CHAPTER 7: TOOLBOXES

A. Water Quality BMP Toolbox

The Water Quality BMP Toolbox is intended for use by Town of Cary staff and citizens for guidance regarding implementation of traditional, non-traditional, and innovative stormwater BMPs within the Town. Toolbox Matrices are provided within this section and outline the following implementation consideration categories:

- Pollutant Removal
- Nutrient Removal (percent removal for the Neuse River Basin and efficiency concentrations for the Jordan Lake watershed)
- Watershed Implementation Benefits
- Stormwater Benefits of the BMP
- Secondary Benefits of the BMP
- Implementation Considerations

The table below lists each of the BMPs included in the Water Quality BMP Toolbox.

Table 7.1 - Commonly and Uncommonly Used Stormwater BMPs in the Town of Cary

Stormwater BMPs Commonly Used in Cary	Stormwater BMPs Not Commonly Used in Cary
▪ Wet Detention Basins ▪ Stormwater Wetlands ▪ Bioretention Areas ▪ Bioretention Areas with Internal Water Storage ▪ Level Spreader and Vegetative Filter Strip ▪ Dry Detention Basins ▪ Grassed (Vegetated) Swales ▪ Sand Filters Underground Detention	▪ Stormwater Irrigation Basins ▪ Cisterns ▪ Stormwater Oil-Water Separators ▪ Green Roofs ▪ Onsite Natural Area Restoration ▪ Restored Riparian Buffer ▪ Permeable Pavement ▪ Proprietary Devices ▪ Post-Construction Soil Remediation ▪ Wetland Slough Floodplain Channels

Each Toolbox item provides a description of an individual BMP, indicates the typical users of the BMP, and lists implementation considerations and benefits associated with the use of each BMP. The implementation considerations and benefits are based on not only stormwater related criteria, but also criteria that are

considered useful for the typical users, such as aesthetic characteristics, siting characteristics, cost considerations, public acceptance, and other benefits. The following outlines each criterion used within the Water Quality Toolbox and provides a description of the intended use.

Typical Users

Different users will have varying interests on the selection of a BMP based on the implementation considerations and benefits the BMP provides. **Table 7.2** below attaches a symbol to a Typical User that would find implementation of that type of BMP common practice. Typical Users are identified by these symbols in each BMP Toolbox.

Table 7.2 - Typical Users Symbols and Descriptions

Symbol	Typical User	Description
	Developments in the Jordan Lake Watershed	BMP is accepted for development in order to comply with stormwater ordinances and regulations within the Jordan Lake Watershed.
	Developments in the Neuse River Watershed	BMP is accepted for development in order to comply with stormwater ordinances and regulations within the Neuse River Watershed.
	Single Family Residences	BMP is not to meet Town of Cary stormwater requirements but is suitable for single family residences. These BMPs normally are cost effective and have a low land requirement.
	Subdivisions and Multi-family Developments	BMP is typically acceptable to meet applicable stormwater ordinances and regulations. These BMPs are also considered to be good choices for residential single family home subdivisions and multi-family developments for reasons such as construction and maintenance costs and aesthetic qualities.
	Commercial and Industrial Developments	BMP is typically acceptable to meet applicable stormwater ordinances and regulations. These BMPs are also considered good choices for commercial and industrial applications for reasons such as relatively low land intensiveness, pollutants addressed, and high-impervious watershed characteristics.
	Town of Cary	BMP provides functions and features that may benefit Town projects and meeting regulatory requirements is not necessarily the primary need. These BMPs will typically have qualities that could make them amenities or may be good for addressing issues such as flooding in a non-traditional manner, for instance.
	Town Roadways	BMP is typically intended to meet State regulatory requirements, but will also function well in narrow confined corridors.

Pollutant Removal

This section provides an overview of the pollutant removal performance of each BMP when designed, constructed, and maintained to the requirements established in the NCDWQ Stormwater BMP Manual (2007-Present). A more detailed description of each parameter and the subsequent values and rankings are provided below.

Total Suspended Solids: Total Suspended Solids (TSS) describes a BMP's ability to remove sediment in stormwater runoff, and is expressed as a percent removal of TSS. TSS are smaller particles of sediment that are suspended in agitated stormwater runoff. These sediment particles contain other targeted pollutants as well, such as metals and pathogens. A high percent removal of TSS, such as 85%, indicates a high performance in pollutant and sediment removal. TSS percent removals indicated in the Toolbox are based on the values published in the NCDWQ Stormwater BMP Manual (2007-Present).

Metals: This parameter describes the BMP's ability to remove metals—such as Cadmium, Copper, and Zinc—from stormwater runoff. Runoff from developed areas contains concentrations of heavy metals that negatively affect aquatic life downstream. The ranking system for this parameter is:

- High: BMP has a significant ability to remove metals from stormwater runoff.
- Medium: BMP has a moderate or average ability to remove metals from stormwater runoff.
- Low: BMP has very little or no ability to remove metals from stormwater runoff.

Pathogens: Many BMPs have the capability to remove or kill enteric bacteria and pathogens found in stormwater runoff, such as Coliform and Streptococci. Runoff from developed areas can contain pathogens and bacteria that pose a threat to human health. The ranking system for pathogens is:

- High: BMP has a significant ability to remove pathogens and enteric bacteria from stormwater runoff.
- Medium: BMP has a moderate or average ability to remove pathogens and enteric bacteria from stormwater runoff.
- Low: BMP has very little or no ability to remove pathogens and enteric bacteria from stormwater runoff.

Oil, Grease, and Other Poly-aromatic Hydrocarbons: BMPs can also remove, process, or break down oil, grease, and other poly-aromatic hydrocarbons (PAHs) from stormwater runoff. Runoff from roads, parking lots, and restaurants can contain high levels of oil, grease, and PAHs that are harmful to downstream environments. The ranking system for this parameter is:

- High: BMP has a significant ability to remove PAHs from stormwater runoff.
- Medium: BMP has a moderate or average ability to remove PAHs from stormwater runoff.
- Low: BMP has very little or no ability to remove PAHs from stormwater runoff.

Nutrient Removal

Neuse Nutrient Percent Removal

Currently, DWQ uses two methods for determining the nutrient removal efficiency of a BMP. The first method is based on the percent total nutrient removal that BMP is assumed to provide. This method is used in the Neuse and Tar-Pamlico Basins for Total Nitrogen (TN) and Total Phosphorus (TP). The various removal rates are given as a percent removal, and are provided in the NCDWQ Stormwater BMP Manual (2007-Present). A description of each parameter follows.

