



CANADA CASE STUDY:

Fetherston Park, North Grenville, Ontario

INNOVATIVE PRIVATE
FINANCING SOLUTION
FOR WASTEWATER
SERVICING HELPED
RESIDENTS KEEP
THEIR HOMES

PROJECT OVERVIEW

Location: North Grenville, Ontario

Community: Private mobile home park

Population: Approx. 80 people

Challenge: Residents of the Park were faced with eviction in 2013 after being unable to raise funds to replace the failing septic systems in the Park.

SOLUTION

An alternative design-build-operate-finance (DBOF) project delivery model was developed for a new decentralized wastewater system.

The solution provider worked with the Park and the Municipality to put in place suitable funding and performance based operating responsibility agreements.

All capital and operating costs for the project are privately financed through the provider, Clearford Water Systems, transferring the financial risk away from the Municipality and residents.

The Park pays a monthly fee for complete onsite water and wastewater servicing that meets all regulatory requirements and contributes to a reserve fund for future capital and operating expenses.

BOTTOM LINE

This fully-funded model for performance-based servicing represents a sustainable and responsible way forward for the Park that can be applied in many communities facing infrastructure renewal for deteriorating wastewater systems.

BACKGROUND

Fetherston Park is a privately owned year-round residential development located approximately 8 kilometres from Kemptville in Eastern Ontario. The site has 41 mobile homes that were originally serviced by private communal systems dating back to circa 1970, including a drinking water well and distribution piping, sewage collection piping, several pumping chambers and five septic systems.

Raw sewage outbreaks were noted over the past 40 years, attributed to failure of the subsurface disposal beds. Concerns over public health and environmental effects drew attention from the Ontario Ministry of the Environment, and the owner was ordered to repair the sewage system. However, the work was never completed and the Municipality was forced to take over operation of the private services.

Septic system failure put community at risk

The Park went into bankruptcy in 2008, leaving residents and the Municipality in a difficult position. The Municipality could not spend public money on private infrastructure and new buyers for the Park were deterred by the high cost of replacing services.

In 2013, the Municipality was forced to distribute eviction notices. Residents rallied to keep their homes and contacted local media in hope of saving their community. An Ontario water industry leader took notice and assembled a team of interested partners to develop a solution for the troubled site.

REGULATORY APPROVALS IN ONTARIO

Onsite septic systems are regulated through the Ontario Building Code, while systems over 10,000 L/day are subject to Provincial standards and approval by the Ministry of the Environment.

The Ministry is concerned with effluent quality discharged to the environment and risk mitigation of impacts to surrounding areas. The local Conservation Authority is also involved in approvals affecting the local watershed.

PROJECT OBJECTIVES

The project had to resolve the public health and environmental concerns over raw sewage breakouts from septic systems in the vicinity of homes, either by repairing or replacing the failing systems so they would comply with regulatory codes and standards.

A more challenging objective was to limit the upfront and long-term costs to residents so they could afford to remain in their homes. No public funding was available and residents did not have the means for a large capital investment to replace their failing sewage system, as is the case in so many communities.



CHALLENGES

It became clear that private funding with a financing component would be required to implement the solution. The industry partners, residents and the Municipality worked together to develop the legal mechanisms for funding and operating responsibility that would support long-term financial and servicing sustainability, as described in the sidebar at right.

Additionally, there were a number of logistical challenges for implementation of the project that had to be considered from an early stage:

- Availability of space—homes are located near narrow roadways and the site is heavily treed;
- Unknown location of buried services—excavation could break existing watermain and sewers, thereby causing additional operational and environmental problems;
- Maintaining services and access to residents—design and construction must allow residents to stay in their homes without significant disruptions;
- Nutrient-sensitive watershed—water quality concerns in the local South Nation River watershed require strict effluent discharge limits.

MUNICIPAL RESPONSIBILITY AGREEMENTS FOR PRIVATE SEWAGE SERVICES

In Ontario, municipalities are directed to establish municipal responsibility agreements for privately owned communal residential water and sewage systems.

This risk transfer mechanism enables a responsible municipal authority to take control of a malfunctioning system to protect the environment and public health if the owner fails to maintain their private system.

In the agreement, specific responsibilities, conditions and best practices are established regarding proper construction, operation and maintenance, and to ensure adequate reserve funds will be available for future remedial works.

