

Have a question about watersheds? Check here first, we may have already answered it through our Help Desk.

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- [Where can I find funding sources for projects and programs I'd like to implement?](#)
- [Does the Center have educational information for homeowners for actions they can take in their neighborhoods, such as rain barrels and recommended lawn care practices?](#)
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Answers

Better Site Design (BSD) / Low Impact Development (LID)

Are curbs and gutters considered good or bad in terms of BSD/LID?

Curbs and gutters are sometimes necessary, such as in dense, ultra-urban areas. However, vegetated open channels are preferable when slopes, soils, and other constraints permit.

Are there any good examples of model codes and ordinances that incorporate BSD/LID principles?

[Nonpoint Education for Municipal Officials \(NEMO\)](#) provides good examples of regulations that incorporate LID.

What are some good examples of communities that have implemented BSD/LID practices?

The [National LID Atlas](#) is a great place to start. Better Site Design: A Handbook for Changing Development Rules in your Community provides case studies of communities that illustrate the BSD principles. This manual is available for purchase at our [Store](#) (hard copy) and the electronic version along with Consensus documents from local site planning roundtables can be downloaded for free on our [Free Downloads](#) page.

What are the recommended stream buffer widths to maintain stream quality?

The minimum stream buffer criteria vary among communities. EPA's [Riparian Buffer Width, Vegetative Cover and Nitrogen Removal Effectiveness](#) provides a summary of the current science and regulations. University of Georgia River Basin Center's report

[A Review of the Literature on Riparian Buffer Width, Extent, and Vegetation](#) provides a scientific basis for recommended buffer widths. For information on design of urban stream buffers, refer to Article 39 in the Practice of Watershed Protection, available [here](#)

. The EPA Green Infrastructure website contains case studies of municipalities that use GI. http://cfpub.epa.gov/npdes/greeninfrastructure/gicasestudies_specific.cfm?case_id=64

Are there any examples of local ordinances that require the use of green space in large parking lots?

Carroll County, MD requires green space in parking lots that is used for stormwater management. Information can be found in the [Carroll County, Maryland Landscape Manual](#) , [Water Resources Management Manual](#)

, and [Carroll County Codes](#)

The City of Chesapeake, VA allows a reduction in the number of required parking spaces in exchange for preservation of mature trees (Section 19-416). The full code is available for free at [municode](#) .

Where can I find developers in my region that are skilled in BSD/LID principles?

You can search the [National Association of Home Builders website](#) for local developers that are skilled in the BSD/LID principles.

Illicit Discharge Detection and Elimination (IDDE)

Is there a form that can be used for collecting information about stormwater outfalls as part of an IDDE program?

Yes, the Center's IDDE Manual contains an Outfall Reconnaissance Inventory field sheet that is designed to record basic characteristics of storm drain outfalls, evaluate suspect outfalls, and assess the severity of illicit discharge problems in a community. The manual can be downloaded [here](#) .

There is an illicit discharge within my neighborhood. Who should I contact?

Your local Department of Public Works is the best place to contact for identification and clean-up of a suspected illicit discharge.

Impacts of Impervious Cover and Development

I'm concerned about the impact of development near my home/business. Who should I contact?

The best place to start is your local environmental agency, such as department of natural resources or department of the environment. These organizations typically have a water quality or stormwater division that can help answer questions about development impacts and regulations within your region. Another organization to contact is your local watershed organization if one exists, such as the Friends of X Creek, or the X Creek Watershed Association. [EPA's Adopt Your Watershed](#) webpage contains a searchable database of more than 2,600 watershed organizations. These groups are often extensively involved in the community and may be able to assist with assessing impacts and planning a course of action.

How do riparian buffers and stormwater management practices affect the Impervious Cover Model (ICM)?

The latest information about the ICM is published in the Journal of Hydrologic Engineering in an article called, "[Is Impervious Cover Still Important? Review of Recent Research](#) ." The article explains the limitations of the ICM, as well as the implications of subwatershed management practices that might influence the model. A summary of these issues can be found [here](#)

. Although few studies have specifically looked at the influence of stormwater BMPs on the ICM, several studies determined that having extensive, intact riparian buffers in the watershed can mitigate the impacts of impervious cover to a certain extent.

Stromwater

What are the typical pollutants and concentrations found in stormwater runoff?

The [National Stormwater Quality Database](#) is a national database of stormwater monitoring data from Phase I communities that has been collected for about 10 years from hundreds of municipal outfalls. The data is analyzed and provides information on the pollutant concentrations found in stormwater runoff for various land use categories.

How much stormwater runoff is generated from various land uses?

The "Runoff Reduction Technical Memo" provides information on the amount of runoff generated from different land covers based on the latest research. The technical memo can be downloaded [here](#) .

