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Niagara Region

Schedule 'C' Municipal Class EA Environmental Assessment

South Niagara Falls Wastewater Solutions

Environmental Study Report

For Public Review

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Volume I

Niagara Region

South Niagara Falls Wastewater Solutions

Executive Summary

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 1 – Executive Summary** 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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LIST OF ABBREVIATIONS

Acronym	Definition
2016 MSPU	2016 Water and Wastewater Master Plan Servicing Update
ACS	Assimilative Capacity Study
CAS	Conventional Activated Sludge
$CBOD_5$	Carbonaceous Biochemical Oxygen Demand
CFU	Colony-Forming Units
EA(A)	Environmental Assessment (Act)
ESA	Environmental Site Assessment
ESR	Environmental Study Report
HDPE	High-Density Polyethylene
HEPC	Hydro Electric Power Canal
IO	Infrastructure Ontario
MCR	Municipal Comprehensive Review
MEA	Municipal Engineers Association
MECP	Ministry of the Environment, Conservation and Parks
MLD	Million Litres per Day
MTO	Ministry of Transportation Ontario
NPCA	Niagara Peninsula Conservation Authority
OPG	Ontario Power Generation
PIC	Public Information Centre
QEW	Queen Elizabeth Way
RAS	Return Activated Sludge
SNF	South Niagara Falls
SNFWWS	South Niagara Falls Wastewater Solutions
SPS	Sewage Pumping Station
SSHLPS	South Side High Lift Pumping Station
SSLLPS	South Side Low Lift Pumping Station
SSO	Sanitary Sewer Overflow
TAN	Total Ammonia Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
WAS	Waste Activated Sludge
WWTP	Wastewater Treatment Plant

1.0 Study Introduction and Background

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.

The SNFWWS study was completed as a **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).

SNF 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 percent is expected in the SNF 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 SNF, will result in capacity constraints at the existing plant as well as critical trunk conveyance infrastructure.

Under the Niagara 2041 MCR process, the Niagara Region's *2016 Water and Wastewater Master Servicing Plan Update* (2016 MSPU) was completed in 2017. A key recommendation from the 2016 MSPU was to establish a new wastewater treatment plant in SNF and have the sewer systems in the southern area connect to this new facility. Niagara Region Council and City of Niagara Falls Council adopted these recommendations in 2017.

The SNFWWS Class EA has advanced the Master Plan's concept to a detailed servicing strategy. The **Schedule C** Class EA process has considered alternative WWTP sites, plant discharge locations, outfall alignments, wastewater trunk sewer and collection system alignments, and design concepts to identify the preferred solution and implementation plan.

2.0 Class Environmental Assessment Process

As a **Schedule C** Class EA study, the SNFWWS study has satisfied the first 4 phases of the environmental assessment process. Phase 5 will be satisfied in detailed design and construction:

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. Key elements of the consultation and engagement process completed under the SNFWWS study include:

- Notice of Commencement – March 2019
- Public Information Centre No. 1 – Study Introduction – May 2019
- Public Information Centre No. 2 – Alternatives and Evaluation Process – November 2019
- Public Information Centre No. 3 – Phase 2 Recommendations – March 2020
- Public Information Centre No. 4 – Phase 3 Recommendations – January 2022
- Project updates regularly through the project website
- Direct communications to the study contact list
- Direct handouts to the potentially impacted property owners
- Milestone consultation with the Ministry of the Environment, Conservation and Parks (MECP), Niagara Peninsula Conservation Authority (NPCA), Ontario Power Generation (OPG), City of Niagara Falls, and City of Thorold through the **Schedule C** Class EA process
- Indigenous consultation including invitation to participate in field investigations and report reviews
- Notice of Completion – July 2022
- 45-day public review period – August 2022 to September 2022

3.0 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 3-1**,** 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 SNF and shown in the figure below as the white dashed area.

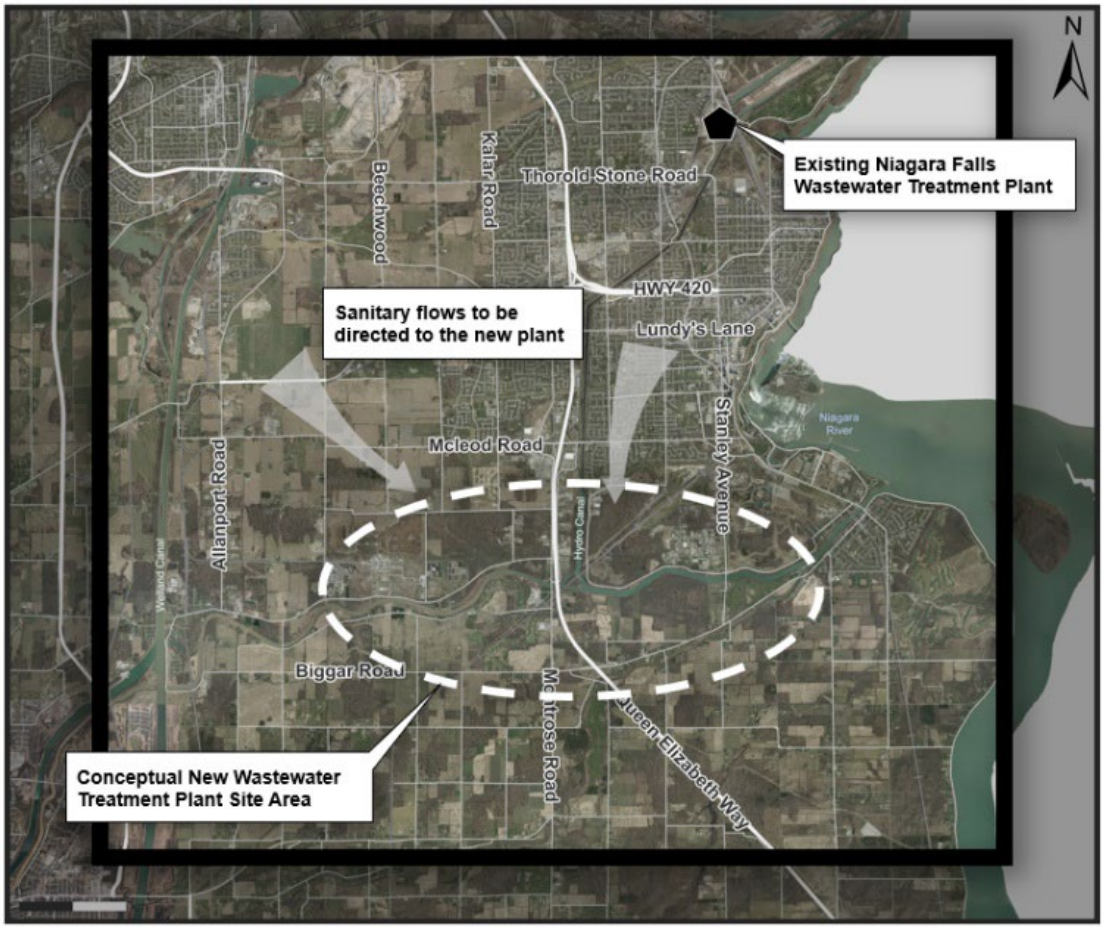

Figure 3-1. South Niagara Falls Wastewater Solutions Study Area

4.0 Phase 1 – Problem and Opportunity Statement

The foundation for the SNFWWS Class EA and the development of the study's problem and opportunity statement was Niagara Region's *2016 Water and Wastewater Master Servicing Plan Update,* completed in 2017.

Further to the recommendations of the 2016 MSPU, the SNFWWS Class EA problem and opportunity statement was defined as follows:

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 SNF, 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 SNF,
   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 Class EA process. The objectives that supported the preferred solution and design concepts included:

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.

5.0 Phase 2 – Identification and Evaluation of Alternative Solutions

5.1 Planning and Flow Basis

The SNFWWS study was based on the planning information and flow basis established through the 2016 MSPU out to the year 2041. During the completion of the Class EA study, additional information 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.

The flow basis for the new SNF WWTP and supporting infrastructure was based on the potential service area for the infrastructure including SNF, generally south of Lundy's Lane and including Thorold South as shown in Figure 5-1.

