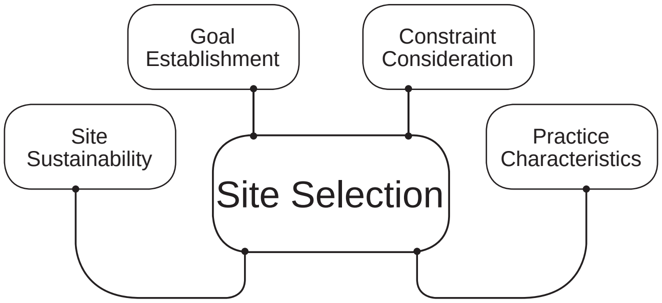
Site Selection

Project Partners Evaluate a Site; Smiths Station, AL

The selection of a site for stormwater control measure (SCM) installation is often the most important step in meeting pollutant removal goals. Site selection should follow four primary, general steps.



Goal Establishment

Site selection should consider constraints of a selected site and the overall project goals. Well-defined and established goals of a particular project are important to identify the best practice for a given location.

Goals may include:

- Conservation or preservation of a site
- Reduced impervious cover
- Reduced impact on water resources
- Water quality improvement
- Use of natural features for stormwater management
- Education about stormwater management or a particular practice
- Demonstration of a particular SCM for technology transfer

Prior to implementing a structural SCM, other means of reducing impervious surfaces and minimizing runoff should be considered in meeting an established goal.

Constraint Consideration

Site Layout: A site layout should be created to show resources and features on site that should be protected as well as site constraints. These include existing buffers, transplantable native vegetation, existing infrastructure, and pretreatment mechanisms.

Constraints: Establishing a list of constraints for a site is crucial to assigning a SCM that will perform efficiently. Site constraints may be natural or man–made structures and are listed in Table 2.1.

Table 2.1

Natural	Man-made
Steep Slopes	Existing Infrastructure
Compacted Soils	Right of Ways
Jurisdictional Wetlands*	Electrical Lines
Stream Channels*	Fiber Optic Cable
100-Year Floodplains*	Sewer Lines
Existing Riparian Buffers*	Water Lines
Forest Conservation Areas*	Other Utilities
Critical Areas*	Roads
Endangered/Threatened Species*	Septic Drain Fields
Water Table depth	Wells
Shallow Depth to Bedrock	

*Potential Environmental Regulatory Constraints

Natural Constraints

In-Situ Soils: Use the USDA Web Soil Survey to identify soil map units and to make initial interpretations for potential uses and limitations of a site. However, since most soil map units have inclusions of other soils that may be quite different, detailed evaluations should be made at the proposed site by a professional soil scientist or soil classifier. On-site evaluations should properly identify a soil or the hydrologic soil group (HSG) and the final decision for use should be made based on the detailed determination of soil series or HSG. For a detailed list of HSG properties, see Table

A.3 in Appendix A on Stormwater Hydrology. A roster for Alabama Professional Soil Classifiers can be found at http://alabamasoilclassifiers.org/.

Compacted Soils: Compacted soils are an issue for many structural SCMs because their compressed structure causes an inability to properly hold and conduct water, nutrients, and air. Compacted soils can be a result of natural forces such as rain, agricultural forces such as tillage operations or crop rotation, and urban forces such as wheel traffic, especially heavy equipment or construction traffic. Compacted soils can limit the function of SCMs, particularly practices whose primary function is stormwater infiltration. When soil is heavily compacted, it contains very few large pores and has a reduced rate of water infiltration and drainage. Once a surface layer is compacted and pore spaces are compressed, runoff occurs resulting in increased soil and water losses.

Poorly Drained Soils: Poorly drained soils may not be suitable to practices relying on infiltration without the use of an underdrain. An infiltration test should be performed on site to determine soil infiltration rates (see Chapter 5.1 on Rain Gardens for information on how to perform an infiltration test). A double ring infiltrometer can also be used to test soil percolation.