What is the impact of road salt on water quality?

Article 3 titled "Influence of Snowmelt Dynamics on Stormwater Runoff Quality" from "The

Practice of Watershed Protection” provides an overview of the mechanisms involved in snow pollutant accumulation and the movement of various pollutants from the snowpack. The article can be downloaded here. An article by Kaushal et al, “Increased Salinization of Fresh Water in the Northeastern United States” presents information on the increases in salinity associated with increases in impervious cover. The article can be downloaded [here](#).

Why is it important to manage small storm events?

Chapter 1 of the Urban Stormwater Retrofit Practices Manual describes the importance of managing small storm events. This manual is available for purchase at our [Store](#) (hard copy) and the electronic version can be downloaded for free on our

[Free Downloads](#)

page. In addition, you may also want to read an article by Robert Pitt from the University of Alabama, “

[Small Storm Hydrology and Why it is Important for the Design of Stormwater Control Practices.](#)”

Where can I find model ordinances for stormwater management?

The [Stormwater Manager’s Resource Center](#) provides model ordinances for illicit discharge detection and elimination, erosion and sediment control, open space design, operation and maintenance, and groundwater protection. The Center’s publication, “Managing Stormwater In Your Community: A Guide for Building An Effective Post Construction Program” provides information for developing a post-construction stormwater ordinance and can be downloaded for free from our [Free Downloads](#) page.

Where can I find general information on stormwater utilities?

The U.S. EPA webcast, “[Financing a Municipal Stormwater Program \(Stormwater Utilities 201\)](#)” describes stormwater funding methods and the advantages of developing a stormwater utility. Additional resources include the

[Internet Guide to Financing Stormwater Management](#)

and the

[University of North Carolina Environmental Finance Center](#)

Are there any examples of multi-jurisdictional stormwater utility districts?

Clayton County, GA has a multi-jurisdictional stormwater utility and the Clayton County Water Authority has developed a document that can be downloaded [here](#) .

What are some good examples of communities that have adopted progressive stormwater management practices (i.e., bioretention, permeable pavement) through local ordinances?

San Diego has adopted standards and requirements which are intended to reduce pollution that enters waterways San Diego developed a LID Handbook which serves as the guidance structure for these LID techniques <http://www.co.san-diego.ca.us/dplu/docs/LID-Handbook.pdf> . Other examples of effective stormwater programs can be found here http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/region3_factsheet_swmp.pdf

How can I set up a fee-in-lieu program that can be used to trigger stormwater retrofits?

The Center prepared a white paper on Nutrient Trading in the State of Virginia that discusses the topic of fee in lieu program. The paper can be found [here](#) . In addition, the State of Maine Department of Environmental Protection has also produced guidance on the utilization of stormwater compensation fees, the document can be found [here](#)

Where are some of the best places to find the latest research and recommendations for stormwater management?

Besides the Center's website, you may want to check out the following websites for the latest

happenings in the stormwater field: Chesapeake Stormwater Network <http://www.chesapeakestormwater.net>

Chesapeake Bay Stormwater Training Partnership ,

<http://www.cwp.org/cbstp/>

, University of New Hampshire

<http://www.unh.edu/erg/cstev/>

, NC State Cooperative Extension

<http://www.bae.ncsu.edu/stormwater/pubs.htm>

, Villanova University

<http://www3.villanova.edu/vusp>

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Stormwater Best Management Practices (BMPs)

What is the installation and maintenance cost of stormwater BMPs?

Appendix E of the Urban Stormwater Retrofit Practices Manual contains an analysis of BMP cost data up until 2006. This manual is available for purchase at our [Store](#) (hard copy) and the electronic version can be downloaded for free on our

[Free Downloads](#)

page.

Where can I find information on BMP design recommendations?

The Urban Stormwater Retrofit Practices Manual contains recommendations for BMP design specifications that provide maximum water quality and quantity benefit. This manual is available for purchase at our [Store](#) (hard copy) and the electronic version can be downloaded for free on our [Free Downloads](#) page. The [Virginia Stormwater BMP](#)

[Clearinghouse](#) also contains recommendations for BMP design. State-specific stormwater manuals also contain BMP design specifications.

How do I conduct a rainfall frequency analysis for my region?

Chapter 1 in the “Urban Stormwater Retrofit Practices Manual” contains information about creating a local rainfall frequency spectrum. The result can be used to set targets for the desired water quality, runoff reduction or channel protection volume. This manual is available for purchase at our [Store](#) (hard copy) and the electronic version can be downloaded for free on our [Free Downloads](#) page. For conducting the analysis, you will need a long-term rainfall record from an adjacent weather station.

