

9.0 Local Post-Construction Stormwater Management Programs

9.1 Overview

Prior to the 1980s, stormwater management was synonymous with flood control. Post-construction stormwater management systems consisted primarily of pipes designed to convey stormwater runoff directly to rivers, streams and other aquatic resources. Flood control basins were occasionally installed to reduce peak discharge rates and alleviate localized and downstream flooding, but little thought was given to stormwater quality. Although this stormwater management approach worked well to reduce flooding and protect public safety, it did not address the wider range of negative impacts that land development can have on the health of rivers, streams and other aquatic resources.

During the 1980s, communities began to realize that, in order to better protect aquatic resources from the negative impacts of the land development process, both stormwater quantity *and* stormwater quality had to be addressed. With the introduction of Phase I of the National Pollutant Discharge Elimination System (NPDES) Stormwater Program in 1990, and Phase II of the NPDES Stormwater Program in 1999, communities began to revise and expand their local stormwater management programs. The programs that these communities developed focused on *managing* stormwater quantity and quality and tended to rely heavily on traditional stormwater management practices, such as wet and dry ponds, to *mitigate*, rather than *prevent*, the negative impacts of the land development process.

Since then, a number of communities around the country have concluded that “an ounce of prevention is worth a pound of cure.” They have been working to shift the focus away from the *mitigation* of the negative impacts of the land development process and place it on their *prevention*, by creating post-construction stormwater management programs that successfully integrate stormwater management and natural resource protection with the site planning and design process. These communities are increasingly using their stormwater management programs to protect and/or restore valuable natural resources, create attractive public and private spaces and engage residents and businesses in environmental stewardship.

Picking up on this national trend, this Section provides information that can be used to shift the focus of local post-construction stormwater management programs onto the *prevention*, rather than the *mitigation*, of the negative impacts of the land development process. Georgia’s coastal communities should find it to be a valuable resource in their efforts to develop local post-construction stormwater management programs that are consistent with the integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design presented in this Coastal Stormwater Supplement (CSS).

9.2 Developing an Effective Local Post-Construction Stormwater Management Program

In order to better protect coastal Georgia’s aquatic and terrestrial resources from the negative impacts of the land development process, communities located within the 24-county coastal region need to develop post-construction stormwater management programs that effectively *integrate* natural resource protection and stormwater management with the site planning and design process. In order to accomplish this, communities should consider the following questions when developing (or improving) their programs:

- What are some of the local natural resource protection and stormwater management goals?

- What valuable terrestrial and aquatic resources can be found within and around the community?
- What negative impacts can the land development process have on these valuable natural resources?
- What kind of approach to post-construction stormwater management can be used to effectively balance land development and economic growth with the protection of these valuable natural resources?
- What stormwater management and site planning and design criteria are needed to support the selected approach?
- How can local land use planning and zoning efforts be linked with the selected approach and how can they be used to protect valuable natural resources from the negative impacts of the land development process?
- What codes and ordinances (e.g., stormwater management ordinance) are needed to provide a sound legal foundation for the selected approach?
- What kind of additional information (e.g., stormwater guidance manual) needs to be provided to support the selected approach?
- How can the community's existing plan review and approval process be used to verify compliance with the selected stormwater management and site planning and design criteria?
- What type of inspection program is needed to verify that green infrastructure and stormwater management practices are properly installed during construction?
- What type of inspection and maintenance program is needed to help ensure that green infrastructure and stormwater management practices will continue to function as designed over time?
- What type of tracking system is needed to evaluate the effectiveness of the local post-construction stormwater management program over time?

Although answering these questions is no easy task (i.e., answering these questions typically requires a thorough understanding of the existing local post-construction stormwater management program), answers to all of these questions can be readily obtained within the context of the eight-step *stormwater management program development process* illustrated in Figure 9.1 and outlined below:

- Step 1: Program Planning
 - Step 1.1: Assess Community and Its Watersheds
 - Step 1.2: Assess Existing Stormwater Management Program
 - Step 1.3: Develop Program Goals and Objectives
 - Step 1.4: Develop Implementation Plan and Program Budget
- Step 2: Develop Stormwater Management Approach
 - Step 2.1: Develop an Approach to Address Stormwater Management at the Site Scale
 - Step 2.2: Develop Supporting Stormwater Management and Site Planning & Design Criteria
 - Step 2.3: Develop an Approach to Address Stormwater Management at the Watershed Scale
- Step 3: Develop Post-Construction Stormwater Management Ordinance
- Step 4: Develop Stormwater Guidance Manual
- Step 5: Develop Plan Review and Approval Process
 - Step 5.1: Scope Out Plan Review and Approval Process
 - Step 5.2: Create Permit Applications, Instructions and Checklists
 - Step 5.3: Forecast Staff Needs and Acquire Plan Review Staff
 - Step 5.4: Provide Training for Plan Reviewers and Site Designers