Total Nitrogen (TN): The facility's capability to remove total nitrogen in stormwater runoff is expressed in a percent removal of total TN. A high percent removal of TN, such as 45%, indicates the BMP is suitable for and efficient at total nitrogen removal, whereas a low percentage, such as 10%, indicates the BMP provides some TN removal, but more efficient options are available. TN percent removals indicated in the Toolbox are based on the values published in the NCDWQ Stormwater BMP Manual (2007-Present).

Total Phosphorus (TP): The facility's capability to remove total phosphorus in stormwater runoff is expressed in a percent removal of total TP. A high percent removal of TP, such as 40%, indicates the BMP is suitable for and efficient at total phosphorus removal, whereas a low percentage, such as 10%, indicates the BMP provides some TP removal, but more efficient options are available. TP percent removals indicated in the Toolbox are based on the values published in the NCDWQ Stormwater BMP Manual (2007-Present).

Jordan Lake Nutrient Effluent Concentration

The second method for determining nutrient removal efficiency of BMPs is the Jordan/Falls Lake Stormwater Nutrient Loading Accounting Tool (2012). Using this tool, TN and TP removal are based on the percent removal of runoff volume (from evaporation or infiltration, for instance) and an assumed fixed effluent concentration of TN and TP. A description of each parameter is provided below.

Volume Reduction Percent: Volume reduction percent describes the amount of runoff volume removed by the BMP. The parameter is expressed in a percent removal of total stormwater volume. Volume reductions provided by a BMP have become a key component of nutrient removal in the Jordan Lake watershed based on the methodologies of calculating nutrient loading by effluent concentration in the Jordan/Falls Lake Stormwater Nutrient Loading Accounting Tool (2012). A high percent volume reduction, such as 50%, indicates a high performance in volume removal and subsequently TN and TP removal. A percent volume reduction of 0-5% indicates a low performance in volume removal and subsequently TN and TP removal.

TN Effluent Concentration (mg/L): TN effluent concentration is the presumed effluent concentration in mg/L of TN following stormwater treatment in the BMP. Effluent concentrations are used in combination with the runoff characteristics of the site and volume removal of the BMP to determine

a nutrient discharge loading rate in lbs/acre/year. A low effluent concentration of TN, such as 0.95 mg/L, indicates a high performance in TN removal. A TN effluent concentration of 1.44 mg/L indicates that the BMP provides some TN removal, but more efficient BMPs for TN removal are available. TN effluent concentrations indicated in the Toolbox are based on the values published in the Jordan/Falls Lake Stormwater Nutrient Loading Accounting Tool (2012).

TP Effluent Concentration (mg/L): This parameter is the presumed effluent concentration in mg/L of TP following stormwater treatment in the BMP. Effluent concentrations are used in combination with the runoff characteristics of the site and volume removal of the BMP to determine a nutrient discharge loading rate in lbs/acre/year. A low effluent concentration of TP, such as 0.11 mg/L, indicates a high performance in TP removal. A TP effluent concentration of 0.39 mg/L indicates that the BMP provides some TP removal, but more efficient BMPs for TP removal are available. TP effluent concentrations indicated in the Toolbox are based on the values published in the Jordan/Falls Lake Stormwater Nutrient Loading Accounting Tool (2012).

Watershed Implementation Benefits

As described above, the stormwater treatment requirements and BMP design guidance varies somewhat among the Town's watersheds. This variation relates to the effectiveness of a BMP's stormwater treatment capabilities within these watersheds. As such, the pollutant removal, nutrient removal, and runoff volume removal performance differences are provided for the Neuse River Basin, the Swift Creek Watershed (a sub-basin of the Neuse), and the Jordan Lake Watershed. Detailed descriptions of these performance criteria and their rankings follow.

Pollutant Removal: Pollutant removal is the presumed capacity of a BMP to remove metals, pathogens, sediment, and PHAs through TSS removal within the given watershed. The ranking system for pollutant removal is provided below:

- High: The BMP has a significant ability to remove pollutants through TSS removal when compared to other BMPs within this watershed.
- Medium: The BMP has a moderate or average ability to remove pollutants through TSS removal when compared to other BMPs within this watershed.
- Low: The BMP has very little or no ability to remove pollutants through TSS removal when compared to other BMPs within this watershed.

Nutrient Removal: Nutrient removal is evaluated by a BMP's capacity to remove TN and TP, which is assessed through the presumed percent reductions of volume TN and TP, or through effluent concentrations of TN and TP. Presumed nutrient removal capabilities have a greater frequency of variance due to the differences in regulations and guidance between the Neuse River Basin and Jordan Lake watersheds, as described in the Nutrient Removal section. The ranking system for nutrient removal is provided below:

- High: BMP has a significant ability to remove TN and TP when compared to other BMPs within this watershed.
- Medium: BMP has a moderate or average ability to remove TN and TP compared to other BMPs within this watershed.
- Low: BMP has very little or no ability to remove TN and TP when compared to other BMPs within this watershed.

Water Quantity Reduction: Provides an assessment of the BMP's capacity to provide peak runoff attenuation and volume reductions in the various watersheds. The ranking system for this parameter is provided below:

- High: BMP has a significant potential to provide peak runoff attenuation and volume reductions when compared to other BMPs within this watershed.
- Medium: BMP has a moderate or average potential to provide peak runoff attenuation and volume reductions when compared to other BMPs within this watershed.
- Low: BMP has very little or no potential to provide peak runoff attenuation and volume reductions when compared to other BMPs within this watershed.

Stormwater Benefits

In addition to water quality, other stormwater related benefits are important to consider when selecting a BMP for implementation. The BMP's capability to provide peak runoff attenuation, runoff volume reduction, rainwater harvesting, and infiltration are also essential functions of many BMPs. These parameters should be considered when trying to reduce the impact of runoff discharges from a development. Detailed descriptions of each parameter and their ranking systems are provided below.

Peak Runoff Attenuation: Peak runoff attenuation is the capability of a BMP to provide additional stormwater detention to reduce the peak discharge from the site. Peak runoff attenuation is often regulated for a specific design storm, and is required in addition to nutrient and pollutant removal. The ranking system for this parameter is provided below:

- Yes: The BMP has the ability to provide peak runoff attenuation when it is designed into the system. BMPs have varying capacities to provide peak attenuation. (A more detailed description of peak attenuation capacity is included in this document in the Watershed Implementation Benefits section under Water Quantity Reduction.)
- No: The BMP does not have the capability to provide peak runoff attenuation.
- Possible: Peak runoff attenuation is possible for smaller storm events, but not recommended under standard design.

