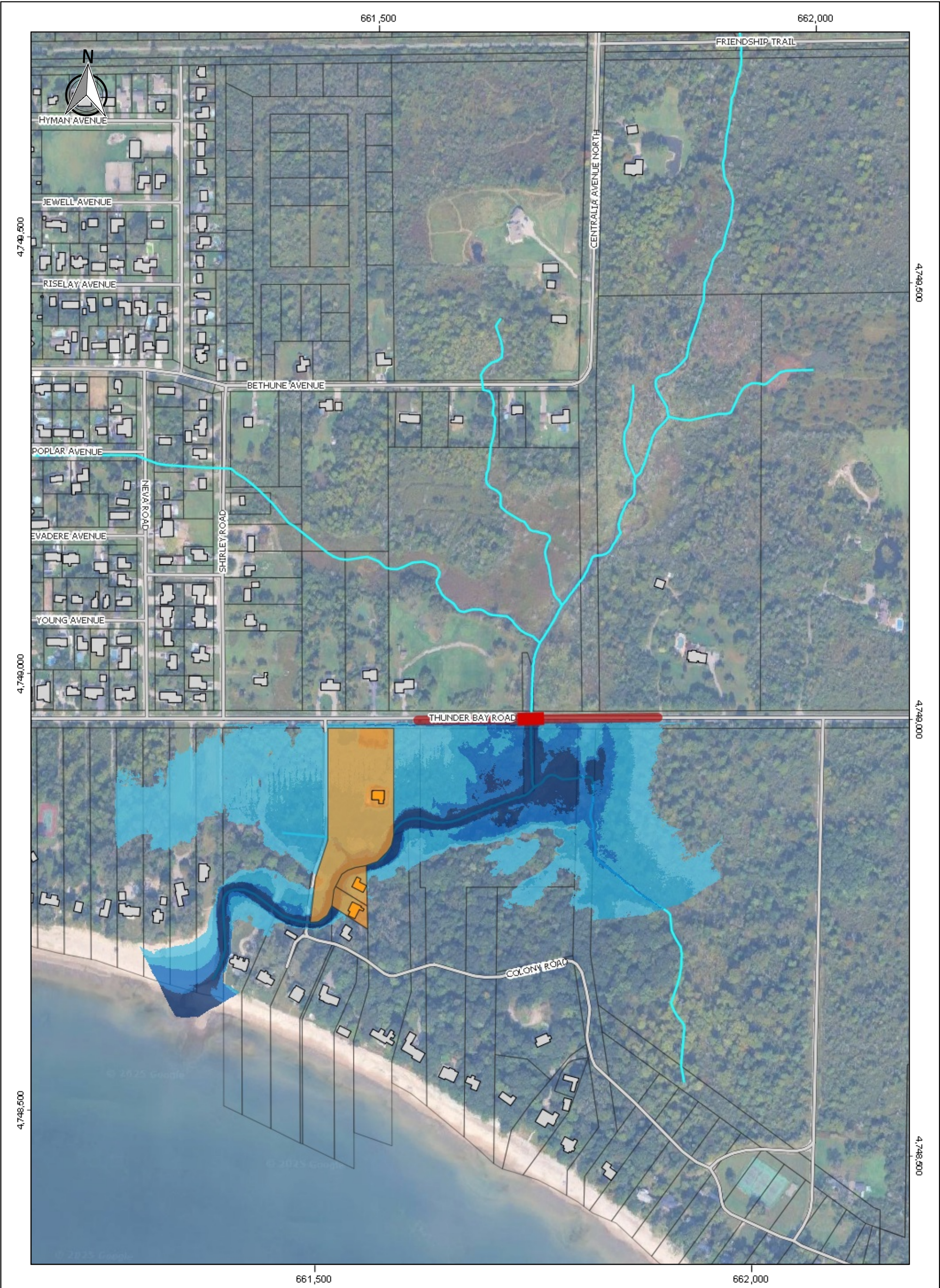
Bay Road is a main road within the study area. Opportunity for recreation and greenspace opportunities are limited, although the planned bike lanes could be added to Thunder Bay co-currently with the road raise.

