



# The Watershed Resources Registry (WRR)

An Innovative, Collaborative Approach to Improving  
Regulatory Streamlining, and Achieving Sustainable  
Watershed Restoration & Protection

*Dominique Lueckenhoff, Deputy Director  
Water Protection Division, USEPA Region 3*

*Ralph Spagnolo, Water Protection Division,  
USEPA Region 3*

*Michael Herzberger, GIS Manager  
Maryland Environmental Service*

AASHTO 2014 National Stormwater Practitioners Meeting

July 31, 2014

Washington, D.C.





# watershed resources registry

*Coming together is a beginning; keeping together is progress; working together is success.*

*Henry Ford*





## History

- A collaborative national/regional pilot that grew out of the *Green Highways Partnership* and the Maryland State Highway Administration (MDSHA) proposal for making the Route 301 Project the *1<sup>st</sup> Green Highway* in Maryland.
- **Purpose 1:** Develop transferable framework for integrated watershed management to address the Federal Compensatory Mitigation Rule – ultimately enabling creation of “watershed banking” capability.
- **Purpose 2:** Achieve increased regulatory efficiencies through integration of CWA Sections 401, 402, and 404 (303(d), 319, etc.) in a watershed context – thereby also enabling greener (more sustainable) stormwater management.



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US Army Corps of Engineers®



## What is the WRR?

- It is a comprehensive replicable framework and GIS-based targeting tool that:
  - Integrates and streamlines regulatory programs
  - Guides resource planners
  - Saves time and \$\$, and increases program efficiencies
  - Screens for preferred actions and maximizes watershed benefits
  - Is transparent, predictable and reliable
  - Facilitates multiagency input and coordination



## Why is the WRR unique?

*Unlike many mapping and targeting tools...*

***There is extensive participation by federal, state and local government, including:***

Regulators

- |       |       |                    |     |
|-------|-------|--------------------|-----|
| EPA   | USACE | FWS                | MES |
| FHWA  | MDE   | MDNR               | MDP |
| MDSHA | ICPRB | County Governments |     |

Regulated Community

There is agency collaboration and program integration between:

Allows For Concurrent reviews

- **CWA 319, 401,402,404, 303(d)**
  - Watershed planning, permit review, mitigation assessments
  - TMDL and WIP applications
  - Stormwater management
- **NEPA review**

- **Green Print and Rural Legacy** priorities
- **Section 7** (Endangered Species Act)
- **Transportation and land use planning**
- **Resource conservation/ environmental resource planning**





## Interagency Partnering - Objectives:

- **1. Integrate watershed data from multiple agencies and programs in a single database**
  - Increase decision-making efficiency regarding users' particular priorities
  - Achieve secondary benefits to watershed as a whole; the decision of one regulator or planner aids the priority of another.
  - Addresses both agency and watershed needs





- **2. Increase regulatory and non-regulatory program integration via the watershed approach**
  - Begin with CWA 401, 404, 402, 303(d), and 319
  - Provide support to local planning & watershed efforts
  - Seek best ways to coordinate and streamline application of regulatory tools to address greatest watershed-driven resource needs for sustainable performance & results



- **3. Streamline and improve regulatory efficiencies and resource planning via minimization of redundancies in decision-making**
  - Ensure compliance with federal compensatory mitigation rule
  - Incorporate all information into the decision-making framework for regulators, planners, nongovernmental organizations, permit applicants, industry, and others.







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## WRR NEPA Streamlining & Regulatory Efficiency

Linked permit process with NEPA



### Time & Dollar Savings

60 to 80% time reduction & 10- 13% cost reduction  
**5.6 Yrs Reduced to ~ 2 Yrs**

### Other Benefits

Brought the 401/404 regulators evaluations into the NEPA phase of project development thereby reducing redesign and re-analysis of project designs after NEPA



Collaborative decision making process among agencies – linked review of 7-11 additional processes & resources



Additional 20 to 30 % time and cost reduction  
**~ 1-1.2 yr**

Provided a framework for integrated and collaborative decision-making. Allowed Regulatory/Resource agencies to deliberate a balance decision among varied resources



collaborative decision-making process with GIS and Ecological Analysis



Additional 30% reduction in time and cost with decisions based on integrated ecological analysis  
**~ 9 mos – 1 yr**

Provides a broader regional or ecosystem analysis for infrastructure processes. Identification and evaluation of impacts and also assists in developing regional conservation planning.



Watershed based analysis tool used to streamline many agency decision-making processes. Collaborative development of tool by multiple regulatory agencies



WRR can provide an additional 50% reduction in each step of the process that involves data collection, analysis, and evaluation  
**~ 4-5 mos (Projected)**

Multiple endusers for WRR tool from private sector to many levels of public sector. Can encompass planning & project development & permitting and regulatory/non-regulatory analyses.



404 (b)(1)  
Guidelines  
Analysis

## Standard (MD)

### CWA 401/404 Permit Process

**1**  
Pre-  
application  
Meeting &  
Coordination

Corps permit reviewer meets with applicant to explain requirements of 404 including the amount and type of aquatic resource information needed.

**2**  
Application  
Initial Review  
Jurisdiction &  
completeness

Currently **66% or more of applications are not considered complete at time of submittal** and often require several iterations before considered federally complete.

**3**  
Alternatives  
Analysis &  
Agency  
Coordination

Analyzing alternatives including avoidance & minimization can require numerous iterations of data gathering and analysis including field reviews. This includes determination of potential mitigation sites

**Average Time: 120 days**

### CWA 401/404 Permit Process **with WRR**

Corps permit reviewer can show the applicant to the WRR website/tool and explain the process and information requirements. Reviewer at this time could ascertain the Corps jurisdiction on the project

The WRR can assist applicants in submitting complete permits quicker and with less revisions. Permit Reviewer will be able to ascertain jurisdiction and type of permit earlier. **Initial WRR Perf. Target = Reduce 66% to 30% or less.**

Applicant, permit reviewer and agencies can work to identify any additional avoidance & minimization changes using the WRR. Also potential mitigation sites can be evaluated using the WRR. Field reviews can be expedited.

**Projected Average Time: 60-80 days**



## WRR Suitability Analyses (SA)

- Upland Preservation
- Upland Restoration
- Wetland Preservation
- Wetland Restoration
- Riparian Zone Preservation
- Riparian Zone Restoration
- Preserve Healthy Stormwater Systems
- Restore Degraded Stormwater Systems



## Factors for Preserving Healthy Natural Stormwater Infrastructure

Relative Factors

- in a Blue Infrastructure watershed
- in area with well-drained soils
- in a 100-year (1 point) or 500-year (½ point) floodplain
- within 100 ft (1 point) or 500 ft (½ point) of an impaired (303-D listed) stream
- in a Tier II watershed
- in a Stronghold Watershed (1 point for “1”; ½ point for “2”)
- in Chesapeake Bay Commission Critical Area (LDA or RCA only)
- in a Green Infrastructure hub or corridor
- in an area of potential Forest Interior Dwellings Species Habitat
- is forested riparian buffer (1 point if within 200 ft of stream; 2/3 point if within 400 ft of stream; 1/3 point if within 600 ft of stream)
- is relatively high in impervious surfaces
- is forested near (200 ft) or in an area where impervious surfaces are relatively higher
- in an unprotected Targeted Ecological Area (GreenPrint)
- is within 200 ft of a protected Targeted Ecological Area (GreenPrint)
- is near (200 ft) but not in a protected Targeted Ecological Area (GreenPrint)
- in a Priority Funding Area
- in a wetland

Absolute Factors

- cannot already be protected
- cannot be open water



## Factors for Restoring Degraded/Failing Stormwater Infrastructure Systems

Relative Factors  
Discouraged Factors

- in a Blue Infrastructure watershed
- in a Biological Restoration Initiative (BRI) watershed
- in an area that was probably developed before 1985 (1 point) or between 1985 and 2000 (1/2 point)
- is an area of relatively higher impervious surfaces
- in an impaired watershed (as indicated by §303-d)
- is within 200' (1 point) or within 600' (1/2 point) of a stream designated for uses II, II or IV
- in a Stronghold Watershed (1 point for “1”; ½ point for “2”)
- in a Tier II watershed

- flood plains
- forested areas
- karst geology
- in a wetland



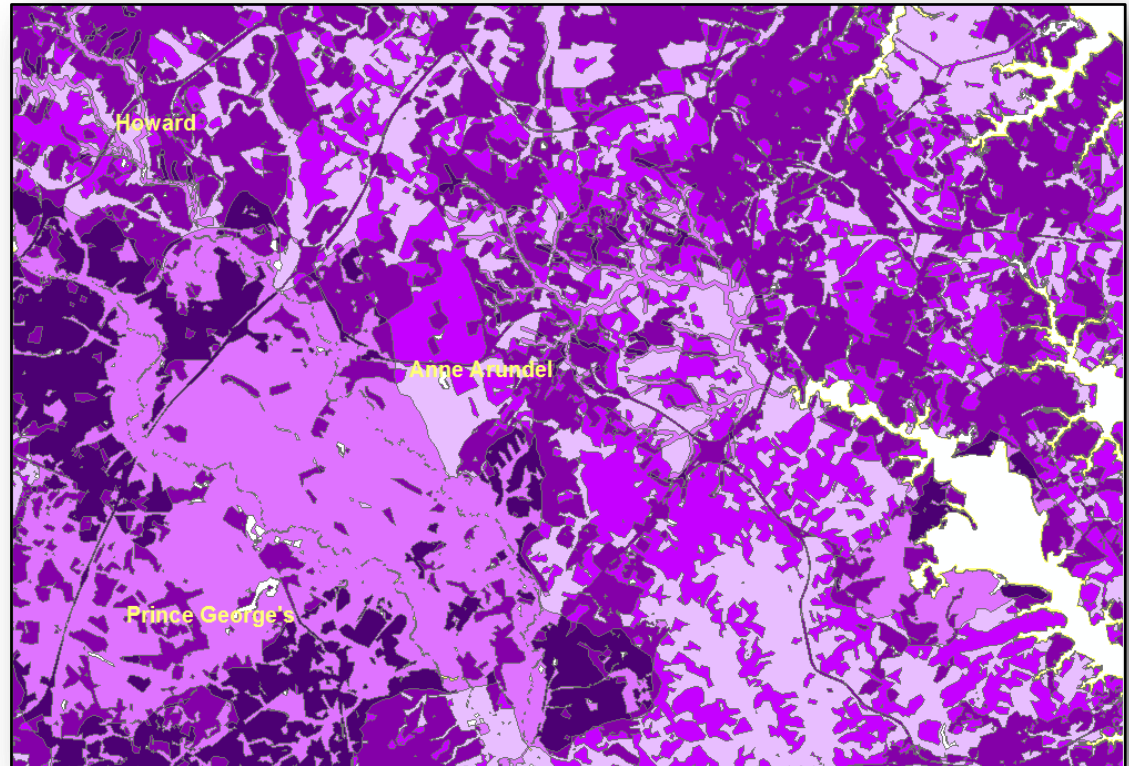


## Philosophy of the WRR: Stormwater Models

- Any relatively healthy or intact system (including wetlands, streams, uplands, etc.) will have positive stormwater benefits and should be preserved.
- Direct users to general areas that should be considered for restoration (or preservation) and to sway them away from areas that are less desirable for restoration (or preservation) based on landscape characteristics or other factors.
- The intent is not to identify all areas that are technically feasible but to use the Watershed Approach to guide users to areas that are both strategic and preferred for restoring healthy hydrology.
  - For example, the goal is to direct users to areas of high imperviousness rather than previous approaches which directed users to existing green space.

## Setting the Stage: How did we get here?

- Not intended to be site specific
- Planning level tool designed to direct users to a general area that then needs to be ground investigated
- Feedback from stakeholders that the model outputs were too general
- Potential to refine and increase the utility of the tool by applying NPDES – specific BMP data



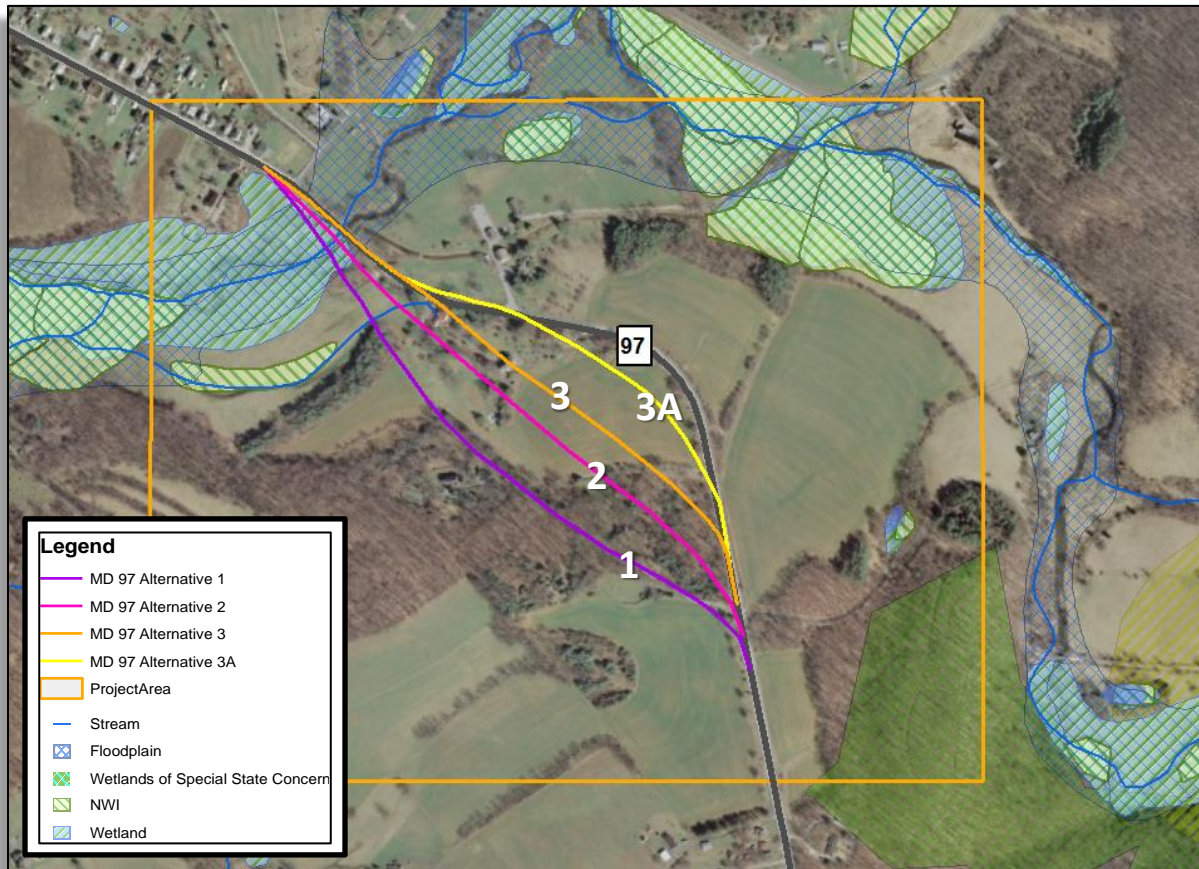


## Request for Input from Agency Stakeholders

- Letter of request sent out in July of 2013 with initial comment end date of 8/16
  - Stormwater Model Criteria
  - Potential New Data Sources
- Continued follow up and interagency coordination throughout the fall
- Weekly stormwater conference calls between EPA and MES – intermittent participation by DNR and SHA