Steep Slopes: Steep slopes increase water velocities that may exceed the designed velocity for a particular practice, resulting in increased erosion and decreased residence time and infiltration. Practices such as constructed stormwater wetlands (CSWs) that require larger land areas may not function where slopes constrict the available area for the practice site. Smaller SCMs in series that follow existing site contours may be necessary to overcome steep slopes. Slopes can be graded, but soil moving (especially if not used for another purpose on site) can be expensive and should be considered during site selection. For the purpose of this handbook, a steep slope refers to any slope > 3:1.

Shallow Slopes: Conversely, shallow slopes can also affect SCM selection. Practices that require pretreatment basins, forebays, or an elevation difference to drive the practice function (e.g. water movement throughout a practice) may be expensive to construct on flat sites. In shallow sloped or low relief areas, practices that require a hydraulic head may not be optimal. See Minimum Head under Additional Goals for more information.

Sun/Shade Tolerance: Sunlight availability is limiting for vegetation selection or when there is a need to treat pathogens using sunlight. Practices such as bioretention and rain gardens usually function best in full sun to dry down efficiently between rain events. Conversely, some portions of CSWs require partial shade.

Water Table Depth: Infiltration practices, such as bioretention may be limited by water table depth. For CSWs, the seasonally high water table may be used to maintain the permanent pool elevation in the wetland.

Groundwater Contamination: Groundwater contamination is a risk for practices that intercept the water table. SCMs should never release runoff filtering a "hotspot" into groundwater. Hotspots are defined as commercial, industrial, or other operations that produce higher levels of stormwater pollutants and/or have concentrated pollutants.

Shallow Depth to Bedrock: SCM options can be greatly limited by a shallow depth to bedrock due to infiltration and excavation constraints. Shallow depth to bedrock may also prevent the excavation of pretreatment devices, such as forebays, or the SCM itself. When a shallow depth to bedrock is present, the site may be limited to the use of grassed filter strips, restored riparian buffers, or rooftop runoff management techniques.

Potential Environmental Regulatory Constraints

Jurisdictional Wetlands: Jurisdictional wetlands are areas that support hydric soils, wetland hydrology, and hydrophytic vegetation and are connected to waters of the United States. These wetlands are regulated by the Army Corps of Engineers and require a permit (Section 404 of the Clean Water Act) to work within their proximity. SCMs that discharge or have the potential to overflow polluted effluent should not be located in the vicinity of jurisdictional wetlands. Wetland delineation to define the wetland area may be necessary. Many local county and municipal entities have regulatory setbacks for delineated wetlands, some as much as 100' for designated subwatersheds.

Endangered/Threatened Species: The Alabama Natural Heritage Program's list of Rare, Threatened, or Endangered Plants and Animals of Alabama should be consulted to determine any species of concern for the site (http://www.alnhp.org/).

Stream Channels and Existing Riparian Buffers: Stream channels should not be impacted by LID as this goes against its overall goal of improving and protecting water quality. Impaired watersheds, local buffer ordinances, and environmental regulations limiting development adjacent to stream channels may limit site selection. Existing riparian buffers should only be improved by the addition of a SCM to the site. Most municipalities have their own streamside buffer ordinance that limits land disturbance and construction adjacent to a waterbody.

100-year Floodplains: The 100-year floodplain is the land area adjacent to a waterbody that would flood or be covered by water during a 100-year flood. These areas may affect development and SCM placement.

Forest Conservation Areas: Forest conservation areas and wildlife management areas have been created across the state to prevent habitat loss for threatened and endangered species. These areas are protected and should not be impacted during or after construction.

Alabama Regulatory Requirements: The National Pollutant Discharge Elimination System (NPDES) program was developed in 1972 under the authority of the Clean Water Act. This program controls water pollution by regulating point sources, including but not limited to Municipal Separate Storm Sewer Systems (MS4s), construction activities, industrial activities, and multi-sector general permits, which discharge into the waters of the United States. The Water Permits Division within the United States Environmental Protection Agency (USEPA) Office of Wastewater Management leads and manages the NPDES permit program in partnership with USEPA Regional Offices, States, Tribes, and other Stakeholders. Through the NPDES program, Alabama has approval by USEPA for the State NPDES Permit Program, Regulation of Federal Facilities, the State Pretreatment Program, and General Permit.

