Volume 2

Niagara Region

South Niagara Falls Wastewater Solutions

Comprehensive Overview

SOUTH NIAGARA FALLS WASTEWATER SOLUTIONS REPORT OUTLINE

The Environmental Study Report (ESR) for the South Niagara Falls Wastewater Solutions (SNFWWS) Class Environmental Assessment (EA) is a comprehensive document that describes the planning, evaluation, and decision-making process for the recommended SNFWWS program components including the new wastewater treatment plant (WWTP) site, plant outfall location, and associated sewer servicing strategy. The SNFWWS documentation is compliant with the requirements of the Environmental Assessment Act (EAA) and is being placed on public record for a 45-day review period.

The ESR is organized into four volumes:

Volume 1 – Executive Summary

Provides a brief overview of the SNFWWS program. It summarizes the information contained in Volumes 2, 3, and 4 including the problem and opportunity statement, purpose of the study, planning, policy and technical considerations, and description of the recommended SNFWWS program components.

Volume 2 – Comprehensive Overview

Provides the full planning and decision-making process for the SNFWWS program components. Presents the results through each Phase of the Class EA process including the site selection process for the new WWTP facility, the plant outfall receiving waterbody, the deep trunk sewer, Thorold South servicing strategies, costing review, and next steps for implementation.

Volume 3 – Supporting Documents

Includes a complete list of documents, including all supporting technical memoranda and discipline investigation reports that supported the evaluation of siting, outfall locations, sewer alignments, and design concepts including technical considerations, treatment technologies, and considerations for natural environment, cultural heritage, archaeological significance, agricultural considerations, risk management, and more.

Volume 4 – Public and Agency Consultation

Contains all relevant documentation of the public consultation process including notices, comments and responses, and distributed information. Presentation material from all Public Information Centres (PICs) held during the process is included. Additional presentation materials and discussion information from workshops held with indigenous communities, approval agencies, and other stakeholders are also included.

This report is the complete **Volume 2 – Comprehensive Overview** which is one of the four volumes that make up the complete South Niagara Falls Wastewater Solutions Environmental Study Report and should be read in conjunction with the other volumes.

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Appendix V2.6: SNFWWS Program Cost Estimates

LIST OF ABBREVIATIONS

Acronym	Definition
2016 MSPU	2016 Water and Wastewater Master Plan Servicing Update
AA	Archaeological Assessment
ACH	Air Changes Per Hour
ACS	Assimilative Capacity Study
ANSI	Areas of Natural and Scientific Interest
BAF	Biological Aerated Filter
BH	Borehole
BNR	Biological Nutrient Removal
BOD_5	Biochemical Oxygen Demand
CAS	Conventional Activated Sludge
CCME	Canadian Council of Ministers of the Environment
CCTV	Closed-circuit Television
CH_4	Methane
CHAR	Cultural Heritage Assessment Report
CHER	Cultural Heritage Evaluation Report
CHIA	Cultural Heritage Impact Assessment
CHVI	Cultural Heritage Value or Interest
CLI	Canada Land Inventory
COSSARO	Committee on the Status of Species at Risk in Ontario
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSO	Combined Sewer Overflows
DFO	Department of Fisheries and Oceans Canada
EA(A)	Environmental Assessment (Act)
ECA	Environmental Compliance Approval
EPA	Environmental Protection Areas
EPBM	Earth Pressure Balance Machine
ESA	Environmental Site Assessment
ERIS	Environmental Risk Information Services
ESR	Environmental Study Report
GGH	Greater Golden Horseshoe
GHG	Greenhouse Gas
GLWQA	Great Lakes Water Quality Agreement
H_2S	Hydrogen Sulfide
HCD	Heritage Conservation District
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
HEPC	Hydro Electric Power Canal
HPR	Hydrogeological Data Report
HIA	Heritage Impact Assessment
HIAR	Hydrogeological Impact Assessment Report
HVA	Highly Vulnerable Aquifers

Acronym	Definition
ICD	International Control Dam
IJC	International Joint Commission
IP	Intermediate Pressure
IPZ	Intake Protection Zone
LIO	Land Information Ontario
MBCA	Migratory Bird Convention Act
MBL	Multiple Bottom Line
MCEA	Municipal Class Environmental Assessment
MCR	Municipal Comprehensive Review
MEA	Municipal Engineers Association
MECP	Ministry of the Environment, Conservation and Parks
MH	Maintenance Hole (also known as Manhole)
MTCS	Ministry of Tourism, Culture and Sport (formerly MHSTCI)
MHSTCI	Ministry of Heritage, Sport, Tourism and Culture Industries
MNDMNRF	Ministry of Northern Development, Mines, Natural Resources and Forestry
MLD	Million Litres per Day
MTBM	Microtunnel Boring Machine
MTO	Ministry of Transportation
NEB	National Energy Board
NPCA	Niagara Peninsula Conservation Authority
NPEI	Niagara Peninsula Energy Incorporated
NRBN	Niagara Regional Broadband Network
NYPA	New York Power Authority
OASD	Ontario Archaeological Sites Database
OHA	Ontario Heritage Act
OMAFRA	Ontario Ministry of Agricultural, Food and Rural Affairs
OMB	Ontario Municipal Board
OP	Official Plan
OPG	Ontario Power Generation
OWES	Ontario Wetland Evaluation System
PHC	Petroleum Hydrocarbons
PIC	Public Information Centre
PPS	Provincial Policy Statement
PSW	Provincially Significant Wetlands
PTTW	Permit to Take Water
PWQO	Provincial Water Quality Objectives
QEW	Queen Elizabeth Way
ROW	Right-of-Way
RSC	Record of Site Condition
RSPS	Raw Sewage Pumping Station
SARA	Federal Species at Risk Act
SGRA	Significant Groundwater Recharge Areas
SSHLPS	South Side High Lift Pumping Station
SSLLPS	South Side Low Lift Pumping Station

Acronym	Definition
SAR	Species at Risk
SPR	Source Protection Regions
SPS	Sewage Pumping Station
SUE	Subsurface Utilities Engineering
SWH	Significant Wildlife Habitat
SWHTG	Significant Wildlife Habitat Technical Guide
SWHMiST	Significant Wildlife Mitigation Tool
SWP	Source Water Protection
TAN	Total Ammonia Nitrogen
TBM	Tunnel Boring Machine
TP	Total Phosphorus
TSS	Total Suspended Solids
VOC	Volatile Organic Compounds
WAS	Waste Activated Sludge
WSER	Wastewater System Effluent Regulations
WWTP	Wastewater Treatment Plant
XHP	Extra High Pressure

1.0 Study Introduction

1.1 Introduction

Niagara Region has undertaken the South Niagara Falls Wastewater Solutions (SNFWWS) study to identify, develop and implement a wastewater servicing strategy and conceptual design for a new wastewater treatment plant (WWTP) and associated collection and conveyance infrastructure in South Niagara Falls (SNF). The SNFWWS program will not only provide servicing capacity for the City of Niagara Falls but will also provide servicing capacity and net benefit to the communities of Thorold South, St. Catharines, and Niagara on the Lake. The strategy includes diversion of existing and future flows for Thorold South into the new SNF system and plant.

1.2 Background

South Niagara Falls was first identified for significant growth through *Niagara 2041*, where Niagara Region undertook a Municipal Comprehensive Review (MCR) of growth planning, water and wastewater infrastructure, and transportation infrastructure to establish a plan for Niagara's future. Of the total population and employment growth expected in the City of Niagara Falls by 2041, over 64 per cent is expected in the south Niagara Falls area.

The existing Stanley Avenue WWTP, operated by Niagara Region, is located in the north end of the City of Niagara Falls. The projected growth in the City, including south Niagara Falls, will result in capacity constraints at the existing plant as well as critical trunk conveyance infrastructure.

The Region's *2016 Water and Wastewater Master Servicing Plan Update* (2016 MSPU), which was completed in 2017, explored two primary alternatives to address the south Niagara Falls wastewater servicing strategy:

Option 1: "Go North"

- Maintain current conveyance direction in south Niagara Falls as neighboring systems in Thorold South, St. Catharines, and Niagara-on-the-Lake,
- Maintain one WWTP in Niagara Falls,
- South Niagara Falls growth would trigger infrastructure upgrades through the City to the existing WWTP, and,
- Thorold South growth would trigger upgrades downstream through St. Catharines.

Option 2: "New Plant"

- Provide a new south Niagara Falls WWTP,
- Avoid major infrastructure upgrades through the existing built core of the City,
- Integrate servicing of Thorold South, and,
- Provide flexibility to integrate servicing future growth in North Niagara Falls and Niagara-on-the-Lake (St. David's Area).

Option 2 “New Plant” was selected as the preferred alternative. The “New Plant” provided the greatest flexibility and support for long-term servicing and benefit to south Niagara Falls, plus overall Niagara Falls and surrounding systems. It was recommended in the 2016 MSPU that a new WWTP be constructed and that a Schedule C Class EA be completed to confirm the site and related infrastructure.

1.3 SNFWWS Class EA Study

The SNFWWS study has followed the **Schedule C** Class Environmental Assessment (Class EA) in accordance with the Municipal Class Environmental Assessment process, prepared by the Municipal Engineers Association (MEA) (October 2000, as amended in 2007, 2011 and 2015).

The SNFWWS study objectives were to:

- Confirm the overall servicing objectives and perform first principal engineering analysis of the servicing alternatives,
- Satisfy the Municipal Class Environmental Assessment (Class EA) requirements for the servicing solution,
- Consider unique opportunities and challenges associated with utility and infrastructure services, environment and natural features, and socio-economic impacts,
- Provide effective communication and consultation with stakeholders, agencies, Indigenous Communities, and the public throughout the entire Class EA study process,
- Analyze and develop the selection of the preferred solution to ensure successful implementation of the infrastructure components,
- Identify any issues and consider potential remediation,
- Provide sufficient level of preliminary design to demonstrate the extents of the infrastructure, improve project lifecycle cost estimating, provide detailed implementation requirements, and identify overall operational concepts, and,
- Deliver comprehensive documentation of the strategy, evaluation, and recommendations.

The SNFWWS Class EA has advanced the 2016 MSPU’s concept to a conceptual servicing strategy and considered alternative WWTP sites, WWTP outfall receiving waterbodies, wastewater trunk sewer and collection system alignments, and design concepts to identify the preferred servicing solution and implementation plan.

2.0 Class Environmental Assessment Process

SNFWWS is being undertaken in accordance with requirements of the **Schedule C** Municipal Class Environmental Assessment process (October 2000, as amended in 2007, 2011, and 2015).

2.1 Environmental Assessment Act

Ontario's *Environmental Assessment Act (EAA)* was passed in 1975 and proclaimed in 1976. The EAA requires proponents to examine and document the environmental effects that could result from major projects or activities and their alternatives. Municipal undertakings became subject to the EAA in 1981.

The EAA's comprehensive definition of the environment is:

- Air, land, or water,
- Plant and animal life, including human life,
- The social, economic, and cultural conditions that influence the life of humans or a community,
- Any building, structure, machine or other device or thing made by humans,
- Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities, and,
- Any part of combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.

2.2 Principles of Environmental Planning

The EAA sets a framework for a rational, objective, transparent, replicable, and impartial planning process based on the following five key principles:

1. **Consultation with affected parties.** Consultation with the public and government review agencies is an integral part of the planning process. Consultation allows the proponent to identify and address concerns cooperatively before final decisions are made. Consultation should begin as early as possible in the planning process.
2. **Consideration of a reasonable range of alternatives.** Alternatives include functionally different solutions, "alternatives to" the proposed undertaking and "alternative methods" of implementing the preferred solution. The "Do Nothing" alternative must also be considered.
3. **Identification and consideration of the effects of each alternative on all aspects of the environment.** This includes the natural, social, cultural, technical, and economic environments.
4. **Systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects.** The evaluation shall increase in the level of detail as the study moves from the evaluation of "alternatives to" to the evaluation of "alternative methods".
5. **Provision of clean and complete documentation of the planning process followed, to allow "traceability" of decision-making with respect to the project.** The planning process must be documented in such a way that it may be repeated with similar results.

2.3 Municipal Class Environmental Assessment Process

The Municipal Class EA approach streamlines the planning and approvals process for municipal projects that are:

- Recurring,
- Similar in nature,
- Usually limited in scale,
- Predictable in the range of environmental impacts, and,
- Responsive to mitigation.

The Municipal Class EA outlines the procedures to be followed to satisfy requirements for water, wastewater, stormwater management, and road projects. The process includes five phases:

1. **Phase 1**: Problem or Opportunity Definition
2. **Phase 2**: Identification and Evaluation of Alternative Solutions to Determine a Preferred Solution while taking input from the public and other stakeholders into consideration
3. **Phase 3**: Examination of Alternative Methods of Implementation of the Preferred Solution while taking input from the public and other stakeholders into consideration
4. **Phase 4**: Documentation of the Class EA process in the form of an Environmental Study Report (ESR) for public review
5. **Phase 5**: Implementation and Monitoring

Public and agency consultation are integral to the Class EA planning process. Projects subject to the Class EA process are classified into following four “schedules” depending on the degree of the expected impacts. Figure 2-1 illustrates the Municipal Class EA planning and design process with the phases required for each schedule.

- **Schedule A** projects are minor or emergency operational and maintenance activities and are approved without the need for further assessment. These projects are typically smaller in scale and do not have a significant environmental effect.
- **Schedule A+** projects are also pre-approved; however, the public is to be advised prior to the project implementation. Although projects of this class do not usually have the potential for adverse environmental impacts, they tend to be broader in scale in comparison to Schedule A projects.

- **Schedule B** projects require a screening of alternatives for their environmental impacts and Phases 1 and 2 of the planning processes must be completed. The proponent is required to consult with the affected public and relevant review agencies. If there are still outstanding issues after the public review period, requests may be made to the Minister of the Environment, Conservation and Parks for a Section 16 Order. A Section 16 Order request involves requesting a higher level of assessment be undertaken; either to a Schedule C Class EA or an Individual EA. Provided that no significant impacts are identified and no requests for a Section 16 Order are received, Schedule B projects are approved, and work may proceed directly to implementation.
- **Schedule C** projects must satisfy phases 1 through 4 of the Class EA process, prior to proceeding to Phase 5 - Implementation. These projects have the potential for greater environmental impacts. Phase 3 involves the assessment of alternative methods of carrying out the project, as well as public consultation on the preferred conceptual design. Phase 4 normally includes the preparation of an Environmental Study Report (ESR) that is filed for public review. Provided no significant impacts are identified, and no requests for Section 16 Order are received, Schedule C projects are approved, and work can proceed to implementation.

2.4 Selection of the Class Environmental Assessment Schedule

There are major components to the study including a new WWTP site, an outfall location for the new WWTP, a new trunk sewer, and a Thorold South servicing strategy. These components are dependent on each other and based on the Municipal Engineers Association (MEA) Municipal Class EA Guidance Manual have been combined into one single project.

The Municipal Class EA Guidance Manual, Appendix 1, outlines activities that shall follow planning procedures related to the Schedule. The construction of a new sewage treatment plant must follow the planning process associated with **Schedule C** activities.

Based on the Municipal Class EA guidance, the anticipated complexity of this project, the interconnectivity of the strategies and facilities to the community, and stakeholder sensitivity for this project, the Region is completing this project as a **Schedule C** Class EA and providing additional opportunities of public consultation, beyond the minimum for **Schedule C** undertakings.

The SNFWWS study satisfied Phases 1 to 4 of the Class EA process with the completion of the ESR, and the first stage in Implementation (Phase 5) – Enhanced Conceptual Design Report. This process is outlined in Figure 2-1.

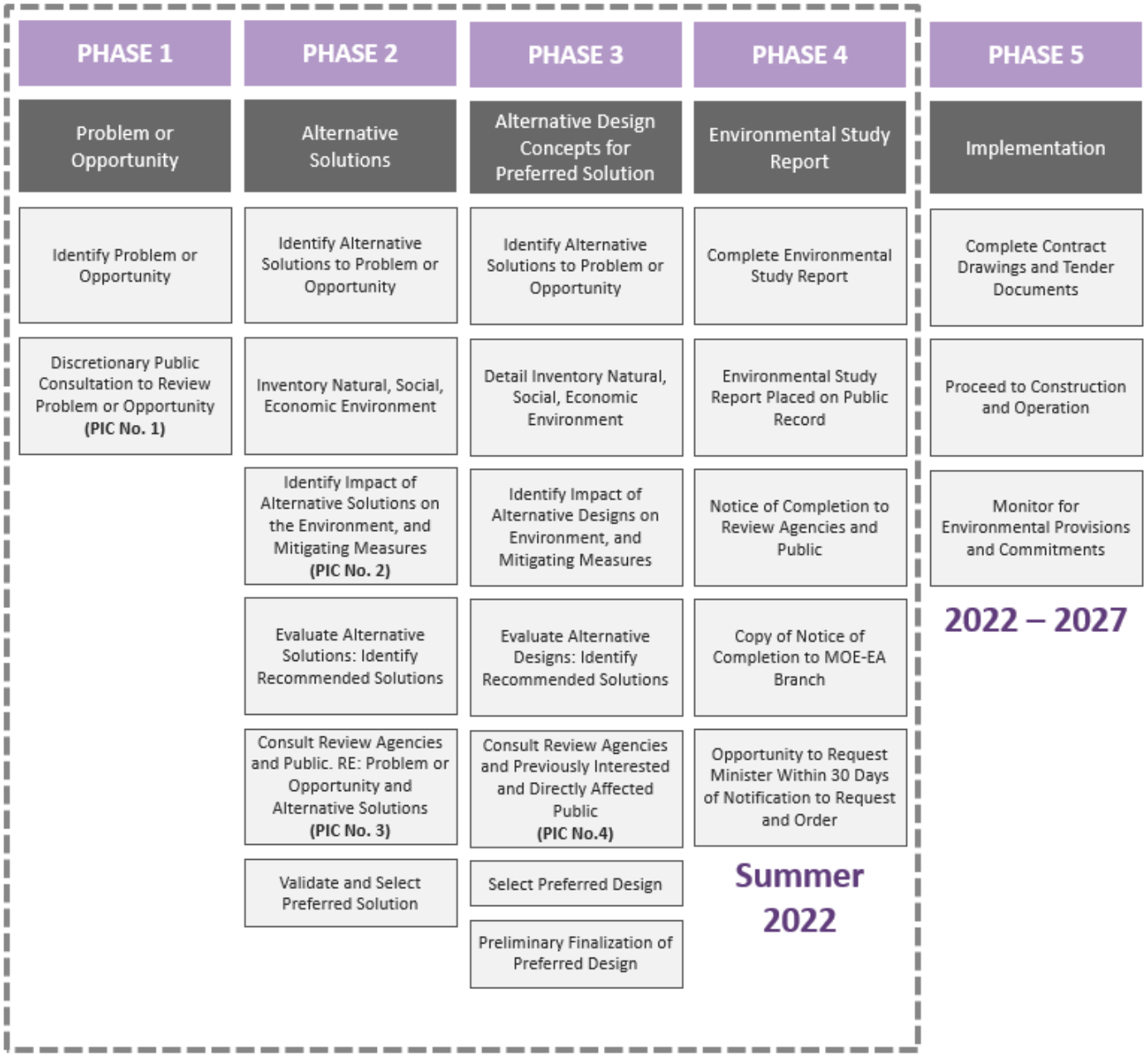


Figure 2-1. Municipal Class EA Planning and Design Process

2.5 Public and Stakeholder Consultation

Public and stakeholder consultation and participation was an important component to the success of this study and is mandated as part of the Class EA Process. Given the complexity and potentially sensitive nature of this study, it was imperative that the EA ensures meaningful consultation and extensive two-way communication with all stakeholders to provide information, listen to, and work to address issues and concerns. Effective consultation with the public and stakeholders was used to obtain valuable comments and feedback on the overall study process, and better understand potential sensitivities and issues related to the Class EA. The overarching strategy for public and stakeholder consultation included several goals and objectives that went beyond simply meeting legislative requirements.

The primary goals and objectives of the public consultation process were:

- Present clear and concise information at key stages of the study process,
- Solicit community, regulatory, Regional and Local staff input,
- Identify concerns that might arise from the undertaking,
- Undertake a comprehensive Aboriginal communities' consultation to complete the Duty to Consult with Aboriginal communities,
- Consider stakeholder comments when developing the preferred solution, and,
- Meet and exceed Municipal Class EA Consultation requirements.

The Communications and Consultation program for this Class EA was driven by five key principles:

- **Respect:** for all parties engaged in the process,
- **Clear, consistent communication:** to ensure broad understanding, and that all communicators on behalf of the Class EAs are using consistent messages,
- **Demonstrated organizational and community values:** to ensure all communications reflect the values of Peel Region as an organization and as a community,
- **Transparency:** to communicate the EA process and its results openly, and
- **Flexibility:** changeable to adapt to different stakeholders, concerns and opportunities that may arise throughout the EA process.

A broad a range of methods was used through the Class EA process to advise the public and stakeholders of the Class EA and solicit input. Methods include notices, newsletters, a project website, comment forms, and public consultation events (physical and virtual).

Volume 4 of the SNFWWS Environmental Study Report contains all relevant documentation of the public consultation process including notices, comments and responses, and distributed information. Presentation material from all Public Information Centres (PICs) held during the process is included. Additional presentation materials and discussion information from key workshops held with appropriate Indigenous communities, relevant agencies, approval bodies and other stakeholders are also included.

3.0 Policy Overview

This section presents a summary of the Federal, Provincial, and Local legislation and policies relevant to the study area and the SNFWWS Class EA.

3.1 Federal Legislation

3.1.1 Great Lakes Water Quality Agreement

The *Great Lakes Water Quality Agreement (GLWQA) (2012)* commits the governments of Canada and the United States to restoring and protecting the Great Lakes. Objectives include protecting and maintaining the lakes for safe drinking water supply, swimming and recreational use, and safe fish and wildlife for human consumption. Issues and potential threats that are addressed in the GLWQA are derived from nutrients, chemicals, vessel discharges, invasive species, and climate change.

The International Joint Commission (IJC) plays a key role in the GLWQA, by evaluating efforts to restore the Great Lakes ecosystem, engaging the public, completing research, and assessing the effectiveness of the USA and Canadian programs in meeting the agreement's goals and objectives. Progress reports prepared by the USA and Canadian governments are reviewed and evaluated by the IJC every three years, after which the IJC will complete extensive research and consult with the public in order to prepare their assessment report on a triennial basis. The first Progress Report was released in 2017.

Key recommendations in the GLWQA and supported by the IJC in the 2017 Progress Report include:

- Developing binational approaches to climate change adaptation and resiliency, including recognizing the impacts on water infrastructure and improving capacity to respond to extreme events.
- Updating phosphorus reduction targets in vulnerable areas of the Great Lakes to reduce the threats such as harmful algae. The offshore waters of Lake Erie's eastern, central, and western basins continue to have high total phosphorus levels and as such is recognized as the priority.

3.1.2 Canada-Ontario Great Lakes Agreement

The Canadian and Ontario governments have worked together for over 40 years to protect the Great Lakes and associated ecosystems and communities. *The Canada-Ontario Great Lakes Agreement (2014)* explains how the federal and provincial governments cooperate and coordinate activities to prioritize protecting waters, improving wetlands, beaches, and coastal areas, protecting habitats and species, enhancing understanding and adaptation, and promoting innovation and community engagement.

The *Agreement* helps provide the means by which Canada and Ontario interact to help meet Canada's obligations under the GLWQA, described above. Goal 2 of Annex 1 of the *Agreement* states that science-based phosphorous concentration and loading targets should be established for the Great Lakes.

Ontario and Canada have released a draft of a *Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health, 2020 (draft July 2019);* this document builds on the current *Agreement* and further discusses ongoing and emergent issues, including algal blooms.

3.1.3 Strategy for the Management of Municipal Wastewater Effluent

The *Canada-wide Strategy for the Management of Municipal Wastewater Effluent* was developed in 2019 by the Canadian Council of Ministers of the Environment (CCME). The *Strategy* sets out a framework that addresses issues related to governance, wastewater facility performance, effluent quality and quantity and its associated risk and economic considerations in a way that provides consistency and clarity to the wastewater sector across Canada.

The *Strategy* requires that all facilities achieve minimum National Performance Standards and develop and manage site-specific Effluent Discharge Objectives. The *Strategy* also outlines risk management activities to be implemented to reduce the risks associated with combined and sanitary sewer overflows. The *Strategy* requires among other elements that overflow frequencies for sanitary sewers not increase due to development or redevelopment. The same applies for combined sewers, unless occurring as part of an approved combined sewer overflow management plan. Neither should occur during dry weather, except during spring thaw and emergencies. Source control of pollutants is recommended and monitoring and reporting on effluent quality required.

3.1.4 Wastewater Systems Effluent Regulations

The *Wastewater System Effluent Regulations (WSER)*, issued in 2012 and amended in 2015, are the primary instrument that Environment Canada uses to implement the CCME *Canada-wide Strategy for the Management of Municipal Wastewater Effluent*. The WSER governs both federal and provincial wastewater standards for compliance and are applicable to any wastewater system that treats an average daily volume of at least 100 cubic metres per day. Under the WSER, acute lethality testing using rainbow trout needs to be performed monthly beginning January 1, 2015; compliance also comes into effect at the same time.

3.1.5 Fisheries Act

The *Fisheries Act* is a federal legislation for the protection of fish habitat from biological, physical, or chemical alterations that are harmful and/or destructive. The Department of Fisheries and Oceans Canada (DFO), in conjunction with various other agencies including Environment Canada, Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) and, the Ministry of the Environment, Conservation and Parks (MECP) are responsible for the enforcement and management of fisheries resources. The following sections of the *Fisheries Act* were relevant to the SNFWWS Class EA:

- **Section 20:** requirement and approval for fish passage facilities.
- **Section 22:** provision of sufficient amounts of flow at and downstream from obstructions such as dams.
- **Section 30:** requirement to install fish guards or other protection measures at water intakes.
- **Section 32:** prevention of the destruction of fish by means other than fishing.
- **Section 35:** prohibits harmful alteration, disruption, or destruction of fish habitat.
- **Section 35 (2):** allows the Minister of Fisheries and Oceans to authorize harmful alteration, disruption, or destruction of fish habitat provided that no net loss of the productive capacity of fish habitat occurs.
- **Section 36:** prohibits the deposit of deleterious substances into water frequented by fish.

Under the SNFWWS Class EA, an assimilation capacity assessment of the preferred receiving waterbody was carried out to determine the effluent requirements to satisfy Provincial Water Quality Objectives (PWQO) and receive acceptance through MECP.

3.1.5.1 Fish Habitat

Where development is proposed within or adjacent (i.e. within 30 metres) to fish habitat, an assessment must be completed to demonstrate that development will not adversely affect the features or its ecological function.

In general, development should be designed to avoid or minimize adverse impacts to fish and fish habitat. Development and site alteration within fish habitat may be permitted in accordance with provincial and federal requirements (i.e. *Fisheries Act*). Where impacts to fish or fish habitat cannot be avoided, consultation with DFO may be required to determine if an authorization under the *Act* is required.

3.1.6 Migratory Bird Convention Act

The *Migratory Birds Convention Act (MBCA)* was established in 1917 and amended in 1994 and 2005, to protect migratory birds, their eggs, and their nests. The MBCA was created to implement the Migratory Birds Convention between Canada and the United States.

The *Act* lists protected families and subfamilies of migratory birds and lays out legislation surrounding activities that may impact migratory birds or nests, including when and where activities may occur.

3.1.7 Species at Risk Act

The *Species at Risk Act (SARA)* focuses on restoring and maintaining populations of species that are at risk of extinction or extirpation due to human activity such as habitat destruction, hunting, introduction of competing species, or other anthropogenic causes.

Species are designated at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) by using biological information on a species deemed to be in danger. The COSEWIC reviews research information on population and habitat status, trends and threats and applies assessment criteria based on international standards. Once a species is added to Schedule 1 – List of Wildlife Species at Risk, it benefits from legal protection afforded and the mandatory recovery planning required under the *Act*.

3.2 Provincial Legislation

3.2.1 Provincial Policy Statement

The *Provincial Policy Statement (PPS)* sets the policy foundation for land use planning and development in Ontario, providing guidance and support for appropriate land use planning and development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment. The PPS contains policies relevant to wastewater infrastructure planning including, but not limited to:

- Requirement that infrastructure be provided in a coordinated, efficient, and cost-effective manner with considerations to climate change,
- Planning for infrastructure should be financially viable over their lifecycle and available to meet current and projected needs,
- Optimization of the use of existing infrastructure and public service facilities before developing new infrastructure,
- More specifically, the Provincial Policy Statement recommends that wastewater services should:
    - Direct and accommodate expected growth in a manner that promotes the efficient use and optimization of existing municipal water and wastewater services.
    - Ensure that these systems are provided in a manner that:
        - can be sustained by the water resources upon which such services rely,
        - is feasible, financially viable and complies with all regulatory requirements, and,
        - protects human health and the natural environment,
        - Promote water conservation and water use efficiency, and,
        - Integrate servicing and land use considerations at all stages of the planning process.

The *Greenbelt Plan*, the *Niagara Escarpment Plan*, and the *Oak Ridges Moraine Conservation Plan* work within the framework set out by the *Growth Plan for the Greater Golden Horseshoe* for where and how future population and employment growth should be accommodated.

3.2.2 Growth Plan for the Greater Golden Horseshoe

The *Growth Plan for the Greater Golden Horseshoe*, which falls under the *Places to Grow Act (2005)*, was first introduced in July 2017, and later amended as of May 16, 2019. The *Growth Plan* sets out a vision and policies to manage rapid growth. It integrates land use planning, infrastructure planning and investment as well as demographic, economic growth and health considerations to support the achievement of complete communities, a thriving economy, a clean and healthy environment, and social equity.

The *Growth Plan* describes permissible population and employment growth areas for upper and single tier municipalities. Like other provincial plans, the *Growth Plan* builds upon the policy foundation provided by the PPS and provides land use planning policies to address issues facing specific geographic areas in Ontario. While the PPS provides for a time horizon of up to 20 years to make enough land available to meet projected needs, it also suggests that a provincial plan may provide an alternate time horizon for specific areas of the province. The *2019 Growth Plan* provides that the applicable time horizon for land use planning is 2041.

3.2.3 Ontario Heritage Act

The province and municipalities are enabled to conserve significant individual properties and areas through the *Ontario Heritage Act (OHA)*. Under Part III of the OHA, compliance with the *Standards and Guidelines for the Conservation of Provincial Heritage Properties* is mandatory for provincially owned and administered heritage properties and holds the same authority for ministries and prescribed public bodies as a Management Board or Cabin Directive.

For municipalities, Part IV, and Part V of the OHA enables councils to “designate” individual properties (Part IV), or properties within a Heritage Conservation District (HCD) (Part V) as being of “cultural heritage value or interest” (CHVI). Evaluation for CHVI under the OHA is guided by *Ontario Regulation 9/06*, which prescribes the “criteria for determining cultural heritage value or interest”. If a property meets one or more of these criteria, it may be eligible for designation under Part IV, Section 29 of the OHA. The designation is recognized through municipal by-law, and the property must be included on a “Register” maintained by the municipal clerk. A municipality may also “list” a property on the Register to indicate it as having potential CHVI. Importantly, designation or listing in most cases applies to the entire property, not only individual structures, or features.

For provincial properties, evaluation of potential cultural heritage resources must apply *Ontario Regulation 10/06 (O. Reg 10/06): Criteria for Determining Cultural Heritage Value or Interest of Provincial Significance*. Should a property meet the criteria, consent from the Minister of Tourism, Culture and Sport (MTCS, formerly the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI)) may be required prior to demolition or disposal.

3.2.4 Endangered Species Act

The *Endangered Species Act* was originally written in 1971 and amended in 2008. Similar to the *Federal Species at Risk Act (SARA)*, the *Endangered Species Act* aims to provide protection to plant and animal species that are at risk of extinction or extirpation from Ontario.

Species thought to be at risk in Ontario are initially determined by the Committee on the Status of Species at Risk in Ontario (COSSARO), and if approved by the provincial MNDMNRF, species will be added to the provincial list of endangered and threatened species in compliance with the *Endangered Species Act*. The *Endangered Species Act* immediately provides habitat protection to all species listed as threatened, endangered or extirpated.

The *Endangered Species Act* provides guidance on determining whether anthropogenic activities, such as construction, could impact regulated species and considers biology and behaviour of the species, details of the activity, and how the activity may affect the species' ability to carry out its life processes.

3.2.5 Planning Act

The *Planning Act* establishes the rules for land use planning in Ontario and describes how land uses may be controlled in communities. It also defines the respective roles and responsibilities of the province and municipalities, listed below:

Provincial Responsibility

- Issuance of Provincial Policy Statement
- Promotion of provincial interests
- Preparation of provincial plans, such as the Greenbelt Plan and Growth Plan for the Greater Golden Horseshoe
- Provision of advice to municipalities and the public on land use planning issues
- Administration of local planning controls and approvals where required

Municipal Responsibility

- Decision-making for future community planning
- Preparation of planning documents such as Official Plans and Zoning By-Laws
- Ensuring that planning decisions and documents are consistent with Provincial plans
- For Upper-Tier Municipalities (such as Niagara Region), approval authority for lower-tier municipalities' Official Plans

3.2.6 Sustainable Water and Sewage Act

The *Sustainable Water and Sewage Systems Act (2002)* legislates financial planning and sustainability of municipal water and wastewater systems and specifies reporting requirements.

In 2010, *Bill 13, Sustainable Water and Wastewater Systems Improvement and Maintenance Act* was tabled to repeal the *Sustainable Water and Sewage Systems Act.*

Key points of *Bill 13* are as follows:

- Sets out the purposes of the *Act*, which include ensuring that public ownership of water services and wastewater services is maintained.
- Establishes the Ontario Water Board as an agent of the Crown and sets out the Board's objectives, powers and duties which relate to the regulation of water services and wastewater services.
- Sets out the responsibilities of municipalities or groups of municipalities that are designated as regulated entities by regulation.
- Regulated entities must prepare business plans for the provision of water services or wastewater services. The plan must contain, among other things, an assessment of the full cost of providing water services or wastewater services to the public and a description of how the regulated entity intends to pay this full cost.

3.2.7 Water Opportunities and Conservation Act

The Ontario Government passed the *Water Opportunities and Conservation Act* in 2010. The purposes of the *Act* are as follows:

- To foster innovative water, wastewater and storm water technologies, services, and practices,
- To create opportunities for economic development and clean-technology jobs in Ontario, and
- To conserve and sustain water resources for present and future generations.

To further the purposes of the *Act*, the Minister of the Environment and Climate Change may establish aspirational targets in respect of the conservation of water and other matters.

The *Act* requires certain municipalities, persons, and entities to prepare, approve and submit to the Minister of the Environment municipal water sustainability plans for municipal water services, municipal wastewater services, and municipal storm water services under their jurisdiction. The Minister may establish performance indicators and targets for these services. The *Act* also authorizes the making of regulations requiring public agencies to prepare water conservation plans, achieve water conservation targets, and consider technologies, services and practices that promote the efficient use of water and reduce negative impacts on Ontario's water resources.

3.2.8 Safe Drinking Water Act and Clean Water Act

Several changes were made to Ontario's legislation and management of drinking water following Justice O'Conner's inquiry into the Walkerton E.Coli outbreak in 2000, including introduction of the *Safe Drinking Water Act* and *Clean Water Act*.

The *Safe Drinking Water Act* was developed in response to the Walkerton E.Coli outbreak and was adopted in 2002. The *Act* provides for the protection of human health and the prevention of drinking water hazards through the control and regulation of drinking water systems and drinking water testing.

The *Clean Water Act* was adopted in 2006 with the objective to protect existing and future sources of drinking water including rivers, lakes, and underground aquifers. Under the *Clean Water Act*, the *Source Water Protection (SWP) Plans* were mandated in order to identify and assess risk of threats, such as agricultural runoff and sewage, to drinking water sources. The SWP Plans also document Intake Protection Zones (IPZs), which delineate high risk areas that must be protected from potential contamination.

SWP Plans were prepared for 19 sub-watershed-based Source Protection Regions (SPR) across Ontario to protect existing and future sources and to identify areas of significant drinking water threats. The SNFWWS study area is located within one Source Water Protection Region: The Niagara Peninsula Source Protection Area (located between Lake Ontario and Lake Erie, with jurisdiction over Niagara Region, as well as portions of the City of Hamilton and Haldimand County).

3.2.9 Environmental Protection Act and Ontario Water Resources Act

The Environmental Protection Act (EPA) is the primary pollution control legislation in Ontario and is used with the *Water Resources Act* to protect air and water quality in Ontario. The EPA prohibits the discharge of contaminants into the environment that are likely to cause adverse effects, by establishing limits for air emissions and wastewater effluent that must not exceed. Environmental Compliance Approvals (ECAs) are issued under the Act. In addition, the *Act* controls the removal, transport, and disposal of excess soils, if they are deemed to be contaminated.

The Ontario Water Resources Act focuses on the protection of groundwater and surface water in Ontario. The *Act* regulates the approval, construction, and operation of wastewater treatment facilities, including ensuring that effluent discharges to receiving waters meet Provincial Water Quality Objectives (PWQOs). Permits-to-Take-Water (PTW) from the ground or surface water sources of more than 50,000 liters of water per day are also regulated under the Water Resources Act.

3.2.10 Water Management – Policies, Guidelines, PWQO

To support municipalities in meeting the *Environmental Protection Act* and *Ontario Water Resources Act*, the MECP has developed water management guidelines. The two most relevant to this Class EA are described below:

MECP Procedure F-5-1

Procedure F-5-1 outlines treatment requirements for municipal and private sewage treatment works discharging to surface waters. Effluent requirements are established on a case-by-case basis considering the characteristics of the receiving water body. All sewage treatment works shall provide secondary treatment or equivalent as the "normal" level of treatment unless individual receiving water assessment studies indicate the need for higher levels of treatment. Existing works not complying with the guideline are required to upgrade as soon as possible.

The Procedure stipulates effluent design objectives for BOD, suspended solids, total phosphorus, and ammonia and provides guidelines for BOD and suspended solids. Sewage treatment works designed according to the guidelines should be able to meet the objectives on an average annual basis and not exceed the guidelines.

Procedure F-5-1, Section 3.3 states that bypassing of raw sewage and primary effluent from nominally separated sewerage systems will not be allowed except in emergency conditions. However, Section 3.5 allows the use of "excess primary treatment" to handle extraneous wet weather peak flows where secondary treatment for these flows is "impractical or uneconomical". Effluent criteria and compliance assessment programs are not necessary for excess primary treatment. This policy supports the development of appropriate levels of primary and secondary treatment capacity, particularly with respect to subjecting peak flows to a minimum of primary treatment and the determination of secondary treatment peak capacity.

MECP Procedure B-1-5

Procedure B-1-5 describes the procedures to establish receiving-water based effluent requirements for point source discharges, such as wastewater treatment plant outfalls. The Procedures aims to ensure that point-discharges to surface water bodies do not negatively impact receiving water quality relative to Provincial Water Quality Objectives (PWQO). Procedure B-1-5, Section 3.1.1 states that effluent limits are the legally enforceable effluent requirements, and that these limits are based on either achievable treatment technology or scientifically sound data on receiving water quality requirements. Section 3.1.1 states that effluent objectives are used where the available data on the parameters to be controlled are insufficient to form the basis for a legally enforceable limit.

Violations of an effluent objective can require the discharger to report on the causes and impacts of the violations as per their Facility ECA (formerly referred to as Certificate of Approval) and the MECP policy.

Surface waters in Ontario are subject to requirements of the five Policies, as applicable to an undertaking:

- **Policy 1** applies to water bodies with quality that is better than PWQO and specifies that water quality must be maintained at or above the Objective.
- **Policy 2** applies to water bodies with quality that does not currently meet PWQO and shall not be further degraded. Policy 2 reinforces that measures should be taken to improve water quality to meet Objectives.
- **Policies 3 and 4** prohibit the release of banned hazardous substances and to minimize the release of no-hazardous substances, respectively.
- **Policy 5** addresses mixing zone effects; the mixing zone is defined as an area where the receiving water quality is degraded at the point of discharge and may hinder beneficial use of the water body. Policy 5 prescribes that mixing zones should be as small as possible to limit effects on beneficial use and shall not be used in lieu of reasonable and practical treatment.

For this Class EA, Policies 1 (or 2, dependant on the plant discharge location) and 5 applied. The Procedure also stipulates methods for developing effluent criteria and assessing receiving waters. In compliance with this procedure, a receiving water assessment and Assimilative Capacity Study (ACS) is required.

The completed ACS is available in the SNFWWS ESR Volume 3, Appendix 3.5.

3.2.11 Nutrient Management Act

As part of *Ontario's Clean Water Strategy*, the *Nutrient Management Act, 2002* was developed to reduce the potential for water and environmental impacts from agricultural. The *Act* is administered jointly by the Ontario Ministry of Agricultural, Food and Rural Affairs (OMAFRA) and the MECP and sets the framework for best practices regarding application of nutrients to agricultural fields, including fertilizers, manure, and wastewater biosolids. The *Act* does not currently apply to the SNFWWS Class EA as biosolids are not currently applied on agricultural lands. However, the Act may apply if biosolids management practices are changed in the future as an outcome of this Class EA.

3.2.12 Conservation Authority Regulation and Policy

The legislative mandate of a Conservation Authority, as set out in *Section 20 of the Conservation Authorities Act*, is to establish and undertake programs designed to further the conservation, restoration, development, and management of natural resources.

Conservation Authorities are local agencies that protect and manage water and other natural resources at the watershed level.

In addition, Conservation Authorities have the delegated responsibility from the Ministries of Natural Resources and Municipal Affairs and Housing to implement *Section 3.1 (Natural Hazards) of the Provincial Policy Statement*, consistent with the Provincial one-window planning initiative.

NPCA also administers *Ontario Regulations 166/06, 160/06, 162/06*, respectively, under *Section 28 of the Conservation Authorities Act*. In general, these regulations prohibit altering a watercourse, wetland or shoreline and prohibit development in areas adjacent to river and stream valleys, hazardous lands and wetlands, without the prior written approval from the Conservation Authority (i.e., issuance of a permit).

The Conservation Authorities also support approval under the *Lakes and Rivers Improvement Act* administered by the Ministry of Natural Resources. *The Lakes and Rivers Act* was introduced in 1990 to protect the province's surface water resources. The *Act* regulates the public and private use of Ontario's lakes and rivers, including governing any works that interfere with wetlands or the alternation to shorelines and watercourses.

Where development is proposed within or adjacent (within 120 metres) to a significant wetland or Niagara Peninsula Conservation Authority (NPCA) regulated wetland greater than 2 hectares in size, an assessment must be completed to demonstrate that development will not adversely affect the feature or its ecological function. Where development is proposed within or adjacent (within 30 metres) to a NPCA regulated wetland less than 2 hectares in size, an assessment must be completed to demonstrate that development will not adversely affect the feature or its ecological function

Watercourses and waterbodies occurring within the study area are components of the Lower Welland River and south Niagara Falls watershed (NPCA 2012). Within the study area, the following watercourses and waterbodies were identified:

- Niagara River,
- Welland River (including Chippawa Creek),
- OPG Hydro Electric Power Canal,
- Lyon's Creek East,
- Beaver Dams Creek, and,
- Ussher's Creek.

Any development proposed within these features or the regulated limits may require a permit from the NPCA.

3.2.13 Ministry of Mines, Northern Development, Natural Resources and Forestry

Provincially Significant Wetlands: The MNDMNRF designates Provincially Significant Wetlands (PSWs). PSWs are designated based on a scientific point-based ranking system known as the Ontario Wetland Evaluation System. Wetlands are assessed based on a range of criteria, including biology, hydrology, societal value, and special features. Development is not permitted within a PSW according to provincial policies (MMAH 2014).

Areas of Natural and Scientific Interest: ANSIs are designated by the province according to standardized evaluation procedures. ANSIs are tanked by the MNDMNRF as being either provincially or regionally significant. Development may be permission within or adjacent (i.e. within 50 metres) to a provincially significant ANSI where an assessment demonstrates that development will not adversely affect the feature of its ecological function.

3.3 Local Legislation and Policy

3.3.1 Niagara Region Water and Wastewater Master Servicing Plan

As mentioned in Section 1.2**,** the SNFWWS Class EA was initiated based on the preferred alternative of the Region's *2016 Water and Wastewater Master Servicing Plan Update (2016 MSPU).* The 2016 MSPU identified capacity concerns for the existing wastewater system, with 64% of new growth in Niagara Falls occurring in south Niagara Falls.

The 2016 MSPU recommended a new south Niagara Falls WWTP. The new WWTP was found to provide the greatest flexibility and support for long-term servicing and benefit to south Niagara Falls, plus overall Niagara Falls and surrounding systems. This option was also found to provide the greatest opportunity to mitigate construction, capacity, and cost risks.

3.3.2 Niagara Region Official Plan

The *Niagara Region Official Plan (OP)* is the policy document guiding land use within the Niagara Region. The document contains Niagara Region objectives for development and conservation, as well as policies that implement provincial legislation and provide planning context to lower tier municipalities.

Section 7.A of the OP contains objectives and policies that apply throughout the Region, including those relevant to this project such as:

- **Policy 7.A.4.1:** Development and site alteration may be permitted within an Earth Science Area of Natural and Scientific Interest (ANSI) if it has been demonstrated that there will be no significant negative impacts on the Earth Science features for which the area was identified or on ecological functions related to the ANSI.
- **Policy 7.A.4.3:** Linear public utilities and infrastructure may be permitted within an Earth Science ANSI if there is no reasonable alternative location, and they are designed to avoid or minimize negative impacts.
- **Policy 7.A.6.4:** Development and site alteration may be permitted within floodplains if it has been demonstrated to the satisfaction of the Conservation Authority that it is in accordance with the Conservation Authority's "Fill, Construction and Alteration to Waterways Regulation" (as amended) or its successor, and subject to the Conservation Authority's approval.

Section 7.B of the Region's OP contains policies that apply to lands falling within the Core Natural Heritage System, defined by the following Policy:

- **Policy 7.B.1.1:** The Core Natural Heritage System consists of:
    a. Core Natural Areas, classified as either Environmental Protection Areas or Environmental Conservation Areas,
    b. Potential Natural Heritage Corridors connecting the Core Natural Areas,
    c. The Greenbelt Natural Heritage and Water Resources Systems, and
    d. Fish Habitat.
- **Policy 7.B.1.3** of the Niagara Region OP defines Environmental Protection Areas to include:

… provincially significant wetlands; provincially significant Life Science Areas of Natural and Scientific Interest (ANSIs); and significant habitat of endangered and threatened species. In addition, within the Greenbelt Natural Heritage System, Environmental Protection Areas also include wetlands; significant valleylands; significant woodlands; significant wildlife habitat; habitat of species of concern; publicly owned conservation lands; savannahs and tallgrass prairies; and alvars.

… significant habitat of endangered and threatened species will be identified through the Planning and Development review process. Where such habitat is identified, development and site alteration shall be subject to the policies for Environmental Protection Areas.

- **Policy 7.B.1.4** of the Region's OP defines Environmental Conservation Areas to include:

… significant woodlands; significant wildlife habitat; significant habitat of species of concern; regionally significant Life Science ANSIs; other evaluated wetlands, significant valleylands; savannahs and tallgrass prairies; and alvars; and publicly owned conservation lands.

3.3.3 City of Niagara Falls Official Plan

The *City of Niagara Falls Official Plan (OP)* for the Niagara Falls Planning Area outlines the long-term objectives and policies of the City with respect to the growth and development of urban lands; the protection of agricultural lands and the conservation of natural heritage areas; and the provision of necessary infrastructure.

The City's OP is to be brought into conformity with the policies of the Niagara Region OP were approved by Niagara Region.

3.3.4 City of Thorold Official Plan

Section A2.7 of the City of Thorold OP is dedicated to cultural heritage with the goal to "continue to identify, conserve, and enhance the City's significant cultural heritage resources. Schedule E of the OP maps cultural heritage sites designated under the *Ontario Heritage Act.*

Part D3 of the OP addresses heritage and archaeological resources. Council may require a Heritage Impact Assessment (HIA) to support development applications (Section D3.2.1). The OP requires public authorities to have regard to the retention and protection of identified cultural heritage resources. (Section D3.2.1.1).

3.3.5 Niagara Escarpment Plan

The *Niagara Escarpment Plan* includes a variety of topographic features and land uses extending 725 kilometers from Queenston on the Niagara River to the islands off Tobermory on the Bruce Peninsula. Designated a UNESCO World Biosphere Reserve in 1990, the Niagara Escarpment is an internationally recognized landform and is the cornerstone of Ontario's Greenbelt.

The Niagara Escarpment is a protected area under the Province of Ontario's *Niagara Escarpment Planning and Development Act* and the Niagara Escarpment Plan, subsequently referred to as "the Plan" in this section. The Plan serves as a framework of objectives and policies to strike a balance between development, protection, and the enjoyment of this important landform feature and the resources it supports. The *Plan* outlines land use designations, development criteria and related permitted uses, including farming, forestry, and mineral resource extraction.

The objectives of the *Niagara Escarpment Plan* are:

1. To protect unique ecologic and historic areas,
2. To maintain and enhance the quality and character of natural streams and water supplies,
3. To provide adequate opportunities for outdoor recreation,
4. To maintain and enhance the open landscape character of the Niagara Escarpment in so far as possible, by such means as compatible farming or forestry and by preserving the natural scenery,
5. To ensure that all new development is compatible with the purpose of the *Plan*,
6. To provide for adequate public access to the Niagara Escarpment, and,
7. To support municipalities within the *Niagara Escarpment Plan* area in their exercise of the planning functions conferred upon them by the *Planning Act*.

4.0 Study Problem and Opportunity

4.1 Study Area

The SNFWWS Class EA has taken a holistic wastewater servicing approach in establishing the study area such that, at a conceptual level, all potential options for plant siting, outfall locations, and collection system alignments have been included.

The study area depicted in Figure 4-1**,** generally extended north of the existing Stanley Avenue WWTP including the north limits of Niagara Falls as well as the Thorold South area, east to the Niagara River, south of the existing Niagara Falls urban boundary to Highway 27 (Schisler Road) and west including the Welland Canal.

The more localized study area for the new treatment plant was focused on South Niagara Falls and shown in the figure below as the white dashed area.

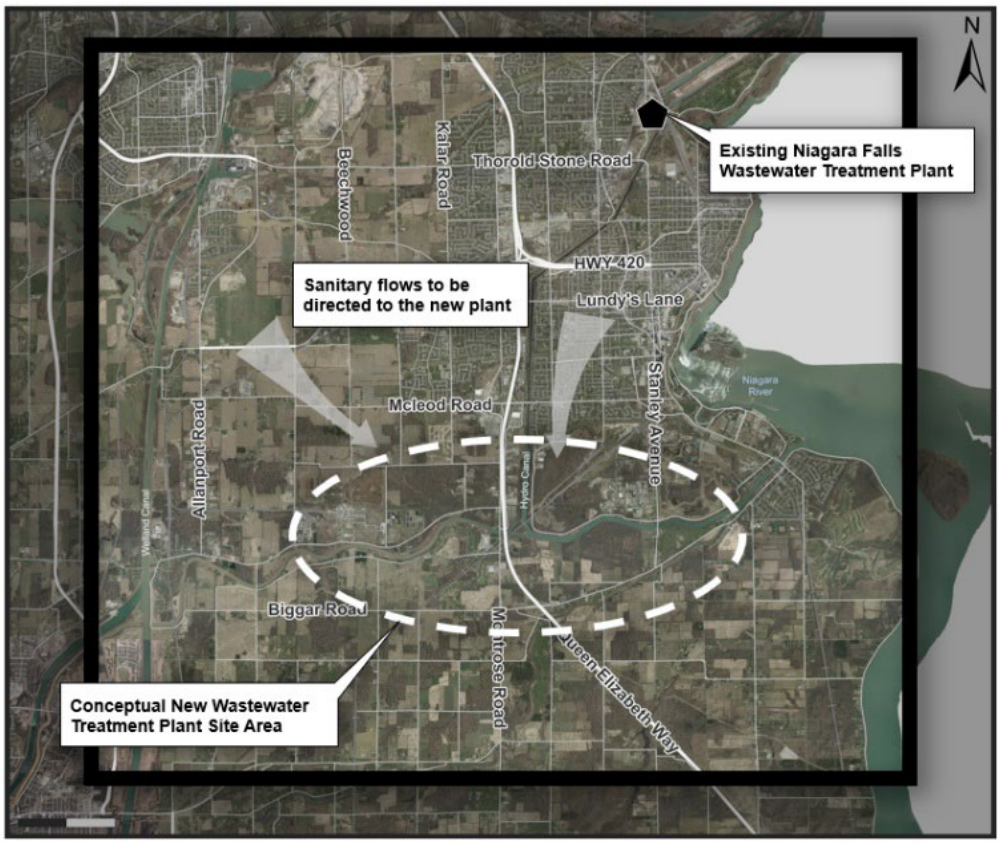


Figure 4-1. South Niagara Falls Wastewater Solutions Study Area

4.2 Planning and Flow Basis

The SNFWWS Class EA was initiated following the recommendation of the Region's 2016 MSPU and based on servicing the 2041 planning horizon. The new SNF WWTP will service areas of Niagara Falls, in general south of Lundy's Lane and areas of Thorold South. The 2041 projections are based on growth within the approved urban area boundaries of Niagara Falls and Thorold. Post period growth beyond 2041 was considered in areas within the urban area boundaries as well as potential growth in the vicinity of the 2041 service area.

