

Floating Treatment Wetlands Remove Contaminants From City Stormwater

Project Location: Metra Park, Billings, Montana USA

The following case study demonstrates the capabilities of Floating Island International's (FII) patented floating treatment wetland (FTW) technology and its ability to purify water by significantly reducing concentrations of numerous contaminants. Constructed of post-consumer polymer fibers and vegetated with native plants, FTWs mimic the ability of natural wetlands to clean water by bringing a "concentrated wetland effect" to any water body – in this case, a city stormwater pond.

Overview

In November 2008, City of Billings personnel constructed a pond to treat a portion of stormwater discharges originating from a 174-acre drainage dominated by light industrial and commercial properties.

A large FTW was installed in the Metra pond shortly after its construction, along with a smaller FTW in the channel preceding the pond. The FTWs were planted with native grasses and other vegetation in May 2009.

Installation Data

| | |
|--------------------|--|
| Location | Billings, Montana USA |
| Parameters Studied | Total suspended solids, chemical oxygen demand, total phosphorus, total nitrogen, copper, lead, zinc, oil and grease |
| System Type | Stormwater pond |
| Total FTW Size | Area of 1500 ft ² (140 m ²); thickness of 8 in. (20 cm) |
| Water Source | Stormwater runoff from paved parking surfaces |
| Installation Date | Spring 2009 |
| Flow Rate | Variable, depending upon precipitation |
| Water Body Depth | Approximately 4 ft (1.2 m) |
| Water Body Area | 3600 ft ² (330 m ²) |
| % Coverage | 42% of pond covered by FTW |

Operational Data

| | |
|--------------------------------------|----------------------------|
| Average O&M Costs (Labor, Materials) | 1 hour/month; no materials |
| Training Required to Operate | 1-day training seminar |
| Additional Inputs | None |
| Anticipated Lifespan | At least 10 years |

Results

The FTW was installed in late 2008 and planted with vegetation in early 2009; this vegetation became established in 2009 and 2010. Billings has an arid climate so stormwater flow occurs infrequently. Three samples taken in 2009 showed little removal of the eight contaminants measured. However, two samples taken in late 2010 and early 2011, after the FTW vegetation had matured, showed dramatic contaminant reductions between the stormwater pond inlet and outlet. Average concentrations from the last two sampling events are shown in the table below.

Stormwater Pond Results

| Contaminant | Average Conc. (mg/L) | | Average Removal |
|------------------------------|----------------------|--------|-----------------|
| | Inlet | Outlet | |
| Total suspended solids (TSS) | 391 | 28 | 93% |
| Chemical oxygen demand (COD) | 256 | 30 | 88% |
| Total phosphorus (TP) | 0.81 | 0.099 | 88% |
| Total nitrogen (TN) | 3.14 | 0.867 | 72% |
| Copper | 0.091 | 0.009 | 90% |
| Lead | 0.085 | 0.004 | 95% |
| Zinc | 0.875 | 0.056 | 94% |
| Oil & grease (O&G) | 7.1 | 1.2 | 83% |



FTW under construction, November 2008

The last two samples were taken during typical precipitation events, about 0.1 inch each. Estimated flows into the pond were 1000-2000 gpm. Estimated flows during higher-precipitation events may be up to 4000 gpm or higher. As the success of the FTW technology and the demonstration project builds, modifications are being made at the inlet and outlet structures to better understand the flow rate of treated water; however, estimates of several hundred gpm are likely and possibly conservative.



Metra stormwater pond with FTW, June 2011

Conclusions

The FTW installed in the City of Billings Metra Park stormwater pond has very effectively removed the eight contaminants monitored; removal percentages from the last two sampling events range from 63% to 98%. The FTW's effectiveness was substantially improved after its vegetation had matured for two growing seasons. The large jump in treatment effectiveness from the first year of operation shows the effect of the FTW compared to the pond by itself.