EPA
United States
Environmental Protection
Agency

EPA Tools and Resources Webinar: Green Infrastructure Modeling Toolkit

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EPA/ORD's Safe & Sustainable Water Resources Research Program

December 14, 2016

Watch as you wait

Watch the Toolkit video:
https://www.epa.gov/water-research/green-infrastructure-modeling-toolkit

Webinar Summary

Need for Water Runoff Control: Stormwater discharges continue to cause impairment of our Nation's waterbodies. Conventional stormwater infrastructure, or gray infrastructure, is largely designed to move stormwater away from urban areas through pipes and conduit. Runoff from these surfaces can overwhelm sewer systems and end up contaminating local waterways. When stormwater runs off impervious streets, parking lots, sidewalks, and rooftops, it carries pollutants, such as motor oil, lawn chemicals, sediments, and pet waste to streams, rivers, and lakes. Runoff flows can also cause erosion and flooding that can damage property, infrastructure, and wildlife habitat. In addition to runoff problems, impervious surfaces also prevent water from penetrating the soil and recharging groundwater supplies.

Green Infrastructure: Green infrastructure, such as rain gardens, green roofs, porous pavement, cisterns, and constructed wetlands, is becoming an increasingly attractive way to recharge aquifers and reduce the amount of stormwater runoff that flows into wastewater treatment plants or into waterbodies untreated. It provides many environmental, social, and economic benefits that promote urban livability, such as improved surface water quality, water conservation, and improved aesthetics and property values. Green infrastructure is also incorporated into municipal separate storm sewer system (MS4) and National Pollutant Discharge Elimination System (NPDES) stormwater permits for retention requirements for various states across the Nation.

Green Infrastructure Modeling Toolkit: Researchers in EPA's Office of Research and Development (ORD) have been studying green infrastructure practices and developing models and tools to help communities manage their stormwater runoff and address nutrient impairment. This webinar will present a toolkit consisting of five EPA green infrastructure models and tools, along with communication material, that can be used as a teaching tool and as a quick reference resource for use by planners and developers when making green infrastructure implementation decisions, and can also be used for low impact development design competitions. The models and tools included in the toolkit are the National Stormwater Calculator (SWC), Green Infrastructure Wizard (GIWiz), Watershed Optimization Support Tool (WMOST), Storm Water Management Model (SWMM), and Visualizing Ecosystem Land Management Assessments (VELMA).

Toolkit available on EPA's website: epa.gov/water-research/green-infrastructure-modeling-toolkit

Stormwater Management Issues: How did we get here?

- Land development alters natural hydrologic cycle
- Combined sewer systems
- Wastewater systems discharge runoff and overwhelm treatment facilities
- Aging water infrastructure (gray)

Implications for communities:

- Release of untreated wastewater
- Increased runoff of stormwater
- Water quality degradation (e.g., pathogens, nutrients and resulting algal blooms, chemical contaminants)
- Stream erosion and degradation of aquatic ecosystems

Stormwater Management Issues: How did we get here?

Runoff Concerns: Combined Sewer Overflows (CSOs)

A cause for concern…

- Approximately 772 U.S. cities have water concerns due to CSOs.
- Estimated 850 billion gallons of untreated wastewater is discharged into U.S. waterways annually due to CSOs.
- Estimated 3,500 to 5,500 gastrointestinal illnesses occur annually from CSO contaminated recreational waters.

Total estimated water infrastructure needs for the United States include

- **$48.0 billion for combined sewer overflow control, and**
- **$19.2 billion for stormwater management.**

(EPA Clean Water Needs Survey 2012)

Green Infrastructure as a Solution to Runoff Issues

- Plants, soils, landscape design, and engineered techniques used to retain, absorb, and reduce polluted stormwater runoff.
- City or county scale: green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water.
- Neighborhood or site scale: green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water.

Green Infrastructure Practices

- Downspout Disconnection
- Rainwater Harvesting
- Rain Gardens
- Planter Boxes
- Bioswales
- Permeable Pavements
- Green Streets and Alleys
- Green Parking
- Green Roofs
- Urban Tree Canopy
- Land Conservation

