United States Environmental Protection Agency

EPA EPA 903-K-17-001
June 2017

STORM SMART SCHOOLS

A Guide to Integrate Green Stormwater Infrastructure to Meet Regulatory Compliance and Promote Environmental Literacy

Acknowledgments

The *Storm Smart Schools Guide* was made possible through the United States Environmental Protection Agency (EPA) *Making a Visible Difference in Communities* initiative technical assistance services. This guide is a product of a year-long collaboration between EPA Region III, the Virginia Newport News Public Schools (NNPS), and the City of Newport News' Departments of Engineering and Public Works.

Lead Project Stakeholders:

Pennie Boyack | Environmental Health & Safety Supervisor | NNPS

Kerri Carpenter | Sustainability & Conservation Specialist | NNPS

Randy Davis | Landscape Supervisor | NNPS

Jeanna Henry| Watershed Coordinator | EPA Region III

Joseph Grist | Environmental Compliance Administrator | Dept. of Engineering | City of Newport News

Elizabeth Ottinger | NPDES Permits | EPA Region III

Jennifer Privette | Sustainability Manager | Dept. of Public Works | City of Newport News

Dr. Lorna Rosenberg | Green Schools Coordinator | EPA Region III

Kelly Somers | Physical Scientist | EPA Region III

Keith Webb | Executive Director of Plant Services | NNPS

Kyle Zieba | NPDES Enforcement | EPA Region III

Extended Support From:

Morgan Altizer | Intern | City of Newport News

Jacob G. Andrus | STEM Instructional Specialist | NNPS

Louis Bott | Environmental Services Manager | Dept. of Engineering | City of Newport News

Raquel Cox | Principal | Sedgefield Elementary School | NNPS

Dr. Jonathan Essoka | Making a Visible Difference in Communities Coordinator | EPA Region III

Laurie Fox | Horticulture Associate | Hampton Roads AREC | Virginia Tech

Dominique Lueckenhoff | Acting Director | Water Protection Division (WPD) | EPA Region III

Tammie Organski | City GIS, Information Technology | City of Newport News

Michelle Price-Fay | Associate Director |Office of State and Watershed Partnerships | EPA Region III

Denise Rigney | Contract Officer Representative | Water Protection Division (WPD) | EPA Region III

Allison Watts | Environmental Specialist | Dept. of Engineering | City of Newport News

EPA Region III Contract Support

CSRA Inc.

Low Impact Development Center, Inc.

Contents

Foreword

Public health and environmental impacts affect people most significantly where they live—at the community level. Many of the United States Environmental Protection Agency's (EPA's) programs focus on providing support to communities, especially in environmentally overburdened, underserved, and economically distressed areas, which have the greatest needs.

EPA's Making a Visible Difference in Communities initiative selected the City of Newport News, Virginia as one of many communities nationwide to receive assistance. Additionally, the Clean Water Act (CWA) requires the City of Newport News to manage stormwater through their Municipal Separate Storm Sewer System (MS4) permit. Managing Stormwater by integrating green infrastructure practices on schools grounds provides local governments an opportunity to meet CWA and MS4 requirements and achieve other benefits.

Newport News agreed to work with EPA on a Green School Grounds project focused on green infrastructure practices for stormwater management on school grounds while incorporating environmental literacy. EPA provided technical assistance to the City of Newport News and the Newport News Public Schools (NNPS) to capture the process, information, and decisions necessary for evaluating and selecting school grounds for the installation of green infrastructure best management practices (BMPs).

The City of Newport News and the NNPS, in conjunction with EPA Region III, selected Sedgefield Elementary as the demonstration site. EPA Region III assisted NNPS and the City of Newport News with organizing a community-based design charrette at the elementary school. The charrette resulted in the creation of a conceptual site plan that uses green infrastructure practices to address stormwater issues at Sedgefield Elementary. NNPS incorporated outdoor learning into this process, which provided an opportunity to support environmental literacy for students of all ages.

Image courtesy Sedgefield Elementary, Newport News, Virginia

This guide serves several purposes. It:

- Captures the approach used to identify and select a school and the green infrastructure BMPs used at the school to manage stormwater;
- Is a resource to community stakeholders, local governments and schools to address the multiple aspects of the process, including planning, design, construction, operation and maintenance, and ongoing stewardship of green infrastructure BMPs; and
- Provides a "how to" focused on school grounds to use green infrastructure BMPs to meet regulatory requirements, protect public health and the environment, and provide multiple community and educational benefits.

Introduction

Local governments throughout the United States struggle to meet stormwater management requirements. Stormwater runoff is a leading cause of water pollution in urban and suburban areas due to the high percentage of impervious surfaces such as roadways, parking lots, and rooftops. When it rains, stormwater washes over these surfaces, picking up sediment, oil and grease, heavy metals, bacteria, trash, and other pollutants from the urban landscape (EPA 2003). This runoff flows into stormwater collection systems and discharges into local streams, negatively impacting water quality in the local watershed. Stormwater runoff also contributes to localized flooding and flooding around waterways.

EPA recognizes the need for innovative and cost effective solutions to manage stormwater runoff and improve water quality to meet federal Clean Water Act (CWA) goals. School grounds present unique opportunities for on-site stormwater management. Public school systems or departments of education typically own or manage large amounts of public land in any given community. Impervious surfaces such as rooftops, basketball courts, bus loops, and parking areas often cover a large percentage of a school's site. Additionally, school sites often have open or underutilized space. Land owned by the public school system, such as sports fields, may contribute pollutants, such as fertilizer, that discharge through stormwater runoff. These sites provide opportunities for Best Management Practices (BMPs) installation and/or stormwater retrofits to improve stormwater treatment.

The Newport News Public Schools (NNPS) system in the City of Newport News, Virginia, is the largest school system on the Virginia Peninsula. Over the past year, the city and NNPS worked together to identify ways to incorporate green infrastructure at schools to manage stormwater runoff, reduce localized flooding events, and provide enhanced recreational amenities and aesthetic improvements to their school grounds. They also used the opportunity to integrate green infrastructure into the school curriculum.

> **"Green infrastructure** uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments. At the city or county scale, green infrastructure is a patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the neighborhood or site scale, stormwater management systems that mimic nature soak up and store water."
>
> —EPA, 2016b

This step-by-step guide is the result of an approach that NNPS and the City of Newport News Virginia used to identify school grounds to help meet stormwater management requirements for its Phase I Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit and address localized flooding issues. NNPS and the City of Newport News Virginia identified key steps to follow when installing green stormwater infrastructure on school grounds while incorporating environmental literacy goals. These steps include 1) creating a vision by engaging stakeholders and the community, 2) establishing a plan of action, 3) evaluating school sites, 4) preparing a concept, 5) identifying funding sources, 6) building it, 7) championing it, and 8) maintaining it. We call these the "Storm Smart Steps." (See page 8, Eight Steps to a Storm Smart School.)

The Where to Learn More section of this guide identifies additional resources to help the reader through each step in the process. The resources include links to model tools that help integrate regulatory compliance, green infrastructure concepts, and environmental literacy into a project or focus area. This guide demonstrates a process by which city government, school facility operators, administrators, and educators work together to improve water quality while providing students, parents, and teachers with the knowledge and skills to act responsibly to protect and restore their local watershed.

Purpose

This guide provides a series of Storm Smart Steps that local governments, schools and other community stakeholders can follow to identify school grounds and integrate green infrastructure into projects and/or a program to achieve regulatory compliance, manage stormwater, and improve environmental literacy. There is no one-size-fits-all solution, and this guide provides an example of how one community in EPA's Mid-Atlantic Region applied the Storm Smart Steps.

Incorporating green infrastructure practices on school grounds helps improve local and regional water quality by capturing, retaining, and/or infiltrating rain where it falls. This reduces the amount of pollution entering local streams, rivers, and other water bodies. Stormwater projects that incorporate green infrastructure on school grounds provide the community an often-overlooked opportunity for local stormwater officials, school facilities staff, and educators to engage children and adults with the environmental problems associated with stormwater runoff in their communities. The Storm Smart Schools guide identifies the key components to establish and maintain successful partnerships between local governments, school facilities staff, and educators.

Guide Objectives

- Encourage partnerships between local governments, public school systems and the community.
- Connect K-12 educational curriculums with green infrastructure and stormwater to support environmental literacy.
- Facilitate green infrastructure opportunities on school grounds.
- Engage students with long-term stewardship of green infrastructure.
- Increase compliance with stormwater regulations and requirements.

Image courtesy Sedgefield Elementary, Newport News, Virginia

Background

Understanding the Issues and Requirements

Stormwater management is essential for healthy communities in the 21st century. Without it, pollution entering local water bodies and the risk of flooding increases. Stormwater runoff is one of the largest sources of water pollution in urban and suburban areas. It presents many environmental, social, and economic challenges. Rain and snowmelt that flows over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, does not soak into the ground and generates stormwater runoff. The runoff picks up pollutants like trash, chemicals, oils, and dirt/sediment that harm rivers, streams, lakes, and coastal waters. These pollutants directly impact water quality. Population growth and expanding urban/urbanized areas significantly contribute to the amount of pollutants in the runoff as well as the volume and rate of runoff from impervious surfaces. Urban areas often use MS4s to transport stormwater runoff and then discharge it, untreated, into local water bodies. Owned by a state, city, town, village, or other public entity, an MS4 is a conveyance or system of conveyances (e.g., storm drains, pipes, and ditches) used to collect or convey stormwater to waters of the U.S. It is not a combined sewer and it is not part of a sewage treatment plant or publically owned treatment works.