[NOAA](#) has several websites with long-term rainfall records.

What are the design recommendations for agricultural stormwater BMPs?

The EPA has an online training module for [Agricultural Management Practices for Water Quality Protection](#). In addition, NRCS has produced [Field Office Technical Guides](#) that provide agricultural BMP design specifications that are county-specific for all U.S. states.

What is the typical maintenance requirement associated with various Stormwater BMPs?

The Center's publication "Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program" provides information on developing a maintenance program for stormwater BMPs. This document can be downloaded [here](#).

What is the pollutant removal potential of stormwater BMPs?

Appendix D of the Urban Stormwater Retrofit Practices Manual provides a summary of the pollutant removal rates based on the event-mean-concentration of pollutants. These numbers are based on the results of the National Pollutant Removal Performance Database, version 3. The Runoff Reduction Method Technical Memo provides pollutant removal estimates based on a combination of event-mean-concentration and runoff volume reduction. The report Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin, provides an example of the pollutant removal potential of non-structural practices. All of these Center documents are available for downloaded [here](#).

How do I monitor structural and/or non-structural practices to evaluate their performance?

The Center's report, "Monitoring to Demonstrate Environmental Results: Guidance to Develop Local Stormwater Monitoring Studies using Six Example Study Designs" describes how to set up a monitoring program to include scoping, budgeting, staffing, and funding needs, as well as equipment and sampling requirements. This document can be downloaded [here](#) .

Can restoration of compacted urban soils be utilized as a stormwater BMP?

Yes. For more information on the restoration of urban soils, refer to Articles 36 and 37 in the Practice of Watershed Protection, available for download [here](#) . Many communities are beginning to incorporate soil restoration into their stormwater management guidance and regulations as an accepted practice. Check with your state or local stormwater management regulations to see if credit is given for this practice in your community. An example specification for soil amendments from the state of Virginia is provided [here](#) .

Are there any guidelines specific to karst regions?

The Chesapeake Stormwater Network (CSN) produced a technical bulletin, [Stormwater Guidance for Karst Terrain in the Chesapeake Bay Watershed](#)

What is the best way to rank potential stormwater BMPs to decide which should be implemented first?

Chapter 4 of the Urban Stormwater Retrofit Practices Manual contains information on ranking stormwater BMPs. This manual is available for purchase at our [Store](#) (hardcopy) and the electronic version can be downloaded for free on our

[Free Downloads](#)

page.

Where can I find contractors in my region that are skilled with innovative BMPs, such as bioretention, permeable pavement, etc.?

Only some states currently have certification programs for contractors. However you can find a Stormwater Inspection and Maintenance Contractor Directory at BMPClean.org.

Monitoring

What is the best approach to monitor the effectiveness of stormwater BMPs?

The guidance document, “Monitoring to Demonstrate Environmental Results: Guidance to Develop Local Stormwater Monitoring Studies using Six Example Study Designs”, presents the broad concepts and methods behind setting up monitoring studies. It covers a range of monitoring areas depending on the sophistication of the monitoring program – from characterizing the quality of stormwater to developing a paired watershed study. The elements of a monitoring program presented in the guidance document include: scoping, budgeting, funding, and staffing needs, as well as equipment and sampling requirements. This document can be downloaded for free on our [Free Downloads](#) page.

What is the general guidance on collecting samples for water quality monitoring?

The Illicit Discharge Detection and Elimination manual contains guidance on the collection of water samples. The manual can be downloaded for free on our [Free Downloads](#) page. General guidance can be found on the EPA website here http://water.epa.gov/type/watersheds/monitoring/monitoring_index.cfm

Where are some of the facilities that test soil and water samples?

The facilities that test soil and water services vary depending on your region. The first place to check for facilities that test soil is the local agricultural department or University extension service. For water sample testing contact the local department of public works, nearby universities, and local environmental agencies. There are also a number of private labs that conduct water quality sample analysis that a simple online search should find.

Where can I find water quality data for my watershed?

Depending on the size of the watershed you are addressing there may not be existing or current water quality data, however both EPA and the USGS have water quality data from a vast number of sites across the country. EPA and USGS websites also contain links to state water quality data and reports. Go [here](#) to access the USGS information. Go [here](#) to access EPA information. State or local Agencies that deal with environmental regulations may also have water quality data available on the internet or by hard copy upon formal request.

Education and Outreach

Where can I find information about effective education and outreach campaigns?

The Urban Subwatershed Restoration Manual 8: Pollution Source Control Practices presents methods to assess subwatershed pollution sources in order to develop and target education and/or enforcement efforts that can prevent or reduce polluting behaviors and operations. This manual is available for purchase at our [Store](#) (hard copy) and the electronic version can be downloaded for free on our [Free Downloads](#) page. The

[EPA Nonpoint Source Outreach Toolbox](#)

also contains a wealth of information on educating the public about nonpoint source pollution and stormwater runoff.