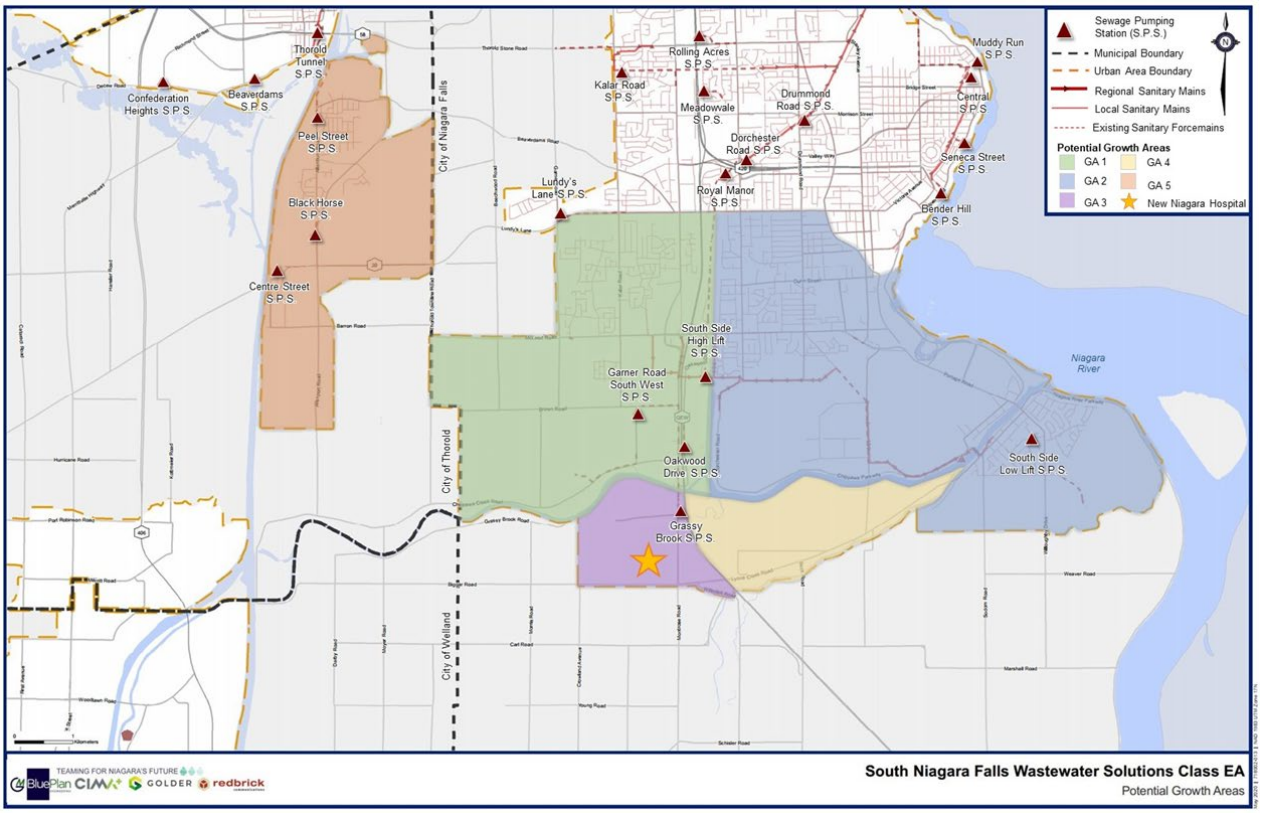

Figure 5-1. New South Niagara Falls Wastewater Treatment Plant Service Area

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 Million Litres per Day (MLD)

Based on the planning and flow basis, the Phase 1 capacity for the new SNF WWTP was established as 30 MLD to meet at least the 2041 growth needs. As shown below, flows in 2051 were estimated and flows beyond 2051 were shown for illustrative purposes to demonstrate the need for the Phase 2 (future expansion) capacity of 60 MLD, as well as potential long-term needs beyond 60 MLD for consideration as part of the decision making for the preferred solution and design concepts.

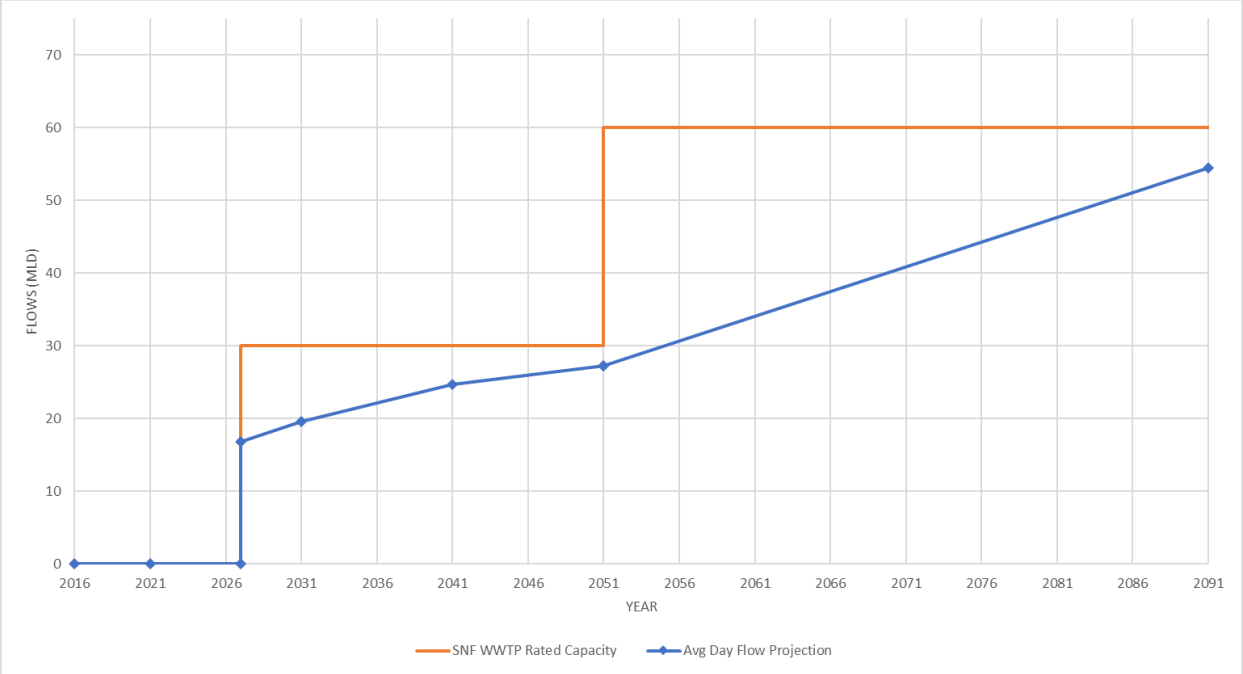

Figure 5-2. New South Niagara Falls Wastewater Treatment Plant Flow Projections

As shown in Figure 5-2, 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 2051.

5.2 Identification and Evaluation of Alternative Solutions

The development of overall SNFWWS program alternatives required a complex process identifying individual components for the solution as well as review of alternatives integrating all of the individual components.

The Phase 2 Class EA evaluation process completed the following key steps:

- overall review of the study area,
- establish the evaluation methodology, criteria and weighting,
- establish a long list of alternatives,
- consider the individual components of the servicing program,
- evaluate the long list of alternatives to establish a short list of alternatives, and
- undertake a comparative evaluation of the short list to develop the preliminary preferred SNFWWS solution.

Phase 2

The key SNFWWS program components developed under Phase 2 were:

1. The new SNF WWTP site,
2. The effluent receiving water location,
3. The new SNF trunk sewer location,
4. Potential impact on existing and future collection system infrastructure, and,
5. Potential impact on the Thorold South strategy.

5.2.1 Component Review

New SNF WWTP Site

For the new SNF WWTP site, potential site locations were considered within the boundary of the focused WWTP site study area. The rationale for establishing the focused WWTP site study was to ensure the new SNF WWTP was located in close proximity to the growth areas, receiving water bodies, and existing trunk infrastructure, as well to ensure efficient infrastructure planning to support long-term growth needs.

A land use and property review was undertaken to determine potential WWTP sites. The sites considered needed to meet the following criteria:

- Appropriate land size (greater than 40 acres),
- Positive integration with understanding of the surrounding existing and future land uses for the site property as well as neighbouring properties,
- Proximity to the Region's existing wastewater system and future growth areas building on the need to facilitate connection to the wastewater collection system and the ability to facilitate servicing of long-term growth areas, and,
- Proximity to a natural water body to support effluent discharge.

From a review of the broad study area and focused WWTP site study area, it was determined that the western limits of the focused WWTP site study area provided opportunity related to neighbouring land uses, however, the greatest potential of sites were located near the centre core of the focused area closest to Welland River East (Chippawa Creek) and the Hydro Electric Power Canal (HEPC).

A long list of 10 WWTP sites was identified as shown in Figure 5-3.