## Avoid and Minimize Using the WRR



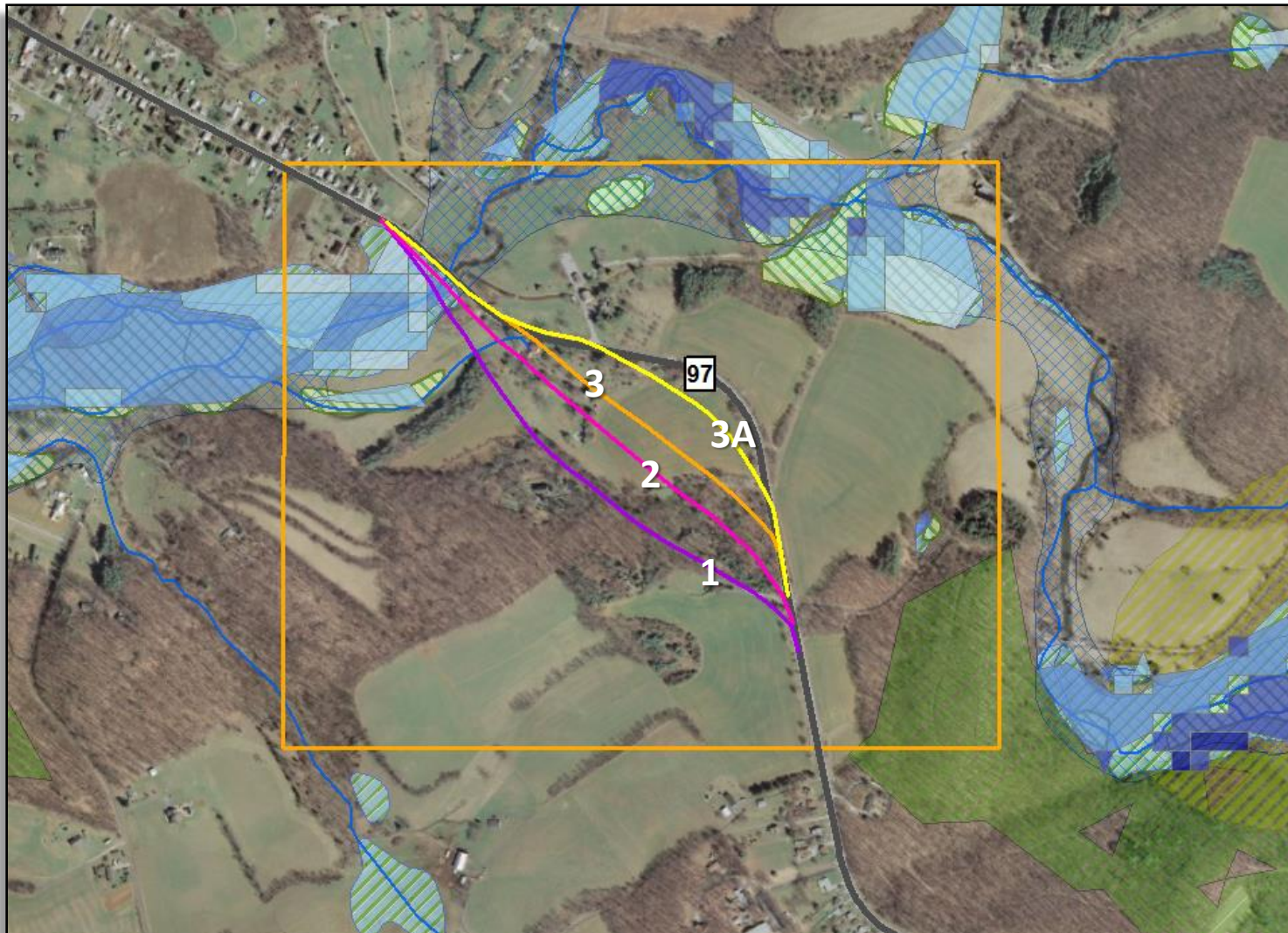
### Considerations for Potential Alignments:

- Wetlands
- Streams
- Floodplains
- Green/Blue Infrastructure
- Land Use/Land Cover
- Forest Interior Dwelling Species
- Targeted Ecological Areas
- Sensitive Species Area
- Chesapeake Bay Critical Area
- Property Owner Information

### Watershed Resources Registry Case Study

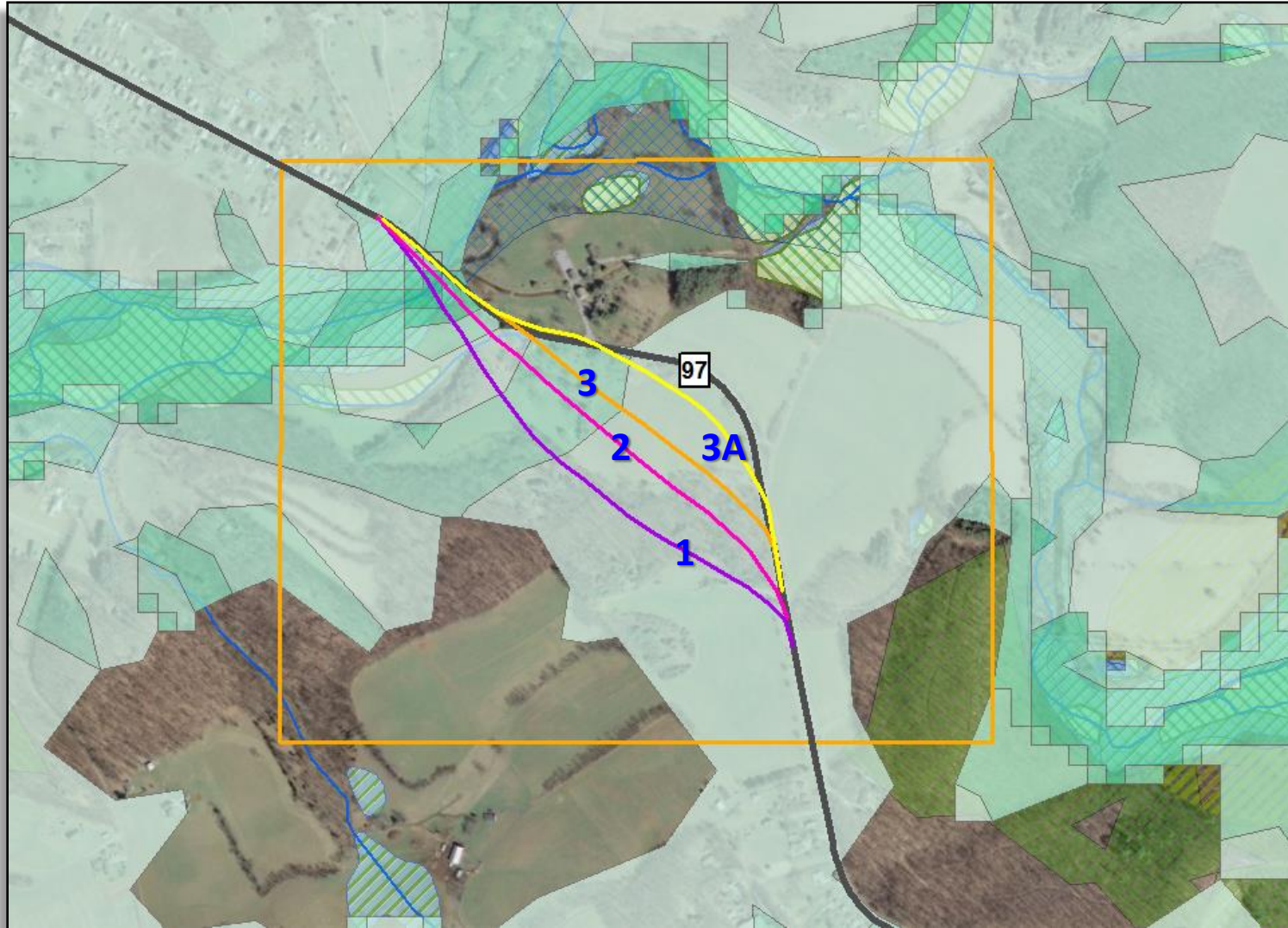


## Potential Preservation Impacts: Wetland Preservation





## Potential Preservation Impacts: Stormwater Preservation





## Avoidance and Minimization Results

Impact Types	No-Build Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 3A
<b>Community Impacts</b>					
Residential Displacements	0	1	1	2	0
Residential Properties Impacted	0	7	9	9	6
<b>Range of Natural Environmental Impacts</b>					
100-Year Floodplain Affected (acres)	0	1.64	1.78	1.77	0
Wetlands Affected (acres)	0	1.35	1.36	0.56	0
Streams (lf)	0	289.3	409	113.7	11.1
Woodlands Affected (acres)	0	7.6	3.8	4.1	1.1
<b>WRR Preservation Opportunity Impacts</b>					
Wetland Preservation (acres)	0	1.77	10.6	0.6	0
Upland Preservation (acres)	0	15.4	11.45	11.29	8.5
Riparian Preservation (acres)	0	8.9	6.6	5.09	3.02
<b>TOTAL ACRES</b>	<b>0</b>	<b>26.07</b>	<b>28.65</b>	<b>16.98</b>	<b>11.52</b>



Typical PACM Matrix Using the WRR Results

### Watershed Resources Registry Case Study





## Using the WRR to Identify Mitigation Sites

**Watershed Resources Registry**

EPA USACE FWS FHWA SHA MDE DNR Help

**Location Details Results**

**Watershed Resources Improvement Opportunities**

- Upland Preservation: Not Suitable
- Upland Restoration: 3
- Wetland Preservation: Not Suitable
- Wetland Restoration: 2
- Riparian Preservation: Not Suitable
- Riparian Restoration: 2
- Stormwater Natural Infrastructure Preservation: Not Suitable
- Stormwater Compromised Infrastructure Restoration: 4

**Watershed Characteristics:**

View Watershed Profile  
 HUC: 020700090404  
 HUC Name: Upper Big Pipe Creek  
 Maryland 8 Digit Watershed: 02140304  
 Maryland 12 Digit Watershed: 021403040283

Metadata: [HUC](#) | [MD Watershed](#) | [Stronghold](#)

**Waterways**

Nearest Stream: Unnamed Tributary to Big Pipe Creek  
 Stream Use Designation: IV-P  
 Distance: 347 ft  
 Water Body Distance: 347 ft

Metadata: [Stream Use Designations](#) | [Water Body](#)

**Water Quality Impairments**

Metadata  
 Impairments: Biological, Nutrients, Sediments

**Physiographic Region**

Metadata  
 Province: Piedmont Plateau Province

**Geology**

Metadata  
 Name: Marburg Schist

**Wetlands**

Wetlands of Special State Concern: None within 500 ft

**Opportunities Results**

**Address Results**

**Map Contents**

- Stormwater Restoration
- Upland Restoration

**Find Opportunities**

Select a County: Carroll

Select a Watershed: Upper Big Pipe Creek:020700090404

Select Potential Opportunities:

- Upland Preservation
- Upland Restoration
- Wetland Preservation
- Wetland Restoration
- Riparian Preservation
- Riparian Restoration
- Stormwater Natural Infrastructure Preservation
- Stormwater Compromised Infrastructure Restoration

Select Score:

