Master Plan Report (DRAFT)

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Region of Waterloo

Draft Wellesley Water and Wastewater Master Plan
February 9, 2026

Master Plan Report (DRAFT)

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Executive Summary

Background

The Township of Wellesley (Township) is one of seven local municipalities in the Region of Waterloo (Region). The Wellesley Urban Area (Wellesley) is one of 11 settlement areas that comprise the Township of Wellesley. The Region is responsible for maintaining servicing within Wellesley's water and wastewater systems to provide capacity for the existing population and for new growth in the service area while meeting regulatory requirements. The Region undertook the Wellesley Water and Wastewater Master Plan (WWWMP) to address anticipated water and wastewater treatment needs to 2051, and in doing so, to improve the reliability and resiliency of Wellesley's water and wastewater assets. The WWWMP has incorporated recent population forecasts, condition assessments, and relevant concurrent upgrades and projects.

The goals of the WWWMP include assessing existing and future scenario infrastructure capacity, identifying required infrastructure upgrades and improvements, and systematically developing a prioritized implementation plan that is endorsed by the Region and project stakeholders. The proposed recommendations meet the Region's social and environmental stewardship standards and the regulatory requirements for infrastructure upgrades and improvements while providing technical and cost-effective solutions that meet both energy management and resiliency objectives.

Existing Water System Conditions

The purpose of this section is to describe the existing conditions within Wellesley's Water system.

Wellesley Water Treatment Plant

Water demand data was analyzed from 2018 to 2022. The existing average per capita demand, maximum day demand (MDD) factor, and peak hour demand (PHD) factor were determined to be 179 L/c/day, 1.69, and 2.28, respectively. The demands were used to assess the exiting capacity of the Wellesley WTP. The rated capacity of the Wellesley WTP is 3,006 m^3/d, however the maximum water taking allowed by the Permit to take Water (PTTW) is 1,503 m^3/d. Therefore, the overall WTP capacity is limited by the well taking capacity. Current plant usage consists of an average day demand (ADD) of 668 m^3/d, MDD of 1,128 m^3/d, PHD of 1,522 m^3/d, representing a usage of 44 percent, 75 percent, and 101 percent of overall capacity, respectively. The Wellesley WTP has sufficient capacity for the current ADD and MDD but does not meet the current PHD.

Raw and treated water quality data collected at the Wellesley WTP between 2002 and 2022 was utilized to assess the water quality. Overall, treated water arsenic and fluoride levels are below the regulatory limits, and iron, manganese, and strontium are within acceptable guideline objectives.

Wellesley Water Distribution System

The Region's existing water distribution model for Wellesley was used to evaluate system pressures. The preferred design pressure ranges for average day and maximum day are 350 kPa (50 psi) to 550 kPa (80 psi). The preferred minimum hour and peak hour pressure ranges are 275 kPa and 700 kPa. No distribution system pressure constraints were identified under non-emergency flow conditions.

The basis for fire flows for various building types were developed and reviewed with the local fire department to confirm these estimates were sufficient for their needs as part of the engagement activities for this Master Plan. The fire flow requirements by building types, can be summarized as follows:

- Fire Flow (Industrial/Commercial/Institutional): 175 L/s – Duration: 2.13 hours
- Residential Fire Flow: minimum 75 L/s
- Preferred Residential Fire Flow: minimum preferred 125 L/s

ICI fire flow constraints exist within the distribution system under existing conditions, and two locations at dead-end streets have insufficient residential fire flow capacity. However, the current fire-fighting practice includes reliance on tanker trucks to supplement flows from the distribution system, as required.

Treated water storage is provided at the Wellesley WTP by a three-celled reservoir with a total usable volume of 902.3 m^3 (Cell A: 188.5 m^3; Cell B: 279.8 m^3; Cell C: 434.0 m^3). The main purpose of this water reservoir is to provide a standby volume of water for firefighting and an additional volume for emergency conditions. In addition, the reservoir will also provide the required volume for primary disinfection.

Water treatment plant treated water volumes and water billing volumes were compared to determine the distribution system losses, which is defined as unaccounted for water. The calculated annual distribution system losses are approximately 18 percent, which falls within a typical range of 10-20 percent. However, opportunities may exist to improve the efficiency of the distribution system.

Existing Wastewater System Conditions

The purpose of this section is to describe the exiting conditions within Wellesley's Wastewater system.

Wellesley Wastewater Collection System

Flow monitoring within Wellesley's collection system was completed between March and June 2023 to understand existing sewer capacity conditions. The flow monitoring data was then used to calibrate a sanitary hydraulic model for Wellesley's wastewater collection system.

The level of service used as criteria to identify collection system constraints included no surcharging during dry weather periods and wet-weather events up to the 5-year design storm, and hydraulic freeboard greater than 1.8 m during wet weather events greater than the 5-year design storm.

The hydraulic model results were compared against the level of service criteria to identify existing capacity constraints within Wellesley's wastewater collection system during dry weather flow (DWF), the 5-year design storm, and the 25-year design storm. During DWF, the hydraulic model indicated the level of service criteria were met (i.e., no surcharging). During the 5-year design storm, surcharging was simulated in several locations including along the Firella Creek Trunk Sewer. During the 25-year design storm, further surcharging was identified and areas with freeboard greater than 1.8 m were identified.

Wellesley Wastewater Treatment Plant

Historical flow data were reviewed from 2019 to 2021. On a hydraulic basis, the plant has been operating at approximately 75 to 80 percent of the design average daily flow (ADF) capacity of 1,100 m^3/d. Typical per capita flow rates vary from 225 to 450 L/cap/d, with an average per capita flow rate of 239 L/cap/d. The daily flow was less than the design peak day flow (PDF) factor of 3.5 approximately 99.7% of the time. Thus, the design PDF factor was exceeded for a total of one day per year. The instantaneous flow was less than the design peak instantaneous flow (PIF) factor of 4.0 approximately 99.6% of the time. Thus, the design PIF factor was exceeded for a theoretical total of 35 hours per year. The high peak flows are the result of inflow and infiltration (I/I) in the wastewater conveyance system. Data indicates that recorded peak flows can reach up to ten times the annual average flow rate.

Historical raw wastewater concentration data from 2019 to 2021 were analyzed to established current plant loadings. Weekly sampling results were available for biochemical oxygen demand (BOD_5), carbonaceous biochemical oxygen demand ($cBOD_5$), total suspended solids (TSS), total Kjeldahl nitrogen (TKN), total ammonia nitrogen (TAN), and total phosphorus (TP). The raw wastewater per capita load rates are lower than typical observed values. The lower per capita loads would to be attributed to the domestic discharges without significant industrial discharges in the sewershed. Future load projections should account for the possibility of development in the sewershed. For planning purposes, higher per capita load rates in line with typical ranges are recommended. The design per capita values, summarized in Table ES-1, are within typical ranges cited by Metcalf & Eddy (Metcalf & Eddy, 2013).

Table ES-1. Historical Per Capita Loads and Planning Design Basis

Parameter	2019 – 2021 Per Capita Load, g/cap/d	Typical Per Capita Load, g/cap/d [a]	Planning Design Basis, g/cap/d
BOD_5	38	50 – 120	50
TSS	55	60 – 150	60
TKN	9	9 – 18	15
TP	1.2	1.5 – 4.5	1.5

[a] Adapted from Metcalf & Eddy (2013)

Historical sludge generation data from 2019 to 2021 were analyzed from plant operations data. Waste Activated Sludge (WAS) generated at the Wellesley WWTP is stored in an aerated holding tank prior to haulage to the Waterloo WWTP for further processing. The sludge holding tank is periodically decanted to headworks. The typical per capita sludge generation rate for extended aeration plants with chemical phosphorous removal is 50 to 55 g/cap/d per MECP guidelines (MOE, 2008). The sludge generation rate as calculated based on plant data is significantly lower than typical values. As such, a process model was developed to estimate per capita sludge generation rates for use in planning. Overall, the solids holding tank provides less than the recommended 5-day storage volume. However, this conclusion should be confirmed during future design stages using data from the recently installed WAS flow meters at the plant.

Future Conditions

This section describes future conditions of the Water and Wastewater systems within the Township of Wellesley.

Community Growth Projections

The residential population projections were used to estimate future flows and water demand to determine the future need for Wellesley's water and wastewater infrastructure and to identify when the recommendations should be implemented to service anticipated growth. The population projections were developed by the Region in 5-year increments to the planning horizon of 2051, as shown in Table ES-2. The population within the Study Area is anticipated to increase by 1,887 people, from 3,730 to 5,617.

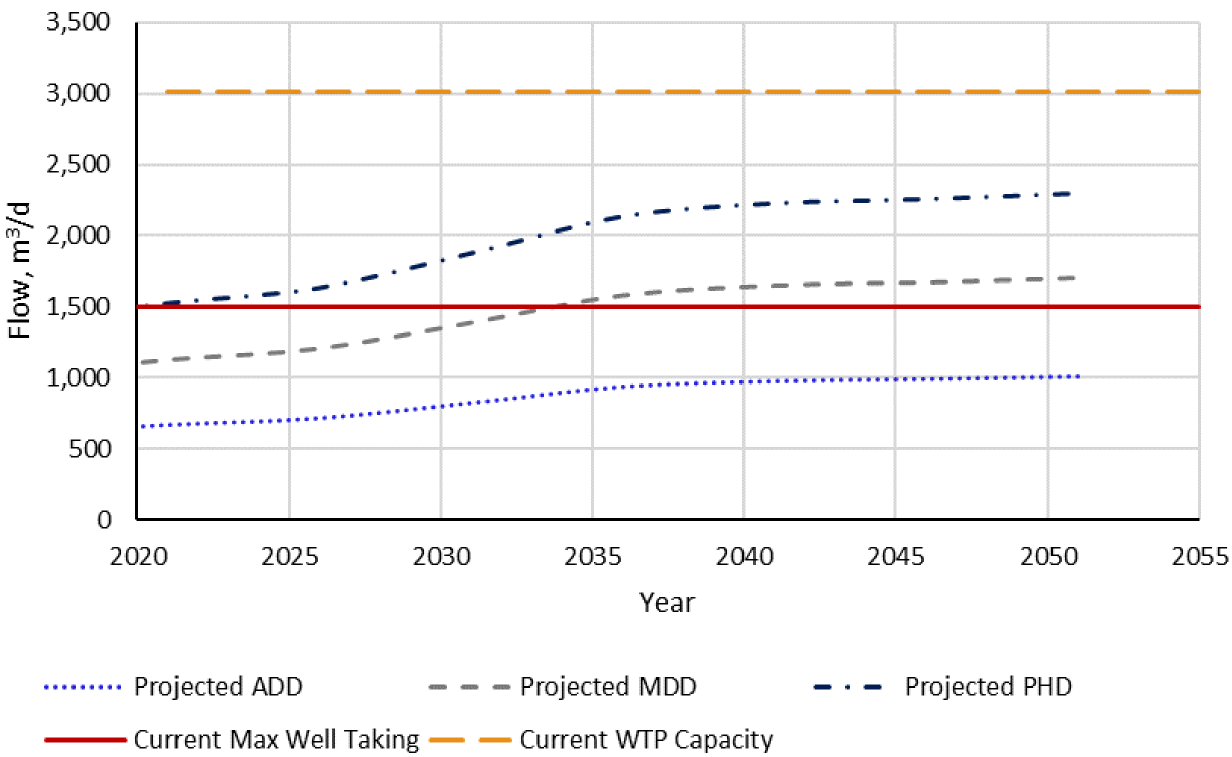
Table ES-2. Village of Wellesley Population Projections

Population	Year
2021	3,730
2026	3,992
2031	4,587
2036	5,218
2041	5,443
2046	5,518
2051	5,617

Water Treatment and Distribution

Water demand projections are presented in Figure ES-1.

Figure ES-1. Water Demand Projections



Wastewater Collection System

A future conditions scenario representing the year 2051 was created in the sanitary hydraulic model. The future hydraulic model results were compared against the level of service criteria to identify future capacity needs within Wellesley's wastewater collection system during DWF, the 5-year design storm, and the 25-year design storm. For the future scenario, the level of service criteria were not met during the 5-year design storm and 25-year design storm.

Wastewater Treatment

Wastewater flow projections through 2051 are presented in Table ES-3.

Table ES-3. Wellesley WWTP Service Area Population and Flow Projections

Parameter	Value	Basis
Design Year	2051	-
Population	5,617	-
AADF, m^3/d	1,345	239 L/cap/d
PDF, m^3/d	4,700	3.5 peaking factor
PHF/PIF, m^3/d	5,370	4.0 peaking factor

Influent loading projections through 2051 are presented in Table ES-4.

Table ES-4. Wellesley WWTP Influent Load Projections

Parameter	Value
Design Year	2051
Population	5,617
Average BOD_5 Load, kg/d	281
Average TSS Load, kg/d	337
Average TKN Load, kg/d	84
Average TP Load, kg/d	78.4

Summary of Future Needs

The following is a summary of the future needs within Wellesley's water and wastewater systems:

- **Water Treatment.** The future water treatment needs include the following:
  - Well Capacity – The current well taking capacity is expected to be exceeded by the projected MDD by 2034, therefore a plan for obtaining a minimum of 196 m^3/d (2.3 L/s) additional well capacity must be initiated around 2025.
  - Future Disinfection and Water Pumping & Storage Needs – Currently, additional pumping capacity, additional CT volume, and additional treated water storage, are identified to be required within the planning horizon (to 2051).
  - The Wellesley WTP treated water is currently in compliance with all regulatory limits in Ontario. However, should strontium become regulated within the planning horizon, alternative approaches for treatment will need to be considered. The capability to address naturally elevated strontium and fluoride concentrations was considered as a value-added factor in the WWWMP alternatives evaluation. We recommend the Region continue to monitor the regulatory landscape in the coming years and take the appropriate measures as recommended by the province.
- **Water Distribution.** Modelling was completed to identify constraints in the Wellesley Urban Area water distribution system throughout the planning horizon. ICI fire flow constraints were identified but can continue to be mitigated by maintaining the implementation of the current fire-fighting practice which

includes supplying additional fire flows via tanker trucks. Residential fire flow requirements (at 75 L/s) are met with the exception of two locations at dead-end streets under existing and future conditions.

- **Wastewater Treatment.** Process capacity constraints include influent pumping, screening, secondary treatment, tertiary treatment, chemical dosing, ozone disinfection, and sludge storage. Of note, the Region is in the process of upgrading the disinfection system from ozone disinfection to UV disinfection, and it is anticipated that the UV design will provide sufficient capacity for growth to 2051.
- **Wastewater Collections.** Future constraints occur during wet weather flow within the Firella Creek Trunk Sewer, the WWTP Influent PS, and various local sewers. It should be noted that the WWTP Influent PS constraint was also identified as a constraint under the wastewater treatment category of future needs.

Problem and Opportunity Statement

The Region of Waterloo is undertaking a Water and Wastewater Master Plan for the Village of Wellesley to address anticipated water and wastewater treatment needs, and including water distribution and wastewater collection needs, over the next 30 years. Because the population of the Village of Wellesley is expected to increase over the next 30 years, it is critical that the water and wastewater infrastructure can meet the anticipated future treatment, distribution and collection system servicing requirements. This Water and Wastewater Master Plan represents an opportunity to review the existing service levels and identify projects that are required to be implemented to meet the future needs.

Environmental Assessment Process

This section describes the steps of a Class Environmental Assessment and the decision-making framework behind certain steps in the process.

Overview of Study Approach

The Class EA process is a decision-making framework that effectively meets the requirements of the *EA Act* and is comprised of the following five phases.

1. Identify the problem or opportunity
2. Identify alternative solutions and establish a preferred solution
3. Examine alternative methods of implementing the preferred solution that will minimize negative effects and maximize positive effects
4. Prepare the project file
5. Implement the preferred solution

The Master Plan will follow MCEA Approach #2 for completing a Master Plan, which involves the preparation of the WWWMP at the end of Phases 1 and 2 of the MCEA process, while including sufficient supportive studies and investigations required to proceed to Phases 3 through 5. Approach #2 includes public and external agency consultation and an evaluation of alternative solutions.

Decision-Making Process

The alternatives were evaluated based on relative benefit/impact on criteria from the following categories: Environmental, Social, Technical and Financial. Alternatives were assigned a score according to a performance scale ranging from very well aligned with criteria to low alignment with criteria. Following the alternative scoring, each criteria category was weighted equally to calculate an overall scoring for each alternative. A sensitivity analysis using the category weightings was also completed to determine the impact different category weightings have on the evaluation outcome and ultimately assess the robustness of the alternative.

The detailed evaluation criteria included the following:

- Environmental
  - Protects environmental features
  - Protects wildlife and species at risk
  - Protects groundwater, streams and river
  - Minimizes climate change impacts
- Social
  - Minimizes impacts to residents related to noise, odour, traffic, and aesthetics
  - Minimizes impacts to businesses
  - Manages and minimizes construction impacts
  - Conserves built heritage and/or cultural heritage landscapes
  - Conserves archaeological resources
  - Protects health and safety
- Technical
  - Provides reliable service
  - Meets existing and future needs
  - Aligns with existing and planned infrastructure
  - Aligns with existing and future land use
  - Aligns with approval and permitting process
  - Manages and minimizes construction risks
  - Ability to adapt to climate change
- Financial
  - Requires low lifecycle costs

Well Capacity Alternatives Evaluation

The short-listed alternatives to address well capacity needs include the following:

1. Do Nothing (kept as a baseline) – Maintain existing well supply.
2. Increase Existing Well Supply – Explore additional water taking from existing production wells.
3. Supplement Existing Wells with New Well Supply – Maintain existing well supply and supplement with a new well that is pumped to the WTP. This alternative is split into the following sub-alternatives:
   a. Alternative 3A: the new well is to be constructed within the urban boundary, with the watermain connection crossing through the downtown section of the Village.

   b. Alternative 3B: the new well is to be constructed at a new site located outside the urban boundary near the south-east end of the Village with a watermain connection that would not cross through the downtown section of the Village.

4. Supplement Existing Wellesley Water System with External Supply – Maintain existing well supply and provide additional treated water supply from another drinking water system such as the Integrated Urban Supply (IUS).

Alternative 2: Increase Existing Well Supply is the preliminary preferred alternative to address future well capacity constraints, based on the detailed evaluation scoring and sensitivity analysis. This alternative is preferred, however, subject to further hydrogeological study. There is uncertainty, regarding the ability to acquire approvals for increasing the existing well supply because the potential impact to groundwater quantity and quality from increasing the water taking rate has not yet been studied adequately.

Alternative 3B: Supplement Existing with New Well Supply (Outside Urban Boundary) ranked very similarly to Alternative 2 and is recommended to be considered as a preferred alternative should the hydrogeological study on Alternative 2 provide negative results. Therefore, the recommended preliminary preferred alternative that can be taken forward for further study and selection includes both Alternative 2: Increase Existing Well Supply, and Alternative 3B: Supplement Existing with New Well Supply (Outside Urban Boundary).

Water Distribution and Storage Alternatives Evaluation

The short-listed alternatives identified to address the future disinfection, water pumping, and storage needs include the following:

1. Do Nothing (kept as a baseline) – Maintain existing reservoir and pump station with the pump station as the sole source of supply for domestic and emergency use.

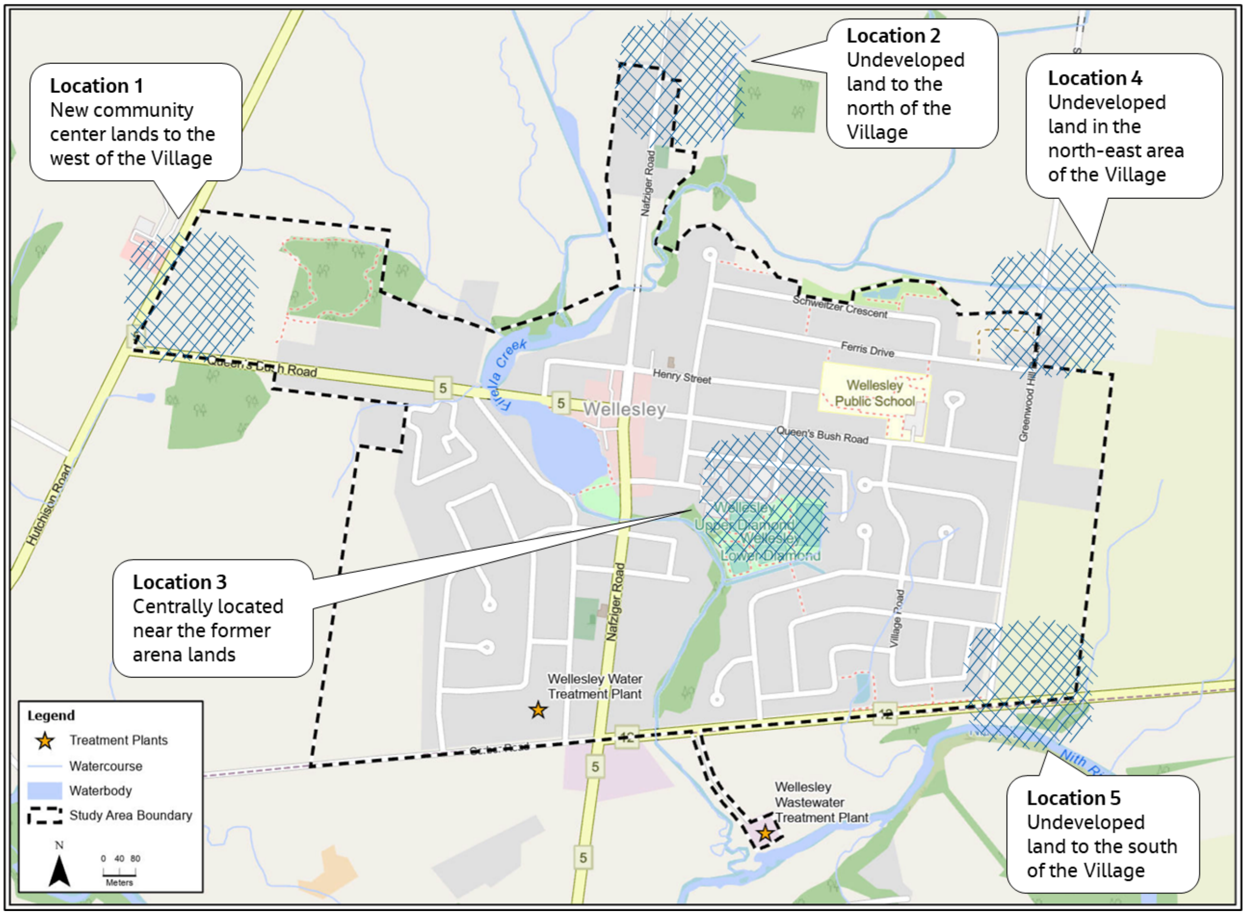
2. New Storage Off-Site – Maintain existing reservoir for disinfection. Construct floating storage, such as an elevated tank, to provide additional storage for emergency use (i.e., fire demand). Maintain existing pump station for domestic use.

Only Alternative 2: New Storage Off-Site, will meet the future needs. Evaluation was completed for the floating storage location alternatives. A list of potential locations for the floating storage was developed, including the general locations indicated in Figure ES-2 and below:

1. Bill Gies Recreation Centre lands to the west of the Village
2. Undeveloped land to the north of the Village
3. Centrally located near the former arena lands
4. Undeveloped land in the north-east area of the Village
5. Developed land to the south of the Village

Based on the detailed evaluation results, Location 1 was selected as the preferred location.

Figure ES-2. Floating Storage Alternative Locations



The alternatives for addressing fire flow are consistent with the alternatives for future disinfection and water storage needs. The total Fire flow available (FFA) is limited by the practical capacity of the existing water distribution system. It is understood that, within the planning horizon, any additional fire flow needed beyond the distribution system capacity limits can be provided through the fire department's own supply and delivered via tanker trucks, consistent with the current practice. However, when the anticipated future development within Wellesley is undertaken, there may be additional requirements for improvements to the water distribution system that would provide additional value in regard to servicing. The following watermain upgrades are recommended, based on modelling results carried out under the WWWMP, to be further investigated for implementation as additional planning information is made available to the Region in regard to the anticipated future development:

- **Residential Fire Flow Needs**. The needs for residential fire flow were identified where FFA is less than 75 L/s. These correspond to watermain dead-ends ranging in size from 50 mm to 100 mm in diameter (Pond View Drive dead-end and Village Place). These dead-end watermains should be upgraded to a size of 150 mm in diameter. By doing so, the FFA increases to 110 L/s, according to the modelling results.
- **ICI Fire Flow Needs.** The needs for ICI fire flow were identified where FFA is less than 175 L/s. It is recommended that the 200 mm diameter watermain on Queen's Bush Road from David Street (approximately 510 m in length) be upgraded to 250 mm diameter to adequately service the proposed water tower near to the Bill Gies Recreation Centre located at Queen's Bush Road and Hutchison Road.

The proposed water tower provides enough FFA to meet the requirements for the Bill Gies Recreation Centre due to its close proximity. However, to meet the fire flow required for the other ICI locations evaluated, upgrading the 200 mm diameter watermain on Queen's Bush Road from Nafziger Road to the Bill Gies Recreation Centre (approximately 900 m in length) to 300 mm diameter is required.

- Based on the additional planning information that is made available to the Region in regard to the anticipated future development, other watermain upgrades that may provide additional distribution needs should also be further investigated for implementation through additional hydraulic modelling.

Wastewater Collections and Conveyance Alternatives Evaluation

Alternatives were grouped into alternatives to address the Firella Creek Trunk Sewer needs (Group A), and alternatives to address the local sewer needs (Group B).

The short-listed alternatives to address the Firella Creek Trunk Sewer needs (Group A Wastewater Collections Alternatives) include the following:

1. **Group A -Alternative 1.** Do nothing and maintain status quo (included as a means of comparison).
2. **Group A -Alternative 2.** Implement I/I reduction measures, WTP backwash mitigation measures, offline storage locations to equalize flows along the Firella Creek Trunk Sewers.
3. **Group A -Alternative 3.** Implement I/I reduction measures, WTP backwash mitigation measures, upsize or twin Firella Creek Trunk Sewer.

Alternative 3: Implement I/I reduction measures, WTP backwash mitigation measures, upsize or twin Firella Creek Trunk Sewer, is the preferred Group A alternative.

The short-listed alternatives to address the local sewer needs (Group B Wastewater Collections Alternatives) include the following:

1. **Group B -Alternative 1.** Do nothing and maintain status quo (included as a means of comparison).
2. **Group B -Alternative 2.** Implement I/I reduction measures, pipe capacity increases as necessary for local sewers.
3. **Group B -Alternative 3.** Implement I/I reduction measures, new trunk/sub-trunk sewers to collect flows from future developments on the east and west extents of the study area, pipe capacity increases as necessary for local sewers.

Alternative 2: Implement I/I reduction measures, pipe capacity increases as necessary for local sewers is the preferred Group B alternative. The I/I reduction component should be further explored prior to implementing the recommended infrastructure upgrades associated with Alternative 2. Reducing I/I could substantially decrease the number of recommended local sewer upgrades with the Study Area. After I/I implementation strategies are investigated and implemented, the wet weather flow and sewer constraints within Wellesley's wastewater collection system should be reassessed.

Wastewater Treatment Alternatives Evaluation

This section summarizes the short-listed alternatives for select wastewater treatment processes.

Influent Pumping

The short-listed alternatives to address influent pumping needs include:

- Alternative 1: Do Nothing
- Alternative 2: Replace existing duty/standby pumps with larger capacity pumps and construction of equalization tank.
- Alternative 3: Construct a new pump station and construct an equalization tank.

The influent pump station alternatives were considered in conjunction with the determination of the preferred Firella Creek Sanitary Trunk Sewer because of the impact of the trunk sewer alternatives on the peak flow rates received at the WWTP.

Alternative 3: New Pump Station/ Equalization Tank is recommended for influent pumping. The equalization tank will provide storage for flows in excess of the future peak hourly flow capacity considering a peaking factor of 4.0 (i.e., flows in excess of 5,370 m^3/d) during wet weather events. This concept will be considered when developing concepts for downstream processes (i.e., secondary treatment and tertiary treatment) that are impacted by peak flows.

Headworks

The short-listed alternatives to address the needs for headworks include:

- Alternative 1: Do Nothing
- Alternative 2: Replace existing screen and retrofit channel to increase capacity
- Alternative 3: Construct a new headworks facility

Alternative 2: Existing Screen Replacement is recommended for the screening facility upgrade.

Secondary Treatment

The short-listed alternatives to address the needs for secondary treatment include:

- Alternative 1: Do Nothing
- Alternative 2: New Secondary Treatment Plant Construction
- Alternative 3: Implement an alternative process intensification technology into Plants 1 and 2 (Densification with AGS or MABR)
- Alternative 4: Implement wet weather management technology

Secondary treatment needs are impacted by peak flows. The preferred Influent Pumping alternative is Alternative 3: Construct a new pump station/equalization tank. The equalization tank would be part of the plant's wet weather management strategy and provide storage for flows in excess of the future peak hourly flow capacity considering a peaking factor of 4.0 (i.e., flows in excess of 5,370 m^3/d) during wet weather events. The size of the equalization tank can be optimized and may be paired with wet weather management technology to handle excess flow, which will be confirmed as part of a Schedule C Class EA. Therefore, it is recommended that Alternative 4: Implement wet weather management technology be eliminated from further analysis under Secondary Treatment but be evaluated as part of an overall wet weather management strategy in conjunction with the equalization tank as part of a Schedule C Class EA.

A multi-step approach is recommended for secondary treatment with further evaluation as part of a Schedule C Class EA:

1. Complete additional process modelling and evaluation to confirm if process intensification is feasible to increase secondary treatment capacity at the Wellesley WWTP. If process intensification is confirmed as a feasible strategy, proceed with implementation within the necessary timeframe.

2. If process intensification is confirmed as not feasible through the evaluation completed within the Schedule C Class EA, proceed with a secondary treatment expansion.

Both Alternative 2: New Secondary Treatment Plant Construction and Alternative 3: Implement an alternative process intensification technology will be carried forward as potential preferred solutions as part of this Master Plan.

Sludge Storage

The short-listed alternatives to address the needs for sludge storage include:

- Alternative 1: Do Nothing
- Alternative 2: Replace existing storage tank with a new larger storage tank
- Alternative 3: Construct a second storage tank

Alternative 3: Construct a Second Storage Tank, is recommended for the Wellesley WWTP.

Tertiary Filtration

The short-listed alternatives to address the needs for tertiary treatment include:

- Alternative 1: Do nothing and use the redundant filter to handle flows exceeding 4,400 m^3/d
- Alternative 2: Expand existing tertiary filtration process with additional filter

Alternative 2: Existing Tertiary Filtration Expansion, was selected as the preferred solution for tertiary filtration at the Wellesley WWTP.

Engagement

This section summarizes the consultation and engagement conducted through this Master Plan.

Engagement Plan and Approach

As part of the Wellesley WWWMP, a Consultation and Engagement Plan was developed. The Consultation and Engagement Plan establishes a strategy to provide meaningful information about the project to the identified audiences, as well as provide engagement opportunities over the course of the Master Plan development.

The goal for consultation and engagement was to effectively inform the public, agencies, and other stakeholders about the Class Environmental Assessment process for Master Planning, as well as the study background and goals, and provide sufficient opportunities for two-way communication opportunities. Specific goals of the Consultation and Engagement Plan include:

- Providing accessible methods and opportunities for consultation and engagement

- Addressing comments, questions, and concerns so they can be considered within the study process

- Garnering support from members of the public, agencies, and other stakeholders that the process is fair, transparent, and defensible

Managing and incorporating input from the community was used to guide the Master Plan decision-making process and support the identification and development of informed water and wastewater infrastructure solutions.

A separate Indigenous Community Engagement Plan was developed as part of this Master Plan. The MECP has established guidelines for engagement with Indigenous communities through the environmental assessment process. Communities were contacted to identify interests in the Wellesley WWWMP, to support the planning process, and to understand how potential impacts of a proposed alternative might be prevented or mitigated.

In a letter dated April 20, 2023, the MECP confirmed the following communities are anticipated to have a potential interest in the WWWMP:

- Mississauga's of the Credit First Nation
- Six Nations of the Grand River

Meaningful engagement with Indigenous communities was an important component of this study. Notices were sent to the Mississauga's of the Credit First Nation, Six Nations of the Grand River, and HCCC. No responses to the notices were received. Record of the correspondence conducted with these parties can be found in Appendix A.

Relevant agencies and stakeholders were engaged at various stages of the Master Plan to provide their input and feedback to inform the project team in the planning process. The following agencies were engaged:

- Fisheries and Oceans Canada (DFO)
- Grand River Conservation Authority
- Ministry of Citizenship and Multiculturalism (MCM)
- Ontario Ministry of the Environment, Conservation and Parks (MECP)
- Ontario Ministry of Transportation (MTO)
- Ministry of Municipal Affairs and Housing (MMAH)
- Township of Wellesley

Engagement Activities

The following provides an overview of the engagement activities completed for this Master Plan:

- Project Notices:
  - Notice of Commencement
  - Notices of Public Consultation Centers (PCC)
  - Notice of Study Completion
  - Inserts that notified Wellesley residences of upcoming PCCs and the Notice of Study Completion were distributed to residences through utility bill distribution
- Public Consultation Centers (PCC)
  - PCC1 was held on April 19, 2023, at 7pm via Microsoft Teams Webinar. The presentation included an overview of the master planning process and the project Study Area, a summary of the Wellesley water and wastewater systems and next steps. A total of 13 people, including presenters, attended the PCC, and attendees were encouraged to complete a PCC survey.

- PCC2 was held on June 20, 2024, at 7pm via Microsoft Teams Webinar. The presentation included an overview of the master planning process, a summary of identified water and wastewater system constraints, short-listed water and wastewater system alternatives, and the evaluation criteria. A total of 12 people, including presenters, attended the PCC, and attendees were encouraged to complete a PCC survey.
- PCC3 was held on December 12, 2024, at 7pm via Microsoft Teams Webinar. The presentation included a review of the evaluation criteria and alternatives presented at PCC2 and shared the preliminary recommendations on the preferred alternatives for water supply and wastewater. A total of 14 people, including presenters, attended the PCC, and attendees were encouraged to complete a PCC survey.