Runoff Volume Reduction: Runoff Volume Reduction describes the retention provided by the BMP and the reduction in the total amount of flow from the site. Volume reductions can be affected by the amount of water a BMP retains to maintain proper function, infiltrates, or evaporates. Volume

reductions for some BMPs can also be increased through the addition of a rainwater harvesting feature. The ranking system for runoff volume reduction is provided below:

- Yes: The BMP provides runoff volume reduction.
- No: The BMP does not have the ability to provide runoff volume reduction.
- Possible: Some volume reduction is possible through a modified design, or for smaller storm events and drainage areas.

Rainwater Harvesting: Rainwater harvesting involves an evaluation of a BMP's potential to retain stormwater runoff for irrigation and non-potable applications. Rainwater harvesting BMPs can help reduce the demand for potable water for these applications, as well as provide additional volume reduction for the BMP. The ranking system for this parameter is provided below:

- Yes: BMP is intended for rainwater harvesting use.
- No: BMP is not capable of providing rainwater harvesting.
- Possible: BMP can be modified to include a rainwater harvesting component while maintaining the required BMP function.

Infiltration: An infiltration BMP percolates stormwater runoff through permeable soils, allowing the runoff to infiltrate into the groundwater. BMPs designed for stormwater infiltration can help recharge groundwater and decrease the amount of stormwater runoff from a site. Additionally, impurities from the runoff are treated as it filters through permeable soils. Infiltration BMPs are highly dependent on site soils and perform poorly in heavy, compacted clay soils. The ranking system for infiltration is provided below:

- Yes: The BMP allows infiltration of runoff, and is likely designed for this function.
- No: The BMP has little or no ability to allow infiltration of runoff.
- Possible: The BMP may allow some infiltration of water, but it is not the BMP's sole function.

Secondary Benefits

BMPs can include functions and features that can provide additional improvements to a site or the environment. Secondary benefits can include the BMP's ability to improve the appearance of a site, improve the surrounding natural landscape and habitat, or provide recreational uses. Detailed descriptions of secondary benefits and their rankings are provided below.

Aesthetic Potential: The general attractiveness of the BMP is often based on the appeal of the BMP to the public and the extent to which the BMP blends with the surrounding landscape and structures. Another important factor is how well the owner maintains the BMP. Many stormwater BMPs have the potential to be designed as a landscape amenity or include aesthetic features that improve public perception and appeal. The ranking system for this parameter is provided below:

- High: Indicates the BMP has strong potential to be incorporated as a landscape feature or amenity based on the design features of the structure. The nature of the BMP is such that it can easily be incorporated as a landscape feature if designed as such.
- Medium: Indicates the BMP has medium potential to be incorporated as a landscape feature or amenity based on the design features of the structure. There are some aspects of the BMP that make it more challenging to incorporate it as a landscape feature.
- Low: Indicates poor potential aesthetic features due to "engineered" or "industrial" appearance of the BMP. The nature BMPs often have few potential aesthetic features.

It is important to note that the Town of Cary Site Design Standards adopted in 2012 "facilitate the creation of Best Management Practices (BMP) as site amenities" through requiring additional blending with and integration into the surrounding landscape. See Section 6.3 of the Site Design Standards for details.

Dual Use: The BMP can have other functions in addition to stormwater treatment. Dual Use BMPs can often be used for stormwater treatment and recreational use, aesthetic site improvements, or irrigation for example. The ranking system for dual use is provided below:

- High: The BMP has the potential for dual use and is often used for multiple functions.
- Medium: BMP has some ability to provide multiple functions.
- Low: The BMP has little to no ability to provide multiple functions.

Natural Habitat Function: BMPs can provide an environment that provides the function of aquatic and/or terrestrial habitat. The ranking system for natural habitat function is provided below:

- High: Indicates that the BMP largely provides the function of natural habitat.
- Medium: BMP provides some function of natural habitat; however, that function may be limited or native to the local environment.
- Low: BMP provides little or no function of natural habitat; these BMPs typically are engineered structures.

Natural Appearance: Natural appearance evaluates whether the BMP provides an appearance consistent with the native or natural environment. The ranking system for this parameter is provided below:

- High: A majority of the BMP appears natural.
- Medium: BMP contains components that look natural, but also contains some highly visible engineered structures.
- Low: The BMP stands out as a man-made structure and does not provide a natural appearance.

Groundwater Recharge: This is an evaluation of the BMP's ability to allow stormwater runoff to recharge groundwater. BMPs typically provide groundwater recharge through infiltration or recycling stormwater back through the drainage area as irrigation water. Groundwater recharge can provide an import function in the urban setting, since impervious areas prevent this recharge from occurring. The ranking system for groundwater recharge is provided below:

- High: The function of the BMP provides or relies on groundwater recharge.
- Medium: The BMP may provide some recharge of the groundwater, but it is not the primary function of the BMP.
- Low: The groundwater is not recharged by the BMP.

Temperature Reduction: Temperature reduction is defined as the BMP's ability to reduce the temperature of stormwater runoff or discharge. Stormwater runoff absorbs heat as it flows over impervious surfaces (roads, parking lots, roofs, etc.). As this runoff moves downstream, it causes a rise in downstream water temperatures, which is harmful to aquatic life. BMPs can achieve temperature reductions through providing shade to detained stormwater, cooling stormwater in underground systems, or reducing impervious surfaces on a site. These BMPs can also help reduce the surrounding air temperature, which is a concern in urban areas. The ranking system for temperature reduction is provided below:

- High: BMP includes elements or functions that significantly reduce the temperature of stormwater runoff.
- Medium: BMP provides some level of temperature reduction in stormwater runoff.
- Low: BMP does not reduce the temperature of stormwater runoff, and may increase temperatures.

Implementation Considerations

Implementation considerations largely involve project and siting constraints, which are often equally as important as the treatment the BMP provides. A BMP's cost, maintenance, public safety, and public acceptance are examples of additional considerations that are important during the implementation process. These factors—described below, along with their rankings—can help gauge the treatment value of a BMP for a given site.

Land Required: This describes the amount of land that is typically required to implement a BMP when designed, constructed, and built to the proper standards. The ranking system for this parameter is provided below:

- High: A large amount of land is required for the standard implementation of this BMP.
- Medium: An average amount of land is required for the standard implementation of this BMP.

- Low: A small amount of land is required for the standard implementation of this BMP.

Size of Treatable Drainage Area: This guideline means the capacity of the BMP to provide stormwater treatment for large tracts of development. BMPs vary in the amount of drainage area that can be received under normal design conditions. The ranking system for size of treatable drainage area is provided below:

- Large: BMP has the capacity to receive runoff from a large drainage area.
- Medium: Drainage areas for this BMP will be average in size, and may have limitations.
- Small: BMP can normally handle only a small or limited drainage area.

