United States Environmental Protection Agency

EPA Tools and Resources Webinar

National Stormwater Calculator: *Great Lakes Applications*

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SWC National Stormwater Calculator

United States Environmental Protection Agency

National Stormwater Calculator (SWC)

- Software application developed by US EPA that estimates the annual amount of rainwater and frequency of runoff from a specific location in the United States, including Puerto Rico
- Used to inform site developers on how well they can meet a stormwater retention target with and without the use of green infrastructure
  - Performing screening level analysis of small footprint sites up to several dozen acres in size with uniform soil conditions
- Allows users to consider how runoff may vary based both on historical weather and potential future climate
  - Estimates are based on local soil conditions, land cover, and historic rainfall records
- Can be used by landscape architects, urban planners and homeowners

Access the Mobile Web App

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

Great Lakes Applications

- US EPA’s Great Lakes Restoration Initiative
  - SWC used in green infrastructure (GI) projects to reduce the impacts of polluted runoff on nearshore water quality
- Northeast Ohio Regional Sewer District’s Green Infrastructure Grants Program
  - SWC used in GI grants program to achieves ultimate goal of calculating gallons captured
- University of Michigan’s Great Lakes Integrated Sciences and Assessments program
  - SWC provides tribal natural resources departments with considerable time and costs savings and helps build tribal science capacity

SWC Case Study: Great Lakes Restoration Initiative

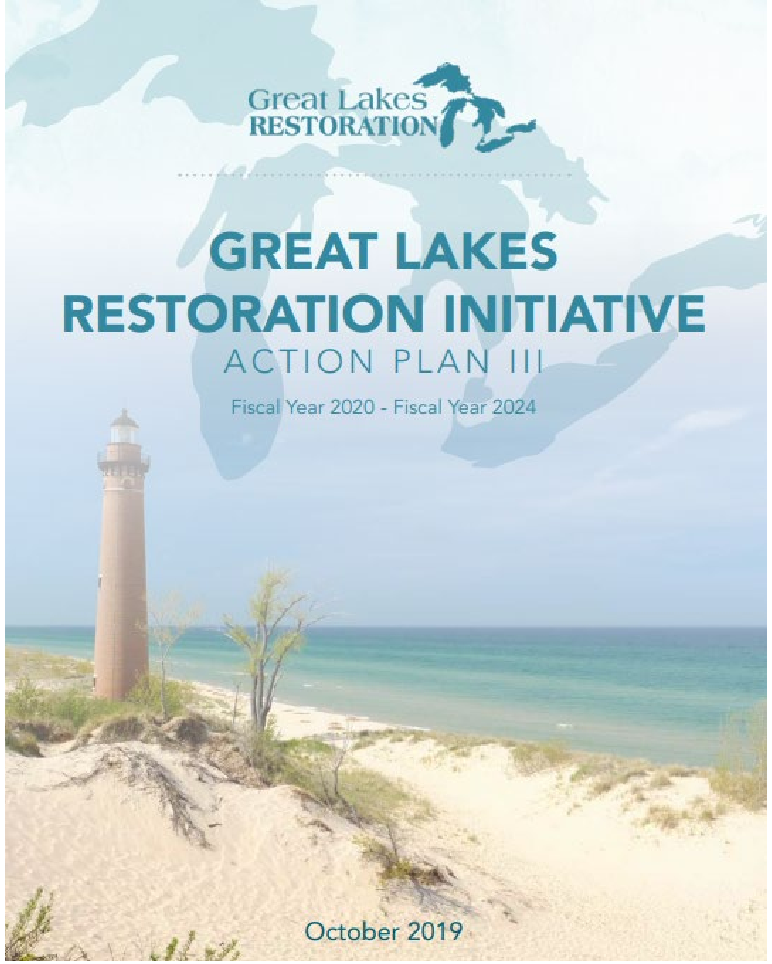
Karly McMorrow, ORISE fellow
US EPA Great Lakes National Program Office

Great Lakes Restoration Initiative (GLRI)

- Accelerating actions that will leave the Great Lakes better for the next generation
- Protecting and restoring the largest system of fresh surface water in the world
- Providing funding to 16 federal organizations

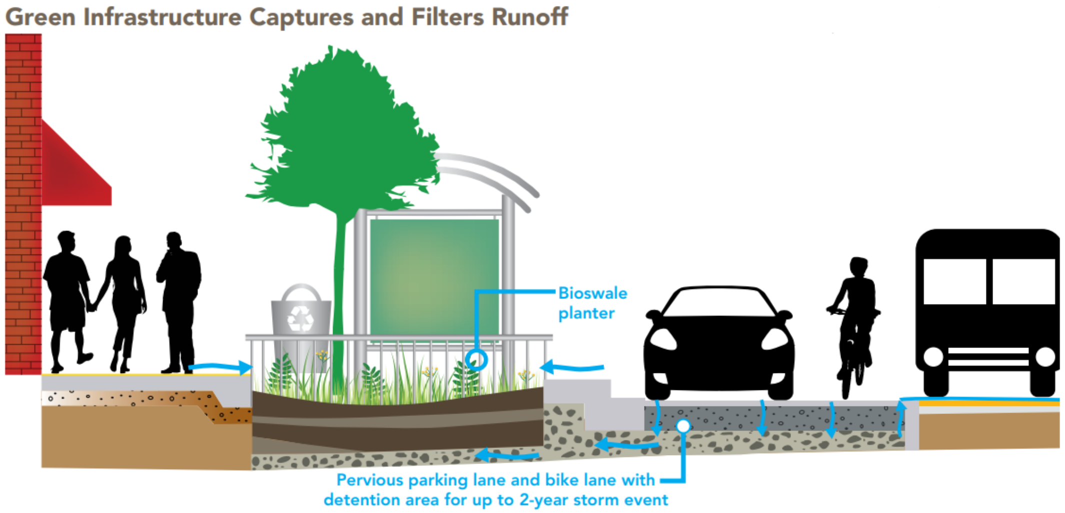
GLRI Action Plan III

- GLRI federal agencies will continue to use GLRI resources to strategically target the biggest threats to the Great Lakes ecosystems
- Focus Areas:
  1) Toxic Substances and Areas of Concern
  2) Invasive Species
  3) Nonpoint Source Pollution Impacts on Nearshore Health
  4) Habitats and Species
  5) Foundations for Future Restoration Actions