One component of the NPDES program focuses on stormwater discharges from MS4s. Stormwater runoff is most commonly transported through MS4s and deposited in local waterbodies.

This regulation was implemented in two phases:

Phase I (1990) - requires areas (cities/counties) with populations of 100,000+ to obtain permit coverage for point discharges.

Phase II (1999) - requires small MS4s >50,000 but <100,000 population to obtain permit coverage for their discharges.

Each jurisdiction is required to develop and implement a stormwater management plan that includes the following six minimum measures:

- Public education
- Illicit discharge detection and elimination
- Construction
- Post construction
- Pollution prevention
- Good housekeeping

A particular storm event (return period) and criteria are established for the following standards: (1) remove pollutants from runoff to improve water quality, (2) prevent erosion of downstream streambank and channel, (3) provide overbank flood protection, and (4) safely pass or reduce the runoff from extreme storm events. Table 2.2 illustrates the sizing criteria and a description for each standard.

Table 2.2

Sizing Criteria	Description
Water Quality	Treat the runoff from 80% of the storms that occur in an average year. This is the runoff resulting from a rainfall depth of approximately 1"-1.5" (first flush) depending on the location in Alabama. For more information on the first flush, see Appendix A on Stormwater Hydrology.
Channel Protection	Provides extended detention of the 1-yr storm event released over a period of 24 hours to reduce bankfull flows and protect downstream channels from erosive velocities and unstable conditions.
Overbank Flood Protection	Provides peak discharge control of the 25-year storm event such that the post- development peak rate does not exceed the predevelopment rate, resulting in reduced overbank flooding.
Extreme Flood Protection	Evaluates the effects of the 100-year storm on the management system, adjacent property, and downstream properties and facilities. Manages the impacts of the extreme storm event through detention controls and/or floodplain management.

Man-made Constraints

Existing Infrastructure: Existing infrastructure is often costly to relocate or remove. Consequently, any damage to infrastructure should be avoided. Existing infrastructure may also impact factors such as soil permeability due to imported fill, area constraints and restrictions (e.g. practice size), location of the SCM on site, and many others. Existing infrastructure should be located prior to site design by calling Alabama 811 (for more information, visit: www.al1call.com). Common infrastructure concerns are presented below.

Right of Ways: Right of ways (ROW) should be considered for maintenance access and may affect SCM location, construction, and maintenance. If a city or municipality installing the practice intends to manage the SCM "in-house," often a municipal ROW is beneficial and the practice is designed to a standard allowing maintenance access for vehicles and equipment required to perform annual maintenance. However, when ownership of the ROW is not the same as the entity charged with SCM maintenance, a Memorandum of Understanding (MOU) may be necessary to guarantee access in all phases of SCM development as well as post-construction maintenance.

Electrical Lines: To allow for maintenance without interfering or damaging the SCM or electrical lines, avoid locating SCMs within 100' of electrical lines. Occasionally a SCM may be located within a 100' radius of electrical lines and in these cases, maintenance practices must be scrutinized to avoid damage and selected vegetation should not encroach vertically on electrical lines. Low growing shrubs or herbaceous perennials are suggested when vegetation height is constrained.

Fiber Optic Cable: Fiber optic cable lines that carry data and communication may run above or below ground. Call Alabama 811 to locate any fiber optic cable lines that may be impacted during construction or post-construction during maintenance.

Water and Sewer lines: Avoid damage to water and sewer lines. These can be located using site plans, Alabama 811, or local utilities companies. As-built plans should be used whenever possible for more accurate locations of these lines. By using Alabama 811 assurance can be given that water and sewer lines are avoided.

Irrigation Lines: Irrigation lines may also be found on site and may need to be removed and replaced following construction. Irrigation is useful in establishing plants for the practice post construction.

Roads: Existing roads and future roads planned for the site should be considered during planning. Future roads may contribute additional runoff to the SCM as well as create erosion and sediment control concerns.

Septic Drain Fields: A general rule of thumb is that SCMs should not be sited within 25' or above septic drain fields.

