Wet Pond (Nutrients) BMP 12

Description

This BMP is similar to BMP 11— Wet Pond for Conventional Pollutants, but has a shallow marsh area that provides additional treatment of pollutants, especially nutrients. The shallow marsh is contained within the "permanent pool" volume.

Applications

If well planned, wet ponds can meet a variety of objectives. These may include protection of infrastructure and property, improving water quality, and providing recreational opportunities. Due to their marsh areas, wet ponds used for nutrient removal provides greater habitat enhancement than conventional wet ponds. Marsh establishment may be impossible in some arid environments.

In order to serve as a multi-purpose facility, the wet pond should function in such a manner as to be compatible with overall stormwater systems both upstream and downstream. This provides a watershed approach to stormwater management as well as local flood control.

If the wet pond facility is planned as an artificial lake to enhance property values and promote the aesthetic value of the land, pretreatment in the form of landscape retention areas or perimeter swales should be incorporated into the stormwater management facility. If possible, catch basins should be located in grassed areas. By incorporating this "treatment train" concept into the overall collection and conveyance system, the engineer can prolong the utility of these permanently wet installations and improve their appearance. Any amount of runoff waters, regardless how small, that is filtered or percolated along its way to the final detention area can remove oil and grease, metals, and sediment. In addition, this will reduce the annual nutrient load to prevent the wet pond from becoming eutrophic with excessive algal blooms, low oxygen levels, and odor.

The site selection for the nutrient control wetland should consider both the natural topography of the area and property boundaries. Aesthetic and water quality considerations may also dictate locations. The facility will become an integral part of the environment and, therefore, should be designed to be seen as an amenity, if possible. Use of good landscaping principles is encouraged. The planting and preservation of water-tolerant trees and other vegetation should be an integral part of the design of the wet pond and marsh areas of the facility.

In planning new detention facilities, keep in mind that the goal of improved water quality downstream may conflict with certain desired uses of the facility. It is only logical that if the basin is used to remove pollutants, the water quality within the basin itself will be lowered, thus reducing the applicability for uses such as recreation, aesthetics, and natural habitat. If the facility treats runoff from large paved areas, high levels of metals and other pollutants may be trapped in sediments in the facility. Consumption of fish in this situation

should be discouraged.
The design of urban detention facilities should be coordinated with a basin plan for managing stormwater runoff. In a localized situation, an individual property owner can, of course, by his or her actions alone, provide effective assistance to the next owner downstream if no other areas contribute to that owner's problems. However, uncontrolled proliferation of impoundments within a watershed can severely alter natural flow conditions, causing compounded flow peaks or increased flow duration that can contribute to downstream degradation. In addition, upstream impacts due to future land use changes should be considered when designing the structure. Land use planning and regulation may be necessary to preserve the intended function of the impoundment.

Limitations

Drainage area – 5 to 20 ac.
Minimum bedrock depth – 3 ft
NRCS soil type – C, D
Drainage/flood control – yes
Max slope – 5%
Minimum water table – 2 ft
Freeze/thaw – fair

Targeted Pollutants

Sediment – 80%
Phosphorus – 65%
Trace metals
Bacteria
Hydrocarbons

Design Parameters

Site Constraints
The same site constraints apply as in BMP11— Wet Pond (Conventional Pollutants). The primary difference is that a wet pond for nutrient removal requires the establishment of a shallow marsh in order to provide additional treatment of runoff, particularly nutrients. A relatively constant supply of water throughout the summer is necessary as well as a shallower depth. The latter requires that the pond's surface area will need to be greater to contain the same runoff volume.

Marsh Establishment
Establishment of fresh water marshes in ponds can aid in water quality improvement. Marsh areas create a sink for many pollutants with a high degree of water treatment or purification, depending upon the runoff detention time and the availability of wetland plants and aquatic life to assimilate pollutants.

Wetland-associated plants will establish themselves naturally in shallow, wet ponds. It may be beneficial, however, to accelerate marsh establishment by planting appropriate native vegetation in shallow areas. Certain wetland plant species have a greater capacity for pollutant assimilation and are less maintenance intensive than others.

The shallow marsh areas should be planted according to the advice of a wetlands specialist. Nursery sources are recommended wherever possible. Small (2 to 4 inch) containers are encouraged to avoid transporting large amounts of potting soil to the pond. White roots and active basal budding

indicate a healthy stock.
Most wetlands specialists prefer to have someone on site during the construction phase to ensure that the littoral shelf where the marsh plants will be located is positioned and graded properly. Knowing the exact elevation of the normal water level of the facility after construction is essential to the success of the marsh element of the system.