Prior to the 1980s, the importance of treating stormwater runoff was not fully recognized. When passed in 1972, the CWA's primary emphasis was to reduce the amount of pollution discharging into waterways from wastewater treatment plants and industrial facilities. By the 1980s, regulators and others began to understand the importance of treating stormwater runoff from farmland, city streets, construction sites, and suburban lawns. In 1987, Congress amended the CWA, which spurred new regulations and programs with requirements for different sized communities.

This landscape's dry stream bed collects and routes stormwater to rain gardens and a 1,400-gallon pond.

Issued in 1990, EPA established Phase I of the National Pollutant Discharge Elimination System (NPDES) MS4 regulations requiring MS4 operators serving populations of 100,000 or more to develop comprehensive stormwater management programs to reduce the discharge of pollutants from their storm sewer systems. In 1999, EPA extended regulations to cover smaller communities, known as Phase II MS4s. Phase II MS4 regulations apply to communities located in urbanized areas as defined by the Bureau of Census or on a case-by-case basis by the NPDES permitting authority. Phase II requires smaller entities that operate MS4s in urban areas to obtain NPDES permits. Individual NPDES permits generally cover Phase I MS4s and general NPDES permits cover Phase II MS4s. NPDES permits for regulated MS4s require permittees to develop a stormwater management program (SWMP), which describes the stormwater control practices that the permittee implements to comply with permit requirements and minimize the discharge of pollutants from the sewer system. Phase II permit holders must implement six minimum control measures to reduce polluted stormwater runoff. Together, the Phase I and Phase II regulations aim to keep harmful pollutants out of local waterbodies.

The City of Newport News manages their MS4 system under a Phase I permit. As such, the city must have an SWMP.

Six Minimum Control Measures

Public Education and Outreach to distribute learning materials and personally inform citizens about the impact polluted stormwater runoff has on water quality.

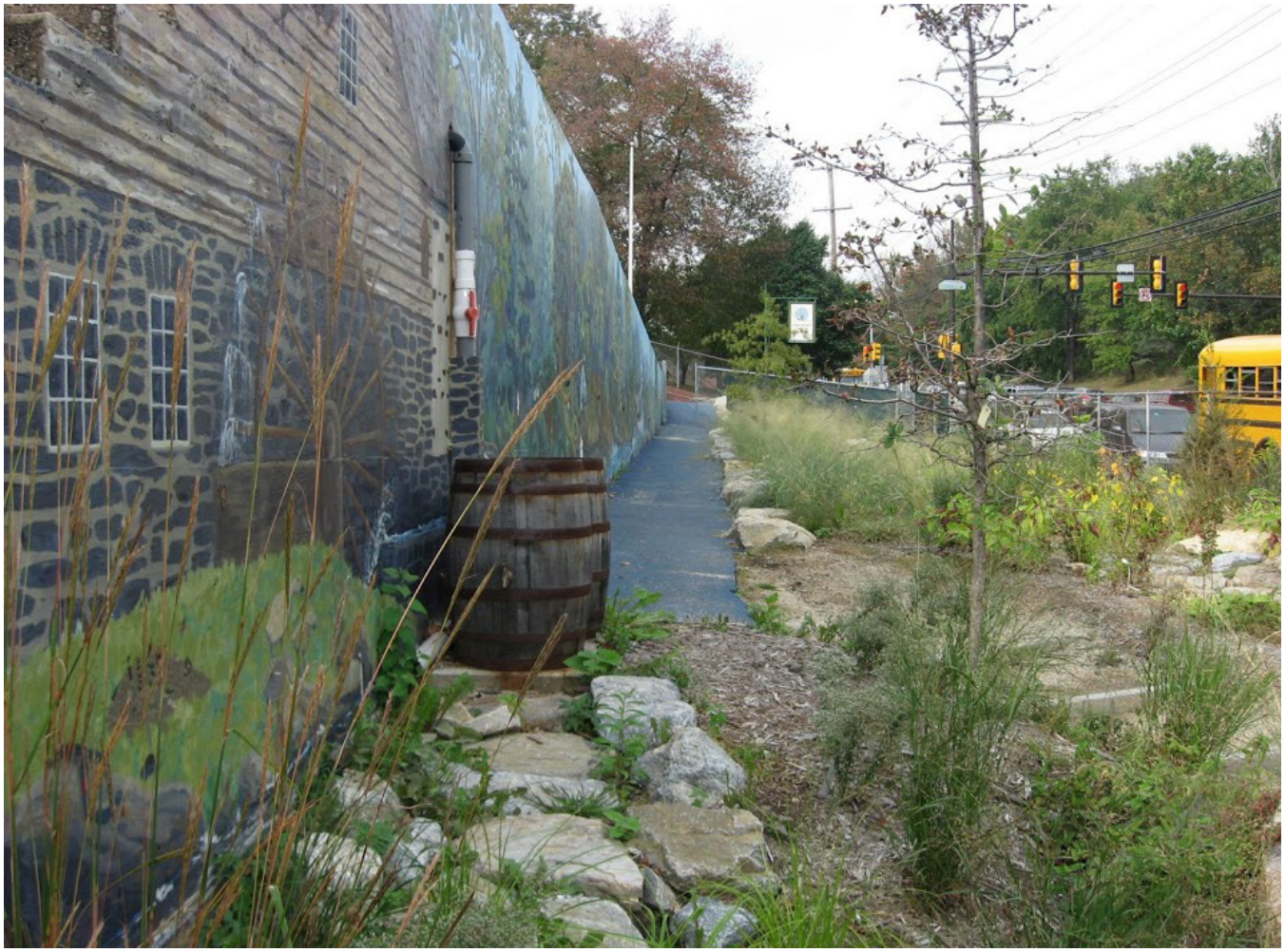
Public Involvement/Participation to provide for citizen representation in program development and implementation.

Illicit Discharge Detection and Elimination program to detect and eliminate illicit discharges to the storm sewer system and enforce penalties, where appropriate.

Construction Site Runoff Controls to control sediment and erosion from construction sites for any construction activities that disturb 1 acre or more of earth.

Post-Construction Runoff Control to address the discharge of post-construction stormwater runoff from new development and redevelopment for any projects that disturb 1 acre or more of earth.

Pollution Prevention/Good Housekeeping methods and procedures to reduce polluted runoff from municipal operations.



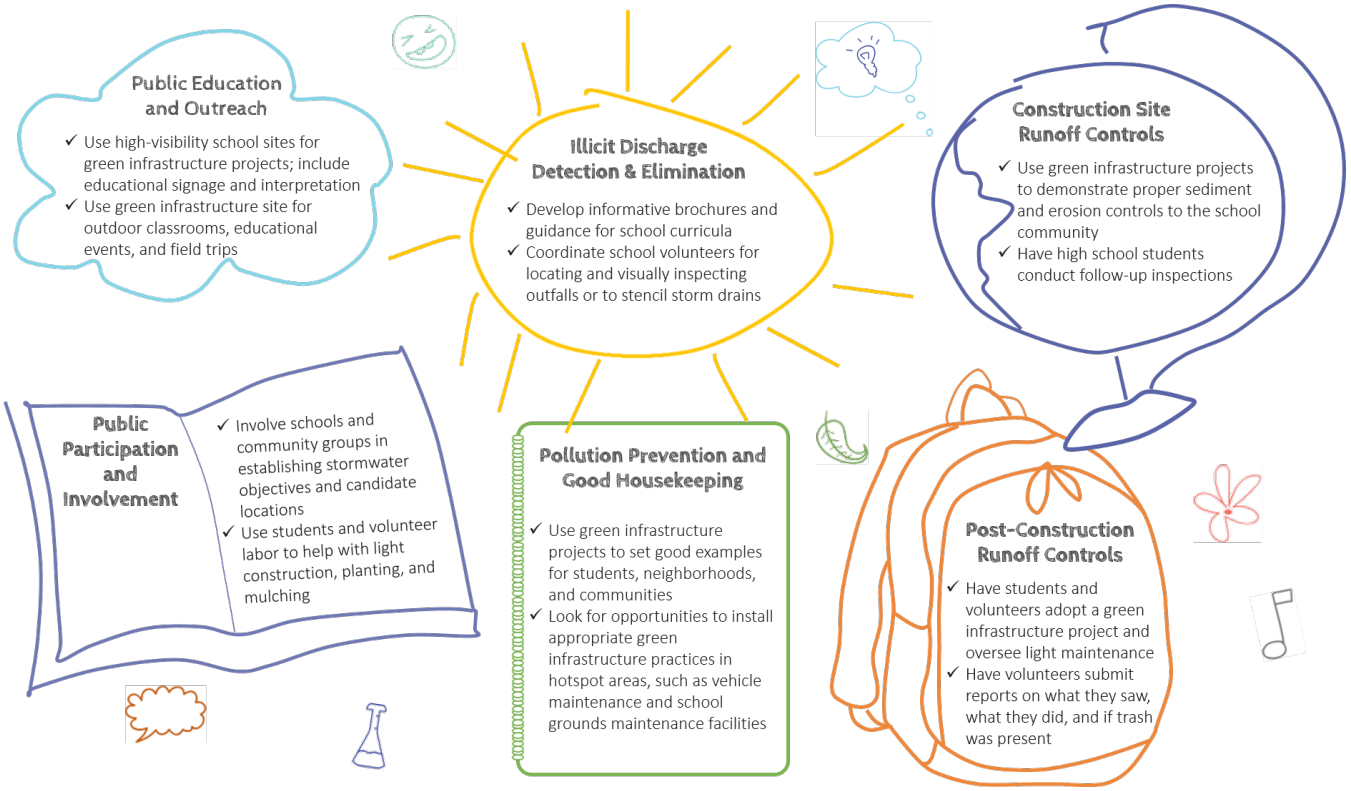
Green stormwater infrastructure includes a wide range of approaches, including rain barrels, which catch rain water for plants instead of running off into storm drains and streams.

