Floating Islands Outperform Constructed Wetlands

Project Location: Rehberg Ranch Residential Subdivision, Billings, Montana USA and McLean's Pit Landfill, Greymouth, New Zealand

Promising pilot studies with BioHaven® floating islands or floating treatment wetlands (FTWs) show superior results when compared to constructed wetlands. In comparing municipal wastewater and landfill leachate treated with both systems, BioHavens had higher removal rates and percent removal for ammonia, total nitrogen, biochemical oxygen demand (BOD) and total suspended solids (TSS).

FTW for Municipal Wastewater

Located on the outskirts of Billings, Montana (pop. 120,000), the Rehberg Ranch residential subdivision (pop. 560) was built beyond the reach of the city's municipal sewer system. Developers constructed an aerated lagoon wastewater treatment system engineered and designed to meet US EPA secondary standards for BOD and TSS.

In November 2009 Floating Island International (FII), with funding from the City of Billings and the Montana Board of Research and Commercialization Technology, installed an experimental FTW design in one of the subdivision's two aerated lagoons. The City implemented a rigorous monitoring regime to measure efficacy of the FTW system in comparison to the control lagoon with no FTW. Both lagoons received the same wastewater.

FTW for Landfill Leachate

Landfill leachate is a problematic water stream in New Zealand and worldwide. Greymouth is a South Island town of approximately 3,000 people. The town identified a need for improved treatment of its municipal landfill leachate, which is a dilute stream because of the area's extremely high annual rainfall (3.5 m or 140 inches).

In Stage 1 of the project, FII licensee Waterclean Technologies constructed and installed 288 m^2 (3100 ft^2) of BioHavens to cover approximately 20% of the lagoon surface in half of the lagoons, in November 2009. The wetland plants being utilized are *Carex virgata* and *Cyperus ustulatus*.

Constructed Wetlands

Constructed wetlands with horizontal sub-surface flow have been used for wastewater treatment for more than 30 years. Most wetlands have been designed to treat municipal or domestic wastewater, but are now also used to treat wastewaters such as landfill leachate, industrial waters and agricultural wastewater. In a 2009 review article in the journal "Ecological Engineering," data from several hundred constructed wetlands for municipal and domestic wastewaters, and from approximately ten landfill leachate installations, were summarized (*Vymazal, J., 2009, The Use of Constructed*

Wetlands with Horizontal Sub-Surface Flow for Various Types of Wastewater, Ecological Engineering 35, 1-17, www.sciencedirect.com).

Results

Table 1 shows the performance of the Rehberg Ranch FTW compared to the average performance of several hundred constructed wetlands for municipal/domestic wastewater as consolidated in the Vymazal study. The percent removals of BOD, total nitrogen and ammonia were much higher for the FTW. Due to its smaller size (Table 1), the load removed was much higher in the FTW for these parameters and TSS.

TABLE 1. MUNICIPAL/DOMESTIC WASTEWATER

	Percent Removal		Removal Loading (mg/ft²/day)		Removal Loading (g/m²/day)	
Parameter	**FTW**	**Constructed Wetlands**	**FTW**	**Constructed Wetlands**	**FTW**	**Constructed Wetlands**
BOD	89%	81%	5,500	720	59.2	7.8
Total Nitrogen	69%	39%	1,000	93	10.8	1.0
NH_4-N	83%	21%	1,050	49	11.3	0.5
TSS	53%	68%	1,300	772	14.0	8.3
Size (m²)	214	1,197				

Table 2 shows performance of the BioHaven at McLean's Pit compared to the average performance of approximately ten constructed wetlands for landfill leachate. The percent removals of BOD, total nitrogen and TSS were much higher for the FTW, and the load removed was much higher in the FTW for BOD and total nitrogen.

TABLE 2. LANDFILL LEACHATE

	Percent Removal		Removal Loading (mg/ft²/day)		Removal Loading (g/m²/day)	
Parameter	**FTW**	**Constructed Wetlands**	**FTW**	**Constructed Wetlands**	**FTW**	**Constructed Wetlands**
BOD	46%	33%	685	101	7.4	1.1
Total Nitrogen	40%	33%	2,000	79	21.5	0.9
TSS	89%	55%	160	214	1.7	2.3
Size (m²)	288	872				

FTW influent (left) vs. effluent (right) at McLean's Pit, May 2010

Extensive FTW root system for nutrient uptake – McLean's Pit

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Rehberg Ranch FTW – July 2010

Compared to the small size required for FTWs, the large area typically required for constructed wetlands is illustrated in the aerial photo below:

Jackson Bottom Wetlands Preserve, Hillsboro, OR

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