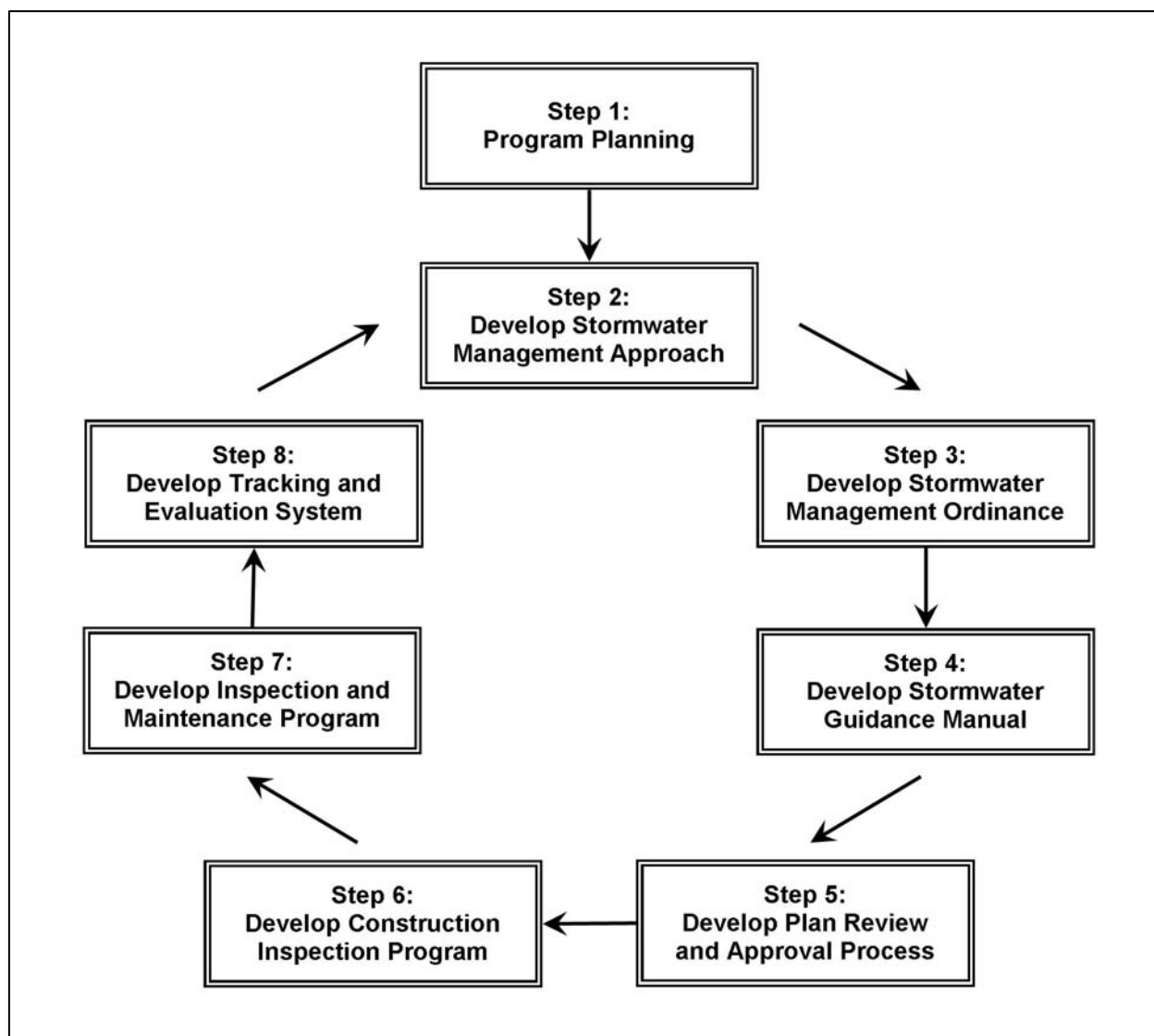


Figure 9.1: Post-Construction Stormwater Management Program Process Development Process

(Source: Center for Watershed Protection)

- Step 5.5: Set Up Performance Bond Process, Forms and Tracking System
- Step 6: Develop Construction Inspection Program
 - Step 6.1: Scope Out the Inspection Process
 - Step 6.2: Create Checklists and As-Built Certification Forms
 - Step 6.3: Forecast Staff Needs and Acquire Inspection Staff
 - Step 6.4: Provide Training for Inspectors and Contractors
- Step 7: Develop Inspection and Maintenance Program
 - Step 7.1: Scoping the Inspection and Maintenance Program
 - Step 7.2: Create Checklists, Inspection Forms and Enforcement Tools
 - Step 7.3: Forecast Staff Needs and Acquire Inspection Staff
 - Step 7.4: Create and Disseminate Outreach Materials for Responsible Parties
- Step 8: Develop Program Tracking and Evaluation System
 - Step 8.1: Develop a Framework for Program Tracking and Evaluation
 - Step 8.2: Develop Program Tracking and Evaluation Protocols
 - Step 8.3: Write Annual Reports

Each step in this *stormwater management program development process* is described in more detail below.

9.3 Step 1: Program Planning

The first step in building an effective stormwater management program is to conduct some preliminary program planning. Each of the tasks involved in completing this part of the *stormwater management program development process* are described in more detail below.

9.3.1 Step 1.1: Assess Community and Its Watersheds

The first task is to collect some basic information about the community and its watersheds. This information will help identify current stormwater management problems, needs and regulatory requirements and will help communities make informed decisions during the development (or improvement) of their programs. Information that should be collected about the community and its watersheds includes geographic, demographic and water quality information, as described below.

Geographic Information

A community's planning, engineering or public works department will likely be able to provide the maps and other geographic information that are needed to develop an effective stormwater management program. For example, soil and floodplain maps can be used to identify areas where new development is most appropriate and to identify areas where it should be avoided. Key geographic information to collect includes:

- Maps
 - Watersheds
 - Floodplains
 - Soils
 - Land use
 - Land cover
 - Aquatic resources (e.g., rivers and streams, wetlands, coastal marshlands)
 - Terrestrial resources (e.g., maritime forests, marsh hammocks, pine flatwoods)
 - Roads
 - Existing stormwater infrastructure
- Precipitation data
- Areas prone to flooding

Demographic Information

It is important for a community to understand its demographic information in order to identify where development has occurred in the past and where it is likely to occur in the future. When developing a stormwater management program, a community should consider how future development will interact with both aquatic and terrestrial resources. For instance, will new development consist primarily of residential development located on the urban fringe or will it consist of redevelopment located closer to the urban core? Key demographic information to collect during the program planning phase includes:

- Current population
- Anticipated population growth
- Current land use and zoning

- Proposed land use and zoning changes
- Proposed construction projects (e.g., number, type)
- Build out analysis showing full development potential under existing zoning
- Transportation and infrastructure plans

Water Quality Information

Water quality data can be used to help identify local pollutants of concern and impaired water bodies. Communities should design their local post-construction stormwater management programs to address these pollutants of concern and to help protect any impaired aquatic resources. While this information may be less readily available than the geographic or demographic data described above, it is still very important to the development of an effective stormwater management program. Key water quality information to collect includes:

- Water quality sampling data
- Location of water quality monitoring stations
- Existing water quality criteria and designated use information
- Existing 303(d) impairments
- Existing TMDLs
- Areas of local concern (e.g., eroded channels, water quality problem areas)
- Information about groundwater resources (e.g., location of public wells, source water protection areas, groundwater recharge areas)
- Location of other local aquatic resources in need of protection (e.g., high value streams, freshwater wetlands, tidal creeks, shellfish harvesting areas)

All of the basic geographic, demographic and water quality information described above can be used to complete a simple assessment of a community and its watersheds. Additional information may need to be collected to complete a more thorough assessment of local conditions.

9.3.2 Step 1.2: Assess Existing Stormwater Management Program

After collecting some basic information about the community and its watersheds, the next step is to assess the community's existing post-construction stormwater management program. This "self-assessment", which will help a community identify gaps and determine what improvements need to be made, can be completed by answering some basic questions about a community's existing stormwater management program:

- What valuable terrestrial and aquatic resources can be found within and around the community?
- What negative impacts can the land development process have on these valuable natural resources?
- Is the community's existing post-construction stormwater management program adequately protecting these terrestrial and aquatic resources from the negative impacts of the land development process?
- What state and/or federal regulations apply to the community's post-construction stormwater management program?
- Are these state and/or federal regulations adequately addressed by the community's existing post-construction stormwater management program?
- Does the community have a comprehensive set of post-construction stormwater management and site planning and design criteria that support the existing post-construction stormwater management program?