Green Infrastructure as a Solution to Runoff Issues

Rainwater collected in planter box then channeled into rain garden
Boulder, CO

Irrigation by disconnected downspout
Denver, CO

Green roof
Salt Lake City, UT

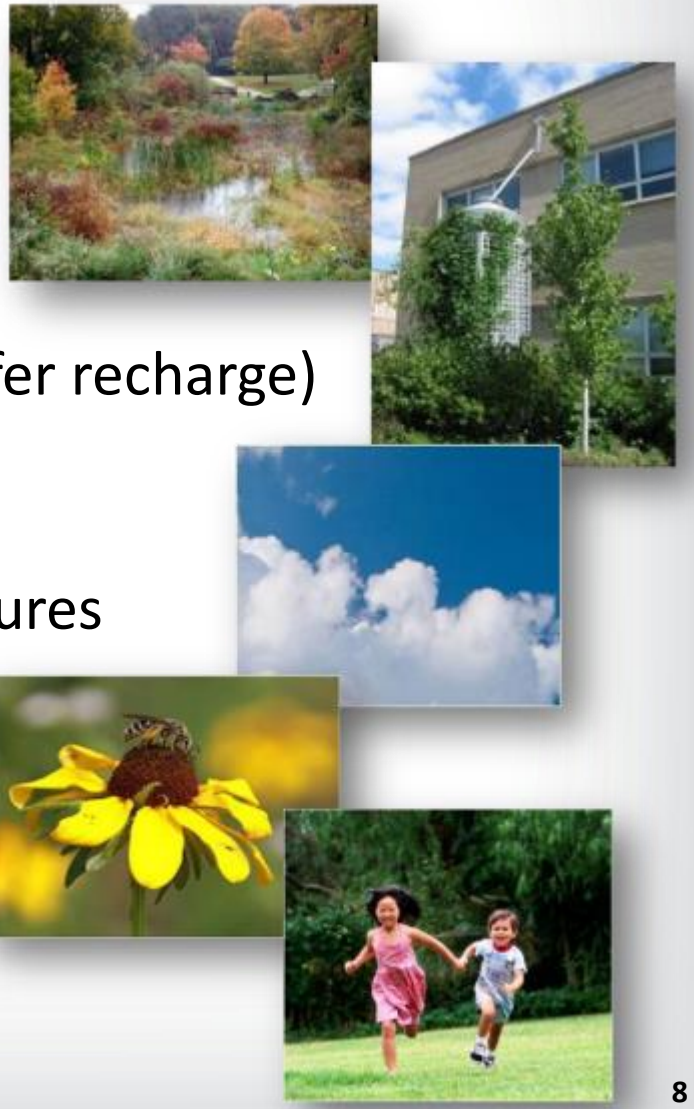
Vegetative swale
Fort Carson, CO

Pervious pavement sidewalk
Sioux City, SD

Retention pond
Fargo, ND

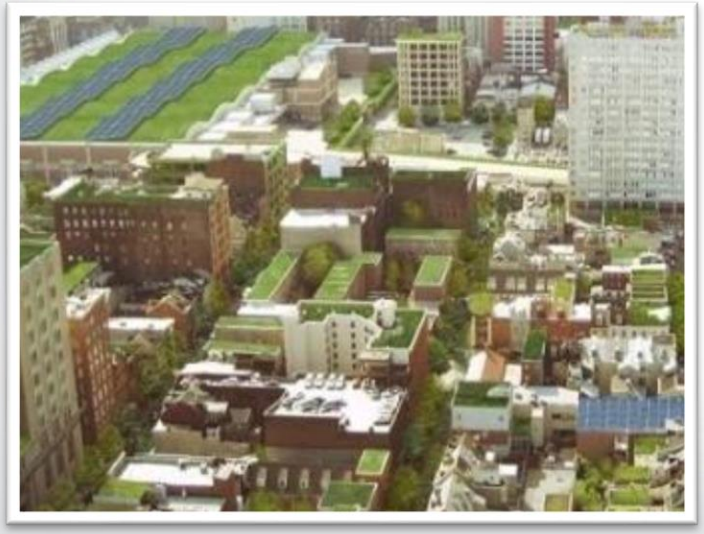
Benefits of Green Infrastructure

- Water quality control
- Mitigation of flood and erosion risks
- Increase water supply (harvesting & aquifer recharge)
- Private and public cost savings
- Improve air quality by reducing temperatures and reducing emission pollutants
- Climate resiliency
- Provide habitat for wildlife
- Community aesthetic and health benefits



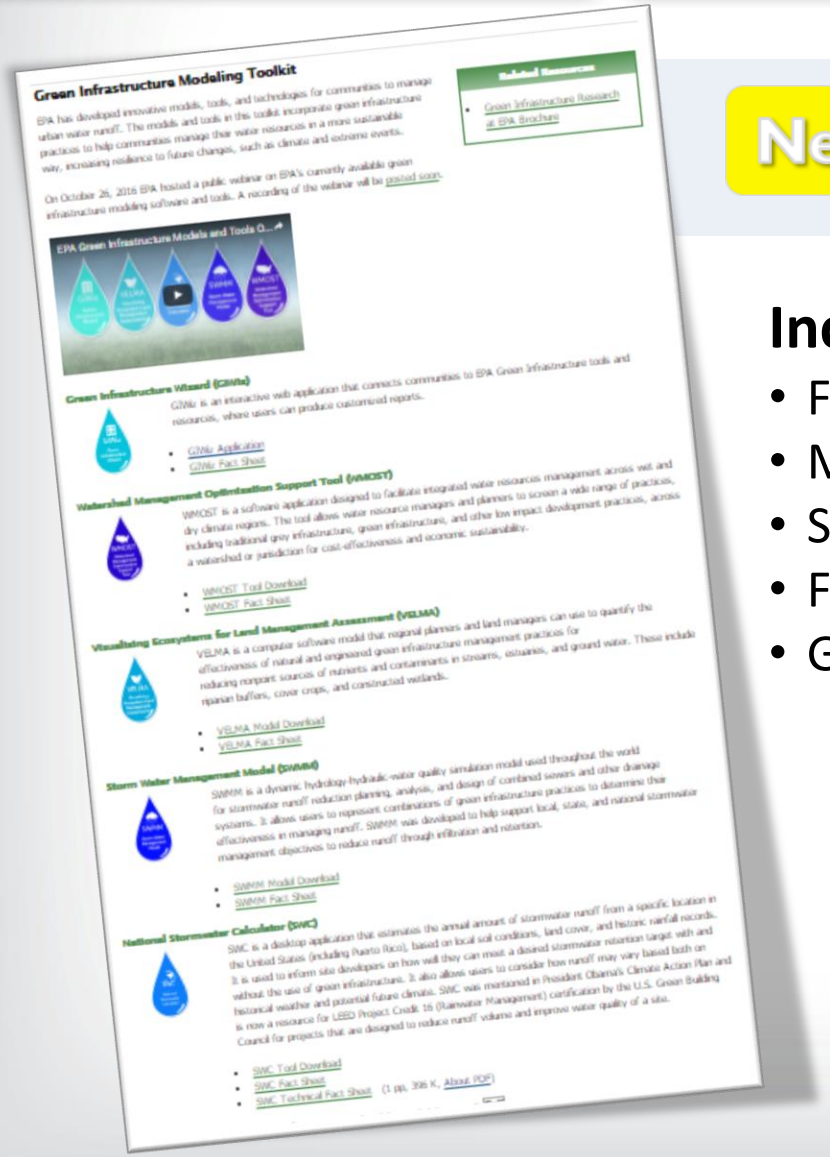
What is EPA doing to help?

