Floating Wetlands for Enhanced Treatment in Stormwater Management Ponds

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Introduction

• Conventional stormwater ponds have limited ability to improve water quality.
• The Floating Wetlands are being assessed as a treatment system for water quality improvement in stormwater ponds through microbial action in the root mass and nutrient translocation to the plant biomass.
• The study looks at removal of nutrients (phosphorus and nitrogen), contaminants (E.coli and microcystins) and trace metals

Methods

Field scale study

• Floating wetlands were constructed and placed on nine of fifteen ponds
• Floating pond size: 5.2m by 9.14m per pond
• Field scale study composed two controls and three treatments each with three replicates:
  - Control 1: no covering, no input
  - Control 2: covering, no input
  - Treatment 1: no covering, low input
  - Treatment 2: no covering, high input
  - Treatment 3: covering, high input
• Water quality parameters:
  - pH, Dissolved Oxygen, temperature, conductivity,
  - Nutrients: Phosphorus (TP, orthophosphate, acid hydrolyzable), Nitrogen (NH3, NO3/NO2)
  - Pathogens: Total coliform/E.coli, microcystins

Mesocosm study

• Study composed of fourteen 140L bins
• Floating wetlands were placed on eight of the fourteen bins
  - four bins with floating wetlands
  - four bins with floating mat (no plants)
  - six bins without floating wetland
• Water quality parameters:
  - pH, Dissolved Oxygen, water temperature, conductivity,
  - Nutrients: Phosphorus (TP, orthophosphate, acid hydrolyzable), Nitrogen (NH3, NO3/NO2)
  - Pathogens: Total coliform/E.coli, microcystins

Preliminary Results

• Phosphorus levels are reduced through time (see Figure 8)
  - A result of phosphorus uptake by plants and biofilm
• Dissolved oxygen levels are very low in ponds with mats (see Figure 7)
  - Reasons: lack of water movement due to coverage, mats inhibits diffusion and reduce algal growth
• Chlorophyll a levels are decreased in bins with mats (see Table 1)

Future Research

• Testing for Microcystin removal
• Increased testing on E.coli removal by mats (indoor lab scale study)

Table 1: Average chlorophyll a levels for bins (with and without coverage) Summer of 2011

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<th>Date of Collection</th>
<th>no mat</th>
<th>mat with plants</th>
<th>mat without plants</th>
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</thead>
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<tr>
<td>September-26-11</td>
<td>3.85</td>
<td>1.16</td>
<td>1.61</td>
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<td>October-10-11</td>
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<td>October-31-11</td>
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<td>2.38</td>
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<td>November-07-11</td>
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<td>2.57</td>
<td>2.38</td>
</tr>
</tbody>
</table>

Figure 1: Pond 1 (high inputs with mat covering) located at the research site at Fleming College, Lindsay, ON

Figure 2: Pond 4 (no mat no input) located at research site at Fleming College, Lindsay ON

Figure 3: Aerial view of the research site at Fleming College, Lindsay, ON

Figure 4: Mesocosm study of the fourteen bins

Figure 5: Floating wetlands with and without plants (Nov. 10 2011)

Figure 6: Visual of engineered Floating Wetland

Figure 7: Dissolved Oxygen levels in ponds (with and without coverage) Summer of 2011

Figure 8: Total phosphorus levels in mesocosm study (top) and field study (bottom) over the summer of 2011. Values based on averages of all bins and ponds

Figure 9: Growth on floating wetlands in summer 2010, June 2011, and August 2011

Sponsors

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