

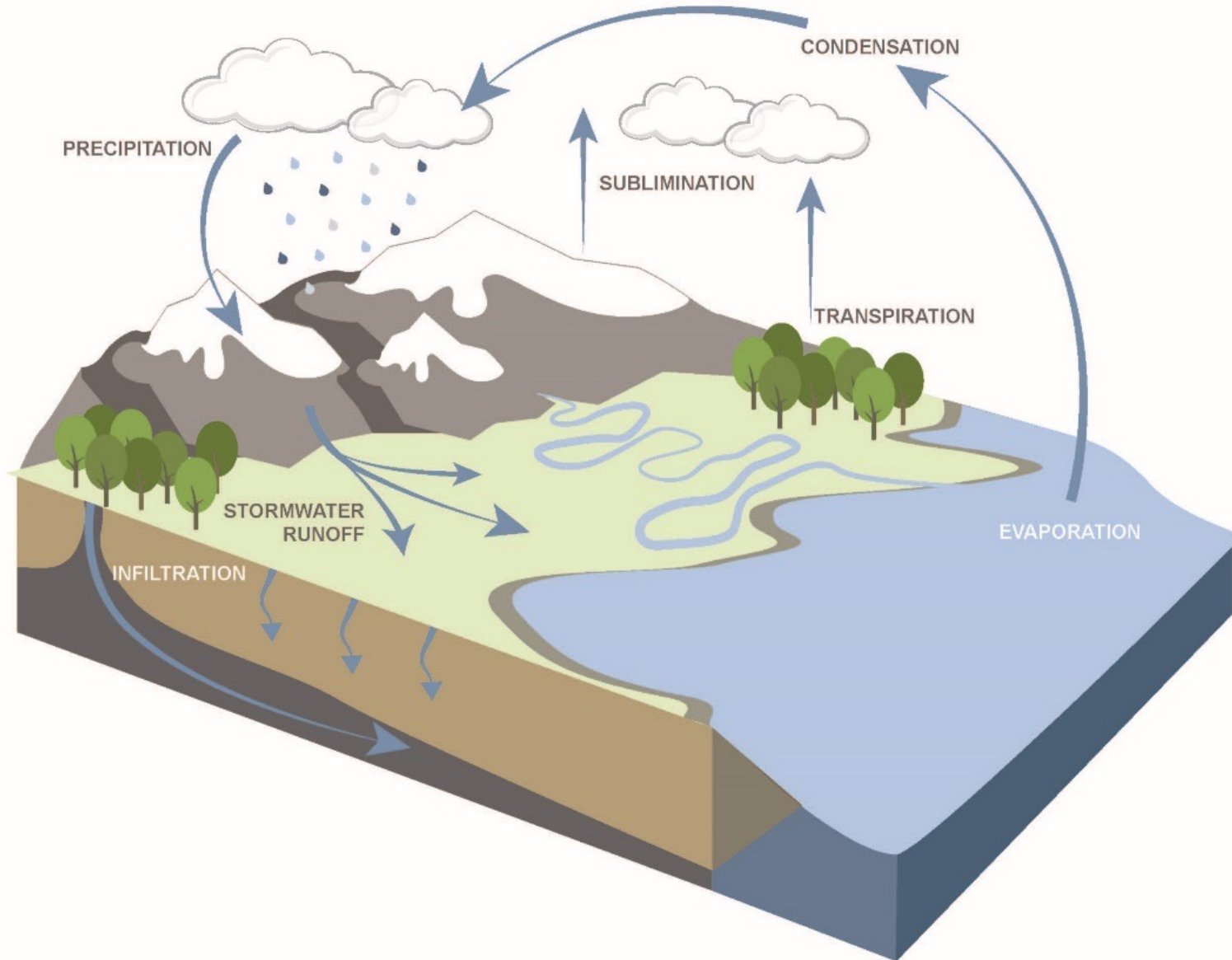
Green Stormwater Infrastructure Overview



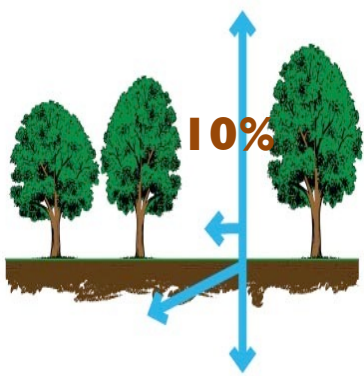
RUTGERS
New Jersey Agricultural
Experiment Station