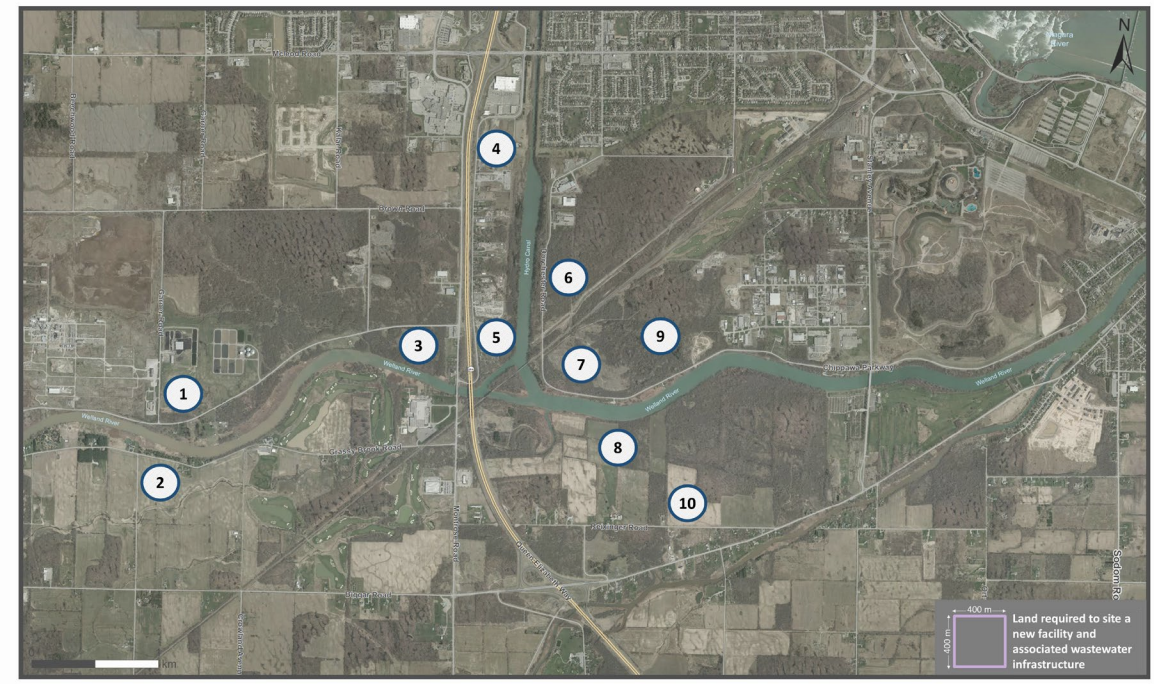

Figure 5-3. Long List of Alternative New Wastewater Treatment Plant Sites

Effluent Receiving Water Bodies

The new WWTP will require a new effluent discharge outfall to a receiving water body. The potential water bodies in the study area were the Welland River West, Welland River East (Chippawa Creek), the HEPC, and the Niagara River. Evaluation of the four water bodies identified the following considerations:

1. **Welland River West**
   - Requires enhanced treatment (observations established using the Assimilative Capacity Study (ACS) results, technical review, and NPCA, MECP, and OPG review and input),
   - Typical low flow conditions, and,
   - Existing quality not favourable.

2. **Hydro Electric Power Canal**
   - Controlled flows and existing quality are favourable, and,
   - Plant represents only 0.1% of Hydro Canal Flow.

3. **Welland River East (Chippawa Creek)**
   - Existing flow and quality are favourable, and,
   - Plant represents only 0.1% of Chippawa Creek Flow.

4. **Niagara River**
   - Typical high flow conditions,
   - Increased coordination with the United States, and,
   - Plant represents only 0.02% of Niagara River Flow.

Figure 5-4. Alternative Receiving Water Body Locations

The Welland River East (Chippawa Creek) and the HEPC were identified as the most suitable receiving water bodies.

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 SNF 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:

Sites 1 and 2	• Longer distance away from the SSHLPS 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 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 SNF growth areas as well as the South Niagara Hospital and future growth areas

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.

5.2.2 Existing Conditions and Supporting Studies

The Phase 1 and 2 Class EA supporting studies were conducted for the study area, and for the potential wastewater treatment plant sites, outfall locations, and sewer alignments at a baseline level to support the evaluation of the alternatives and development of the preferred solution.

The work completed for the Phase 1 and 2 Class EA evaluation of alternatives included:

- Natural Environment Baseline Study (full study area),
- Cultural Heritage Screening (full study area),
- Geotechnical and Hydrogeological baseline studies (full study area),
- Stage 1 Archaeological Assessment (potential WWTP sites, preferred trunk sewer, and Thorold servicing strategy),
- Environmental Contamination Screening (potential WWTP sites),
- Agricultural Screening (potential WWTP sites),
- Preliminary Air, Odour and Noise Assessments (potential WWTP sites), and,
- Assimilative Capacity Screening (for the four potential receiving waterbodies).

Key findings from these additional supporting studies indicated common themes across the study area and similar issues for each of the alternatives. It was noted that sites and land use in closer proximity to the natural water bodies would have a higher potential for environmental and archaeological findings and mitigation requirements. Once preferred sites and infrastructure alignments had been chosen, additional detailed investigations would be required.

The supporting Phase 1 and 2 investigation reports are available for review in ESR Volume 3.

5.2.3 Evaluation of Integrated Alternatives

Ahead of the evaluation process, the evaluation methodology, criteria, and weightings were developed and reviewed publicly. It was determined that a multiple bottom line comparative evaluation approach would be completed through each stage of the evaluation and that the weighting for the criteria would be as follows:

Criteria	Weighting
Environmental	25%
Cultural / Heritage	25%
Legal / Jurisdictional	10%
Technical	20%
Financial	20%

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.

5.2.3.1 New SNF WWTP Site

The first step of evaluation resulted in short-listing from 10 to 4 sites. The short-listed sites included a range of locations and receiving water bodies and are as follows:

- Site 1 discharging to the HEPC
- Site 4 discharging to the HEPC
- Site 5 discharging to the HEPC
- Site 8 discharging to the Welland River East (Chippawa Creek)

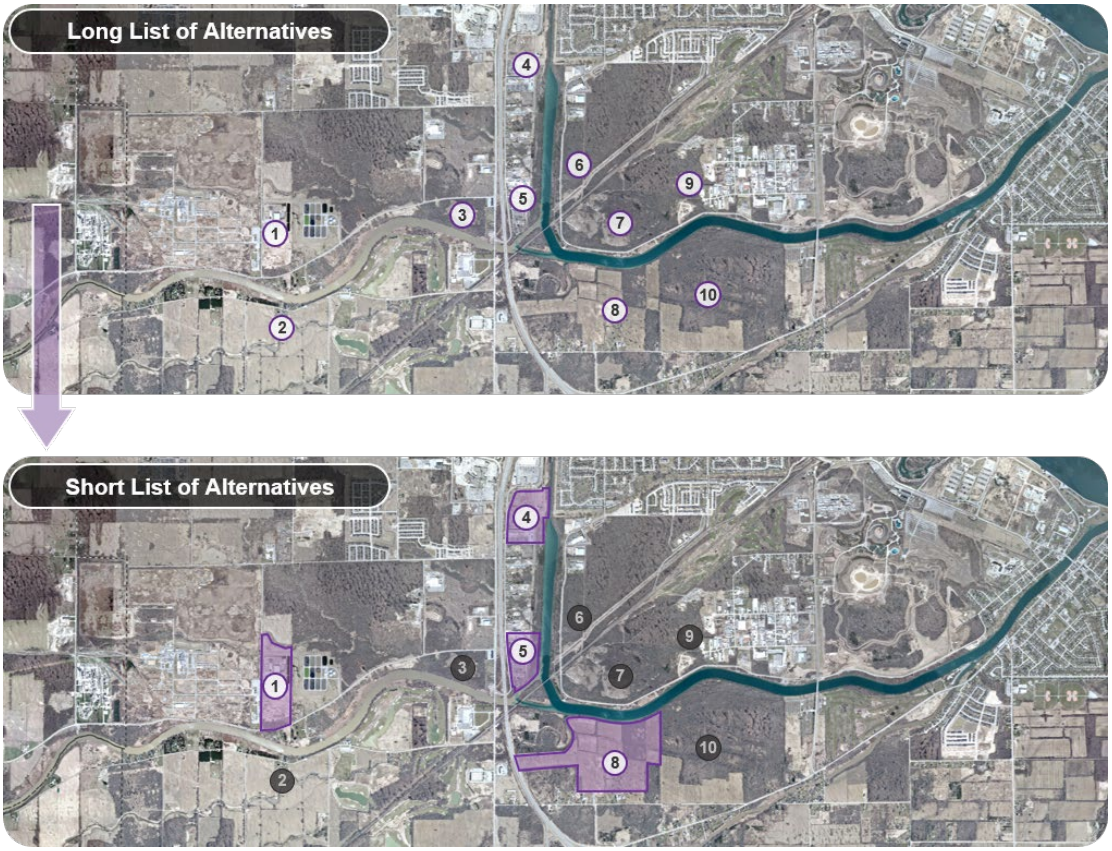

Figure 5-5. Short List of Alternative Wastewater Treatment Plant sites

Phase 2 identified **Site No. 8** as the preferred location for the new WWTP with the outfall discharging to Welland River East (Chippawa Creek) based on the following key factors:

- Strategic location in the heart of the future growth areas,
- Strategic location to maximize gravity servicing to the new WWTP – cost effective collection system strategy,
- Provides expansion flexibility, supports 2041 and long term growth areas,
- Supportive location with MECP for outfall discharge to Chippawa Creek,
- Sufficient site area to work within environmental and archaeological constraints,
- Manageable property costs, and,
- Supportive location along with a SNF trunk sewer alignment that provides for Sanitary Pumping Station (SPS) decommissioning, reduced long term operating costs, and significant wet weather overflow reductions.