What is the Connection to Schools?

Schools play an essential role in public education, involvement, and outreach efforts. They serve as centers of learning and connect neighbors to one another. Schools provide the ability to combine environmental education with environmental service-learning opportunities. In addition to educating children, schools can serve as a vital source of community education that can support the NPDES permittees requirements for public outreach and education.

Recognizing this, Virginia's Governor Terry McAuliffe signed an executive order on April 22, 2015 to establish the Virginia Environmental Literacy Channel. The purpose was to encourage schools to engage students in meaningful science and environmental education efforts, including meaningful outdoor experiences (Commonwealth of Virginia 2015). Education agencies, natural resource agencies, and groups such as the Virginia and National No Child Left Inside Coalitions facilitate the creation of environmental education plans at the state level.

The Spratley Gifted Center in Newport News, VA is one example of how schools incorporate green infrastructure stormwater management into their curriculum. Fourth-graders at the school helped install a rain garden in a grassy corner outside their building, just across the driveway from a storm drain. The rain garden slows the flow of rainwater across Spratley's front driveway and helps filter out pollutants that otherwise would flow into the bay. Constructing the rain garden enhanced the lessons the students learned as they began their Virginia natural resources unit (Hammond, 2016). Other possible environmental service-learning opportunities available to schools include conducting neighborhood cleanups, planting trees, and converting hard surfaces into school gardens, pollinator gardens, and/or rain gardens.



School lands also provide valuable opportunities for an NPDES permittee to implement stormwater management practices and/or retrofit areas to meet current permit requirements. Prior to the late 1980s, school construction and other developments often did not include stormwater controls. The average age of school buildings in the NNPS system is 50 years; therefore, the majority of school grounds lack existing on-site stormwater management. Additionally, stormwater management techniques and BMPs evolved over time, and we now have a better understanding of how to manage and use stormwater. In the 1980s and 1990s, large structures, such as manmade ponds, managed stormwater for flood protection. BMPs, such as green infrastructure and low impact development techniques, manage stormwater on-site and mimic natural conditions. Many newer NPDES permits require retrofitting existing unmanaged and/or inadequately managed stormwater runoff. The permit may specify that the permit holder reduce the amount of untreated impervious surface area, reduce specific pollutant loads to nearby waterways, or require other measures to improve water quality.

Typically, a Phase I NPDES permit issued to a municipal government covers all areas within the jurisdictional boundary, which includes those areas served by or otherwise contributing to discharges from the jurisdiction's MS4. This includes municipally-owned properties such as city buildings, libraries, parks, and schools. Phase II MS4 permits can be issued to a municipality or individual campus-type institutions such as military bases, colleges/universities, hospitals, etc. A municipality's MS4 permit may include school grounds, or, in some instances, a school system might have its own NPDES MS4 permit. Prince William County Public Schools and the Stafford County School Board are examples of school systems in Virginia that hold their own Phase II NPDES permits. For the example used in this guide, the City of Newport News Phase I MS4 permit includes the NNPS.

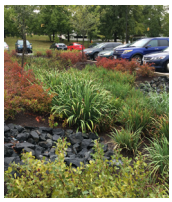
Why Green Infrastructure?

In addition to providing a cost-effective and resilient approach to managing wet weather impacts, Green infrastructure provides many community benefits. Single-purpose gray stormwater infrastructures—conventional piped drainage and water treatment systems—move urban stormwater away from the built environment. Green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits. These benefits include improving water quality and helping communities stretch their infrastructure investments further.

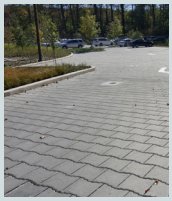
Given their connection in the community, existing stormwater management challenges, and the opportunity to incorporate education, school grounds provide an excellent opportunity to meet a number of MS4s regulatory requirements.

Techniques such as rain gardens, like this one in the High Point neighborhood in Seattle, WA, retain stormwater runoff, which can help reduce peak flooding.

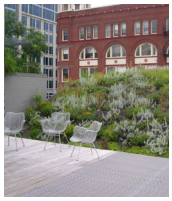
Example Green Infrastructure Practices



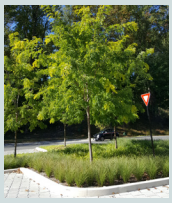
Bioswales – Bioswales are vegetated, mulched, or xeriscaped channels that provide stormwater treatment and retention as it moves from one place to another. Vegetated swales slow, infiltrate, and filter stormwater flows. As linear features, they are particularly well suited to being placed along streets and parking lots.



Permeable Pavements – Permeable pavements infiltrate, treat, and/or store rainwater where it falls. They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. This practice could be particularly cost effective where land values are high and flooding or icing is a problem.



Green Roofs – Green roofs are covered with growing media and vegetation that enable rainfall infiltration and evapotranspiration of stored water. They are particularly cost-effective in dense urban areas where land values and stormwater management costs are likely to be high.



Urban Tree Canopy – Trees reduce and slow stormwater by intercepting precipitation in their leaves and branches. Many cities have set tree canopy goals to restore some of the benefits of trees that were lost when the areas were developed. Homeowners, businesses, and community groups can participate in planting and maintaining trees throughout the urban environment.

Downspout Disconnect – This simple practice reroutes rooftop drainage pipes from draining rainwater into the storm sewer to draining it into rain barrels, cisterns, or permeable areas. It can be used to store stormwater and/or allow stormwater to infiltrate into the soil.

Rainwater Harvesting – Rainwater harvesting systems collect and store rainfall for later use. When designed appropriately, they slow and reduce runoff and provide a source of water. This practice is particularly valuable in arid regions, where it could reduce demands on increasingly limited water supplies.

Rain Gardens – Rain gardens are versatile features that can be installed in almost any unpaved space. Also known as bioretention, or micro-bioretention cells, these shallow, vegetated basins collect and absorb runoff from rooftops, sidewalks, and streets. This practice mimics natural hydrology by infiltrating, evaporating, and transpiring stormwater runoff.

Planter Boxes – Planter boxes are urban rain gardens with vertical walls and either open or closed bottoms. They collect and absorb runoff from roofs, sidewalks, parking lots, and streets and are ideal for space-limited school sites in dense urban areas.

For more information, see Where to Learn More (pages 23-27) or visit www.epa.gov/green-infrastructure.

Images courtesy the Low Impact Development Center

Eight Steps to a Storm Smart School

Many strategies exist to help local governments and public school systems manage stormwater runoff and educate students and surrounding communities. The eight steps below guide communities as they integrate green infrastructure in various phases of a project, including planning, design, construction, funding, and operation and maintenance. The City of Newport News used these eight steps to identify, evaluate, and select a school for this project.

Step 1: Get Organized

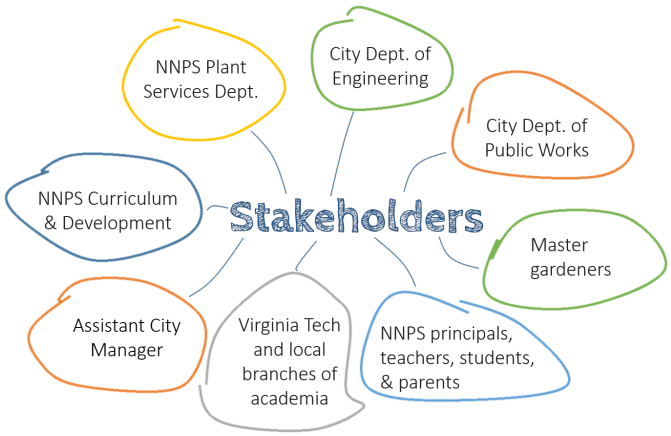
Successful development and implementation of on-site green infrastructure stormwater management largely depends on community commitment and involvement. It is critical to build partnerships with key stakeholders and interested parties at the outset. Stakeholders that participate in the decision-making process are more willing to share in implementation. Including a diverse group of people and organizations is important. Doing so brings different talents, interests, concerns, and values to the table. The knowledge, experience, and perspectives of stakeholders help ensure that the plan or program development addresses or incorporates critical issues or community concerns.

Identify and include all categories of potential stakeholders at the project's start, not just those who volunteer to participate. Do not forget about those who can contribute resources and assistance to the planning effort or those who work on similar programs that can be integrated into a larger effort. After identifying key stakeholders, begin the process of engaging each stakeholder. Keep in mind that stakeholders are more likely to get involved if there is a clear benefit to their participation.

After engaging stakeholders, plan and coordinate a "Kick-Off Meeting" for everyone to come together. Use the Kick-Off Meeting to focus on the community's specific stormwater needs, provide an understanding of the drivers and requirements, and establish an organizational structure for the group.

How to Get Stakeholders Involved

- Identify categories of stakeholders
- Determine roles and responsibilities
- Define a structure to facilitate participation
- Identify skills and resources
- Identify benefits to stakeholders
- Get commitments
- Conduct outreach to build awareness and support



- Begin by having a knowledgeable member—such as the person responsible for stormwater compliance—explain the community-specific stormwater management requirements.
- Identify the group's leader or co-leader(s)—potentially one from the local government and one from the public school system to ensure engagement on both sides.
- Discuss the group's structure. Depending on the group's size, it may be appropriate to develop a Steering Committee with sub-committees that focus on different aspects of the project (stormwater compliance, educational curriculum around green infrastructure practices, etc.).
- Establish communication methods and a process at the very beginning to ensure everyone understands and has an equal opportunity to participate. Ensure the process includes methods for disseminating information to and receiving feedback from the group and community.
- Determine a meeting schedule that accommodates the group so that all stakeholders are available. Consider having a "core" group that meets more frequently, then reports out and requests feedback, guidance, and resources from the larger group.
- Determine the need for a partnership agreement, memorandums of understanding, or other agreement between the public school system and local government agencies. This agreement describes how the parties will work together to integrate green infrastructure to design, build and maintain the project. Some jurisdictions require these types of agreements for the MS4 permittee to meet permit requirements. It is important to understand that a successful partnership takes time to cultivate and a commitment to maintain. Expect some highs and some lows along the way.

