



Monday March 30, 2026

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UAPP 411/611

# CLEAR

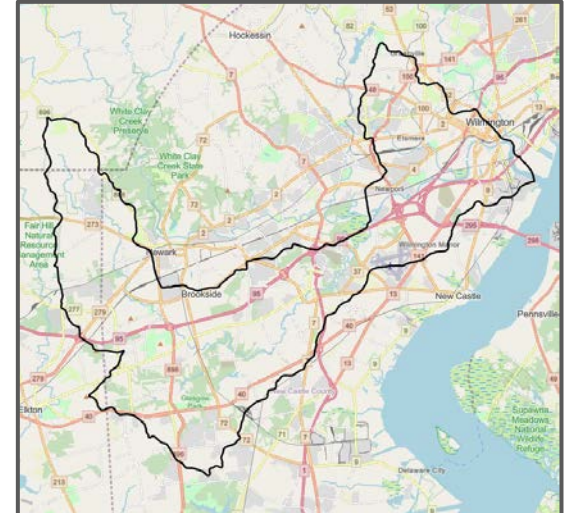
## Christiana Land, Ecosystem, and Aquatic Restoration

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# Outline

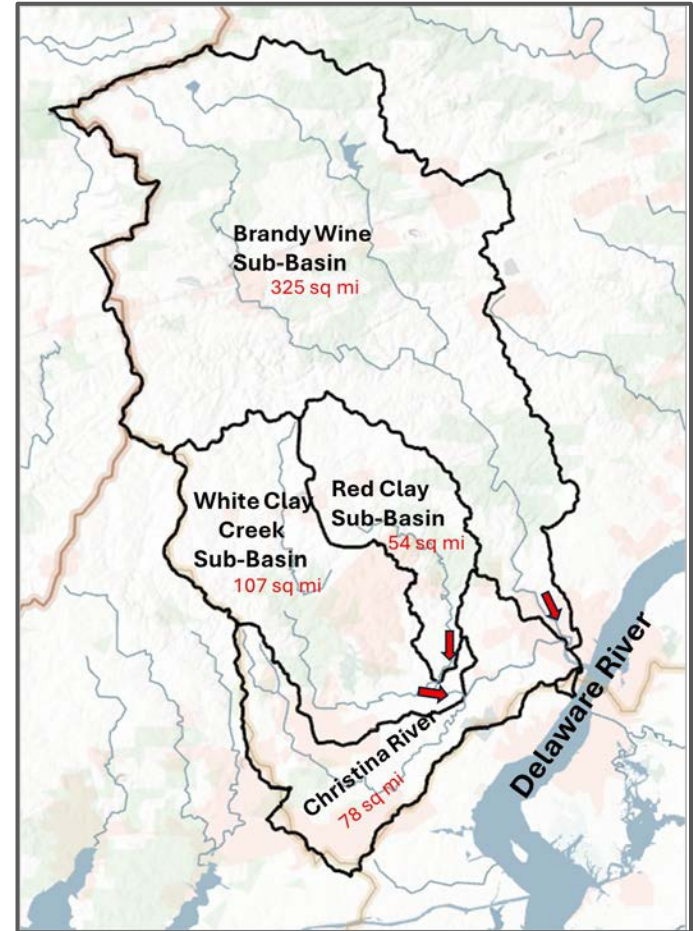
- Background Information
- History and General Problems
- Mission Statement
- Current Policies, Mandates, and Governing Bodies
- Specific Problems and Solutions
  - Problem 1: Bacteria Concentration
  - Problem 2: Stormwater Runoff
  - Problem 3: Habitat Loss
- Key Takeaways
- Questions
- Sources



# Background Information

## Area of Interest: Christina River Watershed

- Extends into Pennsylvania and Maryland, but Primarily located in **Northern Delaware**
- Part of the larger Christina Basin
- Encompasses **78 square miles**
- Christina River and Brandywine Creek are home to **8,400 registered boats** used by Delaware's mariners.
- 15% of the water is used for **agriculture**



# History and General Problems

## Water quality is impaired in the Christina River....

- Frequently, **concentrations of bacteria** exceed safe swimmable standards
- Urbanization is causing habitat loss and an increase in urban runoff due to the high proportion of **impervious surfaces**.
  - Impervious surface cover is generally considered **impacted at 10%** or higher within a watershed.
- Christina River has been adversely affected by industrial point-source chemical pollution
  - **Fish consumption advisories** have been issued due to concerning levels of PCBs found in fish tissue
  - DNREC is *currently addressing this issue*.