Select Score Operator: >=

Where Acres is Greater Than (>): Any Area

Where Acres is Less Than (<): Any Area

Find Opportunities

**Upper Big Pipe Creek Watershed**

Project Area

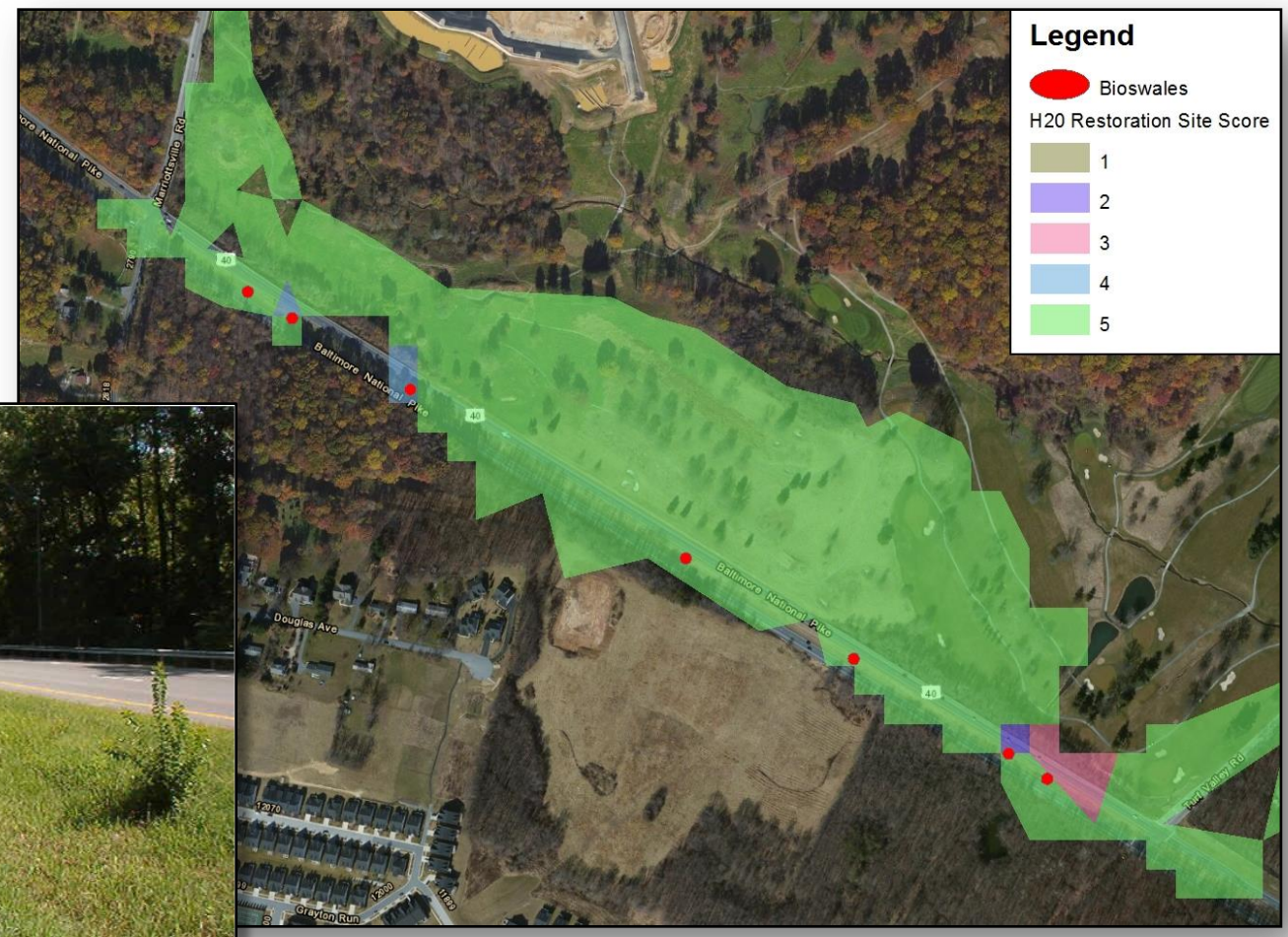
Potential Mitigation Site

### Watershed Resources Registry Case Study





## Stormwater Facilities



Watershed Resources Registry Case Study



## Alternative Strategies



I-695 and MD 150  
Baltimore County  
Site Score: 3



### Watershed Resources Registry Case Study





## Capitol Program

	Costs	Time	Cost Savings with WRR	Time Savings with WRR
Site Search	\$50,000	4 months	\$37,500	3 months
Design	\$210,000	18 months	\$60,000	6 months
Agency Coordination/Regulatory Review	\$10,000	12 months	\$2,500	3 months
<b>Total</b>	<b>\$270,000</b>	<b>2.8 years</b>	<b><u>\$100,000</u></b>	<b><u>1 year</u></b>

\*Cost/time savings would be post Location Approval and includes only mitigation tasks.







## In Summary, the WRR is....

- **Transferable**
  - National datasets and Maryland datasets
  - Uses web services for readily available & public domain datasets
- **Transparent**
  - All applicants have same results available to them, consistent approach to protection
  - Maps and scores governmental agencies' preservation and restoration priorities
  - Information is available prior to making large investments of time and money
  - Tool developed collaboratively with widespread agreement among multitude of regulatory agencies





## In Summary, the WRR is....

- **Predictable**
  - Tool developed collaboratively with widespread agreement among multitude of regulatory agencies
  - WRR Suitability Analyses incorporate CWA guidelines allowing for early designs to meet regulatory requirements
- **Efficient**
  - Saves applicant design & agency review time: no need to recreate an analytic review tool for each application, or when mitigation is offered.
- **Effective**
  - Improved transportation & environmental outcomes





## In Summary, the WRR is....

- **Highly Adaptive**
  - Tool allows the transfer of data into other personal GIS platforms
- **Compatible**
  - Can be used in conjunction with other tools, such as the **EPA National Stormwater Calculator**, to determine most cost effective BMP options within WRR opportunity sites



## EPA National Stormwater Calculator

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

**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.

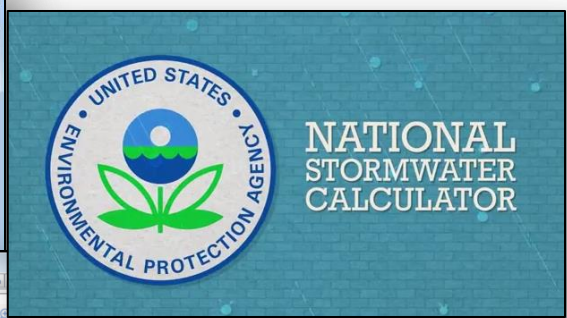
The analysis takes into account local soil conditions, topography, land cover and meteorology. Different types of low impact development (LID) practices can be employed to help capture and retain rainfall on-site. Localized climate change scenarios can also be analyzed.

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 1.1.0.0

Select the Location tab to begin analyzing a new site.



**National Stormwater Calculator**

Overview | Location | Soil Type | Soil Drainage | Topography | Precipitation

**Describe your site's topography:**

- View soil survey data
- Flat (2% Slope)
- Moderately Flat (5% Slope)
- Moderately Steep (10% Slope)
- Steep (above 15% Slope)

When soil survey data is displayed you can select a slope category directly from the map.

Help

Describe how steep the site is.

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



## National & Regional Roll-out Strategies

- AASHTO Technical Implementation Grant Awarded (September, 2013)
- National Workshop Planned (October 15 & 16, 2014, Inner Harbor of Baltimore, Holiday Inn)
  - 19 States will be invited
  - EPA Regions, Corps' Districts, and DOT's Invited, among others
- Watershed driven GIS tools such as WRR mentioned in (Section 5102 of The Grow America Act) for Transportation

*“watershed-driven web-based geographic information systems; and use of innovations in design, procurement and purchasing to improve project delivery and efficiency and reduce costs”*
- Development of Prototypes for Chesapeake Bay States
  - Maryland WRR Implemented & Complete
  - Delaware held first Meeting May 9, 2014
    - DNREC, DELDOT, Corps' and EPA
  - Others to follow



# watershed resources registry

## New WRR Application Interface

The screenshot displays the Watershed Resources Registry application interface. At the top, the title "Watershed Resources Registry" is shown in a green header bar, with a "Login to add Site Assessments: Log In" button on the right. Below the header, there are navigation tabs for "Overview", "Contents", "Details", and "Results".

On the left side, there is a "Legend" panel with a vertical scroll bar and navigation arrows. The legend includes several categories with expandable/collapsible icons:

- Site Assessments
- WRR/BasemapWebMercat
- Watershed Resources Imp
  - Upland Preservation
  - Upland Restoration
  - Wetland Preservation
  - Wetland Restoration
  - Riparian Preservation
  - Riparian Restoration
  - Stormwater Natural Infras
  - Stormwater Compromised
- Watershed Characteristics
- Waters/Streams
- Water Quality Impairments

At the bottom of the legend panel is an "Add Data" button. The main area of the interface is a map of the Eastern United States, showing states like West Virginia, Maryland, Virginia, Delaware, New Jersey, and Pennsylvania. Major cities like Pittsburgh, Harrisburg, Washington, Baltimore, Philadelphia, and Richmond are labeled. The map includes a scale bar (0, 50, 100 km) and a "powered by MDIMap" logo. A toolbar at the top of the map area contains icons for home, layers, search, edit, grid, and info, along with "ZOOM TO COUNTY" and "ZOOM TO WATERSHED" dropdown menus.

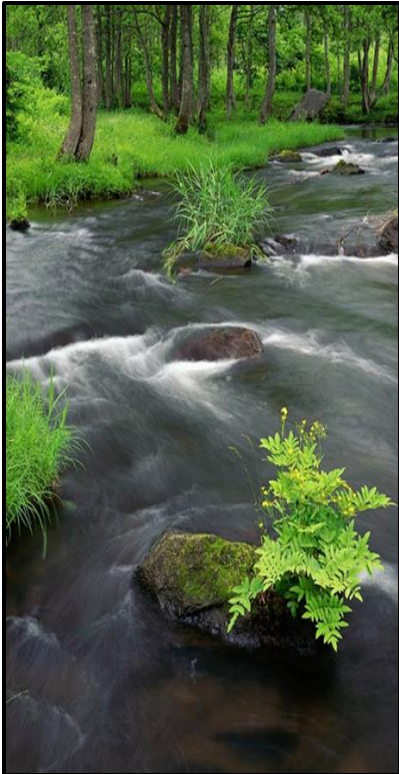




## WATERSHED RESOURCES REGISTRY WORKSHOP

October 16 - 17, 2014 - Baltimore, Maryland

Holiday Inn Inner Harbor (301 West Lombard Street • Baltimore, Maryland 21201)



The American Association of State Highway and Transportation Officials (AASHTO) has selected the Watershed Resources Registry (WRR), (<http://www.watershedresourcesregistry.com/>) for accelerated advancement to transportation agencies nationwide.

### Keynote Speakers:

- **Nancy Stoner**, Acting Assistant Administrator for the Office of Water, US EPA
- **Eric Beightel**, Senior Environmental Policy Advisor, US DOT
- **Jennifer Moyer**, Acting Regulatory Chief, US ACE



# WATERSHED RESOURCES REGISTRY WORKSHOP

October 16 - 17, 2014 - Baltimore, Maryland



The 1 ½ - day event will provide an overview, including:

- WRR background and development
- Benefits/applications of use
- What's needed for early adopters
- Implementation assistance
- Implementation plan and timeline

Join us to learn how the WRR has helped drive a shared watershed vision for the transportation and regulatory/resources communities in Maryland. And, more importantly, how it can help you, too!

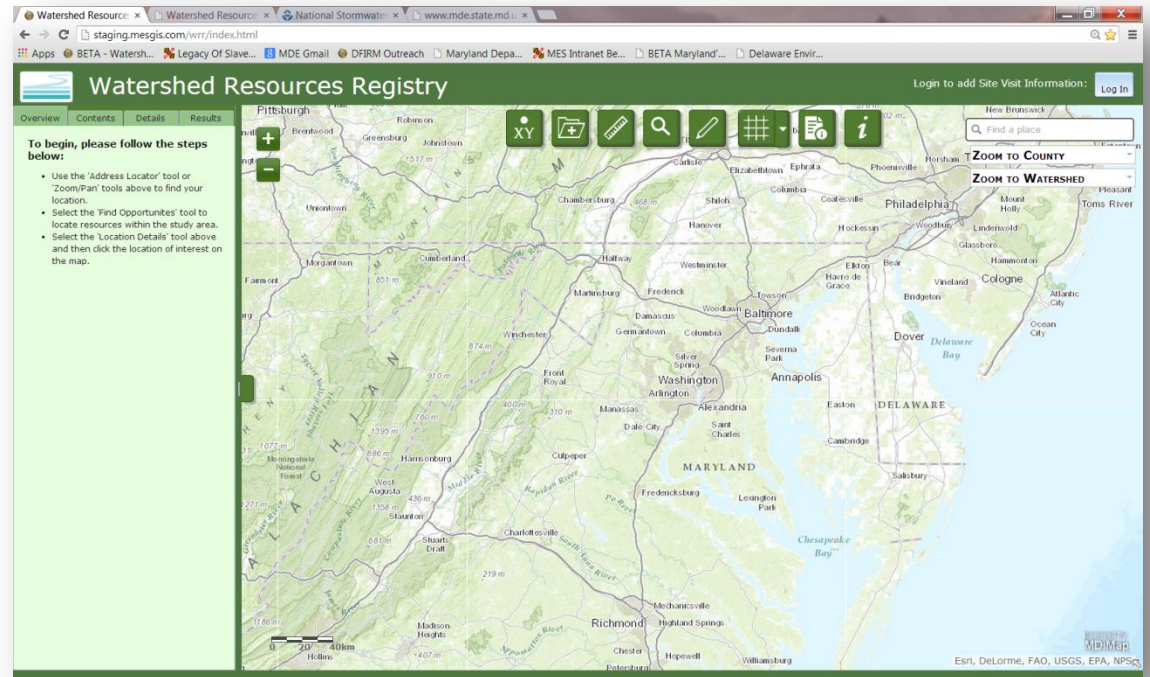
Hosted by the AASHTO Innovation Initiative and MD SHA:







## Using the WRR to Avoid, Minimize, and Mitigate



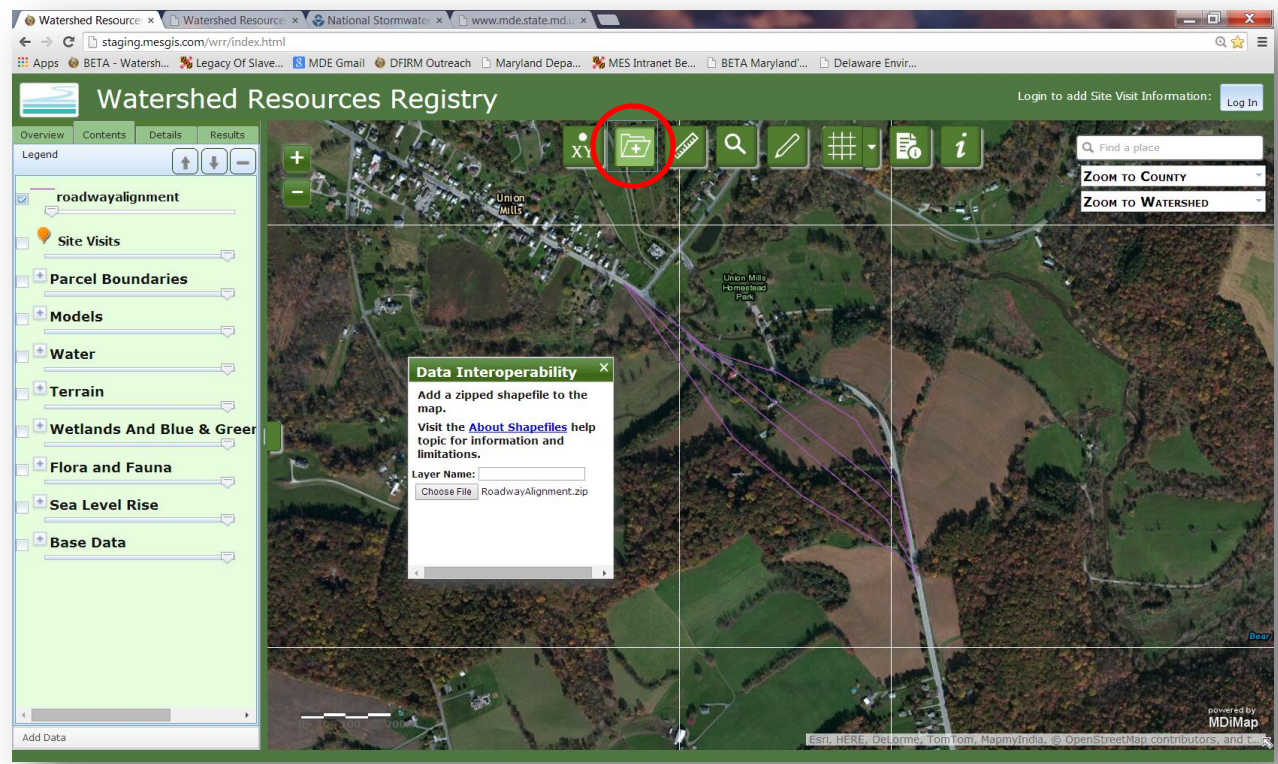


- Transportation Planner
- Engineers have provided several roadway alignment options in ESRI Shapefile format for upcoming project
- Need** to perform avoidance and minimization techniques to determine what would be the best alignment with the least amount of environmental and financial impacts
- Need** to find potential mitigation opportunities within the watershed
- Need** to share findings with inter-agency review team

## Scenario 1

## Loading Data into the WRR

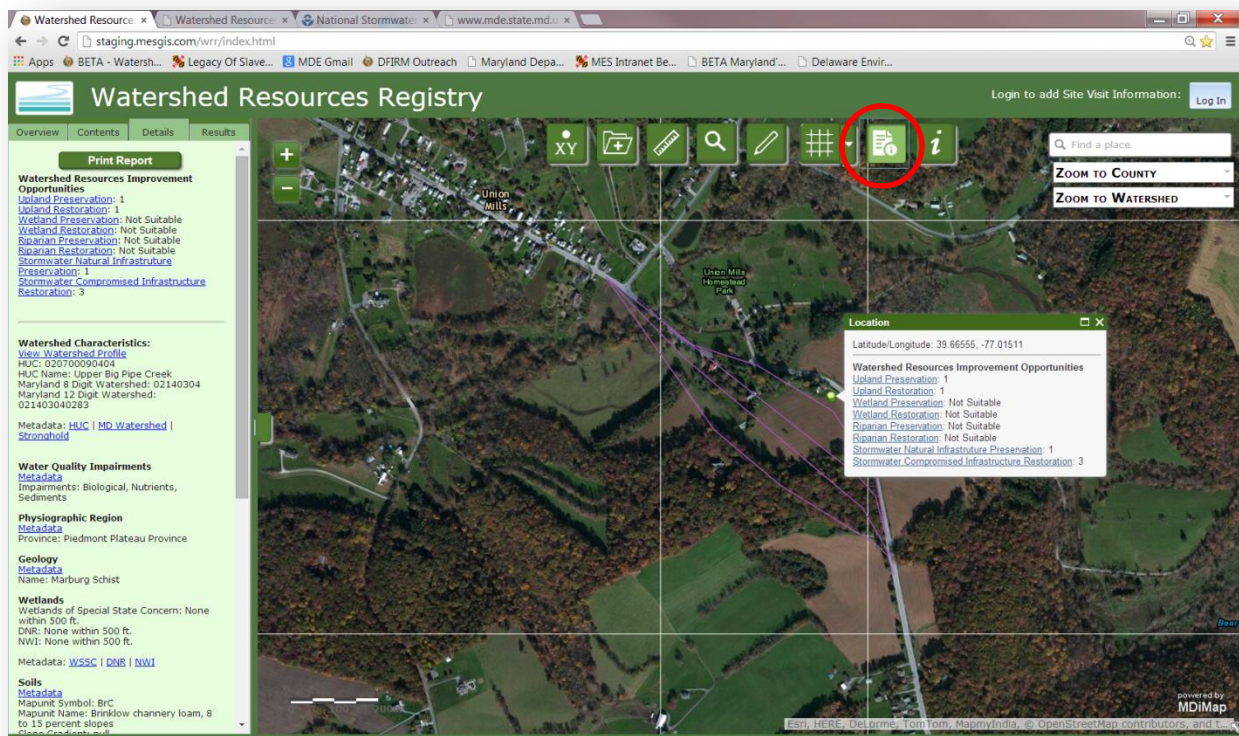
- Use Add Data Button to overlay shapefile atop map
- Shapefile must be compressed into zip file format
- Projection must be defined in Shapefile
- Zooms user to immediate extents





## Using Location Details Tool

- Quickly determine and assess watershed, soils, green infrastructure hubs, gaps, corridors, impairments, potential restoration and preservation opportunities, site visits, etc. at the click of a button





## Using Location Details Tool Continued

- Results are returned in the Details tab just left of the mapping interface
- Follow links to metadata, criteria sheets, and to view watershed profile
- Click on buttons to find Site Visit Information near your map selection along with printing the map and report

[Print Report](#)

### Watershed Resources Improvement Opportunities

[Upland Preservation](#): 1  
[Upland Restoration](#): 1  
[Wetland Preservation](#): Not Suitable  
[Wetland Restoration](#): Not Suitable  
[Riparian Preservation](#): Not Suitable  
[Riparian Restoration](#): Not Suitable  
[Stormwater Natural Infrastructure Preservation](#): 1  
[Stormwater Compromised Infrastructure Restoration](#): 3

### Watershed Characteristics:

[View Watershed Profile](#)  
 HUC: 020700090404  
 HUC Name: Upper Big Pipe Creek  
 Maryland 8 Digit Watershed: 02140304  
 Maryland 12 Digit Watershed: 021403040283

Metadata: [HUC](#) | [MD Watershed](#) | [Stronghold](#)

### Water Quality Impairments

[Metadata](#)  
 Impairments: Biological, Nutrients, Sediments

### Physiographic Region

[Metadata](#)  
 Province: Piedmont Plateau Province

### Geology

[Metadata](#)  
 Name: Marburg Schist

### Wetlands

Wetlands of Special State Concern: None within 500 ft.  
 DNR: None within 500 ft.  
 NWI: None within 500 ft.

Metadata: [WSSC](#) | [DNR](#) | [NWI](#)

### Soils

#### [Metadata](#)

Mapunit Symbol: BrC  
 Mapunit Name: Brinklow channery loam, 8 to 15 percent slopes  
 Slope Gradient: null  
 Drainage Class: Well drained  
 Hydrologic Group: B  
 Hydric Classification : Not Hydric

### Green Infrastructure

There are no hubs within 500 ft.  
 There are no gaps within 500 ft.  
 There are no corridors within 500 ft.

Metadata: [Hub](#) | [Gap](#) | [Corridor](#)

### Blue Infrastructure

#### [Metadata](#)

There is no blue infrastructure within 500 ft.

### Species Related Data

There are no forest interior dwelling species areas within 500 ft.

Metadata: [FIDs](#)

### Priority Funding Area:

#### [Metadata](#)

Location inside a PFA

### Land Use/Land Cover

Land Use Type (2002): Pasture  
 Land Use Type (2007): Pasture

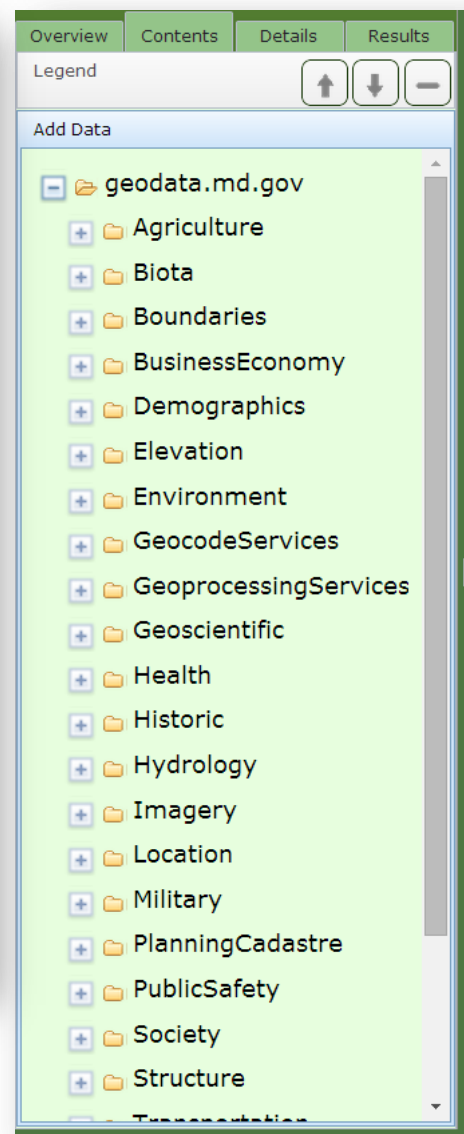
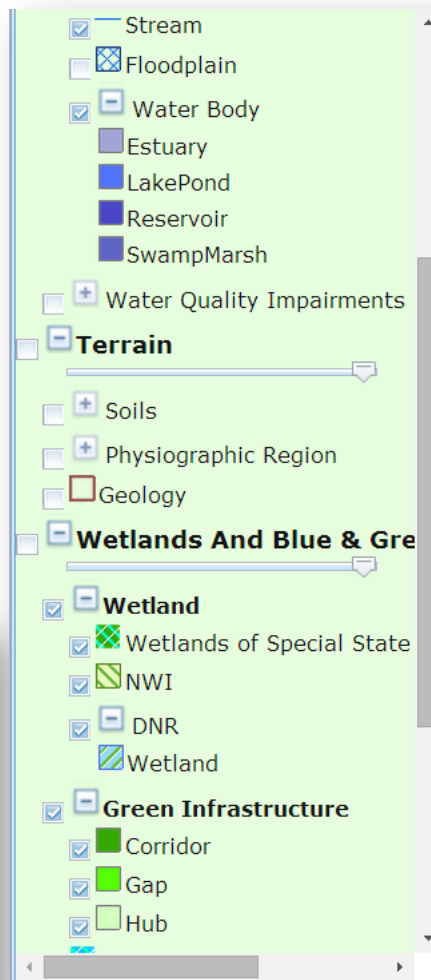
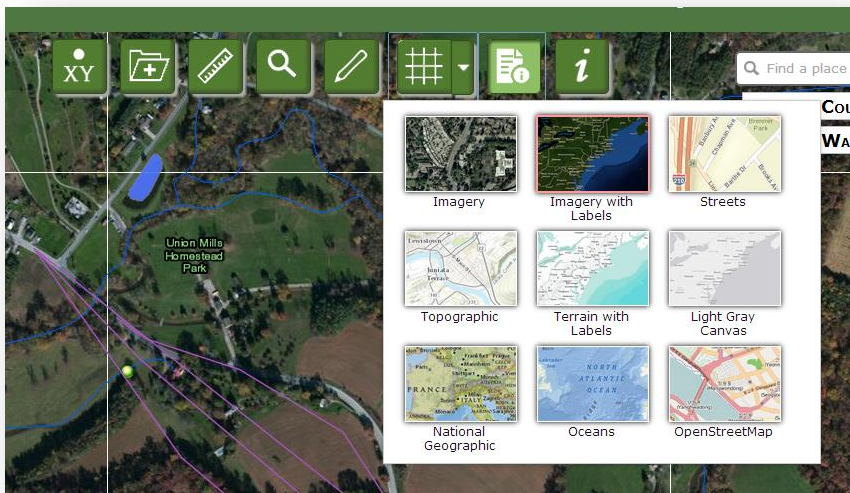
Metadata: [Metadata](#) | [Metadata](#)

[Click for Site Visit Information Within 500ft](#)



## Conduct Visual Analyses

- ~50 Layers Available by default in TOC
- Choose from 9 ESRI Basemaps
- Online linkage to MD iMap data





