

# **CHAPTER 4**

## **STORMWATER POLLUTION PREVENTION PLAN OR EROSION AND SEDIMENT CONTROL PLAN**

### **Purpose**

A stormwater pollution prevention plan, or SWPPP, is required under all Missouri land disturbance general permits. Some local governments also regulate land disturbance activities and therefore require a SWPPP or what they may refer to as an Erosion and Sediment Control Plan. The purpose of a SWPPP is to identify possible pollutants that may enter stormwater runoff and to identify best management practices, or BMPs, that will minimize or eliminate possible water quality impacts from stormwater runoff. BMPs are physical, structural or managerial practices that prevent or reduce pollution. Best management practices may be used when used singly or in a combination to produce the desired level of results.

A SWPPP must be developed for each construction project subject to regulations and must be prepared prior to any land disturbance. The SWPPP will define and schedule the erosion, sediment and good housekeeping control measures to be used on the construction site to prevent or minimize erosion that could occur and keep sediment and other pollutants from exiting the site.

It is stated in the Missouri land disturbance general permit: "...before disturbing earth, or submitting an application, the permittee must develop a SWPPP specific to the land disturbance activities at the site. This plan must be developed before permit coverage can be issued. The permittee must fully implement the provisions of the SWPPP required as a condition of this general permit throughout the term of the land disturbance project."

In all cases, the permittee and their representative or the contractor(s) responsible for installation, operation and maintenance of the best management practices must have a current copy of the stormwater pollution prevention plan with them when on the project site. In some cases, the permittee may be required to submit a copy of the SWPPP to the Missouri Department of Natural Resources or the local government office. The Missouri Land Disturbance General Permit requires a copy of the stormwater pollution prevention plan be provided to all contractors responsible for installation, operation or maintenance of any best management practice.

[Chapter 1](#) contains information on regulations and permits. The Missouri Department of Natural Resources' regional office may be contacted for additional information.

## The Plan

The stormwater pollution prevention plan should serve as a guide for the selection, location, installation and maintenance of practices to control all anticipated erosion and prevent sediment and other pollutants from leaving the site. A SWPPP is an evolving document that includes text, site maps and forms that are maintained and updated throughout the construction project as the construction site evolves. The requirements for what information must be included in the stormwater pollution prevention plan are located within the Missouri land disturbance general permit. If a construction project is within a community that also regulates land disturbance, the contractor will need to include their SWPPP guidelines.

The following items are typical components required in a SWPPP:

- Identification of the person responsible for implementing the SWPPP.
- Physical and environmental description of the site including soils, slopes, vegetation and water resources.
- Description of the construction activity.
- Description of the potential for discharge of sediment and other pollutants from the construction site.
- Narrative, plan sheets and construction details and specifications for erosion, sediment and good housekeeping controls.
- Narrative describing the timing and schedule of installation of erosion, sediment and good housekeeping controls.
- Methods used for final stabilization of all exposed soil areas (should be coordinated with post-construction plans during the initial site design process and again before implementation).
- Information related to conformance with wetland permits (if applicable), the need for environmental review or results of such review, impacts of discharges on endangered or threatened species, and impacts of discharges on historic places or archeological sites.
- Site map showing the following information:
  - Location of areas not to be disturbed.
  - Limits of disturbed area.
  - Location and type of temporary and permanent BMPs.
  - Existing and proposed grades with direction of stormwater flow information before and after construction.
  - Impervious surfaces and soil types.
  - Location of construction phasing.
  - Location of surface waters (e.g., streams, lakes, wetlands) within 0.5 mile of the project.

Developments in an area draining to a water body that has been listed on Missouri's impaired water body list (a list required by Section 303(d) of the Clean Water Act), special measures may need to be taken to ensure conformance with the required total maximum daily load, or TMDL,

implementation plan. Contractors can determine if the stream might be included in an active TMDL restricted stream by contacting the Missouri Department of Natural Resources or by viewing EPA's approved TMDL list available on the Missouri Department of Natural Resources Web site at [www.dnr.mo.gov/env/wpp/waterquality/index.html](http://www.dnr.mo.gov/env/wpp/waterquality/index.html)

Note: After a TMDL has been approved by EPA, the stream will ultimately be removed from the impaired water body list. While the water body may still be impaired, it is moved to the TMDL implementation list. The TMDL implementation document then becomes the governing document for addressing the impaired waters.

