



# VILLAGE OF CUMBERLAND

## High Performance Wastewater Lagoon Upgrade Project

Project Description, July 2024

### PURPOSE

The Village of Cumberland has developed an innovative project for upgrading its lagoon-based wastewater treatment. Due to a combination of geography and history, the Cumberland wastewater system faces a unique set of challenges, with very high wet weather flows in winter, a receiving creek that virtually dries up in summer, sensitive downstream river/estuary habitat and aquaculture industry to protect.

After careful study of the existing treatment system, and the water and nutrient behavior in the receiving environment, a solution has been developed. This proposed treatment upgrades will:

- Provide treatment to meet all the regulatory needs,
- Provide capacity for population double the current size of Cumberland
- Incorporate enhanced treatment of emerging contaminants such as pharmaceuticals,
- Use the treated water to provide flow to stagnant wetland ponds
- Improve aquatic habitat
- Provide recreational trails, and
- Deliver the service in a sustainable and climate change resilient manner.

### HISTORY

The Village of Cumberland has a two-cell lagoon wastewater treatment system, which was built in 1968. The sanitary sewer collection system is much older, dating back to the 1920s and includes some areas that have a combined sanitary and storm sewer system. The combined sewers, some remaining old clay pipes and other incidental sources on inflow and infiltration make for a wastewater collection system that receives very high levels of wet weather flows, peaking at 12 times greater than the dry weather flow. This is much greater than most wastewater systems, where the wet weather flow is typically double or triple the dry weather flow.

The collected wastewater is treated in a two-cell lagoon system, with the smaller lagoon being aerated and the larger one being a settling lagoon. The treated effluent is currently discharged, without disinfection, into Maple Lake Creek, which is a tributary to the Trent River, which in turn flows into the estuary of Baynes Sound, a major shellfish aquaculture region. While these streams see very high winter flows, they are very dry in the summer, with the effluent discharge being the only summer flow in Maple Lake Creek, and almost half the flow of the lower Trent River.

The area of the lagoons was a natural swamp area that was drained in the 1930s, by excavating the ditch that is now Maple Lake Creek, to create farmland. Farming in the area was abandoned in the 1960s and since then forest regeneration has occurred on the upland areas, but invasive reed canary grass has established in the low-lying areas, creating a virtual monoculture and preventing a re-establishment of native wetland forest. It has long been a goal of Cumberland to restore this area to a functional and vibrant habitat for plants and animals, and allow for public access for wildlife viewing.

### PROJECT OBJECTIVES

The major technical objectives are to:

- a. Improve the wastewater treatment to meet all current and near future regulatory standards



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- b. Provide high performance disinfection – with particular emphasis on destruction of human viruses - for the protection of public health and aquaculture in the downstream waters of the Trent River and Baynes Sound
- c. Ensure the treatment process, and the treatment works themselves, are resilient to future climate change impacts of winter flooding and summer heat.

The major works required to achieve this are:

- Optimize the lagoon biological treatment to ensure performance under summer and winter conditions
- Chemical phosphorus removal to prevent algae blooms in the downstream creek and river
- Tertiary filtration to achieve reclaimed water standards
- High intensity ultra-violet (UV) disinfection of tertiary treated flow (up to 7200m<sup>3</sup>/day). Provision has been included to add additional chlorine disinfection if needed to achieve virus reduction targets)
- Chlorine disinfection of excess wet weather flow (over 7200m<sup>3</sup>/day), with dichlorination followed by flow through a grassed detention basin.
- Design for reliability and redundancy to ensure treatment performance in all conditions
- Provide for Cumberland growth from the current population of 4500 people to 8000.

These works will provide a tertiary high standard of treatment for flow from the current dry weather flow of 900m<sup>3</sup>/day up to 7200m<sup>3</sup>/day and still provide secondary treatment and disinfection to excess wet weather flows from 7,200 to 14,400 m<sup>3</sup>/day. As Cumberland continues to separate the old combined storm-sanitary sewers – and complete other infiltration control work – the wet weather flows will decrease to below 7200m<sup>3</sup>/day, the excess wet weather flow system can be decommissioned. This will end the use of chlorine for disinfection. The timeframe for this sewer rehabilitation and flow reduction is by 2035.

