Living Green: Sustainable Water Systems

November 6, 2025

Rutgers Cooperative Extension Water Resources Program

MS4 Technical Assistance Program

Gillian Mulvoy

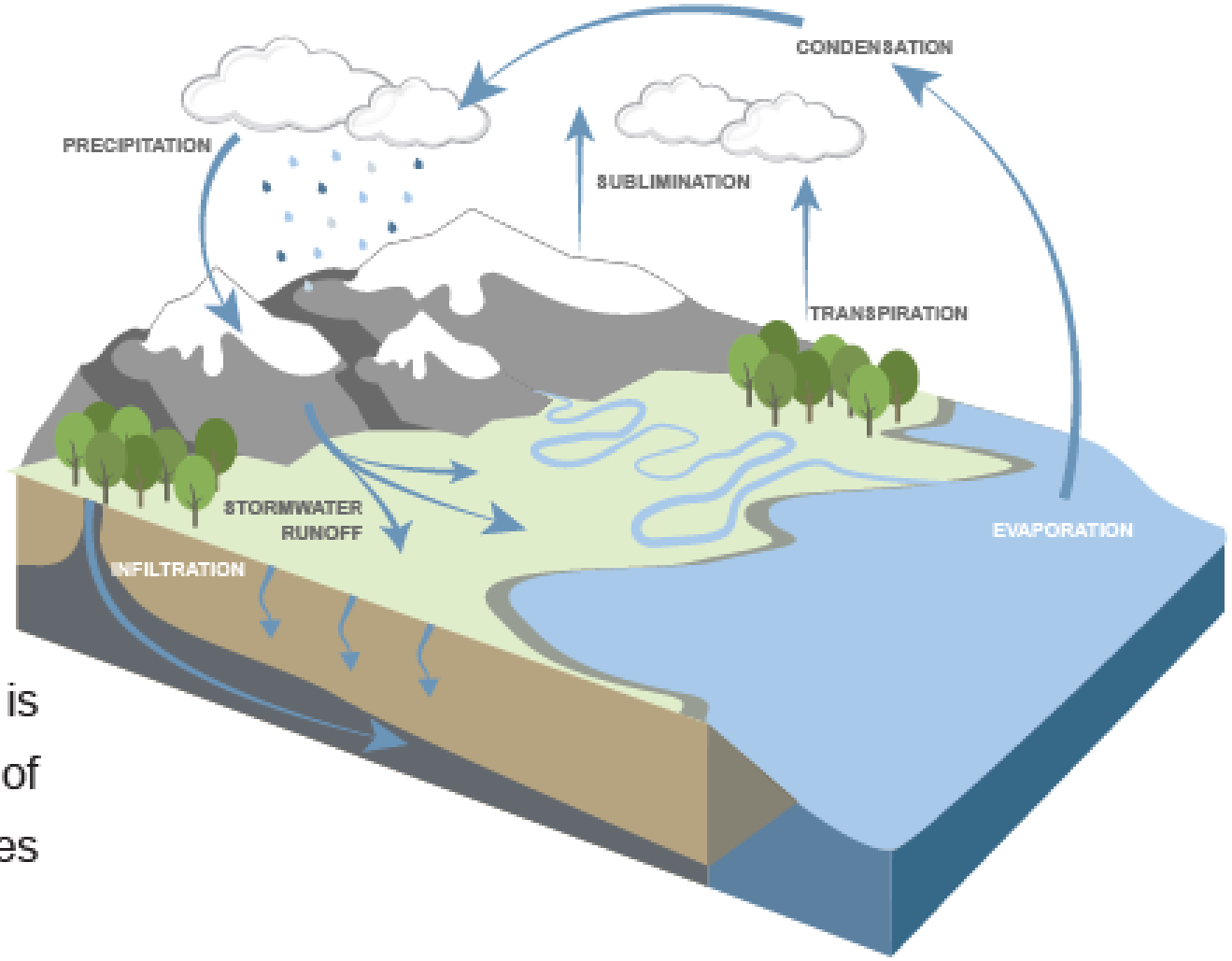
RUTGERS UNIVERSITY
Water Resources Program
New Jersey Agricultural Experiment Station

Water Resources Program

Our mission is to identify and address community water resources issues using sustainable and practical science-based solutions.

What is Stormwater Runoff?

Water from rain or snowmelt that flows over ground surfaces into lakes and streams



WATER CYCLE

The natural water cycle is a balanced movement of water from varying states (solid, liquid, gas).

What is Impervious Cover?

Surfaces that prevent stormwater runoff from penetrating the ground as it would naturally.