## **Understanding the Site Plan and Design**

The land site should have desirable natural drainage and soils with good potential for the intended development. Detailed soil surveys and geological investigations should have been completed to assess the suitability for the intended development.

Designate areas on the site map with severe limitations such as floodplains, steep slopes, drainageways, existing bodies of water and unstable soils to be left undisturbed and used as green space to protect water quality. Check local ordinances for limitations of construction in floodplains and near waterways.

Designate natural vegetation and trees to be left undisturbed during construction. Existing areas of grass, shrubs and trees will provide natural erosion and sediment control while enhancing the attractiveness of the project. Check local ordinances for stream corridor setbacks. In some cases, these areas can also be enhanced to help meet water quality protection requirements for both construction and post-construction runoff control.

The site development should be designed so that minimum earth grading and other site preparation is required. Opportunities should be sought to speed up the design approval process by making the design meet the intentions of the municipality's comprehensive or watershed management plan to protect natural resources. Also refer to the numerous resources on contemporary green infrastructure and low impact development designs. Such designs will help the contractor comply with federal, state and local requirements to protect water quality. Much information is available on how these contemporary practices may even minimize your project costs. There are additional resources listed at the end of this chapter.

Rough grading should be completed in phases to keep disturbed areas small and to minimize the amount of time soil will be bare of vegetation. The permit states: "Where soil disturbing activities cease in any area for 14 days or more, the permittee must construct and install BMPs to establish interim stabilization. If the slope of the area is greater than 3:1 or if the slope is greater than 3 percent and greater than 150 feet in length, then the permittee must establish interim stabilization within seven days of ceasing operations on that part of the site."

The SWPPP must present a plan for the installation of best management practices (see [Chapter 6 - Practice Installation and Maintenance](#)) to control overland sheet flow, limit erosion and keep sediment and other pollutants on the site.

Topsoil should be stockpiled and stabilized to protect it from erosion and then, following final grading, spread over the areas to be permanently vegetated. Topsoil is rich in organic matter, microorganisms and nutrients for successful vegetation establishment.

The SWPPP must contain a schedule for the installation of best management practices. The installation of best management practices should occur in concert with the development

schedule. All best management practices should be in place prior to any disturbance in the area they protect. It is very important to understand the ultimate plan for post-construction runoff to effectively plan, prepare, schedule and coordinate conversion from construction site BMPs to permanent practices. Contractors should schedule the installation of post-construction BMPs after the site is stabilized. There should be no potential for erosion on the site or sediment discharge into the post-construction BMPs.

Provide for operation and maintenance of the permanent, post-construction BMPs after the site is stabilized. If selected, designed, installed and operating properly, these structures will provide stormwater quantity and quality protection after the construction phase of the project is complete.

**Developing the SWPPP**  
**Information that Goes in the SWPPP**

The SWPPP, or erosion and sediment control plan, has many sections of information in it. The appropriate Missouri Department of Natural Resources general permit for land disturbance and local ordinances should be reviewed to make sure all required information is included in the SWPPP. Table 4.1 provides a checklist of information to be included in the SWPPP. The text column refers to the narrative portion of the document. The site maps are the drawings within the SWPPP. The forms are those documents created as required in the general permit. Each control measure should provide installation and maintenance information, which should be found on the detail sheet. Refer to [Chapter 6](#) for a list of all best management practices.