- How are local land use planning and zoning efforts used to protect local natural resources from the negative impacts of the land development process?
- Do local land use planning and zoning efforts complement or counteract the community's existing post-construction stormwater management program?
- What mechanism (e.g., ordinance) is used to provide a legal foundation for the existing post-construction stormwater management program?
- Does the ordinance (or other legal mechanism) need to be updated to better support the community's approach to post-construction stormwater management?
- Does the community provide any technical guidance and support (e.g., stormwater guidance manual) on its existing post-construction stormwater management program?
- Does the community consider post-construction stormwater management in its existing site plan review and approval process?
- What tools are in place (e.g., permit applications, instructions, checklists) to assist local design consultants and plan reviewers with the community's existing site plan review and approval process?
- Are green infrastructure and stormwater management practices inspected during construction to ensure that they are being properly installed?
- Are green infrastructure and stormwater management practices regularly inspected and maintained after installation to ensure that they continued to function as designed over time?
- What enforcement procedures are in place to ensure that any observed maintenance deficiencies get corrected?
- How is the effectiveness of the local stormwater management program evaluated over time?

The questions provided above can be used to conduct a basic "self-assessment" of a local post-construction stormwater management program. Information about conducting a more detailed assessment of an existing stormwater management program is provided in *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program* (Hirschman and Kosco, 2008).

9.3.3 Step 1.3: Develop Program Goals and Objectives

After collecting some basic information about the community and its watersheds, the next step is to use the information to develop some goals and objectives that will help guide the rest of the *stormwater management program development process*. Additional information about developing stormwater management program goals and objectives is provided below.

Define Program Goals

All stormwater management program goals should take into account local natural resource protection and stormwater management goals and any applicable state and/or federal stormwater management regulations. Potential stormwater management program goals include:

- Satisfy state and/or federal regulatory requirements
- Reduce the impacts of the land development process on local aquatic and terrestrial resources
- Protect and/or enhance the habitat value of local aquatic and terrestrial resources
- Maintain pre-development hydrology
- Protect and/or improve water quality
- Minimize flood risk and property damage

- Protect public health and safety
- Ensure a functional drainage system
- Protect floodplains
- Protect drinking water supplies
- Inform local land use planning and zoning efforts
- Support infill and redevelopment projects

Often, a consensus building approach, with input from elected officials and the general public, can be used to help define local stormwater management program goals. Communities will often develop multiple goals to help guide the development of their local post-construction stormwater management programs.

Develop Program Objectives

Once some stormwater management program goals have been defined, information obtained from the program “self-assessment” should be used to develop more specific, measurable objectives that can be used to evaluate progress in working toward each goal. For instance, a community may have selected the protection of water quality as one of its stormwater management program goals. Measurable objectives related to this goal might include:

- Maintaining the designated uses of streams and other aquatic resources found within and around the community
- Implementing a water quality monitoring program
- Establishing a post-construction stormwater management criteria that addresses water quality protection

With these objectives in place, specific action items and program elements can begin to be developed.

9.3.4 Step 1.4: Develop Implementation Plan and Preliminary Budget

Once a community has defined some program goals and objectives, the next step in the process is to determine what needs to be done to meet those goals and objectives and how much it will cost to do so. Each of these tasks is described in more detail below.

Develop Implementation Plan

An implementation plan outlines all of the tasks that need to be completed to satisfy a program’s goals and objectives. While this may appear to be a daunting task, implementation plans can be readily prepared using a logical, step-wise approach that involves:

- Developing action items for each program objective
- Developing a phased implementation plan for each of the action items

Additional information about completing each of these tasks is provided below.

Information gathered during the community’s “self-assessment” can be used to develop action items for each program objective. For instance, a community may have decided that it is not doing enough to protect local water quality and the health of local rivers and streams. Consequently, it may have selected establishing a post-construction stormwater management criteria that addresses water quality protection as one of its program objectives. Action items related to this objective might include:

- Conducting research on the water quality protection criteria used by other communities
- Reviewing and revising the existing post-construction stormwater management ordinance to include water quality protection
- Holding public meetings to gather input on the proposed revisions

Action items will vary from community to community, depending to the status of the community's existing post-construction stormwater management program and the specific program goals and objectives that it has selected. Some potential action items are provided in Table 9.1.

Program Objective	Action Items
<ul style="list-style-type: none"> • Develop a stormwater management approach that better addresses water quality protection 	<ul style="list-style-type: none"> • Craft or revise stormwater management approach to address water quality protection • Develop or revise supporting stormwater management and site planning & design criteria • Develop or revise existing post-construction stormwater management ordinance
<ul style="list-style-type: none"> • Develop a stormwater management approach that better addresses the preservation of pre-development site hydrology 	<ul style="list-style-type: none"> • Craft or revise stormwater management approach to address the preservation of pre-development site hydrology • Develop or revise supporting stormwater management and site planning & design criteria • Develop or revise existing post-construction stormwater management ordinance
<ul style="list-style-type: none"> • Ensure that local land use planning and zoning efforts complement, rather than counteract, the goals and objectives of the program 	<ul style="list-style-type: none"> • Link existing program with local land use planning and zoning efforts • Evaluate the local comprehensive plan to ensure that it is consistent with the community's site-scale approach to stormwater management • Examine local development rules to ensure that they are consistent with the community's site-scale approach to stormwater management
<ul style="list-style-type: none"> • Ensure that stormwater management is adequately addressed during the plan review and approval process 	<ul style="list-style-type: none"> • Create and/or review and revise plan review and approval process • Coordinate plan review and approval process with appropriate state and federal agencies
<ul style="list-style-type: none"> • Provide better technical guidance and support for the existing program 	<ul style="list-style-type: none"> • Develop or adapt a stormwater guidance manual • Develop or adapt permit applications, instructions and checklists to support existing plan review and approval process
<ul style="list-style-type: none"> • Ensure that all green infrastructure and stormwater management practices are properly installed during construction 	<ul style="list-style-type: none"> • Develop program to inspect green infrastructure and stormwater management practices during construction • Require submittal of as-built plans at end of construction phase • Provide training to local contractors on the proper installation of green infrastructure and stormwater management practices

Table 9.1: Example Action Items for Local Stormwater Management Programs	
Program Objective	Action Items
<ul style="list-style-type: none"> Ensure that all green infrastructure and stormwater management practices continue to function as designed over time 	<ul style="list-style-type: none"> Develop and/or review and revise inspection and maintenance program Develop system to track inspection results and maintenance activities Develop database of people and/or parties that are responsible for inspecting and maintaining privately-owned stormwater management practices

It is not necessary, and usually not possible, for a community to pursue and complete all of its selected action items at the same time. Instead, a phased implementation plan that sets a reasonable schedule for completion of each of action item should be developed.

