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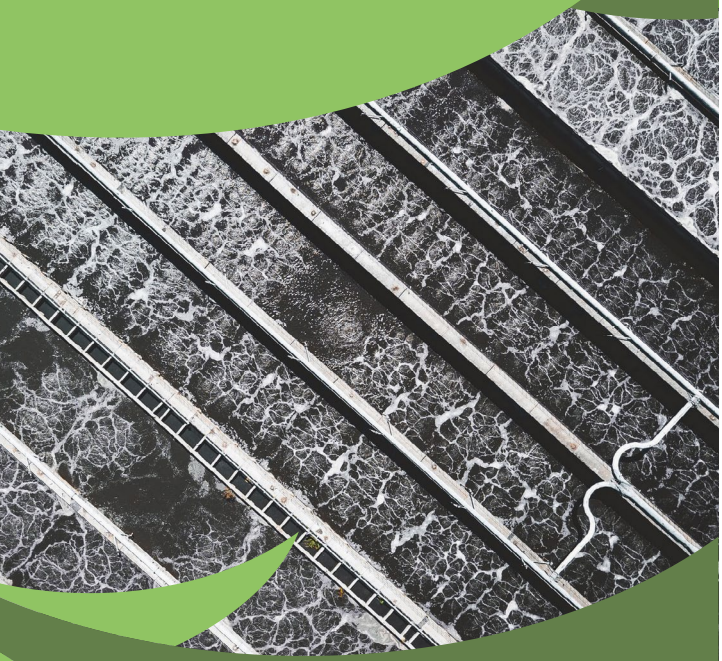

Canadian Water Network
Igniting interest.
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Infrastretching to defer wastewater capital costs

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The challenge: Underperforming wastewater treatment plants

Wastewater treatment plants (WWTPs) provide essential services by removing biodegradable organic matter, suspended solids, and nutrients from the influent through biological and physical processes. Treatment is required to protect receiving waters and meet regulatory discharge limits. Wastewater treatment relies on microbial communities that metabolize dissolved and colloidal pollutants that are not removed during primary settling.[1]

Although WWTPs are designed to meet regulatory requirements, the design itself is only a starting point and not a limit on performance. Wastewater infrastructure is typically engineered with a scalable biological platform that can be optimized when operators actively manage biological and hydraulic processes. However, realizing this potential requires operational capacity that exceeds minimum regulatory monitoring.[1]

In many municipalities, operators are limited by insufficient process data, constrained budgets, and reliance on basic compliance monitoring. This can leave plants functioning well below their true capability, which results in premature capital expansion, unnecessary operating costs, or undetected process stress. Growth pressures, evolving regulations, and increasing influent variability from industrial and commercial dischargers further amplify these challenges.[2]

As municipalities confront aging infrastructure, population growth, and rising capital costs, the need to stretch existing assets has become essential to long-term financial sustainability. Without stronger operational insight, municipalities may assume that plants require costly expansions when significant latent capacity remains untapped.[2]

Overview: An optimization strategy

Improved process control shifts plant operations from a passive, design-limited model to an active, data-driven model. Instead of treating the plant as a “black box,” where performance is assumed to match design specifications, operators use data to fine-tune biological and hydraulic processes in real time.[3]

Certified wastewater operators oversee these processes. To understand the true state of treatment performance, operators require robust process data collection that goes beyond minimum sampling requirements. This includes daily monitoring, solids mass balance, trend analysis, seasonal understanding, and investigation of stressors such as industrial discharges or inhibitory compounds.[3]

Through optimization, operators monitor and adjust parameters such as aeration, solids retention time, return and waste sludge rates, chemical dosing, and effluent quality targets. This enables them to uncover additional hydraulic and treatment capacity, stabilize performance, and achieve higher effluent quality at lower cost.[3]

U.S. EPA's Composite Correction Program

The Composite Correction Program (CCP), developed by the U.S. Environmental Protection Agency in the early 1980s, is a capacity-building framework for wastewater operators. It helps operators deepen their understanding of biological and hydraulic processes within a treatment plant, including operations, maintenance, and technical components. The CCP also emphasizes understanding the plant's administrative environment and physical design so operators can identify any limitations that may affect the facility's ability to achieve high effluent quality economically.