**Table 4.1 SWPPP Checklist of Requirements**

Information Required	Sections within the SWPPP			
	Text	Site Map	Forms	Detail Sheet
Site Description (e.g., soils, topography, vegetation)	X			
Discharge Points and Receiving Waters	X	X		
Limits of Disturbance – permitted boundary		X		
Temporary BMP's				
Description of installation and maintenance	X			X
Description of where and why used	X			X
Location		X		
Removal or conversion of controls with site stabilization	X			
Permanent BMPs				
Description of when to install - schedule	X	X		X
Location		X		
Good Housekeeping BMPs	X	X		X
Inspection of all BMPs – when and how	X		X	X
Sequencing and scheduling of work with BMP installation	X	X		
Amending and Updating the SWPPP	X	X	X	
Public Notification	X	X	X	
Contractor Responsibility	X			
Site Stabilization and Termination of Permit Coverage	X			

The following tables also provide questions and goals to set during the design of the construction project. Table 4.2 provides questions on the existing natural resources to be shown on the plan. Table 4.3 provides site development goals to strive for during the design of the construction project.

**Table 4.2: Existing Natural Resource Considerations**

<b>Natural Resource</b>	<b>Questions</b>	<b>Actions</b>
Wetlands	<p>Are wetlands on-site?</p> <p>Are permits needed (e.g., 404/401 permits) from the Army COE or Missouri Department of Natural Resources?</p>	<p>Show all wetlands on map.</p> <p>Obtain COE/ Missouri Department of Natural Resources permits or documentation before plan approval.</p>
Streams and Floodplains	<p>Are major waterways on the site?</p> <p>Are permits needed from the Army COE or Missouri Department of Natural Resources?</p> <p>Is the site located within the 100- or 500-year flood plain?</p> <p>Is the municipal or county stream buffer (setback) shown?</p> <p>Is the site in a flooding or erosion prone area?</p>	<p>Show major waterways.</p> <p>Obtain COE/ Missouri Department of Natural Resources permits or documentation before plan approval.</p> <p>Obtain local floodplain Development Permit if applicable</p> <p>Show 100- and 500-year flood plains on map.</p> <p>Show stream buffer.</p> <p>Show areas prone to flooding.</p> <p>Show stream bank erosion areas.</p>
Karst	<p>Are sinkholes, springs or seeps located on the site?</p> <p>What is the depth to bedrock?</p>	<p>Local buffer requirements may apply and should be shown.</p> <p>Show sinkholes, springs, seeps and other karst features.</p> <p>Show areas with shallow depth to bedrock.</p>
Existing Topography	<p>What is the existing topography?</p> <p>Are there areas with slopes steeper than 20 percent?</p> <p>What are the site's soil types?</p> <p>What is the existing stormwater drainage area and flow path?</p>	<p>Show existing topography, identify areas with slopes greater than 20 percent.</p> <p>Show site soil type.</p> <p>Show areas with erodible soils.</p> <p>Show gullies, swales, ditches, etc.</p>
Ponds	<p>Are there existing ponds on or adjacent to the property?</p> <p>Does the pond provide recreational benefits?</p> <p>Does the pond provide flood detention benefits?</p> <p>What is the condition of existing ponds (i.e., depth of sediment in pond, bank erosion, invasive plants)?</p>	<p>Show all ponds on map, including any existing detention basins.</p>
Vegetated Cover	<p>Is the site forested?</p> <p>Are grassy/prairie areas on the site?</p>	<p>Show forest and prairie areas.</p> <p>Show large trees (&gt;12" diameter).</p>
Existing Property Use	<p>What is the site's current use?</p> <p>What buildings, structures and other impervious surfaces are present?</p> <p>Are there utilities through the site?</p>	<p>Show existing impervious areas and utilities.</p>
Surrounding Property Use	<p>What is the surrounding property use?</p>	<p>Show property boundary and surrounding property uses.</p>

