

U.S. EPA National Stormwater Calculator: Cost Module & Mobile Web App

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Outline

U.S. EPA National Stormwater Calculator

- Stormwater Calculator (SWC) Background Information
- Low Impact Development (LID) Cost Estimation Module
- SWC Web Application
- Example Application: Northport, MI
- Interpreting Results
- Training & Outreach
- Discussion & Questions

National Stormwater Calculator Website

EPA United States Environmental Protection Agency

Environmental Topics Laws & Regulations About EPA Search EPA.gov

Related Topics: [Water Research](#) CONTACT US SHARE

National Stormwater Calculator

Register now for a [free webinar](#) on January 31, 2018 that will provide a demonstration and introduce new features.

Tool to help control runoff and promote the natural movement of water

EPA's National Stormwater Calculator (SWC) is a software application that estimates the annual amount of rainwater and frequency of runoff from a specific site. Estimates are based on local soil conditions, land cover, and historic rainfall records. It is designed to be used by anyone interested in reducing runoff from a property, including site developers, landscape architects, urban planners, and homeowners.

The SWC accesses several national databases that provide soil, topography, rainfall, and evaporation information for a chosen site. The user supplies information about the site's land cover and selects low impact development (LID) controls they would like to use. The LID controls include seven green infrastructure practices.

[Access the Mobile Web App](#)

Additional Information

EPA's National Stormwater

- Green Infrastructure as Low Impact Development Controls +
- Capabilities +
- Real-World Applications +
- Software and Documentation +

<http://www2.epa.gov/water-research/national-stormwater-calculator>

What We Developed and Why?

A Stormwater Management (Green Infrastructure/LID) Design and Planning Tool

- To estimate post-construction urban stormwater runoff discharges
- Screening-level stormwater runoff reduction and cost analyses of various green infrastructure/LID practices, including:
 - Green roofs, rain gardens, cisterns, etc. throughout the U.S.
- Allow non-technical professionals to conduct screening level stormwater runoff for small to medium sized (less than 1 - 12 acres) sites

Green Infrastructure Modeling Toolkit



Toolkit website: <https://www.epa.gov/water-research/green-infrastructure-modeling-toolkit>

***Toolkit video:** https://www.youtube.com/watch?time_continue=2&v=xHp-OeUneqQ

Potential Applications

- State or MS4 (Municipal Separate Storm Sewer System) Post Construction Stormwater Design Standards
- Voluntary Stormwater Retrofits for private property owners
- LID/Green Infrastructure Design Competitions: DC Water Green Infrastructure Challenge, etc.
- Climate Resiliency Planning: Rockefeller Foundation's 100 Resilient Cities
- Green Building Programs: LEED (U.S. Green Building Council) and Sustainable Sites Initiative stormwater credits

Recent Examples of Urban Stormwater Management Projects: Great Lakes Region

- **Wisconsin:**
 - Manitowoc: rain garden along Blue Rail Marina Beach
 - Oak Creek: porous pavement parking area and bioretention along lakeside bluff
- **Michigan:**
 - Northport: pervious pavement, rain gardens, and tree box filters for Grand Traverse Bay
- **Indiana:**
 - Michigan City: green infrastructure streetscape (rain gardens & bioswales)

Communities using the SWC

- Northeastern Regional Ohio Sewer District (Cleveland, OH):

[Home](#) > [Stormwater](#) > [Green Infrastructure Grant Program](#)

Green Infrastructure Grant Program



<https://www.neorsd.org/stormwater-2/green-infrastructure-grant-program>

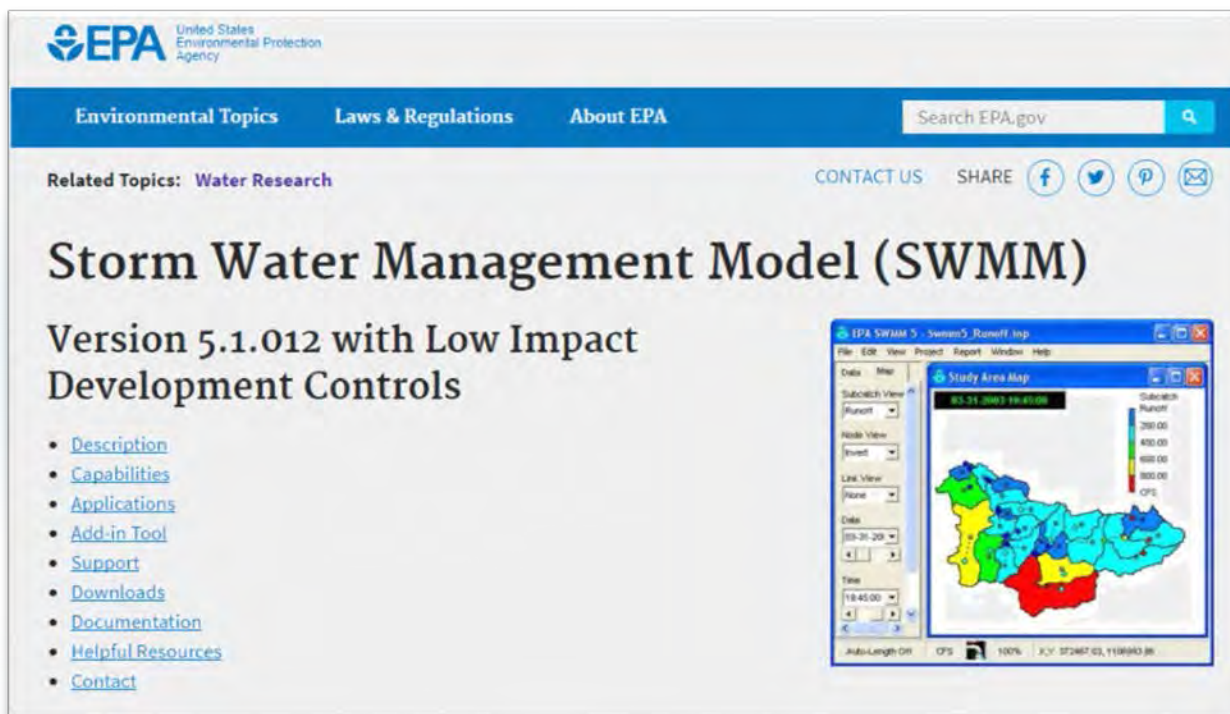
- EPA's Green & Complete Streets Building Blocks Program Recipients (2016- 2017):

- Manatee County, FL
- Baltimore, MD
- Central Falls, RI




<https://www.epa.gov/smartgrowth/building-blocks-sustainable-communities>

Storm Water Management Model (SWMM)



- SWC is based on SWMM: dynamic rainfall-runoff simulation model for long-term simulation of runoff quantity
- SWMM produces stormwater runoff estimates in the background of the SWC

National Stormwater Calculator (SWC) Desktop Application

 National Stormwater Calculator

Overview | Location | Soil Type | Soil Drainage | Topography | Precipitation | Evaporation | Climate Change | Land Cover | LID Controls | Results

Welcome to the EPA National Stormwater Calculator


This calculator estimates the amount of stormwater runoff generated from a land parcel under different development and control scenarios over a long-term period of historical rainfall.

The analysis takes into account local soil conditions, topography, land cover and meteorology. Different types of low impact development (LID) practices can be employed to help capture and retain rainfall on-site. Localized climate change scenarios can also be analyzed.

Site information is provided to the calculator using the tabbed pages listed above. The Results page is where the site's runoff is computed and displayed.

This program was produced by the U.S. Environmental Protection Agency and was subject to both internal and external technical review. Please check with local authorities about whether and how it can be used to support local stormwater management goals and requirements.

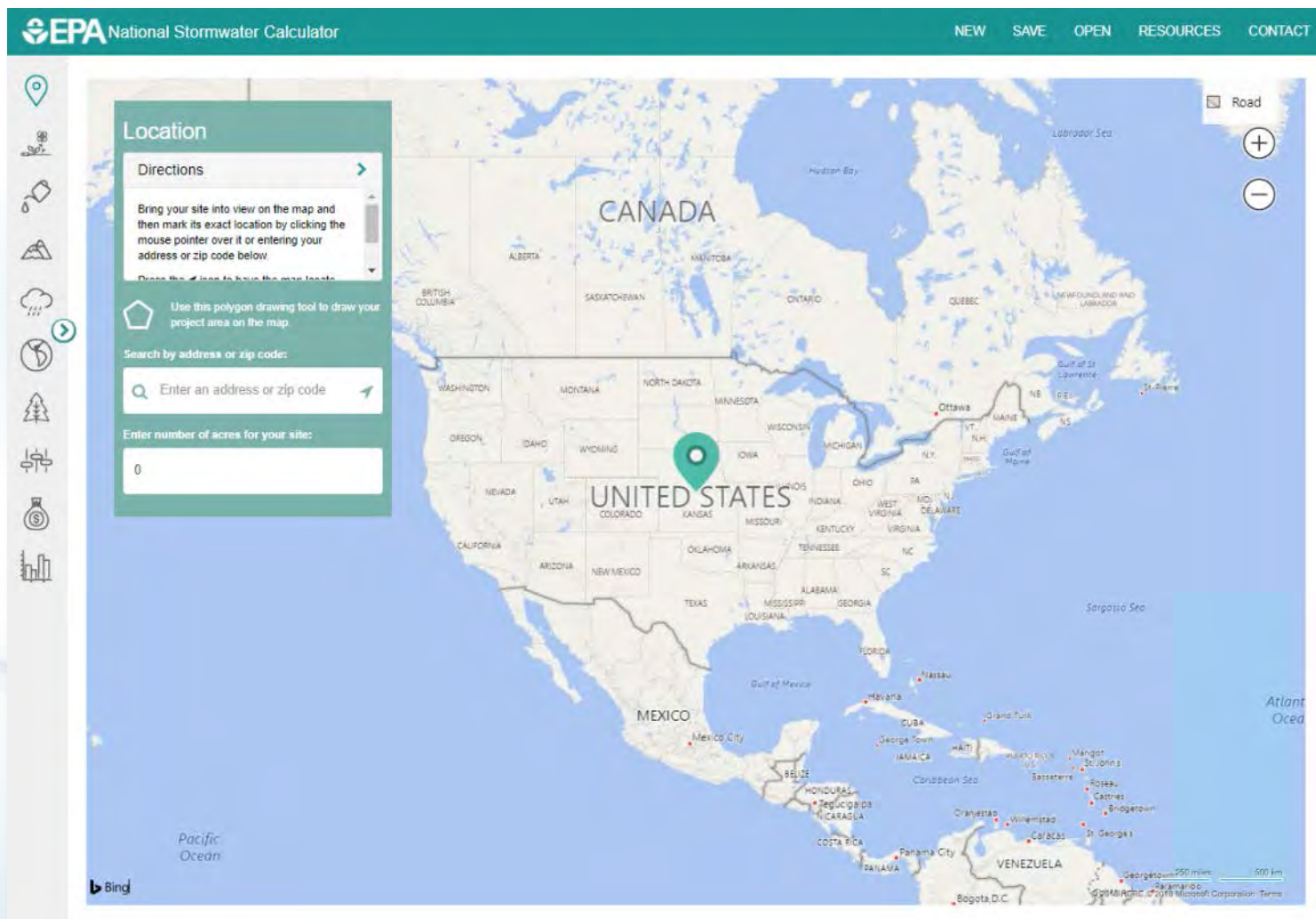
Release 1.2.0.0



Select the Location tab to begin analyzing a new site.