Site 8 comprised two properties: 7047 Reixinger Road and 6811 Reixinger Road.

5.2.3.2 New SNF Trunk Sewer

The new SNF trunk sewer is the critical piece of trunk conveyance infrastructure needed to redirect flows from the existing SSHLPS to the new SNF WWTP and to support existing and future local system connections. The new SNF trunk sewer requires, in general, a north to south corridor and must consider key environmental and infrastructure crossings. Three alternative alignments were evaluated.

- Alignment 1: The OPG corridor (approximately 6.0 km of 900 mm to 1800 mm diameter pipe)
- Alignment 2: Oakwood Drive (approximately 5.9 km of 900 mm to 1800 mm diameter pipe)
- Alignment 3: Montrose Road (approximately 5.2 km of 900 mm to 1800 mm diameter pipe)

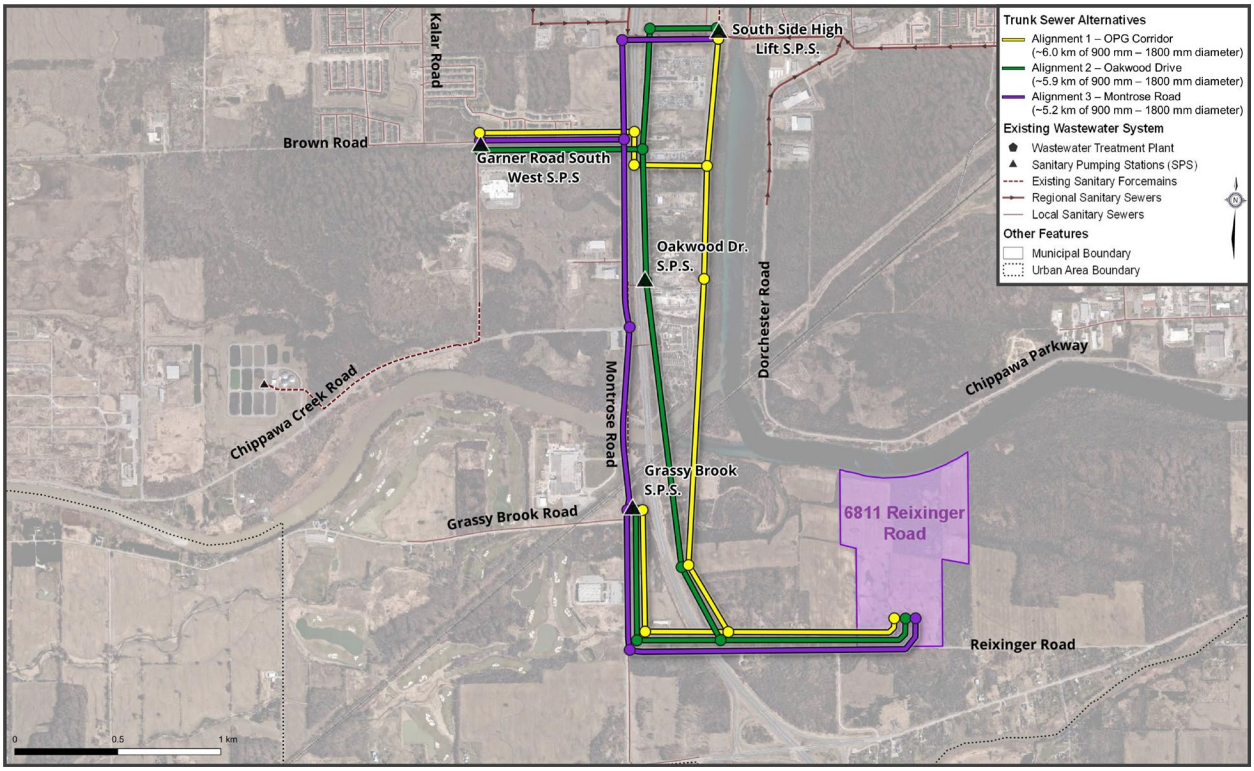

Figure 5-6. New SNF Trunk Sewer Alternatives

The Phase 2 evaluation resulted in selecting the preferred alignment for the new SNF trunk sewer as **Montrose Road**. This preferred solution for the new SNF trunk sewer provides the following key benefits:

- Majority of alignment will be constructed within existing road right-of-way 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 Ministry of Transportation Ontario (MTO),
- Shortest length of trunk sewer,
- Provides deep connections at Brown Road, Chippawa Creek Road, Blackburn Parkway and Reixinger Road to accommodate future growth, and,
- Least expensive alternative.

5.2.3.3 Thorold South Servicing

The Thorold South servicing solution requires a new Black Horse SPS, new forcemain, and new trunk sewer to capture and redirect existing flows from Peel Street SPS to the new SNF trunk infrastructure.

Four alternative sites for the new Black Horse SPS were evaluated:

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

Five infrastructure alignments for the forcemain and sewers were evaluated and shown in Figure 5-7:

- Forcemain on Allanport Road, sewer on Turner Road and Brown Road,
- Forcemain on Allanport Road, sewer on Barron Road, McLeod Road, Beechwood Road and Brown Road,
- Forcemain on Allanport Road, sewer on Allanport Road and Chippawa Creek Road,
- Forcemain on Uppers Lane, sewer on Beechwood Road and Brown Road, and,
- Forcemain on Uppers Lane, sewer on Garner Road and Brown Road.

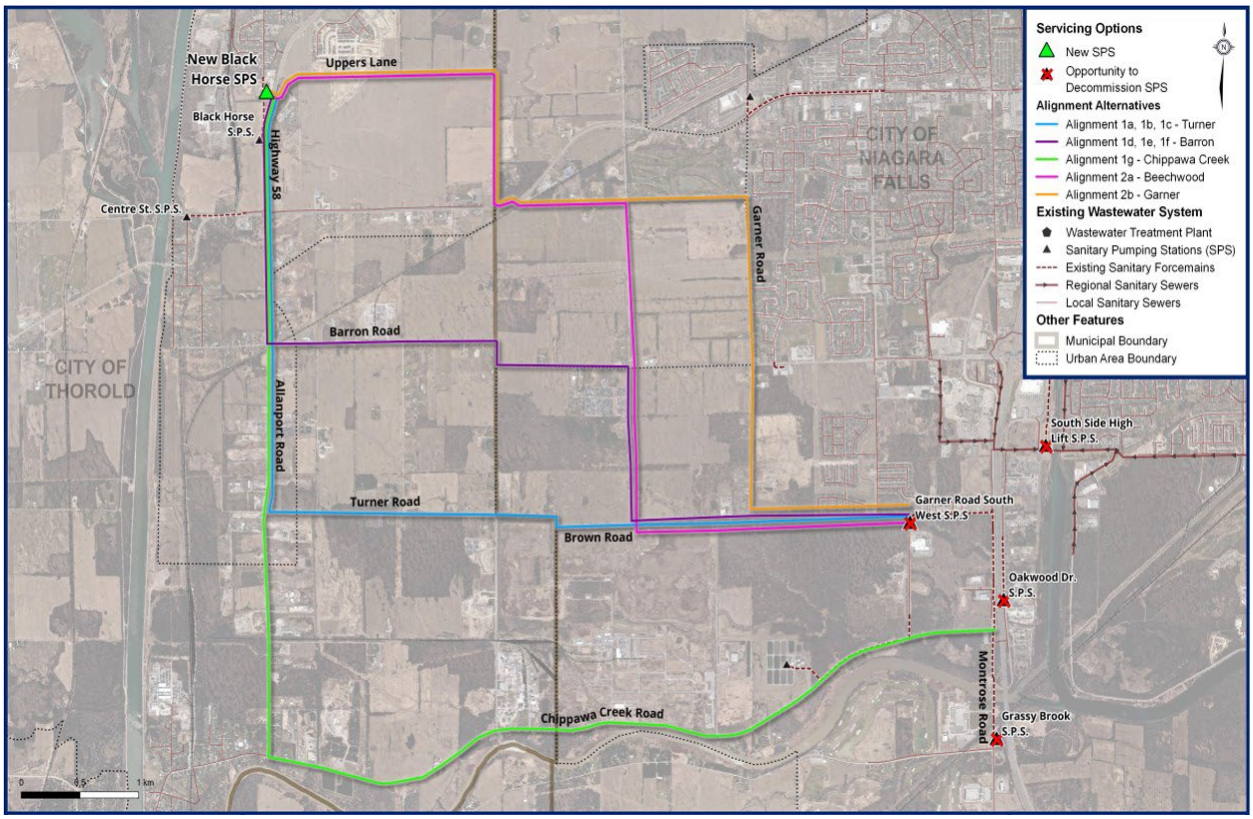

Figure 5-7. Thorold South Servicing Alternatives

The Phase 2 evaluation resulted in selecting the preferred site for the new Black Horse SPS as **south of the existing fire hall (701 Allanburg Road)** and the preferred alignments as locating the forcemain on **Allanport Road with the sewer along Barron Road, McLeod Road, Beechwood Road and Brown Road**.