Create Program Budget

At this point in the process, a preliminary estimate of the costs associated with each of the action items should be developed. In addition, potential funding sources should be identified. Funding is essential to the success of a local post-construction stormwater management program and will be required to both develop the program and ensure the ongoing operation of the program. In terms of the long-term operation of a program, the key funding issues are: (1) how much will it cost, on an annual basis, to fund the program; and (2) how this funding can be provided.

In coastal Georgia, revenues from taxes currently serve as the main funding source for local post-construction stormwater management programs. However, a number of alternative funding methods exist, including bonds, impact fees, permit and plan review fees, special assessments, special service fees and user fees. Each funding source has its own advantages and limitations, and every community should explore the various funding options to put together a funding plan that will: (1) provide the necessary revenue; and (2) earn the support of local elected officials and the general public.

One particular source of funding that shows particular promise in coastal Georgia are stormwater user fees, also known as *stormwater utilities*. In fact, two recent state and regional planning initiatives support the development of stormwater utilities within the 24-county coastal region:

- Draft Coastal Comprehensive Plan: The Draft Coastal Comprehensive Plan recommends that local governments “develop stormwater utility programs across the region” to meet specific watershed management goals outlined in the Plan (DCA, 2008). In addition, the plan outlines performance standards for local governments to achieve “excellence standards” and one of those standards includes implementing a stormwater utility.
- Comprehensive Statewide Water Management Plan: Georgia’s Comprehensive Statewide Water Management Plan recommends that local governments set up and implement stormwater utilities to address non-point source pollution (EPD, 2008). The plan encourages the use of stormwater utilities as a mechanism for funding the administration, operations and maintenance and capital construction costs of local stormwater management programs and non-point source pollution controls.

While there can be administrative, political and legal hurdles to overcome during the development of a stormwater utility, once in place, a utility can become an excellent source of

consistent, dedicated funding for a local post-construction stormwater management program. Georgia's coastal communities can use the information presented in the *Stormwater Utility Handbook: A Step-by-Step Guide to Establishing a Utility in Coastal Georgia* (Carter, 2008) to begin the process of developing a stormwater utility.

9.4 Step 2: Develop a Stormwater Management Approach

Once the preliminary program planning step has been completed, the next step in the process of developing a local post-construction stormwater management is to develop a stormwater management approach that will best satisfy the program's chosen goals and objectives. Each of the tasks involved in completing this step are described in more detail below.

9.4.1 Step 2.1: Develop an Approach to Address Stormwater Management at the Site Scale

To better protect local natural resources from the negative impacts of land development and nonpoint source pollution, it is *recommended* that Georgia's coastal communities adopt the integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design presented in this CSS. This site-scale approach, which has been designed to help balance land development and economic growth with the protection of aquatic and terrestrial resources, involves:

- Identifying the valuable natural resources found on development sites prior to the start of any land disturbing activities.
- Protecting these valuable natural resources from the direct impacts of the land development process through the use of better site planning techniques.
- Limiting land disturbance and the amount of impervious and disturbed pervious cover created on development sites through the use of better site design techniques.
- *Reducing* post-construction stormwater runoff rates, volumes and pollutant loads, through the use of better site planning and design techniques and low impact development practices, to help:
 - Maintain pre-development site hydrology
 - Prevent downstream water quality degradation
 - Prevent downstream flooding and erosion
- *Managing* post-construction stormwater runoff rates, volumes and pollutant loads, through the use of stormwater management practices, to help:
 - Prevent downstream water quality degradation
 - Prevent downstream flooding and erosion

If successfully integrated into local post-construction stormwater management efforts, this integrated approach to natural resource protection, stormwater management and site design will lead to better protection of the aquatic and terrestrial resources that contribute so greatly to the region's natural beauty, economic well-being and quality of life.

9.4.2 Step 2.2: Develop Supporting Stormwater Management and Site Planning & Design Criteria

The next step in the process is to translate the selected approach into some supporting stormwater management and site planning and design criteria. These criteria will provide a foundation for the chosen stormwater management approach, and will establish how the site planning and design process will be carried out within the community.

It is *recommended* that Georgia's coastal communities adopt the post-construction stormwater management and site planning and design criteria presented in this CSS. They have been designed to support the integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design that is detailed within the document. The criteria have also been designed to help communities comply with the requirements of various state and federal environmental policies, programs and regulations, including the NPDES Municipal Stormwater Program and Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA). Communities may adapt the criteria "as-is" or may review and modify them to meet more specific local natural resource protection and stormwater management goals and objectives.

9.4.3 Step 2.3: Develop an Approach to Address Stormwater Management at the Watershed Scale

The integrated approach to natural resource protection, stormwater management and site design presented in this CSS is applied at the site scale. While integrating natural resource protection and stormwater management with the site planning and design process helps protect valuable aquatic and terrestrial resources from the negative impacts of the land development process, local natural resource protection and stormwater management goals can be more rapidly achieved by simultaneously addressing this topic at the watershed scale as well.

Addressing stormwater management at the watershed scale involves integrating natural resource protection and stormwater management goals with broader land use planning and zoning efforts. This can be accomplished by completing three basic tasks:

- Linking local post-construction stormwater management and land use planning and zoning efforts
- Evaluating the local comprehensive plan to ensure that it is consistent with the community's site-scale approach to stormwater management
- Examining local development rules to ensure that they are consistent with the community's site-scale approach to stormwater management

Each of these tasks is described in more detail below.

Linking Local Stormwater Management and Land Use Planning and Zoning Efforts

To more rapidly achieve local natural resource protection and stormwater management goals and objectives, communities need to establish a link between their post-construction stormwater management programs and their land use planning and zoning efforts. By making this link, communities can use their land use planning and zoning efforts as the "first stormwater BMP," and can work to protect and conserve the valuable aquatic and terrestrial resources found within and around the community.

When working at the watershed scale, the need for additional natural resource protection and stormwater management techniques and practices becomes clear. For instance, while better site planning techniques, which are applied at the site scale, can be used to protect and conserve valuable natural resources on a development site, they cannot be used to direct growth away from these important aquatic and terrestrial resources. And while better site design techniques, which are also applied at the site scale, can be used to minimize the creation of new impervious cover on a development site, they cannot be used to move this new impervious cover away from sensitive aquatic and terrestrial resources, such as shellfish harvesting areas

and marsh hammocks. Only by using environmentally-sensitive land use planning and zoning strategies, such as the creation of overlay zoning categories, special use districts and infill and redevelopment zones, can a community move beyond the site scale and more effectively address both natural resource protection and stormwater management.