Focus Area 3: Nonpoint Source Pollution Impacts on Nearshore Health

- Continue to accelerate implementation of green infrastructure (GI) projects to reduce the impacts of polluted runoff on nearshore water quality
- GLRI federal agencies will work with local partners to slow down and soak up stormwater runoff, and filter pollutants
- Under GLRI partners fund on average $4.5M GI grants
  - ***EPA's National Stormwater Calculator*** **(SWC, or an equivalent formula) is required to calculate the gallons of stormwater runoff reduction**



Stormwater Gallons as a Metric

- This measure tracks the estimated number of gallons (in millions) of untreated stormwater captured or treated under GLRI-funded projects, so if an agency is reporting 10,000,000 gallons, they would simply enter "10."
- Acceptable results for this measure: Estimates of stormwater captured or treated due to implementation of GLRI-funded projects in urban, rural, or mixed land cover watersheds
- Report GLRI progress in Reports to Congress and the President

FOCUS AREA 3

Measures of Progress with Annual Targets	Baseline/ Universe	FY 2020 Target	FY 2021 Target	FY 2022 Target	FY 2023 Target	FY 2024 Target
• 3.2.1. Estimated gallons (in millions) of untreated stormwater runoff captured or treated.	Baseline: 252 Universe: N/A	350	400	450	500	550
• 3.2.2. Miles of Great Lakes shoreline and riparian corridors restored or protected.	Baseline: 26 Universe: N/A	33	40	47	54	61

Measure 3.2.2 is applicable for restoration or protection from nonpoint source runoff, a subset of a similarly worded measure from the Habitat Focus Area under Action Plan II. "Baselines" identify results through FY 2018. "Targets" are cumulative. "Universes" are not applicable.

Take Home Messages: GLRI Case Study

- GLRI was created to protect and restore the largest system of fresh surface water in the world
- GLRI federal agencies will continue to use GLRI resources to strategically target the biggest threats to the Great Lakes ecosystems
- Focus Area 3, Objective 3.2 reduce untreated stormwater runoff, is committed to accelerate implementation of GI practices to infiltrate stormwater runoff and to implement watershed management projects in urban and rural communities to reduce runoff and erosion
- SWC was used to estimate the annual amount of rainwater and frequency of runoff from a specific site

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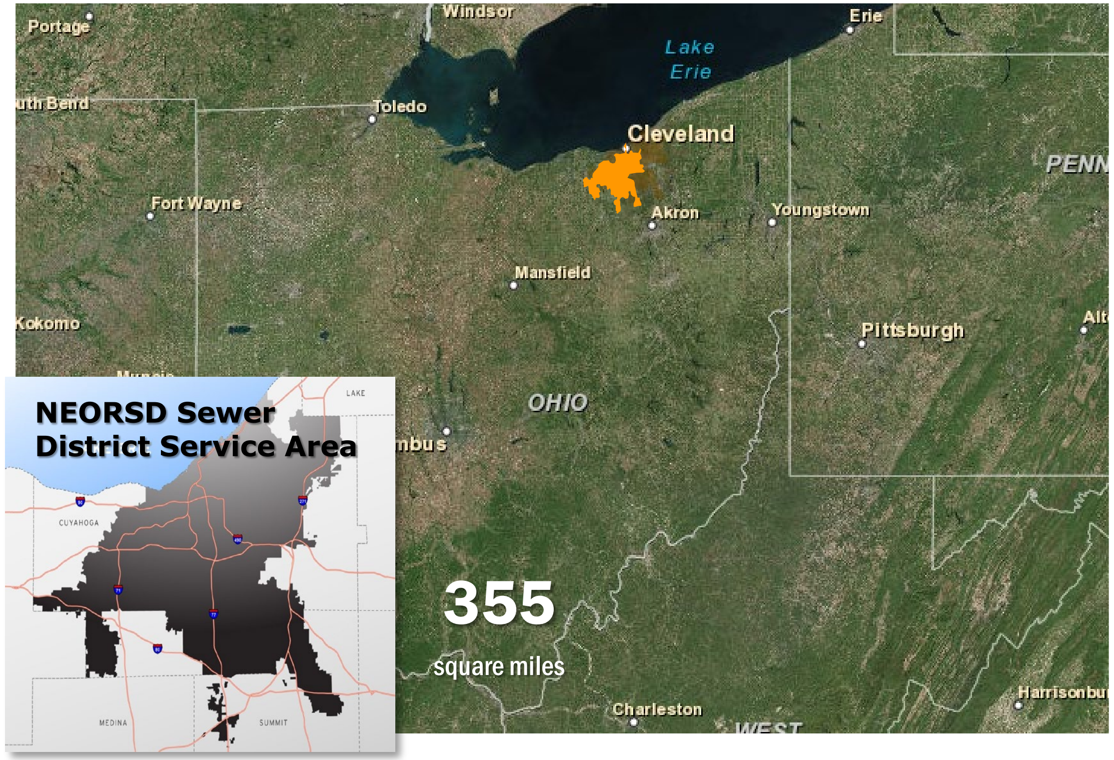
SWC Case Study:
Northeast Ohio Regional Sewer District (NEORSD)

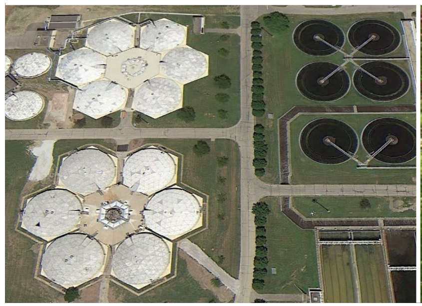
Christopher S. Hartman
Northeast Ohio Regional Sewer District

Northeast Ohio Regional Sewer District

What We Do

- Stormwater & Sanitary Services to 62 communities
  - 1 million customers
  - 90+ billion gallons treated annually
  - 3 wastewater treatment plants
  - 326 miles of interceptor sewers
  - 476 miles of Regional Stormwater System
- Water Quality Monitoring
- Lake Erie Beach Monitoring and Maintenance





