A-3. Vegetation

Chapter Contents

Importance of Vegetation in SCMs

The proper selection of vegetation is a critical aspect to the function and success of many stormwater SCMs. Plants increase pollutant removal by providing resistance to the flow of stormwater and subsequently reducing runoff velocity. Slower runoff velocities translate into more time for the functioning of pollutant removal pathways such as settling, filtering, infiltration, and adsorption (Schueler, 1996). Additional benefits from SCM vegetation and include:

- Providing the organic carbon needed for microbial transformation processes.
- Improving infiltration capacities.
- Increasing plant vigor.
- Moderating environmental factors such as water temperature and oxygen concentrations in sediment.
- Stabilizing the soil with plant roots, including aggraded sediments, and remove pollutants that adhere to the sediment particles from runoff.
- Increasing pollutant removal by vegetation up-take (phytoextraction).
- Ameliorating the heat island effect.
- Improving aesthetics & wildlife habitat

Plant Selection - Stormwater Wetlands & Wet Ponds

The interplay between plants, hydrology, and soil composition are vital to the water quality function of stormwater wetlands and wet detention basins. Therefore, it is essential that selected plant materials are appropriate for the anticipated conditions. Hydrologic zones describe the degree to which an area is inundated by water. Plant selection should be consistent with anticipated hydrology. These inundation levels have been divided into four zones shown below. The descriptions of these zones in this chapter are meant to depict them in only the broadest terms. For specific design guidance and recommended plant species, please see the Stormwater Wetland and Wet Detention Basin chapters of this manual.

Deep Pool - Open water and permanent deep pools ranges are best colonized by plants with submerged roots. The function of vegetated deep pools areas is to slow flow velocities and trap sediment, to absorb nutrients in the water column, improve oxidation and create habitat for wildlife and mosquito predators such as frogs, fish, and dragonfly nymphs during dry times.

Shallow Water - Shallow Water includes all areas that are inundated by the normal pool to a depth up to 9 inches. This zone does become drier during periods of drought. Shallow water zones, such as littoral shelves should be vegetated with emergent plants and provide some of the best treatment zones in the wetland.

Shallow Land - The shallow land zone is the temporary storage volume portion of a Wet Pond or Stormwater Wetland. The primary landscaping objectives for this zone are to stabilize the slopes characteristic of this zone and optimize pollutant removal. Shallow land zones should be planted with wetland vegetation capable of growing in alternating dry and inundated conditions.

Upland - This zone extends above the maximum design water surface elevation (never inundated) and often includes the outermost buffer of a pond or wetland. Plant selections should be made based on soil condition, slope stability, light, ease of maintenance, and function within the landscape because little or no water inundation will occur.

Plant Selection - Bioretention Cells

Plants used in bioretention cells must be able to withstand widely varying soil moisture conditions. Conditions in bioretention cells can be very dry for long time periods, punctuated with periods of temporary submergence. Although some plant species used in stormwater wetlands and wet detention ponds can be used in bioretention cells, they are often not suitable for all areas in these SCMs. Additionally, bioretention cells can have an alternate planting option where the entire surface of the cell is grassed. Sod should be installed when grass is used for bioretention cells as seeding is typically not a viable option. For specific design guidance and recommended plant species, please see the Bioretention chapter of this manual.

Plant Placement

- The type of vegetation shall be restricted on dams and berms that impound water either permanently or temporarily during storm events. This restriction does not apply to cut slopes that form pond banks, only to the top, and front and back embankment slopes of dams and berms. Trees or woody shrubs shall not be planted on water impounding dams and berms. This helps avoid channeling or piping of impounded water along roots, damage to the integrity of dams and berms should trees topple, and to enable inspection of the SCM. Only non-clumping turf grasses shall be planted on water impounding dams and berms. Non-clumping turf grasses allow for unobstructed visibility of dam and berm slopes for detecting potential dam safety problems such as animal burrows, slumping, sink holes, or fractures in the berm and reduce the risk of erosion on embankments.
- Planting of trees and shrubs should not be located where they would adversely impact inspection and maintenance access pathways, inlet or outlet pipes, or manmade drainage structures such as spillways or flow spreaders. Species with roots that seek water (e.g., willow and poplar), should be avoided within 50 feet of pipes or manmade structures. This also allows for future inspection and maintenance activities, and to avoid shading of areas intended to be maintained in grass.
- All landscape material, including grass, should be planted in good topsoil. Native underlying soils may be suitable for planting if amended with sufficient quantities of well-aged compost tilled into the subgrade. Compost used should meet specifications for Grade A compost quality.
- Soil in which trees or shrubs are planted may need additional enrichment or additional compost top-dressing depending on the results of soil analysis. Consult a plant nursery, landscape professional, or arborist for site-specific recommendations.
- Evergreen trees and trees which produce relatively little leaf-fall are preferred in areas draining to a detention device. Leaf litter has the potential to accumulate in and around outlet devices, which can clog small weirs or orifices.
- Trees should be set back so that branches do not extend over the permanent pool of a detention device (to prevent leaf-drop into the water and clogging issues).
- Drought-tolerant species are recommended.

