Chapter 2:
Strategies for Local Governments

2.1 Getting Ready for Low Impact Development

Stormwater regulation and policy are the basis for coastal water protection. Stormwater management program regulation and planning strategies are major tenets that support successful LID implementation. This chapter outlines the current federal, state, and local stormwater regulations and presents planning and regulatory strategies needed for coastal SC LID implementation. At the local level, planning improvements, better development patterns, effective LID implementation, and accurate LID reporting support state policy goals.

2.2 Applicable Regulations and Requirements for LID

Federal and State Stormwater Regulations

The US Environmental Protection Agency (EPA)'s National Pollutant Discharge Elimination System (NPDES) permitting program is the result of laws enacted by Congress that are then developed and implemented under the law's regulations. The Clean Water Act establishes environmental programs, including the NPDES program, to protect the Nation's waters and directs EPA to develop, implement, and enforce regulations consistent with this law. The NPDES stormwater program regulates stormwater discharges from municipal separate storm sewer systems (MS4s), construction activities, and industrial activities. The goal is to reduce pollution that enters the receiving waterways from point and non-point sources of pollution.

South Carolina is authorized to implement the NPDES Stormwater Program and administer its own stormwater permitting program. The SC Department of Health and Environmental Control (SCDHEC) manages the state stormwater program. It is important to note that South Carolina's Construction General Permit operates on a five-year cycle and this manual references the permit requirements that were reissued on January 1, 2013 (SCDHEC, 2013). More information is available in Appendix H and online at: http://www.scdhec.gov/HomeAndEnvironment/Water/Stormwater/

To protect water quality during construction and development, the state (or MS4 local government under Phase II NPDES requirements) generally requires a permit for projects within ½ mile of a receiving waterbody or those that disturb greater than one acre. Typically, projects within ½ mile of a receiving waterbody should capture and store onsite the first ½ inch of runoff from the site or the first one inch of runoff from the built upon area, whichever is greater. For certain land disturbance activities, state regulations require that peak post-development discharge rates from the site must be at or below pre-development rates for the 2- and 10-year, 24- hour storm events (approximately 4.5 and 6-inch rain events, respectively, but this varies regionally). During construction, a site-level stormwater management plan should demonstrate an 80% sediment trapping efficiency for the 10-year, 24-hour storm event if the project disturbs greater than 10 acres and drains to a common point (SCDHEC, 2002). The latest SCDHEC BOW stormwater BMP manual includes the best available information as of 2005 (SCDHEC, 2005; also check website for updates). Table 2.2-1 summarizes the applicable state regulatory requirements for pre- and post- land development in South Carolina.

Table 2.2-1. South Carolina Regulatory Requirements for Land Development

Extent of Land Disturbance (acres)	Applicable Regulatory Requirements
Automatic Permit Coverage, 0.1-0.5 acres (non-LCP*, within ½ mile of CRW**)	R.72-307H, SCR100000, Coastal Zone Stormwater Management Program Refinements
Less than one acre (non-LCP*, not within ½ mile of CRW**)	R.72-307H, permit coverage not required
One to two acres of disturbance (non-LCP*, not within ½ mile of CRW**)	R.72-307H, SCR100000
0.6-2.0 acres of disturbance (within ½ mile of CRW**)	R.72-307H, SCR100000, Coastal Zone Stormwater Management Program Refinements
More than two and less than five acres of disturbance	R.72-307I, SCR100000 When located within ½ mile of CRW** Coastal Zone Stormwater Management Program Refinements also apply
Five acres or more of disturbance	R.72-307, SCR100000 When located within ½ mile of CRW** Coastal Zone Stormwater Management Program Refinements also apply

** LCP – Larger Common Plan of Development*
*** CRW – Coastal Receiving Water*

From these regulations, the State has established minimum stormwater quality and quantity requirements for the local governments located within the eight coastal counties. Note, when infiltration is used to satisfy Coastal Zone Stormwater Management Program Refinements, design criteria established in R.720307.C(11) applies. Table 2.2-2 summarizes the requirements based on BMP and location. For the purposes of this Manual, most LID BMPs are considered as "infiltration" practices, thus providing an incentive for designers (only requiring the storage of one inch of runoff over the impervious area).

Table 2.2-2. SC Coastal Zone Management Program Stormwater Quality BMP Requirements

BMP Facility Type	Water Quality Volume Requirements*		
	5 acres or more of land disturbance	Within 0.5 Miles of a Receiving Waterbody in the Coastal Zone**	Within 1,000 Feet of Shellfish Beds
Water quality facility with permanent pool of water (detention)	Storage volume above permanent pool of 0.5 inches of runoff from site based upon drainage area, required to release over a 24-hour period	Storage volume over permanent pool of 0.5 inches of runoff from entire site based upon drainage area or 1.0 inches of runoff from built upon portion of the site, whichever is greater	Not applicable
Water quality facility without permanent pool of water (detention)	Storage volume of 1.0 inches of runoff from site based upon drainage area, required to release over a 24-hour period	Storage volume of 0.5 inches of runoff from entire site based upon drainage area or 1.0 inches of runoff from built upon portion of the site, whichever is greater	Not applicable
Infiltration practices (including LID practices)	Storage volume of 1.0 inches of runoff from impervious surfaces, required to drain completely in 72 hours	Storage volume of 0.5 inches of runoff from entire site based upon drainage area or 1.0 inches of runoff from built upon portion of site, whichever is greater, required to drain completely in 72 hours	Storage volume of 1.5 inches of runoff from built upon portion of site, required to drain completely in 72 hours

** Projects which result in land disturbance less than 1 acre, but are part of a larger common plan of development (LCP) may also be subject to coverage under the NPDES Construction General Permit.*
*** Section III.C.3.XIIIA of the Coastal Zone Management Program Refinements also applies to projects less than 5 acres.*

This *Planning and Design Guide* allows innovative stormwater management that may be used to comply with state regulations and also uses the best available science and practical knowledge to implement LID. See the LID BMP Specifications in Chapter 4 for detailed information. In addition to the state-level stormwater requirements, many local governments have established additional or unique conditions in their local regulations.

Local Regulations and Ordinances

The Coastal Zone of South Carolina is currently organized into 8 counties (Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry and Jasper) and 51 municipalities. Within this group of individual counties and municipalities, there are two urbanized areas designated as Regulated Small Municipal Separate Storm Sewer Systems (MS4s): Charleston and Myrtle Beach (See Table 2.2-3). The designations are based on urbanized areas determined by the latest census, and it is anticipated that the Beaufort area will be designated as another MS4 in the near future.

Table 2.2-3. Regulated Small MS4s in the Coastal Zone

Urbanized Area	Municipality
Charleston – North Charleston (including Ladson, a CDP*)	Berkeley County Charleston Charleston County Dorchester County Folly Beach Goose Creek Hanahan Isle of Palms Lincolnville Mount Pleasant North Charleston Sullivan's Island Summerville
Myrtle Beach (including Forestbrook, Garden City, Little River, Murrells Inlet, Red Hill & Socastee CDPs)	Atlantic Beach Briarcliffe Acres Conway Georgetown County Horry County Myrtle Beach North Myrtle Beach Surfside Beach

** The US Census Bureau recognizes CDPs (Census-Designated Places) as the statistical counterpart to incorporated places such as cities, town, and villages. CDPs are areas that lack a formal government but are otherwise similar to incorporated places.*

The SC Department of Health and Environmental Control (SCDHEC) defines MS4s as "a system of conveyances that include, but are not limited to, catch basins, curbs, gutters, ditches, man-made channels, pipes, tunnels and/or storm drains that discharge into Waters of the State." These MS4s are required to obtain National Pollutant Discharge Elimination System (NPDES) Phase II permits in order to discharge stormwater into Waters of the State; the current NPDES General Permit for Storm Water Discharges from Regulated Small MS4s became effective January 1, 2014, and includes the urbanized areas listed in Table 2.2-3 (SCDHEC, 2013). Communities subject to the SMS4 Permit are required to develop new development and redevelopment standards for sites greater than 1 acre that "demonstrate the runoff reduction and pollutant removal necessary to approximate pre-development conditions to the Maximum Extent Practicable (MEP) and to protect water quality." Projects in an MS4 must design, construct, and maintain stormwater management practices that control rainfall on-site, and prevent the off-site discharge of 1" of runoff from the site's disturbed area.

In addition to the Regulated Small MS4s listed below, SCDOT has been designated as a large MS4 and has been issued its own NPDES General Permit for Stormwater Discharges.

Table 2.2-4 summarizes examples (as of September 2013) of coastal counties and municipalities

which have requirements that are stricter than this state requirement for stormwater volume control. Information for the design manuals and local ordinances for these local governments is included in the References section at the end of this chapter.

Table 2.2-4. Unique Stormwater Volume Control Requirements

Municipality	Stormwater Volume Control
Beaufort County (*Including the City of Beaufort and Town of Port Royal*)	All stormwater from the 95th percentile storm (1.94 inches) must be retained on site
Town of Bluffton	In areas of Hydrologic Soil Groups A&B, the development shall control and infiltrate the first one inch of stormwater runoff from the entire development or maintain the pre-development hydrology for the Water Quality Design Storm Event (95th percentile storm = 1.95 inches), whichever is greater
Horry County	Three Options: 1. Redevelopment projects must achieve a 10% reduction in runoff volume (from pre-redevelopment levels) 2. Reduce impervious cover on the site by at least 20% 3. Reduce the post-development peak discharge rates by 20% for the 10- and 25-year, 24-hour storms
Jasper County	The 85th percentile storm (1.2 inches) must be retained on site
City of Myrtle Beach	As a minimum, the first inch of rainfall from each storm over the developed portion of the site shall be retained on site
City of North Myrtle Beach	Minimum storage volume shall be provided to retain on-site the first inch of runoff generated by any storm event over the developed or redeveloped portion of the site
Town of Hilton Head	The first flush runoff (0.5 to 1.0 inch) from paved streets and parking areas shall be filtered through vegetation, grass, gravel, sand or other filter mediums to remove oil, grease, gasoline, particulates and organic matter is required before the runoff leaves the site or enters any natural or manmade waterbody.
Town of Surfside Beach	As a minimum, adequate storage volume shall be provided to retain on-site the first inch of runoff generated by any storm event over the developed or redeveloped portion of the site.

The State requires the following minimum standards for water quantity management: post development peak discharge rates shall not exceed pre-development discharge rates for the 2- and 10-year frequency, 24-hour duration storm event. Implementing agencies may utilize a less frequent storm event (e.g. 25-year, 24-hour) to address existing or future stormwater quantity or quality problems. Hydraulic modeling is required for the 100-year, 24-hour storm to demonstrate that the discharge from a stormwater control structure will not cause downstream damage. Table 2.2-5 summarizes some of the local stormwater design criteria that exceed this minimum state standard, as of August 2013.