Economic Environment (ranks 6th - lowest): Economically, Alternative 4 ranks the lowest. Capital costs are high due to the road raise, and estimation of necessary bridge retrofit work. Maintenance and life cycle costs are high as the gates would need to be inspected and maintained regularly, as well as operated during storm surge events. Flood damage reduction is improved for the lake induce flood events, but increases for the riverine flood events, leading to a neutral score. Funding potential is low as this alternative results in an increase to the Regulatory flood extents, unless the bridge is also replaced/upgraded to improve conveyance.

Technical Environment (ranks 5th): Technically, Alternative 4 is feasible but complex. Raising Thunder Bay Road is possible but could require modification or retrofits to the bridge structure. The backflow prevention gates would need to be installed and only operated during storm surge events. A pump station or portable pumps will need to be installed to manage upland riverine flooding, if concurrent riverine and lake surge events occur. Functionally, the alternative solution does meet some of the flood protection objectives, but increases Regulatory (riverine) flood risk which means it is unlikely to be accepted unless the conveyance of the bridge is also increased.

The solution eliminates the flood risk from the 5-year storm surge within the study area (See Figure 6.6), but increases the flood risk during 25-year and greater (including the Regulatory flood event, Figure 6.5), leading to a low score in the flood risk category.

Summary (ranks 6th): Alternative 4 does protect the community of Thunder Bay from flooding during the 5-year storm surge, however it poorly performs in all evaluation criteria categories.



Six Mile Creek

Buildings

Parcels

Roads

Alternative 4

Culvert

Road Re-profiling

Optional Property Purchase

5 year Storm Surge Depth (m)

≤ 0.00

0.00 - 0.50

0.50 - 1.00

1.00 - 1.50

1.50 - 2.00

> 2.00

1:4,000

NAD83(CSRS) / UTM zone 17N

0100200 m

References: Town of Fort Erie, Ontario GeoHub, LIO

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Town of Fort Erie

Six Mile Creek Flooding Project

Alternative 4: Resulting Flood Depths during the 5-Year Storm Surge

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. McKay

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Figure: 6.6

6.3.6 Alternative Solution 5: Lake Front Barrier and Backflow Prevention System

Alternative 5 creates a barrier along the Lake Erie shoreline with operational gates for backflow prevention, protecting residents along Six Mile Creek from surge flooding. The barrier elevation equals the 5-year surge level plus freeboard. Road access would be required for maintenance. A pump station has been included to alleviate upland riverine flooding.

A continuous barrier at the interface of the Creek and Lake Erie could potentially obstruct riverine flows and worsen upstream flooding. To mitigate this, the design assumes the barrier would incorporate a structure with operable gates that open fully. These gates would only be closed to block lake surge. This structure would need to be effectively as wide as the 100-year riverine flood extent (approximately 35 m wide) at the river mouth to avoid impacts upstream. Easements would be required from the surrounding private properties for construction and placement of the permanent structure.