Lesson Learned from the City of Newport News

The cooperative spirit that developed through the Green Schools Ground Initiative provided planning and implementation support to help the City of Newport News staff comply with their current NPDES MS4 Permit (effective July 1, 2016). In some areas in Virginia, such as Fairfax and Stafford counties, the city/county and school system each applies for a separate NPDES permit. In Newport News, the two municipal entities work together under one NPDES permit. NNPS is a partner in compliance with the city, meaning that the NNPS High Priority Municipal Facilities will have Stormwater Pollution Prevention Plans developed and maintained under the same protocols and procedures as the city's High Priority Municipal Facilities. Similarly, any turf/landscaping nutrient management plans and integrated pest management control plans within the NNPS must meet the city's MS4 Permit requirements. The city and NNPS formed a compliance partnership independently of the Green Schools Initiative; however, the partnership that evolved through this initiative laid the foundation for broader discussions between the city and NNPS about stormwater and nutrient control.

Stakeholders Involved in Newport News

Many stakeholders helped identify green infrastructure retrofit and educational opportunities on school grounds in Newport News, VA. City staff responsible for oversight of the NPDES MS4 Phase I permit were a key stakeholder. NNPS facilities management staff has a personal interest in greening and sustainability; flooding concerns partly motivated this interest. EPA provided a professional facilitator to help the group accomplish its tasks.

Green roofs can reduce and slow stormwater runoff in the urban environment; they also filter pollutants from rainfall.

Step 2: Develop a Plan of Action

After establishing a stakeholder group, it is time to determine what the group collectively wants to achieve. "Begin with the end in mind" (Stephen Covey, 1989); clearly articulating the goals and objectives is essential for building consensus and achieving success. A facilitator can help guide the group through this process.

There are four essential tasks to developing the group focus: 1) identifying the issues and opportunities, 2) defining the problem(s), 3) establishing achievable goals and objectives, and 4) developing a plan.

Task 1: Identify Issues and Opportunities

Identify the stakeholder group and community partners' issues of concern, and identify the available educational and stormwater management opportunities. Those issues and opportunities the group prioritizes as being the most important should be the focus of what the group wants to accomplish.

Developing a list of questions to ask ahead of time helps identify the issues most important to each member (see example questions in the sidebar). Questions will vary depending on whether the discussion is about implementation at one school or an entire school system. Prioritize significant issues that need urgent action versus issues to address later.

A community's focus can be broad or specific. A more specific focus might be the best option if the community or school system has a priority stormwater management issue (e.g., flooding) that requires a greater level of effort and resources, or if time and budget constraints limit what can be achieved. For NNPS, localized flooding at several schools was the overriding concern.

How Do We Get Focused?

- Identify and prioritize your stormwater management issues
- Define the problem
- Create realistic goals and objectives
- Develop a plan

Questions to Ask

- What role does or should your school/ school system play in meeting your community's stormwater management objectives?
- What are the stormwater- related issues most affecting your school or community?
- What is currently being done about them?
- Are there any groups/areas that you feel are not effectively serviced?
- Are there underutilized areas on your school property/properties that can be utilized for stormwater management?
- How much useable acreage does your school need for modernization projects?
- What environmental education links can be made (such as water quality, climate change, habitat, or biodiversity)?
- What other initiatives can or should be connected to this project?
- Is your purpose to develop a pilot or create a program?

Task 2: Define the Problem

After identifying the issues and opportunities, discuss the specific problems to address. For instance, older school sites built prior to the promulgation of the CWA stormwater regulations (as in the case of NNPS) may lack stormwater controls. Localized flooding is an issue for Sedgefield Elementary, and the specific problems identified included poor drainage, excess ponding, and inadequate storm drainage. Additionally, it is important to recognize and discuss possible barriers to project implementation.

Ask questions to 1) help evaluate and fine-tune the rationale for the stormwater improvements and 2) identify the information, resources, and external support needed to implement the stormwater management projects or program. Some questions to ask include:

- What is the situation now and what is the desired future?
- How severe is the problem and what are its contributors?
- Is there a project champion, such as a principal, teacher, or parent?

Task 3: Create Goals and Objectives

After organizing a dedicated group of stakeholders, identifying the issues, and defining the problem, it is time to create goals and objectives. The group must develop and agree upon the goals and objectives; therefore, stakeholder participation is essential.

People often use the terms 'goals' and 'objectives' interchangeably, but it is important to avoid confusion and understand the difference. Goals are the long-term project destination. They should reflect the community-specific focus and need to be attainable, realistic, and address all stakeholders' vested interest. Objectives are the road map that lays out all the steps the group will take to achieve its goal. Projects may have more than one goal, and there are often several objectives for each goal.

For example, the group goal may focus on creating a system-wide program that provides multiple educational opportunities while integrating functional green infrastructure practices on school grounds. Alternatively, the group may decide to begin with a pilot school site to "test the waters" and build experience before developing a program.

Goal:

- Long-term
- General guidelines
- Represent community-specific focus (e.g., reduce pollution by...)

Objectives:

- Realistic
- Measurable
- Time-bound
- Specifc
- Achievable

Task 4: Develop Strategies

Develop strategies that clearly articulate how the effort will meet the desired goals and objectives. For each strategy, identify the stakeholders' roles and responsibilities, the resources each will bring to the table, and how the group will communicate and celebrate their accomplishments. As discussed in Step 1, the public school system and other local government agencies can establish memorandums of understanding or agreements that provide the framework of how each will work together to plan, design, build, fund and maintain the green infrastructure project(s).

Step 3: Identify Selection Criteria

Now it is time to decide the selection criteria to identify and prioritize project locations. Identify the must-haves, nice-to-haves, and shall-nots. For example, does the project:

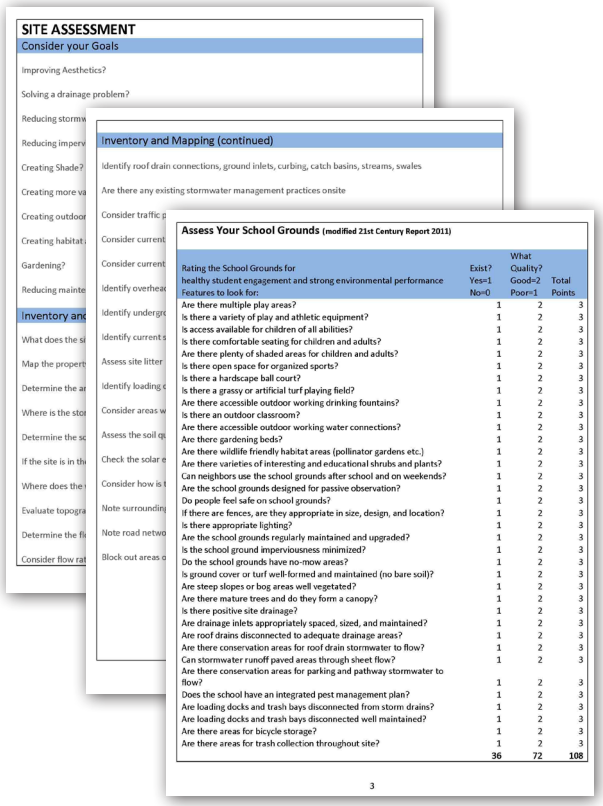
- Support community goals.
- Reduce pollutants from entering local waterways.
- Support compliance with existing stormwater requirements.
- Advance learning and education.
- Engage and benefit an underserved community.
- Reduce or have the potential to reduce existing environmental problems.

The evaluation criteria varies depending on the project goals and project types considered. After identifying and agreeing upon the selection criteria, the next step is to evaluate potential green infrastructure retrofit locations (changes to current landscape site). Geographic Information Systems (GIS)-based tools help map boundaries and areas of consideration. A follow-up field assessment (site visit) (see Appendix: Newport News Field Assessment Criteria) helps refine the project and determine the feasibility of installing green infrastructure stormwater BMPs on a particular school ground.

Criteria		Sub-Criteria	Scale
Improved Water Quality	40%	Achieves MS4 credit	Yes/No
		Achieves TMDL credit	Yes/No
		Reduces pollutant loads	Low/Med/High
		Reduces/disconnects impervious surfaces	Low/Med/High
		Enhances drinking water	Yes/No
Community Objectives	30%	Reduces flooding	Yes/No
		Provides educational opportunity	Low/Med/High
		Increases green space	Yes/No
		Provides recreation	Yes/No
		Supports underserved community	Yes/No
Project Feasibility/ Readiness	30%	Project durability	Low/Med/High
		Project cost	Low/Med/High
		Uses accepted practice	Yes/No
		Ready to implement	Yes/No
		Funding available	Yes/No
		Community support	Low/Med/High

Conduct a field assessment immediately following an average rain event. Seeing the site just after a rain event provides key information about areas of the property that experience stormwater issues (e.g., flooding, standing water). Additional considerations in site selection include available space, slopes, required setbacks, utility locations, environmentally sensitive features, soils and hydrologic conditions, water table depths, drainage areas, and whether the site has been identified for school modernization projects or other needs.

Someone who knows green infrastructure principles and practices and is familiar with local stormwater requirements should lead the site evaluation. Taking photographs and creating a rough sketch during the field assessment helps identify site challenge areas, such as flooding, and potential locations for green infrastructure features.