Wilmington Riverwalk



Atlantic Striped Bass

# Mission Statement

The mission of CLEAR is to **evaluate ongoing damage to the Christina River watershed** and provide specific recommendations for remediation strategies that **build upon existing cleanup efforts.**

Considering the quality of the watershed is impaired, our suggestions will help to facilitate cleanup and **restoration of the watershed and surrounding ecosystem.**

The project timeline is set for **15 years.** By 2041 the suggestions outlined by CLEAR should be fully implemented.



Christina Bike Bridge

# Current Policies, Mandates, and Governing Bodies

## Legislation, Agreements, and Projects:

- NPDES permits for discharging high nutrient wastewater in the Christina Basin
- Christina Basin Clean Water Partnership
  - UD Water Resources Center coordinates for the state of Delaware
- Christina-Brandywine River Remediation Restoration and Resilience (CBR4) Project

## Federal, State, and Local Agencies:

- Federal: Environmental Protection Agency (EPA)
- State: Delaware Department of Natural Resources and Environmental Control (DNREC)
- Local Stewards: Christina Conservancy, University of Delaware Water Resources Center



# Problem #1: Increasing Bacteria Concentrations

Concentration of enterococcus bacteria **frequently exceed safe limits** for recreation.

EPA mandates that a single sample of river water must **not exceed 100 colony forming units (CFU)** per 100 mL.

Common sources of bacteria include...

- **Leaky septic systems**
- Pet waste
- Runoff
- Combined sewer overflows

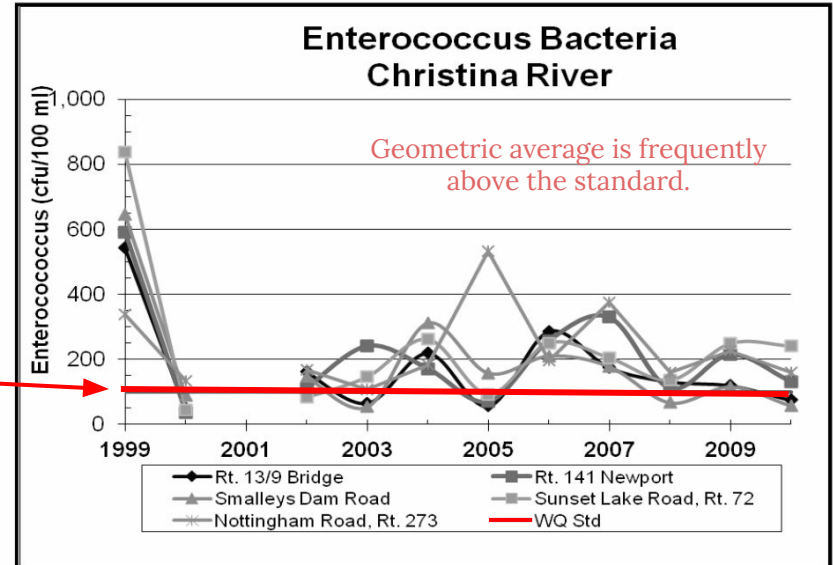


Figure 3.16: Geometric Mean Enterococcus Bacteria in the Christina River Watershed. Taken from Christina Basin Watershed Plan (August 2012).

# Solution to Problem #1: Homeowner Education



Example postcard from the [EPA's SepticSmart](https://www.epa.gov/septic) education program

Many septic systems malfunction because of **improper maintenance**.

We recommend sending out **informational postcards** to Christina River Watershed **residents with septic systems**.

The EPA has a “SepticSmart” system with pre-filled informational postcards and flyers **reminding residents** to keep up with septic maintenance.

## Problem #2: Stormwater Runoff

39% of non tidal streams in the Piedmont have poor habitat due to **increased frequency** and rate of **runoff from urban/suburban development**.

High amounts of impervious cover [such as asphalt], and total suspended solids (TSS) generally correspond to impaired stream water quality and habitat. (UDWRC, 2003)

