EPA Tools and Resources webinar: National Stormwater Calculator

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U.S. EPA's Office of Research and Development

Outline

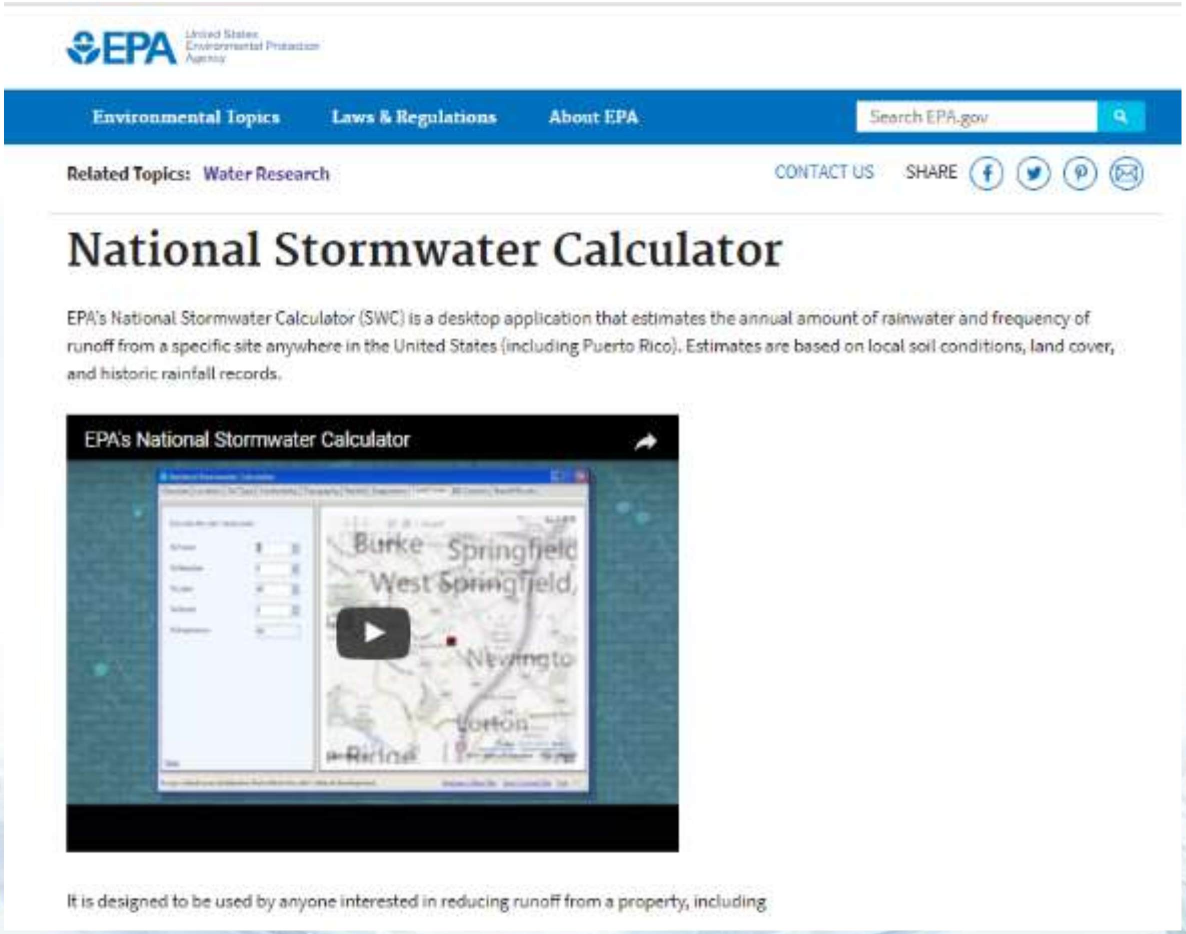
U.S. EPA National Stormwater Calculator

- **Stormwater Calculator Background Information**
- **Potential Applications**
- **Using the Calculator:** Manatee County, FL (May 2017 Application)
- **Example Application:**
  - U.S. Climate Resilience Toolkit
- **Development of Mobile Web Application**
- **Discussion & Questions**

Typical Urban Stormwater Impacts

- **Water Quality:** Nutrient and insecticide runoff, fecal coliform bacteria, leading to impaired waters and beach closures
- **Hydrologic, Geomorphic, and Biological:** Flooding, stream bank erosion, impaired aquatic habitat, and sewer overflows
- **Flooding:** Transportation infrastructure and private property damages

National Stormwater Calculator Website



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

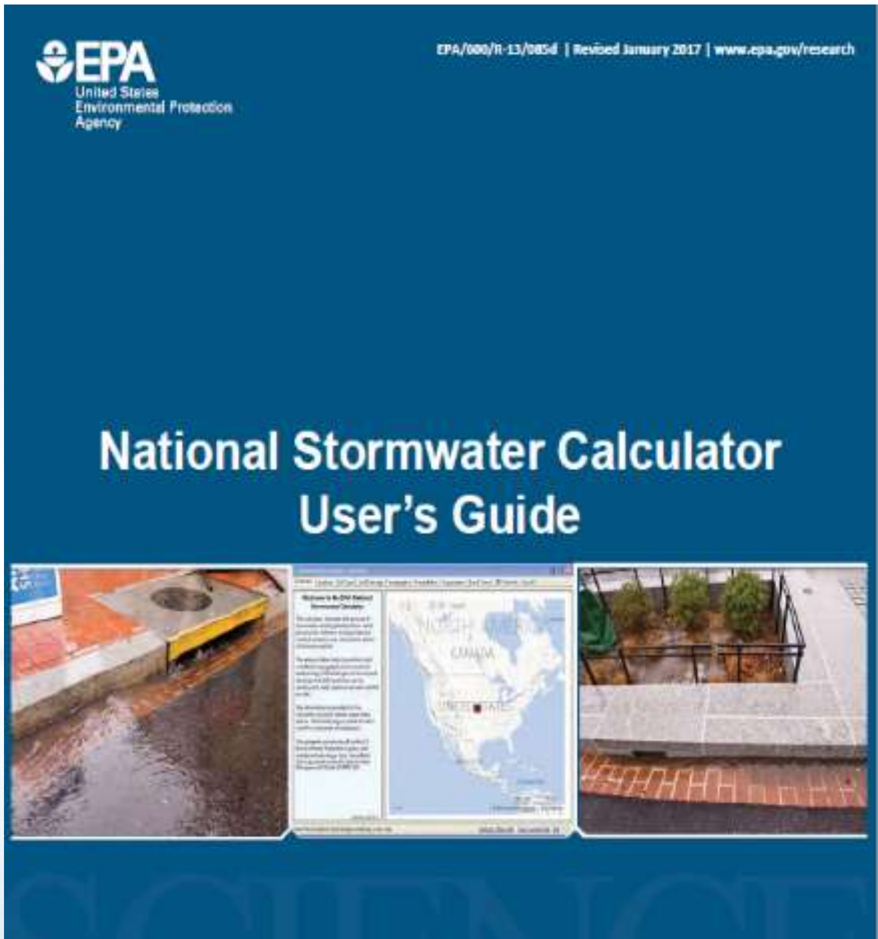
What Have We Created and Why?

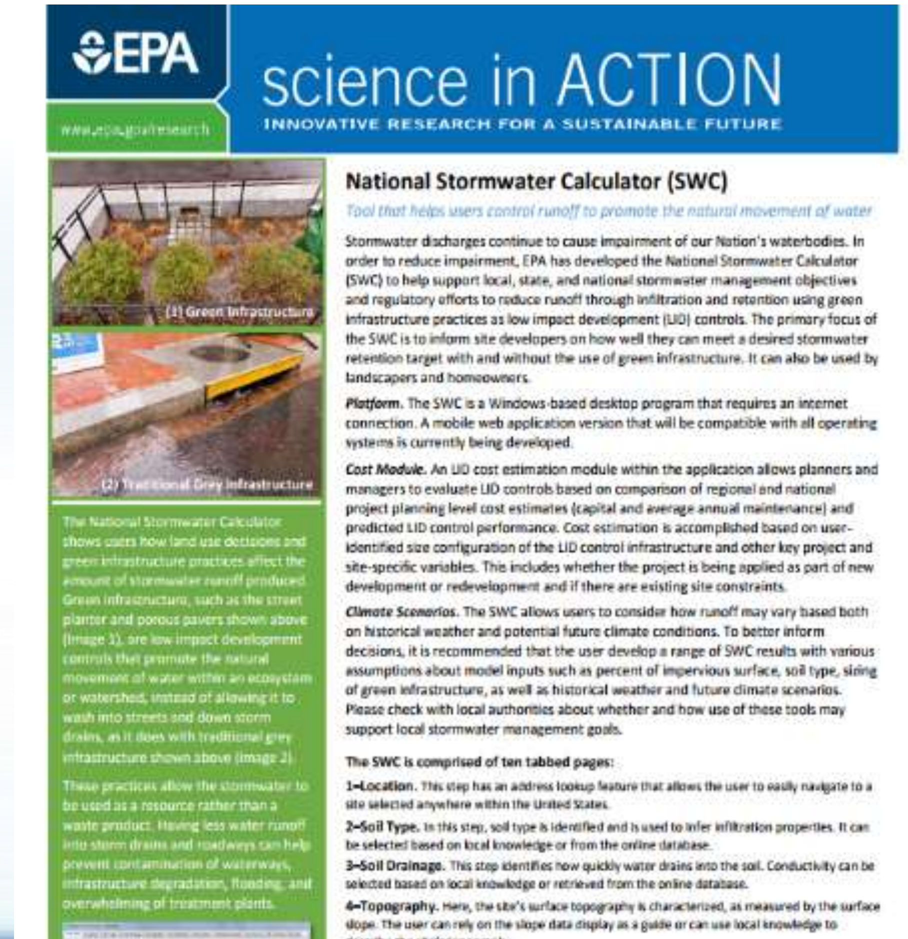
- **Stormwater Management (Green Infrastructure/Low Impact Development (LID)) Design and Planning Tool**
  - —Model post-construction urban stormwater runoff discharges
  - —Allow for screening-level analysis of various green infrastructure practices, including planning level costs (green roofs, rain 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

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 (U.S. Green Building Council) and Sustainable Sites Initiative stormwater credits
- Climate Resiliency Planning: Rockefeller Foundation's 100 Resilient Cities
- LID/Green Infrastructure Design Competitions: Campus RainWorks Challenge, DC Water Green Infrastructure Challenge, etc.

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





EPA

www.epa.gov/research

science in ACTION

INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

(1) Green Infrastructure

(2) Traditional Grey Infrastructure

The National Stormwater Calculator shows users how land use decisions and green infrastructure practices affect the amount of stormwater runoff produced. Green infrastructure, such as the street planter and porous pavers shown above (image 1), are low impact development controls that promote the natural movement of water within an ecosystem or watershed, instead of allowing it to wash into streets and down storm drains, as it does with traditional grey infrastructure shown above (image 2).

These practices allow the stormwater to be used as a resource rather than a waste product. Having less water runoff into storm drains and roadways can help prevent contamination of waterways, infrastructure degradation, flooding, and overwhelming of treatment plants.

National Stormwater Calculator (SWC)

Tool that helps users control runoff to promote the natural movement of water

Stormwater discharges continue to cause impairment of our Nation's waterbodies. In order to reduce impairment, EPA has developed the National Stormwater Calculator (SWC) to help support local, state, and national stormwater management objectives and regulatory efforts to reduce runoff through infiltration and retention using green infrastructure practices as low impact development (LID) controls. The primary focus of the SWC is to inform site developers on how well they can meet a desired stormwater retention target with and without the use of green infrastructure. It can also be used by landscapers and homeowners.

Platform. The SWC is a Windows-based desktop program that requires an internet connection. A mobile web application version that will be compatible with all operating systems is currently being developed.

Cost Module. An LID cost estimation module within the application allows planners and managers to evaluate LID controls based on comparison of regional and national project planning level cost estimates (capital and average annual maintenance) and predicted LID control performance. Cost estimation is accomplished based on user-identified size configuration of the LID control infrastructure and other key project and site-specific variables. This includes whether the project is being applied as part of new development or redevelopment and if there are existing site constraints.

Climate Scenarios. The SWC allows users to consider how runoff may vary based both on historical weather and potential future climate conditions. To better inform decisions, it is recommended that the user develop a range of SWC results with various assumptions about model inputs such as percent of impervious surface, soil type, sizing of green infrastructure, as well as historical weather and future climate scenarios. Please check with local authorities about whether and how use of these tools may support local stormwater management goals.