SITE ASSESSMENT
Consider your Goals

Improving Aesthetics?
Solving a drainage problem?
Reducing stormw
Reducing imperv
Creating Shade?
Creating more va
Creating outdoor
Creating habitat
Gardening?
Reducing mainte
Inventory and
What does the s
Map the propert
Determine the ar
Where is the sto
Determine the sc
If the site is in th
Where does the
Evaluate topogra
Determine the fl
Consider flow rat

Inventory and Mapping (continued)

Identify roof drain connections, ground inlets, curbing, catch basins, streams, swales
Are there any existing stormwater management practices onsite
Consider traffic p
Consider current
Consider current
Identify overhea
Identify undergr
Identify current s
Assess site litter
Identify loading
Consider areas w
Assess the soil q
Check the solar
Consider how is
Note surrounding
Note road netwo
Block out areas o

Assess Your School Grounds (modified 21st Century Report 2011)

Rating the School Grounds for healthy student engagement and strong environmental performance Features to look for:	Exist? Yes=1 No=0	What Quality? Good=2 Poor=1	Total Points
Are there multiple play areas?	1	2	3
Is there a variety of play and athletic equipment?	1	2	3
Is access available for children of all abilities?	1	2	3
Is there comfortable seating for children and adults?	1	2	3
Are there plenty of shaded areas for children and adults?	1	2	3
Is there open space for organized sports?	1	2	3
Is there a hardscape ball court?	1	2	3
Is there a grassy or artificial turf playing field?	1	2	3
Are there accessible outdoor working drinking fountains?	1	2	3
Is there an outdoor classroom?	1	2	3
Are there accessible outdoor working water connections?	1	2	3
Are there gardening beds?	1	2	3
Are there wildlife friendly habitat areas (pollinator gardens etc.)	1	2	3
Are there varieties of interesting and educational shrubs and plants?	1	2	3
Can neighbors use the school grounds after school and on weekends?	1	2	3
Are the school grounds designed for passive observation?	1	2	3
Do people feel safe on school grounds?	1	2	3
If there are fences, are they appropriate in size, design, and location?	1	2	3
Is there appropriate lighting?	1	2	3
Are the school grounds regularly maintained and upgraded?	1	2	3
Is the school ground imperviousness minimized?	1	2	3
Do the school grounds have no-mow areas?	1	2	3
Is ground cover or turf well-formed and maintained (no bare soil)?	1	2	3
Are steep slopes or bog areas well vegetated?	1	2	3
Are there mature trees and do they form a canopy?	1	2	3
Is there positive site drainage?	1	2	3
Are drainage inlets appropriately spaced, sized, and maintained?	1	2	3
Are roof drains disconnected to adequate drainage areas?	1	2	3
Are there conservation areas for roof drain stormwater to flow?	1	2	3
Can stormwater runoff paved areas through sheet flow?	1	2	3
Are there conservation areas for parking and pathway stormwater to flow?	1	2	3
Does the school have an integrated pest management plan?	1	2	3
Are loading docks and trash bays disconnected from storm drains?	1	2	3
Are loading docks and trash bays disconnected well maintained?	1	2	3
Are there areas for bicycle storage?	1	2	3
Are there areas for trash collection throughout site?	1	2	3
	36	72	108

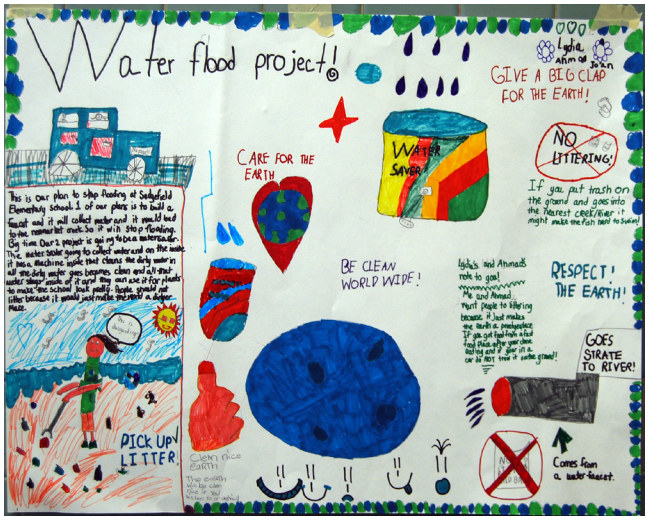
3

Newport News Field Assessment Criteria *(see Appendix)*

Step 4: Prepare A Concept Design

Now it is time to prepare a concept design! A concept design allows the group to see the initial ideas morph into a rough sketch. Use information gathered in steps one through three to develop an initial concept design. Often a blend of BMPs best achieves the site's stormwater needs. It may be beneficial to work through preliminary calculations and consider construction and maintenance activities to meet stormwater goals. Retrofit designers often work backwards from a set of existing site constraints to meet stormwater management objectives.

Additional design elements to consider include safety concerns, accessibility requirements, fire codes and fire lanes, real estate limitations, and maintenance costs. Just as meeting water quality goals may be a requirement, green infrastructure installations also must maintain a safe environment, be aesthetically pleasing, and comply with the Americans with Disabilities Act requirements.



Sedgefield Elementary students brainstorm ideas to reduce stormwater issues at their school.

Engage Stakeholders in the Design Process

It is important to engage stakeholders in the design process. In addition to determining how to incorporate green infrastructure elements into a specific school site, Stakeholders also may consider how to integrate the green infrastructure elements into the public school systems educational curriculum (e.g., Standards of Learning) and/or how to establish a plan for developing educational and engaging outdoor experiences or programs. Another key component of the design is operations and maintenance. All stormwater management systems, whether green or gray, require maintenance. To maximize the environmental benefits and reduce green infrastructure project costs over the long-term, consider ongoing operations and maintenance in the design.

One tool for getting to the design stage is to hold a one-day or multi-day meeting such as a design charrette. A charrette is an intensive, multi-disciplinary workshop where citizens, design experts, and others come together to develop a design or vision for a project or planning activity (EPA 2016a). Workshop attendees largely depend on what the group wants to achieve. Is it to prepare a concept design or options prior to presenting them to the larger community? Is it a master plan for a school ground?

Prior to the meeting, notify charrette participants about the group's previously identified focus, goals, and objectives, as well as the charrette's goals and objectives. Provide participants with information on green infrastructure practices and anything else on which the group intends to focus. This brief advance preparation allows for optimal use of the charrette format and the stakeholders time.

After the workshop, prepare a short report and a concept design summarizing the charrette results. The report should build on the charrette's result summary and focus statement. Include in the report specific short and long-term ideas, priorities, partners, and (if available) information on budgets and a financing plan.

Sedgefield Elementary Design Charette Summary

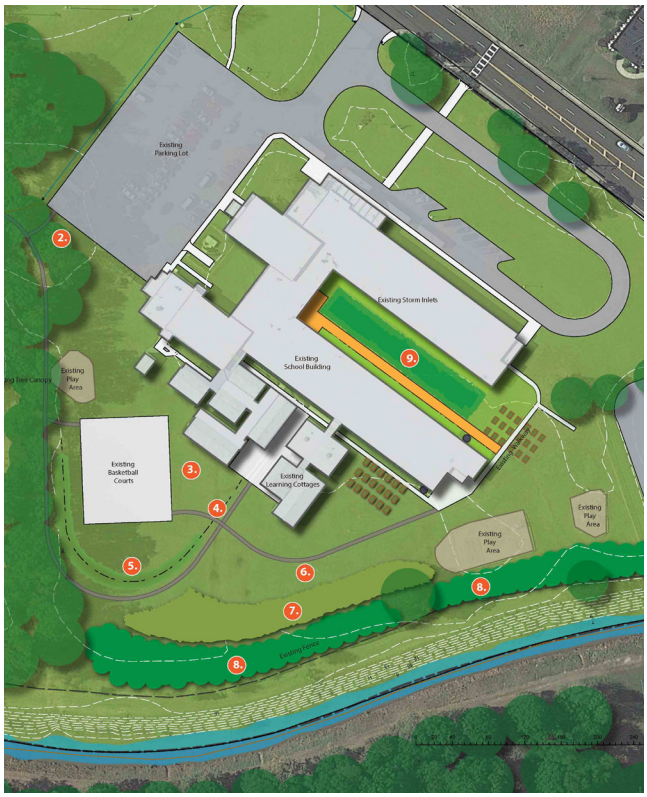
On October 7, 2016, NNPS hosted a design charrette for Sedgefield Elementary School in the school's gymnasium. Local businesses contributed light refreshments and lunch to the more than 30 participants.

The morning focused on providing attendees with information on the project's purpose, which includes the opportunity to promote environmental literacy, and an overview of the benefits of green infrastructure. In the afternoon, attendees toured the school grounds to see which areas rainfall and stormwater impacted the most.

Attendees separated into three adult design teams and one student design team. Using drawing paper and aerial maps, the teams highlighted areas of concern and noted details for specific green infrastructure practices (such as cisterns, trees, and rain gardens). Each of the four groups brainstormed design alternatives and shared their ideas with the larger group. Students in 3rd, 4th, and 5th grade presented their ideas on the design elements they wanted incorporated on their school grounds.

Finalize the Concept Design

If the school system and local permitting authority provide input at the charrette, great! Now is the time to seek school system approval. For projects that need a construction or development permit, seek regulatory input and approval as well. Many municipalities strongly recommend and some even require a pre-application meeting with appropriate permit review staff. During the meeting, each entity communicates its perceptions of the project and discusses how to incorporate their needs into the concept. If necessary, collect and integrate additional information into the initial development concept. The preliminary site plan is now complete and ready to submit for planning review.



Sedgefield Elementary concept design plan prepared through the design charrette process.

