

POMPERAUG RIVER

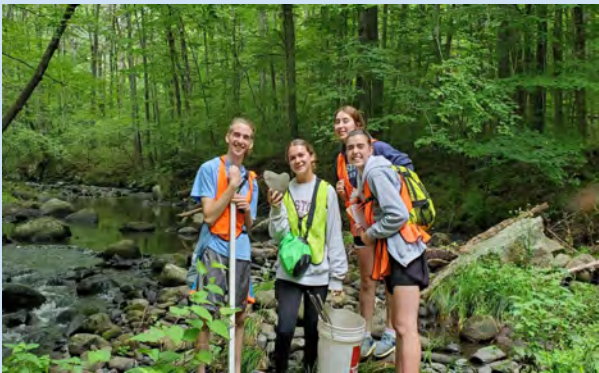


Benefits of Buffers & *Water Quality Update*

CONSERVATION
CONVERSATION

Presentation and Discussion in Collaboration
with Southbury Public Library

July 19th, 2022





Welcome & Introduction



Carol Haskins
Executive Director
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Coalition

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www.pomperaug.org

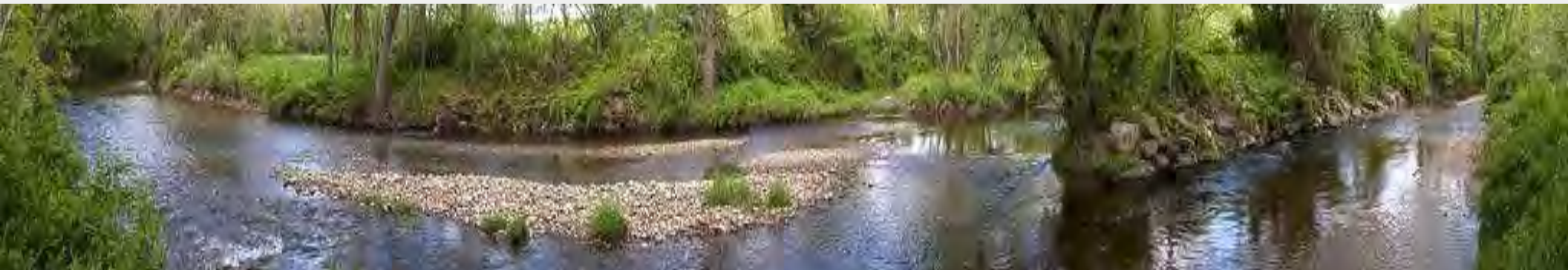




PRWC Mission

Pomperaug River Watershed Coalition's mission is to advocate for excellent water quality in the Pomperaug Watershed communities through the use of science and education.

We share our knowledge and expertise with others committed to protecting water resources for future generations.





Acknowledgement

**Thank you to
Brooke Tillotson and Zoe Kleeblatt**
– 2022 Dr. Marc J. Taylor Interns –
**for preparing the slides
included in this presentation!**





Goals

1

What We Do

What does PRWC do in the watershed?

2

State of the Watershed

Water quality conditions and land use

3

Buffers ... What & Why

What are buffers and what do they do?

4

Buffers ... Who

Who can plant buffers?

5

Buffers ... Where

Where can buffers be planted?

6

Open Discussion

Your thoughts and questions!



Why water matters





About PRWC

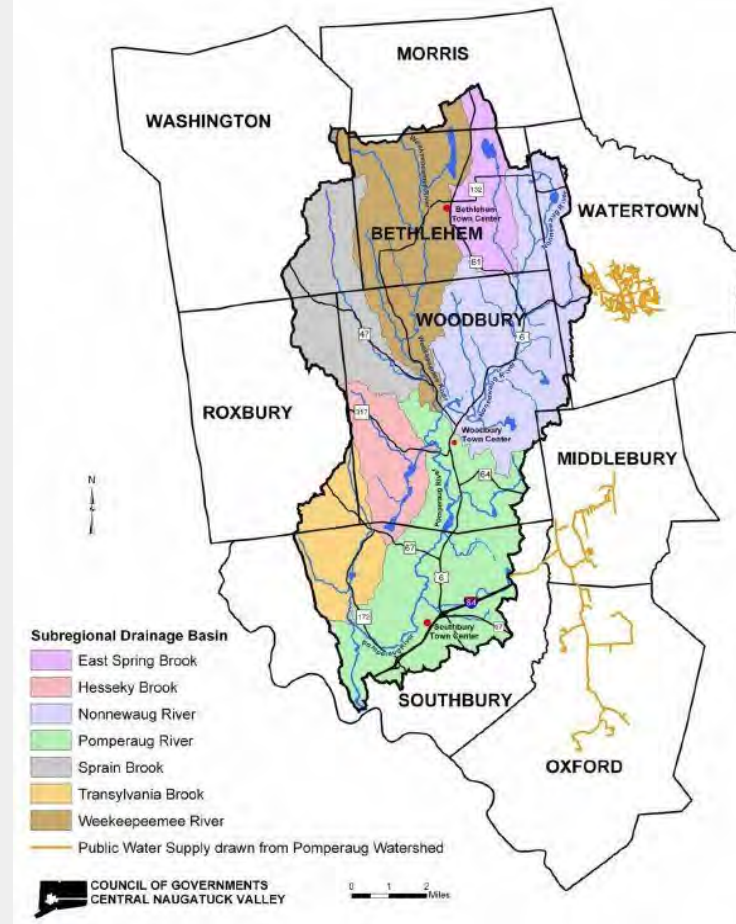
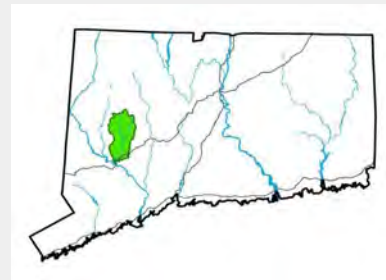
What We Do

- Stewardship
- Science
- Education



Where We Are

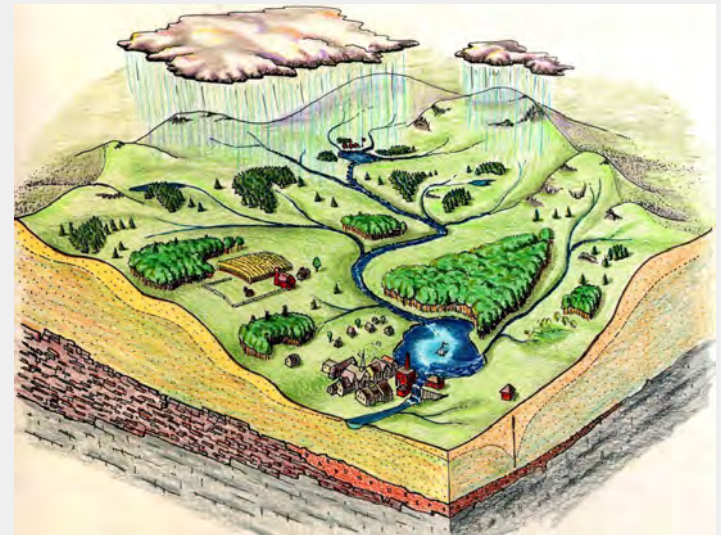
- 90² Miles
- Drains to Housatonic River & Long Island Sound





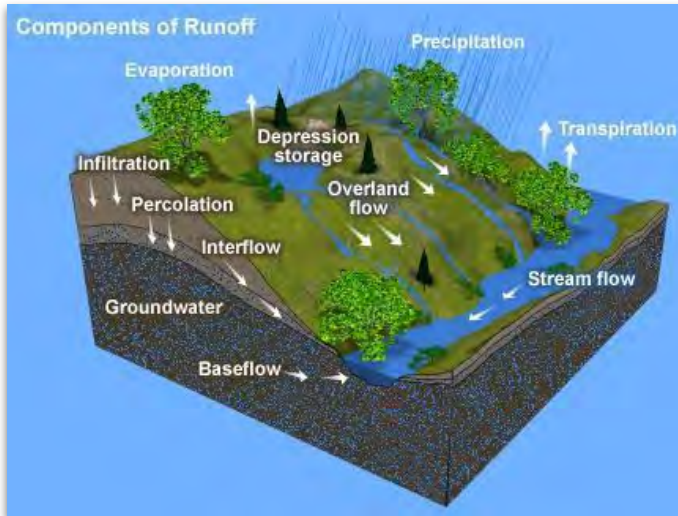
What is a watershed?

- 💧 A section of land that drains to a common point
- 💧 Water flows from higher elevations downhill to collect to a common body of water
- 💧 The land surrounding a body of water where rain drains to
- 💧 Includes surface water and groundwater

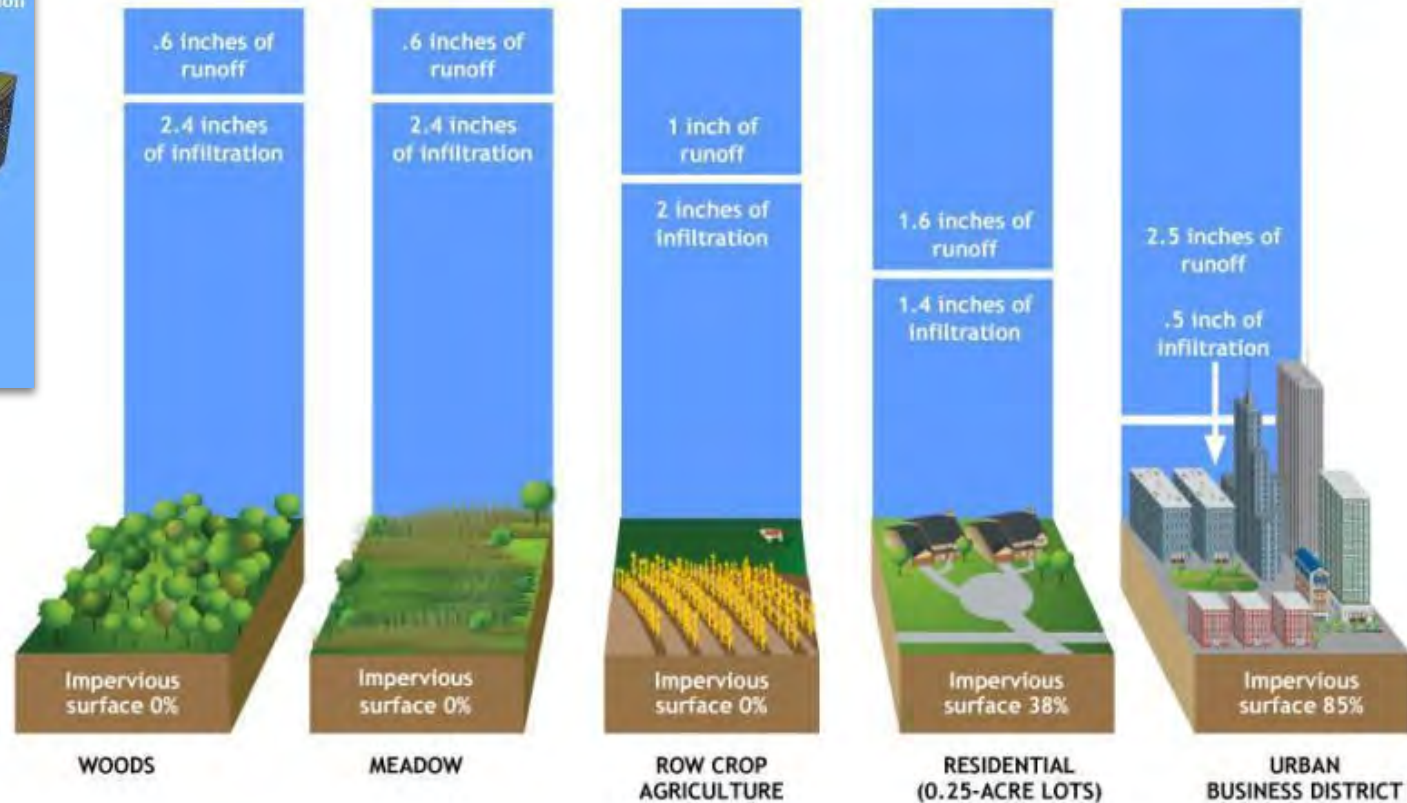





Precipitation & Runoff



Impervious surfaces increase pollution in stormwater runoff.

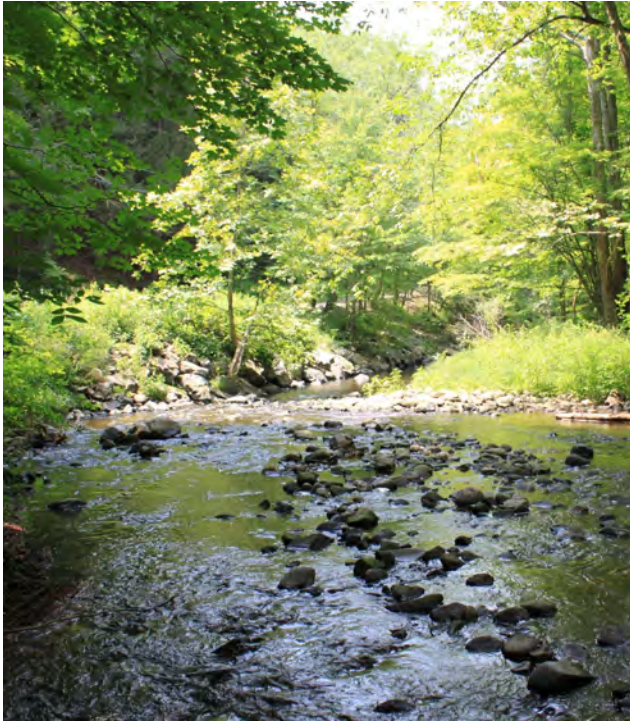


A scenic photograph of a forest stream. The stream flows over a bed of smooth, rounded rocks, creating small ripples and splashes. The banks are covered in lush green trees and foliage, with sunlight filtering through the leaves. A semi-transparent blue rectangular overlay is positioned on the left side of the image, containing the title text in white. The overall atmosphere is peaceful and natural.