The SWC is comprised of ten tabbed pages:

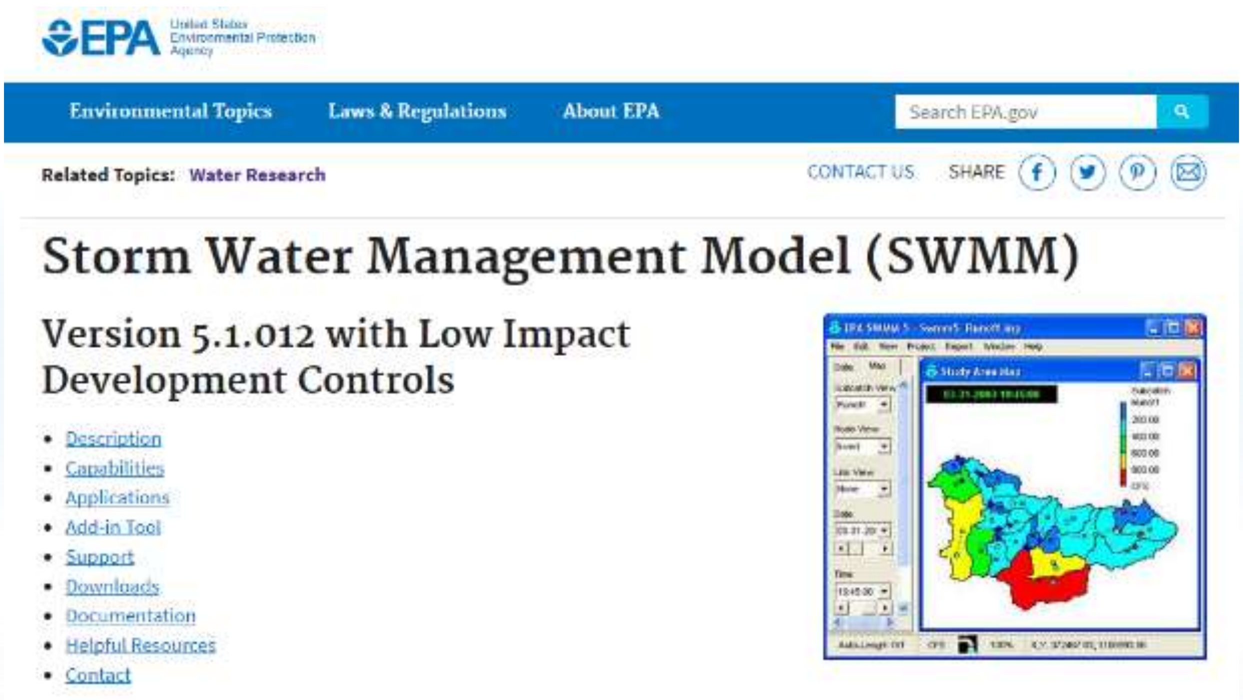
1–Location. This step has an address lookup feature that allows the user to easily navigate to a site selected anywhere within the United States.

2–Soil Type. In this step, soil type is identified and is used to infer infiltration properties. It can be selected based on local knowledge or from the online database.

3–Soil Drainage. This step identifies how quickly water drains into the soil. Conductivity can be selected based on local knowledge or retrieved from the online database.

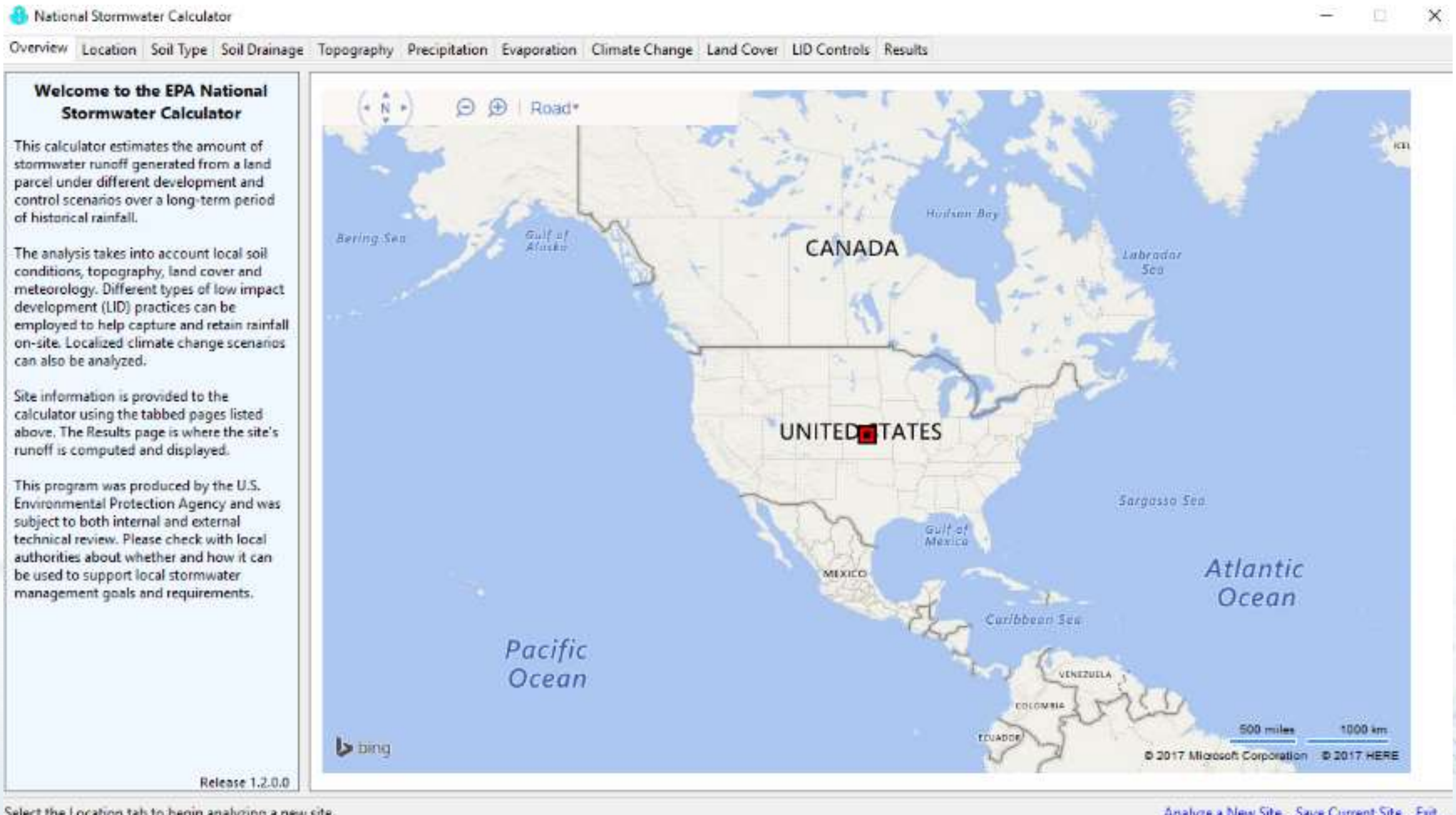
4–Topography. Here, the site's surface topography is characterized, as measured by the surface slope. The user can rely on the slope data display as a guide or can use local knowledge to describe the site's topography.

Storm Water Management Model (SWMM)



- Calculator 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 Stormwater Calculator

National Stormwater Calculator (SWC) Desktop Application

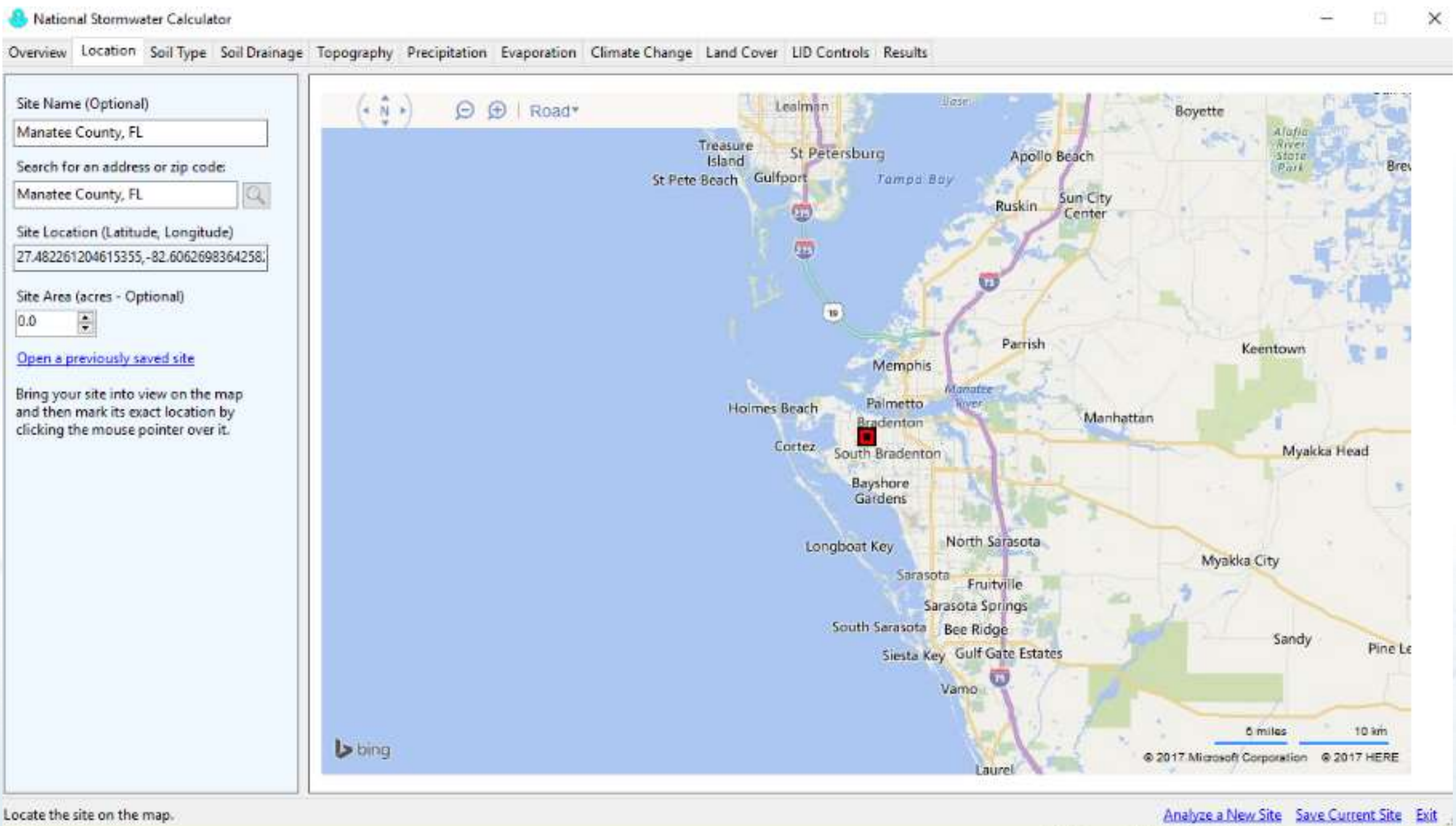


SWC:
Site Parameters and Embedded GIS Data-sets

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

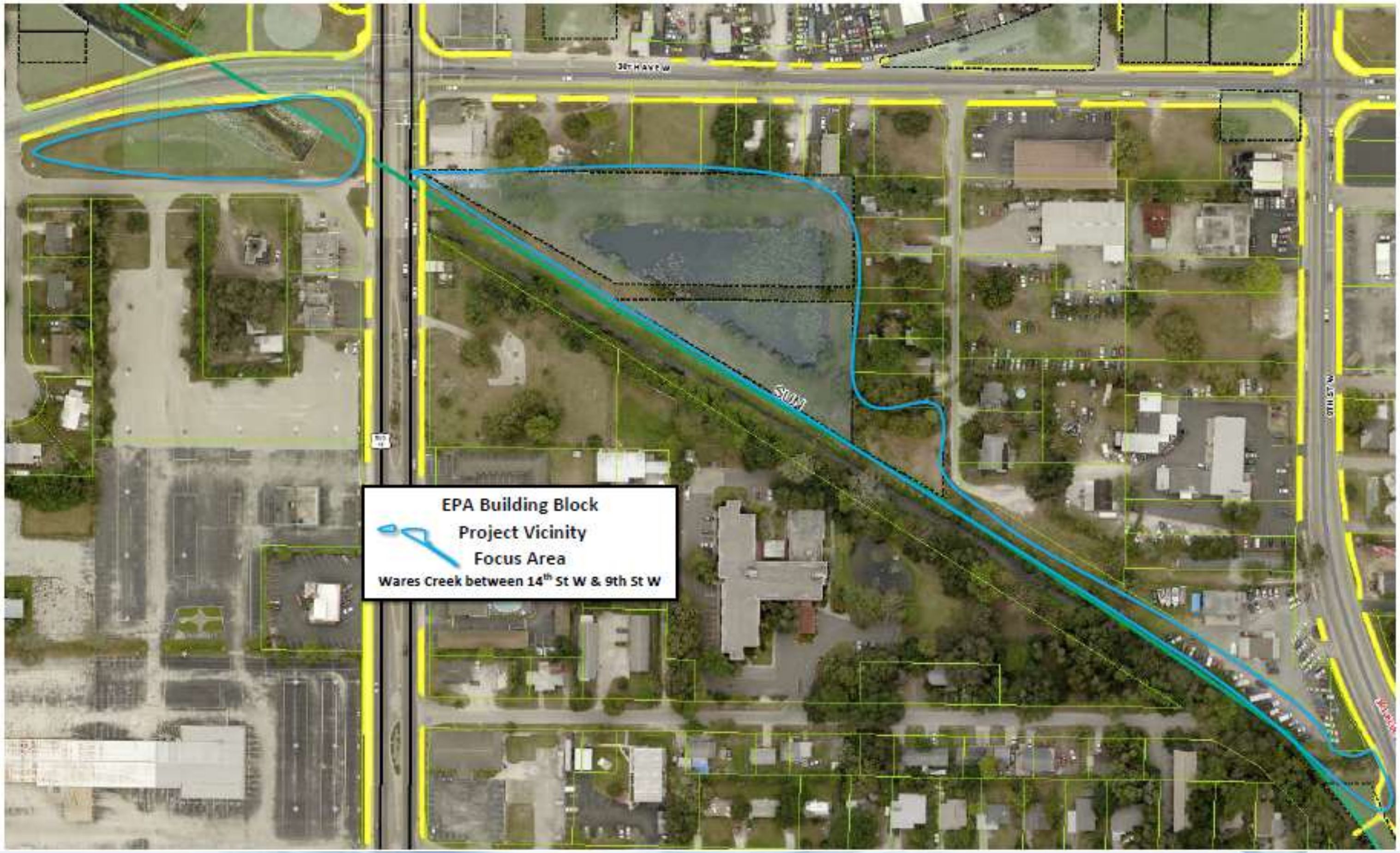
SWC Application: Manatee County, FL

Green & Complete Streets Workshop (May 2017)