# watershed resources registry



## Watershed Resources Registry

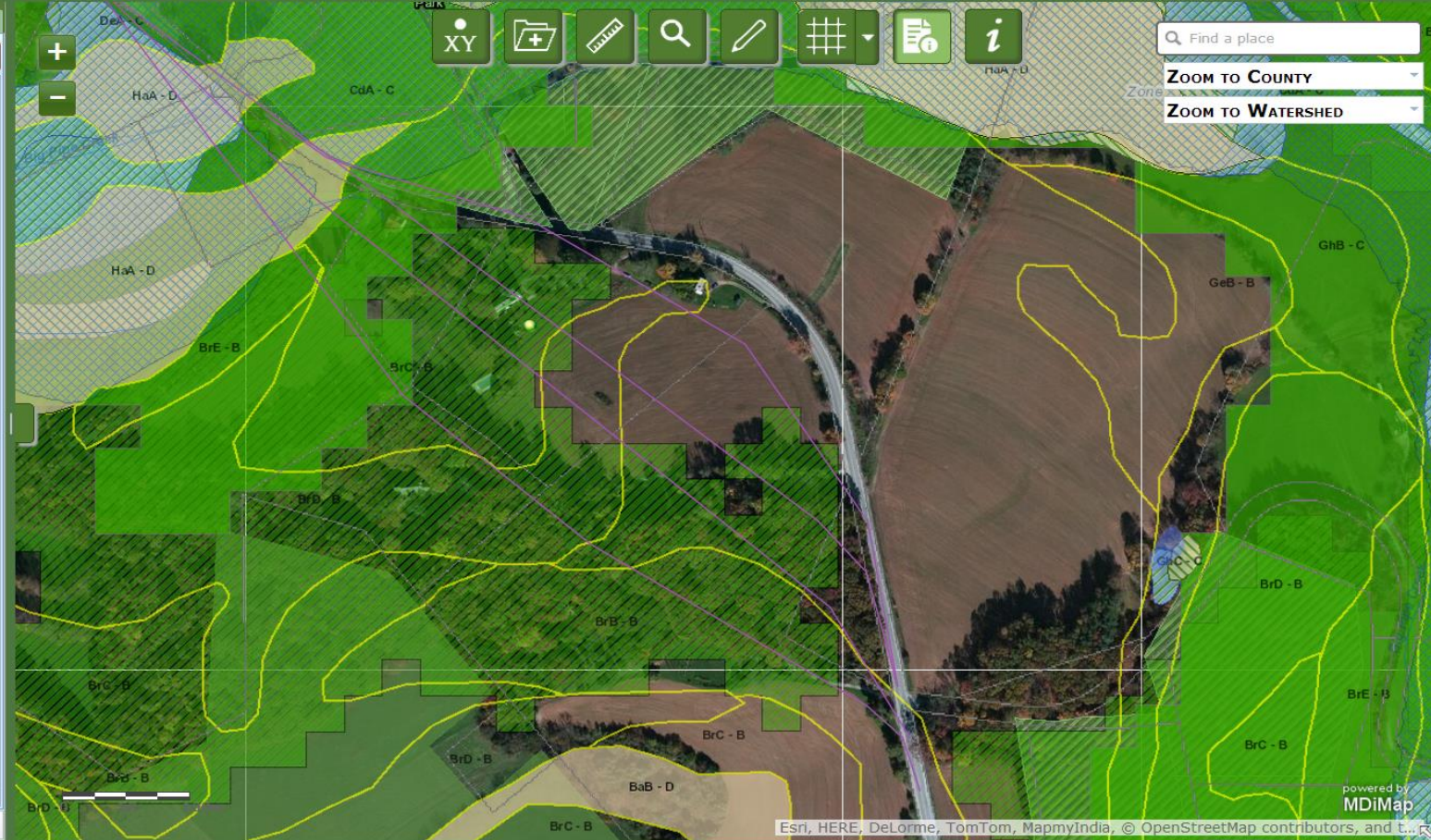
Login to add Site Visit Information: [Log In](#)

Overview Contents Details Results

Legend

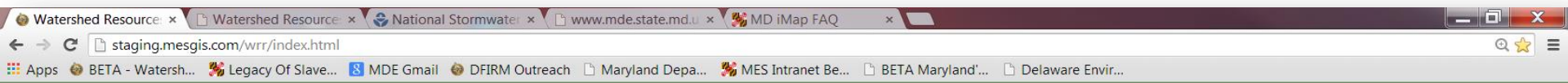
- Physiographic Region
- Geology
- Wetlands And Blue & Gre**
  - Wetland**
    - Wetlands of Special State
    - NWI
    - DNR
    - Wetland
  - Green Infrastructure**
    - Corridor
    - Gap
    - Hub
  - Blue Infrastructure**
- Flora and Fauna**
  - Species Related Data**
    - Sensitive Species Project F
    - Targeted Eco Area
    - Forest Interior Dwelling Sp
- Sea Level Rise**
- Base Data**

Add Data





# watershed resources registry



## Watershed Resources Registry

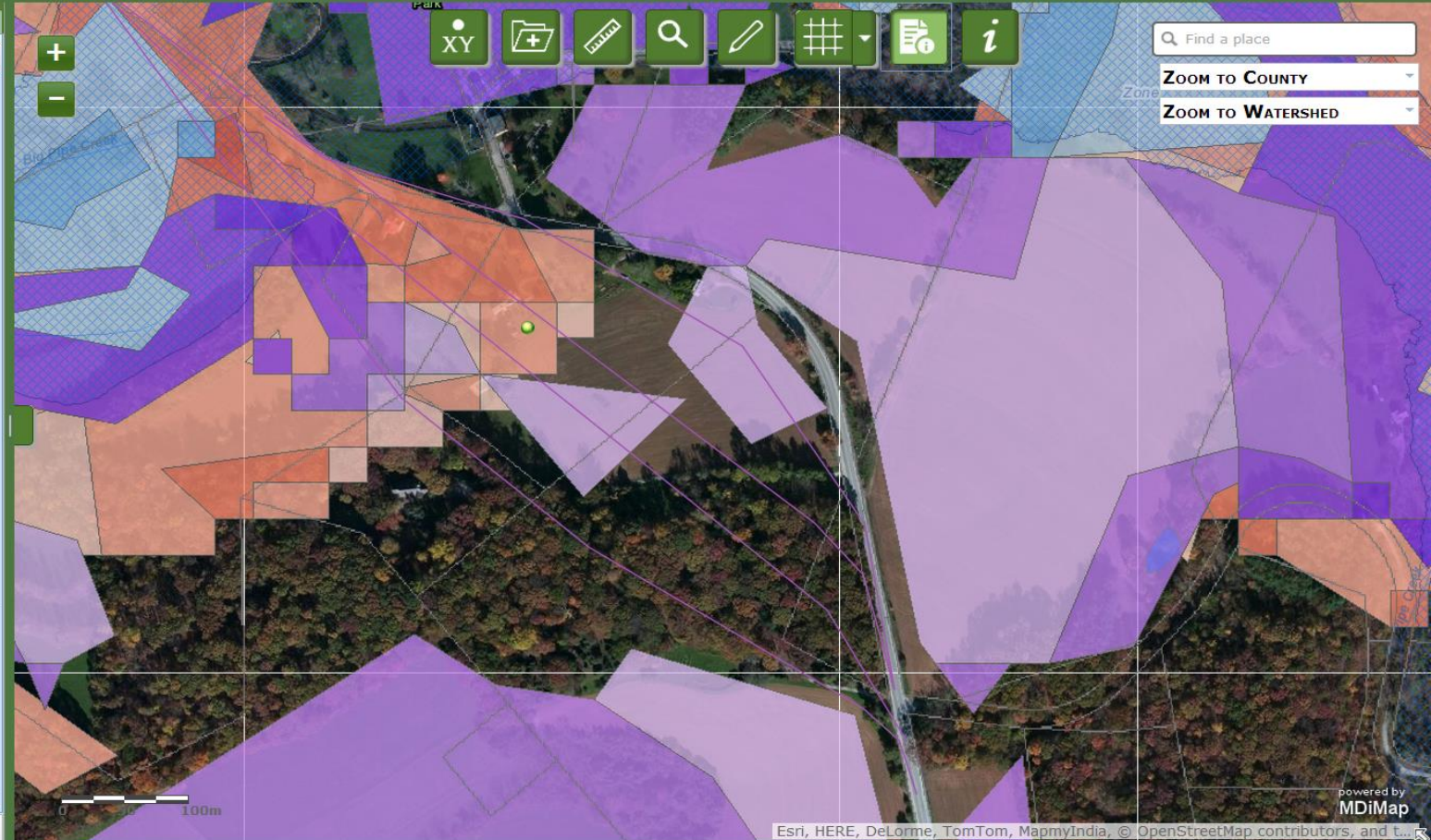
Login to add Site Visit Information: [Log In](#)

Overview Contents Details Results

Legend

- Watershed Resources Imp
  - Upland Preservation
  - Upland Restoration
    - Not Suitable
    - 1
    - 2
    - 3
    - 4
    - 5
  - Wetland Preservation
    - Not Suitable
    - 1
    - 2
    - 3
    - 4
    - 5
  - Wetland Restoration
  - Riparian Preservation
    - Not Suitable
    - 1
    - 2
    - 3
    - 4
    - 5
  - Riparian Restoration

Add Data







## Export Information for Field Verification

- Key Lat/Long from Print Map into GPS unit for navigating in the field.

7/28/2014 Watershed Resources Registry

### Watershed Resources Map

Map Projection: State Plane Maryland (NAD83 - Meters)

**Selected Location - Coordinates**

Latitude/Longitude: 39.66538, -77.01704

**Watershed Resources Improvement Opportunities**  
 Upland Preservation: 2  
 Upland Restoration: Not Suitable

**Watershed Characteristics:**  
[View Watershed Profile](#)

<http://staging.mesgis.com/wrr/index.html>

Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, GE, Swisstopo, and the GIS User Community, Esri, NCEM, Palanis, TomTom, MapInfo, Copernicus, and the GIS User Community





## Export Information for Field Verification Continued

- Add notes and site description characteristics directly to print map page

7/29/2014

Watershed Resources Registry

[Wetland Preservation](#): Not Suitable  
[Wetland Restoration](#): Not Suitable  
[Riparian Preservation](#): 2  
[Riparian Restoration](#): Not Suitable  
[Stormwater Natural Infrastructure Preservation](#): 2  
[Stormwater Compromised Infrastructure Restoration](#): Not Suitable

HUC: 020700090404  
 HUC Name: Upper Big Pipe Creek  
 Maryland 8 Digit Watershed: 02140304  
 Maryland 12 Digit Watershed: 021403040283

Metadata: [HUC](#) | [MD Watershed](#) | [Stronghold](#)

### Selected Location Information

**Water Quality Impairments**  
[Metadata](#)  
 Impairments: Biological, Nutrients, Sediments

**Green Infrastructure**  
 There are no hubs within 500 ft.  
 Gap Distance: 417 ft.  
 Corridor Distance: 396 ft.

Metadata: [Hub](#) | [Gap](#) | [Corridor](#)

**Physiographic Region**  
[Metadata](#)  
 Province: Piedmont Plateau Province

**Blue Infrastructure**  
[Metadata](#)  
 There is no blue infrastructure within 500 ft.

**Geology**  
[Metadata](#)  
 Name: Marburg Schist

**Species Related Data**  
 There are no forest interior dwelling species areas within 500 ft.

Metadata: [FIDs](#)

**Wetlands**  
 Wetlands of Special State Concern: None within 500 ft.  
 DNR: None within 500 ft.  
 NWI: None within 500 ft.

Metadata: [WSSC](#) | [DNR](#) | [NWI](#)

**Soils**  
[Metadata](#)  
 Mapunit Symbol: BRC  
 Mapunit Name: Brinklow channery loam, 8 to 15 percent slopes  
 Slope Gradient: null  
 Drainage Class: Well drained  
 Hydrologic Group: B  
 Hydric Classification : Not Hydric

**Priority Funding Area:**  
[Metadata](#)  
 Location inside a PFA

**Land Use/Land Cover**  
 Land Use Type (2002): Open Urban Land  
 Land Use Type (2007): Cropland

Metadata: [Metadata](#) | [Metadata](#)

### Additional Notes:

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http://staging.mesgis.com/wrr/index.html

2/3

7/28/2014

Watershed Resources Registry

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**Disclaimer:**  
 The Mapping Services provided herein are for reference only. EPA, USACE, FWS, FHWA, SHA, MDE, DNR, and/or its affiliates can make no warranty as to the accuracy or correctness of the data generated from this service. No quantitative assessment regarding the spatial or attribute accuracy of data was conducted. Information should be used for planning purposes only.





# watershed resources registry

## Upload Site Visit Information

- Login
- Click on Button to Add Site Description
- Click on Map Location
- Fill Out Form
- Upload Photographs/Documents
- Click Save

The screenshot shows the 'Watershed Resources Registry' interface. On the left, there are navigation tabs for Overview, Contents, Details, and Results. A 'Print Report' button is visible. The main content area is divided into several sections: 'Watershed Resources Improvement Opportunities', 'Watershed Characteristics', 'Physiographic Region', 'Geology', and 'Soils'. Each section contains links to 'Metadata' and 'View Watershed Profile'. The central part of the screen features a map with a 'Site Description Form' overlaid. The form includes fields for First Name (Mike), Last Name (Herzberger), Date of Site Visit, Approximate Size of Site, Entity (State), Project Name, Email (mherz@menv.com), and Phone (410-729-8250). There are also checkboxes for 'Do you consent to having your contact information being made public?' and 'I'm looking for the following opportunities:'. Below the form are 'Save and Add Attachments' and 'Save and Close' buttons. On the right side of the map, there is a search bar and a 'Zoom to County' / 'Zoom to Watershed' dropdown menu. A 'Log Out' button is in the top right corner.