[Analyze a New Site](#) [Save Current Site](#) [Exit](#)

SWC Mobile Web App



LID Cost Estimation Module (Released May 2017):

- **Intended Uses:**

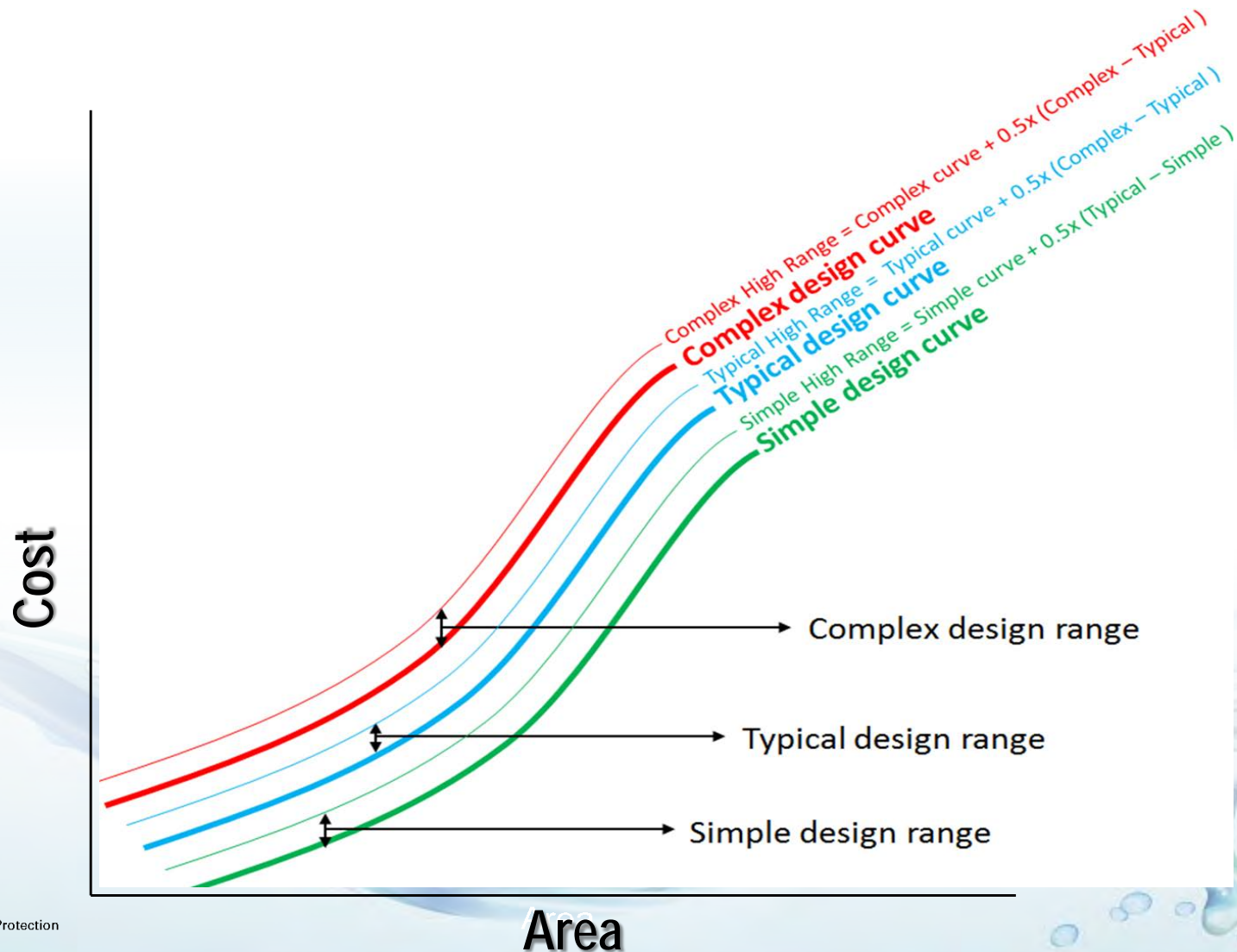
- Planning level cost estimates (magnitude of costs between planning scenarios)

- **Limitations:**

- Doesn't provide final construction costs
- Doesn't provide lifecycle costs (gives annual operation and maintenance (O & M) costs, not replacement costs)
- Regional costs not available for all areas of the US (many of the Western states)

LID Cost Estimation Module:

Accounting for Uncertainty with Cost Estimates (Regression Cost Curves)



LID Cost Estimation Module:

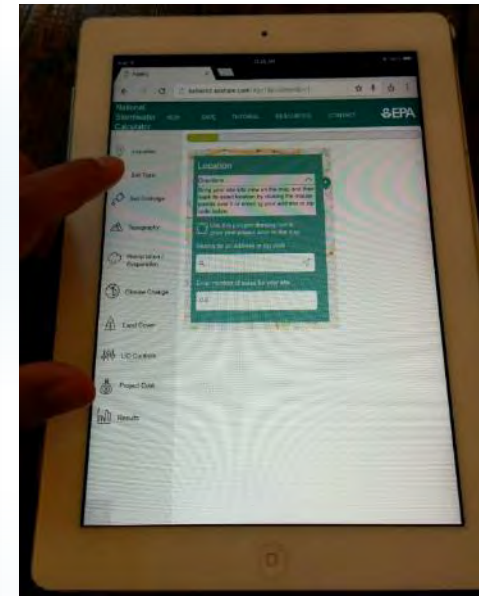
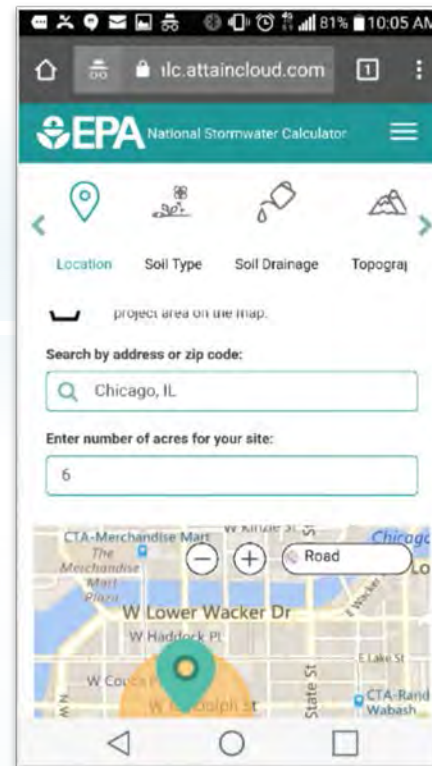
Development of Regionalized LID/Green Infrastructure Costs

- **Utilization of Bureau of Labor Statistics (BLS) Data for regional costs**
 - National Producer Price Index: outputs of service, construction, utilities, and other goods producing entities
 - Examples include: concrete storm sewer pipe, construction sand and gravel, etc.
 - Consumer Price Index: regional/city data (23 major US cities)
 - Examples include: fuels and utilities, energy, and diesel fuel
- **Data easily updated and maintained annually by EPA**
- **Development of regional costs comparable to Engineering News Record (ENR) and RS Means**

Release of SWC Web App

Sept. 2017

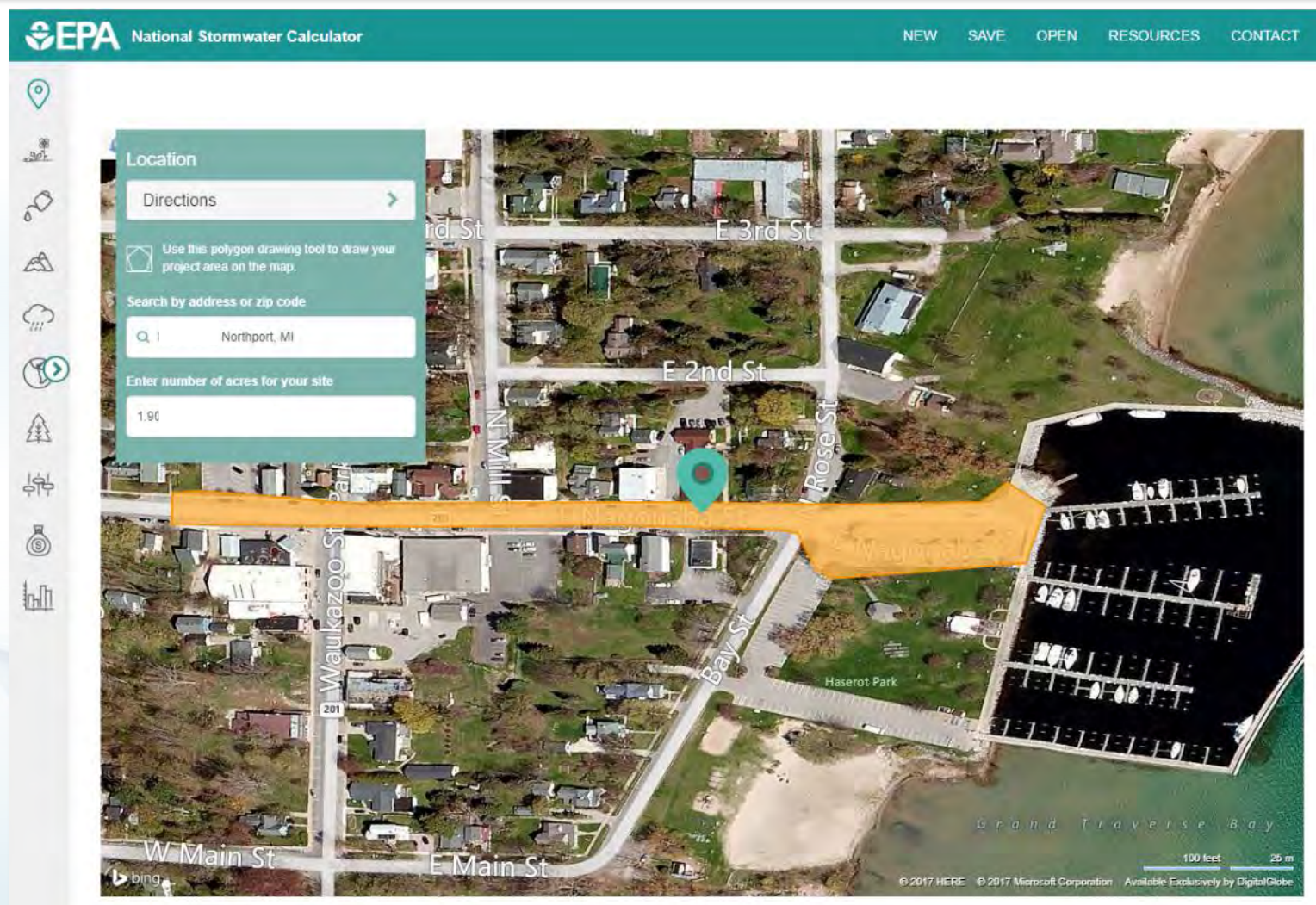
- Ability to function on any web browser
- Mobile friendly design (tablets and smartphones)
- Platform neutral: functions on Windows, Apple, and Linux computers
- Not found in an “app store” (Google Play or Apple Store)
 - Save it as a “favorite” website
- Requires a live Internet connection



