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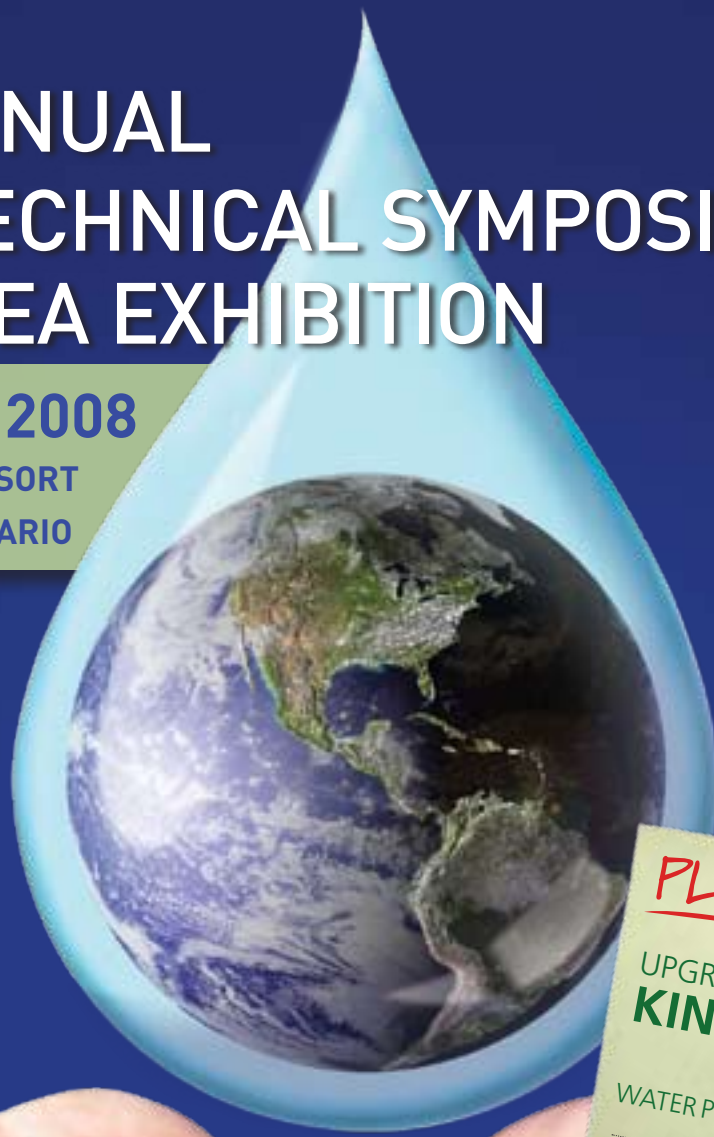
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UPGRADES TO
**KINGSTON'S
RAVENSVIEW**
WATER POLLUTION CONTROL PLANT

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Aerial view of 17 hectare site shows restricted footprint and proximity of cottages to the plant in the lower left.

KINGSTON IS SETTING AN EXAMPLE In wastewater treatment upgrades

Upgrades to the Ravensview Water Pollution Control Plant represent the most costly municipally-funded capital project in Kingston's history. The three-year, \$115 million undertaking, slated for completion in 2009, incorporates one of North America's largest Biostyr™ Biological Aerated Filter (BAF) installations.

Benefits from the complete overhaul, which increases capacity by one-third, involve far more than sewage treatment infrastructure – they set a new standard in environmental stewardship, cost management practices, and community care.

From primary screening to discharge, the Ravensview expansion is designed to decrease odour, noise, air pollution and energy consumption, while treating up to 95,000 cubic metres per day (cu. m/d).

City officials and construction partners wanted to do more than simply bring the 50 year old plant into the modern era and beyond. Despite a larger capacity, they demanded a decreased environmental impact, improved air and water quality, increased noise abatement, energy efficiency, and superior biosolids handling, as well as a guaranteed legacy.

Allen Lucas, P.Eng., project manager of the Ravensview expansion for Utilities Kingston, embarked on a partnered approach. "Partnering focuses on the strength of each participant to efficiently and safely achieve a quality end product, on time and within budget, without unresolved disputes."

Dan Lalonde, P.Eng. is assistant manager of J.L. Richards & Associates' Kingston office, the engineering company co-ordinating the Ravens-

view expansion. Mr. Lucas and Mr. Lalonde issued a tender reflecting the spirit of Kingston Council's environmental ethos, which dictates that all municipal projects consider a



Early stages of BAF cells showing inlets for some of the 77,000 nozzles.



Forming the backwash channel at the base of the BAF.



Ravensview 2007.

Leadership in Energy and Environmental Design (LEED) designation. LEED has no industrial program, but the administration building is aiming for a silver LEED designation and general LEED principles are adopted throughout the project.

Pomerleau Ontario Inc. was successful with a bid of \$83,100,000 for the construction portion of the project. The federal government, through the Canada Strategic Infrastructure Fund (CSIF), committed \$25 million funding assistance in July 2003 to initiate the project.

