This program is partially funded by the Rutgers New Jersey Agricultural Experiment Station, The Geraldine R. Dodge Foundation, NJ Sea Grant Consortium, The William Penn Foundation and is a collaboration of the Rutgers Cooperative Extension Water Resources Program and the Green Infrastructure Subcommittee of Jersey Water Works.

Please enter your full name and affiliation in the chat. This is how will take attendance.
Green Infrastructure Champion Training: Part 6
“Green Infrastructure Projects for Schools”

March 25, 2022
Virtual Class

water.rutgers.edu
Rutgers Cooperative Extension

Rutgers Cooperative Extension (RCE) helps the diverse population of New Jersey adapt to a rapidly changing society and improves their lives through an educational process that uses science-based knowledge.
Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.
Happy 50th Anniversary, Clean Water Act!

Goals of the Federal Clean Water Act:

1. To eliminate the discharge of pollutants into the nation’s waters (zero discharge of pollutants by 1985)
2. To achieve water quality levels that are fishable and swimmable by mid-1983
The Clean Water Act at 50:
Promises Half Kept at the Half-Century Mark

EMBARGOED FOR RELEASE:
March 17, 2022
### TABLE 1: U.S. WATERS CLASSIFIED AS “IMPAIRED” BECAUSE OF TOO MUCH POLLUTION

<table>
<thead>
<tr>
<th>Waterbody Type (unit)</th>
<th>Total Assessed</th>
<th>Total Impaired</th>
<th>Percent Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivers, Streams, and Creeks (miles)</td>
<td>1,401,320</td>
<td>703,417</td>
<td>50%</td>
</tr>
<tr>
<td>Lakes, Ponds, and Reservoirs (acres)</td>
<td>20,403,021</td>
<td>11,168,767</td>
<td>55%</td>
</tr>
<tr>
<td>Bays, Estuaries, and Harbors (sq. miles)</td>
<td>76,557</td>
<td>19,470</td>
<td>25%</td>
</tr>
</tbody>
</table>

*Source: The most recent available state Integrated Water Reports filed with EPA. Note: impairments include of waters assessed in the most recent cycle (six to 10 years, depending on the state), plus those assessed in earlier cycles.*

### TABLE 2: U.S. WATERS DESIGNATED AS IMPAIRED, BY USE

<table>
<thead>
<tr>
<th>Designated Use</th>
<th>River &amp; Stream</th>
<th>Lake &amp; Reservoir</th>
<th>Bay &amp; Estuary Square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Miles Assessed</td>
<td>Acres Assessed</td>
<td>Sq. Miles Assessed</td>
</tr>
<tr>
<td></td>
<td>% Impaired</td>
<td>% Impaired</td>
<td>% Impaired</td>
</tr>
<tr>
<td>Aquatic Life</td>
<td>1,174,369</td>
<td>16,712,149</td>
<td>33,026</td>
</tr>
<tr>
<td>Drinking Water</td>
<td>337,339</td>
<td>8,831,357</td>
<td>-</td>
</tr>
<tr>
<td>Water Recreation</td>
<td>653,443</td>
<td>15,373,880</td>
<td>31,369</td>
</tr>
<tr>
<td>Fish Consumption</td>
<td>419,403</td>
<td>10,943,113</td>
<td>25,069</td>
</tr>
</tbody>
</table>

*Source: Most recent state Integrated Reports filed with EPA. Percentage impaired is of assessed waterways.*
States with asterisks reported useable data only for swimming and other primary water contact recreation impairments, not for secondary water contact recreation, such as kayaking. Ohio is not included because it does not count impairments like the other states.
### Table 8: States with Most Square Miles of Impaired Estuaries

<table>
<thead>
<tr>
<th>State</th>
<th>Assessed (Sq. Miles)</th>
<th>Impaired (Sq. Miles)</th>
<th>% Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Louisiana</td>
<td>6,079</td>
<td>5,574</td>
<td>91.7%</td>
</tr>
<tr>
<td>Florida</td>
<td>2,544</td>
<td>2,533</td>
<td>99.6%</td>
</tr>
<tr>
<td>Maryland</td>
<td>2,403</td>
<td>2,404</td>
<td>100.0%</td>
</tr>
<tr>
<td>Virginia</td>
<td>2,449</td>
<td>2,137</td>
<td>87.3%</td>
</tr>
<tr>
<td>Texas</td>
<td>2,610</td>
<td>1,248</td>
<td>47.8%</td>
</tr>
<tr>
<td>North Carolina</td>
<td>3,210</td>
<td>949</td>
<td>29.6%</td>
</tr>
<tr>
<td>California</td>
<td>836</td>
<td>834</td>
<td>99.8%</td>
</tr>
<tr>
<td>Delaware</td>
<td>775</td>
<td>775</td>
<td>100.0%</td>
</tr>
<tr>
<td>Alabama</td>
<td>784</td>
<td>634</td>
<td>81.0%</td>
</tr>
<tr>
<td>New Jersey</td>
<td>650</td>
<td>630</td>
<td>97.0%</td>
</tr>
</tbody>
</table>