### ASPIRATIONAL GOALS

Cumberland has always desired to go above and beyond the regulatory requirements. The wastewater project incorporates some additional goals for treatment performance and environmental enhancement:

- Effluent polishing by a “Biochar Media Reed Bed”, a specially-designed constructed wetland with biochar (adsorbent charcoal) and within the soil and wetland plants on the surface. This removes many of the pharmaceuticals and other trace organic contaminants from the treated water.
- Using the reed bed treated water to irrigate an area of the existing wetlands to bring water to stagnant ponds and for further natural polishing of the water before reaching the creek
- Providing wetland treatment of stormwater flows entering the wetlands area from the Village
- Upgrading the lagoon berms to meet current seismic protection standards by infilling the ditch section of Maple Lake Creek adjacent to the eastern berm
- Creating a new, naturalized streamform channel for Maple Lake Creek on the east side of the wetland area, to replace the infilled section.
- Aquatic habitat enhancement in Maple Lake Creek by adding natural form weirs and fishways to maintain summer water levels deep enough to prevent elevated water temperatures and create viable fish habitat.
- Creating a recreational amenity by providing access trails through the wetland area

The reed bed, wetland augmentation and habitat enhancement components are not regulatory requirements but are the actioning of Cumberland’s strategic goals to “remove man-made toxins” from the treated water and to “restore degraded ecosystems.” They are real world examples of using naturalized treatment systems to treat water, enhance ecosystems and improve the human experience.