**Login** ✕

Email:

Password:

**Login**

**Forgot Password**      **Register New User**

The page at staging.mesgis.com says:

Your site visit ID is: 12001.

**OK**

**Site Description Form** ✕

**Attachments:**

[RubScrapeLickingBranch.jpg\(X\)](#)

Add:  No file chosen  
Saving graphic for attachment editing...



## Share Results

- Provide Coordinates from location details or print map to isolate location of Interest. Using XY tool, key Coordinates and click Zoom
- Provide Site ID to isolate specific site visit. Key ID into search panel

The screenshot shows the Watershed Resources Registry interface. A map of Maryland is displayed with various watershed boundaries. A 'Zoom X/Y' dialog box is open, showing the following coordinates:

Latitude:  Ex: 39.14082

Longitude:  Ex: -76.85762

\*Decimal Degrees

Below the map, a message box states: "The page at staging.mesgis.com says: Your site visit ID is: 12001." with an "OK" button.



# watershed resources registry

## Search Site Visits

**Watershed Resources Registry**

Overview Contents Details Results

To begin, please follow the steps below:

- Use the 'Address Locator' tool or 'Zoom/Pan' tools above to find your location.
- Select the 'Find Opportunities' tool to locate resources within the study area.
- Select the 'Location Details' tool above and then click the location of interest on the map.

**Find Visit Information**

Select a county: [All Counties]

Select a Watershed: [All Watersheds]

Select only sites where property owners are willing to participate.

Between Date Range?  
Site Visits between: 7/28/2014 and 7/28/2014

Or

Search by Site Visit ID: [ ]

Find Visits

Overview Contents Details Results

**Found Site Visits**

Using the following criteria

Site Visit ID: 12002

Zoom	View	ID	Date
		12002	12/32

Construction on site/public notices/tags/survey markings: Undefined

Site appears suitable for:

- Upland Preservation
- Wetland Preservation
- Riparian Preservation
- Stormwater Natural Infrastructure Preservation
- Upland Restoration
- Wetland Restoration
- Riparian Restoration
- Stormwater Compromised Infrastructure Restoration

NWI classification (if applicable):

**Site Visit Information**

First Name: Mike  
Date of Site Visit: 12/32/1969  
Entry:  
Project Name:  
Email: mherz@menv.com  
Site Description:

Consent to having contact information being made:

Looking for the following opportunities:

- Upland Preservation
- Wetland Preservation
- Riparian Preservation
- Stormwater Natural Infrastructure Preservation

**Landscape Characteristics**

Land Use:

- Commercial
- Medium Density Residential
- Industrial
- Open Space

Land Type:

- Low Density Residential
- High Density Residential
- Agricultural

Print Close



**Click for Site Visit Information Within 500ft**

View	Id	Date	Organization
	12001	12/32/1969	MES
	12002	12/32/1969	MES



## Scenario 2

- Transportation Planner
- Find Stormwater Restoration-type Opportunities within Back River-Hawk Cove Watershed in Baltimore County, Maryland
- Determine planning-level efficiencies that could be gained by performing activity in this location on State-owned land



## Find Opportunities

Overview Contents Details Results

**Found Opportunities**  
Using the following criteria  
Model: Stormwater Compromised Infrastructure Restoration  
County: Baltimore County  
Watershed: 020600030703  
Score >= 5  
Acrage > 50

Zoom	Remove	Code	Acres
		5	322.15
		5	147.63
		5	95.63
		5	74.33
		5	65.52
		5	52.33
		5	50.96

Watershed Resources Registry

Overview Contents Details Results

To begin, please follow the steps below:

**Find Opportunities**

Select a county: Baltimore County

Select a Watershed: Back River-Hawk Cove-Chesapeake Bay:020600030703

Select Potential Opportunities:

- Upland Preservation
- Wetland Preservation
- Riparian Preservation
- Stormwater Natural Infrastructure Preservation
- Upland Restoration
- Wetland Restoration
- Riparian Restoration
- Stormwater Compromised Infrastructure Restoration

Select Score:

Select Score Operator: >=

Where Acres is Greater Than (>): 50

Where Acres is Less Than (<): Any Area

Find Opportunities



## Exploring Find Opportunity Results

- Use Zoom tool in Results panel by clicking on Zoom icon to review areas
- Remove records from Results panel by clicking on Remove icon

The screenshot shows the Watershed Resources Registry interface. On the left, the 'Results' panel displays a table of found opportunities. The table has columns for 'Zoom', 'Remove', 'Code', and 'Acres'. The 'Zoom' column contains magnifying glass icons, and the 'Remove' column contains red 'X' icons. The 'Acres' column lists values: 322.15, 147.63, 95.63, 74.33, 65.52, 52.33, and 50.96. The main map area shows an aerial view with green-shaded watershed boundaries. A search bar at the top right contains the text 'Find a place'. Below the search bar are dropdown menus for 'Zoom TO COUNTY' and 'Zoom TO WATERSHED'. The browser's address bar shows the URL 'staging.mesgis.com/wrr/index.html'.

Zoom	Remove	Code	Acres
		5	322.15
		5	147.63
		5	95.63
		5	74.33
		5	65.52
		5	52.33
		5	50.96





## Exploring Find Opportunity Results Continued

- Run location details tool to determine desktop-level site characteristics
- Toggle layers on/off to perform visual analyses

The screenshot shows the Watershed Resources Registry web application. The browser address bar indicates the URL is `staging.mesgis.com/wrr/index.html`. The page title is "Watershed Resources Registry".

**Watershed Resources Improvement Opportunities:**

- Upland Preservation: Not Suitable
- Upland Restoration: Not Suitable
- Wetland Preservation: Not Suitable
- Wetland Restoration: Not Suitable
- Riparian Preservation: Not Suitable
- Riparian Restoration: Not Suitable
- Stormwater Natural Infrastructure Preservation: 1
- Stormwater Compromised Infrastructure Restoration: 5

**Watershed Characteristics:**

- [View Watershed Profile](#)
- HUC: 0206000303
- HUC Name: Back River-Hawk Cove-Chesapeake Bay
- Maryland 8 Digit Watershed: 02130901
- Maryland 12 Digit Watershed: 021309011039
- Metadata: [HUC](#) | [MD Watershed](#) | [Stronghold](#)

**Water Quality Impairments:**

- [Metadata](#)
- Impairments: Bacteria, Biological, Nutrients, Sediments, Toxics

**Physiographic Region:**

- [Metadata](#)
- Province: Atlantic Coastal Plain Province

**Geology:**

- [Metadata](#)
- Name: Potomac Group

**Wetlands:**

- Wetlands of Special State Concern: None within 500 ft.
- DNCR: None within 500 ft.
- NWI: None within 500 ft.
- Metadata: [WSSC](#) | [DNR](#) | [NWI](#)

**Soils:**

- [Metadata](#)
- Mapunit Symbol: Ur
- Mapunit Name: Urban land, 0 to 8 percent

The map interface includes a search bar with the text "Find a place", zoom controls for "COUNTY" and "WATERSHED", and a "Location" popup window showing coordinates: Latitude: 39.32849, Longitude: -76.49254. The popup also lists the same "Watershed Resources Improvement Opportunities" as the sidebar.

Footer text: DigitalGlobe, GeoEye, Microsoft | Esri, HERE, DeLorme, TomTom, MapmyIndia, © O. powered by MDiMap





# Determine Property Ownership

- Use Parcel Layer to determine property boundary
- Use Identify tool to click on parcel boundary to determine ownership status
- Direct linkage to Maryland Department of Assessments and Taxation Database

**Parcels**

Account ID 04151519848638  
 SDAT Url [More info](#)  
 Zoom to

Search Result for BALTIMORE COUNTY

[View Map](#)    [View GroundRent Redemption](#)    [View GroundRent Registration](#)

Account Identifier: District - 15 Account Number - 1519848638

**Owner Information**

Owner Name: STATE OF MARYLAND STATE ROADS COMMISSION    Use: EXEMPT COMMERCIAL  
 Mailing Address: GOLDEN RING SHOP 8375 PULASKI HIGHWAY BALTIMORE MD 21237-2948    Principal Residence: NO    Deed Reference: /046477 00133

**Location & Structure Information**

Premises Address: 8361 PULASKI HWY 0-0000    Legal Description: 2.45 AC SS OLD PHILADELPHIA RD SE COR PULASKI HWY

Map:	Grid:	Parcel:	Sub District:	Subdivision:	Section:	Block:	Lot:	Assessment Year:	Plat No:
0089	0018	0509		0000				2012	

Special Tax Areas:    Town: NONE    Ad Valorem:    Tax Class:

Primary Structure Built	Above Grade Enclosed Area	Finished Basement Area	Property Land Area	County Use
28766			2.4500 AC	01



## Export Information for Supplemental Desktop Analyses & Field Verification

- Key Lat/Long from Print Map into Stormwater Calculator for further site-specific LID BMP's that could be implemented.
- Key Lat/Long from Print Map into GPS unit for navigating in the field post Desktop Analyses.

7/30/2014 Watershed Resources Registry

### Watershed Resources Map

Map Projection: State Plane Maryland (NAD83 - Meters)

Selected Location - Coordinates

- Latitude/Longitude: 39.32646, -76.49569

Watershed Resources Improvement Opportunities

- Upland Preservation: Not Suitable
- Upland Restoration: Not Suitable

Watershed Characteristics:

- [View Watershed Profile](#)

<http://staging.mesgis.com/wrr/index.html>

Sources: DigitalGlobe, GeoEye, Earthstar Geographics, CNR/SNAIP, USDA, USDA, AeroGRID, IGN, Esri, DeLorme, HERE, Swisstopo, Esri, Swisstopo, Esri, HERE, DeLorme, TomTom, Interim, iDB, OpenStreetMap contributors, and the GIS User Community



## EPA National Stormwater Calculator

**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 1.1.0.0

Select the Location tab to begin analyzing a new site.

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



# watershed resources registry

National Stormwater Calculator

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

Site Name (Optional)

Search for an address or zip code:

Site Location (Latitude, Longitude)  
 39.32661037099307,-76.4955817639

Site Area (acres - Optional)

[Open a previously saved site](#)

Bring your site into view on the map and then mark its exact location by clicking the mouse pointer over it.

Site data have changed - results need to be refreshed.

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

## Location Selection:

- Address/zip code
- X/Y coordinates
- Site Area





# watershed resources registry

## Soil Type:

- runoff potential
- soil survey data

National Stormwater Calculator

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

What type of soil is on your site?

View soil survey data

A - low runoff potential

B - moderately low

C - moderately high

D - high runoff potential

When soil survey data is displayed you can select a soil type directly from the map.

Select a soil type for the site.

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



# watershed resources registry

## Soil Drainage Rate:

- drainage rate (inches/hr)

National Stormwater Calculator

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

How fast does standing water drain from your site (inches/hour)?

0.2 (Default = 0.04)

View soil survey data

- <= 0.01 inches/hour
- > 0.01 to <= 0.1 inches/hour
- > 0.1 to <= 1.0 inches/hour
- > 1 inches/hour

When soil survey data is displayed you can select a value directly from the map.

[Help](#)

Enter the soil's drainage rate. [Analyze a New Site](#) [Save Current Site](#) [Exit](#)





# watershed resources registry

## Topography:

National Stormwater Calculator

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

Describe your site's topography:

View soil survey data

- Flat (2% Slope)
- Moderately Flat (5% Slope)
- Moderately Steep (10% Slope)
- Steep (above 15% Slope)

When soil survey data is displayed you can select a slope category directly from the map.

[Help](#)

Describe how steep the site is. [Analyze a New Site](#) [Save Current Site](#) [Exit](#)







# watershed resources registry

**Precipitation Rate:**

- rain gauge location
- hourly rainfall data

National Stormwater Calculator

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

Select a rain gage location to use as a source of hourly rainfall data:

- 1 - MD SCI CTR BALTIMORE (1999-2006) 43.54"
- 2 - BALTIMORE WASH INTL AP (1970-2006) 41.96"
- 3 - ABERDEEN PHILLIPS FLD (1970-2006) 46.62"
- 4 - ANNAPOLIS POLICE BRKS (1970-2005) 46.00"
- 5 - CLARKSVILLE 3 NNE (1970-2004) 44.79"

[Save rainfall data for other uses](#)

[Help](#)

Select a source of long-term hourly rainfall data.

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





## Evaporation

## Rates:

- select closest weather station

National Stormwater Calculator

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

Select a weather station to use as a source for evaporation rates:

- 1 - MD SCI CTR BALTIMORE (2000-2006) 0.23 inches/day
- 2 - BALTIMORE WASH INTL AP (1970-2006) 0.22 inches/day
- 3 - ANNAPOLIS POLICE BRKS (1970-2005) 0.23 inches/day
- 4 - CLARKSVILLE 3 NNE (1970-2003) 0.21 inches/day
- 5 - CHESTERTOWN (1970-2006) 0.18 inches/day

[Save evaporation data for other uses](#)

[Help](#)

Select a source of monthly average evaporation rates.