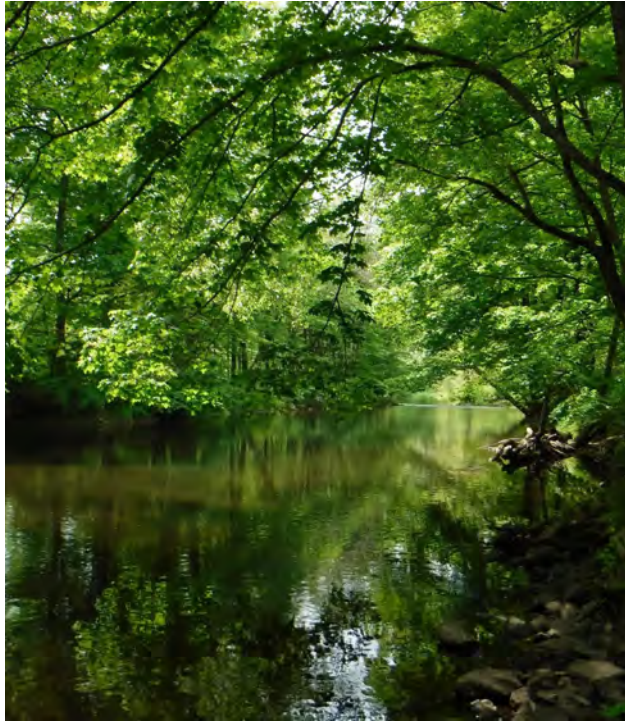
State of the Pomperaug Watershed



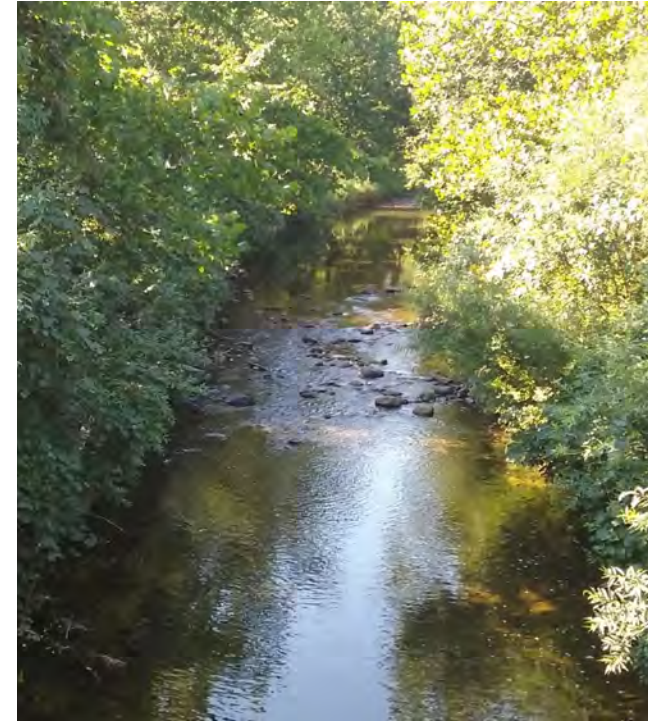
Local Rivers



Nonnewaug



Pomperaug



Weekepeemee



Pomperaug's Changing Landscape

2,550 acres
Forest lost



1,116 acres
Ag lost



414 acres
Impervious added



Relative land cover change between 1985 and 2015 by watershed (Source: UCONN CLEAR)



Stream Assessments & Impairments

CT DEEP Waterbody Assessments, Aquatic Life Use Support

Map of Connecticut CT DEEP Waterbody Assessment Segments showing Aquatic Life Use Support

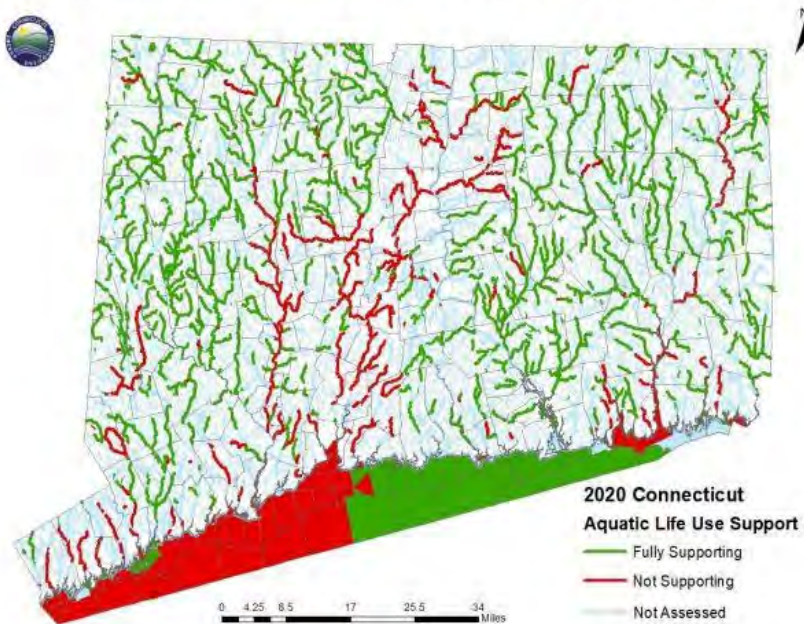


Figure 2-2. Waterbody segments assessed for Aquatic Life Use Support

CT DEEP Waterbody Assessments, Recreational Use Support

Map of Connecticut CT DEEP Waterbody Assessment Segments showing Recreational Use Support

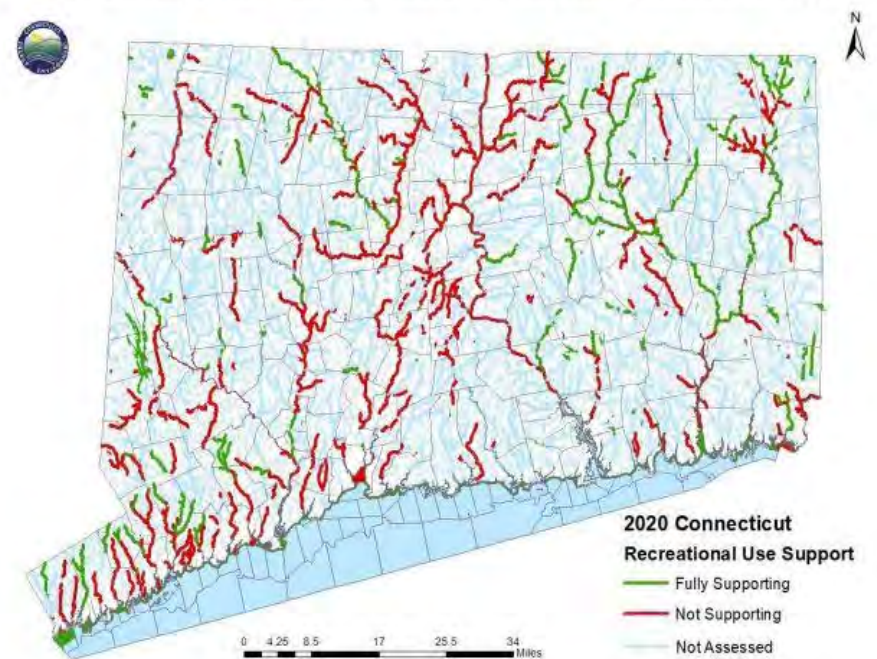


Figure 2-3. Waterbody segments assessed for Recreational Use Support



Local Impairments

CT DEEP Waterbody Assessments, Recreational Use Support

Map of Connecticut CT DEEP Waterbody Assessment Segments showing Recreational Use Support

282 of 496
assessed stream
segments do not
support recreation

Often based on
limited data

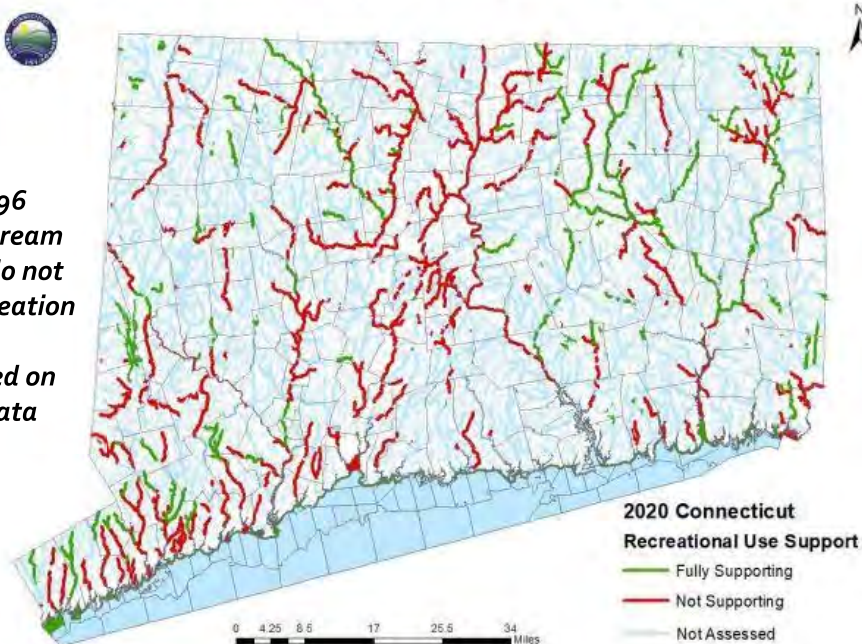
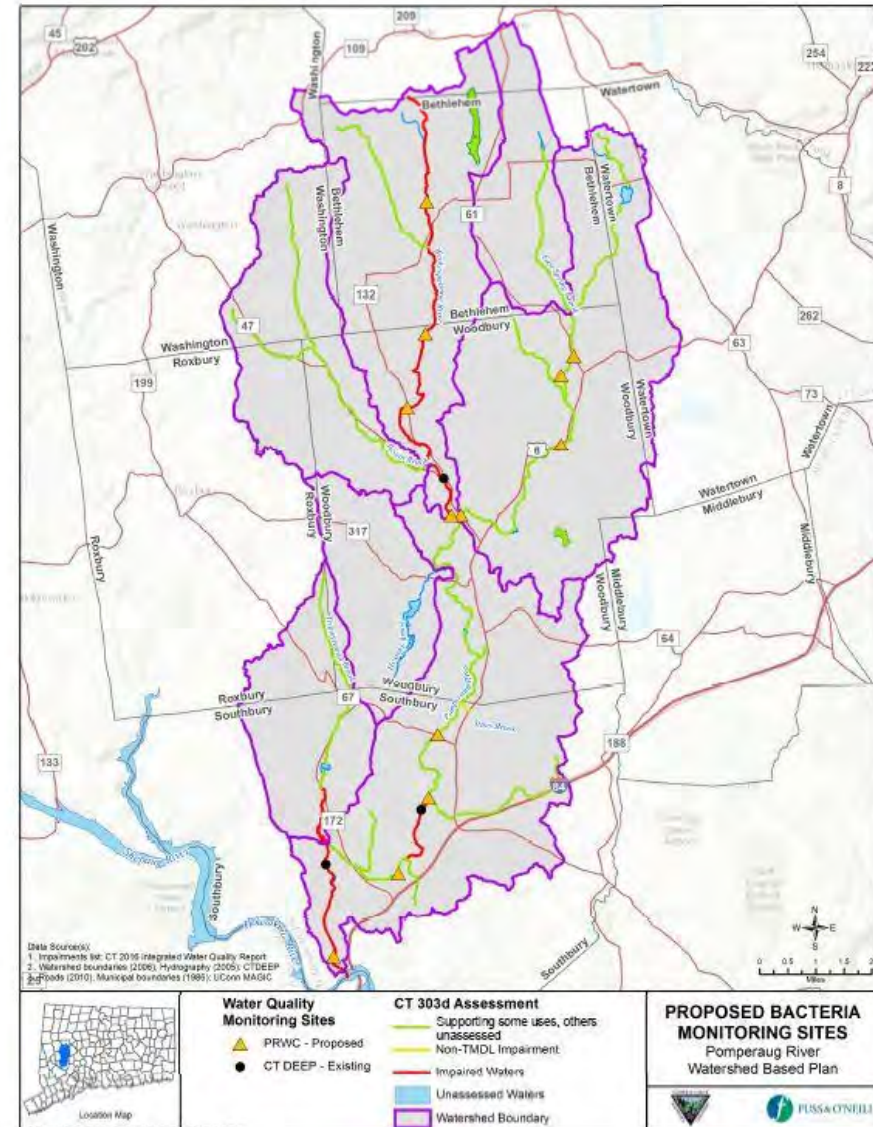
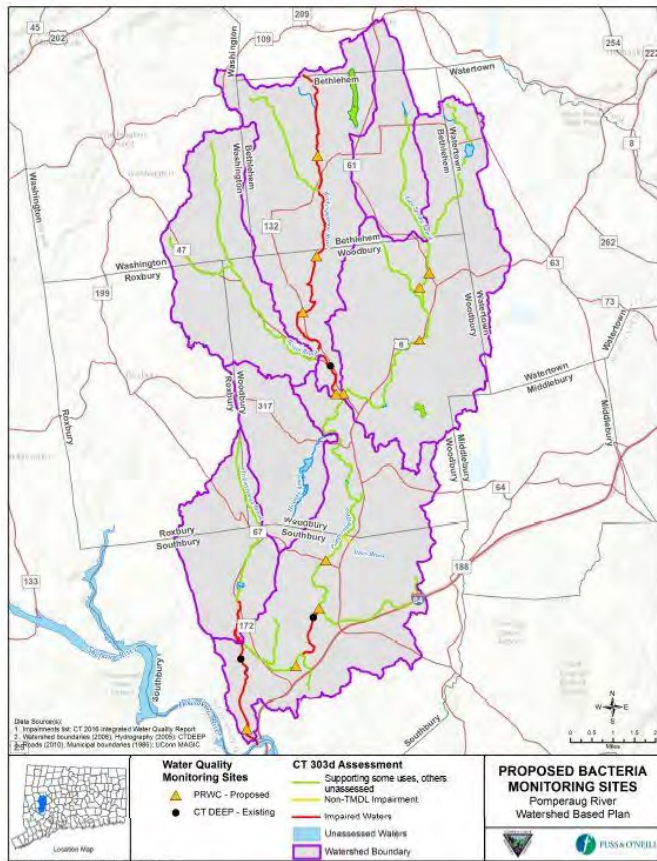