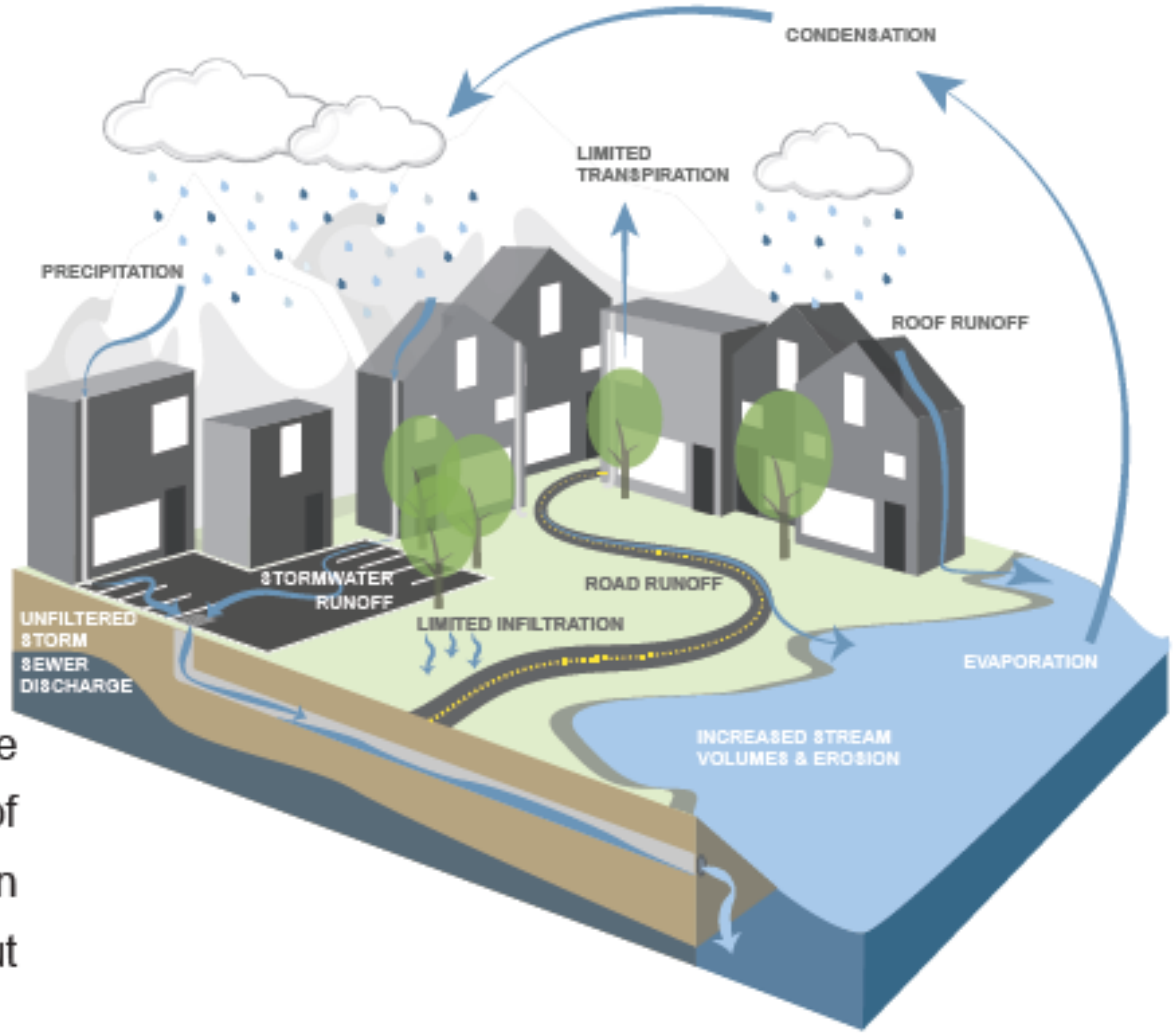
Impacts of Development on Stormwater Runoff

more development → *More impervious surfaces* → *more stormwater runoff*

Urban Water Cycle

URBAN WATER CYCLE

Impervious surfaces have decreased the amount of infiltration and transpiration that takes place throughout the natural water cycle.



Pollutants Found in Runoff

Sediment
Soil particles transported from their source

Biochemical Oxygen Demand (BOD)
- Oxygen depleting material
  - Leaves
  - Organic material

Toxics
- Pesticides
  - Herbicides
  - Fungicides
  - Insecticides
- Metals (naturally occurring in soil, automotive emissions/ tires)
  - Lead
  - Zinc
  - Mercury
- Petroleum Hydrocarbons (automotive exhaust and fuel/oil)

Nutrients
- Various types of materials that become dissolved and suspended in water (commonly found in fertilizer and plant material):
  - Nitrogen (N)
  - Phosphorus (P)

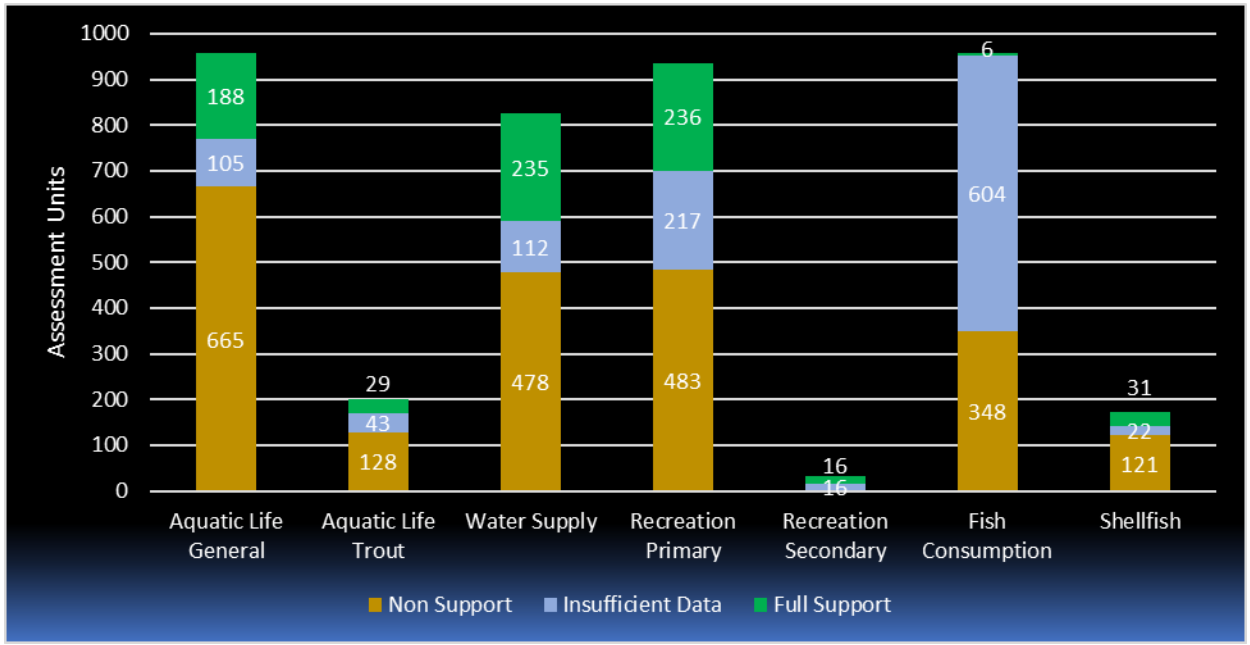
Bacteria/ Pathogens
Originating from:
- Pets
- Waterfowl
- Failing septic systems

