Stantec

Memo

To:	Guy Bourgon, P. Eng.	From:	Pierre Wilder, P. Eng.; Kevin Alemany, P. Eng., M.A.Sc.; Christène Razafimaharo, M. Sc., EIT
	Town of Carleton Place		Stantec Consulting, Ottawa
File:	Water & Wastewater Master Plan	Date:	February 14, 2022

Reference: Alternatives Evaluation Technical Memorandum

Introduction

Stantec Consulting has been retained by the Town of Carleton Place (the Town) to undertake a Municipal Class Environmental Assessment (MCEA) and prepare a Master Plan for the expansion of the Town's Water Treatment Plant (WTP) and Wastewater Treatment Plant (WWTP) and the addition of a new water storage reservoir. The Master Planning assignment will evaluate the Town's potable water and wastewater infrastructure needs over 5-year, 10-year and 20-year horizons. In addition to the treatment facility expansions and the water reservoir, the assessment will investigate current and future needs of the potable water distribution and wastewater collection systems.

Projected growth in the Town and the identified system constraints were previously presented in the **Design Basis Memo** and the **Phase 1 Report**. The purpose of this technical memorandum is to present planning-level alternatives for the different infrastructure components as part of the Town's Master Plan. Evaluation criteria and a rating system are presented and used to assess the different alternatives.

Alternatives Evaluation Criteria & Rating System

The criteria for the evaluation of the alternatives fall into four main categories:

- Natural environment
- Social environment
- Technical
- Economic & legal environment

Table 1 presents the criteria and the related key considerations and impacts to assess. Each alternative is then qualitatively assessed against each criteria using a reasoned argument approach, according to the following 4-point scale:

- Preferred
- Moderately preferred
- Partially preferred
- Least preferred

Reference: Alternatives Evaluation Technical Memorandum

Table 1: Alternatives Evaluation Criteria

Category	Criteria
Natural Environment	**Aquatic Environment** • Potential to impact fish and fish habitat • Potential to impact surface water quality and quantity
	Terrestrial Environment • Potential to impact wildlife/habitat (i.e., Species-at-Risk, spawning areas, significant ecological areas, etc.) • Potential to affect vegetation (i.e., wooded areas, wetlands, conservation areas, etc.) • Potential to impact individual trees or landscaped features
Cultural Environment	**Archaeological Resources** • Potential to impact undisturbed lands
	Built Heritage Resources / Cultural Landscape • Potential to impact known built heritage resources or cultural landscapes/features
Socio-Economic Environment	**Noise/Vibration & Air Quality** • Potential to impact noise sensitive areas (i.e., residential dwellings, daycares, etc.) • Potential to affect local air quality
	Property Requirements • Requires acquisition of private property
	Aesthetics • Potential to impact visual aesthetics of study area
	Land Use • Potential to impact existing and future designated land use and/or community use
	Consistency with Municipal Planning Objectives and Existing/Proposed Development • Satisfies the goals and objectives of the Town's Official Plan • Compliance with municipal/regional policies

Reference: Alternatives Evaluation Technical Memorandum

Category	Criteria
	• Potential to support existing and future development within the area
	Health & Safety • Potential to impact health and safety of residents • Potential to impact health and safety of employees • Potential impacts to groundwater quality (i.e., wells, effect Source Water Protection area, etc.) • Potential to encounter contaminated subsurface conditions
	Community Access • Disruption to existing traffic, private property and business access during construction or operation
Technical Environment	**Functionality/Reliability of Water Treatment** • Quality of source water at intake • Treated potable water quality • Reliability of the treatment process
	Functionality/Reliability of Water Distribution • Potential impacts to drinking water quality • Provision of drinking water supply servicing for the existing and future projected population • Provision of adequate water storage for emergency firefighting services
	Functionality/Reliability of Water Storage • Potential impacts to drinking water quality • Provision of safe and reliable water storage system for the existing and future projected population • Provision of adequate water storage for emergency firefighting services
	Functionality/Reliability of Wastewater Collection • Provision of reliable wastewater collection for the existing and future projected population • Potential for risk of sewage backups and basement flooding • Potential impacts due to surface flooding or system overflows
	Functionality/Reliability of Wastewater Treatment • Treated effluent quality • Reliability of the treatment process

Reference: Alternatives Evaluation Technical Memorandum

Category	Criteria
	• Potential for risk of sewage backups and impacts to collection system
	Monitoring Requirements & Efficiencies • Impacts to operational monitoring requirements and efficiency
	Cost • Relative capital, operational and maintenance costs ($)
	Utilities • Potential to impact existing utilities
	Constructability & Feasibility • Potential to disrupt existing traffic, property access or functionality of existing facilities during construction • Location, depth of excavation, soil conditions, rock removal, groundwater control, in-water works, workable construction area, construction duration
	Expandability • Potential to be expanded or flexible to meet future population needs
	Climate Change • Ability to increase resilience to climate change (i.e., severe weather events) within the study area • Impacts to known climate change contributors (i.e., GHG emissions)

Reference: Alternatives Evaluation Technical Memorandum

Alternatives Evaluation 1: Potable Water Treatment Plant (WTP)

The following is a summary of the water treatment plant (WTP) planning constraints and needs, some of which are discussed in the **Phase 1 Report**:

- An expansion to approximately 20,700 m^3/d (i.e., 72% increase of current capacity) is needed in the long-term to accommodate population growth over a 20-year planning horizon. As the existing facility is approaching its current rated capacity, some expansion is already required to meet the maximum day demand without consuming any emergency storage from the facility's clearwells or from the existing water tower.
- The plant's existing low-lift raw water pumps are currently under capacity for the maximum day demand due to operational limitations. The existing wet well is not deep enough to upgrade these pumps to meet the future flow due to net positive suction head requirements. Thus, a new wet well and low lift pumping station is likely required in any expansion option.
- The high-lift pumps technically have sufficient firm capacity to meet the next 15 years of Town growth, however, the configuration of the clearwells (with two largest pumps in one tank) make it difficult for operators to take the larger clearwell out of service. The pump will eventually need to be upgraded to meet the 20-year maximum day demand of 208.5 L/s (18,000 m^3/d).

Some key features of the existing Water Treatment Plant site that relate to the evaluation criteria and were considered in the evaluation of alternatives include:

- The existing water intake pipe is near the deepest part of the Mississippi River between the Mississippi Lake and the Mississippi Dam in downtown Carleton Place. Moving the plant to a new location would need to consider water depth at the intake and its potential impacts to boat traffic disturbances, source water quality, intake screening, positive pressure gradient and water availability. Any excavation within the River to replace or install a new intake pipe, if necessary, will need to consider environmental impacts to the River. Trenchless installation is preferred.
- A water-taking study is underway to confirm water availability. The presence of the Mississippi Dam downstream of the WTP site and the Mississippi Lake upstream provide additional buffer from low water levels and drought.
- A geotechnical investigation was not completed at the existing site, however based on background document review and the proximity to the River, it is expected that any deep excavations would encounter both rock conditions and high groundwater levels.
- A Species At-Risk (SAR) review was completed at the existing site and did not identify any SAR on the existing property but found several potentially suitable habitats. These

should be considered at the design stage. If a new site is preferred for expansion or new construction, an additional SAR should be conducted.

- A Stage 1 Archaeological Assessment (AA) was completed at the existing site and evaluated the site as having no or low archaeological potential, with no need for further investigation recommended. If a new site is preferred for expansion or new construction, an additional AA should be conducted.
- The original WTP building (constructed in 1914) was registered in 2021 as a "property of cultural heritage value or interest" and should be preserved and protected in all alternatives. This building currently houses the intake screens, low lift pumps and backup generator.
- The Canoe Club property to the north of the existing WTP is owned by the Town. A patch of cleared land to the east of the Canoe Club may be a suitable site for new construction or future plant expansion, however, the Canoe Club building and waterfront should be preserved and maintained.
- Some opportunities for improvement or optimization of the existing facility have been identified by the operators, specifically related to existing process efficiency and health and safety concerns (i.e., chemical storage capacity). Expansion or new plant construction should consider these issues during design.
- The following alternatives are proposed and evaluated for the WTP:

Alternative A: Do Nothing

The "do nothing" approach does not allow for growth to occur beyond the existing potable water and wastewater systems' capabilities. The mandate as directed by the Town for this assignment is to determine infrastructure needs to support planned and projected growth. Additionally, considering climate change, the impacts of climate change on water supply for the Town and potential resilience measures should be considered.

Alternative B: Water Conservation Measures

In the absence of upgrading the existing water treatment plant capacity, significant water conservation measures would be required to mitigate the higher existing water usage per capita and the additional demand from new users, however this will likely not be sufficient to provide required capacity for future demand needs. Implementing water conservation measures would be aimed at reducing water consumption rates, such that future demand needs could be met while maintaining the existing WTP capacity. Since 2002, the Town has already implemented a by-law to impose controls on outdoor water use during the spring and summer. However, such measures are likely not desirable to the residents of the Town as a long-term measure. The efficiency of the water conservation measures would have to be reviewed and confirmed with WTP data. Water conservation measures could include measures such as installation of water meters at all service connections

(residential, commercial, industrial and institutional) and a rate structure that would discourage the overuse of water on a per capita basis.

Alternative C: Expand Existing WTP On-Site

This alternative would maintain the existing WTP site footprint and involve expanding processes to meet planned growth. A high-level review of the required process expansion footprints indicates that the 2041 demand could be met by expanding the existing facility on the current property, as shown in **Figure 1**. For some processes, this could be achieved by expanding individual processes within the existing building footprint, by increasing hydraulic loading (on a $m^3/m^2/h$ basis) within maximum acceptable capacity as recommended by Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines. For others, new structures will be required to be constructed on site.

This is a viable option, as the current site can accommodate all the new building to meet the target rated capacity. The existing raw water intake can support the higher water demand, but the new low lift pumps would require a larger and deeper basin than the current one. Such basin would be set below the new chemical feed building, which could also house a new backup generator for the plant. Additional clearwell cells and increased high lift pump capacity will also be required. As previously noted, the original 1914 building has cultural heritage value or interest and will be preserved in any expansion of the site. This building may continue to be used for chemical storage, maintenance activities and administrative purposes.

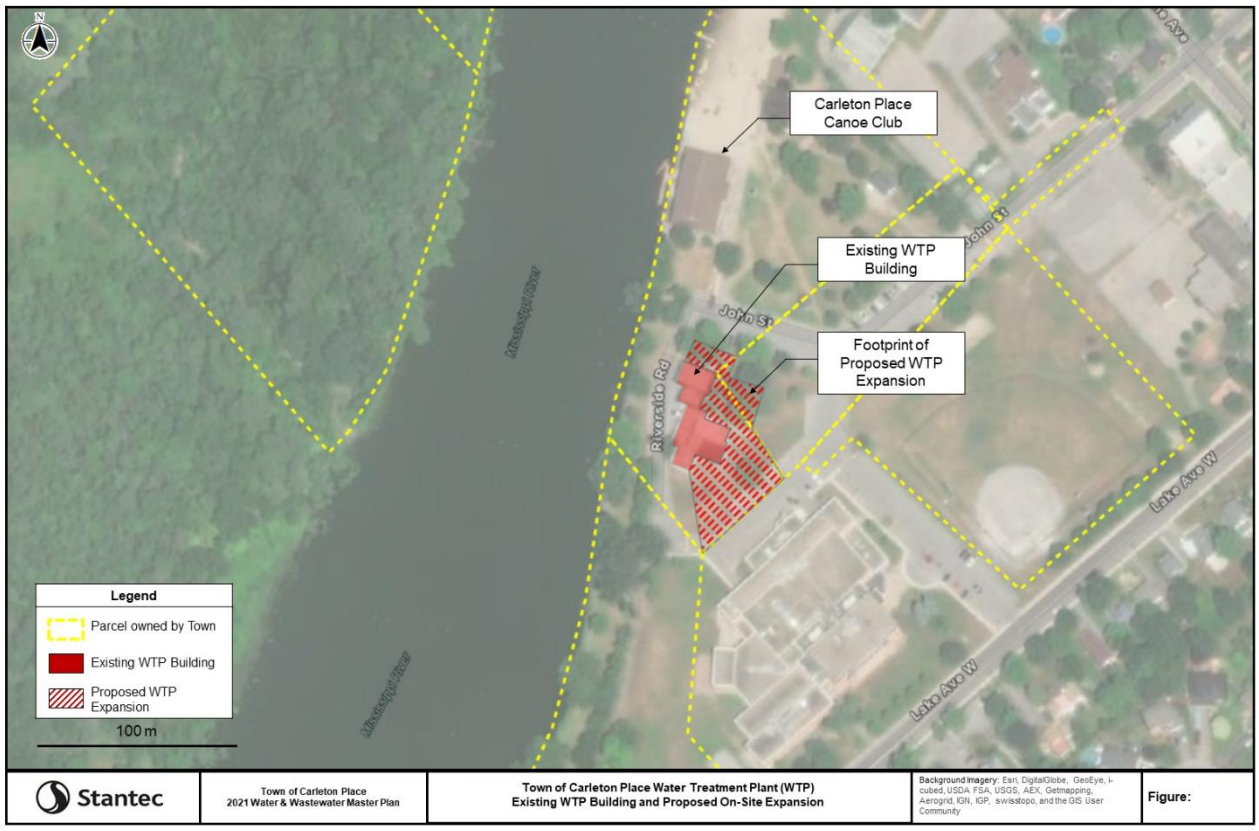
The proposed expansion of the ACTIFLO and gravity filter processes may consist of one of the following options:

- Add two ACTIFLO tanks, plus three steel tank gravity filters;
- Add two ACTIFLO tank and two concrete tank gravity filters; and
- Add two ACTIFLO tanks plus two concrete tank gravity filters and replace steel filters by concrete filters.

These sub-alternatives would be evaluated in subsequent stages of the EA process. Once the existing ACTIFLO basins and/or circular steel tank filters reach the end of their service life, there may still be enough land on site to replace those with new facilities before decommissioning; however, this would use all land available on this site, leaving no possibility to expand plant capacity. A future expansion area or new plant would need to be identified and secured before 2041. New plant sites are discussed with Alternative D. Further expansion may be practical into the open park space to the East of the existing Canoe Club building.