Example views from smartphone and tablet

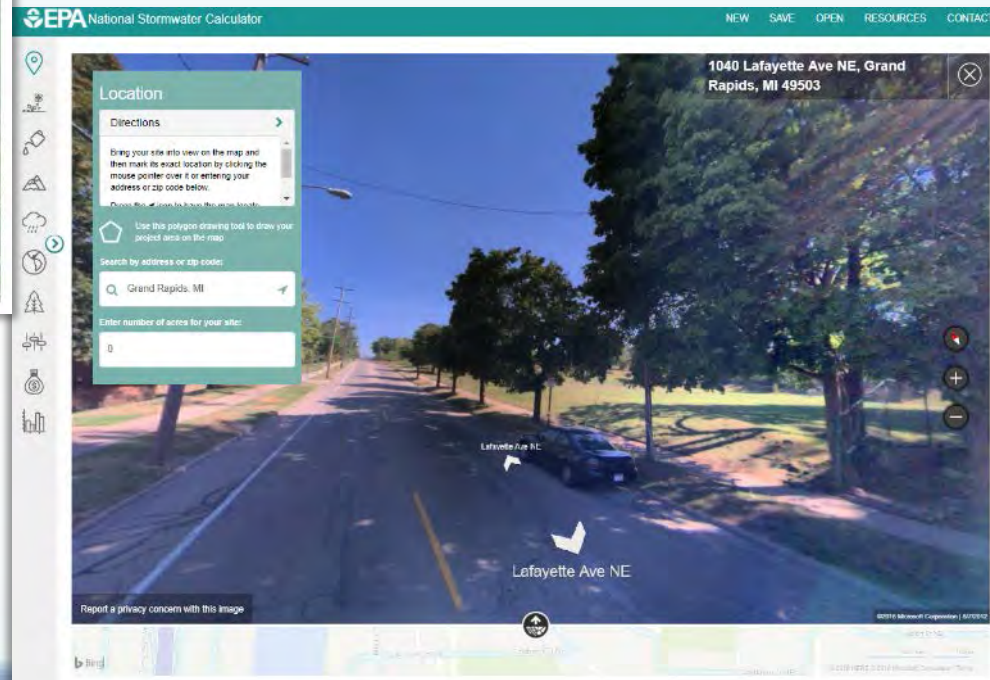
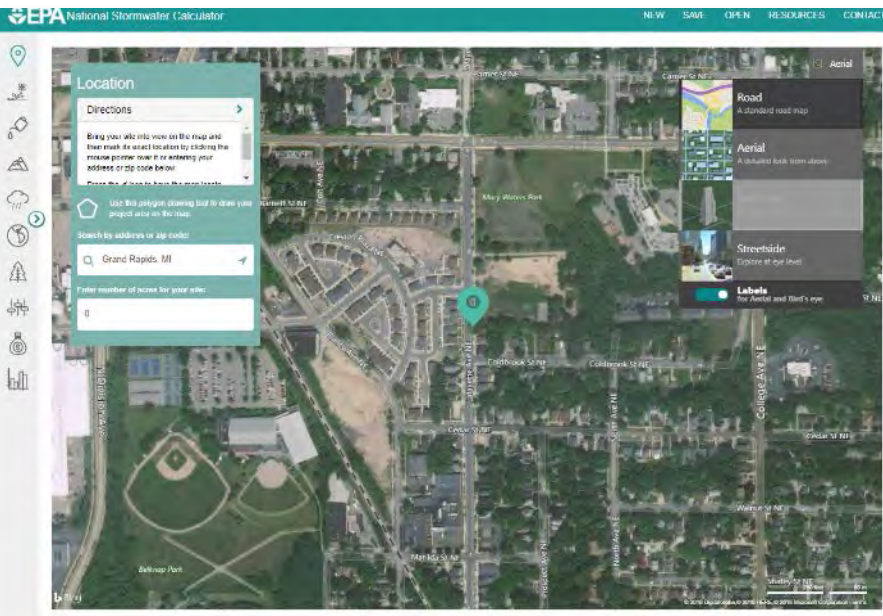
SWC Mobile Web App Application (Northport, MI)

Location:



Bing Maps:

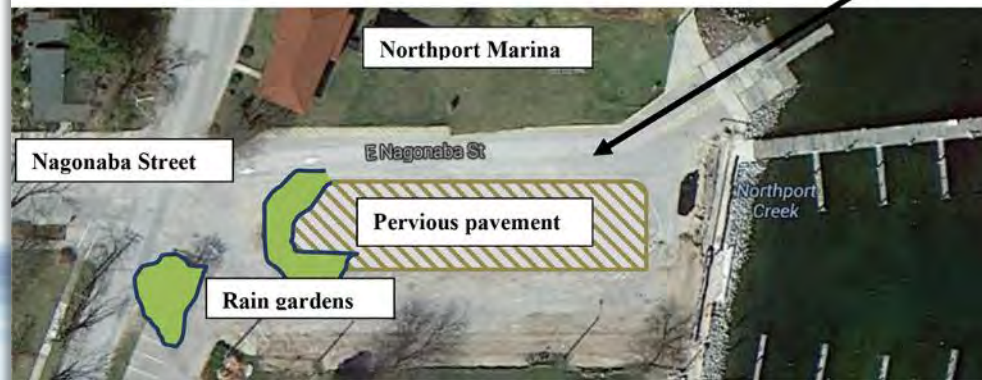
**new streetside view for major urban areas*



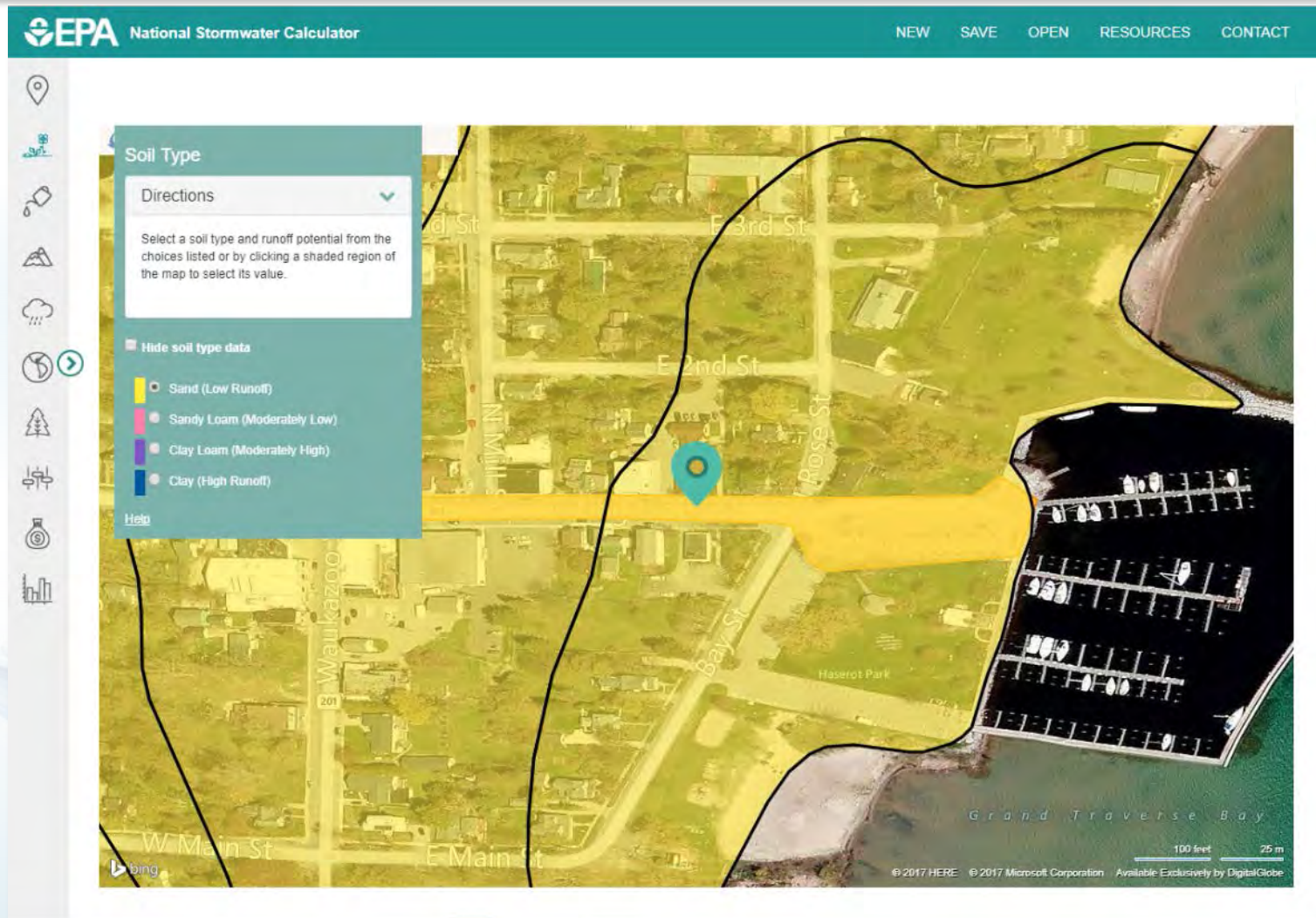
SWC Mobile Web App Application (Northport, MI)