Figure 2-3. Waterbody segments assessed for Recreational Use Support



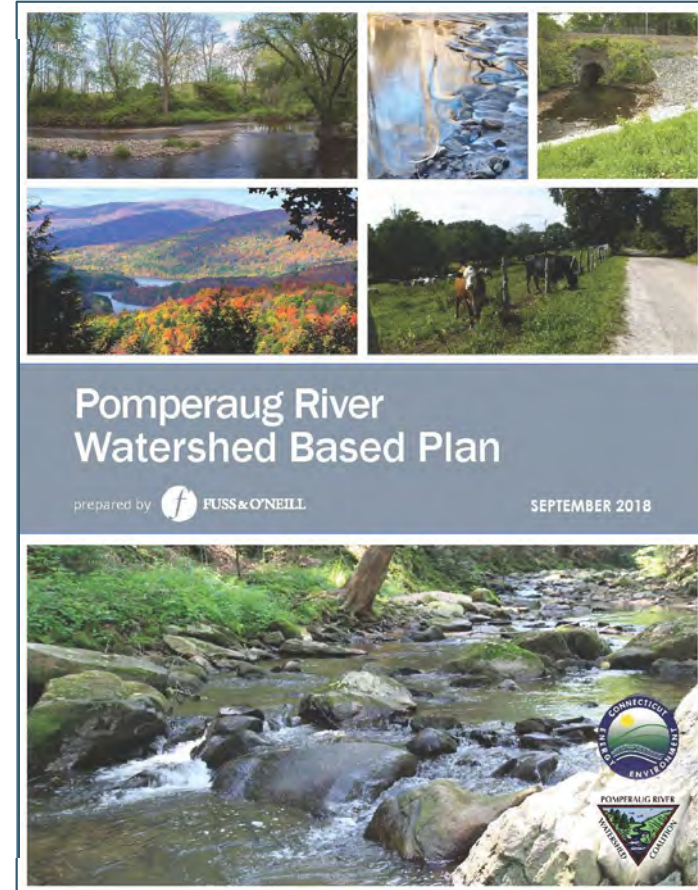


Addressing Impairments



Watershed Plan Objectives:

- Update baseline conditions in the watershed
- Identify existing water quality issues and pollutant sources
- Identify water quality monitoring needs
- Prioritize projects to improve and protect water quality
- Improve water quality and de-list "impaired" waters

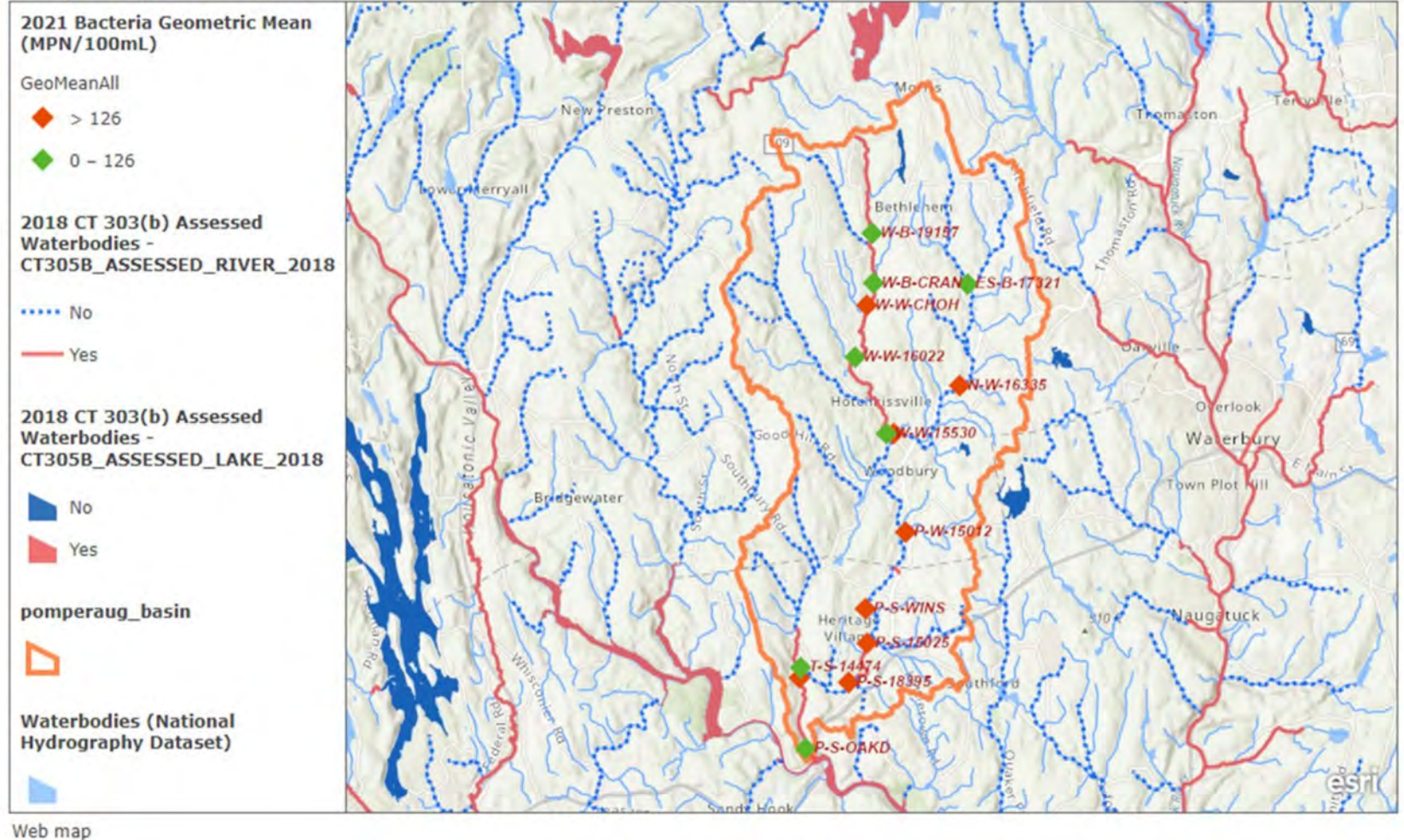




PRWC launched a bacteria and nitrate monitoring program in 2019, which includes sampling at 15 sites throughout the watershed.

The goal of PRWC's monitoring is to establish an improved baseline of water quality conditions.

Pomperaug Watershed: Ambient Water Quality Monitoring Program



Esri, NASA, NGA, USGS | Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA



2021

Geometric Mean
Bacteria
(MPN/100mL)

WET

Pomperaug Watershed: Ambient Water Quality Monitoring Program

2021 Bacteria Geometric Mean
(MPN/100mL) - WET

GeoMeanWet

◆ > 126

◆ 0 - 126

2018 CT 303(b) Assessed
Waterbodies
(CT305B_ASSESSED_RIVER_2018)

..... No

— Yes

2018 CT 303(b) Assessed
Waterbodies
(CT305B_ASSESSED_LAKE_2018)

■ No

■ Yes

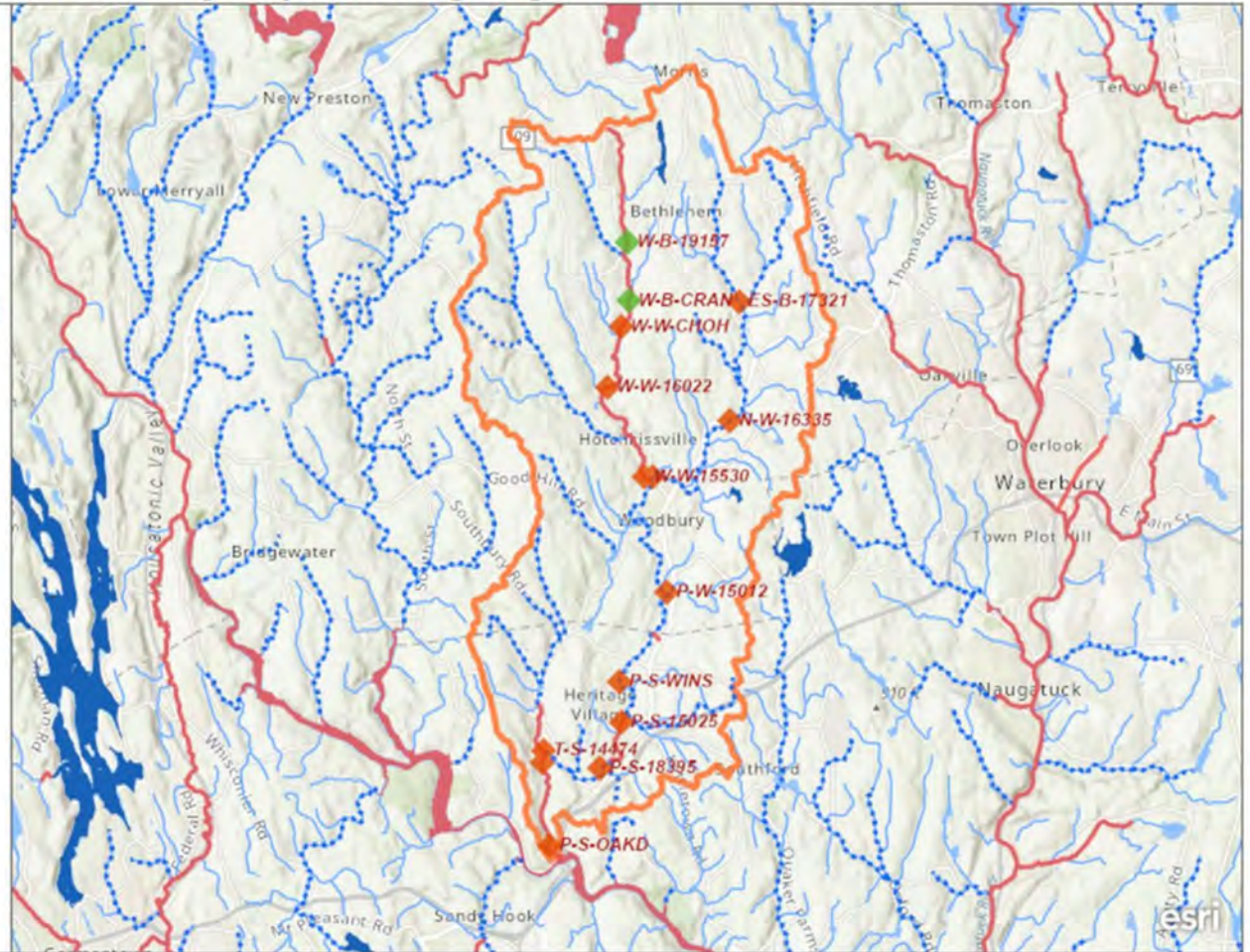
pomperaug_basin



Waterbodies (National
Hydrography Dataset)



Web map



Esri, NASA, NGA, USGS | Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA



2021

Geometric Mean
Bacteria
(MPN/100mL)