Thermal Stress
Heated runoff, removal of streamside vegetation

Debris
Litter and illegal dumping

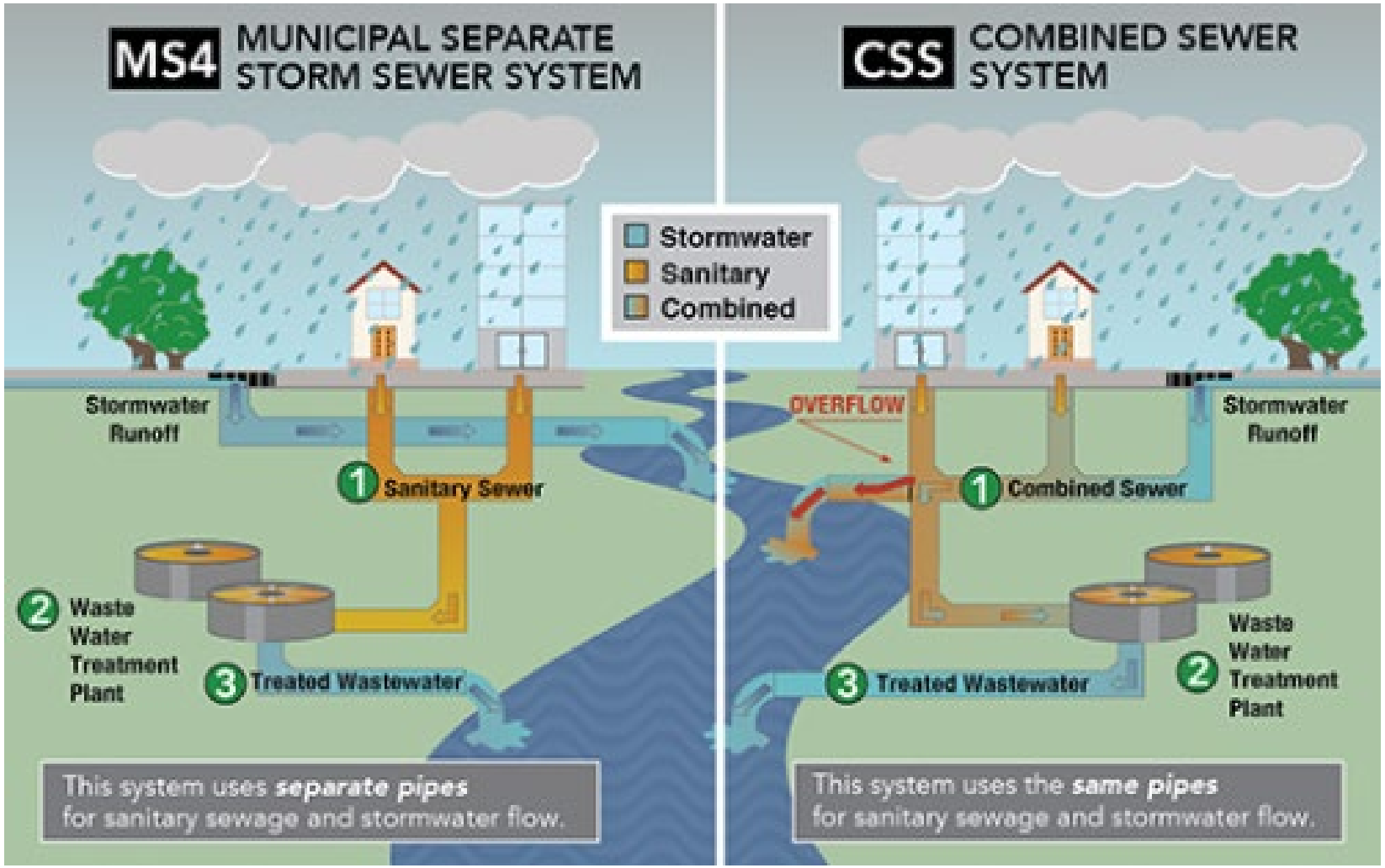
Why Care about Water Quality?

Designated Use	Description
 Aquatic Life (General)	Can these waters support a healthy ecosystem? Monitoring focuses on determining excessive nutrients and impaired biological communities which are the primary causes of designated use impairment.
 Aquatic Life (Trout)	Can species of trout survive and reproduce in these waters? These waterbodies are monitored for meeting dissolved oxygen and cold-water temperature ranges capable of supporting trout species.
 Recreation	Can we swim, boat, and do other activities in these waters? Three bacterial indicators that are monitored and tested to determine recreational use are fecal coliform, *E. coli*, and Enterococcus.
 Water Supply	Can we use these waters as sources for drinking water? Ambient water quality is monitored in rivers and lakes for chemical pollutants, metals, and toxins before undergoing treatment to be used as a water supply.
 Shellfish Harvest	Can we eat clams, oysters, or mussels from these waters? NJDEP monitors fecal coliform levels and the bacterial species *Vibrio parahaemolyticus* to ensure safe harvests of shellfish.
 Fish Consumption	Can we eat fish from these waters? Fish tissue in different species are currently monitored for metals including "legacy" pollutants such as PCB, DDT, and chlordane which are no longer manufactured, but are still found in fish tissue.