Northeast Ohio Regional Sewer District

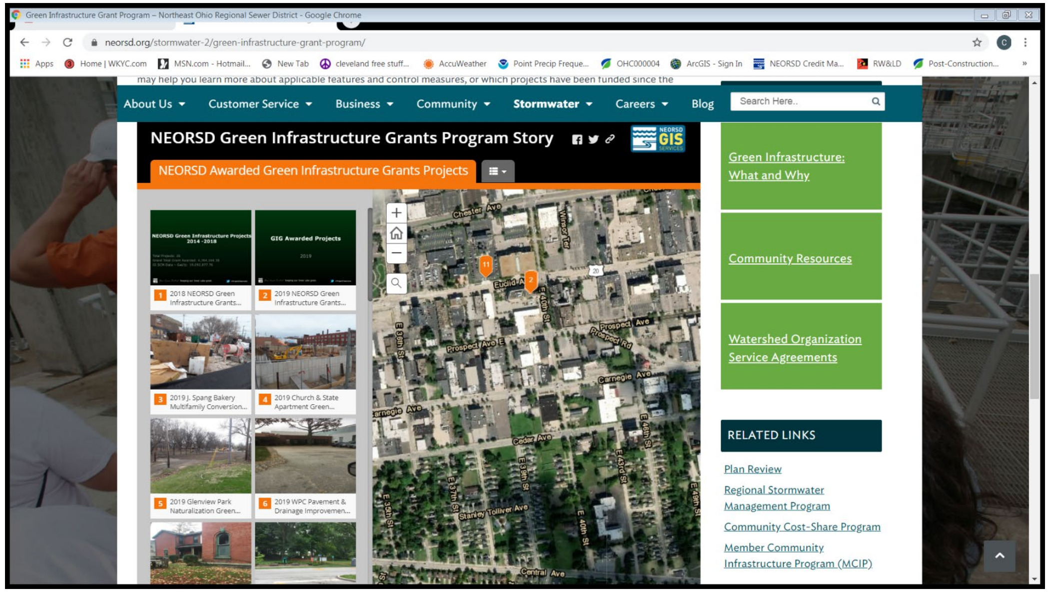
NEORSD's Green Infrastructure (GI) Policy

- Advocate for strategic and cost-effective implementation and maintenance of GI technologies
- Protect, preserve, enhance and restore the natural hydrologic function
- Maximize co-benefits
- Achieved via:
  - Capital Improvement and Operation & Maintenance (O&M) Program
  - Member Community Infrastructure Program
  - Water Resources Restoration Sponsorship Program (WRRSP)
  - Code of Regulations (Combined & Separate Sewers)
  - **GI Grants Program**

Northeast Ohio Regional Sewer District

Green Infrastructure Grants Program

- Open to member communities, governmental entities, non-profit organizations 501(c)(3), or businesses working in partnership
- GOAL: Remove stormwater from combined sewer system
- Applicants maintain long-term ownership and provide maintenance of the GI practices
- Green Infrastructure Story Map



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Green Infrastructure Grants Program

- Approximately $2M annually
  - Since 2016, NEORSD has awarded $8.3M
- Maximum $250,000 request
- 8-10 projects funded annually
- Increase resiliency of combined sewer system
- Decrease the volume of stormwater runoff
  - Projects reduce stormwater runoff by 26 million gallons every year

Northeast Ohio Regional Sewer District

Why We Use the SWC

- Calculate annual gallons captured
- Robust collection of resources for applicants with varying skill sets
- Consistent methodology (when comparing applicants)

All of these issues addressed!

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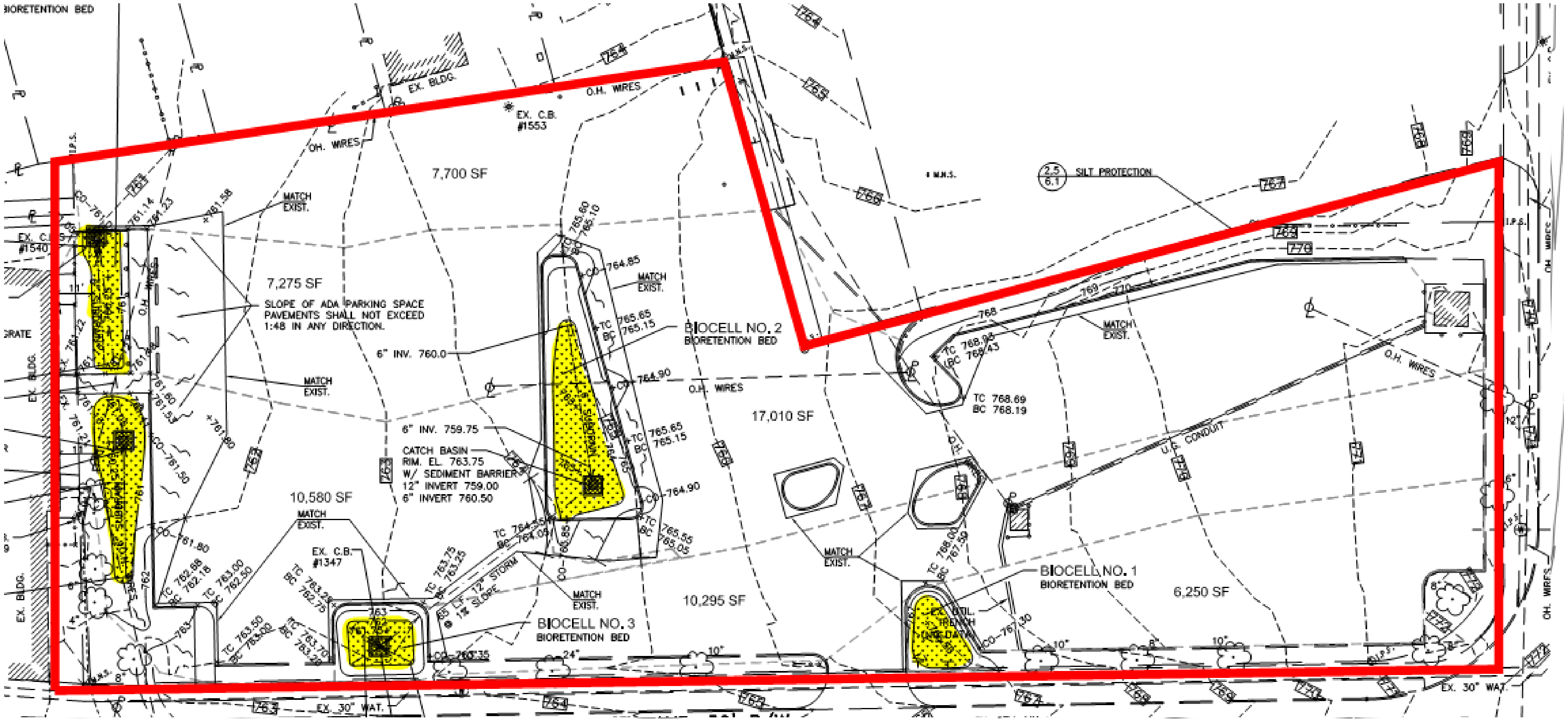
Why We Use the SWC