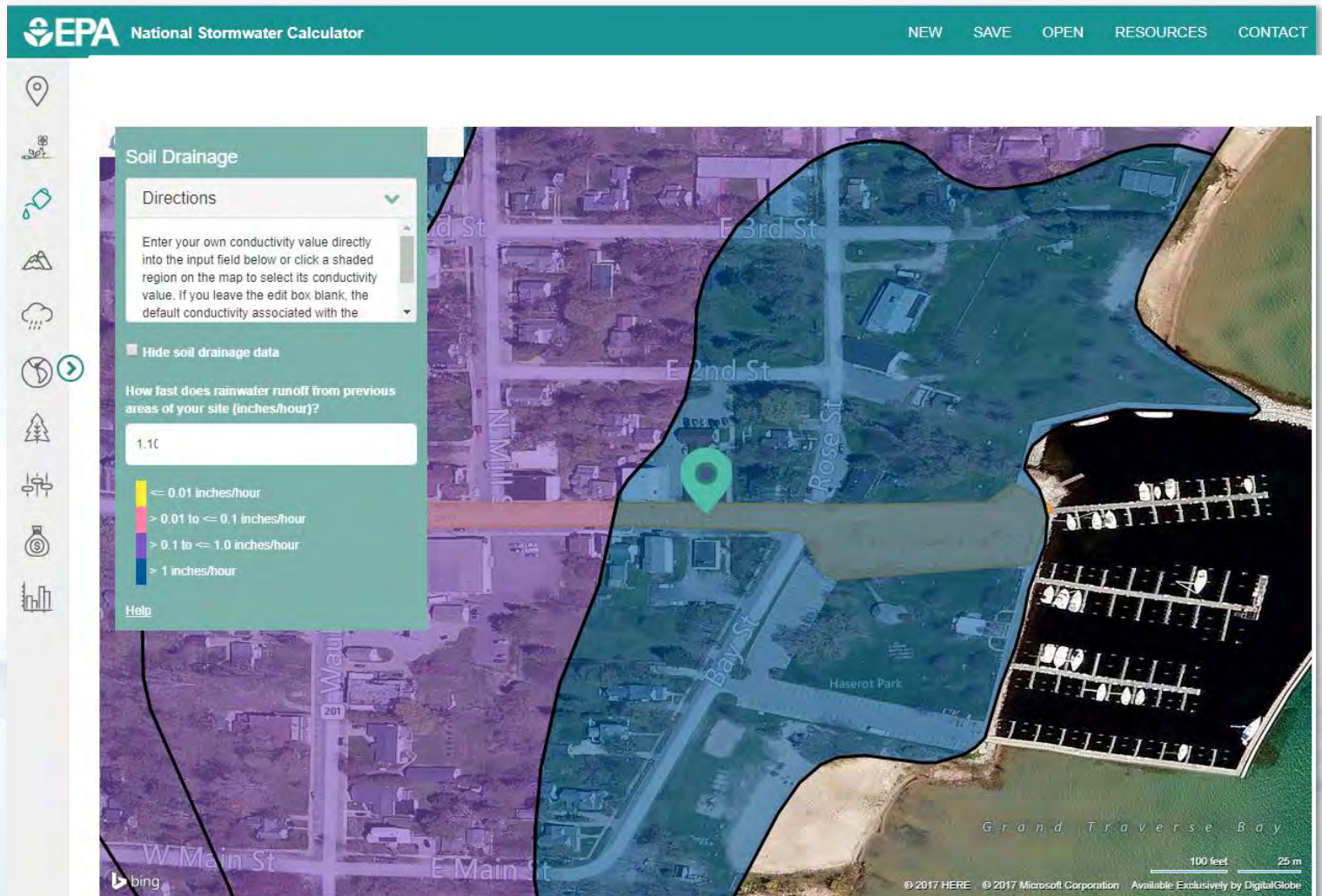
The Watershed Center Grand Traverse Bay (2016)



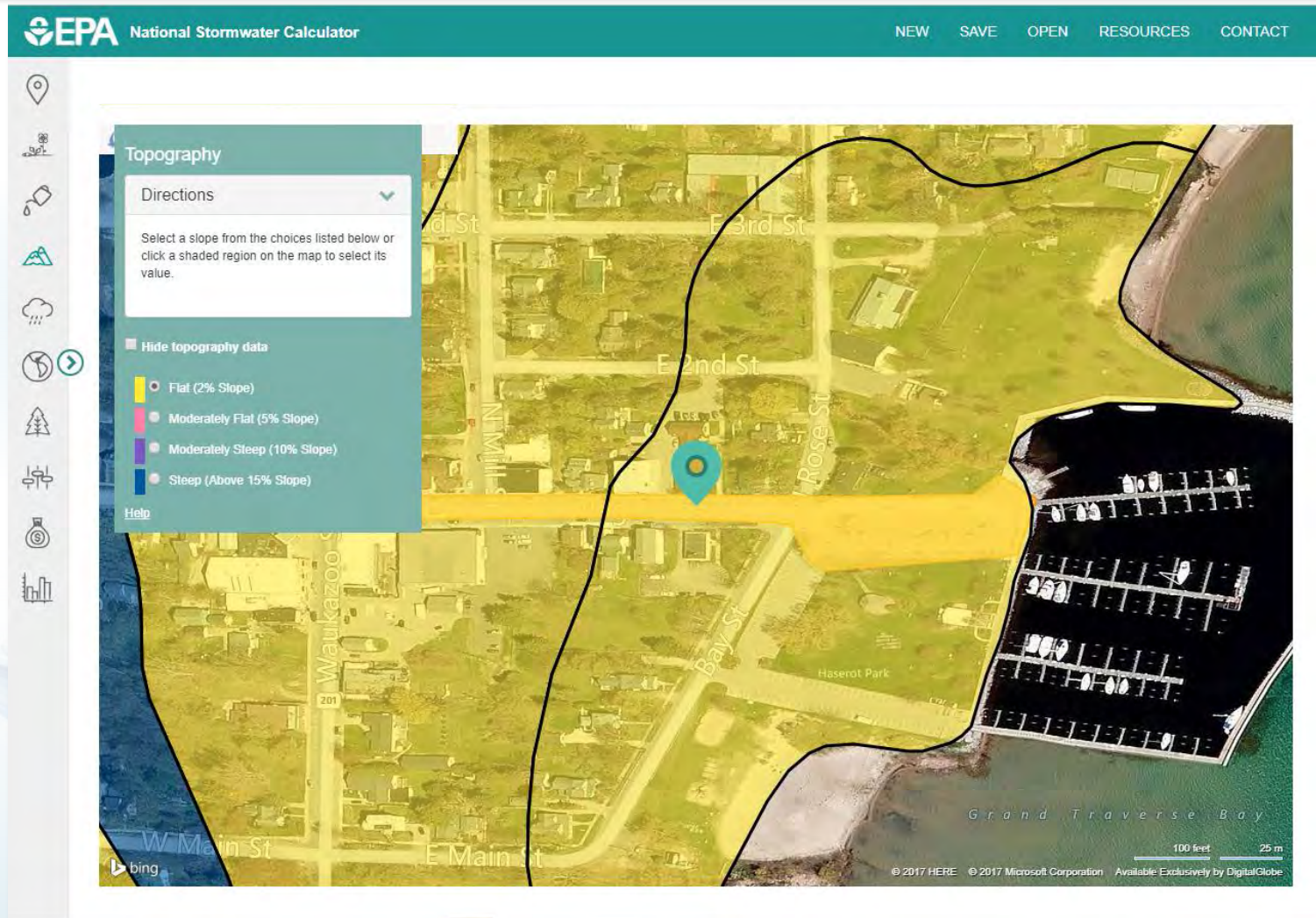
Soil Runoff Potential:



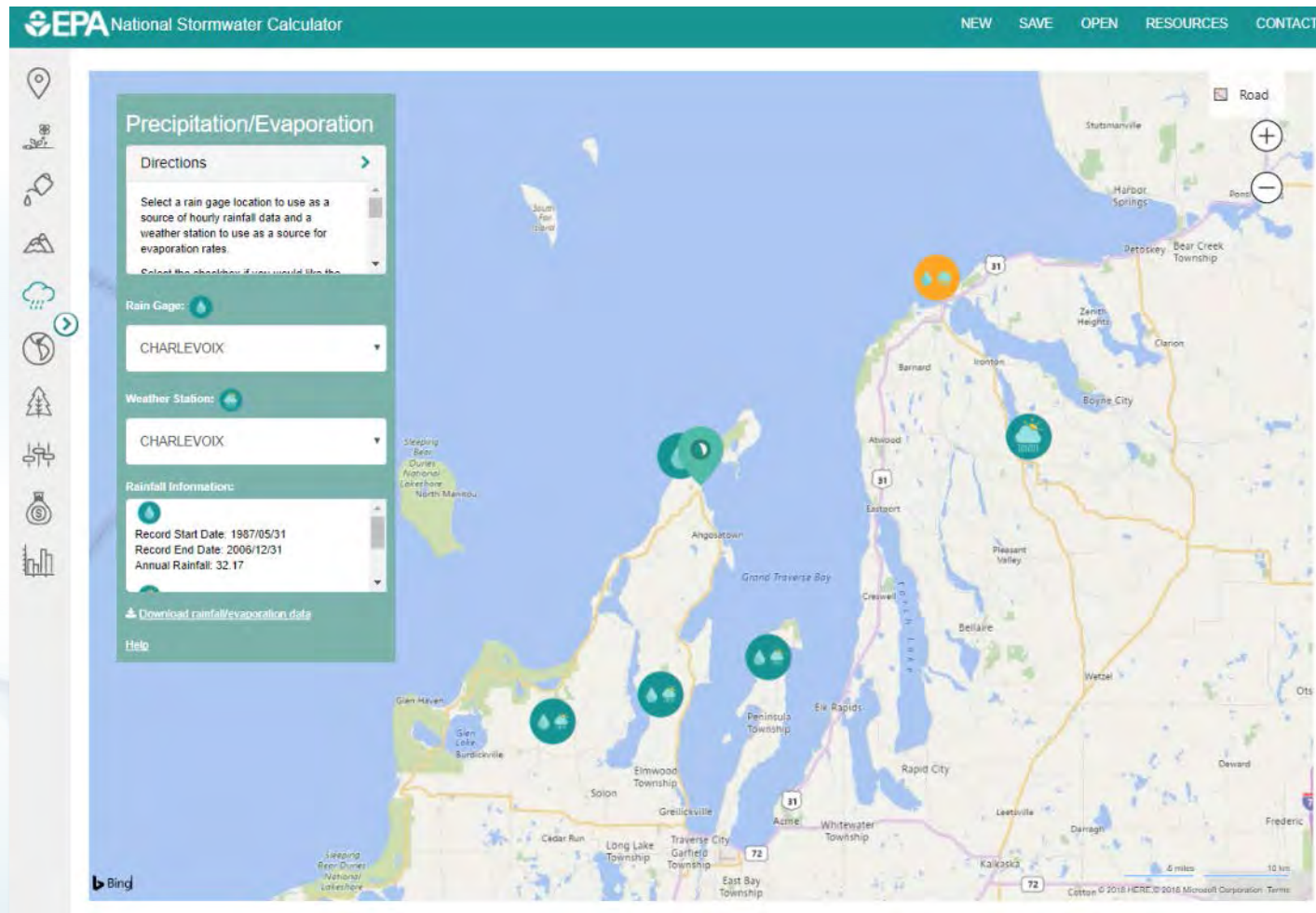
Soil Infiltration Capacity:



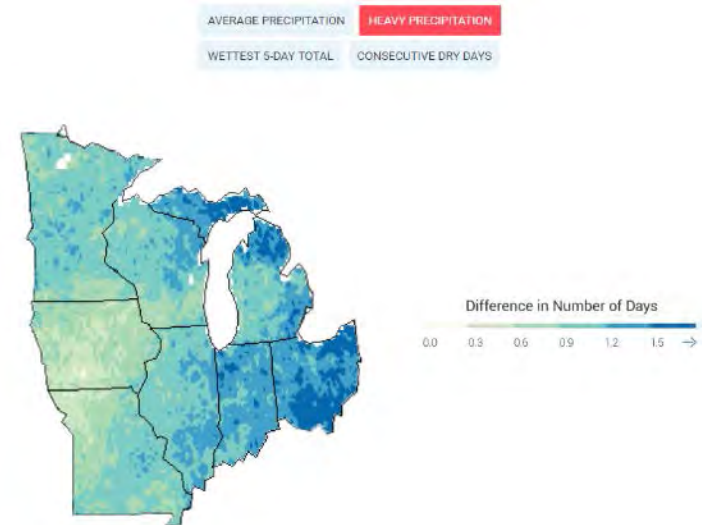
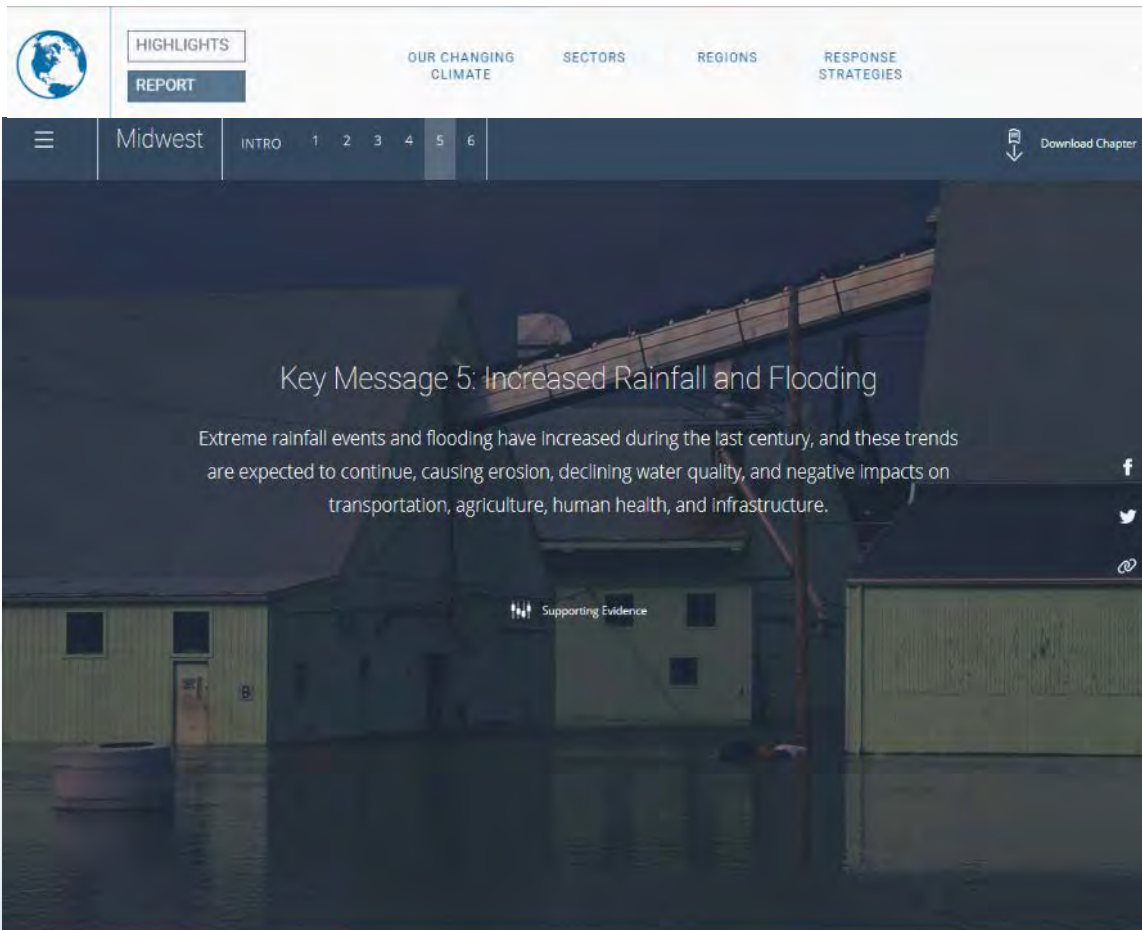
Topography/Slope:



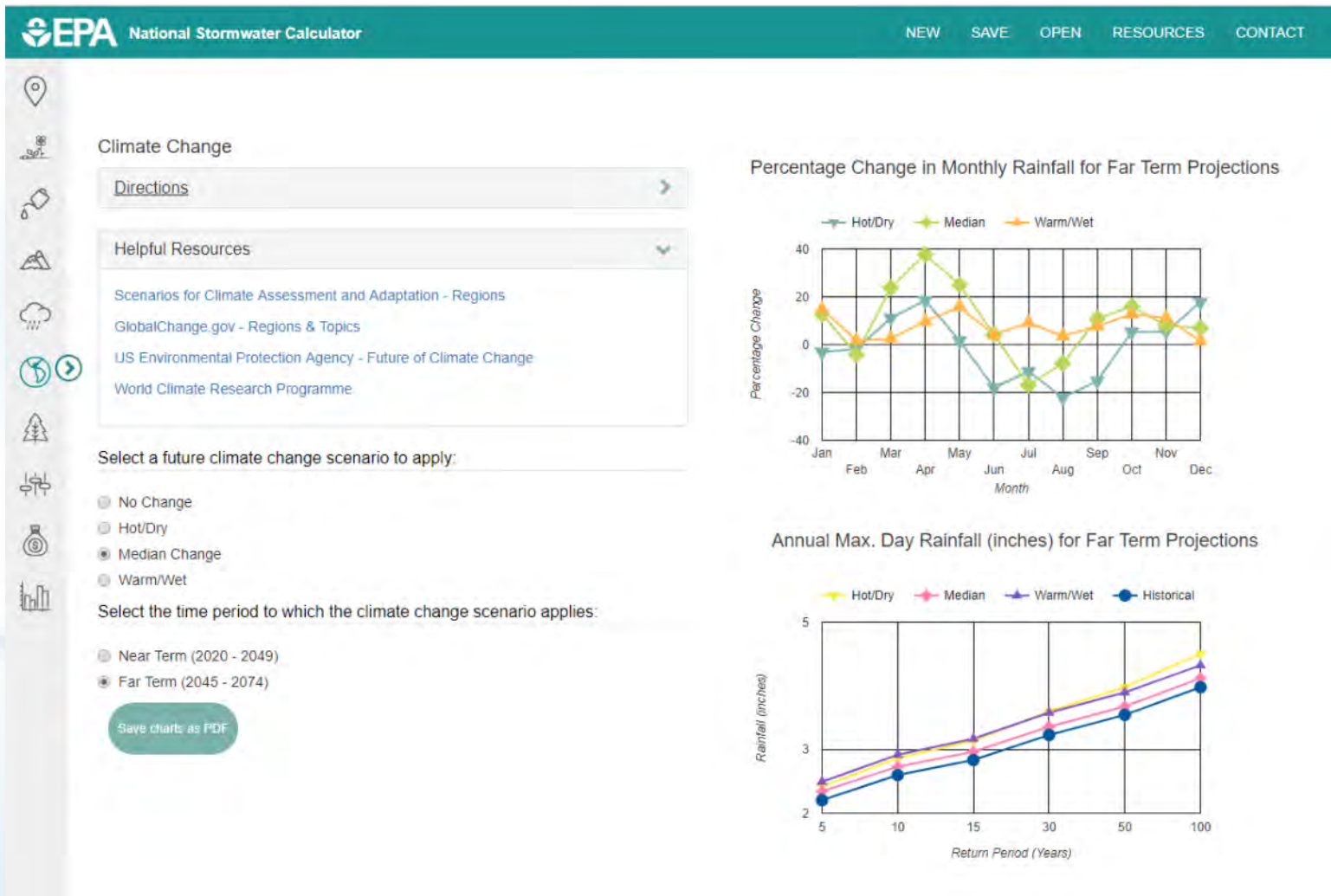
Historical Weather (precipitation & evaporation):



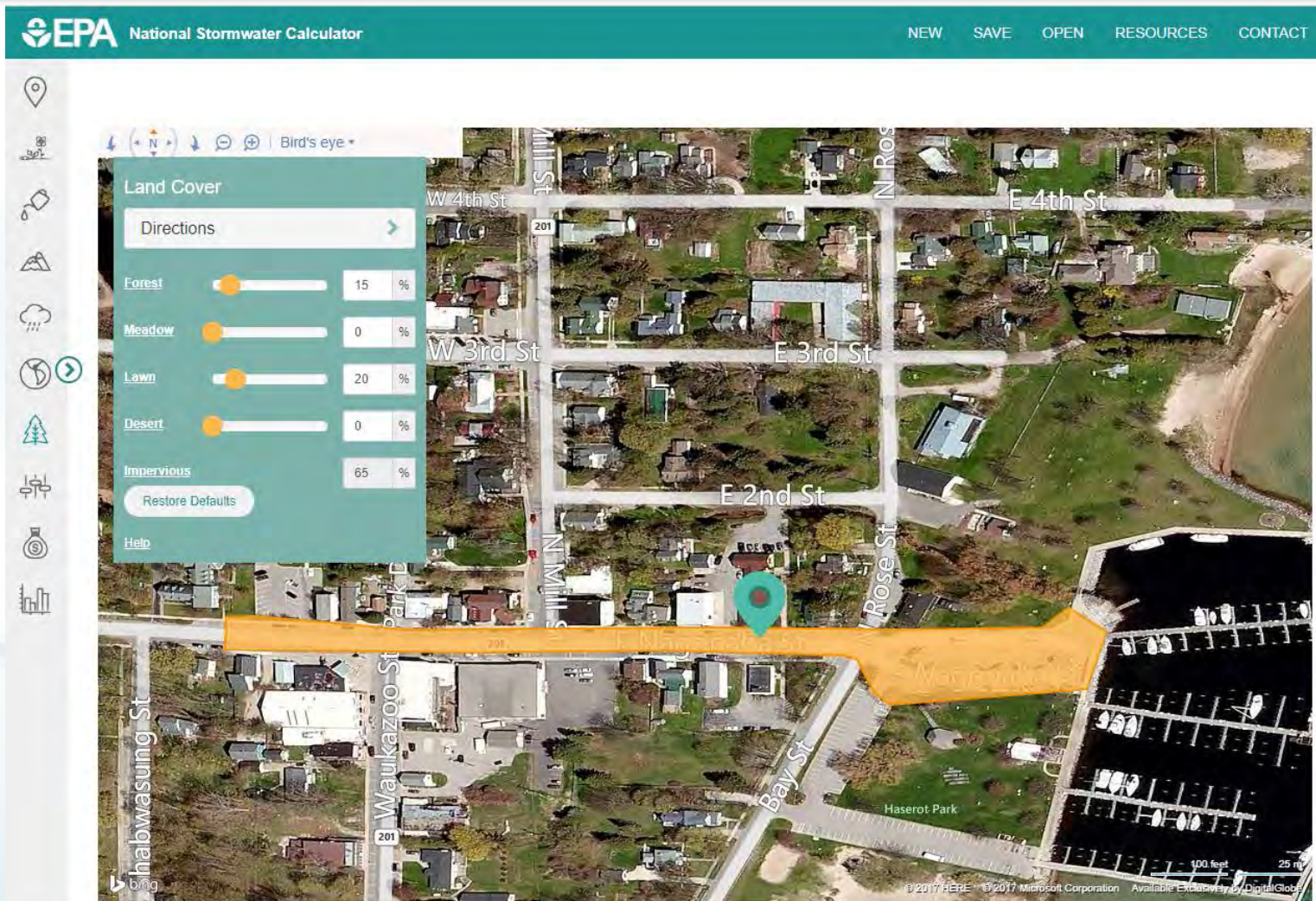
Climate Change Scenarios & Extreme Storm Events:



Climate Change Scenarios & Extreme Storm Events:



Land Cover:



LID Controls:

The screenshot displays the EPA National Stormwater Calculator interface. On the left, a sidebar contains navigation icons. The main panel is titled "LID Controls" and features a "Directions" button. Below this, several LID controls are listed with sliders and percentage values:

LID Control	Value (%)
Disconnection	0
Rain Harvesting	0
Rain Gardens	10
Green Roofs	0
Street Planters	55
Infiltration Basins	0
Permeable Pavement	20

Below the sliders, the "Design Storm for Sizing" is set to 1.0 in. A "Restore Defaults" button is also present. A "Help" link is at the bottom left of the LID Controls panel.

On the right, a 3D diagram illustrates the layers of permeable pavement:


- Concrete Pavers
- Permeable Joint Material
- Open-graded Bedding Course
- Open-graded Base Reservoir
- Open-graded Subbase Reservoir
- Underdrain (as required)
- Geotextile - Design Option per Engineer
- Uncompacted Subgrade Soil

Text descriptions explain that continuous permeable pavement systems are excavated areas filled with gravel and paved over with porous concrete or asphalt mix. Modular block systems use permeable block pavers. Rainfall passes through the pavement into the gravel storage layer below, where it infiltrates at natural rates. Pavement layers are 4 to 6 inches high, while the gravel storage layer is 6 to 10 inches high. The Capture Ratio is the percent of the treated area (street or parking lot) replaced with permeable pavement. A "Learn More" link is provided.


Below the diagram, sliders for "Pavement Thickness" (set to 9 in.), "Gravel Layer Thickness" (set to 10 in.), and "% Capture Ratio" (set to 14%) are shown. A "Pre-Treatment" checkbox is checked. At the bottom, there are buttons for "Size for Design Storm", "Save and Return", and "Restore Defaults".

The background of the calculator shows an aerial view of a residential area with streets labeled "Waukazoo St", "Bay St", and "Hawthorne St". A scale bar indicates 100 feet and 25 meters.


Project Cost (Development Type):

 **National Stormwater Calculator**

NEW SAVE OPEN RESOURCES CONTACT



Project Cost

Directions 

Verify cost estimation variables below. Click on each option to learn more.

Choose a Project Type


- ☒ [Re-Development](#)
- ☐ [New Development](#)

Choose your Site Suitability

- ☐ [Poor](#)
- ☒ [Moderate](#)
- ☐ [Excellent](#)

Choose your Cost Region

Cost Region



Milwaukee(190.0 miles) 

Regional Multiplier

Re-Development

Re-Development is construction that is a change in existing development (land cover, land use, or similar development alteration) which requires new or alteration of existing stormwater management facilities.

Costs of removal, decommissioning, or alteration of existing structures or additional (new) infrastructure is typically required to connect existing structures and results in costs that are greater than what would be anticipated with a new development site.

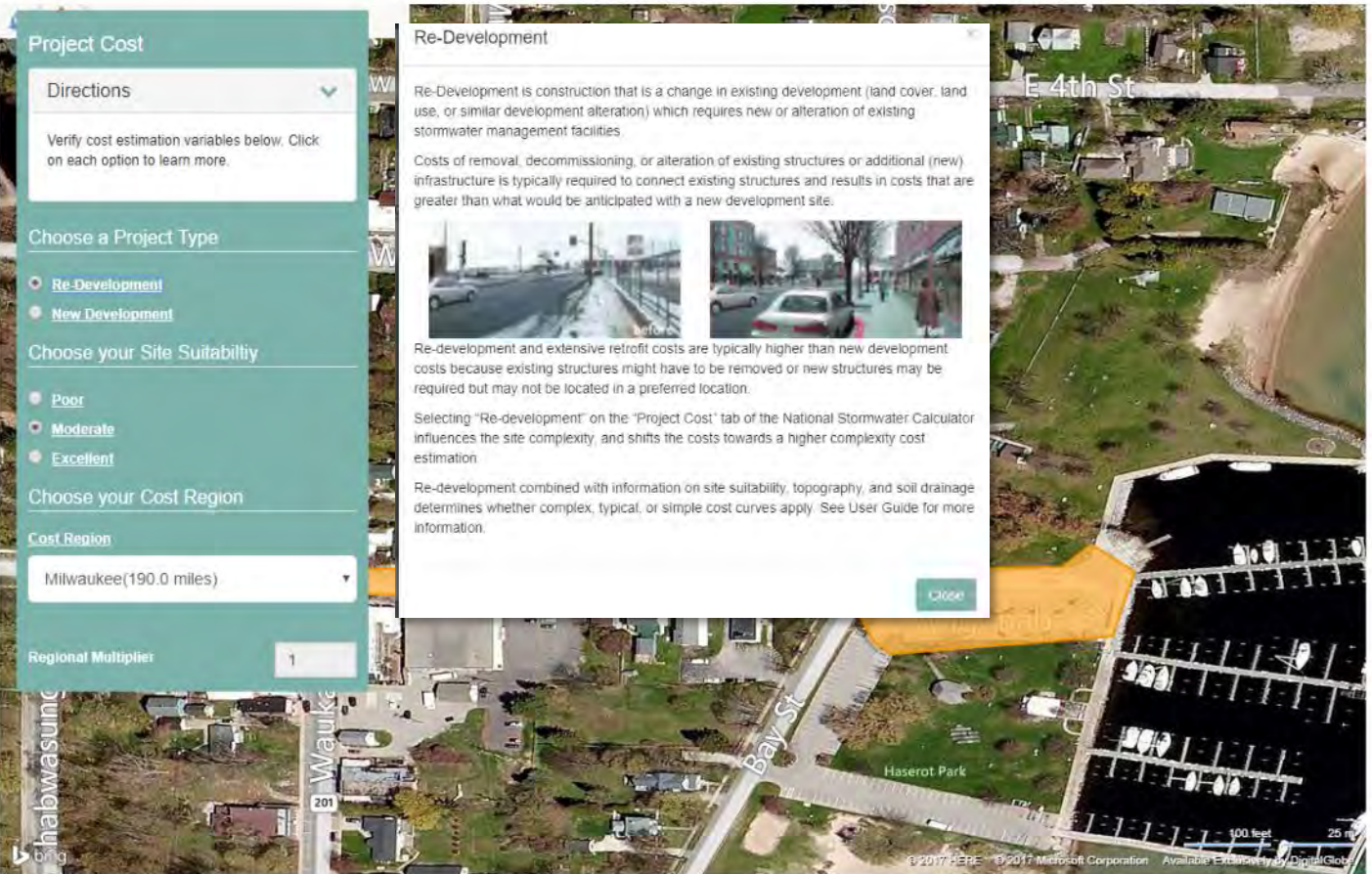


Re-development and extensive retrofit costs are typically higher than new development costs because existing structures might have to be removed or new structures may be required but may not be located in a preferred location.

Selecting "Re-development" on the "Project Cost" tab of the National Stormwater Calculator influences the site complexity, and shifts the costs towards a higher complexity cost estimation.

Re-development combined with information on site suitability, topography, and soil drainage determines whether complex, typical, or simple cost curves apply. See User Guide for more information.

[Close](#)




E 4th St

Haserot Park

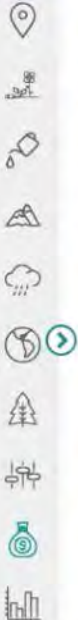
100 feet 25 ft

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Project Cost (Site Suitability):

 **National Stormwater Calculator**

NEW SAVE OPEN RESOURCES CONTACT



Project Cost

Directions 

Verify cost estimation variables below. Click on each option to learn more.

Choose a Project Type

- ☒ Re-Development
- ☐ New Development

Choose your Site Suitability

- ☐ Poor
- ☒ Moderate
- ☐ Excellent

Choose your Cost Region

Cost Region

Milwaukee(190.0 miles)


Regional Multiplier

Moderate Site Suitability

Site suitability is a measure of construction feasibility and includes factors such as topography, soil type, slope, and other physical features that might result in higher implementation costs.

Moderate site suitability refers to sites that have several of the following characteristics:


- Few physical obstructions,
- Few utility conflicts,
- Other features that may make construction of stormwater management infrastructure challenging and likely more costly, but less than a site with poor site suitability.





Sites determined to have moderate suitability for LID practices may result in higher costs because of the potential need for additional excavation, accommodation for physical obstructions including utilities, required retaining walls, moderately challenging access, limited dewater, the addition of engineered or custom media blends, or need to address geotechnical or groundwater concerns.

Selecting "Site Suitability - Moderate" on the "LID Controls" tab of the National Stormwater Calculator influences the site complexity, and may shift the costs towards a higher complexity cost estimation compared to.

Moderate site suitability combined with information on development type, topography, and soil drainage determines whether complex, typical, or simple cost curves apply. See User Guide for more information.

















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Project Cost (Bureau of Labor Statistics Cost Region):

 **National Stormwater Calculator**

NEW SAVE OPEN RESOURCES CONTACT



Project Cost

Directions

Verify cost estimation variables below. Click on each option to learn more.