Reference: Alternatives Evaluation Technical Memorandum

Figure 1: Potential Footprint of On-Site WTP Expansion



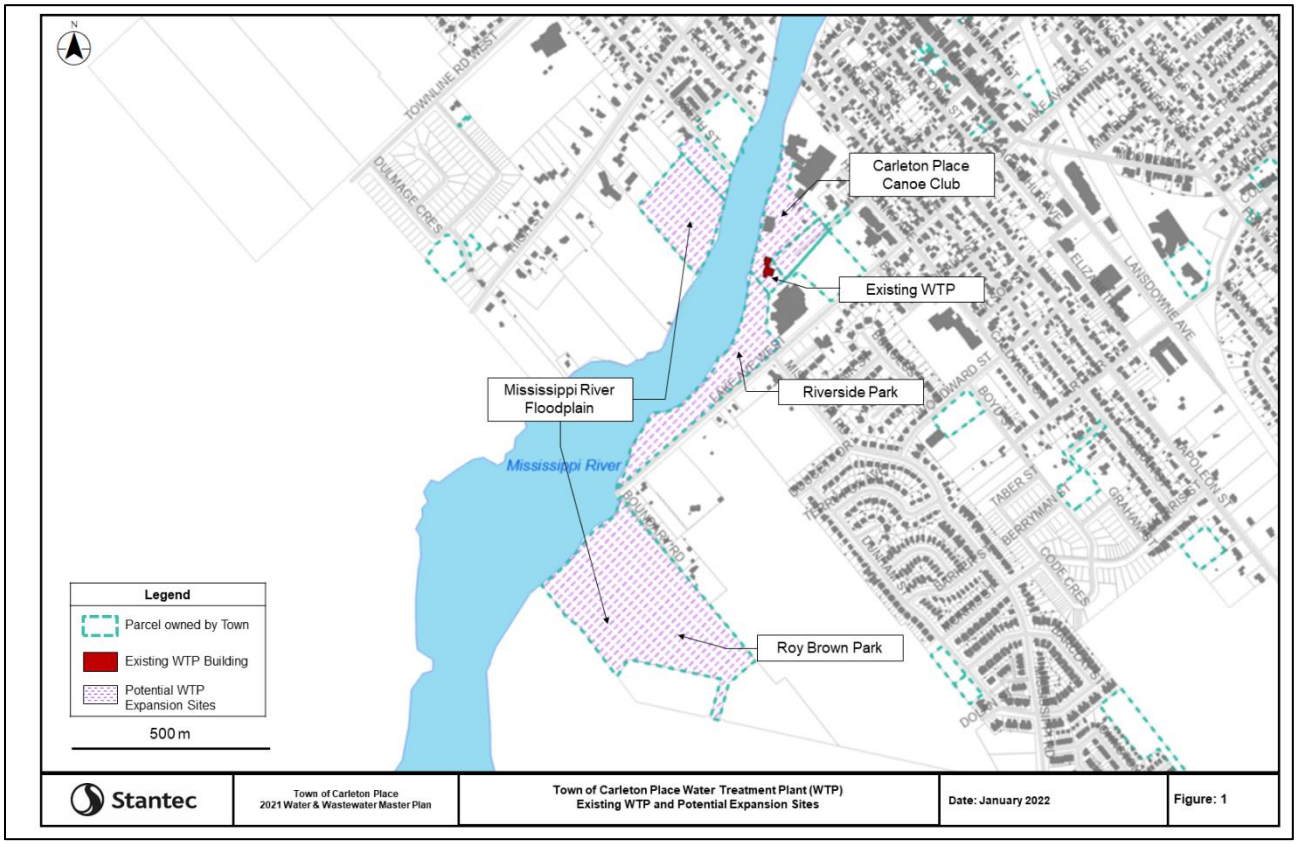
Alternative D: Build an Additional WTP (Off-Site)

Building a second WTP would require developing a new site along the Mississippi River. Space is constrained, as most of the available land along the river is already developed. Nevertheless, the Town owns five undeveloped parcels along the river, providing options, should this alternative be selected. These parcels are highlighted in **Figure 1** hereafter, and consist of:

- Two parcels north of the Mississippi River, across from the existing WTP;
- One parcel along the Mississippi River, along Lake Ave W, extending towards another parcel southwest of Boundary Road and Lake Ave W; and
- One parcel adjacent to the existing WTP, to the north (behind the Canoe Club).

Reference: Alternatives Evaluation Technical Memorandum

Figure 2: Existing WTP and Potential WTP Expansion Sites



Two of these sites are located across from the existing WTP, north of the Mississippi river. One site is located over a kilometer southwest from the existing WTP. A new WTP on any of these sites would require a separate raw water intake line, with the following constraints:

- Implementing a second raw water intake pipe could further impact the Mississippi River during construction.
- Operating a second plant would lead to a doubling of the operational fixed costs (sampling, reporting, SCADA, building heating), while the variable costs (chemicals, pumping power costs) would increase with water demand. Practically, the operating cost charged on a per cubic meter basis would increase drastically on the first year of operation, without tangible benefit in terms of service pressure and water quality.

Reference: Alternatives Evaluation Technical Memorandum

Build an Additional WTP (Off-Site), North of the Mississippi River, Across from the Existing WTP

The wooded area available north of the Mississippi River, across from the existing WTP, can accommodate a new WTP. A new raw water intake pipe, with its inlet set at the river low point, similar to the existing intake pipe, would be required and have negative impacts on the river during construction. This area is part of the Mississippi River floodplain, with some wetlands, which could be deemed valuable for conservation purposes, and may also be impractical to build new structures on without significant importing of fill to support foundations. These are probable reasons that no residential, commercial, institutional, or industrial development have occurred within this area to date. Since this area has yet to be cleared, there are also higher probably impacts to plants and animal habitats, and potential for encountering SAR or archeological artifacts. Furthermore, the Town's existing water distribution system has been implemented considering the location of the existing WTP as the source of water. Building a new WTP on the north side of the river would have implications on the water distribution system, as some of the existing watermains may need to be replaced or twinned to accommodate the higher flow rate associated with a new WTP. Alternatively, a new large diameter watermain could be installed across the river, to connect the new WTP to the existing WTP. However, this would add impacts to the Mississippi River. For those reasons, the site north of the river, across from the existing WTP would not be considered for a new WTP off-site.

Build an Additional WTP (Off-Site), Along Lake Ave W and Southwest of Boundary Rd

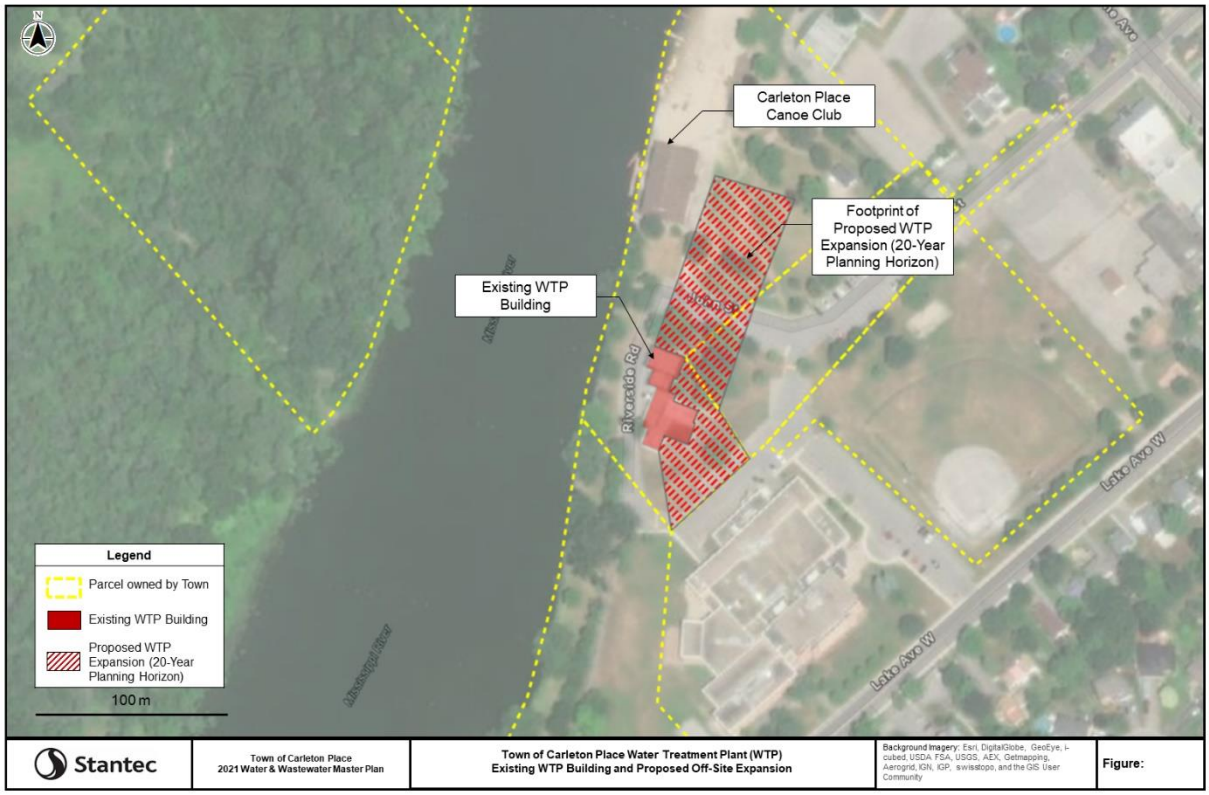
The Town owns the parcels along the river, extending over a kilometer southwest of the existing WTP, along Lake Ave W, as well as southwest of Boundary Rd. Building a new WTP on these sites would have less impacts as building a new WTP across the river, with regards to river crossings and conservation areas. Nonetheless, these areas consist of parklands, hence a development on these sites have significant social impacts and may not be acceptable to the public. The areas southwest of Boundary Road may be similar to that on the north side of the river, where wetlands and forested areas present geotechnical and environmental challenges. The operational, maintenance and monitoring cost would also still increase. Furthermore, unlike the existing WTP's raw water intake pipe, a new raw water intake pipe at one of these sites would not be located at the lowest river elevation. This has repercussions on raw water quality during the summer season and less buffer in the event of potential droughts. With boat traffic in these shallower areas, a higher concentration of sediment would be disturbed and could enter the intake pipe, which could result in higher suspended solids concentration. This would require a higher level of treatment, i.e., an increase in operating costs. This solution would be retained only if it is the only one technically feasible, however, due to the additional environmental impacts to the river associated with this option, it is not further considered.

Reference: Alternatives Evaluation Technical Memorandum

Build an Additional WTP (Off-Site), Adjacent to the Existing WTP to the North (Behind the Canoe Club)

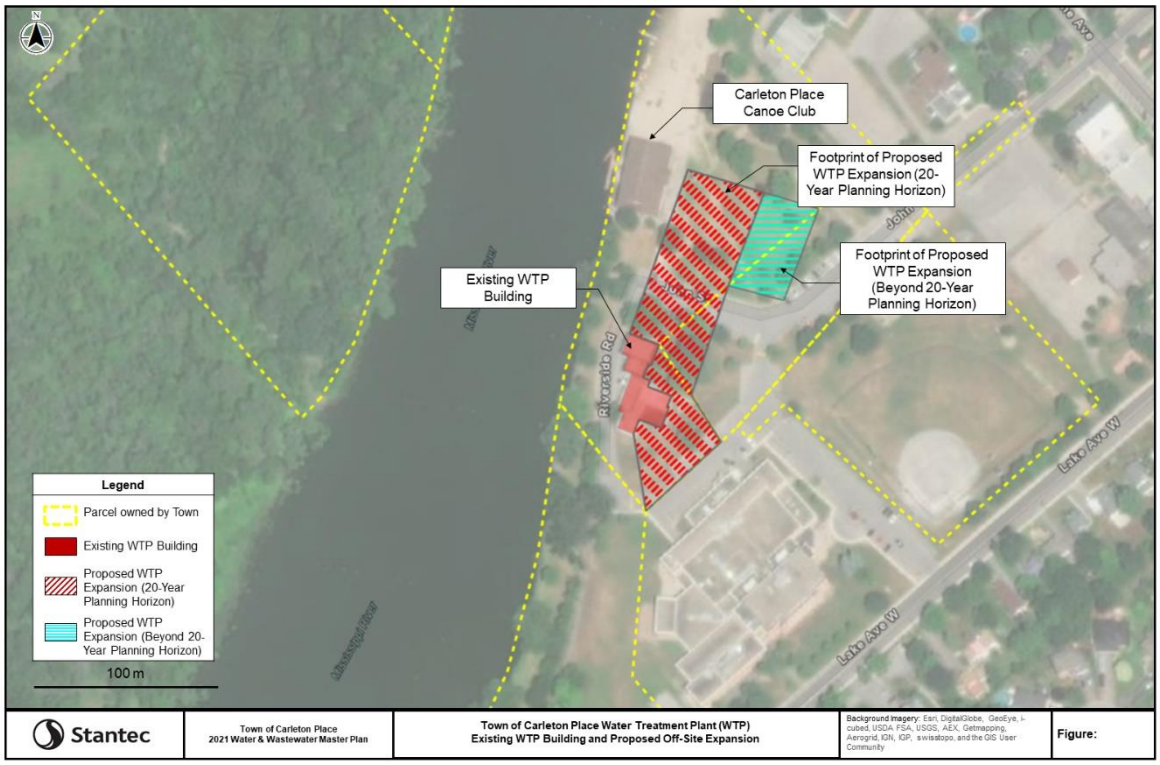
Another option to build an additional WTP (off-site) would involve building a new WTP adjacent to the existing WTP, to the north (behind the Canoe Club). As with other options, the original 1914 building will be retained on the existing site for its heritage value and may continue to be used for chemical storage, maintenance activities and administrative purposes. It would also be practical to re-use the existing WTP's raw water intake pipe and clearwells. This would involve a new intake screening and low lift pump building on the new site. A new ACTIFLO room and have an underground pipe transferring filtered water from the new filter building to the expanded clearwell. A new effluent discharge line would be required at the filter backwash equalization tank. The benefit of such location would be to keep the increase of fixed costs to a minimum, as there would be only one site, and one series of raw water and treated water testing. This alternative is illustrated in **Figure 3**. Furthermore, this option could allow for future expandability beyond the 22 MLD capacity, i.e., beyond the current 20-year planning horizon, as shown on **Figure 4**. This expansion beyond the current 20-year planning horizon would occur on the existing parkland behind the Canoe Club and may have social impacts on residents.

Figure 3: Potential Footprint of New Adjacent WTP



Reference: Alternatives Evaluation Technical Memorandum

Figure 4: Potential Future Footprint of New and Expanded WTP, Beyond 20 Year Planning



Alternative E: Municipal Groundwater Well

This alternative would involve changing the Town's raw water source to groundwater. Based on a preliminary assessment and review of previous studies, the Mississippi River capacity is adequate to meet future needs, and a change in the raw water source is not deemed necessary.