The CCP was widely adopted across the United States in the 1980s for improving wastewater treatment plant performance without requiring extensive new infrastructure.[5]

Similar opportunities exist in drinking water treatment, where optimizing coagulation, filtration, sedimentation, oxidation, and disinfection enables operators to improve water quality, reduce chemical demand, minimize energy use, and extend asset life.

In Ontario, many operators and managers have adopted the Composite Correction Program (CCP), a structured approach that strengthens operational capacity, improves process understanding, and identifies latent capacity within existing assets. CCP provides operators with the tools to determine whether performance issues stem from design limitations, operational practices, or upstream contributors. This enables municipalities to defer capital projects, improve effluent quality, and support population growth using existing infrastructure.[4]

Brantford, Ontario's experience demonstrates how applying CCP principles to day to day operations enabled a medium-sized municipality to avoid a $27.75 million plant expansion, while significantly improving effluent quality.[4]

About the City of Brantford

The City of Brantford, located along the Grand River in southwestern Ontario, owns and operates its drinking water and wastewater services to a community of nearly 100,000 residents. Brantford's drinking water is sourced from the Grand River and treated at the Holmedale Water Treatment Plant. The city also maintains a comprehensive wastewater collection and treatment network, including nine wastewater pumping stations, gravity trunk sewers, and a treatment facility that collects flows from both sides of the Grand River.[7]



Case study: Brantford's strategy for unlocking hidden WWTP capacity

Why Brantford changed course

In 2011, the City of Brantford embedded CCP principles into day-to-day WWTP operations. The work began as part of a planned plant expansion to keep pace with growth and maintain compliance with federal and provincial effluent quality regulations. Although the facility met regulations, it faced operational pressures and a forecast to serve a population of approximately 163,000 by 2041, up from roughly 95,000, which was driven by Ontario's Places to Grow plan. The City had earmarked $27.75 million for a major expansion.

The new general manager for the public works commission scrutinized the plan and found red flags. The plant, which was operated by a qualified third party, was consistently compliant and running at only approximately 42 percent of hydraulic design capacity.[6] That raised a simple question: why build when the existing plant might do more?

Up until this point, the City had assumed that operational liability, meaning responsibility and risk for how the plant operated and performed, had been transferred through the contract. This is a common misconception among municipalities that hire third-party WWTP operators. Given the low utilization and compliance record, the City chose to investigate whether optimization could unlock latent capacity before committing to new infrastructure.[6]

What the diagnostics revealed

Brantford launched a CCP review to test whether expansion was truly necessary.

Plant capacity: The review found a conservative design with no major process bottlenecks. Modest process control improvements demonstrated that the plant could treat current and

future wastewater loads and volumes. With an understanding of potential latent capacity, specific unit processes or the entire plant could be re-rated. Rerating required operators to demonstrate, through data and performance evidence, that the existing processes could reliably accept additional hydraulic flow and organic loading without compromising effluent quality. Once demonstrated, the regulator could approve the re-rating, thereby increasing the plant's officially recognized treatment capacity. This meant the facility could meet growth needs without immediate capital expansion.4 Although the City did not re-rate the plant because sufficient latent capacity was available, the plant was showing signs of deterioration (e.g., concrete failing) due to age. Currently, the City's focus is on maintaining the state of good repair and replacing units due to age.

Operator insights: Operators had reported recurring "stress" events caused by very high-strength influent being discharged by industry discharging wastewater with nitrogen-inhibitors. As part of the CCP, a full year of process data was collected through a Comprehensive Technical Assistance (CTA) study. The analysis determined that the intermittent upsets were caused by an upstream industrial source, not by limitations within the plant. This distinction aligned with the introduction's emphasis on using long-term data to diagnose true constraints.[4]

Policy gap: The City's sewer use bylaw lacked tools to address the upstream industrial source that was affecting the WWTP's ability to treat influent. The City could not require pretreatment or restrict inhibitory discharges. This left the utility to absorb the associated costs and risks. Addressing this policy constraint became a necessary part of optimization.[4]

Fixing the cost drivers: Sewer use by law reform

Brantford used a collaborative, data-driven process that brought together Operations, Pollution Control, Economic Development, and senior leadership to reform its sewer use bylaw. In early 2014, Council approved changes to:

- Ban inhibitory substances that destabilize biological treatment.
- Cap overstrength discharges and require on site pretreatment by major industrial users.