Step 5: Secure Funding and Gather Resources

As the group works toward the final design, prepare a detailed budget that itemizes the material and labor needs, the existing resources available as identified in the strategy, and funding necessary to install the green infrastructure project. Even though securing appropriate funds can be a challenge, there are various and innovative mechanisms available to fund green infrastructure stormwater BMPs.

It is important to identify financing mechanisms that provide sufficient and stable funding over time. A good resource for identifying financing mechanisms is the Staying Green report written by American Rivers and Green For All. In some cases, federal, state and local grants (visit www.grants.gov) and EPA's Clean Water State Revolving Funds provide funding for green infrastructure projects and practices. Funding needs do not end after installing the green infrastructure project; therefore, do not overlook BMP operation and maintenance costs. To credit any pollutant reductions towards achieving water quality goals and to meet NPDES MS4 permits requirements, stormwater management practices must function throughout their design life cycle.

Step 6: Build It!

The next step is to construct the green infrastructure practice(s). But wait! Many of the critical installation techniques and green infrastructure elements may be new to the construction team and can easily be misinterpreted and/ or inappropriately executed. A clear set of plans and construction documents, knowledge of intent, and experience in installing green infrastructure practices is necessary. School administrations may need to properly-train school facility management departments to do the work in-house. Schools working with outside consultants may consider using a pre-qualification process; requiring mandatory pre-bid meetings and a bid bond that guarantees the project owner that the bidder will accept the job if selected. These tools help to ensure a reputable contractor pool.

Good communication with the construction team is essential. So, too, is developing a stormwater pollution prevention plan (EPA 2007). The construction team and others involved in the project review the plan at the pre-bid, pre-construction, and weekly construction meetings as well as after storm events. Amend the plan when inspections indicate ineffective practices or other changes occur that impact the discharge of pollutants. Knowledge and understanding of state erosion and sediment control plans is necessary to implement permit requirements and is critical for project success. Virginia's Erosion and Sediment Control Handbook provided erosion and sediment guidelines for the Sedgefield project.

There are many opportunities for teachers, students, and local community volunteers to actively assist in the project installation. For example, students and volunteers can get their hands dirty planting native plants and adding mulch to complete a rain garden installation (see Spratley Gifted Center example, page 5). Teachers can provide lessons on the installation process. Actively engaging the school community provides a method to learn about stormwater management.

Oxon Hill Middle School students in Oxon Hill, MD install plants at a newly constructed micro-bioretention cell on school grounds. Image courtesy of the Clean Water Partnership.

Step 7: Champion It

School grounds are great locations for incorporating interpretive signage. They help to serve as an educational opportunity and to alert the school community that a green infrastructure practice is located on-site.

Green infrastructure projects provide many opportunities for outdoor learning. Lesson plans can incorporate environmental education, math, art, and a host of other subjects and learning experiences. There are several guidelines available for planning environmental education curriculum. In Virginia, good resources include Virginia's No Child Left Inside Act, Standards of Learning, and problem-based learning projects. The Where to Learn More section highlights several good resources. Taking the classroom out into the community does not require implementation of a green infrastructure practices on-site. School and community groups alike have organized a wide variety of programs, from neighborhood and stream clean-ups and fall leaf pick-ups to storm drain stenciling projects.

Engaging educators and students is important to give them experience and confidence to use the green infrastructure stormwater project in their teaching and learning. If a full-out environmental education plan is not in the future, incorporate the project into an existing community event, such as an Earth Day celebration. Cultivating staff and students into green infrastructure experts nurtures local green infrastructure champions.

Interpretive signage at Capital Heights Elementary School in Capital Heights, MD. Image courtesy of the Clean Water Partnership.

Step 8: Maintain it!

All stormwater management systems, whether gray or green, require regular, proactive maintenance. In fact, NPDES MS4 permits require a permittee to implement a program to ensure adequate long-term operation and maintenance of BMPs. The permit provides the requirements, which include developing standard operating procedures and an inventory for the inspection, evaluation, and maintenance of each BMP. Identifying upfront which stakeholder is responsible for the various aspects of this program is critical.

Appropriate operation and maintenance activities ensure that green infrastructure continues to function properly and yield expected water quality and environmental benefits, protect public safety, meet regulatory requirements, and protect the community investment. Consider the following factors to ensure green infrastructure projects perform as expected:

- Type of maintenance to be performed;
- Maintenance frequency and available personnel/volunteers to perform maintenance;
- Component (such as plants, shrubs, and permeable pavement) replacement costs; and
- Availability of sufficient, dedicated funds to cover operation and maintenance activities, including component replacement costs.

There is an opportunity to engage secondary school students in long-term inspection, operations, and maintenance programs. For example, a school district can incorporate field inspection and investigations to meet new science education standards and provide opportunities for students to develop solutions to real world problems. Other Storm Smart Schools developed Field-Based Investigation Programs to provide effective secondary school education that meets municipality and school district needs. Including school operations and staff from the very beginning of the process provides for creative collaboration with students, teachers, and municipal officials to achieve long-term operation and maintenance of BMPs.

Image courtesy of Montgomery County Department of Environmental Protection

Shifting the burden of basic maintenance activities to student-led or volunteer groups helps relieve pressure on limited school and municipal resources. Routine maintenance on vegetated green infrastructure practices is largely similar to general landscape maintenance. Removing trash, leaf litter, and invasive species and conducting regular inspections are simple, effective ways to get volunteers involved. Volunteer programs such as the City of Columbia, Missouri's 'Adopt-a-rain garden' program (Shelton, 2014) creates opportunities to engage trained students and community members to take a proactive role in green infrastructure maintenance.

Maintaining green infrastructure practices requires knowledge of plants and plant health. Communities can seek assistance from local Master Gardeners' program, Horticultural societies, and other local or national gardening organizations with similar knowledge. These groups may provide communities with the operation and maintenance support needed to keep installed green infrastructure practices in optimal performance.

Step and Repeat

Once you are done with the project, do not stop there! Evaluate success over time by collecting information, not just on the green infrastructure project's environmental benefits, but also on the benefits to the school and the community. Assess over time, and use this information to refine any future plans of action and determine which green infrastructure project to tackle next.

Do you have a Storm Smart success story that you want to share? You can apply to be featured on the U.S. EPA's G3 website by submitting your story online at the following website link: https://www.epa.gov/G3/forms/apply-become-g3-featured-community.

This sidewalk is being constructed using permeable pavement, which reduces runoff, rebuilding groundwater and reducing sudden surges in local streams.

References

American Rivers and Green for All. (2016). Staying Green: Strategies to Improve Operations and Maintenance of Green Infrastructure in the Chesapeake Bay Watershed. Retrieved from http://americanrivers.org/wp-content/uploads/2016/05/staying-green-strategies-improve-operations-and-maintenance.pdf.

Commonwealth of Virginia Office of the Governor. (2015, April 22). Executive Order Number Forty-Two (2015): Establishing the Virginia Environmental Literacy Challenge. Retrieved from https://governor.virginia.gov/media/3797/eo-42-establishing-the-virginia-environmental-literacy-challengeada.pdf.

Covey, S. (1989). The Seven Habits of Highly Effective People. New York, NY: Simon and Schuster.

EPA. (2016a, October 31). Public Participation Guide: Charrettes. Retrieved from https://www.epa.gov/international-cooperation/public-participation-guide-charrettes.

EPA. (2016b, September 23). What is Green Infrastructure? Retrieved from https://www.epa.gov/green-infrastructure/what-green-infrastructure.

EPA. (2007). Developing Your Stormwater Pollution Plan: A Guide for Construction Sites. (EPA-833-R-06-004). Retrieved from https://www3.epa.gov/npdes/pubs/sw_swppp_guide.pdf.

EPA. (2003). Protecting Water Quality from Urban Runoff: Clean Water is Everybody's Business. (EPA 841-F-03-003). Retrieved from https://www3.epa.gov/npdes/pubs/nps_urban-facts_final.pdf.

Hammond, J. (2016, November 26). Spratley students help Chesapeake Bay Foundation plant rain garden. Retrieved December 28, 2016 from http://www.dailypress.com/news/ education/dp-nws-cbf-rain-garden-spratley-20161122-story.html.

Shelton, A. (2014, September 2). City offers volunteers chance to adopt a rain garden. Retrieved December 20, 2016, from http://www.columbiatribune.com/news/ local/city-offers-volunteers-chance-to-adopt-a-rain-garden/article_c1fac8e0-4b0a-5f0a-88cb-30569f7d5b3e.html.

Glossary

Best Management Practice (BMP) – Structural, non-structural, and managerial techniques designed to more effectively protect receiving water quality and control stormwater quantity by temporarily storing and/or treating stormwater runoff.

Charrette – An intensive, multi-disciplinary workshop where citizens, design experts, and others come together to develop a design or vision for a project or planning activity.

Clean Water Act (CWA) – The federal environmental law governing water pollution. The CWA provides the basic structure for regulating discharges of pollutants into the waters of the United States and for regulating quality standards for surface waters.

Concept Design – A sketch prepared during preliminary stage of design that identifies significant natural features to be protected, the footprint of existing or planned development and, in the case of stormwater management, the preliminary location of green infrastructure practices. For green infrastructure concepts, it is important to determine how stormwater runoff from a proposed development, redevelopment, or stormwater retrofit will be controlled to minimize damage and the discharge of pollutants to neighboring properties and waterbodies.

Green Infrastructure – Refers to the practice of using vegetation, soils, and other elements to restore some of the natural processes required to manage water and create healthier urban environments. At the city or county scale, green infrastructure is a patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the neighborhood or site scale, stormwater management systems mimic nature to soak up and store water.