In this way, the local Municipality is assured of the quality and condition of the servicing at Fetherston Park should they be required to assume control of the private system.

SOLUTION

Private financing for performance-based service

Like many communities, the Park could not afford the upfront capital cost of replacing the sewage system, but residents agreed that they could afford a reasonable monthly user fee.

Since the Park would also have to pay for operating costs, it was decided that the service agreement should include both capital and operating costs in order to transfer financial risk from the Municipality and residents to the solution provider.

The scope of services was defined for performance of design, build, operation and financing (DBOF) of the new water distribution and wastewater systems, with all-inclusive operation, maintenance and management services by a qualified licenced operator and full compliance with regulatory requirements. Given the projected capital and operating costs for the new water and sewage systems, the solution provider determined that a term of contract of 32 years would result in affordable monthly service fees for residents subject to increase only for inflation and additional units connected to the system.

Advanced technology for reliable performance

Through an environmental planning process, alternative solutions were evaluated including:

- Replacement of onsite septic systems,
- New 8-km long sewerage main to municipal sewer,
- New decentralized communal system with advanced wastewater treatment.

The preferred solution was a decentralized communal small diameter gravity sewer

(SDGS) collection system, also called septic tank effluent gravity (STEG) sewer system, with advanced membrane bioreactor (MBR) treatment rated for an average daily flow of 30 m³/day. Consideration was made in the design for expansion of both the collection system and treatment plant to accommodate potential future growth of the Park. Most importantly, the plant was designed with efficiencies enabled by the use of SDGS servicing.

The SDGS system provides primary treatment and partial digestion of raw sewage in interceptor tanks for each home. Effluent wastewater from the interceptor tanks is conveyed through small diameter variable grade sewers to a lift station and equalization tank, then to the MBR treatment plant.

TECHNOLOGY SELECTION

Different wastewater treatment technologies were considered, such as moving bed bioreactor and extended aeration.

A membrane bioreactor (MBR) plant was selected because of its compact size and reliably high quality treated effluent. SDGS enables treatment efficiencies at the plant—headworks and primary sedimentation are not required because these functions are performed by interceptor tanks at each home.

Due to time and space constraints, it was decided that a containerized plant should be manufactured and delivered to site for a plug-and-play solution. The MBR plant design includes an aeration tank with alum injection for phosphorus removal, tertiary membrane filters, and ultraviolet (UV) disinfection.

A gravity outfall to a nearby drainage ditch discharges treated effluent to a tributary stream of the South Nation River. The advanced MBR plant achieves a high quality effluent that meets strict discharge limits for the nutrient-sensitive watershed. The effluent criteria and design for the sewage works were reviewed and approved by the Ministry of the Environment, as presented in Table 1 below.

“The Clearford One decentralized communal wastewater collection and treatment system delivers a complete servicing solution. The system’s packaged approach provides flexibility when retrofitting existing sites and allows for easy expansion as developments grow. Clearford One was an affordable solution presented for this project and literally saved Fetherston Park.”

—Karen Dunlop
Director of Public Works,
Municipality of North Grenville

Table 1: Fetherston Park Treatment Performance

Effluent Parameter	Objective ⁽²⁾	Limit ⁽²⁾	Measured Max ⁽³⁾
CBOD ₅ ⁽¹⁾	5 mg/L	10 mg/L	<2 mg/L
Total Suspended Solids	5 mg/L	10 mg/L	1.8 mg/L
Total Phosphorus	0.1 mg/L	0.3 mg/L	0.05 mg/L
Ammonia-Nitrogen	4 mg/L (Winter) 2 mg/L (Summer)	5 mg/L (Winter) 3 mg/L (Summer)	1.0 mg/L (Winter) 0.10 mg/L (Summer)
E.coli	80 CFU/100 ml	100 CFU/100 ml	<1 CFU/100 ml

Notes:

(1) CBOD₅—carbonaceous biochemical oxygen demand, 5-day

(2) Treated effluent criteria from site specific Ontario Environmental Compliance Approval

(3) Measured maximum monthly average from June to December 2016

CONSTRUCTION

A general contractor was selected in a tender process while the treatment plant supplier started final procurement of equipment and assembly of the containerized MBR plant. Construction lasted for five months starting in September 2015.

Phasing challenges during installation

As with any existing community, the main challenge was construction phasing so that water and sewage servicing could be maintained to residents for the duration of construction. The location of existing services was poorly documented. Any excavation carried the risk of breaking the existing buried water and sewer services, thereby disrupting service and delaying construction.