Working with states and communities to identify green infrastructure implementation opportunities.



Developing modeling tools to integrate green infrastructure into stormwater management approaches.

EPA's Green Infrastructure Modeling Toolkit


Green Infrastructure Modeling Toolkit

EPA has developed innovative models, tools, and technologies for communities to manage urban water runoff. The models and tools in this toolkit incorporate green infrastructure practices to help communities manage their water resources in a more sustainable way, increasing resilience to future changes, such as climate and extreme events.

On October 26, 2016 EPA hosted a public webinar on EPA's currently available green infrastructure modeling software and tools. A recording of the webinar will be posted soon.

Related Resources
- Green Infrastructure Research at EPA Brochure

EPA Green Infrastructure Models and Tools O...

Green Infrastructure Wizard (GIWiz)
GIWiz is an interactive web application that connects communities to EPA Green Infrastructure tools and resources, where users can produce customized reports.
- GIWiz Application
- GIWiz Fact Sheet

Watershed Management Optimization Support Tool (WMOST)
WMOST is a software application designed to facilitate integrated water resources management across wet and dry climate regions. The tool allows water resource managers and planners to screen a wide range of practices, including traditional grey infrastructure, green infrastructure, and other low impact development practices, across a watershed or jurisdiction for cost-effectiveness and economic sustainability.
- WMOST Tool Download
- WMOST Fact Sheet

Visualizing Ecosystems for Land Management Assessment (VELMA)
VELMA is a computer software model that regional planners and land managers can use to quantify the effectiveness of natural and engineered green infrastructure management practices for reducing nonpoint sources of nutrients and contaminants in streams, estuaries, and ground water. These include riparian buffers, cover crops, and constructed wetlands.
- VELMA Model Download
- VELMA Fact Sheet

Storm Water Management Model (SWMM)
SWMM is a dynamic hydrology-hydraulic water quality simulation model used throughout the world for stormwater runoff reduction planning, analysis, and design of combined sewers and other drainage systems. It allows users to represent combinations of green infrastructure practices to determine their effectiveness in managing runoff. SWMM was developed to help support local, state, and national stormwater management objectives to reduce runoff through infiltration and retention.
- SWMM Model Download
- SWMM Fact Sheet

National Stormwater Calculator (SWC)
SWC is a desktop application that estimates the annual amount of stormwater runoff from a specific location in the United States (including Puerto Rico), based on local soil conditions, land cover, and historic rainfall records. It is used to inform site developers on how well they can meet a desired stormwater retention target with and without the use of green infrastructure. It also allows users to consider how runoff may vary based both on historical weather and potential future climate. SWC was maintained in President Obama's Climate Action Plan and is now a resource for LEED Project Credit 16 (Rainwater Management) certification by the U.S. Green Building Council for projects that are designed to reduce runoff volume and improve water quality of a site.
- SWC Tool Download
- SWC Fact Sheet
- SWC Technical Fact Sheet (1 pg, 396 K, About PDF)

New! epa.gov/water-research/green-infrastructure-modeling-toolkit

Included in the Toolkit:

- Five EPA models/tools
- Manuals
- Summary video
- Fact sheets
- Green infrastructure brochure

Additions coming soon:

- Webinar recording
- Case studies
- Testimonials

How the Toolkit can help Regions, States, and Communities

- Quick reference resource for use by planners and developers when making green infrastructure implementation decisions.
- Low impact development (LID) design competitions.
- Teaching and training tool.

Green Infrastructure Wizard (GIWiz)

GIWiz

- Database of EPA's green infrastructure tools and resources.
- Interactive web application that connects communities with these tools and resources.
- Wizard that provides customized links and exploration, based you your objectives and specifications.
- Decision support tool for green infrastructure implementation.
- Simple means to generate a report about tools and resources of interest.

Database content is expanding

V1 Sept 2015: 270 Tools and Resources

V2 Sept 2016: 395 Tools and Resources

Why GIWiz?

GIWiz

It can be difficult for users to navigate the vast array of available EPA green infrastructure tools, information resources, and case studies.

GIWiz makes searching easy

Example search: *EPA, green infrastructure, regulator, compliance*

National Stormwater Calculator (SWC)

SWC

Desktop application that estimates the annual amount of stormwater runoff from a specific location in the United States, including Puerto Rico.

- Used to inform site developers on how well they can meet a stormwater retention target with and without the use of green infrastructure.
- Can be used by landscape architects, urban planners, and homeowners.
- Allows users to consider how runoff may vary based both on historical weather and potential future climate.