Additionally, the Town would have to undergo all the required processes to be able to extract groundwater. Groundwater extraction south of the Mississippi River may not be a viable option due to the presence of the Beckwith contaminated groundwater plume, which would create safety concerns. Hydrogeological investigations would be required to identify any groundwater potential north of the Mississippi River.

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Summary 1: Potable Water Treatment

Table 2 shows the evaluation of the alternatives for the WTP. Based on this evaluation of alternatives, the preferred alternative to meet future growth needs is **Alternative C**, to expand the WTP on-site. As the WTP expansion will be constrained by the existing site's boundaries, there may be limited space available for increasing system storage beyond the required clearwell expansion for chlorine disinfection. Further investigation will be completed to determine whether the site can accommodate the need for additional system storage or whether the addition of a new off-site storage tank is a required in the short term (see **Alternatives Evaluation 2: Water Storage**).

Climate Change Considerations

- The Phase 1 Report also discusses climate change projections and potential impacts to each system. The impacts of climate change and extreme weather events on the WTP include:
- Increased runoff's impact on source water quality due to increased precipitation;
- Flooding during higher river flows due to increased precipitation;
- Low flows impact on water intake and water quality due to decreased precipitation/prolonged droughts;
- Increase in water demand linked to temperature increases;
- Water quality issues linked to temperature increases;
- Formation of frazil ice at intake structure during low water levels; and
- Severe storms interrupting deliveries or leading to power outages.

To address potential climate change impacts and increase resilience to climate change, different measures could be integrated in the selected alternative. Opportunities for climate change adaptation include:

- Adaptation to flooding risks
  - Build new process structures and buildings above the floodplain limit, with a buffer to accommodate future floods,
  - Relocating equipment away from flood-prone areas, and
  - Verify and update emergency measures for flooding;
- Adaptation to increased precipitation and impact on source water quality
  - Design processes to increase chemical dosing and other operational parameters in case of degraded source water quality,
  - Adapt chemical supply planning based on modified usage, and
  - Consider changes in proportion of process wastewater;

Reference: Alternatives Evaluation Technical Memorandum

- Adaptation to low water levels due to drought
  - Design low-lift pumps and basin considering potential low water levels, and
  - Ensure that existing raw water intake (or any new proposed raw water intake) is at the deepest point, minimizing the risk of frazil ice formation.
- Adaptation to degraded source quality due to drought
  - Design processes which can handle increased solids loading;
- Adaptation to increased potable water demand with increased temperatures
  - Integrate process water usage efficiency in design, and
  - Encourage water conservation in the Town; and
- Adaptation to impacts of severe storms
  - Design storing capacity to provide additional reserve and minimize impacts of delayed deliveries on plant operation, and
  - Size backup power generators for critical plant processes.
- Opportunities for climate change mitigation (GHG emissions reduction) and energy savings are considered in the evaluations herein and include:
- Upgrading pumps and other processes to increase their efficiency (or selecting new high-efficiency pumps and motors);
- Optimizing pump operation and other processes to reduce energy consumption and process water usage;
- Upgrading backup generator with energy efficient model; and
- Using renewable energy sources.

Reference: Alternatives Evaluation Technical Memorandum

Table 2: Evaluation Summary for WTP

Evaluation Criteria		Alternative Solutions				
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Conservation Measures**	**Alternative C: Expanding Existing Site**	**Alternative D: Build New/Additional WTP behind Canoe Club**	**Alternative E: Municipal Groundwater Well**
Natural Environment						
Aquatic Environment	• Potential to impact fish and fish habitat • Potential to impact surface water quality and quantity	• No impact to fish and fish habitat. • No impact to surface water quality and quantity.	• Moderate potential to reduce water taking, minimizing impacts on fish and fish habitat. • No impact to surface water quality and quantity.	• High potential to impact fish and fish habitat through increased water-taking due to population growth. • High potential to impact surface water quality and quantity due to site's proximity to the Mississippi River and potential for runoff during construction. However, impacts may be mitigated through design and construction management measures.	• Higher potential to impact fish and fish habitat through increased water-taking due to population growth and potential requirement for new raw water intake source. • High potential to impact surface water quality and quantity due to site's proximity to the Mississippi River and potential for runoff during construction. However, impacts may be mitigated through design and construction management measures.	• No impact to fish and fish habitat. • High potential to impact surface water quality and quantity due to the presence of Beckwith contaminated groundwater plume.
Terrestrial Environment	• Potential to impact wildlife/habitat (i.e., Species-at-Risk, spawning areas, significant ecological areas, etc.) • Potential to affect vegetation (i.e., wooded areas, wetlands, conservation areas, etc.) • Potential to impact individual trees or landscaped features	• No impact to wildlife/habitat. • No impact to vegetation. • No impact to individual trees or landscaped features.	• No impact to wildlife/habitat. • No impact to vegetation. • No impact to individual trees or landscaped features.	• Moderate-High potential to impact wildlife/habitat, including migratory bird nests. • Low potential to affect vegetation. • High potential to significantly impact individual mature trees that would require removal to accommodate expansion.	• Higher potential to impact wildlife/habitat, including migratory bird nests. • High potential to affect vegetation through the reduction of park land and vegetated areas. • High potential to significantly impact to individual mature trees that would require removal to accommodate new WTP. However, impacts may be mitigated through design and construction management measures.	• Moderate potential to impact wildlife/habitat, vegetation and individual trees/landscaped features depending on existing conditions of selected groundwater well site. However, impacts may be mitigated through design and construction management measures.
Natural Environment Summary		**Preferred**	**Preferred**	**Moderately Preferred**	**Least Preferred**	**Partially Preferred**
Cultural Environment						
Archaeological Resources	• Potential to impact undisturbed lands	• No impact to undisturbed lands.	• No impact to undisturbed lands.	• Low potential to impact undisturbed lands as expansion can be accommodated within previously disturbed lands (i.e., existing ROW/parking lots).	• Higher potential for archaeological finds as greater amount of land would be impacted by the construction of new WTP, including park land.	• Moderate potential to impact undisturbed lands depending on existing conditions of selected groundwater well site. Additional studies would be required for the selected site to determine potential to impact undisturbed lands.

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions				
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Conservation Measures**	**Alternative C: Expanding Existing Site**	**Alternative D: Build New/Additional WTP behind Canoe Club**	**Alternative E: Municipal Groundwater Well**
Built Heritage Resources / Cultural Landscape	• Potential to impact known built heritage resources or cultural landscapes/features	• No impact to known built heritage or cultural landscapes/features.	• No impact to known built heritage or cultural landscapes/features.	• High potential to impact known built heritage resources of cultural landscapes/features as existing WTP has been identified by the Town as having Cultural Heritage Value.	• Moderate potential to impact known built heritage resources of cultural landscapes/features as a greater amount of land would be impacted by the construction of a new WTP. • Additional studies would be required for the preferred site to determine potential to impact known built heritage resources or cultural landscapes/features.	• Moderate potential to impact known built heritage resources of cultural landscapes/features, as a greater amount of land would be impacted by the construction of a new groundwater well. • Additional studies would be required for the preferred site to determine potential to impact known built heritage resources or cultural landscapes/features.
Cultural Environment Summary		**Preferred**	**Preferred**	**Moderately Preferred**	**Partially Preferred**	**Least Preferred**
Socio-Economic Environment						
Noise/Vibration & Air Quality	• Potential to impact noise sensitive areas (i.e., residential dwellings, daycares, etc.) • Potential to affect local air quality	• No impact to noise sensitive areas. • No impact to local air quality.	• No impact to noise sensitive areas. • No impact to local air quality.	• Moderate potential to increase noise near adjacent high school and park land temporarily during construction. • Low potential to affect local air quality besides temporary construction dust and vehicle exhaust.	• Moderate potential to increase noise near adjacent high school and park land temporarily during construction. • Low potential to affect local air quality besides temporary construction dust and vehicle exhaust.	• Moderate potential to increase noise temporarily near noise sensitive areas during construction, depending on the site selected for new groundwater well. • Low potential to affect local air quality besides temporary construction dust and vehicle exhaust.
Property Requirements	• Requires acquisition of private property	• No impact to private property.	• No impact to private property.	• Low potential to impact private property as expansion would remain within Town owned ROW/existing parking lots.	• Low potential for property impacts as preferred site is situated on existing park space next to Canoe Club which is currently owned by the Town.	• High potential to impact private property depending on site selected.
Aesthetics	• Potential to impact visual aesthetics of study area	• No impact to visual aesthetics of study area.	• No impact to visual aesthetics of study area.	• Moderate potential for visual aesthetic impacts as modifications to exterior of existing building will change existing views/landscape of area	• High potential to impact existing aesthetics through reduction of park land and construction of new WTP buildings which will change the existing views/landscape of the area.	• High potential to impact visual aesthetics • Construction of new Groundwater Well facilities expected to change existing views/landscape of selected site.
Land Use	• Potential to impact existing and future designated land use and/or community use	• No impact to existing land use.	• No impact to existing land use.	• Low impact to existing land use as expansion can be accommodated within existing ROW/parking lots.	• High potential to impact existing land use as WTP would be built upon existing parkland behind Canoe Club reducing amount of space for community recreational use.	• Moderate potential to impact existing land use depending on preferred site.

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions				
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Conservation Measures**	**Alternative C: Expanding Existing Site**	**Alternative D: Build New/Additional WTP behind Canoe Club**	**Alternative E: Municipal Groundwater Well**
Consistency with Municipal Planning Objectives & Existing / Proposed Development within the Area	• Satisfies the goals and objectives of the Town's Official Plan • Compliance with municipal/regional policies • Potential to support existing and future development within the area	• Does not satisfy the goals and objectives of the Town's Official Plan to support future projected population growth. • Does not interfere with any municipal/County policies • Does not support future development within the Town.	• Does not satisfy the goals and objectives of the Town's Official Plan to support future projected population growth. • Does not interfere with any municipal/regional policies. • Low potential to support future development within the Town.	• High potential to satisfy the goals of the Town's Official Plan to support future projected population growth within the 2041 horizon but does not support longer-term infrastructure needs beyond 2041. • Not consistent with local policy to preserve known built heritage. However, mitigation measures could be implemented during design and construction to preserve the cultural heritage value of the existing WTP. • High potential to support existing and future development within Town.	• Highest potential to satisfy the goals of the Town's Official Plan to support future projected population growth. • Not consistent with local policy to preserve existing parkland/recreational space. • High potential to support existing and future development within the Town.	• Moderate potential to satisfy the goals of the Town's Official Plan to support future projected population growth depending on site selected. • Moderate potential to comply with municipal/regional policies depending on site selected. • Moderate potential to support existing and future development within the Town, depending on preferred site and groundwater available.
Health & Safety	• Potential to impact health and safety of residents • Potential to impact health and safety of employees • Potential impacts to groundwater quality (i.e., wells, effect Source Water Protection area, etc.) • Potential to encounter contaminated subsurface conditions	• Moderate potential to impact health of residents due to inability to provide sufficient water treatment services for drinking water. • Low potential to improve health and safety of employees. • No impact to groundwater quality. • No potential to encounter contaminated subsurface conditions.	• Moderate potential to impact health of residents due to inability to provide sufficient water treatment services for drinking water. • Low potential to improve health and safety of employees. • No impact to groundwater quality. • No potential to encounter contaminated subsurface conditions.	• Low potential to impact the health and safety of Town residents. • Moderate potential to improve health and safety of employees through improvement in chemical storage and transfer processes • Low potential to impact groundwater quality including private wells. • Low potential to encounter contaminated subsurface conditions.	• Low potential to impact the health and safety of Town residents. • High potential to improve health and safety of employees through improvement in chemical storage and transfer processes • Low potential to impact groundwater quality including private wells. • Moderate potential to encounter contaminated subsurface conditions on new site.	• Moderate risk to health and safety of Town residents due to associated Beckwith contaminated plume. • High potential to improve health and safety of employees through improvement in chemical storage and transfer processes • High potential to impact groundwater quality including private wells. • High potential to encounter contaminated subsurface conditions.
Community Access	• Disruption to existing traffic, private property and business access during construction or operation	• No impacts to existing traffic, private property or businesses.	• No impacts to existing traffic, private property or businesses.	• Moderate potential to increase existing traffic near adjacent high school and Canoe Club during construction.	• Moderate potential to impact access to and increase traffic near adjacent high school and Canoe Club during construction and throughout operational phase.	• Moderate impacts to traffic/property access are anticipated depending on site location.
Socio-Economic Environment Summary		**Moderately Preferred**	**Moderately Preferred**	**Preferred**	**Partially Preferred**	**Least Preferred**

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions				
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Conservation Measures**	**Alternative C: Expanding Existing Site**	**Alternative D: Build New/Additional WTP behind Canoe Club**	**Alternative E: Municipal Groundwater Well**
Technical						
Functionality/Reliability of Water Treatment	• Quality of source water at intake • Treated potable water quality • Reliability of the treatment process	• Low potential to impact quality of source water at intake. • Moderate potential to impact treated potable water quality as population grows. • Moderate potential for reliability of treatment process to be negatively impacted as population grows.	• Low potential to impact quality of source water at intake. • Moderate potential to impact treated potable water quality as population grows. • Moderate potential for reliability of treatment process to be negatively impacted as population grows.	• No impact to source water quality as existing intake may be kept. • No impact to treated water quality as expansion processes will maintain existing potable water quality • Moderate potential for functionality/reliability of treatment plant to increase through optimization of some operation processes.	• No impact to source water quality as existing intake may be kept. • No impact to treated water quality as new processes will maintain existing potable water quality • High potential for functionality/reliability of treatment plant to increase through optimization of all operation processes.	• High impact to source water quality at intake due to known contaminated groundwater plume • Moderate potential to impact treated water quality as practical treatment options may not be enough to make the water potable • Need for functionality/reliability through additional studies, although very unlikely to be a practical option due to contaminated groundwater plume.
Cost	• Relative capital, operational and maintenance costs ($)	• No capital cost associated. • Moderate-High repairs and maintenance costs anticipated to increase over for existing facility to keep up with current and future population demands	• Low capital cost associated to initiate water conservation program. • Moderate-High repairs and maintenance costs anticipated to increase over for existing facility to keep up with current and future population demands	• Moderate capital costs. • Moderate operations and maintenance costs when compared to running two WTPs.	• Higher capital cost to build new WTP than expand. • Higher operational and maintenance costs to run two WTPs.	• Highest capital costs due to development of new site and installation of deep groundwater well. • Low operational and maintenance costs.
Utilities	• Potential to impact existing utilities	• Moderate impact. Insufficient potable water supply to residences.	• Moderate impact. Insufficient potable water supply to residences.	• Low impact. Sufficient potable water supply to residences. Upgraded hydro connection may be needed at the site.	• Moderate impact. Sufficient potable water supply to residences. New hydro, telecoms, sewer and gas utility connections can be made from adjacent site.	• Moderate impact. Sufficient potable water supply to residences. New hydro, telecoms, sewer and gas utility connections required at the site.
Constructability & Feasibility	• Potential to disrupt existing traffic, property access or functionality of existing facilities during construction • Location, depth of excavation, soil conditions, rock removal, groundwater control, in-water works, workable construction area, construction duration	• No impact to existing traffic, property access or functionality of existing facilities. • No construction required.	• No impact to existing traffic, property access or functionality of existing facilities. • No construction required.	• High impacts to functionality of existing facilities are anticipated during construction to dismantle existing equipment and begin operations of new equipment. • Geotechnical investigation of new site will be required, however no in-river works needed as existing intake pipe has capacity to serve future flow rates.	• Low impact to functionality of existing facilities during construction. • Geotechnical investigation of new site will be required, as well as in-water works depending on preferred site location. May require in-water works to establish new raw water intake source. Construction of new WTP will take the longest to construct when compared to Alternative C and E.	• No impacts to functionality of existing facilities during construction. • Comprehensive environmental, geotechnical, hydrogeological investigations of site would be required.