**Table 4.3: Site Development Goals, Questions and Methods**

Goal	Questions	Methods (To the Maximum Extent Practicable)
Minimize the Generation of Stormwater Runoff	<p>Can land disturbance be minimized?</p> <p>Can additional green space be preserved?</p> <p>Can proposed development be located in already developed areas?</p>	<p>Limit clearing, grading, and earth disturbance.</p> <p>Use clustered development with open space designs.</p> <p>Use narrower, shorter streets, right-of-way and sidewalks.</p> <p>Allow smaller radii for cul-de-sacs.</p> <p>Reduce parking space requirements.</p> <p>Preserve and protect forested areas, especially areas with large trees. Show tree preservation areas on plans.</p> <p>Allow for shared driveways and parking areas.</p> <p>Provide incentives for site redevelopment.</p>
	<p>Can stormwater safely flow overland to buffer areas (i.e., avoid piping)?</p>	<p>Grade to allow stormwater to sheet flow into buffer or conservation easement areas.</p> <p>Limit use of curb and gutter streets.</p> <p>Use grass channels for street drainage and stormwater conveyance.</p> <p>Allow roof downspouts to flow overland into vegetated cover.</p>
	<p>Can stormwater be captured and infiltrated into the ground?</p>	<p>Rainwater infiltration systems. Examples include rain gardens, dry wells and other landscape infiltration methods.</p> <p>Emphasize managing stormwater at the point of generation.</p>

**Determine Limits of Disturbance**

The SWPPP must show the limits of disturbance by outlining all areas on the site map where soil will be disturbed or vegetative cover removed. These areas will require erosion and sediment control best management practices. The permitted limits of disturbance must include all areas of soil that will or may be disturbed to complete the construction project. This includes parking and lay down areas, equipment and material staging or storage areas and areas where the contractor will store borrow or fill material. The SWPPP must also outline areas to be left undisturbed and the locations where protective fencing needs to be installed.

**Determine Drainage Areas**

When beginning the erosion and sediment control design of a construction site, the contractor should first look at the drainage patterns over the site. If there is land uphill of the site with the potential to discharge stormwater onto the contractor’s site, the contractor should decide whether or not to accept the discharge and whether or not to design controls for the additional area. If the contractor wishes the design to be solely for the stormwater coming from their permitted site, then you must design diversions for the discharge above your site. These diversions are the very first controls put in place and must be totally stabilized prior to any stormwater being allowed to flow into, through or discharge from them. The diversions must not increase the amount of sediment being discharged from the site.

The SWPPP must separately outline all of the drainage areas that occur on the site. The SWPPP must also identify all of the locations where stormwater is discharged off the development site throughout the entire construction project. Furthermore, the SWPPP must identify the points where the development site will discharge stormwater into natural water ways and identify the distance from the permitted limits of the construction project to the water body.

### **Select Specific Control Measures**

Four areas of concern should be evaluated for each drainage area: soil stabilization (erosion control), runoff control (sediment control), pollution prevention and permanent or post-construction runoff controls. Specific practices to control these areas are described in [Chapter 6 - Practice Installation and Maintenance](#). As control measures are selected, identification symbols and a symbol legend should be placed on the site map. Drawings and specifications for all structural practices and vegetation specifications should be included in the plan including information on proper installation, maintenance and inspection of each control measure. Temporary controls need additional information as to how and when the control is to be removed and the area stabilized.

### **Soil Stabilization/Erosion Control**

Erosion control devices include vegetation, mulch and compost, rolled products such as blankets, and any other device that is laid on the disturbed soil surface to cover and protect it from raindrop impact and wind erosion. These devices dissipate the energy from the wind and rain so soil particles are not dislodged and moved in the stormwater flow.

### **Runoff/Sediment Controls**

Sediment control devices slow the stormwater flow and/or temporarily pool the flow to dissipate the energy of the flowing water. Slowing the flow reduces the water's capacity to transport sediment off the site. Devices effective at reducing flow velocity include silt fences, wattles, inlet protection, sediment traps and ponds, check dams, etc. When using these devices for sediment control on the construction site, contractors should consider the effects that temporary pooling of water, or flooding, may have on areas adjacent to the pooling device.