Evaluating the Local Comprehensive Plan

Consistency between the local post-construction stormwater management program and the local comprehensive plan is very important. Local comprehensive plans can have a significant impact on local development patterns, which in turn, can have a significant impact on local aquatic and terrestrial resources. Consequently, a community's comprehensive plan should be evaluated to ensure that it complements, rather than counteracts, local natural resource protection and stormwater management efforts.

Examining Local Development Rules

A community often has many different "development rules" that regulate the site planning and design process. For instance:

- Local street design standards may require the use of certain street and sidewalk widths on a development site
- Local plumbing codes may require that downspouts be directly connected to the storm drain system
- Local zoning ordinances may require large building setbacks that restrict the use of better site design techniques on a development site

Many communities across the country have found that these and other "development rules" (e.g., subdivision ordinances, zoning ordinances, parking lot and street design standards) have prevented developers from encouraging an integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design. These communities have found that their own codes and ordinances are responsible for the wide streets, expansive parking lots and large lot subdivisions that are crowding out the very natural resources that they are trying to protect (CWP, 1998). Obviously, it is difficult for a community to adopt an integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design when its own local "development rules" restricts its use.

Consequently, a community should review and revise its "development rules" to ensure that they complement, rather than counteract, its local natural resource protection and stormwater management efforts. Impediments to the use of an integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design may be found in all of these "development rules":

- Zoning Ordinance
- Subdivision Codes
- Subarea or District Master Plans
- Street Standards or Road Design Manual
- Parking Requirements
- Building and Fire Regulations/Standards
- Stormwater Management or Drainage Criteria
- Buffer or Floodplain Regulations
- Environmental Regulations
- Tree Protection or Landscaping Ordinance

- Erosion and Sediment Control Ordinances
- Public Fire Defense Master plans
- Grading Ordinance

Detailed guidance on reviewing and revising a community's "development rules" is provided in *Better Site Design: A Handbook for Changing Development Rules in Your Community* (CWP, 1998).

9.5 Step 3: Develop Post-Construction Stormwater Management Ordinance

Once a stormwater management approach has been decided upon, and some supporting stormwater management and site planning and design criteria have been crafted, the next step in the *stormwater management program development process* is to develop a post-construction stormwater management ordinance. While many of Georgia's coastal communities may already have "development rules" that address post-construction stormwater management (e.g., drainage ordinance, flood control ordinance), these rules may not fully support an integrated approach to natural resource protection, stormwater management and site design (Table 9.2). Therefore, it is *recommended* that communities use the model post-construction stormwater ordinance presented in Appendix D to update and revise their existing stormwater management regulations. Communities may adopt the model ordinance "as-is" or may review and modify it to meet more specific local natural resource protection and stormwater management goals and objectives.

Table 9.2: Common Inconsistencies Between Existing Development Rules and the Approach to Stormwater Management Presented in this Coastal Stormwater Supplement

Existing Development Rules	Common Inconsistencies
Existing Drainage and Stormwater Management Codes and Ordinances	<ul style="list-style-type: none"> • Existing drainage ordinances may stress collection and conveyance of stormwater runoff, rather than on-site stormwater management • Existing stormwater management ordinances may be out-of-date and may only address flood control (instead of water quality, stormwater runoff reduction, etc.) • Existing stormwater management ordinances may not allow the use of low impact development practices (e.g., stormwater planters, rain gardens, rain barrels) on development sites • Existing stormwater management ordinances may not provide adequate "credit" for the use of green infrastructure practices, such as better site planning and design techniques (e.g., site restoration and reforestation, disconnection of impervious cover, protection of primary and secondary conservation areas) and low impact development practices (e.g., stormwater planters, rain gardens, rain barrels) on development sites

9.6 Step 4: Develop Stormwater Guidance Manual

Although they provide a foundation for a community's chosen stormwater management approach, and establish how the site planning and design process will be carried out within the community, a community's stormwater management and site planning and design criteria are typically only addressed in a cursory fashion within the local post-construction stormwater

management ordinance. Additional information about these criteria, and the green infrastructure and stormwater management practices that can be used to meet them, should be provided in a stormwater guidance manual to ensure that the community's chosen stormwater management approach is effectively implemented on the ground.

Ultimately, the information contained within a stormwater guidance manual influences:

- How well natural resource protection and post-construction stormwater management will be integrated with the site planning and design process
- How green infrastructure and stormwater management practices will be used to address the local post-construction stormwater management and site planning and design criteria
- The types of green infrastructure practices that will be used on new development and redevelopment sites and whether they will be encouraged or required
- The types of stormwater management practices, such as wet ponds and wetlands, that will be used on new development and redevelopment sites
- The size, function, performance and appearance of both green infrastructure and traditional stormwater management practices
- How easily green infrastructure and stormwater management practices can be accessed for maintenance and the frequency and type of maintenance that they require

It takes a significant amount of effort to create a stormwater guidance manual. Fortunately, Georgia's coastal communities do not have to undertake this daunting task. Instead, they can simply reference this CSS, particularly if they have adopted the integrated, green infrastructure-based approach to natural resource protection, stormwater management and site design that is detailed within. It provides valuable information about the supporting stormwater management and site planning and design criteria and about the green infrastructure and stormwater management practices that can be used to meet them. Communities are encouraged to review and modify the contents of this CSS, as necessary, to meet more specific local watershed and stormwater management goals and objectives.

9.7 Step 5: Develop a Plan Review and Approval Process

The next step in the *stormwater management program development process* is to develop a plan review and approval process that can be used to verify compliance with the community's post-construction stormwater management and site planning and design criteria.

The plan review and approval process is much more important than it may first appear. After development plans are approved, construction equipment starts rolling and land disturbing activities, such as clearing and grading, begin. At this point, making changes to development plans can be very time consuming and difficult to achieve. Consequently, the plan review and approval process is the best opportunity to get things right with regards to natural resource protection and stormwater management. A well-organized plan review and approval process is a tremendous asset to a local post-construction stormwater management program and can help ensure that:

- Green infrastructure and stormwater management practices satisfy a community's site planning and design and post-construction stormwater management criteria and are properly applied on development sites

- Post-construction stormwater management systems make use of green infrastructure practices, such as environmentally-sensitive site planning and design techniques and small-scale, low impact development practices
- Green infrastructure and stormwater management practices are located within easements and have adequate access for inspection and maintenance
- Maintenance agreements that assign long-term maintenance responsibility for green infrastructure and stormwater management practices are in place
- Local review and approval of development plans is coordinated with state and/or federal review and approval of development plans for erosion and sediment control, streams, wetlands, floodplains and dams
- Information about green infrastructure and stormwater management practices is provided so that inspection and maintenance staff will have the information needed to complete follow-up inspections

While reviewing green infrastructure and stormwater management practices during the plan review and approval process may be a relatively new concept for a community, many of Georgia's coastal communities already have a plan review and approval process in place. Some of the biggest challenges to integrating the stormwater management review process with existing plan review and approval processes include: (1) securing adequate and well-trained staff; and (2) conducting stormwater management reviews concurrent with other plan reviews for drainage, utilities, erosion control, roads and site layout.