Illicit Discharge – Any discharge to a storm sewer system that is not composed entirely of stormwater, except for discharges allowed under an NPDES permit. Examples include pouring paint into or near a storm drain; directing vehicle wash water into a storm drain; or washing dumpster pads and allowing runoff to go into the storm drain.

Municipal Separate Storm Sewer System (MS4) – A conveyance or system of conveyances that is owned by a state, city, town, village, or other public entity that discharges to waters of the U.S and is designed or used to collect or convey stormwater (e.g., storm drains, pipes, ditches).

National Pollutant Discharge Elimination System (NPDES) – A permit program that addresses water pollution by regulating point sources that discharge pollutants to waters of the United States. Created in 1972 by the Clean Water Act, the NPDES permit program is authorized to state governments by EPA to perform many permitting, administrative, and enforcement aspects of the program.

- **NPDES Phase I MS4 permits** were first issued in 1990 and require medium and large cities or certain counties with populations over 100,000 or more to obtain NPDES permit coverage for their stormwater discharges.
- **NPDES Phase II MS4 permits** were first issued in 1999. The regulation requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges.

Retrofit – see 'Stormwater Retrofit'.

Stakeholders – Individuals and organizations or their representatives who hold a special interest in an issue or program – such as the stormwater program – since they may be affected by it.

Stormwater Pollution Prevention Plan (SWPPP) – A site-specific construction document that: 1) identifies potential sources of stormwater pollution at a construction site; 2) describes practices to reduce pollutants in stormwater discharges from the construction site; and 3) identifies procedures the operator will implement to comply with the terms and conditions of a construction general permit. Some states use different terms other than SWPPP. Other common terms include: Construction Best Practices Plan; Sediment and Stormwater Plan; Erosion, Sediment, and Pollution Prevention Plan; Construction Site Best Management Practices Plan; and Erosion and Sediment Control Plan.

Stormwater Retrofit – Stormwater BMPs installed on existing developments and providing treatment to areas that are either currently untreated or inadequately treated by existing stormwater management devices.

Urbanized Area (UA) – A densely settled core of census tracts and/or census blocks that have a population of at least 50,000, along with adjacent territory containing non-residential urban land uses, as well as territory with low population density included to link outlying densely settled territory with the densely settled core. (https://www3.epa.gov/npdes/pubs/fact2-2.pdf)

Where to Learn More

Green Infrastructure

EPA - Green Infrastructure (website)

https://www.epa.gov/green-infrastructure

This website includes a range of information on green infrastructure practices and policy, planning, and design tools. Here, viewers can learn more about the basics of green infrastructure, the different green infrastructure practices, and the benefits they provide. This website provides information on up-to-date resources and issues from EPA experts.

EPA's Making a Visible Difference in Communities (website)

https://www.epa.gov/smartgrowth/making-visible-difference-communities

Environmental and public health impacts affect people most significantly where they live – at the community level. EPA's Making a Visible Difference in Communities initiative focuses on providing better support to communities, especially in environmentally overburdened, underserved, and economically distressed areas where the needs are greatest. This webpage provides information on the communities where EPA provides support, offers a variety of online resources, and provides webinars on green infrastructure and other relevant topics.

Planning and Design

A Guide to Stormwater Management on School Campuses (guidebook)

http://www.phillywatersheds.org/sites/default/files/CampusStormwaterGuide.pdf

This concise guidebook presents basic schoolyard stormwater management strategies and instructions for implementing and maintaining them on school campuses and the community. The resource also offers best-management practices for everyday activities that reduce the amount of pollutants in stormwater runoff.

Philadelphia Water Department, Schuylkill Action Network, Partnership for the Delaware Estuary, & U.S. Environmental Protection Agency. (2007). A Guide to Stormwater Management on School Campuses. Region Three. (20 pages)

A Practical Guide to Planning, Constructing, and Using School Courtyards (guidebook)

http://www.montgomeryschoolsmd.org/uploadedFiles/curriculum/outdoored/outreach/PlanningConstructingUsingSchoolCourtyards_062012_.pdf

This resource promotes the use of school courtyards for instruction and leisure activities for all age groups; emphasizes the importance nature plays in the educational growth and development of children; and offers examples and guidelines for designing and maintaining courtyard spaces.

Maryland State Department of Education. (2012). A Practical Guide to Planning, Constructing, and Using School Courtyards. (103 pages)

Developing Great Schoolyards: A Handbook for Elementary Schools (guidebook)

http://www.21csf.org/csf-home/publications/DevelopingGreatSchoolyards20111025.pdf

Quality schoolyards provide opportunities for the physical challenges, exercise, sensory play, fantasy play, organized sports, and unsupervised free play that allow for healthy, well-rounded development. This document identifies key elements of healthy,

safe, and educationally rich schoolyards from a survey of public elementary school outdoor spaces in the District of Columbia.

21st Century School Fund. (2011). Developing Great Schoolyards: A Handbook for Elementary Schools (1st ed.). Washington DC. (31 pages)

Green Schools Initiative (website)

http://greenschools.net/

This is a California organization working to transform schools into sustainability models. They promote engaging youth in hands-on, inquiry-based learning and actions to improve the health and sustainability of facilities and operations. Their work focuses on training teachers, parents, facility directors, school board members and others through a seven-step approach 1) form a committee, 2) adopt a vision, 3) conduct a survey, 4) make a plan, 5) monitor progress, 6) integrate into curriculum, and 7) celebrate success. The organization provides tools and resources to support schools in reducing their environmental footprint; and advocates for state policies supporting healthy, sustainable schools and environmental literacy.

Green Schoolyard Guidelines (website)

https://www.educationoutside.org/green-schoolyard-guidelines

Education Outside partnered with the San Francisco Unified School District (SFUSD) to provide assistance and training for green schoolyard and outdoor classroom design ideas, implementation, and curricular connections. The website offers guidance materials, sample maintenance agreements, and eligibility requirements for the services provided by Education Outside.

SFUSD GSY Guidelines_2013 (companion document)

https://www.educationoutside.org/sites/default/files/SFUSD%20GSY%20Guidelines_2013.pdf

Guidelines compiled for the SFUSD to help: identify the roles and responsibilities of school communities, SFUSD staff, and community greening partners vis-à-vis schoolyard design and maintenance; establish parameters for good design of green schoolyards, including gardens, play spaces, and outdoor classrooms; and guide the selection of plants and other materials used in green schoolyards.

International School Grounds Alliance (website)

http://www.internationalschoolgrounds.org

The International School Grounds Alliance (ISGA) is a global network of organizations and professionals working to enrich children's learning and play by improving the way school grounds are designed and used.

ISGA Videos (website)

http://www.internationalschoolgrounds.org/videos/

http://www.lund.se/Global/Naturskolan/Diverse/ISGMguide2015.pdf

Extensive collection of videos that highlight green school ground projects around the world. Topics include step-by-step approaches, project tours and student interviews.

How to Start a School Garden

http://www.pps.net/Page/2095

Portland Public Schools System has a six-step application process to install a garden on a school site including a consultation with a Resources Conservation Coordinator; an example of a signed maintenance agreement; and five review points required for the School's Facility Management's approval: verification of funding; evaluation of safety; feasibility review of location, size, and plant material; assessment against codes and standards; and a signed maintenance agreement. 3 pages.

Portland Public Schools (PPS). (2015). How to Start a School Garden. Green Schoolyard Guidelines. Portland, Oregon. (4 pages)

Rainscapes for Schools (guidebook)

http://www.montgomerycountymd.gov/DEP/Resources/Files/downloads/rainscapes/fact-sheets/RainScapesForSchoolsReport2016.pdf

This report outlines goals for the Rainscapes for Schools program and identifies techniques to support those goals, which include improved water quality, hands-on environmental education, and MS4 compliance. A six-step process explains the responsibilities of DEP and Public Schools that participate in the program. The program covers rain gardens, conservation landscaping, tree planting, and a treatment train of these practices. The guidebook profiles 12 completed projects.

Maryland Department of Environment Protection (DEP). 2016. RainScapes for Schools: Environmentally Friendly Landscapes for Healthy Watersheds. (Report). Montgomery County, MD. (22 pages)

Schools for the Future: Designing School Grounds

http://www.ltl.org.uk/pdf/designing-school-grounds-smallpdf-com-1377013362.pdf

This comprehensive resource considers all participants in school grounds development (including teachers, governing bodies, community members, designers, and contractors) and multiple aspects of the planning, funding, design, and implementation. The guide also provides activities to engage students in the process.

Department for Education and Skills. (2006). Schools for the Future: Designing School Grounds. London: The Stationery Office (TSO). . (122 pages)

Schoolyard Habitat Project Guide

https://www.fws.gov/cno/pdf/HabitatGuideColor.pdf

This how-to guide provides a 9-step process for transforming school grounds into a place that engages the school community in habitat restoration. This guide covers planning, installing, and sustaining a project.

US Fish and Wildlife Services & Willow Oak Group. (2011). Schoolyard Habitat Project Guide: A planning guide for creating schoolyard habitat and outdoor classroom projects (2nd ed.). (132 pages)

Stormwater Management in Your Schoolyard

http://water.rutgers.edu/Projects/SWMIYSchoolyard/SWMIYSchoolyard.html#K8

The Stormwater Management in Your Schoolyard program was developed by the Rutgers Cooperative Extension Water Resources Program in collaboration with the Northeast States & Caribbean Islands Regional Water Center and the New Jersey Sea Grant Consortium. This website provides educational lectures, hands-on activities, and community-level outreach for students on the topics of water quality issues and stormwater management practices, such as rain gardens and rain barrels.