Landscape Plans

Healthy, thriving vegetation plays a key role in the performance of many stormwater SCM facilities. Facility-specific planting requirements are given in their respective chapters. These requirements are based on the collective experiences of NC DEQ and North Carolina State University Biological and Agricultural Engineering faculty and staff as well as standard landscape industry methods for design and construction. The landscape planting design must include elements that ensure plant survival and overall functional success. Plant selection is a complex task, involving matching the plant's physiological characteristics with a site's particular environmental conditions. The following factors should be considered:

- Site conditions (e.g., Amount of sunlight and shade, wind direction and intensity, type and quantity of pollutants contained within stormwater runoff, etc.).
- Soil moisture and drought tolerance.

- Sediment and organic matter build-up.
- Potential for outlet structure clogging (e.g., root structure).
- Maintenance.
- Wildlife use (including mosquitoes).
- Preference for native and non-invasive species
- Plant growth rate and ultimate height
- Aesthetics/ability to meet both landscape and stormwater SCM requirements.

Individual plants often have physiological characteristics difficult to convey in a general list. It is necessary to investigate specific information to ensure successful plant selection. There are many resources available to guide designers in the selection of plant material for stormwater SCM facilities. Knowledgeable landscape architects, wetland scientists, urban foresters, and nursery suppliers provide valuable information for considering specific conditions for successful plant establishment and accounting for the variable nature of stormwater hydrology.

Plant species recommendations are provided in each relevant SCM design chapter. Those species lists provided are based on what has been observed in NC to have better performance or survival for unique conditions present in each type of SCM.

Landscape plans should be prepared by a licensed professional. They should include the following items, at a minimum:

1. **Landscape plan sheet(s)**
   - An appropriately scaled construction drawing (typically at 1" = 20') to accurately locate and represent the type and spacing of plant material used within the SCM facility. Representation of plant material should be to scale and depicted at the mature width or spread.
   - A key that identifies all plant material used in the planting plan. The symbols used to identify the plants will correlate with the plant schedule. Plant groupings on the drawing are usually shown by an identifying symbol and the number of plants in that particular group.
   - A list any other necessary information to communicate special construction or installation requirements such as mulching, hydro-seeding, tacking, materials, or methods such as specific plants that must be field located or approved by the designer and size or form matching of an important plant grouping.

2. **Plant list/table**
   - This must include scientific name, common name, quantity, nursery container size, container type (e.g., bare root, b&b, plug, container, etc.), appropriate planting season, and other information in accordance with the SCM facility-specific planting section and landscape industry standards.
   - Source of the plant materials must be indicated in the plant schedule. Plant material should be purchased from a similar provenance[1] or local source if possible to ensure maximum survivability.
   - Native plants species should be specified.
   - No invasive species should be specified.

3. **Soil media specifications.** If topsoil is specified, indicate the topsoil stockpile location or source of the topsoil if imported to the site. Required or anticipated soil

amendments or treatments such as fertilization and tilling should be included.

4. **Construction notes with sequencing, soil and plant installation instructions, and initial maintenance requirements.**

5. **A description of the landscape contractor's responsibilities.**

6. **A warranty period stipulating requirements for plant survival/replacement.**

During the warranty period, all plants that do not survive should be replaced as needed to maintain the function of the vegetation. Establishment procedures, such as control of invasive weeds, animal and vandal damage, mulching, re-staking, watering, and mesh or tube protection replacement, should be considered to improve plant vigor and survival. Staking should be removed after establishment (approximately 12 months), to prevent girdling (strangling) of all woody plants.

The landscape design should consider minimizing the need for herbicides, fertilizers, pesticides, or soil amendments at any time before, during, and after construction and on a long-term basis. Furthermore, the landscape plan should be designed to minimize the need for mowing, pruning, and irrigation.

Grass or wildflower seed should be applied at the rates specified by the suppliers. If vegetation cannot be established with seeding by the time of substantial completion of the stormwater facility portion of the project, then other revegetation methods such as wildflower sod, plugs, container plants, or other means should be considered to establish the required vegetation and protect against erosion before water is allowed to enter the SCM.

Non-clumping turf grasses are better at providing soil stabilization to prevent erosion in and around SCMs. It is recommended that perennial grasses such as hybrid Bermuda or centipede are used in the Coastal Plain and Piedmont, and cool season turf grass such as fescue or bluegrass are used in the Mountains. When specifying sod in a SCM that uses infiltration or filtration, avoid sod that is grown in soil that has an impermeable layer (such as clay).