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



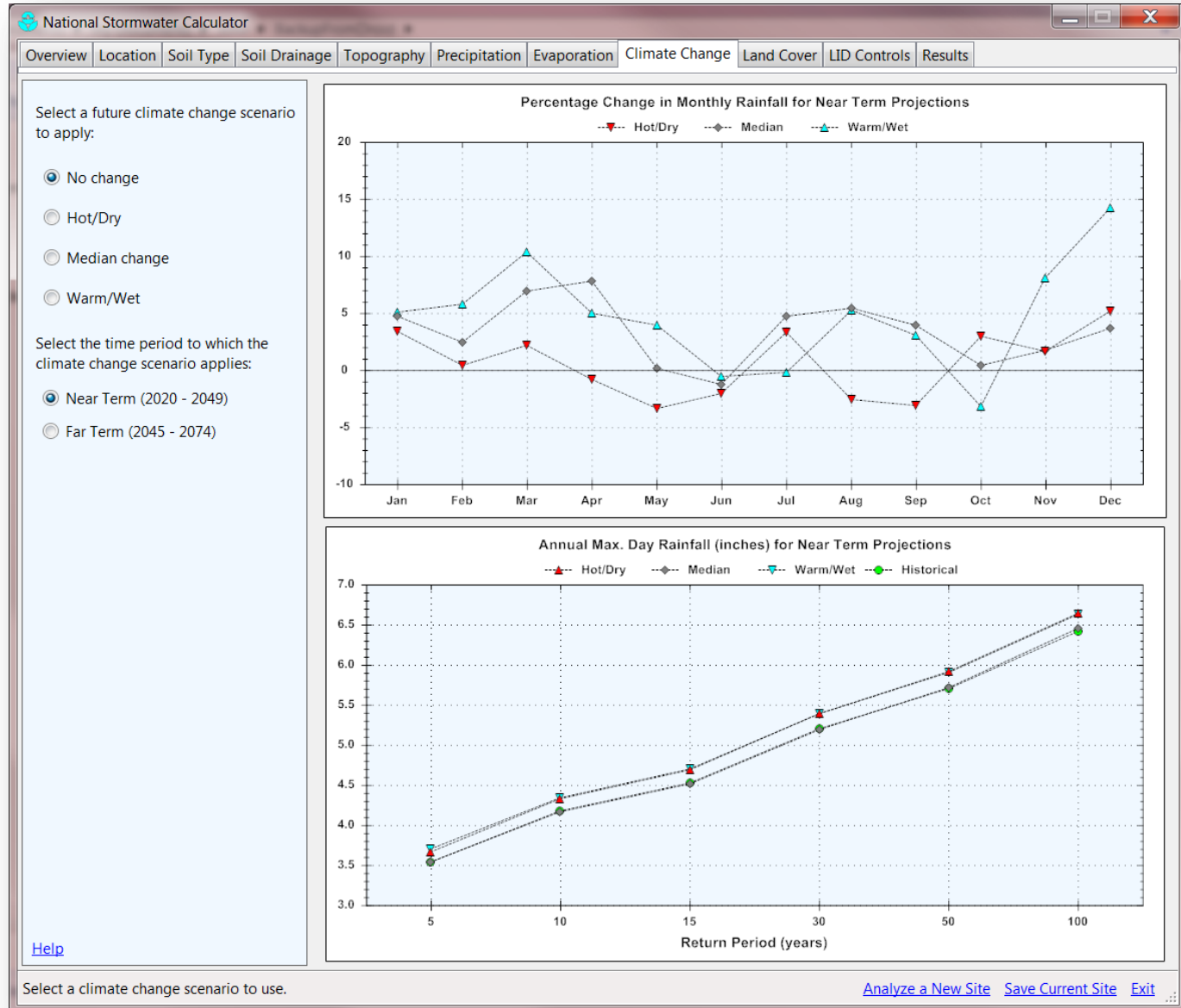


# watershed resources registry

## Percent Change in Monthly Rainfall

### Climate Change:

- select scenario
- select time period





# watershed resources registry

## Percent Land Cover:

- forest
- meadow
- lawn
- desert
- impervious

National Stormwater Calculator

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

Describe the site's land cover for the development scenario being analyzed:

% Forest	5
% Meadow	15
% Lawn	0
% Desert	0
% Impervious	80

Hover the mouse over a cover category to see a more detailed description.

[Help](#)

Describe the site's land cover.

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



# watershed resources registry

## LID Controls:

- Disconnection
- Rain Harvesting
- Rain Gardens
- Green Roofs
- Street Planters
- Infiltration Basins
- Permeable Pavement

National Stormwater Calculator

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

What % of your site's impervious area will be treated by the following LID practices?

<a href="#">Disconnection</a>	0
<a href="#">Rain Harvesting</a>	10
<a href="#">Rain Gardens</a>	0
<a href="#">Green Roofs</a>	10
<a href="#">Street Planters</a>	0
<a href="#">Infiltration Basins</a>	20
<a href="#">Permeable Pavement</a>	20

Design Storm for Sizing (inches) (see Help) 1.50

Click a practice to customize its design.

[Help](#)

Assign LID practices to capture runoff from impervious areas.

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



# watershed resources registry

## Results

## Runoff Scenario Comparison

National Stormwater Calculator

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

**Options**

Years to Analyze: 8

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 Frequency

Rainfall Retention Frequency

Runoff By Rainfall Percentile

Extreme Event Rainfall / Runoff

[Help](#)

**Current Scenario**

Annual Rainfall = 40.84 inches

43%  
11%  
46%

**Baseline Scenario**

Annual Rainfall = 40.84 inches

19%  
11%  
70%

Legend: Runoff (blue), Infil. (green), Evap. (red)

Statistic	Current Scenario	Baseline Scenario
Average Annual Rainfall (inches)	40.84	40.84
Average Annual Runoff (inches)	17.94	28.59
Days per Year With Rainfall	64.58	64.58
Days per Year with Runoff	37.72	51.71
Percent of Wet Days Retained	41.59	19.92
Smallest Rainfall w/ Runoff (inc...)	0.13	0.12
Largest Rainfall w/o Runoff (inc...)	0.40	0.21
Max. Rainfall Retained (inches)	1.43	0.69

Runoff results are up to date.

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





# watershed resources registry

## Results

## Site Description

National Stormwater Calculator

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

**Options**

Years to Analyze: 8

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 Frequency

Rainfall Retention Frequency

Runoff By Rainfall Percentile

Extreme Event Rainfall / Runoff

[Help](#)

Parameter	Current Scenario	Baseline Scenario
<b>Site Characteristics</b>		
Site Area (acres)	6.0	6.0
Hydrologic Soil Group	C	C
Hydraulic Conductivity (in/hr)	0.2	0.2
Surface Slope (%)	5	5
Precip. Data Source	MD SCI CTR BALT...	MD SCI CTR BALT...
Evap. Data Source	MD SCI CTR BALT...	MD SCI CTR BALT...
Climate Change Scenario	None	None
<b>Land Cover</b>		
% Forest	5	5
% Meadow	15	15
% Lawn	0	0
% Desert	0	0
% Impervious	80	80
<b>LID Controls</b>		
Disconnection	0	0
Rain Harvesting	10 / 4	0
Rain Gardens	0	0
Green Roofs	10 / 100	0
Street Planters	0	0
Infiltration Basins	20 / 5	0
Porous Pavement	20 / 100	0
<b>Analysis Options</b>		
Years Analyzed	8	8
Ignore Consecutive Wet Days	False	False
Wet Day Threshold (inches)	0.10	0.10

[Help](#)

Runoff results are up to date.