Annual Gallons Captured



Northeast Ohio Regional Sewer District

Why We Use the SWC

Annual Gallons Captured

National Stormwater Calculator Report

Site Description

Parameter	Current Scenario	Baseline Scenario
Site Area (acres)	1.48	1.48
Hydrologic Soil Group	A	A
Hydraulic Conductivity (in/hr)	4	4
Surface Slope (%)	5	5
Precip. Data Source	CLEVELAND WSFO AP	CLEVELAND WSFO AP
Evap. Data Source	CLEVELAND WSFO AP	CLEVELAND WSFO AP
% Meadow	0	0
% Lawn	15	7.5
% Desert	0	0
% Impervious	85	92.5
Years Analyzed	20	20
Ignore Consecutive Wet Days	False	False
Wet Day Threshold (inches)	0.10	0.10

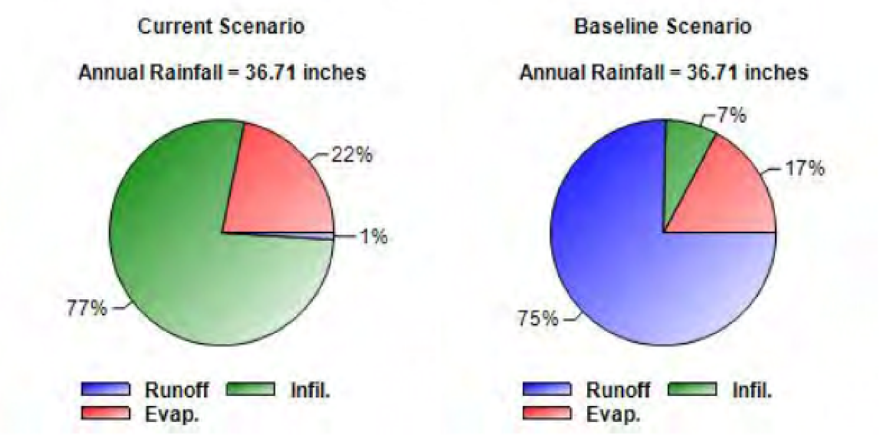
LID Control	Current Scenario	Baseline Scenario
Disconnection	0	0
Rain Harvesting	0	0
Rain Gardens	100 / 5	0

Summary Results

Kamms

Statistic	Current Scenario	Baseline Scenario
Average Annual Rainfall (inches)	36.71	36.71
Average Annual Runoff (inches)	0.34	27.74
Days per Year With Rainfall	78.05	78.05
Days per Year with Runoff	0.75	62.31
Percent of Wet Days Retained	99.04	20.17
Smallest Rainfall w/ Runoff (inches)	1.00	0.10
Largest Rainfall w/o Runoff (inches)	2.57	0.22

Annual gallons captured = [(Baseline Runoff – Current Runoff)/12 in/ft) x (Acres x 43,560 SF/acre)] x 7.4805 gal/CF



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SWC as a Resource

SWC is a good collection of resources to help walkthrough potential applications on low impact development (LID) controls, the different modules, and how they will inform the application

- Not all applicants have hired a design engineer
- Train potential applicants on SWC tool in a pre-proposal workshop
  - Available to answer questions throughout the Request for Proposals period

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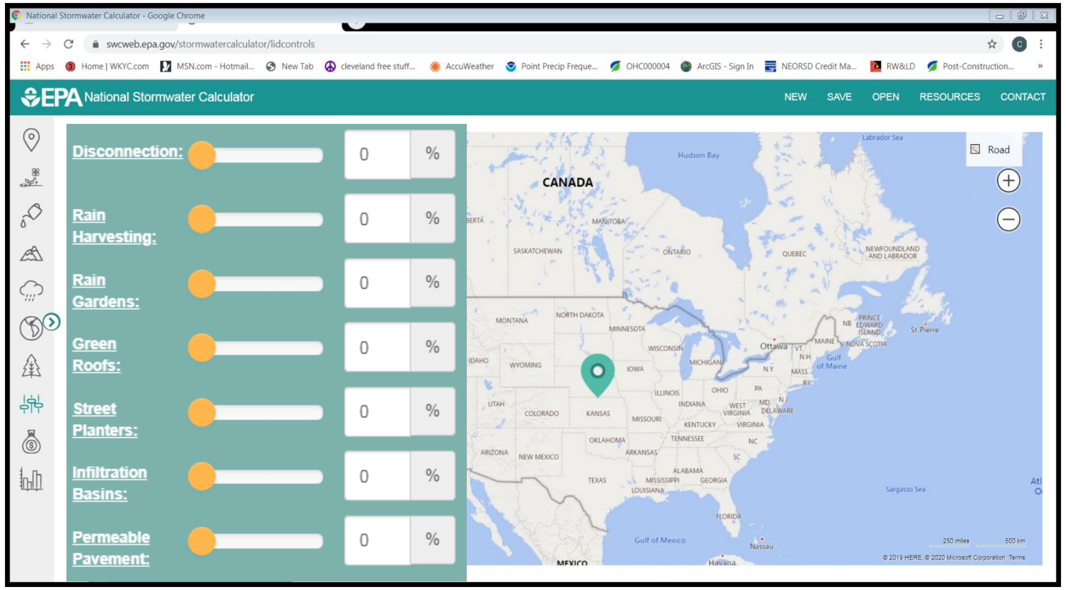
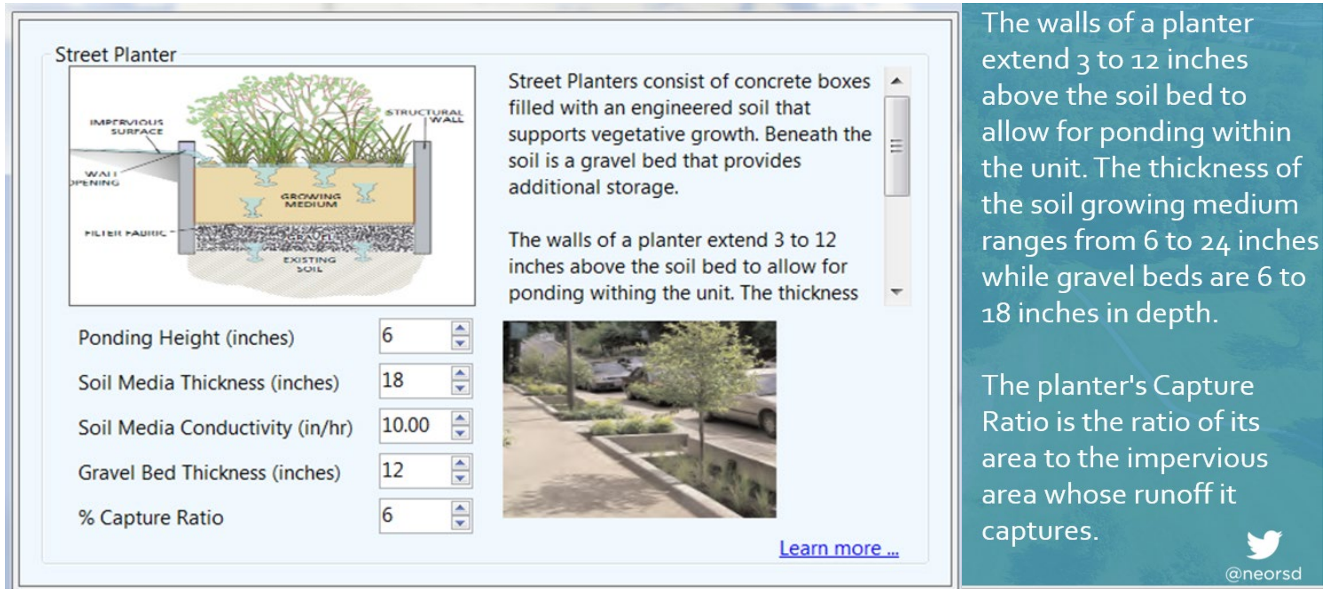
SWC as a Resource