Relative Cost: Relative cost is defined as the cost of design, construction, and maintenance of the BMP in relation to the amount of stormwater treatment provided. The ranking system for this parameter is provided below:

- High: Expensive to implement and install. Cost of the BMP does not normally warrant level of stormwater treatment provided, unless special site constraints are present.
- Medium: Cost of BMP and treatment provided are generally balanced and justified.
- Low: BMP provides a high amount of treatment provided relative to the normal cost of implementation and installation.

Maintenance Burden: Maintenance burden is the frequency, difficulty, and cost of maintenance typically required to maintain the BMP's function. The ranking system for maintenance burden is provided below:

- High: BMP requires regular maintenance with substantial cost. Maintenance most likely is difficult to perform.
- Medium: BMP has an average frequency and difficulty of maintenance.
- Low: BMP has few maintenance requirements, and may only require regular or scheduled inspections to ensure repairs are not needed.

Constructability Issues: This specification evaluates how easy the BMP is to construct and install. Length of construction time, confined space for construction, amount of disruption, and whether the BMP normally requires any special materials or knowledge to properly install are considered. The ranking system for this constructability issues is provided below:

- High: BMP is easy to construction and install. Minor difficulty should be expected during construction.
- Medium: BMP contains elements that create some difficulty during construction, or require special equipment, knowledge, or skill.
- Low: Construction of the BMP will be difficult, most likely requiring a lengthy construction time and specialty equipment and/or contractors.

Public Acceptance: Public acceptance involves the public's typical perception of a BMP when designed, constructed, and maintained properly. BMPs that are aesthetically pleasing, provide recreational dual use, or have a more manicured natural look normally score high in public acceptance. Alternatively, BMPs that are unattractive or thought to attract mosquitos, for example, score low. An important factor in determining the above is how well the owner maintains the BMP. The ranking system for this parameter is provided below:

- High: The BMP contains elements that the public normally accept and may enjoy.
- Medium: BMP is generally accepted by the public for use, with few concerns.
- Low: BMP contains elements that may cause concerns with the public or generate complaints following implementation.

Public Safety Concerns: Evaluates whether the BMP includes unsafe features that could pose a threat to the public. Common safety concerns are standing water, health risks (e.g., mosquitoes), large standing structures, steep slopes, or deep holes. The ranking system for public safety concerns is provided below:

- High: The BMP contains elements that could pose a threat to public safety. Safety features are required for this BMP.
- Medium: The BMP contains elements that could pose a threat to public safety, especially in high traffic areas. Safety measures should be considered when siting this BMP.
- Low: Safety is generally not a concern with this BMP.

Groundwater Proximity Required: This evaluates whether the design of the BMP requires the presence of groundwater to function properly or to increase the effectiveness of the BMP. The ranking system for groundwater proximity is provided below:

- High: The BMP requires groundwater to function properly. Groundwater must be present at or just below the BMP's surface.
- Medium: Groundwater would be beneficial for the BMP, but alternative design measures can accommodate a lack of groundwater.
- Low: The BMP does not need groundwater to function, and groundwater may be detrimental to function.

Groundwater Avoidance Required: Groundwater avoidance evaluates whether the design of the BMP requires that groundwater is not present within proximity of the structure. The presence of groundwater near these BMPs is often detrimental to their function. The ranking system for groundwater avoidance is provided below:

- High: The BMP does not need groundwater to function, and groundwater is detrimental to its function. BMP typically requires a minimum clearance from the seasonal high water level of groundwater.
- Medium: It would be beneficial for the BMP to avoid groundwater, but alternative design measures can accommodate the presence of groundwater.

- Low: This BMP needs groundwater to function, and absence of groundwater may be detrimental to the efficacy of the BMP.

Retrofit Opportunity: This involves evaluation of whether the BMP has the potential to be incorporated into an existing developed site. BMPs that provide effective retrofit opportunities are easily incorporated into high density developments, or existing BMPs. Cost is not normally a consideration when identifying BMP retrofit opportunities, as the site is normally constrained. The ranking system for retrofit opportunity is provided below:

- High: The BMP is easily incorporated into an existing site, takes up little space, or modifies an existing BMP.
- Medium: BMP provides some retrofit opportunity, but is not commonly used in this manner.
- Low: Typically very difficult to install this BMP into an existing developed site.

Residential/Subdivision Use: This identifies the BMP's effectiveness in residential areas and larger subdivision developments. These areas typically have more land availability and require BMPs that can receive runoff from larger drainage areas, or easily be used. Space is less of an issue when siting BMPs on these developments. The ranking system for residential/subdivision use is provided below:

- High: BMP is effective and commonly used in residential and subdivision developments.
- Medium: BMP is suitable for residential and subdivision developments, but better options are available.
- Low: BMP is not suitable or less suitable for residential and subdivision developments. Unnecessary cost often is associated with siting these BMPs when space is available for alternative BMPs.

Urban/High Density Development: This factor identifies the BMP's effectiveness in urban areas and high density developments where space is limited. BMPs that provide treatment within a limited space, utilize relatively unused spaces of the development, or have retrofit capabilities are the most effective BMPs in these areas. The ranking system for urban/high density development is provided below:

- High: BMP is highly effective for use in urban areas and high density developments.
- Medium: BMP has some capacity for use in urban areas and high density developments, but may require design modification for maximum effectiveness.
- Low: BMP is not recommended or commonly used in urban areas and high density developments.

Wet Detention Basin

DESCRIPTION

Wet Detention Basins are stormwater BMPs that detain runoff and maintain a permanent pool of water. Pollutant and nutrient removal is mostly achieved in the permanent pool volume.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	85%
Metals (Cadmium, Copper, Zinc)	Medium
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Medium

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	25%
Total Phosphorus (TP)	40%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	10%
TN Effluent Concentration (mg/L)	1.01
TP Effluent Concentration (mg/L)	0.11

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	Medium	High

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	Medium	High

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	Medium

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	Yes
Rainwater Harvesting	Possible
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	High
Dual Use	High
Natural Habitat Function	Medium
Natural Appearance	Medium
Groundwater Recharge	Medium
Temperature Reduction	Low

IMPLEMENTATION CONSIDERATIONS

Land Required	Med-High
Size of Treatable Drainage Area	Large
Relative Cost	Medium
Maintenance Burden	Medium
Constructability Issues	Medium
Public Acceptance	Medium
Public Safety Concerns	Medium
Groundwater Proximity Required	High
Groundwater Avoidance Required	Low
Retrofit Opportunity	Low
Residential/Subdivision Use	High
Urban/High Density Development	Low

