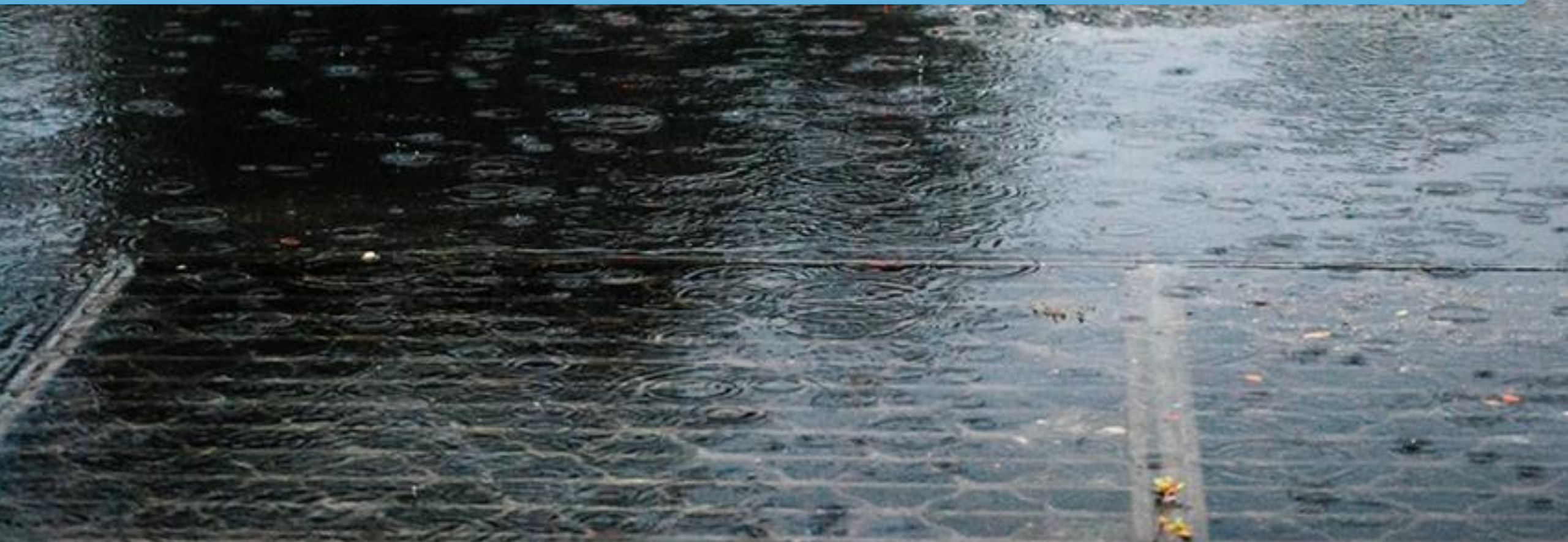
A Local Government Guide to the Chesapeake Bay

Module 6: Protecting Your Infrastructure Through Stormwater Resiliency



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***Please refer to individual slide notes for data references and information sources.**

A Guide For Local Governments

As a local leader, your decisions set the course for your community. Your actions determine the health and vitality of your jurisdiction, as well as that of your local waterways and the Chesapeake Bay. You can achieve win-win outcomes by prioritizing local economic development, infrastructure resiliency, public health, and education while also protecting your environment.

This module is one in a series created by the Chesapeake Bay Program to support and inform decision making by local officials. We encourage you to examine the full suite of modules:

1. How Your Watershed Works
2. Foundations of Clean Water
3. Healthy Water for the Economy
4. Capitalizing on the Benefits of Trees
5. Preserving Local Character and Landscapes
6. **Protecting Your Infrastructure Through Stormwater Resiliency**
7. Building the Workforce of Today *and* Tomorrow

To help local government representatives better understand how the information in the modules aligns with their priorities, look for these icons:

Economic Development

Public Health & Safety

Infrastructure Maintenance & Finance

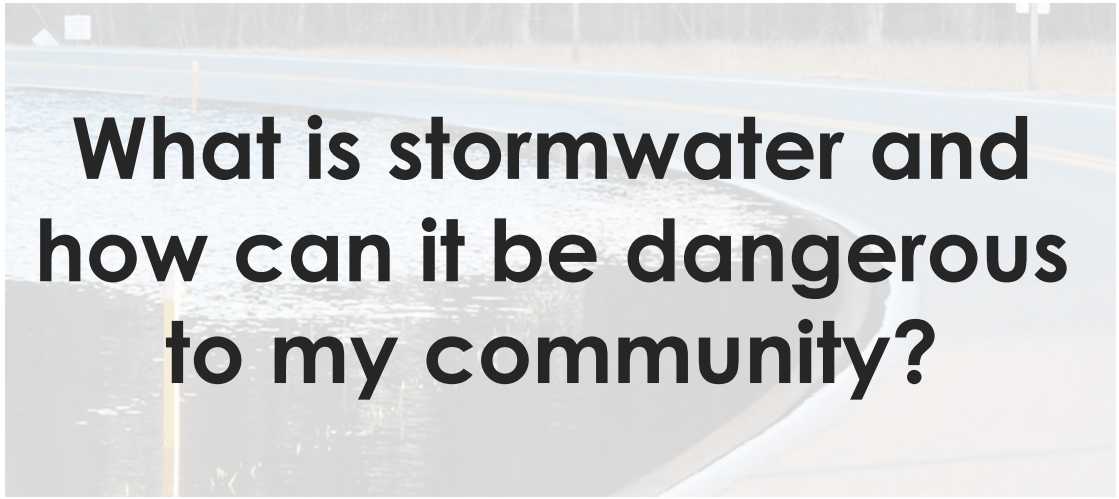
Education

Laying Foundations

Managing stormwater runoff and increasing resiliency can mitigate flooding and flood-related damages to local community infrastructure. In addition to hazard mitigation, increasing resiliency also improves water quality. Stormwater runoff can carry bacteria, nutrients, and other pollutants into local waterways used for water supplies, fishing, swimming, and other recreational activities, posing a public health threat.