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions				
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Conservation Measures**	**Alternative C: Expanding Existing Site**	**Alternative D: Build New/Additional WTP behind Canoe Club**	**Alternative E: Municipal Groundwater Well**
Expandability	• Potential to be expanded or flexible to meet future population needs	• Not able to be expanded or flexible to meet future population needs.	• Not able to be expanded or flexible to meet future population needs.	• Moderate potential to expand for projected 20-year population horizon, but no further. Future expansion area or new plant would need to be identified and secured before 2041 horizon.	• High potential to expand for projected 20-year population horizon and further.	• Additional studies required to determine ability to support long-term growth once site is selected.
Climate Change	• Ability to increase resilience to climate change (i.e., severe weather events) within the study area • Impacts to known climate change contributors (i.e., GHG emissions)	• No potential to increase resiliency to climate change. • No impacts to known climate change contributors.	• No potential to increase resiliency to climate change. • No impacts to known climate change contributors.	• Moderate potential for increased resiliency to climate change through implementation more robust and efficient treatment processes, increased chemical storage and generator capacity, and flood-resistant facility design. • Moderate potential to increase known climate change contributors through increased energy consumption, although there are opportunities to implement more energy efficient processes.	• Moderate potential for increased resiliency to climate change through implementation of more robust and efficient treatment processes, increased chemical storage and generator capacity, and flood-resistant facility design. • High potential to increase known climate change contributors through increased energy consumption, although there are opportunities to implement more energy efficient processes.	• High potential to increase vulnerability to climate change through increased vulnerability to drought. • Low potential to increase known climate change contributors.
TECHNICAL SUMMARY		**Partially Preferred**	**Partially Preferred**	**Preferred**	**Moderately Preferred**	**Least Preferred**
Overall Conclusion		Not Recommended	Not Recommended	**Recommended Solution**	Not Recommended	Not Recommended

Legend
Preferred
Moderately Preferred
Partially Preferred
Least Preferred

Reference: Alternatives Evaluation Technical Memorandum

Alternatives Evaluation 2: Water Storage

The following is a summary of the water storage planning constraints and needs, some of which are discussed in the **Phase 1 Report**:

- Previous Master Plan studies analyzed the Town's water storage requirements using the Ministry of the Environment, Conservation and Parks (MECP) formula and fire flows, which shows an existing storage deficit of 373 m^3. For a 20-year planning horizon, an additional storage volume of 4,926 m^3 would be required using this calculation, to accommodate population growth in the Town. The MECP fire flow values are known to be more conservative than other acceptable guidelines, and thus the current study has re-evaluated this. In comparison, using the Fire Underwriters Survey (FUS) fire flow standards and a baseline fire flow of 13,000 L/min for 2.75 hours (to meet the typical fire flow requirements in the Town), there is an existing storage surplus of 650 m^3, which is sufficient to service the Town until 2025.
- Considering that the FUS fire flow values are used in many similarly sized municipalities, the Town accepts this to provide a reasonable fire storage volume. To meet the 2041 storage requirements, an additional volume of 1,930 m^3 is required (potentially up to 2,500 m^3 depending on the actual usable volume in the water tower and WTP clearwells). With the expansion of the WTP, the clearwells will be expanded in volume, which can be used to account for some of the Town's emergency storage volume. The clearwell expansion volume depends on various design parameters for the WTP expansion project, which will be evaluated during conceptual design, however it is assumed to be 1,590 m^3 for this alternatives evaluation, which is in line with the previous studies. The remaining storage volume deficit of approximately 500 m^3 to 1,000 m^3 may be provided on the WTP site or off-site within the distribution system.
- In 2018, JLR investigated various locations for off-site water storage reservoirs in a Water Storage Study completed subsequent to the Master Plan Addendums. The Town's preferred location for additional storage is north of the Mississippi River, at a proposed municipal yard site on Bates Dr, which Stantec has further investigated in the current study. If adding off-site storage is the preferred alternative, the location of this storage will be further evaluated to confirm that the proposed location is still preferred.
- Also to be considered, the Town and OCWA have noted that occasionally on maximum day demands (hot summer days), the water treatment plant is not currently able to keep up and leads to stored water being consumed at the elevated storage tank (EST). This issue could be addressed by an increase in the WTP treatment capacity (including high lift pump upgrade) and/or addition of more water storage at the WTP or a new off-site reservoir.

Reference: Alternatives Evaluation Technical Memorandum

Some key features of the proposed off-site water storage site (Bates Drive) that relate to the evaluation criteria and were considered in the evaluation of alternatives include:

- A geotechnical investigation was not completed at the existing site but may be completed in conjunction with other planned works at the site. This may inform during the preliminary design stage whether an at-grade or partially or fully-buried storage tank is preferred. A second elevated water tower was not evaluated as it presents significantly higher aesthetic and economic impacts and potential issues from interactions with the existing elevated tank.
- A Species At-Risk (SAR) review was completed at the existing site and did not identify any SAR on the existing property but found several potentially suitable habitats. These, however, are mostly within the surrounding forested area (e.g., wood thrush). It is recommended that a proposed water storage tank be constructed entirely within the existing cleared area.
- A Stage 1 Archaeological Assessment (AA) was completed at the proposed municipal yard site and evaluated the site as having no or low archaeological potential, with no need for further investigation recommended. This site has already been cleared and partially graded.

The following alternatives are proposed and evaluated:

Alternative A: Do Nothing

The “do nothing” approach does not allow for growth to occur beyond the existing potable water and wastewater systems’ capabilities. The mandate as directed by the Town for this assignment is to determine infrastructure needs to support planned and projected growth. This alternative would influence options available for the potable water distribution system, as watermain upgrades would remain the only alternative to the constraints identified.

Alternative B: Expand WTP Clearwell

In the 2018 Master Plan update, it was suggested that an off-site storage reservoir may be the preferred option for addressing future and current storage deficits. Now that the water storage requirements (specifically for firewater storage) have been recalculated using a target fire flow in line with the FUS guidelines, the addition of off-site storage is shown to be much less pressing than previously suggested. Furthermore, accelerated Town growth and updated WTP capacity figures are indicating that upgrading the plant is a higher priority than previously believed, and this in turn will help alleviate current water storage issues. For these reasons, it is practical to reconsider the idea of adding further storage at the WTP site along with the treatment plant expansion as it will be much more cost effective and cause less construction-related disruption overall.

Reference: Alternatives Evaluation Technical Memorandum

In this alternative, additional storage for planned growth would be achieved solely through WTP clearwell expansion. This alternative would influence the options available for the WTP, as the option selected will require sufficient space for clearwell expansion. The proposed clearwell expansion associated with the WTP would be designed specifically for disinfection needs, thus an additional buffer volume would need to be added to address system storage deficiencies.

With respect to the available land on the existing WTP property, the WTP expansion and additional water storage are expected to consume most of the remaining land parcel area, affecting the future expandability of the storage option. Thus, a new off-site storage would eventually still be required beyond the 20-year planning horizon.

For reference, the water reserve volume is the sum of the following three theoretical volumes:

- The operational reserve, representing 25% of the maximum day demand (about half average day demand at ultimate serviced population). This reserve is generally distributed over the WTP clearwell, the existing EST, and any other new reservoir, such as the off-site reservoir discussed below.
- The fire reserve, which is provided by the EST, as the WTP clearwell does not have any fire pumps. High lift pumps are to meet only the maximum daily demand and upgrading them to fire flow capacity may be cost prohibitive for this option.
- The emergency reserve, corresponding to 25% of the total of the two previous volumes. It is generally distributed over all reservoirs. The portion allocated to the WTP clearwell could be set within a separate concrete wall compartment, to be used for chlorine contact time disinfection purpose, by setting the overflow at the top of the wall. In case of emergency the plant Operator could open a sluice gate at the bottom of the wall to expose the high lift pumps to this volume.

A disadvantage of this option is the timing required for implementation. General expansion of the WTP will help to address current capacity issues, which are known to impact the Town's water storage reserves during maximum day demands. However, this project is a longer lead time for planning, design and construction than a new off-site storage tank, and as such with not resolve the current issues for an additional year compared with a separate off-site storage tank.

This alternative would also influence options available for the potable water distribution system, as watermain upgrades would remain the only alternative to the distribution system constraints, particularly north of the river and in the southwest quadrant of the Town. Further analysis will be completed as part of this Master Plan to better define these watermain upgrade requirements.

Reference: Alternatives Evaluation Technical Memorandum

Alternative C: Add New Storage Off-Site

In addition to meeting future water storage volume requirements, the main advantage of adding a new off-site storage facility is in additional reliability in the event of failure or outage of the elevated storage tower and/or one or more watermain crossings across the river. Additionally, it may help alleviate fire flowrate issues on the north side of the river; these watermain upgrade requirements will be further analyzed and better defined in this Master Plan study. It also allows the entirety of the existing WTP property to be used towards treatment process upgrades. And finally, this option can be implemented faster than a WTP expansion, and thus will address the existing issues with maximum day demands consuming the EST capacity.

The main disadvantage of this option is that it will be significantly more expensive to design, construct and operate than providing the additional storage on the WTP site and considering the low volume of storage needed under FUS fire flow rates, it is less cost effective to construct than a typical storage structure. To address the fire flowrate issues in the distribution system, as noted above, the storage facility would need to be equipped with fire pumps, which are considerably more expensive, and would also only provide a fraction of the required fire volume (thus could not be relied on as a true standalone source of firewater). Furthermore, this adds another facility for the Town to operate and maintain. Additionally, the local area near Bates Drive will be impacted by construction-related disturbances, such as dust, traffic and noise. And finally, adding a 3rd storage location (in addition to the EST and the WTP clearwells) complicates the coordination of storage and adds an operational challenge to prevent stagnancy.

New storage could consist of:

- An at-grade or buried reservoir with a pumping station
- Elevated storage (secondary water tower)
- High-level ground storage (at-grade reservoir, at a high elevation)

Given the topography of the Town (from a low of ~128 m in the residential neighborhood bound by McNeely Ave, Stonewater Bay and the Mississippi River, to a high of ~146 m along Mississippi Road north of the Hwy 7), a high-level ground storage would not be feasible to achieve the required pressures. Elevated storage in the form of a water tower would limit the opportunities for future expansions (if needed). An at-grade reservoir with a pumping station would offer options for future volume expansion, in addition to hydraulic flexibility with pumping. This was the preferred alternative previously evaluated by JLR (2018), where different potential off-site storage locations were analyzed. The Town's preferred location for additional storage is north of the Mississippi River, at Bates Dr (see **Figure 5**) where a new municipal yard is planned to be developed. The location of the

proposed water storage reservoir and pumping station within the cleared land is to be confirmed and will depend on the Town's final preferred configuration of the municipal yard.

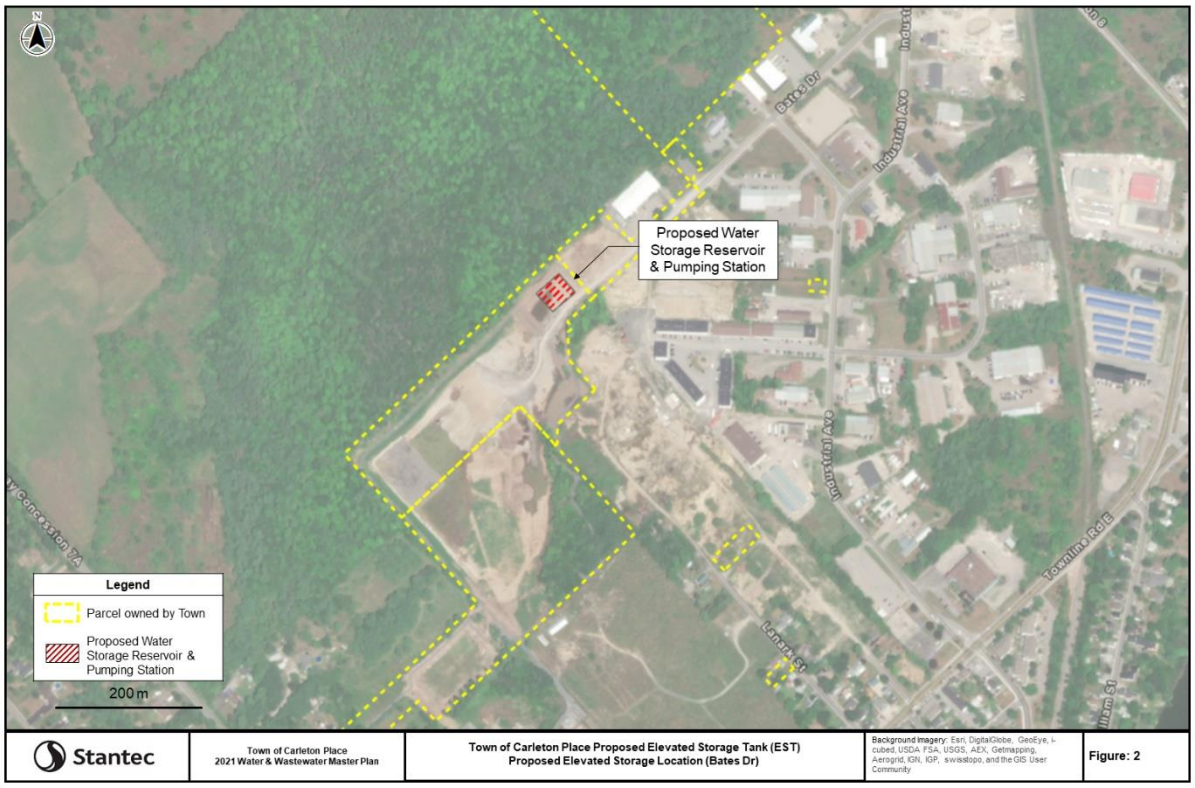
Should this alternative be selected, it may be implemented alone or combined with other water distribution system upgrades, as discussed in the **Potable Water Distribution System – Add Storage** alternative section. In either case, there will likely still be some required watermain upgrades along Bates Drive to connect to the future municipal yard to the distribution system, although larger pipes may be required for the storage option. Other watermain upgrades and looping may also still be required to address future flow deficiencies, which will be confirmed by further modelling in this study.