Stormwater Wetland

DESCRIPTION

Stormwater Wetlands are engineered and constructed wetlands that have similar functions and processes of natural wetlands for treating stormwater. Stormwater Wetlands use physical, chemical, and biological processes to provide pollutant and nutrient removal to stormwater runoff.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	85%
Metals (Cadmium, Copper, Zinc)	Medium
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Medium

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	40%
Total Phosphorus (TP)	35%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	120%
TN Effluent Concentration (mg/L)	1.08
TP Effluent Concentration (mg/L)	0.12

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	High

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	High

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	High

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	Yes
Rainwater Harvesting	No
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	High
Dual Use	Low
Natural Habitat Function	High
Natural Appearance	High
Groundwater Recharge	Medium
Temperature Reduction	Medium

IMPLEMENTATION CONSIDERATIONS

Land Required	High
Size of Treatable Drainage Area	Large
Relative Cost	Medium
Maintenance Burden	Medium
Constructability Issues	Medium
Public Acceptance	Medium
Public Safety Concerns	Medium
Groundwater Proximity Required	High
Groundwater Avoidance Required	Low
Retrofit Opportunity	Low
Residential/Subdivision Use	High
Urban/High Density Development	Low

Bioretention Area

DESCRIPTION

Bioretention Areas make use of landscaping and soil media to provide water quality treatment. Pollutant and nutrient removal is achieved through adsorption, filtration, sedimentation, volatilization, ion exchange, and biological decomposition. Some runoff detention can be provided above the water quality volume.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	85%
Metals (Cadmium, Copper, Zinc)	High
Pathogens (Coliform, Streptococci)	High
Oil, Grease, and Hydrocarbons	High

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	35%
Total Phosphorus (TP)	45%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	35%
TN Effluent Concentration (mg/L)	1.00
TP Effluent Concentration (mg/L)	0.12

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	High

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	Yes
Rainwater Harvesting	No
Infiltration	Yes

SECONDARY BENEFITS

Aesthetic Potential	High
Dual Use	High
Natural Habitat Function	Medium
Natural Appearance	Medium
Groundwater Recharge	Medium-High
Temperature Reduction	High

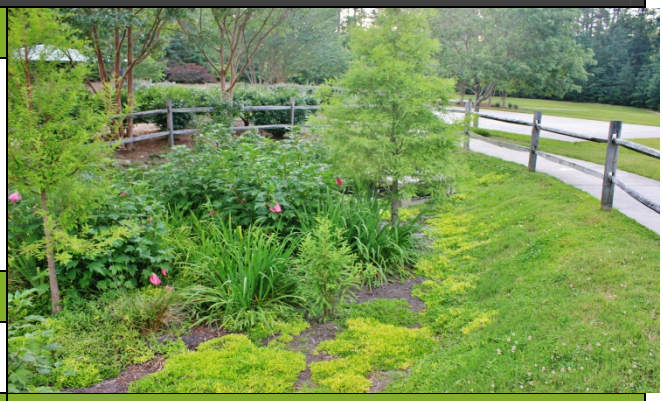
IMPLEMENTATION CONSIDERATIONS

Land Required	High
Size of Treatable Drainage Area	Small
Relative Cost	Medium-High
Maintenance Burden	Medium-High
Constructability Issues	High
Public Acceptance	High
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	High
Retrofit Opportunity	Medium
Residential/Subdivision Use	High
Urban/High Density Development	High

Bioretention Area with Internal Water Storage

DESCRIPTION

Same as a Bioretention Area, but includes an under drain pipe with a 90 degree up-turned elbow (that stores water in the bottom of the bioretention media called the Internal Water Storage (IWS) zone. This zone creates an anaerobic condition promoting denitrification while also increasing the ability for stormwater to infiltrate into the surrounding soils.



TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	85%
Metals (Cadmium, Copper, Zinc)	High
Pathogens (Coliform, Streptococci)	High
Oil, Grease, and Hydrocarbons	High

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	40%
Total Phosphorus (TP)	45%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	50%
TN Effluent Concentration (mg/L)	0.95
TP Effluent Concentration (mg/L)	0.12

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	High

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	Yes
Rainwater Harvesting	No
Infiltration	Yes

SECONDARY BENEFITS

Aesthetic Potential	High
Dual Use	High
Natural Habitat Function	Medium
Natural Appearance	Medium
Groundwater Recharge	High
Temperature Reduction	High

IMPLEMENTATION CONSIDERATIONS

Land Required	Med-High
Size of Treatable Drainage Area	Small
Relative Cost	Medium-High
Maintenance Burden	Medium-High
Constructability Issues	Medium
Public Acceptance	High
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	Low
Retrofit Opportunity	Medium
Residential/Subdivision Use	High
Urban/High Density Development	High

Level Spreader and Vegetated Filter Strip

DESCRIPTION

This BMP consists of a Level Spreader placed in series with a Vegetated Filter Strip. This BMP is installed to provide diffused flow into a buffer, and is sometimes used in series with another BMP to provide additional stormwater treatment. Level Spreaders and Vegetated Filter Strips help protect downstream waters and remove pollutants and nutrients.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	40%
Metals (Cadmium, Copper, Zinc)	Medium
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Medium

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	30%
Total Phosphorus (TP)	35%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	40%
TN Effluent Concentration (mg/L)	1.20
TP Effluent Concentration (mg/L)	0.15

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Medium	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Medium	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Medium	Medium

STORMWATER BENEFITS

Peak Runoff Attenuation	No
Runoff Volume Reduction	Yes
Rainwater Harvesting	No
Infiltration	Yes

SECONDARY BENEFITS

Aesthetic Potential	Low
Dual Use	Low
Natural Habitat Function	Low
Natural Appearance	Low
Groundwater Recharge	Medium
Temperature Reduction	Medium

IMPLEMENTATION CONSIDERATIONS

Land Required	Low-Medium
Size of Treatable Drainage Area	Low
Relative Cost	Low
Maintenance Burden	Medium
Constructability Issues	High
Public Acceptance	Medium
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	Low
Retrofit Opportunity	High
Residential/Subdivision Use	High
Urban/High Density Development	Low

Dry Detention Basin

DESCRIPTION

Dry Detention Basins are stormwater BMPs that detain runoff, but do not maintain a permanent pool of water. Stormwater runoff detention is typically the primary use of Dry Detention Basins. With good design and proper installation, dry ponds can have low visual impact.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	50%
Metals (Cadmium, Copper, Zinc)	Low
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Low

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	10%
Total Phosphorus (TP)	10%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	0%
TN Effluent Concentration (mg/L)	1.20
TP Effluent Concentration (mg/L)	0.20

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Low	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Low	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Low	Low

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	No
Rainwater Harvesting	Possible
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	Low-Medium
Dual Use	High
Natural Habitat Function	Medium
Natural Appearance	Medium
Groundwater Recharge	Low
Temperature Reduction	Low

