# PUTNAM VALLEY CENTRAL SCHOOL DISTRICT
# PUTNAM VALLEY, NY

**MS4PY6 STORMWATER PROGRAM**

**FACT SHEET # 5**
**DECEMBER 2015**

**BIORETENTION SYSTEMS: DESIGN CONSIDERATIONS, BASED ON NYSDEC GUIDELINES**

**FOR MORE INFORMATION CONTACT YOUR STORMWATER COORDINATOR:**

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## 1. WHAT IS A BIORETENTION SYSTEM

A bioretention system consists of an excavation backfilled with a sand/soil mixture and planted with native vegetation, oriented to receive and filter storm runoff from impervious areas and lawns. Bioretention systems are used to remove a wide range of pollutants, such as suspended solids, nutrients, metals, hydrocarbons, and bacteria from stormwater runoff. They can also be used to reduce peak runoff rates and improve infiltration of stormwater.

## 2. APPLICATIONS

Bioretention systems can be used to filter runoff from both residential and nonresidential developments. Sources of runoff can be overland flow from impervious areas or discharge diverted from a drainage pipe. Bioretention systems are most effective if they receive runoff as close as possible to the source. Bioretention systems can be large or small and can be installed in:

- **Median Strips**
- **Parking Lots**
- **Lawn Areas.**

When properly implemented, these systems can reduce the **volume of runoff** to a storm sewer, **replenish groundwater**, **reduce flooding** and **improve the environment**.

Bioretention systems **should not be planned** in areas having the following characteristics:

**1. High Water Table:** The water table is within 2 feet of the filter bottom
**2. Under Trees** Mature trees would have to be removed to build the system
**3. Severe Slopes:** Slopes are greater than 10%
**4. Near Septic Or Water Wells:** Do not install these systems near septic fields or water wells.

## 3. DESIGN CONSIDERATIONS

Bioretention system designs should allow for treatment of the runoff volume generated by the design storm.

- **Design Storm:** The minimum design storm shall be the 2 hour, 1.25" event. The system shall be designed to fully drain the ponded water in less than 72 hours.
- **Size:** The overall size of the bioretention area should be 5 to 7 percent of the drainage area
- **Width:** Minimum width is 10 - 15 feet (excluding filter strips)
- **Length:** Minimum length is 40 feet
- **Ponded Depth:** Ponded area depth maximum should be 6 inches
- **Planting Soil Depth:** Planting soil minimum depth should be 3 feet

## 4. PRE-TREATMENT SYSTEM COMPONENTS

- **Pretreatment Filter Strip:** This is necessary to reduce incoming velocities and capturing coarser sediments, which will extend the life of the system.
- **Filter Strip Location:** The location would be either just above or just below the inflow point into the system. A sand or gravel infiltration diaphragm may also be included as part of the filter strip. The maximum flow slope should be 6%.
- **Vegetated Filter Strip:** The filter strip should be vegetated with a thick cover of perennial adapted grasses, and sized as follows:
  - **Impervious Parking Lots:** maximum 75' long flow approach length; strip 25 feet wide
  - **Intensively Managed Turf:** maximum 150' long flow approach length; strip 20 feet wide
- **Intake Structure and Flow Regulator:** This element performs the function of capturing and diverting the storm ensuring non-erosive velocities and non-clogging with sediment and debris. Often, this will consist of an opening in the curb that pavement runoff is directed toward and through, into the bioretention area. If a retrofit, this can often be at the point of an existing catch basin, which would be closed and the curb behind it opened to the bioretention filter strip.
- **Pea Gravel Curtain Drain:** This element provides an overflow feature to help augment infiltration into the planting soil/sand bed. This then allows a greater portion of the stormwater to be treated by the facility. The curtain drain should consist of 6 inch perforated plastic pipe, 1/8-1/4" diameter clean bank run gravel placed in a 12" wide trench that is 2-3 feet deep and running perpendicular across the inflow path from the flow regulation device.

## 5. THE PLANTING SOIL/SAND BED

The planting soil/sand bed consist of the following key components:

- **Shallow Ponding Area:** This component provides surface storage for the rain event. It also allows for particle settling during the detention period. Maximum ponding depth shall be six (6) inches.
- **Surface Mulch Layer:** The mulch layer provides an environment for plant growth by maintaining moisture, providing microorganisms, and decomposing incoming organic matter. The surface layer acts as a

filter for finer particles still in suspension and maintains an environment for the microbial community to help break down urban runoff pollutants. This should consist of 1”- 2’’ shredded hardwood or chips. It should be applied to a depth of 2”- 4”, and replenished as needed.

- **Planting Soil Bed:** The planting soil bed provides the environment for water and nutrients to be made available to the vegetation. The soil particles can adsorb some additional pollutants through cation exchange, and voids within the particles can store some of the rainwater. It should consist of 10-25% clay along with 30-55% silt and 35-60% sand textural classes. The pH should range from 5.5 to 6.5. This material shall be placed in lifts of 12” – 18”. The total depth of the planting soil mix should be 3 to 4 feet.
- **Plants:** The plant material takes up some of the nutrients and other pollutants. The environment around the root systems breaks down some pollutants and converts others to less harmful compounds. The use of native plant material is recommended for this component whenever possible. The goal of the planting plan should be to simulate native plants
- **Sand Bed:** The sand bed is provided to keep finer soil particles from washing out through the underdrain system and it provides an aerobic filter as a final polishing treatment media. It should be 12-18 inches thick. Sand should be clean and have less than 15% clay and silt.
- **Gravel Underdrain System:** This element is utilized to collect and distribute the treated runoff. This system helps to keep the soil environment aerobic. It usually consists of a gravel layer extending 10 inches above and surrounding a 6” diameter perforated plastic pipe. The gravel should be clean bank run and should be 3 ½ - 2” diameter. Underdrains are optional because if soil conditions beneath the system are permeable, the filtered runoff will drain into the ground beneath. The underdrain plastic pipe should be 6” diameter rigid schedule 40 PVC. Inflow holes should be ¼” diameter on 6” centers. Underdrain pipes should be placed 10” apart and have a minimum grade of 0.5%.
- **Overflow System:** This component is necessary to bypass the larger storm flow volumes to the downstream receiving drainage system. This usually consists of a conventional catch basin, inlet, or overflow channel located slightly above the shallow ponding limit.

## 6. OPERATIONS AND MAINTENACE

Bioretention facilities are not to be installed until the contributing drainage area is completely stabilized.

- **Monthly Inspections:** are recommended until vegetation is established.
- **Annual Inspections:** should be conducted after vegetation is established
- **Maintenance:** Normally, accumulated sediment and debris removal (especially at the inflow point) will be the primary maintenance function. The filter strip should be mowed at least once a month during the growing season. Other possible tasks will include replacement of dead vegetation, pH regulation (usually liming), erosion repair at inflow points, mulch replenishment, drain unclogging, and repair of overflow catch basins and/or pipes.