Pre-Proposal Workshop

- Review of each LID Control





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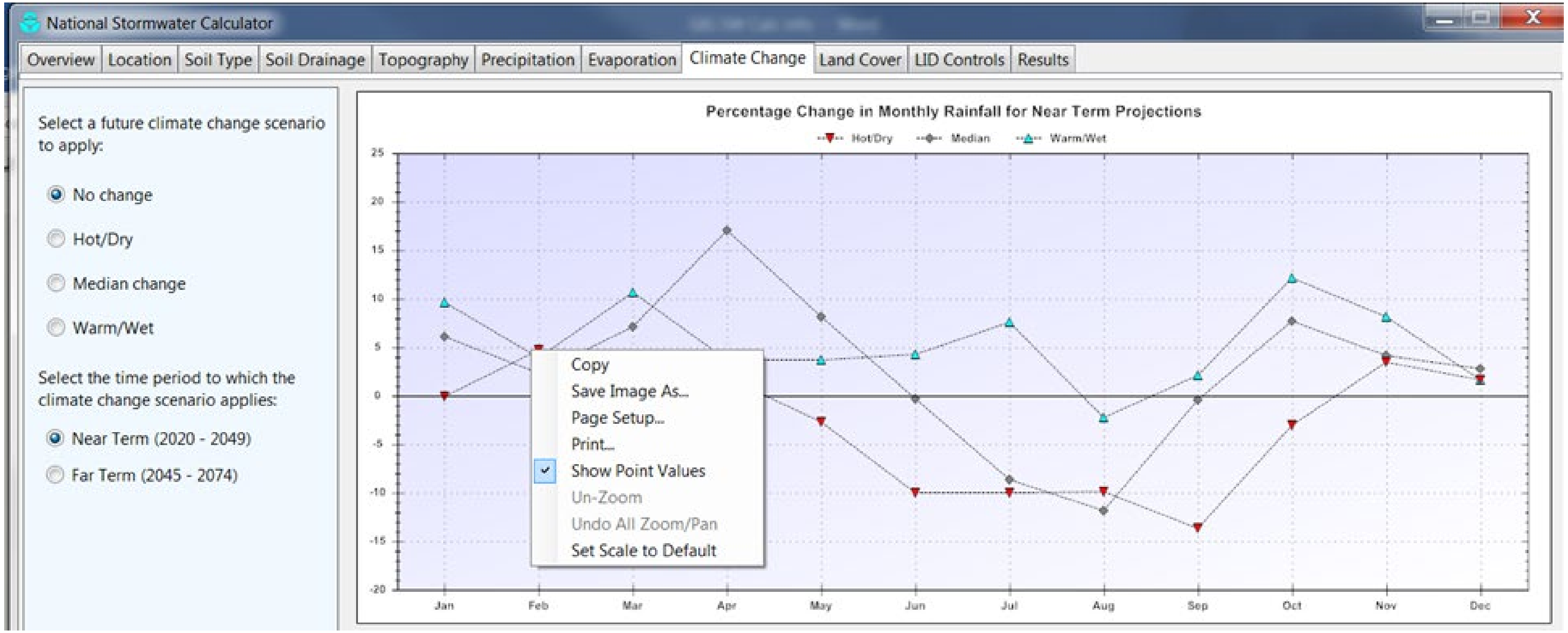
SWC as a Resource

Pre-Proposal Workshop

- Review of each Module
  - Location
  - Soil Type
  - Soil Drainage
  - Topography
  - Precipitation
  - Evaporation
  - Climate Change
  - Land Cover
  - LID Controls



