

Wet Weather Treatment



What is Wet Weather Treatment?

When the combined sewer system reaches capacity during heavy rainfall, stormwater and sewage is treated at a wet weather treatment facility before it is discharged to local water bodies. Treatment helps protect human health and the environment by reducing the amount of untreated combined sewage that overflows into Lake Washington. Wet weather treatment facilities are generally sited along the shoreline near a CSO overflow location. Conveyance pipes are needed to carry CSOs to the wet weather treatment plant site.

Benefits

- Can handle large volumes and back-to-back storm events

Constraints

- Requires large, above ground facilities
- Can be difficult to site in urban areas
- Noise and traffic from maintenance vehicles
- Discharges higher pollutant loads compared to storage options
- Requires a new outfall
- High operation and maintenance costs
- Longer construction time

Relative Cost of This Option

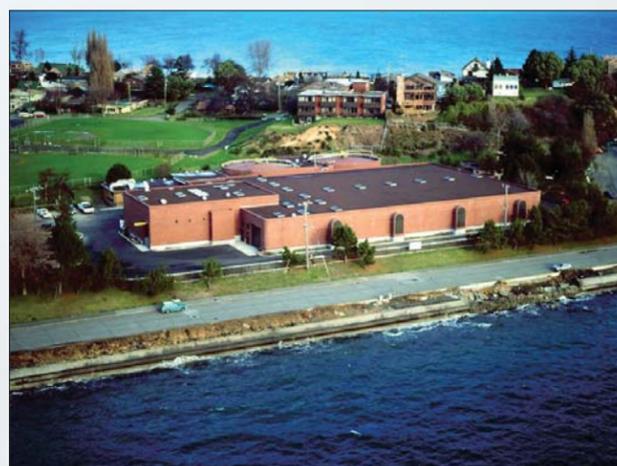
Separation - \$\$

Storage - \$\$\$

Wet Weather Treatment - \$\$\$\$\$

Flow Transfer - \$\$\$\$

What Does it Look Like?



Alki Wet Weather Treatment Plant
(65 MGD Capacity)
Seattle, WA



Wet Weather Treatment Plant
(12 MGD Capacity)
Bremerton, WA



Actiflo Wet Weather Treatment Facility
(60 MGD Capacity)
Salem, OR

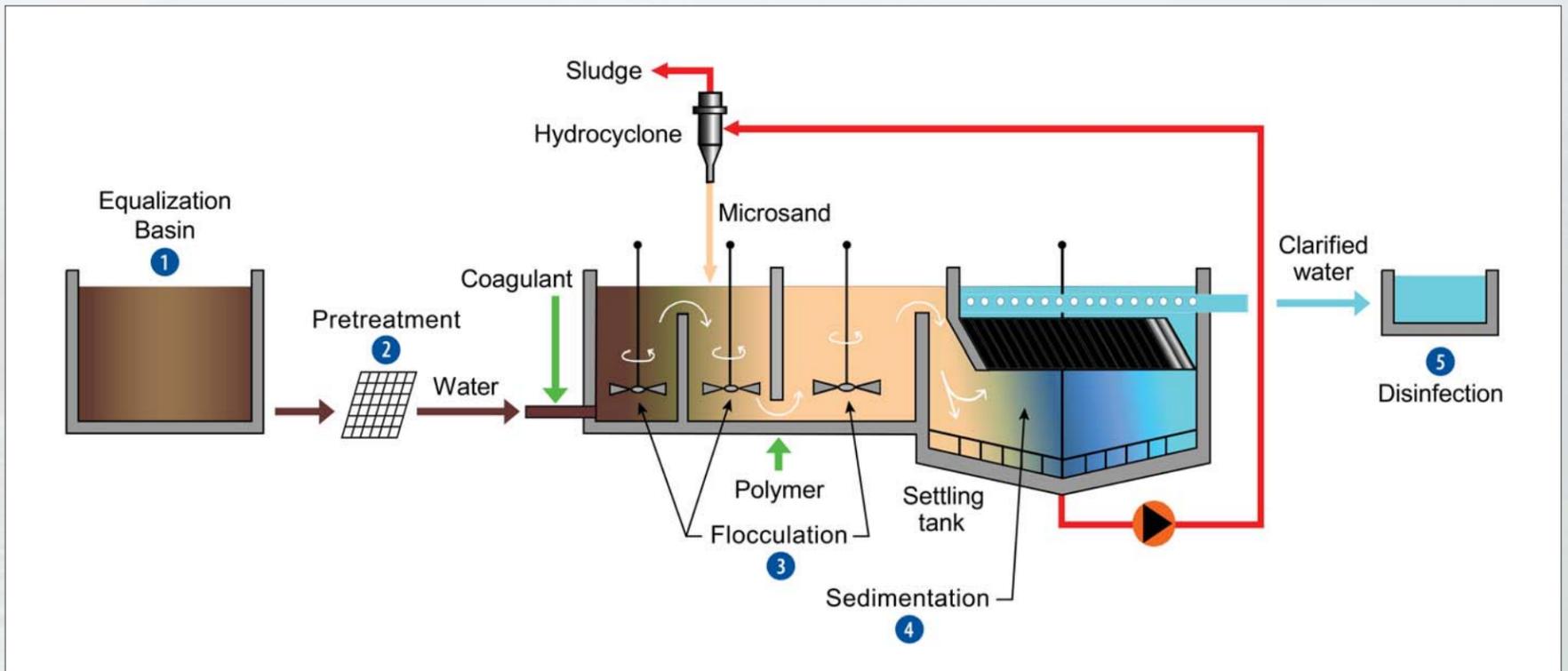


Wet Weather Treatment Plant
(330 MGD Capacity)
Milwaukee, WI

Wet Weather Treatment



How Does it Work?