Protecting Your Infrastructure Purpose

What You'll Learn



What is stormwater and how can it be dangerous to my community?

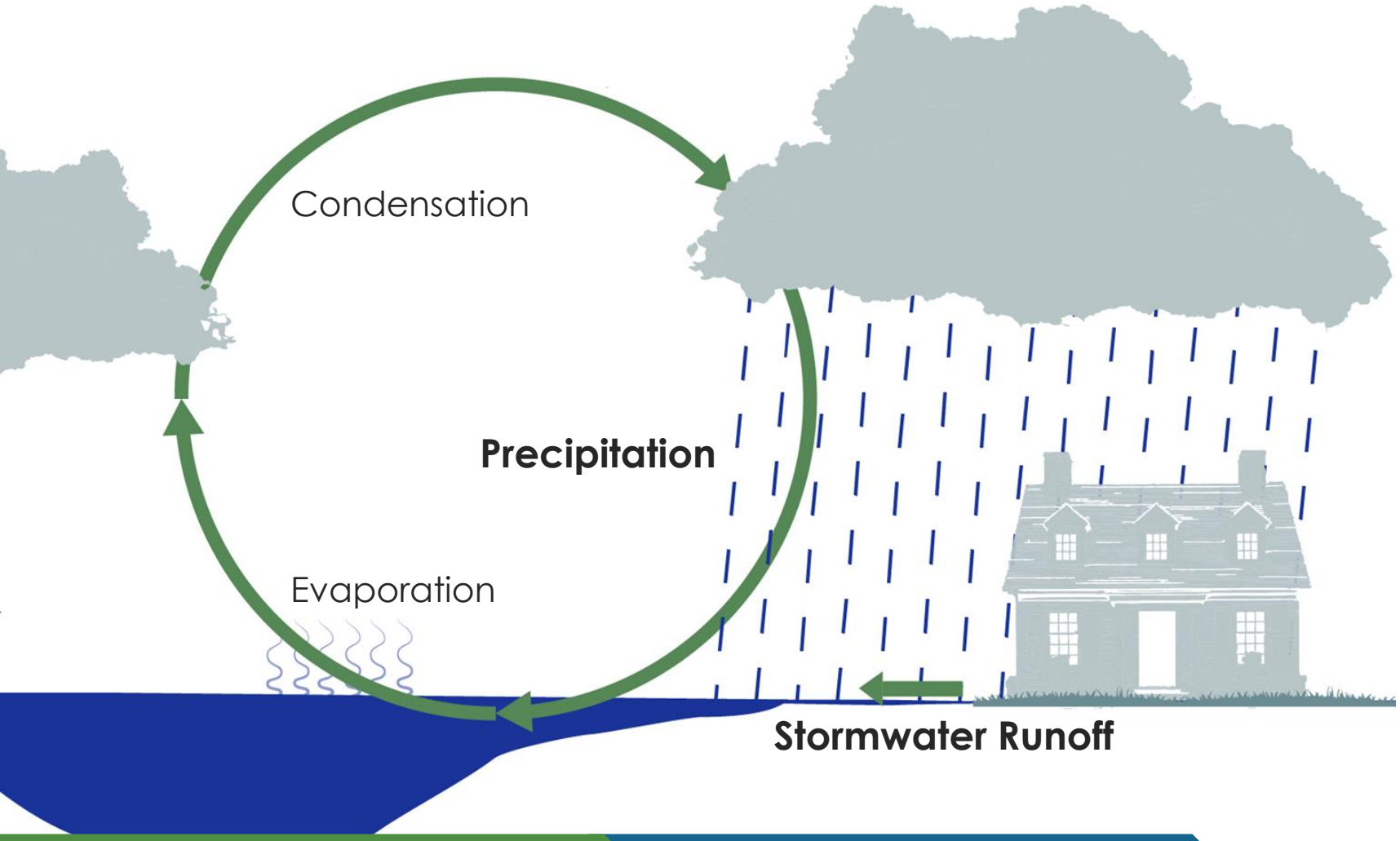
What can I do to mitigate flood-related damage?

How will future climate conditions impact infrastructure?

Understanding Stormwater

Rain and snow are natural phenomena. Let’s discuss how they turn into stormwater that impacts your community.