DRY

Pomperaug Watershed: Ambient Water Quality Monitoring Program

2021 Bacteria Geometric Mean
(MPN/100mL) - DRY

GeoMeanDry

◆ > 126

◆ 0 - 126

2018 CT 303(b) Assessed
Waterbodies -
CT305B_ASSESSED_RIVER_2018

..... No

— Yes

2018 CT 303(b) Assessed
Waterbodies -
CT305B_ASSESSED_LAKE_2018

■ No

■ Yes

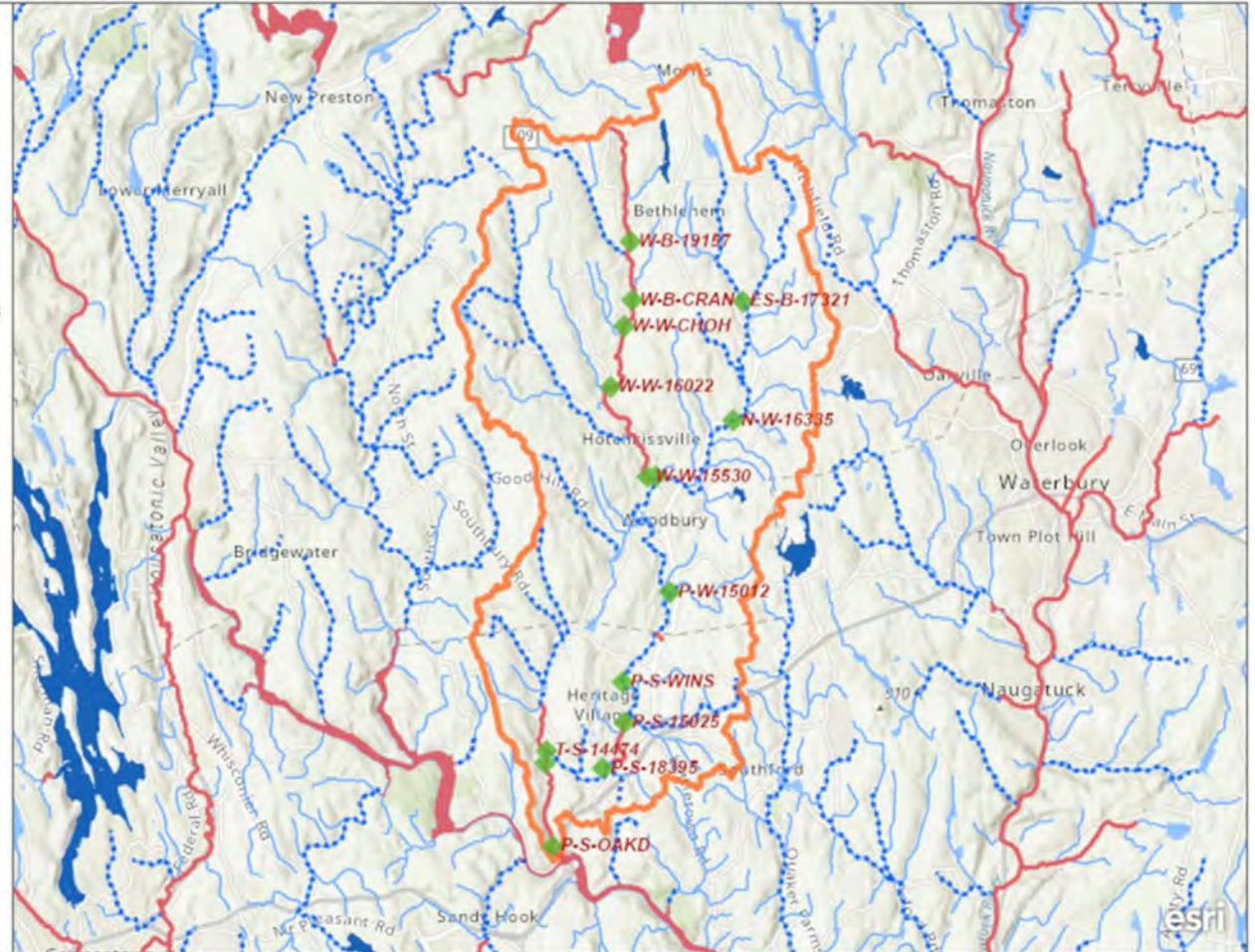
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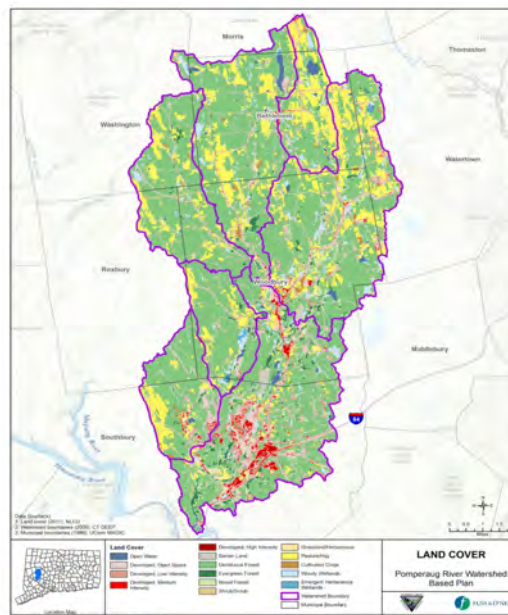


GIS Analysis & Modeling

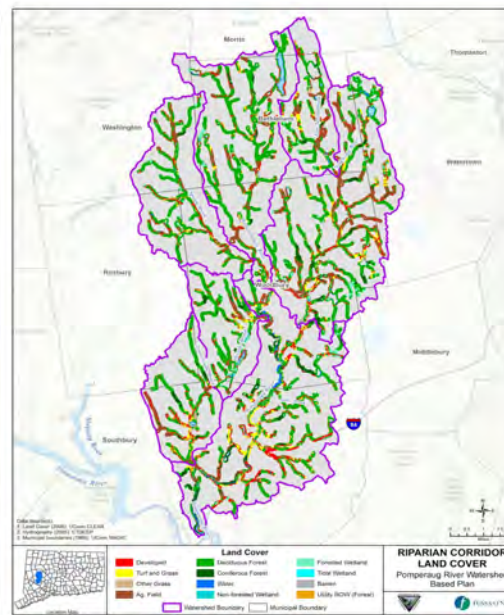
Soils



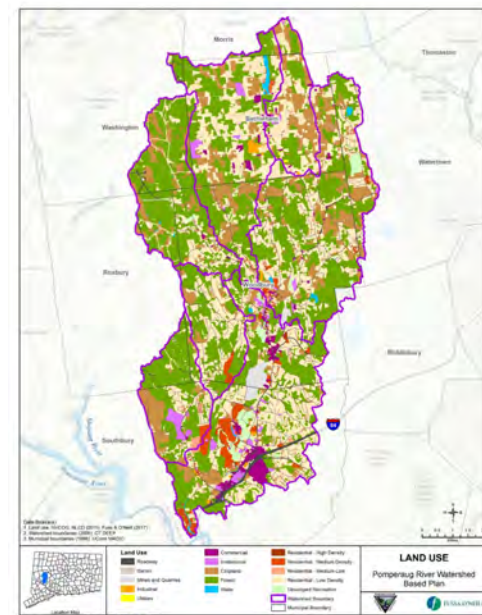
Land Cover



Riparian Land Cover



Land Use





GIS Analysis & Modeling

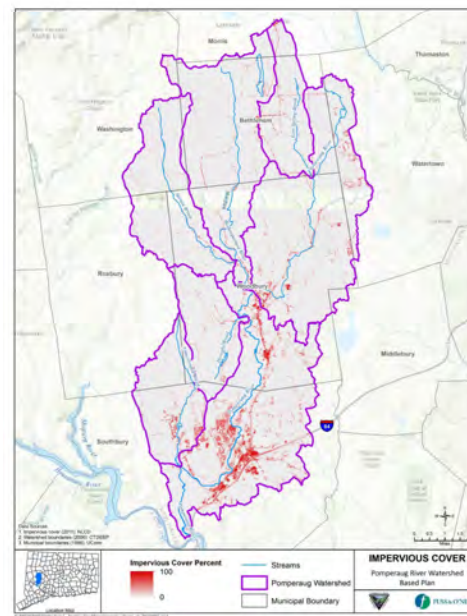
Open Space



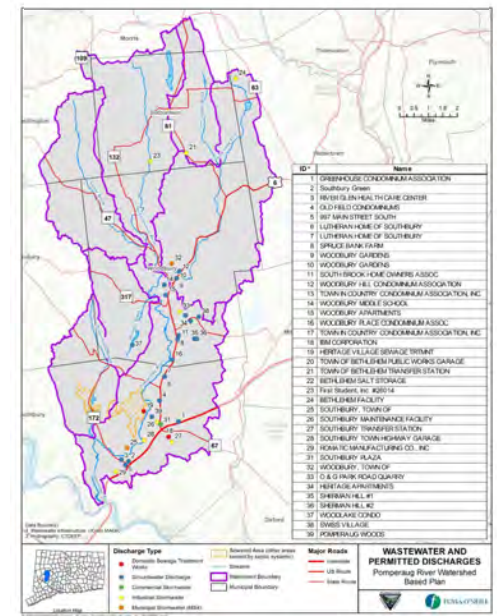
Forest, Wetland, & Habitat



Impervious Cover

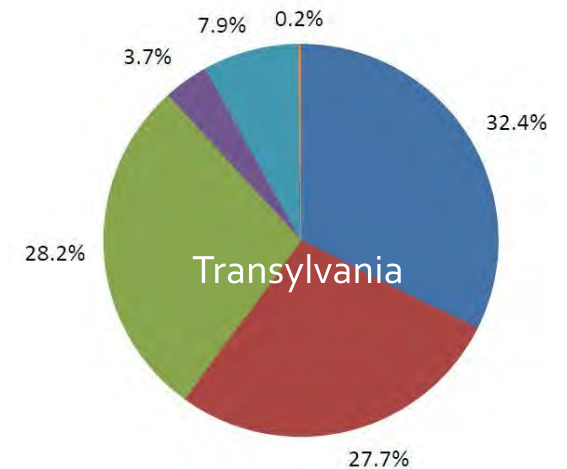
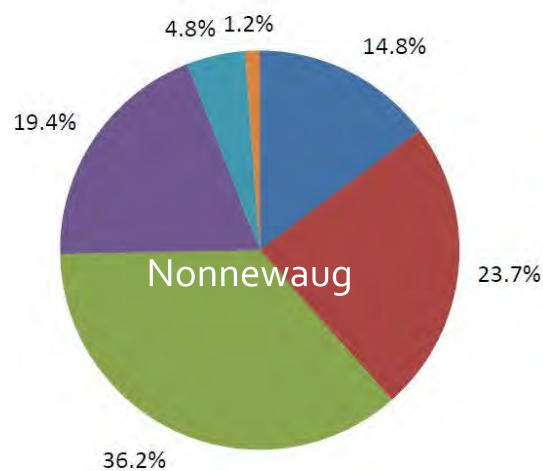
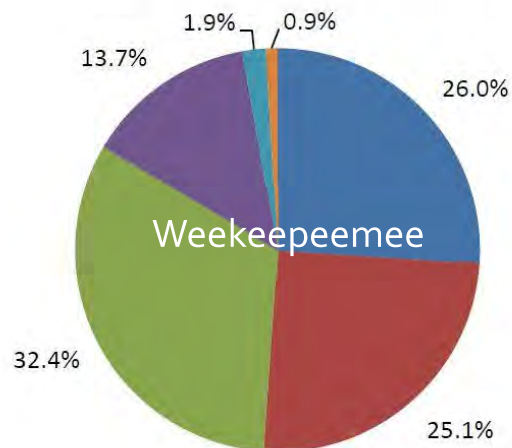
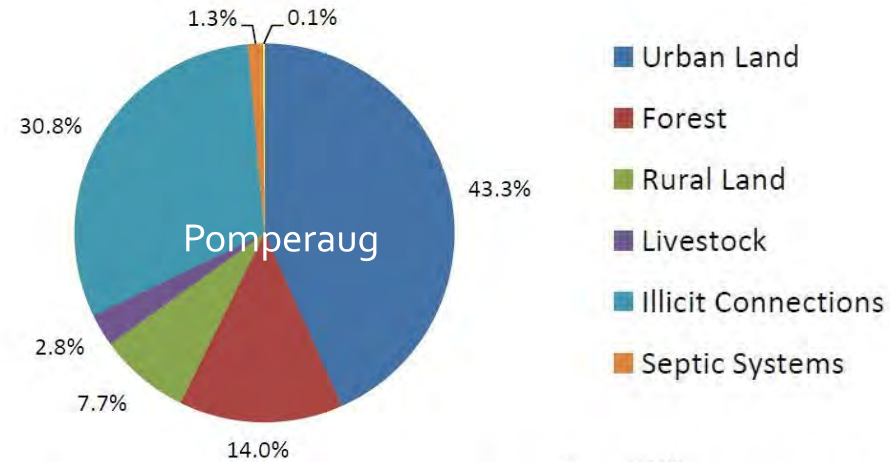


Point Discharge





Model Results – Sources of Bacteria





Visual Assessment Surveys

- Riparian conditions, land uses, withdrawals, discharges
- Broad look at in-stream conditions (habitat and streambank stability)
- Opportunities for reducing stormwater runoff and habitat improvements





