



# **Environmental & Science & Engineering** MAGAZINE

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# ALL-TERRAIN SEWER SYSTEM KEY TO NOVA SCOTIA HOME BUILDER'S CONSERVATION PHILOSOPHY

By **Joseph Harmes**

The Villages of Seven Lakes, an award-winning development about 25 minutes from Halifax, Nova Scotia, is the largest project in Atlantic Canada modeled on the innovative building philosophy known as conservation design. This concept prioritizes the uniqueness of both the built and natural habitats of a rural setting and maximizes cost efficiency by utilizing green and sustainable infrastructure practices, ranging from housing density to wastewater transport and treatment.

The journey to groundbreaking in 2014 was arduous. It took six years to consolidate separate parcels into a single 634-acre forested building site touching seven lakes, and four more in bureaucratic haggling with local authorities for a development agreement. Meanwhile, the developer continuously worked on the design so that 60% of the property would forever be a wildlife preserve (a goal of conservation design communities) while situating 634 moderately sized and priced homes on just 254 acres.

But, the labour-intensive part was conservation design itself because the diverse elements didn't dovetail easily. These included:

- Formulating community character components like low-profile ingress and egress.
- Walking, hiking and bike paths.
- Preserving as many trees as possible.
- Protecting riparian buffers, wetlands and migratory paths.

"The placement of all roads, services, infrastructure, wells, wastewater systems, driveways, houses and lawns has to be carefully thought out," says the project manager Brad Harnett.

## THE WASTEWATER CONUNDRUM

The development plan meticulously sprinkles residential clusters throughout the landscape, with each home site measuring one-quarter to three-quarters of an acre. But, incorporating a wastewater infrastructure for these detached "little villages" proved challenging and crucial to the development's success.

"Infrastructure for stormwater or wastewater can either degrade the environment or play a beneficial role," says Randall Arendt, an author, designer and consultant, whose work influenced the concept of Seven Lakes.

Traditional gravity sewer design came with numerous caveats. Foremost was environmental integrity as gravity sewers would require clear-cutting acres of trees for the sewer's large-diameter, deeply excavated mains blasted through bedrock. This becomes even more costly and disruptive when installed in areas with high groundwater tables, where dewatering is required.

"The (Seven Lakes) terrain is quite challenging and a gravity system would have required many manholes and several pump stations. Some homes would still require pumps to get  
*continued overleaf...*



The area consists of lots of bedrock. Gravity sewers would have required large, deep trenches whereas pressure sewer mains are installed just below the frost line.

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up to the sewer main,” says Harnett.

Although the Halifax Regional Municipality (HRM) approves of modern septic systems instead of gravity in some circumstances, they have noted that, except for newer tanks, “few of the existing septic tanks are large enough, and almost none are fitted with filters.” A bigger concern is that “maintenance and operation requirements are rarely met in HRM” and “many people believe that a tank that works well never needs to be pumped.”

“Septic tanks at each home would have to be monitored and pumped at a potentially high cost and there would always be the fear of contamination from leaks,” says Harnett. Additionally, ground conditions around many parts of the property were not suitable for properly functioning septic tank drain fields.

“Focus groups showed that prospective buyers, most of who have never lived in a rural area, are nervous of having to maintain a septic system,” says Gail Penney, president of the Penney Group, who long envisioned a conservation design community like Seven Lakes and brought it to fruition. “Septic wasn’t the choice for us because it is too limiting, for buyers, the environment and for developers. In the long term, it presents too much risk for the environment and ultimately the development overall.”

“Many homebuyers have had no prior experience with individual septic systems and do not understand or trust them,” says Arendt. “Wastewater infrastructure rarely registers as a consideration among homebuyers, except perhaps as a very minor one, and only when innovative wastewater solutions are highlighted as part of the marketing.”

#### A ‘GO-TO’ INFRASTRUCTURE

The developers consulted WSP/Parsons Brinckerhoff, who recommended the All-Terrain Sewer, designed, engineered and manufactured by Environment One Corporation.

A key component of the system is the E/One grinder pump station. It is housed in a tank about the size of a dishwasher that is buried in the ground, with its lid easily camouflaged with minor landscaping. Components include a 1 hp, semi-positive displacement pump whose robust torque can move wastewater

through small-diameter, inflow-and-infiltration-free pressurized pipe for a distance of more than 4.8 km, or straight up 56 m to a force main or treatment plant.

“Our sewer is a low-pressure system using 5 cm- to 10 cm-small diameter pipes and E/One grinder pumps, which are installed at each home,” says Harnett. “The grinder pump station collects all of the wastewater from the home and grinds it into slurry. It is then pumped directly to our wastewater treatment plant,” he explains.

According to Harnett says: “Frost does not normally penetrate deeper than 1.68 m and our sewer lines are installed at least that deep. If rock is an issue and we cannot achieve that depth we can insulate the pipe.”

#### AFFORDABILITY

Depending on the location, the price of an All-Terrain Sewer can be comparable, or even cheaper, than septic. Savings of almost 50% might be realized in comparison to gravity systems. Up-front costs to install a complete wastewater infrastructure are substantially reduced as it is a low-impact system with grinder pumps and pipe installed only when construction of a home begins.

The technology also has meant builders can utilize large sites or small isolated plots, once thought financially, environmentally and/or geologically impractical to sewer.

“E/One’s All-Terrain Sewer allows us to place homes anywhere on our site, whether it be at the top or bottom of a hill and anywhere in between,” Harnett says. Besides the aquatic ecosystem, the topographical challenges at Seven Lakes included slopes exceeding 30%, rock outcroppings and potential archeological sites.

“Traditional septic systems result in expansive lawns, and large spaces between home sites. Our design addresses these issues. We can design our lots to suit the land and the needs of homebuyers first and foremost,” says Penney. “We do not need to plan the homes around the soil conditions required for septic design.”

When presented the options, Harnett says: “It was either a developer-financed on-site wastewater treatment plant, or individual on-site septic disposal systems.”

He estimates the cost of the treatment plant and infrastructure was approximately \$1.2 million. For the first 100 homes it was about \$12,000 each, much less than constructing 100 individual septic systems with tanks and disposal fields. Also, they were able to construct the 100 homes in an area of approximately 40 acres which would not be possible using traditional on-site systems. The greatest number of homes using traditional treatment methods in this area would be no more than 20 or so, due to topographical constraints.

The developers calculated each home would produce approximately 1,000 litres of wastewater daily. It is transported through tightly-sealed pipe to the Seven Lakes wastewater treatment facility, which could be built to a smaller, more economical scale because of the absence of I&I. Once there, wastewater passes through five tanks (each with a holding capacity of 100,000 litres) and is separated into scum, effluent and sludge.

The effluent is delivered to another system where nutrients are broken down in a biological process, before passing through ultraviolet light for tertiary treatment. Finally, it is pumped uphill to a subsurface infiltrator system which delivers the effluent to a large, sandy dispersal field to help recharge groundwater.

Seven Lakes has incorporated an alert system at the wastewater treatment plant which is totally automated and is monitored by computer 24/7. If there is a problem with the system, it sends a message to the plant operator’s cell phone. They can log into the system and switch pumps on or off and adjust the system remotely. ■

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*Joseph Harmes is a freelance writer who has documented the evolution and acceptance curve of low-pressure sewer systems since the early 1990s. For more information on this project, email: [gvorsheim@eone.com](mailto:gvorsheim@eone.com)*