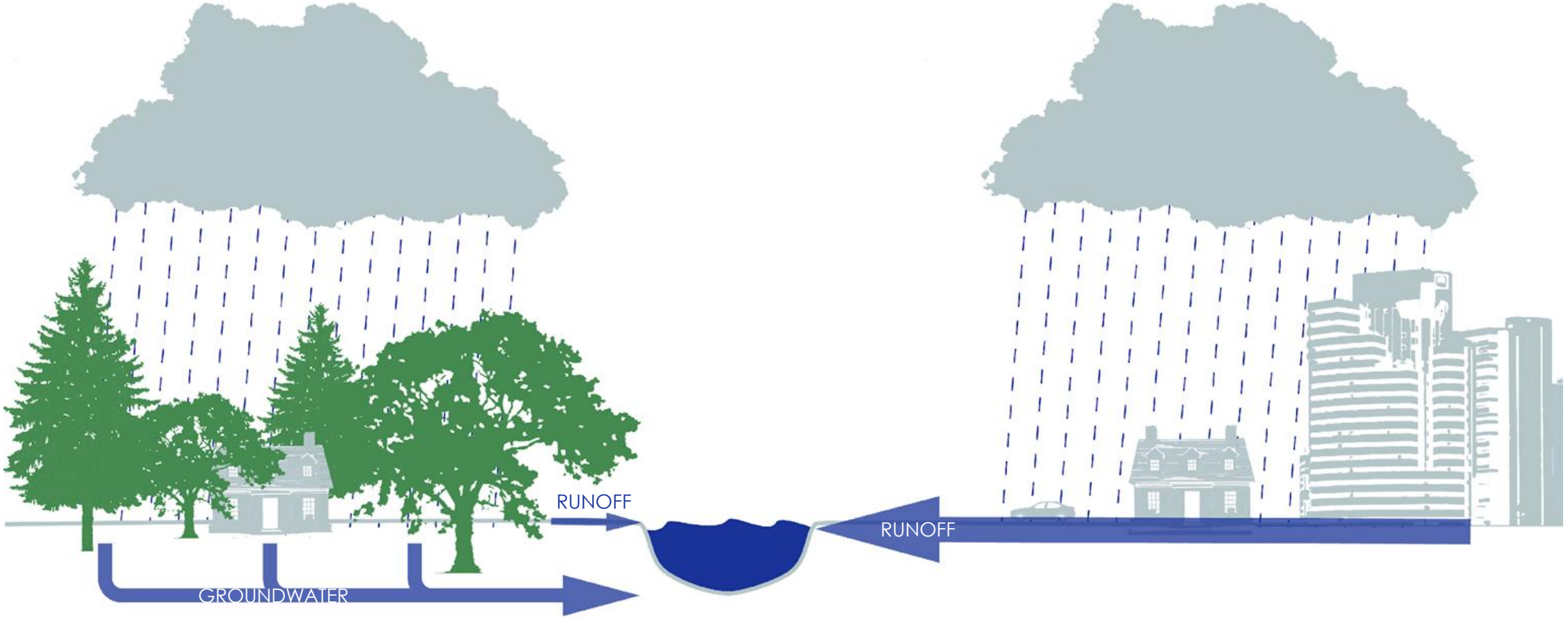
Understanding Stormwater



Stormwater is the water left over after a rainstorm or snowmelt. When we get precipitation, some of the water is absorbed into the ground. However, the water that flows down roads, across fields, out of gutters, and more is called stormwater, or runoff. Learn more through the Chesapeake Bay Program.