Streamwalk Assessment Surveys

Weekeepeemee River Streamwalk Observations

Double Hill Road to Confluence w/ Nonnewaug River ~8.5 miles

- **19 Impaired Buffer Areas**
- **8 Road Crossings**
- **6 Trash and Debris Accumulations**
- **5 Stormwater Outfalls**
- **5 Channelized Sections**
- **5 Sites with Livestock Present (*at least two more visible from aerial images*)**
- **4 Bank Erosion Areas**
- **3 Stone Dams (DIY)**
- **3 Water Diversions (Irrigation)**
- **3 Miscellaneous Observations**
- **1 Beaver Dam**
- **1 Ford-style stream crossing (*at least two more visible from aerial images*)**
- **Lots of evidence of wildlife – deer, raccoons, beaver, coyote, squirrels, mice, birds, fish**



Buffer Enhancement Opportunities

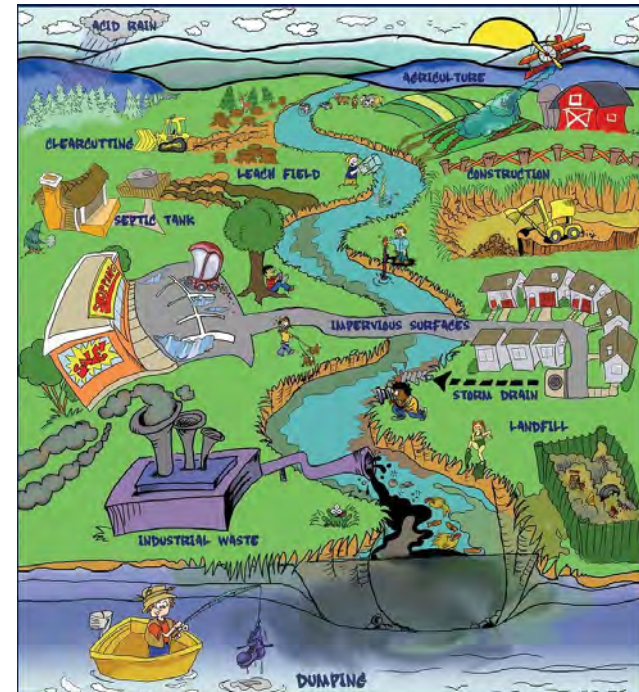




Best Management Practices (BMPs)

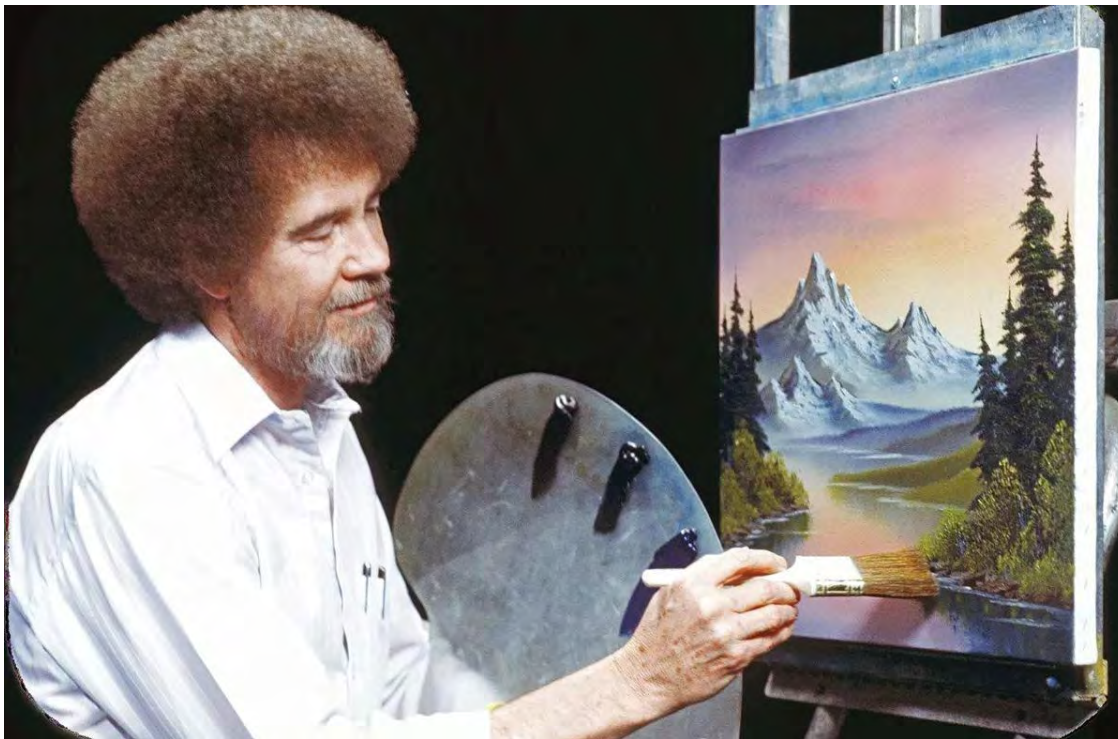
- **Agricultural BMPs**
 - Filter berms & Filter Strips
 - Increased riparian buffer
- **Structural stormwater BMPs**
 - Infiltration & bioretention systems
 - Underground solutions
- **Non-structural BMPs**
 - Geese management
 - Septic system management and outreach
 - Illicit discharge detection and elimination (IDDE)
 - Manure/nutrient management
 - Land use regulatory controls

We all have a roll to play in helping maintain high quality streams to restore those with impairments!






Best Management Practices (BMPs)




**What is the
most effective BMP
for the Pomperaug
Watershed?**

**VEGETATED
BUFFERS!**



Questions on Water Quality?

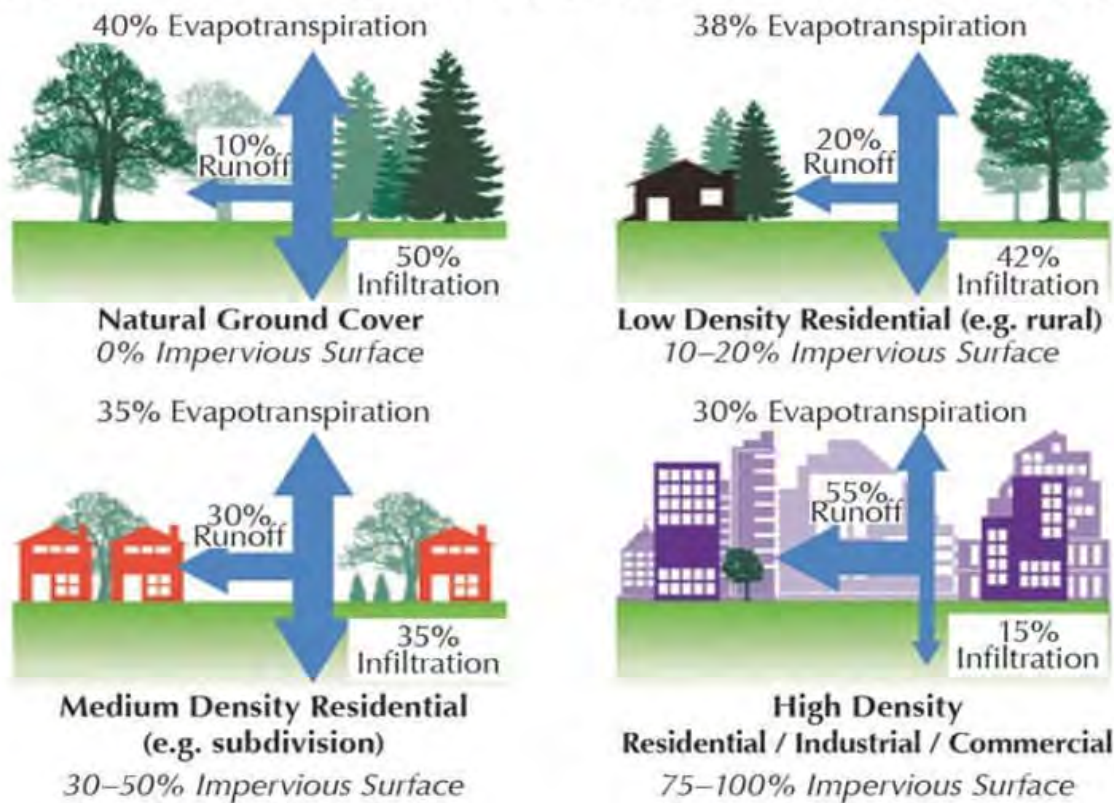
A photograph of a river flowing through a dense forest. The river is in the foreground, with white water rapids. The banks are covered with trees and fallen branches. A semi-transparent blue rectangle is overlaid on the left side of the image, containing the text "What is a buffer to you?". Below this rectangle, there are two more overlapping rectangles: a darker blue one and a lighter blue one, both partially visible.

What is a buffer
to you?

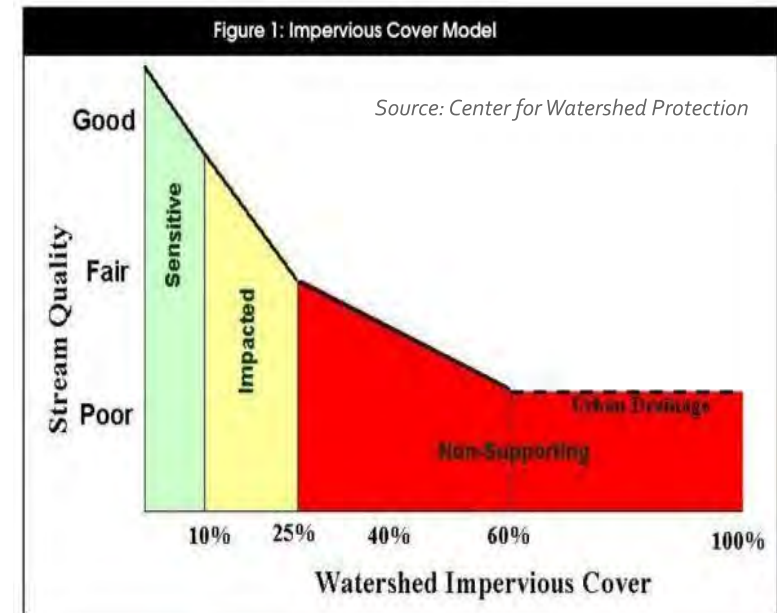


Why Buffers?

EFFECTS OF IMPERVIOUSNESS ON RUNOFF AND INFILTRATION



View Runoff Simulator
<https://wikiwatershed.org/>

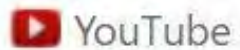




The Benefits of Buffers



Benefits of Buffers



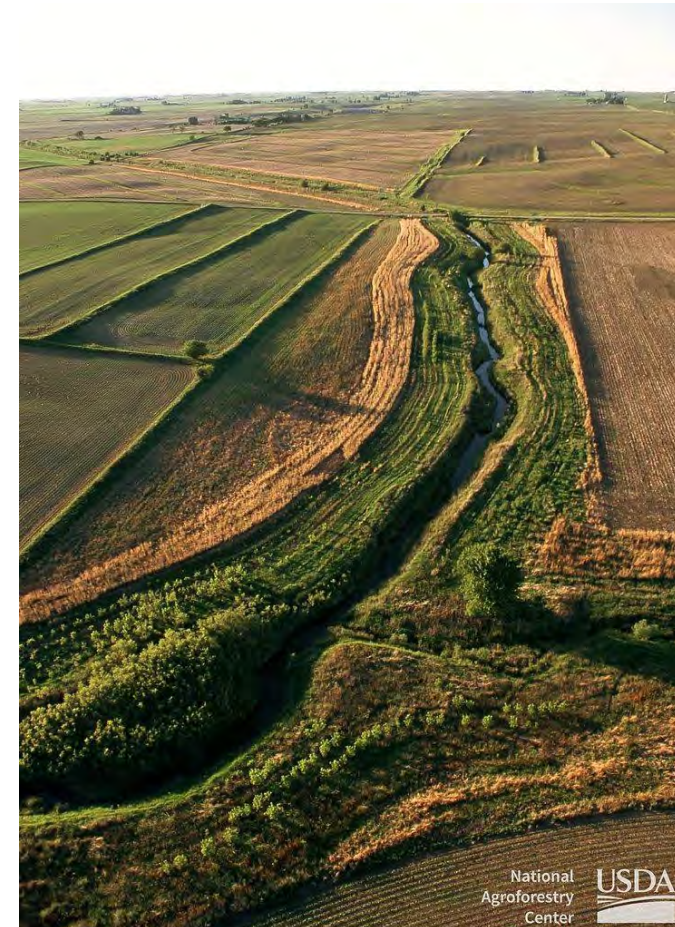
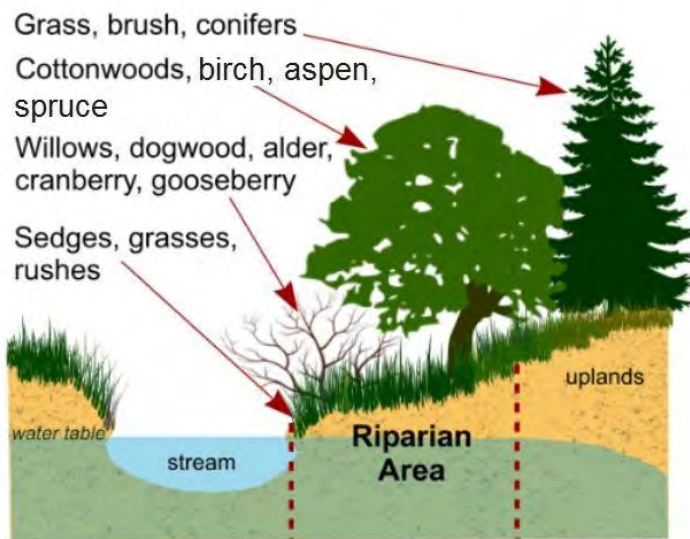
<https://youtu.be/KlhZEFMGTxI>



What is a Riparian Buffer?