Each of the tasks involved in developing an effective plan review and approval process is described in more detail below.

9.7.1 Step 5.1: Scope Out Plan Review and Approval Process

The *recommended* plan review and approval process includes the following steps:

1. Pre-application meeting
2. Submittal and review of stormwater concept plan
3. Consultation meeting
4. Submittal and review of stormwater design plan

These steps help create a plan review and approval process that complements the *integrated* approach to natural resource protection, stormwater management and site design detailed in this CSS. This allows the site designer and the plan reviewer to work together to meet local natural resource protection and stormwater management goals, rather than turning the plan review and approval process into a contentious endeavor. While setting up a site plan review and approval process, it is also important to consider issues like integrating stormwater management reviews with other plan reviews for drainage, utilities, erosion control, roads and site layout, balancing staff time between plan reviews and site inspections and involving the public in the review process.

9.7.2 Step 5.2: Create Permit Applications, Instructions and Checklists

In a community's plan review and approval process, the main customers will be the applicants who will be submitting development plans for review and approval. A smooth plan review process relies on providing clear instructions to both developers and site planning and design teams. While often overlooked, completing this task, by providing application forms and instructions that indicate exactly what information needs to be submitted for review, has the potential to significantly improve a community's plan review and approval process. When site

design information is presented in a consistent, organized manner, plan review and approval becomes much easier for local plan review staff.

9.7.3 Step 5.3: Forecast Staff Needs and Acquire Plan Review Staff

Proper staffing is an essential element of any successful plan review and approval process. If the stormwater management portion of the plan review and approval process will be significantly different or more time-intensive than any other elements of the existing plan review and approval process, additional plan review staff may need to be acquired. Plan reviewers that will be reviewing post-construction stormwater management plans should have experience in civil or environmental engineering, be knowledgeable about a community's stormwater management approach and its supporting site planning and design and stormwater management criteria and be qualified to review every element of a stormwater management design plan.

9.7.4 Step 5.4: Provide Training for Plan Reviewers and Site Designers

Once the local plan review and approval process has been developed and is ready to be implemented, it is important to provide training to the local plan reviewers and site planning and design teams that will be involved with the process. Without adequate training, the quality of submitted stormwater management plans will be lower, and the time needed to complete each review will be greater. This will increase the overall number of submittals needed to get a single project through the process, which will result in an increased financial burden being placed on the local development community as well as on the local post-construction stormwater management program.

9.7.5 Step 5.5: Set Up Performance Bond Process, Forms and Tracking System

Performance bonds are financial tools used to guarantee that any construction that affects the public interest is performed in an appropriate manner and in accordance with the terms and conditions of applicable local codes and ordinances. In a typical stormwater management performance bond, a developer or property owner guarantees that construction of post-construction stormwater practices will be completed in accordance with the approved stormwater management design plan. Should the developer or property owner fail to initiate or complete construction of the post-construction stormwater practices according to the terms of the approved plan, the performance bond ensures that enforcement action can be taken by the jurisdiction at the developer's or property owner's expense.

There are a number of important things to consider when developing a local performance bond process, including:

- Process for establishing the total required dollar amount of the bond and security (e.g., percentage of total estimated construction cost)
- Responsibility for determining the required dollar amount of the bond and security (e.g., jurisdiction, site developer/owner)
- Allowable forms of bond security (e.g., surety bond, letter of credit)
- Required duration of the bond and the process under which it will be released
- General procedures for ordinance enforcement, including issuing notices of violation and levying penalties
- Conditions under which the bond will be enforced (e.g., will bond be enforced as a penalty?)
- Responsibilities of surety when surety bonds are submitted as security

- Bond tracking system for community

Many aspects of the performance bond process involve complex contract and legal issues. Therefore, it is *recommended* that a community interested in developing a local performance bond program enlist the help of a qualified attorney. Additional information about developing a local performance bond program, including a bond estimating tool, is provided in *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program* (Hirschman and Kosco, 2008).

9.8 Step 6: Develop Construction Inspection Program

The next step in the *stormwater management program development process* is to establish an inspection program that can be used to ensure that green infrastructure and stormwater management practices are properly installed during construction. While many of Georgia's coastal communities currently conduct site inspections during the construction phase of a development project, many of these inspections are not comprehensive enough to ensure that green infrastructure and stormwater management practices are being properly installed.

Many green infrastructure and stormwater management practice failures can be attributed to improper installation. An inspection program that thoroughly inspects these practices during construction can be used to prevent many of these problems from occurring in the first place. An effective construction inspection process can also help ensure that:

- Low impact development and stormwater management practices are built according to specifications and as shown on approved stormwater management plans
- Better site planning and design techniques are properly implemented on development sites
- Proper materials and construction techniques are used to install green infrastructure and stormwater management practices

Each of the tasks involved in developing an effective construction inspection program is described in more detail below.

9.8.1 Step 6.1: Scope Out the Inspection Process

The first task that needs to be completed when developing a local construction inspection program is to scope out the inspection process. A list of scoping questions is provided below to assist communities in completing this task:

- Does the community already inspect development sites during construction?
- What level of integration is desired and/or possible between a stormwater-focused inspection program and other existing construction inspection programs?
- What is the current level of knowledge among inspectors about the design and installation of green infrastructure and stormwater management practices?
- How often will green infrastructure and stormwater management practices on active construction sites need to be inspected?
- How many staff will be needed to inspect green infrastructure and stormwater management practices on active construction sites?
- Is there an existing tracking system for inspections and enforcement actions that can be modified to include the inspection of green infrastructure and stormwater management practices during construction?

The answers to these questions will help a community identify the action items that will need to be completed to develop an effective construction inspection program. Ultimately, a community's construction inspection program should include:

- Pre-construction meetings to verify the project schedule and to ensure that contractors and inspectors understand each other's expectations
- Routine inspections to observe progress
- Inspections of green infrastructure and stormwater management practices at critical milestones (e.g., it is much easier to inspect an underdrain in a bioretention area before it has been covered with soil than after it has been covered)
- Confirmation of as-builts as a final check to see that all green infrastructure and stormwater management practices were properly installed

9.8.2 Step 6.2: Create Checklists and As-Built Certification Forms

As with the plan review process, a smooth construction inspection process relies on providing reliable information to local developers, site designers and plan reviewers. There are a number of components that need to be inspected on every development site during construction to ensure that green infrastructure and stormwater management practices are being properly installed. These inspection items should be recorded on checklists and outlined in the educational materials that are provided to the development community. This will help formalize the inspection process and set clear expectations for everyone that is involved with it. When this information is presented in a consistent, organized manner, construction site inspection becomes much easier for local inspection staff. It also becomes easier to track inspection results and trigger enforcement actions as they become necessary.