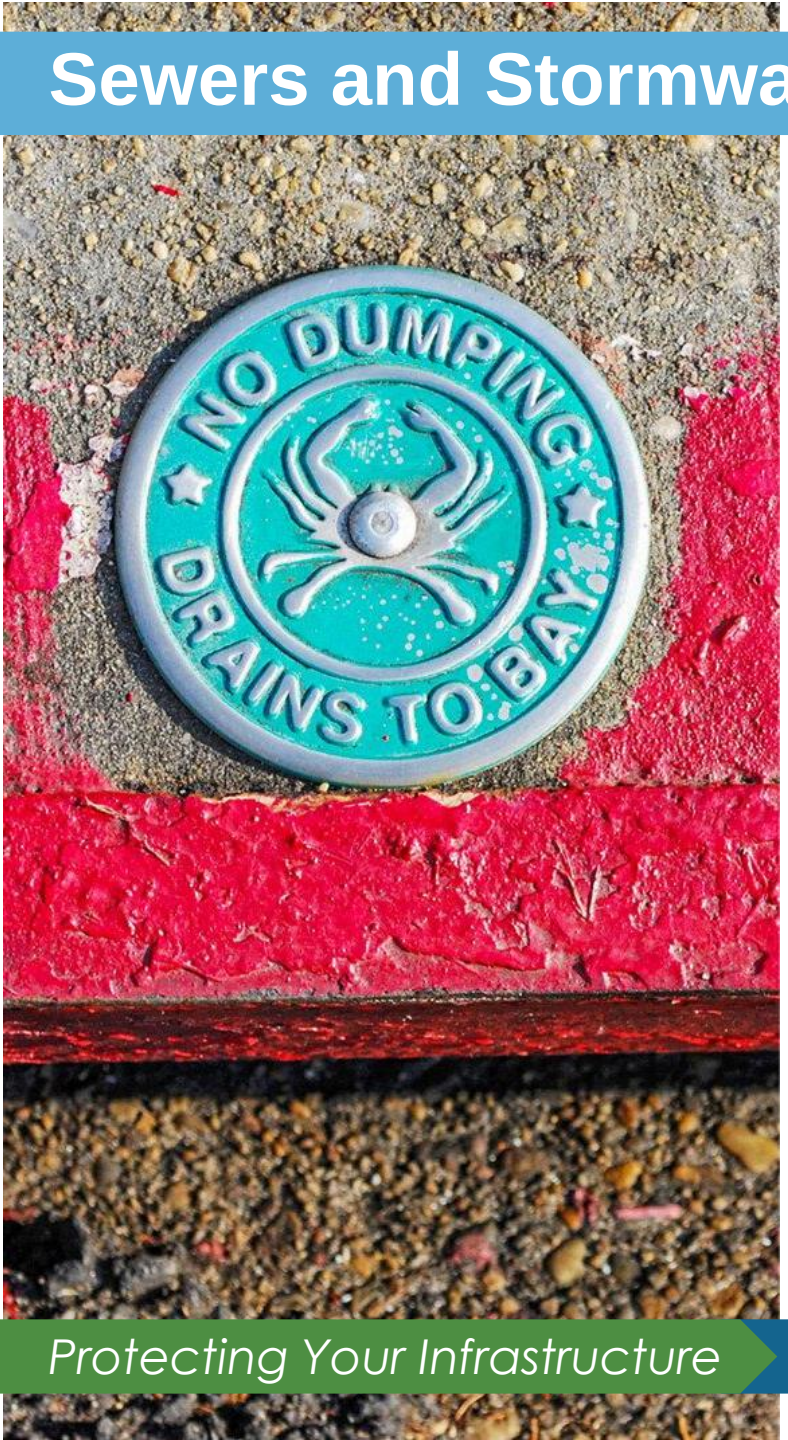
Understanding Stormwater

More impervious surfaces, or surfaces that prevent water absorption like roads and roofs, mean that less water is absorbed and more runoff flows through your community.



Nature provides cost-effective stormwater management. Forests, wetlands, and other natural landscapes absorb rainwater, where built systems lead to more runoff.

Sewers and Stormwater



In combined systems, the storm sewer system is connected to the sanitary sewer system. A **M**unicipal **S**eparate **S**torm **S**ewer **S**ystem (or MS4) gathers stormwater and discharges it, without treatment or combination with sanitary sewer systems, directly into local waterways. MS4 communities need a permit to discharge the untreated water, through the National Pollution Discharge Elimination System (NPDES). The permit limits what can be discharged and includes monitoring and reporting requirements to ensure sustained water quality and community health.

Only communities that the United States Census Bureau classifies as Urbanized Areas, based on population density, are required to become part of the MS4 program. Some large institutional campuses, such as colleges, hospitals, prisons and military installations, are also designated as MS4s. Other municipalities can choose to develop their own stormwater management programs.

What's At Stake?

Stormwater runoff can damage public infrastructure and private property through flooding and wash pollutants into local waterways.

Critical Infrastructure

Flooding can endanger critical infrastructure in your community, including roads, electricity, clean water, and cellular phones.

Roads

Roads are central to schools, businesses, and emergency services. Your community needs vehicles like school buses and ambulances to be able to reach residential areas.

Electricity

Water can damage the structures needed to get electricity to residences. In addition, electricity and standing water are a dangerous combination.

Clean Water

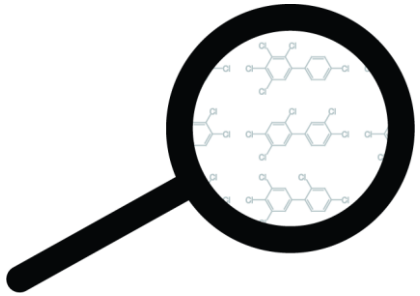
Excess stormwater can overwhelm sewer and stormwater systems and wash pollutants into local waterways and drinking water. These pollutants, including bacteria & nutrients, can endanger your community's health.

Cellular Networks

When electricity goes out, cellular towers must rely on batteries and/or generators, which may not outlast the power outage. Your community relies on cell phones to communicate, especially in emergency situations with no power/internet access.

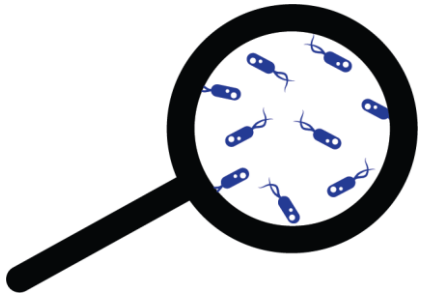
Public Health

Stormwater picks up litter and other pollutants from the land that it passes over. These pollutants include microplastics, bacteria, toxic contaminants, sediment, nutrients that fuel algae, and more. This water gets discharged directly into local waterways without treatment.



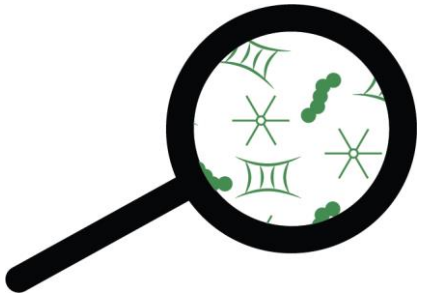
TOXIC CONTAMINANTS

including pesticides, pharmaceuticals, heavy metals and more, and can harm human health and wildlife.



BACTERIA

from sewage, wildlife and pet waste, and/or dead and decaying animals pose a threat to human and aquatic health.



ALGAE

use nutrients to grow. Excess nutrients can fuel excess algae in water bodies. When the algae die and decay, they use up oxygen and can cause fish kills. Additionally, some algae produce toxins that can harm humans and animals.