*Source: Most recent state Integrated Reports filed with EPA.*
### River and Stream Miles by State

<table>
<thead>
<tr>
<th>State</th>
<th>Total Miles</th>
<th>Miles Assessed for Any Use</th>
<th>% Assessed for Any Use</th>
<th>% Impaired for Any Use</th>
<th>Specific Designed Uses</th>
<th>Miles Assessed</th>
<th>% Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Jersey</td>
<td>19,425</td>
<td>19,425</td>
<td>100%</td>
<td>95%</td>
<td>Water Contact Recreation</td>
<td>19,426</td>
<td>41%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Public Drinking Water</td>
<td>14,693</td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aquatic Life</td>
<td>19,426</td>
<td>61%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fish Consumption</td>
<td>19,426</td>
<td>42%</td>
</tr>
<tr>
<td>New Mexico</td>
<td>95,172</td>
<td>6,250</td>
<td>7%</td>
<td>65%</td>
<td>Water Contact Recreation</td>
<td>4,529</td>
<td>23%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Public Drinking Water</td>
<td>2,220</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aquatic Life</td>
<td>2,309</td>
<td>62%</td>
</tr>
<tr>
<td>New York</td>
<td>87,126</td>
<td>57,186</td>
<td>66%</td>
<td>11%</td>
<td>Water Contact Recreation</td>
<td>15,197</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Public Drinking Water</td>
<td>7,157</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aquatic Life</td>
<td>57,186</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fish Consumption</td>
<td>57,186</td>
<td>2%</td>
</tr>
</tbody>
</table>

### Lake and Reservoir Acres by State

<table>
<thead>
<tr>
<th>State</th>
<th>Total Acres</th>
<th>Acres Assessed for Any Use</th>
<th>% Assessed for Any Use</th>
<th>% Impaired for Any Use</th>
<th>Specific Designed Uses</th>
<th>Acres Assessed</th>
<th>% Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Hampshire</td>
<td>188,545</td>
<td>167,462</td>
<td>89%</td>
<td>90%</td>
<td>Water Contact Recreation</td>
<td>148,175</td>
<td>42%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Public Drinking Water</td>
<td>170,179</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aquatic Life</td>
<td>166,521</td>
<td>89%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fish Consumption</td>
<td>185,081</td>
<td>100%</td>
</tr>
<tr>
<td>New Jersey</td>
<td>47,620</td>
<td>47,620</td>
<td>100%</td>
<td>97%</td>
<td>Water Contact Recreation</td>
<td>47,619</td>
<td>46%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Public Drinking Water</td>
<td>46,578</td>
<td>43%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aquatic Life</td>
<td>47,619</td>
<td>61%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fish Consumption</td>
<td>47,619</td>
<td>63%</td>
</tr>
<tr>
<td>New Mexico</td>
<td>89,042</td>
<td>68,381</td>
<td>77%</td>
<td>86%</td>
<td>Water Contact Recreation</td>
<td>61,054</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Public Drinking Water</td>
<td>2,236</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aquatic Life</td>
<td>47,417</td>
<td>69%</td>
</tr>
<tr>
<td>New York</td>
<td>687,102</td>
<td>578,426</td>
<td>84%</td>
<td>55%</td>
<td>Water Contact Recreation</td>
<td>522,188</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Public Drinking Water</td>
<td>393,039</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aquatic Life</td>
<td>578,426</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fish Consumption</td>
<td>578,426</td>
<td>39%</td>
</tr>
</tbody>
</table>
July 1, 2002 – Chris Obropta starts working for Rutgers Cooperative Extension (95% NJ’s Waterways Impaired)

2003 CAFO (confined animal feed operation) regulations

2004 New Stormwater Management Regulations

2004 Municipal Separate Storm Sewer System (MS4) Permits issued

2011 New Jersey Fertilizer Law

2021 Updated Stormwater Management Regulations

March 17, 2022 EIP Report Released (95% NJ’s Waterways Impaired)
"The Clean Water Act at 50: Promises Half Kept at the Half-Century Mark." According to this document (see attached), NJ is ranked #2 behind Delaware in most impaired waterways at 95% (Delaware is 97%). When I started the Rutgers Cooperative Extension Water Resources Program 20-years ago, 95% of NJ Waterways were impaired. Here we are 20-years later and according to this report, we have made no headway. Now what? I guess we just must try harder. We need to up our game! Think about where we are and where we need to go. We have a big following of impressive stakeholders. Let's figure out how to engage these stakeholders to take action and clean up NJ's waters.

