



## General Description

Constructed wetlands are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from wet ponds primarily in being shallower and having greater vegetation coverage.

A distinction should be made between using a constructed wetland for storm water management and diverting storm water into a natural wetland. The latter practice is not recommended and in all circumstances, natural wetlands should be protected from the adverse effects of development, including impacts from increased storm water runoff. This is especially important because natural wetlands provide storm water and flood control benefits on a regional scale.

Wetlands are among the most effective stormwater practices in terms of pollutant removal and they also offer aesthetic value. As stormwater runoff flows through the wetland, pollutant removal is achieved through settling and biological uptake within the wetland. Flow through the root systems forces the vegetation to remove nutrients and dissolved pollutants from the stormwater.

## Inspection/Maintenance Considerations

Wetlands need a continuous base flow to maintain aquatic plants. Salts and scum can accumulate in wetlands and, unless properly designed and managed, can be flushed out during larger storms. Wetlands can also release nutrients during the non-growing season. Wetlands can become a breeding area for mosquitoes and midges unless carefully designed and maintained. A proactive and routine preventative maintenance plan (which can vary according to location) is crucial to minimizing vector habitat.

## Maintenance Concerns, Objectives, and Goals

- Vector/Pest Control
- Sediment and Trash Removal
- Vegetation/Landscape Maintenance
- Invasive Species Management
- Bank Erosion
- Nutrient Release During Winter
- Clogging of the Outlet

## Targeted Constituents

✓ Sediment	■
✓ Nutrients	▲
✓ Trash	■
✓ Metals	■
✓ Bacteria	■
✓ Oil and Grease	■
✓ Organics	■

### Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



To maximize wetland removal of pollutants, the vegetation must be harvested frequently. Harvesting is particularly important with respect to the removal of phosphorus and metals, less so nitrogen. Harvesting should occur by mid-summer before the plants begin to transfer phosphorus from the aboveground foliage to subsurface roots, or begin to lose metals that desorb during plant die off. While not stated by the manufacturer, it is also desirable that every few years the entire plant mass including roots be harvested. This is because the belowground biomass constitutes a significant reservoir (possibly half) of the nutrients and metals that are removed from the stormwater by plant (Minton, 2002).

If pretreatment is provided then maintenance consideration must be given to the build up of debris and floatables.

Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after several storm events for bank stability, vegetation growth, drainage system functioning, and structural damage.</li> </ul>	After construction
<ul style="list-style-type: none"> <li>■ Inspect for invasive vegetation, differential settlement, cracking; erosion, leakage, or tree growth on the embankment; the condition of the riprap in the inlet, outlet, and pilot channels; sediment accumulation in the basin; clogging of outlet; and the vigor and density of the vegetation on the basin side slopes and floor. Correct observed problems as necessary.</li> </ul>	Semi-annual inspection
<ul style="list-style-type: none"> <li>■ Inspect for damage to the embankment and inlet/outlet structures. Repair as necessary.</li> <li>■ Note signs of hydrocarbon buildup such as floating oil on water surface.</li> <li>■ Monitor for sediment accumulation in the facility and forebay.</li> <li>■ Examine inlet and outlet devices to ensure they are free of debris and are operational.</li> </ul>	Annual inspection
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Replace wetland vegetation to maintain at least 50% surface area coverage in wetland plants after the second growing season.</li> </ul>	One-time
<ul style="list-style-type: none"> <li>■ Repair undercut areas, erosion to banks, and bottom as required.</li> <li>■ Where permitted by the Department of Fish and Game or other agency regulations, stock constructed wetlands regularly with mosquito fish (<i>Gambusia</i> spp.) to enhance natural mosquito and midge control</li> </ul>	As needed maintenance
<ul style="list-style-type: none"> <li>■ Clean and remove debris from inlet and outlet structures.</li> <li>■ Mow side slopes and remove grass clippings.</li> <li>■ Remove litter and debris from banks, basin bottom, trash racks, outlet structures, and valves as required.</li> </ul>	Frequent (3-4 times/year) maintenance
<ul style="list-style-type: none"> <li>■ Supplement wetland plants if a significant portion have not established (at least 50% of the surface area).</li> <li>■ Remove nuisance plant species.</li> </ul>	Annual maintenance (if needed)
<ul style="list-style-type: none"> <li>■ Clean forebay to avoid accumulation in main wetland area to minimize when the main wetland area needs to be cleaned.</li> </ul>	5- to 7-year maintenance
<ul style="list-style-type: none"> <li>■ Harvest plant species if vegetation becomes too thick causing flow backup and flooding. More frequent plant harvesting may be required by local vector control agencies.</li> </ul>	5- to 7-year maintenance (or more frequently as required)
<ul style="list-style-type: none"> <li>■ Monitor sediment accumulations, and remove sediment when the accumulated sediment volume exceeds 10-20% of the basin volume, plants are “choked” with sediment, or the wetland becomes eutrophic. It is suggested that the main area be cleaned one half at a time with at least one growing season in between cleanings. This will help to preserve the vegetation and enable the wetland to recover more quickly from the cleaning.</li> </ul>	As needed maintenance (20- to 50-years)

## Additional Information

The following observations should be made during the inspections:

- Type and distribution of dominant wetland plants in the marsh
- The presence and distribution of planted wetland species
- The presence and distribution of invasive wetland species
- Signs that invasive species are replacing the planted wetland species
- Percentage of unvegetated standing water (excluding the deep water cells which are not suitable for emergent plant growth)
- The maximum elevation and the vegetative condition in this zone, if the design elevation of the normal pool is being maintained for wetlands with extended zones
- Stability of the original depth zones and the microtopographic features, accumulation of sediment in the forebay and micropool, and survival rate of plants in the wetland buffer.

## References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.