Constructed Stormwater Wetlands

Types: Shallow Marsh System, Basin/Wetland System, Extended Detention Wetland, Pocket Wetland

F. X. Browne, Inc., Lansdale, PA
http://www.fxbrowne.com/html/FXB%20Wetland%20CS/fxbi_constructed%20wetland_CS.htm
Retrieved June 10, 2008

DESCRIPTION

Constructed stormwater wetlands are man-made wetlands specially designed to store and filter stormwater runoff. As stormwater is held in the wetland, particles settle out and nutrients are taken up by vegetation. Over the long-term, microorganisms break down petroleum hydrocarbons carried in stormwater runoff from roads, driveways and parking lots. Additionally, vegetation takes up metals that have settled out of stormwater and into the sediment. When stormwater enters the wetland it displaces a portion of the existing water, which flows out to a drainage system or receiving waterway, however, these systems typically have the capacity to store large volumes of water. This information sheet covers four types of stormwater wetlands: shallow marsh system, basin/wetland system, extended detention wetland and pocket wetland. A fifth type, gravel wetland, is discussed in a separate information sheet.

BENEFITS

Overall

- Treats stormwater runoff
- Reduces peak stormwater flows
- Reduces stormwater runoff volume and flow rate
- Provides local flood control
- Improves quality of local surface waterways
- Enhances the beauty of residential, commercial or industrial sites
- Provides wildlife habitat
- Reduces soil erosion
- Provides some recreational benefits

Pollutant Removal

High pollutant removal efficiencies are one of the major benefits of constructed stormwater wetlands. Properly designed stormwater wetlands can be very effective at eliminating many pollutants that are of concern in the Charles River watershed:

- Total Suspended Solids: 65% - 90%[4]
- Total Phosphorus: 15% - 75%[1]
- Total Nitrogen: 0% - 55%[1]
- Total Zinc: 30% - 70%[1]
- Total Copper: 20% - 65%[1]

Volume Attenuation/Flow Reduction

Constructed stormwater wetlands effectively reduce peak flows.[2] Stormwater wetlands can also reduce overall stormwater runoff volume to surface waterways through evaporation, however, they do not typically recharge a significant amount of water into the ground as groundwater.[1]

MAINTENANCE

Needs and Frequency

- Mow embankments as needed
- Inspect vegetation biannually
- Re-plant vegetation as necessary
- Inspect and remove debris/trash from inlet and outlet structures
- Monitor and control invasive species dispersal
- Dredge and properly dispose of sediment from pretreatment chambers (annually) and wetland areas (every 10 years)

Cost

Approximately $780 - $1640 for a one acre wetland[5]

INSTALLATION COST

Approximately $39,000 - $82,000 for a one acre wetland[5]

Buzzards Bay National Estuary Program, Sprague's Cove, MA
http://www.buzzardsbay.org/sprafact.htm
Retrieved June 10, 2008

CONSTRUCTED STORMWATER WETLAND TYPES

Shallow Marsh System: These systems consist of a combination of pools (low marsh) and vegetated hummocks (high marsh). Pools wind through the high marsh in meandering pathways to extend the amount of time stormwater is held and treated in the system and to increase contact between stormwater and vegetation. These systems are generally shallow and therefore receive no groundwater inputs, so they typically require large drainage areas to contribute the necessary water volume to the system.

Basin/Wetland System: These systems are a combination of stormwater wet ponds and shallow marsh systems. These systems can treat the same volume of stormwater runoff as a shallow marsh system but generally require less space and have higher pollutant removal efficiencies.

Extended Detention Wetland: These systems also consist of low and high marsh areas, however, low marsh areas are deeper than in the shallow marsh systems and are therefore designed to hold a larger volume of stormwater runoff while using less surface area. These systems are designed to accommodate rapid water level increases during storm events and then gradually return to normal water levels in the 24 hours following the storm.

Pocket Wetland: These systems are excavated to intercept the groundwater table and use groundwater to retain water in the system. Since these systems do not rely solely on runoff to provide moisture, they can accommodate smaller drainage areas than other types of constructed stormwater wetlands.