Table 2.2-5. Unique Stormwater Peak Discharge Control Requirements

Municipality	Peak Stormwater Control
Horry County	Projects greater than 5 acres or redevelopment projects must reduce post-development peak discharge by 20% for the 10-year and 25-year storms
City of Hardeeville	The post-development peak discharge shall not exceed the pre-development peak for developments from 0-299 acres (25-year storm); over 300 acres (50-year storm)
Beaufort County Berkeley County Charleston County Dorchester County Georgetown County Horry County Jasper County City of Beaufort City of Charleston City of Conway City of Georgetown City of Goose Creek City of Hanahan City of Myrtle Beach City of North Charleston City of North Myrtle Beach Town of Bluffton Town of Hilton Head Town of Port Royal Town of Summerville Town of Surfside Beach	Post-development peak discharge shall not exceed pre-development rate for 2, 10, and 25-year storm

2.3 Regional Planning Strategies

The past few decades of stormwater management have focused on using control and treatment strategies that are largely hard-infrastructure-engineered, end-of-pipe, and site-focused practices primarily concerned with peak flow rate and suspended solids concentration control. The collective experience of communities across the United States demonstrates that looking only at site-level practices will not repair damaged waterbodies and will likely put more streams on impaired lists over time (US EPA, 2013). Factors at the site, district/neighborhood, and regional scales can drive the creation of unnecessary impervious cover and other land cover conditions that produce excessive runoff. These factors are embedded in a community's land use codes and policies. Therefore, a comprehensive approach to stormwater management should include an examination of a locality's land development regulations, policies, and ordinances to align better with water quality goals.

Some common land use regulations, codes, and policies that can drive impervious cover include the following from Hirschman and Kosco (2008):

- ✧ Zoning ordinances
- ✧ Subdivision codes
- ✧ Street standards or road design guidelines
- ✧ Parking requirements
- ✧ Minimum setback requirements;
- ✧ Site coverage limits
- ✧ Height limitations

The conservation principles and neighborhood site design guidance for LID outlined in Chapter 3 are supported by codes and ordinance updates. The first step in this process is to review local codes and ordinances objectively. During this review, opportunities for updates and/or improvements are recorded. The codes and ordinance review team can share findings, make recommendations for improvements, and implement changes as appropriate. Each local jurisdiction is unique with respect to the specific policies, window of opportunity, time frame, and additional variables. Code and ordinance reviews, updates, and improvements are a key strategy to plan for future conditions that best meet the community needs.

Planning for Future Growth Conditions and Patterns

Proper planning can lead to more sustainable future growth patterns. For example, updating current codes and ordinances can support future development patterns that use the better site design development principles, protect trees, promote stormwater LID, reduce the impervious cover and urban footprint, and additional site assessment principles for LID discussed in this manual.

Land use development can occur in conjunction with better stormwater management and additional watershed goals. Future land development should be done under updated codes, ordinances, and policies that promote LID as much as possible. Planning for future growth conditions and patterns means promoting LID, reducing impervious cover, and preserving natural areas. Preserving natural areas can be accomplished by promoting growth in more suitable areas. For example, by directing and concentrating new development in areas targeted for growth, communities can reduce or remove development pressure on undeveloped parcels and protect sensitive natural lands and recharge areas. Coastal land use planners must weigh these options carefully before determining where to direct future growth. Table 2.3-1 provides tools to direct development in Coastal Plain watersheds. Because communities vary in their current state of buildout, proximity to the coast, legal authority to regulate land use and resources, and regulatory climate, a tailored approach using multiple tools, such as those suggested here, may be necessary to support planning for future growth conditions and patterns.

To protect important natural resources from development impacts while still accommodating growth, coastal communities should encourage redevelopment and infill over conversion of natural lands to development. Concentrating development in certain areas while limiting it in other areas reduces sprawl and may be the only way to maintain the pristine condition of undeveloped subwatersheds, since even low levels of impervious cover are associated with waterway degrada-

Table 2.3-1. Tools to Direct Development in Coastal Plain Watersheds

Tool	Description	Where Applicable	Advantages	Disadvantages
Real estate disclosures	Require notification of new or potential property owners about erosion or flood risk	Hazard areas	Ensures property owners are aware of risks on their own property	Does not prevent development or shoreline hardening; requires good data on location of hazard areas
Insurance incentives/ disincentives	Deny property or flood insurance for structures in high-risk erosion or flood areas; place a mandatory surcharge on flood insurance; provide insurance that is not subsidized to protect coastal flooding impacts (see Briggert-Waters Act); grant lower insurance premiums for implementing better site design (BSD)	Hazard areas	More accurately reflects costs of developing in hazard areas; promotes good development practice	May not be enough to discourage development or encourage use of BSD; requires good data on location of hazard areas; requires mechanism to enforce use of BSD
Limit/direct expansion of infrastructure	Fund/approve infrastructure expansions in planned growth areas only	Rural areas	Reduces sprawl and associated infrastructure costs	May encourage use of septic systems in areas with unsuitable soils
Urban growth boundaries	Defined area for urban and rural growth to occur	Anywhere, but probably most useful in rapidly urbanizing watersheds	Applies restrictive boundary on growth	Difficult to coordinate between multiple jurisdictions
Transfer or purchase of development rights	Exchanging or purchasing development rights from land with valuable natural resources to land in a more appropriate growth area.	Watersheds that have both pristine and urban/ urban areas	If done correctly, results in placement of development in areas with existing infrastructure and provides protection of rural lands	Challenging to establish the trading market
Watershed based zoning	Revise zoning to achieve targeted impervious cover goals on a watershed basis	Watersheds with very little development	Directly ties land use to stream conditions	Disconnection between watershed boundaries and jurisdictional boundaries

Table 2.3-1. Tools to Direct Development in Coastal Plain Watersheds

Tool	Description	Where Applicable	Advantages	Disadvantages
Natural resource protection regulations (e.g. floodplains, wetlands)	Require protection of specific resources	Rural, suburban and urban areas	Directly protects resources from being developed	Requires legal authority to adopt local ordinances
Overlay zoning	Superimposes additional standards onto existing zoning provisions to protect natural resources or hazard areas	Rural, suburban and urban areas	Does not require changes to existing zoning	Requires legal authority to establish overlay districts
Managed retreat policy	Allows the shoreline to migrate inland unobstructed by demolishing or relocating structures inland	Shoreline areas	Less expensive than structural shoreline stabilization; maintains natural shoreline processes	May be politically unpopular and lower shoreline property values
Buy-back or relocation assistance program	Provides grants, loans or purchase of property located in retreat area or setback area so that property owners can relocate inland	Shoreline areas	Can avoid 'takings' claims; less expensive than structural shoreline stabilization; maintains natural shoreline processes	Can be costly and politically unpopular; may be difficult to identify land to relocate to.
Incentives for redevelopment infill, and brownfield/greyfield development	Provide financial incentives or reduced requirements to encourage redevelopment and infill	Highly urban areas	Reduces development pressure on greenfield areas; reduces need for infrastructure expansion; can improve water quality if done right	Can further degrade water quality if not done right or if environmental regulations are relaxed for these sites
Large lot zoning	Majority of land zoned 0.5 to 0.05 du*/acre	Rural or suburban communities often used for drinking water protection	Provides some measure of protection for sensitive subwatersheds; relatively easy to implement	Can contribute to regional sprawl
Watershed impervious cover caps	Used to limit IC and ultimately the amount and type of development in a given watershed	Watersheds with very little development	Directly ties land use to stream conditions	Difficult to measure change in IC over time

References: CWP, 1998; CSN, 2008; Schueler, 2000.
** du = density unit*

Regional Planning Case Study: Coastal Waccamaw Council of Governments

The Waccamaw Regional Council of Governments oversees the Section 208 program, which coordinates regional planning initiatives focusing on water quality issues affecting Horry, Georgetown, and Williamsburg Counties. The Waccamaw Region Section 208 Water Quality Management Plan was recently updated in 2011 and examines both regional wastewater treatment needs and the need to address concerns related to non-point source pollution. One of the main focus areas in the plan is to expand the use of green infrastructure and Low Impact Development management strategies in the region. The Waccamaw Regional COG staff worked closely with several stakeholders to outline potential LID applications on a site scale, neighborhood scale, and even on a watershed scale. The importance of these innovative stormwater management techniques was emphasized throughout the plan.

The Waccamaw Regional COG has led other water quality planning projects in the region, most recently in the Murrells Inlet community. Local stakeholders sought to develop a watershed-based plan to address fecal coliform impairments in Murrells Inlet's Shellfish Harvesting Areas. Local stakeholders from both Horry and Georgetown Counties have worked closely with state agencies including SC DHEC and SC DNR to recommend strategies to improve water quality and restore local oyster reef habitats. Through extensive monitoring, data analysis and an assessment of potential sources of bacteria, the planning steering committee recognized that most of these sources are land-based and are being transported to the main channel primarily through stormwater runoff. Recently there have been LID project installations in Murrells Inlet. Expanding LID applications throughout the community is something that is promoted as a major recommendation in the Murrells Inlet Watershed-Based Plan.

For more information: www.wrcog.org

Case Study provided by Dan Newquist, Coastal Waccamaw Council of Governments

tion. Also, the area slated for intense development is likely already impaired. Encouraging redevelopment and infill of these areas is recommended as it provides an opportunity to improve water quality conditions by treating existing impervious cover through the use of BMPs designed for highly urban areas (e.g., green alleys, stormwater planters, green rooftops, streetside bioretention, etc.). Redevelopment should be done in a smart way, so as to make it attractive to homeowners. This would include planning to have walking distance amenities including local shopping areas, parks, nature trails, access to water, etc.

Codes and ordinances supported by qualified staff are important for successful planning for future conditions. Finally, policy that has flexibility to make changes based on new information can better support planning now for future growth conditions and patterns.

Code and Ordinance Checklists

The regulatory framework of federal, state, and local regulations and codes is another defining factor of coastal areas. In some cases, there are regulatory overlays, such as the Coastal Zone Management Act, and most coastal states have more stringent regulations along the immediate coastline. Factors at the site, district/neighborhood, and regional scales can drive the creation of unnecessary impervious cover and other land cover conditions that produce excessive runoff. These factors are embedded in a community's land use codes and policies. A comprehensive approach to stormwater management should therefore include an examination of a locality's land development regulations, policies, and ordinances. For example, a subdivision ordinance dictates minimum houses per acre, street width, and the distance a house is set back from the road. All of these measures create impervious surface. It is for the municipality to determine whether the creation of this impervious surface and the generation of the

associated runoff are appropriate. In this way, the municipality can align its development regulations with its stormwater goals. Table 2.3-2 lists common land use development regulations, codes, and policies that could be reviewed for consistency with stormwater goals.