For both the Stanley Avenue WWTP and SNF WWTP, the Post 2041 growth projections have been estimated primarily to establish a long-term potential capacity requirement at the plants. They do not represent an estimate vetted through Regional or Local planning processes. They also do not represent a target year for growth but simply a potential long-term need.

The goal was to identify growth projections for both plants at key milestones including:

- Existing conditions,
- In service date for the SNF WWTP,
- 2041 needs, and,
- Potential post-2041 needs (2051 planning projections are expected and will be included in the 2021 Niagara Region Water and Wastewater Master Servicing Plan Update)

4.2.1 Wastewater Service Area

In general, the new SNF WWTP will service areas of Niagara Falls south of Lundy's Lane and areas of Thorold South. By diverting flows to the new SNF WWTP, the strategy will also create the opportunity to service future growth areas and improve wet weather management in the Port Weller sewer shed area of St. Catharines and in the St. David's area of Niagara-on-the-Lake.

The 2041 projections are based on growth within the approved urban boundaries of Niagara Falls and Thorold. Post-period growth beyond 2041 has been considered in areas within the urban boundaries, as well as potential growth in the vicinity of the 2041 service area.

To support the growth projection review for the new SNF WWTP, Trunk Sewer, and Thorold South Servicing, further analysis was undertaken on the following growth areas within the overall service area:

- **Growth Area No. 1 (GA1)** located in SNF area, west of the Hydro Electric Power Canal (HEPC) and north of Welland River West,
- **Growth Area No. 2 (GA2)** located in SNF, east of the HEPC and north of Chippawa Creek (Welland River East),
- **Growth Area No. 3 (GA3)** located in SNF, west of QEW and south of Welland River West,
- **Growth Area No. 4 (GA4)** located in SNF, east of QEW and south of Chippawa Creek,
- **Growth Area No. 5 (GA5)** located Thorold South,
- **Growth Area No. 6 (GA6)** located in SNF, potential future growth areas (no specific geographic boundary), and
- **Growth Area No. 7 (GA7)** located in other potential areas that could be connected to the new SNF WWTP (no specific geographic boundary).

The new SNF Trunk Sewer and Thorold South Servicing Strategy will need to convey existing and future flows from each of the following service area locations:

- Currently captured by the existing South Side High Lift SPS (SSHLPS) at the most upstream manhole,
- Previously pumped north from the Garner Road SPS at Brown Road,
- New flows conveyed from Thorold South at Brown Road,
- Previously pumped north from the Grassy Brook SPS at the station location,
- New growth area flows west of the QEW at Grassy Brook and Reixinger Road,
- New growth area flows east of the QEW at Reixinger Road,
- Future flows from Chippawa, and,
- Potential future flows from south of Lyons Creek Road/Biggar Road along the QEW corridor.

These catchment areas are shown in Figure 4-2.

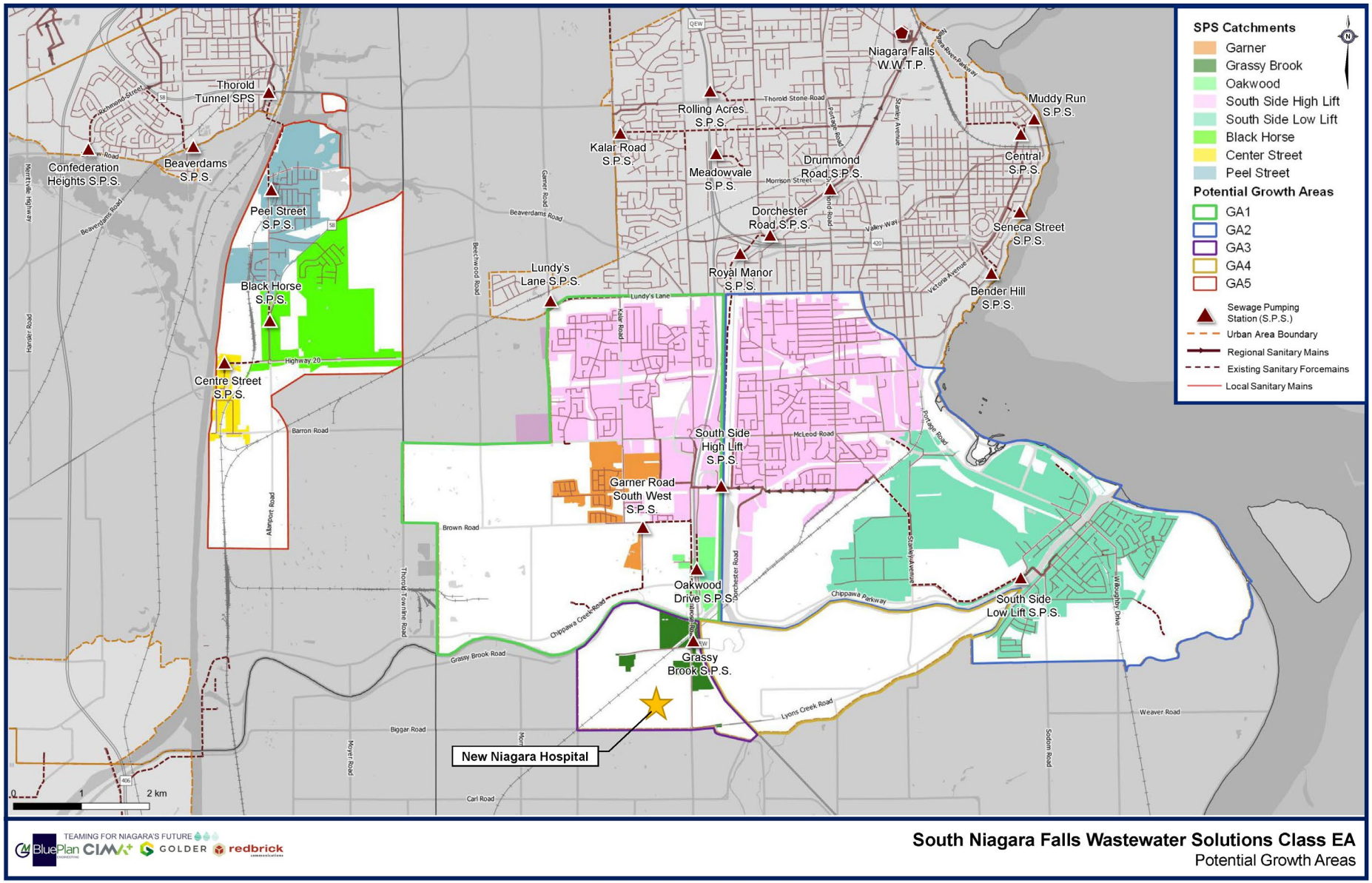


Figure 4-2. Existing and Approved Secondary Plan Catchment Areas contributing to SNF Growth

4.2.2 Growth and Flow Projections

The projected flows for the 2041 Planning Horizon as well as flow projection considerations post 2041 are provided in the SNFWWS ESR Volume 3, Appendix V3.7.1.

During this Class EA process, Niagara Region had initiated the 2021 MSP Update which is looking at potential growth out to 2051. The additional information from the 2021 MSP Update regarding year 2051 and long-term planning potential was made available for consideration. The updated 2051 planning information validated the 2016 MSPU 2041 forecast and provided additional context for capacity planning for the new SNF WWTP. Based on the preliminary stages of the Niagara 2051 planning review, the implementation and timing of the preferred solution continues to be supported and is required to support growth.

The service area population and flow projections for the year 2041 are:

- **2041 Population:** approximately 69,400 people
- **2041 Employment:** approximately 20,500 jobs
- **2041 Total Average Day Flows:** 24.7 MLD

Based on the planning and flow basis, it was estimated that the Phase 1 capacity for the new SNF WWTP should address at least a 20 to 25-year planning period at 30 MLD. As shown below, the Phase 2 (future expansion) capacity of 60 MLD, as well as potential long-term flows beyond 60 MLD, were considered as part of the decision making for the preferred solution and design concepts.

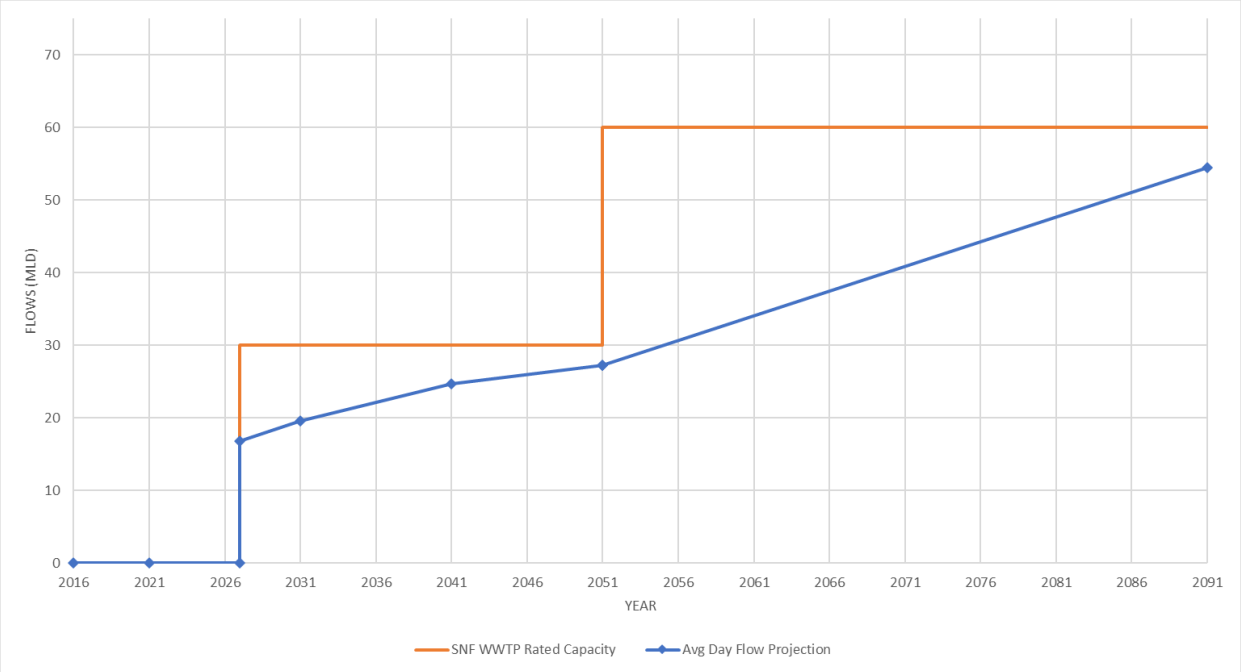


Figure 4-3. New South Niagara Falls Wastewater Treatment Plant Flow Projections

As shown in Figure 4-3, it is anticipated that the Phase 1 SNF WWTP with capacity of 30 MLD will be sufficient to service anticipated population and flow projections to 2041 and 2051.

4.2.3 Related Servicing Needs

In addition to the baseline growth and flow projections, there were specific servicing needs within the wastewater service area to be considered for the location and capacity of the SNF infrastructure:

- Flows from the new South Niagara Hospital located on the west side of Montrose Road south of Reixinger Road,
- Development Timing / Build-Out for Grand Niagara Secondary Plan Area,
- Development Timing / Build-Out for Grassy Brook Secondary Plan,
- Development Timing / Build-Out other areas in GA2, GA4 and GA5, and,
- Assumptions for Growth Areas East/West of QEW (GA6 and GA7), Chippawa, Etc.

4.3 Problem and Opportunity Statement

The foundation for the SNFWWS Class EA and the development of the study's problem and opportunity statement was the Region's 2016 MSPU. Using this foundation, the SNFWWS Class EA problem and opportunity statement was defined as follows:

SNFWWS Problem and Opportunity Statement

1. **Address key issues raised through the 2016 MSPU including:**
    a. Accommodate growth,
    b. Improve and increase capacity in the existing sanitary and combined stormwater systems, and,
    c. Manage wet weather flows.
2. **Develop the preferred solution identified conceptually in the 2016 MSPU including:**
    a. Build a new wastewater treatment plant in South Niagara Falls, and,
    b. Improve the existing sewer system and connect it to the new plant.
3. **Establish the study purpose to determine:**
    a. Where to locate the new wastewater treatment plant in South Niagara Falls,
    b. Which body of water will receive the clean, treated water from the new plant, and,
    c. How best to integrate the wastewater network to address growth, make the system as efficient as possible, and manage wet weather flow.

The SNFWWS study also identified key study objectives to be addressed through each phase of the process and in determining the preferred solution and preferred design concepts:

1. **Protect the Environment**
    a. Reduce pollution into rivers and the environment, and,
    b. Minimize flooding.
2. **Accommodate Growth**
    a. Increase system capacity, and,
    b. Support economic development.
3. **Provide Flexibility for the Future**
    a. Address 2041 projections and consider long term capacity requirements,
    b. Ensure the facility has the ability to respond to changing regulations and needs, and,
    c. Free up capacity in existing infrastructure such as the Stanley Avenue WWTP.
4. **Establish the new WWTP as a Community Asset**
    a. Ensure the new facility fits well within the local community,
    b. Engage the local community in the solution, and,
    c. Mitigate and manage issues such as odour, noise, air quality, and traffic.

4.4 Key Study Considerations

Introducing a new wastewater treatment plant within a community is acknowledged to be a significant undertaking. As part of the planning completed in Phase 1 of the study, there was additional focus placed on key considerations related to siting a new WWTP. From a high-level perspective, the new SNF WWTP siting process considered the following:

- **Appropriate Land Size:** The site must have suitable land size for a new plant. The potential size is approximately 400 metres x 400 metres (16 hectares). Equal to almost 30 Canadian football fields.

- **Positive Integration into Surroundings:** The existing and surrounding land use is an important factor for a new plant site. The Project Team considered potential impacts to the local environment and community and how they would be addressed. These measures included how to mitigate noise, visual impacts, odour, traffic, and construction.

- **Proximity to the Region's Wastewater System and Future Growth Areas:** The site ideally needs to be close to the existing wastewater system and close to future servicing areas.

- **Proximity to a Natural Waterbody:** The site must be close to a nearby river or lake where the clean, treated water can be released. This includes the review of environmental features, wildlife habitats and water quality.

5.0 Evaluation of Alternative Solutions

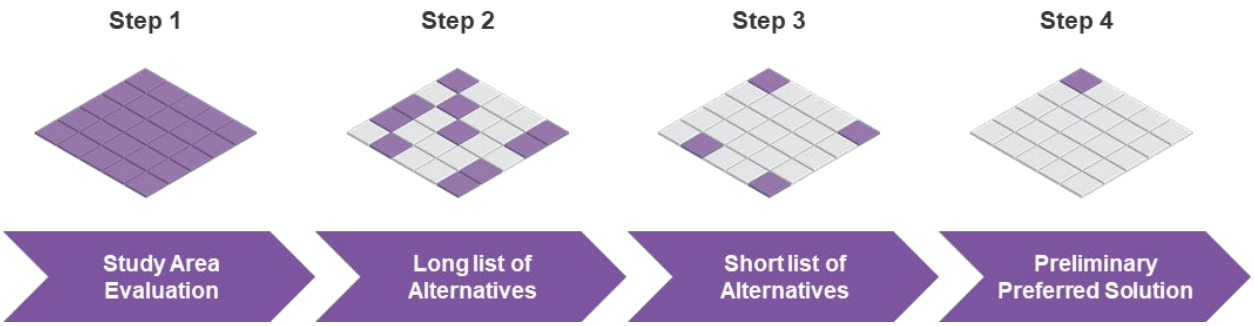
5.1 Evaluation Process

This section describes the stepped evaluation process undertaken to identify, develop strategies and evaluate alternative solutions to address the Problem and Opportunity Statement:

> *"Where to locate the new wastewater treatment plant; which body of water to discharge the clean, treated water from the new plant; and how to best integrate the wastewater network to address growth, increase system efficiency and manage wet weather."*

This study has required balancing decisions related to the WWTP site, the outfall location, and the wastewater collection system. To balance these needs, the evaluation process undertook multiple steps:

- Step 1: Study Area Screening and Evaluation,
- Step 2: Evaluation of Long List Alternatives,
- Step 3: Evaluation of Short List Alternatives, and
- Step 4: Selection of the Preferred Solution.



Step 1: Study Area Screening Evaluation

Following 2016 MSPU recommendations, the SNFWWS general study area focused on south Niagara Falls, primarily south of Lundy's Lane. This became the review area to select a long list of alternatives for the new WWTP, outfall location, and collection system strategy. Step 1 is detailed in Section 5.3.

The study area was reviewed for natural environment constraints, with special attention on sensitive features including: Provincially significant wetlands (PSWs), environmental protection areas (EPAs), environmental conservation areas (ECAs), species at risk (SAR), significant woodlots, and impacts to aquatic life. Further to environmental sensitivity, potential impacts to social-cultural features were reviewed. This included avoidance of lands within close proximity to existing and future residential use and areas with known cultural or archaeological significance. The outfall location requires discharging to a receiving waterbody, therefore lands not located near a receiving waterbody were generally not considered.

Step 2: Long List Alternatives

Following the review of study area opportunities and constraints garnered through the completion of the study area inventory and establishing general high-level technical viability criteria such as sufficient land area; a long list of viable alternatives was developed. The alternatives encompassed the three components of the WWTP site, outfall location, and collection strategies and different combinations of the three components. The evaluation of the long list alternatives applied a high-level 5-point Multiple Bottom Line (MBL) criteria in order to consider and screen the long list and select a short list of reasonable alternatives. Step 2 is detailed in Section 5.5.

Step 3: Short List Alternatives

The long list evaluation resulted in the selection of the short-list of alternatives. Each short listed alternative comprised of a WWTP site and associated preferred outfall location and collection strategy. The evaluation of the short-list alternatives was supported by further area focused environmental inventory desktop review and applied in greater detail the 5-point MBL criteria with criteria weighting. Following stakeholder consultation, the evaluation process, and criteria, placed higher emphasis on potential environmental (25%) and social-cultural (25%) impacts, with key technical (20%), financial (20%) and legal-jurisdictional (10%) considerations. This step resulted in 5 individual scores for each criterion for each short-listed alternative.

Step 3 then reviewed the results of the individual criteria scores for each short-listed alternative to arrive at overall total score for each and a secondary review was undertaken to comparatively evaluate combined short list solutions. This step resulted in the selection of preferred solution. Step 3 is detailed in Section 5.6.

Step 4: Preferred Solution

The preferred solution was selected and summarized and depicted in Section 6. and includes the new WWTP site, the receiving waterbody for the outfall location, and the collection system strategy to connect the existing wastewater network to the new plant. Step 3 is detailed in Section 5.8.

5.2 Existing Conditions and Supporting Studies

The following section outlines inventory completed for existing study area conditions. The supporting documents are available in Volume 3 of the SNFWWS ESR.

5.2.1 Natural Environment

The study area review completed an inventory of natural environmental features that may conflict with siting a new plant and related infrastructure (Figure 5-1). The following sections details the reviewed areas of natural and scientific interest, provincially significant wetlands, significant woodlands, significant valleylands, significant wetland habitat, species at risk, and regulated watercourses and waterbodies.

In summary, there were a number of natural environment features identified within the study area. For evaluation consideration, Table 5-2 outlines the development constraint, the regulated setback, and the feasibility of siting a WWTP within the identified natural environment feature.

5.2.1.1 Areas of Natural and Scientific Interest

ANSIs are designated by the province according to standardized evaluation procedures. ANSIs are ranked by the MNDMNRF as being either provincially or regionally significant.

There are two provincially significant ANSIs within the study area, both along the Niagara River in the eastern portion of the study area. Niagara River Bedrock Gorge Earth Science ANSI, and the Niagara Gorge Life Science ANSI.

Development may be permitted within or adjacent (i.e., within 50 metres) to a provincially significant ANSI where an assessment demonstrates that development will not adversely affect the feature or its ecological function.

5.2.1.2 Provincially Significant Wetlands

PSWs are designated by MNDMNRF and are determined based on a scientific point-based ranking system known as the Ontario Wetland Evaluation System (OWES). Wetlands are assessed based on a range of criteria, including biology, hydrology, societal value, and special features (MNRF 2019).

Several PSWs are mapped within the southern portion of the study area, including Niagara Falls Slough Forest Wetland Complex, Lyons Creek Wetland Complex, Lower Grassy Brook Wetland Complex, Usshers Creek Wetland Complex, Welland River East Wetland Complex, Thompson Creek Wetland Complex, Warren Creek Wetland Complex, South Allanburg Slough Forest Wetland Complex, and Upper Grassie Brook Wetland Complex.

In addition to PSWs, there are other wetland areas mapped throughout the study area according to Appendices III-A and III-C of the City's OP (Niagara Falls 2017), including:

- Locally Significant Wetlands in the northwest portion of the study area,
- NPCA regulated wetlands greater than 2 hectares in the northwest and southern portions of the study area, and,
- NPCA regulated wetlands less than 2 hectares in the southern portion of the study area.

5.2.1.3 Species at Risk

The potential for the species to occur was determined through a probability of occurrence. Searches will be conducted during Phase 3 Class EA field surveys for suitable habitats and signs of all SAR identified through the desktop screening. If the potential for the species to occur in the study area was moderate or high in the desktop screening, the screening will be refined based on the results of the field surveys (i.e., habitat assessment completed between May and September). Any habitat identified during ground-truthing or other field surveys with potential to provide suitable conditions for additional SAR not already identified through the desktop screening will also be assessed and recorded.

Species considered for this report include species listed in both the *Endangered Species Act* and the *Species at Risk Act (SARA)*. A desktop assessment was completed to determine which SAR had potential habitat within the study area, and any species with ranges overlapping the area were screened by comparing their habitat requirements to habitat conditions in the study area.

Based on the desktop assessment, 62 species designated as special concern, threatened, or endangered under the *Endangered Species Act* and *SARA* were assessed to have moderate potential to occur within the study area. Of these species, 41 are designated as threatened or endangered under the *Endangered Species Act* and receive individual and habitat protection. The other species identified as having moderate potential to occur within the study area do not have regulatory protection under the *Endangered Species Act*, however their habitats must be considered under the Significant Wildlife Habitat Criteria of the *Provincial Policy Statement* in the impact for the Class EA.

The majority of potentially suitable habitat for these species is concentrated in the Provincially Significant Wetlands (PSWs) and large woodlands. In addition to these areas, habitat is focused mainly in other areas of woodland, riparian habitat, and waterbodies in the study area. Some species, such as the Chimney Swift and Little Brown Myotis, may use anthropogenic structures for habitat. The following table identifies the *threatened* or *endangered* SAR that were assessed to have *moderate* potential to occur within the study area.

Table 5-1. Potential Threatened or Endangered Species at Risk

Species	Type
Birds (11)	Acadian Flycatcher, Bank Swallow, Barn owl, Barn Swallow, Bobolink, Cerulean Warbler, Chimney Swift, Eastern Meadowlark, Eastern Whip-poor-will, Least Bittern, and Louisiana Water thrush
Mammals (4)	Small-footed Myotis, Little Brown Myotis, Northern Myotis, and Tri-coloured Bat
Amphibians (3)	Allegheny Mountain Dusky Salamander, Jefferson Salamander, and Northern Dusky Salamander
Reptiles (3)	Blanding's Turtle, Eastern Hog-nosed Snake, and Five-lined Skink
Fish (3)	American Eel, Lake Chubsucker, and Lake Sturgeon
Molluscs (2)	Kidneyshell and round-hickorynut
Moss (1)	Spoon-leaved Moss
Vascular Plants (14)	American Chestnut, American Columbo, American Ginseng, American Water-willow, Butternut, Cherry Birch, Cucumber Tree, Deerberry, Eastern Flowering Dogwood, Red Mulberry, Round-leaved Greenbrier, Spotted Wintergreen, Virginia Mallow, and White Wood Aster

5.2.1.4 Official Plan Designated Features

Based on the City's and Region's OP mapping, corridors and linkages have also been mapped in the southern portion of the study area, which may include valleylands, contiguous woodlands and wetlands, creeks, hedgerows and service corridors. Official Plan policies state that new development should not interfere with the function of such features, and where possible, connections between natural features should be enhanced or rehabilitated (Niagara Falls 2017; Region of Niagara 2015). The City also designates two other categories of natural heritage features including EPAs or ECAs. Development is generally not permitted within these areas, with some exceptions for passive recreational or conservation projects.

EPAs include PSWs, NPCA regulated wetlands greater than 2 hectares in size, provincially significant Life Science ANSIs, habitat of endangered and threatened species, floodways and erosion hazard areas, and environmentally sensitive areas.

ECAs include significant woodlands, significant valleylands, SWH, fish habitat, significant Life and Earth Science ANSIs, sensitive groundwater areas (as identified by relevant natural environment study), and locally significant wetlands or NPCA regulated wetlands less than 2 hectares in size.

5.2.1.5 Significant Wildlife Inventory

Significant wildlife habitat (SWH) is one of the more complicated natural heritage features to identify and evaluate. SWH is evaluated and designated based on the criteria and guidelines contained in the NHRM (MNR 2010), as well as the Significant Wildlife Habitat Technical Guide (SWHTG) and the Significant Wildlife Habitat Mitigation Support Tool (SWHMiST). There are four general types of significant wildlife habitat: seasonal concentration areas, migration corridors, rare or specialized habitats, and species of conservation concern.

Significant wildlife habitat is typically identified on a site-specific basis and is therefore not often mapped at a landscape level in local OPs. According to LIO mapping, there are several deer wintering areas, a type of seasonal concentration area SWH, throughout the study area.

5.2.1.6 Significant Woodlot Inventory

The Region does not provide detailed mapping of significant woodlands, and defines significant woodlands as those that meet one or more of the following criteria (Region of Niagara 2015):

- Contain threatened or endangered species, or a species of concern,
- Meets site thresholds,
  - 2 hectares (within or overlapping Urban Area Boundary), or
  - 4 hectares (outside Urban Area and north of the Niagara Escarpment), or
  - 10 hectares (outside Urban Area and south of the Niagara Escarpment).
- Contains interior woodland habitat,
- Contains old growth forest and is a minimum size of 2 hectares,
- Overlaps or contains one or more other significant natural heritage features, or,
- Abuts or is crossed by a watercourse or waterbody and is a minimum size of 2 hectares.

The City has mapped significant woodlands within the municipality on Appendix III-C of the OP (Niagara Falls 2017). Based on this mapping, there are several significant woodlands throughout the study area. Significant woodlands are generally located outside of the urban core of the study area, with the exception of woodlands along watercourses, such as the Hydro Canal through the city center. Woodlands that are not already mapped as significant by the City should be evaluated for significance based on the Regional criteria.

5.2.1.7 Significant Valleylands

General guidelines for determining significance of valleylands are presented in the Natural Heritage Reference Manual (MNR 2010). Recommended criteria for designating significant valleylands include prominence as a distinctive landform, degree of naturalness, importance of its ecological functions, restoration potential, and historical and cultural values. Neither the City nor Region provided detailed mapping of significant valleylands (Niagara Falls 2017; Region of Niagara 2015). However, it is likely that the majority of valleylands associated with permanent watercourses in the study area are significant based on NHRM guidelines.

5.2.1.8 Surface Water

Watercourses and waterbodies occurring within the study area are components of the Lower Welland River and South Niagara Falls watershed (NPCA 2012). There are several watercourses and waterbodies in the study area, including some major surface water features such as:

- Niagara River
- Welland River
- Hydro Electric Power Canal
- Lyon's Creek East
- Beaver Dams Creek
- Thompsons Creek
- Grassy Brook
- Usshers Creek

The majority of the major watercourses and waterbodies in the study area are considered warm water features. Warm water aquatic features are generally considered to be more robust and tolerant to external effects. Fish species occupying warm water are likewise considered to be more tolerant to changes in groundwater discharge. In contrast, cold water systems are supported by groundwater inputs and are considered to be capable of supporting cold water fish species, which may be sensitive to reductions in groundwater discharge. Many cold-water systems contain transitional cool water areas that often support both cold water and warmwater species. Cool water features and fish species are generally considered similarly to those designated cold water.

5.2.1.9 Fish Habitat

There are numerous native and non-native fish species present in watercourses and waterbodies of the Lower Welland River and South Niagara Falls watershed, including top predator warm species such as largemouth bass (Micropterus salmoides), and northern pike (Esox Lucius) and baitfish (i.e., minnows) (NPCA 2008; 2011).

Where development is proposed within or adjacent (i.e., within 30 metres) to fish habitat, an assessment must be completed to demonstrate that development will not adversely affect the feature or its ecological function. In general, development should be designed to avoid or minimize adverse impacts to fish and fish habitat. Development and site alteration within fish habitat may be permitted in accordance with provincial and federal requirements (i.e., *Fisheries Act*). Where impacts to fish or fish habitat cannot be avoided, consultation with the DFO may be required to determine if an authorization under the *Act* is required. Phase 3 of the Class EA will look to conduct fish habitat surveying to determine potential impact from the plant outfall.

5.2.2 Record of Site Condition

A Record of Site Condition (RSC) is filed with MECP to summarize the environmental condition of a property based on the completion of an environmental site assessment. An initial review of the RSC registry was completed by Golder Associates to determine the potential presence of adverse environmental conditions within the study area. The search found four RSCs for local properties within the study area. These records initiated the Environmental Risk Information Services (ERIS) EcoLog Report described in the SNFWWS ESR Volume 3, Appendix V3.4.

Table 5-2. Summary of Natural Environment Setback Considerations

Natural Environment Feature	Responsible Agency	Development Constraint	Setback	Setback Feasibility	Mitigation
Areas of Natural and Scientific Interest	City of Niagara Falls	Development within or adjacent (i.e. within 50 metres) requires impact assessment	None	N/A	• Must demonstrate no adverse impacts to feature or function
Provincially Significant Wetland	NPCA and MNDMNRF	Development within 120 metres require impact assessment	30 metres	Negotiable	• No development permitted within Provincially Significant Wetland • Must demonstrate no adverse impacts to feature or function • Development proposed within 30-120 metres may require a permit from the NPCA
NPCA Regulated Wetland (greater than 2 hectares)	NPCA	Development within 120 metres require impact assessment	30 metres	Negotiable	• Must demonstrate no adverse impacts to feature or function • Development proposed within wetland or regulated limits may require a permit from the NPCA
Locally Significant Wetland	NPCA	Development within 30 metres require impact assessment	30 metres	Negotiable	• Must demonstrate no adverse impacts to feature or function • Development proposed within wetland or regulated limits may require a permit from the NPCA
NPCA Regulated Wetland (less than 2 hectares)	NPCA	Development within 30 metres require impact assessment	30 metres	Negotiable	• Must demonstrate no adverse impacts to feature or function • Development proposed within wetland or regulated limits may require permit from the NPCA
Significant Woodland	City of Niagara Falls	Development within or adjacent (i.e. within 120 metres) requires impact assessment	10 to 50 metres	Negotiable	• Must demonstrate no adverse impacts to feature or function • Vegetated setback varies based on location (i.e. within or outside an area with a completed Watershed Plan)
Significant Valleyland	City of Niagara Falls	Development within or adjacent (i.e. within 50 metres) requires impact assessment	7.5 metres	Absolute	• Must demonstrate no adverse impacts to feature or function • Vegetated setback required from stable the top of bank
Significant Wetland Habitat	City of Niagara Falls	Development within or adjacent (i.e. within 120 metres) requires impact assessment	Varies	Negotiable	• Must demonstrate no adverse impacts to feature or function
Species at Risk – Endangered or Threatened Species	MECP	Development within or adjacent (i.e. within 120 metres) requires impact assessment	Varies	Absolute	• No development permitted within habitat for endangered or threatened species • Must demonstrate no adverse impacts to species or its habitat • If species or habitat will be impacted, permitting under the Endangered Species Act may be required
NPCA Regulated Areas (watercourse or waterbody)	NPCA	Development within or adjacent (i.e. within 30 metres) requires impact assessment	5 metres	Absolute	• Development proposed within regulated limits may require a permit from the NPCA

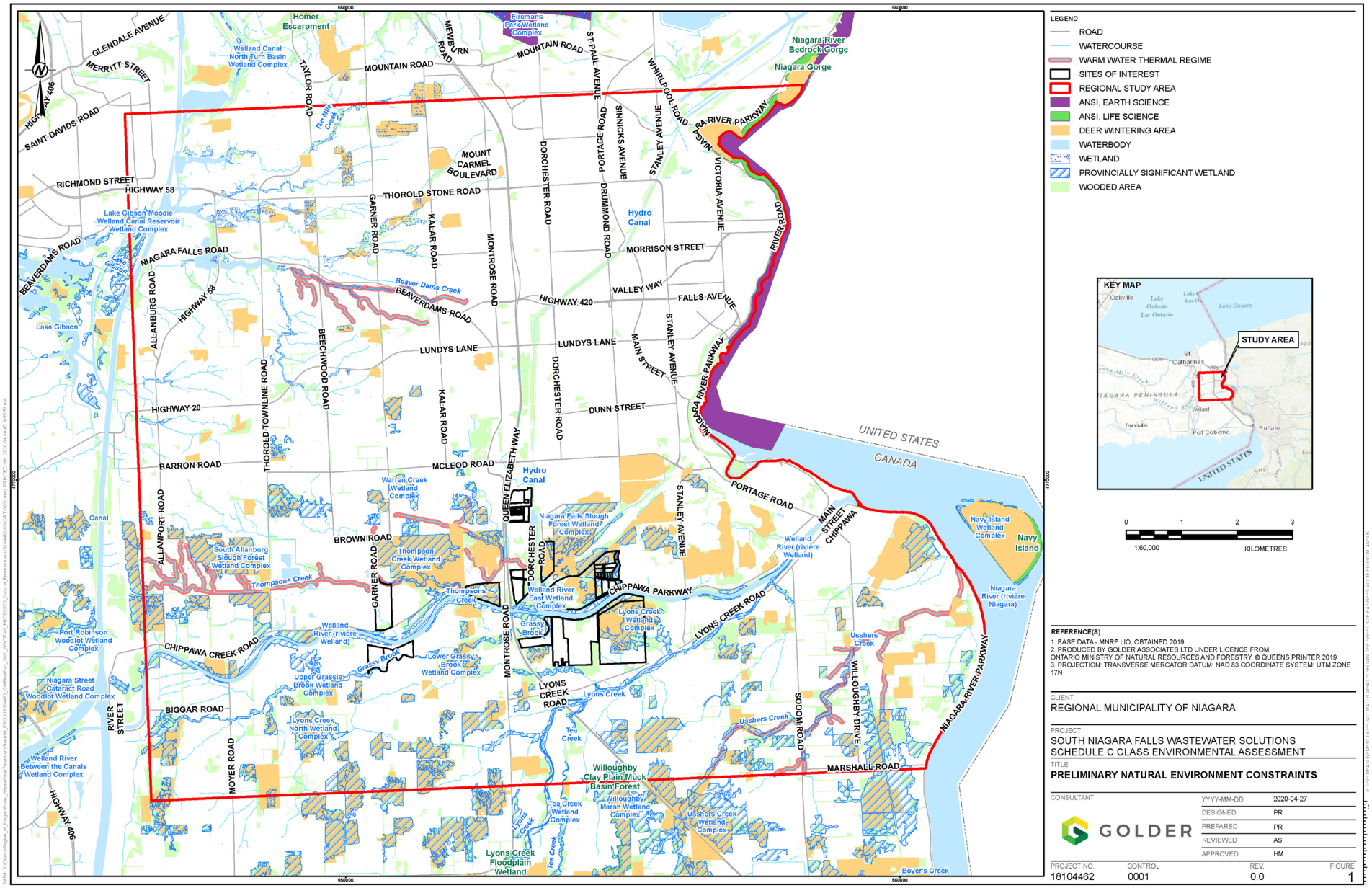


Figure 5-1. Existing Natural Environment Features

5.2.3 Physical Environment

To support the selection of the long list sites and collection strategies, a review of geotechnical and hydrogeological conditions were completed. This determined the need for level of further investigations during the Class EA site selection process.

5.2.3.1 Geotechnical Conditions

Further details on Geotechnical conditions are presented in the SNFWWS ESR Volume 3, Appendix V3.9.

- **Regional Geology:** The study area is generally located within the Haldimand Clay Plain physiographic region with the northwest corner of the study area extending to the Niagara Escarpment physiographic region to Lake Erie, as delineated in The Physiography of Southern Ontario (Chapman and Putnam 1984).
- **Subsurface Conditions:** A desktop review of the available subsurface information near the proposed trunk sewer alignment has been carried out, obtained from publicly available sources. The detailed subsurface soil, bedrock and groundwater conditions encountered in the boreholes and the results of in situ and laboratory test results are provided on the borehole records. Consideration should be given to the distance between the proposed alignment and WWTP and the borehole locations when interpreting the borehole information.

  Based on available borehole information, the subsurface conditions along the proposed sewer alignment beneath any at/near surface layers of topsoil, organics and fill consist of up to about 30 metres thick glaciolacustrine cohesive soils overlying a dense to very dense non-cohesive soils comprised of sandy silt to silty sand, with varying amount of gravel. Generally, the glaciolacustrine cohesive deposit has a consistency of very soft to very stiff.
- **Bedrock Conditions:** Based on the available information, the depth of bedrock in the vicinity of the proposed sewer alignment generally ranges from 12 metres (north) to deeper than 30 metres (south) below ground surface.

It is possible that the upper few metres of bedrock may be more weathered and fractured. Below the more weathered/fractured zone, the bedrock is expected to be of moderately weathered to fresh.

5.2.3.2 Hydrogeological Conditions

Further details on Hydrogeological conditions are presented in the SNFWWS ESR Volume 3, Appendix V3.10.

- **Groundwater Conditions:** Based on the limited available information, the prevalent groundwater level at the Sites of Interest. The groundwater level should be expected to fluctuate seasonally in response to changes in precipitation and snow melt and is expected to be higher during the spring and periods of precipitation. Perched groundwater conditions are expected within the till soils.

5.2.4 Existing Utilities

There were a number of existing utilities located within south Niagara Falls (Figure 5-2). This includes Canadian National (CN) Railway and Canadian Pacific (CP) Railway Lines, National Energy Board (NEB) Gas Line, and Hydro One servicing lines. Utility infrastructure was taking into consideration during the siting and alignment evaluation based on ease of relocation if site was deemed otherwise appropriate.

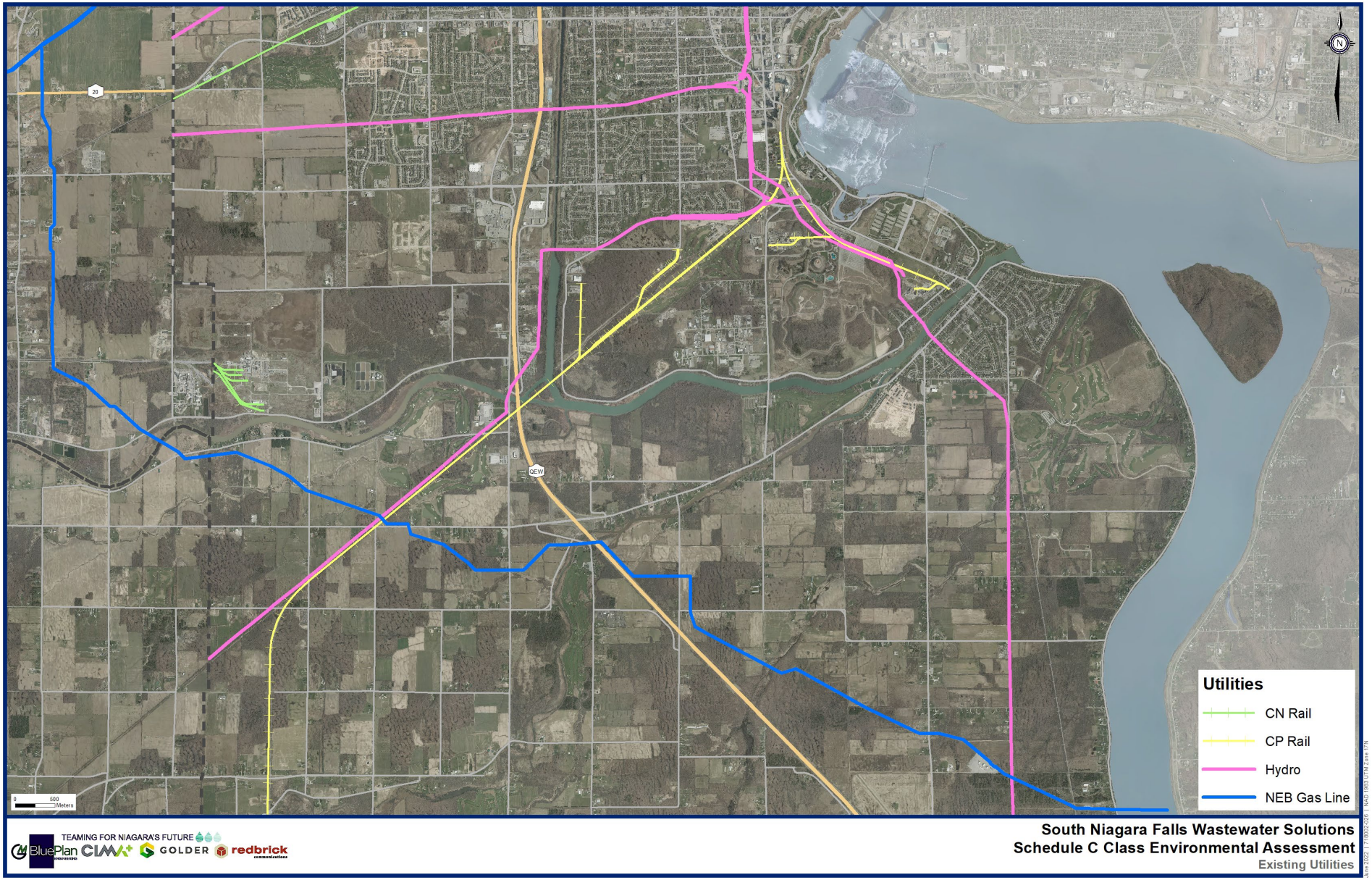


Figure 5-2. Existing Utilities in South Niagara Falls

5.2.5 Social-Cultural

5.2.5.1 Existing and Future Land Use

The Official Plan for the City of Niagara Falls is an approved planning document with a 20-year vision (to 2041) outlining long-term objectives and policies with respect to the growth and development of urban lands, the protection of agricultural lands and the conservation of natural heritage areas, and the provision of necessary infrastructure.

Similar to the City of Niagara Falls, Niagara Region has an Official Plan land use mapping that encompasses NPCA designated lands including EPAs and ECAs.

The Schedule A to the City of Niagara Official Plan identifies future land use throughout the entire City of Niagara Falls, including the SNFWWS study area (Figure 5-3). Further, existing land use will be reviewed across the entire study area to better identify compatible WWTP sites, plant outfall locations and sewer alignments.

5.2.5.2 Archaeological Investigations

At the study area level, general consideration was taken to determine likelihood of discovering archaeological findings within a potential WWTP site. Sites located adjacent to natural receiving waterbodies or within a known area of high potential were carefully reviewed.

The next step included the Phase 2 Class EA Stage 1 Archaeological Assessments. All archaeological assessments are available in the SNFWWS ESR Volume 3, Appendix V3.2.

5.2.5.3 Cultural Heritage Baseline

The objective of screening for cultural heritage within the study area is to identify known or potential resources and determine if further cultural heritage studies will be required for the SNFWWS Class EA.

Following the Ministry of Tourism, Culture and Sport (MTCS), formerly MHSTCI, criteria for evaluating potential for Built Heritage Resources and Cultural Heritage Landscapes (2016) checklist, high-level desktop analysis for this Cultural Heritage Screening Report (CHSR) identified six National Historic Sites of Canada, one designated Heritage Railway Station, 60 protected heritage properties designated under the *Ontario Heritage Act*, 58 commemorative or interpretive plaques from various government agencies, and 24 cemeteries within the study area. The study area also contains many properties with buildings or structures 40 or more years old, points of interest related to the Welland Canal, places related to the War of 1812, and public art and monuments.

The next step included the Cultural Heritage Screening Report (CHSR) for the long list of potential WWTP sites. This was used to determine and refine cultural potential to feed into the detailed evaluation process ahead of selecting the preferred study components. All Cultural Heritage reports are available in the SNFWWS ESR Volume 3, Appendix V3.3.

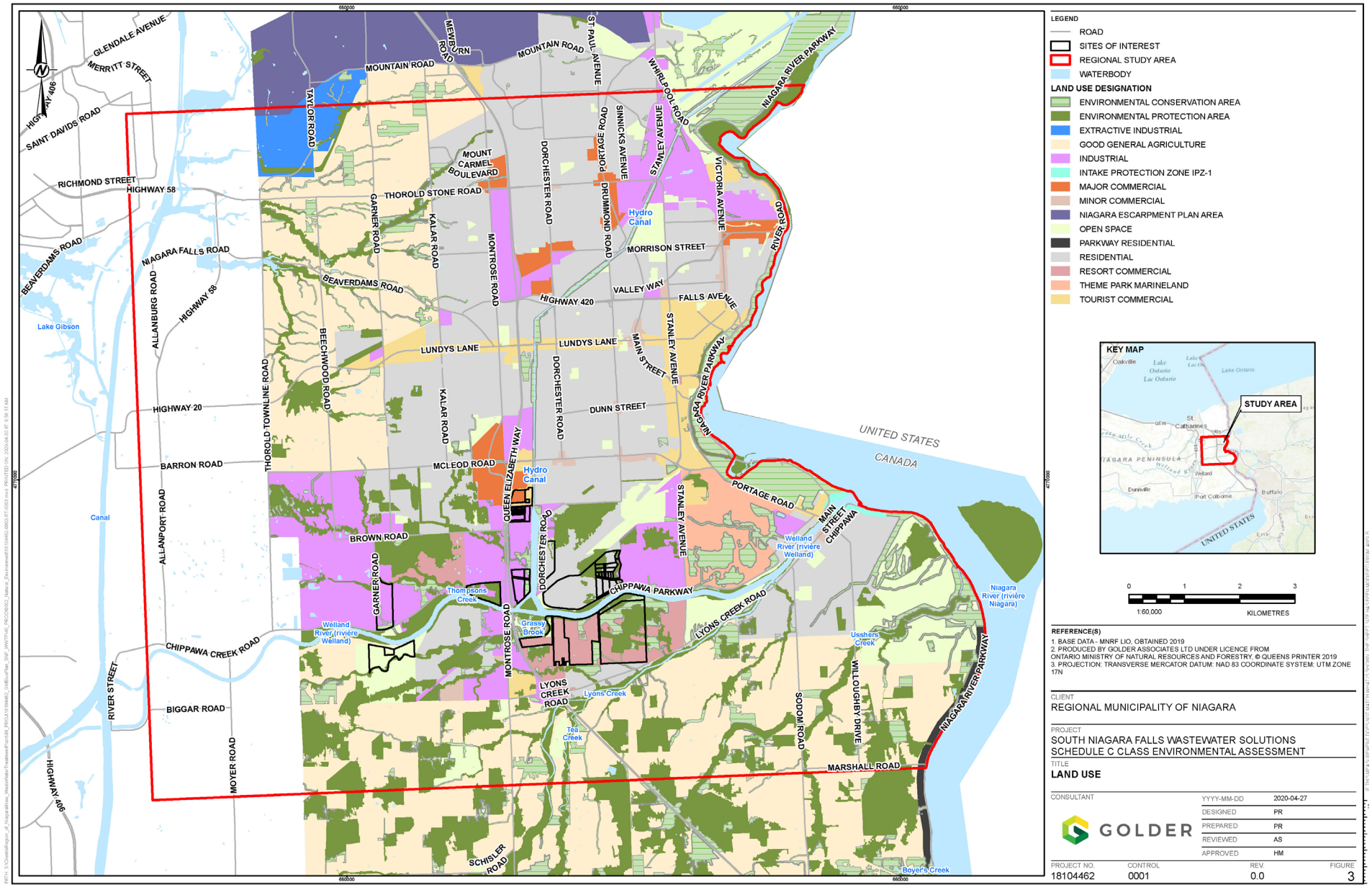
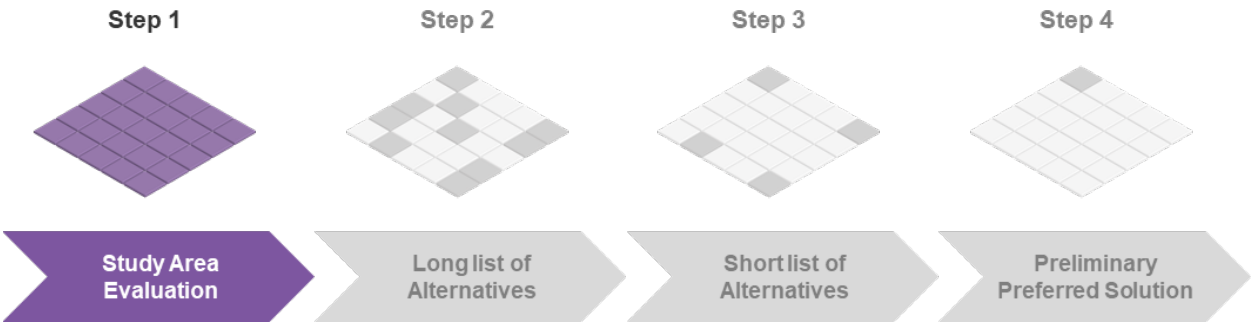


Figure 5-3. Study Area Land Use Designations

5.3 Study Area Screening and Evaluation

5.3.1 Screening Approach

The goal of Step 1 Study Area Screening and Evaluation is to establish a range of site locations across various geographical areas of the study area to be taken forward into detailed evaluation. It was anticipated that not more than twelve sites were established in Step 1.



The study area screening considered both the full Study Area as well as the anticipated focused localized study area for the new WWTP as described in Section 4.0. Step 1 leveraged the overall study area desktop analyses for natural environment, social and cultural, legal/property, and other supporting studies.

As noted, developing the overall solution is a complex process that requires balancing decisions related to the wastewater treatment plant site, the outfall location, and the wastewater collection system.

The study area screening approach was based on scanning the overall study area and identifying potential sites not constrained by:

- Natural environment constraints with special attention on sensitive features,
- Provincially significant wetlands,
- Environmental protection areas,
- Environmental conservation areas,
- Species at risk,
- Significant woodlots, and,
- Impacts to aquatic life.

Further to environmental sensitivity, potential impacts to social-cultural features were reviewed. This included avoidance of lands within close proximity to existing and future residential use and areas with known cultural or archaeological significance.

The outfall location requires discharging to a receiving waterbody, therefore lands not located near a receiving waterbody were generally not considered.

5.3.2 Screening Considerations

The addition of a new wastewater facility will be an asset to the community in many ways. Existing as well as future surroundings are important factors when siting a new wastewater facility.

The general study area was screened to highlight areas to avoid through an optioneering exercise to generate a long list of alternatives. Major constraints included natural environment features, avoidable social-cultural impacts, incompatible existing and future land use. The study area was also reviewed based on meeting set technical and principle general criteria.

- **Appropriate Land Size:** The site must have suitable land size for a new plant. The potential size is approximately 400 metres x 400 metres (16 hectares). Equal to almost 30 Canadian football fields.