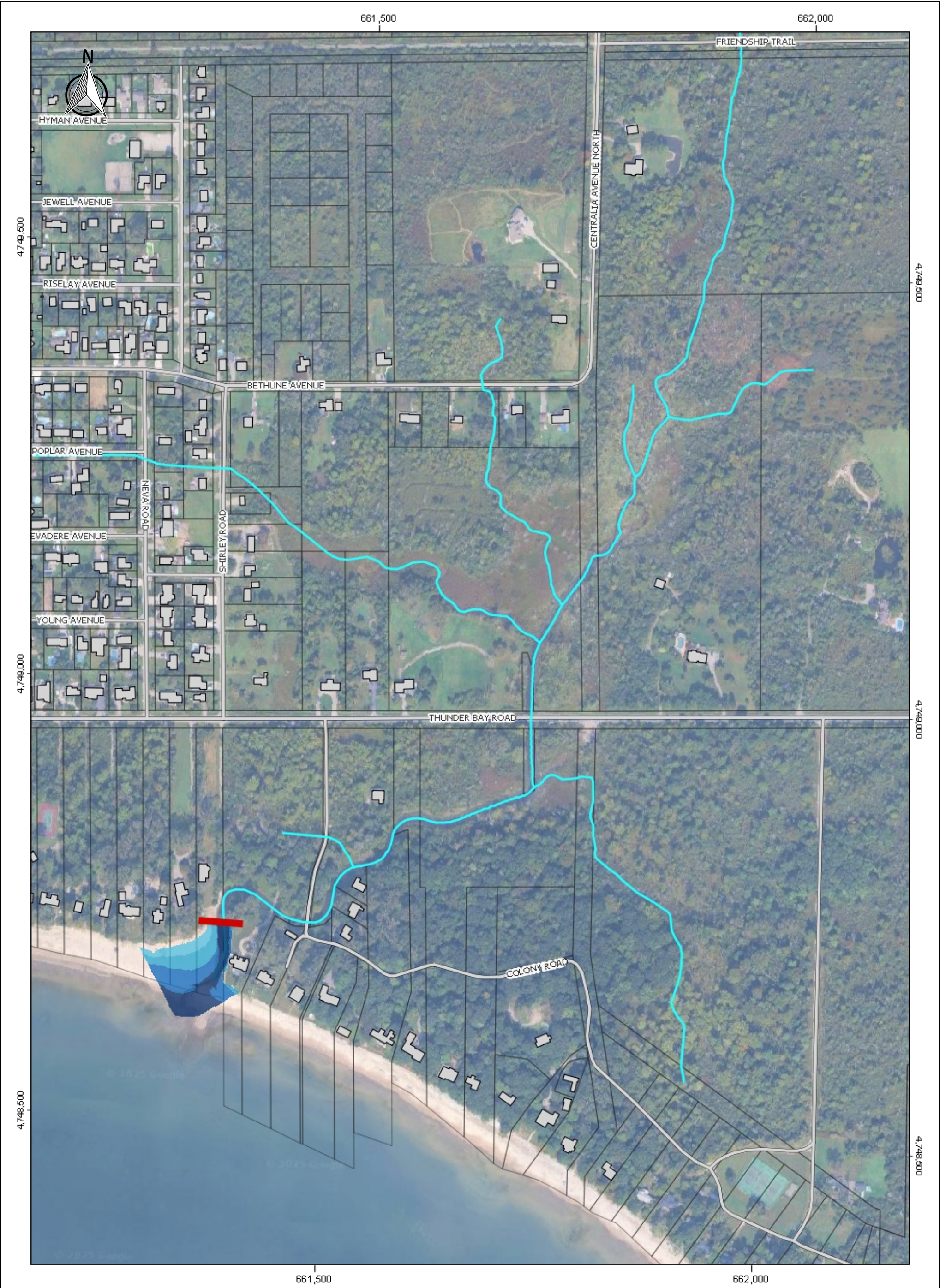
Natural Environment (Ranks 5th): This alternative ranks low environmentally. It has significant terrestrial, and aquatic habitat impacts due to shoreline works. The barrier during storm surges could also have the most effect on water quality compared to the other alternatives as the upstream storage could lead to sedimentation build up when the gates are closed. Vegetation restoration is possible but may be limited as the barrier will need to be maintained and accessible by road. Climate change resiliency is low, due to hardened structure and the fixed position of the gates, there is minimal opportunity for additional resiliency or future adaptability.

Socio-Cultural Environment (Ranks 6th - lowest): Socially, Alternative 5 performs very poorly. Property owner acceptance scores low due to impacts on lakefront properties. The cultural heritage and archaeological impacts are highest for the alternative due to the direct impacts to Lake Erie Shoreline (CHL-01) and indirect impacts to 2923 Colony Road (BHR-03). Public safety improves during storm surge events for the community upstream, but there could be safety issues with the gates in the long-term, as well as disruption during construction. Recreation / trail opportunities are moderate, with potential for informal connection to adjacent naturalized areas.