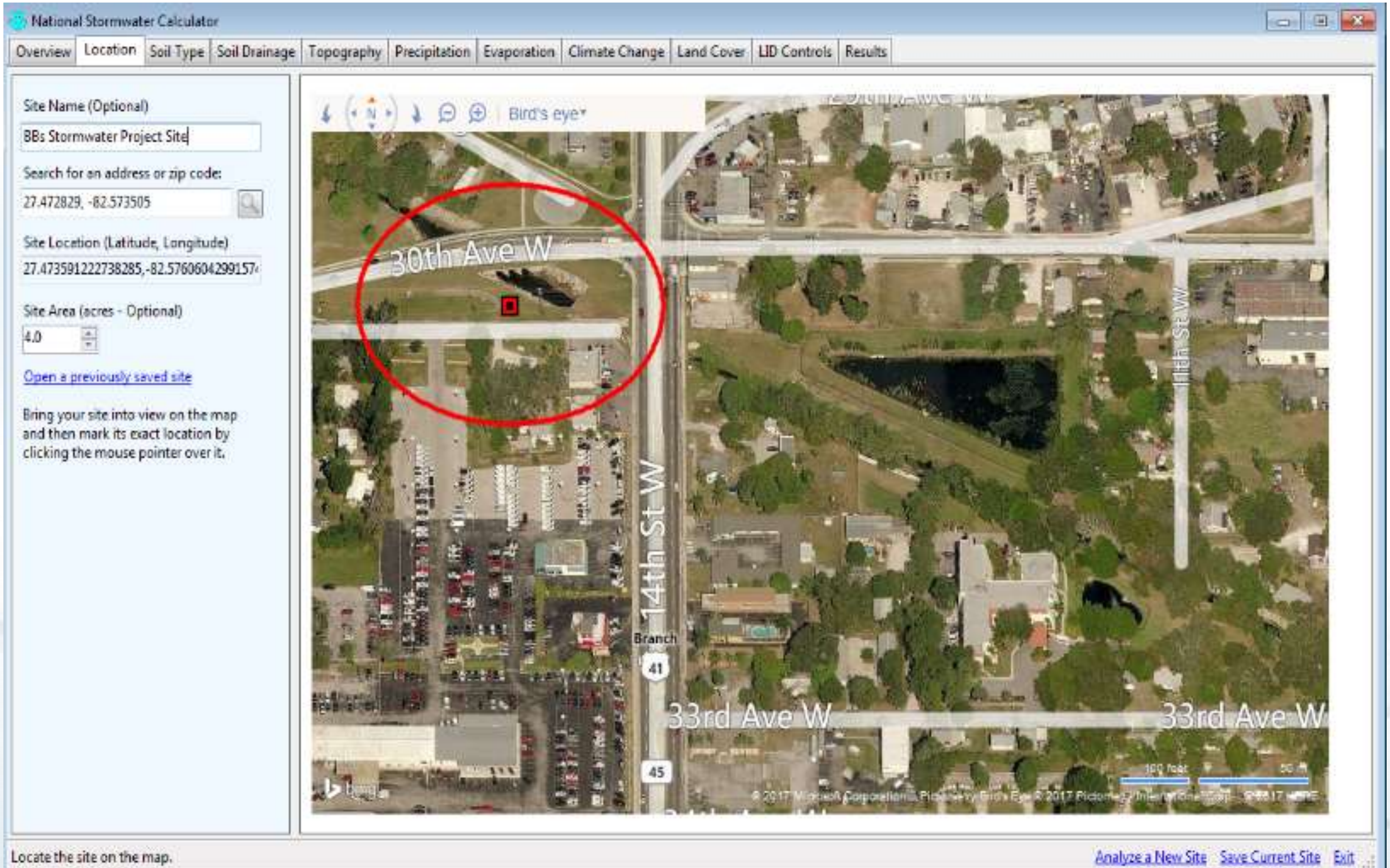
SWC Analysis for Manatee County, FL:

Potential Stormwater Management Areas (Wares Creek, 14th St. W. – 9th St. W.)



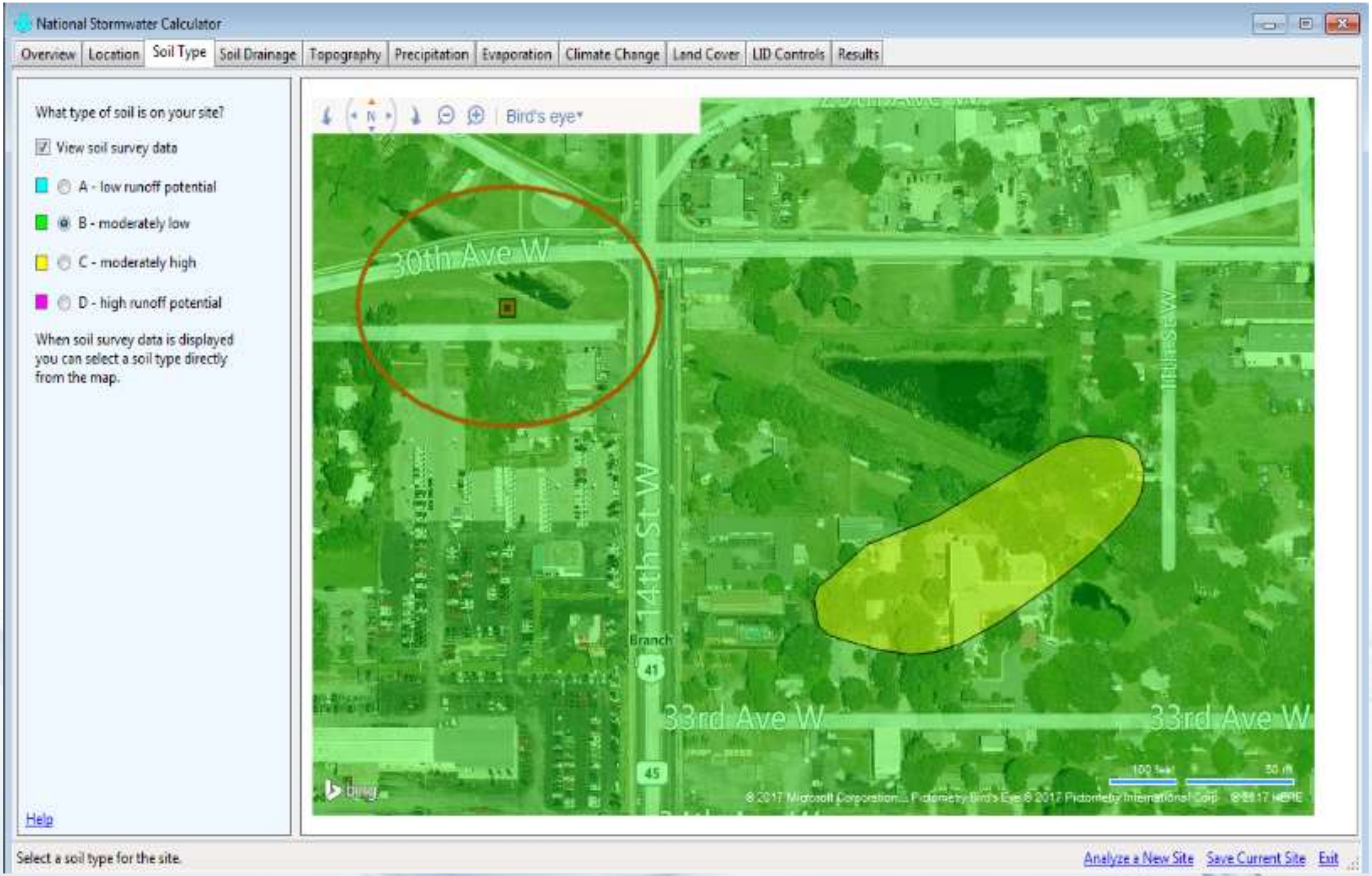
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Project Location



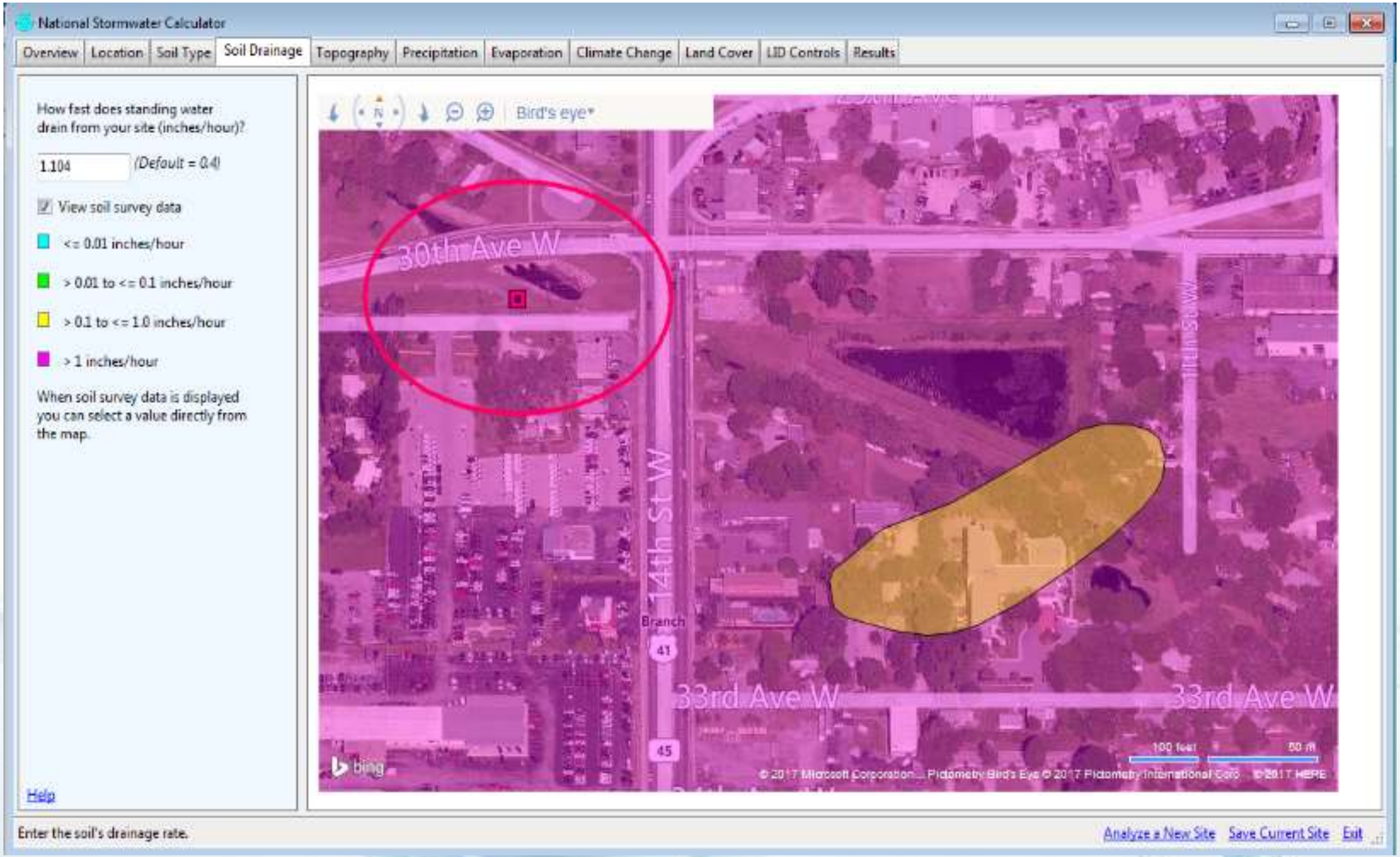
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Soil Rainfall Runoff Potential