- ***Addition of cost module in January 2017***
- ***Mobile web compatible by Fall 2017***

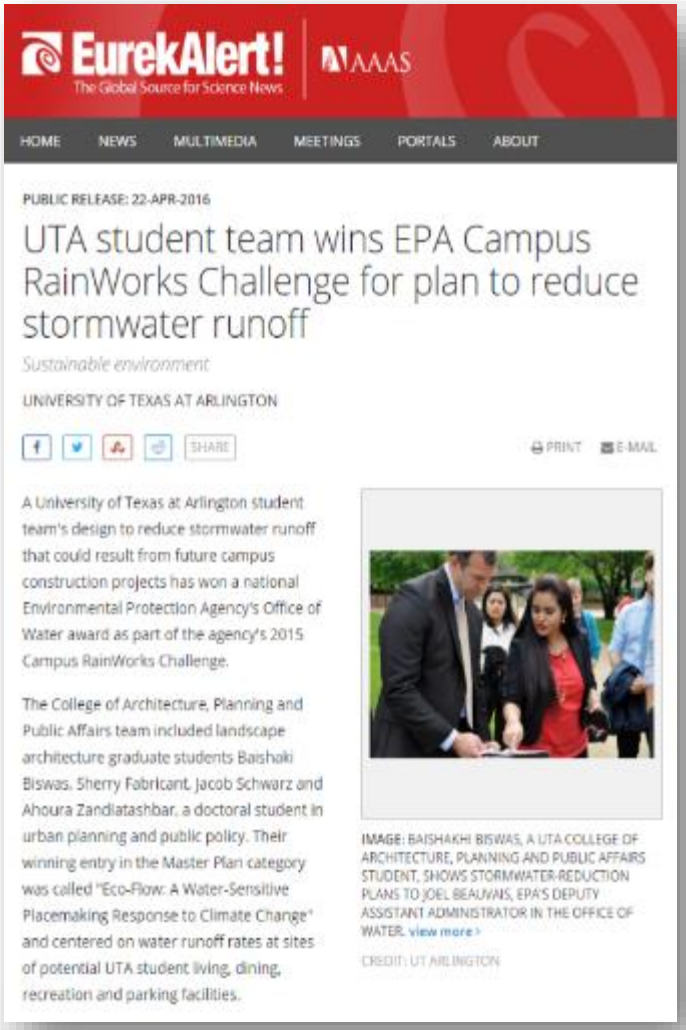
Potential Applications

- State or MS4 (Municipal Separate Storm Sewer System) Post Construction Stormwater Design Standards.
- Voluntary stormwater retrofits for private property owners.
- Voluntary programs: LEED (US Green Building Council) and Sustainable Sites Initiative stormwater credits, Rockefeller Foundation's 100 Resilient Cities.
- Climate Resiliency Planning.
- Low impact design/green infrastructure design competitions: Campus RainWorks Challenge, DC Water Green Infrastructure Challenge, etc.

Real-World Applications and Outreach

SWC

Design Competitions



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PUBLIC RELEASE: 22-APR-2016

UTA student team wins EPA Campus RainWorks Challenge for plan to reduce stormwater runoff

Sustainable environment

UNIVERSITY OF TEXAS AT ARLINGTON

SHARE PRINT E-MAIL

A University of Texas at Arlington student team's design to reduce stormwater runoff that could result from future campus construction projects has won a national Environmental Protection Agency's Office of Water award as part of the agency's 2015 Campus RainWorks Challenge.

The College of Architecture, Planning and Public Affairs team included landscape architecture graduate students Baishaki Biswas, Sherry Fabricant, Jacob Schwarz and Ahoura Zandiatashbar, a doctoral student in urban planning and public policy. Their winning entry in the Master Plan category was called "Eco-Flow: A Water-Sensitive Placemaking Response to Climate Change" and centered on water runoff rates at sites of potential UTA student living, dining, recreation and parking facilities.

IMAGE: BAISHAKHI BISWAS, A UTA COLLEGE OF ARCHITECTURE, PLANNING AND PUBLIC AFFAIRS STUDENT, SHOWS STORMWATER-REDUCTION PLANS TO JOEL BEAUVAIS, EPA'S DEPUTY ASSISTANT ADMINISTRATOR IN THE OFFICE OF WATER. view more >

CREDIT: UT ARLINGTON

AAAS (American Association for the Advancement of Science):
http://www.eurekalert.org/pub_releases/2016-04/uota-ust042216.php

Demonstration Workshops

Climate Resiliency Planning

SWC

U.S. Climate Resilience Toolkit

Steps to Resilience | Case Studies | Tools | Expertise | Regions | Topics | Search

Students Design Low-Impact Landscape to Reduce Stormwater Runoff

High school students in Kentucky became proficient in using the EPA's Stormwater Calculator. When their county planned a new library, they put their skills to work.

Case Studies › Students Design Low-Impact Landscape to Reduce Stormwater Runoff ›

The challenge of new development

Mount Washington, Kentucky, a commuter town close to Louisville, has seen marked population growth over the last decade. With that growth comes new schools, new libraries, and other urban development. Recently, the Bullitt County Library Board purchased a 1.25 acre plot of land in the city's downtown to build a new library. While the city requires that all new development projects retain a percentage of the stormwater that falls on the lot, the Library Board's drawings didn't necessarily meet those needs. Dale Salmon, who works for Mount Washington's Stormwater Quality Program, saw this as a huge opportunity for learning.