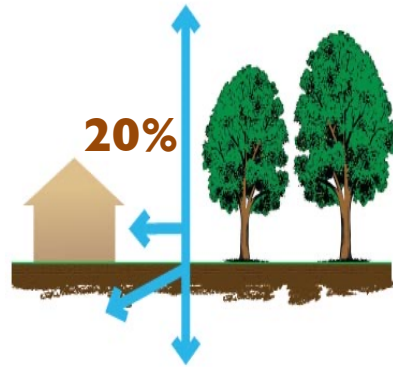
The Natural Water Cycle



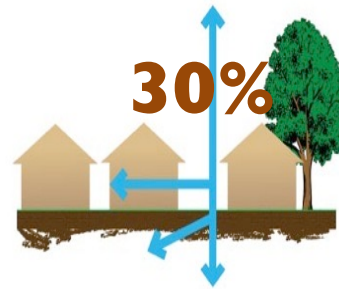
Impervious Surfaces



More development



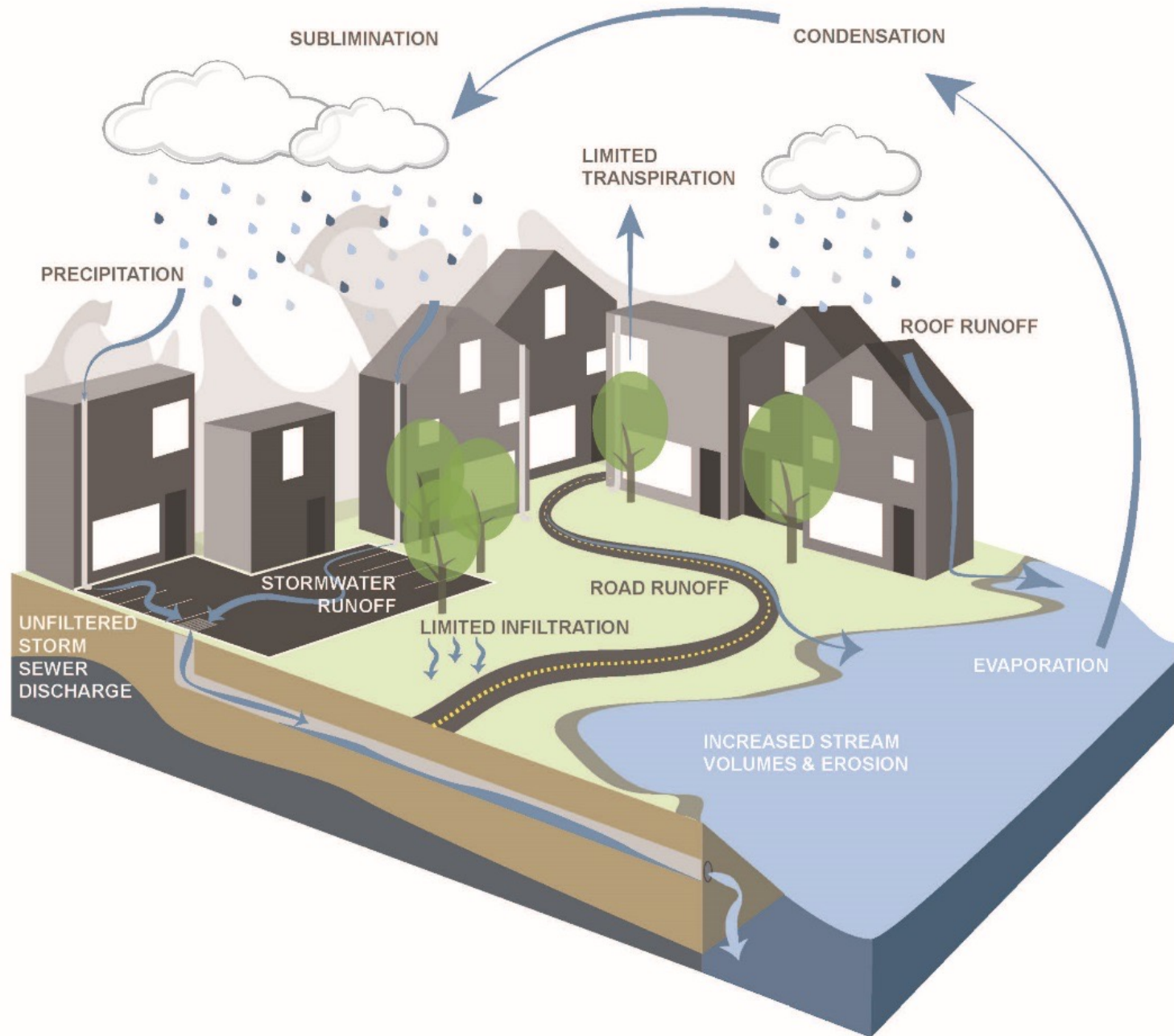
More impervious surfaces



More stormwater runoff



The Urban Water Cycle



What is stormwater?

Stormwater is the water from rain or melting snows that can become “runoff,” flowing over the ground surface and returning to lakes and streams.



Water Quality



Water Quantity (flooding)



More Flooding



And even more flooding



Is Green Infrastructure a solution?

...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

Stormwater management practices that protect, restore, and mimic the native hydrologic condition by providing the following functions:

- Infiltration
- Filtration
- Storage
- Evaporation
- Transpiration



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