Economic Environment (Ranks 5th): Economically, Alternative 5 ranks moderately. The alternative has the highest capital and maintenance costs. The flood damage reduction is strong as the solution would fully eliminate the properties along Six Mile Creek from flooding during the 5-year storm surge, without the need for property purchase. However, easements would be required to enable the placement and construction of this alternative. Funding potential scores high, as the solution aligns with flood mitigation and shoreline protection external funding programs.

Technical Environment (Ranks 4th): Technically, Alternative 5 faces a lot of technical challenges due to the complexity. While it does improve the upstream flood risk, constructability / feasibility is low due to shoreline conditions and lack of publicly owned property. Approvability will be difficult due to the adjacent landowners as well as the environmental and cultural impacts. Functionality is moderate, providing flood protection but with significant ecological and socio-cultural trade-offs.

Summary (Ranks 5th): Alternative 5 offers strong storm surge flood protection (Figure 6.6) but ranks lowest culturally and environmentally. The solution also faces some large technical challenges around construction and property acquisition as there is a large open span that would be required to maintain the existing flow capacity.



Six Mile Creek

Buildings

Parcels

Roads

Alternative 5

Barrier

5 year Storm Surge Depth (m)

<= 0.00

0.00 - 0.50

0.50 - 1.00

1.00 - 1.50

1.50 - 2.00

> 2.00

1:4,000

NAD83(CSRS) / UTM zone 17N

0100200 m

References: Town of Fort Erie, Ontario GeoHub, LIO

Town of Fort Erie

Six Mile Creek Flooding Project

Alternative 5: Resulting Flood Depths during the 5-Year Storm Surge

Date: December, 2025

Project No: 36481

Submitter: J. Arce-Rodriguez

Reviewer: A. McKay

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Figure: 6.7

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6.3.7 Overall Evaluation

Table 6.3 shows how each alternative has been ranked for each subcategory. Coloured and shaded circles are shown across the screening results to give an easy visualization of each alternative's score. More advantageous alternatives have circles which are coloured in, and the least advantages alternatives are empty circles.

Table 6.3 Overall Category Rankings

Category	Do Nothing	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
		Floodplain Landform Flood Barrier	Road ROW Flood Barrier w/Property Purchase	Property Purchase	Thunder Bay Road Flood Barrier w/Backflow Prevention	Lakefront Flood Barrier w/Backflow Prevention
Natural Environment						
Socio-Economic Environment						
Economic Environment						
Technical Environment						
Overall	4 th 	1 st Most Preferred 	2 nd 	3 rd 	6 th Least Preferred 	5 th 

7 Preferred Solution

Alternative 1 – Landform Barrier is selected as the preferred alternative. The alternative offers the best overall score across social, environmental, economic, and technical criteria:

- **Social Acceptance and Safety:** Ranked highest for socio-cultural factors. It significantly reduces flood risk for residents along Shirley Road, Neva Road and Bethune Avenue without requiring property purchase and has positive property owner support. There are no impacts to the identified BHRs. A Stage 2 assessment is required as there is some archaeological potential with the proposed landform area.
- **Economic Efficiency:** Lowest capital and lifecycle costs among alternatives, with high funding potential through municipal/provincial/federal grants. It effectively mitigates flooding damages for most properties. There are three optional properties that can be purchased south of Thunder Bay Road.
- **Technical Feasibility:** Provides robust flood protection for the 5-year storm surge with 0.3 m freeboard, and hydraulic modelling confirms no increase in Regulatory riverine flood risk. Constructability is rated high despite some design challenges.
- **Environmental Considerations:** While it has moderate to high impacts on terrestrial habitat and some aquatic habitat disruption, these can be mitigated through restoration and naturalization post-construction. Climate resiliency is ranked highest due to adaptability and redundancy.

7.1 Key Design Considerations

There are several key design considerations associated with the preferred alternative solution. The following design items will need to be assessed the during subsequent stages of the design and construction phases of the project to ensure that the solution is effective and maintains or reduces the impacts that have been identified through this EA.