Current water system configuration implies that the WTP high lift pumps would operate when water level is dropping below a pre-set level at the elevated storage tank. This renews a portion of that reserve on a daily basis, contributing to minimal chlorine residual drop that is caused by higher water temperature within the tank.

With a third reservoir in Town, the overall operation sequence would have to be revised. The new reservoir being located at the north-west limit of Carleton Place, on Bates Dr, would have to be partially drained with own pumps every day, for renewing the portion of volume corresponding to the operational reserve dedicated to this site. This would contribute to maintaining the chlorine residual higher. Without such cycling, age of water within that reservoir would be too long, and chlorine residual would be at risk of dropping below minimum required limit.

Reference: Alternatives Evaluation Technical Memorandum

Figure 5: Proposed Elevated Storage Location (Bates Dr) and Anticipated Footprint



Evaluation Summary 2: Water Storage

Table 3 shows the evaluation of alternatives for water storage. Based on this evaluation of alternatives (see Evaluation Summary 1: Potable Water Treatment), the preferred alternative to address the future water storage requirements is Alternative B (to add storage at the WTP site). The selection of this alternative also has implications for the potable water distribution network (see Additional Considerations: Potable Water Distribution System).

Climate Change Considerations

- The Phase 1 Report also discusses climate change projections and potential impacts to each system. The impacts of climate change and extreme weather events on water storage include:
- Increase in water demand linked to temperature increases;
- Chlorine depletion in July and August, and possibly extending in September, due to temperature increases;
- Impact of freeze-thaw cycles on pipes and concrete structures; and

Reference: Alternatives Evaluation Technical Memorandum

- Severe storms leading to power outages at pumping stations.

To address potential climate change impacts and increase resilience to climate change, different measures could be integrated in the selected alternative. Opportunities for climate change adaptation include:

- Adaptation to increased potable water demand with increased temperatures
  - Encourage water conservation in the Town
- Adaptation to impacts of temperature increases on chlorine depletion
  - Adapt chemical supply planning based on potential increased usage
- Adaptation to impacts of freeze-thaw cycles on pipes and concrete structures
  - Regularly monitor state pipes and concrete structures
  - Adapt plan for infrastructure rehabilitation
- Adaptation to impacts of severe storms
  - Provide backup power generators
- Opportunities for climate change mitigation (GHG emissions reduction) and energy savings are considered in the evaluations herein and include:
- Using high-efficiency pumps and motors
- Optimizing pump operation
- Using renewable energy sources
- Water consumption efficiency/water conservation measures.

Reference: Alternatives Evaluation Technical Memorandum

Table 3: Evaluation Summary for Water Storage

Evaluation Criteria		Alternative Solutions		
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Expand WTP Clearwell**	**Alternative C: Add New Storage Off-Site at Bates Drive Location**
Natural Environment				
Aquatic Environment	• Potential to impact fish and fish habitat • Potential to impact surface water quality and quantity	• No impact to fish and fish habitat. • No impact to surface water quality and quantity.	• Moderate potential to impact fish and fish habitat due to site's proximity to the Mississippi River, although these risks may be present regardless due to WTP expansion. • Higher potential to impact surface water quality and quantity due to site's proximity to the Mississippi River and potential for runoff during construction. However, these risks may be present regardless due to WTP expansion, and impacts may be mitigated through design and construction management measures.	• Low potential to impact fish and fish habitat as site is located relatively far from any large body of water when compared to Alternative B. • Moderate potential to impact surface water quality and quantity from potential runoff during construction. However, impacts may be mitigated through design and construction management measures.
Terrestrial Environment	• Potential to impact wildlife/habitat (i.e., Species-at-Risk, spawning areas, significant ecological areas, etc.) • Potential to affect vegetation (i.e., wooded areas, wetlands, conservation areas, etc.) • Potential to impact individual trees or landscaped features	• No impact to wildlife/habitat. • No impact to vegetation. • No impact to individual trees or landscaped features.	• Moderate-High potential to impact wildlife/habitat, including migratory bird nests as additional trees may need to be removed. • Low potential to affect vegetation. • Moderate potential to impact individual mature trees that would require removal to accommodate expansion. • Impacts may be mitigated by vegetation and tree protection plans and tree placement planning	• Low potential to impact wildlife/habitat • Site currently vacant/undeveloped. • Low potential to affect vegetation. • Low potential to significantly impact individual mature trees as site has already been cleared. • Impacts (if any) may be mitigated through design and construction management measures.
Natural Environment Summary		**Preferred**	**Least Preferred**	**Moderately Preferred**

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions		
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Expand WTP Clearwell**	**Alternative C: Add New Storage Off-Site at Bates Drive Location**
Cultural Environment				
Archaeological Resources	• Potential to impact undisturbed lands	• No impact to undisturbed lands.	• Low potential to impact undisturbed lands • Site retains little to no archaeological potential	• Low potential to impact undisturbed lands • Site retains little to no archaeological potential.
Built Heritage Resources / Cultural Landscape	• Potential to impact known built heritage resources or cultural landscapes/features	• No impact to known built heritage or cultural landscapes/features.	• Potential to impact known built heritage resources as existing WTP building has been identified by the Town as having Cultural Heritage Value. However, mitigation measures would be designed through Heritage Impact Assessment and implemented during construction to conserve the cultural heritage value of the existing building. • Site modifications will be undertaken as part of water treatment service expansion	• Low potential to impact known built heritage resources of cultural landscapes/features. • Further investigation would be required to confirm
Cultural Environment Summary		**Preferred**	**Moderately Preferred**	**Moderately Preferred**
Socio-Economic Environment				
Noise/Vibration & Air Quality	• Potential to impact noise sensitive areas (i.e., residential dwellings, daycares, etc.) • Potential to affect local air quality	• No impact to noise sensitive areas. • No impact to local air quality.	• Potential to temporarily increase noise near adjacent high school and park land during construction through construction vehicles/equipment. • Low potential to affect local air quality besides temporary construction dust and vehicle exhaust. • Impacts can be mitigated by construction management and adherence to local noise by-bylaw	• Low potential to increase noise near noise sensitive areas temporarily during construction. • Low potential to affect local air quality besides temporary construction dust and vehicle exhaust. • Impacts can be mitigated by construction management and adherence to local noise by-bylaw
Property Requirements	• Requires acquisition of private property	• No impact to private property.	• Low potential to impact private property as expansion would remain within Town owned ROW/existing parking lots.	• Low potential to impact private property as new water storage facility can be accommodated within Town owned land. • Higher potential to impact property in association with expansion of linear servicing infrastructure
Aesthetics	• Potential to impact visual aesthetics of study area	• No impact to visual aesthetics of study area.	• High potential for visual aesthetic impacts as modifications to exterior of existing building will change existing views/landscape of area. • Impacts can be mitigated by new/enhanced landscaped features	• Low potential for visual aesthetic impacts as site is located within an existing industrial area.
Land Use	• Potential to impact existing and future designated land use and/or community use	• No impact to existing or designated land use.	• Low impact to existing and future land use as expansion can be accommodated within existing ROW/parking lots.	• Low potential to impact existing and future land use as new water storage facility can be accommodated within Town owned land.

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions		
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Expand WTP Clearwell**	**Alternative C: Add New Storage Off-Site at Bates Drive Location**
Consistency with Municipal Planning Objectives & Future Development within the Area	• Satisfies the goals and objectives of the Town's Official Plan • Compliance with municipal/regional policies • Potential to support existing and future development within the area	• Does not satisfy the goals and objectives of the Town's Official Plan to support future projected population growth • Does not interfere with any municipal/regional policies. • Does not support future development within the study area.	• High potential to satisfy the goals and objectives of the Town's Official Plan as it will support future projected population growth to the 2041 horizon but may have the ability to support the needs of the future population beyond 2041. • Somewhat consistent with local policy to preserve known built heritage. However, mitigation measures would be implemented during design and construction to conserve the cultural heritage value of the existing WTP. • High potential to support existing and future development within the area.	• High potential to satisfy the goals of the Town's Official Plant to support future projected population growth. • Complies with municipal and regional policies. • High potential to support existing and future development within the area.
Health & Safety	• Potential to impact health and safety of residents • Potential to impact health and safety of employees • Potential impacts to groundwater quality (i.e., wells, effect Source Water Protection area, etc.) • Potential to encounter contaminated subsurface conditions	• Higher potential to impact health of residents due to limited capacity of existing water storage to provide sufficient drinking water. • Low potential to improve health and safety of employees. • No impact to groundwater quality. • No potential to encounter contaminated subsurface conditions.	• Positive impact the health and safety of Town residents by adding firewater capacity. • Low potential to improve health and safety of employees. • Low potential to impact groundwater quality including private wells. • Low potential to encounter contaminated subsurface conditions.	• Positive impact to impact the health and safety of Town residents by adding firewater capacity. • Low potential to improve health and safety of employees. • Low potential to impact groundwater quality including private wells. • Higher potential to encounter contaminated subsurface conditions, when compared to the other alternatives. Additional studies required to confirm presence/absence of subsurface contamination.
Community Access	• Disruption to existing traffic, private property and business access during construction or operation	• No impacts to existing traffic, private property or access to businesses.	• Moderate potential to increase existing traffic near adjacent high school and Canoe Club during construction. • Traffic and/or property impacts during operation anticipated to be negligible given that site is currently in operation.	• Moderate potential to increase existing traffic during construction; however, as site is located on a dead-end street accessibility impacts to local traffic, private property and/or businesses are not anticipated. • Minor changes in local traffic anticipated during operation in association with staff travelling to/from the new facility
Socio-Economic Environment Summary		**Least Preferred**	**Preferred**	**Moderately Preferred**

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions		
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Expand WTP Clearwell**	**Alternative C: Add New Storage Off-Site at Bates Drive Location**
Technical				
Functionality/Reliability of Water Storage	• Potential impacts to drinking water quality • Provision of safe and reliable water storage system for the existing and future projected population • Provision of adequate water storage for emergency firefighting services	• Low potential to impact drinking water quality. • Lowest potential to provide safe and reliable water storage system for the existing and future population due to limited capacity of existing water storage system. • Lowest potential to provide adequate water storage for emergency firefighting services due to limited capacity of existing water storage system.	• Low potential to impact drinking water quality. • High potential to provide safe and reliable water storage system for the existing and future population. • High potential to provide adequate water storage for emergency firefighting services.	• Low potential to impact drinking water quality. • High potential to provide safe and reliable water storage system for the existing and future population. • High potential to provide adequate water storage for emergency firefighting services.
Monitoring Requirements & Efficiencies	• Impacts to operational monitoring requirements and efficiency	• No monitoring requirements applicable.	• Single site reduces operational monitoring needs as there is no need to travel to off-site storage facility.	• New facility on separate site increases operator monitoring needs through travel and SCADA requirements.
Cost	• Relative capital, operational and maintenance costs ($)	• No capital cost associated. • Moderate-High repairs and maintenance costs anticipated to increase overtime for existing facility to keep up with current and future population demands.	• Moderate capital, operational and maintenance costs as WTP is already anticipated to be expanded.	• Highest capital cost to bult new off-site water storage facility. Highest operational and maintenance costs associated with operating a new storage facility site, as well as potential upgrades required to local watermains.
Utilities	• Potential to impact existing utilities	• Moderate potential to impact utilities due to insufficient firewater availability in long-term horizon (20-year)	• Sufficient firewater availability in long-term horizon. Low potential to impact existing utilities.	• Sufficient firewater availability in long-term horizon. Low impact to existing utilities but new hydro, telecoms, sewer and gas utility connections required at the new site.
Constructability & Feasibility	• Potential to disrupt existing traffic, property access or functionality of existing facilities during construction • Location, depth of excavation, soil conditions, rock removal, groundwater control, in-water works, workable construction area, construction duration	• No impact to existing traffic, property access or functionality of existing facilities. • No construction required.	• Moderate impacts to functionality of existing facilities are anticipated during construction to dismantle existing equipment and begin operations of new equipment. However, WTP expansion is already anticipated. Thus, the construction of additional water storage is not anticipated to impact functionality further.	• No impacts to functionality of existing facilities during construction. • Comprehensive environmental, geotechnical, hydrogeological investigations of site would be required to confirm site suitability
Expandability	• Potential to be expanded or flexible to meet future population needs	• Not able to be expanded or flexible to meet future population needs.	• Low potential to be expanded or flexible to meet future population needs past the 20-year horizon.	• High potential to expand for projected 20-year population horizon and further.