Additional information about developing checklists for your local construction inspection program, including example construction inspection checklists, is provided in *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program* (Hirschman and Kosco, 2008).

9.8.3 Step 6.3: Forecast Staff Needs and Acquire Inspection Staff

Staff trained in the proper installation and maintenance of green infrastructure and stormwater management practices will be needed to ensure that these practices are installed correctly on development sites. These inspectors can be inspectors from other municipal departments (e.g., building or erosion and sediment control inspectors), stormwater plan reviewers, specialized stormwater inspectors or private consultants. Some of the pros and cons associated with each of these options are presented below:

- Existing employees from other departments provide the advantage of efficient staff utilization, but it is possible that stormwater inspections will not get the attention they deserve
- Stormwater plan reviewers are likely to be most familiar with green infrastructure and stormwater management specifications, but inspection can be time-consuming, and using plan reviewers could delay the plan review and approval process if there are many inspections to conduct
- Specialized stormwater inspection staff may be the best choice for ensuring proper green infrastructure and stormwater management practice installation, but depending upon the number and type of development projects occurring within a community, having specialized stormwater inspection staff can consume a lot of financial resources

- Use of private consultants can free up stormwater staff for other activities, but they generally do not have enforcement authority; this option also places an additional financial burden on the community

Every one of Georgia's coastal communities should explore the various options and select an approach that will best meet its own needs and budgetary constraints.

9.8.4 Step 6.4: Provide Training for Inspectors and Contractors

Construction inspectors must possess the skills necessary to identify conditions that could affect green infrastructure or stormwater management practice installation or hinder long-term performance. To help ensure that the local inspection staff has the skills that it needs, a community should develop and implement a training program (or take advantage of a training program at the regional or state level) that addresses the following elements:

- Construction site sequencing
- Design and function of green infrastructure and stormwater management practices
- Material specifications
- Green infrastructure and stormwater management practice installation techniques and sequencing
- Confined space training, especially in communities where underground stormwater management practices will be used
- Unique issues with proprietary devices
- Common pitfalls in construction that affect the function of green infrastructure and stormwater management practices
- Inspection protocols/process, both for contractors and agency staff
- Enforcement response plan and tools

Training and certification for contractors is also important. This helps to ensure that contractors are installing and inspecting green infrastructure and stormwater management practices appropriately and ensures that they are better able to communicate with local inspection staff when problems are observed on site.

9.9 Step 7: Develop Inspection and Maintenance Program

A great deal of effort has been put into getting to this point in the *stormwater management program development process*. Crafting an approach to post-construction stormwater management, adopting a stormwater management ordinance and developing (or referencing) a stormwater guidance manual are significant milestones. Getting green infrastructure and stormwater management practices included on site plans and getting them installed properly on development sites are also major accomplishments. Yet, getting well-designed green infrastructure and stormwater management practices in the ground is only the first step ensuring that they will perform as designed over time. Ongoing maintenance is also needed to ensure that these practices will continue to help control and minimize the negative impacts of the land development process.

Communities across coastal Georgia are becoming increasingly aware of the fact that both green infrastructure and stormwater management practices are infrastructure. And, like any other type of infrastructure, deferred maintenance has its price, both in terms of financial resources and the health of local aquatic resources. It is well understood that green infrastructure and stormwater management practices that are not properly maintained will ultimately fail to perform as designed, and may become nuisance or safety problems. Problems

that arise from deferred maintenance usually circle around and fall into the community's lap. Therefore, it is in any community's best interest to develop an effective inspection and maintenance program.

The tasks associated with developing an effective inspection and maintenance program are described below.

9.9.1 Step 7.1: Scoping the Inspection and Maintenance Program

The first task that needs to be completed when developing an inspection and maintenance program is to scope out the program. There are three general approaches that a community can use to develop an inspection and maintenance program: (1) private property owners are responsible for performing maintenance, with the local program providing oversight and guidance; (2) the local program is responsible for performing maintenance; and (3) a hybrid approach with a blend of public and private maintenance. Every one of Georgia's coastal communities should explore each of these options and select an approach that will best meet its own needs and budgetary constraints.

When scoping an inspection and maintenance program, a community needs to consider how often inspections will occur, the information that will need to be collected during each inspection, the maintenance requirements that are contained in the local post-construction stormwater management ordinance and how these requirements will be enforced. A list of scoping questions is provided below to assist communities in completing this task:

- How many green infrastructure and stormwater management practices can be found within the community?
- What is the current condition of these green infrastructure and stormwater management practices?
- What types of maintenance tasks are already being conducted within the community?
- Who is currently responsible for maintenance of green infrastructure and stormwater management practices?
- How often will existing green infrastructure and stormwater management practices need to be inspected?
- What is the current level of knowledge among inspectors about the maintenance requirements of green infrastructure and stormwater management practices?
- How often will maintenance need to take place on existing green infrastructure and stormwater management practices?
- Is there an existing tracking system that can be used to track the results of maintenance inspections?

The answers to these questions will help a community identify the action items that will need to be completed to develop an effective inspection and maintenance program.

9.9.2 Step 7.2: Create Checklists, Inspection Forms and Enforcement Tools

Forms and checklists need to be created so that inspection and maintenance activities can be tracked. Inspection documents should describe the existing condition of each green infrastructure and stormwater management practice, propose remedies for any noted deficiencies and identify potential enforcement actions. Checklists and inspection forms should:

- Be quantitative, so that maintenance needs can be easily prioritized and ranked
- Allow for the distinction between routine and structural maintenance needs

- Be very specific about possible problems to reduce subjectivity
- Link problems to specific actions
- Gather data on the design features of practices for future use
- Where possible, track the function of the practice over time for future research (e.g., health of vegetation)

These documents should be carefully compiled, as the information contained within them may be necessary for enforcement action in the future. Additional information about developing checklists and inspection forms, including example inspection checklists, is provided in *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program* (Hirschman and Kosco, 2008).

