Greenville County Technical Specification for:

WQ-25 PLANTER BOX

1.0 Planter Box

1.1 Description

Planter Boxes are designed to capture, temporarily store, and filter stormwater runoff. Planter Boxes are intended to be placed next to buildings or adjacent to roadways. Drainage areas to Planter Boxes may include building roofs and paved roadways or driveways. Drainage may be conveyed to the Planter Box with curb cuts/extensions or through non-erosive roof downspouts.

The boxes are filled with gravel on the bottom, filter media, and vegetation. Runoff infiltrates into the soil where it is used by the plants, stored and filtered, if the runoff volume is large the water may pond on the surface for a limited period of time.

1.2 Design

1.2.1 General Requirements

The following general requirements will be met for all Planter Box installations:

- The contributing drainage area will be less than 15,000 square feet.
- Box locations will have adequate relief between land surface and the stormwater conveyance system to allow percolation through the filter media and underdrain to the stormwater conveyance system.
- Planter Boxes will not be located in areas with excessive shade in order to avoid poor vegetative growth. For moderately shaded areas, shade tolerant plants will be used.
- Planter Boxes will not be located near large trees that may drop leaves or needles.

1.2.2 Design Requirements

The required method to design an individual Planter Box or to design a Planter Box as part of a treatment train with other water quality BMPs is to use the Greenville County IDEAL Model to demonstrate overall site compliance with applicable County water quality standards. See County Design Manual for site-specific applicable water quality standards.

The following design requirements will be met for all Planter Box installations:

- Planter Boxes are designed with a 12-inch maximum ponding depth.
- Planting mix depth is a minimum of 2 feet.
- Ensure a vertical distance of 2 feet between the bottom of the Planter Box area and the seasonally high ground water table, to be verified by a geotechnical report if requested by the County.
- Planter Boxes are designed to drain to below the planting soil depth in less than 48 hours.

1.3 Materials

1.3.1 Underdrain System

Place an underdrain system beneath the filter media for **all** Planter Boxes as many of the native soils found in Greenville County do not allow for adequate infiltration. The perforated underdrain drain pipe must be connected to a stormwater conveyance system or discharge to a stabilized outlet that daylights (emerges from the ground and is open to the air).

In extreme situations where an underdrain is not feasible due to unique site constraints, infiltration rate must be a minimum 0.5 inches per hour, verified by site specific soil samples at the elevation of the bottom of the Planter Box where infiltration will occur.

Provide an underdrain system that consists of a continuous closed joint perforated plastic pipe underdrain with a minimum 4-inch diameter, an 8-inch minimum gravel filter layer, non-woven geotextile fabric to wrap the perforated pipe and separate the gravel layer from the native soils and the filter media, and a minimum 4-inch diameter non-perforated PVC outlet pipe.

Underdrain systems will be made of materials specified in Table 1.

Table 1: Underdrain Material Specifications

Material	Specification
Aggregate	Use coarse aggregate No. 57 or No. 5 consisting of crushed slag or gravel.
Pipe Underdrains	Use PVC perforated pipe (AASHTO M 252) underdrains with a minimum diameter of 4 inches.
Outlet Pipe	Use non-perforated PVC pipe with a minimum diameter of 4 inches.
Non-woven Geotextile Fabric	Use Class 2 Type C non-woven geotextile fabric.

1.3.2 Overflow Requirements

Planter Boxes will bypass large flows with an overflow riser. Follow requirements below for Planter Box installations:

- An overflow device is required to be set at a minimum of 4 inches below the top of the Planter Box.
- The overflow riser is designed to safely convey the 10-year 24-hour storm event.
- The overflow riser will be connected to the underdrain and the stormwater conveyance system.
- The overflow riser will be 6 inches or greater in diameter, so it can be cleaned without damage to the pipe. The vertical pipe will provide access to cleaning the underdrains.

1.3.3 Filter Media

The filter media provides a medium for physical filtration for the stormwater runoff with enough organic matter content to support provide water and nutrients for plant life.

Ensure the filter media of the Planter Box is level to allow uniform ponding over the entire area. The maximum ponding depth above the filter media is 12 inches to allow the Planter Box to drain within a reasonable time and to prevent long periods of plant submergence. Provide a filter media with a minimum infiltration rate of 1 inch per hour (optimal range is 1 to 6 inches per hour). The filter media is to be furnished, and on-site soils are not acceptable. The filter media shall be a uniform mix of sand and organic material meeting the following criteria.