How the Preferred Solution Incorporates Engagement Feedback

Incorporating feedback received at the PCC's into the WWWMP is an important and valued component of the master planning process. The points below summarize the feedback received and how the feedback was incorporated into the Wellesley WWWMP.

- **What were the proposed population changes and how those may impact infrastructure needs?** Considered future projected populations based on updated projections in April 2024 and this is reflected in alternatives in PCC3
- **Will development impact the quality of water?** The Region must monitor water quality on a regular basis and ensure it meets all Provincial water quality standards.
- **Concern is raised over central elevated tank location.** Noted. This was reflected in the evaluation under social category of criteria
- **Will this project address low water pressures?** The provision of off-site water storage will help stabilize pressures in Wellesley.
- **How does water efficiency change wastewater flows?** Less water usage has a direct relation to water entering the wastewater system; water efficiency would lead to decrease in wastewater flows.
- **Additional technical information on alternatives**. Alternative evaluation details are covered in PCC3 and further technical details will be provided in the Master Plan Report which will be posted early 2025.
- **Concern is raised over various bottle necks in the local sanitary sewer system, and how the expansion of the Firella Creek Trunk Sewer will impact these areas.** In addition to identifying alternatives for the Firella Creek Trunk Sewer, PCC3 presented alternatives to address the local pipe capacity needs. The evaluation results recommended managing local pipe capacity needs by implementing I/I reduction measures and other pipe capacity increases as necessary.
- **Project timelines and next steps?** Covered in PCC3

Recommendations

Table ES-5 summarizes the recommended water and wastewater system alternatives.

Table ES-5. Summary of Recommended Alternatives

System Type	Constraint Group	Preferred Alternative Description	Cost [a]	EA Schedule	Recommended Implementation Year [b]
Drinking Water	Well Capacity	Increase existing well supply or supplement existing with a new well (outside urban boundary)	$5,320,000	Schedule C Class EA	Before 2034
Drinking Water	Future Disinfection, Water Pumping, and Storage	New storage off-site	$12,803,000 & $250k to $400k for chlorine boosting (if needed)	Schedule B Class EA	Near-Term (within 5 years)
Drinking Water	Water Distribution	Watermain upgrades to accommodate fire flow needs	TBD [c]	Exempt	TBD [c]
Wastewater Collections	Group A – Firella Creek Trunk Sewer	Increase capacity of Firella Creek Trunk Sewer	$5,421,000	Exempt	Near-Term (within 5 years)
Wastewater Collections	Group B – Local Sewer Constraints	Investigate and implement I/I reduction strategies	TBD [d]	TBD [d]	2025
Wastewater Collections	Group B – Local Sewer Constraints	Reassess local sewer constraints	TBD [d]	Exempt	Near-Term (within 5 years)
Wastewater Treatment	Not Applicable	Assimilative Capacity Study	$150,000	Not Applicable	2025
Wastewater Treatment	Influent Pumping	New pump station and equalization tank	$11,383,750	Schedule C Class EA	Near-term (within 5 years) [f]
Wastewater Treatment	Headworks	Replace existing bar screen	$1,050,000	Schedule C Class EA	2032

System Type	Constraint Group	Preferred Alternative Description	Cost [a]	EA Schedule	Recommended Implementation Year [b]
Wastewater Treatment	Secondary treatment	Construct new secondary treatment plant [g]	$3,937,500	Schedule C Class EA	2032
Wastewater Treatment	Sludge Storage	Construct new storage tank	$700,000	Exempt	2032
Wastewater Treatment	Tertiary Filtration	Expand existing filtration process	$2,012,500	Schedule C Class EA	2036

Notes:

[a] Land acquisition costs are not included in cost. Costs are in 2024 dollars.

[b] Refer to TM5 in Appendix B for additional information and assumptions.

[c] TBD = To be determined pending further investigation for implementation as additional planning information for anticipated future development is made available to the Region

[d] TBD = To be determined pending I/I investigation results

[e] Assimilative capacity study to be completed prior to Wellesley WWTP Schedule C EA

[f] The equalization tank is required in the near-term to manage peak flows from the collection system that are conveyed to the Wellesley WWTP. The preferred equalization tank concept (sizing, hydraulics, etc.) will be determined during the future Schedule C Class EA and design. A new influent pumping station will be constructed as part of this contract with the same peak rated capacity as the Wellesley WWTP, with provisions for expansion when the remainder of the WWTP is expanded and following a Schedule C Class EA. The pumping station may include separate wet weather pumps to convey flows to the equalization tank, however, these will not impact the overall rated capacity of the pumping station (i.e., the flow rate that can be pumped through the Wellesley WWTP). The construction of the equalization tank is a Schedule B activity, but is recommended to be incorporated into the Wellesley WWTP Schedule C Class EA.

[g] Secondary treatment expansion was carried forward for costing as a conservative approach. A pilot study is recommended to first be completed to determine the feasibility of process intensification, however these secondary treatment recommendations will be confirmed during the subsequent Schedule C EA. Refer to Section 8.2.4.3 for further details.

Permits and Approvals

The following permits/approvals will be required before the construction of the preferred alternatives:

- Ontario Environmental Assessment Act Approval: Schedule B EA for the new elevated tank (satisfied through this Master Plan). Schedule C EA for the WWTP upgrades and new well (if required). The above requirements will need to be reviewed should any potential regulatory changes occur in the short-term. Consultation with the MECP is recommended.
- ECAs: Amendments to the Region's Consolidated Linear Infrastructure ECA and wastewater treatment plant ECA.
- PTTW Application Groundwater: Category 3 application to increase the water taking capacity, supported by a new hydrogeological assessment.
- Drinking Water Works Permit (DWWP) Amendment for the elevated tank and well.
- Municipal Drinking Water License (MDWL) Amendment for the elevated tank and well.
- PTTW if taking more than 50,000 litres of water per day from environment during construction.
- Receiving Water Quality Assessment (RWQA) prior to implementation of recommended projects.
- Endangered Species Act (ESA):
  - Follow timing windows for tree removals to avoid the maternal roosting period for species at risk (SAR) bats (May 1 and August 31). Recommend consultation with the MECP during design. Information Gathering Form must be completed to verify if a permit is required.
  - Consultation with MECP is recommended prior to removal of any protected SAR bat habitat within the study area. Consideration for SAR and SAR habitat is required for proposed construction within or nearby these areas as per the ESA as administered by the MECP. Further SAR screening is conducted by contacting the MECP's SAR Branch.
- Under the Fish and Wildlife Conservation Act, a License to Collect Fish for Scientific Purposes is required if fish relocation to outside the work area is required. A Wildlife Collector's Authorization will be required if wildlife must be relocated to outside of the work area.
- Under the Public Lands Act & Lakes and Rivers Improvements Act the project may require land tenure under the Public Lands Act. Consultation with the local MNRF office may be required.
- GRCA: Permit for the Regulation of Development, Interference with Wetlands and Alteration to Shorelines and Watercourses (Ontario Regulation 150/06), erosion and sediment control plans.
- MCM: Stage 1 Archaeological Assessment and Cultural Heritage Report for new well supply.
- Environment and Climate Change Canada: Certain rules apply to migratory birds, which are protected under the federal Migratory Birds Convention Act. Environment Canada provides guidance regarding tree removal and construction timing windows.
- Fisheries and Oceans Canada (DFO): Review may be required if future work is proposed in-water, or near water, such as for the water crossings to upsize the sanitary sewers.
- Township of Wellesley: Municipal Consent for works with the Townships right-of-way, Municipal site plan approval for elevated tank, Municipal building permit for elevated tank, Road Work Permit for sanitary sewer upgrades, zoning by-law amendment for the elevated tank.

- Utilities: Utility infrastructure such as electrical, telephone, and gas must be confirmed during preliminary design. Review and approvals must be received.
- Easements and Land Acquisition: Land acquisition is anticipated for the recommended equalization tank at the WWTP, as well as the new elevated tank and well supply. Alternations to the WWTP buffer zone may also be required to satisfy MECP requirements. An expanded or revised easement may be required to implement the Firella Creek Trunk Sewer upgrades.
- Approvals under the Electrical Safety Authority (ESA) and Technical Standards and Safety Act (TSSA) may be required for the recommended WWTP upgrades.

Potential Impacts and Mitigation Measures

This section covers the potential impacts that may occur during the implementation of the preferred alternatives and recommended mitigation measures for such impacts.

Natural Environment

The following impacts and mitigation measures for the natural environment may apply during the implementation of the preferred alternatives:

- **Local Sanitary Sewer Upgrades:** Potential construction impacts to two waterbody crossings (one crossing south of Molesworth Street and one crossing west of Parkview Drive).
- **Firella Creek Trunk Sewer Upgrades:** Construction of the Firella Creek Trunk Sewer will be within the GRCA regulated area and mitigation measures will be required, including the implementation of sediment control plans. Potential impact to woodlots. One creek crossing will also be required.
- **Drinking Water Storage:** Location 1 does not overlap GRCA regulated areas, however there could be potential impacts to nearby woodlots.
- **Increasing Existing Well Supply:** Hydrogeological investigation to assess aquifer impacts.
- **New Well Supply Outside of Urban Boundary** (if required): A species at risk assessment and arborist surveys are to be completed during design. Desktop natural heritage review would be required as this alternative is located outside of the Study Area of this Master Plan.
- **Wastewater Treatment Plant Upgrades:** Property expansion will be required for the equalization tank, likely into neighboring agricultural lands. The equalization tank location and process equipment locations should be selected outside of the GRCA regulatory floodplain. An assimilative capacity assessment will be required prior to WWTP upgrades.
- **Wellhead Protection Area (WHPA):** One WHPA is located in the Study Area and is associated with WY1, WY5, and WY6, situated within the Wellesley WTP property. WHPA-A includes the area within the immediate vicinity of the Wellesley WTP. WHPA-B includes the approximate area from Gerber Road and Nafziger Road, extending northwest to west of Lawrence Street and south of Queens Bush Road. WHPA-C extends beyond WHPA-B to include areas northwest of Seigner Lane and Hutchinson Road in Wellesley Township. The following impacts to the WHPA are possible:
- Sewage systems have a vulnerability score of 8 and 10 within WHPA-A and WHPA-B. Local sanitary sewer upgrades are not part of the recommendations in this WWWMP, however, the Master Plan recommends I/I reduction to reduce wet weather flows in the sanitary collection system. Should any upgrades to local sewers that fall within WHPA-A and WHPA-B be initiated as an I/I option it should be remembered that potential risks to the impact zones include potential spills to the aquifer pertaining to

WY1, WY5, and WY6. This threat could occur during construction, operation, or sewer pipe deterioration or failure.

- The recommended elevated tank (Location 1) falls within WHPZ-C; however, is not considered a significant drinking water threat.
- The following mitigation measures are recommended:
  - The ECA should include terms and conditions to remove the drinking water threat. The ECA should also include a contingency plan in the case of a spill and within WHPA-A the ECA should include enhanced construction to reduce the likelihood of leaks.
  - Dewatering could also be minimized to reduce impacts on the aquifer. The proposed sewers will also be sized and constructed according to typical standards and codes to mitigate the occurrence of wastewater leakage into the aquifer.
- **Waterbody crossings:** Construction methods will be investigated in design. Construction of the recommended projects pose potential impacts to vegetation and tree removals, wildlife habitat removal, and aquatic habitats. Erosion and sedimentation plans will be developed and implemented to limit or eliminate the impact to the adjacent habitats and aquatic environment.
- A detailed natural environment monitoring study with field verification and an Environmental Impact Assessment is required. Mitigation measures are expected to include an Erosion and Sedimentation Plan, a Spills Management Plan, a Tree Impact and Preservation Plan, compliance with the Species Act and Migratory Birds Convention Act, and compliance with the Grand River Source Water Protection Plan.
- Selection of energy efficient equipment to mitigate the impacts due to increased energy consumption at the WWTP and WTP following implementation of the recommended alternatives.
- GHG emissions are anticipated to increase at the WWTP since the equalization tank basin is expected to be an open tank, thereby enabling the release of GHG. However, GHG emissions are expected to be minimal since the duration of storage of the peak flow would be one day or less.
- A desktop review geotechnical study was completed to provide a geotechnical feasibility screening for the preferred alternatives as well as constructability considerations. Geotechnical investigations will be required prior to project implementation. It should be noted that archaeological assessments need to be completed prior to geotechnical investigations.

Social, Economic and Cultural Environment

The following impacts and mitigation measures for the social, economic, and cultural environments may apply during the implementation of the preferred alternatives:

- **Built Heritage Resources and Cultural Heritage Landscapes:** Archaeological Services Inc. (ASI) completed the Cultural Heritage Report for the project study area which consisted of the primary and secondary preferred elevated tank sites to the west and north-east areas of the Village, the Wellesley WWTP, and various underground sewer locations. The report includes an inventory of known and potential built heritage resources (BHRs) and cultural heritage landscapes (CHLs), summary of existing conditions of the study area, a preliminary impact assessment, and proposed mitigation measures.
  - Potential Elevated Tank Location 1 in the west area of the Village will not result in direct or indirect impacts to any BHRs or CHLs.
  - Wellesley WWTP: No direct or indirect impacts to any BHRs or CHLs are expected.

  - I/I mitigation work or construction activities on the various underground sewer locations: Potential for indirect adverse impacts due to construction related vibration to five potential BHRs and six potential CHLs.

- The following mitigation measures were recommended:
  - Construction activities and staging should be suitably planned and undertaken to avoid unintended negative impacts to identified BHRs and CHLs. Avoidance measures may include erecting temporary fencing, establishing buffer zones, issuing instructions to construction crews to avoid identified BHRs and CHLs, and post construction rehabilitation with sympathetic plantings.
  - Where project works are anticipated to be directly adjacent to a designated or listed property, a resource-specific Heritage Impact Assessment (HIA) may be required per Schedule 9.5.1 of the Township's Official Plan. An HIA may be required for CHL 5 located along Henry Street. However, as no direct adverse impacts are anticipated, Heritage Planning at the Region should consider waiving the requirement for an HIA in favour of suitable avoidance and mitigation measures.
  - The Firella Creek trunk sewer should be designed in a manner that does not adversely impact B.H.R. 9 (Gerber Road Bridge). Should avoidance not be feasible and the bridge will be subject to direct adverse impacts, a Cultural Heritage Evaluation Report (C.H.E.R.) is recommended to determine if the bridge has cultural heritage value or interest, as per Ontario Regulation 9/06. If it is determined to have cultural heritage value or interest, a H.I.A. is recommended to assess and mitigate any impacts.
  - To address the potential for indirect impacts to B.H.R.s 1-10 and C.H.L.s 1-6 due to construction related vibration, undertake a baseline vibration assessment during detailed design to determine potential vibration impacts.
  - The Cultural Heritage Report should be submitted by the proponent to heritage staff at the Township, the Ministry of Citizenship and Multiculturalism, and any other relevant stakeholder with an interest in this project.
  - Should future work require an expansion of the study area then a qualified heritage consultant should be contacted to confirm the impacts of the proposed work on potential heritage resources.
  - All subsequent recommended technical cultural heritage studies should be completed by a qualified heritage professional with recent and relevant experience as early in detailed design as possible prior to any construction activities and submitted for review and comment to the Township, the Region, and the Ministry of Citizenship and Multiculturalism, and any other local heritage stakeholders that may have an interest in this project.
  - A Built Heritage Resources and Cultural Heritage Landscapes assessment has not been completed for a new well supply but will be required if it is determined that expanding the existing well capacity is not feasible and a new well supply outside of the urban boundary is required.
- **Archaeology:** A Stage 1 Archaeological Assessment and a subsequent report was completed by ASI. The background assessment determined that six previously registered archaeological sites were located in close proximity (within 1 km) of the Study Area. A Stage 1 Archaeological Assessment property inspection was conducted on November 1, 2024, to assess the archaeological potential along the preferred alternatives based on the geography, topography, and current conditions. The property inspection was visual and did not include excavation or collection of archaeological resources.

  - The property inspection determined that the following preferred alternative exhibits archaeological potential:
    - WWTP Upgrades, including equalization tank: Archaeological potential – require Stage 2 archaeological assessment by test pit and pedestrian survey at 5m intervals.
  - The areas exhibiting archaeological potential will require Stage 2 Archaeological Assessment prior to any construction activities or other proposed impacts, including geotechnical investigations.
- **Noise and Vibration:** Impacts associated with construction can be addressed by the following:
  - Working within Township of Wellesley noise bylaw
  - Working within the MECP's Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning
  - Minimizing construction traffic in local residential streets
  - Larger pumps may increase noise at the WWTP. However, the impact is expected to be minimal given that the land use surrounding the WWTP is generally agricultural.
- **Odour:** Odour is not expected to increase substantially during construction. Odour generation potential at the WWTP may increase due to increased flows. However, the impact is expected to be minimal given that the land use surrounding the WWTP is generally agricultural. Providing a sludge storage tank with a jet aerator would provide sufficient mixing to minimize odour. Achieving minimum scouring velocity thresholds within the sanitary sewers will reduce the risk of odour generation within the sewers.
- **Aesthetics:** The elevated tank is a permanent infrastructure change that will alter the community aesthetics and viewshed. These impacts were considered in detailed evaluation to select a location that minimizes impacts to current residents and businesses. The Firella Creek Trunk Sewer will be underground and will not impact aesthetics. I/I mitigation methods within the local sewers are not anticipated to impact aesthetics. Upgrades at the WWTP are not anticipated to substantially impact the existing aesthetic landscape.
- **Water and Wastewater Servicing**: Temporary disruptions may occur for water and wastewater servicing during the construction of the elevated tank and I/I mitigation measures within local sanitary sewers. Mitigation measures for these disruptions are recommended to be developed during design, as applicable. Bypass pumping will be required during the Firella Creek Trunk Sewer Upgrades. A temporary interruption of the existing process operation, or reduced capacity, may occur at the WWTP during upgrades. Mitigation measures to limit disruption impacts and mitigate the risk of potential effluent quality impacts to the Nith River should be considered during design.
- **Health and Safety:** Development and construction activities may increase the type and volume of traffic (e.g., construction vehicles and equipment) or introduce additional hazards to the environment (e.g., material spill). Vehicles and equipment used during construction will follow traffic laws and multi-passenger vehicles will be used, when possible, to reduce traffic associated with construction activities. Increasing the existing well taking capacity may lead to elevated strontium and fluoride concentrations, which remains to be determined as a part of the hydrogeological study.

Statement of Limitations

This Report has been prepared exclusively for internal use by the Region of Waterloo.

This Report was not prepared in anticipation of any legal proceedings, nor is this Report intended for use or reliance in any way in any legal proceedings related to the project, or otherwise. No liability is accepted for any use or reliance on the information provided herein by third parties. Jacobs accepts no responsibility for damages, if any, suffered by any party as a result of decisions made or actions based on this Report. No other warranty, expressed or implied, is made.

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Contents

Appendices (Provided under separate cover)

Tables

Figures

Acronyms and Abbreviations

Acronym	Description
AADF	Annual Average Daily Flow
ADD	Average Day Demand
ADF	Average Daily Flow
AGS	Aerobic Granular Sludge
ANSI	Areas of Natural and Scientific Interest
ASI	Archaeological Services Inc.
BHR	Built Heritage Resources
BOD_5	Biological Oxygen Demand
$cBOD_5$	Carbonaceous Biochemical Oxygen Demand
CCME	Canadian Council of Ministers of the Environment
CCTV	Closed-Circuit Television
CHL	Cultural Heritage Landscapes
CHR	Cultural Heritage Resource
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CT	Contact Time
DFO	Department of Fisheries and Oceans Canada
DGSSMS	Design Guidelines and Supplemental Specifications for Municipal Services
DWF	Dry Weather Flow
DWWP	Drinking Water Works Permit
EA	Environmental Assessment
ECA	Environmental Compliance Approval
EPA	Environmental Protection Agency

Acronym	Description
ESA	Endangered Species Act
ESDM	Emission Summary and Dispersion Modelling
ESOC	Emerging Substances of Concern
ESR	Environmental Study Report
FF	Fire Flow
FFA	Fire Flow Available
GHG	Greenhouse gas emissions
GLWQA	Great Lakes Water Quality Agreement
GRCA	Grand River Conservation Authority
HCCC	Haudenosaunee Confederacy Chiefs Council
HDI	Haudenosaunee Development Institute
HHA	Haloacetic Acids
HIA	Heritage Impact Assessment
ICI	Industrial, commercial, and institutional
I/I	Inflow and infiltration
IUS	Integrated Urban System
MABR	Membrane Aerated Biofilm Reactor
MCEA	Municipal Class Environmental Assessment
MCM	Ministry of Citizenship and Multiculturalism
MDD	Maximum Day Demand
MDWL	Municipal Drinking Water License
MEA	Municipal Engineers Association
MECP	Ministry of Environment, Conservation and Parks
MMAH	Ministry of Municipal Affairs and Housing

Acronym	**Description**
MNRF	Ministry of Natural Resources and Forestry
MPAP	Municipal Project Assessment Process
MTO	Ontario Ministry of Transportation
N/A	Not Applicable
NDMNRF	Ministry of Northern Development, Mines, Natural Resources and Forestry
LIO	Land Information Ontario
OBBA	Ontario Breeding Bird Atlas
OCWA	Ontario Clean Water Agency
ODWQS	Ontario Drinking Water Quality Standards
OLT	Ontario Land Tribunal
PCC	Public Consultation Centre
PDF	Peak Day Flow
PFAS	Per- and polyfluoroalkyl substances
PHD	Peak Hour Demand
PHF	Peak Hour Flow
PIF	Peak Instantaneous Flow
POI	Point of Impingement
PPS	Provincial Policy Statement
PS	Pumping Station
PSW	Provincially Significant Wetland
PTTW	Permit to Take Water
PVC	Polyvinyl Chloride
PWQO	Provincial Water Quality Objectives
RAS	Return Activated Sludge

Acronym	Description
ROP	Regional Official Plan
RTK	Real-time Kinematic
RWQA	Receiving Water Quality Assessment
SAR	Species at Risk
SARA	Species at Risk Act
SARB	Species at Risk Branch
SARO	Species at Risk Ontario
SRP	Soluble Reactive Phosphorus
SWQP	Surface Water Quality Program
TAN	Total Ammonia Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TN	Total Nitrogen
TP	Total Phosphorous
TSS	Total Suspended Solids
TSSA	Technical Standards and Safety Act
TTHM	Total Trihalomethanes
WAS	Waste Activated Sludge
WHPA	Wellhead Protection Area
WTP	Water Treatment Plant
WWWMP	Water and Wastewater Master Plan
WWTP	Wastewater Treatment Plant

1. Introduction and Background

1.1 Study Purpose and Objectives

The Township of Wellesley (Township) is one of seven local municipalities in the Region of Waterloo (Region). The Wellesley Urban Area (Wellesley) is one of 11 settlement areas that comprise the Township of Wellesley. The Region is responsible for maintaining servicing within Wellesley's water and wastewater systems to provide capacity for the existing population and for new growth in the service area while meeting regulatory requirements. The Region undertook the Wellesley Water and Wastewater Master Plan (WWWMP) to address anticipated water and wastewater treatment needs to 2051, and in doing so, to improve the reliability and resiliency of Wellesley's water and wastewater assets. The WWWMP will incorporate recent population forecasts, condition assessments, and relevant concurrent upgrades and projects.

The goals of the WWWMP include assessing existing and future scenario infrastructure capacity, identifying required infrastructure upgrades and improvements, and systematically developing a prioritized implementation plan that is endorsed by the Region and project stakeholders. The proposed recommendations will meet the Region's social and environmental stewardship standards and the regulatory requirements for infrastructure upgrades and improvements while providing technical and cost-effective solutions that meet both energy management and resiliency objectives.

1.2 Study Area

The Study Area for the Wellesley WWWMP is shown in Figure 1-1. The Study Area was selected to include areas of Wellesley with existing water and wastewater infrastructure as well as areas within and adjacent to the current Village of Wellesley that may require future servicing to fulfill the objectives of the Master Plan for future servicing to address growth. The Study Area encompasses the Wellesley Urban Area as well as additional future growth areas to the east of Greenwood Hill Road and to the west of Lawrence Street. The parcel of land north of Queens Bush Road and east of Hutchinson Road (Regional Road 7), as well as the Wellesley Wastewater Treatment Plant (WWTP) property and access Road, are also included in the Study Area.

Notes:
1. Aerial Source: Region of Waterloo, 2022.

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Figure 1-1
Study Area

Region of Waterloo
Wellesley, Ontario

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1.3 Environmental Assessment Act

The objective of the Ontario *Environmental Assessment Act* R.S.O. 1990, c. E. 18 is to consider the possible effects of projects early in the planning process, when concerns may be most easily resolved, and to select a preferred alternative with the fewest identified impacts.

The *Environmental Assessment (EA) Act* requires the study, documentation, and examination of the environmental effects that could result from projects or activities.

The *EA Act* defines "environment" very broadly as follows:

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

In applying the requirements of the EA Act to projects, two types of EA planning and approval processes are identified:

- Individual EAs (Part II of the EA Act): Projects have terms of reference and individual EAs, which are carried out and submitted to the Ministry of the Environment, Conservation and Parks (MECP) for review and approval.
- Class EAs: Projects are approved subject to compliance with an approved Class EA process; provided that the appropriate Class EA approval process is followed, a proponent will comply with the requirements of the *EA Act*.

1.3.1 Class Environmental Assessment Process

The Class EA process is a decision-making framework that effectively meets the requirements of the *EA Act* and is comprised of the following five phases. These phases are illustrated in Figure 1-2.

1. Identify the problem or opportunity
2. Identify alternative solutions and establish a preferred solution
3. Examine alternative methods of implementing the preferred solution that will minimize negative effects and maximize positive effects
4. Prepare the project file
5. Implement the preferred solution

The Master Plan will be carried out in accordance with the Municipal Engineers Association's (MEA) Municipal Class Environmental Assessment (MCEA) Process (MEA, 2000, as amended 2007, 2011, 2015, 2023, 2024), which is an approved process under the Ontario Environmental Assessment Act. The study will follow MCEA Approach #2 for completing a Master Plan, which involves the preparation of the WWWMP at the end of Phases 1 and 2 of the MCEA process, while including sufficient supportive studies and investigations required to proceed to Phases 3 through 5. Approach #2 includes public and external agency consultation and an evaluation of alternative solutions. The Municipal Engineer's Association Class EA process is shown on Figure 1-2 and includes:

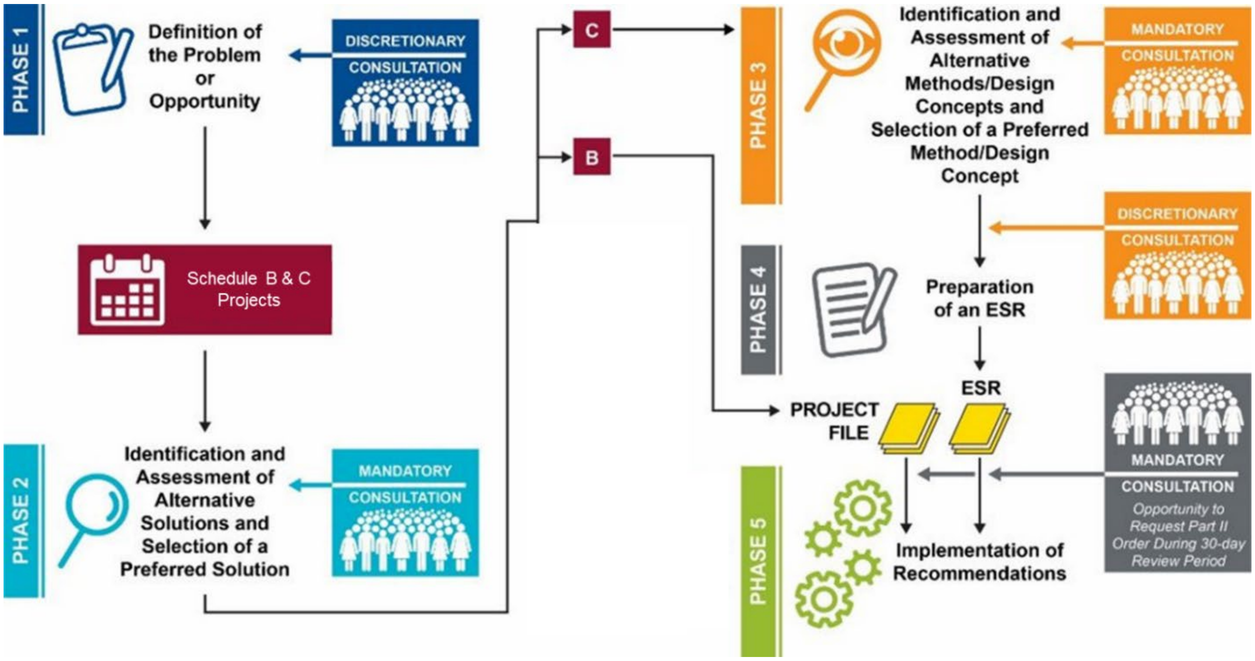
- Schedule B projects must proceed through the first two phases of the process. Proponents must identify and assess alternative solutions to the problem, inventory impacts, and select a preferred solution. They must also contact relevant agencies and affected members of the public. Provided that no significant impacts are identified, and no requests are received to elevate the project to Schedule C or undertake the project as an Individual EA (Section 16 Order), the project may proceed to the next phase.
- Schedule C projects require more detailed study, public consultation, and documentation, as they may have more significant impacts. Projects categorized as Schedule C must proceed through all five phases of an assessment. An Environmental Study Report (ESR) must be completed and available for a 30-day public review period prior to proceeding to implementation.

Various maintenance, operation, rehabilitation, and other small projects that are limited in scale and have minimal adverse environmental effects, formerly classified as Schedule A and A+ projects, are now exempt from the Environmental Assessment Act (MEA, 2000, as amended 2007, 2011, 2015, 2023, 2024).

A Section 16 Order is the legal mechanism in which the status of an undertaking can be elevated before the project can progress. The study's planning and design process allows for concerns to be identified and resolved throughout the course of the project; however, a Part 16 Order request can be submitted to the MECP on the grounds that the order may prevent, mitigate or remedy adverse impacts on the existing Aboriginal and treaty rights of the Aboriginal peoples of Canada as recognized and affirmed in section 35 of the Constitution Act, 1982.

The EA Act as amended through the COVID-19 Economic Recovery Act, 2020, also provides the Minister with the authority to make two types of orders with respect to an undertaking proceeding in accordance with a Class EA. The Minister may, on their own initiative, within a time limited period, require a proponent to undertake an individual EA, referred to as a section 16(1) order, in which case the proponent cannot proceed with the project without first seeking and obtaining approval under Part II of the Act (conduct an individual EA). The Minister may also impose conditions on an undertaking, referred to as a section 16(3) order, where the proponent must meet the conditions outlined in the order.

Figure 1-2. MCEA Process



1.3.2 Project Contact

Primary contacts for the project are as follows:

Region of Waterloo:

Kaoru Yajima
Project Manager
Transportation and Environmental Services, Water Services
Region of Waterloo
150 Frederick Street, 7th Floor
Kitchener, ON N2G 4J3
KYajima@regionofwaterloo.ca

Jacobs Engineering Group:

Tom Mahood
Project Manager
Jacobs
165 King Street West, Suite 201
Kitchener, ON N2G 1A7
tom.mahood@jacobs.com

Project engagement is intended to address all comments received during the consultation period and resolve any outstanding concerns with the project team. In the event there are outstanding concerns that relate to the potential adverse impacts to constitutionally protected Indigenous and treaty rights, a Part 16 Order request on those matters (only) should be addressed in writing to:

Minister Todd McCarthy
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto, ON M7A 2J3
minister.mecp@ontario.ca

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Avenue, 1st Floor
Toronto, ON M4V 1P5
ClassEAnotices@ontario.ca

If other concerns with the Master Plan Report and/or EA process are made known to the Minister, or determined following a review of the document, the Minister reserves the right to issue an order on his or her own initiative within a specified time period.

2. Consultation and Engagement

2.1 Consultation and Engagement Plan

As part of the Wellesley WWWMP, a Consultation and Engagement Plan was developed. The Consultation and Engagement Plan establishes a strategy to provide meaningful information about the project to the identified audiences, as well as provide engagement opportunities over the course of the Master Plan development.

Project communications and engagement with members of the public, review agencies, and other stakeholders (i.e., organizations, businesses) is an important part of the Master Plan MCEA process. The objective of the Consultation and Engagement Plan is to present the activities and methods that will be used throughout the Master Plan.

Specifically, the Consultation Plan presents the following information:

- The MCEA study project team
- The principles guiding the Consultation Plan for this project
- Consultation and communication opportunities, methods, roles, and responsibilities
- An approach to responding to comments and feedback
- An approach to documenting communications and engagement activities, which will be included in the Master Plan record (project file)

The goal for consultation and engagement was to effectively inform the public, agencies, and other stakeholders about the Class Environmental Assessment process for Master Planning, as well as the study background and goals, and provide sufficient opportunities for two-way communication opportunities. Specific goals of the Consultation and Engagement Plan include:

- Providing accessible methods and opportunities for consultation and engagement
- Addressing comments, questions, and concerns so they can be considered within the study process
- Garnering support from members of the public, agencies, and other stakeholders that the process is fair, transparent, and defensible

To achieve these goals, the following specific objectives were defined for the communications and consultation program:

- Provide adequate notice at the start of the Master Plan study to actively encourage inclusive and equitable participation.
- Clearly and effectively communicate information on each alternative solution the Master Plan study considers, including:
  - Benefits, negative effects, and costs of each alternative
  - Rationale for the highest scoring alternative
  - Opportunities for sustainable solutions, particularly relating to water
  - Recommendations to minimize adverse effects and maximize benefits
- Foster public trust and confidence by:
  - Demonstrating the Region is following a comprehensive process, with a team of specialists who have the experience and qualifications to complete a fair, transparent, and educated evaluation of alternatives

- Providing consistent messaging to all interested members of the public and stakeholders and other potential influencers, such as elected officials and other opinion leaders
- Engage stakeholders and the public in consultation that provides balanced information and elicits meaningful input.