A strategy was developed to decommission existing buried services while providing suitable temporary water and sewage servicing to residents until the new systems were commissioned.



Drinking water was provided through a temporary aboveground distribution network connecting to the existing well water supply.

A sewage management plan for continuous sewage servicing was enabled by the use of SDGS with interceptor tanks, as described in the feature sidebar.

IN FOCUS: SDGS PROVIDES CONTINUITY OF SERVICING DURING CONSTRUCTION

Excavation at the site carried the risk of breaking existing buried sewers and causing sewage spills that would create a health concern and slow down construction. This risk was mitigated by using the new interceptor tanks for temporary sewage holding before starting excavation for the SDGS collection system, as outlined in the sequence below.

1 | Thirty new 4000 litre interceptor tanks were installed one adjacent to each home or shared between two homes. The outlet for each tank was capped.

2 | New lateral sewers were installed for each home connecting to the interceptor tank inlets.

3 | Existing sanitary connections for each home were cut and abandoned, and the new laterals were connected to the home plumbing.

4 | Sewage was allowed to fill up the interceptor tanks with capped outlets. Level floats were installed in each tank to indicate when they needed to be pumped out by vacuum truck.

This strategy for construction phasing was a unique solution to SDGS servicing with interceptor tanks. It solved a difficult problem of how to maintain continuity of servicing to homes during construction when the location of existing buried services was unknown and carried a risk of breaking those services.



Common trench water and sewer

Once the temporary drinking water system and sewage holding tanks were operational, full excavation could begin for the new services. Approximately one kilometre each of 75 mm HDPE small diameter sanitary sewer and 31 mm HDPE watermain pipe were installed below the frost penetration depth in a common trench beside the roadways. The HDPE pipe was thermally fused at joints to eliminate infiltration and exfiltration—a strategy approved by the Ministry of the Environment to allow a narrower common trench for water and sewer services.

Water and sewer appurtenances were installed, including valves and valve boxes, blow offs, draining curb stop valves, and sanitary maintenance cleanouts. Installation was slow because of restricted working space to allow continued traffic and pedestrian access on roadways and to the homes. The new water and sewer networks were fully commissioned before making the final connections to the homes. The drinking water distribution system was chlorinated and pressure-tested, while the sanitary sewer system was tested for leakage. The old water and sewer services were abandoned, and the septic systems were decommissioned.

Efficient delivery of containerized treatment plant

While installation of the services was underway, the MBR treatment plant was manufactured off-site inside of a modified 40 foot shipping container at the supplier's workshop. On-site preparations included excavation and delivery of two large precast concrete tanks—one for the flow equalization lift station, the other for waste sludge holding. Buried piping and ducts were installed under a granular pad that was designed to support the weight of the containerized plant.

All of the equipment and components were assembled and pre-tested at the workshop. The container was delivered to site by truck and lowered by crane onto the granular pad over buried vertical pipe stubs for the inlet and outlet. The plant supplier commissioned and seeded the plant with waste activated sludge from a nearby operating wastewater treatment facility. Within several days of start-up, the MBR plant was processing sewage and meeting its discharge quality limits.



REMARKS

The success of the project is a result of problem solving and cooperation among concerned stakeholders. Residents were successful in drawing attention to their difficult circumstance, the Municipality was open to implementing alternative strategies, and the solution provider found a financially and environmentally sustainable model for delivering critical sanitary services to the Park. As communities face significant demand for infrastructure renewal, this model for performance-based delivery of water and wastewater services may offer a much needed solution for funding the next generation of public-use infrastructure

REFERENCES

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G. C. Dumencu, "Decentralized Solutions for Global Wastewater Challenges," WEAO Influents Magazine, Summer 2016, pp. 64-67.

ABOUT CLEARFORD WATER SYSTEMS INC.

Clearford Water Systems Inc. is a provider of unified water management and sanitation systems centred on its proprietary technology, Clearford One, comprised of ClearDigest interceptor tanks, ClearConvey small bore sewers, and ClearRecover final treatment facility. For more information on Clearford Water Systems, please visit www.clearford.com.

CONTACT CLEARFORD WATER SYSTEMS

Kevin Loiselle
President & CEO
Clearford Water Systems Inc.
Email: kloiselle@clearford.com
Phone: 613-599-6474

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