Sand

- 75% to 85% composition by weight
- Medium to coarse washed sand
- Washed river sand and concrete/masonry sand are acceptable
- Do not use lime stone screenings

Organic Material

- 15% to 25% composition by weight
- Compost material that is well decomposed, stable, and weed free

- Derived from leaves, yard debris, wood waste, food waste, or other organic materials
- Does not include manure or biosolids
- Do not use manure-based mushroom compost
- US Composting Council Seal of Testing Assurance (STA) compost is preferred

Acidity/Alkalinity (pH)

- Between 5.2 and 8.0 with an optimal range of 6.0 to 7.5
- Tested prior to installation with documentation to be provided to County
- Utilizing Clemson Extension Agricultural Service Laboratory is recommended. For more information, visit their website at https://www.clemson.edu/public/regulatory/ag-srvc-lab/soil-testing/index.html.

Should the filter media pH fall outside of the acceptable range, modify with pelletized lime (to raise pH) or iron sulfate plus sulfur (to lower pH). Uniformly mix lime or iron sulfate into the filter media prior to use in Planter Box.

The Engineer will submit the source and makeup of the filter media and the pH test results to the County prior to the start of construction of Planter Box. Do not add material to a stockpile of filter media once a stockpile has been sampled. Allow sufficient time for filter media preparation and testing. It is recommended that the Engineer or Contractor consult the County regarding the list of landscape suppliers with the acceptable material that are capable of providing pre-mixed filter media in order to reduce testing and mobilization time and construction delays.

Use a filter media that is uniform, free of stones, stumps, roots or other similar objects larger than 2 inches excluding mulch. Do not mix or dump materials or substances within the Planter Box that may be harmful to plant growth, or prove a hindrance to the planting or maintenance operations.

A filter media that fails to meet the minimum requirements must be amended or replaced.

1.3.4 Plantings

Use plantings that conform to the standards of the current edition of *American Standard for Nursery Stock* as approved by the American Standards Institute, Inc.

For Planter Box applications near roadways, consider site distances and other safety concerns when selecting plant heights.

Use plant materials that have normal, well developed stems or branches and a vigorous root system. Only use plantings that are healthy, free from physical defects, plant diseases, and insect pests. Symmetrically balance shade and flowering trees. Ensure major branches do not have V shaped crotches capable of causing structural weakness. Ensure trunks are free of unhealed branch removal wounds greater than a 1 in. diameter.

Use plant species that are tolerant to wide fluctuations in soil moisture content. Use plantings capable of tolerating saturated soil conditions for the length of time anticipated for the de-watering, as well as anticipated runoff constituents.

Acceptable Planter Box plantings include:

- Native Grasses and Perennials,
- Shrubs, and
- Small Trees.

1.3.5 Mulch Layer

Provide a uniform 3-inch layer of mulch on the surface of the Planter Box to enhance plant growth, enhance plant survival, suppress weed growth, reduce erosion of the filter media, maintain soil moisture, trap fine

sediments, promote the decomposition of organic matter, and pre-treat runoff before it reaches the filter media.

Provide shredded hardwood mulch milled and screened to a maximum 4-inch particle size, uniform in texture, free from sawdust and foreign materials, and free from any artificially introduced chemical compounds detrimental to plant life. Provide mulch that is well aged a minimum of 6 months.

Do not use pine needles or pine bark mulch due to the ability of floatation.

Use alternative surface covers such as native groundcover, erosion control blankets, river rock, or pea gravel as directed by the Engineer. Use alternative surface covers based on function, cost and maintenance.

1.4 Installation

1.4.1 Underdrain System

Prior to placing the underdrain system, alleviate compaction of native soils at the bottom of the Planter Box.

Remove any ponded water from the bottom of the Planter Box. Line the excavated area with a Class 2, Type C non-woven geotextile fabric.

Place a layer of No. 5 or No. 57 Aggregate 3-foot wide, and minimum of 3 inches deep on top of the non-woven filter fabric. Place the pipe underdrains on top of the underlying aggregate layer. Wrap underdrain pipes with a non-woven geotextile filter fabric before they are installed. Lay the underdrain pipe at a minimum 0.5% longitudinal slope. The perforated underdrain drain pipe is connected to a stormwater conveyance system or discharges to a stabilized outlet.