- **Backflow Prevention:** Culverts (2 × 1,200 mm and 1 × 750 mm) require check valves or flap gates to prevent surge backflow while maintaining normal drainage. Given the condition of the current backflow prevention system at the recently installed Shirley Road culvert, which has been made inoperable due to debris accumulation, passive backflow prevent devices as shown in Figure 7.1 below are recommended. Detailed design must address durability, operational needs and debris management.



Figure 7.1 Backflow Prevention Example (Red Valve Company, Inc. 2020)

- **Wetland Function:** Measures to preserve ecological integrity, and habitat connectivity should also be incorporated. The landform barrier is proposed in the riparian edge of the wetland and changes to runoff could have potential impacts on the wetland function. The following items should be carried out in the next phase of design:
 - o Wetland and woodland features within the design area should be staked with Town staff and NPCA to confirm the extents (Figure 4.9).
 - o A localized drainage assessment should be carried out to determine any low points and confirm if additional culverts or drainages need to be installed to allow existing flows path to be maintained.
 - o Hydrogeological investigations should be undertaken to determine the groundwater conditions and confirm if the landform is in an area of recharge or discharge.
 - o Complete a local water balance analysis to ensure the wetland hydrology is not compromised to avoid compositional shifts in the vegetation community/available SAR habitat.
 - o Naturalization strategies for the landform barrier should follow construction.
- **Geotechnical Investigations:** Subsurface analysis for landform barrier stability, seepage control, and frost heave mitigation. The desktop studies showed unmapped, silty-clay and alluvium soils within the study area. The proposed landform borders the area between all three of these three soil types and soils will need to be further evaluated for strength and settlement risks.
- **Landform Barrier Location:** Confirm the approach to implementing the landform barrier. As shown in Alternative 1, the landform barrier can be located fully, partially or completely adjacent to the

rear properties on Shirley Road and Bethane Ave. If the landform barrier is to be located fully or partially within private property, then easement agreements will need to be carried out.

7.2 Lot Level Floodproofing

Individual lot-level floodproofing is a strategy that can be employed by residents in the interim (prior to the implementation of the alternative solution) or as additional resilience. Lot level flood proofing allows individual residents to protect their buildings / structures from lake surge induced flooding up to their desired level of service. The cost for flood proofing is born by the individual owner.

Property owners would need to monitor weather conditions and warnings as many lot level flood proofing usually requires human intervention and adequate lead time for installation of protective measures, such as raising flood gates.

Flood proofing is not formally assessed as part of the EA as it would be up to the individual property owners to implement to the level of service they require. Figure 7.2 shows several examples of residential flood proofing.