9.9.3 Step 7.3: Forecast Staff Needs and Acquire Inspection Staff

Generally, the same local inspection staff that performs inspection of green infrastructure and stormwater management practices during construction can be utilized to perform maintenance inspections. These inspectors may be inspectors from other municipal departments (e.g., building or erosion and sediment control inspectors), stormwater plan reviewers, specialized stormwater inspection staff or private consultants. The same pros and cons that were presented in Section 9.9.3 also apply to maintenance inspections, and should be considered accordingly.

9.9.4 Step 7.4: Create and Disseminate Outreach Materials for Responsible Parties

With improved stormwater regulations comes greater responsibility, both for the regulated community and for the community itself. This is especially true for the inspection and maintenance aspect of a post-construction stormwater management program, which is often neglected. In many communities, the community is responsible for maintaining public stormwater infrastructure. However, most green infrastructure and stormwater management practices are typically installed on private property, which leaves individual property owners and homeowners' associations responsible for their maintenance. On these sites, communities should still perform periodic inspections, and will therefore need to obtain adequate easements or permission for inspection access and emergency repair.

Often, the parties responsible for post-construction stormwater management are residential or commercial property managers that have no prior experience in maintaining stormwater infrastructure. This lack of experience can lead to poor compliance with maintenance requirements. Local governments can improve compliance by providing educational and outreach programs that provide residential and commercial property managers with the knowledge they need to properly inspect green infrastructure and stormwater management practices and perform any required maintenance tasks.

9.10 Step 8: Develop Program Tracking and Evaluation System

The ultimate goal of all local post-construction stormwater management programs should be to better protect coastal Georgia's aquatic and terrestrial resources from the negative impacts of the land development process. In order to achieve this goal, communities should regularly review and revise their programs to address any successes (and failures) that they have had in meeting program goals and objectives. Some of the primary reasons for tracking and evaluating local post-construction stormwater management programs include:

- Identifying and implementing program improvements to better protect coastal Georgia's aquatic and terrestrial resources from the negative impacts of the land development process
- Striving to make programs more efficient and cost-effective
- Documenting program status for annual reports, as required under the NPDES Municipal Stormwater Program
- Preparing for a possible program audit from state and/or federal regulatory agencies

Setting up a program tracking and evaluation system assures that, even if a community's initial stormwater management goals and objectives prove to be unachievable, it can adjust its program and continue to address its natural resource protection and stormwater management goals and objectives. This important final step in the *stormwater management program development process* is discussed in more detail below.

9.10.1 Step 8.1: Develop a Framework for Program Tracking and Evaluation

Fundamentally, a community's tracking and evaluation program should seek to answer three basic questions:

- Are local natural resource protection and stormwater management goals and objectives being met?
- Is the post-construction stormwater management program being implemented as it was originally envisioned?
- What improvements can be made to the local post-construction stormwater management program?

In order to provide the knowledge necessary to objectively answer these three questions, a community should establish and make use of some program tracking indicators. A wide range of indicators may be used, but some of the more popular indicators include:

- Programmatic Indicators: Programmatic indicators are used to evaluate the success of the local post-construction stormwater management program against qualitative program milestones. Example programmatic indicators include: successfully adopting of a post-construction stormwater management ordinance; developing a stormwater guidance manual; hiring additional plan review staff; and establishing a local construction inspection program.
- Water Quality Indicators: Water quality indicators are used to measure the health of the aquatic resources found within and around a community. This can be done directly (e.g., in stream monitoring) or indirectly (e.g., water quality modeling). Although water quality monitoring and modeling can be expensive, some targeted water quality sampling can be very useful in evaluating the success of a local post-construction stormwater management program in meeting its goals and objectives.
- Land Use/Land Cover Indicators: Land use/land cover indicators are used to measure the extent to which development has occurred within a community. Land use/land cover can be an important measure of program success, and it can help guide future local land use planning and zoning decisions.
- Stormwater Infrastructure Indicators: Stormwater infrastructure indicators are used to determine where green infrastructure and stormwater management practices are successfully meeting local natural resource protection and stormwater management

goals and objectives. Tracking and evaluating the performance of individual green infrastructure and stormwater management practices can be an important measure of program success, and it can help guide future decisions about what practices to use (and not to use) within a community.

The indicators that a community chooses to use to evaluate its local post-construction stormwater management program should be relatively simple to measure and track over time.

9.10.2 Step 8.2: Develop Program Tracking and Evaluation Protocols

Once a community has developed a framework for program tracking and evaluation, the next step is to develop a tracking and evaluation protocol for each program tracking indicator. Each protocol should describe the information that needs to be collected to evaluate the indicator and should define how often the indicator will be assessed.

At its core, program tracking and evaluation involves keeping track of all of the tasks that have been completed to meet program goals and objectives. Many of the tasks can be tracked with a simple checklist (e.g., successful adoption of a local stormwater ordinance) and require no detailed or long-term data tracking. Other tasks, however, require more detailed and ongoing record-keeping, sometimes by several different departments within the same community (e.g., keeping track of the condition of all of the green infrastructure and stormwater management practices that have been installed in the community). Regardless of the tracking and evaluation protocols that are used, it is important for a community to keep track of what tasks have and have not been completed so that annual reports can be more easily created.

9.10.3 Step 8.3: Write Annual Reports

All communities that are regulated under the NPDES Municipal Stormwater Program must submit an annual report to the Georgia Department of Natural Resources Environmental Protection Division (GA EPD) documenting the activities that they have completed to comply with the requirements of the program. The NPDES Municipal Stormwater Program requires that these reports include the following information:

- Status of compliance with permit conditions
- Status of selected measurable goals
- Assessment of the appropriateness and effectiveness of the stormwater management program
- Summary of any data, including any monitoring data, collected and analyzed during the reporting period
- Summary of any stormwater management activities planned for the next reporting cycle
- Summary of any proposed changes to the stormwater management program along with a written statement providing rationale for the proposed changes
- List of entities responsible for implementing any aspect of the stormwater management program
- List of any changes in the personnel responsible for implementing and coordinating the stormwater management program

Many communities use their annual reports to simply report the tasks they have completed over the past year, instead of using them to determine if any improvements can be made to the program. For example, if a community reports that it has inspected 12 dry detention basins over the past year, and 10 were in need of maintenance, the community should assess the situation

and determine why so many of the dry detention basins were in need of maintenance. The knowledge gained from this type of annual “self-assessment” can be used to revise and improve the local post-construction stormwater management program over time.

9.11 Summary

By following the eight-step *stormwater management program development process* described above, communities can effectively shift the focus of their local post-construction stormwater management efforts onto the *prevention*, rather than the *mitigation*, of the negative impacts of the land development process. Programs developed in accordance with this eight-step process will not only be consistent with the integrated, *green infrastructure*-based approach to natural resource protection, stormwater management and site design presented in this CSS, but also with the requirements of the NPDES Municipal Stormwater Program.

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