### **Pollution Prevention**

These devices and practices cover good housekeeping, construction exits, concrete washout, masons area, etc. Good housekeeping includes the management of solid waste (trash and debris), sanitary waste, petroleum-based products and hazardous waste. The SWPPP must identify controls for these possible pollutants on the construction site and their proper inspection and maintenance. The SWPPP also must identify the reportable quantities for petroleum and hazardous waste products and discuss the use of a spill kit on the construction site.

### **Post-Construction Control Measures**

It should be stated whether the control is temporary or permanent within the description of each control device. Structural controls that are permanent must also include information on the operation and maintenance of each control after the construction project is complete and the site is fully stabilized. Maintenance requirements should be explained in the post-construction section with the SWPPP. See [Chapter 3](#) for considerations on permanent stormwater control measures.

These permanent devices are not designed for control of sediment as a post-construction device so they should not be put into permanent use until the site is fully stabilized and there is no threat of erosion or sediment discharge from the site. If devices are to be used during both stages of construction, the device must be fully cleaned of sediment deposits and retrofitted as a post-construction device after the entire site is fully stabilized and there is no hazard of soil erosion occurring. It is very important to coordinate transition from construction site best management practices to post-construction stormwater control measures, especially where newer green infrastructure and low impact development practices will be installed.

## Schedule Construction, Stabilization, Inspection and Maintenance Activities

The three main scheduling items required are a construction schedule, a stabilization schedule and an inspection and maintenance schedule. A schedule should also be followed for terminating the project and closing out the permit.

### Construction Schedule

The construction schedule must explain in an orderly fashion what will occur from the beginning to the end of the project. This includes both the sequence of the land disturbing activities and the sequence of controls that need to be in place before each of those activities begin. The installation sequence of control practices and structures is a critical factor in controlling erosion and sediment loss on the construction site.

Phasing of site grading is an important element of the schedule. Sediment basins, diversions and conveyance systems, whether temporary or permanent, should be installed either before grading begins or very early in the rough grading process. These practices must be stabilized immediately after they are constructed in order for them to function properly and to prevent structure failure leading to additional erosion and sediment discharge from the site. The sequence of rough grading and temporary stabilization should be indicated for each area to be graded.

The schedule should indicate the control practices to be used if grading is suspended for an extended period of time (seven to 14 days or more depending on slope and distance to waterway). In areas without sediment traps, temporary structures to divert water from cut and fill slopes, temporary seeding with mulch and tackifier or other practices should be used to stabilize the exposed soil surface.

The SWPPP must indicate the planned times and practices for final stabilization, using seed with mulch or using sod. Final stabilization should occur as soon as practicable following final grading.

### Stabilization Schedule

The stabilization schedule shows the allowable times for seeding and placing sod to ensure successful vegetation establishment and soil protection (See [Temporary and Permanent Seeding](#)). An example is shown in Table 3.1. It should identify the plant species or variety, seeding dates and seeding rates. If alternate species or times are listed, this chart can be used to schedule soil surface protection activities even if the planned construction schedule falls behind. The stabilization schedule should follow closely with the construction schedule. The seeding schedule may also provide for temporary stabilization with annual ryegrass or tackified mulch, if grading is unexpectedly suspended and a permanent seeding cannot be established.

Table 4.1 Example of a Seeding Schedule

Stabilization Type	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT
Permanent Seeding with Mulch Turf fescue: 80 lbs/acre	Acceptable	Optimum	Acceptable			Acceptable	Optimum	Acceptable
Temporary Seeding with Mulch Annual Ryegrass: 75 lb/acre	Optimum	Optimum			Acceptable	Optimum	Optimum	
Mulch with Tackifier (no seed)				Optimum	Optimum			
Fescue or Zoysia Sodding*				Optimum	Optimum			

\* Ground must be moistened to cool soil temperatures before sod is laid. Use only fresh, good quality sod. Irrigate to soil depth of 4 inches immediately after installation and for the first four weeks, or until sod is well established.