Salmon sponsors a student group, "Youth Chamber of Preservationists," made up of four Bullitt East High School juniors. The group is focused on the preservation of Mount Washington's past while caring for the future of the community. The group had been using the U.S. Environmental Protection Agency's (EPA) Stormwater Calculator for months, and they were ready for an

Steps to Resilience:

- Step 1: Explore Climate Threats
- Step 2: Assess Vulnerability & Risks
- Step 3: Investigate Options
- Step 4: Prioritize Actions
- Step 5: Taking Action

Tools:

National Stormwater Calculator—Climate Assessment Tool ›

Storm Water Management Model ›

Topic:

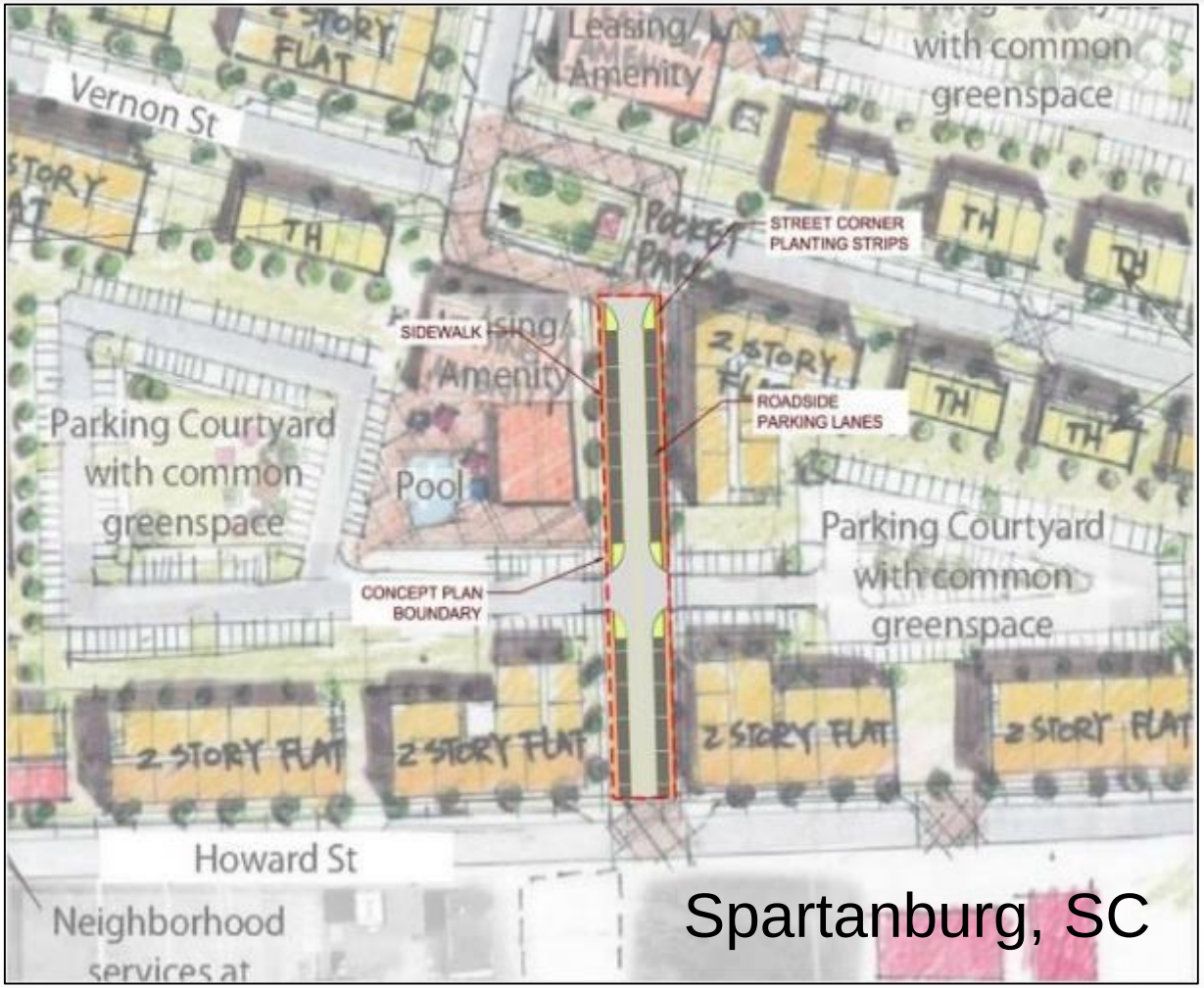
Built Environment › Water and Wastewater ›

Ecosystems › Water Resources ›

http://toolkit.climate.gov/case-studies/improving-water-quality-dealing-first-inch-rain