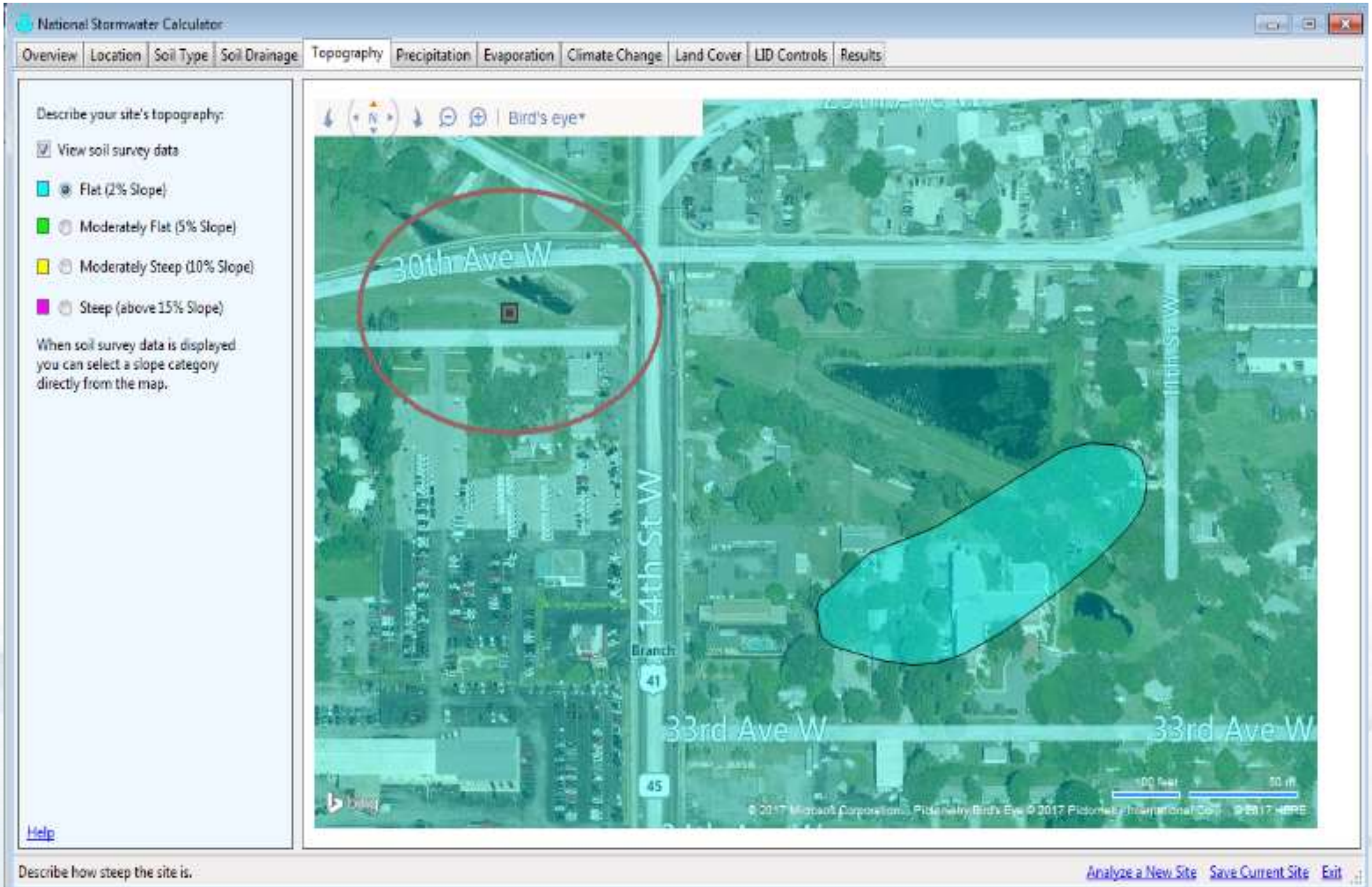
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Soil Drainage



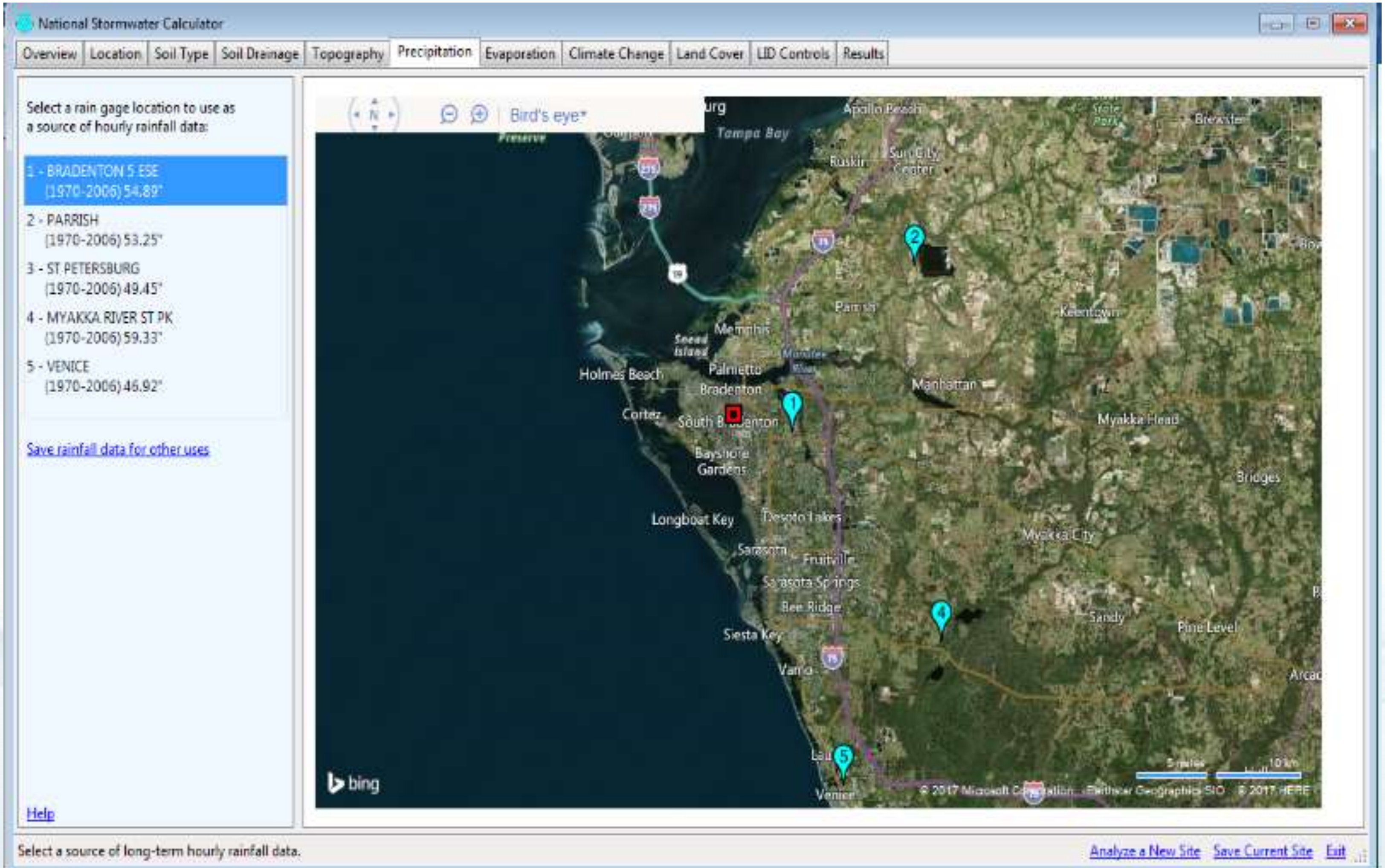
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Topography



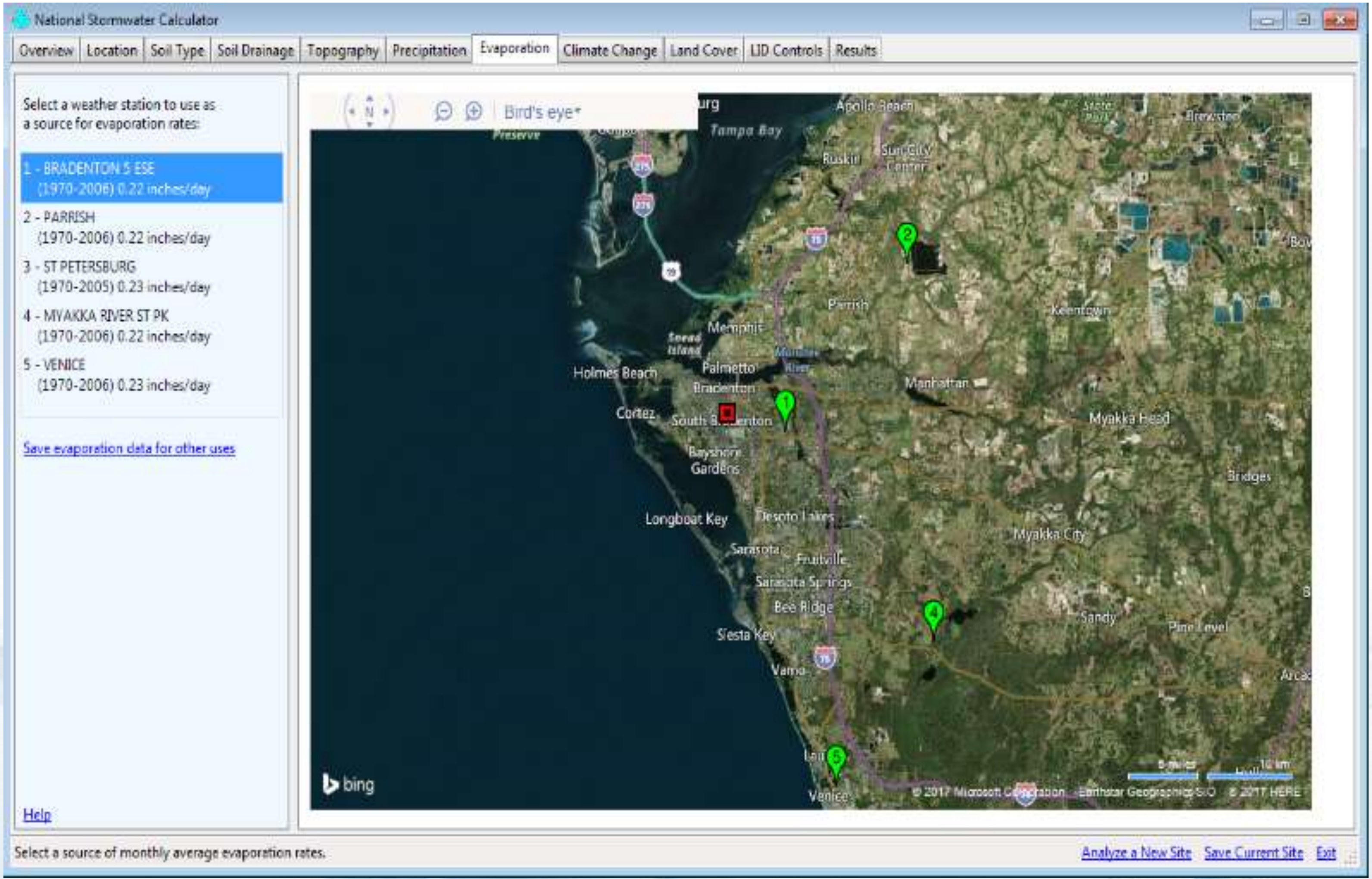
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Historical Precipitation



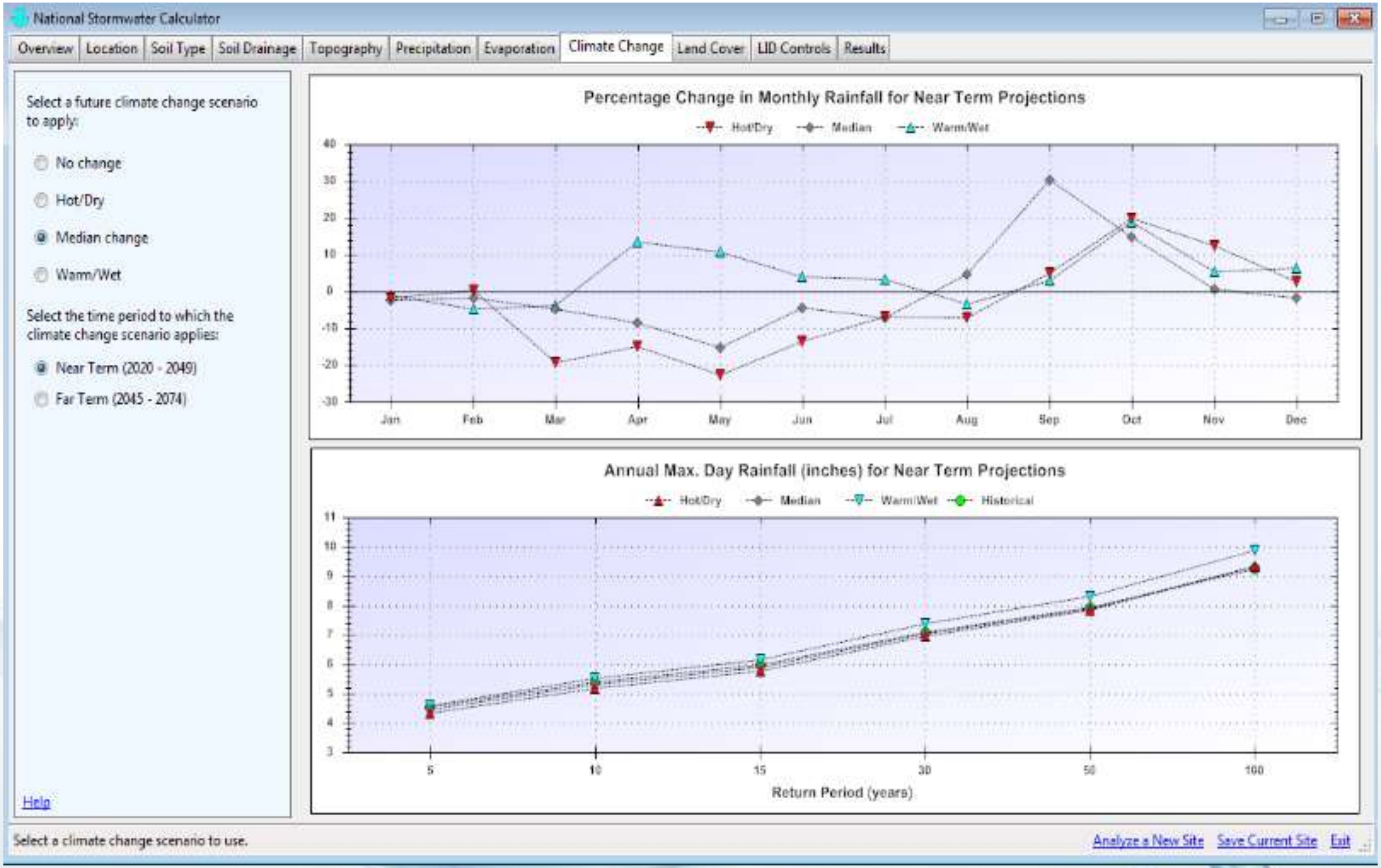
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Historical Evaporation