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions		
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: Expand WTP Clearwell**	**Alternative C: Add New Storage Off-Site at Bates Drive Location**
Climate Change	• Ability to increase resilience to climate change (i.e., severe weather events) within the study area • Impacts to known climate change contributors (i.e., GHG emissions)	• No potential to increase resiliency to climate change. • No impacts to known climate change contributors.	• Moderate potential for increased resiliency to climate change through implementation of adaptation of chemical supply planning, monitoring of pipes and concrete structures, planning for infrastructure rehabilitation, and implementation of backup power generators measures. • Moderate potential to increase known climate change contributors through increased energy consumption, although there are opportunities to implement more energy efficient processes.	• Moderate potential for increased resiliency to climate change through adaptation of chemical supply planning, monitoring of pipes and concrete structures, planning for infrastructure rehabilitation, and implementation of backup power generators. • High potential to increase known climate change contributors through increased energy consumption, although there are opportunities to implement more energy efficient processes.
Technical Summary		**Least Preferred**	**Preferred**	**Moderately Preferred**
Overall Conclusion		Not Recommended	Recommended Solution	Not Recommended

Legend
Preferred
Moderately Preferred
Partially Preferred
Least Preferred

Reference: Alternatives Evaluation Technical Memorandum

Alternatives Evaluation 3: Wastewater Treatment Plant (WWTP)

The following is a summary of the wastewater treatment plant (WWTP) planning constraints and needs, some of which are discussed in the **Phase 1 Report**:

- The existing WWTP meets its limits consistently with the occasional TAN exceedance, which the plant operators (OCWA) are investigating and correcting. The current plant effluent limits and objectives are listed in the **Phase 1 Report**, along with projected future plant loadings.
- The WWTP will require an expansion of its rated capacity by 2,725 m^3/d (i.e., a 35% increase in capacity) to meet 20-year design average daily flows of 10,625 m^3/d. This expansion would be needed in 2024-2025. This is in line with the annual average flow proposed in the 2011 Master Plan for future expansion.
- The existing plant experiences high peak flows upwards of 30,000 m^3/d, particularly during the Spring, and is believed to be significantly influenced by I/I (as discussed above) and potentially illegal sump pump connections. To meet future growth, a peak hourly flow of 42,500 m^3/d should be designed for. The **Design Basis Memo** from the current Master Plan study summarizes current and projects future flow peaking factors.
- An assimilative capacity study (ACS) was conducted prior to the 2011 Master Plans to analyze and propose effluent limits for the expanded plant. During pre-consultation with the MECP on the current study, it was confirmed that an updated ACS would be required, and lower effluent limits than previously proposed are to be expected. This ACS is currently underway, the results of which will be documented in the Phase 2 Report.
- It is expected that tertiary treatment (or ultrafiltration) and potentially nitrification processes will be required to meet the new non-compliance limits for TP and TAN.
- A residuals forcemain from the WTP is being installed in sections as part of road upgrade projects. Once complete, this will provide an opportunity for the WWTP to separate this solids stream and evaluate it with optimization of treatment processes.
- It is unknown at this time whether the existing effluent outfall pipe has sufficient hydraulic capacity to support the projected peak flows.

Some key features of the existing WWTP site that relate to the evaluation criteria and were considered in the evaluation of alternatives include:

- The existing WWTP site is very tight with limited space between processes for interior expansion.

- The land directly north of the WWTP is a hazardous waste depot and compost yard owned and operated by the Town. This depot is intended to be moved to the planned municipal yard on Bates Dr, which may open up space for WWTP expansion or a new plant.
- A geotechnical investigation was not completed at the existing site but based on background document review and the proximity to the River, it is expected that any deep excavations would encounter rock and groundwater.
- A Species At-Risk (SAR) review was completed at the existing site and did not identify any SAR on the existing property but found several potentially suitable habitats. These should be considered at the design stage. This review covered the southern portion of the hazardous waste depot area. If another site is preferred or a complete migration into the depot lands is required, an additional SAR should be conducted.
- A Stage 1 Archaeological Assessment (AA) was completed at the existing site and evaluated the site as having no or low archaeological potential, with no need for further investigation recommended. This assessment covered the southern portion of the hazardous waste depot area. If another site is preferred or a complete migration into the depot lands is required, an additional AA should be conducted.
- Some opportunities for improvement or optimization of the existing facility have been identified by OCWA through a recent Facility Optimization Program. Expansion or new plant construction should consider these issues during design.

The following alternatives are proposed and evaluated:

Alternative A: Do Nothing

The “do nothing” approach does not allow for growth to occur beyond the existing potable water and wastewater systems’ capabilities. The mandate as directed by the Town for this assignment is to determine infrastructure needs to support planned and projected growth. A do-nothing approach will lead to regular exceedances of plant effluent limits and flooding of the sanitary collection system. Additionally, considering climate change, its impacts on wastewater treatment and potential resilience measures should be considered.

Alternative B: Inflow & Infiltration (I/I) Reduction MEasures

In the absence of upgrading the existing WWTP capacity, inflow and infiltration (I/I) reduction measures could be implemented, with the aim of reducing raw sewage inflow to the WWTP, while maintaining the existing WWTP capacity. However, only reducing I/I provides limited solutions to meet the Town’s growth needs and will still result in regular exceedances of plant effluent limits and flooding of the sanitary collection system.

Reference: Alternatives Evaluation Technical Memorandum

Alternative C: Expand Existing WWTP

This alternative consists in expanding the WWTP within the existing site footprint and/or on the neighbouring household hazardous waste and compost yard site to the east (also owned by the Town, see **Figure 6**). The Town has noted that if an expansion onto the neighbouring site is needed, this will trigger a move of the household hazardous waste and compost yard facilities to Bates Dr, which the Town has already been contemplating.

The expansion could be achieved by:

- Expanding individual processes within the existing building footprint
  - This could be achieved by enhancing the treatment capacity of different processes ("intensification" technologies), for example.
- Expanding individual processes within the existing building footprint and on the existing site as needed
- Expanding individual processes within the existing building footprint and on the existing site as needed, as well as on the neighbouring household hazardous waste and compost yard site (maximum footprint illustrated in **Figure 7**). Based on the limited space on the existing site and the anticipated future loadings and treated effluent criteria, it is expected that at least some new structures will be required on the adjacent property.
- It is expected that this option may involve a combination of the following:
- Construction a new or expanded headworks building including raw sewage pumping station;
- Repurposing the existing phys/chem clarifiers as primary clarifiers;
- Increasing (doubling) the aeration tank volume and area;
- Addition of two new secondary clarifiers;
- Converting the secondary digester into a parallel primary digester;
- New dewatering building;
- New mechanical WAS thickening process; and
- New filtration and UV disinfection building.

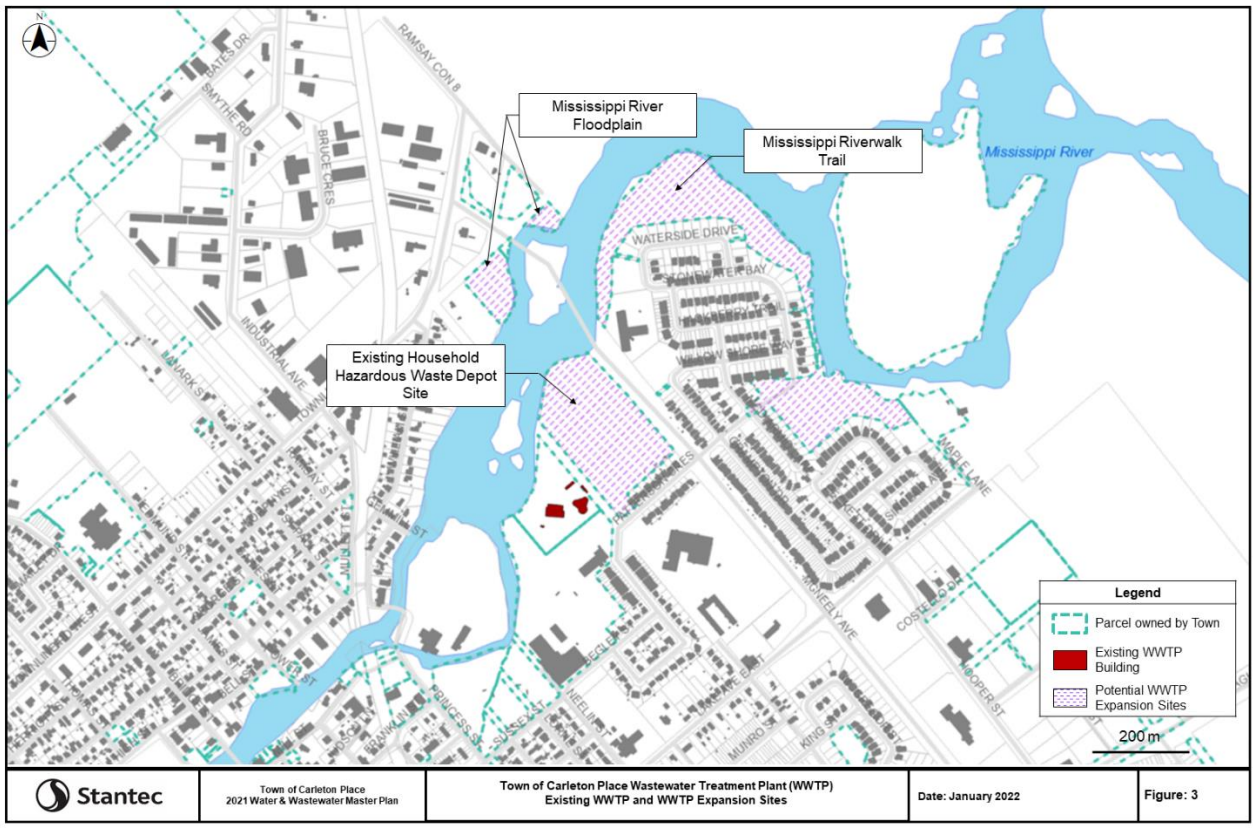
Alternatively, a complete retrofit of the plant into a non-conventional treatment train (such as membrane bioreactor) may be considered during conceptual design.

This option would involve expanding treatment capacity and meeting the Town's long-term growth needs by expanding the facilities both within the existing site and onto the neighbouring household hazardous waste and compost yard site belonging to the Town. This option seeks to make maintain use of the existing processes, where practical, while

Reference: Alternatives Evaluation Technical Memorandum

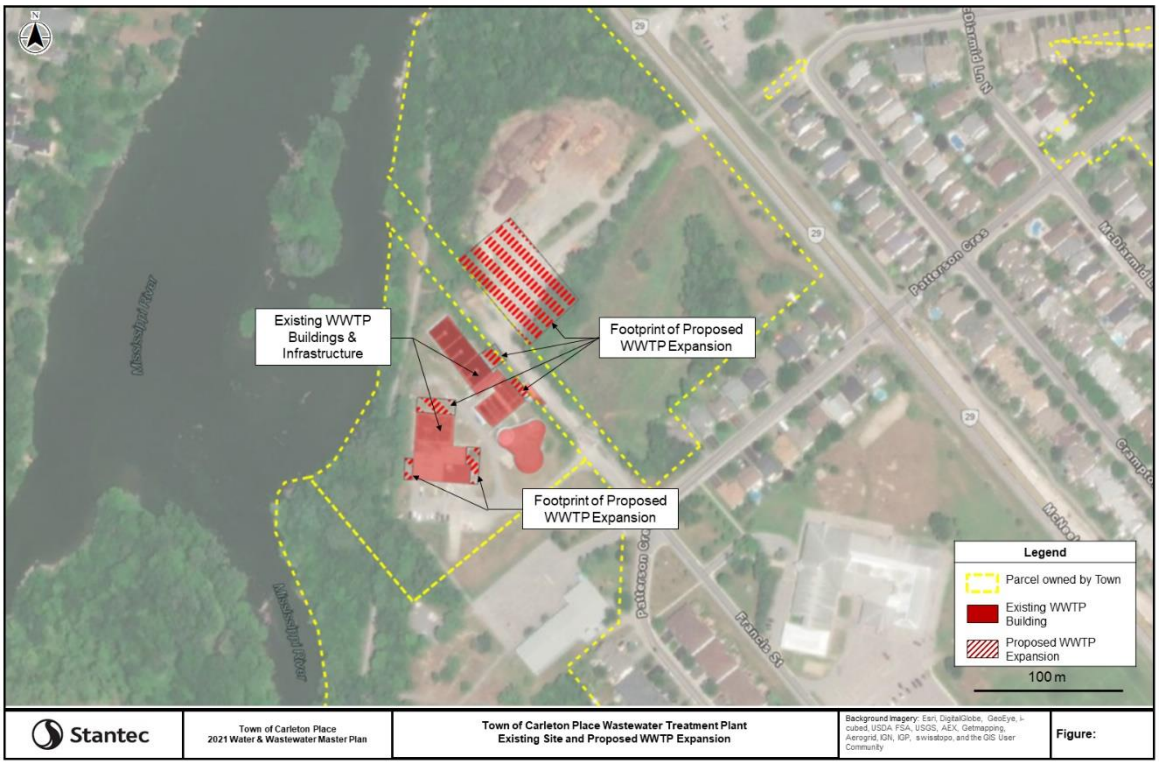
still providing the necessary treatment capacity to accommodate future growth. Although this could lead to a reduction in land, this does not impede on parkland or on the Mississippi Riverwalk Trail, causing limited impact compared to existing conditions. Furthermore, the layout of the sanitary collection system can be maintained. Capital costs would be less than the costs for building a new WWTP off-site, and the operation and maintenance costs would also be less than required to operate a second WWTP. Overall, this option can meet the Town's growth needs, while limiting the impact from additional land use.

Figure 6: Existing WWTP and Potential WWTP Expansion Sites



Reference: Alternatives Evaluation Technical Memorandum

Figure 7: Potential Footprint of WWTP Expansion



Alternative D: Build an Additional WWTP

Building a second standalone WWTP would require developing a new site along the Mississippi River. Space is constrained, as most of the available land along the river is already developed. The Town owns three undeveloped parcels along the river, however these are located upstream or close to the existing WTP, and would not be viable options, as the WWTP effluent could impact the WTP raw water quality. Further options downstream of the existing WWTP are limited (as illustrated in **Figure 6**), as the existing land is located either outside of the Town's boundaries or on designated natural environment areas (including the Mississippi Riverwalk Trail). Building a new WWTP would generate high capital costs and operating two WWTPs would double the operating costs. Additionally, building a WWTP at a different site would have implications for the sanitary collection system, which would have to be upgraded and/or modified to convey flow to the second WWTP. This would be the case for a new plant located on the north side of the river, which would require a new sanitary crossing and probably an additional pumping station.

Reference: Alternatives Evaluation Technical Memorandum

Similar to the WTP siting options, the most ideal location for a complete new WWTP would be immediately adjacent on the Town-owned property, in this case the hazardous waste depot. This option may be similar to expansion but provides an opportunity to start completely fresh with new processes and resolve any current operational issues. The existing plant would be operated during the construction phase and then decommissioned. The only infrastructure that may be kept would be the existing outfall pipe if it is deemed to have sufficient hydraulic capacity.

Figure 8: Potential Footprint of New Adjacent WWTP

Evaluation Summary 3: Wastewater Treatment Plant

Table 4 shows the evaluation of alternatives for water storage. Based on this evaluation of alternatives, the preferred alternative to meet future growth needs is **Alternative C**, to expand the WTWP on-site and partially into the neighbouring property. This alternative will provide capacity to address some of the constraints in the sanitary collection system (see **Additional Considerations: Sanitary Collection System**). The sanitary collection system assessment will help inform the required WWTP expansion.