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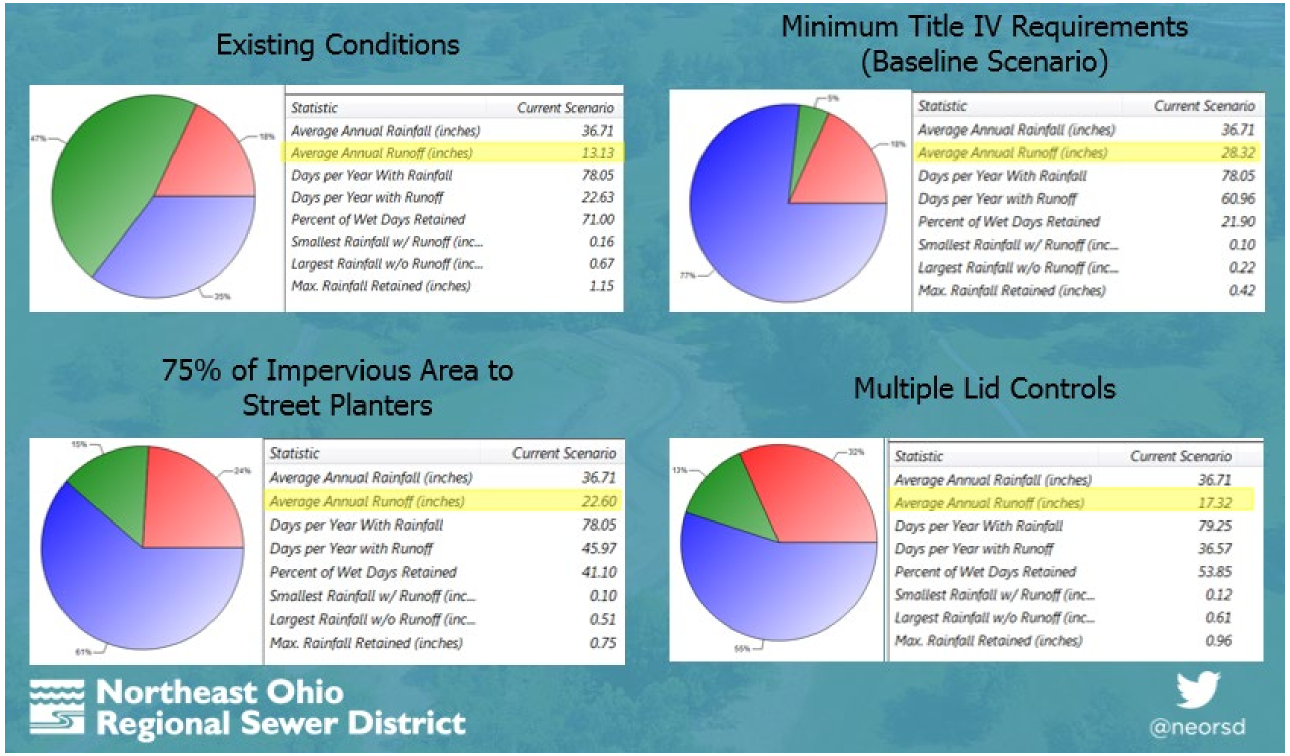
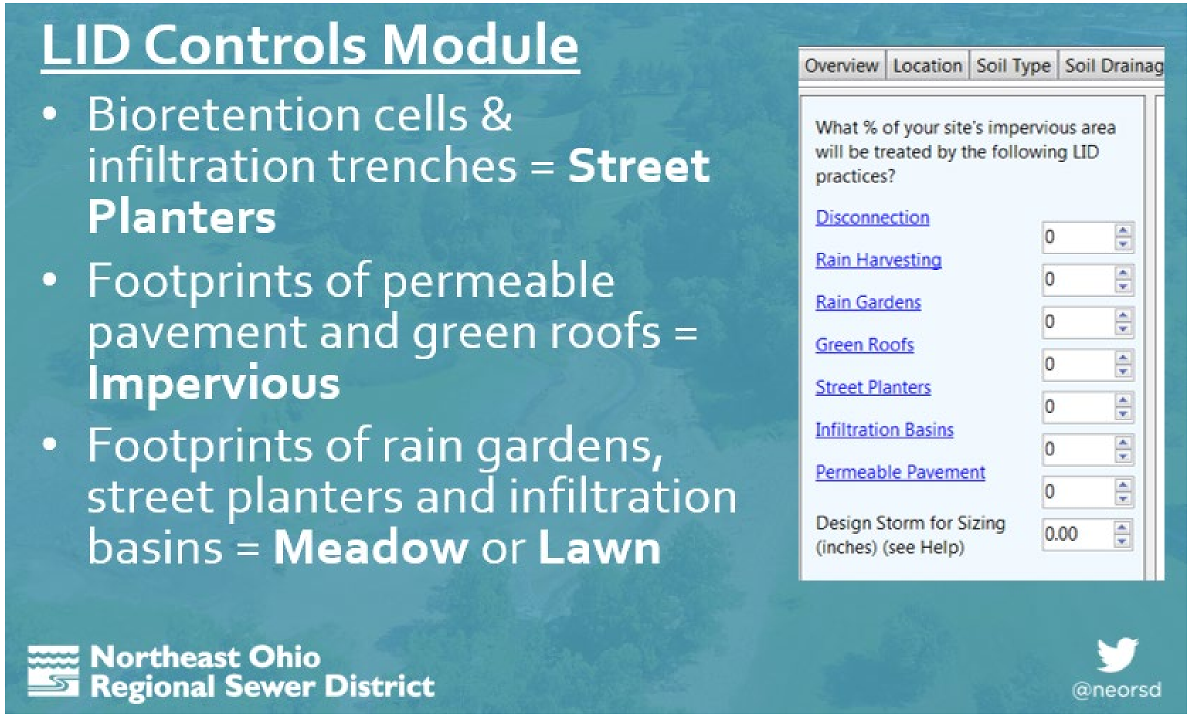
SWC as a Resource

Pre-Proposal Workshop

- Review results of various model runs



- Review of “Helpful Hints” – maximize consistency



Processing of GI Grant Applications

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Provide acre measurements to the nearest hundreth

List each proposed SCM and denote the square footage footprint of each (e.g., Rain Garden – 400 SF).
For "Rain Harvesting", indicate "0" square feet.
Permeable Pavers - 5300 SF

List each proposed SCM and denote the drainage area to each to nearest hundredth of an acre.
Permeable Pavers drainage area .34 acres

Pre-Construction Impervious Acres
0.40
Post-Construction Impervious Acres:
0.33
Change in Impervious Acres
0.16
Impervious Acres Draining to each SCM(s)
.33

		Applicant Info			NEORSD Analysis			
Project size (Acres)	**Post-dvl'p IA**	**Baseline (inches)**	**w/LID (inches)**	**Reduction (gal/yr) A**	**Baseline (inches)**	**w/LID (inches)**	**Reduction (gal/yr) B**	**NEORSD Net Gain/Loss (gal/yr) A-B**
0.4	0.33	29.88	0	324,548	29.88	0	324547	-1
0.33	0.3	22.46	0.64	195081	29.88	1.67	252787	57706
0.55	0.55	35.34	7.05	228849	35.27	14.69	166000	-62849