TYPES OF BIORETENTION

Larger Bioretention Systems

- Single-family lots
- Commercial areas
- Parking lots



Planters & Planter Boxes

- Highly urban areas
- Right-of-way and adjacent to buildings

Rain Gardens

- Single-family lots
- Small commercial areas



Vegetated Curb Extensions

- Bioretention incorporated into right-of-way in urban and suburban areas

Bioretention Swales/ Bioswales/Vegetated Swales

- Typically in right-of-way



Rain Gardens



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

DRAINAGE AREA

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

BERM

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

PONDING AREA

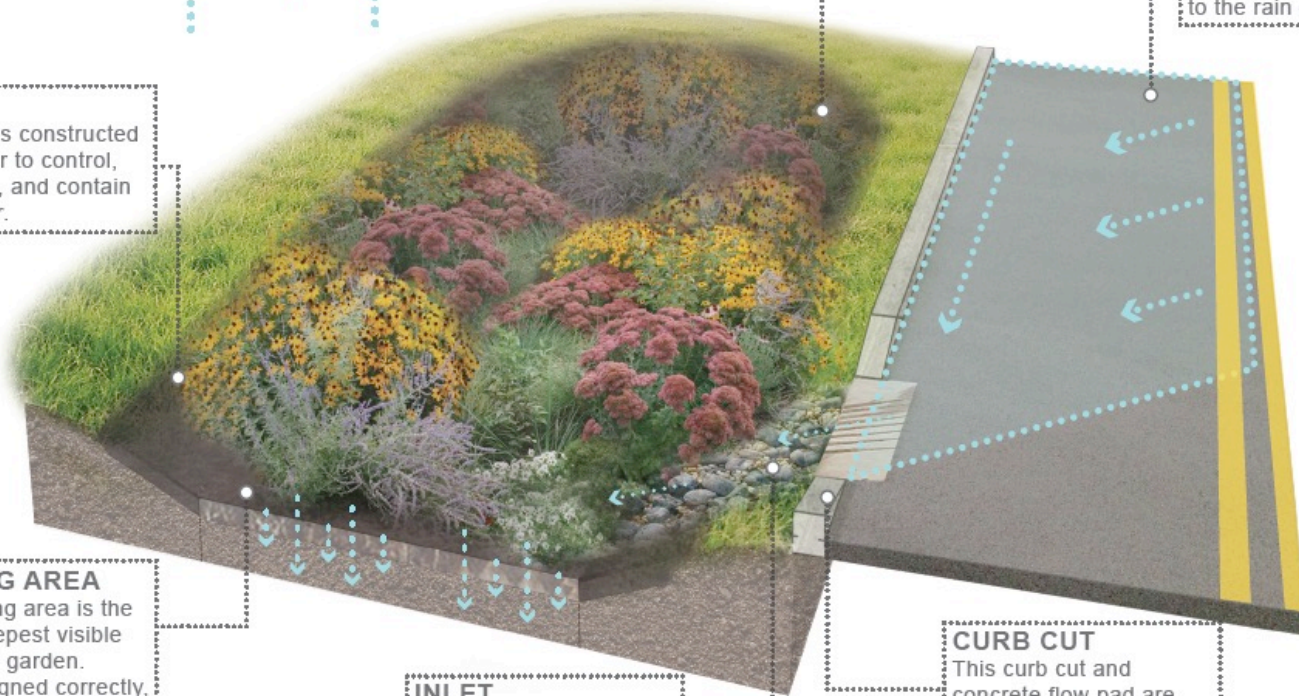
The ponding area is the lowest, deepest visible area of the garden. When designed correctly, this area should drain within 24 hours.