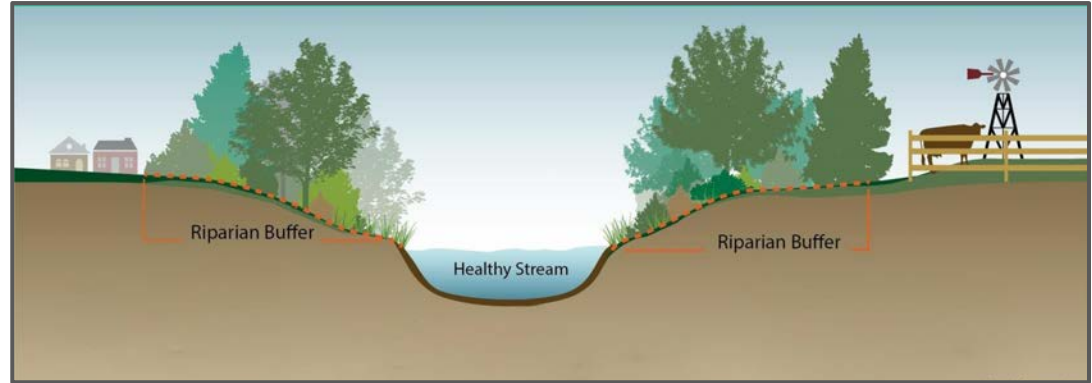
**Total Suspended Solids (TSS)** → Discrete sediment present in the water from soil erosion and stormwater runoff.



# Solutions to Problem #2: Implement Stormwater Treatment Practices and Reduce Impervious Surface

**Improve Riparian Buffers,** vegetated areas adjacent to water bodies like streams, lakes, and wetlands.

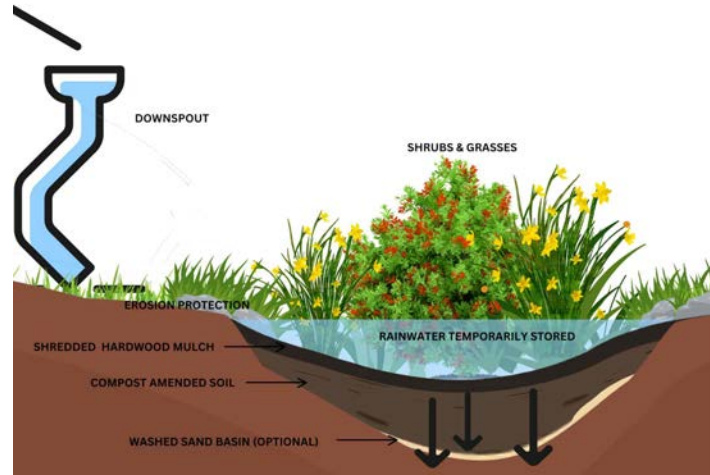
- Protect water quality
- Stabilize banks
- **Filter sediment and pollutants from runoff**



Agreements with state parks and land owners, applying for funding, landscape architect → Purchasing native species, planting them, working with volunteers

# Solutions to Problem #2: Implement Stormwater Treatment Practices and Reduce Impervious Surface

Best management practices (BMPs) for stormwater treatment may include the use of **bioswales** and **natural drainage paths**, along with **rain gardens** and other methods to slow infiltration.



By mimicking the natural absorption and pollutant removal abilities of a forest or meadow, **rain gardens can absorb runoff more efficiently** – as much as 30% - 40% more than a standard lawn.

# Problem #3: Habitat Loss and Degradation

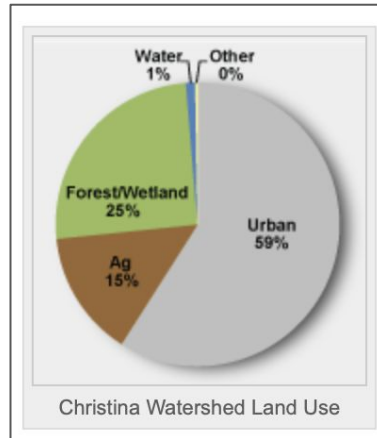
59% of the Christina River watershed is classified as **urban land use**.

Almost half of the naturally occurring wetlands in the Christina watershed have been **eliminated due to development**.

About 1,000 acres of tidal wetlands were **destroyed during the construction of I-95**.



Wetlands in Wilmington, DE



# Solutions to Problem #3: Protect Existing Space and Restore Habitats

## Land **Conservation**

- Easements, Parks
- Critical Habitat Districts
- Preservation of Open space
- Better Site Design



# Solutions to Problem #3: Protect Existing Space and Restore Habitats

## Habitat **Restoration**

- Reforestation
- Wetland Restoration



## Homeowner Programming and **Education**

- Backyard Habitats
- Native Plants



# Key Takeaways

- Point sources impacting the Christina River are largely being addressed through regulatory mechanisms.
- The diffuse, disparate impacts of **nonpoint source runoff and habitat loss** and degradation are the most difficult to address.
- **Homeowner education** and incentive programs regarding septic maintenance, pervious surfaces and native lawn techniques and habitat restoration **hold the highest promise.**





# Questions?

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