Conceptual Design of Green Streets

SWC

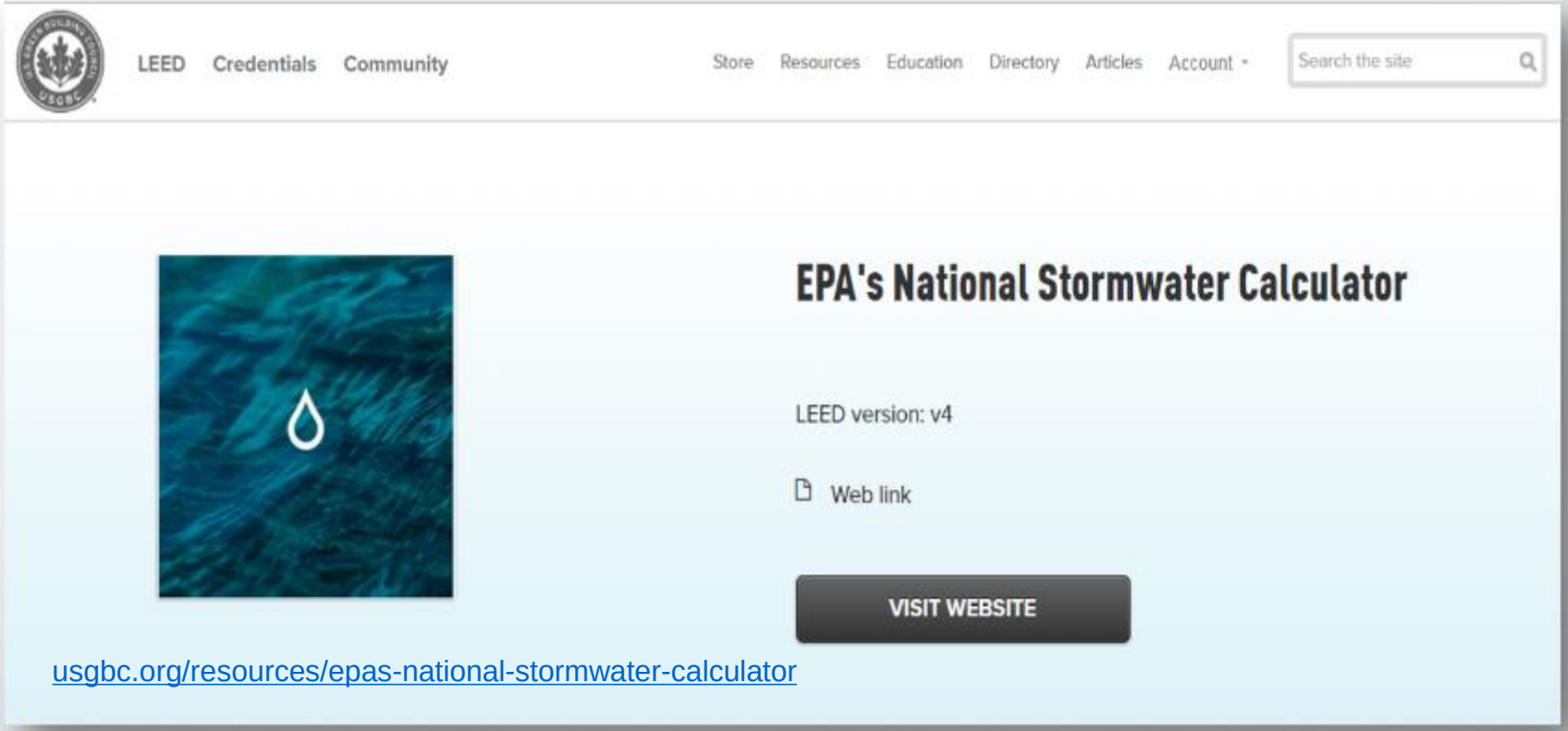


EPA Green Infrastructure Technical Assistance Project

epa.gov/green-infrastructure/northside-neighborhood-green-infrastructure-master-plan-spartanburg-sc

US Green Building Council LEED Resource Tool

Resource for LEED Project Credit 16 (Rainwater Management) certification by the U.S. Green Building Council for projects that are designed to reduce runoff volume and improve water quality of a site.



usgbc.org/resources/epas-national-stormwater-calculator

Green Infrastructure Grant Funding Application

SWC

Applicants must use the SWC for conducting their stormwater runoff analyses for their grant application submission.

Northeast Ohio Regional Sewer District

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http://www.neorsd.org/greenfunding.php

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- Customer Service
- Business with us
- Project Clean Lake and CSO consent decree
- Stormwater and Watersheds
- Educational resources
- Funding opportunities
- Member Community Infrastructure Program MCIP
- Regional Stormwater Management Program

Funding opportunities

Working together from a watershed perspective. The District understands the valuable role that our partners play in helping to address flooding, erosion, and water quality concerns through innovative stormwater management practices, and stream and wetland restoration. This work compliments the District's commitment to clean water and water-quality protection throughout the District's service area and tributary watersheds.

Green Infrastructure Grant Program for the Combined Sewer Area

GREEN INFRASTRUCTURE GRANTS DOCUMENTS

Project partners must download and complete the following forms.