INLET

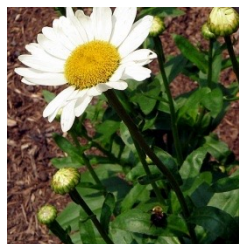
This is the area where stormwater enters. The inlet is often lined with stone to slow water flow and prevent erosion.

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.



Lots of Rain Gardens







Rain Garden
This garden is designed to capture and filter rainwater from the roof and driveway, reducing runoff and preventing erosion. It is a great way to conserve water and improve the health of the surrounding environment.





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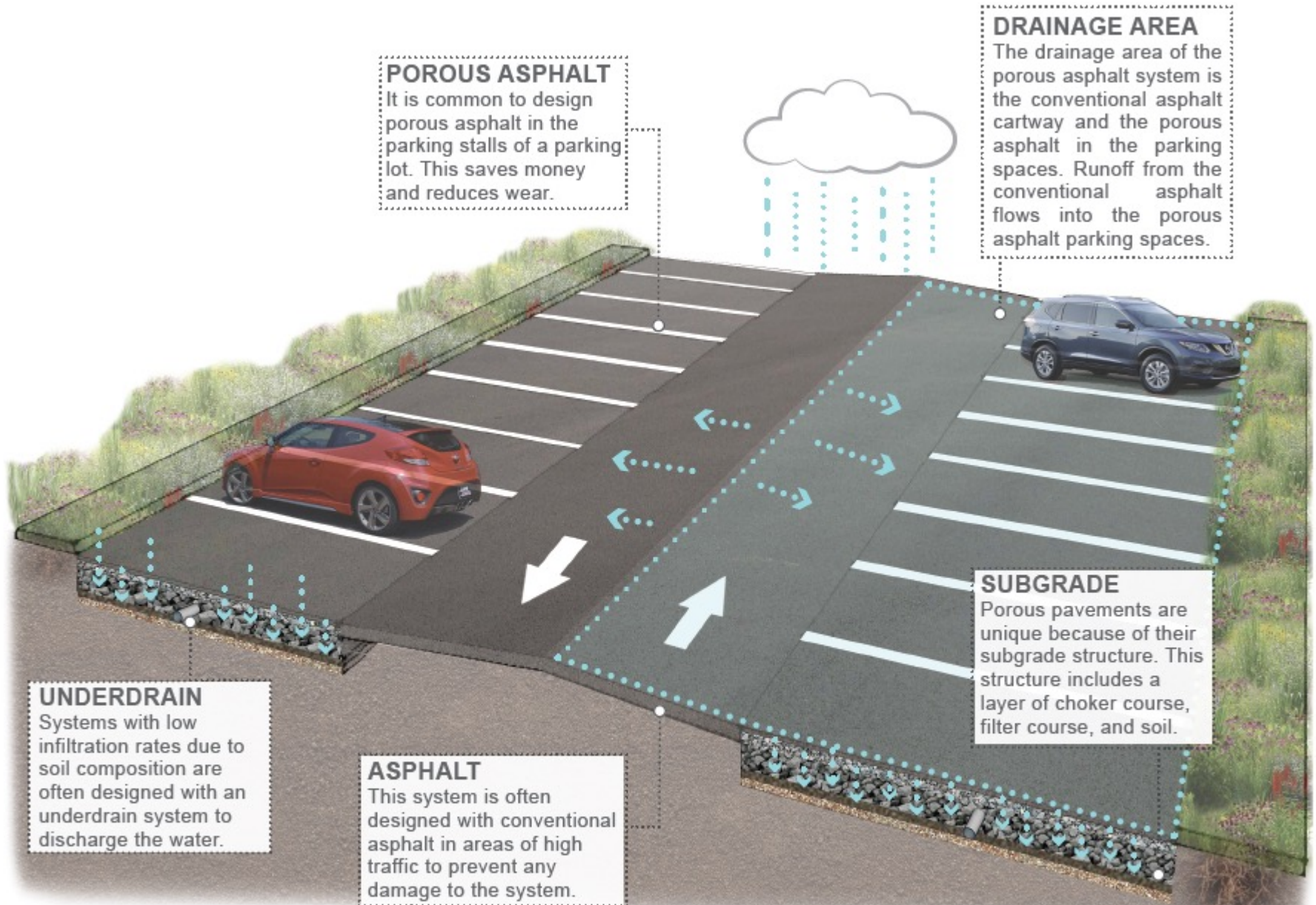
Permeable Pavement