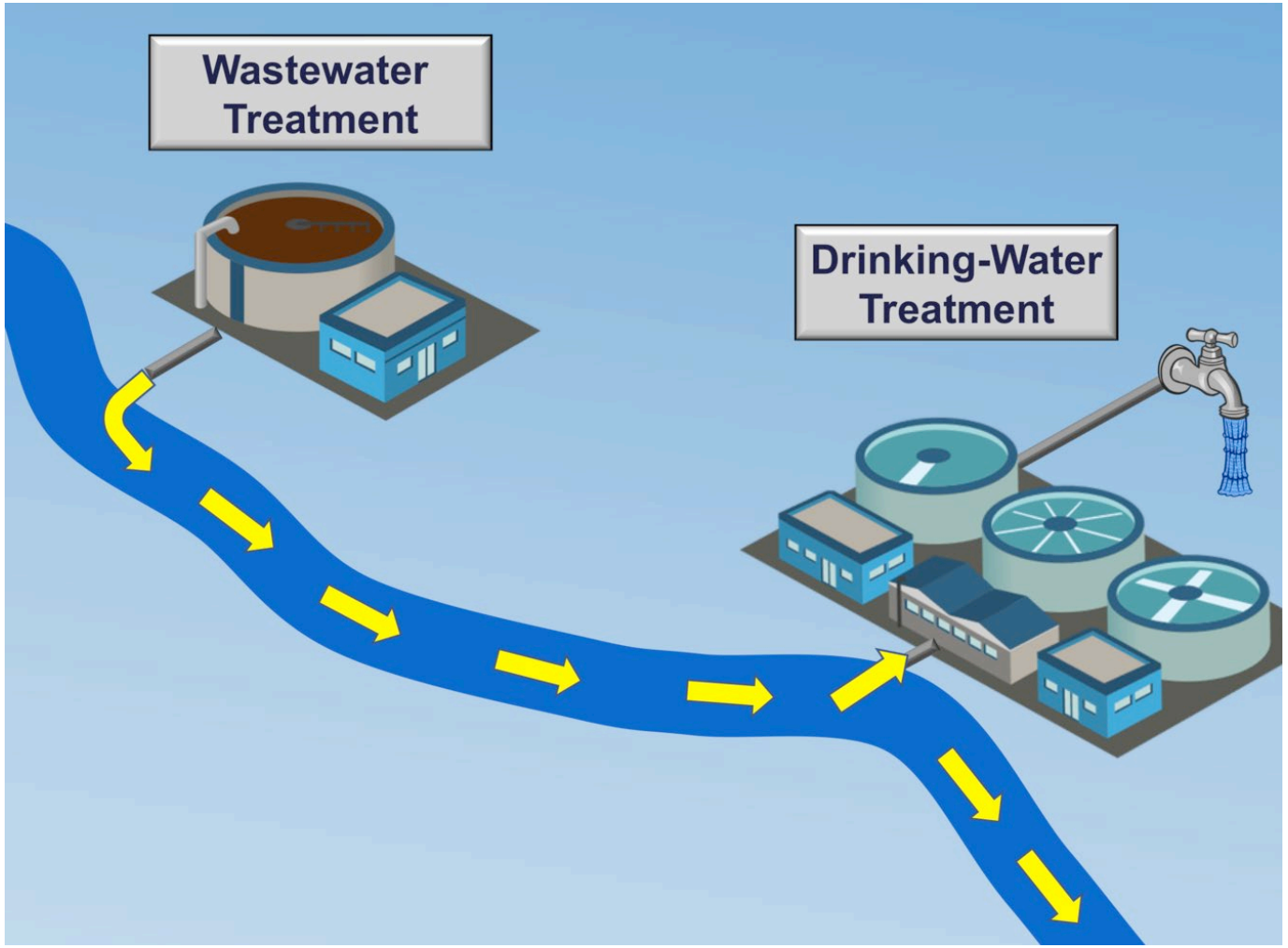


2022 NJDEP Integrated Water Quality Assessment Report

Sewer Systems Discharge to Waterways



Waterways Supply Drinking Water



Green Infrastructure

…an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly.

Green Infrastructure projects:

- capture,
- filter,
- absorb, and
- reuse

stormwater to maintain or mimic natural systems and treat runoff as a resource.

Green Infrastructure Practices

Bioretention Systems

- Rain Gardens
- Bioswales
- Stormwater Planters
- Curb Extensions
- Tree Filter Boxes