Tap the Sky Rainwater Harvesting (website)

http://www.tapthesky.org/

Tap the Sky develops community-driven rainwater harvesting systems in San Francisco public schools and sites throughout the Bay Area. Their mission is to encourage and facilitate rainwater catchment to demonstrate green infrastructure and community resilience. The website features project examples and descriptions; provides resources for designing and implementing rainwater harvesting systems; and focuses on volunteer participation and collaborative partnerships.

Transforming Philadelphia's Schoolyards (guidebook)

http://www.cdesignc.org/uploads/files/547129531651180934-collaborative-transforming-philadelphias-schoolyards-guide.pdf

This guidebook provides a step-by-step process for creating a schoolyard improvement program from initiation through implementation; provides information on incorporating elements into the project that enhance the educational, cultural, environmental, social, and recreational benefits; and shares successful schoolyard projects with a variety of approaches. The guidebook uses six steps, eight design elements, and three school stories to define the planning process and illustrate implementation.

Community Design Collaborative & Philadelphia Water Department. (2015). Transforming Philadelphia's Schoolyards. Philadelphia, PA. (48 pages)

Learning Through Landscapes (website)

http://www.ltl.org.uk/spaces/index.php

This website presents a step-by-step engagement process and over twenty illustrative case studies completed in the UK under their "transforming spaces" section.

USFWS Schoolyard Habitat Project Guide

https://www.fws.gov/cno/pdf/HabitatGuideColor.pdf

This comprehensive how-to guide provides information for planning, installing, and sustaining schoolyard habitat and outdoor classroom projects. The process oriented manual provides design and education tools to support woodland, meadow, and wetland creation..

US Fish and Wildlife Service. (2011). Schoolyard Habitat Project Guide: A planning guide for creating schoolyard habitat and outdoor classroom projects (2nd ed.). Pacific Southwest Region. (132 pages)

Lesson Plans and Activities

Bay Backpack (website)

http://baybackpack.com/

Bay Backpack is a web resource designed to help educators provide their students with hands-on environmental learning experiences about the Chesapeake Bay watershed.

International School Grounds Month: Activity Guide (guidebook)

https://static1.squarespace.com/static/56f1b6cbe707ebc63b90b4ef/t/575739f486db435d67ec8d61/1465334362638/ISGMguide2016_secured-June7.pdf

This guidebook provides 29 hands-on outdoor lessons spanning art, play, biology, botany, and water. It provides guidance on identifying age-appropriate activities, shows the materials needed, and includes directions and variations for each activity.

International School Grounds Alliance. (2016). International School Grounds Month: Activity Guide. (76 pages)

Understanding the Urban Watershed

http://resourcewater.org/rwfiles/Curriculum_Guide.pdf

Compilation of 27 interdisciplinary lessons with background summaries, objectives, vocabulary, activities, and discussion questions. Lessons are organized by six water themes. There is a final stewardship project, and everything is cross-walked to Common Core State Standards (CCSS). 78 pages.

Fairmount Water Works. (2013). Understanding the Urban Watershed: A Regional Curriculum Guide for the Classroom. (NOT ACCESSIBLE WITHOUT LOGIN)

The Edible Schoolyard (website)

http://edibleschoolyard.org

The Edible Schoolyard program targets public schools and aims to build and share a national edible education curriculum for pre-kindergarten through high school. The program involves students in all aspects of growing, cooking, and sharing food at the table and brings academic subjects to life in the garden, kitchen, and lunchroom. The website highlights similar programs across the country and provides principles, tools, resources, and instructional videos.

Virginia Resource Use Education Council

http://www.dcr.virginia.gov/other/environmental-education-portable/environmental-education/
www.dcr.virginia.gov/environmental-education/virginia-resource-use-education-council.html

Virginia Department of Conservation and Recreation, Virginia Resource Use Education Council (VRUEC) through Environmental Educators Leadership Program (EELP) sponsors conservation courses for teachers and trains hundreds of community educators about Virginia's natural resources. The website provides lesson plans, activities, and a self-assessment to evaluate a school's environmental literacy and sustainability efforts.

NWF Building Green School Grounds and Teaching STEM Principles

https://www.nwf.org/Eco-Schools-USA/About-Eco-Schools-USA/STEM.aspx

National Wildlife Federation (NWF), through funding support by the Motorola Foundation, creates authentic outdoor learning laboratories on school grounds and related curriculum to engage and motivate educators, students, and community members in Philadelphia and Chicago. The website provides links to NWF's EcoSchools USA program, STEM-based lesson plans, How-to Guide for Schoolyard Habitats, webinars and additional resources.

General Resources

Back to School: Back Outside (report)

https://www.nwf.org/pdf/Be%20Out%20There/Back%20to%20School%20full%20report.pdf

This comprehensive report summarizes studies of the impact of outdoor education and play on students' learning skills, career success, and test scores. The report also provides guidelines and resources for teachers, parents and communities to support environmental education and outdoor play.

National Wildlife Federation. (2010). Back to School: Back Outside, Create High Performing Students. Reston, VA. (40 pages)

TreeBaltimore (website)

http://www.treebaltimore.org/about/

TreeBaltimore serves as the umbrella organization for all Baltimore agencies and private organizations in their effort to increase the city's tree canopy. The website offers information about the benefits of trees, the financial value of Baltimore's trees, and guidance on places to plant trees, such as school campuses. The organization partners with many, including schools pursuing a goal of 40% tree canopy cover by 2037.

Appendix:
Newport News Field Assessment Criteria

SITE ASSESSMENT

Consider Your Goals

Improving aesthetics?

Solving a drainage problem?

Reducing stormwater runoff leaving site?

Reducing impervious surfaces?

Creating shade?

Creating more varied play areas?

Creating outdoor learning/teaching areas?

Creating habitat areas?

Gardening?

Reducing maintenance?

Inventory and Mapping

What does the site look like?

Map the property, create a site plan

Determine the amount of impervious area

Where is the stormwater coming from?

Determine the sources of runoff (downspouts, roads, parking areas, pathways)

If the site is in the floodplain, consider adjacent streams, swales, roads, etc.

Where does the water go?

Evaluate topography (estimate the slopes, lengths, micro-berms, ponding areas)

Determine the flow paths of runoff (run along curbs or sheet flow)

Consider flow rates and volumes (areas where rain rushes or trickles)

Inventory and Mapping *(continued)*

What does the site look like?

Identify roof drain connections, ground inlets, curbing, catch basins, streams, swales

Are there any existing stormwater management practices onsite?

Consider traffic patterns on the site (wildlife, people, bicycles, cars, machinery)

Consider current vegetated areas, can they get greener?

Consider current play areas/needs, can they be "de-paved"? Can they be divided up?

Identify overhead utilities

Identify underground utilities

Identify current site vegetation (trees, shrubs, herbaceous, grasses), location, condition, species

Assess site litter

Identify loading docks and trash dumpsters

Consider areas where buses wait/load and car drop off/pick up areas

Assess the soil quality (take live samples from around the grounds to have lab assessed)

Check the solar exposure and tree canopy

Consider how the land is used around the school grounds and how this might affect your project

Note surrounding building land uses—residential, commercial, institutional, other

Note road network around school grounds (width, volume, type of traffic)

Block out areas on site map for stormwater disconnection, interception, collection, and treatment.

Assess Your School Grounds (modified 21st Century Report 2011)

Rating the School Grounds for healthy student engagement and strong environmental performance Features to look for:	Exist: Yes=1 No=0	Quality: Good=2 Poor=1	Total Points
Are there multiple play areas?	1	2	3
Is there a variety of play and athletic equipment?	1	2	3
Is access available for children of all abilities?	1	2	3
Is there comfortable seating for children and adults?	1	2	3
Are there plenty of shaded areas for children and adults?	1	2	3
Is there open space for organized sports?	1	2	3
Is there a hardscape ball court?	1	2	3
Is there a grassy or artificial turf playing field?	1	2	3
Are there accessible outdoor working drinking fountains?	1	2	3
Is there an outdoor classroom?	1	2	3
Are there accessible outdoor working water connections?	1	2	3
Are there gardening beds?	1	2	3
Are there wildlife friendly habitat areas (pollinator gardens, etc.)?	1	2	3
Are there varieties of interesting and educational shrubs and plants?	1	2	3
Can neighbors use the school grounds after school and on weekends?	1	2	3
Are the school grounds designed for passive observation?	1	2	3
Do people feel safe on school grounds?	1	2	3
If there are fences, are they appropriate in size, design, and location?	1	2	3
Is there appropriate lighting?	1	2	3
Are the school grounds regularly maintained and upgraded?	1	2	3
Is the school ground imperviousness minimized?	1	2	3
Do the school grounds have no-mow areas?	1	2	3
Is ground cover or turf well-formed and maintained (no bare soil)?	1	2	3
Are steep slopes or bog areas well vegetated?	1	2	3
Are there mature trees and do they form a canopy?	1	2	3
Is there positive site drainage?	1	2	3
Are drainage inlets appropriately spaced, sized, and maintained?	1	2	3
Are roof drains disconnected to adequate drainage areas?	1	2	3
Are there conservation areas for roof drain stormwater to flow?	1	2	3
Can stormwater runoff paved areas through sheet flow?	1	2	3
Are there conservation areas for parking and pathway stormwater to flow?	1	2	3
Does the school have an integrated pest management plan?	1	2	3
Are loading docks and trash bays disconnected from storm drains?	1	2	3
Are loading docks and trash bays disconnected well maintained?	1	2	3
Are there areas for bicycle storage?	1	2	3
Are there areas for trash collection throughout site?	1	2	3
TOTAL	**36**	**72**	**108**

Front and Back Cover Photos:

Top image: University of North Alabama in Florence.
Photo courtesy of David Mark via Pixabay.

2nd row: Rain Gardens; A storm downspout; A terrace planter.
Photos courtesy of the Low Impact Development Center.

United States
Environmental Protection
Agency