Managing and incorporating input from the community was used to appropriately influence the Master Plan decision-making process and support in the identification and development of informed water and wastewater infrastructure solutions.

The full Consultation and Engagement plan is presented in Appendix A.

2.2 Engagement with First Nations and Indigenous Communities

A separate Indigenous Community Engagement Plan was developed as part of this Master Plan. Through the MCEA process, it is important to engage with Indigenous communities to understand traditional knowledge of the lands throughout the past, in the present, and into the future.

The MECP has established guidelines for engagement with Indigenous communities through the environmental assessment process. Communities were contacted to identify interests in the Wellesley WWWMP, to support the planning process, and to understand how potential impacts of a proposed alternative might be prevented or mitigated.

In a letter dated April 20, 2023, the MECP confirmed the following communities are anticipated to have a potential interest in the WWWMP:

- Mississauga's of the Credit First Nation
- Six Nations of the Grand River

The full Indigenous Communications Plan is presented in Appendix A.

Meaningful engagement with Indigenous communities was an important component of this study. Notices were sent to the Mississauga's of the Credit First Nation, Six Nations of the Grand River, and HCCC. No responses to the notices were received. Record of the correspondence conducted with these communities can be found in Appendix A.

2.3 Stakeholder and Agency Engagement

Relevant agencies and stakeholders were engaged at various stages of the Master Plan to provide their input and feedback to inform the project team in the planning process. The following agencies were engaged:

- Fisheries and Oceans Canada (DFO)
- Grand River Conservation Authority
- Ministry of Citizenship and Multiculturalism (MCM)
- Ontario Ministry of the Environment, Conservation and Parks (MECP)
- Ontario Ministry of Transportation (MTO)
- Ministry of Municipal Affairs and Housing (MMAH)
- Township of Wellesley

Records of engagement with these agencies can be found in Appendix A.

As described in Section 1, the Township of Wellesley is a local municipality within the Region. Township planning staff are actively involved in development and land use planning within Wellesley making it important to receive timely information from the Township to be incorporated into the Wellesley WWWMP. Additionally, as of January 1, 2025, the Township has planning authority (refer to Section 3.1.5 for further detail). To facilitate incorporating relevant information from Township planning staff into the Master Plan efficiently, Township staff had the opportunity to review project deliverables and participate in project progress meetings. The project team also met with the Township's Fire Chief on March 16, 2023, to facilitate feedback on water demands for fire protection related to the water distribution system.

2.4 Project Notices

Project notices were used to raise awareness of the project and inform the community of an opportunity to provide input. Notices were posted on the project's engagement webpage, emailed to the project mailing list and agency contact list, and published in local print newspaper (Woolwich Observer and Wilmot Tavistock Gazette).

Notices provided a clear overview of the project rationale and objectives, description of the process, where the community could find project updates, an invitation to participate, and where to provide contact information for the study project team.

Notices were distributed and published at the following phases of the Master Plan:

- Notice of Commencement
- Notices of Public Consultation Centers (PCC)
- Notice of Study Completion

Additionally, inserts that notified Wellesley residences of upcoming PCCs and the Notice of Study Completion were distributed to residences through utility bill distribution. The bill inserts are in Appendix A.

Table 2-1 summarizes the media used for the study notices.

Table 2-1. Study Notices

Communication Method	Study Commencement	PCC1	PCC2	PCC3	Study Completion
Project Webpage	April 6, 2023	April 6, 2023	June 3, 2024	November 27, 2024	TBD [c]
Engage Waterloo Region Webpage	April 6, 2023	April 6, 2023	June 3, 2024	November 27, 2024	TBD [c]
Project Contact List	April 6, 2023	April 6, 2023	June 3, 2024	November 27, 2024	TBD [c]
Utility Bill Inserts	March 31, 2023	March 31, 2023	May 31, 2024	N/A [b]	TBD [c]
Newspaper	Week of April 6, 2023, and April 13, 2023 [a]	Week of April 6, 2023 and April 13, 2023 [a]	Week of June 3, 2024	Week of November 27, 2024	TBD [c]

Notes:

[a] Published in Woolwich Observer; not published in Wilmot Tavistock Gazette

[b] Canada Postal Strike ongoing. Study notices and utility bill inserts were not able to be delivered via courier mail during this time

[c] TBD = To be determined

2.5 Public Consultation Centres

The main objectives of consultation with the public for this WWWMP include the following:

- Notify the public of the assignment's commencement
- To provide information about the Master Plan findings to the public, including existing and future constraints and needs, proposed alternatives, evaluation criteria, and the preliminary preferred alternative
- Receive input and comments on the project from interested stakeholders regarding the identified servicing needs and alternatives
- Receive input and feedback on the preliminary preferred alternatives

Three PCCs were held to communicate with the public and stakeholders to accomplish these engagement objectives, where comments and survey responses from participants were received to collect feedback for the Master Plan. The number of attending participants and the feedback received are summarized in Table 2-2.

Table 2-2. PCC Participation

PCC	Date	Number of Participants [a]	Number of Survey Responses
PCC 1	April 19, 2023	13	3
PCC 2	June 20, 2024	12	6
PCC 3	December 12, 2024	14	0

Notes:

[a] Including three presenters

In addition to the survey responses, various verbal and written comments and questions were received and documented in Appendix A.

2.5.1 Public Consultation Centre 1

PCC1 was held on April 19, 2023, at 7pm via Microsoft Teams Webinar. The Project Team presented PCC1 content to participants. The presentation included an overview of the master planning process and the project Study Area, a summary of the Wellesley water and wastewater systems and next steps. The PCC1 presentation slides are located in Appendix A. Attendees had the opportunity to ask questions verbally, via email, and via the question-and-answer tool on Teams during the PCC. A total of 13 people, including presenters, attended the PCC, and attendees were encouraged to complete a PCC survey. The PCC presentation was recorded and posted on the Region's engagement webpage for the public to access and provide feedback with an online survey form that could be filled out for a period of 30 days.

All questions and comments received during PCC 1, and their associated responses, are documented and can be found in Appendix A.

2.5.2 Public Consultation Centre 2

PCC2 was held on June 20, 2024, at 7pm via Microsoft Teams Webinar. The Project Team presented PCC2 content to participants. The presentation included an overview of the master planning process, a summary of identified water and wastewater system constraints, short-listed water and wastewater system alternatives, and the evaluation criteria. The PCC2 presentation slides are located in Appendix A. Attendees had the opportunity to ask questions verbally, via email, and via the question-and-answer tool on Teams during the PCC. A total of 12 people, including presenters, attended the PCC, and attendees were encouraged to complete a PCC survey. The PCC presentation was recorded and posted on the Region's engagement webpage for the public to access and provide feedback with an online survey form that could be filled out for a period of 30 days.

All questions and comments received during PCC 2, and their associated responses, are documented and can be found in Appendix A.

2.5.3 Public Consultation Centre 3

PCC3 was held on December 12, 2024, at 7pm via Microsoft Teams Webinar. The Project Team presented PCC3 content to participants. The presentation included a review of the evaluation criteria and alternatives presented at PCC2 and shared the preliminary recommendations on the preferred alternatives for water supply and wastewater. The PCC3 presentation slides are located in Appendix A. Attendees had the opportunity to ask questions verbally, via email, and via the question-and-answer tool on Teams during the PCC. A total of 14 people, including presenters, attended the PCC, and attendees were encouraged to complete a PCC survey. The PCC presentation was recorded and posted on the Region's engagement webpage for the public to access and provide feedback with an online survey form that could be filled out for a period of 30 days.

All questions and comments received during PCC 3, and their associated responses, are documented and can be found in Appendix A.

3. Project Context

3.1 Legislative Framework

The Region must operate within the administrative, legislative and financial framework established by relevant levels of government. Key provincial, federal and municipal acts and regulations provide directives and guidance for the planning process. Relevant acts and regulations are described in the following sections and have helped to guide the development of the Master Plan.

3.1.1 Water Treatment and Distribution

Water treatment processes must meet the requirements of the following environmental protection legislation and regulations:

- Guidelines for Canadian Drinking Water Quality, which are established by Health Canada and define water quality goals for water treatment operations to aim to achieve (Health Canada, 2022). These are described in greater detail in TM1 in Appendix B.
- O. Reg. 169/03: Ontario Drinking Water Quality Standards (ODWQS), which defines treated water quality standards that must be met by drinking water systems in Ontario.
- O. Reg. 170/03: Drinking Water Systems, which defines general obligations, monitoring requirements, sampling requirements and reporting requirements for drinking water system owners.
- Grand River Source Protection Plan: includes plans and policies that apply to activities that are identified as drinking water source threats and delineates wellhead protection zones. Examples of these threats can be chemical spills (i.e., diesel) or the release of untreated sewage, and require mitigation measures to promote source water protection. The Source Protection Plan also delineates locations of vulnerable areas (GRCA, 2022a). Impacts on Source Water Protection are discussed in Section 9.3.5.

U.S. Environmental Protection Agency (EPA) standards are also commonly considered in Ontario, as they can be more stringent than guidelines in Canada and serve as a guideline for Canadian drinking water quality standard updates. These more stringent guidelines may be adopted in Canada in the future. Considering EPA standards is a conservative method that provides “future-proofing” and is recommended during master planning.

3.1.2 Wastewater Treatment and Collections

Wastewater treatment processes must meet the requirements of the following environmental protection legislation and regulations.

- Ontario *Environmental Protection Act*, is the primary pollution control legislative tool in Ontario and can be used interchangeable with the *Ontario Water Resources Act*, prohibiting the discharge of contaminants to the environment that cause or are likely to cause adverse effects. Amounts of approved contaminants must not exceed prescribed limits.
- Ontario *Water Resources Act*, as amended by the Safeguarding and Sustaining Ontario’s Water Act, 2007 is the legal foundation of Ontario’s water policy and an important law governing water quality and quantity in Ontario. This Act prohibits the discharge of polluting material in or near water, prohibits or regulates the discharge of sewage, facilitate orders requiring measures to prevent, reduce or

alleviate impairment of water quality, enables the designation and protection of sources of public water supply, and regulates water taking more than 50,000 litres a day.

- Ontario *Safe Drinking Water Act,* S.O. 2002, c. 32: is intended to protect human health through the control and regulation of drinking water systems and drinking water testing. Wastewater systems need to be located, designed, constructed, maintained, and operated in accordance with applicable standards so that drinking water is protected, safe, clean and reliable.
- Ontario *Clean Water Act* requires that communities, through local Source Protection Committees, protect municipal drinking water supplies (and non-municipal supplies if added by the municipality of Minister) from overuse and contamination, now and into the future. This Act aims to prevent contaminants from entering sources of drinking water, including lakes, rivers and aquifers.
- O.Reg. 435/93: Water Works and Sewage Works applies to wastewater collection and treatment facilities, licensing of facility operators and operating standards.
- O. Reg. 267/03: regulates the land application of biosolids under the Nutrient Management Act, 2002.
- Grand River Source Protection Plan: includes plans and policies that apply to activities that are identified as drinking water source threats and delineates wellhead protection zones within the Grand River Conservation Authority limits. Examples of these threats can be chemical spills (i.e., diesel) or the release of untreated sewage, and require mitigation measures to promote source water protection. The Source Protection Plan also delineates locations of vulnerable areas (GRCA, 2022a).
- Canada *Fisheries Act*: manages and protects Canada's fisheries resources prohibiting the deposit of all deleterious substances that may degrade or alter water quality in a manner that directly or indirectly harms fish, fish habitat or the use of fish by humans. The Wastewater Systems Effluent Regulations (include mandatory minimum effluent quality standards) apply in respect of a wastewater system that deposits effluent as part of a wastewater system. Effluent containing deleterious substances will follow the requirements and standards outlined in this regulation.

3.1.3 Provincial Policy Statement

The 2020 Provincial Policy Statement (PPS) came into effect May 1, 2020, under section 3 of the *Planning Act*. The purpose of the PPS is to provide direction on matters of provincial interest related to land use planning and development and to set the foundation for policy regarding the regulation of development and use of land (Ministry of Municipal Affairs and Housing, 2020). The PPS supports a comprehensive, integrated, and long-term approach to planning, and recognizes linkages among policy areas. Municipal official plans are considered the most important "vehicle" for implementation of the PPS. Additional information on the PPS is included in TM1 in Appendix B.

In October 2024, the 2024 Provincial Planning Statement came into effect. The 2024 Provincial Planning Statement replaces the 2020 PPS and the Growth Plan for the Greater Golden Horseshoe. The changes and updates in the 2024 Provincial Planning Statement do not directly impact the development and outcomes of the Wellesley WWMP.

3.1.4 First Nations, Indigenous, and Métis Communities

Meaningful engagement with Indigenous groups, including First Nations and Métis communities that may have an interest in the Wellesley WWMP are important to the success of project. Under the Municipal Class EA process there is a duty to consult with Treaty Rights Holders.

The 2020 PPS encourages meaningful engagement and coordination with Indigenous communities on planning activities (Province of Ontario, 2020). The MECP has confirmed its delegation of the procedural aspects of rights-based consultation for the project. After the Wellesley WWMP was initiated, the 2024 Provincial Planning Statement replaced the 2020 PPS and updates meaningful engagement to a requirement under the PPS.

First Nations in the local area have an interest in the Wellesley WWMP. These First Nations include:

- Mississauga's of the Credit First Nation
- Six Nations of the Grand River
- Haudenosaunee Confederacy Chiefs Council (HCCC) and the Haudenosaunee Development Institute (HDI)

Treaty rights holders may request MECP for an order requiring a higher level of study (i.e. requiring an individual/comprehensive EA approval before being able to proceed), or that conditions be imposed (e.g. require further studies), only on the grounds that the requested order may prevent, mitigate or remedy adverse impacts on constitutionally protected Indigenous and treaty rights. Requests on other grounds will not be considered. Requests should include the requester contact information and full name for the MECP.

3.1.5 Regional Official Plan

The Regional Official Plan (ROP) (Region of Waterloo, 2015) directs growth and change within the Region with the intention of creating a balanced community structure. It is a legal document that contains goals, objectives and policies to manage and direct physical (land use) change and its potential effects on the cultural, social, economic and natural environment within the Region (Region of Waterloo, 2015).

In accordance with the Ontario Planning Act, the Region is required to prepare and maintain an official plan through regular updates. The 2015 ROP was recently reviewed and amended as part of ROP Amendment #6, guided by provincial policies such as the Growth Plan for the Greater Golden Horseshoe (Ministry of Municipal Affairs and Housing, 2020) and the PPS (refer to Section 3.1.3). This plan also serves as a guide for infrastructure planning and strategic investment decisions to support and accommodate forecasted population and economic growth. Objectives and policies applicable to the Project are described in TM1 in Appendix B.

The review to the 2015 ROP was not fully completed at the time of the development of this WWWMP. However, based on recent proposed amendments to Ontario Regulation 525/97, as of January 1, 2025, the Region is an upper tier municipality without planning authority and the responsibility for municipal planning rests solely with area municipalities. Therefore, the responsibility for interpretation and implementation of the ROP now rests with area municipalities, including the Township of Wellesley (Environmental Registry of Ontario, 2024).

Note that under the Cutting Red Tape to Build More Homes Act, 2024 (Bill 185), the Municipal Act was amended such that the municipality (Region) may adopt a water supply and sanitary capacity allocation policy. The policy can include a procedure for tracking the water supply and sanitary capacity available to support approved developments and decision-making for development applications (Ontario, 2024). The Region of Waterloo is currently developing a sanitary allocation policy.

3.1.6 Township of Wellesley Official Plan

The Township of Wellesley Official Plan (Township of Wellesley, 2015), provides a roadmap to guide future development within the Township of Wellesley until the year 2031. Specifically, the Township's Official Plan presents policies that provide direction for both public and private development. It connects the policies within the Regional Official Plan, the Provincial Planning Statement, the Growth Plan for the Greater Golden Horseshoe, and the Township's objectives. Objectives and policies applicable to the Project are described in TM1 in Appendix B.

3.1.7 Ontario Bill 23

On November 28, 2022, Government of Ontario passed the More Homes Built Faster Act, 2022 (Bill 23), a bill that significantly amends and creates new legislation affecting planning and land development across the Province of Ontario. Bill 23 is "part of a long-term strategy to increase housing supply and provide attainable housing options for hardworking Ontarians and their families," with a goal of building 1.5 million homes in 10 years.

Bill 23 In Ontario introduces changes to the *Planning Act* and *Development Charges Act* to create expanded "as of right" development rights for small scale residential development, regulate the use of inclusionary zoning, require municipalities to be more flexible with parkland dedications, limit the application of site plan control, and change how planning authority is exercised in upper-tier and lower-tier municipalities, giving communities more influence over decisions that impact them directly. Changes to the Planning Act will also require municipalities to adopt zoning by-law amendments that ensure that development meets minimum density targets near major transit station areas within one year of identifying such major transit station areas in an official plan. Amendments to the Development Charges Act include several new discounts and exemptions to the rates that municipalities can charge for new development, including affordable and inclusionary zoning units, select attainable housing units, non-profit housing developments, as well as rental construction and development.

The Municipal Act, 2001 is also amended to permit the Minister to make regulations to ensure greater standardization of Municipal By-laws under the act that prohibit and regulate the demolition and conversion of residential rental properties.

Amendments to the *Ontario Land Tribunal Act* (OLT), 2021 are intended to help expedite proceedings, resolve cases more efficiently and streamline process. The legislative changes will clarify the Tribunal's powers to dismiss appeals and award costs to the successful parties. The OLT may be required, through regulation, to prioritize the resolution of certain classes of proceedings and be subject to timelines during such proceedings.

Amendments to the *Ontario Heritage Act* and related regulations will renew and update Ontario's heritage policies and strengthen the criteria for heritage designation and update guidelines. This will promote sustainable development that conserves and commemorates key places with heritage significance and provide municipalities with the clarity and flexibility needed to move forward with priority projects, including housing.

Amendments to the Conservation Authorities Act have the potential to permit development in areas that were previously prohibited through regulation, freeze certain fees payable to the conservation authority and impose new limits on a conservation authority's programs or services, if related to reviewing development applications.

3.1.8 Climate Change

As part of the Master Plan Class EA process, water and wastewater infrastructure alternatives were identified and evaluated with consideration for the benefits and impacts to the natural, social, cultural, technical, and economic environment. Impacts related to climate change are considered in the evaluation of alternatives as part of the environmental criteria.

Climate change has the potential to result in more frequent and more extreme precipitation events. Detailed design of the preferred solutions should consider climate change impacts and the potential need for flood-resilient infrastructure and appropriately sized infrastructure to account for more intense and frequent precipitation events. Inflow and infiltration reduction in the Wellesley wastewater conveyance system should continue to be a focus for the Region to help mitigate the impacts of climate change.

3.1.9 Sewer Use By-Law

A Sewer Use By-Law is a major regulatory by-law that aims to protect public safety, the environment and municipal infrastructure by setting strict limits on what can be discharged into the sewer system and natural watercourses.

The Region's Sewer Use By-Law 21-036 (Region of Waterloo, 2021) came into effect in 2022 and replaces the previous sewer by-law I-90. The by-law regulates the discharge of water and wastewater into the sanitary and storm systems in the Region and specifies connection requirements as well as acceptable and prohibited discharges to the sanitary and storm sewer. The by-law also states that the sanitary sewer and treatment facility that will be treating the discharge must have capacity to accept the discharge.

By-law 21-036 is a tool that is used by the Region to maintain a relatively consistent influent quality to the Wellesley WWTP. It allows the Region to deny connections if there is insufficient capacity within the wastewater system.

3.2 Potential Future Regulatory Changes

This section covers possible regulatory changes that may impact the implementation or operation of the preferred alternatives.

3.2.1 Emerging Substances of Concern

As analytical technologies advance, a growing list of compounds that can have physiological effects on humans and aquatic organisms are being detected in surface waters and in biosolids. These compounds are referred to as Emerging Substances of Concern (ESOCs) and include endocrine disruptors and hormones, pharmaceuticals, personal care products (soaps, shampoos, perfumes, and antimicrobials), pesticides, herbicides, nanoparticles, and per- and polyfluoroalkyl substances (PFAS).

ESOCs enter the wastewater system and the natural environment in various ways. Many ESOCs enter municipal wastewater through bathing, cleaning, laundry, disposal of human waste and unused pharmaceuticals, and agricultural application of pesticides. Removal of some ESOCs in wastewater and drinking water plants does occur, however, removal rates vary with the specific ESOC and type of treatment (EPA, 2010).

While most municipal wastewater treatment plants are not specifically designed to remove ESOCs from wastewater, a number of research projects have reported that removal of some ESOCs occurs in facilities with secondary treatment, as well as those with some form of advanced treatment. In 2010, the MECP conducted a study to determine the world-wide state of research on the removal of ESOCs at municipal wastewater treatment plants (CH2M HILL Canada Limited, 2010). The study indicated that nitrifying wastewater treatment plants appear to eliminate more ESOCs than non-nitrifying plants, and that wastewater treatment plants that nitrify and denitrify further reduce ESOC concentrations. Thus, nitrifying secondary treatment is considered a surrogate for ESOC removal; however, guidelines for the extent to which ESOC removal can be achieved through nitrifying secondary treatment have not been defined.

ESOCs and their fate across wastewater treatment plants is an area of ongoing research. At this level of planning, potential future limits on ESOCs are speculative and are therefore not accounted for in the future expansion plans for Wellesley WWTP that will be developed in this Master Plan. The Region has a Water Research Committee that collaborates with university researchers and various water committees to monitor developments related to ESOCs. It is recommended that in the future, the Region continues to monitor the research developments and regulatory environment surrounding ESOCs and considers the evolving regulatory environment when future liquid treatment expansion projects are being planned in greater detail.

3.2.2 Nitrogen Species

Nitrate in water is linked to various health issues in humans, and also has a fertilizing effect in bodies of water wherein too much nitrate could trigger algae blooms in surface waters where nitrate is the limiting nutrient. Nitrate is typically not the limiting nutrient in Ontario surface waters; phosphorus is typically limiting and is therefore subject to regulatory control. In Ontario, there is no specific regulation for nitrate or Total nitrogen (TN) in wastewater treatment plant effluents; however, TN limits have been implemented in treatment plants elsewhere in Canada that discharge to sensitive receiving waters. The Canadian Council of Ministers of the Environment (CCME) published the *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME, 2019), which notes a limit of 3 mg/L for nitrate (as nitrogen) for chronic exposure in freshwater lakes, rivers and streams that support aquatic life.

Elsewhere in North America, there is a general trend towards application of TN limits due to anoxia in off-shore waters. For example, Florida has eliminated wastewater effluent discharges to the ocean, and areas that discharge to the Long Island Sound and the Chesapeake Bay need to meet exceedingly strict TN limits (as low as 3 mg/L as nitrogen on an annual basis). In Europe, many plants that discharge to sensitive streams are required to meet a TN limit of 10 mg/L (as nitrogen) on a monthly average basis.

The trend toward the application of TN limits in the remainder of Canada and around the industrialized world may lead to the application of TN limits in plants discharging to Ontario streams and lakes at some point in the future. As a first step in that direction, relatively relaxed limits might be applied (20 to 25 mg/L as nitrogen); however, more stringent TN limits could be expected within the foreseeable future to levels in line with those currently applied in Europe.

The Region currently has a Surface Water Quality Program (SWQP) which measures water quality within the Nith River upstream, immediately downstream, and farther downstream of the Wellesley WWTP outfall six times per season during all four seasons (winter, spring, summer, and fall). The SWQP allows the Region to monitor the effects of TN as well as other parameters from the WWTP.

At this level of planning, potential future TN limits are somewhat speculative and are therefore not accounted for in the future expansion plans for Wellesley WWTP that are outlined in this report. It is recommended that in the future, the Region continues to monitor the regulatory environment surrounding TN limits and revisit this parameter when future liquid treatment expansion projects are being planned in greater detail.

3.2.3 Phosphorous Species

Point source phosphorus discharges to the Great Lakes have garnered significant attention because of recent algal blooms across Lake Erie and in localized areas of Lake Ontario, Lake Huron, and Lake Michigan nearshores. In February 2018, the Ontario MECP and Environment and Climate Change Canada published the Canada-Ontario Lake Erie Action Plan to reduce algal blooms caused by phosphorus discharges to the lake. One of the actions within the plan is to establish, by 2020, a legal effluent total phosphorus (TP) concentration limit of 0.5 mg/L for all wastewater treatment plants in the Lake Erie basin that have an average daily flow capacity above 3.78 ML/d. This TP limit is consistent with the binational recommendation for wastewater treatment plant discharges under the Canada-U.S. Great Lakes Water Quality Agreement (GLWQA). The Lake Erie Action Plan also recognizes soluble reactive phosphorus (SRP) as a parameter of interest for nuisance algal blooms due to SRP being readily bioavailable for algae, however, no recommendations or actions were advanced to make SRP a regulated parameter for wastewater facility effluents.

As noted in Section 3.2.2, the Region currently has a SWQP which measures water quality within the Nith River upstream, immediately downstream, and farther downstream of the Wellesley WWTP outfall six times per season during all four seasons (winter, spring, summer, and fall). The effects of Phosphorous from the WWTP can be monitored through this program. However, it is important to note that non-point sources also contribute substantial phosphorous loadings.

The Nith River ambient conditions and the effluent discharges need to be evaluated relative to the MECP's policies for surface water quality management as outlined in the Provincial Water Quality Objectives (MECP, 1994a) and guidelines for Deriving Receiving Water Based Point Source Effluent Requirements for Ontario Waters (MECP, 1994b).

3.2.4 Biosolids Quality and Disposal

The design of the Wellesley WWTP does not include biosolids treatment due to the WWTP's relatively small volume. Waste activated sludge (WAS) is stored in an aerated sludge holding tank prior to haulage to the Waterloo WWTP for further processing. At the Waterloo WWTP, the sludge is anaerobically digested, and dewatered via centrifuges. The biosolids are beneficially used where possible in agriculture or mine tailing pond remediation in northern Ontario, with landfilling used as contingency.

Currently, land application of biosolids requires pathogen reduction, limited metal concentrations, and odour reduction as outlined in O. Reg. 267/03 (Province of Ontario , 2017). Potential future changes in regulations based on increased scrutiny of ESOCs in biosolids could drive biosolids management away from land application. The prevalence and environmental impacts of ESOCs in biosolids is an area of ongoing research in the wastewater industry. It is recommended that in the future, the Region continues to monitor the regulatory environment surrounding ESOCs and biosolids. Potential future ESOC limitations in biosolids would have municipal impacts and should be considered in future biosolids master plans.

3.2.5 Air, Noise and Odour

The Ontario Environmental Protection Act Local Air Quality Regulation (O. Reg. 419/05) regulates the maximum allowable concentration of specific air contaminants "at the point of impingement (POI)", which is typically the property line and other receptors such as building air intakes or windows (Province of Ontario, 2019). Currently, the regulation includes half-hour POI concentration standards and assumes the use of a model that is approved by O. Reg. 346. By February 1, 2020, the MECP will phase in new concentration standards, referred to as Schedule 3 Standards, based on averaging times ranging from ten minutes to 24 hours depending on the contaminant. The new standards also require the use of AERMOD or another approved model, as the existing O. Reg. 346 models do not reflect the latest scientific advancements in air dispersion modelling.

The Schedule 3 Standards have 24-hour and 10-minute odour-based standards for some certain odorous contaminants, including total reduced Sulphur, hydrogen sulphide, and mercaptans. ECA amendment applications after February 1, 2020, must include facility-wide Emission Summary and Dispersion Modelling (ESDM) demonstrating compliance with the new Schedule 3 Standards using an AERMOD model. In ECA applications for wastewater treatment plants, an ESDM report must demonstrate compliance with the 10-minute POI Limit for total reduced sulphur. Accordingly, the Wellesley WWTP will be required to complete an ESDM for air emissions and odours as part of future expansions or retrofits. Additional details are provided in TM1 in Appendix B.

Noise modelling may be undertaken during future expansion/retrofit designs to illustrate compliance with provincial guidelines. Additional information is provided in TM1 in Appendix B.

3.3 Related Studies and Master Plans

Studies and master plans relevant to the development of the WWWMP include the following:

- City of Waterloo Water Distribution Master Plan (GM BluePlan, 2017a)
- Wellesley I/I Assessment and Mitigation Plan: Flow Monitoring Analysis – 2017 Quarter 3 (GM BluePlan, 2017b)
- 2018 Wastewater Treatment Master Plan (CIMA+, 2018)
- Wellesley Water Treatment Plant & System Supply Wells WY1, WY5, WY6 Asset Inventory & Condition Assessment (C3 Water, 2018)
- Assessment of Alternatives for Water Supply at three Rural Water Treatment Systems (CH2M HILL Canada Limited, 2020)
- Design Brief Wellesley Wastewater Treatment Plant Clarifier and RAS Upgrades (CIMA+, 2020a)
- Wellesley WWTP - RAS/WAS Upgrades and Control Strategy (CIMA+, 2020b)
- The Region of Waterloo Development of an Inflow/Infiltration Reduction Program (GM BluePlan, 2021)
- Wellesley Water Treatment Plant - Relocation of Chlorine Dosing Point (CIMA+, 2021)
- Wellesley WWTP - Hydraulic Profile Analysis (Stantec Consulting Ltd., 2021)
- Wellesley WWTP - Phase 2 Filter Recycle Flow Mitigation (Stantec Consulting Ltd., 2022)
- Wellesley WWTP Disinfection Upgrades Preliminary Design Report (CIMA+, 2023)
- Wellesley Blower Technology Assessment (J.L. Richards & Associated Limited, 2024)

Information from these studies were incorporated into the WWWMP, as applicable.

4. Study Area Existing Conditions

Section 4 describes the existing conditions of the Study Area, specifically the natural, social, cultural and technical environment. In addition, the current constraints of the water and wastewater system are identified.

4.1 Natural Environment

This section breaks down the natural environment into various subcategories and presents the existing conditions of each.

4.1.1 Natural Heritage

The Study Area occurs within the Township of Wellesley. In a review of imagery, the Study Area can be characterized as consisting of mostly residential zones, surrounded by agricultural lands transected by local and rural roads as illustrated in Figure 4-1. Firella Creek runs through the Study Area and drains to the Nith River, which is situated to the south of the Study Area. The Nith River valley is designated as a significant valley in the Regional Official Plan (Region of Waterloo, 2015). Pockets of wooded areas occur throughout. The Provincially Significant Wetland (PSW) Firella Creek Swamp occurs outside the village boundaries and Study Area to the north, and the Wellesley West Wetland Complex PSW occurs to the west (NHIC, 2022). The Study Area is within the Grand River Conservation Authority (GRCA) Regulated Area (GRCA, 2022b).

Notes:
1. Aerial Source: Region of Waterloo, 2022.

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Figure 4-1
Desktop Natural Environment Background Data

Region of Waterloo
Wellesley, Ontario

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\\DC1VS01\GISPROJ\W\WATERLOOREGIONOF\CE851700_WELLESLEYWATER\MAPFILES\MASTERPLANREPORT\DESKTOPNATURALENVRBACKGROUNDDATA.MXD VM048279 2/13/2025 2:42:10 PM

4.1.2 Terrestrial Habitat

Based on a desktop review, the Study Area consists primarily of an anthropogenically disturbed residential area. Parkland and cultural meadows occur throughout the Study Area, as well as pockets of wooded areas and agricultural lands as shown in Figure 4-1. Riparian areas associated with Firella Creek also occur.

4.1.3 Aquatic Habitat and Fisheries

According to Land Information Ontario (LIO) and the Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF) mapping (NDMNRF, 2022b), there is aquatic and fish habitat in Firella Creek within the Study Area. The Nith River is to the south of the Study Area and within the 120m lands buffer of the Study Area boundary. The Campbell Agricultural Drain is to the north of the Study Area (GRCA, 2022b).

4.1.4 Wetlands

According to LIO and the MNRF mapping (NDMNRF, 2022b), the Study Area does not contain wetland habitat. However, the 120 m adjacent lands contain the Firella Creek Swamp PSW to the north of the Study Area, and the Wellesley West Wetland Complex PSW is situated to the west of the Study Area (NHIC, 2022).

4.1.5 Areas of Natural and Scientific Interest (ANSI)

There are no ANSIs located within Study Area or within the 120 m adjacent lands (NDMNRF, 2022a).

4.1.6 Wildlife and Wildlife Habitat

The Study Area is generally comprised of residential and disturbed cultural areas. However, watercourses and wooded areas also occur within the Study Area. These watercourses and wooden areas provide habitat for wildlife, particularly avifauna.

A review of the Ontario Breeding Bird Atlas (OBBA), which provides information on avifauna occurrences based on a 10 km^2 area, was completed. The 2nd Atlas of the OBBA includes data collected from 2001 to 2005 (Bird Studies Canada, 2009). The Study Area and 120 m adjacent lands occur within OBBA Square Summary 17MH39 Region #3: Lambton, and 17MH49 Region #4: London.

LIO and MNRF SAR mapping was also accessed (NDMNRF, 2022b) . A Species at Risk (SAR) screening email was sent to the MECP SAR Branch (SARB) as per the Endangered Species Act (ESA) on November 23, 2022. The MECP replied on January 27, 2023, and their comments were incorporated into the SAR listed in Section 4.1.7.

4.1.7 Species at Risk (SAR)

According to the NHIC 1 km^2 area mapping (NDMNRF, 2022b), the Department of Fisheries and Oceans Canada (DFO) (DFO, 2022), OBBA and iNaturalist (iNaturalist, 2022), SAR which may occur within the vicinity of the Study Area and/or 120 m adjacent lands are listed in Table 4-1. The presence of SAR or SAR habitat within the Study Area has not been field verified to date.