Pollution can make recreation in, on, or near water unsafe. Fish and shellfish can become unsafe to harvest and eat. Stormwater runoff can also threaten drinking water in your community or downstream.

Public Health

Detecting public health threats like bacteria in local water is normally the work of public works departments. However, community partners and volunteers can also play a role.

Case study: Henrico County, VA

Chesapeake Monitoring Cooperative (CMC) participants found high levels of *E. coli* bacteria in a local waterway. They and their partners at the local Soil and Water Conservation District asked the Public Works Department (PWD) & Department of Public Utilities if there were broken sewer lines upstream. None were found; geese and other wildlife were suggested as the source of the bacteria.

The next spring, the monitors once again discovered high levels of bacteria. They contacted the local government departments a second time and the PWD was able to track the pollution source to a local pet daycare center that was improperly disposing of pet waste. Public Utilities worked with kennel management to educate employees and establish waste disposal techniques to eliminate this clean water threat.

Protecting Your Infrastructure | What's At Stake?

The CMC works with hundreds of volunteer & citizen science groups to provide easy-to-use, quality data throughout the watershed. Check for data in your area here.

The Economy

Flooding harms businesses and private property. It also threatens the health of local waterways, which often support outdoor recreation and tourism.

Case study: Pennsylvania

Pennsylvania's Emergency Management Agency documented over $160 million in public infrastructure damages during 2018, but only around $60 million was covered by federal disaster aid due to each of the many storms not meeting federal disaster threshold criteria on their own. The remaining $100 million in damage had to be absorbed by municipalities, counties and state agencies.

A benefit-cost analysis of natural hazard mitigation found that **every $1 invested in proactive mitigation steps saves $7** in emergency response and recovery costs in the future.

Outdoor recreation relies on healthy waterways and safe access. Annually, the US outdoor recreation economy provides:

$887 BILLION
in consumer spending

7.6 MILLION
American jobs

$125 BILLION
in federal, state & local taxes

Education

Excess stormwater runoff can cause missed school days during extended closures caused by flooded or damaged school buildings, but it can also impact education through disrupted bus routes, lack of internet access for schoolwork, and other infrastructural impacts.

While only **2%** of Mid-Atlantic schools are in a flood zone, **10%** of Mid-Atlantic students' ZIP codes are in a flood zone. This means that even if a school building is not impacted by flooding, students may not be able to attend school because of flooding at or near their homes.

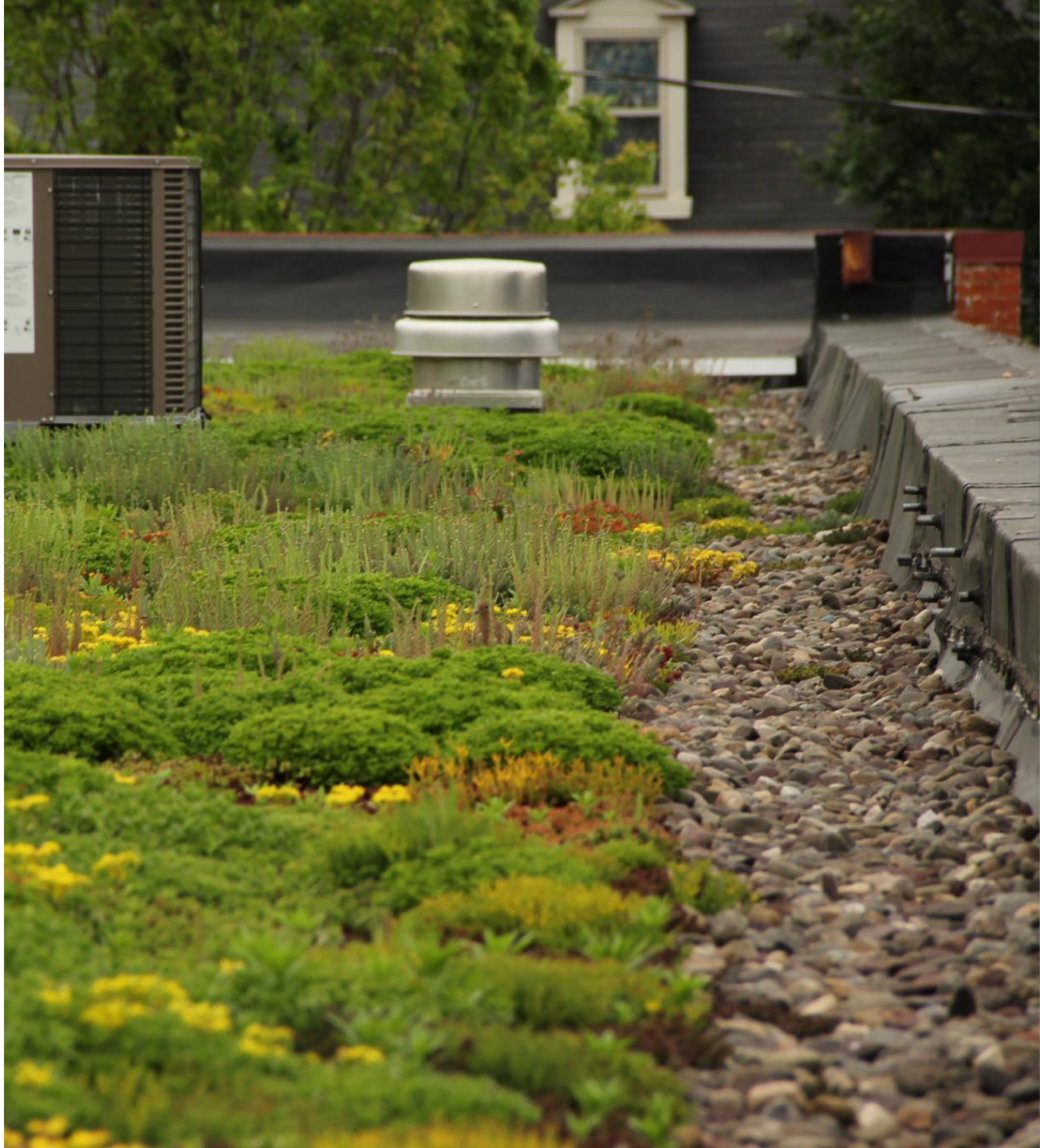
Diversity, Equity, Inclusion, and Justice