EXAMPLE PROJECTS

Long Lake
Littleton, MA
A constructed stormwater wetland was installed along with a series of other stormwater best management practices to capture and filter stormwater runoff before flowing into Long Lake which is used extensively for swimming and boating.[6]

Doyle Conservation Center
Leominster, MA
A constructed stormwater wetland and series of swales built on this property collect and treat stormwater runoff from the Center's parking lot and roof.[8]

ADDITIONAL CONCERNS OR UNKNOWNS

- Landscaping, grading and, if required, fencing may be needed to limit access to ensure safety.
- Massachusetts regulations prevent stormwater wetlands from being sited in existing natural wetland areas other than riverfront area, land subject to coastal storm flow, and isolated land subject to flooding or bordering land subject to flooding.[3]
- Mosquito breeding can be an issue in stormwater wetlands, however, this can often be addressed using a composite approach which considers siting and design techniques, water quality issues and biological controls.
- Stormwater wetlands can raise water temperatures and should not discharge into cold water fisheries.[3]

SOURCES

[1]Center for Watershed Protection. (2007, August). Urban Stormwater Retrofit Practices Appendices. Urban Subwatershed Restoration Manual Series.

[2]Low Impact Development Center (LIDC). (2005, November). Low Impact Development for Big Box Retailers. Available at: http://www.lowimpactdevelopment.org/bigbox/lid%20articles/bigbox_final_doc.pdf.

[3]Massachusetts Department of Environmental Protection (MA DEP). (2008, February). Massachusetts Stormwater Handbook. Available at: http://www.mass.gov/dep/water/laws/policies.htm#storm.

[4]MassHighway and Massachusetts Department of Environmental Protection (MassHighway). (2004, May) The MassHighway Stormwater Handbook for Highways and Bridges. Available at: http://www.mhd.state.ma.us//default.asp?pgid=content/environ/envpublications02&sid=about.

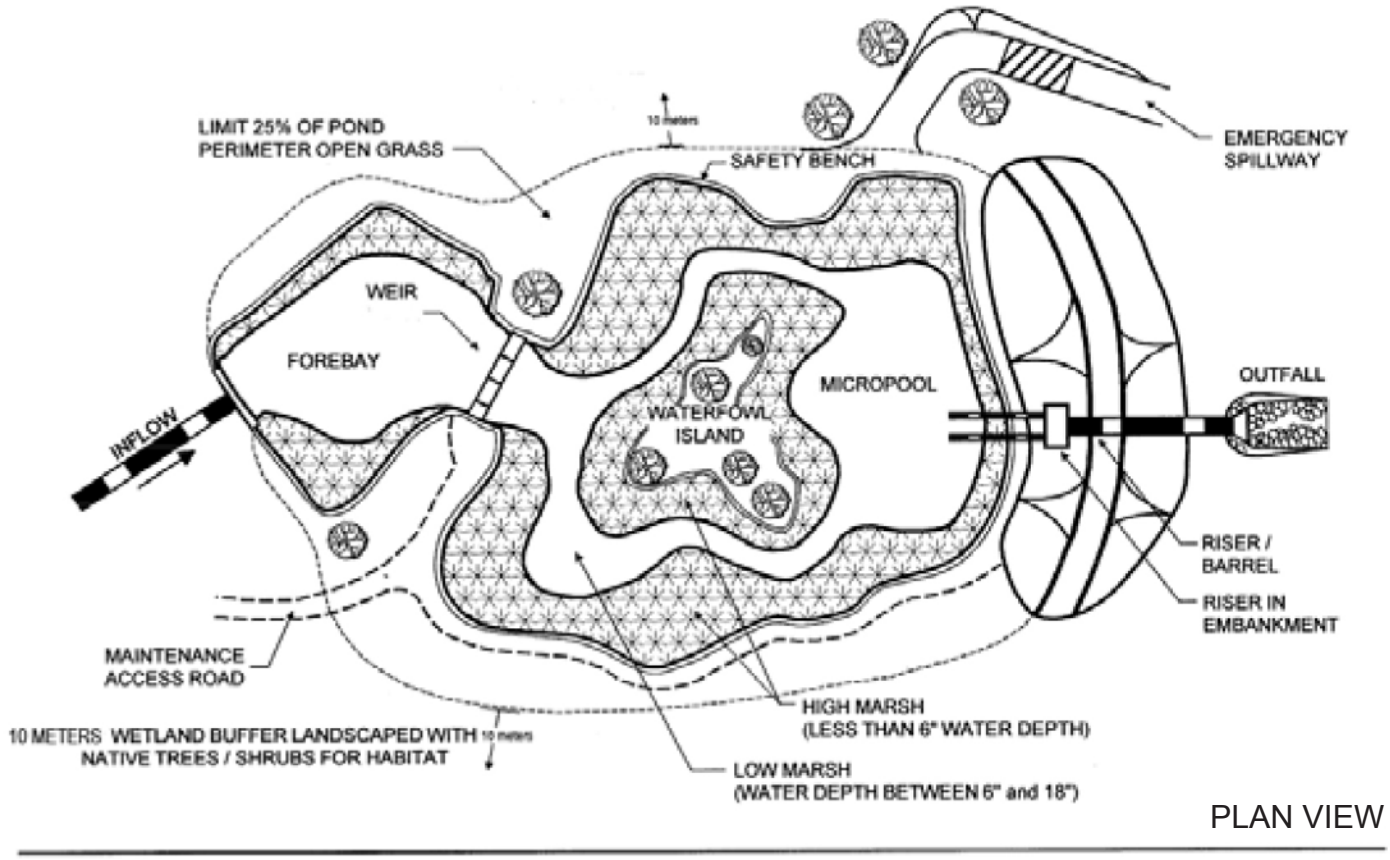
[5]Milwaukee Metropolitan Sewerage District (MMSD). (2007). State of the Art Report; Chapter 4: Summary of Nonpoint Source Technology Analysis. Available at: http://www.mmsd.com/wqi/.