Riparian – land adjacent to rivers and streams*

Buffer – a vegetated area composed of trees, shrubs, and perennials that provide shade and protection to the stream or river to enhance water quality





What Do Buffers Do?

Appendix 1: Benefits of Forested Riparian Corridors

Groundwater Quantity Benefits

Increases groundwater recharge of aquifers adjoining and underlying stream channels.
Reduces the threat of drought for groundwater dependent community water supplies.

Water Quality Benefits

Traps nutrients from surface and subsurface runoff.
Reduces total suspended solids in rivers thereby improving water quality.
Reduces hypoxic conditions in Long Island Sound.
Increases uptake of nutrients through tree root system and associated commensal bacteria.
Provides carbon source for nutrient breakdown from woody debris.
Reduces siltation of sensitive aquatic habitats used for fish spawning.
Reduces light penetration of river (tree canopy), in turn reducing algal and macrophyte growth.

Improved Flood Hazard Management

Reduces downstream flooding from reduced speed of stormwater discharges.
Attenuates peak flooding through surface water drawdown from mature tree root biomes.
Riparian vegetation delays input of water into the floodplain and delays backwater drainage.
Increases floodplain capacity by reducing saturated surface soils from deep rooted trees.

Streambank Stability

Enables root structure along river banks to maintain slope and bank stability
Reduces bank erosion from tree canopy and leaf litter detritus absorption of rainfall impacts
Plant roots provide cohesion to riparian soils reducing soil collapse.
Improves bank stability on steep slopes from large tree deep root systems.
Reduces pesticide use which improves effectiveness of riparian vegetation in stabilizing soils.

Stream Flow Benefits

Improves stream flow from groundwater recharge in periods of low precipitation.

Active and Passive Recreation

Improves active river based recreation activities with improved water quality.
Improves the scenic beauty and passive recreational benefits of surrounding area.
Reduces fragmentation of forest systems along river corridors improving wildlife habitat.
Provides important mental and physical refreshment,
Creates tourist attractions that support local economies.

Wildlife Benefits and Migratory Pathways

Enables migratory pathways for many species of wildlife.
Controls pests in adjoining agricultural lands, by presence of mammals, birds & invertebrates.
Provides natural windcreens for agricultural crops and livestock from extreme heat & cold.
Supports wildlife habitats at ground level from moderated temperatures in forested corridor.
Increases leaf litter discharge to rivers that, once decomposed, serves as food for invertebrates
Bank erosion has benefits, some erosion keeps major channels open and replenishes stream su
Improves biological diversity which is a reservoir for genetic variability critical to species.
Riverbank tree canopy supports temperature sensitive fish habitats from thermal pollution.

Micro-Climate Benefits

Moderates summertime temperatures from riparian vegetation evapotranspiration.
Positively influences two key climate change concerns; temperature and water availability.

Source: <https://westcog.org/wp-content/uploads/2021/08/WestCOG-Riparian-Protections-and-Zoning-Strategies.pdf>



What Do Buffers Do?

Appendix 1: Benefits of Forested Riparian Corridors

Groundwater	Stream Flow Benefits
Increases groundwater recharge of aquifers adjacent to stream	periods of low precipitation.
Reduces the threat of drought for groundwater dependent users	Passive Recreation
Water Quality	Improved water quality.
Traps nutrients from surface and subsurface runoff	benefits of surrounding area.
Reduces total suspended solids in rivers thereby improving water quality	corridors improving wildlife habitat.
Reduces hypoxic conditions in Long Island Sound	ies.
Increases uptake of nutrients through tree root systems	and Migratory Pathways
Provides carbon source for nutrient breakdown	life.
Reduces siltation of sensitive aquatic habitats used for recreation	ence of mammals, birds & invertebrates.
Reduces light penetration of river (tree canopy)	and livestock from extreme heat & cold.
Improved Flood Protection	erated temperatures in forested corridor.
Reduces downstream flooding from reduced sedimentation	composed, serves as food for invertebrates
Attenuates peak flooding through surface water infiltration	channels open and replenishes stream substrate
Riparian vegetation delays input of water into the river	genetic variability critical to species.
Increases floodplain capacity by reducing saturation	re fish habitats from thermal pollution.
Stream Bank Stability	Climate Benefits
Enables root structure along river banks to maintain stream bank	vegetation evapotranspiration.
Reduces bank erosion from tree canopy and leaf litter	Positively influences two key climate change concerns; temperature and water availability.
Plant roots provide cohesion to riparian soils reducing erosion	
Improves bank stability on steep slopes from large trees	
Reduces pesticide use which improves effectiveness	

- We can see the list is extensive!
- Let's focus on some primary categories:
- Captures excess nutrients
 - Bank stabilization
 - Flood resiliency
 - Reduces threat of drought
 - Provides shade:
 - Improves habitat
 - Decreases algal growth
 - Overall water quality protection

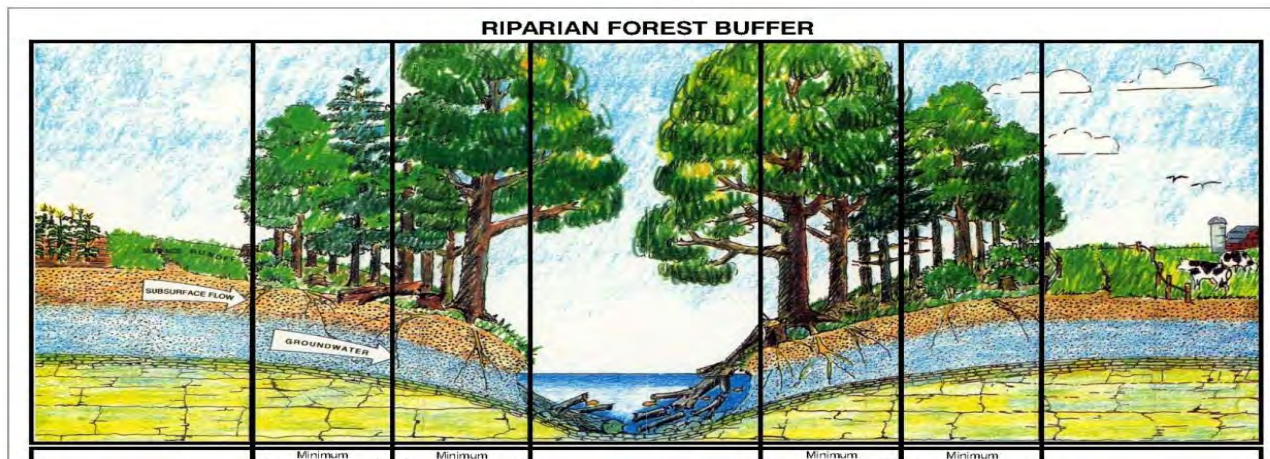
Source: <https://westcog.org/wp-content/uploads/2021/08/WestCOG-Riparian-Protections-and-Zoning-Strategies.pdf>



Maintains / Improves Water Quality

- Reduces suspended solids in rivers
- Traps nutrients from runoff into root systems
- Increases tree canopy (shade) which reduces algae growth and keeps water cool

*Slow it down
Soak it in
Filter it out*





Captures Excess Nutrients and Reduces Pollution



*Slow it down
Soak it in
Filter it out*

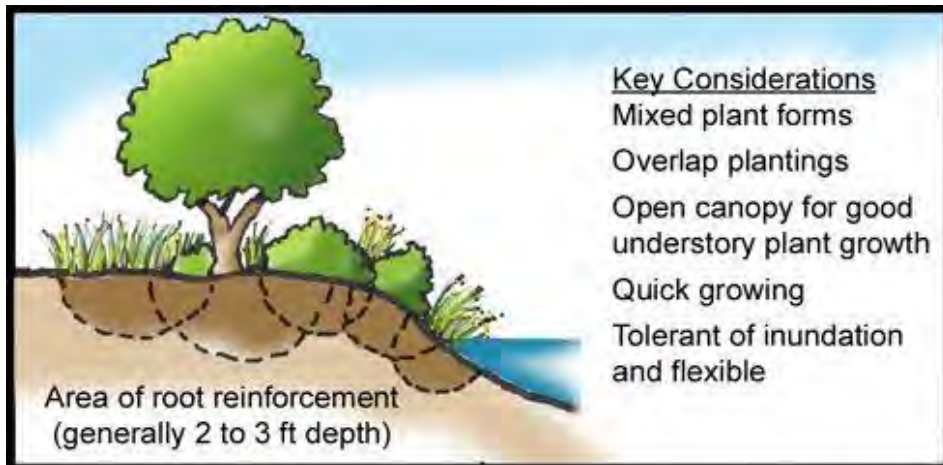
Item #	Buffer Zone			Reduction: 100 x (input-output)/input		
	Width (meters)	Width (Feet)	Plant Cover	Sediment %	Nitrogen %	Phosphorus %
1	4.6	15	Grass	61.0	4.0	28.5
2	9.2	30	Grass	74.6	22.7	24.2
3	19.0	62	Forest	89.8	74.3	70.0
4	23.6	77	Grass/Forest	96.0	75.3	78.5
5	28.2	93	Grass/Forest	97.4	80.1	77.2

Richard Lowrance, et al. , Water Quality Functions of Riparian Forest Buffer Systems in the Chesapeake Bay Watershed, August 1995



Bank Stabilization

- A combination of deep-rooted trees and herbaceous plants with fibrous root systems will help with surface erosion
- Planting to the active channel with inclusion of aquatic plants may help with undercutting



Combine plants with erosion controls





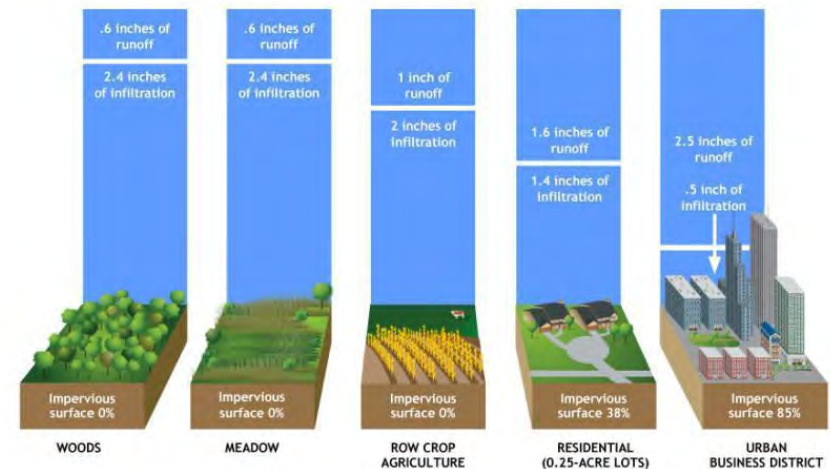
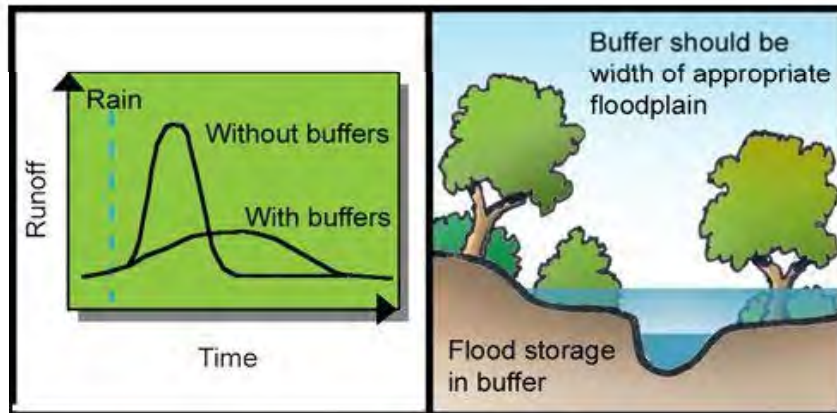
Flood Resiliency