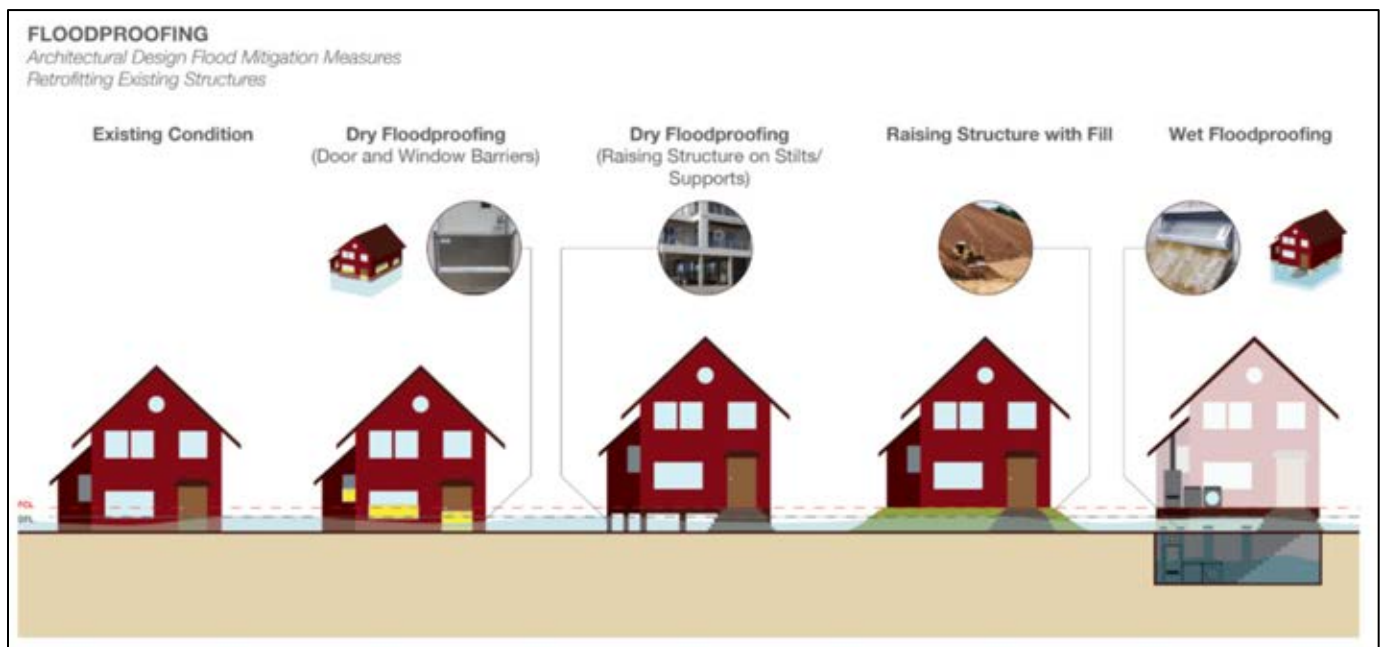


Figure 7.2 Flood Proofing Examples (Fraser Basin Council 2025)

8 Project Implementation and Next Steps

Next steps focus on advancing the landform barrier solution into detailed design and preparation for implementation. Key tasks include:

- confirming the preferred alignment and footprint
- undertaking the required field investigations (e.g., geotechnical, stage 2 archaeological and hydrological)
- complete detail environmental impacts studies (terrestrial, aquatic, SAR)
- refining costs and design parameters based on the investigations and impacts
- continuing engagement with First Nations
- coordinating with relevant agencies and property owners to secure necessary permits and access and easement agreements

The Town should also refine preliminary cost estimates, assess construction sequencing, and identify opportunities to minimize environmental and community impacts during implementation. Once detailed design is complete, the project will proceed to tendering and construction, supported by ongoing stakeholder engagement to ensure the selected flood-mitigation solution aligns with municipal objectives and community expectations.

8.1 Funding

The Town does not currently have funding in place to implement the preferred alternative. The Town should pursue available provincial and federal funding programs that align with climate resilience, disaster mitigation, and infrastructure renewal objectives in Ontario. Potential municipal/provincial funding opportunities include:

- Canada Community Building Fund
- Disaster Mitigation and Adaptation Fund
- Ontario Municipal Partnership Fund

There is potential that the implementation of the preferred alternative will need to be resident/user funded with financing provided by the Town. The potential sources of funding and the likelihood of obtaining the funding (based on the characteristics of the alternative solution) were considered in the analysis. The Town should prepare a funding strategy that outlines project benefits, lifecycle costs, risk reduction outcomes, and alignment with program criteria. Securing external funding will help reduce the financial burden on the municipality, accelerate implementation, and ensure the long-term sustainability of the selected flood-mitigation solution.

8.2 Environmental Management and Mitigation

Mitigation measures must be set in place to safeguard natural heritage features near the project area during construction. Design and construction plans will follow best management practices to minimize negative impacts, protect the environment, and encourage overall environmental improvements.

Environmental monitoring will be conducted during construction and post-construction to ensure the design continues to serve as intended and does not negatively impact the surrounding area.