Reimbursement policy
How to obtain reimbursement

Reimbursement form 1
For project details and signatures

Reimbursement form 2
Expense tracking table

GREEN INFRASTRUCTURE GRANTS

The 2016 Green Infrastructure Grants Program Call For Proposals
DEADLINE 12/21 2015

Download [PDF]

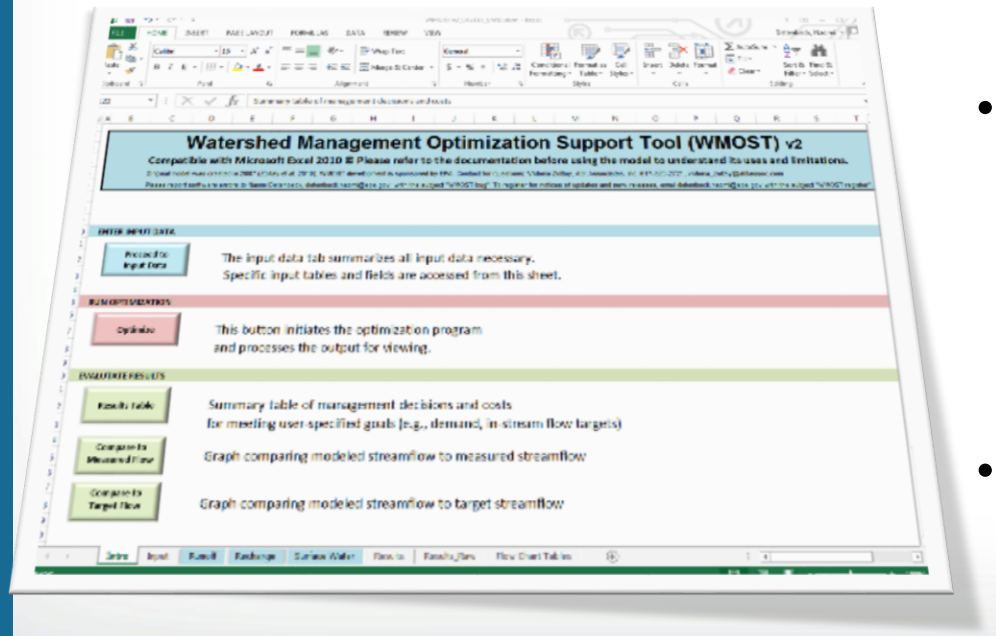
WATERSHED ORGANIZATION SERVICE AGREEMENTS

Project partners must download and complete the following forms.

Watershed Management Optimization Support Tool (WMOST)

WMOST

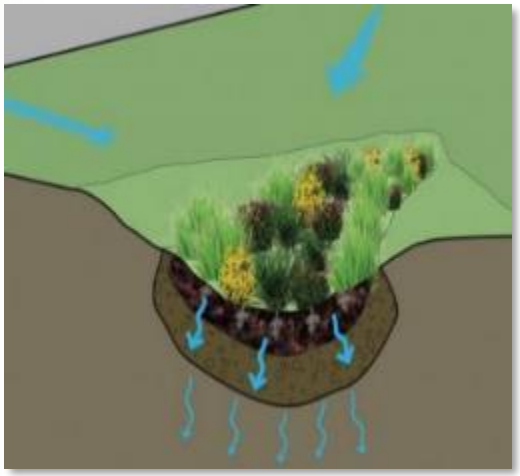
- Decision-support tool for integrated water management at the small watershed/community scale.
- Optimizes cost and evaluates management options in multiple programs, including stormwater, wastewater, drinking water, and land conservation.



- Target users are community decision-makers, such as municipal, regional, or watershed planners; utility managers; and community consultants.
- Used for planning level assessments.

Example Applications

WMOST



- **Ipswich River, MA**
  What is the most cost-effective suite of management actions to meet target baseflows in the Ipswich River?

- **Monponsett Ponds watershed, Halifax, MA**
  What are the tradeoffs among flood control, recreational use, downstream aquatic life use, and sustainable water supply? What are the most cost-effective management practices to both reduce water quality impairments and manage for resilience in the face of climate change?

- **Subwatersheds of Taunton River, MA (multiple communities)**
  What is the value of natural and constructed green infrastructure in reducing flooding and water quality impairments under different development and climate change scenarios?

- **Subwatersheds of Montgomery County, MD**
  What are the most cost effective management practices and tradeoffs involved in meeting both local sediment TMDLs and N/P/SS targets for the Chesapeake Bay TMDL?

- **Subwatersheds of Middle Kansas River, KS**
  What are the most cost-effective management practices to both reduce water quality impairments and manage for resilience in the face of climate change?

Application in Halifax, MA

WMOST

- Coordinated with the town of Halifax, Monponsett Ponds (MP) Watershed Workgroup, and EPA Region 1.
- Developed a case study for the MP Watershed in conjunction with development of WMOST version 2.
- Halifax Board of Health has used the information provided by the case study in applying for grants to implement best management practices in the watershed.