While flooding affects a wide range of demographics, it is most harmful to communities of color, low-income residents, and others who do not have the resources to handle the damage and disruption that flooding causes.

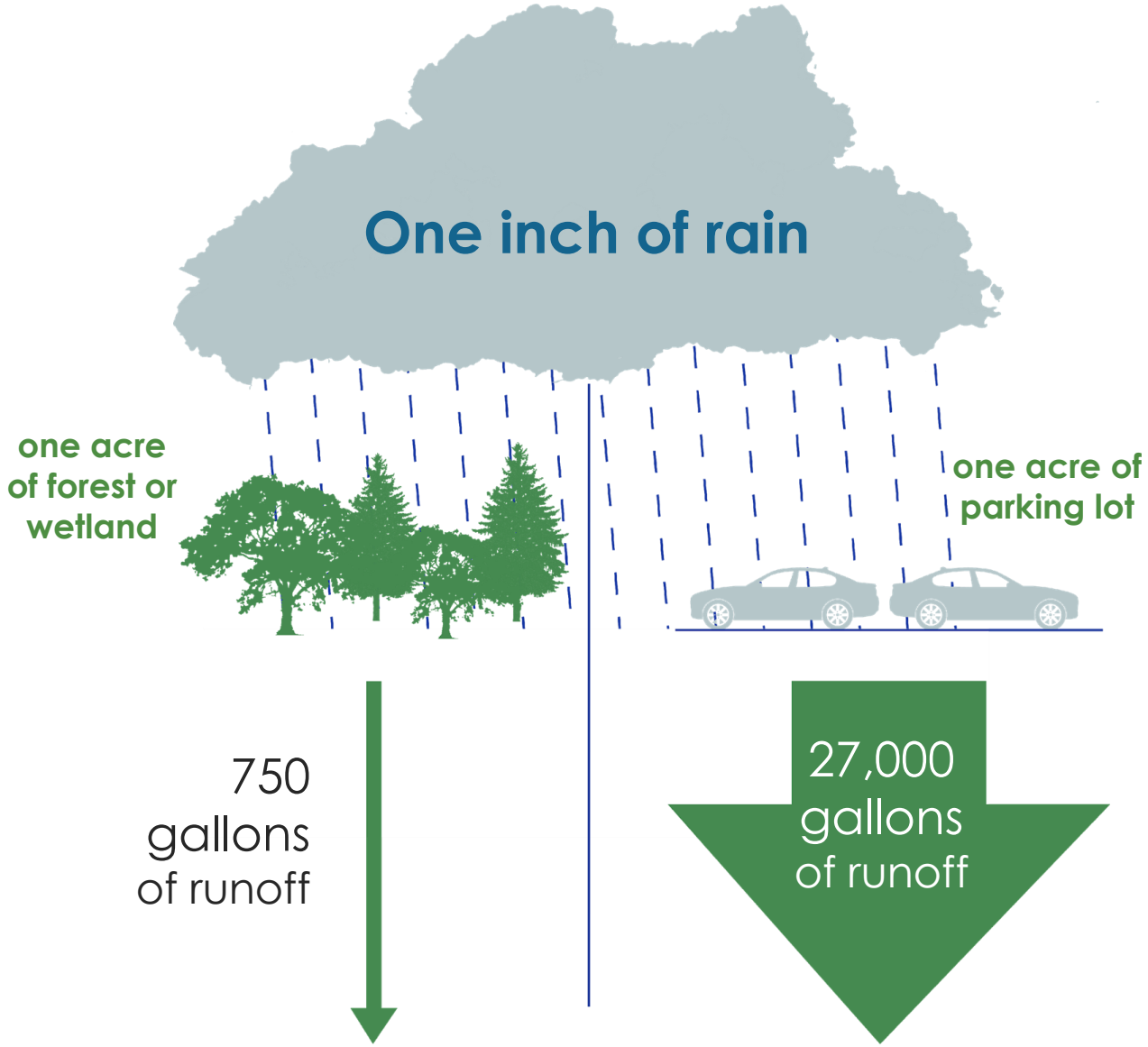
Flooding in the U.S. disproportionately harms African American neighborhoods based on an analysis of federal flood insurance payments. Those without flood insurance are not included in those numbers.

Stormwater Resiliency

Let’s talk best practices and tools to increase your community’s resiliency.