POROUS ASPHALT

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

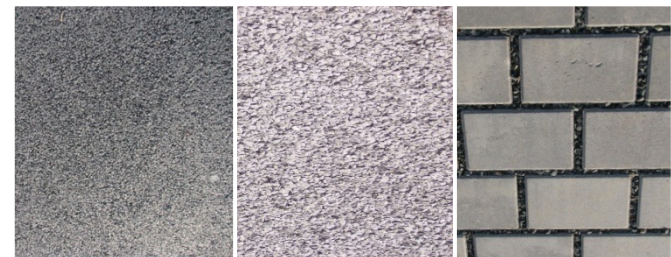
DRAINAGE AREA

The drainage area of the porous asphalt system is the conventional asphalt cartway and the porous asphalt in the parking spaces. Runoff from the conventional asphalt flows into the porous asphalt parking spaces.



Permeable Pavements

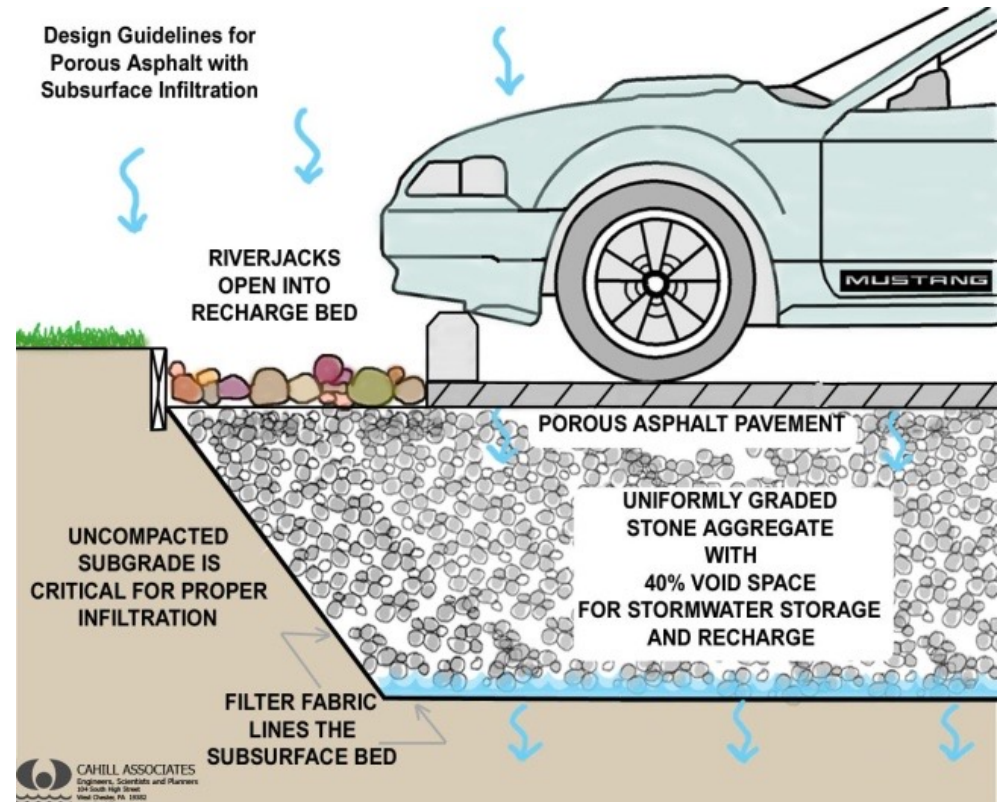
- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Permeable pavers systems are concrete pavers with infiltration between the spaces of the pavers
- 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