Permeable Pavements

Rainwater Harvesting

- Rain Barrels
- Cisterns

Dry Wells

Rooftop Systems

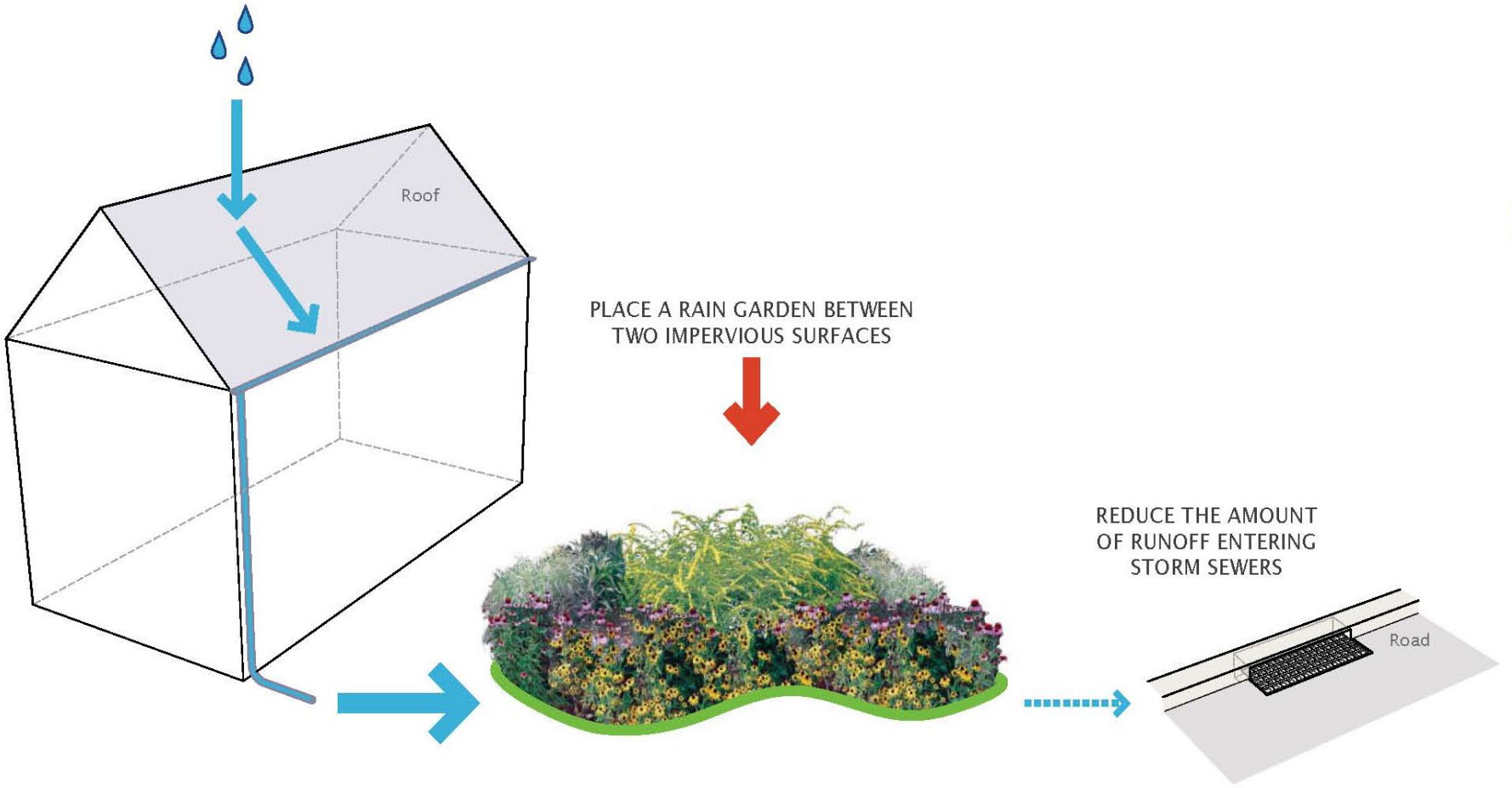
- Green Roofs