Place No. 5 or No. 57 Aggregate around the pipe underdrain system to a minimum depth of 8 inches. Place a Class 2, Type C non-woven geotextile fabric between the boundary of the gravel and the filter media to prohibit the filter media from filtering down to the perforated pipe underdrain.

1.4.2 Filter Media

Install a permeable non-woven geotextile filter fabric between the filter media and the aggregate underdrain. Place the filter media in vertical layers with a thickness of 12 to 18 inches. Compact the filter media by saturating the entire Bioretention area after each lift of filter media is placed until water flows from the underdrain system. Apply water for saturation by spraying or sprinkling. Perform saturation of each lift in the presence of the Engineer. Do not use equipment to compact the filter media. Use an appropriate sediment control BMP to treat any sediment-laden water discharged from the underdrain during the settling process.

The Engineer will provide documentation from the supplier to verify the makeup of the pre-mixed filter media to the County.

1.4.3 Plantings

Plant all Planter Box grasses, native grasses, perennials, shrubs, trees, and other plant materials specified to applicable landscaping standards.

Ensure all plant materials are kept moist during transport and on-site storage. Plant the root ball so 1/8th of the ball is above final filter media surface. Ensure the diameter of the planting pit/hole is at least 6 inches larger than the diameter of the planting ball. Set and maintain the plant straight during the entire planting process. Thoroughly water all plantings after installation.

1.5 Inspection and Maintenance

Regular inspection and maintenance are critical to the effective operation of Planter Boxes. Maintenance responsibility of the Planter Box is vested with a responsible authority by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval.

The surface of the ponding area may become clogged with fine sediments over time. Perform light core aeration or cultivate un-vegetated areas as required to ensure adequate filtration. Other required maintenance includes but is not limited to the tasks listed in Table 2.

Table 2: Summary of Maintenance Requirements

Required Maintenance	Frequency
Pruning and weeding.	As needed
Remove trash and debris.	As needed
Inspect inflow points for clogging. Remove any sediment.	Semi-annual (every 6 months)
Repair eroded areas with soil, plants, and/or mulch.	Semi-annual (every 6 months)
Mulch void areas.	Semi-annual (every 6 months)
Inspect trees and shrubs to evaluate their health.	Semi-annual (every 6 months)
Remove and replace dead or severely diseased vegetation.	Semi-annual (every 6 months)
Removal of invasive vegetation.	Semi-annual (every 6 months)
Test filter media for nutrient/fertilizer requirements.	Annual
Nutrient management per soil test results.	As needed
Pesticide management.	As needed
Water vegetation, shrubs and trees.	As needed, more often during prolonged dry periods
Remove mulch, reapply new layer.	Annual
Test filter media for pH.	Annual
Apply pelletized lime if pH < 5.2.	As needed
Add iron sulfate + sulfur if pH > 8.0.	As needed
Place fresh mulch over entire area.	As needed

1.6 IDEAL Modeling

The County's required method of demonstrating compliance with its water quality standards is to use the Greenville County IDEAL model. To facilitate use of this model, Table 3 shows how to represent this BMP and BMPs similar to this one in the IDEAL model. It lists the parameters needed to successfully run the model and the parameters that affect the sediment trapping efficiency of the BMP.

Table 3: IDEAL Modeling Guide

Planter Box Modeling in IDEAL		
What to Model as in IDEAL	Bioretention Cell	
Similar BMPs	Stormwater Alley	
	Green Roofs	
	Rain Gardens	
	Natural Infiltration Area/ Basin	
	Bioretention Areas/Swales/Basin	
Specifications Needed for IDEAL	Cell area and number of layers within the cell	
	If applicable underdrain details such as: - Subgrade infiltration soil texture and degree of saturation - Underdrain orifice diameter	
	Type of media and depth of each layer of the cell	
	Shape and dimensions of the riser	
	Dimensions, slope, manning's roughness coefficient, and entrance loss coefficient of the barrel	
	Type, shape, and dimensions of the emergency spillway if present	
	Direct loading of bacteria that will be entering the cell	
Parameters that Drive Performance	Feature	How Value Affects Sediment Trapping Efficiency (TE)
	Underlying Soil Texture	Soils with higher infiltration capabilities increase TE
	Area	Increasing area increases TE
	Amount of Clay in Media	More clay increases TE but decreases infiltration rate

1.7 References

City of Santa Barbara. Stormwater BMP Guidance Manual. Chapter 6 June 2008