Guy Bujold, Assistant Deputy Minister for Industry Canada was joined by Ontario Premier Dalton McGuinty for the sod turning August 2, 2006, marking the official start of construction. Premier McGuinty, a long-time vacationer in the area, presented a cheque for \$25 million from ReNew Ontario, and gave the project his personal endorsement. "Building a sewage plant is not the sexiest endeavour, but without it, there will be serious effects both inside and downstream from this community. This government is helping to protect the Great Lakes St. Lawrence Basin and the families who depend on it."

The City of Kingston will fund the remainder, without direct impact on local taxes, recovered through sewage ratepayers and impost fees paid by new development. The Ravensview project team expressed a desire to include a community element, and integrated Partners in Mission Food Bank. "Partnering at the project level is new to Utilities Kingston; we see it as a way of giving back to the community," said Mr. Lucas.

A fundraising barbeque raised \$1,400 and kicked off the onsite food drive. Trees cut during site preparation were sold as firewood and lumber-grade logs, raising more than \$1,000.

Another initiative, Meeting Attendance and Awareness Incentive, brings new meaning to a fine idea. "We want to encourage respect for everyone's time at a meeting, and that means showing up on schedule, and reducing interruptions. We charge \$1 per minute as a late fee, and \$10 if a cell phone rings in a meeting. We look at this as incentive to increase efficiency at meetings." This effort has garnered widespread support; everyone from operators to the president of Utilities Kingston has generously contributed to the cause.

As one of Canada's most historic cities, Kingston is renowned for its stunning architecture and fascinating heritage, but not everything is a coveted inheritance. Sewers in older parts of the city date back to the late 1800s. Conventional wisdom of the day eschewed the need for treatment; combined storm and sanitary sewers flowed directly into the harbour. It was not until 1953 that the city aggressively enforced a dual system.

Kingston began assessing sewage treatment requirements in the early 1900s. The first formal report was commissioned in 1939. Implementation was delayed by World War II.

In the early 1950s, the city constructed an interceptor trunk line along the waterfront from Kingston Penitentiary, past City Hall, to River Street, then through old Barriefield village to the treatment plant, five kilometres east of the Great Cataraqui River. Built on the north shore of the St. Lawrence River, Ravensview was completed in 1957. Its catchment area includes the old town and former Pittsburgh Township.

Ravensview implemented new technology over the years, first in the 1970s and again in 1994, when ferric chloride and aluminum sulphate processes were added to the treatment protocol. Ravensview's current average treatment capacity is 72,800 cu. m/d, but demands of this rapidly growing area are increasing, and the plant no longer meets the city's self-imposed stringent environmental standards.

A dedicated effort began in 2000, identifying and addressing many issues, including challenges posed by site topography, zoning requirements, existing woodlands and residential developments, and, most importantly, the non-negotiable continuing operation of the existing plant.

This fourth overhaul of Ravensview is comprehensive and incorporates "an unusual number of environmentally advanced tools and systems." Officials predict Ravensview will treat waste water with state-of-the-art equipment and best practices that serve as a model to other municipalities throughout North America. It will make the city an international leader in the sewage treatment field, and become an educational and training resource for the public and other operating authorities.

"The general public has no idea what happens when they flip the handle," noted Mr. Lucas. "For the last 50 years, the only thing between their toilets and the St. Lawrence River was these settling tanks. At one time, no one gave a second thought to overflow running directly into the river, but under no circumstances is that acceptable now. We have spent and are spending virtually millions to eliminate overflow. Volume is based on the worst case scenario."

Utilities Kingston and J.L. Richards addressed much more than volume, although that was enough of a challenge. In addition to population-based demand and 100-year storm predictions (a meteorological prediction of an extreme hydrologic event with a reoccurrence interval of once in a century), the engineers inherited problems from the last century.

"Many of our sanitary sewers are deteriorating which produces a lot of grit," explained Mr. Lucas. Until new systems were recently brought online, Ravensview used a clamshell to clean the grit channels. The upgrades include an automated auger to remove the predicted 60 to 70 cu. m produced per year. The liquid goes back into the treatment process, and the grit and gravel is washed and transported to a landfill.

A third screen with a finer mesh will remove more of the floatables. A new sludge dewatering facility with two large-capacity centrifuges will handle effluent faster and more efficiently, and from initial introduction to final removal from the site, the sludge centrifuges, digester gallery, and biosolids storage will be enclosed.

Currently Ravensview has three digesters operating at 37 C and a fourth digester is under construction. The new anaerobic digester is equipped with thermophilic capacity (operating at 55 C instead of 37 C) and exceeds current biosolids management requirements.

"It kills more of the harmful microorganisms and produces a virtually pathogen-free product," explained Mr. Lucas. "We are going above and beyond regulations. We are not required to take measures to this extent, but we are dedicated to setting a positive example for environmental stewardship."