Table 2.3-2. Managing Stormwater in Your Community

Common land use development regulations, codes, and policies that can drive impervious cover.

- Zoning ordinances specify the type of land uses and intensity of those uses allowed on any given parcel. A zoning ordinance can dictate single-use, low-density zoning, which spreads development throughout the watershed, creating excess impervious cover.
- Subdivision codes or ordinances specify specific development elements for a parcel: housing footprint minimums, distance from the house to the road, the width of the road, street configuration, open space requirements, and lot size—all of which can influence impervious cover.
- Street standards or road design guidelines dictate the width of the road for expected traffic, turning radius, the distance for other roads to connect to each other, and intersection design requirements. Road widths, particularly in new neighborhood developments, tend to be unnecessarily wide, creating considerable impervious cover. Often, curb and gutter are required with road design which makes roadside infiltration swales and practices unfeasible and encourages pipe and pond collection systems.
- Parking requirements generally set the minimum, not maximum, number of parking spaces required for retail and office parking. Setting minimums leads to parking lots designed for peak demand periods, which can create acres of unused pavement during the rest of the year.
- Minimum setback requirements can spread development out by leading to longer driveways and larger lots. Establishing maximum setback lines for both residential and retail development brings buildings closer to the street, reducing the impervious cover associated with long driveways, walkways, and parking lots.
- Site coverage limits can disperse the development footprint and make each parcel farther from its neighbor, leading to more streets and roads and thereby increasing total impervious cover throughout the watershed.
- Height limitations limit the number of floors for any building. Limiting height can spread development out if square footage cannot be met by vertical density.

Reviewing current codes and ordinances is recommended to identify opportunities for improvements, such as LID, as well as to identify obstacles to improvements. The code and ordinance reviews can be done by vested stakeholder and/or decision maker groups. Often the process to discuss options serves to educate the group but also spurs innovative solutions and ideas. Several checklists exist to guide the code and ordinance review process, including:

- The US EPA's Water Quality Scorecard focuses on incorporating green infrastructure practices at the municipal, neighborhood, and site scales. This is available at http://www.epa.gov/smartgrowth/water_scorecard.htm.
- The Better Site Design Codes and Ordinances Worksheet (known as the COW) focuses on 22 Better Site Design development principles for projects such as streets and roads, sidewalks, parking lots, open space requirements, etc. These better site design development principles are outlined in Table 3.1-1 in Chapter 3 and the COW worksheet is available at www.cwp.org.

- ✧ The Eight Tools (of Watershed Protection) Audit identifies regulatory and programmatic tools and gaps in watershed protection. This is available at www.cwp.org.
- ✧ Additional reviews may focus on permit compliance (e.g., US EPA's MS4 Program Audit, Stormwater Pollution Prevention Plan, industrial or commercial discharges, etc.) building codes, transportation, or other code and ordinance areas.

It is important to outline the codes and ordinance review goal and potential outcomes, then choose the tool to meet that identified need. Finally, watershed groups, local governments, and states can tailor the tool to better meet the local conditions, current policies, or anticipated outcomes. The COW has been altered and used in several other locations. In fact, the Coastal Community Watershed Management Checklist was based on the COW and updated for the coast. This Coastal Community Watershed Management Checklist includes improved stormwater management benchmarks and is detailed in the next section.

Coastal Community Watershed Management Checklist

One prominent tool that was developed for coastal code and ordinance review is the Center for Watershed Protection's Coastal Community Watershed Management Checklist. Local codes, policies, and incentive programs can, of course, provide an additional and locally-tailored level of protection, and these local initiatives are the chief focus of this checklist.

The Center for Watershed Protection developed this planning checklist to address critical coastal watershed management issues and challenges related to water quality and natural resource protection goals. The Checklist provides an inventory of best practices and policies that local coastal governments, elected officials, watershed managers, and other stakeholders can use to assess the status of watershed protection in their community, and to identify areas for improvement through the use of example resources and case studies.

The Checklist has twenty-eight questions organized by the following six sections:

1. Land Use Planning
2. Hazard Mitigation Planning
3. Pollution Sources
4. Shoreline Management
5. Site Design
6. Stormwater Management

The Checklist Evaluation Worksheet contains all six sections in an Excel spreadsheet for scoring.

These sections are not stand-alone; rather, they represent opportunities for integrated approaches to coastal watershed management. In some cases, related questions are linked across sections. Users are encouraged to consider all six sections in order to gain a comprehensive evaluation of their community's progress toward integrated coastal watershed management. Recognizing that no single checklist can apply equally to all coastal communities, and that some policies or management approaches may be more important than others, this planning tool is intended to help compare one community's approaches to others, and to increase awareness of management options and examples that have had positive benefits in other coastal communities.

Scoring is provided for each question in the Checklist based on the answers provided by the community. A summary score provided at the end of each section is intended to identify the top three strengths and areas for improvement in the community. Key resources and example case studies are provided to support potential changes in areas identified for improvement within a community.

The Checklist provides multiple benefits to coastal communities, such as opportunities to identify:

- ✧ Important coastal watershed management strategies
- ✧ Current practices and policies in their community
- ✧ Ways to enhance or improve these practices and policies
- ✧ Resources and case studies that are needed for improved practices and policies

For example, a coastal community could use the Checklist to learn that their stormwater management program could be improved by providing incentives for the use of low impact development (LID). Examples of other communities that use LID are provided in the Checklist in addition to other resources to support program changes. The Checklist is available online at http://www.cwp.org/coastal-community-watershed-management-checklist.

How to Incorporate LID into Local Land Use Regulations

All of the tools provided in this manual can be implemented through changes to local land use regulations. Depending on the tools a given community may adopt, these provisions will provide a good starting point for adapting local ordinances to include LID principles.

The first step in the process could involve a code and ordinance review as described in this section. The Code & Ordinance Review should identify areas where the 21 Better Site Design Guidelines have not been addressed adequately. Here are some suggestions for how to incorporate low impact development principles into ordinances (adapted from NCCE, 2009 and RI DEM & CMC, 2011):

I. Avoid the impacts of development to natural features and pre-development hydrology

Protect as much undisturbed open space as possible to maintain pre-development hydrology.

- ✧ Provide a definition of "open space."
- ✧ Adopt a Conservation Development Ordinance to protect open space and predevelopment hydrology.
- ✧ Permit open space developments/conservation developments by right, not only by waiver.
- ✧ Require that limits of disturbance are clearly identified as part of any development plan submittal to minimize loss of open space.

Maximize the protection of natural drainage areas, streams, surface waters, and jurisdictional wetland buffers.

- ✧ Amend regulations to require that new lots are created out of freshwater and/or coastal wetland jurisdictional areas, to the extent practical.
- ✧ Revise regulations to direct building envelopes away from steep slopes, riparian corridors, hydric soils, and floodplains, to the extent practical.

- ✧ Develop a community buffer program to establish a naturally-vegetated buffer system along all streams and wetlands to supplement and expand upon the minimum requirements of DHEC-OCRM requirements.

Minimize land disturbance, including clearing and grading, and avoid areas susceptible to erosion and sediment loss.

- ✧ Adopt or continue to enforce an erosion and sedimentation control ordinance that addresses all land development activities.
- ✧ Adopt a grading ordinance to require applicants to maintain as much natural vegetation as possible and limit clearing, grading, and land disturbing activities to the minimum required for construction maintenance and emergency services.
- ✧ Adopt provisions in the Zoning Ordinance and/or Subdivision Regulations for preserving forest cover, protecting significant trees, and providing adequate tree canopy in developed areas.
- ✧ Restrict the minimum requirement for building footprints, construction access, and setbacks.
- ✧ Establish slope protection criteria.
- ✧ Create requirements for the retention of native vegetation and tree canopy.
- ✧ If on-site wastewater treatment is to be used, allow reserve septic fields to remain uncleared.
- ✧ Allow or encourage BMPs in required landscape areas and open spaces (but not riparian buffers, which should remain undisturbed).

Minimize soil compaction and restore soils compacted as a result of construction activities or prior development.

- ✧ Approve requirements within land development regulations that prohibit the compaction of soils in areas needed for post-construction stormwater recharge.
- ✧ Require regular inspection of site construction practices by the municipality to ensure that soils are properly preserved and restored.
- ✧ Direct contractors to reestablish permeability of soils compacted by construction vehicles; for example, till or amend soils of lawn areas prior to seeding.

II. Reduce the impacts of land alteration to decrease stormwater volume, increase groundwater recharge, and minimize pollutant loadings from a site.

Provide low-maintenance, native vegetation that minimizes the use of lawns, fertilizers, and pesticides.

- ✧ Adopt landscaping standards that require the preservation of as much natural vegetation as possible and encourage low-maintenance native landscaping.
- ✧ Prohibit the installation of plant species that may be found on the most recent listing of invasive species as published by the South Carolina Exotic Pest Plant Council.
- ✧ Establish limits for lawn areas in favor of other groundcovers or vegetation.

Minimize impervious surfaces.

- ✧ Planning Development:
  - Adopt compact growth ordinances such as Conservation Development, mixed use, or planned development to minimize impervious surfaces.
  - Incentivize Retrofitting and Infill Development.
  - Examine the feasibility of adopting impervious cover limits for the entire community or for specific watersheds.
  - Relax side yard setbacks and allow narrower frontages for flexible lot placement.
  - Reduce height restrictions and increase floor areas ratios to reduce building footprints.
  - Amend density standards and allowances to encourage natural area protection in exchange for higher densities.
- ✧ Roadway Design:
  - Tailor street width standards to be as narrow as possible while providing adequate circulation for projected traffic volumes; permit a minimum pavement width of 18 to 22 feet on low-traffic local streets in residential areas.
  - Require street right-of-way widths to be the minimum width necessary to accommodate travel lanes, pedestrians and vegetated open swales safely.
  - Revise residential street design to limit or eliminate the use of curbing where possible to allow side of the road drainage into vegetated open swales.
  - Where curbs are necessary to protect the roadway edge, allow perforated curbs (a.k.a. curb cuts) or flat "aprons" (that are flush with the road surface).
  - Modify the requirements for dimension, design, and surface material of cul-de-sacs to reduce total impervious cover and provide greater design flexibility. Allow landscaped islands and bioretention in cul-de-sacs.
  - Adopt flexible sidewalk design standards that help to balance limits on impervious cover with pedestrian needs. For example, permit sidewalk placement on one side of the street in low-density residential areas or provide an alternative pedestrian circulation layout that uses common areas, rather than street rights-of-way. Design sidewalks to disconnect runoff from the stormwater conveyance system and encourage the use of pervious materials.
  - Permit placement of utilities under the paved section of the right-of-way or immediately adjacent to the road edge to allow for swales to be located adjacent to the roadway.
- ✧ Parking Design:
  - Require driveway lengths and widths to be reduced to the extent possible, encourage shared driveways, and promote the use of pervious surfaces wherever appropriate.
  - Adopt both minimum and maximum parking ratios to provide adequate parking while reducing excess impervious cover.