- Blue Roofs



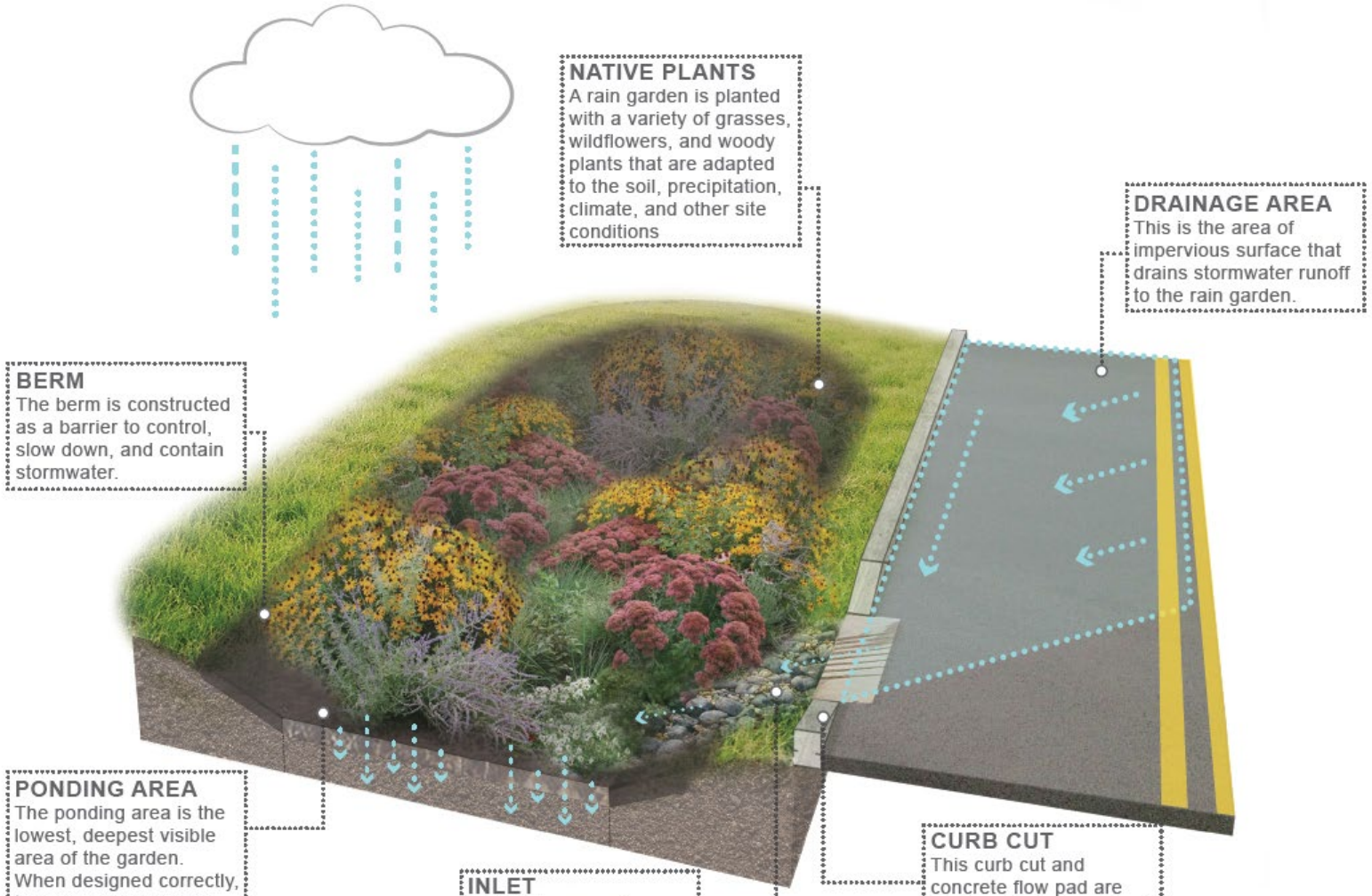




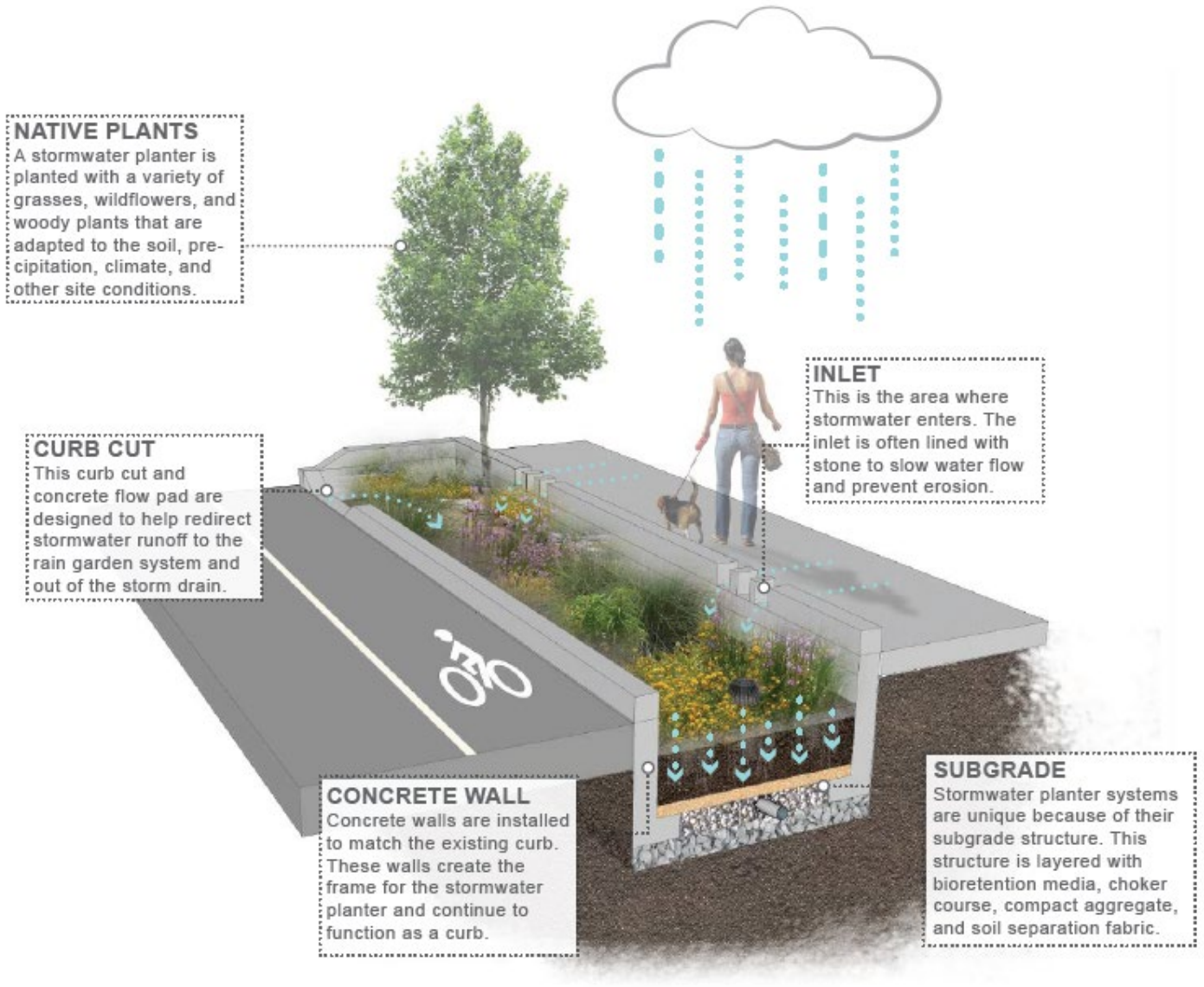

Rain Gardens



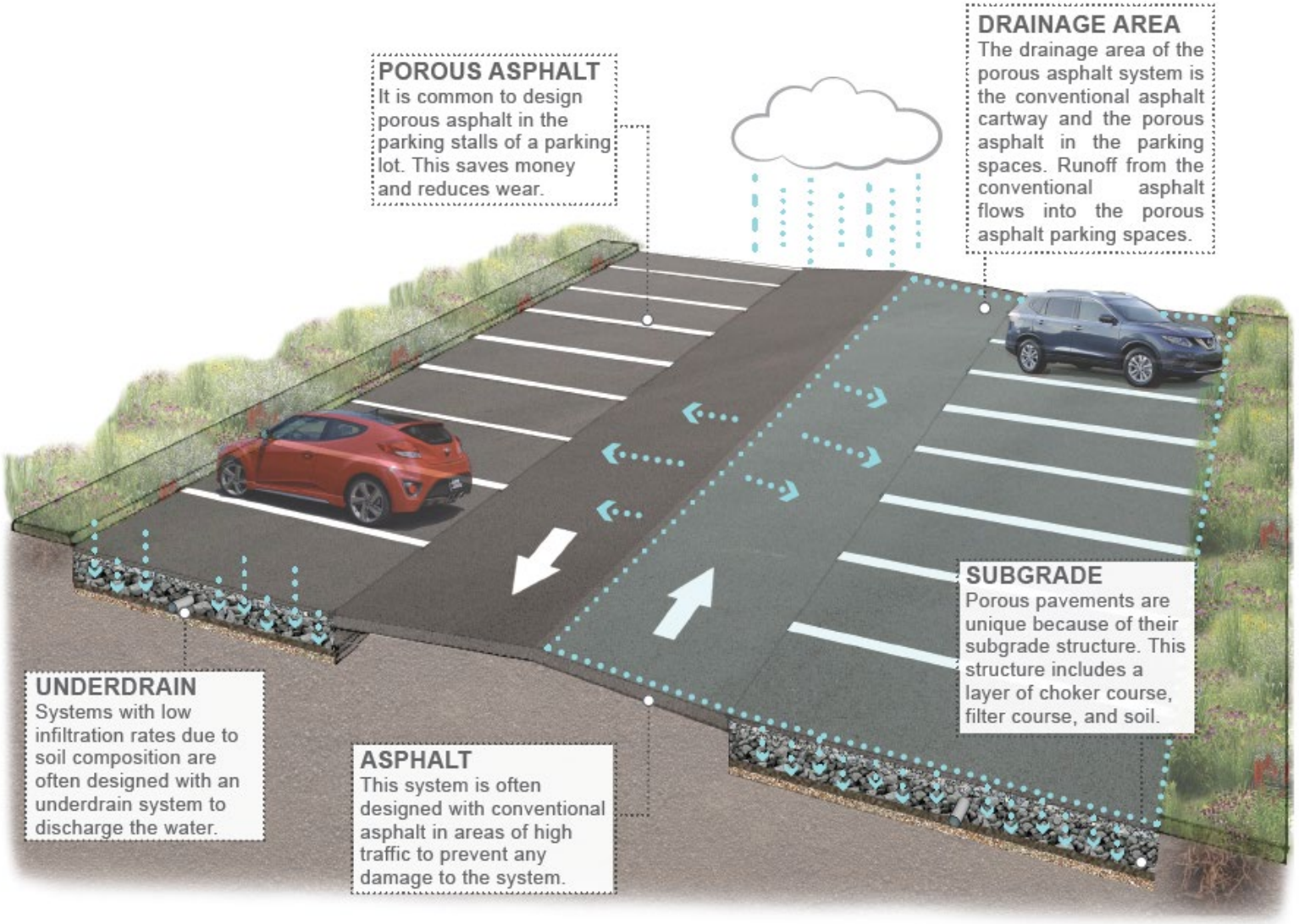