Table 4-1. Potential SAR within or proximal to the Study Area and 120 m adjacent lands

Common Name	Scientific Name	S Rank[a]	SARO[b]	COSEWIC[c]	SARA[d]
Northern Bobwhite	*Colinus virginianus*	S1?B	END	END	END
Least Bittern	*Botaurus lentiginosus*	S4B	THR	THR	THR
Bald Eagle	*Haliaeetus leucocephalus*	S4	SC	NAR	THR
Black Tern	*Chlidonias niger*	S3B, S4M	SC	-	-
Common Nighthawk	*Chordeiles minor*	S4B	SC	SC	THR
Eastern Whip-poor-will	*Antrostomus vociferus*	S4B	THR	THR	THR
Chimney Swift	*Chaetura pelagica*	S3B	THR	THR	THR
Red-headed Woodpecker	*Melanerpes erythrocephalus*	S3	END	END	END
Eastern Wood-Pewee	*Contopus virens*	S4B	SC	SC	SC
Acadian Flycatcher	*Empidonax virescens*	S1B	END	END	END
Bank Swallow	*Riparia riparia*	S4	THR	THR	THR
Barn Swallow	*Hirundo rustica*	S4B	SC	SC	THR
Wood Thrush	*Hylocichla mustelina*	S4B	SC	THR	THR
Golden-winged Warbler	*Vermivora chrysoptera*	S3B	SC	THR	THR
Cerulean Warbler	*Setophaga cerulea*	S2B	THR	END	END
Prothonotary Warbler	*Protonotaria citrea*	S1B	END	END	END
Louisiana Waterthrush	*Parkesia motacilla*	S2B	THR	THR	THR
Yellow-breasted Chat	*Icteria virens*	S1B	END	END	-
Grasshopper Sparrow	*Ammodramus savannarum*	S4B	SC	SC	-
Bobolink	*Dolichonyx oryzivorus*	S4B	THR	THR	THR
Eastern Meadowlark	*Sturnella magna*	S4B, S3N	THR	THR	THR
Transverse Lady Beetle	*Coccinella transversoguttata*	S1	END	SC	-
Yellow-banded Bumble Bee	*Bombus terricola*	S3S5	SC	SC	SC
Monarch	*Danaus plexippus*	S2N,S4B	SC	END	SC
Midland Painted Turtle	*Chrysemys picta marginata*	S4	-	SC	-
Snapping Turtle	*Chelydra serpentina*	S4	SC	SC	SC
Eastern Milksnake	*Lampropeltis triangulum*	S4	-	SC	SC
Rainbow Mussel	*Villosa iris*	S1	SC	SC	SC
Black Ash	*Fraxinus nigra*	S4	-	THR	-
Butternut	*Juglans cinerea*	S2?	END	END	END

[a] NHIC Subnational Rank

[b] Species at Risk Ontario (SARO)

[c] Committee on the Status of Endangered Wildlife in Canada (COSEWIC)

[d] Species at Risk Act (SARA)

Notes:

? = more data required
S1 = Critically Imperiled (often 5 or fewer occurrences)
S2 = Imperiled (often 20 or fewer occurrences)
S3 = Vulnerable (restricted range with relatively few populations - often 80 or fewer
S4 = Uncommon but not rare; some cause for long-term concern due to declines or other factors
S5 = Secure species, common, widespread, and abundant
S#S# = Range given due to uncertainty
B = Status qualifier; breeding
N = Status qualifier; non-breeding
M = Status qualifier; migrant species
H = Status qualifier; possibly extirpated
- = Not at Risk
SC = Special Concern
THR = Threatened
END = Endangered

Based on the background research completed, the following are species of interest that are not SAR but have an S-rank of 1-3.

- Rough-legged Hawk (*Buteo lagopus*)
- Cup Plant (*Silphium perfoliatum)*

MECP correspondence added the following additional SAR:

- American Badger – Southwestern Ontario population (*Taxidea taxus jacksoni*) - END
- Black Redhorse (*Moxostoma duquesnei*) - THR
- Short-eared Owl (*Asio flammeus*) – THR
- Eastern Small-footed Myotis (*Myotis leibii*) - END
- Little Brown Myotis (*Myotis lucifugus*) - END
- Northern Myotis (*Myotis septentrionalis*) - END
- Tri-coloured Bat (*Perimyotis subflavus*) - END

While some of the species from Table 4-1 have the potential to occur within the Study Area or 120 m adjacent lands, field verification and SAR specific surveys are recommended to confirm presence or absence of SAR and associated habitat as part of any follow-on studies that support the design and construction of any WWWMP recommended infrastructure.

4.1.8 Fisheries Data

The following fish species in Table 4-2 are identified according to LIO's Aquatic Resource Area Survey Points: GU 0220-NIT, GU-9999-ZZZ (Figure 4-1), within Nith River, which connects with Firella Creek at the southern boundary and just outside of the Study Area (NDMNRF, 2022a).

Table 4-2. Fish Species Identified in LIO's Aquatic Resource Area Survey Points Near the Study Area

Common Name	Scientific Name
Blackside Darter	*Percina maculata*
Common Shiner	*Luxilus cornutus*
Golden Redhorse	*Moxostoma erythrurum*
Greenside Darter	*Etheostoma blennioides*
Hornyhead Chub	*Nocomis biguttatus*

Common Name	**Scientific Name**
Johnny Darter	*Etheostoma nigrum*
Rainbow Darter	*Etheostoma caeruleum*
Rock Bass	*Ambloplites rupestris*
Rosyface Shiner	*Notropis rubellus*
Stonecat	*Noturus flavus*
Striped Shiner	*Luxilus chrysocephalus*
White Sucker	*Catostomus commersonii*

4.1.9 Flood Plain

The Study Area is within the GRCA Regulated Area. Figure 4-2 (GRCA, 2024) shows the regulatory flood lines within the GCRA Regulated Area. Controlling development in flood prone areas reduces the potential for effects of infrastructure damage and infrastructure within the flood lines may require additional protection measures. A permit from GRCA may be required for construction or development within the Regulated Area to verify activities and verify the proposed infrastructure does not impair the hydrological function of waterways.

Map Centre (X,Y): 519573.09, 4813977.44 | Map Link

This map is not to be used for navigation | 2020 Ortho (ON)

Grand River Conservation Authority

Date: Nov 14, 2024

Grand River Conservation Authority Regulatory Flood Line Map

Legend

- Regulation Limit (GRCA)
- Floodplain (GRCA)
  - Engineered
  - Estimated
  - Approximate
- Floodplain - Special Policy Area (GRCA)
- Slope Erosion (GRCA)
  - Steep
  - Oversteep
  - Toe
- Slope Valley (GRCA)
  - Steep
  - Oversteep
- Regulated Watercourse (GRCA)
- Regulated Waterbody (GRCA)
- Wetland (GRCA)
- Lake Erie Flood (GRCA)
- Lake Erie Shoreline Reach (GRCA)
- Lake Erie Dynamic Beach (GRCA)
- Lake Erie Erosion (GRCA)

Disclaimer: This map is for illustrative purposes only. Information contained herein is not a substitute for professional review or a site survey and is subject to change without notice. The Grand River Conservation Authority takes no responsibility for, nor guarantees, the accuracy of the information contained on this map. Any interpretations or conclusions drawn from this map are the sole responsibility of the user.
The source for each data layer is shown in parentheses in the map legend. See Sources and Citations for details.

Scale 1:22,349

NAD83 UTM zone 17 (EPSG:26917)

4.1.10 Land Use

Land use within the Study Area is primarily classified as urban residential with scattered institutional, industrial, and commercial land use. The Bill Gies Recreation Centre is located in the northwest area of the Study Area and the former arena lands are located within the centre of the Study Area.

The Study Area is bisected by Nafziger Road and Queens Bush Road. Firella Creek flows south through the Study Area and drains into the Nith River immediately south of the Study Area. Wellesley Pond is situated near the centre of the village and is used for recreational fishing. A recreational trail loops around Wellesley Pond. A community garden exists north of Gerber Road and east of Firella Creek. Each fall, the Village of Wellesley hosts an Apple Butter and Cheese Festival that brings in tourists throughout the Region and beyond. A Farmers Market is also hosted in Wellesley on Saturdays in the summer and fall months.

4.2 Social and Cultural Environment

This section breaks down the social and cultural environment into various subcategories and presents the existing conditions of each.

4.2.1 Existing Population

The Region provided existing (2021) population values for Wellesley distributed by Plum Zone (Region of Waterloo, 2024a). Plum Zones within the Study Area include Plum Zone ID 216, 1214, 217, 224, 1018, 219, 220, 1213, and 225. These Plum Zones are shown in Figure 4-3. The total 2021 population within these Plum Zones is 3,730. The existing population by Plum Zone is detailed in Table 4-3.

Figure 4-3. Plum Zones within Study Area

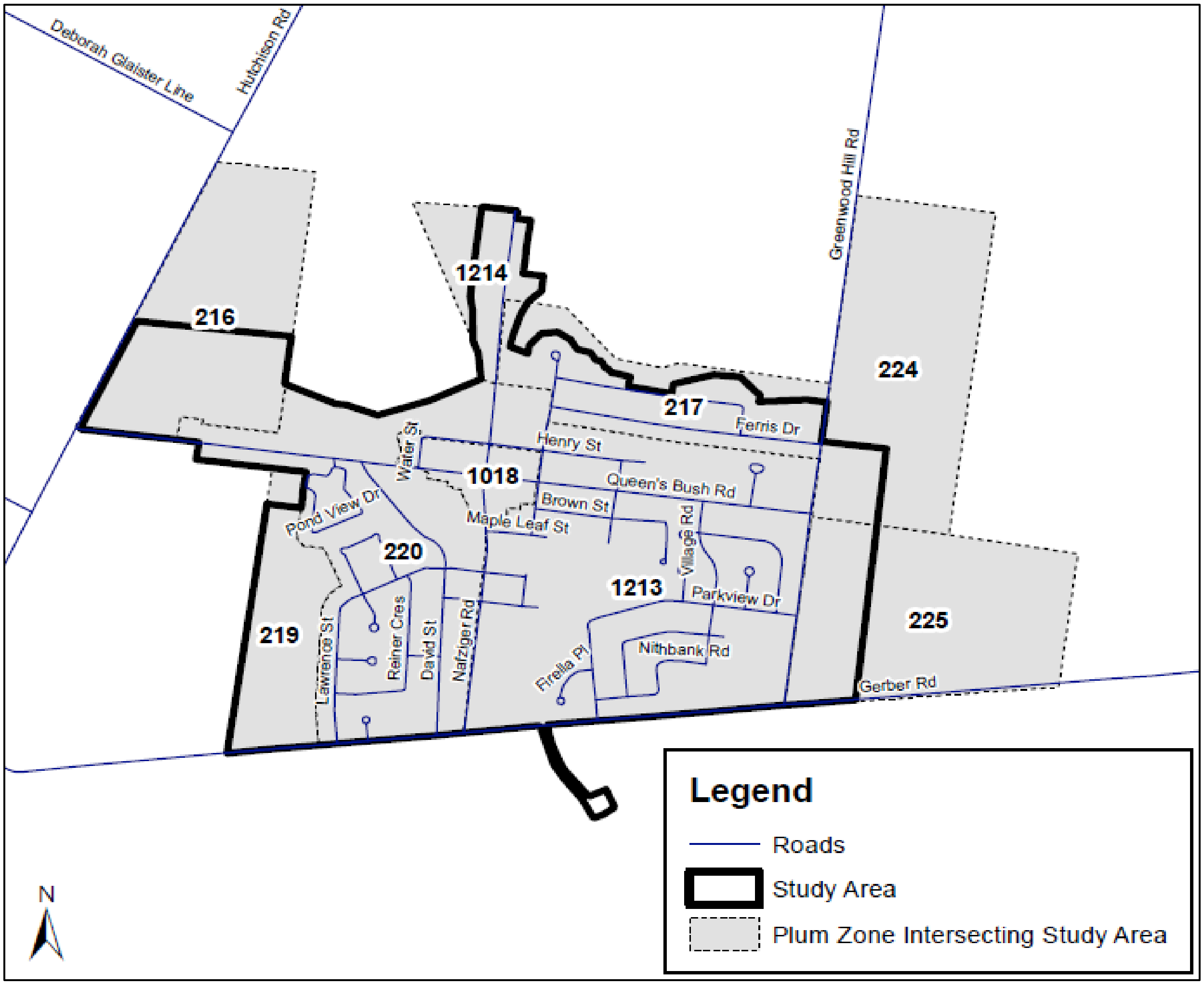


Table 4-3. Wellesley Existing (2021) Population by Plum Zone

Plum Zone ID	Existing (2021) Population
219	3
225	11
224	19
217	676
220	1,195
1018	173
1213	1,598
1214	53
216	2
Total	**3,730**

It was reasoned that the population within the Plum Zones listed in Table 4-3 is concentrated within the Study Area. Therefore, the existing population within the Study Area is 3,730.

4.2.2 Community Health and Safety

Municipal water and wastewater servicing provides significant benefits to community health and safety by providing:

- Reliable, clean, and safe drinking water
- Water for fire suppression
- Reliable wastewater collection and conveyance of wastewater to a treatment facility
- Reliable wastewater treatment
- Protection from property damage and human health impacts caused by basement flooding (due to sanitary sewer system capacity constraints)

The operation of these municipal services contributes to community health and safety and environmental protection by providing reliable treatment.

4.2.3 Odour

Odour in the Study Area is primarily influenced by the existing WWTP operations and, to a lesser extent, vehicle exhaust from surrounding roadways, gas stations, mechanical repair shops, and surrounding farmlands.

4.2.4 Noise

Noise in the local Study Area is influenced primarily by traffic and human activity on surrounding roadways.

4.2.5 Cultural Heritage Resources

Cultural heritage resources include archaeological resources, built heritage resources and cultural heritage landscapes.

4.2.5.1 Built Heritage Resources and Cultural Heritage Landscapes

Archaeological Services Inc. (ASI) undertook a desktop Cultural Heritage Assessment on the built heritage resources (BHR) and cultural heritage landscapes (CHL) within the Study Area. Background historical research was completed, which provided an overview of the history of the Village of Wellesley, from Indigenous settlements to the current land use of villages, churches, schools, and family farms. The desktop background review revealed that there are six known BHRs and no known CHLs within the Study Area. However, an additional 32 potential BHRs and ten CHLs were identified. These locations are identified in in the Desktop Cultural Heritage Report in Appendix C. Identified areas with highest potential for CHLs and BHRs include:

- Molesworth Street (1056-1100 Molesworth Street included in survey)
- Henry Street (1070-1147 Molesworth Street included in survey)
- Queen’s Bush Road (1091-1201 Queen’s Bush Road included in survey)
- Nafziger Road (3620-3741 Nafziger Road included in survey)
- David Street (7-99 David Street included in survey)
- Lawrence Street (2-22 Lawrence Street included in survey)
- Doering Street (1006-1058 Doering Street included in survey)
- Maple Leaf Street

The results from the Desktop Cultural Heritage Report (February 2023, Revised March 2025) were incorporated into the evaluation of the short-listed water and wastewater alternatives.

Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment (Detailed Cultural Heritage Report (dated January 2025, revised February 2025) was completed following the selection of the preliminary preferred alternatives. The results from the Detailed Cultural Heritage Report are included in Section 9.3.1.

4.2.5.2 Archaeological Inventory Resources

A Stage 1 archaeological assessment was carried out under PIF P094-0430-2024 in November of 2024 by ASI for the Wellesley Water and Wastewater Master Plan study area following the selection of the preliminary preferred alternatives. A Stage 1 AA consists of a review of geographic, land use and historical information for the property and the relevant surrounding area, a property visit to inspect its current condition, and contacting MCM to find out whether, or not, there are any known archaeological sites on or near the property. Its purpose is to identify areas of archaeological potential and further archaeological assessment (e.g. Stage 2-4) as necessary. The results from the Stage 1 Archaeological Assessment and potential Archaeological Impacts are included in Section 9.3.2. The full report is included as Appendix C.

4.3 Existing Water System

This section presents an overview of the water systems that service Wellesley.

4.3.1 Wellesley Water Treatment Plant

This section presents an overview of the Wellesley Water Treatment Plant including its current capacity.

4.3.1.1 Facility Overview

The Wellesley Water Treatment Plant (WTP) is located at 2233 Gerber Road, Wellesley, Ontario. Raw water is supplied to the Wellesley WTP through three groundwater production wells (WY1, WY5, and WY6). The Wellesley WTP is equipped with three (3) dual media pressure filters containing greensand and anthracite for iron and manganese treatment, and a sodium hypochlorite system for pre-oxidation and primary disinfection. Treated water is stored in a 3-cell reservoir with a total usable volume of 902.3 m^3 before it is distributed. The reservoir provides treated water storage and contact time for disinfection.

Backwash water for the filtration system is drawn from the treated water reservoir. Used backwash water is sent to an 86 m^3 settling tank equipped with two (2) supernatant pumps with final discharge to the sanitary sewer. The high lift pumping system consists of five (5) high lift pumps which draw water from the reservoir. Two (2) large pumps (rated 60 L/s at 2.5 m) are dedicated fire pumps, and the three (3) small pumps (rated 15.5 L/s at 42.5 m) are used for normal operation. The firm pumping capacity for domestic use is 47 L/s, calculated with the two largest pumps out of use per the MECP Design Guidelines for Drinking-Water Systems (MECP, 2023). The emergency or fire flow pumping capacity is 166.5 L/s, calculated as the total capacity of the pumping station. Requirements for fire flows can be supplemented from the fire department's tanker truck. The high lift pumps operate in Pressure Mode to continuously supply water into the distribution system to maintain system pressure. Each pump has a start discharge pressure setpoint. The high lift pump is requested to start once the discharge pressure drops below the setpoint, and requested to stop once pressure is confirmed to be above the setpoint.

The Wellesley WTP was originally constructed in 1993. A condition assessment was completed for the Wellesley WTP in 2018 by C3 Water (C3 Water, 2018) which identified several short-, medium- and long-term upgrades as summarized in TM1 in Appendix B. The Region is currently undertaking a Wellesley WTP Upgrade project to implement the recommendations.

Raw water is drawn from the wells under Permit to Take Water (PTTW) No. 0345-94UQ6A dated March 6, 2013. The total taking limit is 1,044 Litres per minute (LPM), or 1,503,360 Litres per day (LPD), which also corresponds to the maximum withdrawal rate for any of the three individual wells. The treatment plant is operated under Drinking Water Works Permit (DWWP) No. 012-215, and Municipal Drinking Water License (MDWL) No. 012-115, both dated April 20, 2021. The rated capacity of the Wellesley WTP is 3,006 m^3/d. However, the maximum water taking allowed by the PTTW is 1,503 m^3/d. Additional information on the three production wells is provided in TM1 in Appendix B.

4.3.1.2 Capacity Assessment

Based on an analysis of water demand from 2018 through to 2022, the existing average per capita demand, maximum day demand (MDD) factor, and peak hour demand (PHD) factor were determined. These values are presented in Table 4-4. Further details are provided in TM1 in Appendix B.

Table 4-4. Existing Water Demand

Demand Type	Value
Average per Capita Demand	179 L/c/day
MDD Factor	1.69
PHD Factor	2.28

The demands presented in Table 4-4 were used to assess the exiting capacity of the Wellesley WTP. The rated capacity of the Wellesley WTP is 3,006 m^3/d as stated in the DWWP and MDWL, however the maximum water taking allowed by the PTTW is 1,503 m^3/d. Therefore, the overall WTP capacity is limited by the well taking capacity.

Current plant usage is summarized in Table 4-5. The Wellesley WTP has sufficient capacity in terms of providing average day demand (ADD) and MDD with 44 percent, and 75 percent of the current well taking capacity, respectively. The well taking capacity is not sufficient (101 percent) to provide the current PHD.

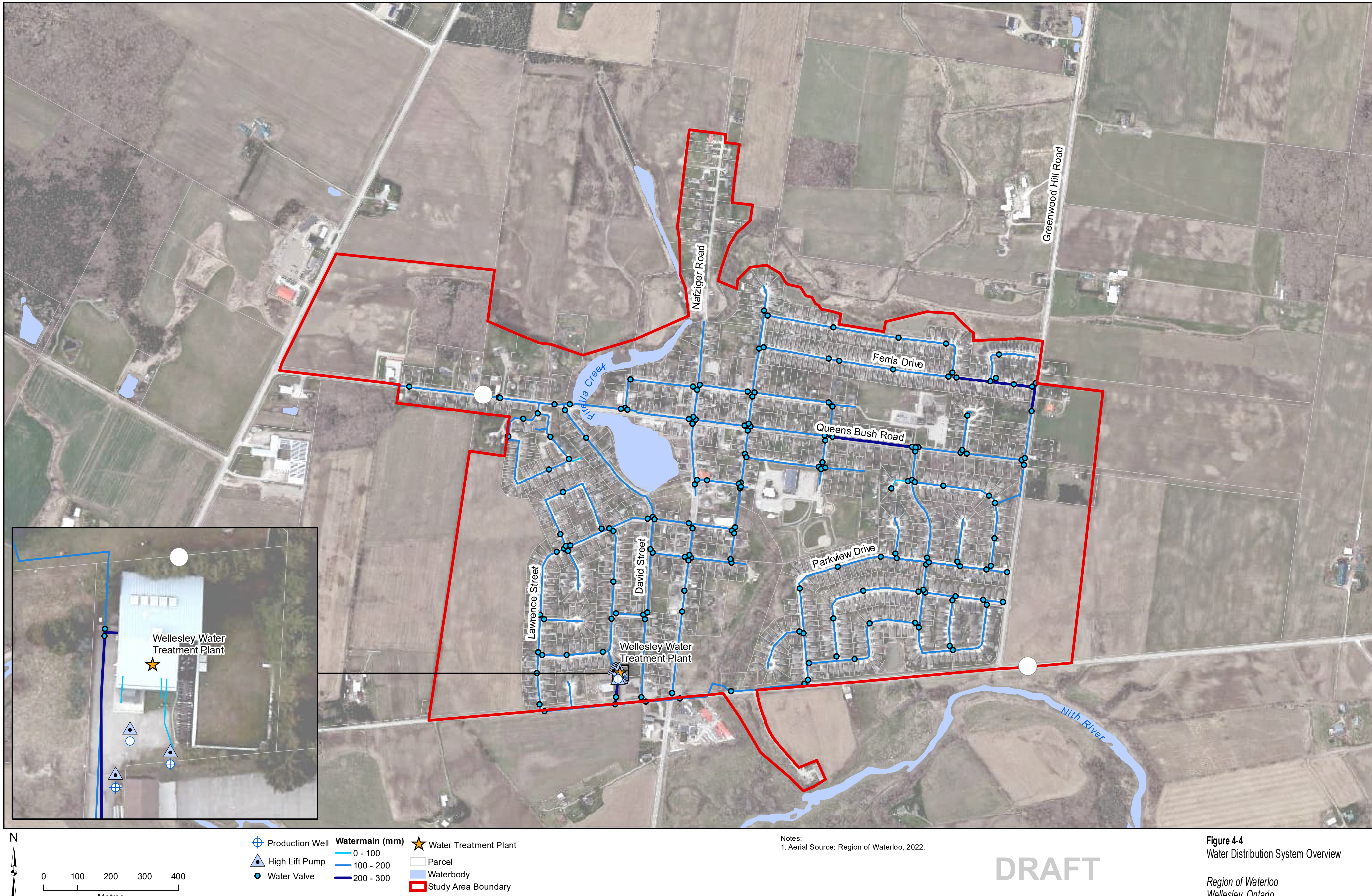
Table 4-5. Current Flows and WTP Capacity

Parameter	Flow, m^3/d	Percent of Well Taking Capacity, %
ADD	668	44
MDD	1,128	75
PHD	1,522	101

Raw and treated water quality data collected at the Wellesley WTP between 2002 and 2022 was utilized to assess the water quality. Overall, treated water arsenic and fluoride levels are below the regulatory limits, and iron, manganese, and strontium are within acceptable guideline objectives.

4.3.2 Wellesley Water Distribution System

The Wellesley water distribution system is comprised of approximately 17.3 km of watermains ranging from 150 mm to 300 mm in diameter with 61 percent of pipes of 200 mm in diameter. The majority of the watermains (approximately 98 percent in length) are made of PVC. The drinking water network has been installed relatively recently with 56 percent and 29 percent of the watermains installed in the decade of 1990s and 2000s, respectively. Just a small fraction (approximately 10 percent) of the watermains were installed prior to 1990. Figure 4-4 provides an overview of Wellesley's water distribution system.



Notes:
1. Aerial Source: Region of Waterloo, 2022.

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Figure 4-4
Water Distribution System Overview

Region of Waterloo
Wellesley, Ontario

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The Wellesley water distribution system does not have floating storage and therefore the volume required for fire storage is provided through a combination of fire flow pumps and reliance on pumper trucks that can utilize water from the Wellesley Pond to help fight fires.

Table 4-6 specifies the minimum and maximum acceptable pressures according to the Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (Region of Waterloo, City of Cambridge, City of Guelph, City of Kitchener, City of Waterloo, Township of North Dumfries, Township of Wellesley, Township of Wilmot, Township of Woolwich., 2022).

Table 4-6. Minimum and Maximum Pressures

Scenario	Pressure (kPa)
Pressure under non-fire flow demand scenario	>275 kPa (40 psi)
Maximum Day plus fire flow	>140 kPa (20 psi)
Maximum static pressure	<700 kPa (100 psi)

The preferred design pressure ranges for average day and maximum day are 350 kPa (50 psi) to 550 kPa (80 psi). The preferred minimum hour and peak hour pressure ranges are 275 kPa and 700 kPa. as described in Table 4-6 (Region of Waterloo, City of Cambridge, City of Guelph, City of Kitchener, City of Waterloo, Township of North Dumfries, Township of Wellesley, Township of Wilmot, Township of Woolwich., 2022). The Region's existing water distribution model for Wellesley was used to evaluate system pressures. The water distribution model is described in TM1 in Appendix B. There are no distribution system constraints under non-emergency flow conditions based on modelled results.

Fire flows for various property types were developed by the nearby City of Waterloo in its most recent Water Distribution Master Plan (GM BluePlan, 2017a). The fire flow for commercial properties from the Water Distribution Master Plan was used to assess the storage capacity at the Wellesley WTP because commercial property most accurately reflects the size of existing properties in the Wellesley Urban Area. The basis for the fire flows for the various building types were reviewed with the local fire department to confirm these estimates are sufficient for their needs as part of the engagement activities for this Master Plan. The fire flow requirements by building types, can be summarized as follows:

- Fire Flow (Industrial/Commercial/Institutional): 175 L/s – Duration: 2.13 hours
- Residential Fire Flow: minimum 75 L/s
- Preferred Residential Fire Flow: minimum preferred 125 L/s

ICI fire flow constraints exist within the distribution system under existing conditions, and two locations at dead-end streets have insufficient residential fire flow capacity. However, as previously noted, the current fire-fighting practice includes reliance on tanker trucks to supplement flows from the distribution system, as required. Additional information on fire flow analysis is provided in TM3 in Appendix B.

Treated water storage is provided at the Wellesley WTP by a three-celled reservoir with a total usable volume of 902.3 m^3 (Cell A: 188.5 m^3; Cell B: 279.8 m^3; Cell C: 434.0 m^3). The main purpose of this water reservoir is to provide a standby volume of water for firefighting and an additional volume for emergency conditions. In addition, the reservoir will also provide the required volume for primary disinfection.

Water treatment plant treated water volumes and water billing volumes were compared to determine the distribution system losses, which is defined as unaccounted for water. The calculated annual distribution system losses are approximately 18 percent, which falls within a typical range of 10-20 percent. However, opportunities may exist to improve the efficiency of the distribution system. Further information is found in TM1 in Appendix B.

4.4 Existing Wastewater System

This section presents an overview of the wastewater systems that service Wellesley.

4.4.1 Wellesley Wastewater Collection System

This section describes the current condition and needs of Wellesley's Wastewater Collection System.

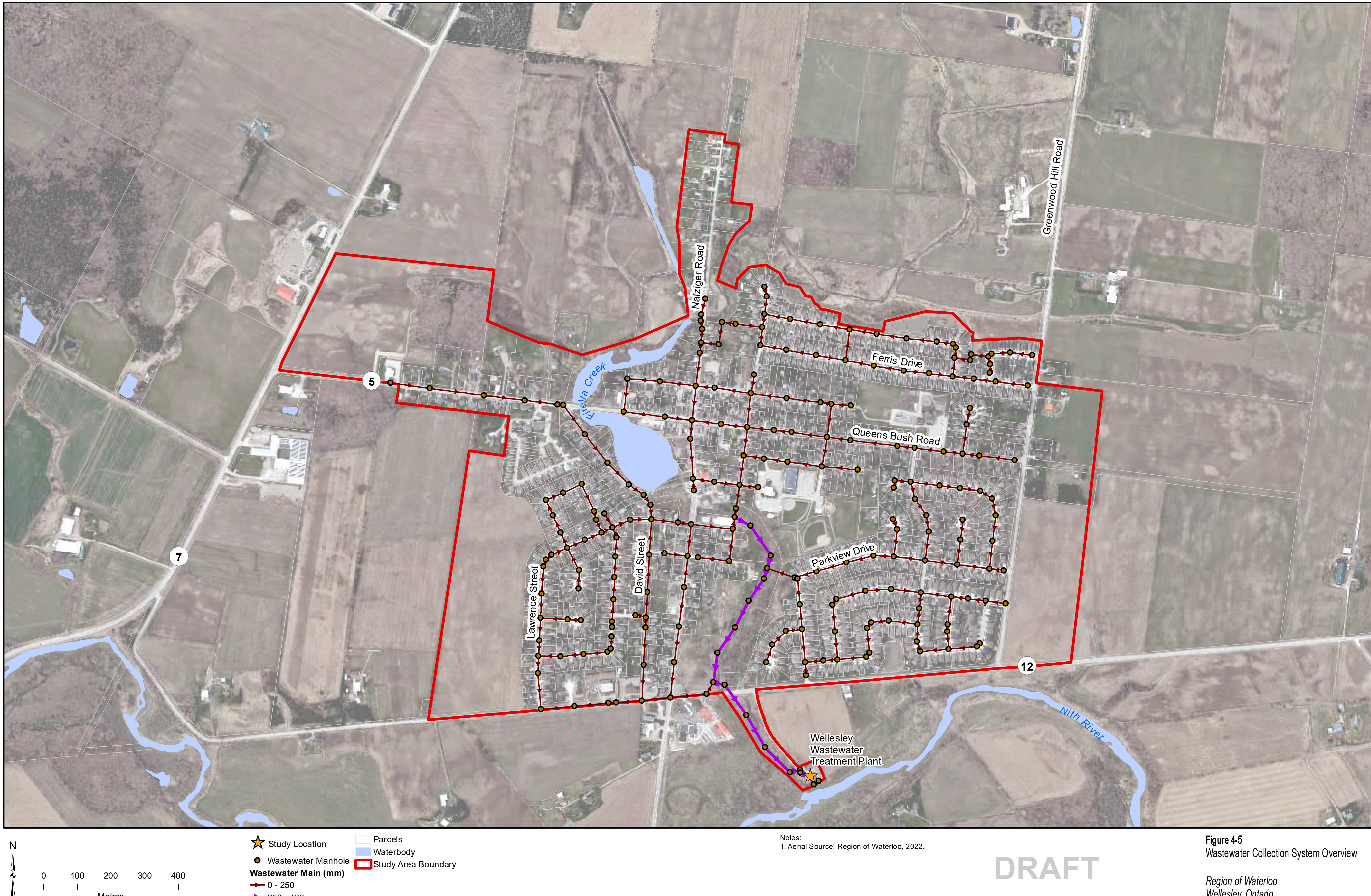
4.4.1.1 Hydraulic Capacity Assessment

Wellesley's wastewater collection system is comprised of approximately 16 km of sanitary gravity sewers draining to the Wellesley WWTP. The sewers range in size from 200 to 350 mm diameter. The Firella Creek Trunk Sewer collects wastewater flow from the local sewers and conveys the flow to the WWTP Influent Pumping Station (PS). The WWTP Influent PS pumps wastewater to the WWTP for treatment. The total tributary area to the wastewater collection system is approximately 145 hectares. The wastewater collection system is shown in Figure 4-5.

Flow monitoring within Wellesley's collection system was completed between March and June 2023 to understand existing sewer capacity conditions. The flow monitoring data was then used to calibrate a sanitary hydraulic model for Wellesley's wastewater collection system. The hydraulic model calibration process and results are described in TM4 in Appendix B.

The level of service used as criteria to identify collection system constraints included no surcharging during dry weather periods and wet-weather periods up to the 5-year design storm, and hydraulic freeboard greater than 1.8 m during wet weather periods greater than the 5-year design storm. Hydraulic freeboard is the difference between the hydraulic grade line within the sanitary pipe and the ground elevation. Typical basement elevations are1.8 in depth, and therefore having a freeboard greater than 1.8 m is suggestive of lower risk of basement flooding.

The hydraulic model results were compared against the level of service criteria to identify existing capacity constraints within Wellesley's wastewater collection system during dry weather flow (DWF), the 5-year design storm, and the 25-year design storm. The results of the existing conditions analysis are described in Table 4-7.



Notes:
1. Aerial Source: Region of Waterloo, 2022.

DRAFT

Figure 4-5
Wastewater Collection System Overview

Region of Waterloo
Wellesley, Ontario

Jacobs

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Table 4-7. Existing Conditions Summary of Modelled Results

Design Storm/DWF	Model Results
DWF	▪ No surcharging [a]
5-year	▪ Pipe capacity constraints along the Firella Creek Trunk Sewer amplified by downstream pump station constraints. Surcharging to surface simulated along the Firella Creek Trunk Sewer. ▪ Pipe capacity constraints along Nafziger Road (north of Maple Leaf Street), Maple Leaf Street, Schweitzer Crescent, Lawrence Street, amplified by surcharging along the Firella Creek Trunk Sewer. ▪ Pipe capacity constraints along Queen's Bush Road (east of Molesworth Street). ▪ Select pipe capacity constraints along Nithbank Road and Parkview Drive. Surcharging is amplified by surcharging along the Firella Creek Trunk Sewer. Surcharging to surface is simulated. ▪ Surcharging due to backflow along various local sewers is simulated. ▪ Approximately 390 m^3 of bypass simulated at the Influent PS.
25-year	▪ Pipe capacity constraints along the Firella Creek Trunk Sewer amplified by downstream pump station constraints. Surcharging to surface simulated along the Firella Creek Trunk Sewer. ▪ Pipe capacity constraints along Nafziger Road (north of Maple Leaf Street), Maple Leaf Street, Schweitzer Crescent, Lawrence Street, amplified by surcharging along the Firella Creek Trunk Sewer. Surcharging to surface is simulated. ▪ Pipe capacity constraints in the vicinity of Nithbank Road and Parkview Drive amplified by surcharging along the Firella Creek Trunk Sewer. Surcharging to surface is simulated. ▪ Pipe capacity constraints along Queen's Bush Road (east of Molesworth Street) with a freeboard greater than 1.8 m. ▪ Select pipe capacity constraints along David Street, amplified by backflow conditions. Surcharging to surface is simulated. ▪ Surcharging due to backflow along various local sewers resulting in freeboard less than 1.8 m. ▪ Approximately 1710 m^3 of bypass simulated at the Influent PS.