IMPLEMENTATION CONSIDERATIONS

Land Required	Medium
Size of Treatable Drainage Area	Large
Relative Cost	Low
Maintenance Burden	Low
Constructability Issues	Low
Public Acceptance	Medium
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	High
Retrofit Opportunity	Low
Residential/Subdivision Use	High
Urban/High Density Development	Low

Grassed (Vegetated) Swale

DESCRIPTION

A Grassed (Vegetated) Swale is a water quality BMP consisting of an open-channel lined with vegetation, and are often placed in series with other BMPs to provide supplemental nutrient and pollutant removal. The velocity and side slopes of a Grassed (Vegetated) Swale are minimized to allow greater contact time with the vegetation layer and filtering of nutrients.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	35%
Metals (Cadmium, Copper, Zinc)	Low
Pathogens (Coliform, Streptococci)	Low
Oil, Grease, and Hydrocarbons	Low

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	20%
Total Phosphorus (TP)	20%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	0%
TN Effluent Concentration (mg/L)	1.21
TP Effluent Concentration (mg/L)	0.26

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

STORMWATER BENEFITS

Peak Runoff Attenuation	No
Runoff Volume Reduction	No
Rainwater Harvesting	No
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	Medium
Dual Use	Low
Natural Habitat Function	Low-Medium
Natural Appearance	Medium
Groundwater Recharge	Low
Temperature Reduction	Low

IMPLEMENTATION CONSIDERATIONS

Land Required	Low
Size of Treatable Drainage Area	Low
Relative Cost	Low
Maintenance Burden	Low
Constructability Issues	Low
Public Acceptance	Medium
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	High
Retrofit Opportunity	Low
Residential/Subdivision Use	High
Urban/High Density Development	Low

Sand Filter

DESCRIPTION

Sand Filters come in both open-surface and underground contained (pictured) facilities. Sand Filters consist of two sections; a grit chamber to collect stormwater runoff, and a sand filter bed that percolate stormwater to provide treatment.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	85%
Metals (Cadmium, Copper, Zinc)	High
Pathogens (Coliform, Streptococci)	High
Oil, Grease, and Hydrocarbons	High

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	35%
Total Phosphorus (TP)	45%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	5%
TN Effluent Concentration (mg/L)	0.92
TP Effluent Concentration (mg/L)	0.14

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	High

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	High

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	Medium

STORMWATER BENEFITS

Peak Runoff Attenuation	Possible
Runoff Volume Reduction	Yes
Rainwater Harvesting	No
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	Low
Dual Use	Medium
Natural Habitat Function	Low
Natural Appearance	Low
Groundwater Recharge	Low
Temperature Reduction	High

IMPLEMENTATION CONSIDERATIONS

Land Required	Medium
Size of Treatable Drainage Area	Small
Relative Cost	High
Maintenance Burden	High
Constructability Issues	High
Public Acceptance	Medium
Public Safety Concerns	Medium
Groundwater Proximity Required	Low
Groundwater Avoidance Required	High
Retrofit Opportunity	High
Residential/Subdivision Use	Low
Urban/High Density Development	High

Underground Detention

DESCRIPTION

Underground Detention is a stormwater BMP that detains runoff in an underground vault, box, or pipe. The sole function of Underground Detention is to provide peak runoff attenuation.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	0%
Metals (Cadmium, Copper, Zinc)	Low
Pathogens (Coliform, Streptococci)	Low
Oil, Grease, and Hydrocarbons	Low

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	None
Total Phosphorus (TP)	None

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	None
TN Effluent Concentration (mg/L)	None
TP Effluent Concentration (mg/L)	None

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	Medium

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	Medium

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	Medium

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	No
Rainwater Harvesting	Possible
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	N/A
Dual Use	High
Natural Habitat Function	Low
Natural Appearance	Low
Groundwater Recharge	Low
Temperature Reduction	High

IMPLEMENTATION CONSIDERATIONS

Land Required	Low
Size of Treatable Drainage Area	Small-Med
Relative Cost	Medium-High
Maintenance Burden	Medium
Constructability Issues	High
Public Acceptance	High
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	High
Retrofit Opportunity	High
Residential/Subdivision Use	Low
Urban/High Density Development	High

Stormwater Irrigation Basin

DESCRIPTION

Stormwater Irrigation Basins modify the design of a Dry Detention Basin or Wet Detention Basin to include a volume of stormwater retention for rainwater harvesting. This retained stormwater can then be used as a non-potable (typically irrigation) water source.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	0%
Metals (Cadmium, Copper, Zinc)	None
Pathogens (Coliform, Streptococci)	None
Oil, Grease, and Hydrocarbons	None

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	None
Total Phosphorus (TP)	None

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	As Designed
TN Effluent Concentration (mg/L)	1.08
TP Effluent Concentration (mg/L)	0.15

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	High

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	High

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Medium	Medium-High

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	Yes
Rainwater Harvesting	Yes
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	Medium
Dual Use	High
Natural Habitat Function	Low
Natural Appearance	Low
Groundwater Recharge	High
Temperature Reduction	Medium

IMPLEMENTATION CONSIDERATIONS

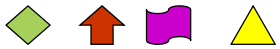
Land Required	High
Size of Treatable Drainage Area	Large
Relative Cost	Medium
Maintenance Burden	High
Constructability Issues	High
Public Acceptance	High
Public Safety Concerns	High
Groundwater Proximity Required	Medium
Groundwater Avoidance Required	Low
Retrofit Opportunity	High
Residential/Subdivision Use	High
Urban/High Density Development	Low

Stormwater Cistern

DESCRIPTION

Stormwater Cisterns consist of an above or below ground storage tank to retain stormwater for the purpose of rainwater harvesting. Harvested stormwater can be used for both irrigation and/or other non-potable uses.