- **Positive Integration into Surroundings:** The existing and surrounding land use is an important factor for a new plant site. The Project Team considered potential impacts to the local environment and community and how they would be addressed. These measures included how to mitigate noise, visual impacts, odour, traffic, and construction.

- **Proximity to the Region's Wastewater System and Future Growth Areas:** The site ideally needs to be close to the existing wastewater system and close to future servicing areas.

- **Proximity to a Natural Waterbody:** The site must be close to a nearby river or lake where the clean, treated water can be released. This includes the review of environmental features, wildlife habitats and water quality.

5.3.3 Screening Summary

From this study area screening and evaluation, a number of potential sites were identified within 4 pockets of the study area:

- North of the Welland River and west of the HEPC,
- South of the Welland River and west of the QEW,
- North of Chippawa Creek and east of the HEPC, and,
- South of Chippawa Creek and east of the QEW.

5.4 Selection of Long List of Alternatives

5.4.1 Wastewater Treatment Plant Sites

The study area screening and evaluation identified a long list of 10 reasonable sites of interest that met requirements and needs for a new WWTP.

The sites of interest are located in the southern part of the study area as shown in Figure 5-4**.** There are ten sites of interest (Sites 1 to 10), encompassing numerous lots and concessions for a total area of approximately 400 hectares.

Sites of interest occupy the following lots and concessions:

- Sites 1, 3 to 7, and 9 occupy portions or the entirety of Lots 187, 197, 205, and 209-216, Geographic Township of Stamford, former County of Welland, now the City of Niagara Falls, Regional Municipality of Niagara,
- Site 2 occupies portions of Lot 5-6, Broken Front Concession, Geographic Township of Crowland, former County of Welland, now the City of Niagara Falls, Regional Municipality of Niagara, and,
- Sites 8 and 10 occupy portions of Lots 5-8, Broken Front on Chippawa Creek, Geographic Township of Willoughby, former County of Welland, now the City of Niagara Falls, Regional Municipality of Niagara.

5.4.2 Outfall Locations

The study area level of outfall evaluation includes all applicable waterbodies that have sufficient quantity to support a new WWTP. This includes four locations:

- Outfall A: Welland River,
- Outfall B: HEPC,
- Outfall C: Welland River East (Chippawa Creek), and,
- Outfall D: Niagara River.

Alternatives for each site were identified based on reasonableness and efficiency with respect to the distance and number of environmental crossings required from site to discharge, and the sensitivity of surrounding natural and physical features. Water quality impacts will be explored as a key component in the refined evaluation process.

The long list evaluation will undertake an Assimilative Capacity Study (ACS) Approach Memorandum which includes existing flow and water quality data to demonstrate modelling approach that will be undertaken during SNFWWS to satisfy MECP requirements of outfall approvals. This memorandum is the first of three ACS reports that will be submitted for Ministry approval related to the outfall location.

Table 5-3. Long List of Potential Wastewater Treatment Plant Outfall Locations

Site ID	Outfall Option A	Outfall Option B
1	Welland River	Hydro-Electric Power Canal
2	Welland River	No other feasible outfall
3	Hydro-Electric Power Canal	No other feasible outfall
4	Hydro-Electric Power Canal	No other feasible outfall
5	Hydro-Electric Power Canal	No other feasible outfall
6	Hydro-Electric Power Canal	No other feasible outfall
7	Chippawa Creek	Hydro-Electric Power Canal
8	Chippawa Creek	Hydro-Electric Power Canal
9	Chippawa Creek	Niagara River
10	Chippawa Creek	Niagara River

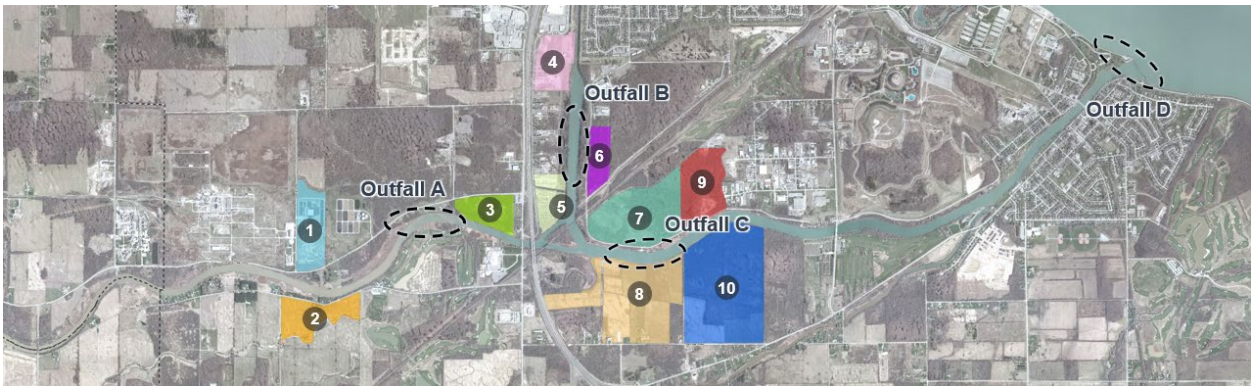


Figure 5-4. Long List of WWTP Sites and Outfall Locations

5.4.3 Collection System Strategies

To address the existing wastewater servicing system opportunities and constraints, the Project Team developed a preliminary plan to conceptually collect existing deficiencies as shown in Figure 5-5**.** Following the identification of the general conceptual servicing strategy and the long list of potential WWTP sites, the Project Team considered a number of collection strategy alternatives. These alternatives look to connect the existing system, while supporting future growth and flow projections. Alternatives identify opportunities to maximize gravity sewers and the decommissioning of existing Sewage Pumping Stations (SPSs) within the general study area.

The study area evaluation presented alternative collection strategies. Each of the long list sites had alternative collection strategies. Through the long list evaluation, a preferred collection strategy will be selected for each of the long list sites. The preferred collection strategies for each long list site will selected based on opportunities to decommission SPSs, ability to maximize gravity conveyance, proximity to support existing and future servicing areas, and ability to better manage wet weather flows with reduction of Combined Sewer Overflows (CSO).

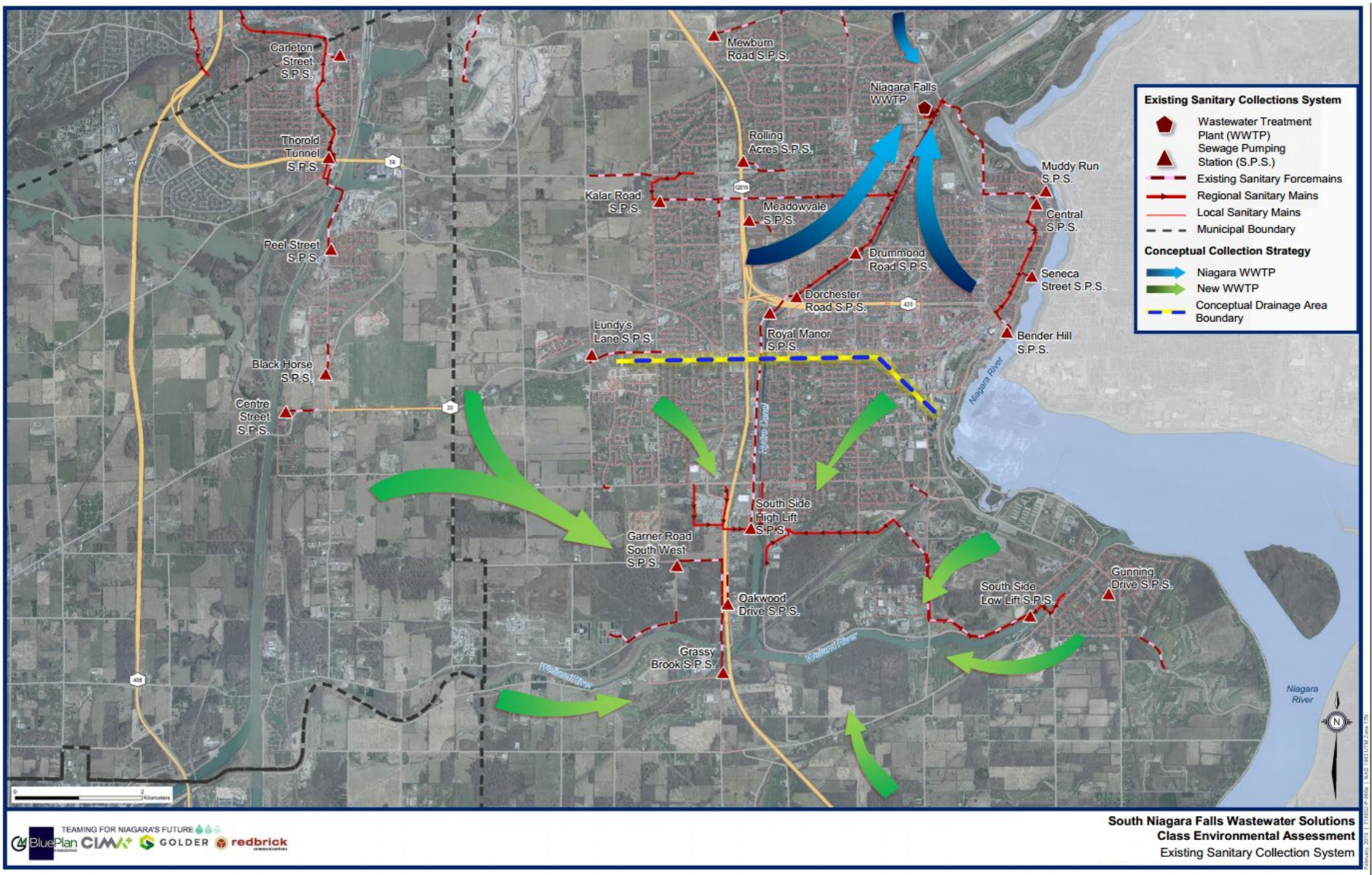


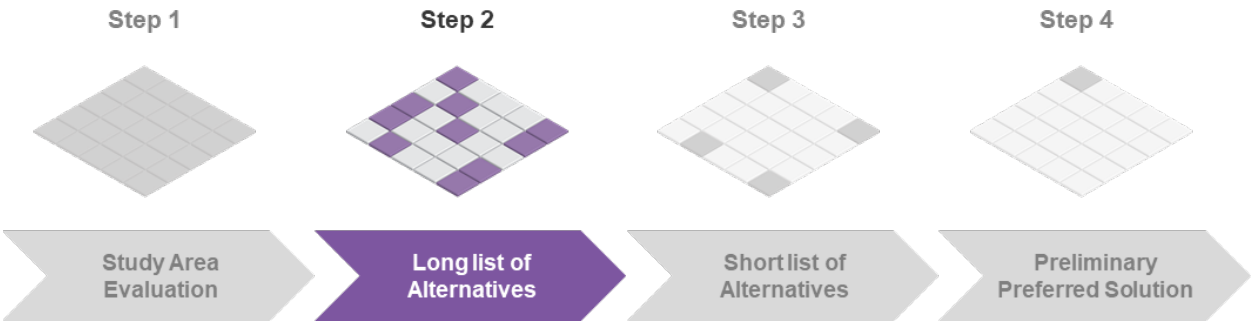
Figure 5-5. Conceptual Collection System

5.5 Evaluation of the Long List Alternatives

5.5.1 Approach

Step 2 is a process of reviewing the long list of alternatives, determining the most favourable alternatives from this long list, and identifying a short list of alternatives that merit very detailed analysis and evaluation.

This step will similarly review the 3 primary components of the wastewater solution including treatment plant site, outfall location, and collection system strategy.



5.5.2 Evaluation Criteria

The evaluation of the long list alternatives applied a high-level 5-point Multiple Bottom Line (MBL) criteria in order to consider and screen the long list and select a short list of reasonable alternatives.

The MBL method and approach, utilizing natural environment, social, legal, technical, and financial criteria that was applied during the long list evaluation is outlined in Table 5-4 below.

Table 5-4. Long List Evaluation Criteria

Multiple Bottom-Line Criteria	Criteria Rationale
Environment	• Minimizes potential effects to water features/resources and receiving body • Minimizes potential impacts on sensitive features • Minimizes impact on species at risk • Minimizes impact on system overflows • Physical environmental consideration • Minimizes environmental risk and climate change
Social / Cultural	• Minimizes impact to Indigenous Communities • Minimizes community concerns for existing and future resident, local businesses, and traffic • Minimizes impact on archaeological/cultural heritage features • Minimizes air quality, noise, dust, and odour impacts • Compatible with current/planned land use
Legal / Jurisdictional	• Land use suitability and availability • Ease in land acquisition • Minimizes approvals and coordination • Allows for worker safety and operability
Technical	• Ability to meet future needs • System security and level of service • Ease of integration with existing system • Ease of construction, operation, and traffic management
Financial	• Low capital cost • Lifecycle cost (operation and maintenance, resourcing, and servicing) • Cash flow and phasing opportunities • Funding and finance opportunities

5.5.3 Supporting Studies

The following section summarizes the completed investigations on the long list of siting and servicing alternatives. The supporting investigations are available in the SNFWWS ESR Volume 3 – Supporting Documents.

5.5.3.1 Natural Environment Baseline

A desktop assessment was completed to identify potential natural environment constraints within the study area. Although the desktop assessment was conducted for the whole study area, there was a particular focus on the area around the 10 Sites of Interest. The following sections highlight key findings of the assessment, with the complete report available in the SNFWWS ESR Volume 3, Appendix V3.1

Provincially Significant Wetlands (PSW)

No Locally Significant Wetlands or NPCA regulated wetlands greater than 2 hectares overlap the Sites of Interest. Although there are several NPCA regulated wetlands less than 2 hectares that overlap the Sites of Interest, they all appear to be within PSW complexes. Therefore, these wetlands less than 2 hectares will be considered under policies relating to PSWs.

The identified PSWs will be taken into consideration for possible plant siting, or outfall and alignment construction. The preferred solution will look to minimize or avoid PSWs were possible.

Where development is proposed within or adjacent (i.e., within 30 metres) to a NPCA regulated wetland less than 2 hectares in size, or a locally significant wetland, an assessment must be completed to demonstrate that development will not adversely affect the feature or its ecological function.

Species at Risk Inventory

The majority of potential areas for Species at Risk (SAR) are concentrated in the PSWs and large woodlands in the southern portion of the study area. In addition, SAR may be located in other areas of woodland, riparian habitat, and waterbodies. Some species, such as chimney swift and little brown myotis, may also use anthropogenic structures for habitat. Several of these habitat types overlap the Sites of Interest.

Further assessment for potential SAR or their habitat will be conducted during Phase 3 Class EA field surveys completed during the core growing season and active wildlife season for southern Ontario (i.e., May – September). Direct effects (i.e., removal of habitat or harm to individuals) and indirect effects (i.e., changes to habitat form or function) on SAR and/or SAR habitat will be considered. Where impacts cannot be avoided, consultation with MECP will be required to determine appropriate permits.

Official Plan Designated Features

Environmental Protection Areas, specifically including PSWs, NPCA regulated wetlands greater than 2 hectares, habitat of endangered and threatened species, and floodways and erosion hazard areas, appear to overlap the Sites of Interest.

Environmental Conservation Areas, specifically including significant woodlands, significant valleylands, SWH, fish habitat, and NPCA regulated wetlands less than 2 hectares in size, appear to overlap the Sites of Interest. According to NPCA watershed reports (NPCA 2008; 2011), there are also areas of moderate and high groundwater vulnerability, which may be considered as sensitive groundwater areas, that overlap the Sites of Interest.

Areas of Natural and Scientific Interest

There are no Areas of Natural and Scientific Interest (ANSIs) present in the long list of alternative WWTP sites. The two identified ANSIs identified within the study are not within close proximity to potential outfall locations or collection system alignments. Therefore, no additional ANSI investigations are required to support the preferred solution.

Significant Wildlife Inventory

Significant wildlife habitat is typically identified on a site-specific basis and is therefore not often mapped at a landscape level in local OPs. According to Land Information Ontario (LIO) mapping, there are several deer wintering areas, a type of seasonal concentration area SWH that overlap portions of the Sites of Interest.

Significant Woodlot Inventory

Several Sites of Interest contain significant woodlands according to the OP mapping. Where development is proposed within a significant woodland, efforts should be made to modify the design plan to minimize encroachment to the extent possible. An analysis of alternative options should be incorporated into the assessment, including considerations of alternative locations, siting options and design plans. If development does require tree removal, compensation planting to offset or replace lost habitat may be required. A Tree Savings Plan may also be required as a condition of development approval (Niagara Falls 2017).

Significant Valleylands

Several of the Sites of Interest are adjacent to, or contain, watercourses and are potentially within a significant valleyland as shown in Figure 5-1

Development may be permitted within or adjacent (i.e., within 50 metres) to a significant valleyland, where an assessment demonstrates that development will not adversely affect the feature or its ecological function. Vegetated setbacks are also typically required from the top of bank of significant valleylands. Where a valleyland coincides with NPCA regulated areas, development within the regulated area will also require a permit from the NPCA. A geotechnical investigation may also be required where development is proposed within erosion hazard areas (Niagara Falls 2017).

5.5.3.2 Stage 1 Archaeological Assessment

A Stage 1 Archaeological Assessment was completed by Golder Associates to evaluate the archaeological potential in the study area, and to provide specific direction for the protection, management, and/or recovery of potential cultural heritage resources within the study area. In order to meet the objectives outlined in the *Standards and Guidelines for Consultant Archaeologists* for the Stage 1 Assessment, Golder archaeologists employed various research strategies including:

- A review of relevant archaeological, historic, and environmental literature related to the study area,
- A review of an updated listing of registered archaeological sites from the Ontario Archaeological Sites Database (OASD), and
- A review of historic maps as well as previously completed archaeological assessments in the study area.
- A thorough review of background information pertaining to the study area indicated a high archaeological potential for the recovery of Indigenous archaeological resources, as well as Euro-Canadian archaeological resources. Various features and characteristics of a property can indicate a higher potential for archaeological resources and are defined within the Standards and Guidelines for Consultant Archaeologists. The determination of the potential resources was based on a number of these features including proximity to previously registered archaeological sites, water sources, historic settlements, and historic transportation routes.

The Stage 1 Archaeological Assessment submitted during Phase 2 of SNFWWS, identified archaeological potential for the long list of WWTP sites, as well as Stage 2 Archaeological Assessment recommendations as shown in Figure 5-6**.** The Stage 1 Archaeological Assessment for the South Niagara Falls Wastewater Solutions Class EA is presented in ESR Volume 3, Appendix V3.2

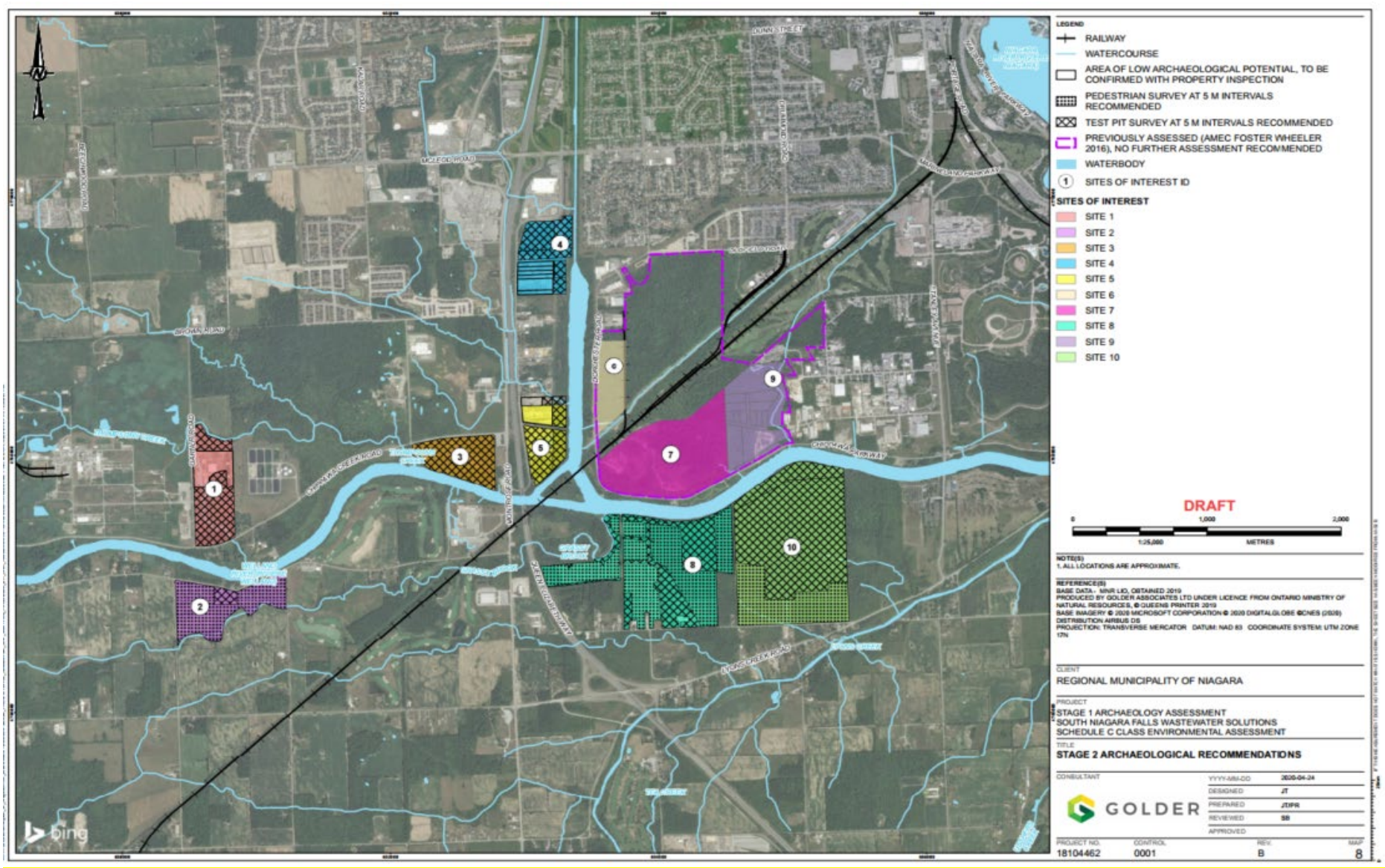


Figure 5-6. Stage 2 Archaeological Recommendations

5.5.3.3 Cultural Heritage Screening

The long list of alternatives screening identified notable cultural heritage features within the potential WWTP sites. A local cemetery, **Dell Cemetery**, is adjacent to Site of Interest 8, and Sites of Interest 2, 5 and 8 contain buildings or structures that are 40 or more years old.

The Cultural Heritage Screening Report for the SNFWWS is presented in Volume 3, Appendix V3.3.

In summary, the Project Team recommends to:

- Consider siting options that avoid all known and potential cultural heritage resources identified in this report If multiple known or potential cultural heritage resources will be crossed or are adjacent to the preferred collection and conveyance corridors, and,
- Conduct a Cultural Heritage Assessment Report (CHAR) with field investigations to identify all known and potential cultural heritage resources potentially impacted by the Project and provide mitigation recommendations to avoid or reduce adverse impacts. The CHAR may recommend conducting subsequent site-specific Cultural Heritage Evaluation Reports (CHERs) or Heritage Impact Assessments (HIAs).

If a Site of Interest that includes a potential cultural heritage property is chosen for the SNF WWTP, the Project Team recommends to:

- Conduct a CHER to determine if the property meets the criteria for cultural heritage value or interest (CHVI) prescribed in *Ontario Regulation 9/06*. If the CHER finds the property has CHVI, conduct an HIA compliant with the City of Niagara Falls Official Plan policies to determine the appropriate mitigation measures.

Table 5-5. Potential Cultural Heritage Constraints for the Long List of Sites of Interest

Site of Interest	Potential Cultural Heritage Constraint	Recommendation if Selected
1	No known or potential cultural heritage resources identified from desktop analysis.	No further studies required.
2	A house and two barns over 40 years old are on the Site of Interest.	Conduct a CHER to determine if the property meets the criteria for CHVI prescribed in *Ontario Regulation 9/06*. If the CHER finds the property has CHVI, conduct an HIA compliant with the City of Niagara Falls Official Plan policies to determine the appropriate mitigations
3	No known or potential cultural heritage resources identified from desktop analysis.	No further studies required.
4	No known or potential cultural heritage resources identified from desktop analysis.	No further studies required.
5	The Site includes a property known as Jellystone Park Niagara Falls, a property that has been a trailer park/campground/resort since 1965. Some of the structures appear to be over 40 years old. The Site is adjacent to the Welland River section of the First Welland Canal and part of the Power Canal.	Conduct a CHER to determine if the property meets the criteria for CHVI prescribed in *Ontario Regulation 9/06*. If the CHER finds the property has CHVI, conduct an HIA compliant with the City of Niagara Falls Official Plan policies to determine the appropriate mitigations.
6	No known or potential cultural heritage resources identified from desktop analysis.	No further studies required.
7	No known or potential cultural heritage resources identified from desktop analysis.	No further studies required.
8	The Dell Cemetery at 6811 Reixinger Road is adjacent to Site of Interest 8. A house and farm complex with buildings over 40 years old is within the Site of Interest 8. The Site is adjacent to the Welland River section of the First Welland Canal and part of the Power Canal.	Conduct a CHER to determine if the property meets the criteria for CHVI prescribed in *Ontario Regulation 9/06*. If the CHER finds the property has CHVI, conduct an HIA compliant with the City of Niagara Falls Official Plan policies to determine the appropriate mitigations.
9	No known or potential cultural heritage resources identified from desktop analysis.	No further studies required.
10	No known or potential cultural heritage resources identified from desktop analysis.	No further studies required.

5.5.3.4 Geotechnical Baseline

The Geotechnical Baseline Report (available in Volume 3, Appendix V3.9) was completed to support planning and early-stage design purposes as well as recommendations for aspects of future geotechnical investigations.

Due to insufficient information available for the design development, the following provides information for the proposed geotechnical and hydrogeological investigations within the boundaries of the Site.

5.5.3.5 Hydrogeological Baseline

The hydrogeology of the study area tends to be controlled by the local geology. The extensive fine-grained glacial deposits generally form aquitard units which can limit infiltration of precipitation. Areas with coarser-grained deposits may form local aquifers and where present at surface, these coarser-grained deposits can enhance infiltration rates. The bedrock units in the study area are considered to be aquifers, especially in the upper few meters that tend to be more highly weathered (WHI, 2005). Hydraulic conductivities in the bedrock are enhanced by the karstic dissolution of the carbonate rock and the presence of highly soluble evaporite minerals, especially common in the Salina Formation. This dissolution of the bedrock contributes to higher hydraulic conductivities in the upper weathered zone of the bedrock but also can contribute to poorer water quality at depth in the bedrock as the dissolved mineral content of the groundwater increases. Shallow groundwater flow is expected to generally follow the ground surface topography with flow towards local surface water bodies like the Welland River / Chippawa Creek, HEPC and Niagara River.

The Hydrogeological Baseline Report is available in Volume 3, Appendix V3.10.

5.5.3.6 Source Water Protection Mapping

The Niagara Peninsula Conservation Authority (NPCA) administers the regional Drinking Water Source Protection process under the *Ontario Clean Water Act, 2006* (NPCA, 2013). Part of the Source Protection planning involves the evaluation of vulnerable areas which could contribute to water quality or quantity issues for municipal drinking water sources. Two of these vulnerable areas, Highly Vulnerable Aquifers (HVA) and Significant Groundwater Recharge Areas (SGRA) are in the study area and the Sites of Interest area, respectively.

The Region completed technical work to support the update of the Source Water Protection Plan and Policy for the Niagara Falls Water Treatment Plant under the capital project to relocate the raw water intake.

HVA are assessed based on a semi-quantitative rating system that looks at the thickness and permeability of the surficial overburden units as well as the presence of potential contaminant transport pathways such as high-risk wells and larger excavations such as aggregate pits and large-scale construction activities. HVAs are present throughout the study area including extensive areas in the northern part and under the developed areas. HVA within the Sites of Interest area are less extensive but do occur on portions of Sites 1, 2, 4 and 5 and directly adjacent to Sites 3 and 8.

5.5.3.7 NPCA Groundwater Monitoring

The NPCA monitors groundwater levels and quality in three monitoring wells located in, or near to, the study area. These wells are all installed into the upper bedrock or overburden / bedrock interface to depths of approximately 27 to 30 metres below ground surface. Groundwater level monitoring at the wells has been carried out since October 2014 and the records show that the groundwater levels in each well have been relatively steady with gradual fluctuations of up to about 0.5 metres.

The presence of sulphur compounds in groundwater of the area has been noted (WHI, 2005) especially in groundwater in contact with the Salina Formation which contains extensive gypsum deposits. This is also observed in the shallow groundwater samples where the wells completed in the Salina (Young Matthews and Baden Powell wells) have groundwater with sulphate levels approximately twice as high as the well completed in the Guelph Formation (Oak Hall well).

Water samples collected from these wells were consistently noted to have a hydrogen sulphide (H2S) odour and the analyses indicate that there is detectable hydrogen sulphide in the water at all wells, though in smaller amounts at the Oak Hall well. Given the historical presence of natural gas wells in the southern part of the study area and the observations of gas venting from the Young \Matthews well it is noted that the percentage saturation of methane (CH4) in this well is markedly higher than the other wells.

5.5.3.8 Assimilative Capacity Screening Memorandum

The ACS Approach Memorandum was submitted to MECP in April 2019 to document existing water quality and available flow data to support methodology for the next ACS step which includes hydraulic screening of potential receiving waterbodies.

The existing waterbodies had unique characteristics. The flow in Welland River East (Chippawa Creek) and the HEPC has been controlled by the operation of the International Control Dam (ICD) since 1954. The ICD is jointly controlled by OPG and New York Power Authority (NYPA) in accordance with the *1950 Niagara Treaty* (Canada, 1950). The treaty between Canada and the United States was intended to maximize the beneficial use of the hydroelectric potential of the Niagara River while maintaining the scenic value of Niagara Falls for tourism.

In addition, construction of the Welland Canal to the west of the study area has changed the hydrology and drainage area of the Welland River as well as several small tributaries. The Welland River passes under the Welland Canal at two locations via sumps that may alter the flow in the river during high flow events. The Lyons Creek watershed area was also decreased by the Welland Canal to the extent that water is pumped from Welland Canal into Lyons Creek to maintain a minimum flow requirement.

Following submission and MECP review of the ACS Approach, the ACS Screening Report was developed for the four outfall locations. The ACS considered four different effluent discharge location alternatives for the purpose of receiving treated wastewater effluent discharges from the new WWTP, as follows:

Alternative Location 1: Welland River

Located immediately east of Triangle Island, the discharge from the new WWTP would mix with flow from Welland River East.

Alternative Location 2: Earth Cut Section of HEPC

Located immediately north of Triangle Island, the discharge from the new WWTP would mix with flow from Chippawa Creek and Welland River East.

Alternative Location 3: Welland River East (Chippawa Creek)

Located immediately west of Triangle Island, the discharge from the new WWTP would mix with flow from Chippawa Creek (composed mainly by water from the Niagara River diverted into the HEPC based on flow demand and flow from Lyons Creek) and occasionally with water from Welland River East when the HEPC is not operational.

Alternative Location 4: Niagara River

Located immediately downstream of the ICD and below Chippawa, the WWTP would discharge directly into the Niagara River via a shoreline discharge.

The modelling approach has been designed with the following objectives:

- Estimate the remaining capacity of the receiving waters to accept WWTP effluent without exceeding applicable guidelines,
- Estimate the recommended effluent objectives for each of the discharge locations and compare those limits to feasible limits based on the available treatment technology, and
- Estimate the existing and future concentrations in the receiving waters at selected locations based on the recommended effluent objectives. Given the complexity of the hydrodynamic conditions in the study area, the first three discharge locations (Locations 1, 2, and 3) will be modelled using a stochastic approach. The fourth location, evaluating a discharge to the Niagara River, is relatively simple by comparison and was modelled using a mass balance approach. The following points outline the methods used to complete the ACS at the four locations and for various parameters:
    - Given the complex and regulated hydrodynamic conditions in Locations 1, 2, and 3; a stochastic model (GoldSim) was used to complete the ACS for total phosphorous, total ammonia, nitrate, and fecal coliforms (E. coli). Estimates for unionized ammonia were calculated based on modelled ammonia and measured average temperature and pH. The ACS was completed for both local and system compliance points to reflect the contribution of the existing Niagara Falls WWTP.
    - To provide a conservative estimate of the assimilative capacity, a mass balance model was developed to estimate the maximum allowable effluent concentrations for total ammonia, unionized ammonia, nitrate, fecal coliforms (E. coli), and total phosphorous for conditions where all the flows in the study area were assumed to be representative of low-flow conditions (e.g., 7Q20 or minimum regulated flow).

- For Location 4, the effluent is not expected to mix with the entire width of the Niagara River before reaching Niagara Falls. As such a 2-Dimensional Gaussian Plume model was used to predict the lateral mixing of the effluent in the Niagara River. This model was used to assess for total phosphorous, total ammonia, unionized ammonia, nitrate, and fecal coliforms (E. coli).
- For parameters associated with oxygen in the water (dissolved oxygen and CBOD5), the maximum allowable effluent concentrations were estimated using a simplified and conservative dissolved oxygen mass balance model for all the locations. Since a high rate of reaeration is expected in the Niagara River and HEPC due to current speeds, this assessment was only completed for a local compliance point.
- A simple mass balance model was used to estimate the maximum allowable effluent concentrations for Total Suspended Solids (TSS) based on an increase of 5 mg/L over the background conditions.

The ACS Approach Memorandum and the ACS Screening Memorandum are available in Volume 3, Appendix V3.5.

5.5.4 Evaluation of Long List of Alternatives

The evaluation process for the long list of alternatives required a combination of independent review of each servicing component – WWTP, outfall, conveyance, as well as a review of the components in an integrated solution. The long list evaluation utilized the MBL criteria including environmental, social / cultural, legal / jurisdictional, technical, and financial considerations for each of the components.

5.5.4.1 Wastewater Treatment Plant Sites

The long list of alternatives for the WWTP site included 10 sites located in the focused Study Area. Each of the sites had identified opportunities and constraints. The full MBL evaluation of the WWTP site alternatives is provided in Table 5-8.

Table 5-6. WWTP Sites Opportunities and Constraints

Site	Description	General Comment
1	Western limits of Chippawa Creek Road (North of Welland River)	• Most western site, north of river • Supportive neighbouring land uses • Greater distance for the outfall and collection system
2	Western limits of Grassy Brook Road (South of Welland River)	• Western site, south of river • Environmental impacts • Difficult outfall and collection system impacts
3	Chippawa Creek Road at Montrose Road (North of Welland River)	• Near confluence of Welland River, Chippawa Creek and HEPC • Environmental impacts • Limited site availability
4	Near existing SSHLPS site (Adjacent to HEPC)	• Good proximity to HEPC • Conflict with existing and future land uses • Efficient collection system strategy
5	South limit of Oakwood Drive (Adjacent to HEPC)	• Good proximity to HEPC • Less conflict with existing and future land uses • Efficient collection system strategy
6	East of HEPC (Northwest limit of developable block)	• Good proximity to HEPC • Conflict with existing and future land uses • Difficult collection system strategy
7	East of HEPC (South limit of developable block)	• Good proximity to HEPC or Chippawa Creek • Conflict with existing and future land uses • Difficult collection system strategy
8	East of QEW South of Chippawa Creek	• Good proximity to confluence of Chippawa Creek and HEPC • Less conflict with land uses • Efficient collection system strategy
9	East of HEPC Southwest limit of developable block	• Good proximity to Chippawa Creek • Conflict with existing and future land uses • Difficult collection system strategy
10	Further East of QEW South of Chippawa Creek	• Good proximity to Chippawa Creek • Less conflict with land uses • Efficient collection system strategy

Based on the evaluation of the long list alternatives, a total of four alternatives for the WWTP site were identified to be short listed and undergo more detailed analysis and evaluation:

- Site 1: west limit of study area, north of Welland River,
- Site 4: north location, near existing SSHLPS,
- Site 5: central location, south of existing SSHLPS, and,
- Site 8: south location, south of Chippawa Creek.

5.5.4.2 Outfall Locations

For each of the long list alternative WWTP sites, a MBL evaluation of the potential effluent discharge locations for the plant outfall was undertaken. In some cases, a WWTP site had the potential to discharge to more than one location.

The full MBL evaluation of the outfall alternatives for each long list WWTP site is provided in Table 5-8.

Based on the evaluation of the long list alternatives, a total of four alternatives, with identified site and outfall location, have been identified to undergo more detailed analysis and evaluation:

- Site 1: west limit of study area, north of Welland River with outfall to HEPC,
- Site 4: north location, near existing SSHLPS, with outfall to HEPC,
- Site 5: central location, south of existing SSHLPS, with outfall to HEPC, and,
- Site 8: south location, south of Chippawa Creek, with outfall to Chippawa Creek.

Table 5-7. Short List of WWTP Site and Outfall Alternatives

Site	Site 1 (Outfall to HEPC)	Site 4 (Outfall to HEPC)	Site 5 (Outfall to HEPC)	Site 8 (Outfall to Chippawa Creek)
Alternative Differentiator	Compatible existing and future land use with opportunity to discharge to Hydro Electric Power Canal.	Efficient collection strategy based on existing infrastructure and close proximity to Hydro Electric Power Canal for discharge.	Relatively efficient collection strategy based on existing infrastructure and close proximity to Hydro Electric Power Canal for discharge.	Suitable land use and close proximity to Chippawa Creek for discharge. Efficient collection strategy including areas south of Chippawa Creek.

Table 5-8. Multiple Bottom-Line Evaluation for Long List WWTP Sites and Outfall Evaluation

	Site 1		Site 2		Site 3	Site 4	Site 5	Site 6	Site 7		Site 8		Site 9		Site 10	
	Option 1A (Welland River)	Option 1B (HEPC)	Option 2A (Welland River)	Option 2B (HEPC)	(HEPC)	(HEPC)	(HEPC)	(HEPC)	Option 7A (HEPC)	Option 7B (Chippawa)	Option 8A (HEPC)	Option 8B (Chippawa)	Option 9A (Chippawa)	Option 9B (Niagara River)	Option 10A (Chippawa)	Option 10B (Niagara River)
Environmental	- Receiving waterbody (Welland River) is more environmentally sensitive than Hydro Electric Power Canal (HEPC) and Chippawa Creek - Site has minimal environmental constraints (Environmental Conservation Area [ECA] that is avoidable) reducing potential for siting impact	- Receiving waterbody (Hydro Electric Power Canal) is less environmentally sensitive than Welland River - Site has minimal environmental constraints (ECA that is avoidable) reducing potential for siting impact	- Receiving waterbody (Welland River) is more environmentally sensitive than HEPC and Chippawa Creek - Site has minimal environmental constraints reducing potential for siting impact	- Receiving waterbody (Hydro Electric Power Canal) is less environmentally sensitive than Welland River - Site has minimal environmental features reducing potential for siting impact - Outfall requires crossing of significant environmental features	- Receiving waterbody (Hydro Electric Power Canal) is less environmentally sensitive than Welland River - Site constrained by environmental features including significnat wetland complexes	- Receiving waterbody (Hydro Electric Power Canal) is less environmentally sensitive than Welland River - Site has minimal environmental features reducing potential for siting impact	- Receiving waterbody (Hydro Electric Power Canal) is less environmentally sensitive than Welland River - Site has minimal environmental features reducing potential for siting impact	- Receiving waterbody (Hydro Electric Power Canal) is less environmentally sensitive than Welland River - Site is constrained by environmental features including signficiant wetland complexes and deer wintering	- Receiving waterbody (Hydro Electric Power Canal) is less environmentally sensitive than Welland River - Site is constrained by environmental features including scattered wetland complexes	- Receiving waterbody (Chippawa Creek) is less environmentally sensitive than Welland River - Site is constrained by environmental features including scattered wetland complexes	- Receiving waterbody (Hydro Electric Power Canal) is less environmentally sensitive than Welland River - Site has minimal environmental features reducing potential for siting impact - Outfall requires crossing of significant environmental features	- Receiving waterbody (Chippawa Creek) is less environmentally sensitive than Welland River - Site has minimal environmental features reducing potential for siting impact	- Receiving waterbody (Chippawa Creek) is less environmentally sensitive than Welland River - Site is moderately constrained by environmental features including scattered wetland complexes	- Receiving waterbody (Niagara River) is less environmentally sensitive than Welland River - Site is moderately constrained by environmental features including scattered wetland complexes	- Receiving waterbody (Chippawa Creek) is less environmental sensitive than Welland River - Site is moderately constrained by environmental features including scattered wetland complexes	- Receiving waterbody (Niagara River) is less environmental sensitive than Welland River - Site is moderately constrained by environmental features including scattered wetland complexes
Social / Cultural	- Site is removed from core existing and future development areas - Receiving waterbody has existing recreational use increasing potential for impact during construction and operation	- Site is removed from core existing and future development areas - Receiving waterbody has existing recreational use increasing potential for impact during construction and operation	- Increased potential impact to future residential properties to the east - Receiving waterbody has existing recreational use increasing potential for impact during constriction and operation	- Increased potential impact to future residential properties to the east - Receiving waterbody has existing recreational use increasing potential for impact during constriction and operation	- Site is well buffered by natural features lowing potential impact to surrounding uses - Receiving waterbody has no public access reducing potential for impact during construction and operation	- Increased potential impact to existing residential properties and existing / future commercial / retail use - Receiving waterbody has no public access reducing potential for impact during construction and operation	- Increased potential impact to future residential properties and existing / future commercial / retail use - Impact to existing use as holiday park / recreational use - Receiving waterbody has no public access reducing potential for impact during construction and operation	- Increased potential impact to future residential properties - Receiving waterbody has no public access reducing potential for impact during construction and operation	- Increased potential impact to future residential properties - Receiving waterbody has no public access reducing potential for impact during construction and operation	- Increased potential impact to future residential properties - Receiving waterbody has existing recreational use increasing potential for impact during construction and operation	- Increased potential impact to future commercial properties - Receiving waterbody has no public access reducing potential for impact during construction and operation	- Increased potential impact to future commercial properties - Receiving waterbody has existing recreational use increasing potential for impact during construction and operation	- Increased potential impact to future residential properties and existing / future commercial / retail use - Receiving waterbody has existing recreational use increasing potential for impact during construction and operation	- Increased potential impact to future residential properties and existing / future commercial / retail use - Receiving waterbody has existing recreational use increasing potential for impact during construction and operation	- Increased potential impact to future commercial properties - Receiving waterbody has existing recreational use increasing potential for impact during construction and operation	- Increased potential impact to future commercial properties - Receiving waterbody has existing recreational use increasing potential for impact during construction and operation
Legal / Jurisdictional	- Suitable existing, future and surrounding land use (industrial) - Sensitive receiving waterbody increasing permitting and approval requirements	- Suitable existing, future and surrounding land use (industrial)	- Suitable existing and future land use (open space) - Sensitive receiving waterbody increasing permitting and approval requirements	- Suitable existing and future and use (open space)	- Existing land use constrained by environmental features - Significant environmental constraints increasing permitting and approval requirements	- Existing land use includes mixed commercial properties and would require several property acquisitions for siting purposes - Suitable future land use (mostly commercial, some industrial)	- Existing land includes a holiday park that has seasonal recreation - Suitable future land use (mostly commercial, some industrial)	- Future land use (residential) is not compatible for siting purposes - Significant environmental constraints increasing permitting and approval requirements	- Future land use (residential) is not compatible for siting purposes - Significant environmental constraints increasing permitting and approval requirements	- Future land use (residential) is not compatible for siting purposes - Significant environmental constraints increasing permitting and approval requirements	- Existing land is being used for agriculture - Suitable future land use (commercial)	- Existing land is being used for agriculture - Suitable future land use (commercial)	- Future land use (residential) is not compatible for siting purposes	- Future land use (residential) is not compatible for siting purposes	- Suitable existing and future land use (commercial) - Significant environmental constraints increasing permitting and approval requirements	- Suitable existing and future land use (commercial) - Significant environmental constraints increasing permitting and approval requirements
Technical	- Complex treatment needed to meet effluent criteria objectives due to more sensitive receiving waterbody - Short outfall to reach receiving waterbody - Inefficient collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Long outfall required to reach receiving waterbody - Inefficient collection strategy	- Complex treatment needed to meet effluent criteria objectives due to more sensitive receiving waterbody - Short outfall to reach receiving waterbody - Difficult collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Long outfall required to reach receiving waterbody - Difficult collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Limited land availability for future phasing due to environmental constraints - Inefficient collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Short outfall to reach receiving waterbody - Facilitates long-term planning and phasing - Efficient collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Short outfall to reach receiving waterbody - Facilitates long-term planning and phasing - Relatively efficient collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Short outfall to reach receiving waterbody - Inefficient collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Short outfall to reach receiving waterbody - Inefficient collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Short outfall to reach receiving waterbody - Inefficient collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Facilitates long-term planning and phasing - Efficient collection strategy	- Reduced treatment complexity needed to meet effluent criteria objectives - Facilitates long-term planning and phasing - Efficient collection strategy	- Short outfall to reach receiving waterbody - Limited land availability for future phasing due to environmental constraints - Difficult collection strategy	- Long outfall required to reach receiving waterbody - Limited land availability for future phasing due to environmental constraints - Difficult collection strategy	- Short outfall to reach receiving waterbody - Limited land availability for future phasing due to environmental constraints - Relatively efficient collection strategy	- Long outfall required to reach receiving waterbody - Limited land availability for future phasing due to environmental constraints - Relatively efficient collection strategy
Financial	- Increased costs associated with treatment and inefficient collection strategy	- Increased costs associated with length of outfall required and inefficient collection strategy	- Increased costs associated with treatment, length of outfall required and difficult collection strategy	- Increased costs associated with length of outfall required and difficult collection strategy	- Reduced costs associated with short outfall - Increased costs associated with inefficient collection strategy	- Reduced costs associated with short outfall and efficient collection strategy	- Reduced costs associated with short outfall and efficient collection strategy	- Reduced costs associated with short outfall - Increased costs associated with inefficient collection strategy	- Reduced costs associated with short outfall - Increased costs associated with inefficient collection strategy	- Reduced costs associated with short outfall - Increased costs associated with inefficient collection strategy	- Increased costs associated with length of outfall required - Reduced costs associated with efficient collection strategy	- Reduced costs associated with short outfall required and efficient collection strategy	- Reduced costs associated with short outfall required - Increased costs associated with difficult collection strategy	- Increased costs associated with length of outfall required and difficult collection strategy	- Reduced costs associated with short outfall required and relatively efficient collection strategy	- Increased costs associated with length of outfall required and relatively efficient collection strategy
Site Differentiator	***Concern with effluent discharge to Welland River and environmental implications.***	***Carried forward primarily because of compatible land use and opportunity to discharge to HEPC.***	***Concern with effluent discharge to Welland River and environmental implications. Difficult and costly collection strategy.***	***Difficult outfall strategy to HEPC. Difficult and costly collection strategy.***	***Insufficient land due to environmental constraints.***	***Efficient location based on existing infrastructure and proximity to HEPC.***	***Relatively efficient collection strategy in proximity to HEPC.***	***Inefficient collection system strategy. Environmental and planning constraints.***	***Inefficient collection system strategy. Environmental and planning constraints.***	***Inefficient collection system strategy. Environmental and planning constraints.***	***Suitable land use and efficient collection strategy including areas south of Chippawa Creek. Alternative was not carried forward as Chippawa Creek presents favourable Site 8 options.***	***Suitable land use and proximity to Chippawa Creek. Efficient collection strategy including areas south of Chippawa Creek.***	***Difficult collection strategy. Land availability constrained.***	***Difficult collection strategy. Land availability constrained.***	***Increased environmental constraints.***	***Increased environmental constraints.***
Feasibility	✗	✓	✗	✗	✗	✓	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗

5.5.4.3 Collection System Strategies

New SNF Trunk Sewer Location and Collection System Impact

Depending on the new SNF WWTP site location there would be various trunk sewer requirements or impacts to the existing and future collection system. The trunk sewer would need to convey flows from the existing South Side High Lift Pumping Station (SSHLPS) located near Oakwood Drive and McLeod Road and support a gravity alignment to the new WWTP along with supporting the long-term service area. The review of the collection system needed to consider length of infrastructure, gravity service areas, the need to introduce sewage pumping stations, and the long-term operation and maintenance requirements.

Based on the long list of site locations, the following key considerations were identified:

Site No.	Key Considerations
Sites 1 and 2	• Longer distance away from the SSHLPS location for the trunk sewer • Future growth areas south of the Welland River would require pumping
Sites 3, 4 and 5	• Closer proximity to the SSHLPS location for the trunk sewer • Future growth areas south of the Welland River would require pumping
Sites 6, 7 and 9	• Inefficient location providing limited long-term benefit for both the trunk sewer and future collection system
Site 8 and 10	• Longer distance away from the SSHLPS for the trunk sewer • Centrally located to support gravity servicing of the south Niagara Falls growth areas as well as the South Niagara Hospital and future growth areas

The full multiple bottom-line evaluation of the preliminary collection system strategies for each long list WWTP site is provided in Appendix V2.2

Based on the evaluation of the long list alternatives, a total of four alternatives, with identified site, outfall location and preliminary servicing strategy, have been identified to undergo more detailed analysis and evaluation:

- Site 1: west limit of study area, north of Welland River, with outfall to HEPC,
- Site 4: north location, near existing SSHLPS, with outfall to HEPC,
- Site 5: central location, south of existing SSHLPS, with outfall to HEPC, and,
- Site 8: south location, south of Chippawa Creek, with outfall to Chippawa Creek.

The four short listed strategies are presented in Figure 5-7.

Thorold South Servicing Impact

The long list of site locations has impact to the Thorold South servicing as they relate to the new SNF trunk sewer. The Thorold South servicing strategy was anticipated to connect to the new SNF trunk sewer. Sites 1 and 2 had the potential of being located sufficiently west to present opportunity for alternative Thorold South infrastructure alignments. Sites 3 to 10 presented similar impacts to Thorold South servicing.

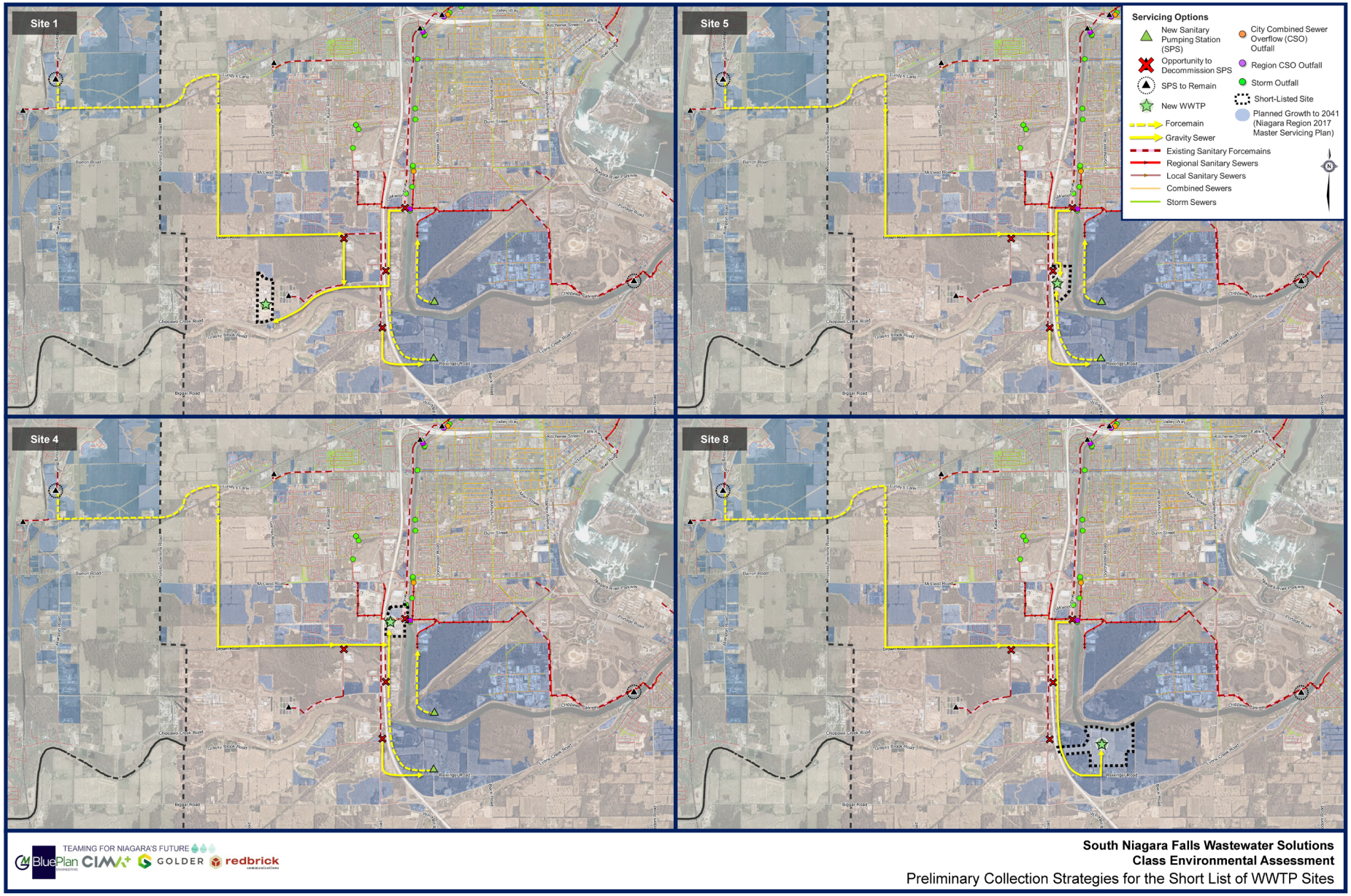


Figure 5-7. Preliminary Collection Strategies for the Short list of WWTP Sites

5.5.5 Short List of Alternatives

Evaluation of the short list of alternatives for the integrated solution applied the multiple bottom line comparative evaluation approach, leveraged the Phase 1 and 2 information documented through the supporting studies, used conceptual detail regarding the technical and financial aspects of each alternative, and ultimately integrated the evaluation for each of the established components:

1. A multiple bottom-line evaluation of the treatment plant site,
2. A multiple bottom-line evaluation of the outfall location,
3. A multiple bottom-line evaluation of the collection system strategy,
4. A common impact evaluation of the Thorold South servicing requirements, and,
5. An integrated evaluation combining the above components.