Wells: SCMs should be located a minimum of 10' from well heads, but local ordinances should be consulted.

Additional Goals

Once constraints are considered, the list of SCMs best suited for a site typically diminishes. Next, determine the treatment needs or requirements of a particular site. The treatment requirement or capability is often determined by regulatory requirements and/or watershed impairment (e.g. peak flow control, total suspended solids reduction, nutrient removal, etc.).

Size of Drainage Area: The size of the drainage area is a primary consideration in SCM selection especially when the practice's performance relies on a permanent level of water. Practices that are designed to handle smaller flows do not perform efficiently and often cannot treat pollutants if sited at the outlet of a larger drainage area or system.

Table 2.3
Comparison of Drainage Area and Size of Practice

Practice	Size of Drainage Area	Size of Practice/ Space Required
Riparian Buffers	S-M	Medium - Large
Level Spreaders and Grassed Filter Strips	S	Small
Constructed Stormwater Wetlands	M-L	Medium - Large
Curb Cuts	S	Small
Bioretention	S	Medium - Large
Rain Gardens	S	Small
Grassed Swales, Infiltration Swales, and Wet Swales	S	Small
Permeable Pavement	S-M	Small
Disconnected Downspouts	S	N/A
Rainwater Harvesting	S	Small - Meduum
Green Roofs	S	Medium - Large

Practice Size (Required Space): Reducing impervious surface cover has the potential to decrease SCM size for the site. Some practices, such as CSWs, require large land areas and aren't applicable in many cases. High-density areas may be a concern; width or depth of a practice may be important for function and/or safety. Various practices, although smaller in size, may be more expensive or lack maximum treatment capability compared to others.

Both the size of the drainage area and the size of the practice can be shown in Table 2.3.

Minimum Head: For SCMs to function properly, a minimum head or elevation difference is often needed to move stormwater through the SCM. The elevation difference on site will affect which practice is selected. For example, CSWs require more change in elevation (hydraulic head) over the length of the SCM to promote flow of water and prevent mosquito breeding habitat. Depending on existing site conditions, excavation or fill to obtain the head required may be costly.

Depth of Ponding: Depth of ponding refers to the amount of standing water present in a SCM. Depth of ponding is used for stormwater storage and may be more or less depending on the practice. For example, bioretention practices typically have 6 – 9" of ponding for a brief period of time following a rain event, but CSWs utilize various hydrologic zones and deep pools may have up to 36" of water at any given time. Ponded water may be a safety concern and should be considered during practice selection. Fencing may be used as long as it does not limit SCM function.

Paired Practices: Paired practices may allow for treatment of larger drainage areas.

Cost: Cost of design, construction, and maintenance often determine feasibility. Consider site goals and pollutant removal efficiencies of each practice when cost may limit practices for a site.

Site Sustainability

Maintenance Level: When practices require extensive maintenance, identifying maintenance personnel early during planning is crucial. Some practices such as CSWs may require a high level of maintenance initially, but may become low maintenance after plant establishment.

Safety: Safety concerns may relate to standing water on site or to wildlife attracted to conditions in a practice. Consider who will utilize the site (humans or animals) and use this list to determine any safety concerns for long-term function and safety of the site.

Community Acceptance: Community acceptance is crucial for long-term adoption of LID practices. A practice with high community acceptance can easily become poorly accepted when a practice is not sited or maintained properly. Community acceptance is key to foster feelings of ownership among community members and to promote these practices as demonstration and educational opportunities.

Table 2.4
Site Selection & General Charactristics by Practice

Practice	BRC	CSW	PP	GR	RH	GS, IS, WS	RB	LS, FS
Sediment	Y	Y	Y	N	N	Y	Y	Y
N	Y	Y	Y	N	N	Y	Y	Y
P	Y	Y	Y	N	N	Y	Y	Y
Metals	Y	Y	Y	N	N	Y	Y	Y
Pathogens	Y	Y	N	N	N	Y	Y	N
Quantity Control	Possible	Yes	Possible	Possible	Possible	No	No	No
Drainage Area	Small	med-large	small	small	small	small	small-med	small
Space Req'd	large	large	small	large	small-med	small	med-large	small
Const Cost	med/high	med	high	high	med	low	med	low
Maint	med/high	med	med	med	med	low	low	low
Comm Acc	med/high	med	high	high	med/high	high	high	high
Habitat	med	high	low	low	N	low	med-high	med

Habitat: Practices that rank high for habitat are likely to attract animals that may be seen as a drawback by the general public.