[a] with the exception of the siphons along Nafziger.

4.4.1.2 Condition-Based Needs

Previous system-wide closed-circuit television (CCTV) of the Wellesley wastewater collection system was completed in 2017. The results of the inspection indicated grease build-up observed in 61 locations in the sanitary system along with several fractures and cracks throughout the system and sags concentrated in the southwest area of the collection system (GM BluePlan, 2018). The majority of the significant grease and encrustation was observed along the lower portion of the Firella Creek Trunk Sewer. Sewer flushing, semi-annual inspections, and a customer education program was recommended to address the grease and encrustation defects. The conveyance restrictions were not recommended for repair, while 21 sewer repairs and eight manhole repairs were recommended to address infiltration defects (GM BluePlan, 2018).

Manhole repairs for several manholes along the Firella Creek Trunk Sewer were completed in 2023, and include raising, grouting, new lid, and/or debris removal. System-wide CCTV inspections were being carried out in 2024 (Region of Waterloo, 2024b).

4.4.2 Wellesley Wastewater Treatment Plant

This section presents an overview of the Wellesley Wastewater Treatment Plant including its current hydraulic capacity along with the raw wastewater characteristics and sludge generation of the plant.

4.4.2.1 Facility Overview

The Wellesley Wastewater Treatment Plant (WWTP) is located at 2156 Gerber Road, across the border from Wellesley in the Township of Wilmot, Ontario. The Wellesley WWTP consists of fine screening for preliminary treatment, two extended aeration package plants for secondary treatment (Plant No. 1 and Plant No. 2), cloth media filtration for tertiary treatment, chemical phosphorus precipitation with alum, and ozone disinfection prior to discharge to the Nith River. Waste activated sludge (WAS) is stored in an aerated sludge holding tank prior to haulage to the Waterloo WWTP for further processing. The plant is operated under an Amended Environmental Compliance Approval (ECA) for Sewage Works (No. 6542-AJCJC9), issued by the Ontario Ministry of the Environment, Conservation and Parks (MECP) on June 29, 2017, with a rated average daily flow (ADF) capacity of 1,100 m^3/d.

Following fine mechanical screening, wastewater flow is split between the two package plants at an estimated 40/60 percent split between Plant No.1 and No. 2, respectively. Flow splitting is described further in TM1 in Appendix B. During peak flow events above 6,400 m^3/d, raw wastewater is mechanically screened and bypassed to tertiary treatment.

Plant No. 1 and No. 2 were constructed in 1973 and 1993, respectively. Each plant consists of a central circular secondary clarifier surrounded by a concentric annular bioreactor. The bioreactors are divided into anoxic and aerobic zones, with nitrified mixed liquor recycle from the last aerobic zone to the anoxic zone. The anoxic zones are approximately 25 percent of the total bioreactor volume. The mixed liquor recycle is pumped in Plant No. 1, while Plant No. 2 achieves recirculation via a pipe alone. This configuration (anoxic zones with mixed liquor recycle) provides denitrification. Alum is added to the bioreactor effluent for phosphorus removal. The tertiary cloth filters were installed in 2019 replacing the previous sand filtration system.

Recent plant upgrades include the Plant No. 1 clarifier and return activated sludge (RAS) and WAS systems for Plant No. 1 and No. 2. These upgrades, as well as additional operational strategies being trialed, are detailed in TM1 in Appendix B.

The Region is planning to replace the ozone disinfection system with a UV system with construction expected to start in 2025.

The existing capacity of individual processes at the Wellesley WWTP is summarized in Table 4-8. The capacities were determined using historical data, literature guidelines for the design of the wastewater treatment processes and the original plant design basis, as described in TM1 and TM4 in Appendix B.

Table 4-8. Wellesley WWTP Process Capacity Summary

Unit Process	Equivalent AADF Capacity (m^3/d) [a]
Influent Pumping	4,400 [a]
Screening	4,490 [a]
Secondary Treatment [b] (Bioreactors and Clarifiers)	1,100
Blowers [c]	1,100
Tertiary Filtration	1,260
Alum System	Storage tank: 13,450 Metering Pumps: 1,140
Disinfection Contact Tank [d]	1,250
Sludge Storage Tank	580
Outfall [e]	8,640 [a]

Notes:

[a] Influent pumping, screening and outfall capacity is provided based on peak hourly capacity.

[b] The secondary treatment is limited by the secondary clarifiers' hydraulic loading rate at peak hourly flow according to MECP design guidelines for maximum allowable hourly surface overflow (SOR) rate (37 $m^3/m^2/d$). The SOR at PHF (4,400 m^3/d) is 43 $m^3/m^2/d$. Given that the maximum allowable SOR depends on sludge settleability, which would be site-specific. Historical data analysis for secondary treatment demonstrates good sludge settling characteristics (defined by the measured sludge volume index). The historical maximum sludge volume index (SVI) was estimated to be 90 mL/g, which is significantly lower than typical SVI for conventional activated sludge (120 to 150 mL/g). Using the concept of flux curve analysis, the maximum allowable SOR for Wellesley secondary clarifiers would be 46 $m^3/m^2/d$, which is higher than the peak hourly SOR of 43 $m^3/m^2/d$. Therefore, considering a peak factor of 4, the clarifier's capacity can handle the rated capacity of 1,100 m^3/d AADF.

[c] A technology review was completed in January 2024. The review recommended blowers that could provide additional capacity up to 1320 m^3/d by installing an additional blower.

[d] The capacity of the disinfection contact tank was evaluated in TM1 based on chemical disinfection. The Region has selected UV process in an ongoing project as the preferred strategy for disinfection upgrades. Consideration may be given to an equalization basin to store the peak flows to maintain the disinfection process capacity without exceedance.

[e] According to the available information, a high-level hydraulic assessment was performed for the outfall. the hydraulic analysis demonstrates that the outfall capacity can handle the projected flows. The peak outfall capacity would be 8,640 m^3/d (2,160 m^3/d AADF capacity), per the plant's hydraulic profile. It is recommended that a detailed evaluation be undertaken during conceptual design to verify the hydraulic capacity of the outfall, considering recent water elevations in the Nith River.

4.4.2.2 Wastewater Treatment Plant Capacity Assessment

This section presents historical flow, raw wastewater concentration, and sludge generation data and compares it to the current capacity of the Wellesley Wastewater Treatment Plant.

4.4.2.2.1 Hydraulic Capacity Assessment

Historical flow data were provided for 2019 to 2021, and historical hourly, and 15-minute flow data was provided for 2020 and 2021 (recorded by the plant SCADA system). Table 4-9 summarizes the historical ADF, peak day flow (PDF), peak hour flow (PHF), and peak 15-minute instantaneous flow (PIF) for each year. The existing plant design basis is also shown for comparison. On a hydraulic basis, the plant has been operating at approximately 75 to 80 percent of the design ADF capacity of 1,100 m^3/d.

Table 4-9. Historical Wastewater Flows (2019 to 2021)

Parameter	2019	2020	2021	Existing Plant Design Basis
ADF, m^3/d [a]	862	856	903	1,100
Percent of Rated Capacity	78%	78%	82%	N/A
PDF, m^3/d	3,796	6,016	5,439	3,850
PDF Peak Factor	4.4	7.0	6.0	3.5 [c]
PHF, m^3/d [b]	N/A	8,475	5,742	4,400
PHF peak factor	N/A	9.9	6.4	4.0 [c]
PIF, m^3/d [b]	N/A	8,581	8,459	4,400
PIF peak factor	N/A	10.0	9.4	4.0 [c]
Serviced Population [a]	3,604	3,652	3,730	N/A
ADF per capita flow rate, L/cap/d [a]	239	234	242	N/A

[a] ADF, population, and per capita data from 2019 to 2021 were obtained from the Region's Water and Wastewater Monitoring Report by the Ontario Clean Water Agency (OCWA) (OCWA, 2020), (OCWA, 2021), (OCWA, 2022)

[b] Hourly and 15-minute instantaneous flows were available from December 2019 to September 2022. PHF and PIF are only included for 2020 and 2021 as these are the only full years of data available.

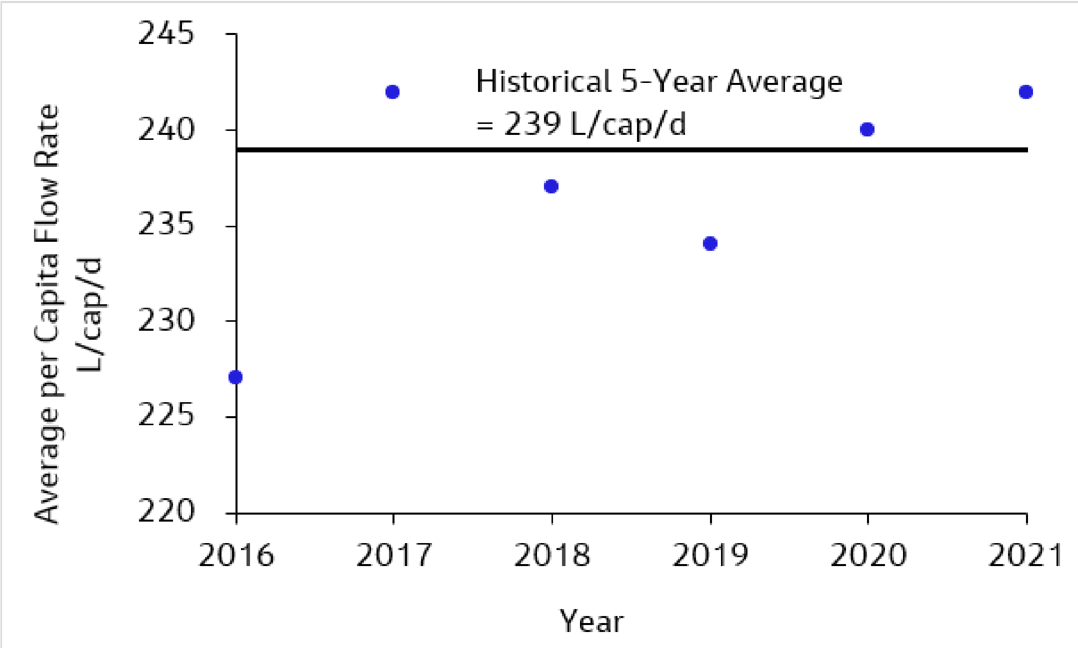
[c] Design peaking factors obtained from the Region of Waterloo 2018 Master Plan (CIMA+, 2018).

Notes:

L/cap/d = litres per capita per day
m^3/d = cubic meters per day

Data for 2016 to 2021 were obtained from the Region's annual water and wastewater monitoring report to evaluate per capita flow rates (OCWA, 2017), (OCWA, 2018), (OCWA, 2019), (OCWA, 2020), (OCWA, 2021), (OCWA, 2022). Typical per capita flow rates vary from 225 to 450 L/cap/d (MOE, 2008). During 2016 through 2021, the per capita flow rate varied from 227 L/cap/d (2016) to 242 L/cap/d (2021), with an average per capita flow rate of 239 L/cap/d. Historical per capita flow rates are presented in Figure 4-6.

Figure 4-6. Historical Per Capita Wastewater Flow Rates



Statistical analyses were completed for the daily flows and 15-minute instantaneous flows obtained from SCADA. The daily flow was less than the design PDF peak factor of 3.5 approximately 99.7% of the time. Thus, the design PDF peak factor was exceeded for a total of one day per year. The instantaneous flow was less than the design PIF peak factor of 4.0 approximately 99.6% of the time. Thus, the design PIF peak factor was exceeded for a theoretical total of 35 hours per year. The high peak flows are the result of inflow and infiltration (I/I) in the wastewater conveyance system. Data indicates that recorded peak flows can reach up to ten times the annual average flow rate. During high flows, treatment bypasses can occur at three points in the plant as follows:

- Wet well bypass: occurs when the wet well level in the raw wastewater pumping station reaches the bypass level. The raw wastewater is bypassed by gravity to the ozone chamber.
- Splitter box bypass: occurs when the wastewater flow exceeds the hydraulic capacity of the splitter box in the headworks facility (downstream of raw wastewater screen). The screened wastewater is bypassed by gravity to the ozone chamber.
- Tertiary bypass: occurs when the wastewater flow exceeds the hydraulic capacity of the filters. The secondary effluent is bypassed by gravity to the ozone chamber.

All bypassed flows are directed to the ozone chamber for disinfection prior to discharge to the Nith River. The total bypass volumes from 2019 to 2021 are summarized in in TM1 in Appendix B with data obtained from the Wellesley WWTP annual reports. Approximately 3 percent of the total annual plant influent volume was bypassed either at the splitter box or tertiary filters in 2019 to 2020, while only 1 percent was bypassed in 2021.

4.4.2.2.2 Raw Wastewater Characteristics

Historical raw wastewater concentration data from 2019 to 2021 were analyzed to established current plant loadings. Weekly sampling results were available for biochemical oxygen demand (BOD_5), carbonaceous biochemical oxygen demand ($cBOD_5$), total suspended solids (TSS), total Kjeldahl nitrogen

(TKN), total ammonia nitrogen (TAN), and total phosphorus (TP). The results of the analysis are detailed in TM1 in Appendix B. In summary, the raw wastewater per capita load rates are lower than typical observed values. The lower per capita loads would to be attributed to the domestic discharges without significant industrial discharges in the sewershed.

Future load projections should account for the possibility of development in the sewershed resulting in per capita loads that are higher than those observed from 2019 to 2021. For planning purposes, higher per capita load rates in line with typical ranges are recommended. As such, conservative per capita loads will be used to forecast future raw wastewater loads to the Wellesley WWTP. This design basis will allow for some conservatism in site utilization requirements and budgeting. The design per capita values are within typical ranges cited by Metcalf & Eddy (Metcalf & Eddy, 2013). The design per capita values are summarized in Table 4-10.

Table 4-10. Historical Per Capita Loads and Planning Design Basis

Parameter	2019 – 2021 Per Capita Load, g/cap/d	Typical Per Capita Load, g/cap/d [a]	Planning Design Basis, g/cap/d
BOD_5	38	50 – 120	50
TSS	55	60 – 150	60
TKN	9	9 – 18	15
TP	1.2	1.5 – 4.5	1.5

[a] Adapted from Metcalf & Eddy (2003)

4.4.2.2.3 Sludge Generation

Historical sludge generation data from 2019 to 2021 were analyzed from plant operations data and are detailed in TM1 in Appendix B. WAS generated at the Wellesley WWTP is stored in an aerated holding tank prior to haulage to the Waterloo WWTP for further processing. The sludge holding tank is periodically decanted to headworks.

The typical per capita sludge generation rate for extended aeration plants with chemical phosphorous removal is 50 to 55 g/cap/d per MECP guidelines (MOE, 2008). The sludge generation rate as calculated based on plant data is significantly lower than typical values. As such, a process model was developed to estimate per capita sludge generation rates for use in planning. The model development and results are described in TM1 in Appendix B. Overall, the solids holding tank provides less than the recommended 5-day storage volume. However, this conclusion should be confirmed during future design stages using data from the recently installed WAS flow meters at the plant.

4.5 Summary of Existing Constraints

The following is a summary of the existing constraints within Wellesley's water and wastewater systems:

- **Water Treatment**. The Wellesley WTP has sufficient capacity in terms of providing ADD and MDD with 44 percent, and 75 percent of the current plant capacity, respectively. The well taking capacity is not sufficient (101 percent) to provide the current PHD and therefore must rely on booster pumping from the clear well. Based on a review of raw and treated water quality data, arsenic and fluoride levels are below the regulatory limits, and iron, manganese, and strontium are within acceptable guideline objectives.

- **Water Distribution**. There are no water distribution system constraints under non-emergency flow conditions. Fire flow demand is, in part, being supplied through reliance on pumper trucks as standard practice.
- **Wastewater Treatment.** Based on 2019-2021 data, the Wellesley WWTP is operating at 75-80 percent of the design ADF capacity of 1,100 m^3/d. Best practices include that an EA is triggered once the plant reaches 80 percent of its capacity. The solids holding tank provides less than the recommended 5-day storage volume.
- **Wastewater Collections.** Existing constraints occur during wet weather flow within the Firella Creek Trunk Sewer, the WWTP Influent PS, and various local sewers as described in Table 4-7.

5. Study Area Future Conditions

Section 5 presents the projected growth of Wellesley and the water and wastewater system needs which result from this growth.

5.1 Community Growth Projections

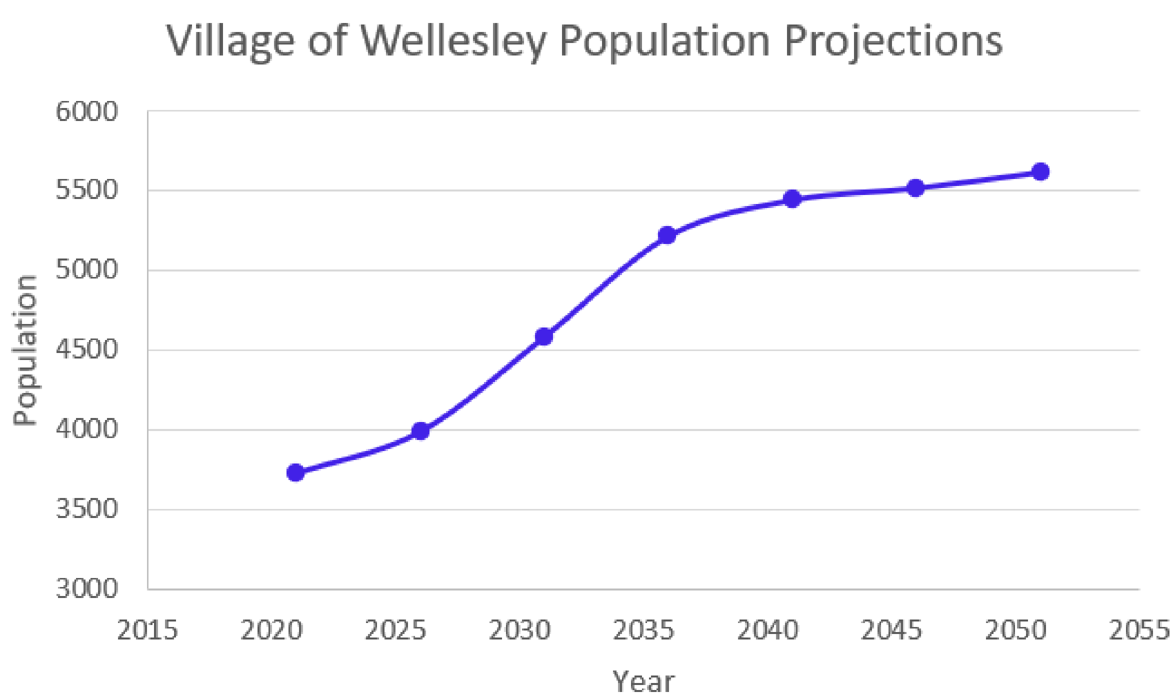
The residential population projections were used to estimate future flows and water demand to determine the future need for Wellesley's water and wastewater infrastructure and to identify when the recommendations should be implemented to service anticipated growth.

Population projections were developed by the Region and provided to Jacobs (Region of Waterloo, 2024a). The population projections were developed in 5-year increments to the planning horizon of 2051, as shown in Table 5-1 and Figure 5-1. The population within the Study Area is anticipated to increase by 1,887 people, from 3,730 to 5,617.

Table 5-1. Village of Wellesley Population Projections

Population	Year
2021	3,730
2026	3,992
2031	4,587
2036	5,218
2041	5,443
2046	5,518
2051	5,617

Figure 5-1. Village of Wellesley Population Projections



ICI growth is anticipated to remain relatively constant throughout the planning horizon of 2051. The anticipated ICI growth includes the Bill Gies Recreation Centre along Queens Bush Road (built in 2024) and a parcel of commercial development on the eastern extent of the Study Area. The future land use at the existing community centre remains uncertain, however it was assumed that some residential growth-related flow increases in addition to the existing ICI flows would occur.

The distribution of flows is based on growth within each Plum Zone. The existing population and the projected 2051 population for each Plum Zone within the Study Area is summarized in Table 5-2. The Plum Zone locations are presented in Figure 4-3. It was assumed that the growth projected within each Plum Zone would be concentrated within the Study Area. Further details on the distribution of the population growth are provided in TM4 in Appendix B.

Table 5-2. 2051 Population Distribution by Plum Zone

Plum Zone	Existing Population (2021)	Future Population (2051)
219	3	775
225	11	703
224	19	225
217	676	676
220	1,195	1,264
1018	173	166
1213	1,598	1,734
1214	53	51
216	2	22
Total	**3,730**	**5,617**

Notes:

Plum zone delineation and population projections based on (Region of Waterloo, 2024a) and (Region of Waterloo, 2024b)

5.2 Water Treatment and Distribution

This section presents water demand projections and the resulting future needs for Wellesley's Water Treatment and Distribution systems.

5.2.1 Water Demand Projections

As described in Section 4.3.1.2, the following design criteria were developed based on the average historical flow data from 2018 to 2022, and were used to develop future water demand projections:

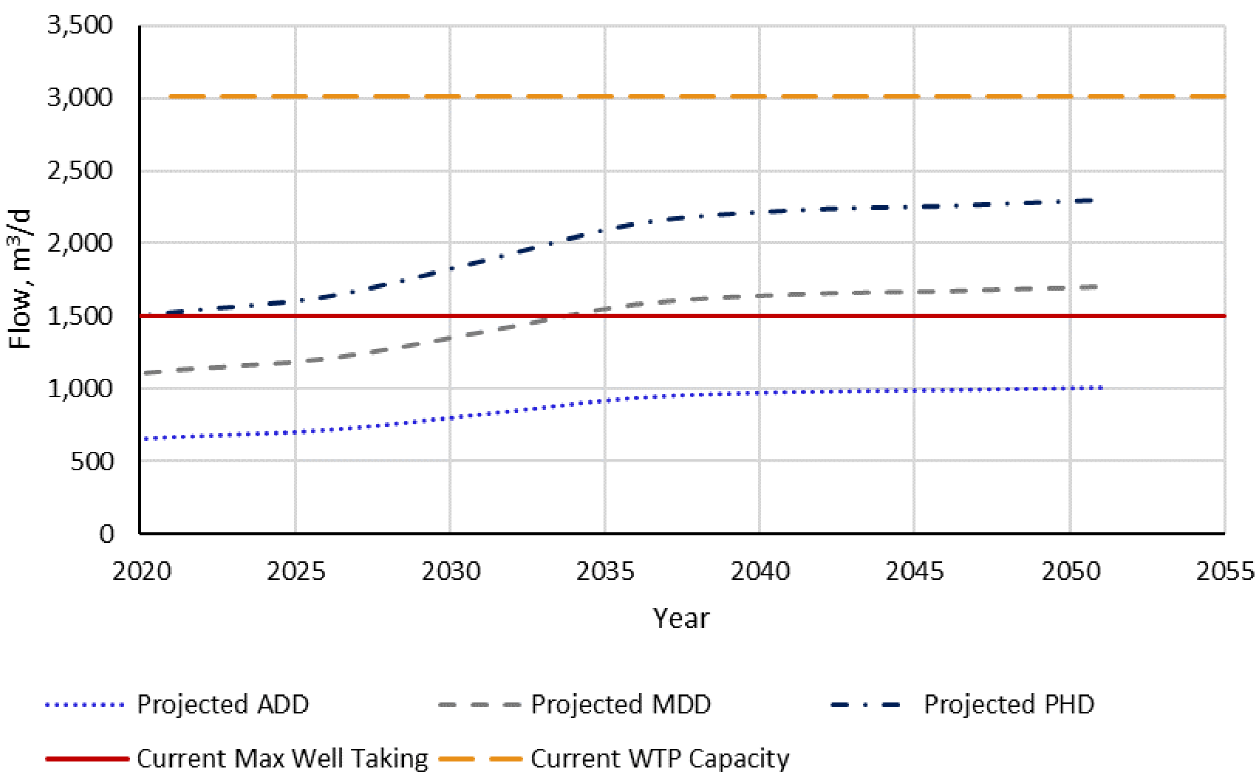
- Average per capita demand: 179 L/cap/day
- MDD Factor: 1.69
- PHD Factor: 2.28

These factors were applied to the population projections described in Section 5.1. Demand projections are presented in Table 5-3 and Figure 5-2.

Table 5-3. Water Demand Projections

Year	ADD, m^3/d	MDD, m^3/d	PHD, m^3/d
2016	605	1,022	1,379
2021	668	1,128	1,522
2026	715	1,208	1,629
2031	821	1,388	1,872
2036	934	1,578	2,130
2041	974	1,647	2,221
2046	988	1,669	2,252
2051	1,005	1,699	2,292

Figure 5-2. Water Demand Projections



5.2.2 Future Needs

The following bullets present a summary of future needs. Capacity assessment details are presented in TM3 in Appendix B.

- **Water Distribution:** Modelling was completed to identify needs in the Wellesley Urban Area water distribution system throughout the planning horizon. ICI fire flow needs were identified but can be mitigated by maintaining the implementation of the current fire-fighting practice which includes supplying additional fire flows via tanker trucks. Residential fire flow requirements (at 75 L/s) are met with the exception of two locations at dead-end streets under existing and future conditions.

- **Chlorine Contact Time (CT) Volume:** The existing reservoir at the Wellesley WTP provides a maximum CT volume of 902.3 m^3. Based on the current operating strategy with the pump station as the sole source of supply, this volume is sufficient to meet the current CT volume regulatory requirement for 2-log virus inactivation. To achieve a future CT volume for the projected 4-log virus inactivation requirements, the addition of 160 m^3 of CT volume would be recommended.
- **Treated Water Storage Capacity:** The existing reservoir at the Wellesley WTP represents the total storage capacity as there is no floating storage in the distribution system. This volume is insufficient to meet the projected future CT volume for 4-log virus inactivation as well as fire, equalization and emergency storage recommendations.
- **Firm Pumping Capacity for Emergency Demand:** The pump station serves as the sole source of supply; therefore, the pumps should meet both the fire flow and MDD in an emergency scenario. The emergency-use firm pumping capacity of 166.5 L/s with all five pumps in operation cannot meet the fire flow demand of 175 L/s. Upgrading the pump station may not be feasible due to the practical limitations of the existing water distribution system capacity. Requirements for fire flows can be supplemented from the fire department's tanker truck as being currently practiced. Firm pumping capacity for domestic use, however, is sufficient to meet PHD throughout the planning horizon.
- **Well Capacity:** The current maximum well taking capacity is 1,503 m^3/d. The projected MDD is expected to exceed this capacity by 2034, therefore a plan for obtaining a minimum of 196 m^3/d additional well capacity should be initiated in 2025. The Wellesley WTP, however, has sufficient capacity (3,006 m^3/d) for treatment throughout the planning horizon.
- **Water Quality:** The Wellesley WTP treated water is currently in compliance with all regulatory limits in Ontario. However, should strontium become regulated within the planning horizon, alternative approaches for treatment will need to be considered. The potential impacts to strontium and fluoride concentrations are considered in the evaluation of alternatives through criteria such as public health and safety and meeting existing and future needs.

The 2051 planning design basis for the Wellesley WTP is presented in Table 5-4.

Table 5-4. Wellesley WTP 2051 Planning Design Basis

Parameter	2051 Recommended Capacity	Current Capacity	Recommended Additional Capacity
ADD, m^3/d	1,005	1,503 [a]	Not Applicable
MDD, m^3/d	1,699	1,503 [a]	61
CT Volume, m^3	1,062	902.3	160
Fire, Equalization and Emergency Storage, m^3	2,204	Not Applicable	2,204
Firm Pumping Capacity for Domestic Use (L/s)	26.5	47.0	Not Applicable
Firm Pumping Capacity for Emergency Use (L/s)	195.0	166.5	28.2

Notes:

[a] Overall capacity is limited by the well taking capacity of 1,503 m^3/d. The WTP capacity of 3,006 m^3/d is sufficient for current and future needs (to 2051).

5.3 Wastewater Collection System

This section presents wastewater collection system flow projections and the resulting future needs for Wellesley's Wastewater Collection system.

5.3.1 Projected Wastewater Collection System Flows

The wastewater conveyance system flows for the future scenarios were based on the projected residential and equivalent ICI populations as presented in Section 5.1.

The future flow generation rates pertaining to wastewater collection and conveyance, based on the Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) (Region of Waterloo, City of Cambridge, City of Guelph, City of Kitchener, City of Waterloo, Township of North Dumfries, Township of Wellesley, Township of Wilmot, Township of Woolwich., 2022), are summarized in Table 5-5.

Table 5-5. Wastewater Collection System Future Flows

Type	Average	Peaking Factor
Residential	275 L/cap/d	Harmon Peaking Factor Formula
Industrial	0.40 l/s/ha	Known discharges or typical industry sewage flow peaking factor from MECP guidelines
Commercial	Core =0.95 l/s/ha; Shopping Mall = 0.3 l/s/ha; General = 0.5 l/s/ha.	Known discharges or 2.5
Institutional	0.25 L/s/ha for institutional uses; 0.015 L/s/bed for hospitals	N/A

During DWF simulations, the design peak wastewater flow (as identified in Table 5-5) was used for the future subcatchments. The peak DWF rate (peak wastewater flow) at each of the future subcatchments was represented as a constant flow in the model.

Average DWF with no peaking factor was used during wet weather flow simulations. Calibrated RTK parameters from nearby parcels were used to incorporate I/I into the future parcels during wet weather flow simulations.

5.3.2 Wastewater Collection System Needs

A future conditions scenario representing the year 2051 was created in the sanitary hydraulic model using the populations and developments described in Section 5.1 and the flow rates described in Section 5.3.1. The future hydraulic model results were compared against the level of service criteria described in Section 5.1 to identify future capacity needs within Wellesley's wastewater collection system during DWF, the 5-year design storm, and the 25-year design storm. The results of the future conditions analysis are described in Table 5-6.

Table 5-6. Future Needs Summary of Modelled Results

Design Storm/DWF	Model Results
DWF	▪ Surcharging due to capacity is simulated along Gerber Road (pipe ID WP129, pipe immediately west of the intersection of Gerber Road and David Street). The surcharging is the result of intermittent flow spikes modelled from the water treatment (refer to TM4 in Appendix B for further details). The surcharging at WP129 is causing backflow conditions resulting in additional surcharging in two pipe segments immediately upstream.
5-year	▪ Pipe capacity constraints along the Firella Creek Trunk Sewer amplified by downstream pump station constraints. Surcharging to surface is simulated along the Firella Creek Trunk Sewer. ▪ Pipe capacity constraints along Nafziger Road (north of Maple Leaf Street), Maple Leaf Street, Schweitzer Crescent, Lawrence Street, amplified by surcharging along the Firella Creek Trunk Sewer. ▪ Pipe capacity constraints along various portions of Queen's Bush Road ▪ Select pipe capacity constraints along Nithbank Road and Parkview Drive. Surcharging is amplified by surcharging along the Firella Creek Trunk Sewer. Surcharging to surface is simulated. ▪ Pipe capacity constraints along Gerber Road, Lawrence Street, and David Street. ▪ Surcharging due to backflow along various local sewers is simulated. ▪ Approximately 352 m^3 of bypass simulated at the Influent PS.
25-year	▪ Pipe capacity constraints along the Firella Creek Trunk Sewer amplified by downstream pump station constraints. Surcharging to surface simulated along the Firella Creek Trunk Sewer. ▪ Pipe capacity constraints along Nafziger Road (north of Maple Leaf Street), Maple Leaf Street, Schweitzer Crescent, Lawrence Street, amplified by surcharging along the Firella Creek Trunk Sewer. Surcharging to surface is simulated. ▪ Pipe capacity constraints in the vicinity of Nithbank Road and Parkview Drive amplified by surcharging along the Firella Creek Trunk Sewer. Surcharging to surface is simulated. ▪ Pipe capacity constraints at various locations along Queen's Bush Road, with a freeboard greater than 1.8 m. ▪ Select pipe capacity constraints along Gerber Road, Lawrence Street, and David Street, amplified by backflow conditions. Surcharging to surface is simulated. ▪ Surcharging due to backflow along various local sewers resulting in freeboard less than 1.8 m. ▪ Approximately 2322 m^3 of bypass simulated at the Influent PS.

5.4 Wastewater Treatment

This section presents a summary of future wastewater flow and loading projections and the resulting future needs. Additional details are presented in Appendix B.

5.4.1 Wastewater Flow Projections

Wastewater flow projections through 2051 were developed using the basis presented in Section 4.4 and are presented in Table 5-7.

Table 5-7. Wellesley WWTP Service Area Population and Flow Projections

Parameter	Value	Basis
Design Year	2051	-
Population	5,617	-
AADF, m^3/d	1,345	239 L/cap/d
PDF, m^3/d	4,700	3.5 peaking factor
PHF/PIF, m^3/d	5,370	4.0 peaking factor

5.4.2 Influent Loading Projections

Influent loading projections through 2051 were developed using the basis presented in Section 4.4 and are presented in Table 5-8.

Table 5-8. Wellesley WWTP Influent Load Projections

Parameter	Value
Design Year	2051
Population	5,617
Average BOD_5 Load, kg/d	281
Average TSS Load, kg/d	337
Average TKN Load, kg/d	84
Average TP Load, kg/d	78.4

5.4.3 Wastewater Treatment Needs

Wastewater treatment process needs were identified based on the future flow and loading projections and are summarized in Table 5-9.