Choose a Project Type

☒ Re-Development

☐ New Development

Choose your Site Suitability

☐ Poor

☒ Moderate

☐ Excellent

Choose your Cost Region


Cost Region

Milwaukee(190.0 miles)

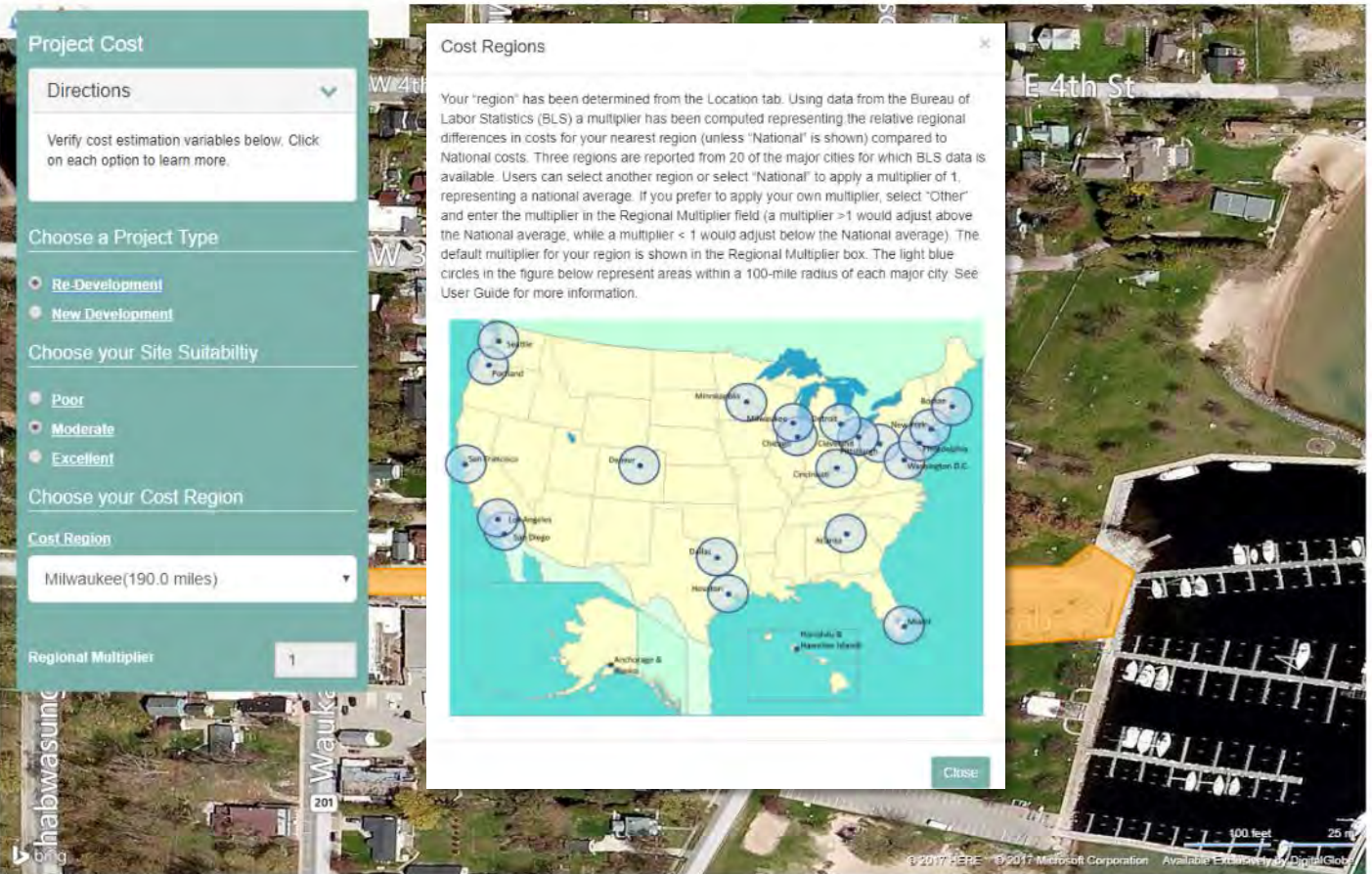
Regional Multiplier

Cost Regions

Your 'region' has been determined from the Location tab. Using data from the Bureau of Labor Statistics (BLS) a multiplier has been computed representing the relative regional differences in costs for your nearest region (unless "National" is shown) compared to National costs. Three regions are reported from 20 of the major cities for which BLS data is available. Users can select another region or select "National" to apply a multiplier of 1, representing a national average. If you prefer to apply your own multiplier, select "Other" and enter the multiplier in the Regional Multiplier field (a multiplier >1 would adjust above the National average, while a multiplier <1 would adjust below the National average). The default multiplier for your region is shown in the Regional Multiplier box. The light blue circles in the figure below represent areas within a 100-mile radius of each major city. See User Guide for more information.



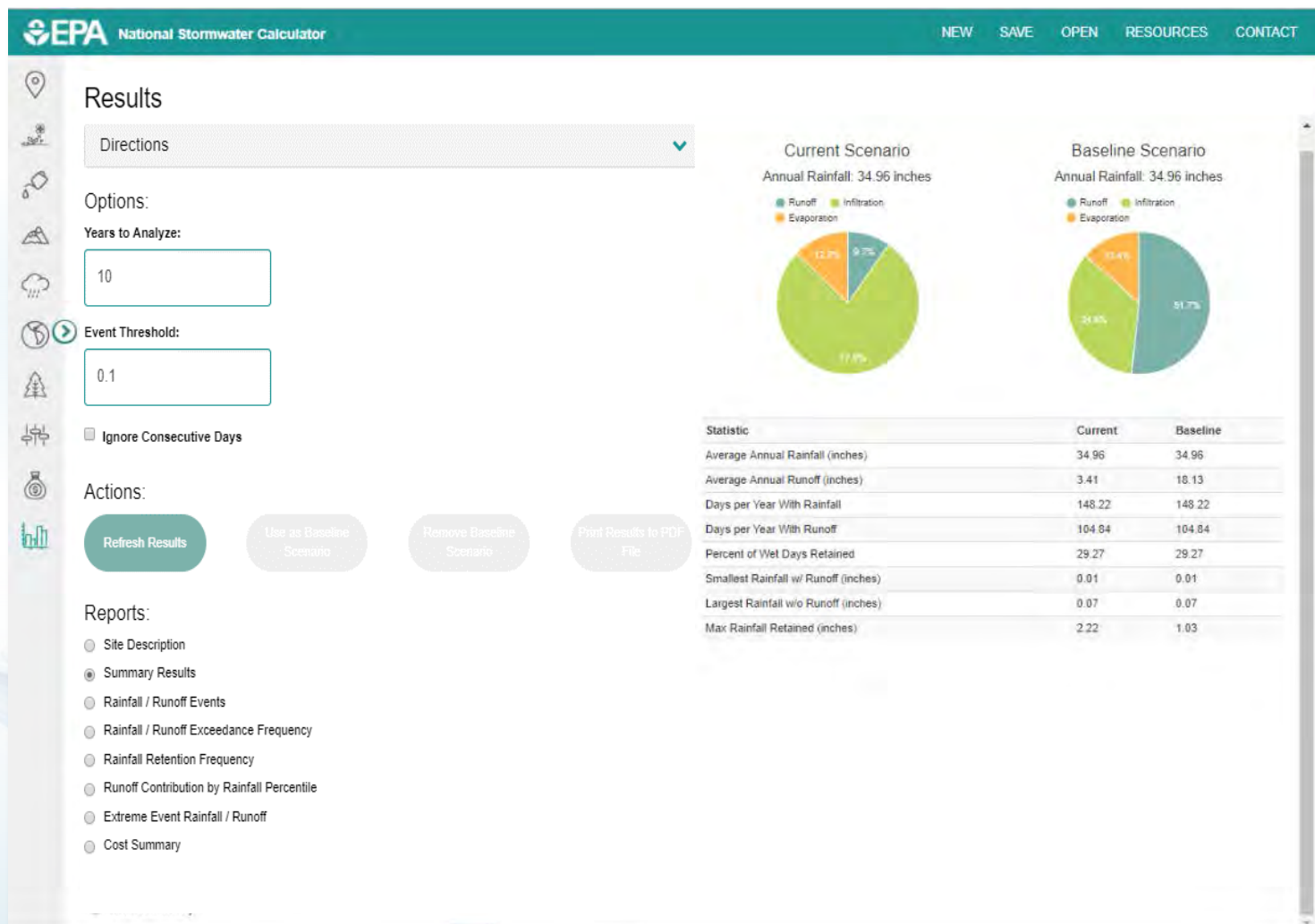
Close




habwasunc Waukesha Wauwatosa Waukegan 201 100 feet 25 m

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Results (Summary):




Results (Cost Summary):



National Stormwater Calculator


[NEW](#)
[SAVE](#)
[OPEN](#)
[RESOURCES](#)
[CONTACT](#)


Results




Directions


Options:




Years to Analyze:

10



Event Threshold:

0.1


☐ Ignore Consecutive Days

Actions:

Refresh Results

Use as Baseline Scenario

Remove Baseline Scenario

Print Results to PDF File

Reports:

- Site Description
- Summary Results
- Rainfall / Runoff Events
- Rainfall / Runoff Exceedance Frequency
- Rainfall Retention Frequency
- Runoff Contribution by Rainfall Percentile
- Extreme Event Rainfall / Runoff
- Cost Summary**

Cost Summary

[Tabular View](#)
[Graphical View](#)

Estimate of Probable Capital Costs (estimates in 2016 US \$)

LID Control Type	Drainage Area %	Has Pre-Treatment?	Current Scenario (C)		Baseline Scenario (B)		Difference (C - B)	
			Current	Baseline	Low	High	Low	High
Disconnection	0	0	No	No	\$0	\$0	\$0	\$0
Rainwater Harvesting	0	0	No	No	\$0	\$0	\$0	\$0
Rain Gardens	10	0	Yes	No	\$4,867	\$9,329	\$0	\$4,867
Green Roofs	0	0	No	No	\$0	\$0	\$0	\$0
Street Planters	55	0	No	No	\$8,766	\$23,274	\$0	\$8,766
Infiltration Basins	0	0	No	No	\$0	\$0	\$0	\$0
Permeable Pavement	20	0	Yes	No	\$12,761	\$17,391	\$0	\$12,761
Total	85%	0%			\$26,394	\$49,994	\$0	\$26,394

Estimate of Annual Probable Maintenance Costs (estimates in 2016 US \$)

LID Control Type	Current Scenario (C)		Baseline Scenario (B)		Difference (C - B)	
	Low	High	Low	High	Low	High
Disconnection	\$0	\$0	\$0	\$0	\$0	\$0
Rainwater Harvesting	\$0	\$0	\$0	\$0	\$0	\$0
Rain Gardens	\$50	\$1,218	\$0	\$0	\$50	\$1,218
Green Roofs	\$0	\$0	\$0	\$0	\$0	\$0
Street Planters	\$103	\$2,439	\$0	\$0	\$103	\$2,439
Infiltration Basins	\$0	\$0	\$0	\$0	\$0	\$0
Permeable Pavement	\$131	\$714	\$0	\$0	\$131	\$714
Total	\$284	\$4,371	\$0	\$0	\$284	\$4,371