Porous Asphalt





Pervious Concrete

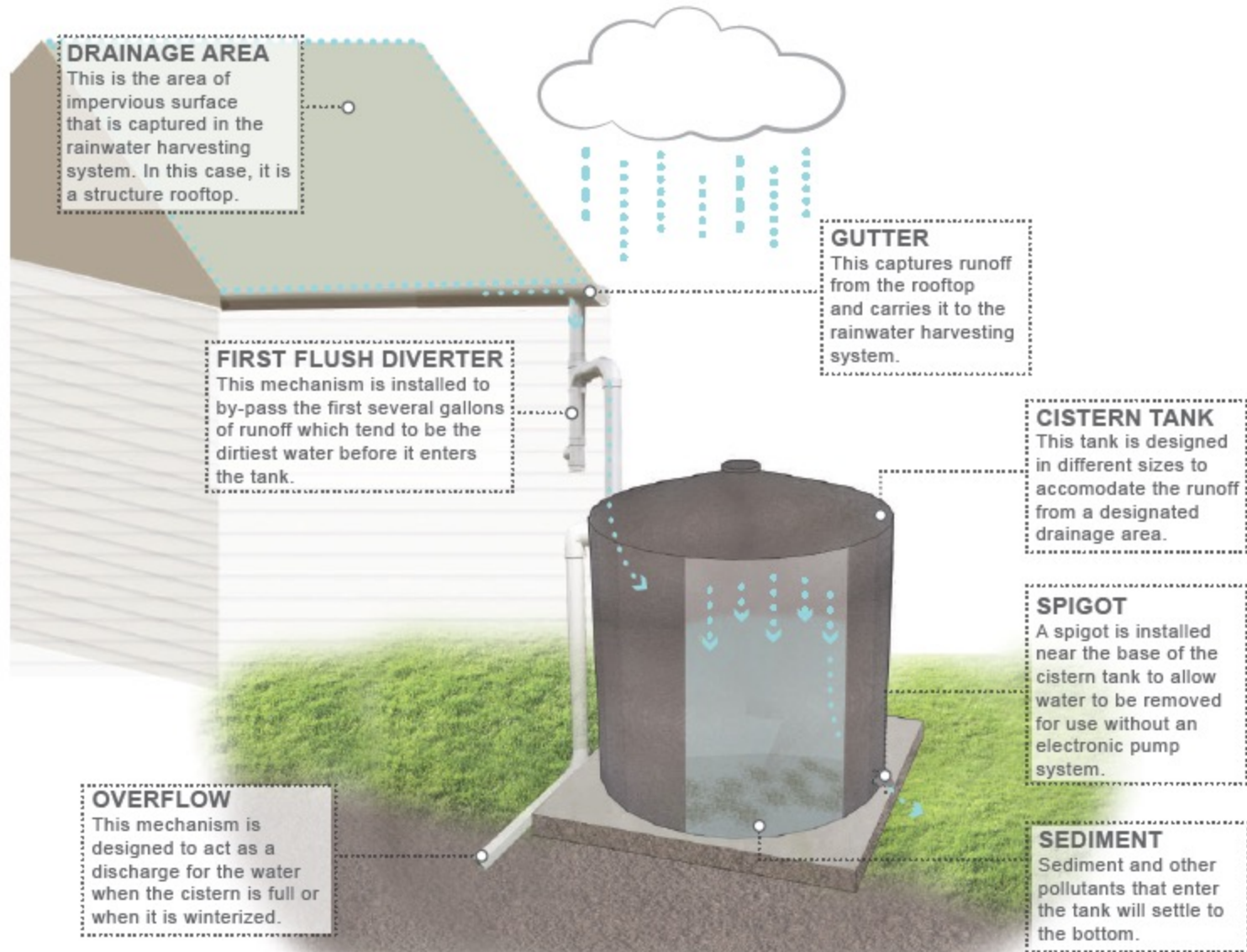


Permeable Pavers

A photograph showing a driveway paved with interlocking concrete pavers. The pavers are arranged in a grid pattern, with grass growing through the openings. The driveway is covered with fallen autumn leaves and some dry grass. In the background, there is a chain-link fence and a dark vehicle parked on the left. The overall scene is outdoors, likely in a residential setting during autumn.

Grass Pavers

Rainwater Harvesting Systems



Rain Barrels



Cisterns









Let's get back to flooding – bioretention is an option but does it take up too much space?