This preferred solution for Thorold South provides the following key benefits:

- New Black Horse SPS site has limited constraints and municipally facilitated property acquisition,
- Infrastructure alignment supports future growth areas in Cities of Niagara Falls and Thorold,
- Alignment anticipated within the road right-of-way (with exception of Allanport Road north of Highway 20 which is owned by the MTO),
- Infrastructure will mainly be constructed by open-cut where trenchless construction will only need to be considered for crossings,
- Traffic impacts can be minimized through construction practices, and,
- Lower cost alternative.

An integral component of the Thorold South Servicing is the redirection of the Peel Street SPS. The Peel Street SPS currently pumps north through the St. Catharines trunk system to the Port Weller WWTP. It is recommended that a new forcemain be constructed on Allanburg Road from the Peel Street SPS to the new Black Horse SPS to redirect the pumping south and ultimately to the new SNF WWTP. This will relieve capacity constraints in the St. Catharines system.

5.3 Integrated Preferred Solution

The Phase 2 evaluation established the preliminary preferred solution as shown in Figure 5-8 for the overall SNFWWS program:

1. The preferred new SNF WWTP to be located at Site 8 on Reixinger Road east of the Queen Elizabeth Way (QEW) and south of the Welland River East (Chippawa Creek),
2. The preferred outfall location as the Chippawa Creek near the confluence with the HEPC,
3. The SNF trunk sewer will convey flows from the SSHLPS site south to the new SNF WWTP along Montrose Road,
4. Thorold South will convey flows from a new Black Horse SPS via a new forcemain on Allanport Road and trunk sewers on Barron Road, McLeod Road, Beechwood Road and Brown Road to the new SNF trunk sewer, and,
5. The SNFWWS strategy provides opportunity to decommission the SSHLPS, Garner Road SPS, Grassy Brook SPS and potentially the Oakwood Drive SPS.

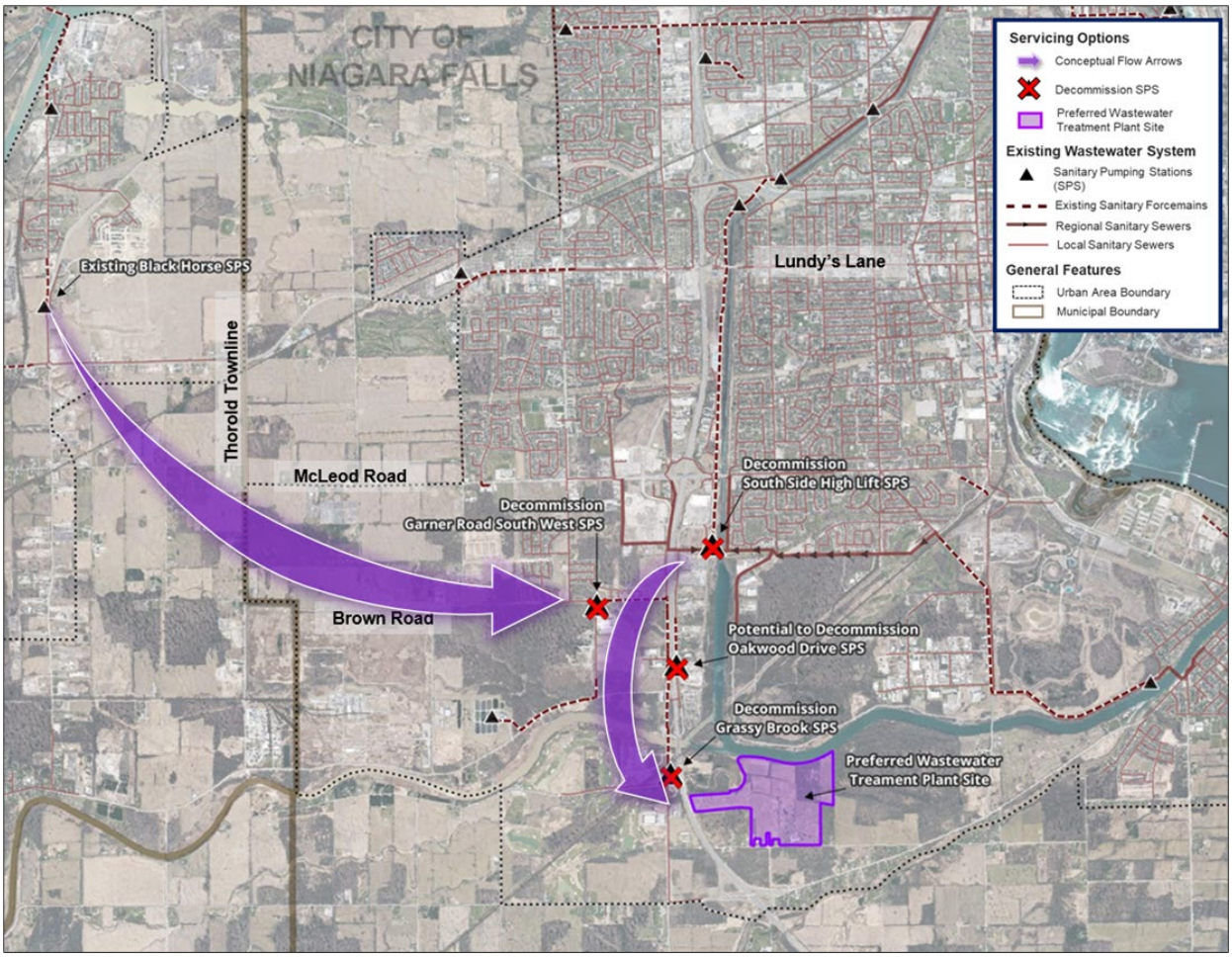

Figure 5-8. Preliminary Preferred Solution

6.0 Phase 3 – Alternative Design Concepts and Methods of Implementation

6.1 Identification and Evaluation of Design Concepts

Phase 3 of the 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 same multiple bottom line evaluation criteria used for each step of the study including environmental, social/cultural, legal/jurisdictional, technical, and financial criteria and weightings:

Criteria	Weighting
Environmental	25%
Cultural / Heritage	25%
Legal / Jurisdictional	10%
Technical	20%
Financial	20%

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

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

The Phase 3 evaluation process ultimately incorporated each component evaluation and preferred design concept into an overall integrated preferred solution and design concept for the SNFWWS program.

6.1.1 Additional Supporting Studies

The Phase 3 field investigations and supporting studies built upon the work completed under Phase 2 and focused the investigations on the preferred solution including preferred WWTP site and infrastructure alignments. The field investigations were completed to determine the feasibility of construction of the infrastructure and to determine the level of mitigation required to minimize/remove potential impacts.

The work completed for the preferred WWTP site and sewer infrastructure alignments included:

- Natural Environment Impact Assessment (Preferred WWTP site, trunk sewer alignment, and new Black Horse SPS site),
- Phase 1 Environmental Site Assessment (ESA) (WWTP site and trunk sewer),
- Phase 2 ESA (WWTP site and trunk sewer),
- Stage 1 Archaeological Assessment – Marine (Preferred outfall – Chippawa Creek),
- Stage 2 Archaeological Assessment – Terrestrial (7047 Reixinger Road [completed through a previous 2015 study], portions of 6811 Reixinger Road [due to unfavourable field conditions], and the preferred Black Horse SPS site for the Thorold South servicing strategy),
- Cultural Heritage Assessment Report (Preferred WWTP site, SNF trunk sewer, and Thorold South servicing strategy),
- Cultural Heritage Evaluation Report (Preferred WWTP site),
- Additional detail for the Assimilative Capacity Study (Preferred outfall – Chippawa Creek),
- Detailed Air, Odour and Noise Impact Assessments (Preferred WWTP site), and,
- Geotechnical and Hydrogeological Assessments (Preferred WWTP site and SNF trunk sewer).

Key findings from these additional supporting studies indicated:

1. There was presence of archaeological findings in the northern portions of the WWTP site that would require additional investigation and mitigation. The location of these findings did influence the location of the plant siting and layout.

2. There was presence of geotechnical conditions prevalent across the study and specifically located along the preferred trunk sewer alignment and WWTP site. These geotechnical conditions did influence the constructability and methodology required to construct the trunk sewer and WWTP facilities.