[6]Roy, S. (2008, March) Low Impact Development Case Studies Presentation. Available at: http://www.crwa.org/projects/METwMyRWA/march08seminar.html.

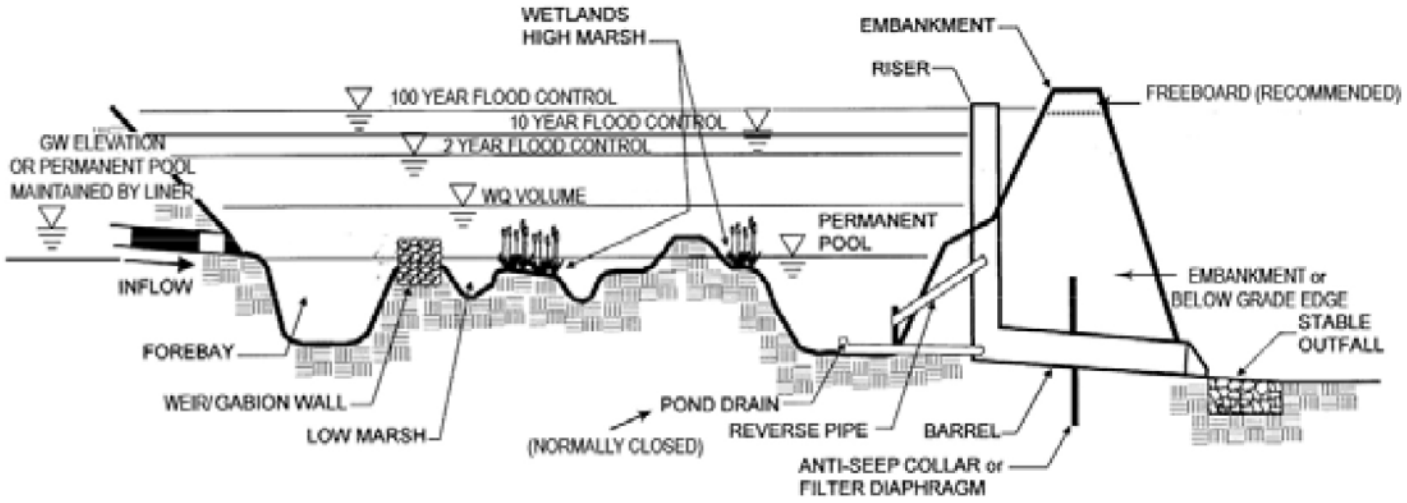
[7]The Stormwater Manager's Research Center (SMRC). (Unknown year). Fact Sheets. Accessed June 20, 2008. http://www.stormwatercenter.net/.