Flood Resiliency

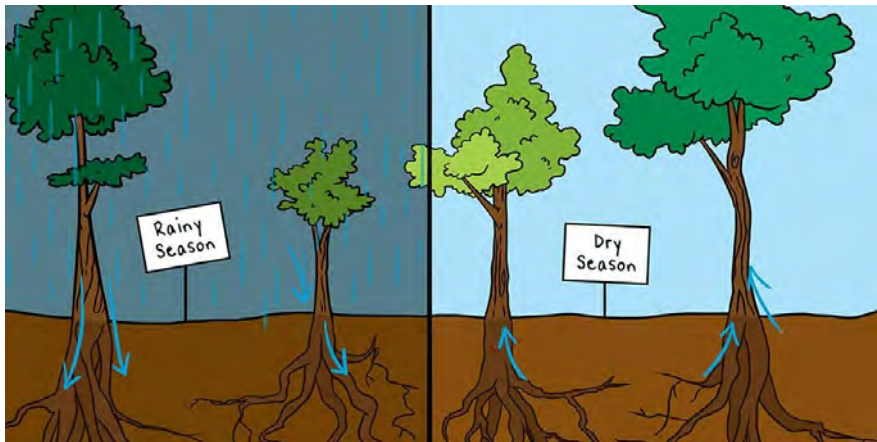
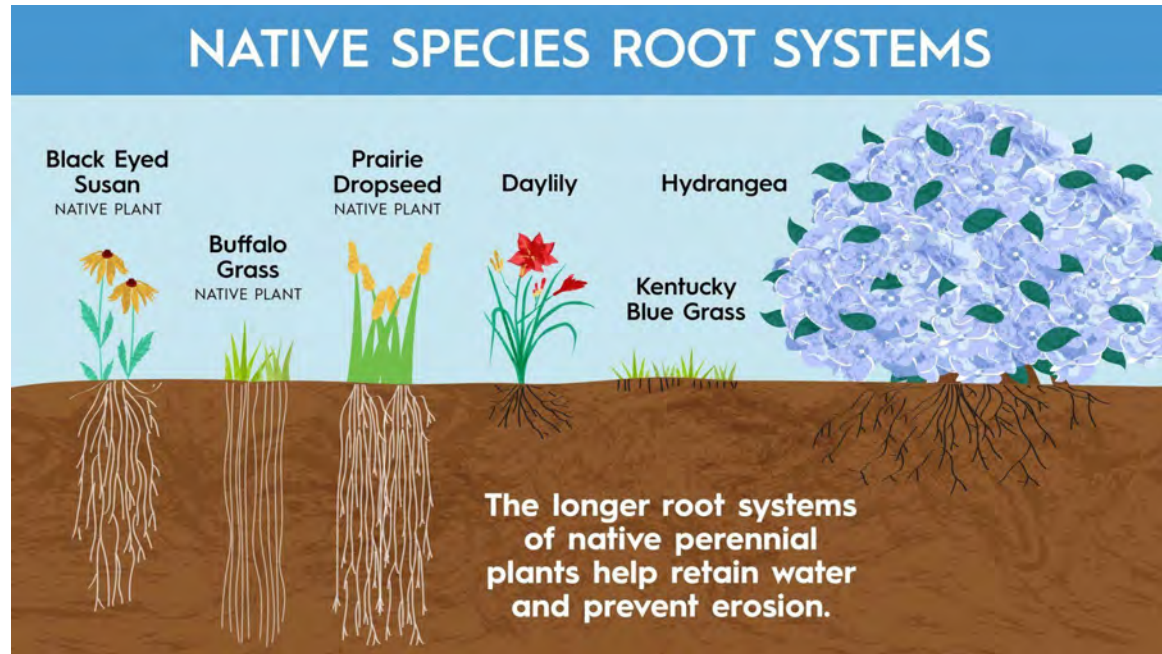
- Slows stormwater discharges
- Plants act as water storage
 - Reduces flooding through surface water drawdown into mature tree roots
- Deepens floodplain through deep root systems
 - Can hold more water in soil





Reduces Threat of Drought

- Root system creates a sponge-like network that helps absorb and retain water in soil during rain events
- Stored water flows underground to support streamflow during dry periods.





Provides Habitat/Shade and Recreation

Provides Shade and Habitat for both terrestrial and aquatic organisms

- Cools down stream temp
- Helps cool water species (eg. brown trout)



Recreation

- Scenic beauty
- Excellent water quality supports swimming, boating, fishing opportunities
- Tourist attraction for economy
- Reduces fragmented forests along river corridors to improve wildlife habitat

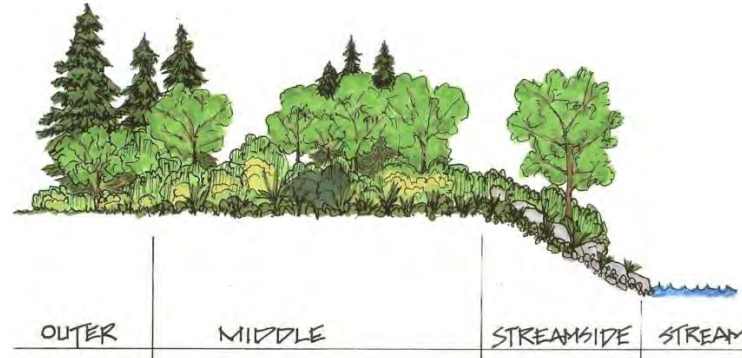




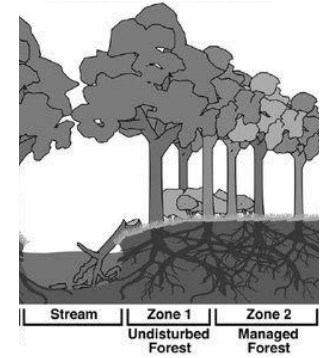
Types of Buffers



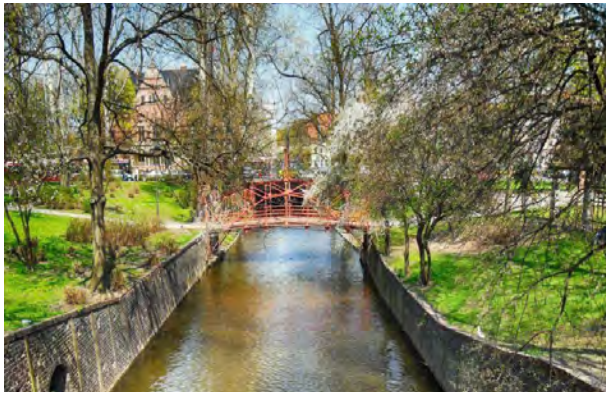
Grass



Three-Zone Forest



Two-Zone Forest



Urban



Naturalized



Wildlife



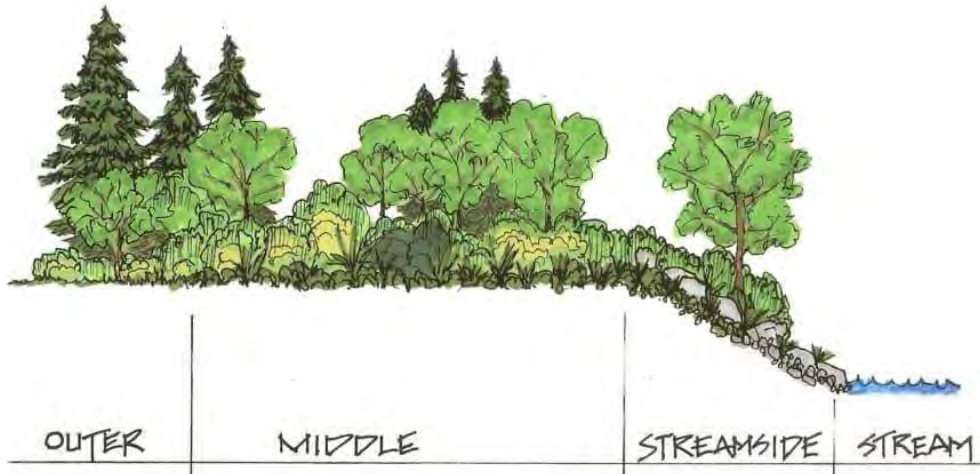
Grass Buffer

- Consists of grasses and wildflowers
- Best for small streams and drainage areas
- Most effective at filtering sediment
- May require maintenance to avoid invaders
- Good for maintaining a sightline to water





Three-Zone Forest Buffer



Zone 1 (Trees):

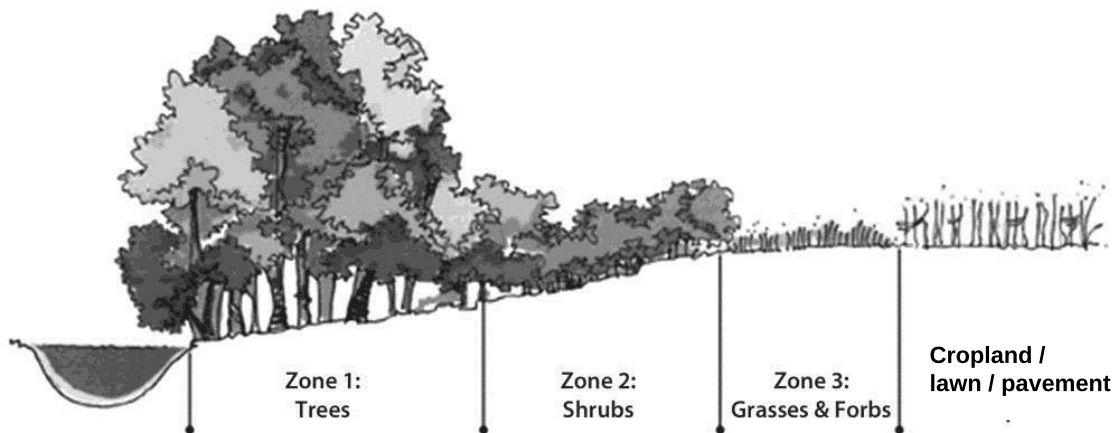
undisturbed trees/shrubs that provide shade, aquatic organism habitat, and bank stabilization

Zone 2 (Shrubs):

managed forest that filters sediment and absorbs nutrients

Zone 3 (Grasses):

grass buffer that slows down/spreads out runoff





Wildlife Buffer

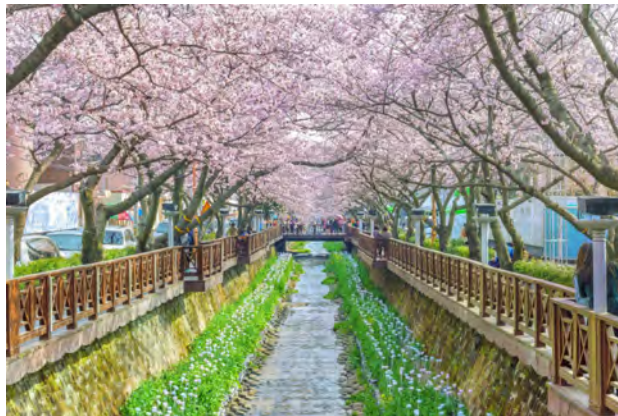
- Similar to 3-zone buffer
- Wider (~300 ft) to provide wildlife corridor
- Plants to aid wildlife food and shelter





Urban Buffer

- Larger plants
- Aesthetic appeal
- Withstand more human impact
- Greenway/recreational trail
- On site stormwater management





Naturalized

- Allow existing vegetation and incoming seeds to establish and grow
- Disperse with native shrubs and trees
- Relatively inexpensive





Scaling to Maximize Benefit

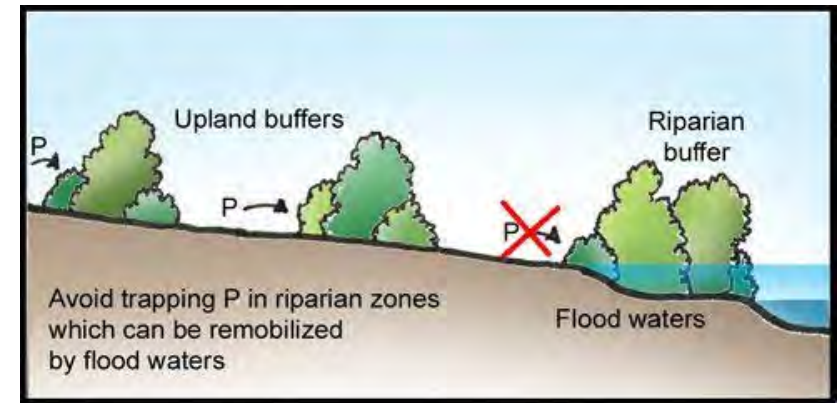
The Wider the Better

Erosion Control

- 10' min for bank stabilization
- 30-100 ft for most erosion

Water Quality

- Nitrogen and phosphorus can be retained in 16-164 ft
- Wider buffer = long-term storage
- Pesticide removal ranges from 49-328 ft
 - Manually sprayed pesticides is better
- Biocontaminants (eg. fecal coliform) require at least 30 ft





Scaling to Maximize Benefit

Aquatic Habitat

The Wider the Better

- Wildlife: minimum width ranges from 33-164 ft
- Leaf litter/debris input (provides energy for stream): range of 50-100 ft
- Stream temperature: ~30 ft, depends on size of channel

Terrestrial Habitat

- Widely varies, minimum is ~300 ft

Flood Control

- 65-500 ft to reduce flood peaks

👍 Rule of Thumb: Add about 2 ft per percent slope





Scaling to Maximize Benefit

Other factors to take into consideration:

- Soil type
- Hydrology
- Underground root systems
- Vegetation type
- Presence of woody debris