TYPICAL USERS



POLLUTANT REMOVAL

Total Suspended Solids	0%
Metals (Cadmium, Copper, Zinc)	None
Pathogens (Coliform, Streptococci)	None
Oil, Grease, and Hydrocarbons	None

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	None
Total Phosphorus (TP)	None

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	As Designed
TN Effluent Concentration (mg/L)	1.08
TP Effluent Concentration (mg/L)	0.15

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	High

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	High

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Medium	Medium-High

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	Yes
Rainwater Harvesting	Yes
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	Low-Medium
Dual Use	Low
Natural Habitat Function	Medium
Natural Appearance	Low
Groundwater Recharge	High
Temperature Reduction	Medium

IMPLEMENTATION CONSIDERATIONS

Land Required	Med-High
Size of Treatable Drainage Area	Large
Relative Cost	Medium
Maintenance Burden	High
Constructability Issues	Medium
Public Acceptance	High
Public Safety Concerns	High
Groundwater Proximity Required	Low
Groundwater Avoidance Required	Low
Retrofit Opportunity	High
Residential/Subdivision Use	High
Urban/High Density Development	High

Stormwater Oil-Water Separator

DESCRIPTION

Oil-Water Separators are underground BMPs designed to remove oil and other PAHs from stormwater runoff. Oils and PAHs are harmful to aquatic life and vegetation. Also the increased use of rainwater harvesting could create a greater need to provide oil and PAH removal for stormwater flowing from parking lots. Water that is heavily polluted with oils and PAHs can damage landscape vegetation and grass.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	0%
Metals (Cadmium, Copper, Zinc)	None
Pathogens (Coliform, Streptococci)	None
Oil, Grease, and Hydrocarbons	None

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	None
Total Phosphorus (TP)	None

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	None
TN Effluent Concentration (mg/L)	None
TP Effluent Concentration (mg/L)	None

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	Low

STORMWATER BENEFITS

Peak Runoff Attenuation	Possible
Runoff Volume Reduction	Yes
Rainwater Harvesting	Pre-treatment
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	N/A
Dual Use	Low
Natural Habitat Function	Low
Natural Appearance	Low
Groundwater Recharge	Low
Temperature Reduction	High

IMPLEMENTATION CONSIDERATIONS

Land Required	Low
Size of Treatable Drainage Area	Small
Relative Cost	High
Maintenance Burden	High
Constructability Issues	High
Public Acceptance	Medium
Public Safety Concerns	High
Groundwater Proximity Required	Low
Groundwater Avoidance Required	High
Retrofit Opportunity	High
Residential/Subdivision Use	Low
Urban/High Density Development	High

Green Roof

DESCRIPTION

Stormwater Green Roofs are specifically designed to retain stormwater on the roof of a building to saturate soil media, irrigate the green roof vegetation, and sustain the process of evapotranspiration.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	0%
Metals (Cadmium, Copper, Zinc)	Low Opportunity
Pathogens (Coliform, Streptococci)	Low Opportunity
Oil, Grease, and Hydrocarbons	Low Opportunity

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	None Currently
Total Phosphorus (TP)	None Currently

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	50%
TN Effluent Concentration (mg/L)	1.08
TP Effluent Concentration (mg/L)	0.15

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Medium	High

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	Yes
Rainwater Harvesting	No
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	High
Dual Use	High
Natural Habitat Function	Medium
Natural Appearance	High
Groundwater Recharge	Low
Temperature Reduction	Medium

IMPLEMENTATION CONSIDERATIONS

Land Required	Low
Size of Treatable Drainage Area	Small-Med
Relative Cost	High
Maintenance Burden	High
Constructability Issues	High
Public Acceptance	High
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	Low
Retrofit Opportunity	Medium-High
Residential/Subdivision Use	Low
Urban/High Density Development	High

Onsite Natural Area Restoration

DESCRIPTION

Onsite Natural Area Restoration includes restoring function of degraded natural systems like streams, wetlands, and riparian buffers. Improving or restoring natural function to these systems provides water quality improvement and remediates degraded natural resources.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	0%
Metals (Cadmium, Copper, Zinc)	High
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	High

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	None
Total Phosphorus (TP)	None

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	None
TN Effluent Concentration (mg/L)	None
TP Effluent Concentration (mg/L)	None

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

STORMWATER BENEFITS

Peak Runoff Attenuation	Possible
Runoff Volume Reduction	Possible
Rainwater Harvesting	No
Infiltration	Yes

SECONDARY BENEFITS

Aesthetic Potential	Medium
Dual Use	High
Natural Habitat Function	High
Natural Appearance	High
Groundwater Recharge	High
Temperature Reduction	High

IMPLEMENTATION CONSIDERATIONS

Land Required	Medium-High
Size of Treatable Drainage Area	Varies
Relative Cost	Medium-High
Maintenance Burden	Low
Constructability Issues	High
Public Acceptance	Low
Public Safety Concerns	Low
Groundwater Proximity Required	High
Groundwater Avoidance Required	Low
Retrofit Opportunity	High
Residential/Subdivision Use	High
Urban/High Density Development	Medium

Restored Riparian Buffer

DESCRIPTION

Restored Riparian Buffers are cleared areas adjacent to streams or rivers that are replanted and reconditioned to provide natural habitat and function. Restored Riparian Buffers are utilized to diffuse and treat stormwater runoff.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	60%
Metals (Cadmium, Copper, Zinc)	High
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Medium

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	30%
Total Phosphorus (TP)	35%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	0%
TN Effluent Concentration (mg/L)	None
TP Effluent Concentration (mg/L)	None

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Medium	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Medium	Medium	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	None

STORMWATER BENEFITS

Peak Runoff Attenuation	No
Runoff Volume Reduction	Yes
Rainwater Harvesting	No
Infiltration	Yes

SECONDARY BENEFITS

Aesthetic Potential	Medium
Dual Use	Low
Natural Habitat Function	High
Natural Appearance	High
Groundwater Recharge	High
Temperature Reduction	High

IMPLEMENTATION CONSIDERATIONS

Land Required	Low-Medium
Size of Treatable Drainage Area	Small
Relative Cost	Low-Medium
Maintenance Burden	Low
Constructability Issues	Low
Public Acceptance	Varies
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	Low
Retrofit Opportunity	High
Residential/Subdivision Use	High
Urban/High Density Development	Low

Permeable Pavement - Infiltration

DESCRIPTION

Permeable pavement - infiltration is an alternative to impervious pavement. Permeable pavement use materials with void space that allow for the passage and storage of stormwater runoff. Permeable pavement infiltration is best used in light traffic areas, such as, parking lots. Permeable pavement is designed to allow infiltration of stormwater into the subsoil providing water quality benefits and regulatory credits as opposed permeable pavement designed only for detention (see below).

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	85%
Metals (Cadmium, Copper, Zinc)	Medium
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Medium

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	30%
Total Phosphorus (TP)	60%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	0%
TN Effluent Concentration (mg/L)	1.44
TP Effluent Concentration (mg/L)	0.39

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	High

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
High	High	High

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	None

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	Yes
Rainwater Harvesting	No
Infiltration	Yes

SECONDARY BENEFITS

Aesthetic Potential	Medium
Dual Use	High
Natural Habitat Function	Low
Natural Appearance	Low
Groundwater Recharge	Medium-High
Temperature Reduction	Medium

IMPLEMENTATION CONSIDERATIONS

Land Required	Low
Size of Treatable Drainage Area	High
Relative Cost	Medium
Maintenance Burden	Medium
Constructability Issues	High
Public Acceptance	High
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	High
Retrofit Opportunity	High
Residential/Subdivision Use	Low
Urban/High Density Development	High

Permeable Pavement - Detention

DESCRIPTION

Permeable pavement - detention is an alternative to impervious pavement. Permeable pavement uses materials with void space that allow for the passage and storage of stormwater runoff. If the infiltration rate of the subsoil is low, then the Permeable pavement can only be used for detention with reduced water quality and regulatory credits as compared to permeable pavement used for infiltration (see above).