Environmental mitigations to be implemented:

- Retain an arborist to oversee a tree inventory, create an arborist report, a tree preservation plan, minimize tree removals and impacts, and provide recommendations for restoration as required by the Town's tree by-law.
- Minimize riparian vegetation removal such that physical and biological functional attributes of the terrestrial vegetation can be maintained as they relate to aquatic ecological function. Removals should be completed through consultation with an ecologist to avoid any sensitive species.
- Conduct a SAR survey for bat habitat trees. Depending on survey results, acoustic surveys may need to be completed (to be confirmed through correspondence with MECP following habitat tree survey). If required, acoustic bat surveys are to be completed between June 1 and June 30 of any given year.
- Plan to carry out all vegetation removal outside of the breeding bird window. Otherwise plan for nest sweeps where that timing is not possible.
- Plan to carry out all tree removals outside of the active window for bats (between early April and late September or November (pending species type) of any given year).
- Develop a compensation strategy including landscape restoration plans. Offsite restoration will be identified for any compensation that cannot be implemented onsite.
- Prepare restoration plans including planting, landscaping, and naturalization detail.
- Plan to carry out all in-water works during applicable timing windows. In-water work is permitted between July 1 and March 31 for this warmwater stream, as determined through correspondence with MNRF.
- Consider invasive species and if applicable, develop an invasive species management plan.
- Evaluate the local groundwater conditions, specifically in the local PSW. Information from the background review noted both groundwater discharge and groundwater recharge conditions within or adjacent to the study area. Groundwater constraints and the potential for short and long-term impacts on associated wetland features and functions will need to be assessed and properly mitigated at the detailed design stage.

- o Complete a water balance study to ensure the PSW hydrology is not compromised to avoid compositional shifts in the vegetation community/available SAR habitat.
- Notify agencies and obtained applicable permits.

8.3 Social and Cultural Investigations and Engagement

As the project advances toward implementation, the landform barrier solution should be advanced in a manner that respects local communities and protects heritage resources. The Town should:

- Continue to assess the flood conditions and consult with impacted landowners as needed throughout the design process.
- Identify temporary construction easements and consult with impacted property owners.
- Look for opportunities to create recreational and greenspace improvements within the landform barrier footprint.
- Carry out Stage 2 archaeological investigations per the requirements identified in the Stage 1 archaeological assessment.

8.4 Detail Design and Construction

The next steps will progress the solution through concept design and eventually into detailed design. The design phase will conclude with the preparation of detailed drawings, specifications, and cost estimates that will support tendering and construction. Elements to be carried out to support the detailed design include:

- Carry out a geotechnical investigation to better characterize subsurface conditions to support detailed design.
- Complete subsurface utility engineering quality level A through D investigations to confirm exact vertical and horizontal alignments as required to mitigate potential conflicts and ensure municipal servicing and utilities are protected appropriately during construction.
- Complete survey - Legal and topographic surveys will be required for detailed design. Subsurface Utility Engineering surveys may be required at detailed design.
- Consider design of temporary flow bypass methods for the tributaries to Six Mile Creek.

- Confirm if Environmental Activity And Sector Registry (EASR) is required as the designs are further refined.
- Complete erosion and sediment control drawings.

8.5 Permits and Approvals

There are several potential permits and approvals that are required prior to construction as detailed design is being carried out. A list of the likely permits and approvals by department/agency are provided below. The list of permits will be reviewed during the detailed design stage.

- Wildlife Scientific Collectors Authorization and Animal Care: No wildlife is to be handled or relocated without a Wildlife Scientific Collectors Authorization from the MNR. This permit shall be obtained by a qualified individual prior to construction.
- DFO Request for Review: DFO approval is required prior to the start of in-water work.
- Licence to Collect Fish for Scientific Purposes: If required, a fish salvage shall be completed in the tributaries during dewatering. A Licence to Collect Fish for Scientific Purposes will be required to capture and handle fish and will be obtained from the MNR.
- ESA Section 23.18: Approval from the MECP for SAR could be required.
- Ontario Regulation (O. Reg) 41/24: a permit under O. Reg. 41/24: Prohibited Activities, Exemptions and Permits will be required from the Niagara Region Conservation Authority.
- Town of Fort Erie – review and apply for any locally required permits (e.g., tree removals, street occupation permit, property acquisition).

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