The Wider the Buffer the Greater the Benefits

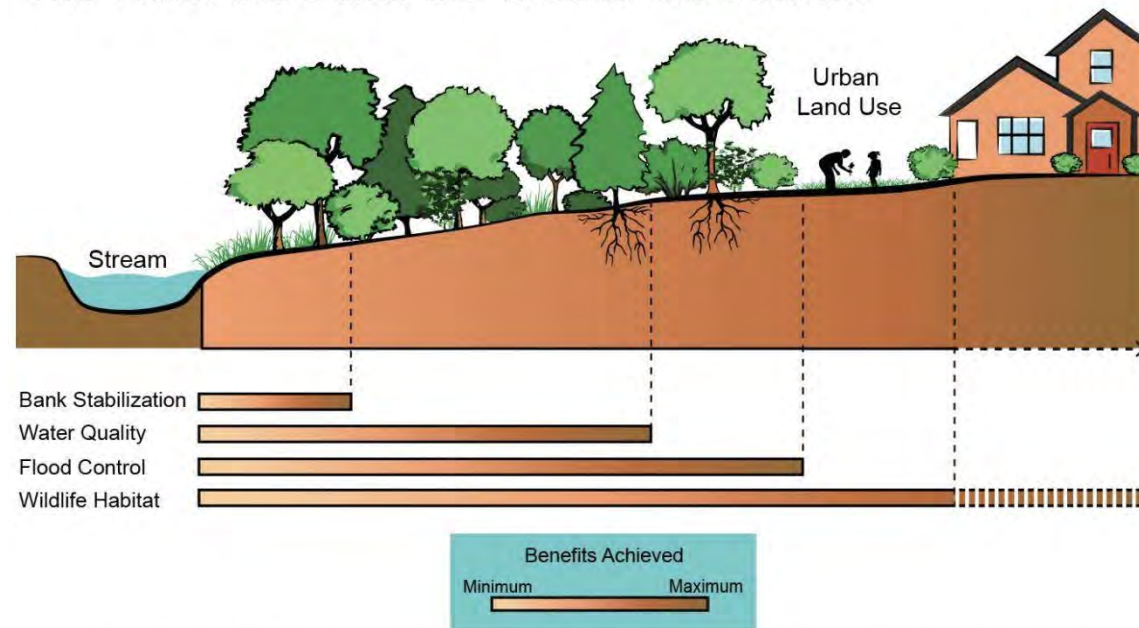


Figure 2. Relationship between riparian buffer width and its functions (adapted from Hawes and Smith, 2005). Distance of benefits varies due to site conditions such as slope.



70%

of all streambanks and shorelines should have forest buffers to maximize ecosystem resiliency and improve water quality



75-150 ft

Minimum buffer width to
achieve and sustain a full array
of water quality benefits

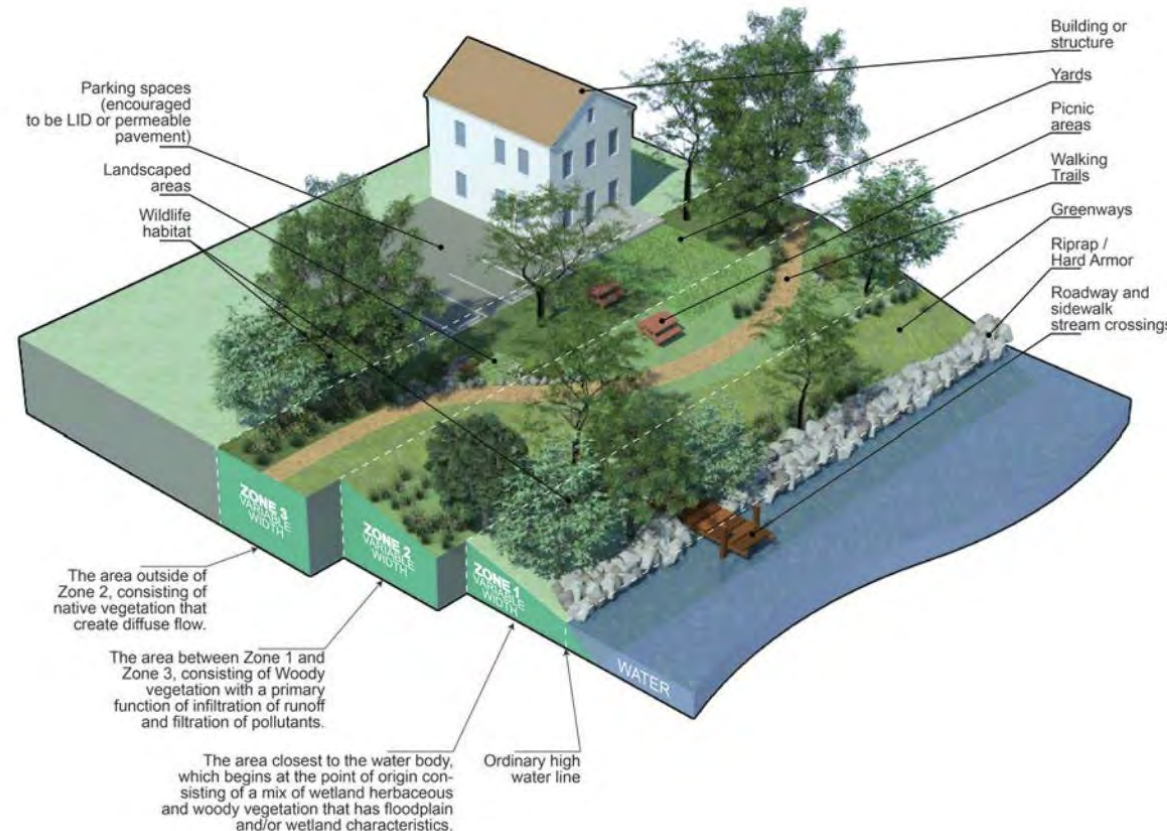


How to Design and Install Your Buffer

Tips:

- Decrease unnecessary impervious areas on property
- **NATIVE** plants based on soil texture, drainage, and moisture as well as sun exposure
- Free soil test at CT CAES New Haven/Windsor Lab
- Professional design & installation or DIY options
- Permits
 - Minimal activity permit
 - May need more erosion control when doing invasive plant removal

Figure 64-3-10.1 Riparian Buffer





What Plants Should I Use?

Table 1: Estimated reduction of nutrient loads from implementation of riparian buffers¹²

Buffer Type	Nitrogen	Phosphorus	Sediment
Forested	48-74%	36-70%	70-90%
Vegetated Filter Strips	4-70%	24-85%	53-97%
Forested and Vegetated Filter Strips	75-95%	73-79%	92-96%

Source: Delaware Department of Natural Resources and Environmental Control



Choose native!

CT's state flower ~ Mountain Laurel

Table 2: Plant type vs. removal efficiency

Function	Grass	Shrubs	Trees
Sediment trapping	High	Medium	Low
Filtration of Sediment born Nutrients, Microbe and Pesticides	High	Low	Low
Soluble forms of Nutrients and Pesticides	Medium	Low	Medium
Flood Conveyance	High	Low	Low
Reduce Stream Bank Erosion	Medium	High	High

Source: Jontos 2004 (modified after Fisher and Fischenich 2000)



Personalize Your Buffer

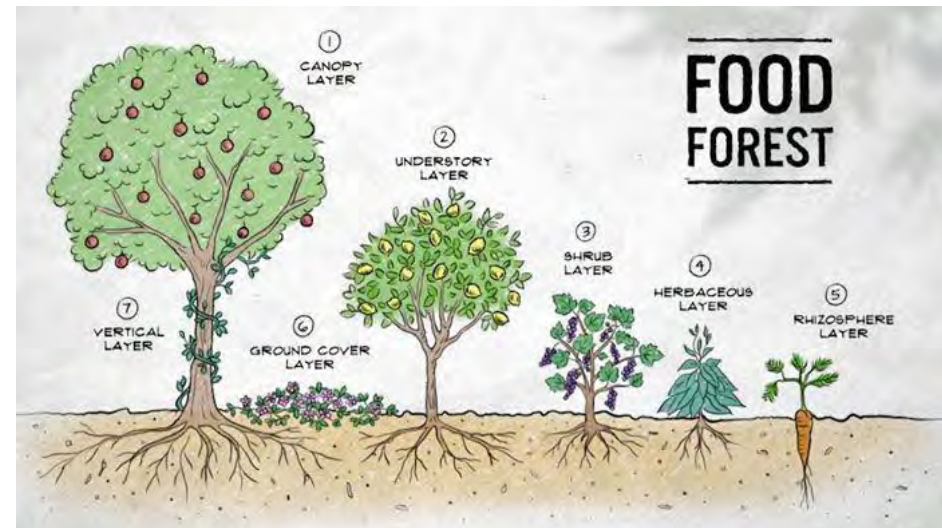
What do you want out of your buffer?

- Consider blooming times for aesthetic value
- Edible plants (try a food forest!)
- Attracting birds/other wildlife
- Erosion control/Flood resiliency
- Runoff absorption
- ... and more!



Elderberry: a native shrub with loads of antioxidants!

Absorb applied garden/lawn products!





I am a ... what can I do?

Landowner/ Business owner with water access

- Plant buffer on property
- tell people about your project

Renter with water access

- Communicate with landlord about enhanced property benefits

Landowner without access

- Tell friends/family/neighbors with water access
- Advocate
- Spearhead town projects
- Organize volunteers

Town employee/ serve on a commission

- Assess the town for most critical areas
- Allocate funding for planting projects

Conservationist

- Work with your organization to plan projects
- Focus on critical areas

Farmer

- Maintain livestock fencing
- Maintain buffers
- Manure & nutrient management





Technical Assistance from NRCS

Site Visits

- Interests & constraints
- Identify site specific BMPs
- Estimate costs, and steps for implementation
- Farmers and private landowners/managers

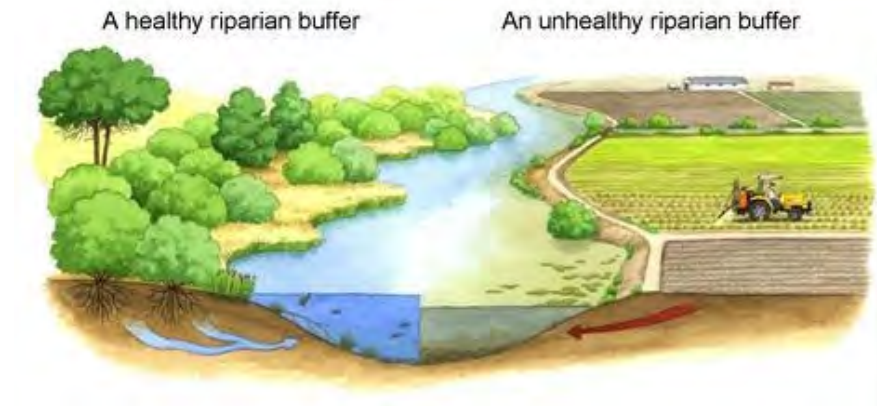




Funding for Weekepeemee Projects

Let's Collaborate!

- \$40,000 riparian buffer along the Weekepeemee River
- install or enhance livestock fencing
- Goal - Enhance buffer widths along 2000 feet of the Weekepeemee River
- Reach out if you might be interested in partnering!

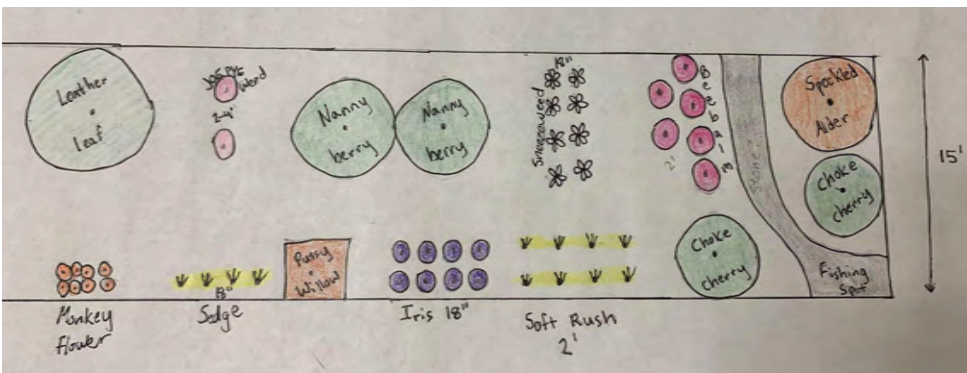




Model Buffer Planting: Lake Stibbs



- 24 plant species
- Over 400 plants
- 350'x15'
- Goals:
 - Reduce geese on lawn
 - Reduce water chestnut population





Model Buffer Planting: Cedarland Park

CEDARLAND PARK BUFFER RESTORATION PROJECT



In 2013, PRWC's Stream Committee identified Cedarland Park as an ideal location for creating a model riparian buffer. The overall project focuses on invasive plant removal and replanting the river and stream banks with native vegetation. These vegetated buffers serve to absorb and slow the flow of rising water during flood conditions, reduce stream bank erosion, provide shade for the river, and provide food and habitat for wildlife. Over the course of three years, volunteers helped establish a native buffer along the stream flowing through the park. In 2016, the buffer along the Pomperaug River was also restored using native plant species.



Visitors to the park will also find safe river access in the form of stone steps that minimize streambank erosion at the existing access points that are heavily used. The vegetation along the bank between the steps was also thinned of the invasive plants and replaced with native plant species.



HELP PROTECT OUR STREAMS!

Volunteers are needed for annual maintenance.
If you are interested, contact PRWC at:

203-263-0076
outreach@pomperaug.org

Thank you!



Questions?

For more information visit www.pomperaug.org/
or email us at outreach@pomperaug.org