Rain Gardens



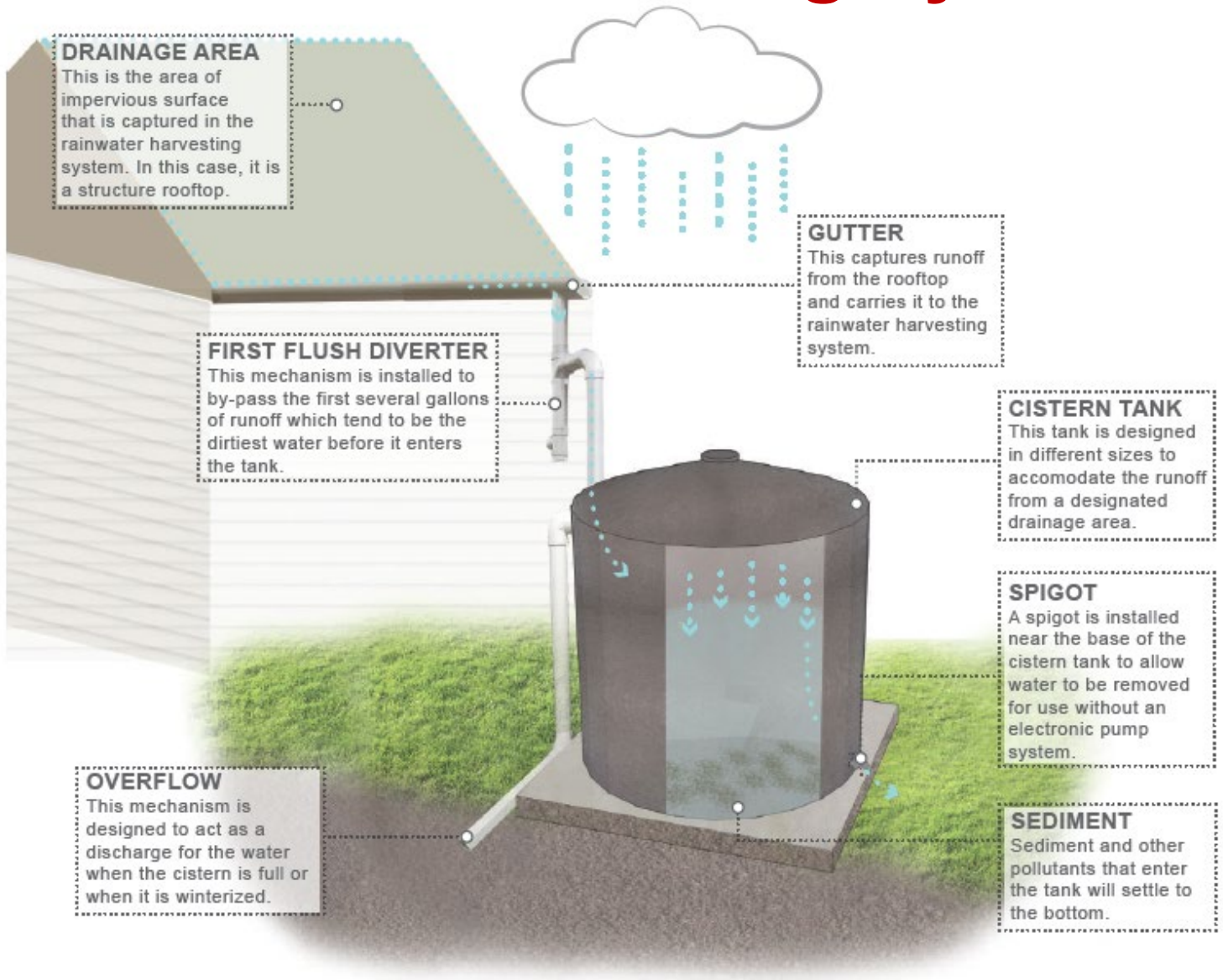
Stormwater Planters



Permeable Pavement



Rainwater Harvesting Systems



What can you do?