Reference: Alternatives Evaluation Technical Memorandum

Climate Change Considerations

- The impacts of climate change and extreme weather events on the WWTP include:
- Increased peak inflow during wet weather event with increased precipitation or severe storms;
- Increased peak inflow during spring melt due to higher temperatures and greater snow loads;
- Flooding during higher river flows due to increased precipitation;
- Lower river flows and reduced assimilative capacity due to decreased precipitation/prolonged droughts;
- Impact of temperature increase on aeration system;
- Odour generation with temperature increase;
- Wet weather treatment of snowmelt with temperature increase; and
- Severe storms interrupting deliveries or leading to power outages.
- To address potential climate change impacts and increase resilience to climate change, different measures could be integrated in the selected alternative. Opportunities for climate change adaptation include:
- Adaptation to flooding risks
    - Build new process structures and buildings above the floodplain limit, with a buffer to accommodate future floods,
    - Relocating equipment away from flood-prone areas, and
    - Verify and update emergency measures for flooding;
- Adaptation to increased peak flow to WWTP due to increased precipitation (and/or snow melt)
    - Design processes to accommodate potential upgrades of pumps and other equipment without major infrastructure upgrades if peak flows increase,
    - Incorporate partial plant bypass to maintain some level of treatment during peaks rather than full bypass, and
    - Consider upgrades within the sanitary collection system to reduce peak inflows to the WWTP;
- Adaptation to reduced assimilation capacity due to drought
    - Design processes to adjust treatment, considering potential reduced assimilation capacity;
- Adaptation to odour issues and other impacts to outdoor WWTP processes with increased temperatures

Reference: Alternatives Evaluation Technical Memorandum

  - Consider higher oxygen demand and lower oxygen transfer capacity in design of aeration basins; and
- Adaptation to impacts of severe storms
  - Design storing capacity to provide additional reserve and minimize impacts of delayed deliveries on plant operation,
  - Size backup power generators for critical plant processes, and
  - Consider co-generation of energy.
- Opportunities for climate change mitigation (GHG emissions reduction) and energy savings include:
- Upgrading pumps (and motors) to increase their efficiency (or selecting new high-efficiency pumps and motors);
- Reduce incoming sewage with I/I reduction and water conservation measures;
- Continue capture of gases from digesters and use flare to convert CH4 to CO2; and
- Consider co-generation of heat and energy once plant reaches a size that is practical for implementation.

Reference: Alternatives Evaluation Technical Memorandum

Table 4: Evaluation Summary for WWTP

Evaluation Criteria		Alternative Solutions			
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: I/I Reduction Measures**	**Alternative C: Expanding Existing WWTP onto portion of Hazardous Waste Depot**	**Alternative D: Build Additional WWTP on Hazardous Waste Depot**
Natural Environment					
Aquatic Environment	• Potential to impact fish and fish habitat • Potential to impact surface water quality and quantity	• No impact to fish and fish habitat. • Moderate potential to impact surface water quality and quantity through risk of flooding the overloaded sanitary collection system which could result in runoff into local water sources.	• High potential to impact fish and fish habitat due to risk of increased bypasses and effluent loadings. • High potential for impacts to surface water quality and quantity as there is a risk of sewage backups to siphon and flooding of the sanitary collection system which could result in runoff into local water sources.	• Moderate potential to impact fish and fish habitat as expansion may require new effluent outfall pipe into Mississippi River, as well as minor impacts from effluent loadings. • High potential to impact surface water quality and quantity due to site's proximity to the Mississippi River and potential for runoff during construction. However, impacts may be mitigated through design and construction management measures.	• Moderate potential to impact fish and fish habitat as new WWTP may require new effluent outfall pipe into Mississippi River, as well as minor impacts from effluent loadings. • High potential to impact surface water quality and quantity due to site's proximity to the Mississippi River and potential for runoff during construction. However, impacts may be mitigated through design and construction management measures.
Terrestrial Environment	• Potential to impact wildlife/habitat (i.e., Species-at-Risk, spawning areas, significant ecological areas, etc.) • Potential to affect vegetation (i.e., wooded areas, wetlands, conservation areas, etc.) • Potential to impact individual trees or landscaped features	• Moderate potential to impact wildlife/habitat through risk of flooding the overloaded sanitary collection system which could result in runoff. • No impact to vegetation. • No impact to individual trees or landscaped features.	• High potential for impacts to wildlife/habitat due to risk of sewage backups to siphon and surface flooding/runoff from overloading the sanitary collection system. • No impact to vegetation. • No impact to individual trees or landscaped features.	• Higher potential to impact wildlife/habitat, including bird nesting habitat, as expansion would extend past existing site into surrounding land. • High potential to impact vegetation through expansion. • High potential to impact individual trees or landscaped features through expansion. However, impacts may be mitigated through design and construction management measures.	• Higher potential to impact wildlife/habitat, including bird nesting habitat, as the greatest amount of land would be required. • Higher potential to impact vegetation. • Higher potential to impact individual trees or landscaped features. However, impacts may be mitigated through design and construction management measures.
Natural Environment Summary		**Preferred**	**Moderately Preferred**	**Partially Preferred**	**Least Preferred**

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions			
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: I/I Reduction Measures**	**Alternative C: Expanding Existing WWTP onto portion of Hazardous Waste Depot**	**Alternative D: Build Additional WWTP on Hazardous Waste Depot**
Cultural Environment					
Archaeological Resources	• Potential to impact undisturbed lands	• No impact to undisturbed lands.	• No impact to undisturbed lands.	• Low potential to impact undisturbed lands as expansion would take place within existing developed site and southern portion of adjacent hazardous waste depot, which retains low to no archaeological potential.	• Higher potential to impact undisturbed lands as existing hazardous waste depot retains low to no archaeological potential, more land would be required to construct a new WWTP.
Built Heritage Resources / Cultural Landscape	• Potential to impact known built heritage resources or cultural landscapes/features	• No impact to known built heritage or cultural landscapes/features.	• No impact to known built heritage or cultural landscapes/features.	• Low potential to impact known built heritage resources or cultural landscapes/features. • Additional studies would be required to confirm.	• Higher potential to impact known built heritage resources or cultural landscapes/features as more land would be required to build a new WWTP. • Additional studies would be required to confirm
Cultural Environment Summary		**Preferred**	**Preferred**	**Moderately Preferred**	**Least Preferred**
Socio-Economic Environment					
Noise/Vibration & Air Quality	• Potential to impact noise sensitive areas (i.e., residential dwellings, daycares, etc.) during construction. • Potential to affect local air quality during construction. • Potential to affect local air quality during operational phase.	• No impact to noise sensitive areas through construction • No impact to local air quality through construction and/or operations.	• Low potential to impact noise sensitive areas during construction. • Low potential to affect local air quality during construction and/or operations.	• Moderate potential for temporary impacts to noise due to construction vehicles. • Moderate potential for temporary impacts to local air quality due to construction equipment exhaust/dust. • Moderate potential for impacts to local air quality during operation phase due to increased bio-gas production and use of flare, as well as occasional odours.	• Higher potential for temporary impacts to noise due to longer construction duration and presence of construction vehicles/equipment, as well as permanent noise impacts from traffic, operations and closer proximity to residential dwellings on Paterson Crescent. • Higher potential for temporary impacts to local air quality due to longer construction duration and equipment exhaust/dust. • Higher potential for temporary impacts to local air quality during operational phase due to increased bio-gas production and use of flare. More noticeable presence of occasional odours due to proximity to residential dwellings on Paterson Crescent.

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions			
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: I/I Reduction Measures**	**Alternative C: Expanding Existing WWTP onto portion of Hazardous Waste Depot**	**Alternative D: Build Additional WWTP on Hazardous Waste Depot**
Property Requirements	• Requires acquisition of private property	• No impact to private property.	• No impact to private property.	• Low potential to impact private property as expansion would take place on existing site, and adjacent Town land.	• Low potential to impact private property as new WWTP would be constructed on adjacent Town land.
Aesthetics	• Potential to impact visual aesthetics of study area	• No impact to visual aesthetics of study area.	• No impact to visual aesthetics of study area.	• Moderate potential for visual aesthetic impacts as expansion may impede view from Mississippi River Walk Trail and change existing views/landscape of area.	• Higher potential to impact existing aesthetics through the construction of new WWTP which may impede the view from Mississippi River Walk Trail and change the existing views/landscape of the area, as well as encroach on current buffer between residential dwellings on Paterson Crescent.
Land Use	• Potential to impact existing and future designated land use and/or community use	• No impact to existing or designated land use.	• No impact to existing or designated land use.	• Low potential to impact existing or designated land use as expansion would take place on existing site, as well as current Hazardous Waste Depot and compost site.	• Moderate potential to impact existing or designated land use as WWTP would be constructed on current Hazardous Waste Depot and compost site.
Consistency with Municipal Planning Objectives & Future Development within the Area	• Satisfies the goals and objectives of the Town's Official Plan • Consistence with municipal/regional policies • Potential to support existing and future development within the area	• Does not satisfy the goals and objectives of the Town's Official Plan to support future projected population growth • Not consistent with municipal/regional policies related to servicing existing and future population in an environmentally responsible manner and account for the health and safety of residents. • Does not support existing and/or future development within the study area.	• Low potential to satisfy the goals and objectives of the Town's Official Plan to support future projected population growth up to 2041 or longer-term infrastructure needs beyond 2041. • Not consistent with municipal/regional policy to provide infrastructure that is able to service the existing and future projected population in an environmentally responsible manner and account for the health and safety of residents. • Low potential to support future development within the study area.	• High potential to satisfy the goals and objectives of the Town's Official Plant to support future projected population growth within the 2041 horizon and beyond. • Consistent with municipal/regional policies related to servicing existing and future population in an environmentally responsible manner and account for the health and safety of residents. High potential to support future development within the study area.	• High potential to satisfy the goals and objectives of the Town's Official Plant to support future projected population growth within the 2041 horizon and beyond. • Consistent with municipal/regional policies related to servicing existing and future population in an environmentally responsible manner and account for the health and safety of residents. High potential to support future development within the study area.

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions			
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: I/I Reduction Measures**	**Alternative C: Expanding Existing WWTP onto portion of Hazardous Waste Depot**	**Alternative D: Build Additional WWTP on Hazardous Waste Depot**
Health & Safety	• Potential to impact health and safety of residents • Potential to impact health and safety of employees • Potential impacts to groundwater quality (i.e., wells, effect Source Water Protection area, etc.) • Potential to encounter contaminated subsurface conditions	• Moderate potential to impact health of residents due to existing WWTP. • Limited capacity to provide sufficient wastewater treatment services for projected population growth. • Low potential to improve health and safety of employees. • No impact to groundwater quality. • No potential to encounter contaminated subsurface conditions.	• Highest potential to impact health of residents due to existing WWTP limited capacity to provide sufficient wastewater treatment services for projected population growth and risk of sewage backup and flooding of the sanitary collection system. • Low potential to improve health and safety of employees. • No impact to groundwater quality. • No potential to encounter contaminated subsurface conditions.	• Low potential to impact the health and safety of Town residents. • Moderate potential to improve health and safety of employees through design of new buildings and processes with improved safety features • Low potential to impact groundwater quality including private wells. • High potential to encounter contaminated subsurface conditions for portion of expansion extending onto existing hazardous waste depot site.	• Low potential to impact the health and safety of Town residents. • Moderate potential to improve health and safety of employees through design of new buildings and processes with improved safety features • Low potential to impact groundwater quality including private wells. • Highest potential to encounter contaminated subsurface conditions as construction of new WWTP would require more land from the existing hazardous waste depot site.
Community Access	• Disruption to existing traffic, private property and business access during construction. • Disruption to existing traffic, private property and business access during operation.	• No impacts to existing traffic, private property or access to businesses.	• No impacts to existing traffic, private property or access to businesses.	• Moderate potential to impact traffic during construction. • Moderate potential to improve sludge storage and dewatering which may improve traffic by reducing frequency of visits by solids disposal trucks.	• Higher potential to impact traffic during construction due to longer construction period, and increased traffic from staffing two WWTPs. • Moderate potential to improve sludge storage and dewatering which may improve traffic by reducing frequency of visits by solids disposal trucks.
Socio-Economic Environment Summary		**Moderately Preferred**	**Partially Preferred**	**Preferred**	**Least Preferred**

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions			
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: I/I Reduction Measures**	**Alternative C: Expanding Existing WWTP onto portion of Hazardous Waste Depot**	**Alternative D: Build Additional WWTP on Hazardous Waste Depot**
Technical					
Functionality/Reliability of Wastewater Collection	• Provision of reliable wastewater collection for the existing and future projected population • Potential for risk of sewage backups and basement flooding • Potential impacts due to surface flooding or system overflows	• No potential to provide adequate wastewater collection for the future project population. • High potential risk of sewage backups and basement flooding due to limited bottleneck at existing facility. • High potential impacts for surface flooding or system overflows due to bottleneck at existing facility.	• Low potential to provide adequate wastewater collection for the future projected population. • Moderate potential for risk of sewage backups to siphon and basement flooding due to bottleneck at existing facility. Somewhat mitigated by I/I reduction. • Moderate potential for impacts due to surface flooding bottleneck at existing facility.	• High potential to provide reliable wastewater collection for the existing and future projected population. • Low potential risk of sewage backups and basement flooding. • Low potential for impacts due to surface flooding or system overflows.	• High potential to provide reliable wastewater collection for the existing and future projected population. • Low potential risk of sewage backups and basement flooding. • Low potential for impacts due to surface flooding or system overflows.
Functionality/Reliability of Wastewater Treatment	• Treated effluent quality • Reliability of the treatment process • Potential for risk of sewage backups and impacts to collection system	• Low potential to improve or maintain treated effluent quality due to limited capacity of existing facility. • Low potential to improve reliability of treatment process due to limited capacity of existing facility. • High potential risk for sewage backups and impacts to collection system due to bottleneck at existing facility.	• Low potential to improve or maintain treated effluent quality due to limited capacity of existing facility. • Low potential to improve reliability of treatment process due to limited capacity of existing facility. • Moderate potential risk for sewage backups and impacts to collection system due to bottleneck at existing facility. Somewhat mitigated by I/I reduction.	• High potential to improve and maintain treated effluent quality. • High potential to improve reliability of treatment process. • Low potential risk for sewage backups and impacts to collection system.	• High potential to improve and maintain treated effluent quality. • High potential to improve reliability of treatment process. • Low potential risk for sewage backups and impacts to collection system.
Cost	• Relative capital, operational and maintenance costs ($)	• No capital cost associated. • Moderate-High repairs and maintenance costs anticipated to increase overtime for existing facility to keep up with current and future population demands.	• Cost is dependent on which I/I Reduction Measure is selected, but is anticipated to be lower than Alternatives C and D. • Moderate-High repairs and maintenance costs anticipated to increase overtime for existing facility to keep up with current and future population demands.	• Moderate capital cost to expand existing WWTP. • Lower operational and maintenance costs when compared to Alternative D.	• High capital cost to build new WWTP. • Potential to optimize processes to mitigate operational and maintenance costs, but overall cost would still be greater than Alternative C as there will be greater operational and maintenance costs associated with running two WWTPs.