[8]UNHSC-NEMO. Innovative Stormwater Management Inventory. Accessed June 20, 2008. www.erg.unh.edu/lid/index.asp.

SHALLOW MARSH CONSTRUCTED STORMWATER WETLAND



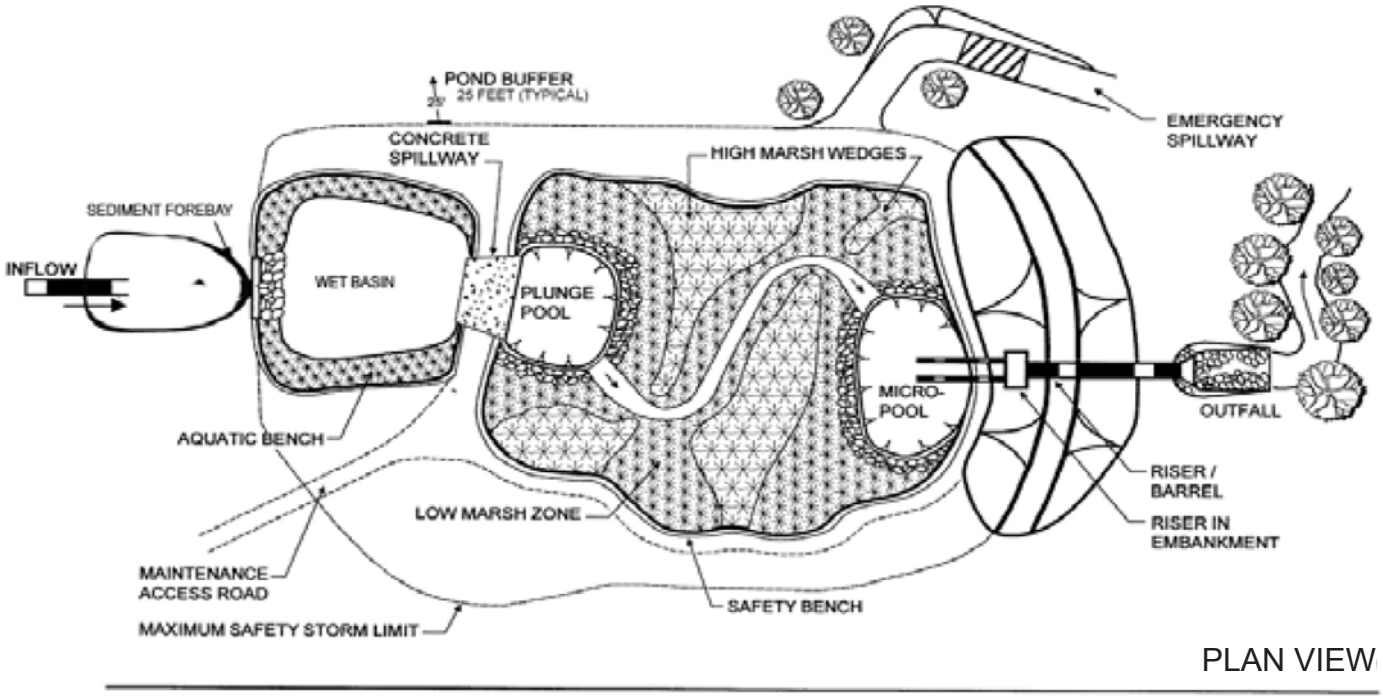
PLAN VIEW



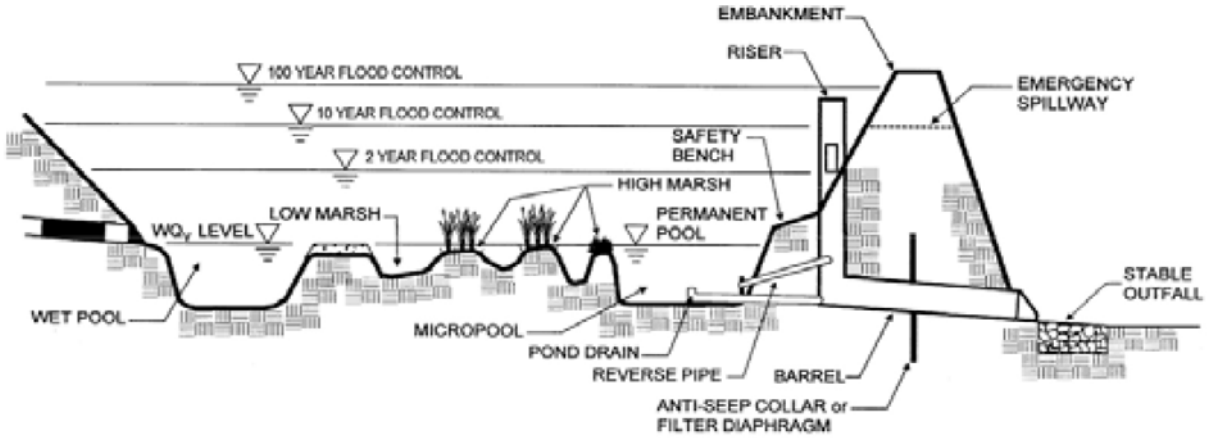
PROFILE

Source:
Massachusetts Stormwater Handbook (February 2008)