**FIGURES**

The overall arrangement of the project is shown in the following figures

**FIGURE 1. Site Location**

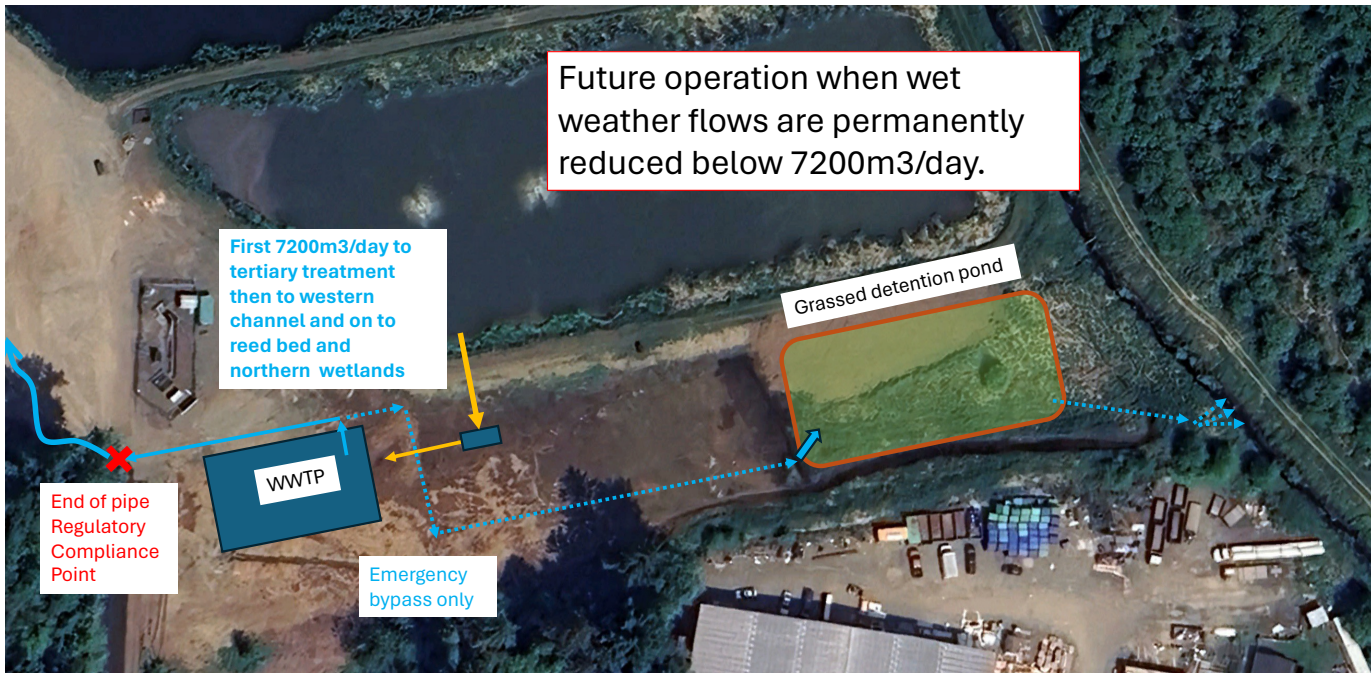


**FIGURE 2. Initial Treatment Operation**

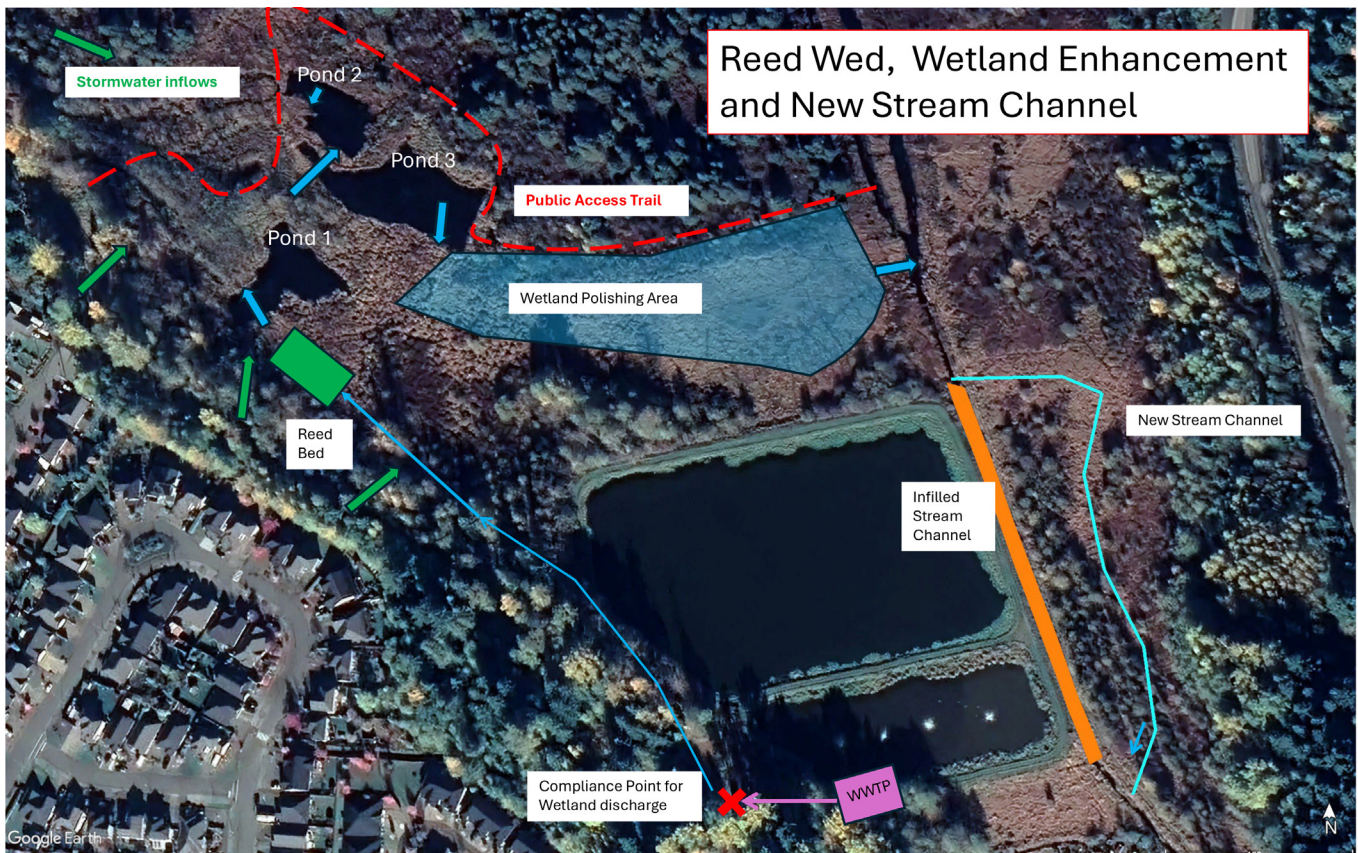




**FIGURE 3. Future Treatment Operation**



**FIGURE 4. Reed Bed and Wetland Enhancement Areas**



**PROJECT COSTS & FUNDING**

As a result of incorporating design changes for climate resiliency and environmental enhancement, and post-COVID inflation, the project costs have doubled since the definition of the project in 2019 from \$9.7 million to \$20.4 million in 2024.

Various federal, provincial and municipal grant funding has been secured for the project, totalling \$10.4m

**TIMELINE**

The project began in 2021 but has experienced numerous delays in the design and construction process. The current schedule of the project is as follows:

Schedule	Activity	2023		2024				2025			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Prelim. design			Completed							
	Detail design										
	Site Clearing										
	Construction										
	Commissioning										

**CONCLUSION**

Overall, this project represents an innovative solution to a uniquely challenging set of constraints. It is the result of careful consideration of the natural environment in which Cumberland exists, to where the water flows to and how to meet the current and future regulatory requirements. It also achieves many of Cumberland’s aspirational goals - for removing man-made toxins, the use of naturalized treatment systems and restoring degraded ecosystems. The proposed solution has been enthusiastically embraced by the people of the Village of Cumberland and will serve the Village for decades to come.