- Don’t litter
- Pick up after your pets
- Limit use of fertilizers
- Reduce imperious surfaces
- Install your own rain garden

What is the MS4 Permit?

- Municipal Separate Storm Sewer System = MS4
  - Created in 2004
  - Required by both federal and state regulations to address water quality and flooding issues in municipal stormwater systems.
  - The MS4 Tier A Permit was recently updated with the new permit becoming effective on January 1, 2023.

A primary objective of MS4 program

… shall be to implement best management practices and other measures that are designed to reduce the discharge of pollutants from the permittee's MS4, municipal maintenance yards and other ancillary operations to the maximum extent practicable pursuant to N.J.A.C. 7:14A-25.6(a)1 and 40 CFR 122.34(a), to protect water quality, and to satisfy the applicable water quality requirements of the Clean Water Act.

Summary of MS4 Requirements

- **Section A**: Stormwater Management Program
  - Overview of MS4 Permit and SPPP

- **Section B**: Minimum Standards for Public Involvement
  - Public participation and published information on stormwater website

- **Section C**: Minimum Standards for Local Public Education
  - Complete 12 points of educational stormwater activities annually

- **Section D**: Minimum Standards for Construction Site Stormwater Runoff
  - Construction runoff covered by separate permit

Summary of MS4 Requirements

- **Section E**: Minimum Standards for Post Construction Stormwater Management in New Development and Redevelopment
  - Sets forth review requirements of development plans for stormwater management

- **Section F**: Minimum Standards for Pollution Prevention/ Good Housekeeping for Municipal Operators
  - Ordinances, community measures, inspection of stormwater facilities, maintain logs, municipal maintenance yards, trainings

- **Section G**: Minimum Stands for MS4 Mapping, and Scouring, and Illicit Discharge Detection and Elimination
  - Mapping requirements, stream scour inspection (20% per year), illicit discharge detection and elimination from outfalls (20% per year)

Summary of MS4 Requirements

- **Section H**: Watershed Improvement Plan
  - Three phase document: Watershed Inventory Report (3rd year), Watershed Assessment Report (4th year), Watershed Improvement Plan Report (EDPA + 59 months)

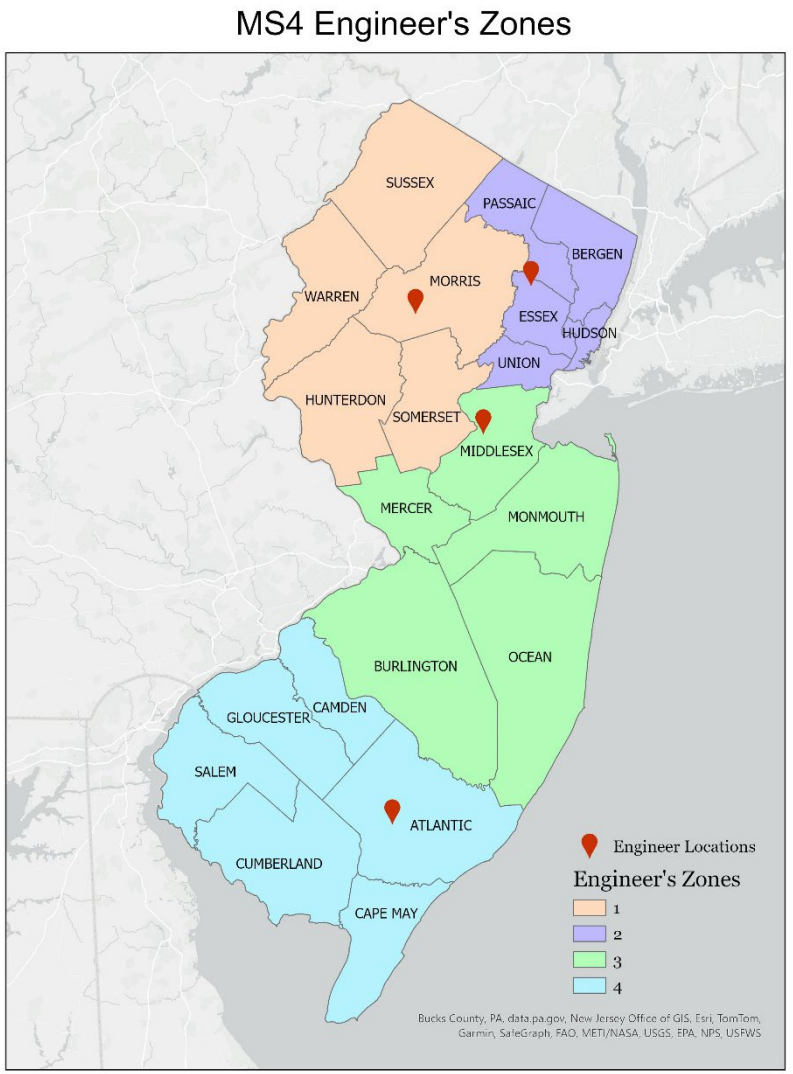
- **Section I**: Additional Measures and Optional Measures
  - Allows additional measures/limits if desired

- **Section J**: Recordkeeping
  - Retain records of the permit for 5 years available on request

- **Section K**: Annual Report and Certification
  - Submit annual report to summarize compliance by May 1st annually

MS4 Technical Assistance Program

- NJDEP funded program to provide towns with support
- 4 regional engineers
- Currently focused on Phase 1 (due January 1st 2026)
- Free first come, first serve service



Questions?

Gillian Mulvoy
Gillian.mulvoy@rutgers.edu

RUTGERS UNIVERSITY
Water Resources Program
New Jersey Agricultural Experiment Station