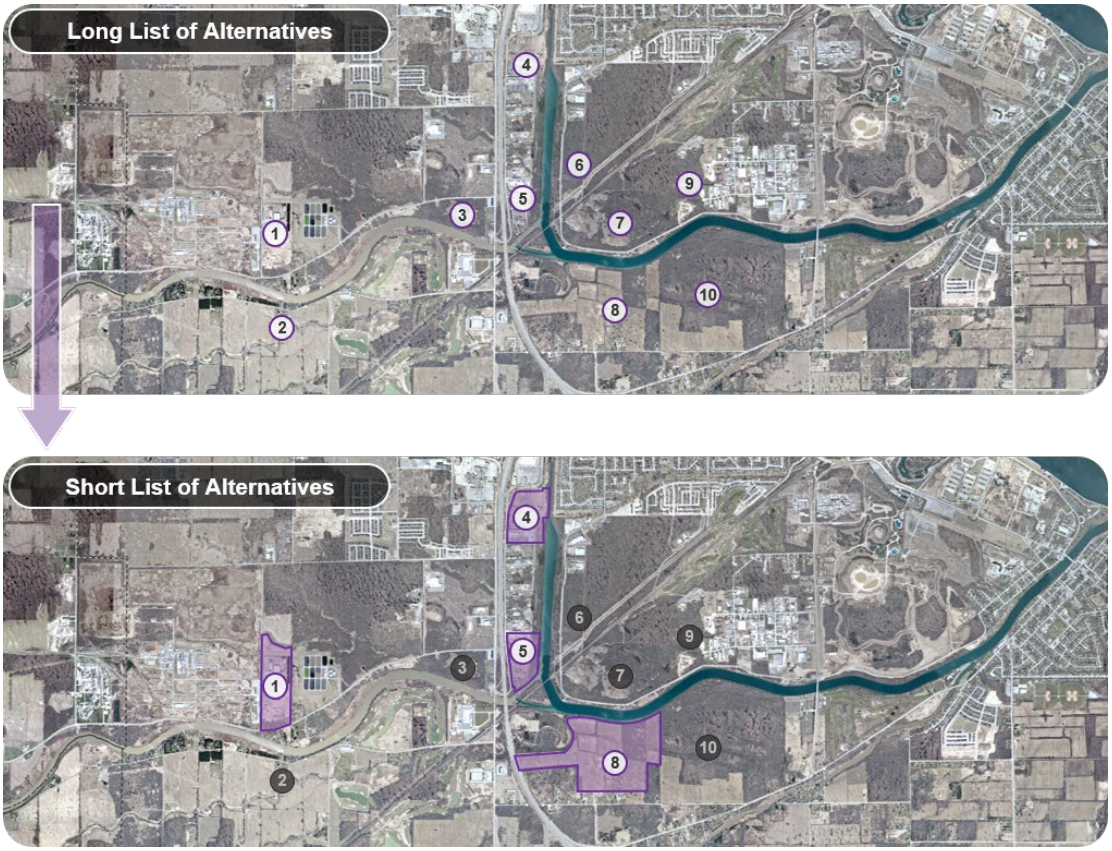


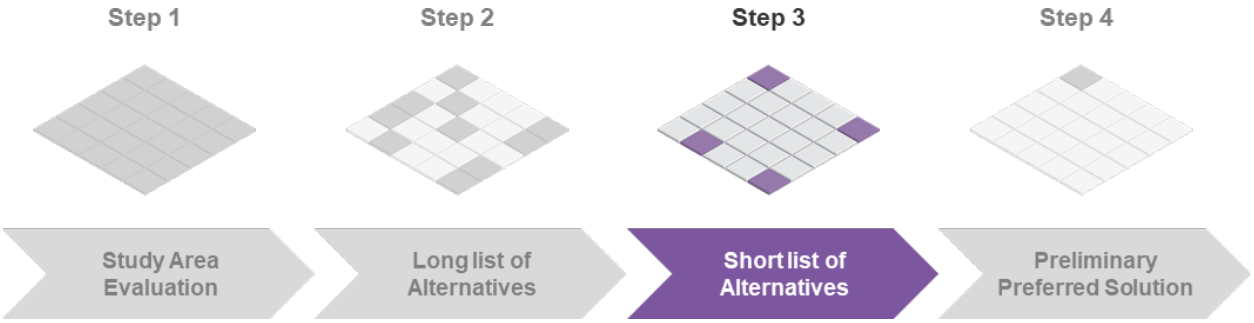
Figure 5-8. Short List of Alternative Wastewater Treatment Plant sites

5.6 Evaluation of the Short List Alternatives

5.6.1 Approach

Step 3 is a detailed and focused process of analyzing and evaluating the four short listed alternatives.

This step continued to review, in more detail, the three primary components of the wastewater solution including treatment plant site, outfall location, and collection system strategy.



Step 3 is further supported through more detailed supporting studies similarly covering natural environment, social and cultural, legal / property, and other elements but focused on the four alternatives.

The goal of Step 3 was to take the short list of four alternatives, utilize detailed evaluation criteria, and establish the preferred solution. The preferred solution will be a balance of the preferred site, preferred outfall location, and preferred collection system strategy.

5.6.2 Evaluation Criteria

The short list alternatives were evaluated using detailed 5-point MBL weighted criteria. This placed higher emphasis on potential environmental and social-cultural impacts, with key technical, financial, and legal-jurisdictional considerations.

The short list of alternatives undertook a more detailed evaluation. This first component of this involved weighting the MBL criteria for better representative of potential impacts an issue or opportunity may have on the preferred solution. A summary of how the criteria weightings were developed is provided below.

Environmental (25%): Protecting the environment was top priority which resulted in an increased weighted evaluation. Key themes that influenced the weighting include the intent to reduce pollution into waterbodies and environment as well as the need to avoid or mitigate sensitive environmental features and habitats.

Social / Cultural (25%): The consideration of potential impact to residents, businesses, cultural/heritage features, and recreational amenities is also top priority. This resulted in an increased weighting during evaluation to better integrate the facility as an investment to the local community. This criterion was further divided into 3 sub-criteria to reflect the potential impact on socio-economic factors, cultural heritage features, and archaeologic potential. The 3 sub-criteria could then be averaged to give an overall socio-cultural score.

Legal / Jurisdictional (10%): Land acquisition and the relationship of the proposed wastewater treatment plant site and infrastructure locations / alignments to other land uses were considered during the evaluation process, with the understanding that this criterion would not carry as much weight as others.

Technical (20%): Since each alternative requires the evaluation of the wastewater treatment plant site, outfall location and sewer routes, the solution must be technically viable and achieve the long-term servicing and treatment goals. This criterion is fundamentally important and therefore carried a higher weighting.

Financial (20%): The use of taxpayers and ratepayers' dollars wisely is critical to this study. This criterion considers capital costs, operational and maintenance costs and cash flow phasing which is considered equally as fundamentally important to technical considerations.

5.6.3 Sub-Criteria Criteria for Short List Alternatives

Further to the weighted MBL, sub-criteria considerations were evaluated. The top four scoring strategies were carried forward in the evaluation process. The sub-criteria evaluated for the short-list alternatives are included in the tables below.

Table 5-9. Short List Evaluation Criteria (Environment weighed at 25%)

Sub-Criteria	Criteria Rationale / Indicators
Environmentally Sensitive Features	• Impact to environmental features such as PSWs, ANSIs, significant woodlots, creeks, and other regulated areas • Ability to maximize natural buffers
Species at Risk	• Proximity to vulnerable/endangered or rare amphibians, wildlife, or fish • Impact on sensitive terrestrial flora and fauna habitats
Water Features/ Resources	• Impact on surface water levels/water quality including surface and groundwater • Potential flooding/erosion risk
Receiving Waterbody	• Impact on effluent criteria/health of receiving waterbody • Ability to meet regulatory requirements and protect existing water uses
System Overflows	• Ability to alleviate existing system strain and reduce overflows
Physical Environmental Considerations (Geology, Hydrogeology, Soil / Land Contamination)	• Impact to environmental crossings • Suitability of subsurface soils and rock characteristics • Anticipated impact to short- and long-term groundwater
Climate Change	• Impact on long-term planning • Level of adaptability / flexibility / resilience

Table 5-10. Short List Evaluation Criteria (Social-Cultural weighed at 25%)

Sub-Criteria	Criteria Rationale / Indicators
Community Concerns for Residents/Local Businesses and Traffic	• Impact on public health and safety • Impact on recreational amenities and ability to coordinate with existing/future population areas
Indigenous Communities	• Impact during construction and operation • Ability to accommodate short- and long-term planning
Archaeological/Cultural Heritage Features	• Impact on nearby agricultural lands or to heritage homes, properties and landscapes • Potential for presence of known archaeological resources/sites
Air Quality and Odour	• Impact to surrounding land users and life cycle air quality (H2S to create odorous environment) • Odour impacts from SPS operation, forcemains and sanitary sewers
Noise, Vibration and Dust	• Impact of noise, vibration and dust on surround land users
Current / Planned Land Uses	• Suitability of land use designation

Table 5-11. Short List Evaluation Criteria (Legal / Jurisdictional weighed at 10%)

Sub-Criteria	Criteria Rationale / Indicators
Approvals/ Coordination	• Compliance with federal, provincial and local plans • Impact on environmental approvals for removal of environmental features • Potential conflicts or conformity with City or Regional Official Plan Policies
Land Use Suitability	• Compatibility with existing and future land use designations • Proximity to physical features (waterbodies, highways.)
Land Acquisition	• Impact on land requirement issues and agency concerns • Degree of complexity relating to land availability, current designated land use and ownership
Worker Safety and Operability	• Accessibility for operation and maintenance

Table 5-12. Short List Evaluation Criteria (Technical weighed at 20%)

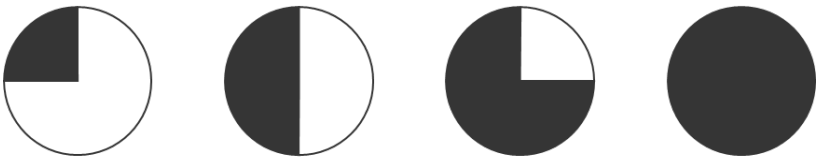
Sub-Criteria	Criteria Rationale / Indicators
Technical Outfall, Treatment, Collection	• Ability to attenuate peak flows and
Compatibility/ Existing and Future Infrastructure	• Ability to minimize operation and maintenance costs • Ability to decommission SPS and minimize wastewater infrastructure footprint
System Security and Level of Service	• Ability to maintain and enhance operational security and service standard for the customer
Traffic Management	• Anticipated degree of construction truck traffic management issues during construction and typical operation and maintenance
Operation and Maintenance	• Impact on long term operation and maintenance requirements • Ease of access to operation and maintain • Potential for deterioration (H2S, condensation, salt)

Table 5-13. Short List Evaluation Criteria (Financial weighed at 20%)

Sub-Criteria	Criteria Rationale/Indicators
Capital Cost	• Total capital (construction) cost for new infrastructure and upgrades for overall servicing strategy
Lifecycle Cost (Operation, Resourcing, Maintenance and Servicing)	• Ability to minimize operation and maintenance costs • Ability to decommission SPS and minimize wastewater infrastructure footprint • Ease of access to maintain and provision of emergency access
Cash Flow/Phasing of Costs	• Impact to cash management and futureproof costing • Opportunity for phasing of costs
Funding Opportunities	• Impact to Development Charges • Ability to receive provincial or federal grants

5.6.4 Comparative Evaluation for Short List Alternatives

Following inventory of all sub-criteria considerations, each short list alternatives were assigned a preferability score. These scores ranged from low preferability to very high preferability. This helped visually depict the evaluation results.



Low **Moderate** **High** **Very High**

A comparative evaluation was completed on the short listed options. This took the three independent strategy component scores and summarized an overall score for each short-listed solution.

The comparative evaluation components included:

1. Siting and Treatment,
2. Outfall Locations, and,
3. Collection Strategy.

Each short list option was provided an overall “Impact” score ranging from Least Preferred, Less Preferred, to Preferred Solution.

5.6.5 Supporting Studies and Investigations

The following section includes the supporting investigations completed during the evaluation of the short list of alternatives. The supporting documents are available the SNFWWS ESR Volume 3 – Supporting Documents.

5.6.5.1 Environmental Risk Screening

The study area investigations determined there were four RSCs for local properties within the study area. Further contamination screening was completed during the short list evaluation process to determine potential sources of contamination that could impact plant siting. The next step to determine potential contamination would be to undertake a Phase 1 Environmental Site Assessment (ESA) on the preferred site. The Phase 1 will conclude if next steps, including a Phase 2 ESA is required. The Environmental Contamination Screening Report is available in the SNFWWS ESR Volume 3, Appendix V3.4.

Site 1

Site 1 consists of two parcels with municipal address of 8800 Garner Road and 8899-8923 Chippawa Creek Road, City of Niagara Falls, Ontario. Site 1 has an area of approximately 26.76 hectares (66.12 acres). The EcoLog ERIS report included the following noteworthy information.

The following information for 8800 Garner Road was noted:

- Niagara Bio Conversion Inc. was approved under environmental registry to discharge into the natural environment other than water (i.e., air) in 1998,
- Power Grow Systems Inc. was listed as a waste disposal site in 2008, 2013, and 2018,
- Terratec Environmental Ltd. had a Environmental Compliance Approval in 2003 (type: air). In addition, 8800 Garner Road was listed under hazardous waste generator (ON8592432) for one or more of the following wastes: waste oils and lubricants, light fuels, organic laboratory chemicals, and alkaline wastes - other metals in 2013 and 2014,
- Abitibi Consolidated Company of Canada was reported to have a revoked and replaced ECA in 2003 and 2004 (approval type: waste management systems),
- Grow-Rich Inc. had a Certificate of Approval for industrial wastewater (stormwater collection and discharge system) in 1989, 1991, and 1992. 8800 Garner Road was listed under hazardous waste generator (ON0381400) for one or more of the following wastes: light fuels, waste oils and lubricants, and landfill leachates between 1986 and 2001, and,
- Two groundwater supply wells were recorded for 8800 Garner Road. The wells were constructed in 1960 and 1979. Water was found at depth of 75 feet (22.8 metres below ground surface) and recorded as a “fresh water” and “sulphur”.

The following information for 8923 Chippawa Creek Road was noted:

- 8923 Chippawa Creek Road was listed in Scott’s manufacturing directory as Power Grow Systems Inc., established in 1992 with work description of fertilizers (mixing only); and,
- Grow-Rich Inc. had a Certificate of Approval (industrial wastewater) in 1992.

Site 4

Site 4 has an area of approximately 21.3 hectares (52.53 acres) and is located on the east side of Oakwood Drive, approximately 500 metres south of MacLeod Road, in the City of Niagara Falls, Ontario. The EcoLog ERIS report included the following noteworthy listings:

The following information for 7606 Oakwood Drive, which was occupied by Regional Municipality of Niagara, was noted:

- Several spills were reported for 7606 Oakwood Drive in 2009, 2014, and 2019. An unknown amount of chlorinated sewage was discharged to the surface due to equipment failure. Environmental impact was confirmed:
    - 7606 Oakwood Drive was listed to have commercial fuel oil tanks,
    - 7606 Oakwood Drive was listed to have a Facility ECA in 2015 for municipal and private sewage works; 7606 Oakwood Drive was listed under hazardous waste generator (ON7658094 and ON8722981) between 2002 and 2016 for one or more of the following wastes: light fuels and PCBs, and,
    - 7606 Oakwood Drive had a Certificate of Approval for industrial air and municipal and private sewage in 2000.
- The following information for 7868 Oakwood Drive was noted:
    - Joe's Concrete Works Limited had a Certificate of Approval for industrial air in 1993,
    - Ensbro Painting Contractors Ltd. was listed under hazardous waste generator (ON1305000) between 1992 and 1998 petroleum distillates,
    - Krown Niagara was listed under hazardous waste generator (ON5206494) between 2005 and 2011 for waste oil skimmings and sludges, and,
    - 234612 Ontario Inc. was listed a pesticide operator.

Site 5

Site 5 has an area of approximately 16 hectares (39.53 acres) and is located on the east side of Oakwood Drive, approximately 1.5 kilometres south of MacLeod Road, in the City of Niagara Falls, Ontario. The EcoLog ERIS report included the following noteworthy listings:

- 8676 Oakwood Drive was occupied by Yogi Bears Jellystone Park Camp and was listed as a retail fuel outlet/propane gas and tanks in 1995.
- The following information was noted for 8620 Oakwood Drive, which was occupied by Modern Mosaic Ltd:
- The property had a Certificate of Approval (i.e., air and industrial sewage) in 2001 and 2004:
    - The property was approved under Environmental Registry to discharge into the natural environment other than water (i.e., air) in 2001, and,
    - The property was listed under an ECA between 2001 and 2004 for industrial sewage work.

Site 8

Site 8 has an area of approximately 63.39 hectares (156.64 acres) and consists of two parcels with municipal address of 6811 and 7047 Reixinger Road, in the City of Niagara Falls, Ontario. The EcoLog ERIS report did not include pertinent information within the immediate site.

5.6.5.2 Agricultural Screening

The short-list of WWTPs, and adjacent lands, were reviewed to identify agricultural resources and elements of the Agri-Food Network which may be impacted by the construction of a new WWTP. The agricultural screening will assess each candidate site and through a comparative analysis, list the candidate sites in order of potential impact on the agricultural system. The scope of work consisted of a desktop review and reconnaissance site investigations of the four sites and includes:

- A review of background information such as soil and Canada Land Inventory (CLI) agricultural capability information and land use information obtained through a review of aerial photographic imagery,
- A reconnaissance level land use survey to identify agricultural and non-agricultural land uses on and in close proximity to each Site,
- A comparative analysis of the four candidate sites using the information collected, and
- A summarization of our findings.

Table 5-14. Agricultural Screening Result

Site	Agricultural Screening Significance
Site 1	The majority of Site 1 is part of an industrial site and is close to other industrial lands. Those lands that are not developed are disturbed and/or idle (not used for agriculture). The only lands used for agricultural production are located immediately to the north of Site 1. These lands are used for annual cultivation of common field crops such as soybeans and corn. There are four residential dwellings and a commercial operation located along the south side of Chippawa Creek Road.
Sites 4 and 5	There are no agricultural uses or the potential for agricultural uses at Sites 4 and 5. The majority of these lands have been developed for commercial uses of for future non-agricultural uses.
Site 8	Although now within the urban area, the majority of Site 8 was used for agricultural purposes. There is a farm operation that is comprised of an empty livestock facility. Historical photographic imagery shows that the barns housed livestock (Holsteins) as late as 2014.

This agricultural screening exercise has determined that the proposed South Niagara Falls WWTP will have no impact on agriculture or agricultural uses if situated on Sites' 4 or 5.

The potential impact of locating the WWTP at Site 1 will be insignificant. Locating the WWTP at Site 1 will have the potential to remove 8.47 hectares of CLI Class 3 lands. There is also a limited potential for construction of the facility to disrupt access to farm fields the cultivated lands to the north of the Site. The implementation of mitigation measures will ensure that potential impacts are avoided or minimized to the extent possible.

The potential for impact on the continuing agricultural cultivation of the lands is greatest at Site 8. It is the only location where the location of the WWTP has the potential to have a direct impact on agricultural lands, investments in infrastructure and land improvements and an existing farm operation.

Approximately 16.19 hectares of CLI Class 3 and / or 4 land will be removed from agricultural production and an existing farm operation is located within Site 8. Development within Site 8 will not impact the Agricultural Land Base (prime agricultural area) as these lands are already located within the urban boundary and are designated for non-farmland uses. However, agricultural uses continue for the short-term. Implementing the mitigation recommended measures will avoid or minimize the potential impacts on the existing agricultural use on the majority of the Site.

The agricultural screening report is available in Volume 3, Appendix V3.8.

5.6.5.3 Wastewater Treatment Plant Sites

Baseline Investigation Summary of Short List Site No. 1

A desktop analysis of Site 1 identified very minimal environmental features on or within the surrounding areas. The existing and future land uses are zoned for industrial and vacant use, and the location is removed from existing and future planned residential uses with an additional advantage of being adjacent to a Biosolids facility. No cultural heritage features were identified on or adjacent to the site and the site is setback from the Welland River, lowering the archaeological potential within the site.

Baseline Investigation Summary of Short List Site No. 4

A desktop analysis of Site 4 identified minimal environmental features within and adjacent to the site. The existing land use includes vacant commercial land and SSHLPS. The site is adjacent to existing commercial, residential, and industrial land and an alternative commercial land use planning process is currently underway after a recent purchase by Smart Centres. The site has been previously disturbed and requires additional assessments to determine archaeologic potential. The site is immediately adjacent to the HEPC which is considered a cultural heritage feature; however, no natural heritage features were identified on the site.

Baseline Investigation Summary of Short List Site No. 5

A desktop analysis of Site 5 identified minimal environmental features within and adjacent to the site. The existing land use includes seasonal recreational use as a holiday park and has been zoned for future industrial use. The site has been previously disturbed and requires additional assessments to determine archaeologic potential. The site is immediately adjacent to the HEPC which is considered a cultural heritage feature and the site was flagged for having structures 40 or more years old, however no other cultural heritage features were identified on site.

Baseline Investigation Summary of Short List Site No. 8

A desktop analysis identified that Site 8 has very minimal environmental constraints within the site. The existing land use is mainly agricultural with residential properties located south of the site. The land is designated for future commercial use, compatible with potential plant siting. The site is occupied and adjacent to Dell cemetery and is flagged as possible having structures over 40 years old. The site is in close proximity to the Welland River, increasing the archaeological potential within the site.

5.6.5.4 Outfall Locations

Based on the WWTP evaluation, two receiving water bodies were short listed for consideration: the HECP and Chippawa Creek. Welland River and Niagara River were not carried forward as the corresponding long list WWTP siting alternatives was not short listed.

5.6.5.5 Collection System Strategy

A preferred collection strategy was selected for each of the alternative WWTP sites. During the short-list evaluation, the opportunities and constraints of each alignment was compared against the weighted sub-criteria.

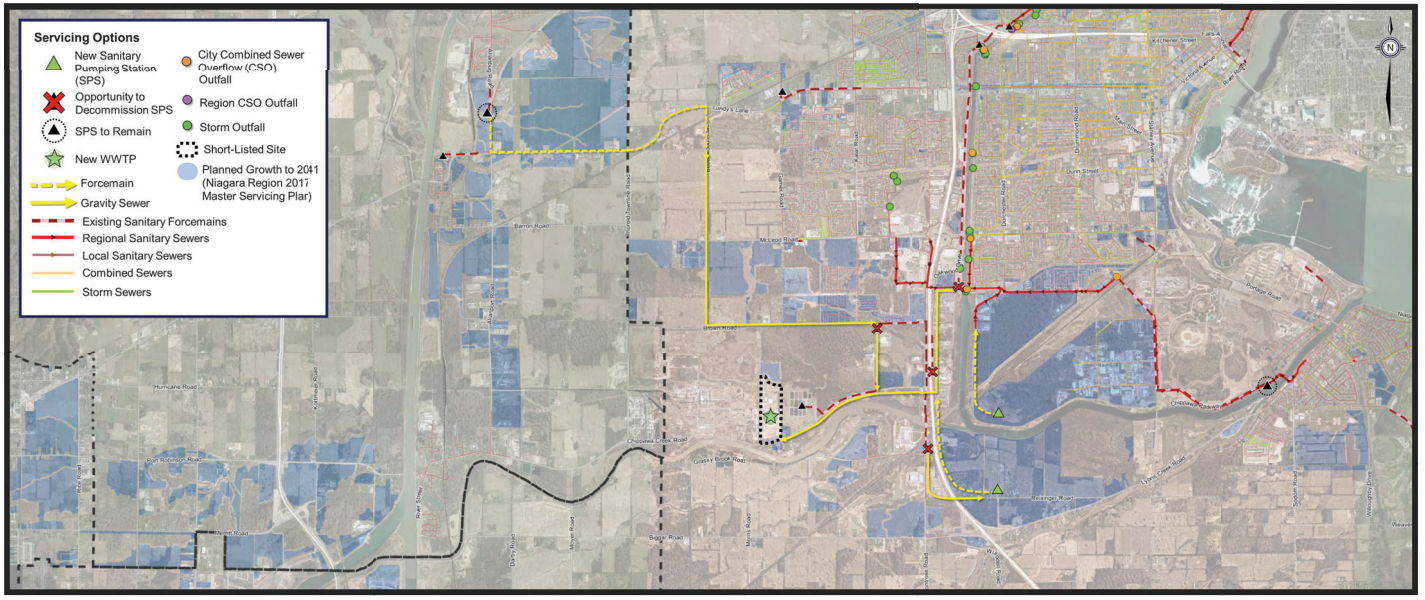
5.6.5.6 Short List Multiple Bottom-Line Evaluation

The detailed multiple bottom-line evaluation of each short list strategy is provided in Appendix V2.3. A summary of the evaluation is presented in Figure 5-9 to Figure 5-12.

Short List of Alternatives – Site 1

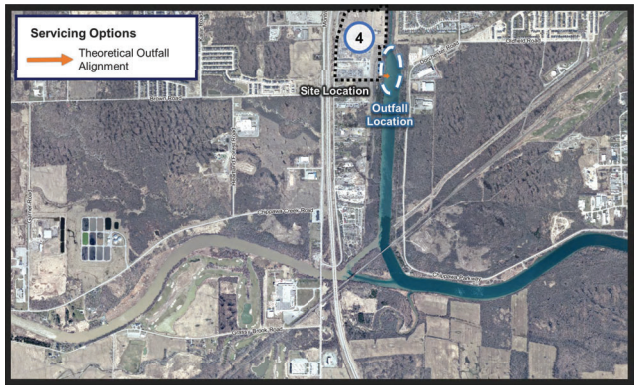
Preferability

Low | Moderate | High | Very High



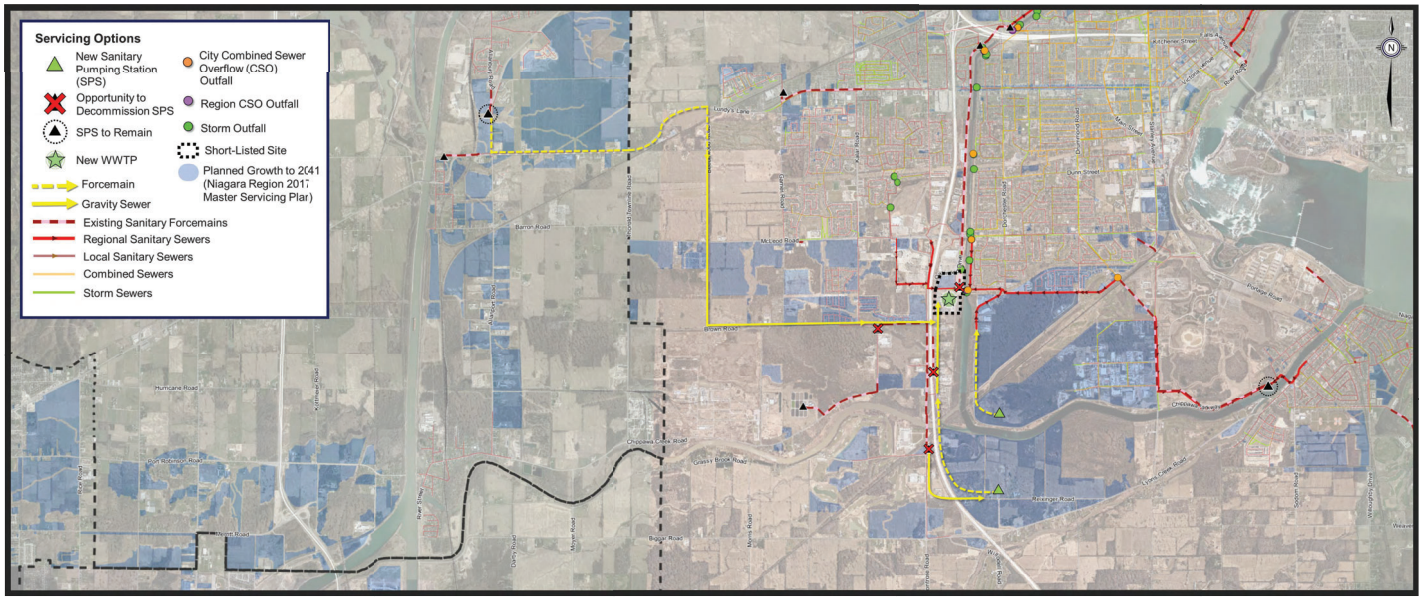
		Site & Treatment	Outfall Location	Collection Strategy
Criteria	**Sub-Criteria**	**Site 1 – Preferred Site Secondary Treatment**	**Site 1 – Preferred Outfall Hydro Electric Power Canal**	**Site 1 – Preferred Collection Strategy Remove High Lift Pumping Station and no Lyons Creek**
Environmental (25%)	• Environmentally Sensitive Features • Species at Risk • Water Features / Resources • Receiving Waterbody • System Overflows • Physical Environmental Considerations • Climate Change			
Social / Cultural (25%)	• Community Concerns for Residents / Local Businesses / Traffic • Indigenous Communities and Archaeological / Cultural Heritage • Air Quality and Odour • Noise, Vibration and Dust • Current / Planned Land Uses			
Legal / Jurisdictional (10%)	• Approvals / Coordination • Land Use Suitability • Land Acquisition • Worker Safety and Operability			
Technical (20%)	• Compatibility / Existing and Future Infrastructure • System Security and Level of Service • Traffic Management • Operation and Maintenance			
Financial (20%)	• Capital Cost • Lifecycle Cost • Cash Flow / Phasing of Costs • Funding Opportunities			

Short List of Alternatives – Site 4



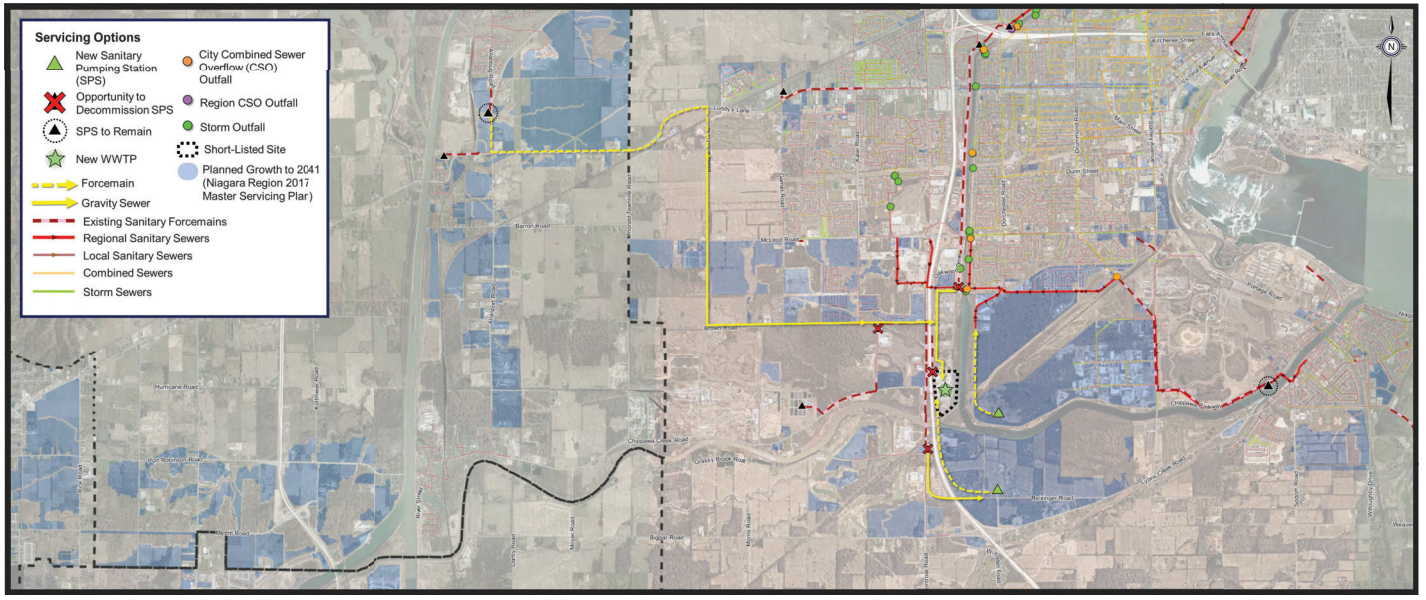
Preferability

Low | Moderate | High | Very High



		Site & Treatment	Outfall Location	Collection Strategy
Criteria	**Sub-Criteria**	**Site 4 – Preferred Site Secondary Treatment**	**Site 4 – Preferred Outfall Hydro Electric Power Canal**	**Site 4 – Preferred Collection Strategy Remove High Lift Pumping Station and no Lyons Creek**
Environmental (25%)	• Environmentally Sensitive Features • Species at Risk • Water Features / Resources • Receiving Waterbody • System Overflows • Physical Environmental Considerations • Climate Change	●	●	◑
Social / Cultural (25%)	• Community Concerns for Residents / Local Businesses / Traffic • Indigenous Communities and Archaeological / Cultural Heritage • Air Quality and Odour • Noise, Vibration and Dust • Current / Planned Land Uses	◔	◑	◑
Legal / Jurisdictional (10%)	• Approvals / Coordination • Land Use Suitability • Land Acquisition • Worker Safety and Operability	◔	◕	◕
Technical (20%)	• Compatibility / Existing and Future Infrastructure • System Security and Level of Service • Traffic Management • Operation and Maintenance	◑	◕	◑
Financial (20%)	• Capital Cost • Lifecycle Cost • Cash Flow / Phasing of Costs • Funding Opportunities	◑	◕	◕

Short List of Alternatives – Site 5



Preferability

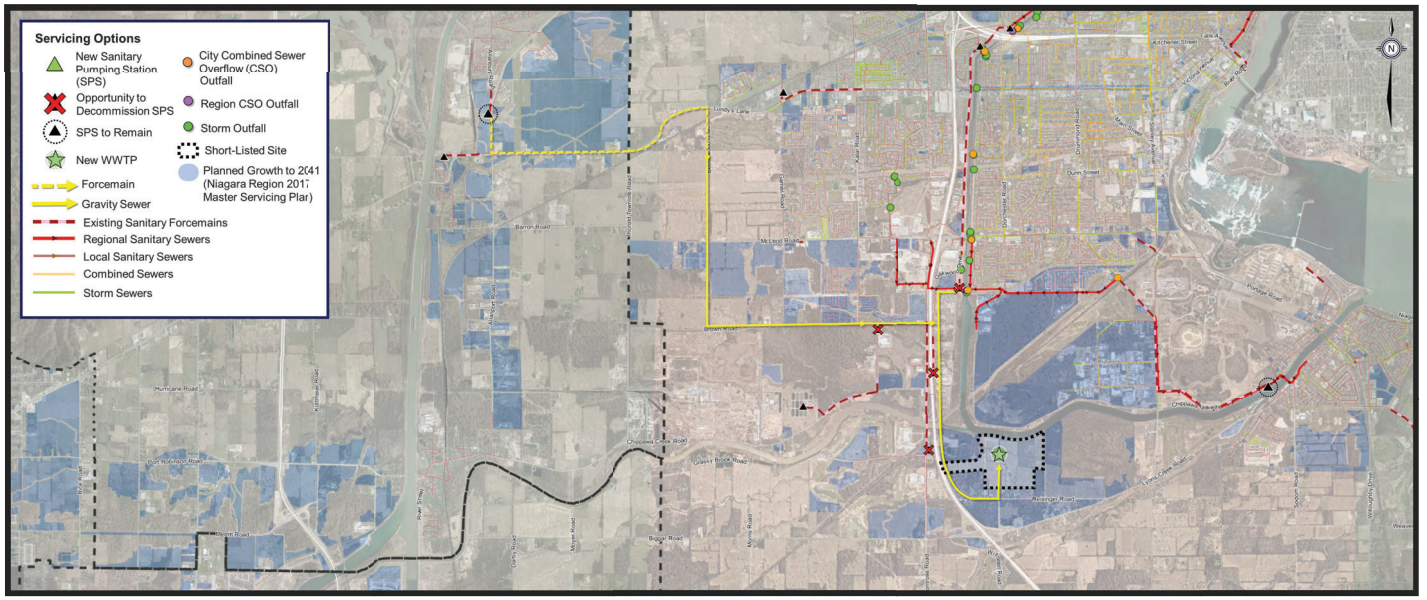
Low | Moderate | High | Very High

		Site & Treatment	Outfall Location	Collection Strategy
Criteria	**Sub-Criteria**	**Site 5 – Preferred Site Secondary Treatment**	**Site 5 – Preferred Outfall Hydro Electric Power Canal**	**Site 5 – Preferred Collection Strategy Remove High Lift Pumping Station and no Lyons Creek**
Environmental (25%)	• Environmentally Sensitive Features • Species at Risk • Water Features / Resources • Receiving Waterbody • System Overflows • Physical Environmental Considerations • Climate Change			
Social / Cultural (25%)	• Community Concerns for Residents / Local Businesses / Traffic • Indigenous Communities and Archaeological / Cultural Heritage • Air Quality and Odour • Noise, Vibration and Dust • Current / Planned Land Uses			
Legal / Jurisdictional (10%)	• Approvals / Coordination • Land Use Suitability • Land Acquisition • Worker Safety and Operability			
Technical (20%)	• Compatibility / Existing and Future Infrastructure • System Security and Level of Service • Traffic Management • Operation and Maintenance			
Financial (20%)	• Capital Cost • Lifecycle Cost • Cash Flow / Phasing of Costs • Funding Opportunities			

Short List of Alternatives – Site 8

Preferability

Low | Moderate | High | Very High



		Site & Treatment	Outfall Location	Collection Strategy
Criteria	**Sub-Criteria**	**Site 8 – Preferred Site Secondary Treatment**	**Site 8 – Preferred Outfall Welland River East (Chippawa Creek)**	**Site 8 – Preferred Collection Strategy Remove High Lift Pumping Station and no Lyons Creek**
Environmental (25%)	• Environmentally Sensitive Features • Species at Risk • Water Features / Resources • Receiving Waterbody • System Overflows • Physical Environmental Considerations • Climate Change	●	◔	●
Social / Cultural (25%)	• Community Concerns for Residents / Local Businesses / Traffic • Indigenous Communities and Archaeological / Cultural Heritage • Air Quality and Odour • Noise, Vibration and Dust • Current / Planned Land Uses	◔	◔	◔
Legal / Jurisdictional (10%)	• Approvals / Coordination • Land Use Suitability • Land Acquisition • Worker Safety and Operability	●	◔	◔
Technical (20%)	• Compatibility / Existing and Future Infrastructure • System Security and Level of Service • Traffic Management • Operation and Maintenance	●	●	●
Financial (20%)	• Capital Cost • Lifecycle Cost • Cash Flow / Phasing of Costs • Funding Opportunities	◔	◔	◑

5.6.5.7 Short List Comparative Evaluation

The comparative evaluation further reviewed the preferred short listed strategies against four key categories: Siting / Treatment, Outfall, Collection Strategy, and Financial Considerations as shown in Table 5-16.

Following the additional inventory, individual scores shown in the previous Figure 5-9 to Figure 5-12 were summed to one overall "solution" score which encompasses the WWTP site, outfall, and collection components.

The results of the 4 short listed servicing solutions scores are presented in Table 5-15.

Table 5-15. Comparative Evaluation Scoring

Criteria	Site 1	Site 4	Site 5	Site 8
Environmental (25%)				
Social / Cultural (25%)				
Legal / Jurisdictional (10%)				
Technical (20%)				
Financial (20%)				
Impact	Least Preferred	Less Preferred	Less Preferred	Preferred

Table 5-16. Comparative Siting Differentiator Evaluation

Site No. 1	Site No. 4	Site No. 5	Site No. 8
Siting / Treatment: • Minor environmental features on the site • Adjacent to existing Biosolids Plant • Furthest removed from core existing and future residential • Low potential for cultural impact • Large area to support siting and flexibility • High potential to buffer odour, air, and noise	**Siting / Treatment:** • Minimal environmental features on the site • Increased property acquisition risk associated with existing and planned commercial developments • Moderate potential for contaminated soil • Low potential for cultural impact • Smaller area limits siting and flexibility • Site closer to residential and commercial uses • Requires increased mitigation to buffer odour, air, and noise	**Siting / Treatment:** • Minimal environmental features on the site • Increased property acquisition risk associated with existing seasonal recreational use and hydro corridor • Moderate potential for contaminated soil • Low potential for cultural impact • Smaller area may limit siting and flexibility • Requires increased mitigation to buffer odour, air, and noise	**Siting / Treatment:** • Minimal environmental features on the site • Low potential for contaminated soil • Good road access for construction and operation • Low potential for cultural impact • Large greenfield area to support siting and flexibility • High potential to buffer odour, air, and noise
Outfall: • Long outfall to Hydro Electric Power Canal • Hydro Electric Power Canal has high flows and favourable mixing conditions • Low potential to impact recreational and waterway use during construction and operation • No impact to Hydro Electric Power Canal during operations • Temporary impact on Hydro Electric Power Canal during construction	**Outfall:** • Short outfall to Hydro Electric Power Canal • Hydro Electric Power Canal has high flows and favourable mixing conditions • Low potential to impact recreational and waterway use during construction and operation • No impact to Hydro Electric Power Canal during operations • Temporary impact on Hydro Electric Power Canal during construction	**Outfall:** • Short outfall to Hydro Electric Power Canal • Hydro Electric Power Canal has high flows and favourable mixing conditions • Low potential to impact recreational and waterway use during construction and operation • No impact to Hydro Electric Power Canal during operations • Temporary impact on Hydro Electric Power Canal during construction	**Outfall:** • Short outfall to Chippawa Creek • Chippawa Creek has high flows and favourable mixing conditions • Low potential to impact recreational and waterway use during operation • No impact to Hydro Electric Power Canal during operations • Temporary impact on Chippawa Creek during construction
Collection Strategy: • Strategy supports existing Sewage Pumping Station decommissioning • Supports Thorold South servicing • Requires additional Sewage Pumping Station and long forcemain strategy for south growth areas • Sewer alignments anticipated in road right-of-way	**Collection Strategy:** • Existing system supports conveyance to this location • Strategy supports existing Sewage Pumping Station decommissioning • Supports Thorold South servicing • Requires additional Sewage Pumping Station and long forcemain strategy for south growth areas • Sewer alignments anticipated in road right-of-way	**Collection Strategy:** • Strategy supports existing Sewage Pumping Station decommissioning • Supports Thorold South servicing • Requires additional Sewage Pumping Station and long forcemain strategy for south growth areas • Sewer alignments anticipated in road right-of-way	**Collection Strategy:** • Deep trunk sewer provides future servicing flexibility • Strategy supports existing Sewage Pumping Station decommissioning • Maximizes gravity servicing of the south growth areas • Deep trunk sewer will require increased tunneling complexity • Supports Thorold South servicing • Sewer alignments anticipated in road right-of-way
Financial Considerations: • Plant construction costs same for all options • Outfall will have elevated construction costs related to length to reach the Hydro Electric Power Canal • Lifecycle costs benefit from Sewage Pumping Station decommissioning • Higher risk associated with future servicing strategy cost • Overall strategy more costly than options 4, 5, and 8	**Financial Considerations:** • Plant construction costs same for all options • Lifecycle costs benefit from Sewage Pumping Station decommissioning • Outfall will have lower construction cost related to shorter length to reach Hydro Electric Power Canal • Higher risk associated with future servicing strategy cost • Overall strategy has similar costs to option 5 but less costly than options 1 and 8	**Financial Considerations:** • Plant construction costs same for all options • Lifecycle costs benefit from Sewage Pumping Station decommissioning • Outfall will have lower construction cost related to shorter length to reach Hydro Electric Power Canal • Higher risk associated with future servicing strategy cost • Overall strategy has similar costs to option 4 but less costly than options 1 and 8	**Financial Considerations:** • Plant construction costs same for all options • Outfall will have elevated construction costs related to water depth • Higher upfront trunk sewer servicing costs • Lifecycle costs benefit from Sewage Pumping Station decommissioning • Lowest risk associated with future servicing strategy cost • Overall strategy more costly than options 4 and 5 but is less costly than option 1

5.7 Preliminary Preferred Solution

The preliminary preferred solution was developed with available and enhanced desktop environmental, social, heritage, and technical information across the study area and related to the identified alternatives. The preliminary preferred solution was also vetted through technical workshops and reviews using the technical experts and thought leaders of the project team as well as staff and stakeholders.

The recommended preliminary preferred solution was: Site 8 – south location, south of Chippawa Creek, with outfall to Chippawa Creek. Site 8 is located at 6811 and 7047 Reixinger Road, Niagara Falls in a location central to future growth that can easily service areas both west and east of the QEW.

The new WWTP outfall will discharge to Chippawa Creek at location near the HEPC and with separation from existing river recreational uses.

The wastewater collection strategy can easily incorporate with the existing system, will provide flexibility for future servicing, will bring capacity to meet peak wet weather flows, and will provide flexibility to decommission several existing sewage pumping stations.

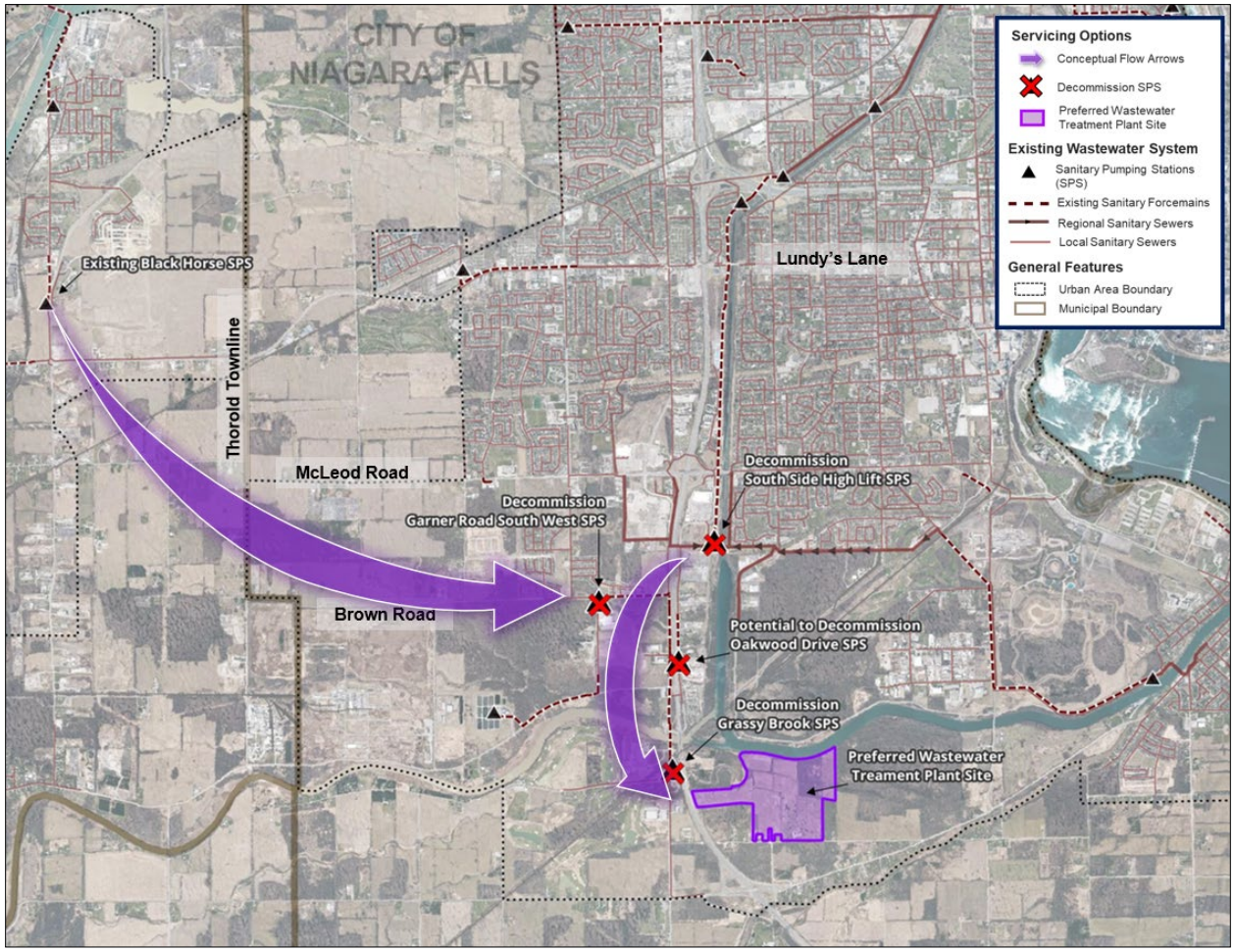
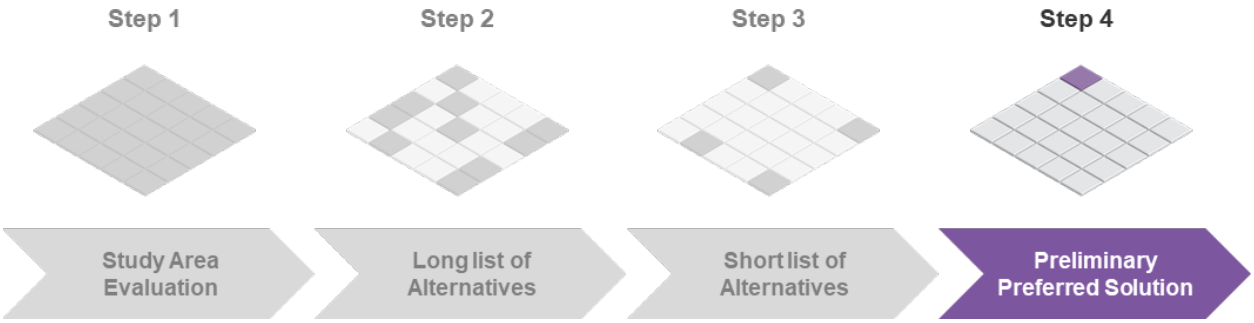


Figure 5-13. Preliminary Preferred Solution

5.8 Development of the Integrated Preferred Solution

The final step of the evaluation process under Phase 2 of the Class EA process, was to further develop the preferred solution including evaluation of the key components of the integrated strategy:

1. The SNF WWTP site and Outfall,
2. The SNF Trunk Sewer, and,
3. Thorold South Servicing.



The preferred solution identified through Steps 1 to 3, is vetted through detailed technical review, and consultation with public, internal stakeholders, and external stakeholders.