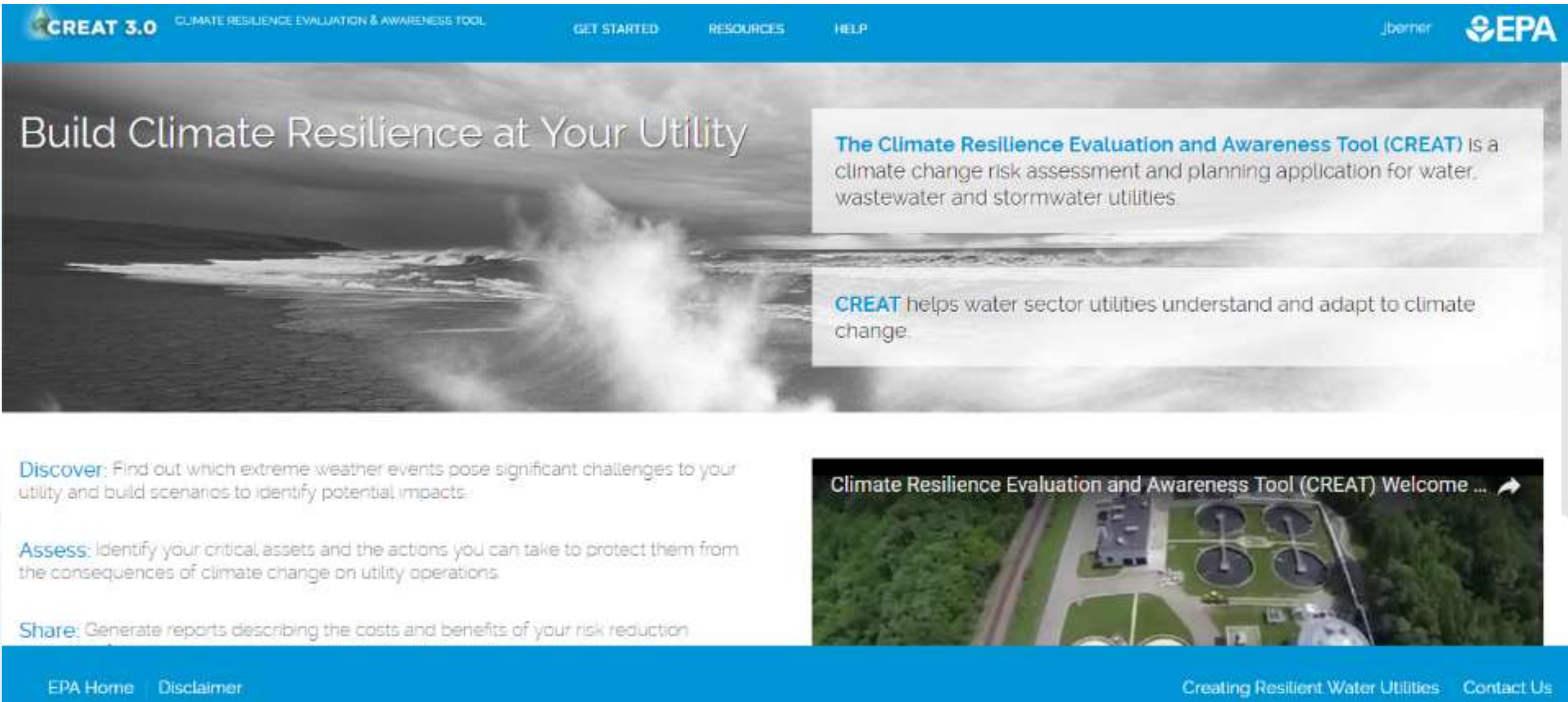


SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Climate Change Scenarios



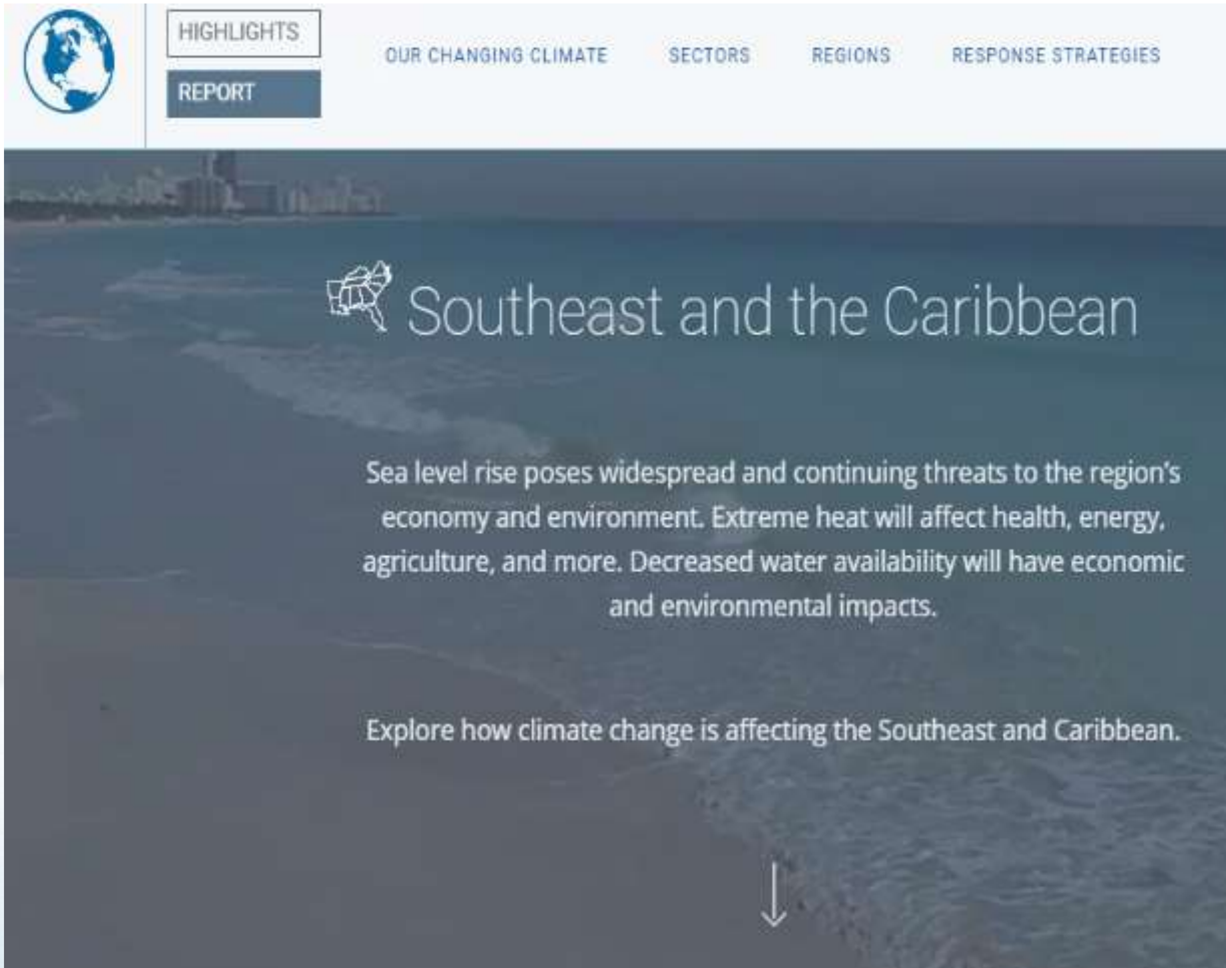
Climate Change Scenario Data: EPA's CREAT 2.0

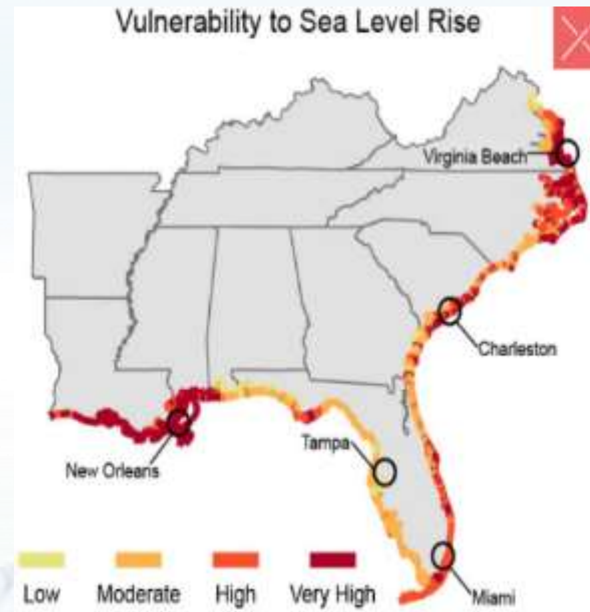


https://creat.epa.gov/creat/

SWC Cost Analysis: Wares Creek, 14th St. W. – 9th St. W.