- Adopt innovative parking design standards that allow for reductions in parking stall and travel lane width.
- Encourage shared parking wherever feasible in order to reduce total impervious cover.
- Allow off-site parking to accommodate re-development and mixed-use compact growth.
- Revise parking lot landscaping requirements to be flexible and encourage LID techniques; for example, require vegetated islands with bioretention functions.
- Allow or require pervious materials for spillover parking and parking lanes.

Manage Impacts at the Source

Infiltrate precipitation as close as possible to the point it reaches the ground using vegetated conveyance and treatment systems.

- ✧ Revise regulations to allow and encourage LID vegetated treatment systems, such as bioretention, swales and filter strips, to promote recharge and treatment of runoff.
- ✧ Break up or disconnect the flow of runoff over impervious surfaces.
- ✧ Amend regulations to encourage runoff to be diverted over pervious surfaces to foster infiltration, runoff reduction, and pollutant removal, where appropriate.
- ✧ Provide source controls to prevent or minimize pollutants in stormwater.
- ✧ Revise regulations to encourage or require appropriate pet waste disposal to prevent pet waste from entering stormwater runoff
- ✧ Require commercial and industrial development to sweep their parking areas on an annual basis.
- ✧ Street sweeping should be done on community streets to limit pollutant transport to water bodies and reduce maintenance of catch basins.
- ✧ Consider adopting a wastewater management district to encourage or require all septic systems to be inspected and maintained regularly.
- ✧ Revise regulations to limit lawn areas and encourage alternative ground covers that require less irrigation and fertilization, where possible.
- ✧ Consider adopting a stormwater utility district to manage the existing impacts of stormwater runoff.

Re-vegetate previously cleared areas to help restore groundwater recharge and pollutant removal.

- ✧ Revise regulations to encourage re-vegetation of cleared areas with native species, where possible.

Form-Based Code

The adoption of alternative zoning ordinances to supplement or reform outmoded local codes can help communities meet water quality and land-use planning goals. Stormwater management is addressed largely by engineering solutions. However, nonconventional land-use planning strategies and regulatory tools, such as form-based codes, are often overlooked as a way to achieve water quality standards.

A form-based regulatory approach focuses on designating appropriate form and scale of development that is contextually sensitive to the surrounding landscape. This contrasts with Euclidean (conventional) zoning, which focuses on segregation of land uses. The form-based codes incorporate new standards for building façades and public spaces, yet conventional regulatory mechanisms, such as building heights and setbacks, are still utilized. While form-based code's primary organizing principle differs from Euclidean codes, it is not a complete departure from conventional zoning regulations, and instead serves as an alternative regulatory option for communities to employ at the regional, neighborhood, or site scale.

In addition to promoting contextually sensitive design, form-based codes foster interconnected patterns of development for the built environment and public realm. Advocates of the form-based approach assert that this is a viable regulatory mechanism for managing stormwater, resulting in development with significantly less impact on sensitive environments and resources.

A number of elements are commonly included in a form-based code, such as a regulating plan, public realm standards, and building form standards. A regulating plan serves as a map, outlining streets and public open spaces and designating where different building form standards apply. Typically, the urban-rural transect model is used for the form-based code regulating plan framework, depicting a gradient of urban forms that range from rural to highly urbanized zones. These designated zones specify the form and character of development appropriate for each zone. Most often the regulating plan is applied to areas within a framework of streets and blocks as opposed to large unrefined geographic areas.

Through the use of a regulating plan, high-density development could be concentrated away from environmentally sensitive areas. Similarly, a form-based code could prescribe appropriate LID practices for public spaces, such as use of bioretention cells or swales, type of vegetation used along public easements, lakes, streams, and streetscapes, or pervious materials for sidewalks – all designed within the context of the surrounding environment. Additional elements can be required to address community-specific needs, such as environmental resource standards to regulate stormwater drainage and infiltration, and landscaping standards to provide tree protection. For example, low impact development practices could be specified for watershed protection and restoration through reduced impervious cover. It is important to note that these standards would need to align with local BMP manual standards to be effective. A transect model could be used to indicate how the different types of LID practices would fit into the character of the zone. This in turn would help to ensure LID practices match with appropriate environmental conditions and development context.

The concept of a form-based code is just beginning to emerge in South Carolina municipal zoning regulations, yet several coastal communities are currently working towards the development and adoption of a form-based approach to zoning. There are, however states in the region that have considered or embraced this new regulatory concept. For instance, communities in Chatham County

North Carolina began exploring the potential for utilizing form-based code to achieve water quality standards for the Jordan Lake Watershed (Berg, 2009; Berg & Bendor, 2010). Also, in Florida the town of Bradenton successfully adopted a form-based code that includes an environmental resource standards element focusing on stormwater management (http://formbasedcodes.org/content/uploads/2014/02/bradenton-form-based-code.pdf).

More examples of where this regulatory tool has been adopted and implemented can be found on the Form-Based Codes Institute Website: www.formbasedcodes.org.

Incorporating LID into Ordinances Case Study: Richland County, SC Open Space Ordinance

From 1980 to 2010, Richland County's population increased by 43 percent to 386,000 residents. Significant urban sprawl has increased stormwater runoff and degraded water quality throughout the undeveloped portions of the County.

In late 2008, funded through a grant from the U.S. Army Corps of Engineers, Richland County partnered with the Center for Watershed Protection to form the Development Roundtable. Richland County's local codes and ordinances were systematically examined by the Roundtable with an eye toward promoting more environmentally-sensitive and economically viable development. The Roundtable included County staff (Administration, Planning, Stormwater and Conservation) and representatives from the development community and environmental and conservation groups. In October 2009, a consensus document entitled "Recommended Development Principles" was published. This document formed the basis for numerous revisions to the County's Land Development ordinances from 2010 through 2012. Ordinance revisions ranged from street and parking lot design, stream buffers, tree conservation, and stormwater management practices.

The open space design and management issue was the final and one of the most contentious issues before the Roundtable. Open space design goals focused on how best to incorporate smaller residential lot sizes to minimize total impervious area, reduce construction and infrastructure costs, provide recreational space, conserve natural areas and promote watershed protection. Over a period of approximately one year, Roundtable participants debated the merits of various open space requirements and how each requirement would benefit the development community and the environment. Open space design was simulated on numerous proposed subdivisions and compared with a conventional minimum lot size zoning requirement. This iterative process produced consensus on open space design principles benefiting both the development and environmental communities. Based on the consensus principles reached by the Roundtable, County staff drafted an optional Open Space Design ordinance. Adopted by County Council in 2013, the ordinance permits variation in lot sizes and relaxation of strict minimum lot size standards, and preserves sensitive lands for conservation within developments. Varied lot sizes not only provide home buyers a variety of more compact and sustainable housing options, but also reduce stormwater runoff by preserving open space, tree cover, stream buffers, wetlands and floodplains consistent with site characteristics.

The ordinance requires all "constrained open space" – a term coined by the County – in the development to be set aside and permanently protected. These areas, considered difficult to develop, include FEMA Special Flood Hazard Areas, stream buffers, wetlands, highly erodible soils with slopes greater than 25 percent, and open water. If the constrained open space comprises 25 percent of the development, no further open space set aside is required to use the ordinance. Constrained open space areas are based on a 1:1 ratio of open space area to actual acreage. Not only does the constrained open space requirement provide important environmental benefits, it avoids development costs and environmental externalities to mitigate stream, wetland, and floodplain impacts.

Developers are further incentivized to set aside "unconstrained open space" areas to obtain a density bonus over the base density in certain low-density residential districts.

Richland County, SC Open Space Ordinance (continued)

The County developed an unconstrained open space credit system based on a number of natural site factors such as location within a 303d listed water, extended stream buffers, hydrologic soil groups and slopes, protection of forests by type and age, and prime agricultural soils. Engineered unconstrained open space credits may be obtained by incorporating low impact development (LID) best management practices (BMPs) such as permeable pavement, infiltration and bioretention systems. Each unconstrained open space credit category listed above has a weight to incentivize setting aside additional open space areas normally not protected within a typical development. For example, installation of bioretention has a weight of two; therefore, every acre of bioretention open space set aside counts as two unconstrained open space credits. Density bonuses, up to a maximum of 20 percent, are based on the total number of unconstrained open space credits set aside in each development. This incentive is significant since LID BMPs are not currently required in County development permits.

The Open Space Design ordinance provides maximum design flexibility to each developer based on the specific natural resource features on the property and the proposed development layout. A copy of the Open Space Ordinance can be found in Section 26-186 of the Land Development Code for Richland County at this website: http://www.richlandonline.com/Government/Departments/PlanningDevelopment.aspx

Case Study Provided by Tracy Hegler, Director, Richland County planning and Developmental Services Department; James B. Atkins, Ph.D., Director, Richland County Conservation Department; Quinton Epps, Richland County General Stormwater Manager

Conservation, Land Use, and Stormwater Management Incentives

Incentives can be an important aspect of land conservation and LID management. Better site design principles that were discussed in this manual include opportunity for incentives, such as higher density units allowed when open space is preserved (See Laurel Oak Preserve Case Study) or conserved or reduced parking lot size when shared parking is used. Generally, fewer parking spaces allow more space for building, which is often an inducement for developers. Other motivations to use LID could be the environmental, recreation, tourism, and improved public health benefits outlined that are associated with clean water goals. Finally, monetary incentives through outright purchase of land for protection or tax reductions for lands placed in easements are also common incentive examples. These are only a few conservation and land use incentives; many other opportunities exist to promote watershed and stormwater goals.

Costs are incentives from two perspectives: 1) the actual cost of land development, LID implementation, and land conservation, and 2) how much these variables save the development cost or profit margin. The amount features cost (actual dollars spent) and the amount of a commodity saved is equal to added value (revenue). For example, space preserved by using smaller LID practices is a savings because the cost was not spent on this commodity and can be realized as a savings or profit margin in the overall revenue. Incentives for willingness to pay or perceptions of conservation, land use, and/or stormwater management should also be considered. For example, Oak Terrace Preserve homeowners were willing to pay more for residences in what they considered to be a "green" community (Vandiver and Hernandez, 2009).