BASIN/WETLAND CONSTRUCTED STORMWATER WETLAND



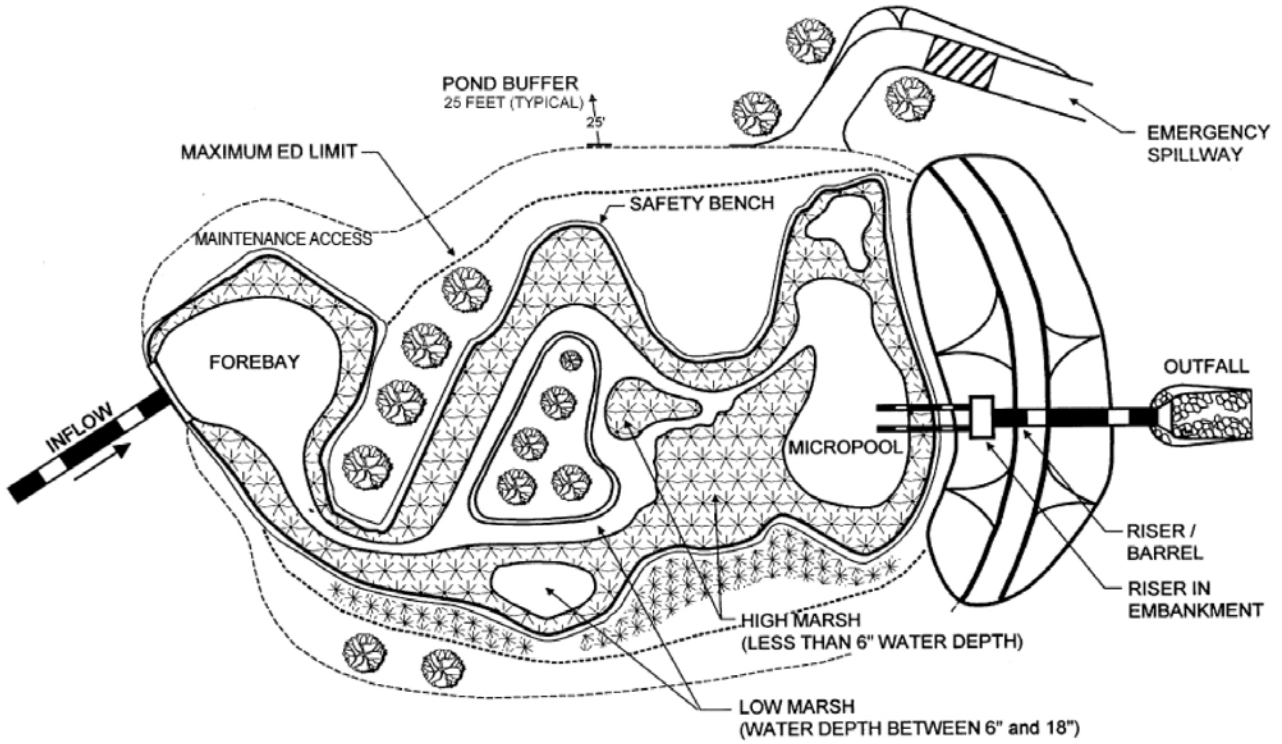
PLAN VIEW



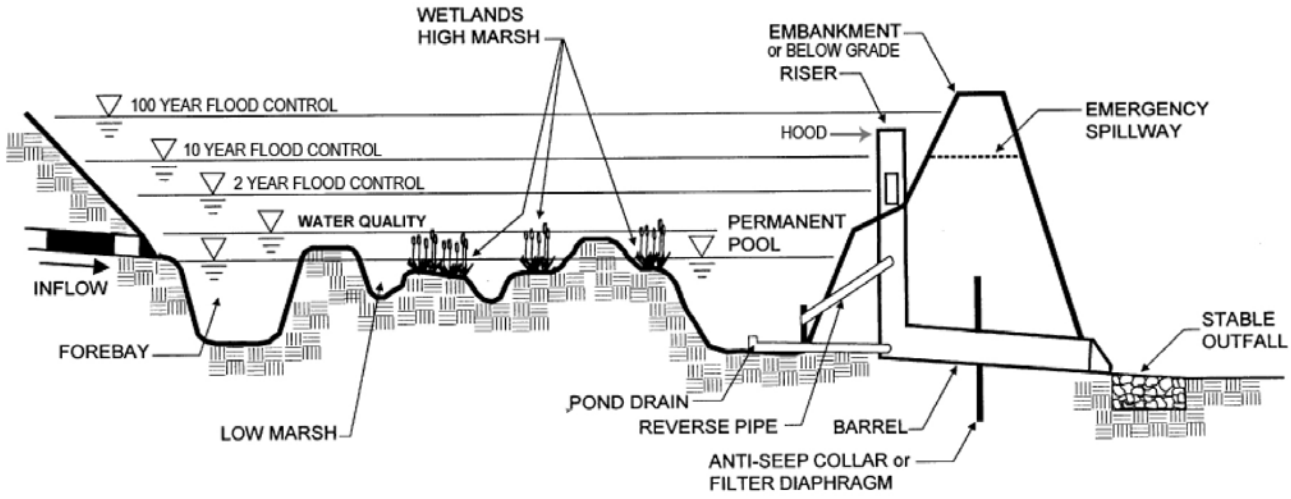
PROFILE

Source:
Massachusetts Stormwater Handbook (February 2008)