Climate Change Impacts for the Southeast

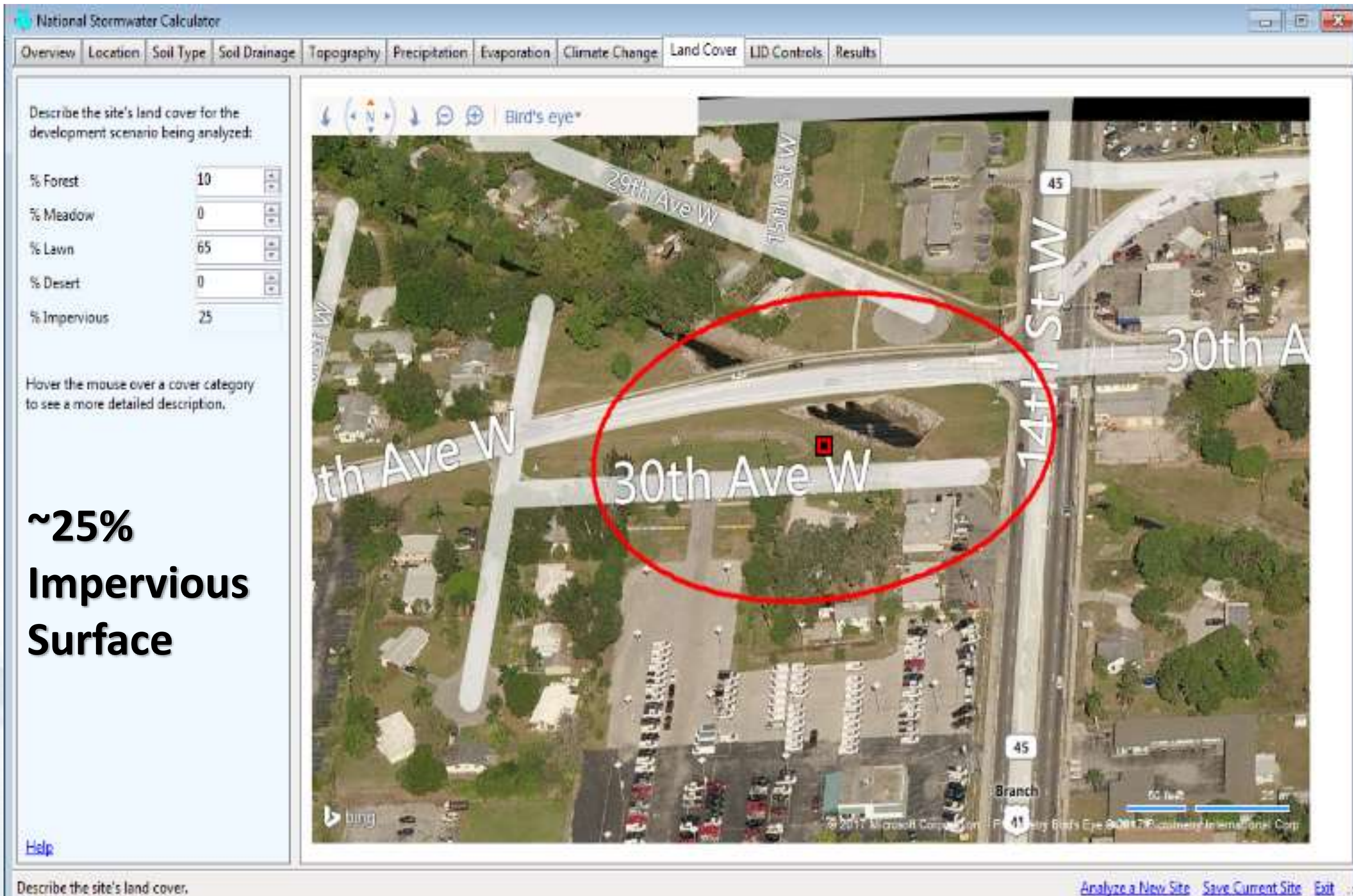




http://nca2014.globalchange.gov/report/regions/southeast

SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

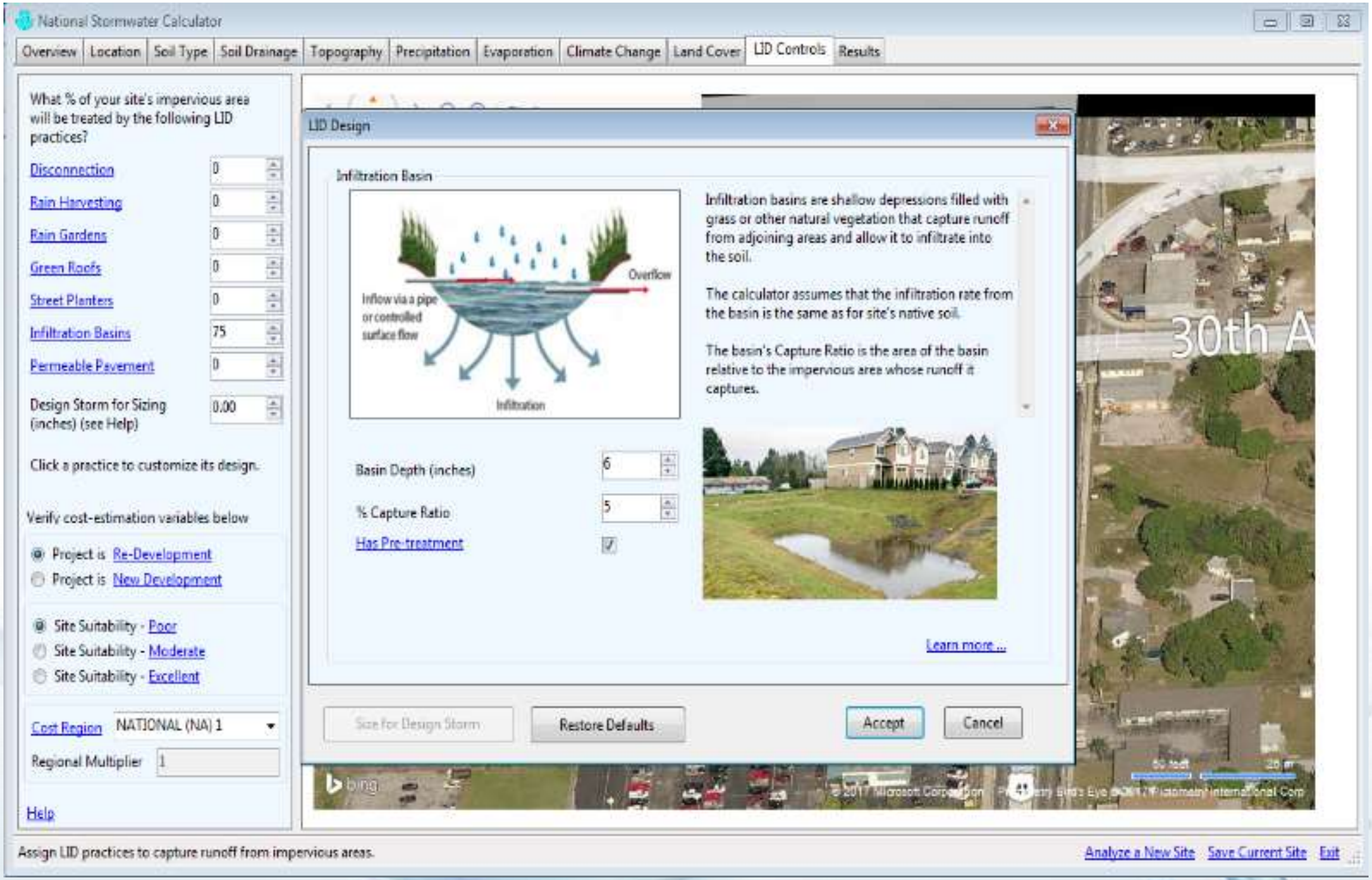
Existing Land Cover



~25% Impervious Surface

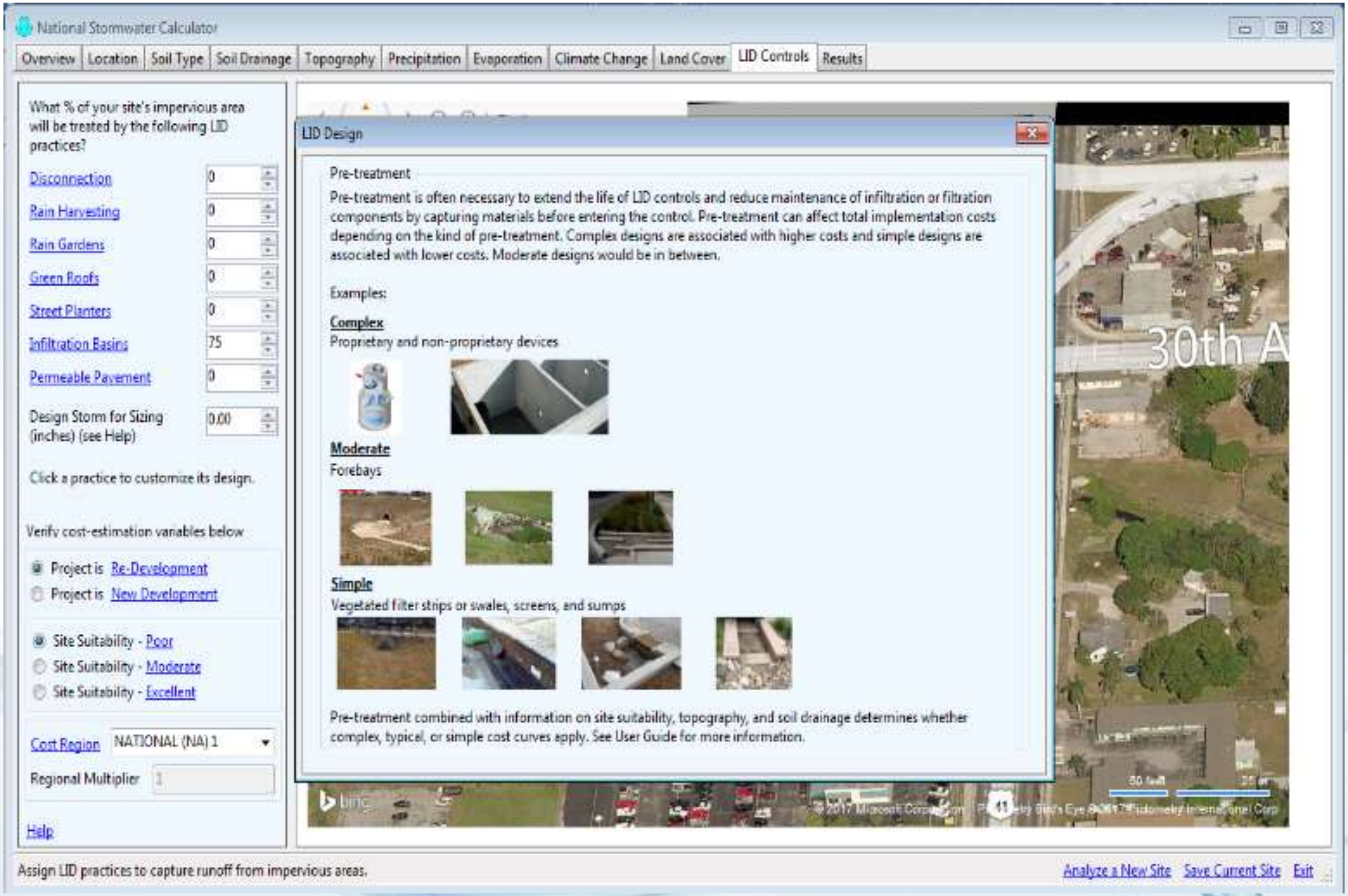
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

<u>Low Impact Development Controls (LID), Infiltration Basin</u>



SWC Analysis: Wares Creek, 14 St. W. – 9 St. W.

Low Impact Development Controls (LID): Pre-treatment



SWC: Cost Estimation Module

- **Intended Uses:**
  - —Planning level cost estimates (magnitude of costs between planning scenarios)

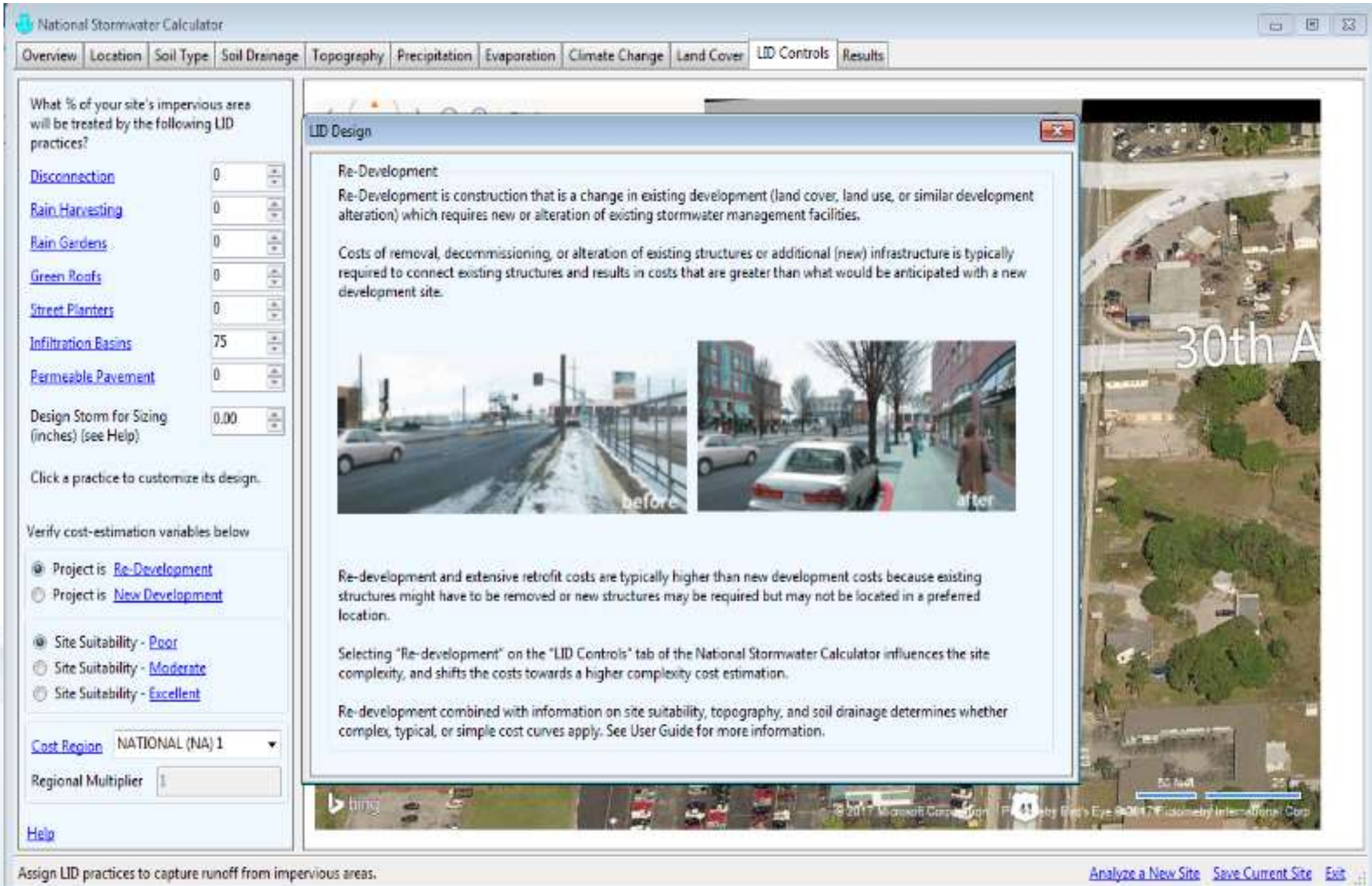
- **Limitations:**
  - —Not final construction costs
  - —Not lifecycle costs (gives annual operations & maintenance (O&M) costs, not replacement costs)

Development of Regionalized
Low Impact Development/Green Infrastructure Costs

- **Utilization of Bureau of Labor Statistics (BLS) Data for regional costs**
  - Outputs of service, construction, utilities, and other goods producing entities
    - Examples include: concrete storm sewer pipe, construction sand and gravel, etc.
  - Regional/city data (23 major U.S. cities)
    - Examples include: fuels and utilities, energy, and diesel fuel

SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

LID: Redevelopment Project

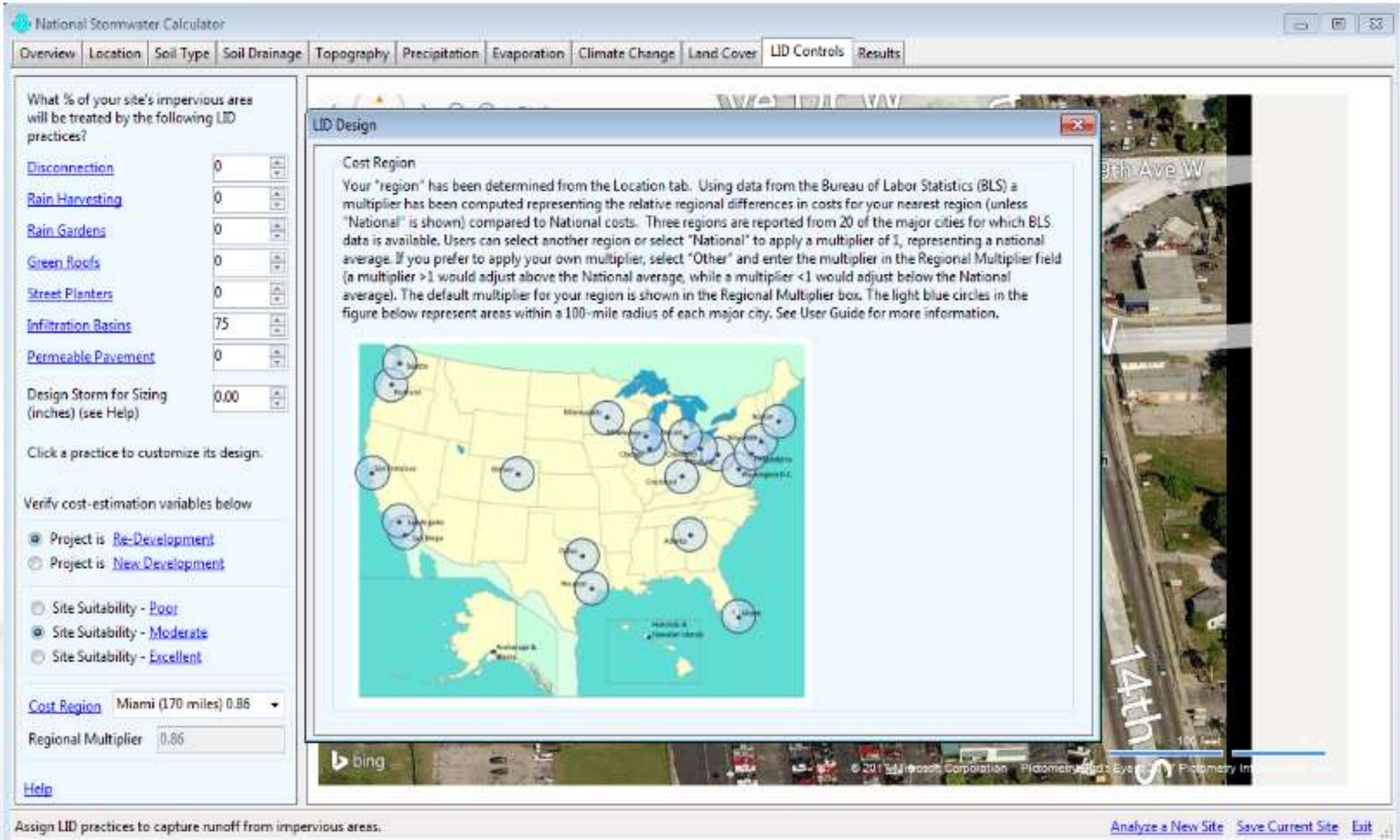


SWC Analysis: Wares Creek, 14^{th} St. W. – 9^{th} St. W.

LID: Site Suitability (Moderate)

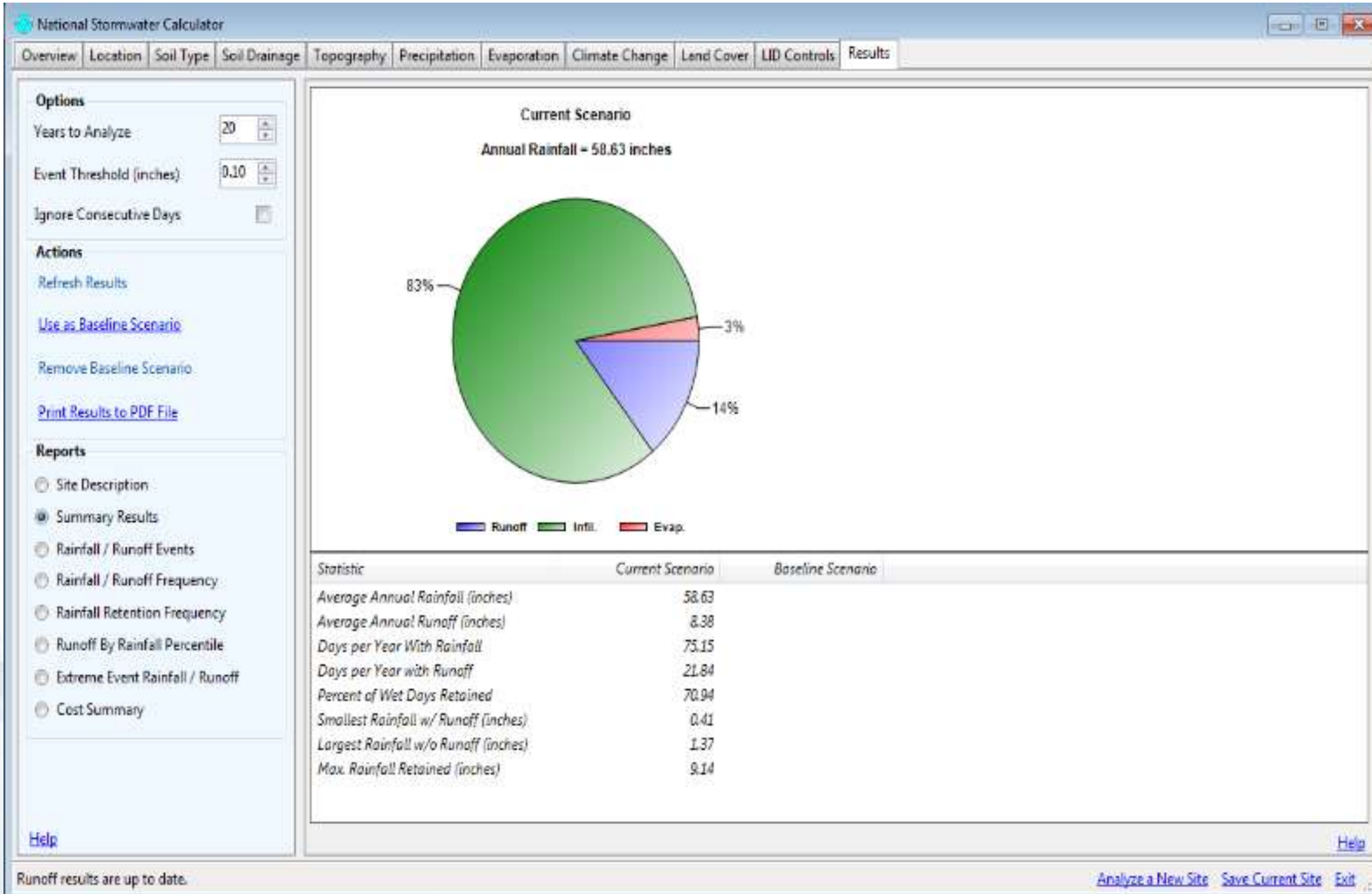
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

LID: US Bureau of Labor Stastics Regional Cost Centers



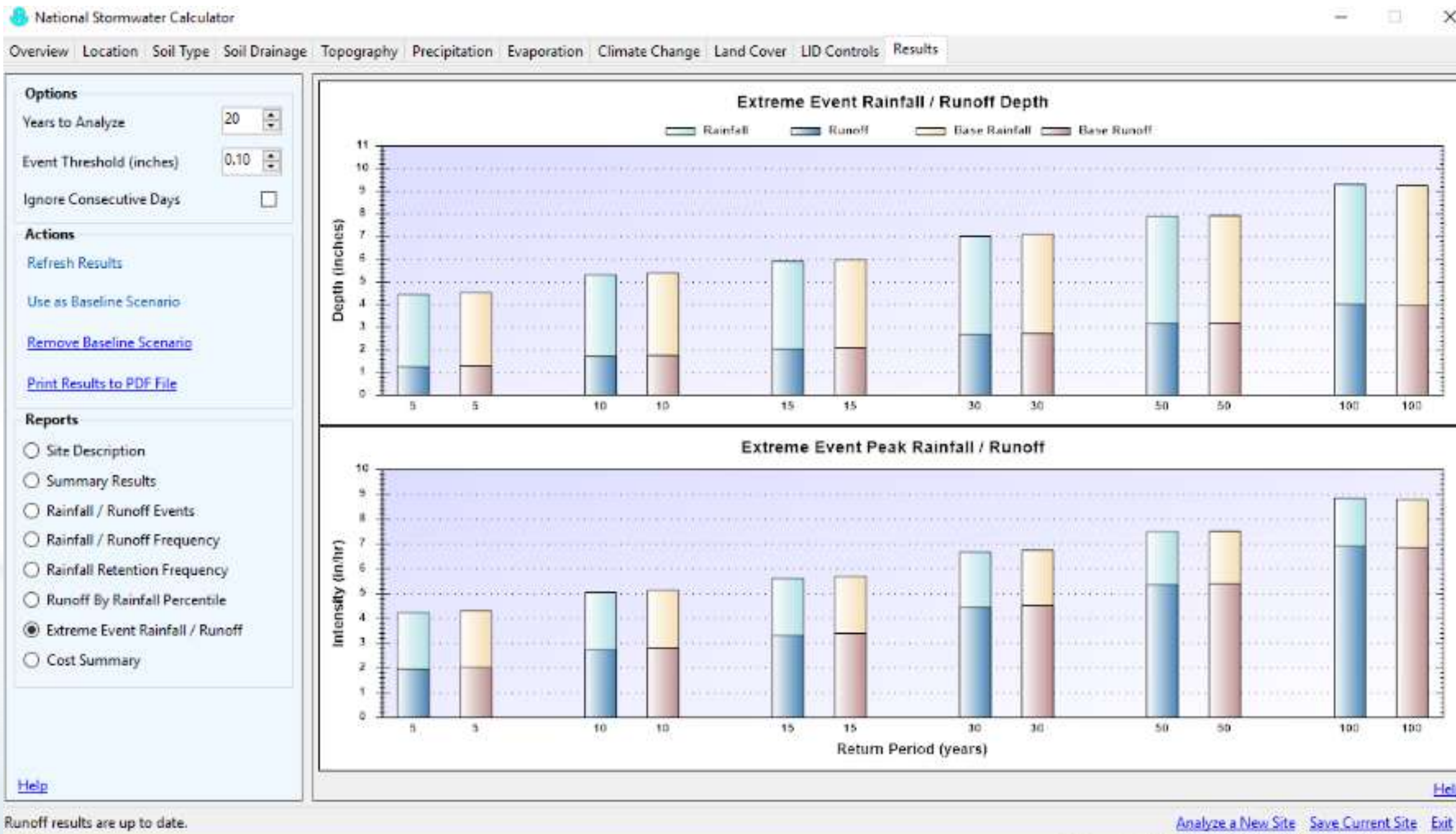
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Runoff Reduction Results