Once the centrifuge and digester process is completed, the dewatered sludge is conveyed underground to the new three-cell biosolids storage facility. It controls odour through negative pressure. "We have always enjoyed a great relationship with our neighbours and they are very pleased with the pending upgrades and our new environmental initiatives," noted Mr. Lucas. "We also have a very conscientious biosolids contractor."

Ravensview's designers wanted local satisfaction combined with a positive global impact, which the new digester helps achieve. A higher operating temperature increases biogas production which will feed the cogeneration facility. In its new incarnation, Ravensview will require approximately one megawatt (MW) for normal operations, requiring installation of a new 44 kilovolt (kV) line to an electrical substation, and electrical upgrades throughout the site. The cogeneration building will house two 575 kW natural gas powered generators for backup in the event of a power disruption, and a 375 kW natural gas/digester gas cogenerator operating continuously. Design of the cogeneration building employed sound-attenuating architecture.

While the heart of the project involves an innovative partnering approach, the core of Ravensview is the Biological Aerated Filters (BAF), a newer technology to North America. With the exception of the composition of the flooring grates, the layout is identical to a system in Geneva, Switzerland.

"Ravensview's designers wanted local satisfaction combined with a positive global impact . . ."



Aerial of the new three-cell biosolids storage building.

This 11-cell BAF installation minimizes energy consumption, improves the treatment process, and increases treatment capacity by 30% – three elements of paramount importance. It also continues a proactive theme consistent with the project. Treatment calls for nine cells to operate at once, leaving one free for maintenance and the other backwashing.

Aeration systems in waste water treatment typically are large consumers of electricity. “Compressor technology was mostly unchanged from the 1930s to 2006,” explained Mr. Lucas. “About a year ago, we decided on new compressor technology. As a result, we will be installing four turbo blowers, which will make this the biggest installation in Canada. In one configuration or another, the blowers run constantly, so installing a system requiring less energy and maintenance is a huge step forward in environmental stewardship.”

The new technology will save 40% in energy consumption compared to older systems, and will pay for itself in fewer than four years.

The turbo fans are part of the new Biostyr™ process. Used at the secondary treatment stage, the system combines biological degradation with clarification of the water in a single cell. Water is filtered upward through biostyrene, a four mm granular material resembling Styrofoam pellets, which float when immersed. Air is injected through jets – in Ravensview’s case 77,000 of them – to maintain circulation of the granular media. As water circulates, the pellets capture

biological pollutants. The system stores an upper layer of treated water used for periodic backwashing to remove excess biomass and retained solids.

Within a compact footprint – important on Ravensview’s restricted 17.6 hectare site – Biostyr™ biofiltration combines a biological reactor to degrade soluble pollutants and a separation phase to remove biomass and particulate pollutants. Nutrient and oxygen content is computer-monitored and automatically adjusted to provide optimum conditions for bacteria.

Through BAF technology, Ravensview will incorporate filters that remove more contaminants, including ammonia, previously difficult to eliminate. In recent years, greater emphasis has been placed on the importance of incorporating secondary biological treatment that will eliminate or neutralize the undetermined effects of exotic contaminants often found in sewage.

This new technology demands a tremendous amount of intensive labour. In total, 45,000 cu. m of rock were drilled, blasted, removed, crushed, and stored onsite for use as backfill, resulting in lower transportation and material costs and a decreased carbon footprint. The expansion will require 16,000 cu. m of concrete, or about 2,000 loads, encasing more than 1.5 million kilograms of reinforcing rod. Over its duration, the project represents 325 worker-years of labour, often with more than 100 workers on site.

Two of the seven 1950s-era primary clarifiers need modification.

“They were totally enclosed because engineers at the time had no way to predict odour levels,” said Mr. Lucas. “Maintenance was impossible.”

To make the 32 m long by 16 m wide by five m deep tanks more accessible, workers removed 450 mm concrete covers. The tanks were emptied and anchored to bedrock to prevent them from floating. That led to another challenge. “One of the biggest successes is the co-ordination of continuous operations and service during construction,” emphasized Mr. Lucas. “There are so many intricacies on a project this size and we do not have the option of even a brief interruption in service.”

Maintaining current operations during construction is of paramount importance, but several ancillary goals are pursued concurrently. The team embraced the mission to establish Ravensview as an educational facility. The new administration has a lab and conference room just for this purpose.

Mr. Lucas is excited about myriad positive environmental and educational aspects of the project. “Cogeneration means reduced energy consumption; the new technology is far more efficient; we salvaged a large green space while increasing capacity; and we have reduced our impact on our neighbours by abating odour and noise. This is a benchmark for future municipal waste water expansions.” ♦

Catherine Stutt is a freelance journalist and editor. For the past 25 years, she has enjoyed focusing on construction profiles, project reports, and economic development throughout Muskoka and eastern Ontario.



Eleven cell BAF has a footprint of 1500 sq metres for the cells and an overall area of 3000 sq m.