Chris
I agree, I think it's a good opportunity to take a step back and say what is really causing these waterways to be impaired and what solutions will actually clean them in a reasonable time period.

What needs to happen in research, planning, politics, and real world action to make that happen? I don't think real world solutions can happen without a combination of all of them, and we certainly have a role to play in each of them.
Why New Jersey Schools?

• 590 School Districts
• 2,526 Public Schools
  – 2,005 Elementary Schools
  – 511 Secondary Schools
• 88 Charter Schools
• Public School Enrollment = 1.37 million
• Charter School Enrollment = 45,982
• Full-time classroom teachers = 116,351

Need more math teachers at NJ Department of Education
More on “why schools”

• Mostly old buildings and parking lots with little or no stormwater management
• Dedicated source of funding ($11.6 billion in state aid in 2022-2023 + local property taxes)
• Educate the youth and the adults will follow
• Enhance all levels of teaching with outdoor education
• Innovative, interdisciplinary “outdoor classrooms”
• Highly visible sites
• Separate government – school board
• Free labor
It is all about controlling runoff from impervious surfaces
Step 1: Depave
Make Something with your De-Pavement

Greater Brunswick Charter School
Existing Courtyard
Existing Courtyard
Design

- **Rain Garden Classroom**
- **Winter Rain Garden**: seeds, berries, + sedge
- **Fall Rain Garden**: grasses + autumn color
- **Summer Rain Garden**: monarch butterfly habitat
- **Outdoor Seating Area**

Legend:
- Gold: Aster, New England Aster
- Green: Switchgrass, Stone Channel, Royal Fern
- Orange: Indian Grass, Big Bluestem
- Pink: Virginia Bluebells, Red-cedar, Dracena
- Blue: Wildflower meadow
- Red: Columbia, Creeping Phlox, Foxtail Grass
Zane North Elementary School
Rain Garden Project
Rutgers Cooperative Extension
April 20, 2017

Site Elements: Infrastructure/Furnishings

Not to Scale
Dimensions to be verified in the field
ZANE NORTH ELEMENTARY

Rain Garden Concept Design

Narrow Garden Paths: Mulch and Gravel

Not to Scale
Dimensions to be Verified in the Field

Zane North Elementary School
Rain Garden Project
Rutgers Cooperative Extension
April 20, 2017
Step 2: Simple Disconnection
Downspout Disconnection

**Downspout Connected to Sewer System**
- Downspout
- Standpipe

**Downspout Disconnected From Sewer System**
- Downspout
- Extension elbow
- Cap
- Standpipe
Useful Water: Disconnect to a Rain Barrel or Cistern

Disconnect your downspout by installing a rain barrel

Impervious area is now “disconnected” from flowing directly into the storm sewer system
Useful Water: Rainwater Harvesting Systems

From Problem to Utility
Useful Water: Filter stormwater through rain garden to roots - water food beds

Jonathan Dayton High School Courtyard
Useful Water: Filter stormwater through rain garden to roots - water food beds
Useful Water: Filter stormwater through rain garden to roots - water food beds
Useful Water: Filter stormwater through rain garden to roots - water food beds
Rooftop runoff is now "disconnected" from flowing directly into the storm sewer system.
Bioretention Systems/Rain Gardens

**BERM**
The berm is constructed as a barrier to control, slow down, and contain stormwater.

**NATIVE PLANTS**
A rain garden is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions.

**PONDING AREA**
The ponding area is the lowest, deepest visible area of the garden. When designed correctly, this area should drain within 24 hours.

**INLET**
This is the area where stormwater enters. The inlet is often lined with stone to slow water flow and prevent erosion.