Signage: Signage may be applicable especially when practices as are used for learning tools. Signage can also be directional or used as a warning when safety is a concern.

Construction Plan Review

Table 2.5 shows a sample check list (courtesy of City of Auburn) that can be used by developers during construction plan review.. This sample checklist can be tailored to fit the needs of a city, county, or municipality.

Table 2.5
Low Impact Development Planning and Design Check List

	1. Natural Resource Assessment
	Natural resources and constraints are identified and shown on the plan (wetlands, rivers, streams, flood zones, meadows, agricultural land, tree lines, steep slopes, and soil types.
	Endangered species of plants and animals on the site are shown on the plan.
	Development is designed to avoid critical water courses, wetlands, and steep slopes.
	Soils suitable for septic & stormwater infiltration have been identified on plans.
	Onsite soils have been assessed to determine suitability for stormwater infiltration.
	Existing natural drainage patterns have been delineated on the plan and are proposed to be preserved or impacts minimized.
	2. Preservation of Open Space
	Calculation of percent (%) of natural open space has been performed (% =______).
	An open space or cluster subdivision design has been used.
	Open space/common areas are delineated.
	Open space is retained in a natural condition.
	Reduced setbacks, frontages, and right-of-way widths have been used where practicable.
	3. Minimization of Land Disturbance
	Proposed building(s) is/are located where development can occur with the least environmental impact.
	Disturbance areas have been delineated to avoid unnecessary clearing or grading.
	Native vegetation outside the immediate construction areas remains undisturbed or will be restored.
	Plan includes detail on construction methods and sequencing to minimize compaction of natural and future stormwater areas.
	4. Reduce and Disconnect Impervious Cover
	Impervious surfaces have been kept to the minimum extent allowed (check methods used):
	Minimized road widths
	Minimized driveway area
	Minimized sidewalk area (one-side of roadway)
	Minimized cul-de-sacs
	Minimized building footprint
	Minimized parking lot area
	Impervious surfaces have been disconnected from the stormwater system, and directed to appropriate pervious areas, where practicable. Pervious areas may be LID practices, or turf areas.
	5. LID Practices Installed
	Sheet flow is used (level spreader) to the maximum extent possible to avoid concentrating runoff.
	Vegetated swales have been installed adjacent to driveways and/or roads in lieu of curb and gutter.
	Rooftop drainage is discharged to bioretention, rain garden or other LID practice.
	Rain water harvesting methods such as rain barrels or cisterns have been installed to manage roof drainage.
	Driveway, roadway, and/or parking lot drainage is directed to Bioretention, rain gardens or other LID practice.
	Cul-de-sacs include a landscaped bioretention island.
	Vegetated roof systems have been installed.
	Pervious pavements have been installed.

A list of suggested items to be considered by developers when submitting site plans for a low impact development subdivision. All items will apply to each individual property due to individual site differences. Check items that have been applied, or explain why the items have not been used.

This checklist can be found online at: http://clear.uconn.edu/projects/TMDL/library/papers/Eagleville%20Brook_draftLIDchecklists.pdf

References

North Carolina Department of the Environment and Natural Resources. 2009. Selecting the Right BMP. From BMP Stormwater Manual.

University of Minnesota. 2001. Soil Compaction: Causes, Effects, and Control. WW-03115.

USEPA. 2009. About NPDES.

Tennis, P. D., M. L. Leming, and D. J. Akers. 2004. Pervious Concrete Pavements. Portland Cement Association, Skokie, IL, and National Ready Mixed Concrete Association, Silver Spring, MD.

::This page::
::intentionally left blank::