Natural Landscapes



Natural landscapes, like forests and wetlands (see next slide), reduce the amount of runoff that your community experiences. As your community develops and more parking lots, roofs, and roads are built, keep in mind that losing natural landscapes and increasing impervious surfaces have negative impacts on stormwater resilience. Make a plan to mitigate these increases in stormwater to keep your community resilient.

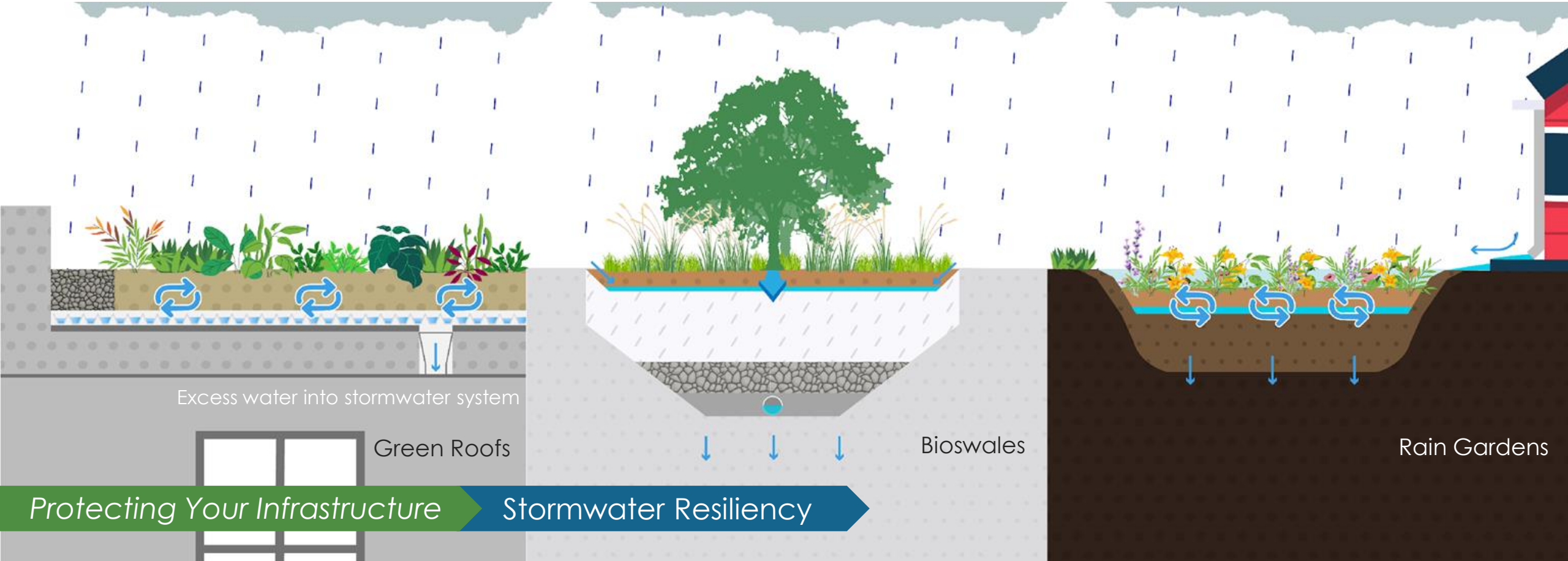
Wetlands

Wetlands are nature's flood insurance. Wetlands capture, filter, hold, and slowly release runoff, like a giant sponge, and can prevent damage to the surrounding infrastructure. By slowing runoff entering rivers and streams, wetlands also slow the erosion of shorelines.

In MD, wetlands reduced property damages from Hurricane Sandy by nearly 30%

Green Infrastructure

Green infrastructure uses natural processes and technology inspired by nature to reduce runoff flows. It often has lower capital costs and public expenditures than traditional grey infrastructure. Green-gray approaches that incorporate some green practices into existing gray infrastructure can save money as well. Lastly, green infrastructure improves community aesthetics. Examples of green infrastructure include:



Sustainable Schools

Schools, including those that are stand-alone MS4s, provide opportunities for the installation of best management practices (known as BMPs) while providing learning opportunities for students.

Learn about sustainable school resources in your jurisdiction:

Case study: Clear Spring, MD

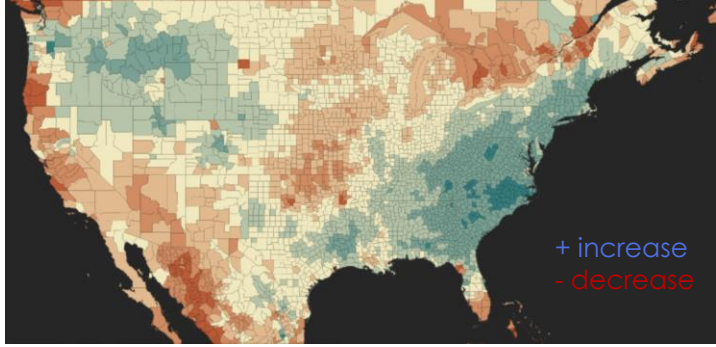
The Claud E. Kitchens Outdoor School was experiencing flooding on their front lawn, driveway, and at the building entrance that caused dangerous ice in the winter. A $10,000 under-road culvert was proposed as a solution.

Instead, the school used a **$5,000 grant** from the National Fish & Wildlife Foundation and Chesapeake Bay Trust to educate teachers about stormwater runoff and a rain garden was installed. The rain garden not only diverts runoff from **90%** of all rain events, but also serves as an outdoor teaching tool.

