EPA
Soil Conservation Service
U.S. Fish & Wildlife Service
TERRENE INSTITUTE
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Degraded Urban Detention Ponds- Recognizing Problems and Finding Solutions

Introduction

Numerous detention ponds of various sizes have been created on the landscape in conjunction with residential, commercial, industrial, and recreational developments. Detention ponds are designed to detain stormwater runoff from developed, impermeable sites for a period of time. The water is then slowly released to adjacent water resources such as a stream, lake, or wetland, or allowed to evaporate or seep into the ground.

Ponds which detain volumes of water for specific periods of time (usually 24 hours) and then later release the water are called extended detention ponds. These ponds are normally dry between storm events. Figure 1 is a schematic for an extended detention pond. Ponds which retain a permanent pool of water which is displaced during storm events is called a wet pond. Figure 2 is a schematic for a wet pond.

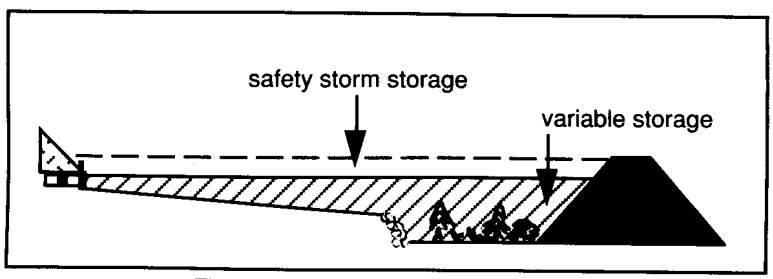


Figure 1. Extended Detention Pond.

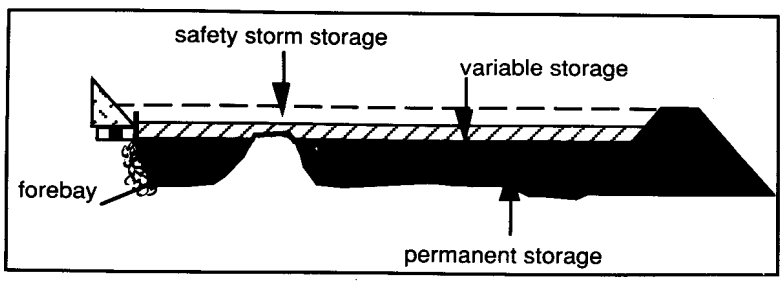


Figure 2. Wet Pond.

Detention ponds reduce the quantity and velocity of stormwater runoff entering our water resources after a rainfall event, thus preventing flooding of low lying areas and erosion of stream channels. To maintain the quality of our water resources, detention ponds serve to improve the quality of stormwater carrying urban pollutants such as nutrients, metals, and sediments.

Unfortunately, if detention ponds are not properly designed, installed and managed to accomodate the quantity and quality of stormwater runoff from developed sites, they can become degraded.

Signs of Degradation

There are some common concerns associated with degraded detention ponds:

- Undesirable water quality, as exhibited by thick algal or aquatic weed growth, turbid or cloudy water, and limited biotic community.
- Insufficient bank stabilization, as exhibited by eroded pond banks, increased pond sedimentation, and sparse vegetation on pond banks.
- Aesthetic issues, as exhibited by odors and nuisance species such as Canada geese.
- Shallow depths or mudflats (excessive sediment deposition in a wet pond) or the presence of standing water in a "dry" pond.
- Volunteer trees inside the pond itself.

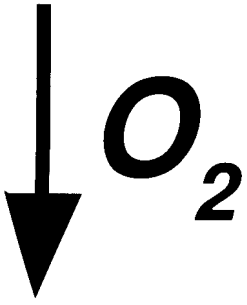
Causes of Degradation

Water Quality

Algal blooms

True algae and blue-green algae thrive in water that is rich with the nutrients phosphorus and nitrogen. Stormwater runoff from residential, commercial, and recreational areas contribute these nutrients in excessive amounts from lawn fertilizer use, and animal excrement from waterfowl and pets.

Algal blooms block sunlight from penetrating the water to the pond bottom, which prevents the growth of more beneficial submergent vegetation. The lack of oxygen producing vegetation in combination with thick algae growth creates a situation where oxygen levels in the water become depleted. Only plant and animal species tolerant of low levels of oxygen can survive in degraded detention ponds.



Turbidity

Turbid water, appearing cloudy or muddy, is caused by suspended particles and/or sediment. Stormwater runoff carries sediment and debris into detention ponds from adjacent developments. Erosion of the pond banks also contributes to the turbidity. When present, bottom feeding fish like carp stir up sediments with their activities.

Limited Biotic Community

Healthy, diverse native plant and animal communities are associated with environments containing clean water and rich soils. Terrestrial plants provide animals with sources of food, nesting materials, cover from predators, and shelter during times of severe weather. Plant cover also acts to filter overland flow of stormwater, thereby improving water quality. Aquatic plants provide shelter for fish and reoxygenation of pond water.

Degraded detention ponds have limited potential to support diverse terrestrial and aquatic plant and animal communities when poor water quality exists. Also, lands immediately adjacent to detention ponds are usually planted with short lawn grasses. This prevents the growth of native plant species, providing minimal habitat for animals.

Insufficient Bank Stabilization

Eroded Pond Banks

Banks that have bare exposed soils, or which are sloughing into the detention ponds are indicative of erosion. Eroded banks signal deficient stabilization for many reasons, including excessive soil moisture, steep slopes, and inappropiate soil types.