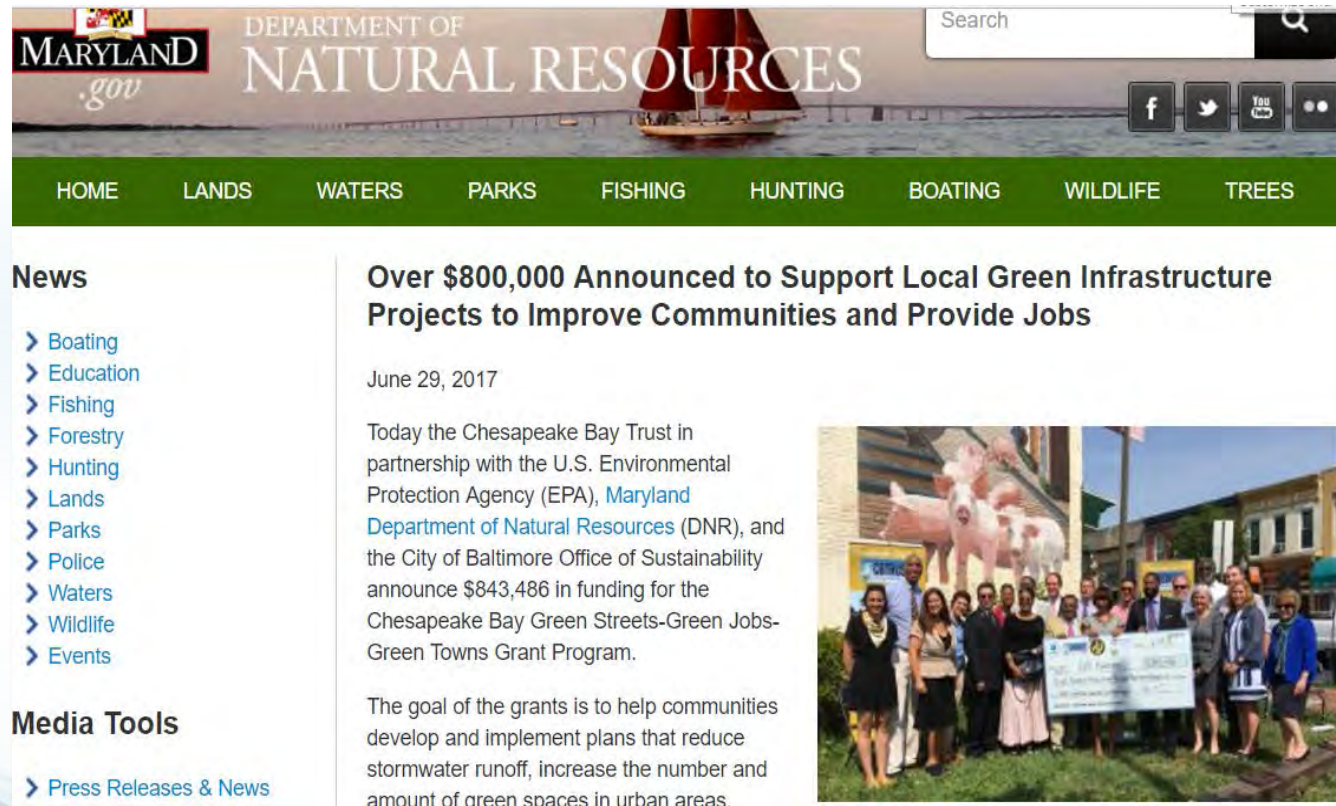
Note: Site complexity variables that affect cost shown below:

Interpreting the Results

- Informing next steps for finalizing costs of stormwater projects and construction plans/designs
- Comparing the relative magnitude of planning level costs for different stormwater management solutions
 - Finding least cost option(s) while meeting performance goals
- Comparisons may be made between national and regional cost estimates:
 - Using local knowledge in selection of regional BLS cost multipliers

SWC Analysis: Potential Next Steps

- Sharing planning results with decision-makers
- Applying for funding
- Developing construction plans/designs



The screenshot shows the Maryland Department of Natural Resources (DNR) website. The header includes the Maryland state logo, the text "MARYLAND .gov", and "DEPARTMENT OF NATURAL RESOURCES". A search bar is in the top right, and social media icons for Facebook, Twitter, YouTube, and a general menu are below it. A green navigation bar contains links: HOME, LANDS, WATERS, PARKS, FISHING, HUNTING, BOATING, WILDLIFE, and TREES. The main content area features a "News" section with a list of topics: Boating, Education, Fishing, Forestry, Hunting, Lands, Parks, Police, Waters, Wildlife, and Events. A featured news article is titled "Over \$800,000 Announced to Support Local Green Infrastructure Projects to Improve Communities and Provide Jobs", dated June 29, 2017. The article text states that the Chesapeake Bay Trust, in partnership with the U.S. Environmental Protection Agency (EPA), the Maryland Department of Natural Resources (DNR), and the City of Baltimore Office of Sustainability, announced \$843,486 in funding for the Chesapeake Bay Green Streets-Green Jobs-Green Towns Grant Program. The goal of the grants is to help communities develop and implement plans that reduce stormwater runoff, increase the number and amount of green spaces in urban areas. To the right of the text is a photograph of a group of people standing in front of a large pink pig sculpture in an urban setting, holding a banner that reads "CHESAPEAKE BAY GREEN STREETS-GREEN JOBS-GREEN TOWNS GRANT PROGRAM". Below the news section is a "Media Tools" section with a link for "Press Releases & News".

News

- › Boating
- › Education
- › Fishing
- › Forestry
- › Hunting
- › Lands
- › Parks
- › Police
- › Waters
- › Wildlife
- › Events

Media Tools


- › Press Releases & News

Over \$800,000 Announced to Support Local Green Infrastructure Projects to Improve Communities and Provide Jobs

June 29, 2017

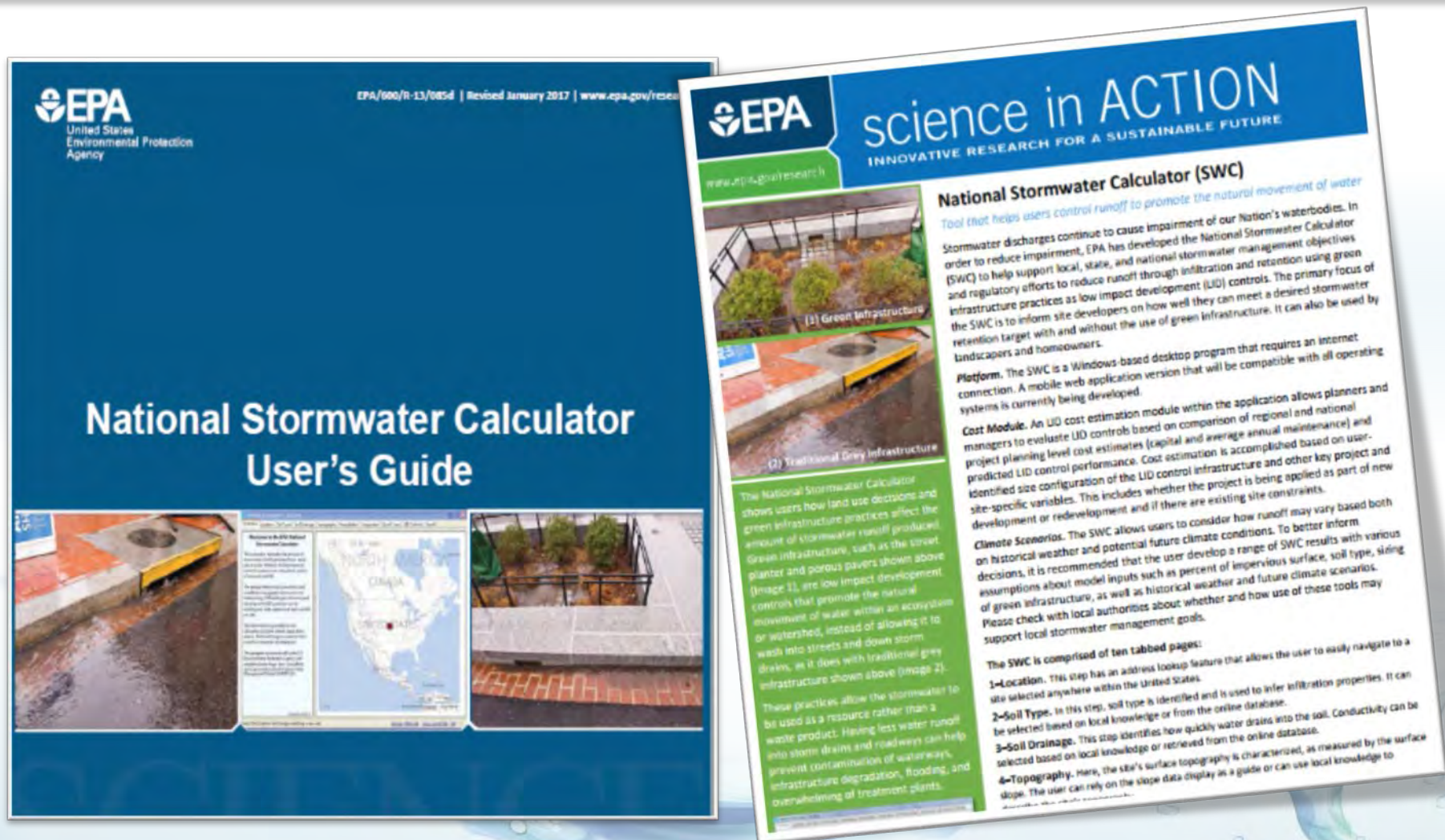
Today the Chesapeake Bay Trust in partnership with the U.S. Environmental Protection Agency (EPA), [Maryland Department of Natural Resources \(DNR\)](#), and the City of Baltimore Office of Sustainability announce \$843,486 in funding for the Chesapeake Bay Green Streets-Green Jobs-Green Towns Grant Program.

The goal of the grants is to help communities develop and implement plans that reduce stormwater runoff, increase the number and amount of green spaces in urban areas.



<http://news.maryland.gov/dnr/2017/06/29/over-800000-announced-to-support-local-green-infrastructure-projects-to-improve-communities-and-provide-jobs/>

Training and Outreach Materials: User's Guide & Fact Sheet



Discussion and Questions

Thank You!

Jason Bernagros

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National Stormwater Calculator Website:

<https://www.epa.gov/water-research/national-stormwater-calculator>

Contact: SWC@epa.gov

SWC:

Site Parameters and Embedded GIS Data-sets

- **Location:** Bing Maps
- **Soils:** NRCS SSURGO (*web service*)
- **Slope:** NRCS SSURGO
- **Hydraulic Conductivity:** NRCS SSURGO
- **Precipitation and Temperature:** National Climate Center (NCDC)-NOAA (*EPA's BASINS Model*)
- **Evaporation:** Calculation based on meteorological data
- **Climate Change Future Scenarios:** Precipitation & evaporation (*EPA's CREAT 2.0*)
- **Land-Cover/Use:** User provided
- **LID Practices (*new costing module available*):** User provided