Table 5-9. Wellesley WWTP Future Needs Summary

Unit Process	Capacity (m^3/d) [a]	Basis	Projected Flow (m^3/d)	Upgrade/Expansion Needed for Planning
Influent Pumping	4,400 [a]	PHF	5,370	Yes
Screening	4,490 [a]	PHF	5,370	Yes
Secondary Treatment (Bioreactors and Clarifiers)	1,100	AADF	1,345	Yes
Aeration Blowers [b]	1,100	AADF	1,345	Yes
Tertiary Filtration	1,260	AADF	1,345	Yes

Unit Process	Capacity (m^3/d) [a]	Basis	Projected Flow (m^3/d)	Upgrade/Expansion Needed for Planning
Alum System	Storage tank: 13,450 m^3 Metering Pumps: 1,140	AADF	1,345	No Yes
Disinfection Contact Tank [c]	1,250	AADF	1,345	Yes
Sludge Storage Tank	580	AADF	1,345	Yes
Outfall [d]	8,640 [a]	PHF	5,370	No

Notes:

[a] Influent pumping, screening and outfall capacity is provided based on peak hourly capacity.

[b] A technology review was completed in January 2024 which recommended blowers that could provide additional capacity to handle ADF up to 1320 m^3/d by installing an additional blower.

[c] The capacity of the disinfection contact tank was evaluated in TM1 based on ozone disinfection. The Region has selected UV disinfection as the preferred strategy for disinfection upgrades in an ongoing project. Consideration may be given to an equalization basin at the pump station to store the peak flows to maintain the disinfection process capacity without exceedance.

[d] A high-level hydraulic assessment was performed for the outfall based on available information. The hydraulic analysis demonstrated that the outfall capacity can handle the projected flows. The peak outfall capacity is 8,640 m^3/d (2,160 m^3/d AADF capacity), per the plant's hydraulic profile. It is recommended that a detailed evaluation be undertaken during conceptual design to verify the hydraulic capacity of the outfall, considering recent water elevations in the Nith River.

5.5 Summary of Future Needs

The following is a summary of the future needs within Wellesley's water and wastewater systems:

- **Water Treatment.** The future water treatment needs include the following:
  - Well Capacity – The current well taking capacity is expected to be exceeded by the projected MDD by 2034, therefore a plan for obtaining a minimum of 196 m^3/d (2.3 L/s) additional well capacity must be initiated around 2025.
  - Future Disinfection and Water Pumping & Storage Needs – Currently, additional pumping capacity, additional CT volume, and additional treated water storage, are identified to be required within the planning horizon (to 2051).
  - The Wellesley WTP treated water is currently in compliance with all regulatory limits in Ontario. However, should strontium become regulated within the planning horizon, alternative approaches for treatment will need to be considered. The capability to address naturally elevated strontium and fluoride concentrations was considered as a value-added factor in the WWWMP alternatives evaluation. We recommend the Region continue to monitor the regulatory landscape in the coming years and take the appropriate measures as recommended by the province.
- **Water Distribution.** Modelling was completed to identify constraints in the Wellesley Urban Area water distribution system throughout the planning horizon. ICI fire flow constraints were identified but can continue to be mitigated by maintaining the implementation of the current fire-fighting practice which

includes supplying additional fire flows via tanker trucks. Residential fire flow requirements (at 75 L/s) are met with the exception of two locations at dead-end streets under existing and future conditions.

- **Wastewater Treatment.** The future wastewater treatment constraints are identified in Table 5-9 in Section 5.4.3. Process capacity constraints include influent pumping, screening, secondary treatment, tertiary treatment, chemical dosing, ozone disinfection, and sludge storage. Of note, the Region is in the process of upgrading the disinfection system from ozone disinfection to UV disinfection, and it is anticipated that the UV design will provide sufficient capacity for growth to 2051.
- **Wastewater Collections.** Future constraints occur during wet weather flow within the Firella Creek Trunk Sewer, the WWTP Influent PS, and various local sewers as described in Table 5-6. It should be noted that the WWTP Influent PS constraint was also identified as a constraint under wastewater treatment.

6. Problem and Opportunity Statement

The Region of Waterloo is undertaking a Water and Wastewater Master Plan for the Village of Wellesley to address anticipated water and wastewater treatment needs, and including water distribution and wastewater collection needs, over the next 30 years. Because the population of the Village of Wellesley is expected to increase over the next 30 years, it is critical that the water and wastewater infrastructure can meet the anticipated future treatment, distribution and collection system servicing requirements. This Water and Wastewater Master Plan represents an opportunity to review the existing service levels and identify projects that are required to be implemented to meet the future needs.

7. Development of Alternative Solutions

Section 7 presents the alternatives developed for Wellesley's Water and Wastewater systems.

7.1 Drinking Water System Alternatives

Several needs regarding well supply capacity, future primary disinfection, and treated water pumping and storage were identified. Alternatives were developed to address these needs separately.

7.1.1 Well Capacity

The existing permitted well taking capacity of 1,503 m^3/d is expected to be exceeded by 2034 and an additional 196 m^3/d is needed in the planning horizon. Several alternatives were considered to meet future water supply needs, forming the long-list of well capacity alternatives. Two major screening criteria were used to screen the long-list of alternatives:

- Ability to resolve identified constraints
- Constructability

The long-list of alternatives and screening results are provided in TM3 in Appendix B. The resulting short-listed alternatives identified to address well capacity constraints include the following:

1. Do Nothing (kept as a baseline) – Maintain existing well supply.

2. Increase Existing Well Supply – Explore additional water taking from existing production wells.

3. Supplement Existing Wells with New Well Supply – Maintain existing well supply and supplement with a new well that is pumped to the WTP. This alternative is split into the following sub-alternatives:

    a. Alternative 3A: the new well is to be constructed within the urban boundary, with the watermain connection crossing through the downtown section of the Village.

    b. Alternative 3B: the new well is to be constructed at a new site located outside the urban boundary near the south-east end of the Village with a watermain connection that would not cross through the downtown section of the village.

4. Supplement Existing Wellesley Water System with External Supply – Maintain existing well supply and provide additional treated water supply from another drinking water system such as the IUS.

Each alternative is described in greater detail in TM5 in Appendix B. A hydrogeological study including full-scale capacity testing is recommended to confirm the suitability of the existing wells to provide the required additional supply. Based on discussions with Region staff, the actual well taking capacity may be less than the 1,503 m^3/d that is specified in the current PTTW.

7.1.2 Future Disinfection, Water Pumping, and Storage Needs

The future design basis for disinfection and water pumping and storage depends on the operating strategy. Alternatives were considered for two operating strategies: 1) pump station as sole source of supply with no floating storage, and 2) floating storage in distribution system as a supplement to the existing reservoir and pump station. However, as discussed further in TM3 in Appendix B, an operating strategy with new storage on-site was screened out as there is insufficient footprint available at the existing WTP site to expand the reservoir. The resulting short-listed alternatives identified to address the future disinfection, water pumping, and storage needs include the following:

1. Do Nothing (kept as a baseline) – Maintain existing reservoir and pump station with the pump station as the sole source of supply for domestic and emergency use.

2. New Storage Off-Site – Maintain existing reservoir for disinfection. Construct floating storage, such as an elevated tank, to provide additional storage for emergency use (i.e., fire demand). Maintain existing pump station for domestic use.

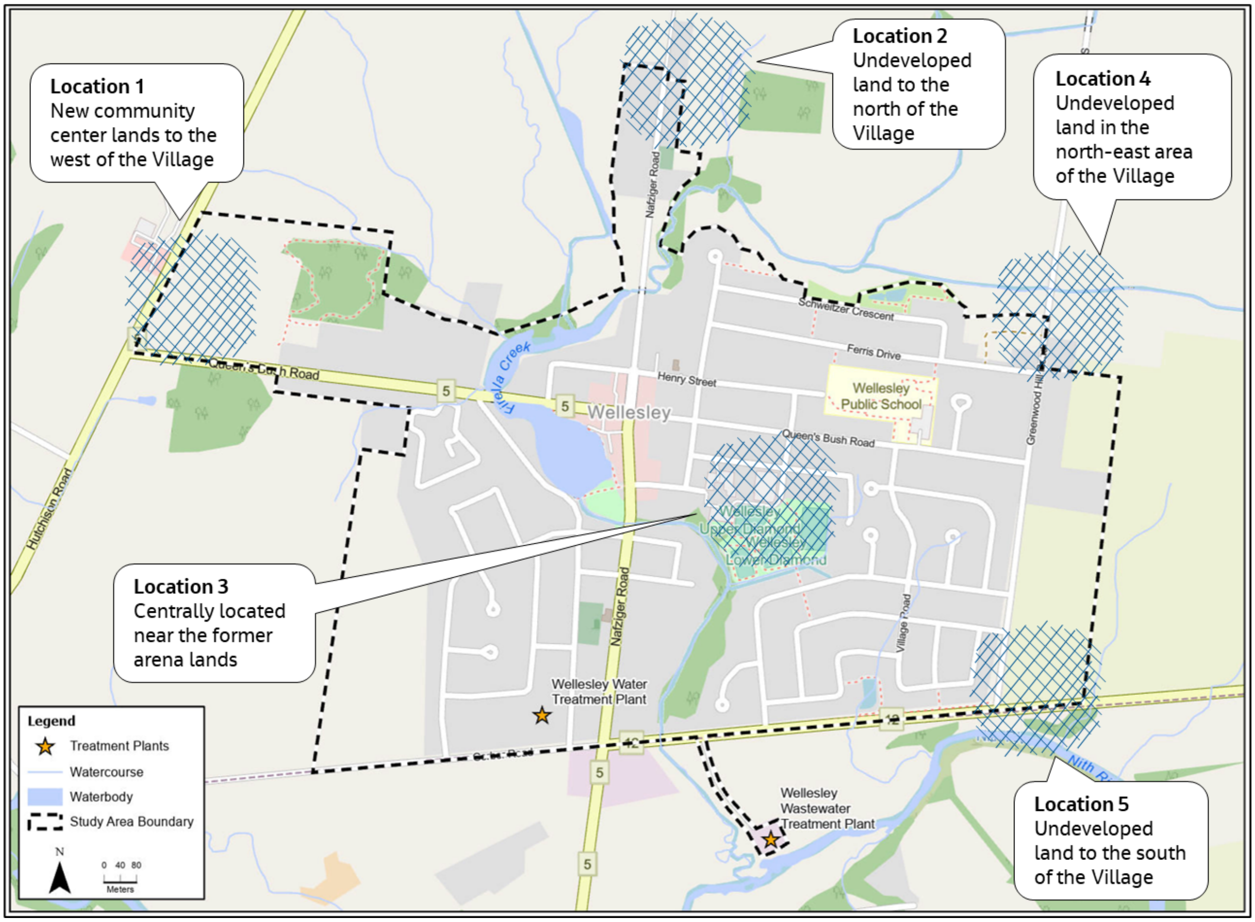
For Alternative 2, the design basis is altered slightly. In this case, additional storage for fire, emergency and equalization demand can be provided through the floating storage, reserving the reservoir volume for primary disinfection. The maximum flow rate for primary disinfection would be equal to the MDD as fire flow would no longer be provided from the reservoir. To be conservative, the PHD was carried as the maximum flow condition for primary disinfection, resulting in a recommended CT volume of 145 m^3. Both the new floating storage and the remaining 758 m^3 of useful volume in the reservoir can be used to meet the fire, equalization, and emergency treated water storage needs. The remaining 1,447 m^3 would be provided by floating storage to meet the total treated water storage needs. The pump station would no longer be needed for pumping fire flow. The existing pump station capacity is sufficient to meet the future MDD and PHD, therefore, no upgrade is needed. Additional information is provided in TM3.

The short-listed alternative for the future disinfection and water pumping and storage constraints includes construction of floating storage, such as an elevated tank. A list of potential locations for the floating storage was developed, including the following general locations:

1. Bill Gies Recreation Centre lands to the west of the Village
2. Undeveloped land to the north of the Village
3. Centrally located near the former arena lands
4. Undeveloped land in the north-east area of the Village
5. Developed land to the south of the Village

These potential floating storage (elevated tank) locations are shown in Figure 7-1. All five locations were considered feasible alternatives and were carried forward for detailed evaluation.

Figure 7-1. Floating Storage Alternative Locations



7.1.3 Fire Flow

The alternatives for addressing fire flow are consistent with the alternatives for future disinfection and water storage needs presented in Section 7.1.2. The total Fire flow available (FFA) is limited by the practical capacity of the existing water distribution system. As described in Section 4.3.2, it is understood that, within the planning horizon, any additional fire flow needed beyond the distribution system capacity limits can be provided through the fire department's own supply and delivered via tanker trucks, consistent with the current practice. However, when the anticipated future development within Wellesley is undertaken, there may be additional requirements for improvements to the water distribution system that would provide additional value in regard to servicing. The following watermain upgrades are recommended, based on modelling results carried out under the WWWMP, to be further investigated for implementation as additional planning information is made available to the Region in regard to the anticipated future development:

- **Residential Fire Flow Needs**. The needs for residential fire flow were identified where FFA is less than 75 L/s. These correspond to watermain dead-ends ranging in size from 50 mm to 100 mm in diameter (Pond View Drive dead-end and Village Place). These dead-end watermains should be upgraded to a size of 150 mm in diameter. By doing so, the FFA increases to 110 L/s, according to the modelling results.

- **ICI Fire Flow Needs.** The needs for ICI fire flow were identified where FFA is less than 175 L/s. It is recommended that the 200 mm diameter watermain on Queen's Bush Road from David Street (approximately 510 m in length) be upgraded to 250 mm diameter for better efficiency and service for the proposed water tower near the Bill Gies Recreation Centre located at Queen's Bush Road and Hutchison Road. The proposed water tower provides enough FFA to meet the requirements for the Bill Gies Recreation Centre due to its close proximity. However, to meet the fire flow required for the other ICI locations evaluated, upgrading the 200 mm diameter watermain on Queen's Bush Road from Nafziger Road to the Bill Gies Recreation Centre (approximately 900 m in length) to 300 mm diameter is required.
- Based on the additional planning information that is made available to the Region in regard to the anticipated future development, other watermain upgrades that may provide additional distribution needs should also be further investigated for implementation through additional hydraulic modelling.

7.2 Wastewater System Alternatives

7.2.1 Wastewater Collection System

A long list of alternative concepts was developed to mitigate the flow constraints within the Wellesley wastewater collection system. The long-list of collection system alternative concepts were then screened based on feasibility. The long-list of collection system alternative concepts and the results of the screening are provided in TM4 in Appendix B. The wastewater collection system concepts passing the screening include the following:

- I/I reduction (downspout disconnection, foundation drain disconnection, sewer lining, cross-connection disconnection)
- WTP Backwash Mitigation
- Pipe Upsizing or Twinning
- Offline Storage (concept considered for the Firella Creek Trunk Sewer)
- New Trunk/Sub-Trunk Sewer (concept considered for the local sewers)

It is expected that source control concepts such as I/I reduction and WTP backwash mitigation will need to be paired with infrastructure upgrades to be a viable solution to the constraints. Combinations of concepts have been identified to comprise the short-list of alternatives. Alternatives were grouped into alternatives to address the Firella Creek Trunk Sewer needs (Group A), and alternatives to address the local sewer needs (Group B).

The following short-listed alternatives are alternatives to address the Firella Creek Trunk Sewer needs:

1. **Group A -Alternative 1.** Do nothing and maintain status quo (included as a means of comparison).
2. **Group A -Alternative 2.** Implement I/I reduction measures, WTP backwash mitigation measures, offline storage locations to equalize flows along the Firella Creek Trunk Sewers.
3. **Group A -Alternative 3.** Implement I/I reduction measures, WTP backwash mitigation measures, upsize or twin Firella Creek Trunk Sewer.

The key difference between Alternative 2 and Alternative 3 is that Alternative 2 will store the flows within the collection system to avoid upsizing the Firella Creek Trunk Sewer and avoiding or reducing the need for subsequent upgrades at the WWTP Influent PS (or Equalization Tank), whereas Alternative 3 will involve upsizing the Firella Creek Trunk Sewer and upsizing the WWTP Influent PS (and Equalization Tank). It is important to note that raw wastewater pumping and storage considerations at the WWTP will be evaluated under the wastewater treatment alternatives. However, the evaluation of the Firella Creek Trunk Sewer alternatives and wastewater treatment alternatives has been integrated since these alternatives are interconnected. The integration involves an assessment of the impacts of Group A alternatives on the influent pumping station alternatives and what set of alternatives collectively represent the most benefit.

The following short-listed alternatives are alternatives to address the local sewer needs:

1. **Group B -Alternative 1.** Do nothing and maintain status quo (included as a means of comparison).
2. **Group B -Alternative 2.** Implement I/I reduction measures, pipe capacity increases as necessary for local sewers.
3. **Group B -Alternative 3.** Implement I/I reduction measures, new trunk/sub-trunk sewers to collect flows from future developments on the east and west extents of the study area, pipe capacity increases as necessary for local sewers.

Details depicting the Group A and Group B Wastewater Collection System alternatives are provided in TM5 in Appendix B.

7.2.2 Wastewater Treatment

Alternative solutions were developed and screened for each major unit process requiring a capacity upgrade/expansion for the planning horizon (raw wastewater pumping, screening, secondary treatment, sludge storage, and tertiary filtration). The alternatives are generally:

1. Replace the existing process or equipment with larger capacity units
2. Construct/install additional process tanks or equipment of the same technology to increase capacity, and
3. Implement an alternative technology/approach to increase capacity.

As noted in Section 7.2.1, the alternatives for the Firella Creek Trunk Sewer and the wastewater treatment plant alternatives are interconnected. The wastewater treatment alternatives were developed on the assumption that storage within the collection system would not be implemented, and flow equalization would be required at the Wellesley WWTP.

In addition to the main unit processes, the blowers and chemical phosphorus removal metering pumps need to be upgraded/replaced to provide capacity for the planning period. The Region conducted a separate study in 2023 to identify the preferred approach to upgrade the existing blower system (Region of Waterloo, 2024a). As such, alternative solutions for the blower system were not developed and evaluated in the Wellesley WWWMP. The existing chemical metering pumps can be replaced with larger capacity units when they reach the end of their useful service life or when additional capacity is required (whichever occurs first). Based on current projections it is anticipated that the capacity of the chemical metering pumps will be exceeded between 2031 and 2036.

The long list wastewater treatment alternatives were screened based on the following criteria:

1. Ability to meet future demand and increase in population (Year 2051)
2. Implementation complexity and how the alternative can be implemented at Wellesley WWTP without significant constraints

The long-list of alternatives for each unit process, the advantages and disadvantages for each, and the results of the screening are provided in TM4 in Appendix B. The short-listed alternatives for the Wellesley WWTP include the following:

- Raw wastewater pumping:
  - Alternative 1: Do Nothing
  - Alternative 2: Replace existing duty/standby pumps with larger capacity pumps and construction of equalization tank, which would provide storage for flows in excess of the future peak hourly flow capacity considering a peak hour/instantaneous factor of 4.0 (i.e., flows in excess of 5,370 m^3/d) during wet weather events.
  - Alternative 3: Construct a new pump station/equalization tank. and construction of equalization tank.
- Headworks:
  - Alternative 1: Do Nothing
  - Alternative 2: Replace existing screen to increase capacity
  - Alternative 3: Construct a new headworks facility
- Secondary treatment:
  - Alternative 1: Do Nothing
  - Alternative 2: New Secondary Treatment Plant Construction
  - Alternative 3: Implement an alternative process intensification technology into Plants 1 and 2 (Densification with aerobic granular sludge [AGS] or membrane aerated biofilm reactor [MABR])
  - Alternative 4: Implement a wet weather management technology (such as cloth media filtration) to handle flows exceeding secondary treatment peak capacity
- Sludge storage:
  - Alternative 1: Do Nothing
  - Alternative 2: Replace existing storage tank with a new larger storage tank
  - Alternative 3: Construct a second storage tank
- Tertiary filtration:
  - Alternative 1: Do nothing and use the redundant filter to handle flows exceeding 4,400 m^3/d
  - Alternative 2: Expand existing tertiary filtration process with additional filter(s)

Note that the above alternatives will be evaluated against the “Do Nothing” alternative (included as a means of comparison).

8. Assessment of Alternatives

Section 8 assesses the alternatives developed in the previous section through a set of evaluation criteria to find the preferred solution.

8.1 Summary of Evaluation Criteria

The alternatives were evaluated based on relative benefit/impact on criteria from the following categories: Environmental, Social, Technical and Financial. The evaluation criteria are presented in Table 8-1. Alternatives were assigned a score according to a performance scale ranging from very well aligned with criteria to low alignment with criteria. The performance scale is presented in Table 8-2. Following the alternative scoring, each criteria category was weighted equally to calculate an overall scoring for each alternative. A sensitivity analysis using the category weightings described in Table 8-3 was also completed to determine the impact different category weightings have on the evaluation outcome and ultimately assess the robustness of the alternative. The full methodology is described in TM2: in Appendix B.

Table 8-1. Evaluation Criteria

Category	Criteria	Description
Environmental	Protects environmental features	Impact of alternative on environmental features including natural areas, designated ANSI, Wetlands, Designated PSWs, and other project specific defined environmental features.
Environmental	Protects wildlife and species at risk	Impact of alternative on wildlife and wildlife habitat, including birds, fish, herptiles, mammals, and insects and any other project specific defined wildlife and their project specific habitats.
Environmental	Protects groundwater, streams and river	Impact of alternative on groundwater quantity and quality, surface water quantity and quality and fluvial geomorphic function of streams and rivers.
Environmental	Minimizes climate change impacts	Impact of alternative on climate scale temperature, wind, precipitation and any other project specific climate scale. Measured through qualitative estimates of relative greenhouse gas(GHG) emissions.
Social	Minimizes impacts to residents related to noise, odour, traffic, and aesthetics.	Impact of alternative over long term on the levels of noise, odour, traffic, and aesthetics in the study area.
Social	Minimizes impacts to businesses	Impact of alternative on long term business operations related to closures, access, and any other project specific disturbances.

Category	Criteria	Description
Social	Manages and minimizes construction impacts	Impact of alternative on short term business operations during construction related to closures, access, and including noise, traffic, environment and any other project specific disturbances.
Social	Conserves known of potential built heritage resources and/or cultural heritage landscapes	Impact of alternative to properties of known or potential cultural heritage value or interest.
Social	Conserves archaeological resources	Impact of alternative on areas of archaeological potential or archaeological resources.
Social	Protects health and safety	Impact of alternative over short term during construction and long term on health and safety of construction and operations personnel and the public.
Technical	Provides reliable service	Resilience of the alternative to impacts from natural and man-made disturbances.
Technical	Meets existing and future needs	Ability of the alternative to meet the existing and future needs as defined by the problem and opportunity statement.
Technical	Aligns with existing and planned infrastructure	Alignment of the alternative with existing infrastructure in terms of integration and operations and ability to accommodate future upgrades to meet projected needs.
Technical	Aligns with existing and future land use	Ability of the impact to accommodate future anticipated land uses.
Technical	Aligns with approval and permitting process	Ability of the alternative to receive permitting and approvals
Technical	Manages and minimizes construction risks	Ability of the alternative to avoid technical risks and adhere to constructability requirements.
Technical	Ability to adapt to climate change	Resilience of the alternative to changes in climate related factors including temperature, wind, precipitation and any other project defined specific climate factors.
Financial	Requires low lifecycle costs	Alternative cost comparison on life cycle costs, which considers construction costs and ongoing operation and maintenance costs over an extended period of time.

Table 8-2. Performance Scale

Rating	Description
5	Very well aligned with criteria
4	Well aligned with criteria
3	Somewhat aligned with criteria
2	Not well aligned with criteria
1	Low alignment with criteria

Table 8-3. Proposed Evaluation Weighting Approaches

Category	Even Weighting	Excluding Cost	High Social	High Environmental	High Technical
Technical	25%	33%	20%	20%	40%
Environmental	25%	33%	20%	40%	20%
Social	25%	33%	40%	20%	20%
Financial	25%	0%	20%	20%	20%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

8.2 Evaluation of Alternative Solutions

This section evaluates the alternatives using the criteria and weighting scheme presented in Section 8.1.

8.2.1 Well Capacity Alternatives Evaluation

As described in Section 7.1.1, the short-listed alternatives to address well capacity needs include the following:

1. Do Nothing (kept as a baseline) – Maintain existing well supply.
2. Increase Existing Well Supply – Explore additional water taking from existing production wells.
3. Supplement Existing Wells with New Well Supply – Maintain existing well supply and supplement with a new well that is pumped to the WTP. This alternative is split into the following sub-alternatives:
    a. Alternative 3A: the new well is to be constructed within the urban boundary, with the watermain connection crossing through the downtown section of the Village.

   b. Alternative 3B: the new well is to be constructed at a new site located outside the urban boundary near the south-east end of the Village with a watermain connection that would not cross through the downtown section of the Village.

4. Supplement Existing Wellesley Water System with External Supply – Maintain existing well supply and provide additional treated water supply from another drinking water system such as the IUS.

The well capacity alternatives scoring against the evaluation criteria is summarized in Table 8-4. Detailed scoring and scoring rationales are included in TM5 in Appendix B.

Alternative 2: Increase Existing Well Supply consistently ranked first throughout all five weighting approaches. In general, this alternative outperformed the others in the environmental, social, and financial categories. Increasing the existing well supply would be the least disruptive to the environment and surrounding community as no construction would be required. Costs would also be significantly lower as the existing assets could continue to be used without any new construction. There is uncertainty, however, regarding the ability to acquire MECP approvals for increasing the existing well supply because the potential impact to groundwater quantity and quality from increasing the water taking rate has not yet been studied adequately.

In the technical criteria, Alternative 2 generally scored lower, because although it would be able to meet the future capacity needs, it does not provide the same level of redundancy and resiliency as the other alternatives. Alternatives 3A and 3B would involve developing a new well source which would provide further redundancy over the three existing wells. Alternative 4 would greatly improve resiliency as it involves connecting a completely redundant and independent treated water supply. Whereas Alternative 2 only provides the same level of redundancy as the existing operations.

Alternative 3B: Supplement Existing with New Well Supply (Outside Urban Boundary) consistently ranked second throughout all five weighting approaches, followed by Alternative 3A: Supplement Existing with New Well Supply (Inside Urban Boundary) which was ranked third. Alternatives 3A and 3B generally outperformed Alternative 4 in the environmental and financial categories. The construction scope for Alternative 4 is significantly more disruptive than Alternatives 3A and 3B as it impacts a much larger area and there are many unknowns as the majority of construction would occur outside of the study area for the WWWMP. An impacts assessment would be required to determine any potential impacts to environmental features, wildlife and habitats, groundwater, surface water and fluvial geomorphic function.

Alternative 1: Do Nothing and Alternative 4: Supplement Existing with External Supply both generally performed poorly in comparison to the other alternatives. Alternative 1 was eliminated in the long-list screening in TM3 but carried forward as a comparative baseline. This alternative would not meet the projected capacity needs. Alternative 4 was more expensive compared to the other alternatives despite performing well in the technical and social categories.

A sensitivity analysis was completed, and the results are shown in TM5 in Appendix B. The sensitivity analysis shows the impact of different weighting approaches on the scores and preferred alternative. Regardless of weighting approach, Alternative 2: Increase Existing Well Supply consistently scored highest and is the first ranked alternative. Alternative 3B: Supplement Existing with New Well Supply (Outside Urban Boundary) was consistently ranked as the second alternative throughout all five weighting approaches, followed by Alternative 3A: Supplement Existing with New Well Supply (Inside Urban Boundary) which was consistently ranked third. Alternative 1: Do Nothing and Alternative 4: Supplement Existing with External Supply were both ranked either fourth or fifth throughout the five weighting approaches. These results indicate Alternative 2: Increase Existing Well Supply is the clear preferred alternative. Alternative 3B: Supplement Existing with New Well Supply (Outside Urban Boundary) is the next preferred alternative, followed by Alternative 3A: Supplement Existing with New Well Supply (Inside Urban Boundary). Both Alternative 1: Do Nothing and Alternative 4: Supplement Existing with External Supply are equally the least preferred alternatives.

Based on the overall evaluation rankings, Alternative 2: Increase Existing Well Supply is the preliminary preferred alternative to address future well capacity constraints. This alternative is preferred, however, subject to further hydrogeological study. Overall, Alternative 3B: Supplement Existing with New Well Supply (Outside Urban Boundary) ranked very similarly to Alternative 2 and is recommended to be considered as a preferred alternative should the hydrogeological study on Alternative 2 provide negative results. Therefore, the recommended preliminary preferred alternative that can be taken forward for further study and selection includes both Alternative 2: Increase Existing Well Supply, and Alternative 3B: Supplement Existing with New Well Supply (Outside Urban Boundary).

Table 8-4. Well Capacity Alternatives Scoring Summary

Average Score or Rank	**Alternative 1: Do Nothing**	**Alternative 2: Increase Existing Well Supply**	**Alternative 3A: Supplement Existing with New Well Supply (Inside Urban Boundary)**	**Alternative 3B: Supplement Existing with New Well Supply (Outside Urban Boundary)**	**Alternative 4: Supplement Existing with External Supply**
Environmental Criteria Category	Very well aligned with criteria	Very well aligned with criteria	Well aligned with criteria	Well aligned with criteria	Somewhat aligned with criteria
Social Criteria Category	Somewhat aligned with criteria	Very well aligned with criteria	Somewhat aligned with criteria	Well aligned with criteria	Well aligned with criteria
Technical Criteria Category	Not well aligned with criteria	Well aligned with criteria	Well aligned with criteria	Well aligned with criteria	Well aligned with criteria
Financial Criteria Category	Very well aligned with criteria	Very well aligned with criteria	Well aligned with criteria	Well aligned with criteria	Low alignment with criteria
Even Weighting Approach Overall Average	Well aligned with criteria	Very well aligned with criteria	Well aligned with criteria	Well aligned with criteria	Somewhat aligned with criteria
Even Weighting Approach Rank	**4**	**1**	**3**	**2**	**5**

Legend:

Very well aligned with criteria

Well aligned with criteria

Somewhat aligned with criteria

Not well aligned with criteria

Low alignment with criteria

8.2.2 Water Distribution and Storage Alternatives Evaluation

Detailed evaluation between Alternative 1: Do Nothing and Alternative 2: New Storage Offsite was not completed as Alternative 1 is incompatible with the future disinfection, water pumping and storage needs. Only Alternative 2: New Storage Off-Site, will meet the future needs. Evaluation was instead completed for the floating storage location alternatives. The five potential floating storage locations are shown in Figure 7-1 in Section 7.1.2 and described as follows:

1. Bill Gies Recreation Centre lands to the west of the Village
2. Undeveloped land to the north of the Village
3. Centrally located near the former arena lands
4. Undeveloped land in the north-east area of the Village
5. Developed land to the south of the Village

The evaluation of the floating storage locations is summarized in Table 8-5. Refer to Appendix B for the full rationale and scoring breakdown. For the purposes of evaluation and design concept development, it is assumed the floating storage would be in the form of an elevated tank.

Table 8-5. Floating Storage Location Alternatives Scoring Summary

Category	Location 1	Location 2	Location 3	Location 4	Location 5
Environmental Criteria Category	Well aligned	Somewhat aligned	Very well aligned	Well aligned	Somewhat aligned
Social Criteria Category	Very well aligned	Somewhat aligned	Not well aligned	Somewhat aligned	Somewhat aligned
Technical Criteria Category	Somewhat aligned	Somewhat aligned	Very well aligned	Well aligned	Well aligned
Financial Criteria Category	Very well aligned	Very well aligned	Not well aligned	Somewhat aligned	Low alignment
Even Weighting Approach Overall Average	Well aligned	Well aligned	Somewhat aligned	Well aligned	Somewhat aligned
Even Weighting Approach Rank	**1**	**2**	**4**	**3**	**5**

Legend:

- Very well aligned with criteria
- Well aligned with criteria
- Somewhat aligned with criteria
- Not well aligned with criteria
- Low alignment with criteria

Locations 1 and 3 were preferred under the environmental criteria. The locations were compared against the natural environment features identified in TM-1 which included various wooded areas within and surrounding the study area, wetlands to the west of the study area, and major water bodies including Firella Creek crossing through the center of the study area and the Nith River to the south of the study area. Locations 1 and 3 were relatively isolated from existing wooded areas, wetlands and water bodies compared to the other locations and the elevated tank could be located well away from any known features to mitigate impacts. Location 2 to the north of the Village is near an existing wooded area and Firella Creek. Location 4 to the north-east of the Village is near the floodplain of the Stroh drain. Location 5 to the south of the Village is near the Nith River. An impacts assessment would be required regardless of the preferred location, however it is possible additional mitigation measures may be required for the locations closer to identified environmental features.

Location 1 was generally preferred in the social criteria while Location 3 was least preferrable. Location 3 is the most central and would therefore cause a more noticeable change to community aesthetics and short-term impacts during construction due to traffic, noise, or odour. Location 1 is located further from the developed residential and commercial areas and would therefore have a less disruptive impact on current residents. For archaeology and cultural heritage, scoring was based on the findings from the Stage 1 Archaeology Baseline Conditions report completed by Archaeological Services Inc. (ASI) in 2023 (ASI, April 2023), and the Cultural Heritage desktop review completed by ASI in 2023 (ASI, February 2023) and verified following the completion of the Stage 1 Archaeological Assessment (ASI, 2025) and Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment (ASI, 2025). All of the potential locations are adjacent to or intersect with an area of archaeological potential. Locations 2, and 3 are located near or within cultural heritage landscapes or known or potential built heritage resources. The Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment (ASI, 2025) indicated that Location 4 would result in a direct adverse impact to a Cultural Heritage Landscape (CHL).

Hydraulic modelling was completed to evaluate the locations from a technical perspective. For the purposes of evaluation, no watermain upgrades were assumed. Modelling was developed for each potential location for both the current (2021) and future (2051) conditions with the following assumptions:

- Two existing 60 L/s pumps not in operation
- No watermain upgrades compared to existing system
- Demand equal to the sum of MDD and fire flow (FF)
- System pressures did not change significantly with the elevated tank location. The main factor considered for scoring was FF availability based on the following for different property types:
- The availability to meet industrial/commercial/institutional (ICI) FF of 175 L/s.
- The availability to meet residential FF of 125 L/s as minimum preferred.
- The availability to meet residential FF of 75 L/s as minimum acceptable.