"Mushy" soils located near the bank edges indicate a prevailing wet condition or the presence of a high amount of organics. This may lead to sloughing or erosion, as continual wetness limits the type of vegetation that can grow. Banks exhibiting these signs will continue to erode until properly stabilized.

Erosion also occurs when pond banks are designed too steep, making it difficult to establish stabilizing vegetation. Eroding pond banks are symptomatic of poor initial landscaping. Also, runoff velocity increases on steep slopes, thereby increasing erosive forces.

Soil type plays a major role in bank stabilization. Highly erosive soils or exposed subsoils surrounding the detention pond will not hold during storm events. Also, if the soil is not suitable for root growth or there is not enough fertile topsoil, stabilizing vegetation cannot be established.

Detention Pond Sedimentation

Detention ponds will fill with sediment when banks are eroding, or as stormwater runoff carrying sediment from adjacent developments is deposited. As ponds fill with sediment and pond volume is reduced, the water quantity function of stormwater detention is greatly diminished. Water quality benefits are severly inhibited as decreased volumes means less time

for effective pollutant removing mechanisms. Sediment also acts to trap the nutrient phosphorus, through the process of adsorption. Too much phosphorus-laden sediment can result in decreased water quality.

Pond sedimentation indicates that the deposited sediments ultimately must be removed (and disposed of) if the wet pond is to effectively remove pollutants.

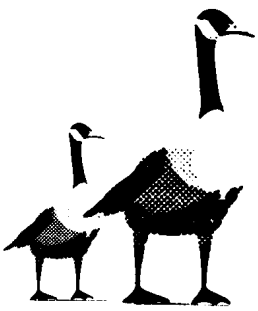
Sparse Vegetative Cover

The lack of vegetative cover around degraded detention ponds may be due to poor soil quality, inappropiate vegetation planted on the site, continual water level fluctuations in the pond, and steep slopes. Vegetation chosen for planting around detention ponds should be carefully selected, and be suitable for these conditions.

Aesthetic Issues

Canada Geese

A major factor in both undesirable water quality and insufficient bank stabilization is the presence of large, residential flocks of Canada geese. Canada geese are attracted to large bodies of open water surrounded by low-growing vegetation. Detention ponds provide abundant habitat for residential geese. These geese congregate in large numbers, heavily graze on bank and shoreline vegetation, and produce excessive amounts of excrement that is extremely rich in phosphorus and nitrogen. This contributes to the degradation of water quality and erosion of pond banks.



Odors

Odor problems generally arise when blue-green algae begins to decompose. The presence of blue-green algae is enhanced when excessive amounts of nutrients enter the detention pond.

Solutions

Establish Diverse Vegetative Buffers

One of the best solutions to address the concerns of undesirable water quality and deficient pond bank stabilization is to establish a vegetative buffer around the detention pond.

The establishment of a vegetative buffer, utilizing a diversity of native plant species, is the most practical and cost efficient alternative to protect and prevent degradation of detention ponds. Vegetative buffers should be established at or near the shoreline and continue landward for a desired distance. Buffers can range in size from 20-30 feet for most urban detention ponds. However, buffers up to 100 feet or more also can be used, depending on your management objectives. Aquatic plant species may also be established in shallow water areas along the shoreline.

A vegetative buffer around the perimeter of a detention pond serves to:

- reduce stormwater runoff from adjacent lawns, roads,and rooftops by encouraging infiltration
- stabilize the banks and shoreline of the basin to prevent soil erosion
- filter nutrients and contaminants from runoff to prevent water quality degradation
- provide fish and wildlife habitat for feeding, breeding, avoiding predators, and shelter
- maintain a diversity of native plant species, including grasses, herbs, shrubs, and trees
- discourage large nuisance flocks of Canada geese and gulls, as they do not prefer habitat with taller grasses, shrubs or trees

Test soils

Soils on development sites, adjacent to detention ponds, should be tested to determine the need for proper amounts of fertilizers. This practice can greatly reduce the risk of excess fertilizer entering the pond. Seedbed preparation with an adequate amount of good topsoil is

necessary along with the appropriate species selection if the entire area needs to be revegetated.

Proper Design

Detention ponds should not be designed with bank slopes steeper than 2:1. Shallower slopes of 3:1 are encouraged for detention ponds. Bank slopes should be minimized to allow stormwater runoff to infiltrate into the soil instead of washing over banks and creating erosion gullies.

The depth of detention ponds influences the water quality of the pond. Generally, a maximum depth of 10 feet is recommended, but site-specific needs may vary.

Pond Cleaning

As sediment accumulates in the pond bottom, it must be periodically removed, usually about once every 10 years. This allows for the maintenance of pond volume for stormwater quantity control. Also, the removal of phosphorus-laden sediments prevents the release of this nutrient into the water column which can degrade water quality in the pond.

Sediment from detention ponds can generally be disposed of at a landfill, as it is not usually considered a hazardous waste. It is recommended that local authorities be contacted prior to pond cleaning to ensure compliance. Sediment removal in wet ponds is extremely important and is often expensive. It is important to include this consideration in the initial design of the pond.

Regular Maintenance and Inspection

Scheduled maintenance of the detention pond is necessary for removal of trash and debris, as well as periodic sediment removal. Inspections of bank slopes, basin floor, and outlet structures should be conducted to identify necessary repairs.

Call for Help!

Below is a list of agencies that may be able to help you answer questions about native plant species, design requirements, soils testing, vegetative buffers, and pond cleaning and maintenance.

Your local unit of Government
Your local Planning Board or City Engineer
Your local Soil and Water Conservation District
Your State Environmental or Water Quality Agencies
U.S. Department of Agriculture-Soil Conservation Service
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Department of Agriculture-Cooperative Extension Service

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