Marsh establishment in facilities that also serve as temporary sediment basins may be difficult during construction due to the need for frequent clean-out of accumulated sediment. Wet ponds should be designed with the need for periodic sediment removal in mind. To continue functioning, marshes also require periodic sediment removal. Sediment should be removed from the deepest parts of the basin where vegetation is sparse. Heavily vegetated areas should be disturbed as little as possible. Overhead scooping equipment works well for dredging selected portions of marsh areas.

Permanent Pool Volume
The permanent pool volume should be equal to the runoff volume of one-third of the 2-year, 24-hour design storm. Review Appendix D for additional information on sizing the detention facility.

Overflows
Detention facility design should take into consideration the possibility of overflows. An overflow device should be installed in all facilities to bypass flows over or around the restrictor system and possibly the marsh portions of the facility. The most common overflow event is snowmelt, but overflows may also result from higher intensity or longer duration storms than the design storm or result from plugged orifices or inadequate storage due to sediment buildup in the facility.

Pond Configuration and Geometry
Wet ponds may be single-celled or multi-celled. The multi-celled version requires more planning and maintenance due to the extra berms involved; however, some studies have shown it to be more effective at pollutant removal. This is especially important, as a sedimentation area will help protect plants in the marsh area from being smothered under excessive sediments.

The total pond area and volume should be consistent with the sizing criteria given in Appendix D, but should be allocated using the following surface area-depth relationship (for the permanent pool volume):

70% of the area @ 2 to 6 feet
30% of the area @ 0 to 2 feet

Liner To Prevent Infiltration
Minimizing fluctuations of the water table is important for successful establishment of marsh vegetation. A nutrient control wet pond should be lined with clay to prevent infiltration rate through the bottom of the pond.

Berm Embankment/Slope Stabilization
Embankment stabilization is similar to that of conventional wet ponds. Exposed earth on the side slopes should be sodded or seeded with the appropriate seed mixture as soon as is practicable. If necessary, geotextile or matting may be used to stabilize slopes while seeding and sodding become established.

Gravity Drain
If vegetation is to be harvested, a gravity drain should be provided similar to that mentioned in BMP 11 Wet Pond (Conventional Pollutants).

Construction Guidelines

Widely acceptable construction standards and specifications such as those developed by the USDA - NRCS or the U.S. Army Corps of Engineers for embankment ponds and reservoirs may aid in building the impoundment. Additional information is also available from the Idaho Transportation Department's Design manual. It is important that appropriate erosion control techniques be used during construction of a wet pond.

Maintenance

Failure of large impoundment structures can cause significant property damage and even loss of life. Only professional engineers registered in the state of Idaho who are qualified and experienced in impoundment design should design such structures. Where they exist, local safety standards for impoundment design should be followed. Impoundment structures should also be regularly inspected for signs of failure, such as seepage or cracks in the berm.

The presence of wet ponds and marshes in established urban areas is perceived by many people to be undesirable. They are often thought of as mud holes where mosquitoes and other insects breed. If the wet pond has a shallow marsh established, the pond can become a welcomed addition to a residential community. Constructed fresh water marshes can provide miniature wildlife refuges, and while insect populations are increased, insect predators also increase, often reducing the problem to a tolerable level. More information about mosquito control can be found in Appendix F. Nevertheless, local government and homeowners associations may wish to drain the ponds during late spring and summer if there if sufficient concern. However, it is imperative that the vegetation in shallow marsh areas not die off during draindown periods; otherwise, the pollutant removal effectiveness of the wet pond can be severely impacted. In addition, the decaying vegetation can create nuisance conditions.

If the facility is a permanent one, some experts suggest harvesting the marsh vegetation in the fall before it dies and releases stored nutrients back into the system. Harvesting should be minimized, especially if heavy equipment is used that will compact the soil. Trash and debris removal should also be done regularly to avoid the facility becoming a convenient dumping ground for trash, construction debris, and yard waste.

Safety, Signage and Fencing
As in BMP 11 Wet Pond (Conventional Pollutants), the use of thorny vegetation as a barrier instead of fencing enhances the habitat aspects of a nutrient removal wet pond.

Heavy Metal Contamination
Studies have shown high accumulation rates of lead, zinc, and copper on and near heavily traveled highways and streets. Runoff from highways and streets can be expected to carry significant concentrations of these heavy metals. If a significant portion of the drainage area into a pond consists of highways, streets, or parking areas or other known sources of heavy metal contamination, there is a potential environmental health hazard. This is of more concern with the nutrient removal wet pond than the conventional pond because of the attractiveness to wildlife of the marsh areas.