Location 3 was preferred from a technical perspective. With the ET in Location 3, the distribution system model was able to meet the FF conditions for approximately 89 percent of ICI nodes and 91 percent of residential nodes. Location 4 was ranked second as in this case the FF conditions were met at 78 percent of ICI nodes and 86 percent of residential nodes. The full results for 2051 are presented in Table 8-6.

From a financial perspective, the alternatives were ranked based on the relative capital cost. Capital costs are preliminary and were scaled based on the expected height of the elevated tank in each location and exclude land acquisition costs. Geotechnical properties were not taken into consideration. Additional investigative studies would be needed for the preferred location to develop an accurate estimate of cost. This TM only includes equipment costs and some civil works for the preferred location. Locations 1 and 2 were the most preferred from a financial perspective while Location 5 was the least preferred.

A sensitivity analysis was completed on the elevated tank locations (TM5 in Appendix B). The sensitivity analysis shows the impact of different weighting approaches on the scores and preferred alternative. Location 1 scored highest in four of the five weighting approaches and is the first ranked alternative. Location 1 was preferable in the financial and social criteria as it is located further from the developed residential and commercial areas and would therefore have a less disruptive impact. Location 1 scored relatively low in the technical category as the location is more isolated and would need to rely more on the fire department's supply to meet fire flow needs for both residential and ICI properties at several nodes in the distribution system. Location 3 performed poorly under the social criteria as it is the most central location and would therefore cause a more noticeable change to community aesthetics and short-term impacts during construction due to traffic, noise, or odour. Location 4 performed poorly under the social criteria since it would result in a direct adverse impact to a CHL. Location 2 had an average score in most criteria other than financial. Location 5 ranked lowest in four of the five weighting approaches. The results of the sensitivity analysis indicate Location 1 is the preferred alternative.

Location 1 in the Bill Geis Recreation Centre lands ranked first in four of the five weighting approaches and is the preferred location for the new elevated tank.

Table 8-6. Distribution System Modelling Performance for Providing 2051 Fire Demand

Performance [a]	**Location 1**	**Location 2**	**Location 3**	**Location 4**	**Location 5**
Percent of ICI Nodes above 175 L/s	11	44	89	78	56
Percent of Residential Nodes above 125 L/s	11	65	91	86	90
Percent of Residential Nodes above 75 L/s	96	99	99	99	99

Notes:

[a] Results are based on a new watermain addition from the elevated tank location to connect to the existing distribution system but excludes upgrades to the existing distribution system.

8.2.3 Wastewater Collections and Conveyance Alternatives Evaluation

This section evaluates the wastewater collections and conveyance alternatives using the criteria and weighting scheme presented in Section 8.1.

8.2.3.1 Group A – Firella Creek Trunk Sewer Alternatives Evaluation

As described in Section 7.2.1, the short-listed alternatives to address the Firella Creek Trunk Sewer needs (Group A Wastewater Collections Alternatives) include the following:

1. **Group A -Alternative 1.** Do nothing and maintain status quo (included as a means of comparison).
2. **Group A -Alternative 2.** Implement I/I reduction measures, WTP backwash mitigation measures, offline storage locations to equalize flows along the Firella Creek Trunk Sewers.
3. **Group A -Alternative 3.** Implement I/I reduction measures, WTP backwash mitigation measures, upsize or twin Firella Creek Trunk Sewer.

The alternative scoring for the Group A Wastewater Collections Alternatives is summarized in Table 8-7. Detailed scoring and scoring rationales are included in TM5 in Appendix B. Because the future collection system peak flow rates received at the WWTP are directly related to the Firella Creek Trunk Sewer alternatives, the alternatives for the influent pumping station at the WWTP were considered in conjunction with the determination of the Group A preferred alternative.

Alternative 1: Do Nothing, scored low under environmental and technical criteria relative to the other alternatives. This is primarily because doing nothing would result in a high risk of basement and surface flooding. Flooding to surface would result in the direct flow of sanitary sewerage into Firella Creek, which would consequently have wildlife impacts and represents a risk of groundwater contamination. Alternative 1 is not able to accommodate growth since the trunk sewer is already constrained under existing wet weather flow conditions. This alternative scored high under social criteria mainly due to construction not being required. No construction minimizes impacts to businesses, archaeological resources, built heritage and cultural heritage landscapes, and impacts to traffic and aesthetics. However, this alternative does pose a health and safety risk due to the high risk of basement and surface flooding during wet weather events. Alternative 1 scored moderately high under economic criteria because there is no capital cost associated with this alternative, however operation and maintenance costs are expected to increase as a result of aging infrastructure.

Alternative 2: Implement I/I reduction measures, WTP backwash mitigation measures, offline storage locations to equalize flows along the Firella Creek Trunk Sewers, scored higher than Alternative 1 and lower than Alternative 3: Implement I/I reduction measures, WTP backwash mitigation measures, upsize or twin Firella Creek Trunk Sewer, overall. Although Alternative 2 reduces the risk of basement flooding and surcharging to surface, implementing this alternative would require a large footprint with potential impacts on nearby woodlots. This alternative would also require pumping and periodic flushing, which would increase greenhouse gas emissions compared to existing conditions. This alternative scored lowest under the social criteria largely due to the potential risk of odour generation from offline storage tanks and due to the impact the tanks could potentially have on community aesthetics. Due to the large volume of storage required (approximately 5,000 m^3), this alternative would reduce the impact of peak flows at the WWTP and also reduce the need for flow equalization upgrades of the influent pumping station. Two offline storage tanks would, however, require land acquisition. Additionally, the offline storage tanks do not align with the current operating practices within the Village, and would require considerable operation and maintenance effort over and above normal practices. The capital cost would be lower compared to Alternative 3, however the ongoing operation and maintenance costs would be higher than Alternative 3.

Alternative 3: Implement I/I reduction measures, WTP backwash mitigation measures, upsize or twin Firella Creek Trunk Sewer, is the preferred Group A alternative. Compared to Alternative 1, Alternative 3 reduces the risk of basement and surface flooding which reduces the risk of impact to the environment and public health and safety. This alternative is compatible with existing infrastructure and the existing operating practices and does not require land acquisition. Although this alternative requires one creek crossing, the impacts on Firella Creek can be mitigated during construction. Alternative 3 is expected to have a high capital cost relative to Alternative 1 and Alternative 2, but a relatively low operations and maintenance cost. Alternative 3 does not reduce the impact of peak flows at the WWTP but managing the additional flows at the plant was deemed to be a better option than Alternative 2, which stores peak flows off-line, because of the need for land acquisition, the implementation of new operation and maintenance practices and the increase in ongoing operation and maintenance costs associated with that alternative. Alternative 3 scored higher than Alternative 1 and Alternative 2 under the environmental, social, and technical criteria categories, and scored highest overall.

Table 8-7. Firella Creek Trunk Sewer Alternatives Scoring Summary

Category	Alternative 1	Alternative 2	Alternative 3
Environmental Criteria Category	▼	▲▼	▲
Social Criteria Category	▲	▲	▲
Technical Criteria Category	▲▼	▲▼	▲
Financial Criteria Category	▲▼	▼	▼
Even Weighting Approach Overall Average	▲▼	▲▼	▲
Even Weighting Approach Rank	**3**	**2**	**1**

Legend:

▲ Well aligned with criteria

▲▼ Somewhat aligned with criteria

▼ Not well aligned with criteria

8.2.3.2 Group B - Local Sewer Constraints Alternatives Evaluation

As described in Section 7.2.1, the short-listed alternatives to address the local sewer needs (Group B Wastewater Collections Alternatives) include the following:

1. **Group B -Alternative 1.** Do nothing and maintain status quo (included as a means of comparison).
2. **Group B -Alternative 2.** Implement I/I reduction measures, pipe capacity increases as necessary for local sewers.
3. **Group B -Alternative 3.** Implement I/I reduction measures, new trunk/sub-trunk sewers to collect flows from future developments on the east and west extents of the study area, pipe capacity increases as necessary for local sewers.

The alternative scoring for the Group B Local Sewer Constraints Alternatives is summarized in Table 8-8. Detailed scoring and scoring rationales are included in TM5 in Appendix B.

Alternative 1: Do Nothing, scored low under environmental and technical criteria relative to the other alternatives. This is primarily because doing nothing would result in a high risk of basement and surface flooding. Flooding to surface could result in direct contamination of the watercourses running through the study area, which would consequently have wildlife impacts and risk of groundwater contamination. Alternative 1 is not able to accommodate growth since the local sewers are already constrained under existing wet weather flow conditions. This alternative scored high under social criteria mainly due to construction not being required. No construction minimizes impacts to businesses, archaeological resources, built heritage and cultural heritage landscapes, and impacts to traffic and aesthetics. However, this alternative does pose a health and safety risk due to the high risk of basement and surface flooding during wet weather events. Alternative 1 scored moderately high under economic criteria because there is no capital cost associated with this alternative, however operation and maintenance costs are expected to increase as a result of aging infrastructure.

Alternative 3: Implement I/I reduction measures, new trunk/sub-trunk sewers to collect flows from future developments on the east and west extents of the study area, pipe capacity increases as necessary for local sewers, scored similarly to Alternative 1 overall. Although Alternative 3 reduces the risk of basement flooding and surcharging to surface, it involves five watercourse crossings where impacts will require mitigation measures during construction. This alternative requires construction within the ROW that will disrupt traffic and has the potential to disrupt businesses in the commercial and industrial area in the vicinity of Nafziger Road. This alternative also requires construction along main roads, including Geber Road, Greenwood Hill Road, and Nafziger Road, which will contribute to traffic disruption. Although Alternative 3 will reduce the length of local sewer upgrades required compared to Alternative 2: Implement I/I reduction measures, pipe capacity increases as necessary for local sewers, along Queens Bush Road, Parkview Drive, and Lawrence Street, local sewer upgrades will still be required. Alternative 3 will require a greater length of new or replaced piping compared to Alternative 2 and will therefore have a higher capital cost compared to Alternative 2. The operation and maintenance cost for Alternative 3 will also be higher than Alternative 2 due to the additional assets added.

Alternative 2: Implement I/I reduction measures, pipe capacity increases as necessary for local sewers is the preferred Group B alternative. This alternative reduces the risk of basement and surface flooding compared to Alternative 1 which reduces the risk of impact to the environment and public health and safety. Alternative 2 includes three watercourse crossings where impacts will require mitigation measures during construction. This alternative is compatible with existing infrastructure and the existing operating regime and does not require land acquisition. This alternative requires construction within the ROW that will disrupt traffic and has the potential to disrupt businesses in the commercial and industrial area in the vicinity of Nafziger Road. Relatively small stretches of construction is required along main roads (Geber Road and Nafziger Road) which will impact traffic. Alternative 2 is expected to have a moderate capital cost relative to Alternative 1 and Alternative 3, and a relatively low operations and maintenance cost. Alternative 3 scored higher than Alternative 1 and Alternative 2 under the environmental and technical criteria categories, and scored highest overall.

The analysis of results was completed without accounting for and quantifying potential I/I reduction. However, it is recommended that I/I reduction strategies be investigated further prior to implementing any infrastructure upgrades.

Table 8-8. Local Sewer Constraints Alternatives Scoring Summary

Category	Alternative 1	Alternative 2	Alternative 3
Environmental Criteria Category	Not well aligned	Well aligned	Well aligned
Social Criteria Category	Well aligned	Well aligned	Somewhat aligned
Technical Criteria Category	Somewhat aligned	Well aligned	Well aligned
Financial Criteria Category	Somewhat aligned	Not well aligned	Low alignment
Even Weighting Approach Overall Average	Somewhat aligned	Well aligned	Somewhat aligned
Even Weighting Approach Rank	**3**	**1**	**2**

Legend:

Well aligned with criteria

Somewhat aligned with criteria

Not well aligned with criteria

Low alignment with criteria

8.2.4 Wastewater Treatment Alternatives Evaluation

This section evaluates the wastewater treatment alternatives using the criteria and weighting scheme presented in Section 8.1.

8.2.4.1 Influent Pumping

As described in Section 7.2.2, the short-listed alternatives to address influent pumping needs include:

- Alternative 1: Do Nothing
- Alternative 2: Replace existing duty/standby pumps with larger capacity pumps and construction of equalization tank.
- Alternative 3: Construct a new pump station and construct an equalization tank.

The evaluation criteria methodology summarized in Section 8.1 was used to assess the shortlisted alternatives for the influent pumping process. A summary of the alternative scoring is included in Table 8-9. Detailed scoring and scoring rationales are included in TM5 in Appendix B. The influent pump station alternatives were considered in conjunction with the determination of the preferred Firella Creek Sanitary Trunk Sewer because of the impact of the trunk sewer alternatives on the peak flow rates received at the WWTP.

Except for the economic criteria, Alternative 1: Do Nothing, scored low under all evaluation criteria compared to other alternatives. This alternative would not provide sufficient capacity for future flows and would result in a high risk of overloading the sewer system, resulting in potential basement and surface flooding. Flooding would contribute to wildlife impacts, groundwater contamination and potential climate change due to GHG emissions. Potential flooding events would negatively impact society due to the risk of increasing odour and traffic issues. Also, Alternative 1 would pose a risk to occupational health and safety due to odour and contamination issues.

Alternative 2: Replace Existing Pumps/Equalization Tank, scored higher than Alternative 1 and lower than Alternative 3: New Pump Station/ Equalization Tank, overall. Although Alternative 2 reduces the risk of surface flooding and minimizes the negative impacts on the environment and society compared to Alternative 1, it requires a large equalization tank. Given the limited space within the facility, the Region will need to purchase land in the rural area north of the existing administration building, resulting in an impact on agricultural land. This alternative could result in impacts on the surrounding wildlife and species due to locating the open equalization basis in the rural area. This alternative would require bypass pumping during construction with complex construction sequencing.

Alternative 3 scored the highest. Similar to Alternative 2, this alternative reduces the risk of surface flooding in the collection system and its associated impacts on the environment and society. Alternative 3 would also require a large equalization tank. However, construction is less complex for this alternative relative to Alternative 2. The existing pump station can remain in operation during the construction of the new pump station. Alternative 3 is expected to have a slightly high capital cost relative to Alternative 1 and Alternative 2 but a relatively lower operations and maintenance cost. Therefore, Alternative 3: New Pump Station/Equalization Tank is recommended for influent pumping. The equalization tank will provide storage for flows in excess of the future peak hourly flow capacity considering a peaking factor of 4.0 (i.e., flows in excess of 5,370 m^3/d) during wet weather events. This concept will be considered when developing concepts for downstream processes (i.e., secondary treatment and tertiary treatment) that are impacted by peak flows.

Table 8-9. Influent Pumping Alternatives Scoring Summary

Category	Alternative 1	Alternative 2	Alternative 3
Environmental Criteria Category	Not well aligned with criteria	Well aligned with criteria	Well aligned with criteria
Social Criteria Category	Well aligned with criteria	Well aligned with criteria	Very well aligned with criteria
Technical Criteria Category	Not well aligned with criteria	Well aligned with criteria	Very well aligned with criteria
Financial Criteria Category	Well aligned with criteria	Somewhat aligned with criteria	Somewhat aligned with criteria
Even Weighting Approach Overall Average	Somewhat aligned with criteria	Well aligned with criteria	Well aligned with criteria
Even Weighting Approach Rank	**3**	**2**	**1**

Legend:

- Very well aligned with criteria
- Well aligned with criteria
- Somewhat aligned with criteria
- Not well aligned with criteria

8.2.4.2 Headworks

As described in Section 7.2.2, the short-listed alternatives to address the needs for headworks include:

- Alternative 1: Do Nothing
- Alternative 2: Replace existing screen and retrofit channel to increase capacity
- Alternative 3: Construct a new headworks facility

The evaluation criteria methodology summarized in Section 8.1 was used to assess the shortlisted alternatives for the screening process. A summary of the alternative scoring is included in Table 8-10.

Detailed scoring and scoring rationales are included in TM5 in Appendix B.

Alternative 1: Do Nothing, scored low under all evaluation criteria compared to other alternatives. The increase in the required screening process capacity without screening expansion would result in deterioration in downstream processes performance, resulting in lower final effluent quality and potential risks for wildlife habitat and exceeding ECA limits associated with receiving water quality deterioration. Also, Alternative 1 would be associated with an increase in GHG emissions due to equipment aging and deterioration in secondary treatment performance. The increase in GHG emissions would negatively impact operator health and safety due to a greater risk of temperature increase and air pollution.

Alternative 2: Existing Screen Replacement scored higher than Alternative 1 and Alternative 3 overall. Alternative 2 scored high for environmental criteria due to the minimal impacts on environmental features and climate change. Compared to Alternative 3: Construction of New Headworks Facility, this alternative scored lower in the technical criterion mainly due to the interruption to the existing processes operation during construction stage. Economically, this alternative scored higher compared to Alternative 3.

Alternative 3 scored lower than Alternative 2 due to the higher lifecycle cost. Other than the economic criterion, this alternative scored either higher or comparable to Alternative 2.

Overall, Alternative 2: Existing Screen Replacement is recommended for the screening facility upgrade.

Table 8-10. Headworks Alternatives Scoring Summary

Category	Alternative 1	Alternative 2	Alternative 3
Environmental Criteria Category	Well aligned with criteria	Very well aligned with criteria	Very well aligned with criteria
Social Criteria Category	Well aligned with criteria	Very well aligned with criteria	Very well aligned with criteria
Technical Criteria Category	Not well aligned with criteria	Very well aligned with criteria	Very well aligned with criteria
Financial Criteria Category	Well aligned with criteria	Somewhat aligned with criteria	Not well aligned with criteria
Even Weighting Approach Overall Average	Well aligned with criteria	Well aligned with criteria	Well aligned with criteria
Even Weighting Approach Rank	**3**	**1**	**2**

Legend:

Very well aligned with criteria

Well aligned with criteria

Somewhat aligned with criteria

Not well aligned with criteria

8.2.4.3 Secondary Treatment

Secondary treatment needs are impacted by peak flows. As described in Section 8.2.4.1, the preferred Influent Pumping alternative is Alternative 3: Construct a new pump station/equalization tank. The equalization tank would be part of the plant's wet weather management strategy and provide storage for flows in excess of the future peak hourly flow capacity considering a peaking factor of 4.0 (i.e., flows in excess of 5,370 m^3/d) during wet weather events. The size of the equalization tank can be optimized and may be paired with wet weather management technology to handle excess flow, which will be confirmed as part of a Schedule C Class EA. Therefore, it is recommended that Alternative 4: Implement wet weather management technology be eliminated from further analysis under Secondary Treatment but be evaluated as part of an overall wet weather management strategy in conjunction with the equalization tank as part of a Schedule C Class EA.

After removing Alternative 4, the short-listed alternatives to address the needs for secondary treatment include:

- Alternative 1: Do Nothing
- Alternative 2: New Secondary Treatment Plant Construction
- Alternative 3: Implement an alternative process intensification technology into Plants 1 and 2 (Densification with AGS or MABR)

The key impact to secondary treatment concepts from implementing an upstream wet weather management strategy is for peak flows. Peak flows in excess of 5,370 m^3/d will be managed through a separate stream, so the secondary treatment alternatives were developed based on treating an AADF of 1,345 m^3/d and a PIF/PHF of 5,370 m^3/d as described in Section 5.4.1, and in conjunction with the loading projections presented in Section 5.4.2.

The evaluation criteria methodology summarized in Section 8.1 was used to assess the shortlisted alternatives for the secondary treatment process. A summary of the alternative scoring is included in Table 8-11. Detailed scoring and scoring rationales are included in TM5 in Appendix B.

Alternative 1: Do Nothing was carried forward for comparison purposes and generally received low scores compared to the other alternatives. This alternative would not meet the projected capacity needs and would have significant environmental, social and technical impacts.

Alternative 2: New Secondary Treatment Plant Construction received the highest scores in the social and technical criteria. The main disadvantage of this alternative is the large footprint relative to the other alternatives, increasing lifecycle cost. Therefore, it scored the lowest in the financial category. Excluding the financial category, Alternative 2 scored higher than the other alternatives.

Alternative 3: Existing Secondary Treatment Intensification, scored the highest overall but similarly to Alternative 2. Alternative 3 has the lowest lifecycle cost compared to other alternatives. However, excluding the financial category, this alternative scored lower compared to Alternative 1 and Alternative 2 due to the uncertainties associated with the reliability of this alternative. Incorporating emerging technology such as intensification with AGS or MABR would require additional process modelling and/or piloting to confirm capacity increase prior to obtaining approvals and permitting.

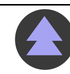
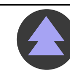
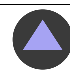
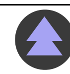
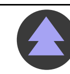
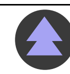
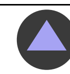
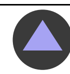
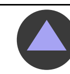
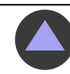
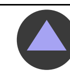
Therefore, a multi-step approach is recommended for secondary treatment with further evaluation as part of a Schedule C Class EA:

1. Complete additional process modelling and evaluation to confirm if process intensification is feasible to increase secondary treatment capacity at the Wellesley WWTP. The Region has successfully implemented MABR for process intensification at the Elmira WWTP and Hespeler WWTP to date. If process intensification is confirmed as a feasible strategy, proceed with implementation within the necessary timeframe.

2. If process intensification is confirmed as not feasible through the evaluation completed within the Schedule C Class EA, proceed with a secondary treatment expansion.

Both alternatives will be carried forward as potential preferred solutions as part of this Master Plan. Alternative 3: Secondary Treatment Expansion will be used for costing purposes, as it is the most conservative concept from a cost perspective.

Table 8-11. Secondary Treatment Alternatives Scoring Summary

Category	Alternative 1	Alternative 2	Alternative 3
Environmental Criteria Category			
Social Criteria Category			
Technical Criteria Category			
Financial Criteria Category			
Even Weighting Approach Overall Average			
Even Weighting Approach Rank	**3**	**1/2**	**1/2**

Legend:

 Very well aligned with criteria

 Well aligned with criteria

 Somewhat aligned with criteria

 Not well aligned with criteria

8.2.4.4 Sludge Storage

As described in Section 7.2.2, the short-listed alternatives to address the needs for sludge storage include:

- Alternative 1: Do Nothing
- Alternative 2: Replace existing storage tank with a new larger storage tank
- Alternative 3: Construct a second storage tank

The evaluation criteria methodology summarized in Section 8.1 was used to assess the shortlisted alternatives for sludge storage. A summary of the alternative scoring is included in Table 8-12. Detailed scoring and scoring rationales are included in TM5 in Appendix B.

Alternative 1: Do Nothing, generally received low scores compared to the other alternatives. It was eliminated in the long-list screening in TM4 but carried forward only for comparison purposes. This alternative would not meet the projected capacity needs and would cause negative environmental, social and technical impacts.

Alternative 2: Replace Existing Storage Tank with a New Larger Storage Tank, scored higher than Alternative 1 and lower than Alternative 3: Construct a Second Storage Tank, overall. However, it scored slightly higher compared to Alternative 3 in the environmental and social categories, given that the existing storage tank would be completely demolished and all existing equipment would be replaced, resulting in lower odour, GHG emissions and health and safety issues. Technically, this alternative would be associated with some reliability concerns if the tank or pumps are offline for maintenance. No redundancy is provided by this alternative. Economically, this alternative would require higher lifecycle cost compared to Alternative 3.

Alternative 3 outperformed the other alternatives overall. It scored slightly lower compared to Alternative 2 in the environmental and social categories due to potential higher odour risks and GHG emissions associated with existing tank equipment aging with anticipated cracks and leaks. Technically, this alternative would be considered the most reliable alternative since it would provide 50 percent redundancy if one tank is taken offline for maintenance. Economically, Alternative 3 would require higher operation and maintenance costs due to additional equipment associated with building a second storage tank. However, the capital cost would be lower for Alternative 3, given the smaller footprint required for the new construction scope compared to Alternative 2, resulting in lower lifecycle costs.

Given all the benefits provided by Alternative 3, Alternative 3: Construct a Second Storage Tank, is recommended for the Wellesley WWTP.

Table 8-12. Sludge Storage Alternatives Scoring Summary

Category	Alternative 1	Alternative 2	Alternative 3
Environmental Criteria Category	Well aligned with criteria	Very well aligned with criteria	Very well aligned with criteria
Social Criteria Category	Well aligned with criteria	Very well aligned with criteria	Very well aligned with criteria
Technical Criteria Category	Not well aligned with criteria	Well aligned with criteria	Very well aligned with criteria
Financial Criteria Category	Well aligned with criteria	Not well aligned with criteria	Somewhat aligned with criteria
Even Weighting Approach Overall Average	Well aligned with criteria	Well aligned with criteria	Well aligned with criteria
Even Weighting Approach Rank	**3**	**2**	**1**

Legend:

Very well aligned with criteria

Well aligned with criteria

Somewhat aligned with criteria

Not well aligned with criteria

8.2.4.5 Tertiary Filtration

As described in Section 7.2.2, the short-listed alternatives to address the needs for tertiary treatment include:

- Alternative 1: Do nothing and use the redundant filter to handle flows exceeding 4,400 m^3/d
- Alternative 2: Expand existing tertiary filtration process with additional filter

The evaluation criteria methodology summarized in Section 8.1 was used to assess the shortlisted alternatives for the tertiary filtration process. A summary of the alternative scoring is included in Table 8-13. Detailed scoring and scoring rationales are included in TM5 in Appendix B.

Alternative 1: Do Nothing, generally scored poorly compared to Alternative 2: Existing Tertiary Filtration Expansion, except for the economic category. This alternative would meet the projected capacity needs when all existing filters are in operation. However, when one filter is out of service for maintenance, it will not meet the projected future growth needs for 2051.

Alternative 2 scored higher compared to Alternative 1 overall. It received higher scores than Alternative 1 in environmental, social and technical categories. The high score is attributed to the benefits offered by this alternative, including service reliability and potentially lower odour and GHG. Economically, Alternative 2 would require higher lifecycle costs given the required new building extension, even though Alternative 1 would require higher operation and maintenance costs due to more frequent maintenance and repairs.

Given all the environmental, social and technical benefits provided by Alternative 2, Alternative 2: Existing Tertiary Filtration Expansion, was selected as the preferred solution for tertiary filtration at the Wellesley WWTP.

Table 8-13. Tertiary Filtration Alternatives Scoring Summary

Category	Alternative 1	Alternative 2
Environmental Criteria Category	Well aligned with criteria	Very well aligned with criteria
Social Criteria Category	Very well aligned with criteria	Very well aligned with criteria
Technical Criteria Category	Well aligned with criteria	Very well aligned with criteria
Financial Criteria Category	Well aligned with criteria	Somewhat aligned with criteria
Even Weighting Approach Overall Average	Well aligned with criteria	Well aligned with criteria
Even Weighting Approach Rank	**2**	**1**

Legend:

Very well aligned with criteria

Well aligned with criteria

Somewhat aligned with criteria

9. Implementation Plan

Section 9 presents the recommended solutions for both the water and wastewater systems, the potential impacts and subsequent mitigation measures for their implementation and the permits and approvals which will be required for implementation.

9.1 Recommended Solution

Table 9-1 summarizes the recommended water and wastewater system alternatives. Further implementation details, assumptions, and cost details are provided in TM5 in Appendix B.

The preferred alternative for future well capacity consists of two similarly ranked preferred alternatives:

1. Increase Existing Well Supply; or
2. Supplement Existing with New Well Supply (Outside Urban Boundary)

The first alternative involves hydrogeological exploration of the opportunity to increase water taking from the existing wells. The second alternative involves hydrogeological exploration to determine the preferred site for a new well, and constructing a new well at the new site located outside the urban boundary near the south-east end of the Village. A new watermain would be constructed to convey flow from the new well to the existing Wellesley WTP. The MDD is projected to exceed the current capacity by 2034. Therefore, the new well taking capacity will need to be investigated, approved and on-line prior to 2034. The new well facility will need to be designed, construction, and on-line prior to 2034 as well. Initiating the project early is recommended to mitigate the risk that the hydrogeological study results do not support increasing the well taking capacity. In this case, the additional well supply would be met by the new well facility.

The preferred alternative for future disinfection, water pumping and storage is to construct an elevated tank off-site. The main driver for this project is the anticipated future regulatory requirements for primary disinfection. Providing additional storage for fire demand is a secondary driver as it is understood these flows can be met by the fire department's own supply. Construction of the elevated tank will allow for de-coupling fire demand from the on-site storage reservoir such that the reservoir can be dedicated for primary disinfection. There is no specific deadline for when the project should be constructed, however it is recommended to initiate the project early in preparation for any regulatory changes.

There are identified constraints within the distribution system related to fire flows but it is understood that, within the planning horizon, any additional fire flow needed beyond the distribution system capacity limits can be provided through the fire department's own supply and delivered via tanker trucks, consistent with the current practice. However, when the anticipated future development within Wellesley is undertaken, there may be additional requirements for improvements to the water distribution system that would provide additional value in regard to servicing. These requirements, and any resulting distribution upgrades, are recommended to be further investigated for implementation as additional planning information is made available to the Region in regard to the anticipated future development.

There is substantial I/I within Wellesley's wastewater collection system based on flow monitoring and modelled results. The I/I reduction component of the Wastewater Collection System Group B -Local Sewer Constraints preferred alternative (Alternative 2) should be further explored prior to implementing the recommended infrastructure upgrades associated with Alternative 2. Reducing I/I could substantially decrease the number of recommended local sewer upgrades with the Study Area. After I/I implementation strategies are investigated and implemented, the wet weather flow and sewer constraints within Wellesley's wastewater collection system should be reassessed.

As described in TM5 in Appendix B, the wastewater collection system, WWTP Influent PS, and equalization tank recommended sizes are subject to change as a result of I/I reduction strategies and the possibility that the collection system hydraulic model may be conservative. Additional flow monitoring and collection system model validation to a larger design storm is recommended. Additionally, a sensitivity analysis on the contributing areas for the future parcels should be considered in future design stages.

Generally, it is recommended that the equalization tank and trunk sewer upgrades are implemented together or within a close timeline to each other to manage peak wet weather flows from the collection system. The equalization tank is required to manage peak flows from the collection system that are conveyed to the Wellesley WWTP. The preferred equalization tank concept (sizing, hydraulics, etc.) will be determined during the future Schedule C Class EA and design. A new influent pumping station will be constructed as part of this contract with the same peak rated capacity as the Wellesley WWTP, with provisions for expansion when the remainder of the WWTP is expanded and following a Schedule C Class EA. The pumping station may include separate wet weather pumps to convey flows to the equalization tank, however, these will not impact the overall rated capacity of the pumping station (i.e., the flow rate that can be pumped through the Wellesley WWTP). The construction of the equalization tank is a Schedule B activity, but is recommended to be incorporated into the Wellesley WWTP Schedule C Class EA. An assimilative capacity study will be required.

Table 9-1. Summary of Recommended Alternatives

System Type	Constraint Group	Preferred Alternative Description	Cost [a]	EA Schedule	Recommended Implementation Year [b]
Drinking Water	Well Capacity	Increase existing well supply or supplement existing with a new well (outside urban boundary)	$5,320,000	Schedule C Class EA	Before 2034
Drinking Water	Future Disinfection, Water Pumping, and Storage	New storage off-site	$12,803,000 & $250k to $400k for chlorine boosting (if needed)	Schedule B Class EA	Near-Term (within 5 years)
Drinking Water	Water Distribution	Watermain upgrades to provide additional fire flow servicing	TBD [c]	Exempt	TBD [c]
Wastewater Collections	Group A – Firella Creek Trunk Sewer	Increase capacity of Firella Creek Trunk Sewer	$5,421,000	Exempt	Near-Term (within 5 years)
Wastewater Collections	Group B – Local Sewer Constraints	Investigate and implement I/I reduction strategies	TBD [d]	TBD [d]	2025
Wastewater Collections	Group B – Local Sewer Constraints	Reassess local sewer constraints	TBD [d]	Exempt	Near-Term (within 5 years)
Wastewater Treatment	Not Applicable	Assimilative Capacity Study	$150,000	Not Applicable	2025
Wastewater Treatment	Influent Pumping	New pump station and equalization tank	$11,383,750	Schedule C Class EA	Near-term (within 5 years) [f]
Wastewater Treatment	Headworks	Replace existing bar screen	$1,050,000	Schedule C Class EA	2032

System Type	Constraint Group	Preferred Alternative Description	Cost [a]	EA Schedule	Recommended Implementation Year [b]
Wastewater Treatment	Secondary treatment	Construct new secondary treatment plant [g]	$3,937,500	Schedule C Class EA	2032
Wastewater Treatment	Sludge Storage	Construct new storage tank	$700,000	Exempt	2032
Wastewater Treatment	Tertiary Filtration	Expand existing filtration process	$2,012,500	Schedule C Class EA	2036

Notes:

[a] Land acquisition costs are not included in cost. Costs are in 2024 dollars.

[b] Refer to TM5 in Appendix B for additional information and assumptions.

[c] TBD = To be determined pending further investigation for implementation as additional planning information for anticipated future development is made available to the Region.

[d] TBD = To be determined pending I/I investigation results

[e] Assimilative capacity study to be completed prior to Wellesley WWTP Schedule C EA

[f] The equalization tank is required in the near-term to manage peak flows from the collection system that are conveyed to the Wellesley WWTP. The preferred equalization tank concept (sizing, hydraulics, etc.) will be determined during the future Schedule C Class EA and design. A new influent pumping station will be constructed as part of this contract with the same peak rated capacity as the Wellesley WWTP, with provisions for expansion when the remainder of the WWTP is expanded and following a Schedule C Class EA. The pumping station may include separate wet weather pumps to convey flows to the equalization tank, however, these will not impact the overall rated capacity of the pumping station (i.e., the flow rate that can be pumped through the Wellesley WWTP). The construction of the equalization tank is a Schedule B activity, but is recommended to be incorporated into the Wellesley WWTP Schedule C Class EA.

[g] Secondary treatment expansion was carried forward for costing as a conservative approach. A pilot study is recommended to first be completed to determine the feasibility of process intensification, however these secondary treatment recommendations will be confirmed during the subsequent Schedule C EA. Refer to Section 8.2.4.3 for further details.