Planning for the Future

Precipitation patterns and water levels are expected to shift in the coming years. Is your community ready?

Planning for More Rain



Use this interactive map to find your county's projected precipitation.

The National Oceanic and Atmospheric Administration (NOAA) expects extreme precipitation events to continue becoming more frequent. The increase in stormwater will likely overwhelm the capacity of current municipal stormwater management systems, leading to flooding and greater runoff of pollutants into local waterways. Adapting may mean building back differently after flood damage, not replacing the same culvert or pipe that failed.

Case study: Binghamton, NY

After record-breaking floods in 2005 and 2011 that caused $675 million in property damages, Binghamton set its sights on flood resiliency. Over 170 flood-mitigation projects are in motion with funding from federal agencies (like FEMA), community development block grants, municipalities, and school districts. The projects include:

- buying out homes in floodplains and replacing them with open spaces like parks, greenways, and an urban garden;
- building new, flood-resistant buildings, like the stilted school with rain gardens and bioswales pictured on the left; and
- elevating essential infrastructure, like sewage treatment pumps.

Planning for Higher Waters

Sea level rise is likely to worsen existing flooding issues because of increased stress on stormwater systems and tidal flooding. Sunny day flooding (or high-tide or nuisance flooding) is accelerating on the East Coast, with VA and MD being home to **6 of the 19** locations nationwide seeing record-setting flood days in 2019. See how your community would fare under various sea level rise scenarios with an interactive map by NOAA.

Case study: Norfolk, VA

Norfolk, VA adopted a zoning ordinance in 2018 that directs new and more intense development to be built on higher ground to mitigate flooding and sea level rise. It establishes a Coastal Resilience Overlay zone where development will have new flood resilience requirements, and an Upland Resilience Overlay designed to encourage new development in areas of the city with lower risk of flooding.

Case study: Annapolis, MD

In 2017, sunny day flooding was estimated to cost Annapolis businesses $86,000-172,000 in lost revenue due to nearly 3,000 fewer visitors to historic downtown. Even after the waters receded, the decrease in patrons remained.

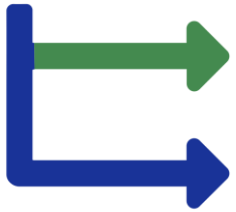
Learn about sunny day flooding in this short video from NASA:

Protecting Your Infrastructure | Planning for the Future

What You Can Do

Meet with your MS4 coordinator or stormwater engineer to discuss strategies, like implementing green infrastructure, to reduce strain on your stormwater management systems.

Protect and restore valuable wetlands and other natural landscapes that act as nature's flood insurance, filter stormwater, and protect your community's infrastructure.



Build flexibility and adaptability into your community's plans to allow for changes in design and construction, as well as maintenance of infrastructure, as conditions change.

To Learn More

Visit the Delaware Department of Natural Resources and Environmental Control website

- Naturally Resilient Communities
  - Includes case studies and funding information for nature-based solutions to flooding
- University of Maryland's Municipal Online Stormwater Training Center (MOST)
  - Online courses ranging from financing to construction and a library of resources, including case studies
- First Street Foundation
  - Information and research on flooding, plus search for flood risk in your community with Flood Factor
- Wetlands Watch
  - Resources on sea level rise, floodplain management, conservation landscaping, and citizen action
- EPA's Green Infrastructure Portal and Green Infrastructure Opportunities that Arise During Municipal Operations
  - Build, learn, and partnership resources, including a summary of the costs, benefits, planning steps, and options for green infrastructure projects
- Chesapeake Bay Program Stormwater Runoff
  - Primer on stormwater runoff and the Chesapeake Bay, including short 1:30 minute video
- Chesapeake Stormwater Network's Why Watersheds Matter
  - Listen to a webcast on watershed importance through Adobe Connect
- Chesapeake Bay Program Toxic Contaminants Workgroup
  - Latest information and products on toxic contaminant issues, including multi-lingual fish consumption communication products
- Chesapeake Bay Program's Planting Your Own Rain Garden
  - Learn and share this one-pager about rain gardens – what they are, what they do, and how to get started

Glossary

Visit the Delaware Department of Natural Resources and Environmental Control website

- Stormwater Runoff

  Precipitation that does not evaporate or soak into the ground but instead runs across the land and into the nearest waterway

- Impervious Surfaces

  Paved or hardened surfaces that do not allow water to pass through (e.g., roads, rooftops, sidewalks, pools, patios, and parking lots)

- MS4: Municipal Separate Storm Sewer System

  A collection of structures designed to gather stormwater and discharge it into local streams and rivers

- Microplastics

  The tiny (<5 mm) fragments, fibers, and microbeads that come from larger plastic litter breaking apart and persist in the environment for an extremely long time

- Toxic Contaminants

  Pesticides, pharmaceuticals, metals and more that can harm human and wildlife health. An example is mercury, which is toxic to nervous, digestive, and immune systems as well as lungs, kidneys, skin & eyes

- Algae

  Simple aquatic plants that can be single-celled or grow in clumps or slimy mats

- Green Infrastructure

  Nature-based solutions that use soil and vegetation to help slow the flow of runoff and manage rainwater where it falls

- Sunny Day Flooding

  Flooding associated with high tide, rather than rainfall, that is temporary with localized impacts