3. Other environmental conditions can be mitigated through technology selection, operation and maintenance practices, appropriate design considerations, and typical construction approaches for the proposed infrastructure and facilities.

The supporting Phase 3 investigation reports are available for review in Volume 3 of this ESR.

6.2 Preferred Design Concepts

6.2.1 South Niagara Falls WWTP and Outfall

Phase 2 identified Site 8 as the preferred location for the new WWTP with the outfall discharging to Welland River East (Chippawa Creek) based on its strategic location, flexible property size and orientation to support long term capacity needs, supportive outfall location, and ability to mitigate property constraints to optimize the site layout on the property.

Site 8 comprised two properties: 7047 Reixinger Road and 6811 Reixinger Road. Phase 3 reviewed the plant orientation within the total site area incorporating additional information obtained through the supporting studies and determined the recommended property limits and requirements for the new plant.

The boundary of Site 8 provided more than sufficient land area for the long term WWTP property needs. As such, Site 8 provided options with respect to layouts, orientations, buffers from neighbouring land uses, proximity to the receiving water body, access to local roads, and vertical or horizontal plant orientations.

Six layout options were developed and evaluated against the following key considerations:

- 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.

One of the most critical constraints across Site 8 was the presence of archaeological findings generally located in the north and northwest limits of the site. Based on this constraint and the evaluation process, 6811 Reixinger Road was determined to be the preferred property with a plant orientation located in the southern limits of the property as shown in Figure 6-1.

The evaluation is summarized as follows:

Property Needs

- 6811 Reixinger Road.
- Requires one property acquisition.
- Site supports Phase 1 WWTP capacity (30 MLD) 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.
- Provides direct access from Reixinger.

Outfall

- Receiving waterbody (Chippawa Creek) meets Ministry approval requirements.
- Alignment requires river edge work for installation and isolated environmental considerations.
- Minimizes archaeological impact, however, prior to construction, additional archaeological work will be required for the outfall corridor.

Figure 6-1. Preferred South Niagara Falls Wastewater Treatment Plant Site

To meet Phase 1 WWTP capacity of 30 MLD (and future effluent quality requirements), the following facility components were developed:

- Raw water pumping station,
- Headworks including screening and grit removal,
- Primary and secondary treatment,
- Disinfection,
- Waste Activated Sludge (WAS) Thickening, and,
- Digestion.

Three key secondary treatment technologies were evaluated for the new WWTP:

- Biological Aerated Filter,
- Biological Nutrient Removal, and,
- Conventional Activated Sludge (CAS).

These alternatives all met wastewater treatment requirements but have varied infrastructure needs, costs, and future flexibility.

CAS, complete with two plug flow aeration tanks and two secondary clarifiers with WAS and Return Activated Sludge (RAS) pumping, were selected as the preferred technology and design concept for the new SNF WWTP based on the following key benefits:

- Proven technology,
- Lowest overall life-cycle cost,
- Easy operation and maintenance,
- Familiar to Region staff, and,
- Ability to incorporate new technologies in the future.

The effluent quality requirements were established through the assimilative capacity analysis and consultation and engagement with approval agencies including the MECP, and are outlined in Table 6-1.

Table 6-1. Effluent Quality Requirements for the 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	7
November to April	12	12
E. Coli (Colony Forming Units CFU/ 100 mL)	200	200

The preferred design concept for the new SNF WWTP provides additional benefit and addresses key climate, sustainability, and energy efficiency principles:

- The equipment selection and location of treatment and facility components will enhance odour control and management including collection and treatment of odours,
- Energy recovery is accommodated through sizing anaerobic digesters as well as the potential to accept winery waste or green bin organics to leverage these materials to generate additional energy,
- CAS technology provides proven and efficient high level of treatment and provides the greatest flexibility to implement future enhancements for energy reduction and intensification at the site,
- The WWTP site has been optimized for long term operations and hydraulics to eliminate the need for future pumping to accommodate enhanced treatment technologies, to improve resiliency, and minimize additional pumping energy and costs, and,
- The WWTP will work in combination with the raw water pumping station and new SNF trunk sewer to optimize incoming flows and provide storage to manage high peak wet weather flows associated with changing climate conditions.

The preferred facility layout was based on supporting the design concept requirements and technology selection, optimizing the site area, providing flexibility for future expansion of the treatment plant, incorporating key sustainability features, and ensuring the view from Reixinger Road would be aesthetically pleasing.

Figure 6-2. Preferred South Niagara Falls Wastewater Treatment Plant Site Layout and Facility Locations

The conceptual design of the new WWTP outfall is based on meeting the requirements of the effluent discharge to Welland River East (Chippawa Creek). 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 High-Density Polyethylene (HDPE) pipe near the shores of the Chippawa Creek extending from 6811 Reixinger Road.

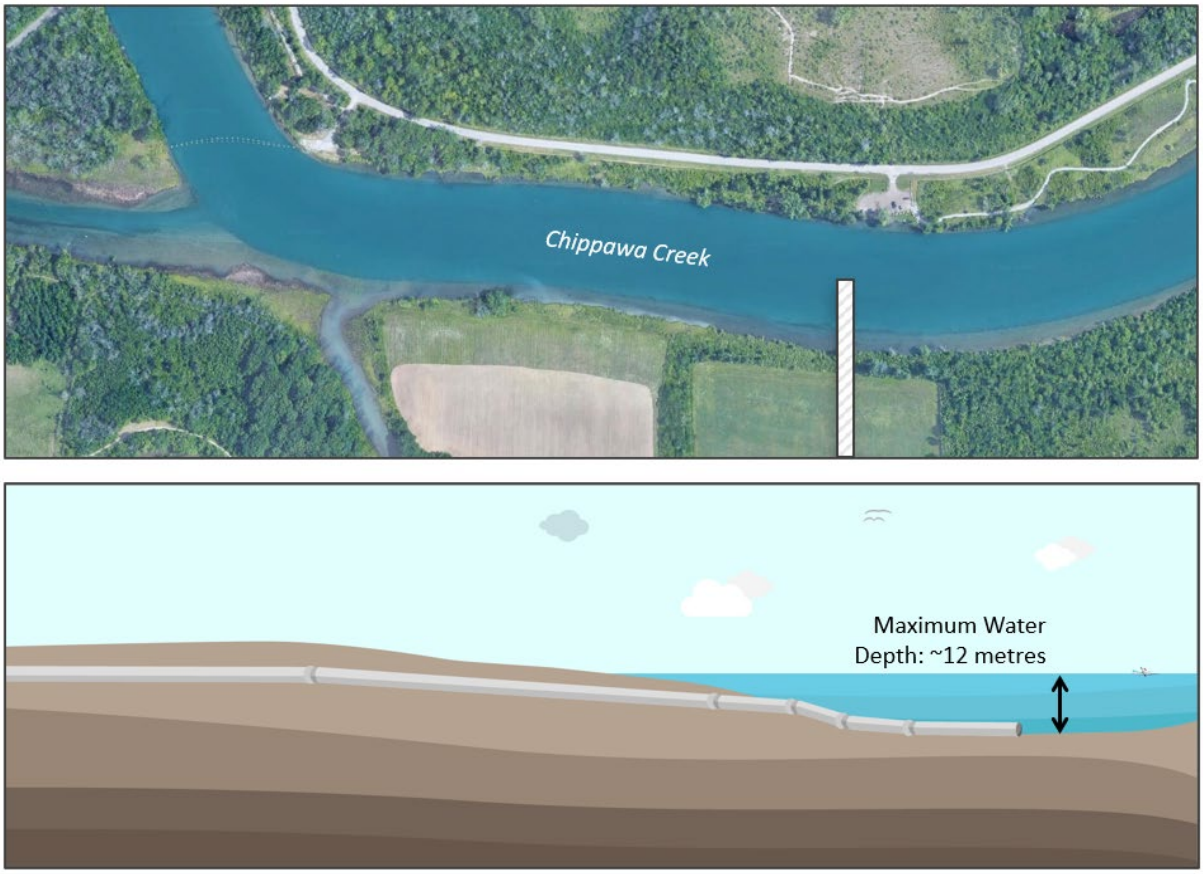

Figure 6-3. Preferred South Niagara Falls Wastewater Treatment Plant Outfall Location

6.2.2 The South Niagara Falls Trunk Sewer

Building on the work completed in the Phase 2 Class EA process, Phase 3 undertook further detailed evaluation of the preferred alignment, enhanced conceptual design level for infrastructure location (plan and profile), and review of the construction methodology for the SNF trunk sewer along Montrose Road.

Various construction approaches were considered for the new SNF trunk sewer on Montrose Road, 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 Phase 3 evaluation and review confirmed the SNF trunk sewer alignment running 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 outletting at the inlet pumping station to the new SNF WWTP.

