Underground Wetlands Reduce Deicing Fluid Disposal at Buffalo Int'l

By Michael Bernos

Notoriously snowy winters require New York's Buffalo Niagara International Airport to use copious amounts of propylene glycol for deicing aircraft. This year, however, it has a new method for managing the overspray that ends up on its runways: engineered wetlands.

The system, already in operation, breaks down the glycol in two to three days by passing it through a series of aeration tubes topped with gravel, mulch and plantings — a method heralded for its environmental friendly approach. The vertical subsurface treatment cells — each the size of a football field and 1 1/2 meters deep — are lined with high-density HDPE material for containment. Because the cells and associated water that carries the deicing fluids are underground, the so-called "dry wetlands" do not attract birds that could interfere with aircraft operations.

For years, the airport treated such fluids off-site; but when expensive infrastructure improvements became necessary to continue such practices, Niagara Frontier Transportation Authority (NFTA) looked for other options. "Treating on-site was the most cost-effective solution, because we could treat everything — stormwater and concentrate — and we could control the cost," explains Kim Minkel, director of Health, Safety and Environmental Quality for NFTA.

Although engineered wetlands are rare in the United States, they're common in Europe, notes Minkel. NFTA was not only intrigued by their success in Europe, it was also impressed with the volume of precipitation they could handle.

To be sure, Minkel and her team studied engineered wetlands in areas with climates similar to Buffalo. In Alaska, for instance, they observed how mining operations use the systems.

Minkel knew she had the right solution for the airport, however, when a feasibility study performed by system consultant Jacques-Whitford showed 95% reduction of propylene glycol. The cost of traditional effluent treatment — considerably higher than wetland treatment — also swayed her decision.

Brewing Stormwater Issues

Propylene glycol disposal became an issue for NFTA in the mid 1990s, when the New York Department of Environmental Conservation (DEC) implemented regulations limiting pollutant discharge, including a maximum of 30 mg of biological oxygen demand (BOD).

"We were good for the propylene glycol limits but had a difficult time with the BOD," Minkel recalls, noting that the excess was "liberal" most months.

Facts & Figures

Project: Propylene Glycol Disposal

Location: Buffalo (NY) Niagara International Airport

Method: Off-site Engineered Wetlands

Consultant: Jacques-Whitford (now Stantec)

Stormwater System Design: Jacques-Whitford & Urban Engineers

Contractor: Kandey Company

Key Benefit: Environmentally friendly way to meet state mandates for pollutant discharge

As a result, DEC issued an order of consent in 1999 that essentially put the airport "on the clock" to meet the limits.

NFTA consequently spent more than $13.1 million over the next four years to meet the BOD and propylene glycol discharge limits, but still continued to exceed allowable levels. Minkel says it was clear something new and innovative was needed.

The airport's storm sewer system, which was installed before the DEC limits were issued, further supported the case for adding engineered wetlands. The system, Minkel says, was porous, with leaks and infiltration issues. As a result, propylene glycol was leaking into the airport's runoff. By contrast, a sanitary system would allow virtually no leakage.

Delivery Dilemma

NFTA researched a number of ways to capture the propylene glycol in order to send it to the engineered wetlands, including vacuum sweeping at the gate to capture and contain as much as 50% of the fluid. It also considered the pricey option of converting the airport's storm sewer system into a sanitary system and centralizing deicing operations — an idea the airlines balked at because of possible scheduling problems.

Ultimately, NFTA chose the project team of Jacques-Whitford and Urban Engineers of New York to create a stormwater system to collect the glycol-contaminated runoff and deliver it to an off-site treatment system using engineered wetlands for treatment. According to Urban's project manager/chief design engineer, finding storage for the first flow flush was a primary challenge because it involves nearly 4 million gallons of water and contains the majority of pollutants that need to be treated.

"Coming up with a storage solution was expensive and threatening the project," recalls Garret Meal, P.E. "Fortunately, we developed a plan to utilize an existing underground tank system on site that we could use to store the first flush."

Even with the tank in use, though, the outfall was exceeding the limits allowed by the state, Meal notes. Urban consequently considered four strategies to reduce storm flow to the state-regulated outfall (a 5-by 3-foot box culvert) that led into the city's stormwater system. By creating a surface area at a low point on airport property, Urban crafted a system capable of treating about 2 million gallons of deicing fluid per day, with no impact on aircraft operations to collect water.

"We really took advantage of every resource we could find to address the hydraulic needs of the system," says Meal.

Options not selected included diverting water flow upstream of the treatment system directly to the wetlands, which diverted the exiting taxiway runoff there as well. Urban also considered recommending the addition of a berm around the wetlands to create a detention area or converting the existing glycol collection system for stormwater retention.

With its new stormwater system in place, the airport began construction of the engineered wetlands. Consultant Jacques-Whitford (now Stantec) completed the design in 2008, and the system began operating in June.

"At-gate deicing is more efficient for the airlines, but sloppier (for the airport)," explains Mark Liner, senior engineer and project manager at Stantec. "The Buffalo Niagara system is designed to capture all the flows from every gate."

The airport's new system, notes Liner, is also designed for variable conditions throughout the year. In winter, disposal of deicing fluid is key: "They have high concentration, low flow during hard freeze," he notes, "and low concentration with high flow during the spring melt."

In summer, the system bolsters the airport's flood prevention measures. "The beds can be emptied and used for stormwater storage," he explains.

According to Minkel, the new system is operating smoothly and is ready for Buffalo's legendary heavy rains and blizzards.

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