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	70-85%
Metals (Cadmium, Copper, Zinc)	Medium
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Medium

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	10%
Total Phosphorus (TP)	10%

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	0%
TN Effluent Concentration (mg/L)	1.44
TP Effluent Concentration (mg/L)	0.39

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

Swift Creek Watershed (Neuse Sub-watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Low	Low	Low

STORMWATER BENEFITS

Peak Runoff Attenuation	Yes
Runoff Volume Reduction	Yes
Rainwater Harvesting	No
Infiltration	Yes

SECONDARY BENEFITS

Aesthetic Potential	Medium
Dual Use	High
Natural Habitat Function	High
Natural Appearance	Low
Groundwater Recharge	Medium-High
Temperature Reduction	Medium

IMPLEMENTATION CONSIDERATIONS

Land Required	Low
Size of Treatable Drainage Area	High
Relative Cost	Medium
Maintenance Burden	Medium
Constructability Issues	Medium
Public Acceptance	High
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	Medium
Retrofit Opportunity	High
Residential/Subdivision Use	Low
Urban/High Density Development	High

Post-Construction Soil Remediation

DESCRIPTION

Topsoil existing onsite prior to development often provide important stormwater management functions that include runoff infiltration, nutrient and sediment adsorption, and pollutant removal. Soil from mass graded sites often loses these characteristics. Post-Construction Soil Remediation can be incorporated into the onsite pervious open space to re-establish onsite topsoil to the pre-existing conditions, or better.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	0%
Metals (Cadmium, Copper, Zinc)	Medium
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Medium

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	None
Total Phosphorus (TP)	None

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	None
TN Effluent Concentration (mg/L)	None
TP Effluent Concentration (mg/L)	None

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	None

Swift Creek Watershed (Neuse Sub-watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	None

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	None

STORMWATER BENEFITS

Peak Runoff Attenuation	Possible
Runoff Volume Reduction	Possible
Rainwater Harvesting	No
Infiltration	Yes

SECONDARY BENEFITS

Aesthetic Potential	High
Dual Use	High
Natural Habitat Function	High
Natural Appearance	High
Groundwater Recharge	High
Temperature Reduction	High

IMPLEMENTATION CONSIDERATIONS

Land Required	Low
Size of Treatable Drainage Area	Small
Relative Cost	Medium
Maintenance Burden	Low-Medium
Constructability Issues	Medium
Public Acceptance	Medium
Public Safety Concerns	Low
Groundwater Proximity Required	Low
Groundwater Avoidance Required	Medium
Retrofit Opportunity	High
Residential/Subdivision Use	High
Urban/High Density Development	Low

Wetland Slough Floodplain Channel

DESCRIPTION

Wetland Slough Floodplain Channels are naturally designed floodplain channels located along a stream, river, or watercourse. The Wetland Slough Floodplain Channel is designed to receive frequent overbank flooding from small, frequent storm events. The bottom of the Wetland Slough Floodplain Channel is designed to promote the development of wetlands in order to provide water quality treatment of floodwaters. These features can also increase flood storage.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	0%
Metals (Cadmium, Copper, Zinc)	Medium
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Low

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	None
Total Phosphorus (TP)	None

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	None
TN Effluent Concentration (mg/L)	None
TP Effluent Concentration (mg/L)	None

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	Low

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	Low

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	Low

STORMWATER BENEFITS

Peak Runoff Attenuation	Possible
Runoff Volume Reduction	Possible
Rainwater Harvesting	No
Infiltration	Yes

SECONDARY BENEFITS

Aesthetic Potential	High
Dual Use	High
Natural Habitat Function	High
Natural Appearance	High
Groundwater Recharge	High
Temperature Reduction	High

IMPLEMENTATION CONSIDERATIONS

Land Required	High
Size of Treatable Drainage Area	Large
Relative Cost	Medium-High
Maintenance Burden	Low
Constructability Issues	Medium
Public Acceptance	Medium
Public Safety Concerns	Low
Groundwater Proximity Required	High
Groundwater Avoidance Required	Low
Retrofit Opportunity	High
Residential/Subdivision Use	Low
Urban/High Density Development	Medium

Street Sweeping

DESCRIPTION

Street Sweeping involves the physical removal of sediment, organic debris, and trash from both streets and parking lots. This can be accomplished using mechanical sweeper, regenerative air, and vacuum filter trucks. Studies have indicated that Street Sweeping can be an effective means of preventing sediment and Total Phosphorus from entering downstream waterways.

TYPICAL USERS

POLLUTANT REMOVAL

Total Suspended Solids	0%
Metals (Cadmium, Copper, Zinc)	Medium
Pathogens (Coliform, Streptococci)	Medium
Oil, Grease, and Hydrocarbons	Low

NEUSE NUTRIENT PERCENT REMOVAL

Total Nitrogen (TN)	None
Total Phosphorus (TP)	None

JORDAN LAKE NUTRIENT EFFLUENT CONC.

Volume Reduction Percent	None
TN Effluent Concentration (mg/L)	None
TP Effluent Concentration (mg/L)	None

WATERSHED IMPLEMENTATION BENEFITS

Neuse River Basin

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	None

Swift Creek Watershed (Neuse Sub-watershed)

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
None	None	None

Jordan Lake Watershed

Pollutant Removal	Nutrient Removal	Water Quantity Reduction
Possible	Possible	None

STORMWATER BENEFITS

Peak Runoff Attenuation	No
Runoff Volume Reduction	No
Rainwater Harvesting	No
Infiltration	No

SECONDARY BENEFITS

Aesthetic Potential	High
Dual Use	Low
Natural Habitat Function	Low
Natural Appearance	Low
Groundwater Recharge	Low
Temperature Reduction	Low

IMPLEMENTATION CONSIDERATIONS

Land Required	Low
Size of Treatable Drainage Area	High
Relative Cost	Medium
Maintenance Burden	Medium
Constructability Issues	Low
Public Acceptance	High
Public Safety Concerns	High
Groundwater Proximity Required	Low
Groundwater Avoidance Required	Low
Retrofit Opportunity	High
Residential/Subdivision Use	High
Urban/High Density Development	High