#### Table Key

Optimum Seeding Times
Acceptable Seeding Times

Information on seeding rates and types of vegetation is available in [Chapter 5](#) within Table 5.3. You may also contact your county soil and water conservation district for proper vegetation and seeding rates for your area. Remember, you may need to modify the seeding information provided in the SWPPP if the construction schedule changes, therefore changing the time of year you will be installing temporary or permanent vegetation.

### **Inspection and Maintenance Schedule**

The inspection and maintenance schedule is a plan for all temporary and permanent erosion, sediment and stormwater control measures throughout the construction project. This written plan should specify the inspection programs as required in the general permit. It should indicate the work materials and equipment to be used, who is responsible and when inspections and maintenance will be provided.

Inspections are necessary immediately after each phase of construction and storm event, as well as periodic inspection and maintenance to ensure proper functioning of control measures. You should schedule inspections after every rain producing runoff for controls that detain, store or convey stormwater. Work time should be accounted for in the schedule to make immediate repairs to damaged areas and control structures.

Inspection and maintenance should be scheduled for structures such as sediment basins and ponds that require regular cleanout in order to keep them working effectively. Sediment should be removed if it has reached one-half of the designed capacity for sediment storage.

The use of vegetation for erosion control purposes also requires a regularly scheduled maintenance program to repair seeded, sodded or other vegetated areas where the desired degree of stabilization has not been achieved. All seeded areas should be checked for plant emergence and density two to six weeks after planting. Spring plantings should be inspected again during the summer or early fall so reseeding can be performed as necessary during the fall planting season.

The SWPPP inspection and maintenance section should also describe who is responsible for inspections and maintenance of all post-construction BMPs after the land disturbance permit coverage is terminated and the permanent devices are functioning as operational water quantity and quality control devices. After the project is complete, proper stabilization has been achieved according to the general permit and inspection and maintenance of permanent practices have been properly passed off to responsible parties, the project closure should include a termination of coverage of the land disturbance permit using [Form H - Request for Termination of a General Permit](#), Form--MO 780-1409 for Missouri Department of Natural Resources (see [Chapter 1: Permit Coverage Application Forms and Fees](#)).

### **Making the SWPPP Work**

Even the best SWPPP cannot cover the specifics of each situation that will arise on a construction site during the life of a project. It is the contractor's or site operator's responsibility to make sure the site complies with the goals and intent of the SWPPP at all times. The SWPPP should show the practices to be in place at the start of construction as well as when the site design is at full build out.

The Missouri Department of Natural Resources Land Disturbance general permit states that the permittee must amend and update the SWPPP as appropriate during the term of the land disturbance activity. The SWPPP should record all land disturbance activities from the beginning of construction to the end with the date of occurrence. This would include the installation of best management practices and their removal or conversion into permanent post-construction stormwater control measures. This can be accomplished by a site activity log or notes on the site maps or a combination of both.

The site map should reflect the current activities at the site at any time throughout the construction project. The first records on the site map should include the installation locations and dates of the perimeter BMPs prior to clearing and grading and the location of the trailer, laydown and parking areas. The clearing and grading areas with appropriate dates should then be recorded. As work progresses additional notes should be made for cut areas, fill areas, utility installation, pouring footings and building pad, areas of temporary and final stabilization, etc. The last records on the site map should include the dates when temporary BMPs were removed and those areas stabilized. The last piece of record keeping at the very end of the project is for the permittee to sign and submit [Form H - Request for Termination of a General Permit](#), Form--MO 780-1409, which will terminate coverage under the general permit. The site must be fully stabilized and all temporary BMPs removed.

The SWPPP is now complete and must be kept in the records for three years from the date the Form H was submitted to the Missouri Department of Natural Resources. Submittal of [Form H - Request for Termination of a General Permit](#), Form--MO 780-1409 is often overlooked, but is an important requirement of the permit. If coverage under the general permit is not terminated, the permittee could continue to be held accountable for activities presumably associated with the permit.