The goal of Step 4 was to further develop the integrated strategy including evaluation of alternative alignments for collection system components as well as further document the WWTP site and outfall to support the evaluation of design concepts under Phase 3.

5.8.1 South Niagara Falls Wastewater Treatment Plant and Outfall

The preferred WWTP site is located at 7047 and 6811 Reixinger Road. This site is approximately 160 acres, which is much greater than the required 40 acres to host the plant and related facilities within the site. This allows the Project Team flexibility and adaptability during the Phase 3 Class EA process to refine and select the most appropriate facility layout within the preferred site based on detailed siting investigations ahead of conceptual design.

Figure 5-14. Preliminary Preferred WWTP Site No. 8

The preferred receiving waterbody is Welland River East (Chippawa Creek). The outfall is intended to head north into the waterbody from the new WWTP site. Based on the detailed ACS report which has been updated based on the preferred solution as part of Phase 3, the exact outfall location will be refined and confirmed for conceptual design.

5.8.2 South Niagara Falls Trunk Sewer

The Phase 2 Class EA process confirmed the need for a trunk sewer to connect the existing High Lift SPS catchment area to the new WWTP site located at 6811 Reixinger Road.

Through the evaluation process, consultation with agencies, Indigenous Communities, utilities, regional, and local municipal staff supported the review of alternative trunk sewer alignments.

5.8.2.1 South Niagara Falls Trunk Sewer Alternatives

Three trunk sewer alternative routes were considered as presented in Figure 5-15. The alternatives included trunk sewer alignments that supported the conceptual route from the SSHLPS to the new WWTP site. The trunk sewer alignment alternatives include:

1. OPG Corridor,
2. Oakwood Drive, and,
3. Montrose Road.

5.8.2.2 South Niagara Falls Trunk Sewer Investigations

To support the evaluation process for the SNF trunk sewer alignments, additional field investigations were completed. The list of investigations completed are summarized in Table 5-17. This table includes key next steps and recommendations for each discipline. The complete reports are available for review IN the SNFWWS ESR Volume 3 – Supporting Documents.

5.8.2.3 South Niagara Falls Trunk Sewer Evaluation

All trunk sewer alternative routes underwent a balanced evaluation process to consider environmental, social/cultural, legal/jurisdictional, technical, and financial criteria. Key differentiators between the trunk sewer alternatives are presented in Table 5-18.

The preferred trunk sewer provides:

1. Greatest ability to decommission multiple SPSs,
2. Ability to stay within exiting rights-of-way, limiting the need to purpose private property,
3. Greater setbacks from MTO rights-of-way, and,
4. Better ability for connection of growth areas in the southwest limits of Niagara Falls.

The detailed trunk sewer evaluation is available in Appendix V2.4.

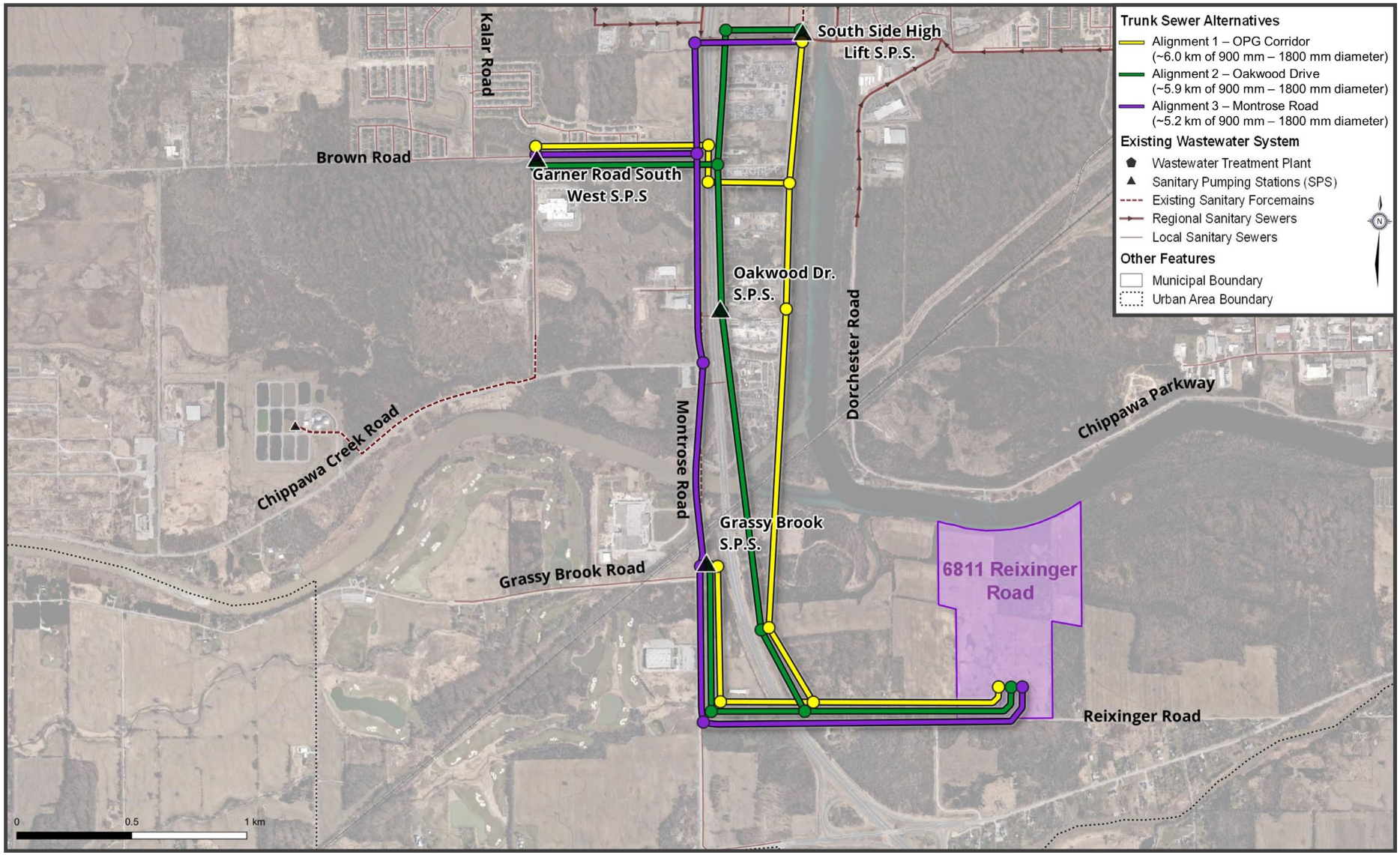
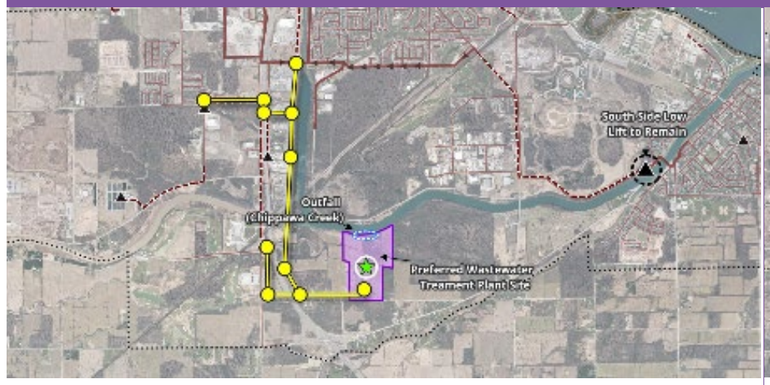


Figure 5-15. Trunk Sewer Alternatives

Table 5-17. New SNF Trunk Sewer Field Investigations

Trunk Sewer Investigations	Purpose	Report(s)	Findings / Recommendations
Natural Environment	• Avoid/minimize impacts to sensitive features (i.e., wetlands, protect woodlots, etc.) at shaft locations and during construction • Mitigate impact at Welland River crossing	• Impact Assessment	• The trunk sewer alignment resides within the existing disturbed road right-of-way limiting impact to the surrounding natural environment. • The shaft locations are located outside the right-of-way and noted as potential nesting habitat/potential for species at risk features. The shaft locations are also within proximity to provincially significant wetlands (35-110m). • The trunk sewer will be tunneled under Lyon's Creek and Welland River reducing impact to water features. • The alignment is within NPCA regulated limits and may require a permit for development.
Environmental Site Assessment (ESA)	• Avoid known sources of contamination (soil or groundwater)	• Phase 1 ESA • Phase 2 ESA	• Phase 1 ESA inventory search identified areas of potential environmental concern with respect to a nearby property having a diesel fuel aboveground storage fuel tank, the presence of diesel and liquid fuel ASTs, the industrial land use (railway) that crosses Montrose Road, and commercial/industrial properties • The Phase 2 ESA investigation program included ten (10) drilled boreholes and installation of two (2) ground water monitoring wells to determine site characteristics and contaminant of potential concern. • No exceedances were identified in any of the soil samples from the boreholes drilled for this investigation. • Exceedances of the Table 1 SCS for metals were identified at both monitoring wells, while only BH-P01 exceeded the Table 2 SCS (for uranium). • There were no exceedances of the Table 1 or Table 2 SCS for PHCs or VOCs.
Archaeological Assessment (AA)	• Avoid/mitigate on-land impacts at shaft locations or along alignment	• Stage 1 AA	• The trunk sewer alignment resides within the existing disturbed road right-of-way. The preferred construction methods include tunnelling at a depth where impacts are not anticipated at the Welland River crossing. No further archaeological work is anticipated for the trunk sewer alignment. • A Stage 2 Archaeological Assessment may be required for supporting shaft locations as confirmed through Detailed Design and prior to construction. Level of archaeological investigations regarding confirmed construction sites will be determined through Detailed Design.
Cultural Heritage	• Confirm any significance at shaft locations or along trunk sewer alignment to remove/mitigate impact	• Cultural Heritage Assessment Report (CHAR)	• During the cultural heritage screening process, ten (10) potential and protected heritage properties were identified within the Montrose Road trunk sewer study area. • Based on the preferred trunk sewer alignment and preliminary preferred shaft locations, potential indirect impacts were identified to one (1) Provincial Heritage Property of Provincial Significance (CHR – Sir Adam Beck Generating Station Power Canal). Shaft location #1 to be contained within 7606 Montrose Road to avoid associated impact. If encroachment is required beyond site boundary, consultation with OPG is required prior to construction. • Post-construction landscaping recommended to return the landscape to pre-construction conditions. • Recommendation to identify CHR2, CHR6-CHR9 on construction mapping for awareness and impact avoidance.
Geotechnical and Hydrogeological	• Confirm solution meets technical needs through subsurface (soil, bedrock, and groundwater) investigations	• Preliminary Investigations	• Borehole investigations were completed along the preferred trunk sewer alignment. The proposed trunk sewer will mainly be installed using trenchless technology. • The information provided by borehole BH20-1 to BH20-5 and BH20-9 indicated that within the proposed trunk sewer alignment, the soils mainly consist of very soft to firm silty clay and the soil will be hard silty clay or dense to very dense cohesionless deposit at alignment with the location of borehole BH20-6 to BH20-9 obstructions such as boulders/cobbles in the dense to very dense cohesionless deposit should be expected.

Table 5-18. Trunk Sewer Alternatives Evaluation

Option 1 OPG Corridor	Option 2 Oakwood Drive	Option 3 Montrose Road
		
• Increased environmental impact with proximity to Hydro Canal (north alignment) and construction through Grassy Brook Park (south alignment). • Requires significant water crossing of the Welland River and rail line to reach WWTP site. • Construction minimized within road right-of-way (ROW) reducing traffic impacts and local disruption. • Sewer length: approximately 6 kilometres of 900 mm to 1800 mm diameter Tunnelled sewer (longest alternative). • Shaft locations: 11 – 12 Total (including inlet Pumping Station). • Preliminary cost estimates (consistent for all alternatives): Each shaft ranges from $10,000 – 12,000/m and tunnelled sewers from $7,000 - $11,000 per metre. • No conflicts with Ministry of Transportation Ontario (MTO) setbacks. • Minimal conflicts with existing utilities. • Most expensive alternative.	• Moderate environmental impact with south crossing of Grassy Brook Park to reach WWTP site. North alignments have minimal impact within road ROW. • Requires local road closure of Oakwood Drive for construction. • Sewer length: approximately 5.9 kilometres of 900 mm to 1800 mm diameter Tunnelled sewer. • Shaft locations: 9 – 10 Total (including inlet PS). • Potential conflicts with overhead hydro and existing utilities along Oakwood Drive. • Significant section of Oakwood Drive encroaches with MTO's required setback. • Crossing near Oakwood Drive and new bridge structure – outside of MTO's preferred 14 metre setback from property line. • Additional sewer along Montrose from Grassy Brook SPS is required to service future growth and hospital needs. • Second-most expensive alternative.	• Majority of alignment will be constructed within existing Road ROW limiting the need to purchase additional properties. • Traffic control will be required along Montrose Road (more businesses and traffic compared to Oakwood Drive). • No conflict with MTO. • Sewer length: approximately 5.2 kilometres of 900 mm to 1800 mm diameter Tunnelled sewer (shortest alternative). • Shaft locations: 8 – 9 Total (including inlet PS). • Welland River crossing drives depth at Reixinger with opportunity to provide gravity sewer solution. • Right-of-way has conflicting underground and overhead utilities that requires more coordination with stakeholders. • Provides deep connections at Chippawa Creek Road and Blackburn Parkway to accommodate future growth. • Least expensive alternative.
Least Preferred	**Less Preferred**	**Preferred**

5.8.2.4 SNF Trunk Sewer Preferred Alignment

Based on the evaluation process, Montrose Road was selected as the preferred alignment for the SNF Trunk Sewer. The new SNF Trunk Sewer will run from the existing SSHLPS, west across the QEW to Montrose Road (south of Canadian Drive) and then south along Montrose Road to Reixinger Road, east again crossing the QEW and discharging to the inlet pumping station of the new SNF WWTP. A sewer branch along Brown Road from the Garner Road SPS (at Brown Road and Heartland Forest Road) will connect to the new SNF Trunk Sewer at Montrose Road. The new SNF Trunk Sewer alignment is shown in Figure 5-16.

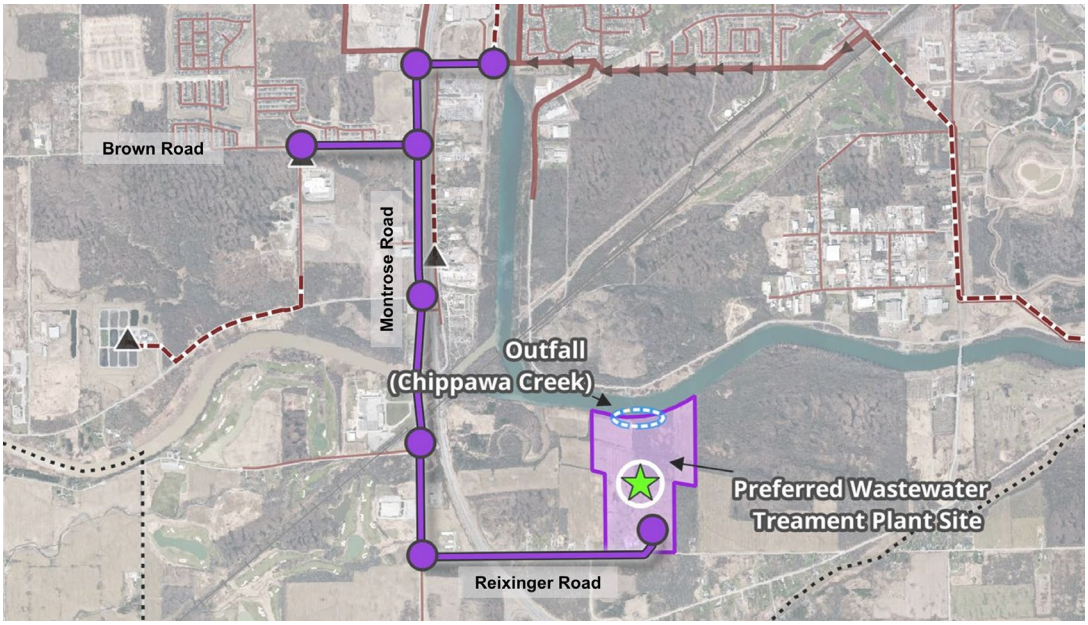


Figure 5-16. The New SNF Trunk Sewer Alignment along Montrose Road

The new SNF Trunk Sewer will receive flows from Southwest Niagara Falls and South Thorold, and ultimately Chippawa and other growth areas located in Niagara Falls and Thorold. At commissioning, the new SNF Trunk Sewer will service existing development in the area as well as the proposed South Niagara Hospital and new development in the Grand Niagara Secondary Plan and Grassy Brook Secondary Plan areas. After commissioning of the sewer, the following pumping stations can be decommissioned:

- South Side High Lift SPS (SSHLPS),
- Garner Road SPS, and
- Grassy Brook SPS.

The new SNF Trunk Sewer will also provide for future opportunity to decommission the Oakwood Drive SPS with a new sewer connection from the sewers upstream of the Oakwood Drive SPS, across the QEW outletting into the Montrose Sewer at Chippawa Creek Road. The cost-benefit to decommission Oakwood Drive does not immediately warrant the costly QEW crossing to connect into the new SNF Trunk Sewer.

5.8.3 Thorold South Servicing

The Phase 2 Class EA process confirmed the need for Thorold South Servicing to form an integral part of the collection system strategy. Flows from the existing service area as well as future service areas will need to be directed to the SNF trunk infrastructure and ultimately to the new WWTP site located at 6811 Reixinger Road.

Through the evaluation process, consultation with agencies, Indigenous Communities, utilities, regional, and local municipal staff supported the review of alternative SPS sites and trunk sewer alignments.

5.8.3.1 Alternative Black Horse SPS Sites

The Thorold South servicing solution requires a new Black Horse SPS to capture and redirect existing flows from Peel Street SPS to the new SNF WWTP. This new Black Horse SPS solution will be designed to accommodate long term servicing needs.

Four alternative Black Horse SPS sites were identified as shown in Figure 5-17 and are described below:

1. South of existing fire hall (701 Allanburg Road),
2. Infrastructure Ontario (IO) Lands (south site along Upper's Lane),
3. South Thorold Site (2468 Davis Road, Thorold), and,
4. Existing Black Horse SPS Site (2525 Davis Road, Thorold).

Figure 5-17. Alternative Black Horse SPS Sites

These alternatives sites underwent the evaluation supported with field investigation results and consideration against the study's established environmental, social/cultural, technical, legal / jurisdictional, and financial criteria. A summary of the Black Horse SPS site evaluation is presented in Table 5-19.

Table 5-19. Black Horse SPS Site Alternatives

Option 1 South of Existing Fire Hall (701 Allanburg, Thorold)	Option 2 Infrastructure Ontario Lands (south site along Upper's Lane)	Option 3 South Thorold Site (2468 Davis Road, Thorold)	Option 4 Existing Black Horse SPS Site (2525 Davis Road, Thorold)
Opportunities • Site is previously disturbed and identified for industrial land use. • Construction will not require any road closures and disruption impacts will be limited. • Available area to be purchased can accommodate approximate 50 m x 40 m site to meet Region standards. • Available site area sufficient to accommodate wet well / dry pit style SPS with exterior valve chamber, upstream manholes for inletting sewers, standby genset and driveway with parking and truck turnaround area. • North and south local sewers along Highway 58 outletting to exiting Black Horse SPS can be modified to discharge to new SPS location, with extensions of the south sewer along the Highway 58 ROW (with crossing to SPS). • Direct route for Peel Street SPS forcemain to run along Allanburg Road and outlet to station via new upstream gravity sewer. • Industrial area property purchase costs. **Constraints:** • Restricted access to lands (entrance coordinated with fire station entrance, with minimum separation distance from Allanburg Road and Highway 58 intersection). • Potential for deep wet well (up to 15 metres deep) may require dewatering / rock excavation. • Tree removals and replanting and potential permit and approval needs. • Relocation of overhead hydro will require approval and permits. • Forcemain easements parallel to Highway 58 (north of Highway 20 required).	**Opportunities:** • Available area to be purchased can accommodate approximate 50 m x 40 m site to meet Region standards. • Available site area sufficient to accommodate wet well / dry pit style SPS with exterior valve chamber, upstream manholes for inletting sewers, standby genset and driveway with parking and truck turnaround area. • Proposed upstream Peel Street forcemain and gravity sewers and proposed outlet forcemain all to run within existing and future ROWs. • North and south local sewers along Highway 58 outletting to exiting Black Horse SPS can be modified to discharge to new SPS location. **Constraints:** • Proposed site area previously disturbed however identified for residential land use / development. • Surrounding area is Greenfield Residential Land Use within area of Rolling Meadows Residential Development. • Construction of development ongoing and disruption impacts of SPS construction will be similar to ongoing residential construction. • Lands are desired for residential development as part of Rolling Acres Secondary Plan development, and SPS site will limit residential development in area – and SPS is less desirable in residential area (potential for noise and odour concerns). • Potential for deep wet well (greater than 15 metres deep to accommodate extension to existing sewers from south) may require dewatering / rock excavation. • Higher residential area property costs. • Forcemain easements along Highway 58 to Highway 20 required.	**Opportunities:** • Available area to be purchased can accommodate approximate 50 m x 40 m site to meet Region standards. • Available site area sufficient to accommodate wet well / dry pit style SPS with exterior valve chamber, upstream manholes for inletting sewers, standby genset and driveway with parking and truck turnaround area. • North and south local sewers along Highway 58 outletting to exiting Black Horse SPS can be modified to discharge to new SPS location. **Constraints:** • Proposed site area previously disturbed however identified for residential land use / development. • Surrounding area is Greenfield Residential Land Use within area of Rolling Meadows Residential Development. • Construction of development ongoing and disruption impacts of SPS construction will be similar to ongoing residential construction. • Lands can be allocated for residential development as part of Rolling Acres Secondary Plan development, and SPS site will limit residential development in area – and SPS is less desirable in residential area (potential for noise and odour concerns). • Existing site located within potential MTO Highway 58 future widening / expansion area. • Any upgrades to entrance onto Highway 58 / Davis Road will require MTO consultation and approval. • New downstream forcemain will require dedicated easement through Rolling Meadows development lands to avoid construction within MTO-owned Highway 58. • Higher residential area property costs. • Forcemain easements along Highway 58 to Highway 20 required.	**Opportunities:** • Existing SPS site can be utilized. • Site location within Industrial land use area. • Construction would not require road closures and disruption impacts will be limited to immediate area. • Available site area sufficient to accommodate wet well / dry pit style SPS with exterior valve chamber, upstream manholes for inletting sewers, upgraded standby genset and driveway with parking and truck turnaround area. • Existing site area is approximately 40mx40m and can accommodate new station to be constructed offline. • North and south local sewers along Highway 58 outletting to exiting Black Horse SPS do not need to be modified to discharge to new SPS location. **Constraints:** • Existing Black Horse SPS site is located within the NPCA Regulated Wetland Allowance. Proposed construction will require conservation authority approval. • Existing site located within potential MTO Highway 58 future widening / expansion area. • Any upgrades to entrance onto Highway 58 / Davis Road will require MTO consultation and approval. • Potential for deep wet well (up to 15 metres deep) near watercourse likely to require watertight shoring or significant dewatering. • Direct route for Peel Street SPS forcemain to run along Allanburg Road and outlet to station via new upstream gravity sewer to be constructed within new dedicated easement outside of MTO (Highway 58) ROW and setbacks. • Increased costs to install underground works with enhanced watertight shoring / dewatering requirements likely.
Preferred	**Less Preferred**	**Less Preferred**	**Least Preferred**

5.8.3.2 Thorold South Servicing Linear Alternatives

Five sewer alternative routes were considered as presented in Figure 5-18.

The alternatives included sewer servicing alignments that supported the conceptual route from the Black Horse SPS in Thorold South to the new SNF Trunk Sewer. The sewer alignment alternatives were:

- Turner Road,
- Barron Road,
- Chippawa Creek Road,
- Beechwood Road, and,
- Garner Road.

5.8.3.3 Thorold South Servicing Investigations

To support the evaluation process for the Thorold South Servicing infrastructure sites and alignments, additional field investigations were completed. These investigations covered:

- Natural Environment,
- Stage 1 and 2 Archaeological Assessment, and,
- Cultural Heritage.

A summary of the additional supporting investigations for Thorold South Servicing are presented in Table 5-20. This includes key next steps and recommendations for each discipline. Complete reports are available in the SNFWWS ESR Volume 3 – Supporting Documents.

5.8.3.4 Thorold South Servicing Linear Evaluation

All Thorold South sewer servicing alternative routes underwent a balanced evaluation process to consider environmental, social/cultural, legal/jurisdictional, technical, and financial criteria.

Key differentiators between the Thorold South servicing alternatives are presented in Table 5-21.

The detailed Thorold South Servicing evaluation is available in Appendix V2.5.

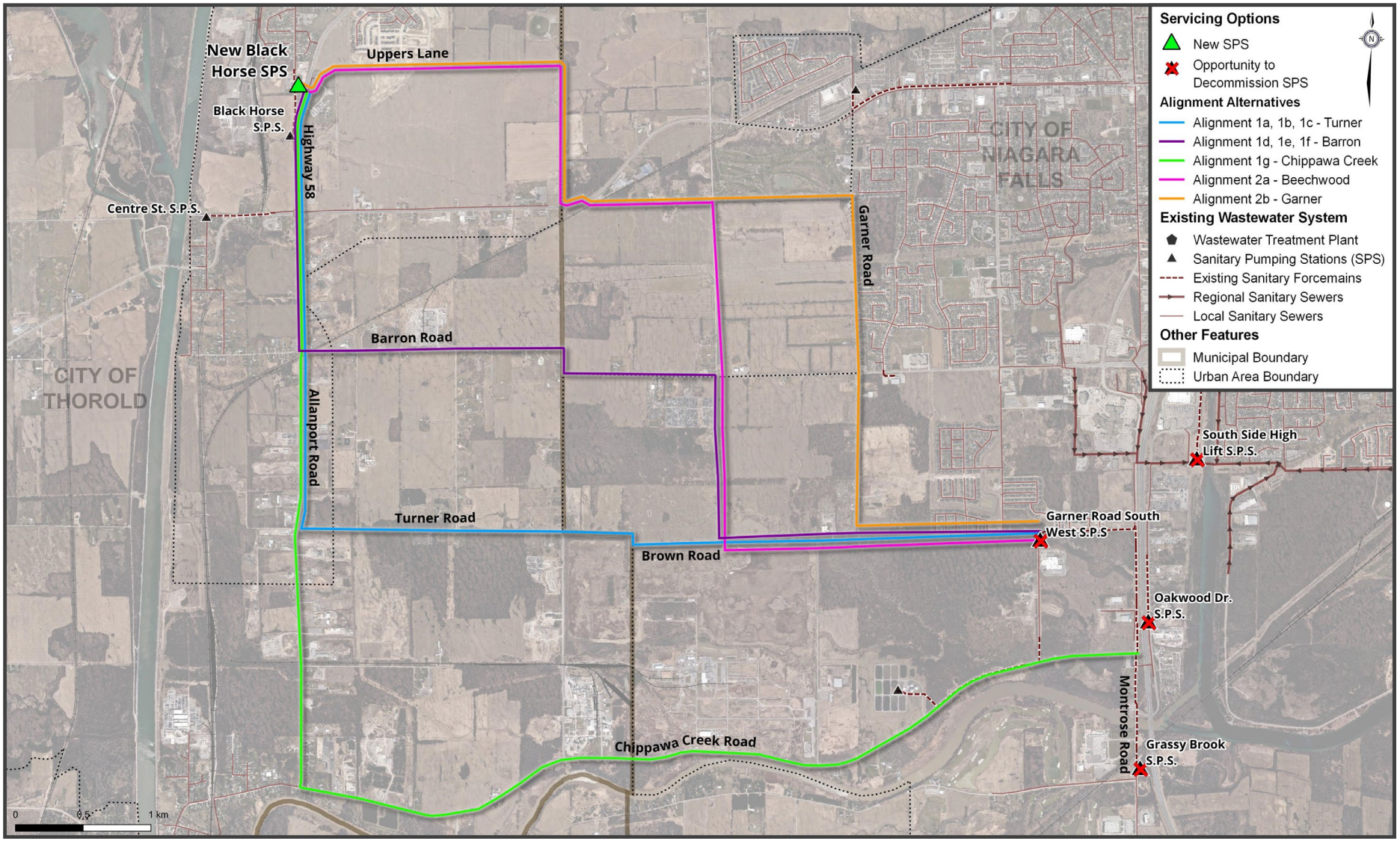
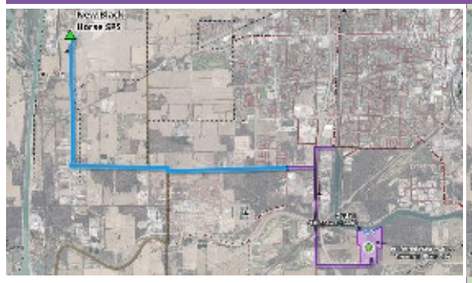
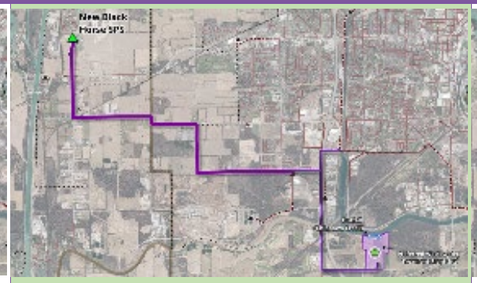
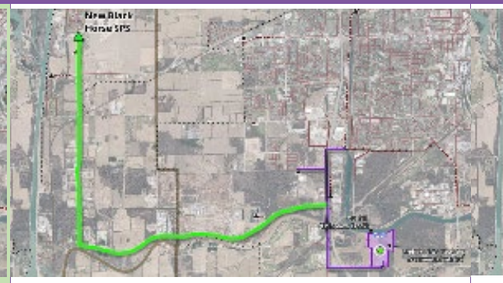
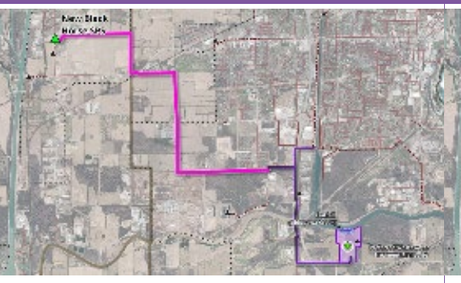
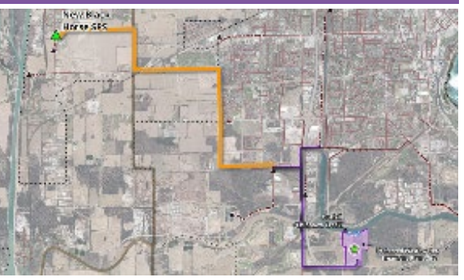


Figure 5-18. Thorold South Servicing Alternatives

Table 5-20. Thorold South Supporting Investigations

Thorold South Sewer Investigations	Purpose	Report(s)	Findings and Recommendations
Natural Environment	Avoid/mitigate impacts to sensitive features (i.e., significant wetlands, protect woodlands, etc.) at new SPS site, shaft locations and sewer alignments (outside of road right-of-way).	• Screening Review	• Inventory collected for servicing alignment alternatives. The preferred alignment will be constructed primarily within the previously disturbed road right-of-way (ROW) minimizing environmental impact. • There are NPCA regulated watercourse crossings at the location of the existing Black Horse SPS as well as Allanport Road, south of Highway 20 (Lundy's Lane) and smaller tributary crossings along McLeod Road. Work will require permitted crossings with construction to be confined to the ROW. • There are additional NPCA floodplain and wetland allowances through Beechwood Road and Brown Road sections and works will require permitted crossings with construction to be confined to the ROW. • The preferred new Black Horse SPS at 701 Allanburg Road is open space and has avoidable environmentally sensitive features. • Construction methodologies for the SPS connection will be determined in detailed design to avoid or minimize environmental features where possible. Consultation will continue with NPCA to confirm all construction details.
Archaeological Assessment (AA)	Avoid / mitigate on-land impacts if identified at new SPS site or outside road ROW.	• Stage 1 AA • Stage 2 AA (new SPS site only)	• Stage 1 AA recommended further investigations to confirm potential based on registered archaeological inventory within 1km of the Thorold South servicing strategy study area. • Stage 2 AA was completed on the new Black Horse SPS siting area (701 Allanburg Road). No archaeological resources were identified within the Stage 2 Study Area, therefore requires no further assessments. • During detailed design, additional assessments may be required along the Thorold servicing alignment if outside of the existing right-of-way or if located outside the cleared SPS siting area. A Stage 2 AA is anticipated for the section of proposed forcemain to be located within a new easement, west of Highway 8 (Davis Road).
Cultural Heritage	Confirm any significance along sewer alignment to remove / mitigate impact.	• Cultural Heritage Assessment Report (CHAR)	• CHAR was completed on the preferred new Black Horse SPS site and Thorold South alignment. • Eight (8) potential heritage properties were identified within the alignment study area: three within the City of Niagara Falls (CHR1-CHR3) and four within the City of Thorold (CHR4-CHR7). • There is potential for indirect impacts to four potential heritage properties (CHR1, CHR3, CHR5, and CHR7) due to nearby land disturbance. • A vibration monitoring plan is recommended during the construction phase of the project. Tunnelled construction methodologies can further minimize potential for impacts.
Geotechnical and Hydrogeological	Ensure sewer solution meets technical constructability needs (tunnelled or open-cut alternatives) through subsurface (soil, bedrock, and groundwater) investigations.	• Preliminary Assessment	• Review of geotechnical and hydrogeological inventory was reviewed for the alternative Thorold alignments. • Following subsurface investigations for the trunk sewer and WWTP site, soil conditions appear prevent across the South Niagara Falls area. • Further subsurface geotechnical and hydrogeological investigations will be completed during detailed design to confirm construction techniques.
Growth and Flow Projections	Confirm strategy with Cities of Niagara Falls and Thorold to support future anticipated servicing needs.	• Technical Memoranda • Baseline Assessment	• Anticipated future growth and flow projections require sewer servicing in Thorold South. • The servicing strategy will provide ability to capture existing flows from Peel Street SPS to the new Black Horse SPS location. The SPSs will be directed to the new SNF WWTP.

Table 5-21. Thorold South Servicing Alternatives Evaluation

Option 1A/B/C Turner Road	Option 1D/E/F Barron Road	Option 1G Chippawa Creek Road	Option 2A Beechwood	Option 2B Garner
				
Opportunities: • Supports servicing existing and future land use south of Lundy's Lane. • Brown Road alignment supports future servicing areas in Niagara Falls. **Constraints:** • Most significant impact to environmental features (Provincially Significant Wetland and additional creek crossings). • Alternative requires additional environmental approvals. If approved, would require significant mitigation on Turner Road. • Additional easement and forcemain costs. • Requires Highway 58 servicing easement. • Requires longer alignment and longer deep trunk on Turner Road.	**Opportunities:** • No major environmental impact. • Avoids wetland approval requirements. • Facilitates servicing of existing and future land use south of Lundy's Lane. • Brown Road alignment supports future servicing areas in Niagara Falls. • Deep sewer along Barron Road supports future servicing. **Constraints:** • Shallow Barron Road sewer reduces gravity servicing of Allanport South area. • Additional easement costs. • Requires Highway 58 servicing easement. • Forcemain requires air release and drain. • Requires longer alignment and longer deep trunk on Turner Road.	**Opportunities:** • Supports servicing existing and future land use south of Lundy's Lane and near Port Robinson. **Constraints:** • Potential environmental impact with proximity to Welland River. • Chippawa Creek Road provides minimal servicing benefits to Niagara Falls areas. • Requires Highway 58 servicing easement. • Forcemain will require air release and drain • Additional easement costs. • Requires longer alignment and longer trunk on Chippawa Creek Road (increased risk of dewatering). • Higher costs.	**Opportunities:** • No major environmental impact. • Beechwood alignment facilitates future servicing for areas of Niagara Falls. • Brown Road alignment and depth supports future servicing for south limits of Thorold South. • Alignment is mostly greenfield and rural road construction. • Direct and shorter alignment route. **Constraints:** • Does not benefit servicing Allanport Road area in Thorold South. • Requires coordination of Uppers Lane alignment and Lundy Lane crossing.	**Opportunities:** • No major environmental impact. • Garner Road alignment supports future Niagara Falls servicing. • Alignment is mostly greenfield and rural road construction. • Direct and shorter alignment route. **Constraints:** • Does not benefit servicing Allanport Road area in Thorold South. • Requires construction along recently serviced and paved Garner Road. • Infrastructure and urban conflicts present on Garner Road. • Brown Road alignment is less supportive for future servicing. • Requires advanced coordination for Uppers Lane alignment and Lundy Lane crossing.
Least Preferred	**Preferred**	**Least Preferred**	**Less Preferred**	**Less Preferred**

5.8.3.5 Thorold South Servicing Preferred Strategy

The preferred strategy for the Thorold South Servicing is consistent with the original strategy identified in the Region's 2016 Water and Wastewater Master Plan. The Black Horse SPS site and conveyance infrastructure alignments have been updated based on the Class EA evaluation.

The new Black Horse SPS will receive flows from the existing Peel Street SPS via a new north-to-south forcemain/gravity sewer through the Allanburg area.

The proposed new Black Horse SPS will be located on lands south of the Thorold Fire Station (located at 701 Allanburg Road). The proposed pumping station will pump flows south via a new forcemain parallel to Highway 58 / Allanburg Road, crossing Highway 20 / Lundy's Lane, along Allanport Road to Barron Road and discharge into a new trunk sewer that will cross under existing CN corridor and follow Barron Road to Thorold Townline Road, south along Thorold Townline Road to McLeod Road, east to Beechwood Road and then south along Beechwood Road to Brown Road where the sewer will run east and outlet into the proposed SNF Trunk Sewer at the Shaft 8 manhole (located at Brown Road and Garner Road).

The Thorold South Trunk Sewer will also provide for future opportunity to convey flows from the Allanport growth area in South Thorold as well as future development in Southwest Niagara Falls. At this time, it is not contemplated to service the Port Robinson area in Thorold from the new Thorold South and SNF trunk infrastructure primarily due to gravity servicing limitations. However, should a new sewage pumping station be introduced in the Port Robinson area, conveyance through the new Thorold South and SNF infrastructure could be considered.

The Thorold South Servicing alignment is shown in Figure 5-19.

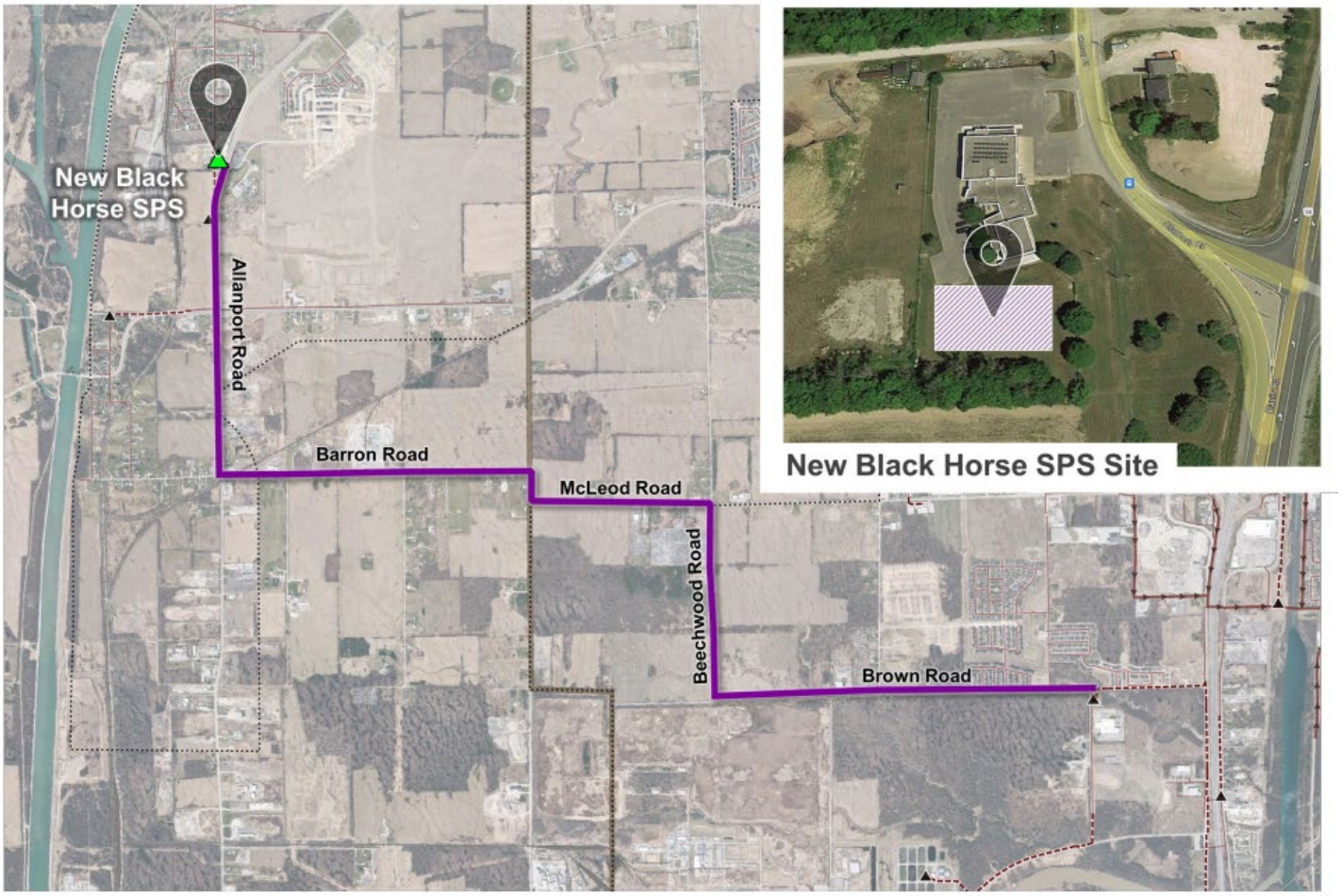


Figure 5-19. Thorold South Servicing (New Black Horse SPS, Forcemain and Trunk Sewer)

6.0 Evaluation of Design Concepts

The Phase 3 Class EA process examined various ways of designing and implementing the preferred solution. The Phase 3 process identified what the solution would look like as well as presented the potential impacts for alternative design concepts. The methodology used to evaluate the alternatives of each design component was founded on the key decision-making principles of the Class EA process, considering environmental, social/cultural, technical, legal/jurisdictional, and financial criteria. Field investigations were completed to determine feasibility of facility construction to minimize/remove potential impacts.

Design concept alternatives were developed and evaluated for the SNFWWS program components as follows:

- The new SNF WWTP and outfall,
- The new SNF Trunk sewer including alignment and preliminary shaft locations, and,
- The Thorold South Servicing including forcemain and sewer alignments and the new Black Horse SPS.

6.1 SNF WWTP Site and Outfall

The Phase 2 preferred solution for the SNF WWTP was site 8, comprising two properties 6811 and 7047 Reixinger Road, Niagara Falls, with the plant outfall discharge to the Welland River East (Chippawa Creek).

Figure 6-1. Phase 2 Preferred WWTP Site (Site No. 8)

Under Phase 3 of the Class EA process, evaluation and refinement of the SNF WWTP facility location within site 8 was required. Similarly, additional evaluation of the outfall location and construction methodology was required.

6.1.1 Supporting WWTP and Outfall Investigations

Field investigations were completed on the preferred WWTP site and Chippawa Creek shoreline to support the evaluation of alternative facility layouts and outfall alignments. The following investigations documents are available in the SNFWWS ESR Volume 3.

- Natural Environment Assessment (Appendix V3.1)
- Archaeological Assessments (Appendix V3.2)
- Cultural Heritage Assessments (Appendix V3.3)
- Contamination Review (Appendix V3.4)
- Assimilative Capacity Studies (Appendix V3.5)
- Air, Odour, and Noise Assessments (Appendix V3.6)
- Planning (Appendix V3.7)
- Agricultural Screening (Appendix V3.8)
- Geotechnical Investigations (Appendix V3.9)
- Hydrogeological Investigations (Appendix V3.10)
- WWTP Design Basis (Appendix V3.11)

Key results and recommendations for the preferred WWTP site and outfall are summarized below and detailed in Table 6-1:

Stage 1 and 2 Archaeological Assessment (terrestrial) – Appendix V3.2.3

Completed on full 7047 Reixinger Road and portions of 6811 Reixinger Road. Field investigations identified sensitive archaeological features in the northern areas of these properties. Proposed sub-surface disturbance in these features (or defined setbacks) would require further consultation and agreements with respective Indigenous Communities and Agencies. No further investigations are required for the southern portion of 7047 Reixinger Road. Southern portions of 6811 Reixinger Road have been cleared from further investigations, however due to unfavourable seasonal weather, Stage 2 investigations will continue on the remaining areas during detailed design when field conditions improve.

Stage 1 Archaeological Assessment (marine) – Appendix V3.2.2

Completed on the shoreline of 7047 and 6811 Reixinger Road. No further investigations are required. Consultation will continue with respective Indigenous Communities and Agencies during detailed design and outfall construction as required.

Natural Environmental Assessment – Appendix V3.1.2

Completed on 7047 and 6811 Reixinger Road. Sensitive features were noted within the greater site where impact can be avoided/minimize through alternative facility layouts. The Region will continue consultation with NPCA during detailed design to ensure construction will minimize or avoid potential impact(s) where possible. Any impact will be discussed on a case-by-case basis.

Phase 1 and 2 Environmental Site Assessment – Appendix V3.4.3, V3.4.4

Completed on 7047 and 6811 Reixinger Road. Recommendations included due diligence risk assessment to assess risk associated with soil and/or ground water exceedances of the Table 1 or 2 SCS to outline mitigation measures. Dewatering activities were also recommended during construction. Ground water monitoring wells are to be maintained or abandoned in accordance with *O.Reg 903 Section 21(3)*. Recommendations indicate no constraints or impediments moving forward with construction on the preferred WWTP site.

Detailed Assimilative Capacity Study (ACS) – Appendix V3.5.3

Completed on Chippawa Creek. In general, the variations in the Chippawa Creek flow and effluent flow rate are not expected to noticeably affect the performance of the outfall design. On July 20, 2020 the Region received provisional acceptance on the submitted ACS effluent criteria pending minor revisions. All revisions were incorporated and submitted with the final ESR. The WWTP facility design will ensure compliance with the approved ACS.

Cultural Heritage Assessment – Appendix V3.3.2, V3.3.3

Completed on 7047 and 6811 Reixinger Road. Potential for cultural significance on the farmhouse and barn were flagged early (exceeding 40+ years old structures) and were formally evaluated and assessed by cultural heritage specialists. No further investigations were recommended. Report findings were submitted to MHSTCI for comment in Spring 2022.

Agricultural Screening – Appendix V3.8.1

Completed on 7047 and 6811 Reixinger Road. Study conducted a review of existing land use, potential agricultural significance, and future land use designations through the City's Official Plan. With the holistic site understanding of historic and future land use designated as resort commercial, the potential for agricultural impact was removed. No further investigations are anticipated.

Geotechnical and Hydrogeological – Appendix V3.9.2, V3.10.1

Borehole program completed on 6811 Reixinger Road (following preferred site layout evaluation). The geotechnical conditions on the WWTP site were reported as suitable to support the building and chambers on H-piles. Further field investigations will be completed through detailed design with confirmed design elements.

Air, Odour and Noise Impact Assessments – Appendix V3.6.1

Completed on 6811 Reixinger Road (following preferred site layout evaluation). The results indicated that maximum cumulative concentrations are below the relevant assessment levels. Predictive noise modelling also indicated that the Project is expected to meet MECP sound level limits at the identified representative PORs. The predicted change in noise levels resulted in a 'negligible' magnitude rating, and therefore no adverse noise effects are expected. As the Project is not yet constructed, the inputs into the modelling have been prepared using published emission factors and data for similar wastewater treatment plants in Ontario.

Topographic Survey

Completed on 6811 Reixinger Road. The results mapped physical properties of the preferred WWTP site to support conceptual design elements.

Table 6-1. Preferred WWTP Site and Outfall Investigations

WWTP Site and Outfall Phase 3 Investigations	Purpose	Report(s)	Key Finding(s)
Archaeological Assessment (AA)	Avoid/mitigate on-land or in-water findings or impacts during site and outfall construction	• Stage 1 AA – Long List WWTP Sites • Stage 1 AA (Marine) – Preferred Outfall Location • Stage 2 AA (completed on Preferred WWTP Site: 7047 Reixinger Road and portions of 6811 Reixinger Road)	• Stage 2 AA was previously completed in 2015 for 7047 Reixinger Road and was used to support the EA investigations. Significant findings on northern portions of the site, however the south portions were cleared of potential and require no further investigations. • Stage 2 AA completed on portions of 6811 Reixinger Road. Significant findings present on northern portion of the site. This will likely require the outfall alignment to complete Stage 3 AA. Areas have been cleared on southern portions of the site but due to seasonal weather conditions, investigations are pending completion during detailed design. There is a low potential for findings due to site being used for farming historically and surrounding property inventory of 7047 Reixinger Road. • Stage 1 marine AA was completed on Chippawa shoreline of 7047 and 6811 Reixinger Road. Potential for archaeological significance was removed and no further investigations were recommended.
Agricultural	Confirm existing and future land use to remove/mitigate potential agricultural impact	• Screening Assessment – Short List WWTP Sites	• An agricultural screening assessment was completed on the preferred WWTP site. It was determined that development within the preferred site will not impact the Agricultural Land Base (prime agricultural area) as these lands are already located within the urban boundary and are designated for non-farmland uses. If agricultural uses continue within the short-term, mitigation measures will avoid or minimize the potential impacts on the existing agricultural use on the site majority.
Air, Odour, and Noise	Confirm sensitive receptors to avoid/mitigate impacts to surrounding environments	• Impact Assessment – Preferred WWTP Site	• An air and odour assessment were completed on the preferred WWTP site. The results indicated that maximum cumulative concentrations of all contaminants are below the relevant assessment criteria. Mitigation controls were included into the design of the new WWTP, which included the use of biofilters to control emissions from the activities with the greatest potential for odorous emissions. As the Project is not yet constructed, the inputs into the modelling have been prepared using published emission factors and data for similar WWTPs in Ontario. Once the project is operational, it is recommended that odour sampling is completed to verify the conceptual assumptions. • A noise assessment was completed on the preferred WWTP site. This assessment evaluated the potential effects of the SNFWWS Program on noise levels based on two criteria. The first was a comparison against applicable noise limits, and the second was an assessment of changes to noise levels relative to existing noise levels at the most sensitive PORs in the vicinity of the Project. Predictive noise modelling indicated that the Project is expected to meet MECP sound level limits at the identified representative PORs. The predicted change in noise levels resulted in a 'negligible' magnitude rating, and therefore no adverse noise effects are expected.
Assimilative Capacity Study	Confirm treatment needs to meet all regulatory standards and requirements	• Detailed Assessment – Preferred Outfall Location	• A detailed ACS was completed for Chippawa Creek. The expected water quality concentrations in the receiving waters are not expected to be measurably different from the existing conditions throughout the study area. • Variations in the Chippawa Creek flow and the effluent flow rate are not expected to noticeably affect the performance of the outfall design. • MECP reviewed the ACS submission and provisionally accepted with minor recommendations on July 20, 2020. All recommendations were incorporated into the final ACS report and submitted with the ESR.
Cultural Heritage	Confirm significance of site features to remove/mitigate impact	• Cultural Heritage Assessment Report (CHAR) – Preferred WWTP Site • Cultural Heritage Evaluation Report (CHER) – Preferred WWTP Site	• The preferred WWTP site (6811 Reixinger Road) includes buildings dated 40 or more years old which were flagged for cultural potential during the early cultural heritage screening process (Golder, 2020). • The property at 6811 Reixinger Road was evaluated against *O. Reg. 9/06 of the Ontario Heritage Act* and found to have Cultural Heritage Value or Interest (CHVI) for historical / associative solely related to its potential to yield archaeological resources related to the Dell family and/or Indigenous land use. Given that the CHVI of 6811 Reixinger Road is solely related to the archaeological potential of the property, no further cultural heritage assessment was recommended for this property. Specifically, a Heritage Impact Assessment (HIA) was not recommended since the existing buildings and landscape elements on the property were not found to retain CHVI.