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SWC Challenges & Limitations

- Terminology does not mirror the GI profession (e.g., bioretention)
- Cannot easily model treatment trains
- Need to be creative with unique Stormwater Control Measures (SCMs)

Northeast Ohio Regional Sewer District

Take Home Messages

- User-friendly (input & output)
- No need for a design engineer
- Improves consistency of Stormwater Control Measures analysis
- Apples-to-apples comparison between applicants
- Achieves ultimate goal of calculating annual gallons captured (pre-development runoff vs. post-development runoff)

Christopher S. Hartman
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SWC Case Study: University of Michigan's Great Lakes Integrated Sciences and Assessments Program

Frank J. Marsik
University of Michigan

GLISA **integrates information** from a wide array of scientific fields, helps **develop collaborations** between entities with similar goals, and **lends climate information support** to decision makers throughout the region.

Motivation

The Bad River Band of Lake Superior Chippewa

- **Heavy rainfall on July 11, 2016**
  - 8 to 10 inches, mostly within 8-hour period
  - In 2016, reservation experienced severe flooding for 4 days (July 11-14)

- **State of Emergency declared for Tribal Lands**
  - Bad River Band Tribal Council
  - State of Wisconsin

Source: Bad River Tribe Natural Resources Department and Emergency Management

Approach

Project Investigators

- Frank Marsik, University of Michigan
- Maria Carmen-Lemos, University of Michigan
- Robin Clark, Inter-Tribal Council of Michigan

GLISA
A NOAA RISA TEAM

Participating Tribes

- Bad River Band of Lake Superior Chippewa
- Bay Mills Indian Community
- College of Menominee Nation
- Keweenaw Bay Indian Community
- Lac Vieux Desert Band of Lake Superior Chippewa Indians
- Little Traverse Bay Bands of Odawa Indians
- Nottawaseppi Huron Band of Potawatomi
- Pokagon Band of Potawatomi
- Saginaw Chippewa Indian Tribe
- Sault Ste. Marie Tribe of Chippewa Indians

INTER-TRIBAL
Ottawa
Ojibwa
Potawatomi
COUNCIL OF MICHIGAN, INC.

Funding from Graham Sustainability Institute Catalyst Grant Program

Motivation

Tribal Climate Workshop (October 2018)

- **Goals**
  - Tribal Nations shared climate adaptation goals and progress
  - Tribal Nations sought to learn about tools available to address concerns about the impacts of extreme precipitation
- **Collaborators**
  - Inter-Tribal Council of Michigan

Source: Frank Marsik

Motivation

Tribal Climate Workshop (October 2018)

- **Tools Presented**
  - Scenario Planning
  - Game of Floods
    - Marin County, CA
  - EPA's National Stormwater Calculator (SWC)

- **Concerns Expressed**
  - Tribal Nations National Resource Departments typically resource limited
    - Human resources
    - Financial resources

Source: Frank Marsik

Scenario

INTER-TRIBAL COUNCIL OF MICHIGAN, INC.

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A NOAA RISA TEAM

Extreme Precipitation & Impact Scenarios

GLISA and the Inter-Tribal Council of Michigan developed a set of extreme precipitation events and accompanying environmental conditions, as described in the four scenarios below, as a resource for the Tribes to use when thinking about how extreme precipitation may impact people and the environment at specific locations/regions. A list of general Tribal impacts is provided, and there is space for new impacts to be added to each scenario as specific concerns, issues, systems, etc. are considered.

Scenario 1
Extreme Precipitation Event During Dry Period in Spring/Summer

Event Description
The previous season experienced less than normal precipitation, and the ground is dry when the extreme rain or snow (in Spring) event occurs. The rain event may be an intense 1-day event or multi-day rain event with extremely high rain totals.

Scenario 2
Extreme Precipitation Event During Wet Period in Spring/Summer

Event Description
The previous season experienced more than normal precipitation, and the ground is saturated when the extreme rain event occurs. The rain event may be an intense 1-day event or multi-day rain event with extremely high rain totals.

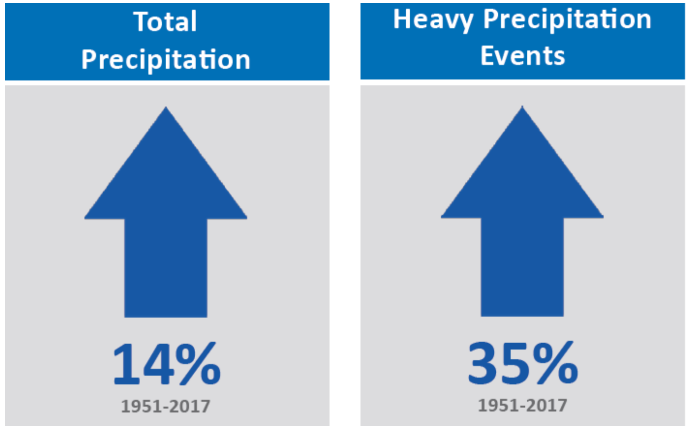
Scenario 3
Extreme Rain Event Over Bare, Frozen Ground

Event Description
Winter conditions leave the ground frozen but without snowpack at the time of an extreme rain event. The rain event may be an intense 1-day event or multi-day rain event with extremely high rain totals.

Scenario 4
Extreme Rain Event Over Deep Snowpack

Event Description
The ground is covered in moderate to deep snow at the time of an extreme rain event. The rain event may be an intense 1-day event or multi-day rain event with extremely high rain totals.