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

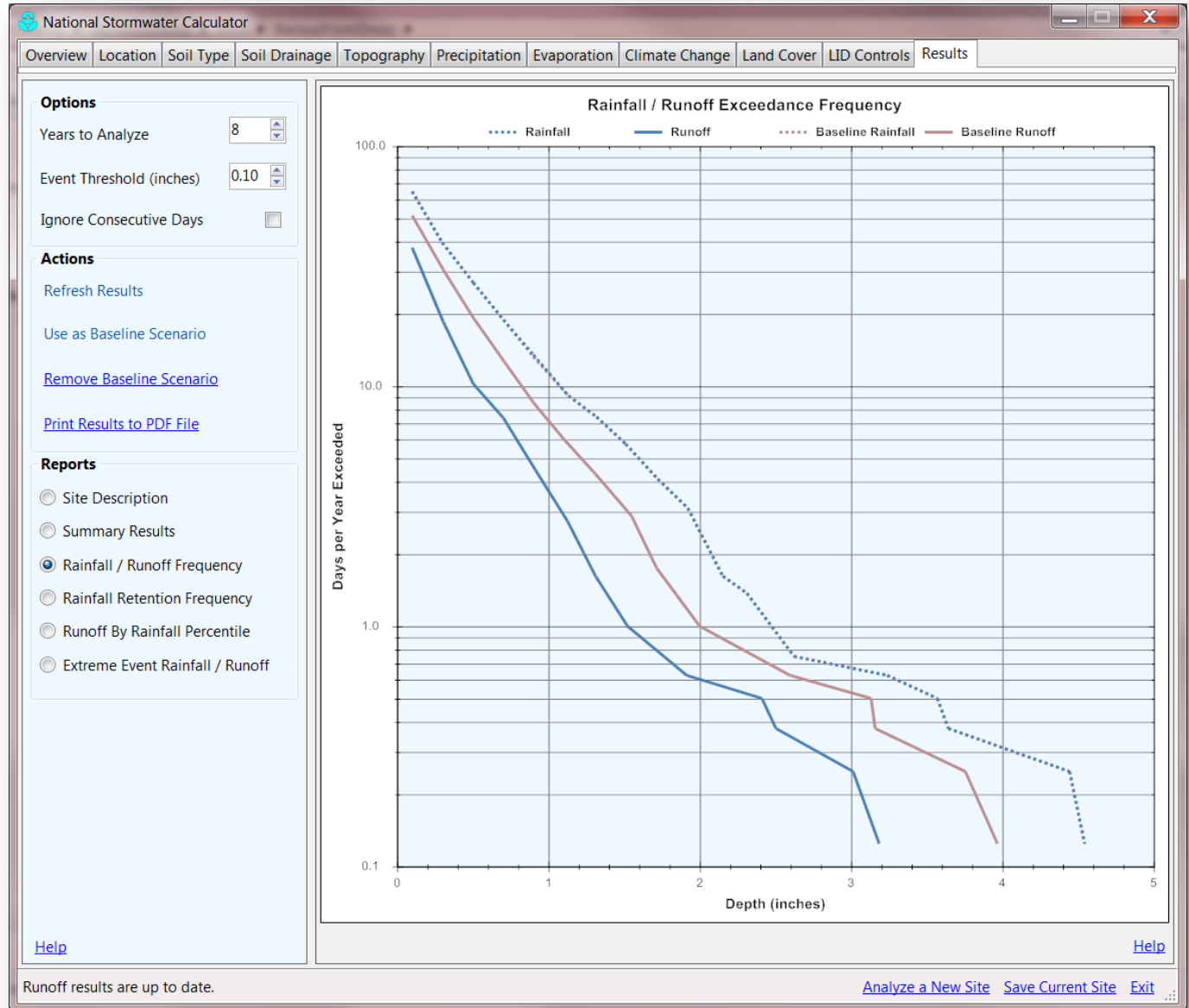




# watershed resources registry

## Results

## Rainfall/Runoff Exceedance Frequency



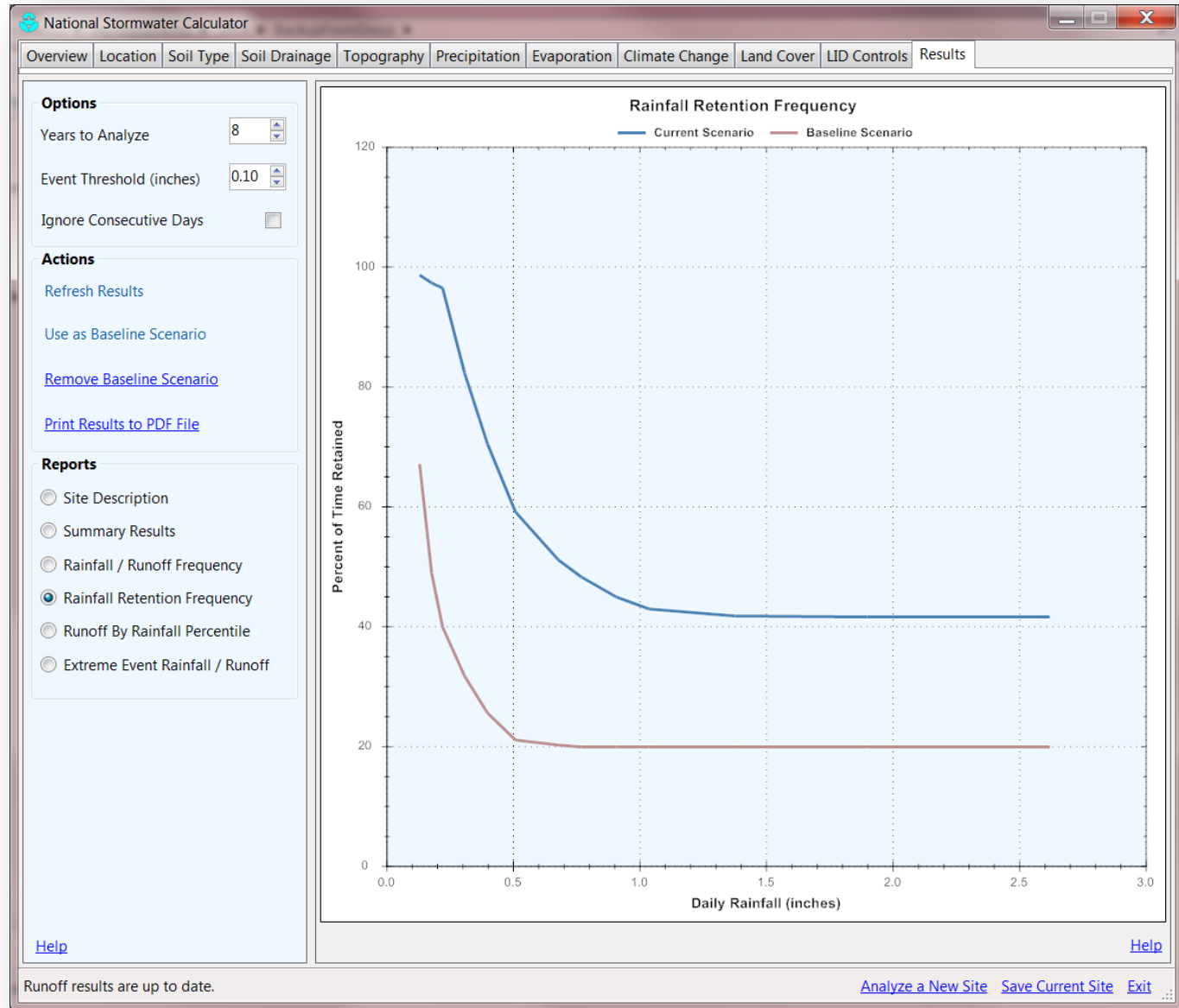




# watershed resources registry

## Results

## Rainfall Retention Frequency

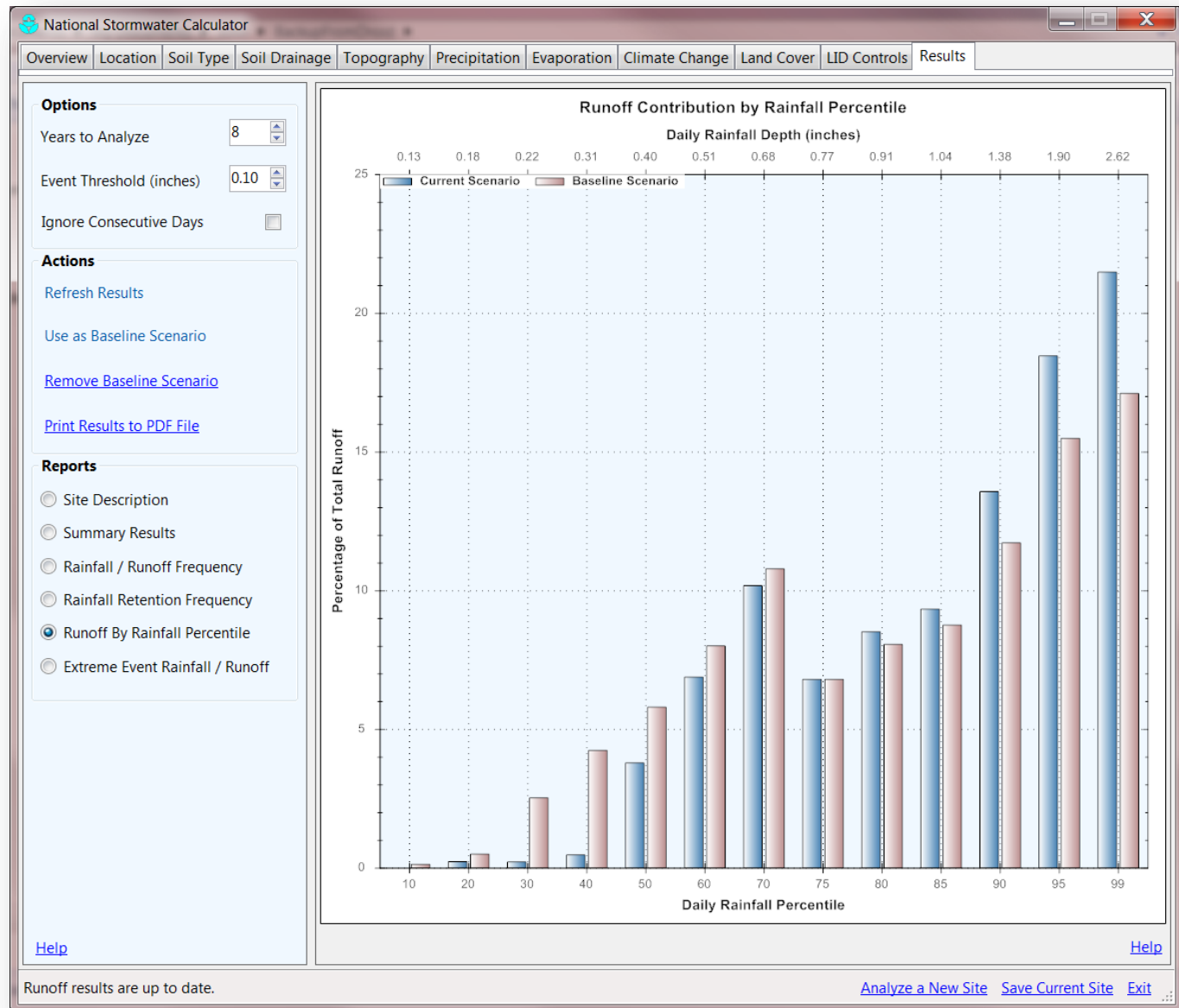




# watershed resources registry

## Results

## Runoff By Rainfall Percentile

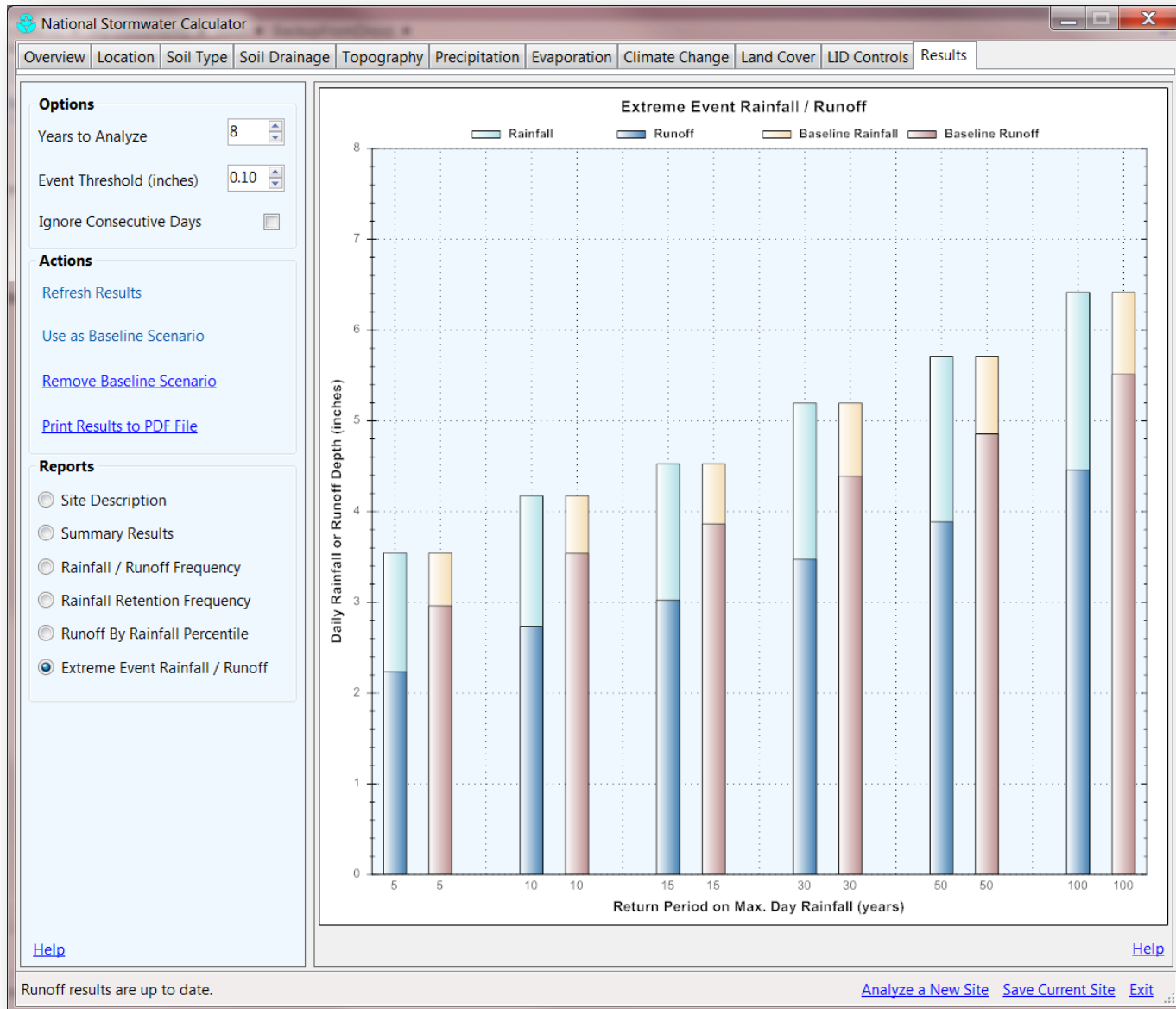




# watershed resources registry

## Results

## Extreme Event Rainfall/ Runoff





## Modifying LID Parameters

Stormwater Calculator Help

Low Impact Development (LID) controls are landscaping practices designed to collect runoff from impervious surfaces and retain it on site.

Enter the percent of the site's impervious area you would like to be treated by the listed LID practices.

Click a practice to learn more about it or to change its design parameters.

Entering a non-zero design storm depth will allow you to automatically size an LID control to capture storms of that size when you click on the LID's name to bring up its design form.






## DISCONNECTION

LID Design
X

**Disconnection**



Disconnection refers to the practice of directing runoff from impervious areas, such as roofs or parking lots, on to pervious areas such as lawns or vegetative strips, instead of directly into storm drains. This gives the runoff an opportunity to infiltrate into the soil before leaving the site.

The Capture Ratio is the ratio of the pervious area receiving the runoff (such as a lawn area) to the impervious area that generates the runoff.

For example, if 5,000 sq. ft. of roof area is directed onto 3,000 sq. ft. of lawn area

[Learn more ...](#)

% Capture Ratio

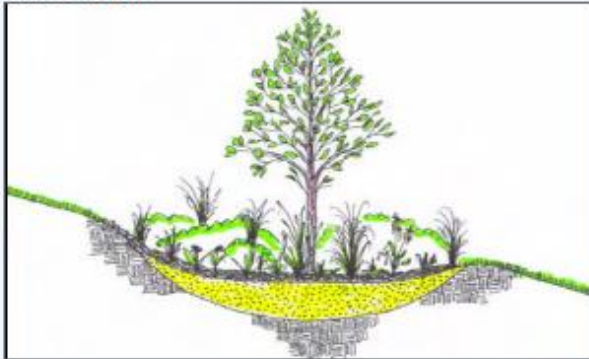
Size for Design Storm
Restore Defaults
Accept
Cancel



## RAIN GARDEN

LID Design
X

**Rain Garden**



Ponding Height (inches)


Soil Media Thickness (inches)

Soil Media Conductivity (in/hr)

% Capture Ratio

Rain Gardens are shallow depressions filled with an engineered soil mix that supports vegetative growth. They are usually used on individual home lots to capture roof runoff.

Typical soil depths range from 6 to 18 inches.



[Learn more ...](#)

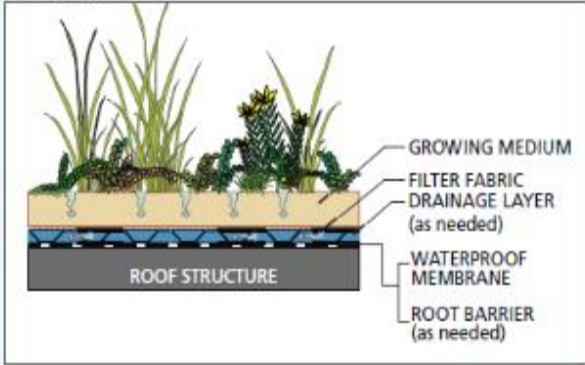
Size for Design Storm
Restore Defaults
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## GREEN ROOF

LID Design X


**Green Roof**



Green Roofs (also known as Vegetated Roofs) are bio-retention systems placed on roof surfaces that capture and temporarily store rainwater in a soil growing medium. They consist of a layered system of roofing designed to support plant growth and retain water for plant uptake while preventing ponding on the roof surface.

Soil Media Thickness (inches)

Soil Media Conductivity (in/hr)



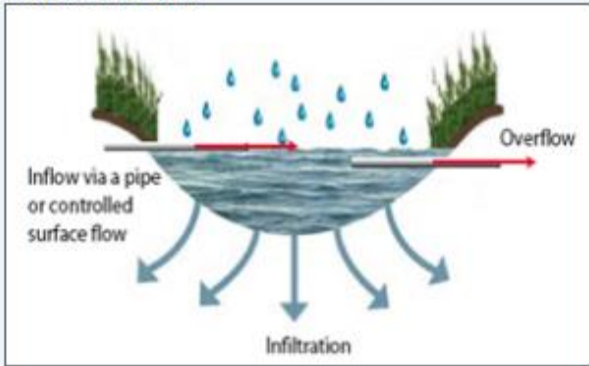
[Learn more ...](#)

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## INFILTRATION BASIN

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X

### Infiltration Basin




Inflow via a pipe  
or controlled  
surface flow

Infiltration

Overflow

Infiltration basins are shallow depressions filled with grass or other natural vegetation that capture runoff from adjoining areas and allow it to infiltrate into the soil.

The calculator assumes that the infiltration rate from the basin is the same as for site's native soil.



[Learn more ...](#)

Basin Depth (inches)

% Capture Ratio

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## PERMEABLE PAVEMENT

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### Permeable Pavement

Design Guidelines for Porous Asphalt with Subsurface Infiltration

UNCOMPACTED SUBGRADE IS CRITICAL FOR PROPER INFILTRATION

FILTER FABRIC LINES THE SUBSURFACE BED

Continuous Permeable Pavement systems are excavated areas filled with gravel and paved over with a porous concrete or asphalt mix.

Modular Block systems are similar except that permeable block pavers are used instead.

Pavement Thickness (inches)

Gravel Layer Thickness (inches)

% Capture Ratio

[Learn more ...](#)

Size for Design Storm

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# THANK YOU

**Dominique Lueckenhoff, EPA Region 3**

Deputy Director

Water Protection Division

[Lueckenhoff.dominique@epa.gov](mailto:Lueckenhoff.dominique@epa.gov)

<http://watershedresourcesregistry.org>

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