Conservation Incentive Case Study: Laurel Oak Grove, James Island, SC

Gross Acreage: 6.34 ac
Open Space Acreage: 3.54 ac
Number of lots: 22
Net Density: 3.54 units/ac
Zoning: City of Charleston cluster development

Laurel Oak Grove was successfully able to integrate several low impact development techniques and LEED certification into affordable housing. When complete, Laurel Oak Grove will have 22 houses (13 in Phase 1 and 9 in Phase 2) situated on 6.3 acres with approximately half of the property in preserved open space. The basis of the site design is founded on the concept of "cohousing" – a practice that clusters houses at a higher density surrounding communal features, such as courtyards. The City of Charleston has a special zoning ordinance for this type of development for the purpose of "permitting unique developments that utilize flexible design that is sensitive to natural areas, provides quality open space, decreases stormwater runoff by reducing impervious surfaces, reduces the cost of infrastructure, and provides a mixture of lot sizes and housing options." HOA dues will be used to pay for the maintenance of common areas, but homeowners also receive 20 hours of educational classes about the green features of their homes and landscapes.

Central bioretention basin serves a dual purpose for community open space and stormwater treatment.

In addition to high density and conserved open space, the site also minimizes impervious surfaces. The 3-ft wide sidewalks are narrower than the typical 5-ft widths. Houses do not have individual driveways; parking is situated along the perimeter of the roadway. The parking spaces are gravel, and are limited to two per house. The asphalt road allows for resident access to the parking and houses on one side of the property; a gated, gravel access road for utilities and emergency vehicles was provided on the back side.

The soils on site have a high infiltration rate, allowing for shallow infiltrations basins and perforated underdrain as the main components of the stormwater management system. The narrow (20' wide) asphalt roadways are bordered by flat ribbon curbs, which allow stormwater to flow to pervious gravel parking areas. Gravel trenches and perforated underdrain pipes are underneath the gravel parking areas so that stormwater runoff will flow through the rock, into the underdrain, and into the infiltration basins. Under saturated soil conditions, the water passes from the infiltration basins into overflow catch basins and into an underground submerged piping system which discharges into low lying, undeveloped areas of the property. The infiltration basins serve a secondary purpose as attractive, vegetated common space features for the homeowners – and are located central to the individual houses.

Case study provided by Tamara Avery, Land Development Manager at Sea Island Habitat for Humanity; Jenny Palmer, P.E., Senior Civil Engineer at Seamon Whiteside; Amanda Herring, Senior Zoning Planner, City of Charleston

Concept plan for Laurel Oak Grove (provided by Seamon Whiteside + Associates)

Stormwater management incentives can also include the ability to meet local Total Maximum Daily Loads (TMDLs). For example, some LID practices may be more effective than traditional BMPs like dry or wet ponds at removing a pollutant of concern (e.g., bacteria) from the environment. Stormwater management is easiest and least costly when done at the earliest stages of land development, such as during the early development stage where there is an opportunity to conserve natural lands (see Section 3.2) and use better site design. Stormwater management increases in complexity and cost as sites involve more urban infrastructure and more stormwater management infrastructure (e.g., pipes or LID structural components). Therefore, there are monetary incentives to incorporate better stormwater management through conservation of natural land, better site design, non-structural LID, and structural LID in a stepwise fashion. LID incentives include:

- ✧ Decentralizing the stormwater treatment practice
- ✧ Reducing the size and cost of the practice
- ✧ Reducing soil disturbance (which decreases grading and compaction, while providing more storage capacity in soils)
- ✧ Reducing impervious cover
- ✧ Supporting TMDL requirements

Incentives can encourage adoption of LID practices in the community. The US EPA's LID Barrier Busters Fact Sheet titled, "Encouraging Low Impact Development" (US EPA, 2012) listed the following four most common type of local incentive mechanisms to plan, design, and build LID projects.

1. Stormwater fee discount or credit – LID practices result in a stormwater credit and/or for those municipalities where there is a stormwater fee, LID practices receive a discount from the fee.
2. Development incentives – Municipalities can offer incentives such as reduced permit fees, expedited permit process, higher density development allowance, and/or exemptions from permitting requirements if LID practices are used.
3. Rebates and installation financing – Municipalities can offer grants, matching funds, low-interest loans, tax credits, and/or reimbursement when LID practices are used.
4. Awards and recognition programs – Municipalities can recognize the people and places where LID practices are implemented. Recognition examples include newspaper articles, website announcements, notes in utility bill mailings, and/or LID-design contests.

Examples of LID in Local Ordinances

Some local governments have included recommendations in design manuals or ordinances that encourage low impact development planning and practices. The list in Table 2.3-1 pulls together the best available information at the time of publication and may be subject to change. Resource information for these ordinances is included in the References section at the end of this chapter.

Table 2.3-3. LID Requirements from Ordinances in the Coastal Zone

Municipality	Requirement
Beaufort County	♦ Established 10% effective imperviousness threshold for development or redevelopment ♦ Pollutants (phosphorus, nitrogen, and bacteria) are specifically targeted for control; treatment achieved by 10% effective imperviousness (N&P) and 5% effective imperviousness (FC) ♦ River protection buffer of 50 feet ♦ Detention and retention ponds shall be designed with relatively flat side slopes along the shoreline, and with meandering shorelines where possible to increase the length of shoreline, thus offering more space for the growth of littoral vegetation for pollution control purposes ♦ No new stormwater discharge shall be permitted onto any beaches/ shorelines
Charleston County	Zoning and Land Development Regulations Ordinance establishes limits on building density, buffer & setback requirements, parking lot islands, tree protection, planting species selection, and screening requirements for ponds
Georgetown County	When wet ponds are employed, retention/planting of littoral vegetation, particularly native wetland plants selected for nutrient and contaminant uptake capacity, shall be included
Horry County	♦ Hwy 707/Holmestown Road overlay zones set limits of 65% imperviousness for the total lot area, unless parking areas utilize LID strategies to infiltrate runoff. A 25-ft vegetated buffer is to be provided along the highway and side/rear setbacks are to be established as vegetated buffers ♦ A landscape plan for all portions of the drainage system shall be part of the stormwater management and sediment control plan to address the following: • Tree saving and planting plan • Types of vegetation that will be used for bank stabilization, erosion control, sediment control, aesthetics, and water quality improvement • Any special requirements related to the landscaping of the drainage system and efforts necessary to preserve the natural aspects of the drainage system • Landscaping shall not be installed within the easement unless it is a part of the drainage system
City of Hardeeville	The Municipal Zoning & Development Ordinance (MZDO) states that impervious areas must drain to pervious surfaces before going into a storm drain system; pervious parking is encouraged
City of Myrtle Beach	“Vegetated buffer strips shall be created and/or preferably retained in their natural state along the banks of all watercourses, waterbodies, or wetlands. The buffer shall be wide enough to allow for periodic flooding, provide access to the waterbody, and act as a filter to trap sediment in runoff”

Table 2.3-3. LID Requirements from Ordinances in the Coastal Zone	
Municipality	**Requirement**
City of North Myrtle Beach	♦ Street design requirement includes landscape requirements ♦ Landscape buffers ♦ Pervious parking spaces are required for all spaces above minimum requirement
Town of Bluffton	♦ All projects shall have in-series BMPs ♦ All stormwater management systems shall contain at minimum one wet detention BMP, one vegetative BMP, and one filter or infiltration-based BMP ♦ 50% of commercial parking must be pervious
Town of Hilton Head	♦ The use of wetlands for storing and purifying runoff is strongly encouraged. Regulated wetlands shall not be disturbed by the construction of detention ponds in them or sufficiently near to deprive them of required runoff or to lower their normal water table elevations. ♦ Landscape design and plantings should further opportunities for percolation, retention, detention, filtration and plant absorption of site-generated stormwater runoff ♦ No new stormwater discharge shall be permitted onto any beaches/ shoreline ♦ Channeling runoff directly into natural waterbodies from pipes, curbs, lined channels, hoses, impervious surfaces, rooftops or similar methods shall not be allowed unless methods of filtration are provided. Instead, runoff shall be routed over a longer distance through sheet flow, swales, drywells or infiltration ditches and other methods to increase percolation, allow suspended solids to settle and remove other pollutants
Town of Mt. Pleasant	♦ Pervious material required for parking spaces beyond minimum requirement
Town of Pawley's Island	♦ The maximum allowable impervious surface area is between 1,000 and 4,000 square feet and shall not exceed 40% of the lot size ♦ Driveways and off-street parking are specifically prohibited from being constructed of impervious material
Town of Summerville	♦ When possible, provide a 20-ft minimum buffer between the property line and the end of all pipes or energy dissipation measures installed

2.4 Neighborhood Planning Considerations for Coastal SC

Among the strategies for improved stormwater management is the use of innovative community and subdivision designs that reduce the impact on water quality and required municipal services.

LID and Compact Development

Compact development patterns generate far less stormwater per unit of development than the typical single use suburban model. Additionally, on the watershed scale, more compact development patterns provide the opportunity to "localize" hydrologic impacts.

According to 2010 census data (summarized in Table 2.4-1), South Carolina's eight coastal counties experienced 24.3 percent population growth in the last decade, which exceeds the state average of 15.3 percent. Beaufort County experienced a 34.1 percent population increase during this time, while Horry County similarly experienced a 37.0 percent increase in population (SC Budget and Control Board, 2014). These numbers do not reflect the increase in commercial development, secondary homes, and vacation resorts and it is estimated that land development occurs at more than double the rate of actual population growth (Beach, 2002 and USDA, 2000).

Table 2.4-1. Resident Population of South Carolina by County*

County	Resident Population (April 2000)	Resident Population (April 2010)	Numeric Change	Percent Change
Beaufort	120,937	162,233	41,296	34.1
Berkeley	142,651	177,843	35,192	24.7
Charleston	309,969	350,209	40,209	13.0
Colleton	38,264	38,892	628	1.6
Dorchester	96,413	136,555	40,142	41.6
Georgetown	55,797	60,158	4,361	7.8
Horry	196,629	269,291	72,662	37.0
Jasper	20,678	24,777	4,099	19.8
TOTAL	981,338	1,219,958	238,620	24.3

** excerpted from South Carolina Budget and Control Board's Community Profiles*

Urban sprawl growth patterns often generate unnecessary impervious cover. But it is important to consider the overall pattern of development. As can be seen in Figure 2.4-1, overall impervious cover for a watershed decreases as site density increases, assuming the same amount of growth.