WWTP Site and Outfall Phase 3 Investigations	Purpose	Report(s)	Key Finding(s)
Environmental Site Assessment (ESA)	Avoid known sources of soil or groundwater contamination	• Phase 1 ESA – Preferred WWTP Site • Phase 2 ESA – Preferred WWTP Site	• Phase 1 ESA inventory search identified areas of potential environmental concern with respect to the use of pesticides through history of agricultural land use, presence of several AFTs and an old engine on-site, and the presence of metal and concrete finishing businesses located within proximity off-site. • Phase 2 ESA was completed and indicated no constraints or impediments in moving forward with construction on the preferred WWTP site.
Geotechnical and Hydrogeological	Confirm solution meets technical needs through subsurface (soil, bedrock, and groundwater) investigations	• Preliminary Assessment – Preferred WWTP Site	• Geotechnical and Hydrogeological field investigations were completed on the preferred WWTP site. It was reported that geotechnical conditions at the WWTP site are suitable to support the buildings and chambers on steel H-piles. Similar soil conditions appear prevalent across the general South Niagara Falls area. • Further investigations will be completed through detailed design to confirm construction approach.
Natural Environment	Avoid/minimize impacts to sensitive features (i.e., provincially significant wetlands, protect woodlots, etc.) during site and outfall construction	• Impact Assessment – Preferred WWTP Site	• Site visit completed with NPCA in November 2020 to validate areas with sensitive natural features. • Based on the size of land required for the WWTP facility, alternatives layouts within the preferred site presented opportunities to minimize or avoid potential impact to the sensitive features as well as the respective setback requirements. • The outfall alignment will need to cross a provincially significant wetland feature to reach Chippawa Creek. Construction methodologies will look to minimize feature impact through further consultation and potential development permit through NPCA. • Consultation completed with DFO confirmed that Request for Review application should be submitted during detailed design to confirm potential mitigation needs with respect to shoreline development (may require permit for development). • Construction shall occur during appropriate seasonal windows to avoid impact to any Species at Risk (SAR). Surveys will be conducted through detailed design to avoid impact to SAR.

6.1.2 WWTP and Outfall Siting Alternatives

Alternative WWTP facility layouts were considered within the preferred site (6811 and 7047 Reixinger Road). The preferred site provides excess flexibility to incorporate future phased expansions and technologies. Six alternative layouts were considered within the site for the WWTP facility footprint and respective outfall discharge alignment, presented as Options A to F in Table 6-2.

The alternative layouts for WWTP facility and outfall alignment considered:

- Ministry setbacks/guidelines,
- Environmental features,
- Air, odour, noise impacts,
- Archaeological potential,
- Cultural heritage significance,
- Site access for operations and maintenance,
- Future flexibility for expansion and technology needs, and,
- Financial costs for property mitigation and acquisition.

Table 6-2. Preferred WWTP Site Layout and Outfall Alignment Alternatives

Option A	Option B	Option C	Option D	Option E	Option F
					
Opportunities: • Good distance and screening from existing residential with low potential for air, odour, and noise impacts (natural buffers) • No anticipated impacts from cultural heritage or contaminated soils **Constraints:** • Requires additional investigations and significant resources to clear known archaeological sites (financial and schedule implications) • Does not meet Ministry approval setbacks from sensitive environmental features • Less efficient site layout with limited flexibility for future expansion • Requires new access road adjacent to the QEW	**Opportunities:** • Good distance and screening from existing residential with low potential for air, odour, and noise impacts (natural buffers) • No anticipated impacts from cultural heritage or contaminated soils **Constraints:** • Requires additional investigations and significant resources to clear known archaeological sites (financial and schedule implications) • Does not meet Ministry approval setbacks from sensitive environmental features • Less efficient site layout with limited flexibility for future expansion	**Opportunities:** • No anticipated archaeological impacts based on previously completed Stage 2 Assessment • Closest alternative to existing residential from air, odour, and noise perspective (potential conflict with Ministry setbacks) • No anticipated impacts from cultural heritage or contaminated soils **Constraints:** • Strategy requires purchasing multiple Reixinger fronting properties to meet Ministry setback guidelines and provide sufficient site access for plant operations • Less efficient site layout with limited flexibility for future expansion	**Opportunities:** • Good distance from existing residential with low potential for air, odour, and noise impacts (natural buffers) • No anticipated impacts from cultural heritage or contaminated soils **Constraints:** • Requires additional investigations to clear known archaeological sites in northern extent • Land surrounding WWTP footprint is limited by sensitive environmental and known archaeological findings (potential conflict with Ministry setbacks) • Strategy requires the purchase of two (2) properties for siting needs • Requires the purchase of both properties now to secure land for future expansion	**Opportunities:** • Furthest removed from existing residential with low potential for air, odour, and noise impacts • No anticipated impacts from cultural heritage or contaminated soils **Constraints:** • Requires additional investigations and significant resources to clear known archaeological sites (financial and schedule implications) • Requires removal of significant wooded area and increases impact to surrounding environment • Would still need additional property for flexibility of future expansion	**Opportunities:** • No anticipated impacts to sensitive environmental features • Good distance from existing residential with low potential for air, odour, and noise impacts (natural buffers) • Provides direct sewer connection and site access for maintenance and operations from Reixinger Road • No anticipated impacts from cultural heritage or contaminated soils • Provides greatest flexibility for future expansion **Constraints:** • Select areas require additional investigations to clear archaeological potential • Requires removal of one residential house and barn • Strategy requires the purchase of one property only for current and future siting needs
Least Preferred	**Least Preferred**	**Less Preferred**	**Less Preferred**	**Less Preferred**	**Preferred**

6.1.3 Preferred WWTP Layout and Outfall Alignment

As presented in siting evaluation Table 6-2, the preferred WWTP layout and outfall alignment were selected within the 6811 Reixinger Road property (Figure 6-2).

Key WWTP site property needs, layout advantages, and outfall considerations are provided below:

- Refined WWTP Property Needs:
  - Requires one property acquisition (6811 Reixinger Road, Niagara Falls, ON), and,
  - Site supports Phase 1 (30 MLD) WWTP and provides flexibility for future expansion.

- WWTP Footprint:
  - Avoids sensitive environmental features and setbacks,
  - Distanced from existing residential to mitigate potential air, odour, and noise impacts,
  - Cultural heritage potential removed through site investigations,
  - Removed from known archaeological sites (prior to construction, further investigations will be required to confirm potential mitigation), and,
  - Provides direct access from Reixinger Road.

- Outfall Alignment:
  - Receiving waterbody (Chippawa Creek) meets Ministry approval requirements.
  - Alignment requires river edge work for installation and isolated environmental crossing. and,
  - Additional archaeological work will be required for the outfall corridor.

Figure 6-2. Preferred WWTP Site Layout and Outfall Alignment

6.1.4 Wastewater Treatment Technologies

A detailed review of treatment technologies was completed for each process component within the treatment plant. Details on the individual technologies considered and the detailed evaluation matrices can be found in the SNFWWS ESR Volume 3, Appendix V3.11.2.

A long list of alternative technologies was developed with the following factors as primary considerations:

- Flexible and adaptable to changing regulations,
- Reliable and proven over the full range of flow and loading conditions,
- Simplify long term operations and maintenance,
- Minimize energy, and,
- Minimize odours.

Table 6-3 provides a long list of wastewater treatment technologies identified for both the liquid and solids trains for the SNF WWTP.

Table 6-3. Long List of Wastewater Treatment Technologies

Unit Process	Long List Technologies	Function	Short Listed during EA
Screening	• Mechanically Cleaned Screens (6 mm)	• Protects the downstream equipment by removing large debris, assists in maximizing the associated treatment efficiency, and minimizes downstream operational and maintenance issues.	✓ 6 mm Step screen
Grit Removal	• Vortex Grit Removal • Aerated Grit Removal	• Physically removes heavy, abrasive, inorganic solids from screened wastewater, to protect the downstream equipment from excessive wear, reduce deposit formation in pipes and basins, and reduce solids handling.	✓ Aerated Grit Removal
Primary Treatment	• Conventional Primary Clarifiers with Separate WAS Thickening • Conventional Primary Clarifiers with Co-thickening	• Primary treatment reduces the load on the downstream biological treatment system by removing TSS and BOD_5 and reduce energy consumption.	✓ • Conventional Primary Clarifiers Oversized for potential Co-thickening. • Technology to be selected during detailed design.
Secondary Treatment	• Conventional Activated Sludge (CAS) • Moving Bed Biofilm Reactor (MBBR) • Biological Aerated Filter (BAF) • Biological Nutrient Removal (BNR) • Aerobic Granular Sludge (AGS) • Membrane Aerated Biofilm Reactor (MABR)	• Removes BOD_5, TSS, suspended and non-settleable colloidal solids, nitrogen, and phosphorous from the wastewater to below acceptable effluent limits.	✓ Conventional Activated Sludge
Disinfection	• Chlorination / Dechlorination • UV Disinfection • Peracetic acid (PAA)	• Protects public safety by killing and inactivating pathogens in treated water. Selection of disinfection technologies must also consider impacts on disinfection by-products (DBPs) formation.	✓ Chlorination / Dechlorination
WAS Thickening	• Separate WAS thickening • WAS Co-thickening	• Reduce sludge volume prior to stabilization and/or dewatering, and final disposal.	✗
Digestion	• Anaerobic Digestion	• Provides pathogen reduction, vector attraction reduction, and solids reduction of biosolids prior to final disposal.	✓ Size, mixing, redundancies to be selected during detailed design

6.1.5 General SNF WWTP Facility Description

The SNF WWTP will be designed and constructed as a conventional treatment plant. The core components and structures of the facility include:

- Raw sewage pumping station
- Headworks building
- Primary clarifier tanks
- Aeration tanks
- Secondary clarifier tanks
- Chlorine contact tanks
- Anaerobic digester control building
- Maintenance building
- Administration building

The design of the above listed structures and their interfaces will be coordinated with: the operation and maintenance requirements including list of equipment, loads, serviceability, and dimensional criteria; and, construction loads, construction sequence and the support of excavation requirements.

The construction of the facility foundations will require piles based on the results of the geotechnical investigations completed as part of the Class EA. Additional details regarding construction methodologies will be confirmed through detailed design and will incorporate additional site investigations.

Additional site works and civil requirements that will be involved with the SNF WWTP site development include:

- Site grading
- Site access roads, parking, and unloading zones
- Spill containment
- Storm water quality control
- Sanitary sewers
- Potable water supply
- Fire hydrants and fire department access
- Site and security lighting
- Berming and screening
- Security fencing and access gates
- Landscaping

The general layout of the SNF WWTP is based on the primary entrance on Reixinger Road. There will be multiple gates as well as a dedicated area for hauled waste. The layout provides for any potential odourous or noise creating buildings or equipment to be located at the extremities of the site and away from existing and future neighbouring uses.

The Air, Noise and Odour analysis for the SNF WWTP is provided in ESR Volume 3 Appendix V3.6. The report demonstrates the adherence to air, noise and odour standards as well as how the SNF WWTP site layout supports the mitigation of these issues.

Design considerations to be reviewed as part of the detailed design of the project will include sustainable building materials. It is anticipated that sustainable building materials can help save on utility and maintenance costs as well as address the project goals.

The SNF WWTP will also be designed with suitability and placement within the area and surroundings in mind. The preferred site provides for adequate natural vegetation screening from the Welland River East (Chippawa Creek) as well as from neighbouring properties. The site landscaping will further enhance this screening. The architectural design concept will address sightlines from Reixinger Road and will focus mainly on four of the following buildings which are located near the entrance:

- Raw sewage pumping station,
- Headworks building,
- Maintenance building, and
- Administration building.

6.2 South Niagara Falls Trunk Sewer

6.2.1 Construction Methodologies

Alternative construction methodologies were identified for the preferred design concept including tunnelling and open cut as shown in Figure 6-3. The project team considered a range of technical variables:

- sewer section lengths,
- sewer grade,
- size of available tunnelling machine,
- depth,
- crossings,
- trunk sewer connection points,
- opportunity to connect to local sewer catchments, and
- flow diversion potential.

The project team evaluated the following three construction methodologies to construct the preferred Montrose Road trunk sewer:

Trenchless Technology (Tunnelling)

- **Tunnel Boring Machine (TBM)** uses specialized boring equipment to excavate beneath the surface to install the sewer pipe. In contrast to micro-tunnelling, use of a TBM produces a larger tunnel diameter, operates at greater depths, and can accommodate longer tunnel driving lengths (that result in fewer shafts required). A TBM is suited for boring in various soil and rock strata, favouring straight alignments which minimize turns.
- **Micro-tunnelling** uses drilling technology to install underground sewer pipes. In comparison to tunnel boring machines, micro-tunnelling accommodates smaller diameter tunnels, operates at shallower depths, and requires an increased number of access shafts.

Trenching Technology

- **Open Cut Construction** were determined not to be viable construction options as it requires significant construction footprint, watertight shoring, dewatering and soils stabilization and would cause major disruption to the Montrose Road corridor. Unlike tunnel boring machines and micro-tunnelling which operate underground, open cut construction can potentially result in significant community and traffic impacts as it causes increased surface disruption. The proposed depth (10 metres or more) for majority of the proposed alignment is generally considered not feasible or practical for constructing via open cut.

The depth of the proposed sewer is driven by the need to achieve a gravity sewer between the required upstream and downstream connection points in the existing wastewater system. The depth of the preferred trunk sewer solution ranges from approximately 13 metres to 20 metres from ground surface to sewer invert.

The construction methodologies were evaluated with consideration to sewer length, depth, crossings, existing sanitary connection points, and required diameter of the sewer. It was determined that **trenchless technology was the preferred option for the trunk sewer alignment,** meeting all the technical requirements, depth, size, and flow requirements and minimizes potential conflicts at surface including impacts to environmental crossings, heritage sites, utility, and servicing infrastructure.

Benefits of tunnelling at depth include:

- The greater depth required reduces the risk of conflict with critical utilities and existing municipal infrastructure located along the road corridors,
- Minimizes impacts to the natural environment,
- Mitigates the crossing at Welland River will be tunnelled to minimize impacts to the waterbody,
- Mitigates the crossings of the major highway (Queen Elizabeth Way) to avoid infrastructure impacts and provide an accepted and approved solution,
- Meets MTO requirements as trenching/opencut over 400 series highways is not permitted,
- Minimizes surface disturbance and the extent of ecological and socio-economic impact to the community, and,
- Tunnelling can accommodate the installation of large pipe sizes to support future growth.

Due to the major highway crossing of Queen Elizabeth Way, major water crossing of Welland River, major social and natural environment surface disturbance if constructing via open cut, significant traffic impacts to Montrose Road resulting in a complete road closure, and the depth of the sewer, open cut was determined not feasible to facilitate the trunk sewer component.

In theory the proposed new trunk sewer strategy can accommodate both TBM and microtunnelling technology. Additional geotechnical and hydrogeological studies will be required during Detailed Design to confirm the preferred tunnelling technology (micro-tunnelling versus tunnel boring machine) for the proposed tunnelled sections of sewer alignment based on local conditions.

Tunnelling contractors have noted that construction of the sewer at greater depths - entirely within the bedrock - is feasible and will mitigate the risk of tunnelling through split face overburden/bedrock conditions. This construction approach may be more cost effective for sewer construction. Any sewer construction cost savings would need to be compared to additional costs (construction and life cycle) associated with a deeper sewer at the WWTP inlet pumping station.

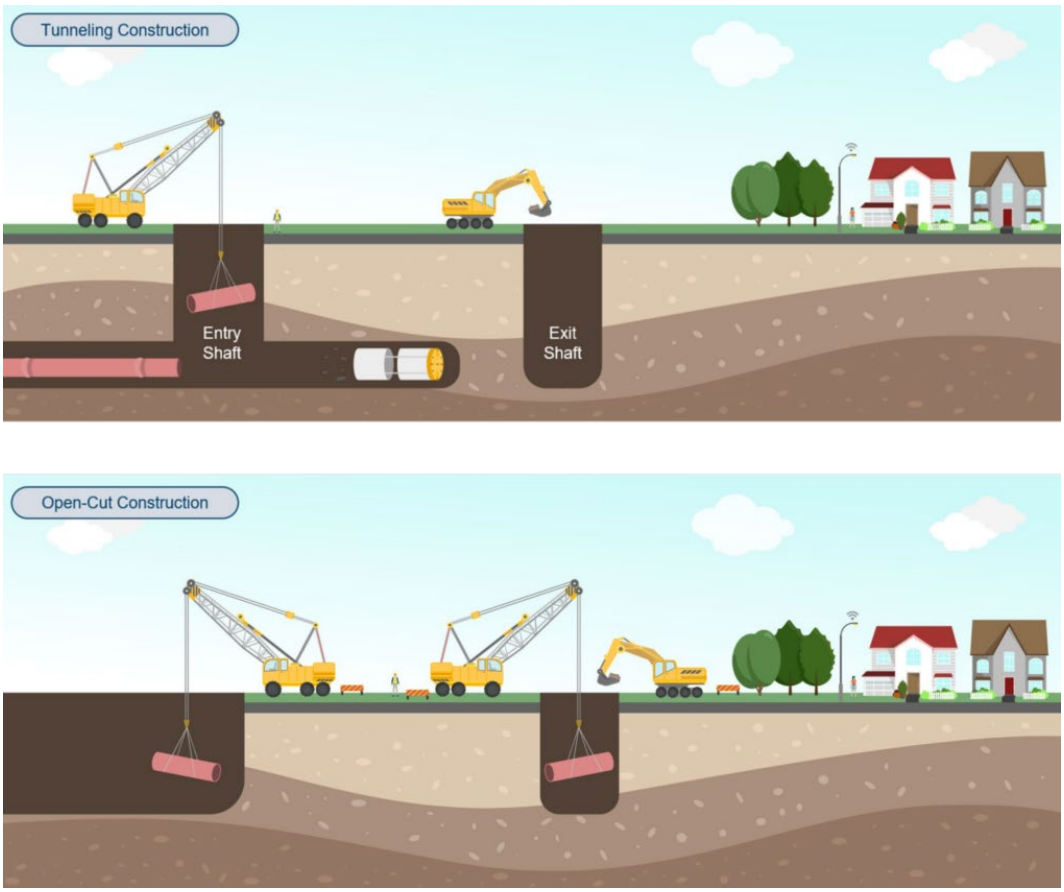


Figure 6-3. Construction Methodology Alternatives

6.2.2 Shaft Construction

The main surface works required with tunnel construction are the entrance and exit shafts located between tunnel drive lengths (distance between shafts). Each of the access shafts will require a staging area where construction equipment can be stored, and excavated material can be brought to the surface to be hauled from the site in trucks. Staging areas will vary in configuration and will be fenced off. The staging, stockpile and storage areas will avoid location within the floodplain where possible and will be identified and isolated at the detailed design stage. Once tunnelling is completed, the staging area will be restored to its original condition. Typical sending and receiving shaft staging area layouts are provided in Figure 6-4 and Figure 6-5.

6.2.3 Evaluation of Shaft Alternatives

Conceptual shaft site locations were categorized based on their study objective:

- Key Connection Point: critical connections to existing trunk sewers to address the problem/opportunity statement.
- Minor Connection Point: minor connection to existing local sewers and/or provide an interim shaft location for constructability.

The screening criteria was based on meeting technical requirements to aid constructability and address the problem and opportunity statement while minimize any associated impacts to the surrounding environments.

Figure 6-4. Example Launch and Sending Shaft

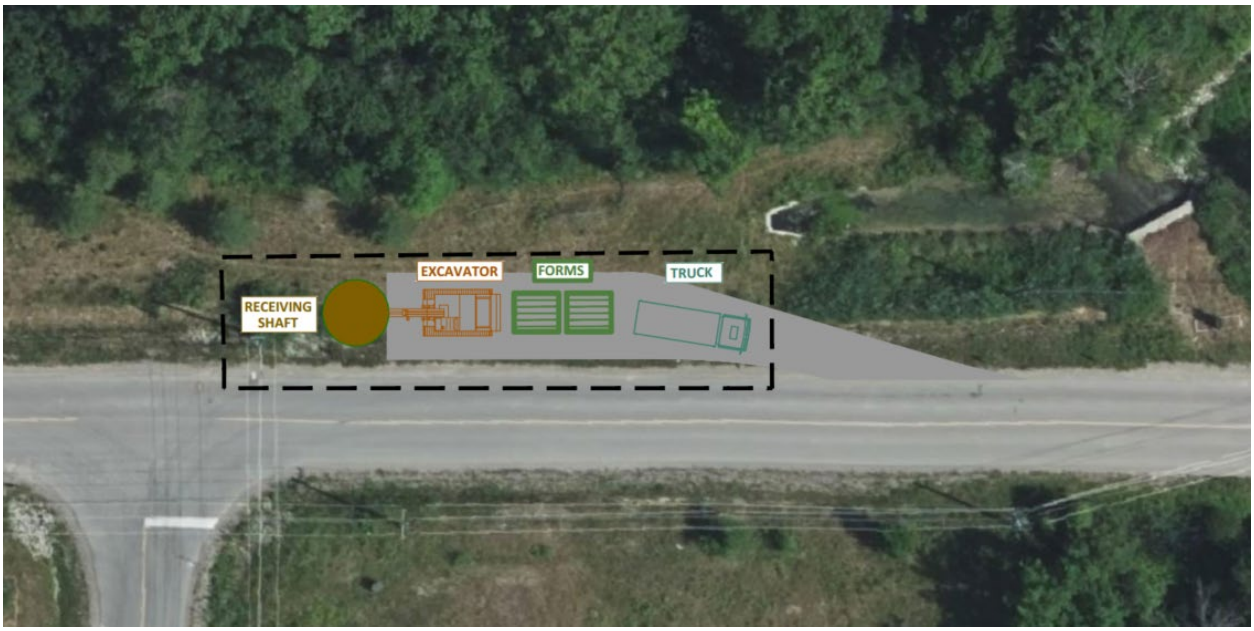


Figure 6-5. Example Receiving Shaft

6.3 Thorold South Servicing

The New Black Horse SPS, forcemain, and proposed trunk sewer were assumed for conceptual design to be constructed primarily by open-cut within existing ROWs. Construction methods and pipe material will be evaluated and selected in detailed design following further geotechnical and hydrogeological investigations. The proposed trunk sewer will also provide future opportunity to collect flows from potential development in areas of South Thorold and Southwest Niagara Falls within the Allanport growth area. Crossings of watercourses and the CN rail will require sections of trenchless construction (via microtunnelling, horizontal directional drilling or jack and bore). This will be reviewed during detailed design.

The conceptual design profile of the New Black Horse SPS Forcemain and Thorold South Trunk Sewer is based on:

- Achieving required depth at the New Black Horse SPS to receive flows from existing area gravity sewers,
- Construction of a forcemain at minimum depth or greater with air release and drain chambers to minimize excessive excavation and work required at greater depths associated with a continually rising forcemain from the New Black Horse SPS, under watercourse crossings and outletting at to the proposed trunk sewer at the intersection of Allanport Road and Barron Road, and,
- Depth required to cross under the CN Rail Corridor along Barron Road by gravity sewer.

It is anticipated that all open-cut construction of the forcemain and gravity sewer will be within overburden. Depth of bedrock at the proposed location of the New Black Horse SPS is to be confirmed as part of detailed design.

6.4 Integrated Preferred Solution and Design Concept

The integrated preferred solution and design concept for the SNFWWS strategy is show in Figure 6-6. The key program components of the integrated preferred solution and design concept were:

- New SNF Wastewater Treatment Plant and outfall,
- New SNF Trunk Sewer on Montrose Road, and,
- New Thorold South Servicing.

This integrated program provides the following key benefits:

- Addresses 2041 growth needs plus 2051 growth needs with flexibility for long term capacity requirements.
- Ability to phase in capacity at the WWTP in the future.
- Provides significant environmental benefits through optimizing wet weather management:
  - Captures peak flows and provides conveyance storage,
  - Minimizes overflows and flooding events across the study area, and,
  - Future connectivity and flexibility supports additional servicing and benefits.
- Current infrastructure planning and technology principles help the Region respond to changing regulations and needs.

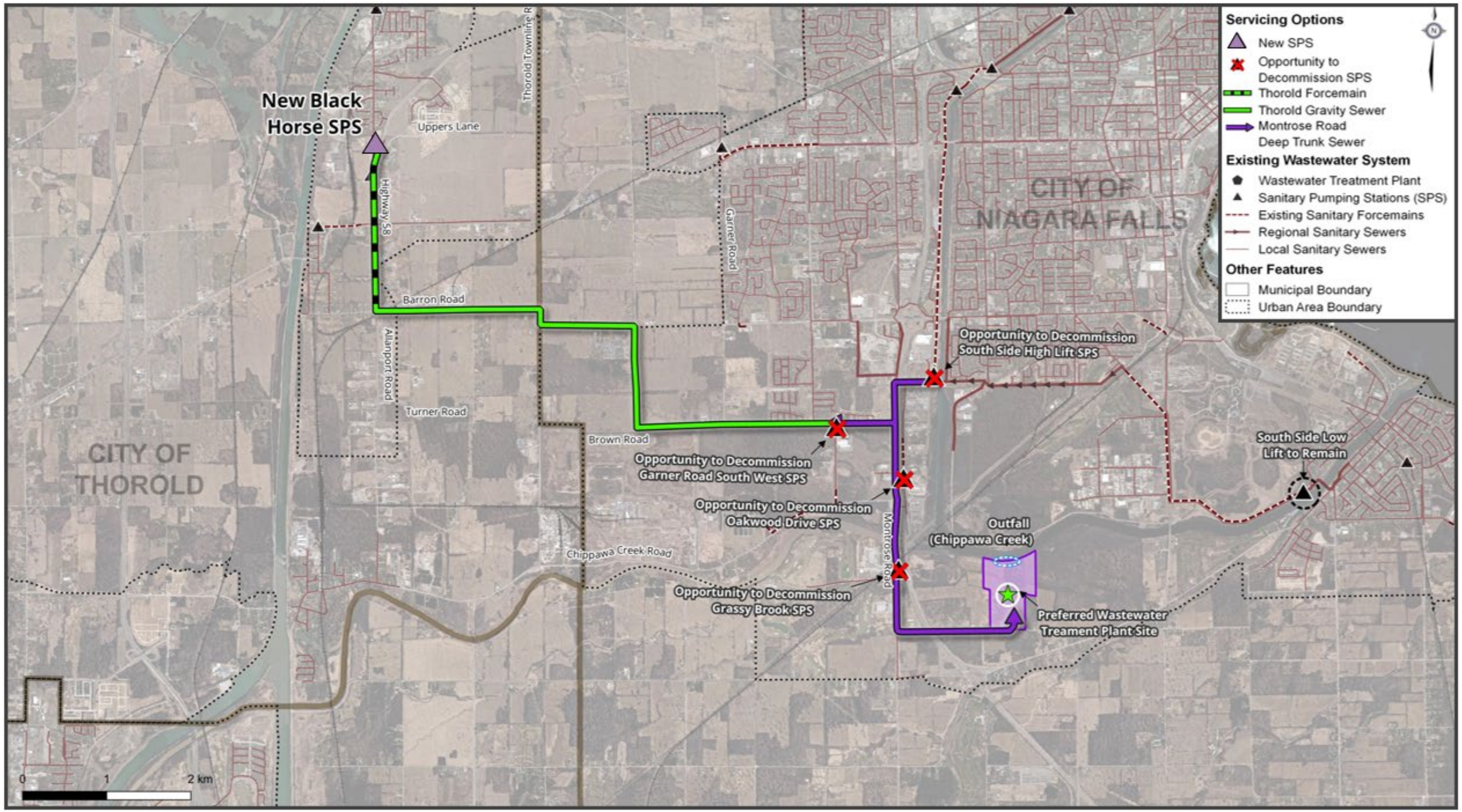


Figure 6-6 Validated Preferred SNF Program Solution

7.0 Preferred Design Concept

7.1 SNF WWTP and Outfall

7.1.1 Facility Layout and Description

The preferred facility layout is based on optimizing the site area and providing flexibility for future expansion of the treatment plant. Figure 7-1 provides a site plan of the treatment plant showing all WWTP design components.

Figure 7-1. Preferred WWTP Design Components

The WWTP conceptual design was developed to ensure that the view from Reixinger Road would be aesthetically pleasing. The architectural design of the buildings that will be visible from Reixinger Road intends to visualize interest by giving sufficient attention to architectural details and to such design elements as texture, pattern, and color. Additionally, sustainable building materials will be considered for this project as they can potentially help save on utility and maintenance costs as well, while contributing to the sustainability of the Region's infrastructure facilities.

The inclusion of solar panels on the roof of infrastructure buildings is increasing in prevalence as technology improves and design becomes more aesthetically pleasing. Both solar panel tiles and mounted structures are effective ways to reduce a building's dependence on non-renewable energy. Feasibility of including solar panels is recommended to be considered as part of preliminary design.

Another major trend in sustainability in recent years has been use of large windows to allow more natural light flow and reduce the need for electric light consumption. For example, during the summer months, the glass turns translucent to block any heating wavelengths that may require air conditioning to work overtime, while in the winter, the glass becomes transparent to allow the sunlight to aid in the heating efforts. Figure 7-2 provides a sample rendering for illustration purposes of the view from Reixinger Road at the plant entrance driveway. More concepts and renderings, incorporating adherence to Niagara Region design standards, will be developed and selected during detailed design.

Figure 7-2. Sample Rendering of the new WWTP from Reixinger Road

7.1.2 Wastewater Facility Components

7.1.2.1 Raw Sewage Pumping Station

The Raw Sewage Pump Station will be designed to transfer raw sewage from the main trunk sewer located on Reixinger Road, to the second floor of the Headworks building, prior to screening channels. The Raw Sewage Pump Station (RSPS) will require a wet well dry well configuration with inclusion of dry pit submersible pumps. The structure of the RSPS will be sized to accommodate Phase 1 capacity as well as future capacity (ultimate) requirements.

For Phase 1, multiple pumps will be proposed and will be sized to provide a firm capacity of 120 MLD. It is anticipated that the Phase 1 pumps would be replaced with new future pumps to accommodate the future Phase 2 capacity and beyond. One discharge forcemain to the Headworks building will be provided in Phase 1, as well as space for a second future discharge forcemain, for the Phase 2 expansion. Suction piping will be sized for Phase 2, to minimize operational interferences during construction of Phase 2. Hauled waste received at the SNF WWTP flows to the RSPS wet well, and mixes with the incoming raw influent, prior to pumping.

Key features of the RSPS include:

- Construction shaft of the pumping station to be utilized to assist with construction of the tunneled main trunk sewer,
- Two wet wells with isolation gates, to assist with maintenance and cleaning,
- Odour control for the wet well,
- Stainless Steel 316L discharge pipe, in accordance with the Region's standards, to minimize space requirements, and to provide enhanced corrosion resistance,
- A service elevator to assist operation staff with access to the lower levels of the station, and,
- Multiple floors for easier access to equipment, piping, and valving.

7.1.2.2 Hauled Waste Receiving Station

Hauled waste will be received at the new SNF WWTP. Waste haulers will transfer septage into the hauled waste receiving station, via camlock piping connections. An example hauled waste receiving station is shown in Figure 3-1. The hauled waste receiving station is equipped with an actuated valve and flowmeter, to monitor and control discharging hauled waste. Discharged hauled waste will be conveyed by gravity, to a precast chamber with a raised outlet, prior to transfer to the RSPS wet well. The purpose of the precast chamber with raised outlet, is to capture rocks and other heavy objects which may be present in the hauled waste, and protect the downstream pumps. The precast chamber would require periodic cleaning by vac truck. Furthermore, an odorous air suction duct will be provided from the precast chamber to the RSPS odour control unit to manage odours. Dual precast chambers will be provided to accommodate maintenance. A heat traced spill pad will be provided to capture any spills at the location of the camlock connection and will drain to the precast chamber. A kiosk complete with a desk, for haulers to fill in a logbook, call Region staff to inform of potential problems, and drop off manual samples from loads, is also provided. A washroom is also provided in the kiosk. Access to the kiosk will be via the same card reader or entry code as unloading.

7.1.2.3 Screening

The screening process of the headworks facility at the new South Niagara Falls WWTP will include multiple mechanical screens to provide duty and standby units. Additional extra channels will be provided adjacent to the screen channels for the future Phase 2 expansion. The conceptual design is based on a step screen with 6 mm openings – step screen is the preferred mechanical screening technology for the proposed SNF WWTP. The screens will convey screenings through a screw conveyor to a single washer/compactor unit. Multiple washer/compactors will be installed to accommodate all screens as part of the future Phase 2 expansion.

7.1.2.4 Grit Removal

The grit removal system at the new SNF WWTP consists of multiple aerated grit tanks (duty and standby) with a peak flow capacity of 120 MLD for each. Multiple aerated grit blowers (duty and standby) provide air for the grit system. Aerated grit tanks are designed for the removal of 0.2 mm (1/16 in), or larger particles with a specific gravity of 2.65.

7.1.2.5 Primary Treatment

The primary clarifiers will consist of multiple tank configuration. Sludge and scum collection mechanisms will transport the primary sludge to a pumping system for transfer to the digester facility. Conceptually, the mechanisms are shown as Fujiwara submerged type. There will be multiple primary clarifier tanks, each providing sufficient surface area to support Phase 1 capacity with WAS co-thickening. Additional space to the west is available for Phase 2 expansion.

Each clarifier is equipped with a sludge collector mechanism and scum removal system. Metal salt addition will be provided for both the primary clarifier and secondary treatment, to help enhance sludge settling, and maximize operational flexibility. Primary clarifier inlet channels and effluent launders will be covered, with air under the covers withdrawn to an odour control unit for treatment.

7.1.2.6 Secondary Treatment

The aeration tanks are designed as three-pass plug flow tanks with sufficient inner dimensions and side water depth to minimize footprint and improve oxygen transfer efficiency.

The mixed liquor enters the secondary clarifiers, where solids and microorganisms are settled and returned to the aeration basin. Activated sludge is recycled to the head of the bioreactors, and a fraction is wasted to the primary clarifiers for co-thickening. There will be multiple secondary clarifiers at the new SNF WWTP.

7.1.2.7 Effluent Disinfection

The disinfection of the secondary effluent will be done using chlorination followed by dechlorination. Chlorine is added to inactivate pathogens, and the residual chlorine is removed so that aquatic life in the receiving water is not impacted. The chemical disinfectant is typically supplied as liquid chlorine (sodium hypochlorite) or chlorine gas.

Sodium hypochlorite is used at most of the Region's WWTPs and is preferred for the new SNF WWTP. Chlorination will be accomplished by injecting a sodium hypochlorite (NaOCl) solution into the effluent by using multiple chemical metering pumps (duty and standby).

There will be multiple chlorine contact chambers, each sized for the ultimate Phase 2 flow with parallel tanks to provide a means for maintenance with one tank off-line during Phase 1. Dechlorination of the effluent is required to eliminate chlorine residual in the receiver, which is toxic to aqua life. The most commonly used chemical for dechlorination at Niagara Region WWTPs is liquid sodium bisulphite. There will be a dechlorination contact channel located upstream of the final effluent flow meter.

7.1.2.8 Anaerobic Digestion

With primary treatment and WAS thickening, anaerobic digestion is recommended for sludge stabilization at the new SNF WWTP. The primary sludge produced from primary treatment plus the thickened WAS are ideal for anaerobic digestion, as it can provide readily available biomass for digestion and has a high energy production potential (i.e. high methane gas yield). One primary digester and a second digester designed to operate either as a primary digester or secondary digester will be provided in Phase 1. Under normal conditions, the secondary digester will be used to temporarily store digested sludge prior to being transferred to the biosolids storage tanks. During peak flow periods or maintenance periods when the primary digester is out of service, the secondary digester will be used as a primary digester. An interconnected digester control building will be constructed with a full basement level for better access to pumps and piping systems.

7.1.3 Design Criteria

To establish expected raw wastewater concentrations and loadings to the new SNF WWTP, the existing Niagara Falls WWTP historical flow, loading and performance data from 2017 to 2020, along with the Garner Road Biosolids Facility historical centrate and typical hauled waste data, were reviewed and statistically analyzed to develop the design basis for the proposed SNF WWTP.

The recommended design basis for the combined raw wastewater, centrate from the Garner Road Facility and hauled waste is summarized in Table 7-1. This design basis was utilized to develop and evaluate alternative design concepts as part of the SNFWWS Class EA.

Table 7-1. Design Basis for the new WWTP

Parameter	Value	Basis
Raw Wastewater Flow		
Average Day	30 MLD	Stage 1 Rated Capacity
Maximum Day	76 MLD	99.5 percentile historic
Peak Hour	106 MLD	99.5 percentile historic
Peak Instantaneous	120 MLD	Design basis for Plant Inlet
Influent Average Concentration (mg/L)		
BOD5	330	Average load divided by the average flow.
TSS	460	
TP	11	
TKN	90	
Influent Average Loading (kg/d)		
BOD5	10,450	Typical per capita load (Metcalf and Eddy, 2003), plus centrate loadings from Garner Road, and hauled waste.
TSS	14,570	
TP	350	
TKN	2,885	
Influent Peak Month Loading (kg/d)		
BOD5	13,600	Typical peak month loading factor of 1.3.
TSS	19,000	
TP	500	
TKN	3,800	
Effluent Objective (mg/L)		
CBOD5	15	• 2020 ACS (Golder) see Volume 3, Appendix V3.5. • Received conditional approval on effluent limits through MECP.
TSS	15	
TP	0.5	
TAN	6.5 (May to Nov.) 12 (Dec. to April)	
Effluent Limits (mg/L)		
CBOD5	25	• 2020 ACS (Golder) see Volume 3, Appendix V3.5.
TSS	25	
TP	0.5	
TAN	8.8 (May to Nov.) 15 (Dec. to April)	

7.1.4 Future Flexibility and Expansion

Based on the growth projections established as part of Niagara Region's Official Plan catchment area allocation completed in support of the South Niagara Falls WWTP Municipal Class EA and Conceptual Design, future flows are expected to reach the Phase 1 design capacity by 2051, and additional capacity to 60 MLD will be required to service additional flows from the service area post-2051. To provide flexibility for the Region to implement future expansions, the conceptual design incorporates process components laid out in such a way to facilitate expansion to 60 MLD with consideration for a potential ultimate 90 MLD with minimal impact to existing plant processes and tanks. Figure 7-3 provides a schematic of the proposed expansion to the Phase 2 flow of 60 MLD as well as future location for 90 MLD requirements. Plant processes and open areas shown shaded in red represent future construction or available space to accommodate future plant processes.

Figure 7-3. Opportunity for Future Expansions

7.1.5 Climate Change Considerations

As part of the Class EA process, the impacts of climate change on and from the project were considered. The considerations for climate change on the project include more frequent and intense wet weather events and changing water levels in the receiving water. The SNF WWTP will be designed to be adaptable to accommodate peak flows based on detailed flow analysis and incorporating wet weather impacts. Additionally, the ACS and WWTP hydraulics have been assessed to ensure that effluent flows can be discharged to Chippawa Creek under a range of Creek flow conditions.

The key considerations for the project on climate change include the impacts of energy usage, and potential generation of greenhouse gases in varying levels such as carbon dioxide, methane and nitrous oxide from treatment processes. The design of the SNF WWTP will incorporate energy conservation through the design of the hydraulics minimizing the need for additional pumping, as well as the potential to generate energy through the anaerobic digestion process. Sizing of the digestion process can be optimized to allow future consideration for additional organic feed sources to generate additional energy. The potential to optimize the treatment process and monitor the generation of various greenhouse gases will be considered in subsequent design phases. This process monitoring can also offer operational cost savings and will be evaluated as part of the preliminary and detailed design phases.

7.1.6 Air, Odour, and Noise Control

The most intense odours associated with the wastewater treatment process evolve from raw sewage, hauled waste, preliminary treatment (screening and grit removal) and primary treatment effluent launders. Odourous air collection and treatment is provided for these areas.

This air will be sent through an odour control system for 99% removal of odorous substances, and then discharged to the atmosphere. The SNFWWS ESR Volume 3, Appendix V3.6 technical memorandum on Odour Control Technologies, evaluated several technologies for the new SNF WWTP. The preferred odour control technology for the various areas is to be determined during detailed design.

The odour control system will be sized to treat air from odorous areas during normal operation. The design approach for the odour control system involves sizing of the odorous air treatment units to ensure reliable and effective removal of odour causing constituents. The odour control system will be designed to provide 99% removal of H_2S.

The odour control systems will treat odorous air collected from the following sources at the SNF WWTP:

- Raw sewage pump station wet well,
- Hauled waste precast chamber,
- Inlet channel, screening channel, grit removal tanks and their associated inlet and outlet channels (all will be provided with covers),
- Conveyor, washer compactor, grit classifiers, and bin room, and,
- Covered primary effluent launder channels.

Odourous areas will be ventilated at multiple air changes per hour (ACH) in the RSPS wet well. This amount of air movement within normally unoccupied spaces will provide a good balance of maintaining fresh air in the room and maintaining lower building operation costs. Fresh air supply will be provided to the headspace below the odour control covers. This supply below the covers will exceed the typical 6 ACH to reduce corrosion potential. An odorous air fan (similar to an exhaust fan in a normal building) will maintain a negative pressure below the covers and move air to the odorous air treatment facility. Odorous air flow and make-up air flow will be balanced to maintain negative pressure below the covers and prevent odorous air from escaping to the headwork building and primary effluent launders.

The Design Basis for the Odour Control System is summarized in Table 7-2 below.

Table 7-2. Conceptual Specification for the Odour Control System

Parameter	Value
Inlet H_2S Concentration at Raw Sewage Pump Station	20 ppm average, 50 ppm peak Range: 10-50 ppm
Inlet H_2S Concentration at Headworks	10 ppm average, 20 ppm peak Range: 1 to 20 ppm
Inlet Air Temperature	5ºC to 30ºC
Total H_2S Removal Efficiency	>99% Removal
Inlet H_2S Concentration at Raw Sewage Pump Station	20 ppm average, 50 ppm peak Range: 10-50 ppm
Inlet H_2S Concentration at Headworks	10 ppm average, 20 ppm peak Range: 1-20 ppm
Inlet Air Temperature	5ºC to 30ºC
Total H_2S Removal Efficiency	>99% Removal

Table 7-3 summarizes the recommended design odorous air flow rates for each system.

Table 7-3. Design Odorous Air Flow Rates

Process	Design Air Exchange Rate	Odorous Air Flow Rate
Raw Sewage Pump Station	6 Air changes per hour	3,500 m3/h
Headworks Building	3 Air changes per hour	43,000 m3/h
Screening, Grit Removal and Primary Clarifier Channels	6 Air changes per hour	7,000 m3/h

Table 7-4 summarizes the odour control system specifications for Raw Sewage Pump Station and Headworks (Headworks and Primary Clarifier Inlet Channels).

Table 7-4. Odour Control System Specifications

Process	Raw Sewage Pump Station	Headworks and Primary Clarifier Inlet Channels
Number	1	1
Capacity	3,500 m3/h	50,000 m3/h
Number of fans	1	4
Power	9 kW	81 kW

7.1.7 Outfall

The conceptual design of the new plant outfall is based on meeting the requirements of the effluent discharge to Chippawa Creek developed as part of the ACS (ESR Volume 3, Appendix V3.5). The conceptual design was developed such that the discharge velocities and mixing zones are optimized to minimize any impacts to Chippawa Creek and meeting all regulatory water quality standards.

The WWTP outfall will consist of an onshore portion of 1800 mm concrete sewer pipe transitioning to a submerged fused HDPE pipe near the shores of the Chippawa Creek extending from 6811 Reixinger Road. This is conceptually shown in Figure 7-4.

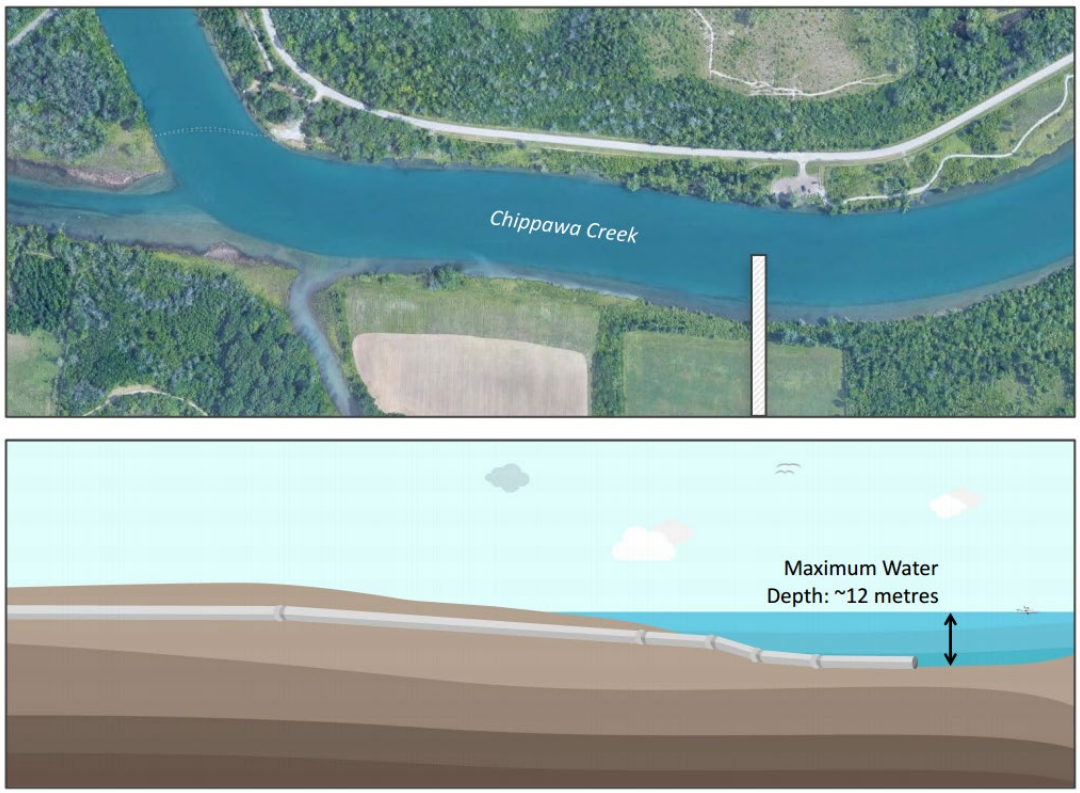


Figure 7-4. Conceptual Outfall Profile

Construction of the outfall will comprise the following key components and considerations:

- Mainly on-land construction,
- Outfall will sink to Chippawa Creek bottom,
- In-water construction duration will be minimized to the extent possible, estimated to be approximately 2 to 3 days,
- No anticipated long-term impacts to recreational water users or aquatic life as there is no surface level infrastructure and all infrastructure will be at the creek bottom,
- Marine archaeological investigations indicated no potential impact to marine archaeology,
- On-land construction area requires further archaeological investigations to ensure appropriate mitigation measures are in place for construction, and
- On-land outfall alignment will minimize impact to natural environment features.

The following points, adopted from the Assimilative Capacity Study (ACS), provide a summary of the conceptual outfall design that is also shown on Figure 7-5:

- Approximately 260 metres of concrete pressure pipe supported on piles,
- An effluent manhole to transition between concrete and HDPE pipe,
- Approximately 150 metres of fused high density polyethylene (HDPE) pipe,
- Multiport diffuser with three duckbill valve ports angled 45 degrees above horizontal (θ),
- The diffuser length (LD) is 24 metres with 12 metres spacings between the ports,
- The distance from riverbank for the first port is 20 m and the distance to the centre of the diffuser is 32 metres (DISTB),
- The ports are located 0.5 metres above the creek bed (h0),
- During normal operation of the International Control Dam (ICD), the ports are oriented in a downstream direction (e.g., pointed in the same direction as creek flow),
- The diffuser is oriented perpendicular to the shoreline and current direction, and,
- An additional three blind flanged diffuser ports will be provided to accommodate the future Phase 2.

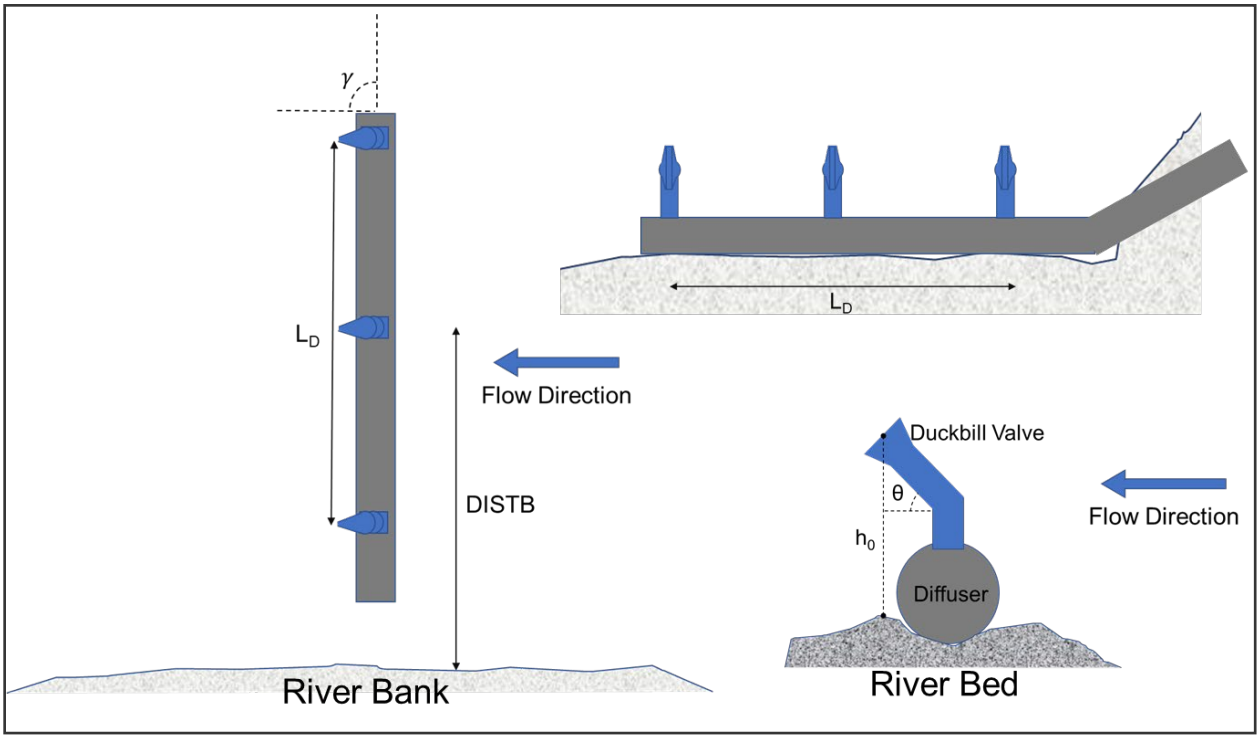


Figure 7-5. Conceptual Outfall Design

7.1.8 Effluent Criteria

The Region received provisional acceptance through MECP on the submitted ACS effluent criteria pending minor revisions. All revisions were incorporated and submitted with the final ESR. The SNF WWTP facility design will ensure compliance with the approved ACS. Niagara Region will monitor water quality to ensure no negative effects to aquatic or human life.

Table 7-5. Effluent Quality Requirements for the new SNF WWTP

Parameters	Effluent Objectives (mg/L)	Effluent Limits (mg/L)
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	15	25
Total Suspended Solids (TSS)	15	25
Total Phosphorus (TP)	0.5	0.75
Total Ammonia Nitrogen (TAN)		
May to October	6.5	8.8
November to April	12	15
E. Coli (CFU/ 100 mL)	200	200

7.2 South Niagara Falls Trunk Sewer

7.2.1 Design Criteria

The new SNF Trunk Sewer will be designed in accordance with the current Niagara Region's Water-Wastewater Project Design Manual with additional guidance from the Ministry of Environment Design Guide for Sewage Works.

Sewer sizing is based on growth projections established as part of Niagara Region's Official Plan catchment area allocation, completed in support of the South Niagara Falls WWTP Municipal Class EA and Conceptual Design.