Industry, originally unaware of the impact of its waste discharge, made the necessary changes to comply with the bylaw. The result for the City was fewer process upsets, lower operating risk and cost, and a more predictable loading profile. These outcomes reflect the optimization principle of stabilizing influent to support consistent biological performance.[4]

Bringing operations in-house to lower long-term costs

In 2015, Council approved transitioning WWTP operations in house to improve control, accountability, and cost effectiveness.[6] The operations team, now experienced in CCP and CTA methods, focused on:

- Process control as a core function: expanded monitoring, targeted testing, and continuous tuning of aeration, Solids Retention Time (SRT), Return Activated Sludge/Waste Activated Sludge (RAS/WAS) rates, and chemical dosing.
- Data-driven capital planning: using operating data to prioritize state of good repair over expansion, and to target maintenance where it avoids future failures and cost spikes.

This shift aligned governance and operations with an optimization model, where staff use process data to manage biology and hydraulics in real time rather than relying on milestone reviews.

The payoff: Avoided capital and lower lifecycle costs

Brantford's "infrastretching" strategy, which prioritizes optimizing existing assets before building new ones, delivered environmental and financial returns.



- **Expansion avoided:** The City removed $27.75 million in planned expansion from its capital plan by unlocking latent capacity and re-rating the plant.
- **Lower operating risk and cost:** Pretreatment requirements reduced ammonia loadings and stabilized operations, cutting emergency interventions like sludge dewatering and significant biosolids haulage and chemical/energy waste.
- **Better effluent and fewer surprises:** Operators now routinely achieve phosphorus levels well below voluntary targets and maintain low ammonia with minimal disruptions, improving river water quality while avoiding run-to-failure costs.
- **Longer asset life:** A strong maintenance culture, often missing in smaller systems, reduces failures, extends asset life, and defers major replacements.
- **Stronger budgets and support:** Formal recognition for performance in a regional program built pride and political backing for stable operating and maintenance budgets, which helps prevent short-term cuts that raise long-term costs.

These results mirror the introduction's central message that optimization is both a technical and financial strategy that can defer capital and improve environmental outcomes.

Regional capacity building: The Grand River Wastewater Optimization Program

Brantford participates in the Grand River Watershed-wide Wastewater Optimization Program (WWOP), where a facilitator supports operators and managers from 11 municipalities to deepen process control skills, run special studies, and optimize existing infrastructure. The program aims to improve effluent quality and enhance water quality in the Grand River watershed. Unlike drinking water, wastewater operators in Ontario lack a dedicated provincial capacity-



building program. WWOP fills that gap by building operator capability, improving watershed outcomes, and helping utilities defer nonessential capital through detailed optimization. This network support reinforces the introduction's emphasis on capacity building as a prerequisite for successful optimization.

Key takeaways

- **Start with process control data.** Collect and analyze long-term biological and hydraulic data to understand treatment performance. Do not rely solely on minimum regulatory monitoring, as it cannot optimize operations or reveal unused capacity.
- **Challenge operational assumptions.** Evaluate plant performance regularly, even when compliance is met. Assess actual hydraulic and treatment utilization. Using evidence-based reviews can prevent unnecessary expansions and uncover efficiencies.
- **Use policy to stabilize influent.** Apply and update sewer use bylaws to protect biological processes, reduce variability, and lower operational risk. Targeted reforms can significantly improve treatment stability.
- **Align governance with optimization.** Adopt in-house operational models where possible to strengthen accountability and enable real-time process adjustments that improve outcomes and reduce lifecycle costs.
- **Invest consistently in people, maintenance, and measurement.** Provide skilled operators, maintain continuous data collection, and implement proactive maintenance programs to extend asset life, improve reliability, and minimize emergency work.
- **Leverage regional capacity building.** Participate in initiatives like WWOP to strengthen operator capability, share best practices, and achieve watershed-scale performance improvements while deferring non-essential capital spending.

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Further reading

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