For example, in the Greenville-Spartanburg region of South Carolina, one of the fastest growing regions of the country, land consumption is currently five times the rate of population growth. This pattern indicates low-density development, or sprawl (Campbell, et al. 2007). Upstate Forever, a local non-profit organization, partnered with Clemson University to examine the water quality

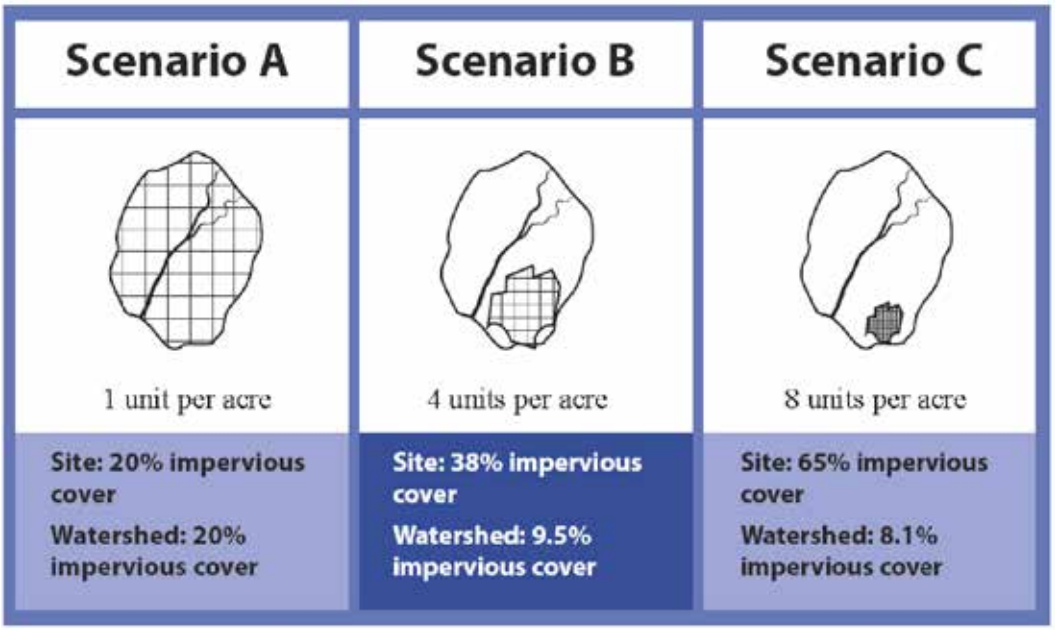


Figure 2.4-1. Illustration of Using Higher Density to Reduce Impervious Cover This illustration, adapted from the U.S. EPA publication "Protecting Water Resources with Higher Density Develoment," shows how increasing density at the site level decreases impervious cover for the watershed (EPA, 2006).

impacts of various growth patterns ranging from the current sprawl to more compact development (land consumption and population growth rates are equal). The researchers found that more compact development would cut the amount of sediment and nutrient (nitrogen and phosphorous) pollution from future development in half. Even though population growth remained the same in each scenario, minimizing the developed land area would result in overall watershed benefits (Privette, et al. 2011).

Planned Unit Development

As part of the 1994 comprehensive land-use planning legislation, a provision for planned development districts (PDDs) was codified into SC law (SC 6-29-740) to achieve comprehensive plan objectives for local governments. The purpose of the provision was to allow for flexibility in the development process, encouraging innovative site planning for residential, commercial, institutional, and industrial developments. Local governing authorities may establish these districts as amendments to locally adopted zoning ordinances with the overall goal of improving design, character, and quality of mixed-use developments while preserving natural features of open spaces. A development permitted as part of a PDD is referred to as a planned unit development (PUD).

PUDs offer a comprehensive approach to the design of large scale developments, as opposed to the conventional lot-by-lot approach typically allowed in community zoning codes and regulations. Unlike conventional development, a PUD allows developers to by-pass standard zoning and development regulations in exchange for site-specific design and development innovations, such as placement of structures, mixed land uses, conservation of open spaces, and natural resource preservation.

The PUD has become an increasingly popular land development practice across rural areas of the U.S. coastal zone, and is a commonly utilized planning tool in large undeveloped land tracts of

coastal jurisdictions in South Carolina. All eight coastal counties and a number of municipalities within their borders have adopted/authorized PUD provisions in their local zoning codes; however, there is significant variation in PUD baseline standards/requirements across or within the local jurisdictions. For example, minimum acreage requirements for PUDs vary across jurisdictions anywhere from 1 acre to 50 acres. Nevertheless, there are a number of common elements often incorporated in varying combinations in PUDs, including: flexibility, open space preservation, resource

Planned Unit Development Case Study: Palmetto Bluff

Palmetto Bluff is a sea island with expansive frontage on the May, Cooper and New Rivers. For most of the last century, Palmetto Bluff has been managed and enjoyed as a private wildlife and forest preserve. The property has been carefully master-planned to grow into a complete, balanced, controlled community within a coastal setting. Its size makes possible the creation of a series of inter-related, yet distinctive settlements and natural preserves. The combination of its location and varied natural features makes this a unique community.

Palmetto Bluff has been designed to preserve the land's beauty, vastness, and rich landscape while taking advantage of the views and sea island setting to create a strong sense of place. Owners, along with their Architect and Landscape Architect are encouraged to work together from the initial phases of design to ensure all aspects of the design are consistent with specific design objectives, such as implementing Sustainable building systems, site development, materials and construction techniques in all development. Reducing consumption of materials and energy, reducing waste and making intelligent choices about how a building is used benefits both Palmetto Bluff as a community and the sensitive sea island landscape as a whole. Palmetto Bluff is committed to the implementation of Sustainable and Low Impact Design concepts such as reducing the house's "footprint" on the land, energy and water conservation measures, reuse and recycling of building materials, and the preservation of the existing forest and river marsh frontage.

The text for the Palmetto Bluff Planned Unit Development is based on the Beaufort County Zoning and Development Standards Ordinance 90/3 with the following amendments:

- River Protection Overlay District
  - The buffer width was changed from fifty (50) feet to an average of one hundred (100) feet, with a minimum of eighty (80) feet.
  - Development setbacks changed from fifty (50) feet to an average of one hundred (100) feet, with a minimum of eighty (80) feet. Additionally, streets and roads to access land within in the PUD can penetrate the buffer provided stormwater runoff is treated.

- Site Design and Development Standards
  - Minimum Off-Street Parking in the planned resort, residential and commercial developments the parking spaces were changed for the following uses. The assumption underlying the change was that a substantial number of visitors would arrive by public transportation, thus requiring fewer spaces than the current requirements.
    - » Auditorium and Theaters: 0.2 spaces for each spectator seat.
    - » Automobile Service Station: One (1) space for each vehicle stored or parked, plus one (1) space for each employee.
    - » Bank: One (1) space for each two-hundred square feet (200 sf) of gross floor space, plus one (1) space for each two (2) employees.
    - » Church: One (1) space for each six (6) seats in the main assembly room.

Palmetto Bluff Contacts: Stephanie Gentemann, Palmetto Bluff Design Review Board; Jay Walea, Palmetto Bluff Conservancy Wildlife Manager; Dallas Wood, Director of Development, Crescent Communities

protection, mixed types of housing, uses, and densities, innovative planning and site design, high quality development, public access opportunities, comprehensive plan and or/long-range plan consistency, unified site design, promotion of agriculture and forestry practices, and water quality protection.

Often local codes and ordinances prohibit or restrict the use of LID strategies, requiring special permits or variances which may discourage developers from implementing LID practices in their designs. Because PUD requirements are generally formulated around a flexible site design process and are not subject to existing conventional outdated codes and ordinances, they provide an opportunity/avenue for increasing LID application (e.g., buffers, bioretention cells and swales, clustering development, dedicated open space, pervious driveways and sidewalks). Incorporating LID features into the site design of a PUD can help maintain the predevelopment hydrology of the property and minimize the impacts of runoff, therefore improving overall water quality.

Generally speaking, LID strategies are minimally addressed in existing South Carolina PUDs; however, communities would benefit by incorporating specific language in PUD development agreements encouraging or requiring LID implementation.

Transfer of Development Rights

Preserving and protecting natural lands from development can be accomplished using Transfer of Development Rights (TDRs) and Purchase of Development Rights (PDRs). TDRs are rural areas that can be sold to private builders. The builder pays the rural land owner in exchange for the ability to build in excess of limits where urban growth areas are designated. TDRs are considered a trading system since the TDR value is based on building demand and the TDR is paid by the builder. However, PDRs are programs that pay landowners to not convert farmland to development. PDR programs are often led and funded by the local government (Anderson and Lohof, 1997). TDR and PDR land selection and prioritization can be supported using natural resource inventories, cost, or opportunity. The TDRs and PDRs strive to meet environmental objectives such as habitat protection and open space preservation.

TDRs and PDRs are voluntary so that legal conflicts are avoided and costs are often lower than land purchase. TDRs and PDRs are commonly outlined in local codes, and there are some state PDR programs (Anderson and Lohof, 1997). Communities can use TDRs and PDRs to protect natural lands from development by compensating property owners in exchange for their commitment to limit development in perpetuity.

Incorporating LID into Existing Development

Developments that occurred with no stormwater management controls or with outdated stormwater management controls, represent an opportunity to capture and treat stormwater runoff. Assessing the site for potential to capture and treat stormwater is an opportunity to improve water quality and provide waterway protection to the community. The potential retrofit site should initially be assessed for LID feasibility, utility conflicts, contributing drainage area, LID practice type and size, estimated costs, and any other constraints or considerations. Retrofits can also be done during redevelopment; often, LID practices are required during redevelopment to meet the most up-to-date regulations. Finally, LID retrofits are commonly identified in watershed planning efforts to meet local water quality goals.

Retrofitting

Stormwater retrofits are structural stormwater management practices that can be used to address existing stormwater management problems in a watershed. These practices are installed in upland areas to capture and treat stormwater runoff before it is delivered to the storm drainage system. They are an essential element of a holistic watershed restoration program that can result in improved water quality, increased groundwater recharge, channel protection, and flood control. Stormwater retrofits can address existing problems and help establish a stable, predictable hydrologic regime by regulating the volume, duration, frequency, and rate of stormwater runoff. In addition, stormwater retrofits can serve as demonstration projects that are visual centerpieces to educate residents and build community interest in watershed restoration.

A nationally recognized and commonly employed method to assess stormwater retrofit potential is the Retrofit Reconnaissance Investigation (RRI) manual (Schueler et al., 2007). This manual was developed for and generally is used in urban watersheds. In addition, the Rural Retrofit Assessment (RRA) was compiled to include common agricultural retrofit considerations. The retrofit manual includes a step by step process that can and should be updated to meet local conditions.