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions			
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: I/I Reduction Measures**	**Alternative C: Expanding Existing WWTP onto portion of Hazardous Waste Depot**	**Alternative D: Build Additional WWTP on Hazardous Waste Depot**
Utilities	• Potential to impact existing utilities	• Moderate impact to sewer system as surcharge and flooding frequency expected to increase. No impact to other existing utilities.	• Minor impact to sewer system by mitigating increase in sewer surcharge and flooding frequency. No impact to other existing utilities.	• Positive impact to sewer system by reducing surcharge and flooding frequency. Low impact to other existing utilities. Upgraded hydro connection may be required.	• Positive impact to sewer system by reducing surcharge and flooding frequency. Moderate potential to impact existing utilities at site due to redevelopment. Connections available from adjacent site.
Constructability & Feasibility	• Potential to disrupt existing traffic, property access or functionality of existing facilities during construction • Location, depth of excavation, soil conditions, rock removal, groundwater control, in-water works, workable construction area, construction duration	• No impact to existing traffic, property access or functionality of existing facilities. • No construction required.	• Low potential to impact to existing traffic, property access or functionality of existing facilities. • Limited construction required.	• Moderate impact to existing traffic during construction, but moderate impacts to the functionality of existing facilities may be experienced during construction of the expansion. • Constrained site may make construction works more challenging; however, a shorter construction period is anticipated when compared to Alternative D.	• Moderate impact to existing traffic during construction, but no impacts to the functionality of existing facilities during construction. • Open space to facilitate construction works, but a longer construction period is anticipated when compared to other Alternatives.
Expandability	• Potential to be expanded or flexible to meet future population needs	• Not able to be expanded or flexible to meet future population needs.	• Not able to be expanded or flexible to meet future population needs.	• Moderate potential to be expanded or flexible to meet future population needs beyond the 2041 horizon as adjacent lands are owned by Town.	• High potential to be expanded or flexible to meet future population needs beyond the 2041 horizon as existing WWTP could be expanded in future, as well as new WWTP.
Climate Change	• Ability to increase resilience to climate change (i.e., severe weather events) within the study area • Impacts to known climate change contributors (i.e., GHG emissions)	• No potential to increase resiliency to climate change. • No impacts to known climate change contributors.	• No potential to increase resiliency to climate change. • No impacts to known climate change contributors.	• Moderate potential to increase resiliency to climate change through the implementation of GHG emission reduction measures within the design of the expansion. • Moderate potential to increase GHG emissions from increased energy consumption during construction and operation.	• High potential to increase resiliency to climate change through the implementation of GHG emission reduction measures within the design of the new WWTP, but GHG emissions would still be higher operating two WWTPs. • Higher potential to increase GHG emissions from increased energy consumption during construction and the operation of two WWTPs.
Technical Summary		**Least Preferred**	**Partially Preferred**	**Preferred**	**Moderately Preferred**
OVERALL CONCLUSION		Not Recommended	Not Recommended	Recommended Solution	Not Recommended

Reference: Alternatives Evaluation Technical Memorandum

Evaluation Criteria		Alternative Solutions			
Factors	**Measures**	**Alternative A: Do Nothing**	**Alternative B: I/I Reduction Measures**	**Alternative C: Expanding Existing WWTP onto portion of Hazardous Waste Depot**	**Alternative D: Build Additional WWTP on Hazardous Waste Depot**
Legend					
Preferred					
Moderately Preferred					
Partially Preferred					
Least Preferred					

Reference: Alternatives Evaluation Technical Memorandum

Additional Considerations

Additional Considerations: Potable Water Distribution System

The following constraints and needs were identified in the **Phase 1 Report**:

- Pressures are expected to generally decrease with growth; however, they remain within the pressure objectives.
- Areas north of the Mississippi River are constrained in terms of fire flow (≤ 60 L/s available), due to constraints in the size of the watermains crossing the river and higher head losses in the watermains, as well as being supplied by dead-end watermains. With the addition of a 3rd watermain crossing at McArthur Island, there are minor improvements in the fire flows, however deficiencies persist and reappear under future growth conditions.
- Areas in the southwestern quadrant of the Town are also constrained in terms of fire flow, due to constraints in the size of the feedermains along Lake Ave and Mississippi Rd, and Moore St and Franktown Rd. Under future growth conditions, the existing fire flow deficiencies will persist in the same areas.

The following alternatives are proposed and evaluated:

Do Nothing

The “do nothing” approach does not allow for growth to occur beyond the existing potable water and wastewater systems’ capabilities. The mandate as directed by the Town for this assignment is to determine infrastructure needs to support planned and projected growth. Also, an important proportion of the current WTP clearwell is dedicated for chlorine contact purpose, and high lift pump basin cannot be isolated; there is a need for some works at these basins, which would affect the overall storage capacity anyway. For these reasons, this alternative is not considered further.

Upgrade Watermains without Adding New Fire Flow Storage

This alternative would involve forgoing additional fire flow storage (i.e., “do nothing” or WTP clearwell expansion for the water storage), and solely implementing watermain upgrades (upsizing or looping).

- Upgrade Watermains - Upsize Feedermains; and
- Upgrade Watermains - Loop Watermains.

Reference: Alternatives Evaluation Technical Memorandum

Add Secondary Fire Flow Storage

This alternative would involve adding storage for maximum day needs and fire flow storage. This would be provided at the preferred off-site water storage location (Bates Drive) and would include the installation of fire pumps as part of the storage facility design. It should be noted that the volume of fire water storage required based on the FUS fire flows (2,145 m^3) is much greater than the storage deficit (500 m^3-1000 m^3) and as such, to provide sufficient fire water redundancy to this area, a larger reservoir would be needed. Situating the new storage facility north of the river may reduce or eliminate the need for watermain upgrades in this area. Preliminary modelling analyses have shown that 1.4 km of watermain in the direct vicinity of the off-site storage has insufficient fire flow conveyance capacity. Some of these potential watermain upgrades could be eliminated with the addition of the new storage facility and pumping station to improve fire flows in the industrial area. However, this does not address fire flow deficiencies in other areas of the Town, such that additional upgrades may still be required to improve conveyance from the proposed off-site storage. This alternative could be combined with watermains upgrades, such that the sub-alternatives would be:

- Add Storage without Upgrading Watermains: In this sub-alternative, only storage would be added, and no additional watermain upgrades would be implemented. Preliminary modelling has shown that the addition of fire water storage on the north side of the Town does not alleviate the watermain capacity issues in the southwest quadrant of the Town.
- Add Storage & Upgrade Watermains: In this sub-alternative, in addition to the new storage, watermains would either be upsized and/or looped to improve pressures and fire flow conveyance. Further modelling and analysis is required in this study to confirm the extent of watermain upgrades required.
  - Add Storage & Upgrade Watermains – Upsize Feedermains, and
  - Add Storage & Upgrade Watermains – Loop Watermains.

Preferred Option – Potable Water Distribution System

In line with the selected alternative for water storage, the preferred alternative to meet future growth needs and increase reliability within the potable water distribution system is to upgrade watermains without adding new fire flow storage. The specific needs for watermain upgrades will be further defined as part of the Phase 2 report.

Climate Change Considerations

- The impacts of climate change and extreme weather events on the potable water distribution system include:
- Increase in water demand linked to temperature increases;

- Chlorine depletion due to temperature increases; and
- Impact of freeze-thaw cycles on watermains.
- Opportunities for climate change mitigation (GHG emissions reduction) and energy savings include:
- Replacing infrastructure which generate high head losses (e.g., valves, leaky watermains)
- Water efficiency efforts

Additional Considerations: Sanitary Collection System

The following constraints and needs were identified in the **Phase 1 Report** & **PCSWMM Memo**:

- Sewer constraints are observed in the design event in the 2041 planning horizon only.
- The Mississippi Quays PS does not meet the respective criteria for the design event in the 2026, 2031 and 2041 planning horizons. In the annual event (pump failure), HGL issues (basement and surface flooding) arise upstream of the Mississippi Quays PS under all planning horizons. Because the ultimate pump capacity is used in the rare event analyses, the Mississippi Quays PS does not present capacity constraints in the rare event under all planning horizons.
- The WWTP is unable to convey the modelled flows in the design and rare event scenarios under all planning horizons. Notably, HGL issues are observed in all annual and rare events from upstream of the McArthur Island siphon, down to the WWTP, including surface flooding just upstream of the siphon. The Town has previously observed similar occurrences of flooding.

Alternatives are proposed, subject to the following limitations:

- Flows are estimated based on parameters from the City of Ottawa Guidelines and Technical Bulletins and can be conservative in certain areas; solutions recommended based on these parameters may therefore also be conservative.
- The alternatives only pertain to the trunk system; the local sanitary system was not analyzed; solutions for the local system or involving upgrades to the local system can therefore not be developed.

Prior to the implementation of any alternatives, it is recommended that flows be confirmed with a flow monitoring program, and that the effectiveness of the alternative be confirmed with a model calibrated to the flow monitoring data.

Reference: Alternatives Evaluation Technical Memorandum

The following alternatives are proposed and evaluated:

Sanitary Collection System Alternatives with WWTP Expansion

If the WWTP is expanded or a new WWTP is constructed adjacent to the existing site, the following solutions for the sanitary collection system (or combinations thereof) could be considered:

Do Nothing in the Sanitary Collection System, with Expansion at the WWTP

In this "do nothing" scenario, the WWTP could be expanded to prevent backwater in the system, but no further upgrades would be implemented in the sanitary collection system. However, this "do nothing" scenario would not address other issues in the system, such as in high I/I areas (to be confirmed with flow monitoring first) and risk of pump station failure.

Conveyance Upgrades, with Expansion at the WWTP

In this scenario, conveyance upgrades are implemented throughout the sanitary collection system, in addition to expanding the WWTP. Conveyance upgrades include:

- Increasing pipe diameters to improve pipe flow capacity;
- Adjusting pipe slopes to improve pipe flow capacity; and
- Laying deeper pipes to reduce HGL issues.

These upgrades would improve flow conveyance to the WWTP, such that volume originally lost to flooding would be conveyed to the WWTP and flows to the WWTP would increase. The WWTP would then be expanded to reduce backwater and bypasses when receiving these flows.

Inflow / Infiltration Reduction, with Expansion at the WWTP

In this scenario, inflow / infiltration (I/I) reduction measures are implemented through the system, in addition to expanding the WWTP. I/I reduction measures include:

- Identifying areas with high I/I (including a flow monitoring program); and
- Relining older pipes.

I/I reduction measures would help reduce the flows to be conveyed by the system, and the incoming flows to the WWTP. The WWTP would then be expanded to reduce backwater and bypasses when receiving the remaining flows.

Reference: Alternatives Evaluation Technical Memorandum

Installation of Backwater Valves, with Expansion at the WWTP

This alternative would involve installing backwater valves at individual properties' service lines, to reduce the risk of basement flooding if the HGLs are within basement level.

Storage within the Sanitary Collection System, with Expansion at the WWTP

This alternative would involve increasing storage capacity in order to control downstream flows to the WWTP in the collection system. This would require odour control measures.

Sanitary Collection System Alternatives without WWTP Expansion

This alternative assumes that the "do nothing" alternative is selected for the WWTP, and that no WWTP expansion will occur. Only sanitary collection system upgrades would be implemented. The sanitary collection sub-alternatives would be as listed previously (when the WWTP is expanded), namely:

- Do nothing;
- Conveyance upgrades;
- I/I reduction;
- Installation of backwater valves; and
- Storage within the sanitary collection system.

Without a WWTP expansion however, backwater issues (and resulting HGL issues) due to constraints at the WWTP would persist under these flow conditions. As a WWTP expansion was determined as the preferred alternative, sanitary collection system alternatives without a WWTP expansion are not considered further.

Preferred Option – Sanitary Collection System

In line with the selected alternative for the WWTP, the preferred alternative to meet future growth needs within the sanitary collection system is to expand the existing WWTP. Sanitary collection system upgrades needed in conjunction with the WWTP expansion may include some of the options discussed above, however, these will be further evaluated following implementation of a flow monitoring program following the completion of this Master Plan.

Climate Change Considerations

- The impacts of climate change and extreme weather events on the sanitary collection system include:
- Increased peak inflow during wet weather event with increased precipitation

- Insufficient flushing velocity with decreased precipitation
- Odour issues from sewers due to convective air circulation as a result of temperature increase
- Increased melt contribution to wet weather flows with temperature increase
- Impact of freeze-thaw cycles on sewers
- Severe storms leading to power outages at pumping stations
- Opportunities for climate change mitigation (GHG emissions reduction) and energy savings include:
- Upgrading pumping station pumps (and motors) to increase their efficiency (or selecting new high-efficiency pumps and motors)
- Reduce incoming sewage to pumping stations with pipe rehabilitation projects and other I/I reduction measures

Conclusions and Next Steps

This memo presents the alternatives for the Town of Carleton Place's water and wastewater Master Plan study. These alternatives are then evaluated against different criteria.

The preferred alternative to meet future growth needs at the WTP is to expand the existing WTP on-site. Further water storage needs will be supplied by a new water storage tank north of the Mississippi River at Bates Dr. The need for further potable water distribution watermain upgrades to address remaining fire flow deficiencies and high head losses will be evaluated in the next steps of this study.

The preferred alternative to meet future growth needs at the WWTP is to expand the existing WWTP on-site as well as on the neighbouring household hazardous waste depot. This alternative should help alleviate issues within the sanitary collection system, for which further upgrades will be evaluated in the next steps of this study.

The next steps of this study will consist of further developing this memo into a Master Plan report (Phase 2 report), whereby an implementation strategy will be developed for each preferred alternative. This implementation strategy will investigate phasing options for individual projects, focusing on immediate needs and grant funding opportunities and providing a growth map for future infrastructure investment.

Reference: Alternatives Evaluation Technical Memorandum

Closure

We trust this information is satisfactory for your purposes. If you have any questions, please contact the undersigned.

Stantec Consulting Ltd.

Digitally signed by Razafimaharo, Christene
Date: 2022.04.25 15:41:18 -04'00'

Pierre Wilder P.Eng.
Environmental Engineer

Phone: 613-790-7690
Fax: 613-722-2799
pierre.wilder@stantec.com

Kevin Alemany M.A.Sc., P.Eng.
Principal, Water

Phone: 613-292-4226
Fax: 613-722-2799
kevin.alemany@stantec.com

Christène Razafimaharo M.Sc., EIT.
Water Resources Engineering Intern

Phone: 343-996-7086
Fax: 613-722-2799
christene.razafimaharo@stantec.com