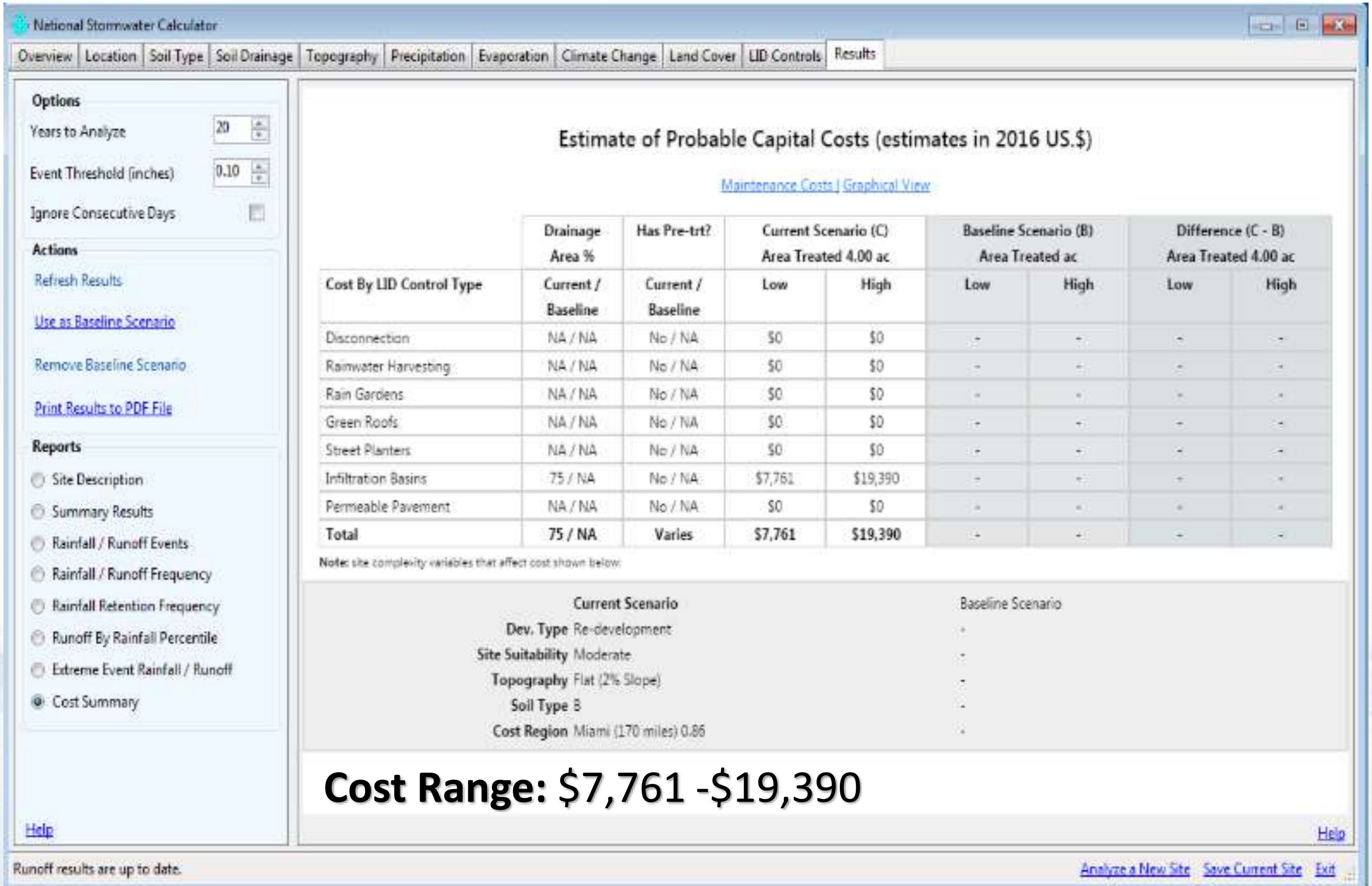
SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

<u>Runoff Results: Extreme Storm Events</u>



SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Capital Costs Summary



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

Maintenance Costs | Graphical View

Cost By LID Control Type	Drainage Area % Current / Baseline	Has Pre-trt? Current / Baseline	Current Scenario (C) Area Treated 4.00 ac Low	Current Scenario (C) High	Baseline Scenario (B) Area Treated ac Low	Baseline Scenario (B) High	Difference (C - B) Area Treated 4.00 ac Low	Difference (C - B) High
Disconnection	NA / NA	No / NA	$0	$0	-	-	-	-
Rainwater Harvesting	NA / NA	No / NA	$0	$0	-	-	-	-
Rain Gardens	NA / NA	No / NA	$0	$0	-	-	-	-
Green Roofs	NA / NA	No / NA	$0	$0	-	-	-	-
Street Planters	NA / NA	No / NA	$0	$0	-	-	-	-
Infiltration Basins	75 / NA	No / NA	$7,761	$19,390	-	-	-	-
Permeable Pavement	NA / NA	No / NA	$0	$0	-	-	-	-
Total	**75 / NA**	**Varies**	**$7,761**	**$19,390**	-	-	-	-

Note: site complexity variables that affect cost shown below.

	Current Scenario	Baseline Scenario
Dev. Type	Re-development	-
Site Suitability	Moderate	-
Topography	Flat (2% Slope)	-
Soil Type	B	-
Cost Region	Miami (170 miles) 0.86	-

Cost Range: $7,761 -$19,390

SWC Analysis: Wares Creek, 14th St. W. – 9th St. W.

Annual Maintenance Costs Summary

O&M Costs of Existing Stormwater Ponds For Project Area: $300 – $3,084.9

National Stormwater Calculator

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

Options

Years to Analyze 20

Event Threshold (inches) 0.10

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 Frequency

Rainfall Retention Frequency

Runoff By Rainfall Percentile

Extreme Event Rainfall / Runoff

Cost Summary

Help

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

Capital Costs | Graphical View

	Current Scenario (C)		Baseline Scenario (B)		Difference (C - B)	
Cost By LID Control Type	Low	High	Low	High	Low	High
Disconnection	$0	$0	-	-	-	-
Rainwater Harvesting	$0	$0	-	-	-	-
Rain Gardens	$0	$0	-	-	-	-
Green Roofs	$0	$0	-	-	-	-
Street Planters	$0	$0	-	-	-	-
Infiltration Basins	$263	$9,542	-	-	-	-
Permeable Pavement	$0	$0	-	-	-	-
Total	**$263**	**$9,542**	-	-	-	-

Note: site complexity variables that affect cost shown below:

	Current Scenario	Baseline Scenario
Dev. Type	Re-development	-
Site Suitability	Moderate	-
Topography	Flat (2% Slope)	-
Soil Type	B	-
Cost Region	Miami (170 miles) 0.86	-

Cost Range: $263 - $9,542

Help

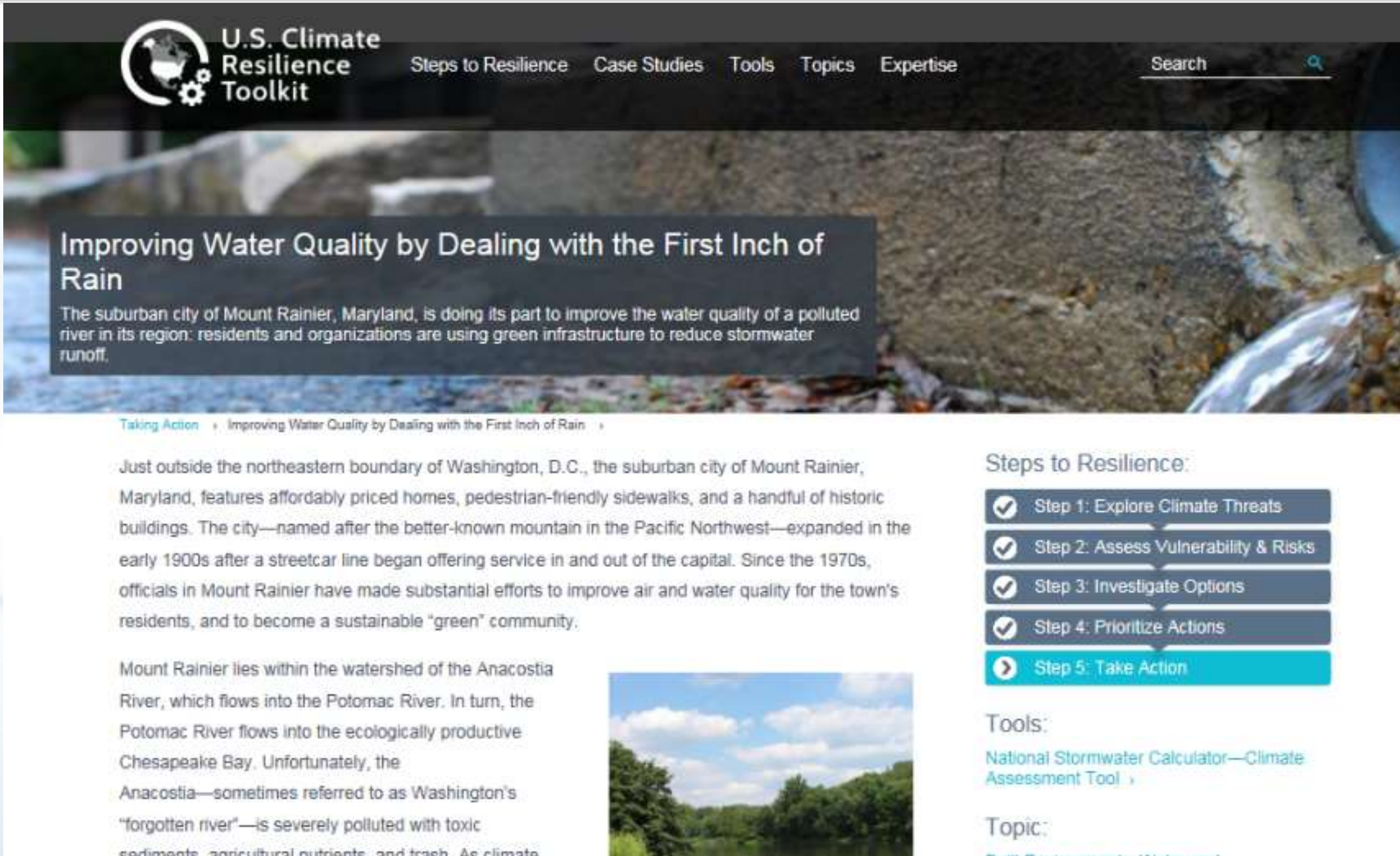
Runoff results are up to date.

Analyze a New Site | Save Current Site | Exit

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
- Comparisons may be made between national and regional cost estimates:
  - Using local knowledge in selection of regional BLS cost multipliers
    - Other nearby cities: Atlanta, Houston, etc.

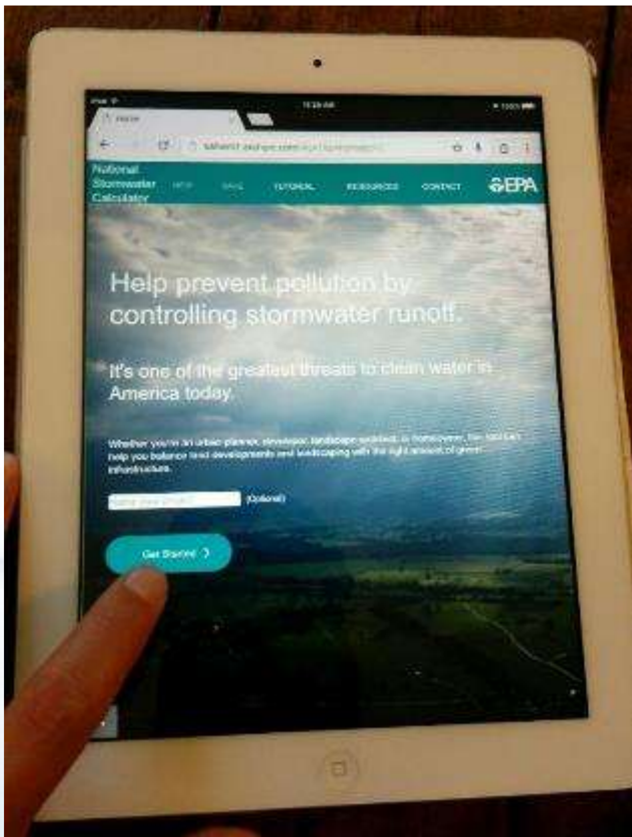
Climate Resiliency Planning Application

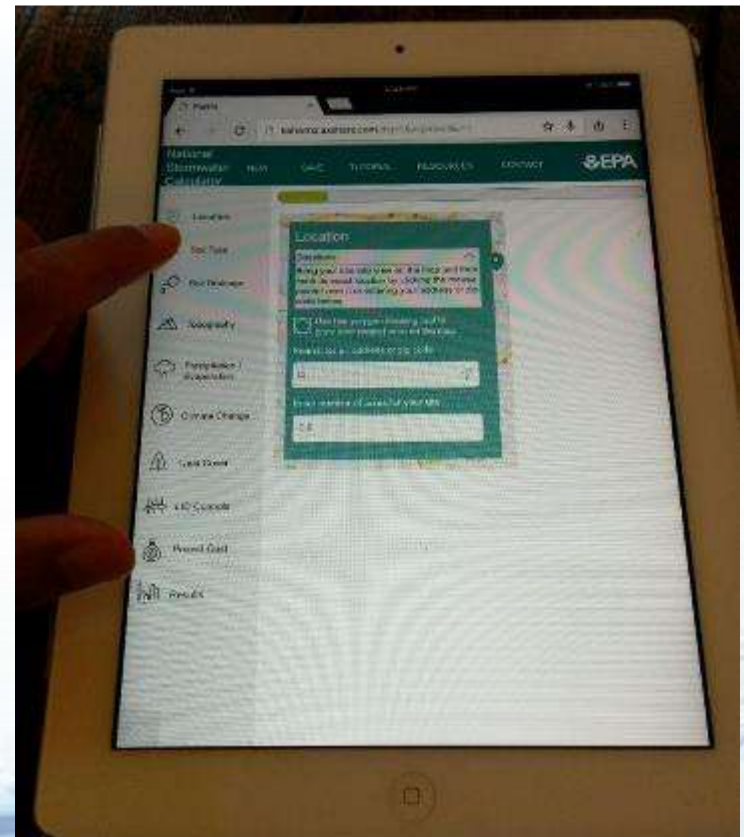


http://toolkit.climate.gov/case-studies/improving-water-quality-dealing-first-inch-rain

Mobile Web App Development: Public Release Expected in Fall 2017

Live demonstrations at WEFTEC 2017 Stormwater Pavilion, Oct. 2 - 3 (Chicago, IL)





Discussion and Questions

Thank You!

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National Stormwater Calculator Website:
https://www.epa.gov/water-research/national-stormwater-calculator
Contact: SWC@epa.gov