Redevelopment

Redevelopment is development that occurs on previously developed land. Redevelopment and new development require stormwater management that meets the local requirements. Redevelopment from a watershed and stormwater management perspective is an opportunity to bring the developed site into compliance with the current stormwater requirements. Redevelopment of impervious surfaces rather than new development of pervious surfaces will prevent further increases in the watershed's impervious cover. In addition, redevelopment is an opportunity to upgrade aging infrastructure, such as sewer and stormwater pipes, that are deteriorated and causing water impairments (US EPA, 2006; Hicks, 2014).

Redevelopment can be a tool to direct development to urban corridors and away from undeveloped areas (i.e., conservation of natural areas). For example, the US EPA lists the following common programs that include redevelopment as part of a larger investment effort: business development districts, Main Street programs for older downtowns, brownfield programs, vacant property conversions, and others. Redevelopment is another way to target development in already developed areas and also provide up-to-date stormwater management to meet water quality and habitat goals.

Infill Development

Infill development occurs in unused or underused areas such as parking lots, vacant lots, greyfields[1], and/or brownfields[2]. Often, these areas already have transportation, utilities, and other amenities in place. Concentrating growth in urban corridors is preferred due to the ability to re-energize urban growth and reduce stress to the natural habitat in undeveloped watersheds.

1 Greyfields are defined as "sites in abandoned or underutilized commercial areas" by the EPA (available at http://www.epa.gov/dced/pdf/sg_stormwater_BMP.pdf)

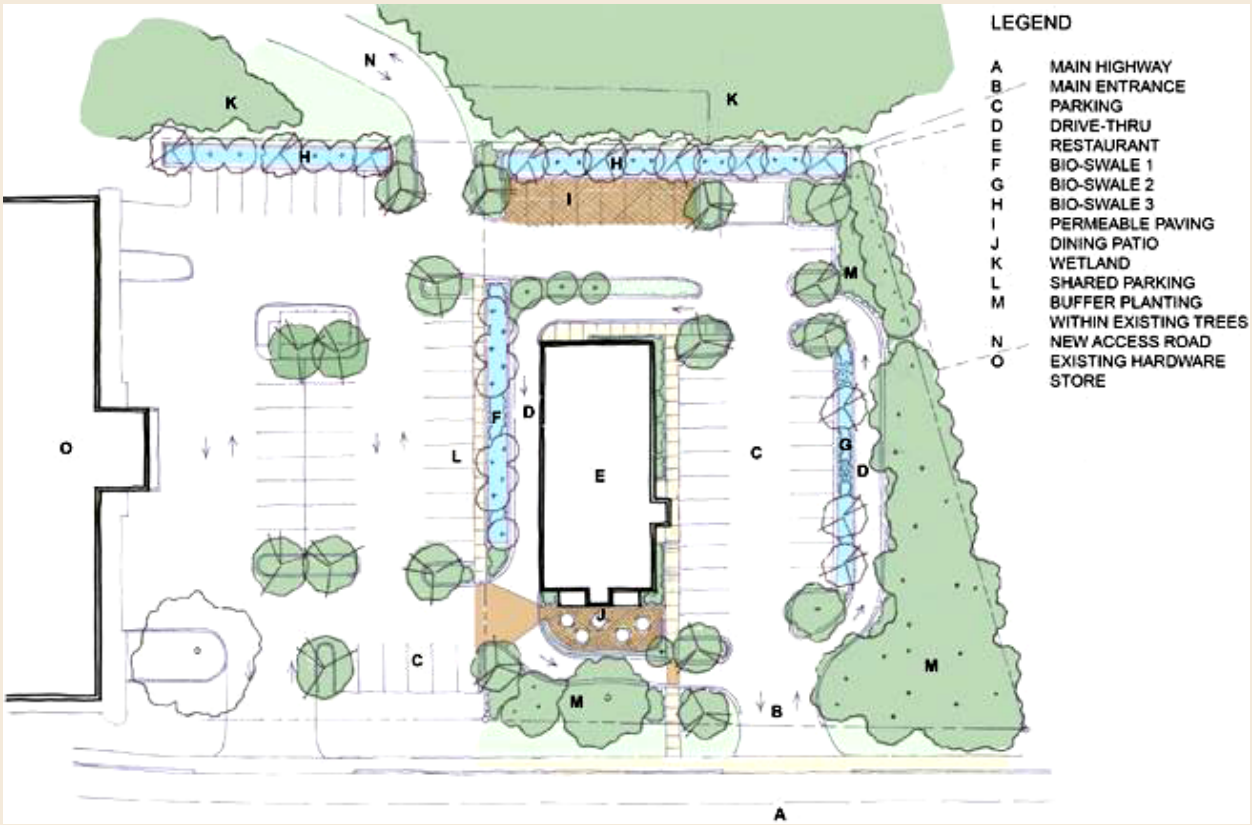
2 Brownfields are defined by the EPA as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of hazardous substance, pollutant, or contaminant." See http://www.epa.gov/swerosps/bf/overview/glossary.htm

Infill development considerations include unintended code barriers, additional site contamination, and/or proximity to the immediate coastline and the associated natural hazards. Development code requirements can be unintended barriers to coastal waterfront redevelopment and may require changes. Additionally, past land use contamination can present real and perceived pollution problems and considerations for infill development.

Redevelopment Development Case Study: Bojangles Restaurant, Mt. Pleasant, SC

On a one-acre lot that once contained a dry cleaning business, a new Bojangles Restaurant was constructed in 2012 along Highway 17 in Mt. Pleasant. The redevelopment plan included modifications to the original building, parking lot, and landscaping plan to incorporate several low impact development BMPs. Perhaps the most unique aspect of this project was native vegetation: many existing trees were preserved and about 45 new trees were planted on the compact, one-acre site. The vegetation is incorporated in ornamental and functional ways: three bioswales along the periphery of the site capture and treat stormwater runoff. The swale along the drive-thru is planted with birch (*Betula nigra*) trees, which are deciduous. The trees provide shade in the summer and allow light to warm the building in the winter. The impervious area in the parking lot was reduced by the incorporation of permeable paving and shared parking spaces with the adjacent business.

Site plan courtesy of J.R. Kramer, Remark Landscape Architecture



Perhaps the biggest opportunity for any stormwater manager is to work with local governments to develop a range of policies and incentives to direct development to already degraded areas. Communities can enjoy a significant reduction in regional runoff if they take advantage of underused properties in abandoned or underutilized commercial areas, such as infill, brownfield, or greyfield sites (Congress for New Urbanism et al., 2001). Redeveloping already degraded sites such as abandoned shopping centers or underutilized parking lots rather than paving greenfield sites for new development significantly reduces total impervious area and water quality impacts.

Protect future development through resource planning to direct growth to redevelopment sites and infill areas. Complete population growth projections at the jurisdictional-scale for all coastal areas in tandem with natural resource identification and mapping to identify key protection areas as growth occurs. These efforts may feed into a local comprehensive plan, policy, or ordinance that guides current and future development patterns into designated areas. Redevelopment in urban areas can protect undeveloped natural resources, support working waterfronts, and incorporate stormwater management where there are no controls or inadequate controls. Infill development is an excellent opportunity for LID stormwater management. As an example, Horry County, SC, has open space advisory boards that are in the process of preparing a plan to promote infill as a prioritization tool (Wood, pers. comm., 2013).

2.5 Regulatory Strategies

Policy implementation for effective stormwater management requires qualified staff, a clear and transparent process, documented procedures, and flexibility. The site plan review process can prepare the applicant for a more successful permit procedure, result in improved LID designs, and reduce staff time. The stormwater management program's process should include documentation with databases, forms and checklists, and staff that support the tracking, inspection, and verification. Flexibility can be built into the program's implementation process by qualified and trained staff; these staff members can have the ability to suggest improvements, alter processes when needed, and offer innovative solutions to permit applicants when needed. Tracking, inspection, and verification provide the level of safety needed to document that the regulations are implemented and ensure that the water quality goals are met to the best of the state's ability. Finally, an enforcement program highlights the importance of compliance with state regulations.

Stormwater management programs should include a clear, comprehensive, transparent site review process, as well as tracking, inspection, verification, and enforcement. LID should be incorporated and highlighted in the stormwater management program.

Site Plan Review Process

Approval of a stormwater plan is an important milestone. After plans are approved, making changes to the situation "on the ground" can be very difficult. Therefore, the plan review and approval process is the best opportunity to get things right with stormwater design. A well-organized stormwater plan review process can help ensure:

- ✧ Stormwater BMP designs meet the standards and specifications in the ordinance and design manual and are being properly applied to the project site.

- ✧ Stormwater plans incorporate innovative practices, such as site design techniques and low-impact development, early in the planning process.
- ✧ BMPs are sited within easements and have adequate access for inspection and maintenance.
- ✧ Proper construction sequences must be specified on plans to ensure that BMPs do not become clogged before the site is stabilized.
- ✧ Adequate maintenance agreements that assign long-term maintenance responsibility are in place.
- ✧ The stormwater BMP plan approval is coordinated with other necessary environmental permits for erosion and sediment control, streams, wetlands, floodplains, and dams.
- ✧ Approved stormwater BMPs are covered by performance bonds to ensure proper installation in the field.
- ✧ The location and specifications of approved stormwater BMPs are properly documented at each site so that inspection and maintenance staff will have the necessary information.
- ✧ The review process generates the appropriate amount of user fees to help defray development review costs.

Local governments have experience with general development plan review, but reviewing LID projects may be a relatively new function within a local agency. A stormwater plan review process does not have to be created anew. The biggest challenges are securing an adequate and well-trained staff and integrating stormwater reviews with other local reviews for drainage, utilities, erosion control, roads, and site layout. More detailed information for site plan review is available in the Managing Stormwater in Your Community Chapter 7, The Stormwater Plan Review Process (CWP, 2008). Finally, ensuring that the stormwater program is fully funded and staffed is another consideration for a successful stormwater program that incorporates LID in the coastal policy.

A Coordinated Approach for Stormwater Management

There is a need for a coordinated approach to stormwater management practice permit, design, build, and maintenance processes. This need was voiced several times in the stakeholder meetings during the development of this manual. A multidisciplinary approach for stormwater management in coastal SC is recommended. Here are key tips to implement this approach in your municipality, locality, agency, and/or group:

1. Set a clear, concise goal to implement low impact development stormwater management practices.
2. Hold and attend trainings to ensure staff and other vested parties are up to date on the subject.
3. Use these training opportunities to communicate common goals, recognize and promote areas that work well, find areas for improvement, develop solutions, and schedule action items from these findings.

