Integrating green infrastructure into a wastewater treatment plant project in Sackets Harbor, New York

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The Village of Sackets Harbor is a small village on the eastern shore of Lake Ontario which traces its roots back to before the War of 1812. Many of its downtown structures were constructed in this era. It is home to Madison Barracks which was built right after the War of 1812, remaining an active duty Army Post until the early 1900s.

The Village's water and sewer systems were initially constructed in the early 1900s with open joint clay tile sewers constructed in common trench with lead joint cast iron watermains. The Village sits on thin silt-laden soils over bedded and fissured limestone bedrock. Most of the homes have stone foundations set on or just into the bedrock.

This background frames the Village's water and sewer situation in 2001. New York State Department of Environmental Conservation (NYSDEC) had just issued a consent order with the Village to address the ongoing hydraulic overloading to the treatment plant. They knew they faced the ongoing challenge of constructing a new or improved wastewater treatment plant and having to correct significant leakage into the sanitary sewer and, at the time, they had no viable means to pay for the upgrade.

They initiated the engineering planning and preliminary design on the anticipation of finding funding. This initial work focused on selecting an energy-efficient, easy-to-operate plant which would reduce annual operating costs. This led the design team to a Sequencing Batch Reactor (SBR)

Covered SBR building

with fine bubble diffusers, premium efficient motors, drives, and blowers all controlled by a web based Supervisory Control and Data Acquisition (SCADA) system. The tankage was covered to reduce weather impacts on operations. Translucent roof panels and high-efficiency LED lighting reduces the lighting load. Green process components included in the early discussions included reed beds to manage biosolids onsite, but concerns with the release of invasive "phragmites" by NYSDEC eliminated this option.

Along with this plant upgrade, planning was started for collection system upgrades as well. The original gravity system conveyed all flows to a deep lake discharge through the harbor. During the late 1960s, the Main Street lift station was constructed at this existing outfall. This station is now within the center of this historic, tourist-oriented harbor. The collection system upgrade identified a diversion of most of the Village's sanitary sewer to flow by gravity to an alternative street at a higher elevation. This reduced the sewer presence in the

West Washington St. lift station with porouse concrete pavement

harbor and reduced the energy needed to pump the sewage to the treatment plant.

This was the status of the project planning when the Environmental Protection Agency (EPA) and NYSDEC started to implement the American Resource and Recovery Act (ARRA) program. The design philosophy was quickly broadened to include analysis of stormwater techniques as well as energy-saving measures as described in the "Green Project Reserve" part of the program. Due to the soil and bedrock conditions described earlier,

the ability to fully manage stormwater within the historic community was limited. The Village was already having issues with flooding basements and sump pumps discharging into the sanitary sewer so it was not practical to add to groundwater in these built-out portions of the Village.

Two areas that were disturbed for the collection piping were identified to support rain gardens along Broad Street, the main thoroughfare. These rain gardens include underdrains which convey the filtered stormwater to Lake Ontario at a much slower rate. We included porous concrete driveways at the new lift station and at the treatment plant, the first time this material was used in Jefferson County. These areas allowed the pavement systems to include underdrains with surface discharge to relieve excess water and reduce the potential of freezing issues.

The inclusion of these techniques in highly visible locations along popular walking paths led the Village to develop a walking map to show off its green infrastructure to visiting tourists as well as its residents. Side-by-side comparisons of conventional sidewalks, asphalt paving, and porous concrete surfaces allow people to readily see this new technology. The rain gardens are right around the corner from traditional street flower beds so the slight changes in ground contour are unnoticeable while viewing the streetscape.
Also included in the project as it finally evolved was a belt press to better manage biosolids with greatly reduced operator labor. This process also reuses treated effluent as process washwater, avoiding more than one-half million gallons/year demand on the Village water system.

A grid-tied, net-metered photovoltaic system was installed at the operator's office, which is large enough to offset its annual power needs.

Belt Filter press

A new fixed-base meter-reading system and individual water meters were installed Village wide including two master meters selling water to adjacent Town districts. This not only saves operator time and vehicle fuel, but more importantly, allows early leak detection within homes and cottages. The antenna system has the ability to read meters for the Town districts as well.

The Village was also able to replace an aging and inefficient pickup truck with a new hybrid vehicle for sewer maintenance within the Village.

During construction, the NYSDEC reissued the State Pollutant Discharge Elimination System (SPDES) permit with tightened limits on ammonia. This necessitated a process change in the plant design which had been approved only six months earlier. The outfall was extended to address near-shore water quality concerns without the need to add energy- and operator-intensive processes to reduce ammonia to the revised limits.

Several institutional hurdles needed to be addressed prior to implementation. Staff underwent significant training on water meter reading, rain garden maintenance, pavement cleaning, as well as the new "batch" treatment process.

The staff readily adapted to the new systems as they were educated on the benefits to the systems and the users. The conservative highway staff had greater appreciation for the porous pavements once they saw the depth of sub-base and drainage systems. The Clerk now regularly calls homeowners to warn them of potential plumbing leaks, greatly reducing the occurrences of flooded basements and unnecessarily high water bills.

In conclusion, the Village selected highly visible locations to showcase their entry into the green infrastructure arena. These carefully selected locations and techniques have been well received by maintenance= staff, Village residents, and visiting tourists. With the confidence that follows successful installations within the community, similar application of these techniques are currently being proposed by private developers in other portions of the Village.

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