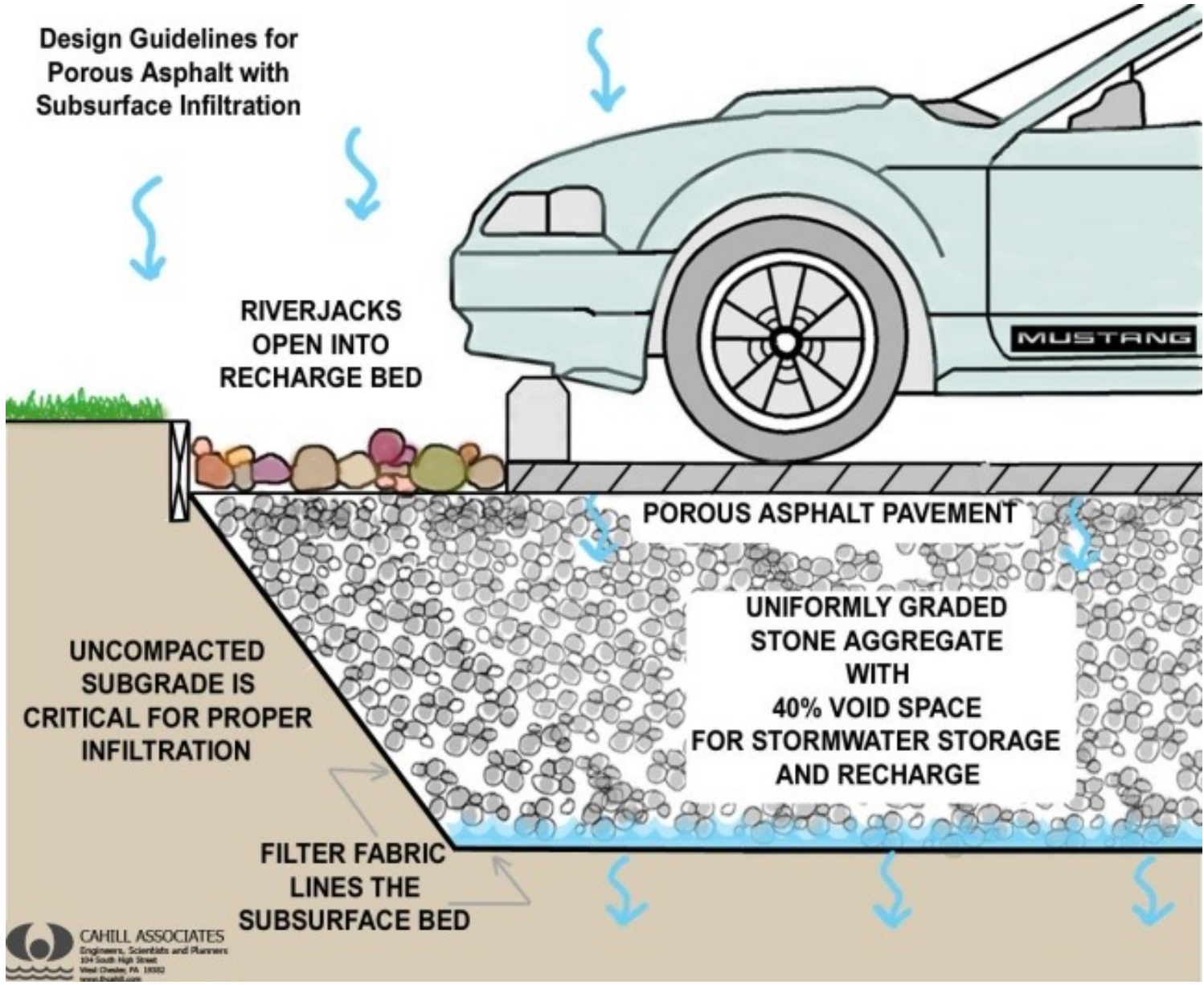


7. 24. 2003





**Design Guidelines for
Porous Asphalt with
Subsurface Infiltration**



What if ...

every time we repave a parking lot in New Jersey, let's convert it into a stormwater management system. For every acre of parking lot, we can capture stormwater runoff from the 100-year storm from four to five acres of impervious surfaces. When we include a rain garden, we can further increase the benefits.

If we can't reallocate funds from the US Defense Budget, maybe can create stormwater utilities so everybody pays their fair share for their contribution to the stormwater runoff problem.