4. Coordinate the agency, group, and people that review site plans, permits, designs, and construction.
    a. Recognize problems early to save time and money.
    b. Streamline the process, cross train, and better ensure the practices meet the standards and meet the goal (#1).
5. Integrate development review and inspections. Develop and use standard operating procedures that ensure a coordinated approach is followed.
    a. Use checklists and standard operating procedures.
    b. Use a documentation and tracking system.
6. Develop and follow a performance review to measure success, to make changes as needed, and to update procedures based on the best available information.
    a. Perform on a regular basis.

These steps for a coordinated approach to stormwater management will promote best practices in the field and are designed to adapt to change based on lessons learned and new information. The objective is to set a clear, concise goal in the municipality, locality, agency, and/or group. For more details on how to set up this coordinated approach for stormwater management, see Chapter 7 "The Stormwater Plan Review Process" in *Managing Stormwater in Your Community: A Guide for Building an Effective Post Construction Progran* (Hirschman and Kosco, 2008). Use this goal to overcome existing barriers and work to refine this coordinated approach for stormwater management in coastal South Carolina.

Tracking, Inspection, and Verification

Tracking, inspection, and verification are important local stormwater program components needed to ensure the natural resource protection that was planned for is achieved. Tracking is commonly achieved using a database such as Microsoft Excel and/or Access, geographic location in mapping systems such as Geographical Information System (GIS), and/or paper files. Inspections are part of the permit process and are completed to ensure that the practice was installed, was installed in the correct location, and was installed per the permit plans. Verification inspection ensures that the practice continues to maintain the natural resource protection that was planned over time. Verification protocols for each type of practice should be developed. Inspection and verification maintain a level of safety because they insert checks and balances into the Stormwater Program to identify practices that are in compliance and identify practices that require corrective or preventative maintenance to meet the compliance threshold. For example, the MS4 permit in South Carolina requires inspection of stormwater BMPs once during each 5-year permit cycle. Tracking is a mechanism that compiles the past and present practices. A standardized, rapid inspection approach should be in place to track, inspect, and verify the low impact development practices. Additional information for tracking, inspection, and verification are available in Hirschman and Kosco (2008) in Section 6.5. "Outlining the Policy and Procedures Manual."

Enforcement

Enforcement is a last resort to bring a stormwater practice into permit compliance. The permitting authority should have a standard process with trigger thresholds, recommended actions, and ultimately strong enforcement options for noncompliance. For example, if a verification field inspection indicates that the practice is not in compliance (e.g., not performing as designed and permitted) then the facility manager should be given a defined time frame (e.g., up to two months) to bring the practice into compliance. Enforcement is a necessary tool to keep the state Stormwater Program in compliance with US EPA federal regulations. Enforcement of stormwater regulations is handled by the SCDHEC BOW's Water Pollution Enforcement Section.

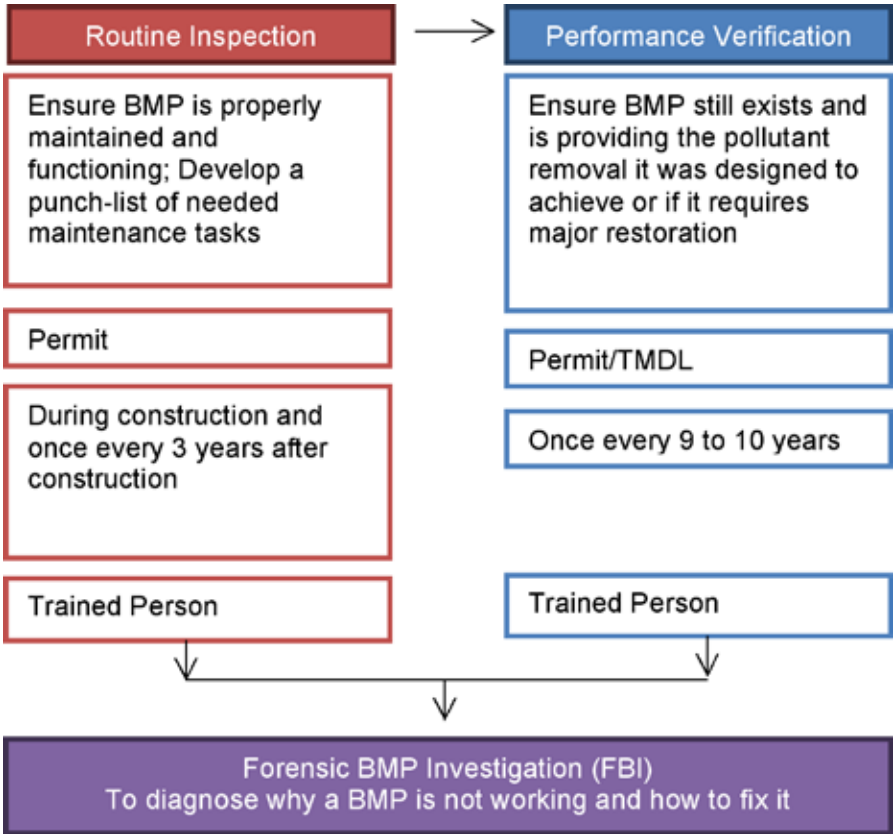


Figure 2.5-2. Routine inspections and performance verification are shown with descriptions, application, timeframe, personnel, and endpoint. Adapted from Goulet and Schueler (2012).

2.6 References:

1. Anderson, Robert C. and Andrew Q. Lohof. 1997. The United States Experience with Economic Incentives in Environmental Pollution Control Policy. Environmental Law Institute. Washington, DC.
2. Beach, Dana. 2002. *Coastal Sprawl: The Effects of Urban Design on Aquatic Ecosystems in the United States*. The Pew Charitable Trusts.
3. Berg, Hannah Elizabeth. 2009. Form-based Solutions for Watershed Protection: A case study of the Jordan Lake Nutrient Strategy in North Carolina. Retrieved February 2014, from CarolinaDigitalRepository. Available online at https://cdr.lib.unc.edu/record/uuid:58b4221a-882d-401d-b5a4-22fe573c7941
4. Berg, H.E. and T.K. BenDor. 2010. A Case Study of Form-based Solutions for Watershed Protection. Environmental Management. 46(3):436-51
5. Campbell, C., J. Allen, and K.S. Lu 2007. Modeling Growth and Predicting Future Developed Land in the Upstate of South Carolina. Strom Thurmond Institute, Clemson University.
6. Center for Watershed Protection (CWP). 1998. Rapid Watershed Planning Handbook: A Comprehensive Guide to Managing Urbanizing Watersheds. U.S. Environmental Protection Agency. Center for Watershed Protection. Ellicott City, MD.
7. Center for Watershed Protection (CWP). 2008. Managing stormwater in your community: A guide for building an effective Post-Construction Program. Ellicott City, MD.
8. Congress for New Urbanism, Pricewaterhouse Coopers, and L. S. Sobel. 2001. Greyfields into Goldfields: Greyfield Mall Characteristics Revitalization Success Stories. From Failing Shopping Centers to Great Neighborhoods. Center for New Urbanism, San Francisco, CA.
9. Goulet, N. and T. Schueler. 2012. Final recommended principles and protocols for urban stormwater BMP verification. CBP Urban Stormwater Workgroup. Annapolis, MD.
10. Hicks, Shannon. 2014. Personal communication.
11. Hirshman, D., J. Kosco. 2008. Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program. EPA Publication No: 833-R-08-001. Center for Watershed Protection, Ellicott City, MD. Available online at: http://www.cwp.org/online-watershed-library/doc_download/70-post-construction-manual-managing-stormwater-in-your-community
12. North Carolina Cooperative Extension (NCCE). 2009. Low Impact Development a guidebook for North Carolina. Available at www.ncsu.edu/WECO/LID
13. Privette, C.V., S.W. Taylor, and J.C. Hayes, Clemson University; L.S. Hallo and H.B. Nix, Upstate Forever. 2011. Forecasting the Impacts of Future Development within the Reedy River Watershed on Water Quantity and Quality.
14. Rhode Island Department of Environmental Management (RI DEM) and Coastal Resources Management Council (CMC). 2011. Rhode Island Low Impact Development Site Planning and Design Guidance Manual.

15. SCDHEC. 2002. Standards for Stormwater Management and Sediment Reduction Regulation 72-300—thru 72-316. Available at: https://www.scdhec.gov/Agency/docs/water-regs/r72-300.pdf

16. SCDHEC. 2005. South Carolina DHEC Storm Water Management BMP Handbook. Available at http://www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/

17. SCDHEC. 2013. NPDES general permit for stormwater discharges from large and small construction activities. SCDHEC, Bureau of Water. SCR100000. Available at http://www.scdhec.gov/Environment/WaterQuality/Stormwater/Overview/

18. Schueler, T. 2000. "The Tools of Watershed Protection." The Practice of Watershed Protection. Eds. T. Schueler and H. Holland. Center for Watershed Protection. Ellicott City, MD.

19. Schueler, T., D. Hirschman, M. Novotney, J. Zielinski. 2007. Manual 3: Urban Stormwater Retrofit Practices Manual.:Urban Subwatershed Restoration Manual Series. Center for Watershed Protection, Ellicott City, MD. Available for download at http://www.cwp.org/online-watershed-library/cat_view/64-manuals-and-plans/80-urban-subwatershed-restoration-manual-series

20. SC Budget and Control Board. 2014. *Resident Population of South Carolina by County: Census 2000 and Census 2010*. Available at: http://www.sccommunityprofiles.org/census2010/pop2010_table6.php

21. USDA NRCS. 2000. Summary report: 1997 national resources inventory (revised December 2000). Washington, DC and Ames, IA: USDA Natural Resource Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/nri/?&cid=nrcs143_013647.

22. US EPA. 2006. Redevelopment Factsheet. US Environmental Protection Agency: Washington, DC. Available online at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

23. US EPA. 2012. Encouraging low impact development: Incentives can encourage adoption of LID practices in your community. EPA 841-N-12-003G. Washington, DC. Available online at: http://water.epa.gov/polwaste/green/upload/bbfs7encouraging.pdf

24. US EPA. 2013. Our built and natural environments: A technical review of the interactions among land use, transportation, and environmental quality. 2nd edition. Office of Sustainable Communities Smart Growth Program. EPA 231K13001. Available online at http://www.epa.gov/dced/built.htm

25. Vandiver, Lisa and Debra Hernandez. 2009. Assessment of Stormwater Management in Coastal South Carolina: A Focus on Stormwater Ponds and Low Impact Development Practices. Charleston, SC.

26. Wood, Ida Leigh. 2013. Personal communication.