EXTENDED CONSTRUCTED STORMWATER WETLAND



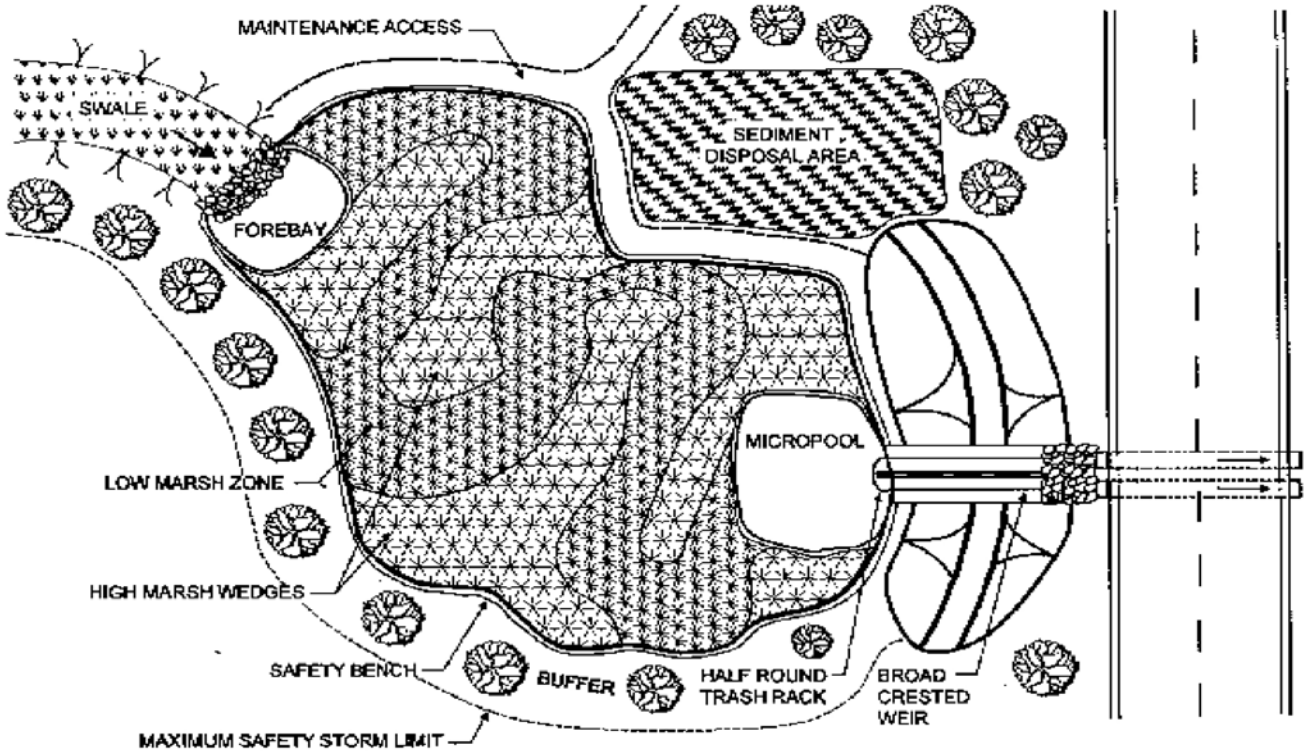
PLAN VIEW



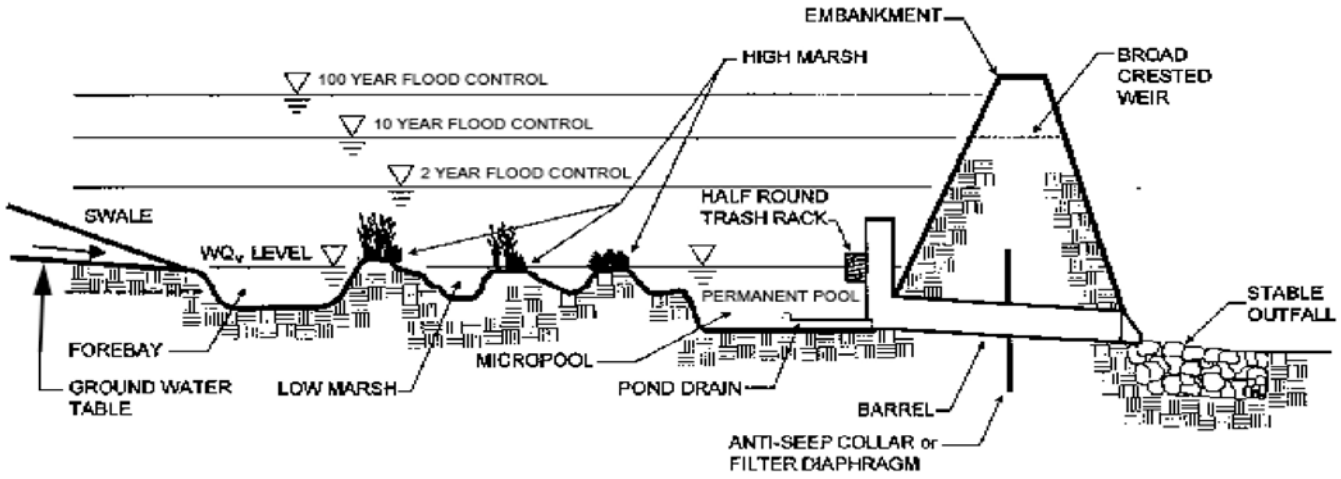
PROFILE

Source:
Massachusetts Stormwater Handbook (February 2008)

POCKET CONSTRUCTED STORMWATER WETLAND



PLAN VIEW



PROFILE

Source:
Massachusetts Stormwater Handbook (February 2008)