## **Design Do's and Don'ts**

The erosion and sediment control industry is constantly evolving to meet the demands of heightened public awareness of erosion and sediment control issues and regulatory requirements. In the 1970's, ponds were used as sediment basins, geotextiles as silt fence, straw bales as sediment barriers and rock as construction exit pads. Best management practices have evolved significantly since 1992 with the Phase I and II NPDES requirements. There has been extensive research on many of the devices mentioned in this guide, as well as newer products and devices. Designing an up-to-date SWPPP may be challenging because information and technology is constantly changing. Following are three long-standing design practices for which the method of implementation has evolved and where confusion might still exist while planning the use of the BMPs on a construction project.

### **Straw Bales**

Straw bales have been proven to be very ineffective for sediment control. They are difficult to install correctly and do not last very long. EPA does not support the use of straw bales as an effective control for sediment on a construction site. They should never be used in concentrated flow channels as check dams or as inlet protection. If used at all they may be effective if installed properly on very flat, small areas where erosion control for the soils is also incorporated over the area.

### **Silt Fence**

Silt fence is another device that should never be used in concentrated flow channels or as an inlet protection device. Remember when using silt fence as a sediment control device, there is the potential during heavy storm events where several feet of stormwater flow may pond behind the device causing flooding of the area. This can create significant damage and cause the device to fail.

Another misuse of silt fence is in the area of perimeter control. One requirement of the construction general permit is to maintain perimeter control. Controls must be in place along the perimeter where stormwater flow exits the permitted area, not the entire perimeter. Silt fence should only be placed along the contour and not up and down slopes, at the top of the hill or any other area that does not directly discharge stormwater flows. When silt fence is not

placed directly on the contour, the storm flow will follow the fence as it travels downhill, picking up volume and velocity. This will increase the chances of a blow out at the lowest point due to the increase of concentrated flow to the area. As a SWPPP designer, remember that sediment control devices slow the flow and pond the water and should not cause flooding. Silt fence has the capability to pond two or three feet of water and sediment behind it, and damage from flooding could occur.

### **Short Circuiting**

The discharge point of the pond should not be located near the point where sediment laden stormwater enters the pond. Pondered water is a great energy dissipation device for sediment control (as long as it does not cause flooding). When sediment laden stormwater enters pondered water, the pondered water acts as an energy dissipater and the heavier sediment particles settle out at the entrance to the pond. With additional time the lighter particles in suspension will also settle out to the bottom of the pond. For this reason the discharge point of the pond should not be located near the point where sediment laden stormwater enters the pond. If the inlet is close to the outlet particles may not have sufficient time to settle to the bottom before being discharged, creating a condition called “short circuiting”.

The longer the traveling time for the water between the inflow and outflow the better the pond will function as a control device. If the pond is short circuiting because the inflow and outflow are too close together, it will not function well as a sediment control device. If due to space and topography, there is no way to design for the inflow into the pond to be as far away as possible to the outflow then design for a baffle wall or weir to be built between the two pipes so the entire pond is used as a control device.

### **Additional Resources**

*A Builder's Guide to Low Impact Development* –National Association of Home Builders Research Center [www.lowimpactdevelopment.org/lid%20articles/Builder\\_LID.pdf](http://www.lowimpactdevelopment.org/lid%20articles/Builder_LID.pdf)

Examples of Green Infrastructure and Design Approaches – EPA  
[cfpub.epa.gov/npdes/greeninfrastructure/technology.cfm](http://cfpub.epa.gov/npdes/greeninfrastructure/technology.cfm)

Green Infrastructure Center  
[www.greeninfrastructurecenter.org](http://www.greeninfrastructurecenter.org)

Low Impact Development Center  
[www.lowimpactdevelopment.org/](http://www.lowimpactdevelopment.org/)

*Low Impact Development for Stormwater Management* – Toolbase Services  
[www.toolbase.org/Technology-Inventory/Sitework/low-impact-development](http://www.toolbase.org/Technology-Inventory/Sitework/low-impact-development)

*Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*  
[www.epa.gov/owow/nps/lid/costs07/](http://www.epa.gov/owow/nps/lid/costs07/)