9.2 Incorporation of Feedback

Incorporating feedback received at the PCC's into the WWWMP is an important and valued component of the master planning process. Table 9-2 summarizes the feedback received and how the feedback was incorporated into the Wellesley WWWMP.

Table 9-2. Incorporation of Feedback

Feedback Received	Response
What were the proposed population changes and how those may impact infrastructure needs?	Considered future projected populations based on updated projections in April 2024 and this is reflected in alternatives in PCC3
Will development impact the quality of water?	The Region must monitor water quality on a regular basis and ensure it meets all Provincial water quality standards.
Concern is raised over central elevated tank location.	Noted. This was reflected in the evaluation under social category of criteria
Will this project address low water pressures?	The provision of off-site water storage will help stabilize pressures in Wellesley.
How does water efficiency change wastewater flows?	Less water usage has a direct relation to water entering the wastewater system; water efficiency would lead to decrease in wastewater flows.
Additional technical information on alternatives	Alternative evaluation details are covered in PCC3 and further technical details will be provided in the Master Plan Report which will be posted early 2025.
Concern is raised over various bottle necks in the local sanitary sewer system, and how the expansion of the Firella Creek Trunk Sewer will impact these areas.	In addition to identifying alternatives for the Firella Creek Trunk Sewer, PCC3 presented alternatives to address the local pipe capacity needs. The evaluation results recommended managing local pipe capacity needs by implementing I/I reduction measures and other pipe capacity increases as necessary.
Project timelines and next steps?	Project timelines and next steps were discussed during PCC3.

Refer to Section 2 and Appendix A for additional information on public engagement and feedback.

9.3 Impacts and Mitigations Measures

This section covers the potential impacts that may occur during the implementation of the preferred alternatives and recommended mitigation measures for such impacts.

9.3.1 Built Heritage Resources and Cultural Heritage Landscapes Impact

Archaeological Services Inc. (ASI) completed the Cultural Heritage Report for the project study area which consisted of the primary preferred elevated tank site to the west area of the Village, the Wellesley Wastewater Treatment Plant at 2156 Gerber Road, and various underground sewer locations. The report includes an inventory of known and potential built heritage resources (BHRs) and cultural heritage landscapes (CHLs), summary of existing conditions of the study area, a preliminary impact assessment, and proposed mitigation measures.

The following is a summary of the findings applicable to the recommended projects:

- Potential Elevated Tank Location 1 in the west area of the Village will not result in direct or indirect impacts to any BHRs or CHLs.
- The proposed expansion at the existing Wellesley Wastewater Treatment Plant will not result in direct or indirect impacts to any BHRs or CHLs.
- I/I mitigation work or construction activities on the various underground sewer locations have the potential to result in indirect adverse impacts due to construction related vibration to five potential BHRs and six potential CHLs as multiple structures are located within 50 meters of the proposed work. Work on the local sewers is anticipated to remain within the existing right-of-way and will not result in any direct adverse impacts.

The following applicable mitigation measures were recommended:

- Construction activities and staging should be suitably planned and undertaken to avoid unintended negative impacts to identified BHRs and CHLs. Avoidance measures may include erecting temporary fencing, establishing buffer zones, issuing instructions to construction crews to avoid identified BHRs and CHLs, and post construction rehabilitation with sympathetic plantings.
- Where project works are anticipated to be directly adjacent to a designated or listed property, a resource-specific Heritage Impact Assessment (HIA) may be required per Schedule 9.5.1 of the Township's Official Plan. An HIA may be required for CHL 5 located along Henry Street. However, as no direct adverse impacts are anticipated, Heritage Planning at the Region should consider waiving the requirement for an HIA in favour of suitable avoidance and mitigation measures.
- The Firella Creek trunk sewer should be designed in a manner that does not adversely impact B.H.R. 9 (Gerber Road Bridge). Should avoidance not be feasible and the bridge will be subject to direct adverse impacts, a Cultural Heritage Evaluation Report (C.H.E.R.) is recommended to determine if the bridge has cultural heritage value or interest, as per Ontario Regulation 9/06. If it is determined to have cultural heritage value or interest, a H.I.A. is recommended to assess and mitigate any impacts.
- To address the potential for indirect impacts to B.H.R.s 1-10 and C.H.L.s 1-6 due to construction related vibration, undertake a baseline vibration assessment during detailed design to determine potential vibration impacts.
- The Cultural Heritage Report should be submitted by the proponent to heritage staff at the Township, the Ministry of Citizenship and Multiculturalism, and any other relevant stakeholder with an interest in this project.
- Should future work require an expansion of the study area then a qualified heritage consultant should be contacted to confirm the impacts of the proposed work on potential heritage resources.
- All subsequent recommended technical cultural heritage studies should be completed by a qualified heritage professional with recent and relevant experience as early in detailed design as possible prior to any construction activities and submitted for review and comment to the Township, the Region, and the Ministry of Citizenship and Multiculturalism, and any other local heritage stakeholders that may have an interest in this project.

A Built Heritage Resources and Cultural Heritage Landscapes assessment has not been completed for a new well supply. If it is determined that expanding the existing well capacity is not feasible and a new well supply outside of the urban boundary is required, a new Built Heritage Resources and Cultural Heritage Landscapes assessment will be required.

9.3.2 Archaeological Impact

A Stage 1 Archaeological Assessment and a subsequent report was completed by ASI. A Stage 1 Archaeological Assessment property inspection was conducted on November 1, 2024, to assess the archaeological potential along the preferred alternatives based on the geography, topography, and current conditions.

The property inspection was visual and did not include excavation or collection of archaeological resources. The Stage 1 Archaeological Assessment by ASI recommends that portions of the study area require a Stage 2 Archaeological Assessment to be completed. Currently, a Stage 2 Archaeological Assessment has not been completed for a new well supply. In relation to our proposed alternatives, the WWTP upgrades, including equalization tank exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit and pedestrian survey at five metre intervals.

The Stage 1 background research determined six previously registered archaeological sites are located within one kilometre of the Project Area [The Stage 1 Project Area includes proposed elevated tank (Elevated Tank Alternative 1), the expansion of the existing WWTP, linear upgrades within the Village of Wellesley, and two additional elevated tank alternatives that are not preferred or secondary preferred alternatives]. Two of these sites, AiHe-39 and AiHe-42, are located within 50 metres of the project study area and have been cleared of further archaeological concern (96-019, 97-017, 98-014).

The following recommendations were made:

1. Parts of the study area exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit and pedestrian survey at five metre intervals, where appropriate. Stage 2 is required prior to any proposed construction activities on these lands;
2. The remainder of the study area does not retain archaeological potential on account of deep and extensive land disturbance, slopes in excess of 20 degrees, or being previously assessed (96-019, 97-017, 98-014/ P017-0706- 2019/ P389-0584-2021). These lands do not require further archaeological assessment; and,
3. Should the proposed work extend beyond the current study area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

Figures indicating the areas identified as exhibiting archaeological potential can be found in Stage 1 report in Appendix C. These areas will require Stage 2 Archaeological Assessment prior to any construction activities or other proposed impacts, including geotechnical investigations.

If during construction previously undocumented archaeological resources are discovered, work on the site must stop immediately and engage a licensed consultant archaeologist to carry out an archaeological assessment, in compliance with Section 48(1) the Ontario Heritage Act must be followed. Similarly, if a burial site is discovered procedures in accordance with the Funeral, Burial and Cremation Services Act, 2002, must be followed.

The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with Ontario Regulation 30/11 the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act.

9.3.3 Natural Environment Impacts

A desktop natural heritage review was completed under the Wellesley WWWMP, as described in Section 4.1. Based on the results of this study the following impacts to the natural environment may apply during the implementation of the preferred alternatives:

- **Sanitary Sewer I/I Investigation and Mitigation.** The local sewers are generally located within the paved right-of-way. However, there are three waterbody crossings (one crossing south of Molesworth Street, one crossing on Nafziger Road, and one crossing west of Parkview Drive) that may be impacted during I/I mitigation works within the local sewers.
- **Firella Creek Trunk Sewer Upgrades.** Construction of the Firella Creek Trunk Sewer (upgrade or twin) will be within the GRCA regulated area and necessary mitigation measures will be required, including the implementation of sediment control plans. Depending on the route determined during subsequent design phases, there is the potential for an impact to woodlots. One creek crossing will also be required which may impact the Firella Creek.
- **Drinking Water Storage.** Location 1 does not overlap GRCA regulated areas, however there are nearby woodlots which may require impact mitigation measures during construction.
- **Increasing Existing Well Supply.** A hydrogeological investigation will be required to assess aquifer impacts.
- **New Well Supply Outside of Urban Boundary (if required).** A species at risk assessment and potential arborist surveys are to be completed during subsequent design stages. This alternative is located outside of the Study Area of this Master Plan and therefore a desktop natural heritage review has not been completed at the time of this Master Plan Report.
- **Wastewater Treatment Plant Upgrades.** Property expansion will be required to implement the equalization tank and property expansion would likely be into neighboring agricultural lands. The equalization tank location and process equipment locations should be selected outside of the GRCA regulatory floodplain. An assimilative capacity assessment will be required prior to wastewater treatment plant upgrades.

The impacts of waterbody crossings depend on the construction methodology selected. Construction methods will be investigated at the detailed design stage. Construction of the recommended projects pose potential impacts to vegetation and tree removals, wildlife habitat removal, and aquatic habitats. Erosion and sedimentation plans will be developed and implemented to limit or eliminate the impact to the adjacent habitats and aquatic environment.

A detailed natural environment monitoring study with field verification and an Environmental Impact Assessment is required to be completed prior to the implementation of the preferred alternatives. Mitigation measures will be developed following the detailed natural environmental monitoring study during the design phase. Mitigation measures are expected to include an Erosion and Sedimentation Plan, a Spills Management Plan, a Tree Impact and Preservation Plan, compliance with the Species Act and Migratory Birds Convention Act, and compliance with the Grand River Source Water Protection Plan (Section 9.3.5).

There are also expected to be minimal impacts to the natural environment due to an increase in energy consumption at the WWTP and WTP following the implementation of the recommended alternatives. Selection of energy efficient equipment could mitigate this impact.

GHG emissions are anticipated to increase at the WWTP since the equalization tank basin is expected to be an open tank, thereby enabling the release of GHG. However, it is expected that GHG emissions would be minimal since the duration of storage of the peak flow would be one day or less.

9.3.4 Geotechnical Impact

A desktop review geotechnical study was completed concurrent to the development of the WWWMP. The purpose of the desktop geotechnical study is to provide a geotechnical feasibility screening for the preferred water and wastewater alternatives as well as constructability considerations. The desktop review of the available geotechnical information determined that the regional area has good coverage from a geological survey point of view. However geotechnical investigations with suitable data were not available at any of the proposed work sites. An assessment of the available information is summarized as follows:

- **Proposed Water Tower Location One.** A previously completed geotechnical investigation at the Bill Gies Recreation Centre (completed by others) consisted of thirteen test pits. The site was generally found to have topsoil overlying sand, silt, silty sand, sand and gravel or a combination of these. The test pit program however only went to a maximum of 3m which is not deep enough for the deep foundations that would be needed to support a new water tower. Available well logs indicated that bedrock was found at approximately 55m to 67m and was logged as limestone and shale. The well logs at this site showed logging of cobbles and boulders which is in line with tills in southern Ontario. When designing the foundation designers will need to consider methods that are capable of dealing with cobbles and boulders. It is anticipated that the proposed water tower location should have soils at depth capable of supporting deep foundations for a water tower but further geotechnical investigation will be required.
- **Firella Creek Trunk Sewer.** A background review of the site indicates generally organic topsoil with silty clay native near surface. Water is noted to be near surface as is to be expected in such close proximity to the Firella Creek. The proposed new trunk sewer will require construction inside potentially sensitive lands with the water table close to surface and recent fluvial deposits/ organics. Care will be required to protect water courses if open-cut is selected as the preferred method for construction. Dewatering may be required for the purposes of supporting a stable excavation. Trenchless methods could potentially be considered to help reduce the challenges posed by open cut, however, may not be feasible based on depth of cover (to be determined in future design stages). Additionally, this sewer would cross Geber Road (Regional Road 12) requiring staged construction for open cut or a trenchless crossing of the road. Geotechnical investigation along the length of the sewer and at the road crossing will need to be carried out during design.
- **Wellesley Wastewater Treatment Plant.** There were no previously completed geotechnical investigations available for review at the Wellesley Wastewater Treatment Plant and as such data for the site was pulled from well log records. The well logs near the Wellesley Wastewater treatment plant generally consist of topsoil at surface with near surface clay being the most commonly logged material. Water levels were not available for nearby well logs.

Overall, the proposed works will require a geotechnical investigation to be undertaken at each site. It should be noted that archaeological assessments need to be completed prior to geotechnical investigations.

9.3.5 Source Water Protection

Surface water intakes and wellheads in source protection areas have been identified as vulnerable areas as per the Clean Water Act, 2006 and as amended, to protect drinking water sources. Drinking water sources can potentially be impacted by projects if work is being completed in designated vulnerable areas.

The Grand River Source Protection Plan (GRCA, 2022a) includes policies that protect water sources within the GRCA limits and is relevant to the Study Area. There is one Wellhead Protection Area (WHPA) within the Study Area. The WHPA is associated with WY1, WY5, and WY6, situated within the Wellesley WTP property as described in Section 4.3.2. WHPA-A includes the area within the immediate vicinity of the Wellesley WTP. WHPA-B includes the approximate area from Gerber Road and Nafziger Road, extending northwest to west of Lawrence Street and south of Queens Bush Road. WHPA-C extends beyond WHPA-B to include areas northwest of Seigner Lane and Hutchinson Road in Wellesley Township.

One identified drinking water threat activity includes “the establishment, operation, or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage” (GRCA, 2022a)). Local sanitary sewer upgrades are not part of the recommendations in this WWWMP, however, the Master Plan recommends I/I reduction to reduce wet weather flows in the sanitary collection system. Should any upgrades to local sewers within WHPA-A and WHPA-B be initiated as an I/I reduction option it should be remembered that sewage systems have a vulnerability score of 8 and 10 within WHPA-A and WHPA-A. Potential risks to the impact zones include potential spills to the aquifer pertaining to WY1, WY5, and WY6. This threat could occur during construction, operation, or sewer pipe deterioration or failure.

Policy number RW-MC-12 within the Grand River Source Protection Plan is relevant to new and existing sanitary sewer works located in WHPA-A and WHPA-B where the vulnerability is equal to 10. This policy indicates that the MECP needs to verify the ECA for the works “includes appropriate terms and conditions to ensure that the activity ceases to be a significant drinking water threat” (GRCA, 2022a). The ECA should also include a contingency plan in the case of a spill and within WHPA-A the ECA should include enhanced construction to reduce the likelihood of leaks (GRCA, 2022a).

Dewatering could be minimized where feasible to reduce any impact on the aquifer. The proposed sewers would also be sized and constructed according to typical standards and codes to mitigate the occurrence wastewater leakage into the aquifer.

The recommended elevated tank (Location 1) falls within WHPZ-C. However, the construction of this structure and the structure itself is not considered a significant drinking water threat.

9.3.6 Noise and Vibration Impact

The noise and vibration associated with the construction can be addressed by the following measures:

- Working within Township of Wellesley noise bylaw
- Working within the MECP’s Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning
- Minimizing construction traffic in local residential streets

Larger pumps have the ability to increase the noise level at the WWTP. However, the impact is expected to be minimal given that the land use surrounding the WWTP is generally agricultural.

9.3.7 Odour Impact

Odour is not expected to increase substantially during construction.

The potential for odour generation at the WWTP may increase due to increased flows from population growth. However, the impact is expected to be minimal given that the land use surrounding the WWTP is generally agricultural. Providing a sludge storage tank with a jet aerator would provide sufficient mixing to minimize odour.

Achieving minimum scouring velocity thresholds within the sanitary sewers will reduce the risk of odour generation within the sewers.

9.3.8 Aesthetics Impact

The elevated tank is a permanent infrastructure change that will alter the community aesthetics and viewshed. These impacts were considered in detailed evaluation to select a location that minimizes impacts to current residents and businesses.

The Firella Creek Trunk Sewer will be underground and will not impact aesthetics. The number of manholes are anticipated to be similar to existing conditions. I/I mitigation methods within the local sewers are not anticipated to impact aesthetics.

Upgrades at the WWTP are not anticipated to substantially impact the existing aesthetic landscape.

9.3.9 Water and Wastewater Servicing Impact

Any water service disruption during the construction of the elevated tank or well (if required) is expected to be short-term and mitigation measures are to be developed during design.

A temporary disruption to wastewater servicing may occur as a result of I/I mitigation measures within local sanitary sewers. Mitigation measures for these disruptions are recommended to be developed during the detailed design stage, as applicable. Bypass pumping will be required during the Firella Creek Trunk Sewer Upgrades. The degree of bypass pumping is dependent on whether the trunk sewer is twinned or upsized.

A temporary interruption of the existing process operation, or reduced capacity, may occur at the WWTP during upgrades, as described in TM5 in Appendix B. Mitigation measures to limit disruption impacts and mitigate the risk of potential effluent quality impacts to the Nith River should be considered for project phasing during design.

9.3.10 Health and Safety Impact

Development and construction activities may increase the type and volume of traffic on surrounding roadways (e.g., construction vehicles and equipment) or introduce additional hazards to the environment (e.g., material spill). Vehicles and equipment used during construction will follow traffic laws and multi-passenger vehicles will be used, when possible, to reduce traffic associated with construction activities.

Increasing the existing well taking capacity may lead to elevated strontium and fluoride concentrations, which remains to be determined as a part of the hydrogeological study.

9.3.11 Construction Impacts

Constructs methods and impacts will be confirmed during future design stages once design concepts and construction methods have progressed. Anticipated construction impacts are generally included in Section 9.3.1 through Section 9.3.10. Additional construction impacts may include the following:

- Increased traffic volume due to increased volume of construction vehicles.
- Potential full or partial road closures for construction staging areas and the crossing of the Firella Creek Trunk Sewer with Gerber Road if open-cut construction methodology is selected.
- Additional temporary negative aesthetic impacts with increased construction equipment and excavations.
- All waste materials from construction will need to be disposed of off-site in accordance with applicable legislation and guidelines.
- Utility disruption may occur during construction.

9.4 Future Approvals/Permits Required

This section presents the approvals and permits that will be required for the implementation of the preferred alternatives in detail.

9.4.1 MECP

The following MECP permits/approvals will be required before the construction of the preferred alternatives:

- **Ontario Environmental Assessment Act Approval.** The Schedule B EA required for the elevated tank will be satisfied through this Master Plan. Under current regulation, an Environmental Study Report must be completed, reviewed, and approved under the Ontario Environmental Assessment Act for the recommended Schedule C WWTP upgrades and the new well (if required). However, it is understood that potential regulatory changes may occur in the short-term. These potential changes include the revocation of the MCEA, and the addition of a more streamlined EA regulation, the Municipal Project Assessment Process (MPAP) (Environmental Registry of Ontario, 2024). If the proposed changes are approved, the elevated tank would not need to undergo an EA but the new well outside of the urban boundary (if required) would still require an EA. The proposed changes suggest that expansions to existing wastewater treatment facilities less than 25 percent of the existing rated capacity would be exempt from an EA. The recommended expansion at the Wellesley WWTP is a capacity increase of 22 percent (from 1,100 m^3/d to 1,345 m^3/d) which is below the proposed threshold for an EA. Consultation with the MECP is recommended.
- **ECAs.** Amendments to the Region's Consolidated Linear Infrastructure ECA and wastewater treatment plant ECA will be required.
- **PTTW Application Groundwater – Category 3.** A Category 3 application will be required to increase the water taking capacity to 1,699 m^3/d. There is a risk that the findings from the required hydrogeological study may not support increasing the water taking capacity or that the actual water taking capacity may be lower than the 1,503 m^3/d limit in the current PTTW. If a new well supply is required, a separate hydrogeological assessment would be required to support a new Category 3 PTTW application.

- **Drinking Water Works Permit (DWWP) Amendment.** A DWWP is required for the elevated tank and well.
- **Municipal Drinking Water License (MDWL) Amendment.** A MDWL is required for the elevated tank and well.
- **PTTW.** A Permit to Take Water is required if it is necessary to take more than 50,000 litres of water in a day from the environment during construction.
- **Receiving Water Quality Assessment (RWQA).** An RWQA is required prior to the implementation of the WWTP recommended projects, as described in Section 10.1.2.2.
- **Endangered Species Act (ESA).** Timing windows for any required tree removals should be followed to avoid the maternal roosting period for SAR bats. This timing window is May 1 and August 31. Consultation with the MECP during the detailed design stage is recommended, and an Information Gathering Form must be completed to determine whether a permit is required.

Additionally, consultation with MECP is recommended prior to removal of any protected SAR bat habitat within the study area. Based on the SAR background review and Natural Features such as the woodlands, consideration for SAR and SAR habitat is required for proposed construction within or nearby these areas as per the ESA as administered by the MECP. Further SAR screening is conducted by contacting the MECP's SAR Branch.

9.4.2 MNRF

Under the Fish and Wildlife Conservation Act, a License to Collect Fish for Scientific Purposes is required if fish relocation to outside the work area is required. A Wildlife Collector's Authorization will be required if wildlife must be relocated to outside of the work area.

Under the Public Lands Act & Lakes and Rivers Improvements Act the project may require land tenure under the Public Lands Act. Consultation with the local MNRF office may be required during detailed design.

9.4.3 GRCA

The following permits and consultations will be required from the GRCA before construction:

- A permit for the Regulation of Development, Interference with Wetlands and Alteration to Shorelines and Watercourses (Ontario Regulation 150/06) will be required.
- Erosion and sediment control plans will be required.
- Consultations are recommended during design.

9.4.4 MCM

A new well supply will result in the need for further Stage 1 Archaeological Assessment and a revised detailed Cultural Heritage Report. A Stage 2 Archaeological Assessment is required for the WWTP upgrades, including the equalization tank. A review letter from the MCM indicating that the archaeological assessment reports, recommending no further assessment, have been entered into the Ontario Public Register of Archaeological Reports is required before construction.

9.4.5 Environment and Climate Change Canada

Certain rules apply to migratory birds, which are protected under the federal Migratory Birds Convention Act. Environment Canada provides guidance regarding tree removal and construction timing windows to avoid impacting migratory bird species.

9.4.6 Fisheries and Oceans Canada

A review by Fisheries and Oceans Canada may be required if future work is proposed in-water, or near water, such as for the water crossings required to upsize the sanitary sewers. This will be further reviewed during future design stages.

9.4.7 Township of Wellesley

It will be necessary to obtain the following permits from the Township of Wellesley:

- Municipal Consent for works with the Townships right-of-way
- Municipal site plan approval for elevated tank
- Municipal building permit for elevated tank
- Road Work Permit for sanitary sewer upgrades
- A zoning by-law amendment may be required for the elevated tank.

9.4.8 Utilities

Utility infrastructure such as electrical, telephone, and gas must be confirmed during preliminary design. Review and approvals must be received.

9.4.9 Easements and Land Acquisition

It is anticipated that land acquisition will be required for the recommended equalization tank at the WWTP. However, this will be confirmed during Schedule C EA. Alternations to the WWTP buffer zone may also be required to satisfy MECP requirements.

An expanded or revised easement may be required to implement the Firella Creek Trunk Sewer upgrades depending on the selected route and whether it is preferred to upsize or twin the trunk sewer.

Land acquisition is also anticipated to be required for the new elevated tank and potential new well site.

9.4.10 Other Permits

Approvals under the Electrical Safety Authority and Technical Standards and Safety Act (TSSA) may be required for the recommended WWTP upgrades.

9.4.11 Summary of Permits

Table 9-3 summarizes the main permits anticipated to be required for each recommended project. Actual permits may vary depending on refined site location and construction methods.

Table 9-3. Summary of Permits/Approvals Anticipated to be Required by Preferred Project

Agency	**Permit/Approval**	**Drinking Water** ***Well Capacity Alt 2: Increase Existing Well Supply***	**Drinking Water** ***Water Distribution and Storage Elevated Tank Location 1***	**Wastewater Collection System** ***Group A: Firella Creek Trunk Sewer Increase Capacity***	**Wastewater Treatment** ***Influent Pumping New PS and Equalization Tank***	**Wastewater Treatment** ***Headworks New Screen***	**Wastewater Treatment** ***Secondary Treatment New Packaged Secondary Treatment Plant***	**Wastewater Treatment** ***Sludge Storage New Sludge Holding Tank***	**Wastewater Treatment** ***Tertiary Filtration Expand Tertiary Filtration***
MECP	PTTW	x		x					
MECP	DWWP	x	x						
MECP	MDWL	x	x						
MECP	Environmental Assessment		x		x	x	x	x	x
MECP	CLI ECA/ECA			x	x	x	x	x	x
MECP	RWQA				x	x	x	x	X
Township of Wellesley	Municipal Site Plan Approval	x	x		x	x	x	x	x
Township of Wellesley	Municipal Building Permit	x	x		x	x	x	x	x
Township of Wellesley	Road Work Permit			x					
GRCA	Ontario Regulation 150/06			x					
MCM	Review Letter	x	x	x	x	x	x	x	x
MCM	Stage 2 Archaeological Assessment				x	x	x	x	x
Region of Waterloo	Land acquisition/easements		x	x	x				
Various	Utility clearances	x	x	x	x	x	x	x	x

10. Recommendations

Section 10 presents general recommendations, future considerations as well as next steps to consider that are associated with the implementation of the preferred alternatives.

10.1 General Recommendations and Considerations

This section details the general recommendations and future considerations for the preferred drinking water and wastewater alternatives.

10.1.1 Drinking Water Alternatives

The following general recommendations and future considerations apply to the recommended drinking water projects:

- A hydrogeological study to confirm the feasibility of expanding the existing well taking capacity under Alternative 2 is required. An updated hydrogeological study would need to be undertaken to confirm that the water taking capacity for the existing wells could be increased from 1,503 m^3/d to 1,699 m^3/d. The study must be conducted by a qualified person which includes a licensed professional geoscientist or accepted professional engineer per the *Professional Geoscientists Act, 2000* of Ontario. The hydrogeological study would be used to support a PTTW amendment. A Category 3 application would be required as the change would increase the current capacity and be a long-term, regular occurrence (Province of Ontario, 2022).
- Full-scale capacity testing is recommended to confirm the actual existing well taking capacity. Based on discussions with Region staff, the actual well taking capacity may be less than the 1,503 m^3/d that is specified in the PTTW.
- If the hydrogeological study results do not support increasing the existing well taking capacity, Alternative 3B: Supplementing Existing with New Well Supply (Outside Urban Boundary) becomes the new preferred alternative. Site selection would require a Schedule C EA and a separate hydrogeological study to identify the new implementation plan.
- A chlorine demand or decay test is recommended during design to confirm the current system water age and determine if chlorine boosting could be required at the elevated tank. Preliminary hydraulic modelling suggests that water age may be an issue. Operating an elevated tank with a useful volume of 1,500 m^3 between 30 and 95 percent with respect to water level was estimated to require approximately 106 hours to complete a full tank emptying and filling cycle. At this rate, it is likely that chlorine boosting would be required at the elevated tank facility. The cost estimate includes an expected range of costs for implementing a chlorine boosting system that is integrated with the elevated tank and does not require a stand-alone building.
- The WTP has a single discharge pipe with no redundancy. Therefore, there is no flexibility to allow this line to be taken offline for maintenance. Constructing the elevated tank will provide buffer capacity should the discharge pipe need to be taken offline. The elevated tank will also provide more flexibility in pump control and pressure management which makes operation of the high lift pumping system easier compared to a closed zone. The Region should also consider constructing a discharge pipe bypass line to provide redundancy should the main discharge line need to be taken offline for maintenance. This constraint is a design level issue and is recommended to be addressed in the design phase.

- The watermain upgrades described in Section 7.1.3 are recommended to support fire flow needs should the current firefighting practice of relying in part on tanker trunks be reconsidered. The Region should continue to coordinate with the Wellesley fire department on the current fire-fighting practice and complete further investigation for implementation of watermain upgrades as additional planning information for anticipated future development is made available to the Region.
- Ultimate population build-out scenarios should be considered for sizing of the recommended infrastructure during future design stages. Actual water demand from the Bill Gies Recreation Centre and development plans for the existing community centre should be incorporated into infrastructure design once known. Consideration for the ratio of residential to ICI flows should be given during infrastructure sizing since changes in this ratio may impact demand.
- A Built Heritage Resources and Cultural Heritage Landscapes assessment has not been completed for a new well supply. If it is determined that expanding the existing well capacity is not feasible and a new well supply outside of the urban boundary is required, a new Built Heritage Resources and Cultural Heritage Landscapes assessment will be required.
- An Archaeological Assessment has not been completed for a new well supply. If it is determined that expanding the existing well capacity is not feasible and a new well supply outside of the urban boundary is required, a new Archaeological Assessment will be required.
- Although the Schedule B EA requirement for the elevated tank (Location 1) is satisfied through this Master Plan, it is recommended that the Region conduct additional engagement on site selection.

10.1.2 Wastewater Alternatives

This section details the general recommendations and future considerations for the preferred wastewater collection and treatment alternatives.

10.1.2.1 Wastewater Collections

The following general recommendations and future considerations apply to the recommended wastewater collection projects:

- Bypass pumping will be required during construction.
- Previous CCTV investigations have revealed grease build-up along the trunk sewer (GM BluePlan, 2018). Consideration should be given to reduce the likelihood of grease build-up during subsequent design stages.
- A 2024 project completed by the Region included raising five manhole lids along Firella Creek Trunk Sewer. It was identified that eight additional manholes remain below the floodplain elevation.
- I/I investigations and mitigation measures are recommended within the Study Area in 2025. Local sewer constraints should be reassessed following the I/I investigations.
- During subsequent design stages, refinement of the recommended trunk sewer diameter should consider a sensitivity analysis on the contributing area of future parcels. Currently, the plum zone area within the study area bounds is included in the modelled contributing area. Contributing area directly impacts modelled wet weather flow generation.
- Ultimate population build-out scenarios should be considered for sizing of the recommended infrastructure during future design stages. Actual wastewater flow from the Bill Gies Recreation Centre and development plans for the existing community centre should be incorporated into infrastructure design once known.

- It is recommended that the hydraulic model be validated against the larger design storm to confirm the recommended trunk sewer diameter sizing if there is an opportunity to capture a larger storm through additional flow monitoring.
- Assumed tie-in locations for future developments in the hydraulic model were based on the nearest manhole. These tie-in locations should be confirmed prior to preliminary design.

10.1.2.2 Wastewater Treatment

The following general recommendations and future considerations apply to the recommended wastewater treatment projects to allow the facility to handle a future projected AADF of 1,345 m^3/d:

- Currently, sludge at the WWTP is hauled once a week. The average historical storage time is approximately 5 days. With 5 days of storage time, the existing storage tank would provide a capacity of up to 580 m^3/d (equivalent AADF capacity). The construction timeline for the new storage tank best aligns with the secondary treatment upgrade timeline (Year 2030) to provide the required storage capacity for the generated sludge from the two existing and new secondary treatment plants. Therefore, more frequent sludge hauling (2 to 3 days) may be required in the short-term.
- A RWQA, in which the receiving water's waste assimilative capacity is evaluated based on the Provincial Water Quality Objectives (PWQO). The results of the RWQA will inform the specific effluent quality objectives and limits for the Wellesley WWTP after expansion. The following should be considered:
  - It is possible that the RWQA results may limit the volume of wastewater that can be treated at the WWTP.
  - The RWQA needs to be approved by the MECP prior to plant expansion.
  - The Nith River is a Policy 2 receiver for total phosphorus. This means that no further lowering of water quality is permitted, and measures must be taken to upgrade water quality.
  - Specific effluent objectives include limits for carbonaceous biological oxygen demand, total suspected solids, ammonia-nitrogen, total phosphorous, and E. Coli.
- Further evaluation of secondary treatment alternatives will be completed as part of the Schedule C Class EA. Process modelling and/or piloting will be completed to confirm if process intensification is a feasible solution to increase secondary treatment capacity.
- Wet weather management technology could be considered in conjunction with the equalization tank as an overall wet weather management strategy during the Schedule C Class EA.
- WWTP property expansion is anticipated to be required. Consultation with Wilmott Township will be required.
- Actual wastewater flow from the Bill Gies Recreation Centre and development plans for the existing community centre should be incorporated into infrastructure design once known. Consideration for the ratio of residential to ICI flows should be given during infrastructure sizing since changes in this ratio compared to existing may impact flow generation and wastewater characteristics.

10.2 Next Steps

The next steps include allocating budget for the recommended alternatives and proceeding to implement the preferred alternatives within the recommended time frames. Specifically, next steps include:

- Confirmation of geotechnical and hydrogeological conditions to confirm the feasibility of expanding the existing well taking capacity is required.

- Complete required hydrogeological study to confirm Alternative 2 for additional well capacity.
- Complete a RWQA and Schedule C EA for the recommended WWTP upgrades.
- Obtain necessary permits and approvals as described in Section 9.4.
- Consideration for validating sanitary hydraulic model using rainfall from a large design storm, if available. Water and wastewater tie-in locations of new developments should be confirmed and updated in the water distribution and wastewater collection models once confirmed as this may impact sizing recommendations.
- Completion of sensitivity analysis on the impact of the contributing areas in the sanitary hydraulic model on the magnitude of local sewer upgrades and size of upgraded trunk sewer.
- Coordination with the Township of Wilmott regarding the Wellesley WWTP expansion and potential for land acquisition requirements.
- Coordinate with overlapping projects.
- Follow potential EA Act changes such as MPAP, as described in Section 9.4.1, to determine impact on project planning.
- It is recommended that flows and water demand continue to be monitored to assess how flows and population growth are realized.
- To address the potential for indirect impacts to BHRs and CHLs due to construction related vibration, undertake a baseline vibration assessment during detailed design to determine potential vibration impacts.
- Complete Stage 2 Archaeological Assessment for WWTP Upgrades, included equalization tank.
- As growth occurs, investigate need for additional water distribution servicing.

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Appendix A
Public Consultation

(Provided under separate cover.)

Appendix B
Technical Memoranda

(Provided under separate cover.)

Appendix C
Supportive Studies
(Provided under separate cover.)