Additionally, there is opportunity to consider upsizing the SNF trunk sewer to accommodate in-pipe peak flow storage to alleviate pressures at the SNF WWTP. Upsizing considerations can be included in the evaluation of the tunnelled construction method.

7.2.2 Major Crossings

The Montrose Sewer will require the following major crossings:

- Queen Elizabeth Way (QEW) south of the SSHLPS / Canadian Drive,
- Welland River at Montrose Road,
- CP Rail Corridor (South of the Welland River), and,
- QEW at Reixinger Road.

The new SNF Trunk Sewer will cross at depths greater than the MTO minimum (5 metres depth below highway centre-line of ditch) as well as CP Rail Corridor. North of the Welland River, depth of the new SNF Trunk Sewer will be primarily driven by the required inverts to accept flows from the inletting sewers to SSHLPS and Garner Road Pumping Stations. At the Welland River and downstream, the depth of the new SNF Trunk Sewer will be driven by the river crossing and depth required under the river to mitigate environmental risk to the riverbed. At Montrose Road, the bottom of the Welland River is approximately 165 metres (approximately six metres below water level). The required crossing depth under the riverbed will be determined as part of detailed design. It is anticipated that 3 metres minimum crossing cover from the bottom of the Welland River will be required based on discussions with trenchless contractors as part of conceptual design. The sewer will range in depth from 13 metres at the upstream end to nearly 20 metres at the WWTP inlet pumping station.

7.2.3 Local Servicing Connections

At commissioning, the new SNF Trunk Sewer will accept flows by gravity from the catchment areas of the existing SSHLPS, Garner and Grassy Brook SPS to allow for their decommissioning. The sewer has been designed with shaft and maintenance hole locations to provide connections to support the decommissioning of pumping stations, as well as opportunity for future Region and local sewer connections to service the broader growth areas.

Servicing connections to the new SNF Trunk Sewer are summarized in Table 7-6.

Table 7-6. New South Niagara Falls Trunk Sewer Servicing Connections

Shaft No.	Servicing Connection	Notes
Shaft 1: South Side High Lift SPS	1. South Side High Lift SPS inlet sewers	New SNF Trunk Sewer will receive flows from sewers inletting to the existing South Side High Lift SPS allowing for decommissioning of the SPS.
Shaft 2: Montrose Road, south of Canadian Drive	1. Local sewers north of Canadian Drive	Shaft 2 primarily to provide for direction change of the new SNF Trunk Sewer to south along Montrose Road. Future opportunity to: • Collect flows from local sewer running along Canadian Drive and south along Montrose; and, • From 750 mm existing Region sewer (ahead of discharge to Shaft 1)
Shaft 3: Montrose Road at Brown Road	1. Brown Road sewer	Shaft 3 will accept the new SNF Trunk Sewer from Shaft 8, which will receive flows from: • Garner Road SPS; and, • Proposed Thorold South Servicing along Brown Road
Shaft 4: Montrose Road at Chippawa Creek Parkway	1. Opportunity for future sewer connection along Chippawa Creek Parkway 2. Opportunity for future sewer connection from Oakwood SPS	Shaft 4 at Chippawa Parkway will not have any proposed local connections but does provide future opportunity for: • Gravity connection from the Oakwood SPS (which will allow for the decommissioning of the Oakwood SPS) • Sewer connection from Chippawa Parkway servicing growth areas north of the Welland River
Shaft 5: Montrose Road at Grassy Brook SPS	1. Grassy Brook SPS	Shaft 5 will receive flows diverted from the Grassy Brook SPS and allow for the decommissioning of the SPS
Shaft 6: Montrose Road and Reixinger Road	1. Proposed City of Niagara Falls Sewer from west 2. Opportunity for future sewer from South Growth Areas	A proposed local sewer to be constructed as part of the Montrose Road Improvements project will be connected to Shaft 6. The local sewer will convey flows from the South Niagara Hospital and Grand Niagara Secondary Plan developments. • There is opportunity for future trunk sewers from growth areas further south to connect to the new SNF Trunk Sewer at Shaft 6
Shaft 7: WWTP Inlet Pumping Station	1. Opportunity for future local sewer 2. Opportunity for future Trunk Sewer from Chippawa	Shaft 7 will be utilized as the wet well for the WWTP inlet pumping station and sewer connections from the east will require to be accommodated via a local sewer connection from Reixinger Road Deep sewer connection fronting the WWTP site and outletting to the WWTP inlet site will provide future opportunity for: • Sewer connections from the Grassy Brook Secondary Plan (located to the east of the WWTP site); and, • Trunk sewer connection from Chippawa
Shaft 8: Brown Road at Garner Road SPS	1. Garner Road SPS Proposed Thorold South Servicing	Shaft 8 will receive flows from: • Garner Road SPS (which will allow for decommissioning of the SPS); and, • Proposed Thorold South Servicing along Brown Road.

For connections to the deep new SNF Trunk Sewer from local sewers at shallow depths, appropriate drop structures and flow inserts to dissipate energy, mitigate odours and minimize hydrogen sulfide corrosion associated with deep vertical sewer drops will be required. Local servicing connections and requirements for flow insert drop structures.

7.2.4 Trunk Sewer Construction Approach

Various construction approaches were considered for the Montrose Road Trunk Sewer, including conventional tunnelling (earth pressure balance machines, small diameter tunnel boring machines), microtunnelling, horizontal directional drilling and open-cut. Through discussions with expert trenchless contractors, it was determined that there are viable alternatives for conventional tunnelling and microtunnelling.

The conceptual design profile of the Montrose Road Trunk Sewer is based on:

- Achieving minimum depths to accept flows from inlet sewers to existing pumping stations to be decommissioned; and,
- Depth required to safely cross under the Welland River.

At this profile depth, the sewer will run through sections of overburden and bedrock - referred to as mixed-face or split-face conditions for tunnelling. The soft cohesive soils and hard, weathered bedrock will provide for challenging construction conditions.

Ahead of geotechnical investigation to be completed in support of detailed design, the depth of the crossing under the Welland River has been estimated to be no less than minimum 2.5 times the diameter of the crossing (tunnelled) pipe. This estimate is based on discussions with tunnelling contractors.

Alternatively, tunnelling contractors have noted that construction of the sewer at greater depths - entirely within the bedrock - is feasible and will mitigate the risk of tunnelling through split face overburden/bedrock conditions. This construction approach may be more cost effective for sewer construction. Any sewer construction cost savings would need to be compared to additional costs (construction and life-cycle) associated with a deeper sewer at the WWTP inlet pumping station.

A summary of the viable construction approach alternatives is shown in Table 7-7.

Table 7-7. Summary of Viable Construction Approach Alternatives for Montrose Road Trunk Sewer

Construction Approach Alternative (Profile Depth Alternative)		Tunnelling Method	Notes
Minimum depth to connect to existing sewers and cross the Welland River / QEW / CP Rail (Within Overburden)	• Flowing soils identified in geotechnical investigation (low blow counts indicate soft cohesive (flowing) soils that will require to be stabilized) • South of Welland River, also dense, cohesionless soils with high potential for cobbles and boulders • Significant variation in elevation of rock profile with potential for bedrock at base of tunnelling operations • Bedrock is hard, weathered dolomite, with potential to redirect cutting head of tunnel off-grade	Microtunnelling	• Microtunnelling Contractors have noted that project is complex but past projects under similar geotechnical conditions have been successfully completed. • Bentonite pressures around cutting head will be designed to accommodate the soft soils above the sewer and potential for hard rock below. • Microtunnel Boring Machines (MTBM) are available for construction of the sewer from 900 mm to 2,500 mm 3,000 mm. • Provides for 'one-pass' (no lining pipe) sewer construction.
		Earth Pressure Balance Machine (EPBM)	• EPBM Contractors have noted that construction within flowing soils conditions with potential for bedrock at base of operations is viable but will be challenging. • EPBM machines available for 3,000 mm and may require 'two-pass' sewer construction (with second lining pipe installed within carrier pipe to achieve smaller diameter sewer installation.
Depth of sewer deepened to entirely within bedrock to eliminate challenge of tunnelling through split face conditions (flowing soils overburden and hard bedrock)	• Tunnelling contractors have suggested that to mitigate risk of tunnelled sewer being redirected off alignment/grade by bedrock or cobbles/boulders within soft flowing overburden, the tunnelling operations deepened to be constructed entirely within rock • This may also result in construction cost efficiencies • Will require consideration	Microtunnelling	• Microtunnelling can also be achieved within the bedrock. • Length of sewer project and individual drives (700 metres to 1500 metres between shafts may require cutting head replacements mid-drive (from within sewer) to cut through the hard bedrock.
		Conventional Tunnelling	• Conventional Tunnelling can be achieved within the rock, including small diameter TBM (2,400 mm diameter). • Two-pass sewer construction (with liner pipe) to be compared to utilizing carrier pipe for sewer installation. • Rock squeeze after tunnelling, will require monitoring ahead and may result in schedule delays to be considered as part of detailed design.

Open-cut construction and HDD were determined not to be viable construction options. Open-cut construction requires significant construction footprint, watertight shoring, dewatering and soils stabilization and disruption to the Montrose Road corridor. Watertight shoring and dewatering and stabilization of the soft soils within the open-cut trench will be cost prohibitive.

Horizontal directional drilling is typically not preferred for construction of on-grade gravity sewers and requires minimum grades of 1 per cent (preferably greater). HDD contractors have noted that the largest pipe diameter for construction is approximately 1350 mm, and drive lengths are limited to approximately 300 metres. Utilizing HDPE pipe for HDD requires that full pipe length be fused prior to installation, requiring significant laydown area within the Montrose Road corridor.

For these reasons, open-cut construction and HDD have been screened out from the conceptual design.

7.2.5 Preferred Trunk Sewer Construction Approach

The proposed alignment generally follows the alignment of the Montrose Road and Reixinger Road ROWs.

Tunnelled sewer drives of greater than 1500 metres can be achieved by microtunnelling, and even longer distances between shafts can be accomplished utilizing conventional / EPBM TBMs. Approximate tunnel drive lengths by diameter are summarized in Table 7-8.

Table 7-8. Maximum Distances between Tunnelling Shafts by Pipe Diameter

Tunnelling Sewer Diameter	Viable Tunnelling Method	Maximum Drive Length (Approx. Distance between Shafts)	Notes
900 mm	Microtunnelling	700 m	900 mm to 1800 mm dia. installed by conventional TBM requires liner pipe ("two-pass")
1200 mm	Microtunnelling	700 m – 1000 m	
1500 mm	Microtunnelling	1000 m – 1500 m	
1800 mm	Microtunnelling	1500 m – 2000 m	
2400 mm / 2500 mm	Microtunnelling Small Diameter TBM	1500 m – 2000 m	~2400 mm can be installed by MTBM or Small Diameter TBM for similar drive distances
3000 mm	Microtunnelling Small Diameter TBM	1500 m – >2000 m	Conventional TBM can provide for longest drive length and distance between shafts

Microtunnelling drive lengths up to 2000 metres has been completed, but for drive lengths greater than 1500 metres, there is increased construction complexity, and the tunnelling work is more challenging.

The conceptual design utilizes the capability of tunnelling operations to install curved pipe sections, and this has been utilized to achieve the following:

1. Horizontal curved drive between Blackburn Parkway and Chippawa Creek Road to provide sewer and shaft locations within the existing Montrose Road ROW (the existing west property limit of Montrose Road at Chippawa Creek Parkway does not provide area for shaft construction,
2. Horizontal curved drive to align the pipe crossing of the Welland River to the west of the existing Montrose Road bridge crossing the Welland River, as well as the existing Grassy Brook SPS forcemain (located east of the Montrose Road bridge) that is to remain in operation until commissioning of the new trunk sewer,
3. Horizontal curved drive along Montrose Road between Grassy Brook Road and Reixinger Road to provide for proposed shaft locations east of the ROW to accommodate connection to the Grassy Brook SPS inlet sewers and minimize construction compound impacts to the travelled roadway, and,
4. Horizontal curved drive at the WWTP site to provide for location of shaft that can be utilized as wet well for WWTP inlet pumping station, within proposed property, not impacting Reixinger Road and aligned with the proposed location of the hauled waste receiving station.

7.2.6 Shaft Construction

Launch and receiving shafts will be required for tunnelling operations, and the proposed shafts have been located at key locations / intersections to provide for proposed connections from existing pumping stations to be decommissioned as well as connections from future growth areas including South Niagara Falls, South Thorold and Chippawa.

The proposed shafts will be utilized for local sanitary connections and manhole access to the trunk sewer. During detailed design, it is to be determined if the shaft is to be modified to be directly utilized as the manhole, or if a separate access manhole is to be installed within the shaft for local sewer connections and access to the trunk sewer. Consideration for drop structures for energy dissipation and mitigation of hydrogen sulfide corrosion and odours for local sewer drops are to be considered as part of detailed design.

It is anticipated that construction will proceed from the WWTP inlet pumping station upstream/upgrade and the project will be completed by multiple TBMs and multiple crews, requiring open shafts and compound areas along Montrose Road throughout the duration of the works.

Appropriate access and laydown areas will need to be established for each shaft location. Compound areas of minimum 1,000 m^2 will be required for all shaft locations.

Shaft construction will be required to be watertight (which will likely still require some dewatering, but not volumes anticipated to exceed Permit to Take Water (PTTW) levels of 50,000 L/day). Tunnelling contractors have suggested that shaft construction can be completed by various methods, including the following:

- Caisson / secant piled wall through the overburden and bedrock to the base of the shaft, and,
- Sunken caisson method through the overburden to the bedrock, with breaking and concrete lining (for watertightness) to the proposed excavation depth.

Construction of a full-depth caisson wall shafts are anticipated to seal off the shaft from water and overburden and rock excavation can be completed inside the shaft with dewatering less than 50,000 L/day. There is potential that shaft walls will be required to be extended to below the base of the shaft to cut-off groundwater seepage/infiltration into the base of the excavation. Cutoff walls may be required to be extended into the bedrock at some shaft locations. The hydrogeological report completed in support of detailed design should provide recommendations on groundwater control at the shafts including recommendations on cutoff wall depths. Further details for each shaft are noted in Section 6.

The sunken caisson and rock breaking (if required), and cement lining approach can be completed by excavation from the surface to a depth of 12 metres with concrete lining to limit groundwater infiltration for excavation within the shaft to the base of the shaft. This method is also intended to limit dewatering and if required can be complemented by the installation of extended cutoff walls and/or an additional grout wall / curtain around the base of the shaft. The grout curtain is installed by drilling small diameter holes through the overburden and bedrock around the constructed shaft and grouting from the surface. This additional groundwater control measure may be required if water from fractures within the bedrock exceeds the amounts anticipated as part of geotechnical work.

As part of detailed design, the following should be addressed to establish base shoring requirements for the shaft and detailed construction cost estimates:

- Required depth of caisson embedment into the bedrock (to protect against active pressures as well as seepage flowing back into the shaft from beneath the excavation),
- Requirement for a concrete plug to be installed at the base of the shoring system to maintain watertightness and resist uplift pressures,
- Minimum caisson interlock to ensure the shoring system is watertight, and,
- Minimum concrete strength and bracing requirements.

Tunnelling contractors have noted that permitted controlled blasting to excavate any rock will be required to ensure construction costs are not excessive (additional millions) and schedule is not extended by years. Tunnelling contactors have indicated that controlled blasting has been successfully completed near built-up areas and it is anticipated that rock blasting for construction of the shafts will be permitted at the proposed shaft locations. Rock blasting may be required for the base of the shafts as well as a slightly larger launch area at the base of the shafts for the TBM to be set up ahead of tunnel construction. Rock blasting impacts will be required to be further reviewed as part of detailed design.

The launch shafts will be constructed to a diameter large enough for the tunnelling equipment and individual sections of sewer pipe to be installed.

Excavated material will be disposed off site. Dewatering will be treated using a particulate filtering system at minimum. Discharge of dewatering volumes will need to be considered as part of detailed design.

Excavated bedrock is typically considered “Inert Fill” and is exempt from many restrictions and requirements that would otherwise apply to waste materials. Detailed disposal requirements for the bedrock can be addressed as part of detailed design.

7.2.7 Additional Considerations for Bedrock Tunnelling

For design alternatives that consider the entire works to be completed in the bedrock, rock squeeze impacts will need to be considered. After rock excavation, the bedrock is expected to have locked-in stresses that will be relieved over 90 to 120 days. Tunnel convergence monitoring will be required to verify that stress relief is complete, and the permanent liner can be installed. If a rigid liner is installed shortly after excavation or in conjunction with the tunnel advance, the swell of the rock as stress is relieved will place significant pressure on the liner.

Microtunnelling can accommodate rock squeeze through tunnel overcut annulus filled with bentonite during construction. After construction, the bentonite can be left to solidify, or compressive grout can be pumped into the annulus. Microtunnelling also does not expose the shale to air or free flowing water which will also mitigate the rock squeeze impacts.

Tunnelled pipe within the bedrock will be 2400 mm diameter to 3000 mm diameter and a two-pass system to install a smaller diameter sewer can be considered. The annular space between the 900 mm along Brown Road, 1500 mm diameter to 1800 mm diameter sewer will be grouted after installation.

7.2.8 In-Pipe Peak Flow Storage

There is a potential opportunity to utilize the new SNF Trunk Sewer for in-line storage. There is flexibility to adapt the size of sewer to suit the availability of tunnel boring machines for construction of the works. If larger diameter TBMs and sewer (2100 mm diameter to 3000 mm diameter are available TBM diameters for works completed in Southern Ontario), the new SNF Trunk Sewer can be appropriately upsized to accommodate additional in-line storage to provide the system with further flow attenuation to manage peaks within the new SNF Trunk Sewer network upstream of the SNF WWTP. Minimum flow velocities to achieve scouring in the new SNF Trunk Sewer under initial phases of development will need to be considered as part of detailed design.

7.3 Thorold South Servicing

7.3.1 Design Criteria

The Thorold South Forcemain and Trunk Sewer has been designed in accordance with the current Niagara Region's Water-Wastewater Project Design Manual with additional guidance from the Ministry of Environment Design Guide for Sewage Works.

Sewer sizing is based on growth projections established as part of Niagara Region's Official Plan catchment area allocation completed in support of the South Niagara Falls WWTP Municipal Class EA and Conceptual Design.

Sizing for the New Blackhorse SPS 400mm diameter forcemain has been based on the recommended sizing determined as part of the Region's 2016 Water and Wastewater Master Plan.

7.3.2 Major Crossings

The Thorold South Forcemain and Sewer will require the following major crossings:

- OPG / Hydro One Transmission Lines Corridor along Allanport Road, and,
- CN Corridor along Barron Road, east of Allanport Road.

There are significant watercourse crossings along Allanport Road at the location of the exiting Black Horse SPS and south of Highway 20, ahead of the outlet to the trunk sewer at Barron Road. Air release and drain chambers will be required to minimize the depth of the proposed forcemain.

7.3.3 Local Servicing Connections

At commissioning, the New Black Horse SPS and Thorold South Trunk Sewer will receive flows from existing catchments and provide opportunity for planned and future potential growth areas to convey flows to the new SPS and trunk sewer.

Key servicing connections to the Black Horse SPS and Thorold South Trunk Sewer are summarized in Table 7-9.

Table 7-9. Key Servicing Connections to Black Horse SPS and Thorold Trunk Sewer

SPS / MH Location	Servicing Connection	Notes
Location No. 1: New Black Horse SPS	• Existing Black Horse SPS Catchment Area • Peel Street SPS • Opportunity for future servicing from Rolling Meadows development	New Black Horse SPS will be designed to accommodate flows from the existing catchment, Peel Street SPS and planned growth including proposed Rolling Meadows development, located northeast of intersection of Highway 20 and Highway 58
Location No. 2: Inlet MH to Trunk Sewer at Allanport Road and Barron Road	• Opportunity for Immediate area of Allanport to connect by gravity sewer • Opportunity for future servicing of broader Allanport Road area via local SPS and forcemain to trunk sewer	• The inlet sewer to the Thorold South Trunk Sewer can provide the immediate area with opportunity to convey flows via local gravity sewer • There is also future opportunity for lands within Allanport South to convey flows via a future SPS and forcemain to the new trunk sewer ○ Topography will not provide for south lands to drain by gravity to the new trunk sewer
Location No. 3: Thorold Townline Road (Barron Road, McLeod Road)	• Opportunity for future servicing of growth areas in South Thorold and Southwest Niagara Falls (currently outside of urban growth areas)	Sewer routing along Thorold Townline Road, McLeod Road, Beechwood Road and Brown Road primarily to provide for construction of the sewer through existing ROW, within minimal environmental impacts, but also provides opportunity to receive future flows from potential future development if the City of Thorold and/or City of Niagara Falls planned growth areas are extended to adjacent lands
Location No. 4: McLeod Road and Beechwood Road		
Location No. 5: Beechwood Road and Brown Road		
Location No. 8: Brown Road at Garner Road SPS (Shaft 8 of Montrose Road Sewer)	• Garner Road SPS • Proposed Thorold South Servicing	Shaft 8 will receive flows from: 1. Garner Road SPS (which will allow for decommissioning of the SPS); and, 2. Proposed Thorold South Servicing along Brown Road.

8.0 Wet Weather Flow Management

A fundamental element of the SNFWWS Class EA Problem and Opportunity statement is to develop a preferred solution and design concept that not only identifies the new SNF WWTP and outfall location but also integrates the wastewater network to address growth, make the system as efficient as possible, and manage wet weather. In addition, a key study objective is to protect the environment through reducing pollution into the rivers and the environment as well as minimize flooding.

The capacity and site planning for the new SNF WWTP and the conveyance strategy, location, size, and depth of the new SNF trunk sewer, are critical infrastructure as part of the overall wet weather flow management program in the broader study area. The wet weather flow management report is available in Volume 3, Appendix V3.7.2.

8.1 Existing Niagara Falls System

The existing Niagara Falls wastewater system, as previously described, consists of a trunk network of pumping stations, sub-trunk sewers, and trunk wastewater interceptor that convey flows generally north to the existing Stanley Ave WWTP.

There are a number of wastewater outfalls or sanitary sewer overflows (SSOs) that discharge to the Hydro Electric Power Canal (HEPC) that ultimately flows to Lake Ontario. The outfalls are primarily related to overflow pipes from the many sewage pumping stations in the network. In particular, the SSHLPS is a large facility with high peak wastewater flows that represent a significant portion of discharges to the HEPC. The key outfall locations in Niagara Falls are summarized below and depicting in the following figure:

- Chippawa Overflow,
- Overflow Downstream of the SSLLPS Forcemain,
- SSHLPS Overflow to Hydro Canal,
- McLeod Road Overflow,
- Royal Manor SPS,
- Dorchester Road SPS,
- Bellevue Street Overflow,
- Drummond Road SPS, and,
- Sinnicks Avenue Overflow.

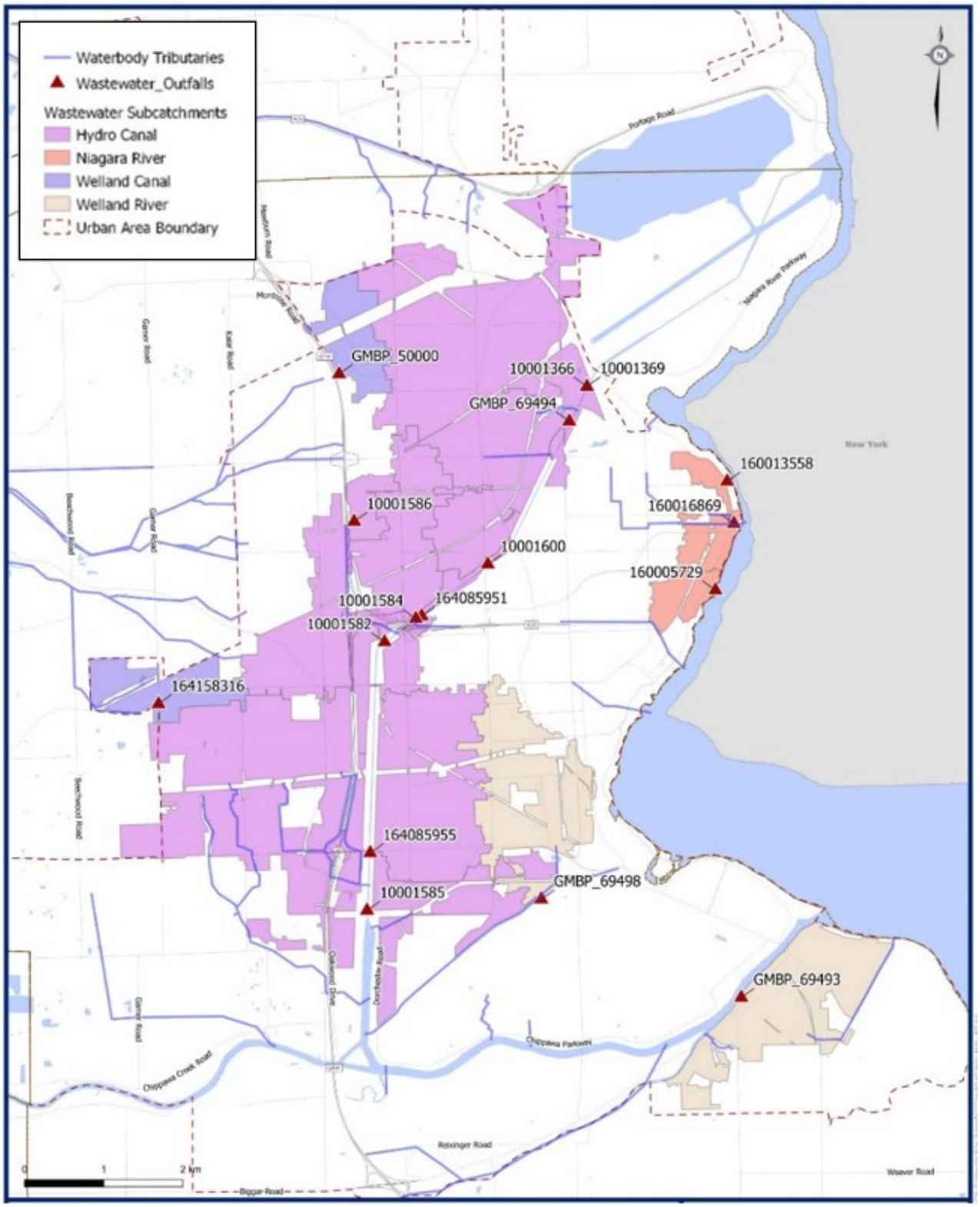


Figure 8-1. Wastewater Outfall Locations within the City of Niagara Falls

8.2 Conveyance Strategy

The new SNF trunk sewer will receive flows at the SSHLPS location and convey all flows to the new SNF WWTP. The SNF trunk sewer is recommended to have a minimum diameter of 1500 mm to 1800 mm and will be installed at depths reaching approximately 20 metres at the SNF WWTP inlet.

This sewer provides not only capacity for future growth in the area, it will also redirect existing flows currently being pumped north through the SSHLPS and convey all these flows, including peak flows, south to the SNF WWTP. The SNF trunk sewer is sized and at a depth to provide conveyance and storage as required to manage the peak flows in the area. Redirection of these flows significantly reduces the flows entering the Stamford Interceptor relieving capacity constraints on the existing trunk infrastructure and allowing less constrained pumping to the Interceptor from the pumping stations further north.

The depth of the new SNF trunk sewer at the inlet to the new SNF WWTP also provides flexibility for future gravity servicing of existing and future growth areas in South Niagara Falls. In particular, the inlet depth has been selected to support potential gravity servicing of the Chippawa area in South Niagara Falls. Chippawa continues to implement wet weather management programs to minimize extraneous flows and overflow occurrences. The Chippawa area is serviced by the SSLLPS and forcemain which have limited capacity to address the full potential peak flows from this area. Providing a trunk sewer gravity feed from Chippawa directly to the new SNF WWTP would eliminate overflows from the trunk system in this area.

8.3 Hydraulic Analysis

In order to determine the level of wet weather management and net environmental benefit, the current Niagara Region full pipe wastewater model for Niagara Falls was used for the hydraulic analysis. The system was modelled under dry weather and wet weather conditions with 2-year and 5-year design storms under existing conditions and future conditions with the SNF trunk infrastructure in place.

The key results of the hydraulic analysis are provided in the following table.

Table 8-1. Wet Weather Management Overflow Volume Reduction under Existing Conditions

Existing Conditions	Dry Weather	2-year Storm	5-year Storm
Total Overflow Volume (m^3) During Storm (excluding Stanley Ave. WWTP bypass)	0	16,505	24,891
Total Overflow Volume (m^3) During Storm (including Stanley Ave. WWTP bypass)	0	47,476	62,336

Table 8-2. Wet Weather Management Overflow Volume Reduction under Future Conditions

Future Conditions with the new SNF trunk infrastructure	Dry Weather	2-year Storm	5-year Storm
Total Overflow Volume (m^3) During Storm (excluding Stanley Ave. WWTP bypass)	0	4,808	7,865
Total Overflow Volume (m^3) During Storm (including Stanley Ave. WWTP bypass)	0	17,400	24,515

8.4 Wet Weather Summary

The SNFWWS design concept and recommendations provide significant wet weather management and net environmental benefit to the study area.

It has been demonstrated through modelling that the system overflows once the new SNFWWS program infrastructure is in place, shown in Table 8-2 are significantly lower than the overflows under current conditions shown in Table 8-1. The new SNF trunk sewer and new SNF WWTP will be capable of capturing and reducing wet weather overflows to the environment by over 60% under the 2-year and 5-year storm events and is anticipated to capture a similar level for most events (17,400/47,476 = 37%, 24,515/62,336 = 39%). The servicing strategy will also fully capture all overflows under a minimum 5-year storm and under more severe wet weather conditions from the SSHLPS location which is one of the most significant contributors to overflow in the existing system. The location and depth of the infrastructure also provides opportunity for additional peak flow capture and overflow reduction through future servicing planning.

9.0 Environmental Impact Assessment and Design Commitments

Several assessments were completed on the preferred design concepts to better understand the potential impacts (SNFWWS ESR Volume 3 – Supporting Documents). The following section provides a summary of the comprehensive SNFWWS Program impacts of recommendations, and the associated mitigation and monitoring measures required during detailed design and construction.

9.1 Climate Change

Niagara Region have prioritized climate resiliency across all services. The implications of climate change on infrastructure can be wide-ranging and can encompass numerous aspects of a project. Likewise, infrastructure upgrades, expansions, operations, and maintenance activities may increase Greenhouse Gas (GHG) emissions thereby impacting air quality and climate.

This section provides an overview of the potential impacts of climate change to the wastewater system and the potential implications of the wastewater system on climate change. The information was used to support the development and evaluation of alternative solutions and design concepts, as well as short and long term adaptative management practices.

9.1.1 Potential Impacts to the Wastewater System

Climate conditions can have an impact on wastewater systems. The following provides a list of weather events and their potential impacts on the wastewater system.

- High Temperatures: an increase in temperatures can lead to water quantity and quality issues,
- Drought: a decrease in wet weather events can lead to water quality issues (higher concentration of wastewater entering the wastewater treatment plants),
- Freeze-Thaw Cycle: freeze-thaw cycles can lead to damaged buried infrastructure,
- Precipitation: increased precipitation can lead to capacity issues and an increased potential for overflows and spills,
- Wind: high winds can lead to an increased power outage, impacting the operation of pumping stations and treatment plants,
- Water Level: increased water levels can lead to flooding of infrastructure,
- Rainfall Events: more frequent and intense wet weather events and changing water levels in the receiving water, and,
- Storms: increased storm events can lead to increased power outages, impacting the operation of pumping stations and treatment plants.

In developing and assessing alternatives, the proposed solution will provide flexibility and redundancy for adapting to the potential climate change impacts described above.

9.1.2 Strategies to Minimize the Impact of the Project on Climate Change

The following proposed solution strategies aim to minimize the project's impact on climate change.

- The WWTP has been designed to be adaptable and accommodate peak flows based on detailed flow analysis and incorporating wet weather impacts,
- Impacts of energy usage, and potential generation of greenhouse gases in varying levels such as carbon dioxide, methane, and nitrous oxide from wastewater treatment processes,
- The assimilative capacity study and WWTP hydraulics have been assessed to ensure that effluent flows can be discharged to Chippawa Creek under a range of Creek flow conditions,
- The use of gravity sewers to reduce the amount of greenhouse gas emissions and solution is supportive of several SPS decommissioning along the preferred trunk sewer,
- Adding redundancy to the wastewater system by connecting to key trunk and local sewers. This will ensure aging infrastructure can be properly rehabilitated and maintained to reduce volume of extraneous flows entering the wastewater system,
- Implementation of real time control at key connections to adapt to continually changing wet weather and flow conditions within the system,
- Design of phased wastewater infrastructure for existing and future peak wet weather conditions to ensure future capacity and avoid potential overflows,
- Restoring natural/grassed areas back to original or enhanced natural conditions,
- Carrying out construction activities outside of key ecological periods to minimize damage to the natural environment and wildlife habitat (e.g., construction outside breeding bird season and high runoff periods in spring),
- The preferred trunk sewer can be used for in-line storage which can support the management of peak flows within the sewer network avoiding or minimizing overflows and peak energy usage at the plant,
- Decreasing the project's carbon footprint by reducing shipment distances of construction resources and materials where possible,
- Using energy efficient technologies during construction where possible, and,
- WWTP incorporates energy conservation through the design of the hydraulics minimizing the need for additional pumping, as well as the potential to generate energy through the anaerobic digestion process.

9.2 Natural Features and Wildlife Habitat Impacts

- Work with NPCA for potential impacts to sensitive natural environmental features:
  - Alignments constructed outside of the right-of-way that could impact features,
  - Work within areas designated as sensitive, and,
  - Any findings through detailed design for shaft locations if noted.

9.3 Watercourse Impacts

- Work with Department of Fisheries and Oceans (DFO) and MNDMNRF for outfall construction.
- Work with NPCA for impacts to watercourses:
  - Trunk sewer major crossing of Welland River, and,
  - Outfall construction in Chippawa Creek, including shoreline.
- Work with MECP with any outfall design / effluent modifications

9.4 Environmental Risk Impacts

- Work with MHSTCI to assess environmental risk (contamination) through detailed design:
  - Additional Phase 2 ESA sampling at WWTP site for silver exceedance,
  - Additional Phase 2 ESA sampling along trunk sewer for uranium and silver exceedance,
  - Complete Phase 2 ESA on sewer shaft locations as required, and,
  - Assess the new Black Horse SPS with Phase 1 ESA.

9.5 Geotechnical Considerations

Detailed geotechnical investigation program will be undertaken by the Region to support the detailed design of the proposed Thorold South and Montrose trunk sewers and WWTP site. Mitigation measures will be recommended, as necessary.

9.6 Hydrogeological Considerations

During detailed design, further Hydrogeological Investigations will be undertaken. The mitigation measures outlined will be further refined, as necessary.

- Detailed hydrogeological investigation programs to be completed by the Region as part of a separate assignment to support the detailed design of the proposed sewers.
- Direct investigation of the subsurface media, such as:
  - Grain-size analyses,
  - Hydraulic testing (slug tests and/or pumping tests),
  - Bedrock coring and documentation of RQD and fracture occurrence/nature, and
  - Water quality testing.
- A door-to-door survey for private wells that may occur within the area of influence, if applicable,
- Review of the project design and planned construction methodologies to assess the potential water taking and potential for impacts,
- Review of the planned dewatering program and development of mitigation measures,
- Hydrogeological investigation program including field investigations and the production of a detailed Hydrogeological Data Report (HDR),
- Hydrogeological Impact Assessment Report (HIAR) with dewatering evaluation for all tunnelling sections and potential impact assessment in support of Permit to Take Water (PTTW) application(s),
- Category III PTTW application(s) completed as per MECP requirements (Operations Division, April 2008),

- PTTW application will need to include the Phase 2 ESA and a contamination mitigation plan should the area be impacted by contamination,
- All monitoring and testing required as part of the hydrogeological investigation program,
- Monitoring well decommissioning as per MECP requirements when instructed by the Agency,
- Further coordination with and approval from the MECP will be required during detailed design,
- Region to continue to consult with review agencies through detailed design, including forwarding route alignment and site plans to NPCA,
- Environmental Management Plan may be required at the detailed design stage based on the potential groundwater impacts. Permitting requirements will be confirmed at the design stage once impacts have been confirmed for all NPCA regulated areas,
- NPCA will be consulted on any potential need for mitigation/potential for complications with the proposed tunnelling during detailed design. Additional / refined information related to construction dewatering will be provided during detailed design, including proposed volumes and methods for handling the effluent/discharge.

9.7 Archaeological Potential

The WWTP site will require Stage 2 AA in select areas during detailed design. The Stage 2 AA will cover the remaining footprint of the recommended WWTP facility and any associated areas where construction may occur.

The preferred outfall alignment within the WWTP site will require a Phase 3 AA. Should deeply buried archaeological resources be identified during ground disturbance activity, ground disturbance activities should be immediately halted and the Archaeology Division of the Culture Programs Unit of the MHSTCI notified.

9.8 Built / Cultural Heritage Impact

Consultation with Cities of Thorold and Niagara Falls may be required during Detailed Design for the indirect heritage properties identified nearby preferred sewer alignments. The recommendation includes vibration studies during construction to minimize potential impacts. Through detailed design, construction methodologies will be confirmed and will look to avoid or mitigate any potential impacts through Ministry review as required.

Further, a heritage permit may be required for identified sites along the preferred sewer routes (if constructing via open cut) as these properties are designated under the *Ontario Heritage Act* (OHA). Tunnelling methodology will significantly reduce surface disturbance.

9.9 Community and Traffic Impacts

During the detailed design phase, a detailed Traffic Management Plan will be undertaken during detailed design. The mitigation measures will be further refined, as necessary. The Region will coordinate with the City of Niagara Falls, City of Thorold, and MTO regarding the preparation of the Traffic Management Plan.

Coordination with MTO will be required due to QEW construction. Additional consultation and coordination will be required with the Cities of Niagara Falls and Thorold during detailed design including:

- Any proposed above ground infrastructure,
- Temporary sidewalk and/or MUTs relocations in the event of a closure during construction,
- Temporary transit stops during construction in the event that a bus stop cannot be maintained during construction. Temporary transit stops should be located as close to the original location as possible,
- Completion of a Tree Preservation/Replacement Plan. The mitigation measures will be further refined, as necessary,
- Avoiding obstruction to any storm runoff collections points by construction activities. If there any proposed relocations, adjustments, or alternations to the City's (Thorold, Niagara Falls) storm infrastructure, the Region shall:
    - Demonstrate that there will be no negative hydraulic impacts,
    - Provide detailed designs to City staff for review,
    - Potential need to complete a pre- and post-construction CCTV inspection of the affected storm infrastructure to the satisfaction of City staff. All inspections and associated reporting shall conform to current NASSCO standards. The Region must provide the condition report and video file to the Cities, and,
    - Provide the Cities with as-constructed drawings and CAD files detailing any revisions/alterations.
- Complete a Construction Noise and Vibration Mitigation Plan during detailed design. The mitigation measures will be further refined, as necessary, and,
- Complete a Restoration Plan for all disturbed areas which will include the restoration of sites to their original condition or enhanced as determined by the Region

9.10 Property Needs

The following section outlines property needs for the new WWTP site, outfall location, new trunk sewer, and Thorold South servicing strategy.

9.10.1 SNF WWTP Property Requirements

The Regional Municipality will acquire one property, 6811 Reixinger Road, Niagara Falls Ontario. This property is required to support required WWTP and outfall siting needs.

9.10.2 SNF Trunk Sewer Property Requirements

The preferred alignment for the new SNF Trunk Sewer is primarily located within the existing Montrose Road right-of-way limits. However, some permanent and temporary construction easements will be required for shaft and sewer sections.

9.10.2.1 Easement through OPG/Hydro One Lands

For the section of sewer from Shaft 1 (located south of the SSHLPS) and Shaft 2 (located along Montrose Road, south of Canadian Drive), a new easement / license agreement will be required within OPG / Hydro One Lands. The easement / license agreement will be approximately 6 metres wide, located within OPG / Hydro One lands, south of the existing 1350 mm diameter sewers inletting to the SSHLPS from the west and the OPG Hydro One north property line. The easement / license agreement is to be located entirely within OPG lands to provide for property negotiations with one owner (OPG), rather than multiple if the easement were located across the property line. The property north of OPG lands is owned by Branthaven Development. The proposed easement / license agreement is shown in Table 9-1.

9.10.2.2 Grassy Brook Shaft within City of Niagara Falls Lands

Shaft 5 located north of the Grassy Brook SPS is to be located within City of Niagara Falls lands (where the current construction compound for QEW improvements works is located). A permanent easement will be required for the shaft and section of sewer that enters from the existing Montrose right-of-way. A temporary construction easement will be required for the compound to complete the tunnelling works. It is anticipated that the current construction compound in the area (being utilized for the QEW bridge works) can be reused as the construction compound for Shaft 5.

The Montrose Road Improvements project second phase will require additional widening in the area of Shaft 8 and consideration for the property requirements for the future road widening should be considered in combination with the new SNF Trunk Sewer needs. The proposed property requirements are shown in Table 9-1.

9.10.2.3 QEW Crossings

The section of sewer running along the OPG Easement / License Agreement from Shaft 1 to Shaft 2 and along Reixinger Road from Shaft 6 (at Montrose Road) to Shaft 7 (at the WWTP site) will require approval from MTO for the crossings of the QEW MTO lands for the proposed trunk sewer.

9.10.2.4 Existing Utilities Along Route

Niagara Peninsula Energy Inc. (NPEI), Bell, Cogeco, Niagara Regional Broadband Network (NRBN) and Enbridge Gas all have utilities running along Montrose Road. There are also overhead hydro transmission lines crossing Montrose Road near the Welland River bridge.

NPEI has existing overheard poles that run along Montrose Road for sections both east and west of the travelled roadway. Phase One of the Montrose Road Improvements project triggered the relocation and upgrade of NPEI poles along Montrose Road from Grassy Brook Road to Biggar Road (south of Reixinger Road). NPEI has commenced design of new works aligned with the road improvements project and extended to north of Grassy Brook Road. Coordination with NPEI through detailed design is required to align NPEI's proposed work with the design of shaft compounds and mitigate the need for any pole support or relocation.

Cogeco and NRBN run service on the NPEI poles and are to be included as part of detailed design Coordination works.

Bell has significant fibre optic infrastructure located along Montrose Road and are upgrading infrastructure as part of the Region's Montrose Road Improvements project. Coordination with Bell and the Montrose Road Improvements project team has commenced to ensure that the new Bell infrastructure to be installed in the area of Montrose Road and Reixinger Road will not conflict with Shaft 6 for the new SNF Trunk Sewer. Continued Coordination with Bell during detailed design will be required.

Enbridge have an existing gas main running along Montrose Road within the extents of the new SNF Trunk Sewer. There is an existing high pressure gas main in the area of Montrose Road and Reixinger Road and plans for installation of an upgraded high pressure main along Reixinger Road, to better service the South Niagara Hospital and future development areas west of the QEW. Shaft 6 has been located with sufficient clearance from the existing high-pressure gas main, and continued consultation will be required throughout detailed design.

Table 9-1. Trunk Sewer Property Requirements

Sewer / Shaft No.	Sewer / Shaft Location	Easement Area and Description
Shaft 1	South Side High Lift Pumping Station (SSHLPS)	• **Permanent Easement:** 10 m x 10 m within OPG / Hydro One Lands for shaft, manhole and connecting sewer from SSHLPS. • **Temporary Easement:** 20 m x 80 m within OPG / Hydro One Lands for tunnelling operations to construct Shaft 1.
Sewer from Shaft 1 to Shaft 2	Easement through OPG Lands (Crossing QEW)	• **Permanent Easement:** 360 m long x 6 m wide easement for tunnelled 1500 mm diameter sewer through OPG lands and crossing MTO to Montrose Road.
Shaft 2	Montrose Road, South of Canadian Drive	• Shaft and construction area located entirely within Montrose Road right-of-way.
Sewer from Shaft 2 to Shaft 3	Montrose Road (South of Canadian Drive to Brown Road)	• Tunnelled sewer located entirely within Montrose Road right-of-way.
Shaft 3	Montrose Road at Brown Road	• Shaft and construction area located entirely within Montrose Road / Brown Road right-of-way.
Sewer from Shaft 3 to Shaft 4	Montrose Road (Brown Road to Chippawa Parkway)	• Tunnelled sewer located entirely within Montrose Road right-of-way.
Shaft 4	Montrose Road at Chippawa Parkway	• Tunnelled sewer located entirely within Montrose Road right-of-way.
Sewer from Shaft 4 to Shaft 5	Montrose Road (Crossing Welland River)	• Permanent Easement: 54 m of proposed sewer located within new permanent easement north of Grassy Brook SPS within City of Niagara Falls lands (current QEW works construction compound).
Shaft 5	Grassy Brook SPS Site	• **Permanent Easement:** 15 m x 56 m for shaft, sections of trunk sewer and sewer connection from Grassy Brook SPS manhole – all located within City of Niagara Falls lands north of Grassy Brook SPS. Reduced area can be considered for permanent easement as detailed design is progressed and proposed sewer alignment is confirmed. Montrose Road Improvements Class EA has identified additional property requirements in the area of Shaft 5 for Phase 2 works (to be designed and constructed in the future) • **Temporary Construction Easement:** 45 m x 56 m for shaft, sections of trunk sewer and sewer connection from Grassy Brook SPS manhole – all located within City of Niagara Falls lands north of Grassy Brook SPS.
Sewer from Shaft 5 to Shaft 6	Grassy Brook SPS Site to Reixinger Road	• **Permanent Easement (Part of Shaft 5 Easement):** Section of sewer from Shaft 5 south on City of Niagara Falls lands included as part of Shaft 5 permanent easement.
Shaft 6	Montrose Road at Reixinger Road	• Shaft and construction area located entirely within Montrose Road / Reixinger Road right-of-way.
Sewer from Shaft 6 to Shaft 7	Reixinger Road (Crossing QEW)	• **Permanent Easement:** 110 m long x 6 m wide permanent easement across QEW (MTO lands) for tunnelled sewer along Reixinger Road.
Shaft 7	WWTP Inlet Pumping Station	• **Easement included as part of WWTP site Property:** Shaft 7 is located within the Proposed WWTP property with property purchase completed in support of the WWTP detailed design.
Shaft 8	Brown Road Pumping Station	• Shaft and construction area located entirely within Brown Road / Heartland Forest Road right-of-way.
Sewer from Shaft 8 to Shaft 3	Brown Road to Montrose Road	• Tunnelled sewer located entirely within Brown Road right-of-way.
Shaft 1	South Side High Lift Pumping Station (SSHLPS)	• Permanent Easement: 10 m x 10 m within OPG / Hydro One Lands for shaft, manhole and connecting sewer from SSHLPS.

9.10.3 Thorold South Servicing Property Requirements

The majority of the Thorold South servicing project will be constructed within existing Region, City of Thorold and City of Niagara Falls right-of-way (ROWs). Property purchase will be required for the New Black Horse SPS site, and a permanent easement will be required for the Black Horse SPS and proposed forcemain north of Highway 20 (Lundy's Lane).

A summary of the site property requirements for the New Black Horse SPS and forcemain north of Highway 20 (Lundy's Lane) is summarized in Table 9-2. It is not anticipated that temporary construction easements will be required for the proposed forcemain and trunk sewer to be located within the existing Region, City of Thorold and City of Niagara Falls rights-of-way.

Table 9-2. Property Requirements

Sewer / Shaft Selection	Property / Easement Type	Property / Easement Area and Description
New Black Horse SPS	Property Purchase for New SPS Site	The New Black Horse SPS will require a site to be purchased/owned by Niagara Region. A 50 metre x 40 metre site is comparable to similar capacity Region pumping stations.
Forcemain from New Black Horse SPS to south of Highway 20 (Lundy's Lane) adjacent to Highway 58 (Davis Road)	6 metre Wide Dedicated Permanent Easement	New 950 metres long permanent dedicated easement required for forcemain if construction is to be completed outside of MTO-owned Highway 58 (Davis Road).

9.10.3.1 Black Horse SPS Site

The property immediately south of the Thorold Fire Station (701 Allanburg Road) has been identified for the New Black Horse Sewage Pumping Station (Figure 5-19). Available site area is approximately 40 metres frontage and 40 metres deep, which will provide for a site equivalent to similar sized pumping station in Thorold (e.g. Confederation Heights SPS). Access to the property will be from Allanburg Road and the entranceway will be required to be configured to meet minimum separation distance from the Allanburg Road and Highway 58 intersection. Location of the entrance will be required to be reviewed and approved by the Region's Transportation Department and MTO.

9.10.3.2 Forcemain Easement from New Black Horse SPS to Highway 20 (Lundy's Lane)

Highway 58 is an MTO owned highway and construction of the new forcemain within the right-of-way may not be permitted. Engagement with MTO as part of detailed design will be required to confirm this. There is an existing 12 metre wide easement located immediately west of Highway 58, and a 6 metre wide dedicated Region watermain easement further west. A new dedicated 6 metre wide easement for this section of New Blackhorse SPS forcemain is recommended. The proposed easement configuration is shown in Figure 9-1.

South of Highway 20 / Lundy's Lane, Allanport Road is a Regional Road and the forcemain can be constructed within the right-of-way.

Figure 9-1. Proposed Forcemain Easement from New Black Horse SPS Site to Highway 20

9.11 Corporate Communications

Region's Corporate Communications department to continue to inform the study contact list, residents and public via online notices and website updates, public notifications via mail, and via existing social medial channels as the project proceeds to Detailed Design.

The Region will continue to inform local Councillors via briefing notes throughout detailed design.

9.12 Utilities

9.12.1 Existing Utilities Along New SNF Trunk Sewer Route

Niagara Peninsula Energy Inc. (NPEI), Bell, Cogeco, Niagara Regional Broadband Network (NRBN) and Enbridge Gas all have utilities running along Montrose Road. There are also overhead hydro transmission lines crossing Montrose Road near the Welland River bridge.

NPEI has existing overheard poles that run along Montrose Road for sections both east and west of the travelled roadway. Phase One of the Montrose Road Improvements project triggered the relocation and upgrade of NPEI poles along Montrose Road from Grassy Brook Road to Biggar Road (south of Reixinger Road). NPEI has commenced design of new works aligned with the road improvements project and extended to north of Grassy Brook Road. Coordination with NPEI through detailed design is required to align NPEI's proposed work with the design of shaft compounds and mitigate the need for any pole support or relocation.

Cogeco and NRBN run service on the NPEI poles and are to be included as part of detailed design Coordination works.

Bell has significant fibre optic infrastructure located along Montrose Road and are upgrading infrastructure as part of the Region's Montrose Road Improvements project. Coordination with Bell and the Montrose Road Improvements project team has commenced to ensure that the new Bell infrastructure to be installed in the area of Montrose Road and Reixinger Road will not conflict with Shaft 6 for the new SNF Trunk Sewer. Continued Coordination with Bell during detailed design will be required.

Enbridge have an existing gas main running along Montrose Road within the extents of the new SNF Trunk Sewer. There is an existing high pressure gas main in the area of Montrose Road and Reixinger Road and plans for installation of an upgraded high pressure main along Reixinger Road, to better service the South Niagara Hospital and future development areas west of the QEW. Shaft 6 has been located with sufficient clearance from the existing high-pressure gas main, and continued consultation will be required throughout detailed design.

9.12.2 Existing Utilities Along Thorold South Servicing Route

Hydro One Networks Inc. (Hydro One) Niagara Peninsula Energy Inc. (NPEI), Bell, Cogeco, Niagara Regional Broadband Network (NRBN) and Enbridge Gas all have utilities within the area of the New Black Horse SPS and along the route of the proposed forcemain and Thorold South Trunk Sewer. Existing Utilities across the Study Area are summarized in Table 9-3.

Table 9-3. Existing Utilities around New Black Horse SPS and Forcemain and Thorold South Trunk Sewer

Utility	Existing Overhead / Buried Plant
Hydro One / NPEI	• Overhead hydro poles along Highway 58, Allanport Road, Barron Road, Thorold Townline Road, Beechwood Road and some sections of Brown Road, and, • Transmission wires crossing Allanport Road, south of Highway 20 (Lundy's Lane).
Bell	• Overhead utility aligned with Hydro One and NPEI Utility Poles.
Cogeco / NRBN	• Overhead utility aligned with Hydro One and NPEI Utility Poles.
Enbridge	• 200 mm Extra High Pressure (XHP) gas main on Thorold Townline Road between Barron and McLeod Road, • 100 mm XHP gas main on McLeod Road between Thorold Townline and Beechwood Road, • 100 mm – 200 mm Intermediate Pressure (IP) gas main on Brown Road, • No gas main on Davis Road between Allanburg and Highway 20, • 50 mm – 100 mm Intermediate Pressure (IP) gas main along intersection of Allanport Road and Highway 20, and, • No gas main on Beechwood Road.