A 900 mm diameter pipe segment along Brown Road from the Garner Road SPS (at Brown Road and Heartland Forest Road) will connect to the SNF trunk sewer at Montrose Road. The minimum sizing for the SNF trunk sewer based on hydraulic and capacity requirement is minimum 1500 mm diameter transitioning to 1800 mm diameter.

The depth of the sewer will range from 13 metres at the SSHLPS to 18 metres at the SNF WWTP raw water pumping station. Furthermore, the SNF trunk sewer will require crossings at QEW / SSHLPS, Welland River, CP Rail Corridor and the QEW at Reixinger Road.

Shaft locations are generally located within the Montrose Road right-of-way with impact to traffic in the area minimized and mitigable. The SNF Trunk Sewer alignment is depicted in Figure 6-4.

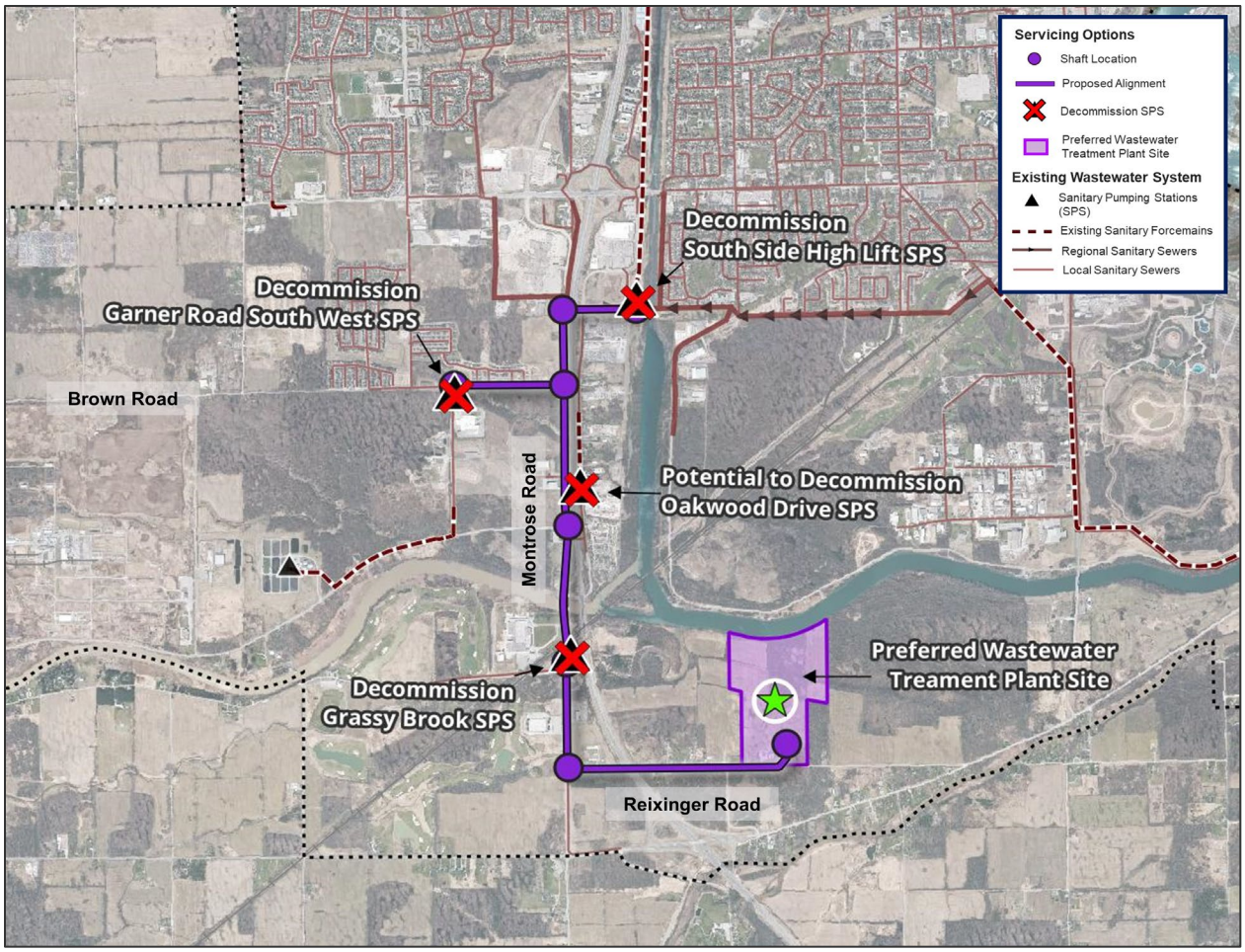

Figure 6-4. Preferred South Niagara Falls Trunk Sewer Alignment

6.2.3 Thorold South Servicing

The Thorold South servicing solution requires a new Black Horse SPS, new forcemain, and new trunk sewer to capture and redirect existing flows from Peel Street SPS to the new SNF trunk infrastructure as shown in Figure 6-5.

Additional evaluation was completed under Phase 3 to confirm the design concepts and implementation requirements for the SPS site, and the forcemain and sewer alignments and construction methodology.

The new Black Horse SPS site will require property acquisition. The SPS will be constructed at a depth to support the existing sewer network as well as the redirected forcemain from the Peel Street SPS. The Thorold South Black Horse forcemain will require property and easement coordination for the corridor north of Highway 20. The trunk sewer will be located a depth to support open cut construction.

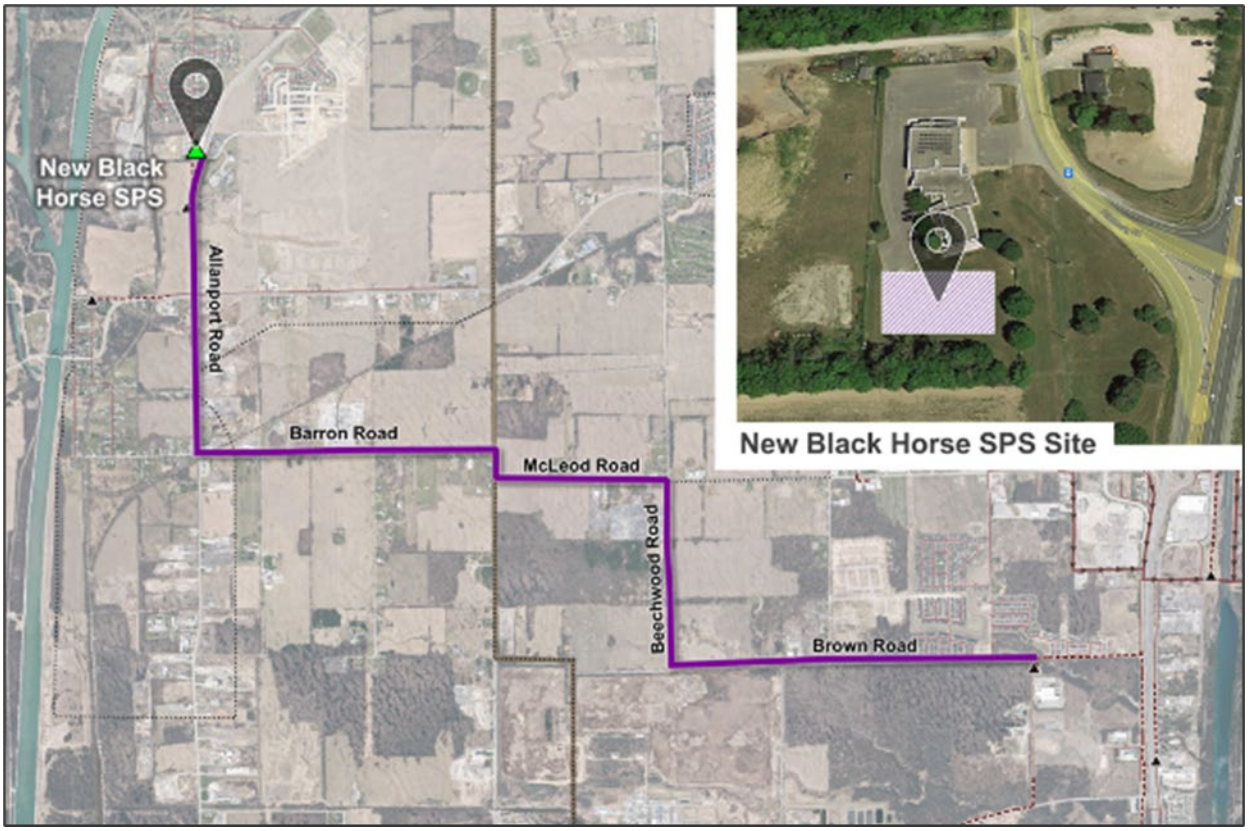

Figure 6-5. Preferred Thorold South Servicing

6.2.4 Integrated Preferred Solution and Design Concept

The SNFWWS Class EA undertook a complex evaluation process to establish an integrated preferred solution and design concepts to address wastewater servicing for the broader study area including SNF and Thorold South. 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 is show in Figure 6-6 and provides the following key benefits:

- Addresses 2041 and 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 by:
  - Capturing peak flows and providing conveyance storage,
  - Minimizing overflows and flooding events across the study area, and,
  - Flexibility for future connectivity to support additional servicing and benefits.
- Current infrastructure planning and technology principles help the Region respond to changing regulations and needs.