Erosion and Sediment Control

Where can I find information about effective erosion and sediment control plans?

The Center's publication "Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program" provides information on developing an effective erosion and sediment control plan. This document can be downloaded [here](#) .

Is there a construction inspection checklist I can use for ESC?

The Center's publication "Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program" provides a construction inspection checklist for ESC. This document can be downloaded [here](#) .

Urban Forestry

What is the pollutant removal potential of trees in urban areas?

The pollutant removal potential for urban trees is quite variable given various amounts of impervious area, soil condition, tree species and size, and available growing among other things. Casey Trees and The Davey Tree Expert Co. developed an online Tree benefit calculator that provides environmental and economic value provided by trees. The calculator can be found at <http://www.davey.com/ask-the-expert/tree-calculator/national-tree-benefit-calculator.aspx>

Additional resources are also available on the Watershed Forestry Resource Guide found [here](#)

What volume of stormwater are trees capable of removing and how can I use them to comply with stormwater regulations in my municipality?

The [Reducing Stormwater Runoff webpage](#) of the [Watershed Forestry Resource Guide](#) developed by the Center and the U.S. Forest Service provides a wealth of information on how trees reduce stormwater runoff. In addition, it provides recommendations on how to measure and provide 'credit' for stormwater runoff reduction by trees. Also under development is the i-tree Hydro tool which can model the impact of trees on stream flow and water quality. This tool should be available in the winter of 2010 and can be found [here](#).

Watershed Treatment Model (WTM)

Where has the WTM been used and who is using it?

The WTM has been used by several communities. Recently, the Center has worked directly with the following communities to use the model: Monroe County, New York; James City County, VA; Montgomery County, MD, Richland County, SC; and Bowie, MD.

Does the "roadways" land cover category include all roadways, or are residential roads included in the "residential" land cover category?

Residential roads are included in the "residential" land cover category. The "roadways" land cover category is used for multi-lane highways.

General

I'd like to share my research, work experience, opinions, etc. with the Center for Watershed Protection. Is that something that the Center is interested in and where can I send the information?

The Center is always interested in hearing from the watershed and stormwater community that

utilizes our resources and services. Feel free to send an email to center@cwpc.org or send mail to 8390 Main St., 2nd Floor. Ellicott City, MD 21043. Also considering joining our membership program, the [Association of Watershed and Stormwater Professionals](#), to connect with other professionals in the field.

I'd like permission to use Center for Watershed Protection resources and photos. Who should I contact?

The Center encourages the use of our materials to promote the science of watershed and stormwater management. When utilizing our materials, we only request that you provide credit to indicate that the material originated from the Center. Please contact center@cwpc.org for questions regarding the use of Center materials.

I'm interested in pursuing a career in the field of watershed/stormwater management. Where can I find information about the profession and search for job opportunities?

The Center's membership program, the [Association of Watershed and Stormwater Professionals](#) contains a career page with information on the profession.

Does the Center provide resources for teachers to use in elementary, middle, and high school?

The Center has worked with University's to provide watershed and stormwater curriculum. Please contact center@cwpc.org if you are interested in working with the Center. There are, however other great teaching resources available for the elementary and middle school level. The EPA maintains a list of resources related to watersheds on its Watershed Academy page found [here](#). Additionally the Wonder of Wetlands (WoW) found [here](#) is a popular program as is its companion the Planning of Wetlands (PoW) found [here](#).

Does the Center have educational information for homeowners for actions they can take in their neighborhoods, such as rain barrels and recommended lawn care practices?

The Center's key audience is generally watershed and stormwater professionals, as well as other planners, elected officials, and managers who are dealing with specific technical watershed issues; however other groups and agencies have produced some excellent educational information for homeowners. Montgomery County, Maryland has a particularly useful website called [Rainscapes](#) which contains a great deal information. [Rainscaping.org](#) is another website that contains a variety of information geared to homeowners. The [EPA Nonpoint Source Outreach Toolbox](#) also contains a wealth of information on educating the public about nonpoint source pollution and stormwater runoff.

Where can I find funding sources for projects and programs I'd like to implement?

Finding funding for project and program implementation is often one of the most difficult parts of watershed management. These funding sources vary regionally and by subject matter. One of the largest clearing houses for grants is the National Fish and Wildlife Foundation who administers grant funds from several large pools. A substantial list of their grant programs can be found [here](#) . There may also be funding opportunities available from the state or local non-profits and foundations, contact your local cooperative extension office, natural resources agency, or watershed group to identify local opportunities.