LAKELAND CENTRAL SCHOOL DISTRICT
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MS4PY5 STORMWATER PROGRAM

FACT SHEET # 4
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BIORETENTION SYSTEMS FOR STORMWATER DRAINAGE FROM SCHOOL PARKING LOTS

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1. A BIORETENTION SYSTEM

A bioretention system is a soil and plant-based, green stormwater management practice that filters runoff adjacent a parking lot, mimicking nature through infiltration and evapotranspiration. A typical bioretention system consists of the following key components:

- **Pre-Treatment Area:** consisting of a grassed buffer located immediately upstream of the bioretention system. The buffer is designed to slow down the velocity of the incoming water and to remove sediment carried by the runoff
- **Ponding Area:** provides for surface storage of the stormwater before filtering the water through the soil bed
- **Ground Cover or Mulch Area:** the organic mulch area protects the soil bed from erosion and retains moisture to sustain plants. The organic mulch also provides a medium for biological activity to break down organic pollutants and adsorb inorganic pollutants
- **Planting Soil Bed:** provides water and nutrients for plant life. Pollutants are removed by plants in the planting bed through filtration, adsorption and biodegradation

- **Underdrain System:** consists of perforated pipes in a gravel bed installed below the planting bed. Filtered and treated stormwater not absorbed by the plants is collected by the perforated pipes and directed to an outfall pipe to a nearby stormwater system
- **Emergency Overflow Pipe:** consists of a 12 inch solid pipe extending about 6 inches above the ground cover or mulch area. The emergency overflow pipe, which is connected to the perforated pipes in the gravel bed, is located downstream of the bioretention system. The emergency overflow pipe is designed to by-pass the bioretention system, during periods of high intensity rainfall.

2. EFFECTIVENESS

According to reported research studies, a bioretention system can potentially remove: 90% of suspended solids, 65% of phosphorous, 50% of nitrogen and 80% of metals from stormwater.

3. BENEFITS

A bioretention system can provide several benefits to the environment:

- **Flood Control:** it provides stormwater flood control through plant adsorption and evapo-transpiration
- **Groundwater Recharge:** water not absorbed by the plants is recharged into the groundwater, depending on surrounding soil permeability
- **Volume Reduction:** through plant adsorption and evapo-transpiration, bioretention systems reduce offsite stormwater runoff
- **Onsite Water Quality Treatment:** Stormwater pollutants are removed by plants through filtration, adsorption and biodegradation of organic and inorganic pollutants

4. LIMITATIONS

A bioretention system has a few limitations:

- **Down-Gradient Location:** The system should be installed down-gradient from the parking lot so that runoff from the parking lot can flow by gravity into the bioretention system
- **Pre-Treatment:** The system requires a pre-treatment area, consisting of a grassed buffer, located immediately upstream. The grassed buffered area is designed to slow down the velocity of the incoming water and to remove sediment carried by the runoff

- **Discharge to a Storm Sewer System:** treated effluent from the bioretention area should be discharged to a nearby storm sewer system if the soils underneath the bioretention area are unsuitable for groundwater infiltration. The minimum permeability of the soils under the bioretention area should be greater than 1inch per hour for successful groundwater infiltration

5. DESIGN CONSIDERATIONS

A bioretention system should incorporate the following design implementation considerations:

- **Surface Area:** The surface area should be between 5 to 10 percent of the upstream parking area being drained
- **Upstream Slope:** area being drained into the bioretention system should be relatively shallow, about 5 percent of less to provide uniform sheet flow into the system
- **Placement Above the Water Table**: the system should be separated from the water table to ensure that groundwater does not enter the bioretenion system
- **Planting Bed Soil Mix:** the soil mix for the planting bed should consist of a uniform mix of soil about 24 inches to 36 inches deep. The soil mix should be comprised of 50 % sand , 30% composted organic material and 20% natural surrounding soil
- **Gravel Bed:** should contain uniformly sized gravel of ¾ to 1 inch sized stone, about 12 inches deep
- **Minimize Compaction:** do not compact the planting soil because compaction will reduce infiltration through the soil
- **Plant Selection:** the bioretention system should include plants suitable for growing in wet soils. Plants should be placed along the perimeter of the bioretention area and should not be placed near the emergency flow outlet.
- **Bioretention Maximum Ponded Depth:** design the ponded area to hold a water depth of 4 inches to 6 inches, so that water can infiltrate into the plant bed in less than 48 hours, to prevent mosquito breeding
- **Inlet Slotted-Curbed Entrance:** the entrance downstream from the grassed pretreatment area should be designed to uniformly distribute stormwater into the ponded area