Climate Change in the Great Lakes Region



http://glisa.umich.edu/gl-climate-factsheet-refs

Motivation

Take Home Messages from Workshop

- Tribal representatives felt that the National SWC provided valuable tool to understand extreme precipitation and impacts
- Tribal representatives concerned about ability to direct resources (human and financial) toward such efforts

Source: Frank Marsik

Approach

- **Project Investigators**
  - Frank Marsik, University of Michigan
  - Marie Carmen-Lemos, University of Michigan
  - Robin Clark, Inter-Tribal Council of Michigan

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A NOAA RISA TEAM

- **Collaborating Tribal Nations within Michigan**
  - Little Traverse Bay Bands of Odawa Indians
  - Grand Traverse Band of Ottawa and Chippewa Indians
  - Saginaw Chippewa Indian Tribe
  - Keweenaw Bay Indian Community

INTER-TRIBAL COUNCIL OF MICHIGAN, INC.
Ottawa Ojibwa Potawatomi

Additional Funding from Graham Sustainability Institute Catalyst Grant Program

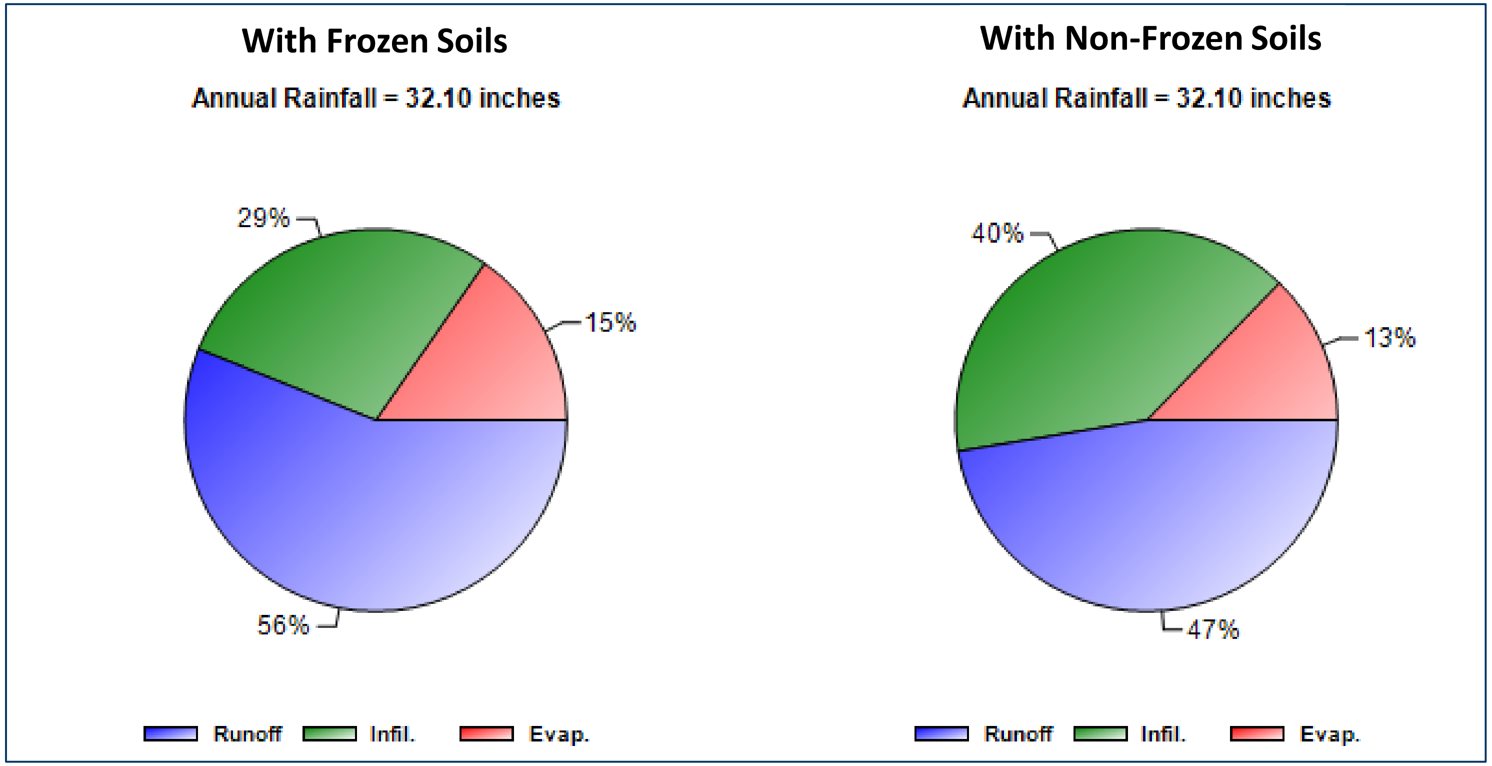
Approach

Each Tribe selected vulnerable sites on their respective tribal lands

- **Performed Current Climate Assessment – without LID Controls**
  - Standard soils
  - Standard soils, Extreme Precipitation
  - Frozen Soils
    - Significant run-off events in spring with frozen and/or snow covered ground
- **Performed Current Climate Assessment – with LID Controls**
  - LIDs used based upon site characteristics
- **Performed Future Climate Assessment – with and without LID Controls**
  - Short-term climate change
  - Long-term climate change

Results

- **Importance of consideration of frozen soils**



Results shown taken from assessment of one of the participating Tribal Nation partners. Site was mixed impervious and natural surfaces.

Impact

Little Traverse Bay Bands of Odawa Indians

- **Assessment provided information about area of concern (frequent spring flooding) that is located on Tribal Reserved Lands**
  - Do not currently own property in area
  - Information would be used if property in area is acquired in the future
- **Post-project conversations led to selection of new site assessment**
  - Plan to use SWC to assess stormwater runoff at site as part of implementation of Tribal stormwater best management practices (BMPs)
  - Results likely used for related proposals to fund proposed BMPs
  - Results likely used for community outreach events

Take Home Messages

- Many tribal natural resources departments are resource-limited (personnel, budget)

- SWC provides these small staffs with considerable time and cost savings
  - Embedded data sets (meteorology, soils, topography, and LID cost structure)

- SWC results can be blended with Traditional Ecological Knowledge
  - Impacts from past extreme events
  - Culturally sensitive approaches to adaptation and best management practices

- SWC is accepted as tool to build case in proposal submissions
  - Example: National Fish and Wildlife Foundation

Acknowledgements:

- **Graham Sustainability Institute** - Funding for workshop and related SWC project
- **Robin Clark and Inter-Tribal Council of Michigan** - Co-development/facilitation of Tribal Climate Workshop and SWC project
- **Partner Great Lakes Tribal Nations** - Trust in their collaborations with GLISA, sharing their knowledge

Contacts

National Stormwater Calculator

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Great Lakes Restoration Initiative Case Study

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Northeast Ohio Regional Sewer District Case Study

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University of Michigan's Great Lakes Integrated Sciences and Assessments Program Case Study

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