**DRAINAGE AREA**
This is the area of impervious surface that drains stormwater runoff to the rain garden.

**CURB CUT**
This curb cut and concrete flow pad are designed to help redirect stormwater runoff to the rain garden system and out of the storm drain.
PARTS OF A RAIN GARDEN

BUFFER

SLOPE

BASE

BUFFER

SLOPE

SOIL

SOIL
Lots of Rain Gardens
Mark out April 2014

2014
- Installed rain garden with assistance from the DPW
- Educated students about rain gardens and planted with them

2016
- Returned to conduct maintenance

Planting June 2014

Post Maintenance August 2016
October 2018

- Educated the Life Skills students about nonpoint source pollution, rain gardens, and how to do maintenance
- Conducted hands on maintenance with the students
WOODS ROAD ELEMENTARY SCHOOL

Site visit March 2011

Post excavation April 2011

Post planting May 2011

Follow up site visit June 2011
Rain garden at Catto School in Camden, NJ
Step 3: Convert to Permeable Pavement

**Porous Asphalt**
It is common to design porous asphalt in the parking stalls of a parking lot. This saves money and reduces wear.

**Drainage Area**
The drainage area of the porous asphalt system is the conventional asphalt curbs and the porous asphalt in the parking spaces. Runoff from the conventional asphalt flows into the porous asphalt parking spaces.

**Underdrain**
Systems with low infiltration rates due to soil composition are often designed with an underdrain system to discharge the water.

**Asphalt**
This system is often designed with conventional asphalt in areas of high traffic to prevent any damage to the system.

**Subgrade**
Porous pavements are unique because of their subgrade structure. This structure includes a layer of choker course, filter course, and soil.
Permeable Pavements

- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Ideal application for porous pavement is to treat a low traffic or overflow parking area
ADVANTAGES

• Manage stormwater runoff
• Minimize site disturbance
• Promote groundwater recharge
• Low life cycle costs, alternative to costly traditional stormwater management methods
• Mitigation of urban heat island effect
• Contaminant removal as water moves through layers of system

COMPONENTS

Design Guidelines for Porous Asphalt with Subsurface Infiltration

- UNCOMPACTED SUBGRADE IS CRITICAL FOR PROPER INFILTRATION
- FILTER FABRIC LINES THE SUBSURFACE BED
- RIVERJACKS OPEN INTO RECHARGE BED
- POROUS ASPHALT PAVEMENT
- UNIFORMLY GRADED STONE AGGREGATE WITH 40% VOID SPACE FOR STORMWATER STORAGE AND RECHARGE
How do we get started?

• Be clear about what you have to offer the school and why you want to work with them
• Ensure them that you are not going to make more work for the teachers or administrators
• Do not scare them with a lengthy discussion on maintenance but inform them of the tasks
• Tell them how the work will be funded, don’t be afraid to ask for funding but make sure they know you have skin in the game
Educational Programming

• Educational program can vary in length
• Community-Based Project Learning was eight weeks – one day in the classroom per week and then building and planting a rain garden
• You can also educate the students when they plant the garden
• Students can continue these efforts beyond the classroom – Eagle Scout Project, National Honor Society, or simply a college resume builder
a) NJ Physiography modeled in the garden
b) Interpretive Design
c) Embedded Narrative
d) Local Aesthetics
e) Built with Town DPW and Board of Education Facilities Personnel
“Physiography/Geology Teaching Garden”

Design Goals:

Demonstrate a rain garden that:

- Is useful as a teaching tool specific to place
- Highlight New Jersey’s geology, and how it is connected to water and plants
- Demonstrate the relationship between paving (imperviousness) and unpaved areas
- Create interest in “real” landscapes by reference and mimicry in the garden
Beyond Water Control: Connecting with Geology, Soils, and Plant Communities
Beyond Water Control: Educational Garden

Rutgers Landscape Architecture, NJAES, Springfield Township
Coastal Plain
(Low)
The Enviroscape Model

• Great for all ages
• Simple to use and conveys all the necessary concepts
• Easy to clean up
• The students can jump right in and make it rain
Stormwater Management in Your Schoolyard Program

http://water.rutgers.edu/Projects/SWMIYSchoolyard/SWMIYSchoolyard.html#K8
Sustainable Jersey for Schools

Two Actions (10 points each):

- Green Infrastructure Assessment & Plan
- Green Infrastructure Installation
What’s next?

• Many of the ICAs, RAPs, and green infrastructure feasibility studies have identified opportunities at schools

• Check if the school is registered in Sustainable Jersey for Schools: [http://www.sustainablejerseyschools.com/actions-certification/participating-districts-and-schools/](http://www.sustainablejerseyschools.com/actions-certification/participating-districts-and-schools/)

• Reach out to the school and see if they are interested in green infrastructure planning or installing a practice
Let's go Peacocks!
QUESTIONS?