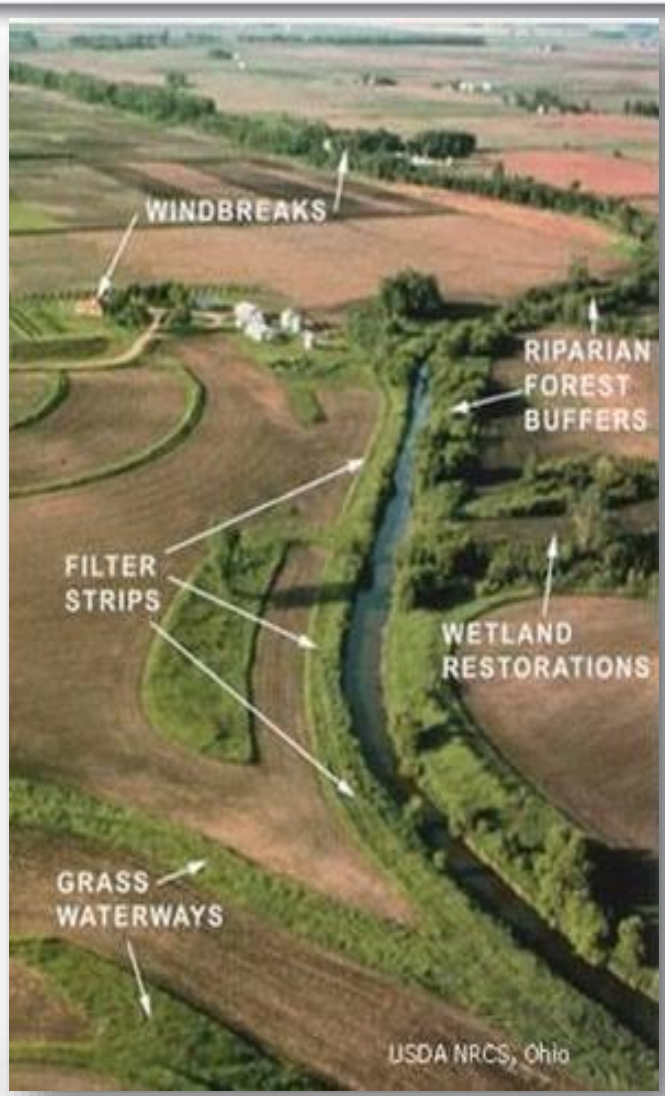
Monponsett Pond Work Group

"The process of applying this model (WMOST) to Halifax, MA was very useful from the beginning, allowing residents and stakeholders to participate in informing the scientists of the complicated issues and challenges facing the Monponsett Ponds. The model analyzed the data and needs of the area, resulting in a very useful report with options and ideas we can implement and use when seeking grant funds. We thank you!" —Cathy Drinan, Halifax Board of Health

Visualizing Ecosystems for Land Management Assessment (VELMA) Model

VELMA

- Identify green infrastructure best management practices for enhancing water quality and ecosystem service co-benefits.
- Users include communities, tribes, land managers, and EPA regions and scientists in Pacific Northwest, Central Plains, Midwest and East Coast.



Broad Applicability

VELMA

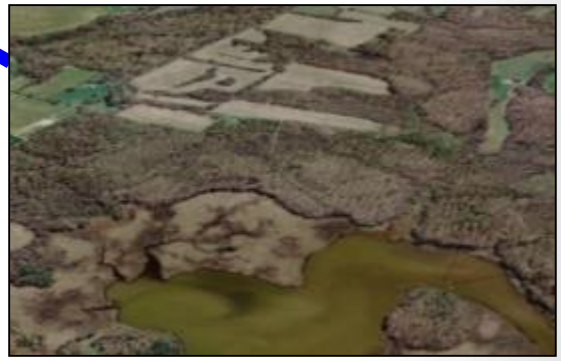
Salmon Recovery Planning
Puget Sound, WA

Urban GI Effectiveness
Seattle, Duluth, Mobile Bay

Constructed Wetland Effectiveness
Agricultural Watershed, OH

Estuarine Water Quality
Tillamook Bay Estuary, OR

Smoke Management Planning
Central Plains Rangelands, KS



Forest Buffer Effectiveness
Chesapeake Bay Agriculture, MD

Storm Water Management Model (SWMM)

SWMM

- Used widely throughout the world for large-scale planning, analysis, and design related to stormwater runoff, combined and sanitary sewers, and other drainage systems in urban areas.
- Many applications for drainage systems in non-urban areas.
- Developed to help support local, state, and national stormwater management objectives to reduce runoff through infiltration and retention.

- Professional tool used by civil and environmental engineers.
- Used at the municipal level to design and manage stormwater and sanitary sewer infrastructure.
- Many large cities across the US and around the world rely on SWMM.

Broad Applicability

SWMM

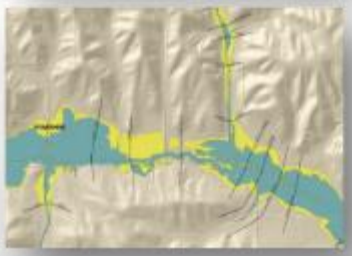
Design and sizing of drainage system components including detention facilities.

Control of combined and sanitary sewer overflows.

Modeling infiltration and inflow in sanitary sewer systems.

Generating non-point source pollutant loadings for waste load allocation studies.

Evaluating best management practices and LIDs for sustainability goals.



Flood plain mapping of natural channel systems.

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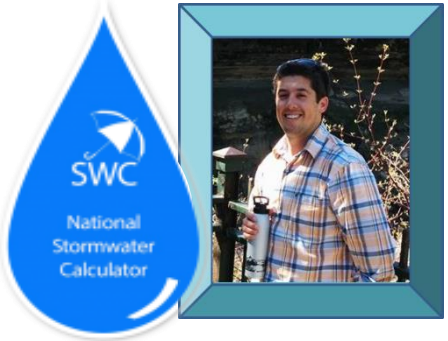

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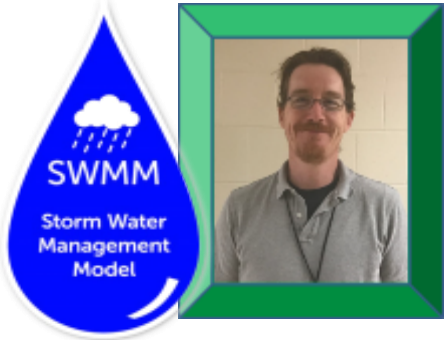

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Questions and Answers Session