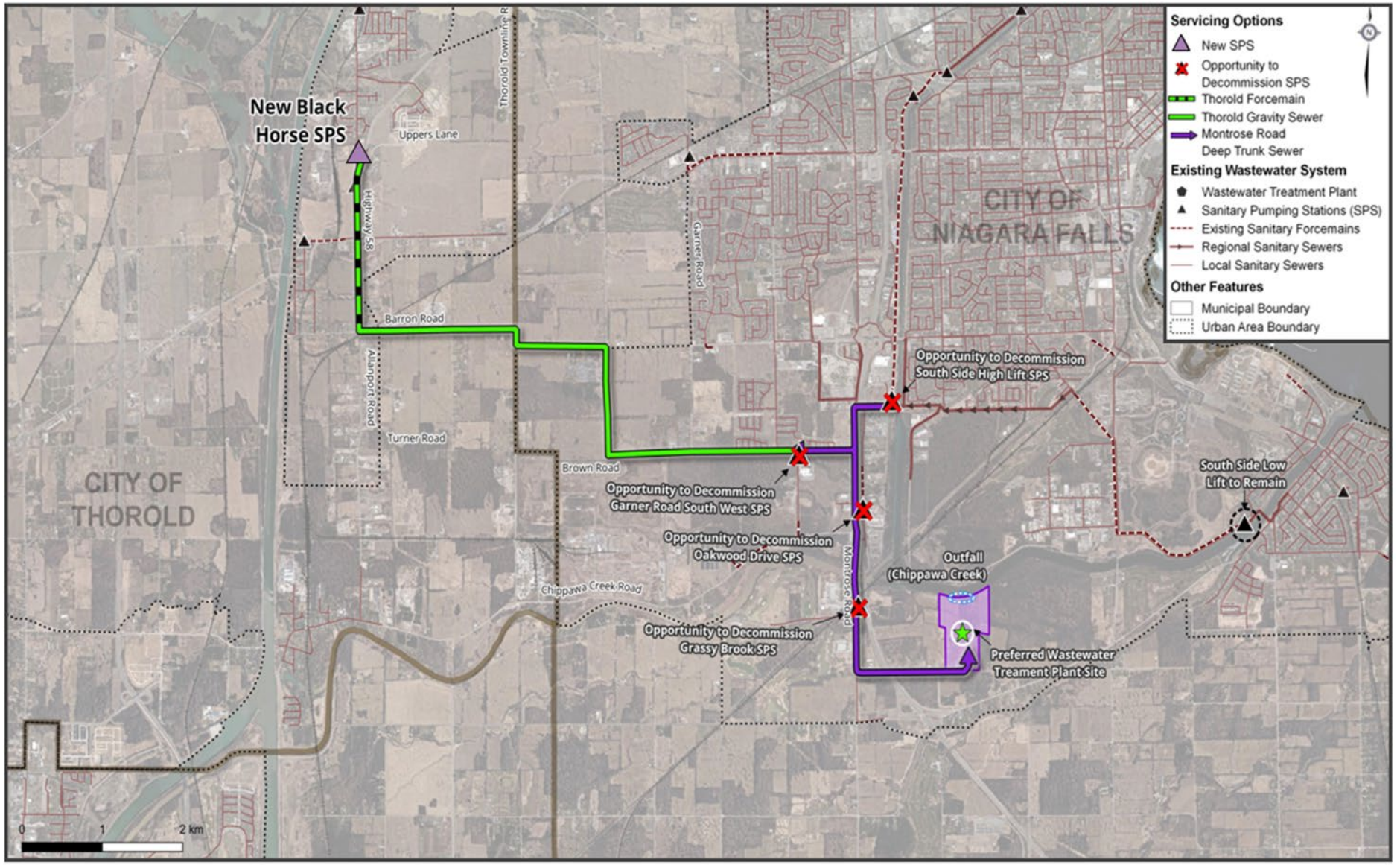

Figure 6-6. Preferred SNFWWS Integrated Solution and Design Concept

7.0 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, including location, size, and depth of the new SNF trunk sewer, are critical infrastructure components as part of the overall wet weather flow management program in the broader study area.

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

There are a number of wastewater outfalls or sanitary sewer overflows (SSOs) that discharge to the 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 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, but it will also redirect existing flows currently being pumped north through the SSHLPS and convey all these flows, including peak flows, to the new SNF WWTP. The SNF trunk sewer is sized and located at a depth that allows for 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 additional pumping capacity 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 SNF. In particular, the inlet depth has been selected to support potential gravity servicing of the Chippawa area in SNF. Chippawa continues to implement wet weather management programs to minimize extraneous flows and overflow occurrences. The Chippawa area is serviced by the South Side Low Lift Pumping Station (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.

The current Niagara Region full pipe wastewater model for Niagara Falls was used for the hydraulic analysis to determine the level of wet weather management and net environmental benefit. 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 results of the hydraulic analysis are summarized in the following tables.

Table 7-1. SNFWWS Hydraulic Analysis for Existing Conditions

Existing Conditions	Dry Weather	2-year Storm	5-year Storm
Total System Yearly Overflow Volume (m^3)	0	16,505	24,891
Total Stanley Avenue WWTP Yearly Overflow Volume (m^3)	0	47,476	62,336

Table 7-2. SNFWWS Hydraulic Analysis for Future Conditions

Future Conditions with the new SNF trunk infrastructure	Dry Weather	2-year Storm	5-year Storm
Total System Yearly Overflow Volume (m^3)	0	4,808	7,865
Total Stanley Avenue WWTP Yearly Overflow Volume (m^3)	0	17,400	24,515

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%. The servicing strategy will fully capture all overflows 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.

8.0 Cost Estimates

The SNFWWS capital program was 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.

The final program cost estimate was developed at a Class 3 level of accuracy which was based on conceptual design information and generally relates to accuracy of ± 20%. This level of accuracy is appropriate for budgeting and approvals but will be further refined during detailed design. The costing approach 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.

The total program costs, as summarized in Figure 8-1, include the full project delivery costs including: additional studies, property, external engineering costs, internal project coordination costs, construction costs, contingency, and non-refundable HST.

Figure 8-1. 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

9.0 Implementation Schedule

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 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 has been based on successful completion of the SNFWWS Class EA in the summer of 2022 and initiating the detailed design process in late 2022. The in-service date for all infrastructure components is approximately the end of 2027 as shown below in Figure 9-1.

Figure 9-1. SNFWWS Implementation 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																						
	SNF WWTP and Outfall																						
	SNF Trunk Sewer																						
	Thorold South Servicing																						
3.	Construction																						
	SNF WWTP and Outfall																						
	SNF Trunk Sewer																						
	Thorold South Servicing																						

10.0 Impact and Mitigation Measures

10.1 Risk Management

From the study outset, individual risks were identified, assessed for likelihood and severity of consequences, and monitored through each phase of the Class EA process. As the study progressed, 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.

SNFWWS proactively reduced risk through Phase 3 with sub-surface field investigations. 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 SNF WWTP, outfall, new SNF trunk sewer and related servicing components.

Following the Class EA process, pre-identified risks will continue to be monitored through detailed design and construction.

- 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

10.2 Implementation Commitments

The Phase 1, 2 and 3 supporting studies provided the appropriate level of information to support the decision making under this Class EA study. It is recognized that additional information will be required to support the follow-on implementation tasks including detailed design and construction.

The Region is committed to completing the following key investigations required for detailed design:

1. Stage 2 Archaeological Assessment for sewer shaft locations and portions of the Wastewater Treatment Plant site,
2. Stage 3 Archaeological Assessment for plant outfall construction areas (as required),
3. Natural Environment Monitoring (to reduce potential construction impacts),
4. Advanced Geotechnical and Hydrogeological investigations to support the design basis for the SNF WWTP and SNF trunk sewer, and,
5. Traffic Impact Assessment and project coordination with Cities of Niagara Falls and Thorold.

In addition, consultation will be required with the following groups to determine specific permit and approval requirements prior to construction:

- Ministry of the Environment, Conservation and Parks,
- Ministry of Northern Development, Mines, Natural Resources and Forestry,
- Ministry of Heritage, Sport, Tourism, and Culture Industries
- 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.

11.0 Closing

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 WWTP and outfall on Reixinger Road,
- 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 SNF 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 wastewater systems to support growth and level of service in these areas.

The SNFWWS program provides broad benefit to multiple municipalities across Niagara Region. These benefits range from addressing the long-term growth capacity requirements, to providing environmental benefits 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.