9.12.3 Topographic Survey Subsurface Utilities Engineering

A topographic survey including updated bathymetry for the Welland River crossing is to be completed as part of the detailed design. Conceptual Design is based on a ground surface developed based on the Region's GIS contours and available bathymetry data.

The Region is to continue to consult with the City of Thorold and City of Niagara Falls as well as Utilities with existing and proposed overhead and underground plant within the area. CNP, NPEI, Bell, Cogeco, NRBN and Enbridge all have existing plant within the proposed Study Area. A qualified subsurface utilities engineering (SUE) to be retained during detailed design to support base plan development.

SUE consultation and coordination during detailed design with the following stakeholders: City of Thorold, City of Niagara Falls, NPEI, Bell, Cogeco, NRBN, Enbridge and Hydro One.

9.13 Construction

- The recommended sewer and shafts will proceed to detailed design pending outstanding coordination and necessary approvals.
- Region to forward route alignment and site plans upon study completion to Enbridge Gas Distribution, Hydro One Networks, Alectra Utilities, Bell and Rogers.
- Region to continue to coordinate with the various utility companies to resolve any potential conflicts that arise during construction.
- Region to coordinate with the Cities of Niagara Falls and Thorold on any related infrastructure that may be impacted.
- A detailed recommended Construction Management plan is to be developed with input from tunnelling contractors on available equipment to be used for the work, general sequencing of works, working hours (including consideration for night work to expedite schedule and resultant community impacts) are to be approved as part of the tunnel work plan and methodology review. The Construction Management Plan will address:
    - Haulage of material,
    - Impact to trees,
    - Restoration plans,
    - Impact to buildings,
    - Impact to street signage, traffic signals,
    - Any sidewalk closures, and,
    - Any short-term temporary lane closures required.
    - Detailed design should consider construction methodologies to mitigate inflow and infiltration, in accordance with Regional policies.
    - A Post-Construction Monitoring Plan will be completed during detailed design.
    - Further coordination with and approval from the City of Niagara Falls to obtain all necessary permits and approvals prior to construction (see Table 9-4).

Considerations for permits and approvals, to be confirmed during detailed design are summarized in Table 9-4.

Table 9-4. Permit Considerations for Detailed Design

Required Permits and Approvals	Detailed Design Notification/ Coordination/ Approval	Notes
Ministry of the Environment, Conservation and Parks (MECP)		
Environmental Compliance Approval (ECA)	After Region Approval of 90% Design	• ECA will be required as proposed sewers are considered a "substantial addition to the existing system". • Completed application, Pipe Data Form and supporting Design Drawings and Design Report will be required as part of the submission package.
Permit to Take Water (PTTW)	Only If Required After Region Approval of 90% Design	• MECP PTTW will be required if it is determined that water taking in excess of 50,000 L/day is required for construction activities. • Geotechnical/hydrogeological report in support of the PTTW application, Design Drawings and Design Report will be required as part of the submission package.
Ontario Ministry of Transportation (MTO)		
Input and Approval, Construction Permit	Throughout Detailed Design, including early engagement for proposed watermain to be constructed along Highway 140	• The area Municipal Corridor Officer should be engaged as part of the detailed design to better understand requirements and constraints. • 60% and 90% Detailed Design Drawings for the proposed works should be submitted to MTO for review and approval after review and approval by Niagara Region. • Construction permit to complete crossings of QEW will be required.
Canadian Pacific Railway Company (CP)		
Utility Corridor Access Permit	Throughout Detailed Design, including early engagement	• Coordination with CP will be required to determine permitting and flagging for the rail corridor crossing. • 60% and 90% Detailed Design Drawings for the proposed works should be submitted to the rai corridor owners and operators for review and approval after review and approval by Niagara Region. • CP has indicated that their rostered geotechnical consultants may be required to be retained to complete investigation in support of crossing works. • Flagging and construction requirements should be incorporated into the Contract Documents.
Niagara Peninsula Conservation Authority (NPCA)		
Welland River Crossing Approval	Throughout Detailed Design, including early engagement	• Welland River crossing and impacts mitigation (including potential for Environmental Management Plan) will be required by NPCA.
Dewatering Discharge Approval	Throughout Detailed Design	• Consultation after Hydrogeological Investigation results and recommendations know to understand volume and water quality requirements for receiving bodies (ditches outletting to watercourses). • Discharge Plan submitted at 60% and 90% Detailed Design stage after review and approval by Niagara Region.
Erosion and Sediment Control Measures Approval	At 90% Detailed Design	• Submission of ESC Plan at 90% Detailed Design stage after review and approval by Niagara Region.
Niagara Region		
Construction Encroachment Permit	90% Detailed Design	• Construction encroachment permit will be required for works to be completed within Montrose Road right-of-way.
City of Niagara Falls		
Dewatering Discharge Approval	Throughout Detailed Design	• Consultation at Hydrogeological Investigation to understand volume and water quality requirements for receiving bodies (ditches and storm sewers). • Discharge Plan submitted at 60% and 90% Detailed Design stage after review and approval by Niagara Region.
Road Occupancy Permit	90% Detailed Design	• Construction of the proposed forcemain and proposed watermain within Barber Drive, Second Concession Road and Barrick Road.
Fisheries and Oceans Canada (DFO)		
Project Review	Throughout Detailed Design, including early engagement to ensure that any required additional studies can be completed ahead of 40% Design Submission	• Tunnelled sewer crossing under the Welland River to be designed to have no impacts on surface water. • DFO to be engaged as part of design process to ensure approval and any required mitigation measures are incorporated.

Table 9-5. SNFWWS Program Impact and Mitigation Measures

Program Component	Potential Impact	Additional Studies during Detailed Design	Mitigation Measures / Net Effects	Monitoring Requirements
Discipline: Natural Environment				
WWTP Site	• Potential habitat for little brown myotis. • Potential impact to barn swallow, eastern meadowlark, and bobolink	• Species-specific survey to confirm presence of little brown myotis habitat. • Notice of Activity registrations for barn swallow, eastern meadowlark, and bobolink	• Mitigation would include authorization under the ESA and consultation with MECP.	• Monitoring requirements to be identified during Detailed Design.
Outfall Location	• Evaluate impacts to fish and fish habitat • Interference within regulation limits of NPCA with crossing of Provincially Significant Wetland	• Consult with Department of Fisheries and Oceans (DFO) for potential Request for Review (RFR) and Project Authorization under the Fisheries Act/permitting for any fish and mussel Species at Risk (SAR) under the Endangered Species Act or SARA.	• Mitigation would include consultation and potential authorization permits from DFO and NPCA.	• Monitoring requirements to be identified during Detailed Design.
Trunk Sewer	• Potential impacts to Natural features at Shaft 1 (Cultural meadow and Grey Dogwood Cultural Thicket) • All other shafts within previously disturbed Region ROW / WWTP Site • NPCA Regulate Area at Montrose Road and Reixinger Road to be altered as part of Montrose Road Improvements project, with Proposed Shaft 6 within the limits of the newly constructed road widening • Tunnelling works under Welland River will required NPCA Permit	• Geotechnical and hydrogeological work to support design of tunnel profile under Welland River to mitigate risks to riverbed from construction • Detailed tree inventory required at all shaft locations upstream of the WWTP site	• Design tunnelled sewer profile to minimize risk of frac-out/environmental impact to Welland River, including development of detailed contingency plan for NPCA approval • Minimize project footprint and duration to the extent possible. • Clearly demarcate and maintain site boundaries to prevent encroachment into adjacent Natural features. • Ensure all equipment is cleaned prior to transportation and maintained free of fluid leaks, for use on the sites to avoid the spread or introduction of invasive species, or noxious weeds. • Remove and properly dispose of all construction-related debris and excess materials following construction.	• Prepare a grading plan, drainage plan and sediment and erosion control plan for each site. • Develop and implement a site-specific spill management plan and always have all components on site in event of a spill.
Thorold South Strategy	• NPCA regulated watercourse crossings at the location of the existing Black Horse SPS (proposed dedicated forcemain easement west of Highway 58) as well as Allanport Road, south of Highway 20 (Lundy's Lane) • Smaller tributary crossings along McLeod Road are NPCA regulated areas and works will require permitted crossings with construction to be confined to the ROW • NPCA floodplain and wetland allowances through Beechwood Road and Brown Road sections and works will require permitted crossings with construction to be confined to the ROW	• Geotechnical and hydrogeological work to support design of tributary and wetland crossings with existing ROWs to mitigate risks to watercourses and surrounding natural environment • Detailed tree inventory required at New Black Horse SPS site and along ROW where open-cut construction may impact roadside trees • Groundwater sampling requirements to be determined as part of geotechnical and hydrogeological investigations scope	• Design forcemain and sewer crossings of watercourses to minimize risk of frac-out/environmental impact, including development of detailed contingency plan for NPCA approval • Minimize project footprint and duration to the extent possible. • Clearly demarcate and maintain site boundaries to prevent encroachment into adjacent Natural features. • Ensure all equipment is cleaned prior to transportation and maintained free of fluid leaks, for use on the sites to avoid the spread or introduction of invasive species, or noxious weeds. • Remove and properly dispose of all construction-related debris and excess materials following construction.	• Prepare erosion and sediment control plans for the extent of the SPS and forcemain and trunk sewer construction. • Develop and implement a site-specific spill management plan and always have all components on site in event of a spill. • Additional monitoring requirements to be identified during detailed design

Program Component	Potential Impact	Additional Studies during Detailed Design	Mitigation Measures / Net Effects	Monitoring Requirements
Discipline: Archaeology (Terrestrial)				
WWTP Site	• Stage 1 Archaeological Assessment (AA) completed on WWTP site which flagged potential for impacts. • Stage 2 AA was completed on portions of the WWTP site. Impacts identified in the northern areas of the site.	• Stage 2 AA is required in remaining areas of the preferred WWTP site during detailed design. • Stage 3 AA is required for outfall alignment.	• Mitigation measures to be confirmed during detailed design with pending WWTP site and shaft investigations. Mitigation will depend on confirmed construction techniques through detailed design.	• Should deeply buried archaeological resources be identified during ground disturbance activity, ground disturbance activities should be immediately halted and the Archaeology Division of the Culture Programs Unit of the MHSTCI notified.
Trunk Sewer	• The Stage 1 AA identified the Shaft 1 area (south of South Side High Lift SPS) as having archaeological potential and a Stage 2 assessment is required • All other shaft areas are within previously disturbed areas and no further archaeological assessment is required • The trunk sewer constructed by trenchless methods through deep land alterations that have no to low archeological potential.	• A Stage 2 AA is required for the Shaft 1 site located south of the existing South Side High Lift SPS within OPG / Hydro One lands. • Stage 2 AA may be required for tunneled trunk sewer alignment pending detailed design consultation around construction methods with Indigenous Communities and MHSTCI. • Shaft 6 at Montrose Road and Reixinger Road will be constructed within an area to be disturbed by the Montrose Road Improvements project and therefore no further archeological assessment is required for this Shaft	• Mitigation measures to be confirmed during detailed design with pending WWTP site and shaft investigations. Mitigation will depend on confirmed construction techniques through detailed design.	• Should deeply buried archaeological resources be identified during ground disturbance activity, ground disturbance activities should be immediately halted and the Archaeology Division of the Culture Programs Unit of the MHSTCI notified.
Thorold South Strategy	• The Stage 1 AA identified the New Black Horse SPS site and the section of forcemain to be installed within the proposed easement (from the new SPS to Highway 20) as having archaeological potential and a Stage 2 assessment is required • A Stage 2 AA was completed for the New Black Horse SPS site and no archaeological resources were identified, and no further archaeological assessment is required for the site. • All other sections of proposed forcemain and gravity sewer are to be located within previously disturbed areas and no further archaeological assessment is required	• Stage 2 AA is required for the section of proposed forcemain to be located within a new easement, west of Highway 8 (Davis Road). • No further archeological assessment is required for the forcemain, gravity sewer and construction areas that will be located within ROWs as the areas are previously disturbed areas • No archaeological resources were identified at the New Black Horse SPS site and no further archaeological assessment is required for the site.	• Mitigation measures to be confirmed during detailed design with pending WWTP site and shaft investigations. Mitigation will depend on confirmed construction techniques through detailed design.	• Should deeply buried archaeological resources be identified during ground disturbance activity, ground disturbance activities should be immediately halted and the Archaeology Division of the Culture Programs Unit of the MHSTCI notified.
Discipline: Archaeology (Marine)				
Outfall Location	• No impact anticipated.	• No additional studies required.	• No mitigation measures required.	• Should deeply buried archaeological resources be identified during ground disturbance activity, ground disturbance activities should be immediately halted and the Archaeology Division of the Culture Programs Unit of the MHSTCI notified.
Discipline: Cultural and Built Heritage				
WWTP Site	• No impact anticipated as noted in the completed Cultural Heritage Evaluation Report (CHER).	• No further assessment required.	• No mitigation measures required.	• No monitoring measures required

Program Component	Potential Impact	Additional Studies during Detailed Design	Mitigation Measures / Net Effects	Monitoring Requirements
Trunk Sewer	• Potential for indirect impacts to: • Sir Adam Beck Generating Station Power Canal (Provincial Heritage Property of Provincial Significance) resulting from Shaft 1 construction activities • 6811 Reixinger Road (WWTP site) resulting from Shaft 7 (WWTP Inlet PS) construction activities	• If encroachment onto the Sir Adam Beck Power Canal property is anticipated, then consultation with the MHSTCI and OPG/Hydro One is recommended	• Post-construction landscaping should be completed to return Shaft 1 work area to pre-construction conditions.	• No monitoring measures required
Thorold South Strategy	• Potential for indirect impacts to four heritage residential and farm properties (8950 Brown Road, 10111 McLeod Road, 1315 Barron Road and 2108 Allanport Road)	• Vibration Monitoring Plan to be completed during detailed design	• Conduct pre- and post-construction and regular condition surveys and reviews during construction to evaluate efficacy and protective measures. • Identify heritage properties within study area as part of Contract Documents for condition surveys (including all properties identified as part of the CHAR)	• Monitor for vibration during all construction related activities
Discipline: Geotechnical and Hydrogeological				
WWTP Site	• Construction of the new WWTP will be within challenging mixed-face geotechnical conditions. • Based on the preliminary investigations the geotechnical conditions at the site are suitable to support the buildings and chambers on steel H-piles. • Impacts on Intake Protection Zones, Event-Based Areas, Significant Groundwater Recharge Areas and Highly Vulnerable Aquifers will be addressed after receipt and review of the final hydrogeological report.	• Further geotechnical and hydrogeological field investigations are required during detailed design to confirm construction approach for the new WWTP facility	• Mitigation measures to be identified during detailed design	• Monitoring requirements to be identified during detailed design
Trunk Sewer	• Construction of the sewers and shafts will be within challenging mixed-face geotechnical conditions: • Soils ranging from soft “flowing” conditions (‘n’ value <10) to very dense cohesionless soils with cobbles/boulders and high groundwater table • Hard, weathered bedrock with potential for extensive groundwater infiltration through seams • Construction dewatering may be required at all shaft sites • Impacts on Intake Protection Zones, Event-Based Areas, Significant Groundwater Recharge Areas and Highly Vulnerable Aquifers will be addressed after receipt and review of the final hydrogeological report.	• Further geotechnical field investigations are required during detailed design, including assessment and recommendations for the following: • Soil sampling to meet O.Reg. 406/19 Excess Soil Management guidelines • Further hydrogeological field investigations are required during detailed design to confirm groundwater quality on site and confirm hydraulic properties of subsurface materials. • Recommendations on depth of any required cutoff walls at shaft locations should be included to support detailed design • Control of groundwater, volume to be dewatered, discharge requirements (volume and water quality compared to receiving bodies) are required for dewatering contractors to effectively bid the work	• Watertight shoring to required depth (may be below base of shaft) to minimize dewatering requirements to manageable volumes (approximately 1 ML/d, Maximum 6 ML/d). • Shaft site to consider dewatering activities and appropriate discharge treatment. • Construction sites should be laid out to ensure that there is capacity to provide sufficient treatment to construction dewatering discharge water before release. • Additional mitigation measures to be identified during detailed design	• Monitoring requirements to be identified during detailed design, including vibration monitoring for any required rock blasting activities to construct shafts and portions of the tunnel.

Program Component	Potential Impact	Additional Studies during Detailed Design	Mitigation Measures / Net Effects	Monitoring Requirements
Thorold South Strategy	• Construction of the New Black Horse SPS may require bedrock excavation at the base of the wet well • There is potential for hard, weathered bedrock with potential for extensive groundwater infiltration through seams • Geotechnical investigations for the downstream Montrose trunk sewer have noted soils ranging from soft "flowing" conditions ('n' value <10) and high groundwater table • Open-cut construction of the forcemain and gravity sewer may require stabilization of soils for pipe and structure bedding • Construction dewatering may be required at the New Black Horse SPS Site, watercourse crossings and at downstream deep trunk sewer locations (along Brown Road near Heartland Forest Road) • Impacts on Intake Protection Zones, Event-Based Areas, Significant Groundwater Recharge Areas and Highly Vulnerable Aquifers will be addressed after receipt and review of the final hydrogeological report.	• Further geotechnical field investigations are required during detailed design, including assessment and recommendations for the following: • Rock profile at/near the New Black Horse SPS site • Soil conditions for open-cut construction, requirements for stabilization of soils to support construction and recommendations to limit construction trench footprint • Soil sampling to meet O.Reg. 406/19 Excess Soil Management guidelines • Further hydrogeological field investigations are required during detailed design to confirm groundwater quality on site and confirm hydraulic properties of subsurface materials. • Recommendations on depth of any required cutoff walls at the pumping station wet well and inlet sewers should be included to support detailed design • Control of groundwater, volume to be dewatered, discharge requirements (volume and water quality compared to receiving bodies) are required for dewatering contractors to effectively bid the work	• Watertight shoring to required depth (may be below base of wet well) to minimize dewatering requirements to manageable volumes • Open-cut construction to consider dewatering activities and appropriate discharge treatment. • Open-cut construction should consider limits of open trench to minimize dewatering volumes • Construction sites should be laid out to ensure that there is capacity to provide sufficient treatment to construction dewatering discharge water before release. • Additional mitigation measures to be identified during detailed design	• Monitoring requirements to be identified during detailed design
Discipline: Environmental Risk				
WWTP Site	• Phase 2 ESA recommended no further investigations required.	• n/a	• The Phase 2 ESA recommendations indicated no constraints or impediments in moving forward with construction on the preferred WWTP site.	• n/a
Trunk Sewer	• Groundwater monitoring noted likely naturally occurring exceedances of Table 1 and Table 2 Site Condition Standards for uranium and silver	• Resampling of monitoring well located near Shaft 1 (South Side High Lift SPS) to confirm silver exceedance	• Excess soils will be required to be disposed of at a receiving site that can accept soils with the identified metal exceedances (any landfill or Class 1 Soil Management Facility, subject to the conditions of the facility's ECA)	• Additional monitoring requirements to be identified during detailed design
Discipline: Traffic Management				
WWTP Site	• Increased truck traffic due to treatment plant operations. Estimated 12 truck loads of digested sludge going to the Garner Road Biosolids Facility from the WWTP each day. • Typical haul route from the WWTP to Garner Road Biosolids Facility is west on Reixinger Road, south on Dell Road, west on Lyons Creek Road, north on Montrose Road, and west on Chippawa Creek Road.	• Detailed Traffic Management Plan.	• Truck traffic and truck loading for construction and operations limited to 7am-7pm Monday to Friday. • Truck route to minimize local traffic impact with appropriate mitigation measures through the Traffic Management Plan.	• Monitoring requirements to be identified during Detailed Design.

Program Component	Potential Impact	Additional Studies during Detailed Design	Mitigation Measures / Net Effects	Monitoring Requirements
Trunk Sewer	• Shaft 3 (Montrose Road and Brown Road) will require closure of Brown Road at Montrose Road • Shaft 6 (Montrose Road and Reixinger Road) will require closure of Reixinger Road, east of Montrose Road • All other shafts are expected to be located off road, minimizing impacts to traffic • Intersection will operate at overall acceptable levels of service and congestion.	• Detailed Traffic Management Plan.	• Trucks entering and exiting shaft sites will be accommodated with entry and exit lanes onto Montrose Road to provide for improved merge with existing traffic • Private entryway from Montrose Road to farm at Reixinger Road East will be provided for duration of Reixinger Road closure • Montrose Road Improvements project works at intersection of Montrose Road and Reixinger Road will be coordinated with trunk sewer project to ensure efficient construction sequencing • Overall construction sequencing will consider timing requirements of Montrose Road Improvements project (Shaft 6 works may be required to be constructed at front end of project to accommodate restoration works for Montrose Road Improvements)	• Monitoring requirements to be identified during Detailed Design.
Thorold South Strategy	• New Black Horse SPS will require trucks entering and exiting the site from Allanburg Road, west of Highway 58 • Forcemain along Allanport Road from Highway 20 (Lundy's Lane) to Barron Road and trunk sewer along Barron Road, Thorold Townline Road, McLeod Road, Beechwood Road and Brown Road will be constructed within the ROW and will require traffic management that may include temporary lane closures • It is anticipated that through traffic can be maintained with potential requirements for full road closure for construction of the trenchless crossings of the CN Corridor along Barron Road	• Detailed Traffic Management Plan.	• Trucks entering and exiting the New Black Horse SPS site will be accommodated with a construction access onto Allanburg Road that complies with entranceway setbacks from the Allanburg Road and Highway 58 intersection	• Monitoring requirements to be identified during detailed design.
Discipline: Air, Odour and Noise				
WWTP Site	• An air and odour assessment results indicated that maximum cumulative concentrations of all contaminants are below the relevant assessment criteria. • Predictive noise modelling indicated that the Project is expected to meet MECP sound level limits at the identified representative PORs.	• As the Project is not yet constructed, the air and odour inputs into the modelling have been prepared using published emission factors and data for similar wastewater treatment plants in Ontario.	• Conceptual Air and odour mitigation controls have been included into the design of the new WWTP, which include the use of biofilters to control emissions from the activities with the greatest potential for odorous emissions. Further evaluation and selection of odour control systems will be completed during detailed design. • The predicted change in noise levels resulted in a 'negligible' magnitude rating, and therefore no adverse noise effects are expected.	• Monitoring requirements to be identified during detailed design.

Program Component	Potential Impact	Additional Studies during Detailed Design	Mitigation Measures / Net Effects	Monitoring Requirements
Trunk Sewer	• Potential for noise and vibration impacts from blasting required for rock blasting for shaft and un-serviced sewer construction.	• Impacts will be assessed as part of the Air, Odour and Noise studies to be completed supporting detailed design.	• Mitigation measures to be identified during detailed design. • Potential for odour from excavated soils (stockpiling and open excavation) to be confirmed through additional geotechnical and hydrogeological work and if required, mitigation measures to be developed through air, odour and noise consultation work	• Preconstruction survey and monitoring to be completed for areas that may be impacted by rock blasting.
Thorold South Strategy	• Potential for noise and vibration impacts from open-cut forcemain and sewer construction • Odour impacts from excavation of New Black Horse SPS wet well (excavated material for deep infrastructure projects has been noted to have odour issues).	• Requirement for Air, Odour and Noise studies will be confirmed during detailed design.	• Mitigation measures to be identified during detailed design. • Potential for odour from excavated soils (stockpiling and open excavation) to be confirmed through geotechnical and hydrogeological work and if required, mitigation measures to be developed through air, odour, and noise consultation work.	• Preconstruction survey and monitoring to be completed for areas that may be impacted by construction.
Discipline: Assimilative Capacity				
Outfall Location	• Potential modifications to outfall concepts during detailed design.	• No additional studies anticipated based on current conceptual design; however, an Outfall Construction Plan is required during detailed design. If the Plan identifies modifications to the accepted criteria, resubmission to MECP is required.	• No mitigation measures anticipated.	• No monitoring measures anticipated.

10.0 Impact Mitigation and Monitoring Measures

10.1 Risk Management

From study outset, individual risks were identified, assessed for likelihood and consequence severity, and monitored through each phase of the Class EA process. As the study progressed and additional investigations and consultation was conducted, several risks were removed or had minimized in severity. However, there were new risks that were introduced or that increased in severity during the Phase 3 Class EA process.

The Project team proactively reduced risk in the project through Phase 3 with sub-surface field investigations, a detailed planning level geotechnical and hydrogeological investigations, Phase 1 and 2 Environmental Site Assessments and Stage 1 and 2 Archaeological Assessments on the majority of the preferred site and sewer route alignments. These investigations refined associated cost estimates for detailed design and construction. Following the geotechnical and hydrogeological investigations, the project team completed third party reviews and consulted constructability experts to validate conceptual design elements for the new WWTP, outfall, trunk sewer and related servicing components.

The project team held study milestone risk review meetings with Region staff to confirm status on key items including property and easement acquisitions, field investigation recommendations, funding opportunities, construction scheduling, and more.

Following the Class EA process, pre-identified risks will continue to be monitored and managed as appropriate through detailed design and construction. These risks are provided in Table 10-1.

10.2 SNFWWS Program Mitigation Needs

The SNFWWS Program identified potential mitigation of impacts on:

- Archaeological Features
- Natural Features and Wildlife Habitat (Terrestrial and Aquatic)
- Groundwater
- Watercourse
- Assimilative Capacity
- Contamination
- Soil / Bedrock
- Cultural / Built Heritage Resources
- Air, Odour and Noise
- Traffic

The associated impacts and monitoring for each discipline are provided above in Table 9-5.

Table 10-1. Risk Levels Following the Class EA Filing

No.	Risk Item	Description	Response
1	**Property Acquisition**	• Project solution requires acquisition of property. Risk that property owner(s) refuse sale or easement rights through negotiations. • Implementation delays, financial, and reputational risk are possible if unable to identify an appropriate alternative.	• Project team actively engaged the property owner from the onset of the EA, specifically when long listed sites were identified onward. • The Region and the property owner, with financial support from the Region, obtained separate narrative appraisal reports prepared by an AACI-accredited appraiser • The Region will acquire the property via an offer or initiation of formal expropriation proceedings to acquire the property on a compulsory basis in accordance with the Expropriations Act. • The expropriation process will allow third party adjudication to decide the final purchase price. • The City of Thorold has raised no concern with acquiring the preferred property for the new Black Horse SPS.
2	**Funding**	• Loss of external funding opportunities if lacking internal communication or knowledge of upcoming grants / application periods. • Further risk if Provincially or Federal funding is not available or received ahead of construction. • Post-EA implementation risk if funding applications are not submitted/if funding is not received ahead of construction.	• Project Team and Region funding staff identified and pursued relevant opportunities during the Class EA process. Green initiatives will be added provisionally to conceptual design to enhance funding opportunities. • The Region will continue to pursue funding for construction.
3	**Conceptual Design Layout**	• Financial impacts (schedule delays, re-evaluation of site alternatives, design modifications) if site investigations or property negotiations shift facility late in the detailed design process.	• Modifications to the WWTP site, outfall, Black Horse SPS site or sewer alignments once in the detailed design phase may have significant cost and schedule impacts. • Property negotiations and further field investigations are being completed during detailed design (i.e. archaeological). Post-EA implementation risk pending site investigation results.
4	**Archaeological Potential**	• Risk of uncovering further archaeological findings beyond the EA during detailed design and construction. • Post-EA implementation schedule risk if discovery of further archaeological items during detailed design or construction following property acquisition. • Significant financial impact if preferred WWTP site, shaft compound, or proposed construction site, is located within identified archaeological areas. Financial implications also related to schedule delays for removal of artifacts.	• WWTP outfall alignment will require additional archaeological investigations to clear temporary construction compound to reach waterbody (Chippawa Creek). • Risk likelihood reduced since siting WWTP within southern portion of 6811 Reixinger Road provides greater distance from known findings in northern portions of the site.
5	**Indigenous Consultation**	• Implementation risk if preferred solution includes unmitigable archaeological / cultural significance findings, or lack of involvement/communications during detailed design. • Post-EA risk if enhanced consultation is not maintained for study participation in field investigations and review of available reports.	• Appropriate investigations were shared during key EA milestones. Ensured open communication prior to, during, and following each scheduled Public Information Centre. • Groups were invited to participate during field investigations and review reports prior to submission to MHSTCI.
6	**Agency Coordination**	• Project risk if ESR does not satisfy Schedule C Class EA requirements. Potential delay if MECP review time for discipline work and ESR are not considered. • Implementation risk if consultation with required agencies is not completed during detailed design or construction.	• Project Team to ensure requirements are met to satisfy the Schedule C Class EA process. • Post-EA risk if enhanced consultation is not maintained for study participation in field investigations and review of available reports.
7	**Air, Odour and Noise**	• Post-EA implementation risk if odour, noise, and/or dust during construction or operation are not managed appropriately.	• Post-EA implementation risk carried forward for management of noise and dust within the immediate construction site.

No.	Risk Item	Description	Response
8	**Geotechnical**	• Post-EA WWTP and Sewer considerations for additional geotechnical investigations to reduce constructability risks.	• Baseline geotechnical investigations were first completed. This was followed by a Terms of Reference scope on the preferred site and trunk sewer alignment. Field investigations undertaken during Phase 3 of EA informed preliminary WWTP design and cost estimation. Although field investigations identified challenging overburden soils, constructability approach for WWTP site plan and sewer alignments determined feasible. • Project Team consulted constructability experts to determine best approach for linear and WWTP siting. Post-EA risk carried forward as additional investigations take place in detailed design.
9	**Natural Environment**	• Implementation risk if preferred outfall location has unavoidable impacts to habitats of threatened or endangered species, species at risk, provincially significant wetlands, or protected lands.	• Project Team worked closely with agencies to ensure areas surrounding the site and outfall for the WWTP will be feasible and mitigated appropriately. • Post-EA coordination will be required with NPCA, MECP, MNDMNRF, DFO, and more regarding outfall construction. Risk anticipated to be low assuming all potential impacts are mitigated appropriately.
10	**Utilities Conflict**	• Implementation and schedule risk if preferred solution includes crossing of CP and CN railway with little involvement or confirmation of required setbacks.	• Linear infrastructure for preferred solution required coordination for railway crossings. CP and CN Railway operators were active stakeholder in the Phase 3 process. • It was determined that an agreement and/or permit will be discussed during the Post-EA detailed design phase.

11.0 Implementation

11.1 Construction Costs Estimates and Funding

The SNFWWS capital program has been reviewed at various stages of the Class EA process:

- Preliminary cost estimate from the 2016 MSPU,
- Phase 2 preliminary cost estimate,
- Phase 3 preliminary cost estimate, and,
- Final cost estimate for the Class EA ESR.

Development of the program cost estimate incorporated several approaches:

- Unit rate costing based on typical component costs using historical tender and construction information,
- Benchmarking of recent similar projects across Ontario,
- Constructability reviews utilizing Region staff and construction industry experts,
- Cost estimate peer review utilizing the project team cost estimating consultant,
- Construction price indexing review,
- Coordination with the Niagara Region engineering and finance departments, and,
- The cost of the SNFWWS program is a function of multiple project components.

Class C planning level cost estimates (± 20% level of accuracy) indicate that the total capital cost for the entire program could be $399.64 million (indexed to the year of cashflow), which includes design, property acquisition, construction, and commissioning of all components.

Further to this cost estimate, the costs will continue to be refined and estimated with greater accuracy and detail as the projects move through detailed design and prior to tendering for construction. The cost estimates have been developed in accordance with Canadian construction cost estimation standards and industry best practice.

It should also be noted that during 2020 and 2021, particularly influenced by conditions related to COVID-19, it has been difficult to provide improved accuracy for the cost estimates as well predict forward looking indices. There has been significant fluctuation in the construction market conditions including material and equipment costs as well as tendered prices received. There is potential that these fluctuations could persist over the next few years that could further impact the program costs.

A breakdown of the project component cost estimates is provided in Appendix V2.6. The total program costs include the full project delivery costs including: additional studies, property, external engineering costs, internal project coordination costs, construction costs, contingency, and non-refundable HST. A summary of the SNFWWS Program cost estimate is provided in the following table.

Figure 11-1. SNFWWS Program Cost Estimates

Project Components	Revised Estimates
South Niagara Falls Wastewater Treatment Plant	$247.66 million
New South-West Trunk Sewer – South Niagara Falls	$107.82 million
New South-West Trunk Sewer	$19.61 million
Black Horse Sanitary Pumping Station (SPS)	$5.91 million
New South Niagara Falls Outfall	$5.74 million
Black Horse Forcemain	$3.32 million
Peel Street SPS Upgrades and Forcemain	$5.92 million
South Side High Lift SPS Decommissioning	$0.63 million
Garner, Oakwood, Grassy Brook SPS Decommissioning	$1.14 million
McLeod Road Overflow Diversion	$1.89 million

$399.64 million Total

As part of the financial plan for the SNFWWS, there is an expectation that external agency or governmental funding will be available to support this program. Specifically, the new SNF WWTP and/or the new SNF Trunk Sewer would be strong candidate(s) for government funding based on the following key aspects:

- The SNF WWTP along with the SNF Trunk Sewer will provide significant environmental benefit through over 60% reduction of wet weather overflow to the environment,
- The Region applied to the Disaster Mitigation and Adaptation Fund for Large Scale Project stream from Infrastructure Canada in October 2021,
- The SNF WWTP is applying innovative and green technologies in its design to support long term operational and maintenance benefit as well as address climate change resiliency,
- The SNF Wastewater Solutions program provides opportunity for decommissioning existing sewage pumping stations which provides direct benefit to Niagara Region's asset management program as well as energy management program, and,
- There is broad benefit to multiple jurisdictions including the City of Niagara Falls, City of Thorold, City of St. Catharines, and Town of Niagara on the Lake.

11.2 Implementation Schedule

The Region's current anticipated implementation timeline for the SNFWWS Program is shown in Table 11-1 below, with the intent on having the new South Niagara Falls WWTP in service by approximately 2027.

Detailed design of the major components, the new SNF WWTP and outfall and the new SNF trunk sewer, will be significant engineering assignments with multi-year requirements. The design assignments will also need to account for the additional field investigations required to support the detailed design decisions.

Construction will also need to be planned over a multi-year timeline. The new SNF WWTP construction will be facilitated and benefit from greenfield construction. The new SNF trunk sewer will need to manage construction on an existing and travelled road right of way.

The project implementation schedule is based on successful completion of the SNFWWS Class EA in the summer of 2022 and initiating the detailed design process in late 2022. As noted, the potential in-service date for all infrastructure components is by the end of 2027.

Table 11-1. Preliminary Detailed Design and Construction Schedule

		2022		2023				2024				2025				2026				2027			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.	Detailed Design, including Supporting Studies, and Preparation of Contract Documents																						
	SNF WWTP and Outfall																						
	SNF Trunk Sewer																						
	Thorold South Servicing																						
2.	Property Acquisition and Easements																						
	SNF WWTP and Outfall																						
	SNF Trunk Sewer																						
	Thorold South Servicing																						
3.	Construction																						
	SNF WWTP and Outfall																						
	SNF Trunk Sewer																						
	Thorold South Servicing																						

11.3 Timing and Phasing

A significant advantage to the new SNF WWTP strategy is the ability to phase capacity expansion over time dependent on the rate of growth and need for expansion. The SNFWWS strategy is based on providing 30 MLD of treatment capacity in the initial construction of the new SNF WWTP. This capacity will address the initial flows conveyed to the plant through the redirection of existing flows. The site planning for the new SNF WWTP is based on the flexibility to expand to 60 MLD and 90 MLD beyond 2051.

The population, employment and flows projections for the program are summarized in the SNFWWS ESR Volume 3, Appendix V3.7.1. A preliminary estimate for the timing and phasing of the capacity is shown in the following figure.

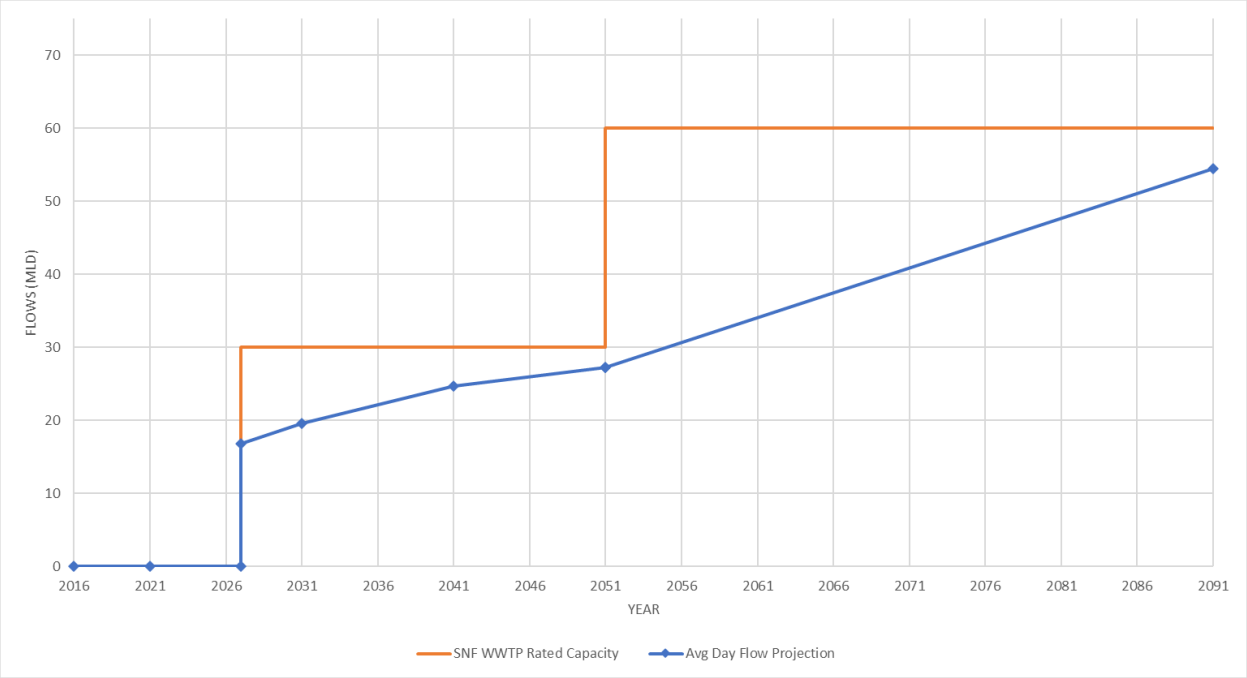


Figure 11-2. New SNF WWTP Capacity Staging

11.4 Permits and Approvals

The following section identifies the preliminary list of SNFWWS Program permits and approvals required from various agencies during detailed design and prior to construction. This list shall be used as a reference tool during detailed design however additional permits and/or approvals may be required as construction methodologies and plans are confirmed.

The preliminary list of permits and approvals covers includes the WWTP site (6811 Reixinger Road, Niagara Falls, ON), outfall location (Chippawa Creek), preferred alignments and shaft locations (Montrose Road Trunk Sewer and Thorold South Sewer Strategy), as well as the new Black Horse SPS site (701 Allanburg Road, Thorold, ON).

As noted in Table 11-2 below, consultation is required with the following groups to determine specific permits and approval needs prior to construction:

- Ministry of the Environment, Conservation and Parks,
- Ministry of Northern Development, Mines and Natural Resources,
- Ministry of Transportation Ontario,
- Niagara Peninsula Conservation Authority,
- Indigenous Communities,
- Department of Fisheries and Oceans,
- Ontario Power Generation,
- City of Niagara Falls,
- City of Thorold,
- CP Railway,
- CN Railway,
- Local Interest Groups, and,
- Utilities.

Table 11-2. Preliminary Approvals and Permitting Requirements for Detailed Design

Consulting Agency, Municipality, or Group	Permit / Approval Required	Permit/ Approval Description
SNFWWS Program Component: Wastewater Treatment Plant		
Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI)	Cultural Heritage Assessment	• Cultural Heritage assessment was completed on 6811 Reixinger Road (existing house and barn). The assessment was submitted to MHSTCI with recommendations there is no cultural significance with existing structures. Next steps will be confirmed following MHSTCI feedback / approval.
	Stage 2 Archaeological Assessments (AA) (terrestrial)	• Stage 1 AA terrestrial investigations completed. Stage 2 AA terrestrial instigations will be completed on portions of 6811 Reixinger Road following the Class EA process. The Stage 2 findings shall be submitted and reviewed through MHSTCI to confirm any next steps for approval.
Indigenous Communities (Haudenosaunee Development Institute, Mississaugas of the Credit River, and Six Nations of the Grand River)	Stage 2 Archaeological Assessments (terrestrial)	• Stage 2 AA terrestrial investigations will be completed on portions of 6811 Reixinger Road following the Class EA process. Invitations must be sent to appropriate representatives for participation in field investigations. The Stage 2 findings shall be submitted and reviewed through respective Indigenous Communities to confirm any next steps for approval.
Ministry of the Environment, Conservation and Parks (MECP)	Conceptual Facility Design and Environmental Compliance Approval (ECA) Application	• Potential impacts to the surrounding social or natural environment will be documented through the conceptual facility design report and submitted with the ECA application.
	Air and Odour Assessment	• Air and Odour modelling completed at the conceptual design level. Air and odour mitigation and monitoring needs during construction or plant operations will be submitted with the ECA application.
	Noise Assessment	• Noise modelling completed at the conceptual design level. Noise mitigation and monitoring needs during construction or plant operations will be submitted with the ECA application.
	Species at Risk	• MECP registration, including a Notice of Activity, is required under the Endangered Species Act if habitat is removed. Detailed design will monitor and involve MECP as required for any potential impact through construction.
	Phase 1 and 2 Environmental Site Assessment (ESA)	• Phase 1 and 2 ESA completed on 6811 Reixinger Road. Results and recommendations will be submitted with the ECA application.
Niagara Peninsula Conservation Authority (NPCA)	Natural Environment Impact Assessment	• Consultation is required with NPCA through detailed design and construction. The conceptual WWTP facility layout does not impact known sensitive environmental features. Potential impacts identified through detailed design must be communicated appropriately for next steps.
City of Niagara Falls	Official Plan Compliance	• Consultation is required with City of Niagara Falls through detailed design and construction. Design details shall demonstrate compliance with applicable guiding policies through the City's Official Plan.
SNFWWS Program Component: Outfall Location		
Ministry of the Environment, Conservation and Parks (MECP)	Assimilative Capacity Study (ACS)	• Provisional acceptance on effluent limits received through MECP in June 2020. MECP comments were included and submitted with the Class EA ESR. The ACS will be submitted during detailed design within the ECA application for Surface Water approval.
	Species at Risk	• MECP registration, including a Notice of Activity, is required under the Endangered Species Act if habitat is removed. Detailed design will monitor and involve MECP as required for any potential impact through construction.
	Outfall Construction Plan	• Outfall construction plan will be submitted to MECP for review.
Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF)	Crown Land Designation	• If the outfall location is within Crown Land, a work order under the Public Lands Act is required. Through the Crown Land Use Policy Atlas, Chippawa Creek does not appear to be within designed lands. Confirmation will be required with MNDMNRF prior to construction.

Consulting Agency, Municipality, or Group	Permit / Approval Required	Permit/ Approval Description
Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI)	Stage 2 and 3 Archaeological Assessments (terrestrial)	• Northern portions of 6811 Reixinger Road include areas with significant AA findings. The outfall alignment will require Stage 3 AA investigations to confirm next steps and mitigation prior to construction.
	Outfall Construction Plan	• Outfall construction plan will be submitted to MECP for review and approval.
Indigenous Communities (Haudenosaunee Development Institute, Mississaugas of the Credit River, and Six Nations of the Grand River)	Stage 2 and 3 Archaeological Assessments (terrestrial)	• Northern portions of 6811 Reixinger Road include areas with significant AA findings. The outfall alignment will require Stage 3 AA investigations to confirm next steps and mitigation prior to construction.
Niagara Peninsula Conservation Authority (NPCA)	Natural Environment (Wetland) Activities	• Mitigation and permitting commitments for fish or surface water is provided in the ESR. Through detailed design, NPCA shall be consulted on potential impacts to wetlands with respect to outfall construction. • Consultation will confirm need for Permit under O.Reg 155/06: Regulation of Development, Interference with Wetlands and Alternations to Shoreline and Watercourses
Department of Fisheries and Oceans Canada (DFO)	Request for Review and Authorization	• Consultation is required with DFO through detailed design. To submit complete drawing sets where possible with a Request for Review (RFR). Following acceptance, an official request for DFO authorization may be required.
Ontario Power Generation (OPG)	In-Water Construction	• Construction is required with OPG during detailed design for proposed in-water construction. Scheduling coordination will be important to reduce or remove potential impact to OPG operations.
Transport Canada	Canadian Navigable Waters Act	• Permit will be required prior to outfall construction.
City of Niagara Falls	Official Plan Compliance	• Consultation is required with City of Niagara Falls through detailed design and construction. Design details shall demonstrate compliance with applicable guiding policies through the City's Official Plan.
Potential Interest Groups	Local Port Authority; Local Boat/Yacht Clubs; Niagara Escarpment Commission; Niagara Parks Commission; Joint Committee between USA/Canada; and St. Lawrence Seaway	• Consultation during detailed design with all potentially interested groups listed. No formal approvals are required at this time, but consideration may limit impact to specific groups or local events.
SNFWWS Program Component: Sewer Alignment / Black Horse SPS		
Ministry of the Environment, Conservation and Parks (MECP)	Species at Risk	• MECP registration, including a Notice of Activity, is required under the Endangered Species Act if habitat is removed. Detailed design will monitor and involve MECP as required for any potential impact through construction.
	Phase 1 and 2 ESA	• Phase 1 ESA completed on conceptual Trunk Sewer alignment. During detailed design, the Phase 2 ESA is required on shaft locations. Results and recommendations will be submitted with the ECA application.
	Conceptual Sewer Design and Environmental Compliance Approval (ECA) Application	• Potential impacts to the surrounding social or natural environment will be documented through the conceptual facility design report and submitted with the ECA application.

Consulting Agency, Municipality, or Group	Permit / Approval Required	Permit/ Approval Description
	Permit to Take Water (PTTW)	• MECP PTTW will be required if it is determined that water taking in excess of 50,000 L/day is required for construction activities • Geotechnical/hydrogeological report in support of the PTTW application, Design Drawings and Design Report will be required as part of the submission package
Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI)	Stage 2 Archaeological Assessments (terrestrial)	• Stage 1 completed along the conceptual preferred trunk sewer alignment. No further investigations are required for work within the road right-of-way. Stage 2 AA is required during detailed design for shaft locations and any construction sites proposed outside of the right-of-way.
Ministry of Transportation Ontario (MTO)	Major Highway Crossing (Queen Elizabeth Way)	• Early consultation confirmed a 14 metre setback from MTO property lines with 5 metre depth requirements. The detail design approach and construction plan for linear portions, that may interest MTO, shall be confirmed prior to construction.
Canadian Pacific (CP) and Canadian National (CN) Railways	Major Railway Crossing	• Consultation required during detail design with submission of design drawings. If work is proposed within the CP road allowance, a CP permit is required. If work is outside the existing CP property limit, a CP agreement is required. Detailed design to confirm approval needs through CN (for Thorold South alignments).
Niagara Peninsula Conservation Authority (NPCA)	Major Water Crossing	• Consultation will confirm need for Permit under O.Reg 155/06: Regulation of Development, Interference with Wetlands and Alternations to Shoreline and Watercourses.
Ontario Power Generation (OPG)	Cultural Heritage Feature	• Potential cultural heritage feature noted near the existing High Lift Sewage Pumping Station (SPS). Conceptually design avoids features, however consultation with OPG during detail will confirm feature significance as design detailed are confirmed.
City of Niagara Falls and City of Thorold	Alignment and Siting Consultation	• Consultation is required with City of Niagara Falls through detailed design and construction. Design details shall demonstrate compliance with applicable guiding policies through the City's Official Plan. Traffic management and permits for temporary road closures will be required.
	Site Plan Approval (City of Thorold Only)	• Submission of Site Plan for New Black Horse SPS, including stormwater management will be required at the 90% Design Stage • Consultation with City of Thorold through Site Plan Application Process and Approval
	Dewatering Discharge Approval	• Consultation at Hydrogeological Investigation to understand volume and water quality requirements for receiving bodies (ditches and storm sewers) • Discharge Plan submitted at 60% and 90% Detailed Design stage after review and approval by Niagara Region
	Road Occupancy Permit	• City of Thorold: construction of the proposed forcemain and proposed watermain within Barron Road, Beechwood Road and Brown Road. • City of Niagara Falls: construction of the proposed forcemain and proposed watermain within Barber Drive, Second Concession Road and Barrick Road.

12.0 Conclusion and Recommendations

The South Niagara Falls Wastewater Solutions (SNFWWS) Class EA Study has developed a comprehensive wastewater program resulting in one of the most significant capital investments in Niagara Region.

The SNFWWS study has developed a preferred solution and design concepts for each of the core components of the program: the new SNF Wastewater Treatment Plant on Reixinger Road with outfall discharging to the Welland River East (Chippawa Creek); the new SNF Trunk Sewer on Montrose Road; and the Thorold South Servicing conveying flows from the new Black Horse SPS to the SNF trunk infrastructure.

The SNFWWS program will redirect flows from South Niagara Falls and Thorold South to the new SNF WWTP providing a long-term growth solution for the area and freeing up capacity in the existing Niagara Falls and St. Catharines systems to support growth and level of service in these areas.

The SNFWWS program provides broad benefit to multiple Municipalities across the Region. These benefits range from addressing the long-term growth capacity requirements to providing environmental benefit through optimizing wet weather management and minimizing overflows and flooding events across the study area.

The SNFWWS preferred solution, design concepts, and current infrastructure planning and technology principles will help the Region respond to changing regulations and needs well into the future.

This **Schedule C** Class EA Study resulted in the identification of:

- New SNF WWTP site at 6811 Reixinger Road, Niagara Falls, ON,
- Outfall location extending from the SNF WWTP to Welland River East (Chippawa Creek),
- New SNF Trunk Sewer extending from South Side High Lift SPS, south along Montrose Road, and crossing east at Reixinger Road to reach the WWTP site (Figure 5-16), and,
- Thorold South Servicing infrastructure (Figure 5-19) including:
    - New Black Horse SPS Site (701 Allanburg, Thorold, ON) south along Allanport Road,
    - Allanport Road / Barron Road east to Barron Road / Thorold Townline Road,
    - Barron Road / Thorold Townline Road south to Townline / McLeod Road,
    - Thorold Townline Road / McLeod Road east to McLeod Road / Beechwood Road,
    - McLeod Road / Beechwood Road south to Beechwood / Brown Road, and,
    - Beechwood / Brown Road east to connect into the Montrose Road trunk sewer along Brown Road.

Consideration of potential impacts was included as part of the evaluation of alternatives and are isolated to only areas of surface disturbance, primarily WWTP siting, shaft locations, and outfall location, which can be addressed by the recommended mitigation measures. Public and agency notifications were provided throughout the course of the Class EA study and to date, there were no comments received that have not already been addressed or cannot be addressed as the project proceeds through detailed design.

Following approval of this Municipal Class EA Study, it is recommended that:

- Based on property requirements identified in Section 9.10, the Region negotiate all required permanent and temporary easements, primarily required for the construction of the project components,
- The mitigation measures identified in Section 10.0 be confirmed and refined during detailed design and implemented during and post-construction,
- The preferred solution proceed to detailed design with the understanding that further investigations are required during Detailed Design and permits and approvals from various agencies will be needed prior to construction,
- The Region continue to consult and coordinate with key review agencies during Detailed Design including City of Niagara Falls, City of Thorold, MTO, MECP, NPCA, MNDMNRF, OPG, DFO, and utilities to ensure design, mitigation and monitoring requirements are reviewed and approved,
- The Region continue to engage with the Indigenous Communities as the project proceeds and additional archaeological investigations are completed, and,
- The Region continue to coordinate with the City of Niagara Falls and City of Thorold regarding coordination of construction timing for any ongoing EA within the study area.