Adapted from Source: Veolia Water Systems (www.KrugerUSA.com)

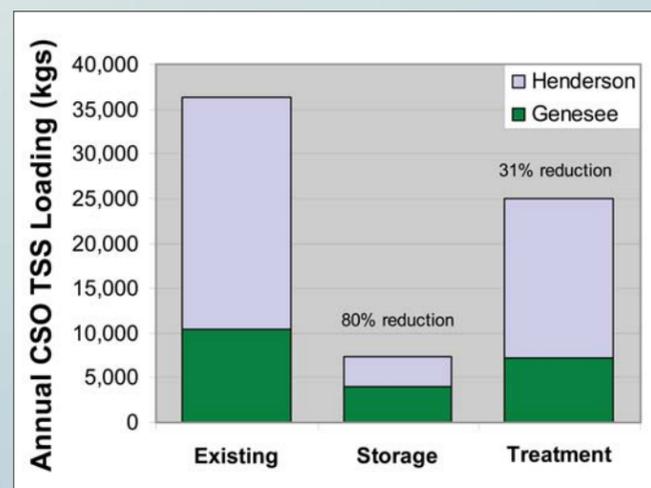
Process

- 1 Equalization Basin – Reduces size of treatment facility
- 2 Pretreatment – removes debris like rags, paper, and leaves
- 3 Flocculation – Polymers and mixing allow small particles to clump together and enhance settling
- 4 Sedimentation – Settling to remove sludge and scum
- 5 Disinfection – Destroys most remaining pathogens or disease causing bacteria before the final effluent is released through an outfall pipe and diffuses into Lake Washington

Things to Consider...



New outfall needed to disperse effluent further out into Lake Washington



Water quality impacts to Lake Washington: Total Suspended Solids (TSS) are reduced over existing condition by wet weather treatment, but less so than with storage

Wet Weather Treatment



What Does it Take to Maintain and Operate it?



- Pre-Event – Maintain equipment and chemical supply
- During Event – Monitor all processes; perform sampling
- Post Event – Clean facilities, restock chemical supply

What Would it Take to Build it?



New pump station



New wet weather treatment facility



New conveyance



Construction impacts

Storage for CSO Reduction



What is Storage?

During heavy rainfall, the combination of stormwater and sewage may exceed the capacity of the combined sewer system. To avoid overflowing into our waterways, excess flows are held in storage facilities such as tanks, pipes, or tunnels. Once a storm is over, the flows are slowly released back into the combined sewer system and sent to an existing treatment plant.

Benefits

- Provides temporary storage for combined sewage that can then be treated after a storm at the wastewater treatment plant
- Completed facility is below ground and landscaping and design can reduce visual impact

Constraints

- Can be difficult to site in urban areas

Relative Cost of This Option

Separation - \$\$

Storage - \$\$\$

Wet Weather Treatment - \$\$\$\$\$

Flow Transfer - \$\$\$\$

What Does it Look Like?



Tank Construction

(Oakwood RTB)
Detroit, MI



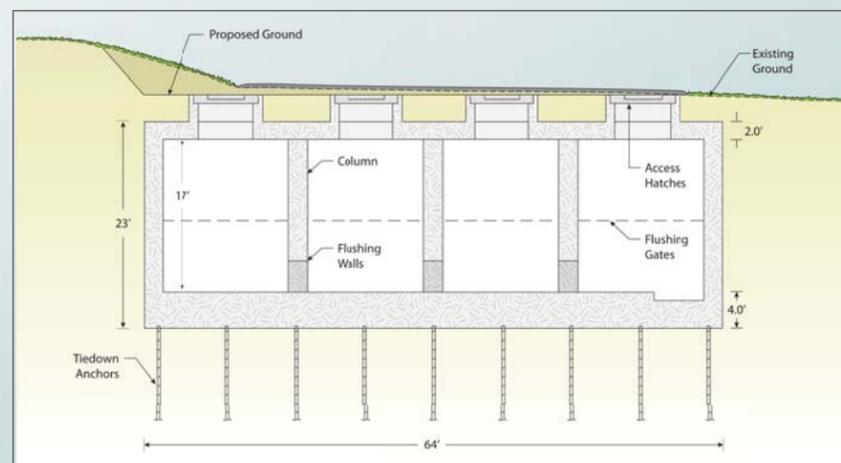
CSO storage tunnel

(Henderson Tunnel)
Seattle, WA

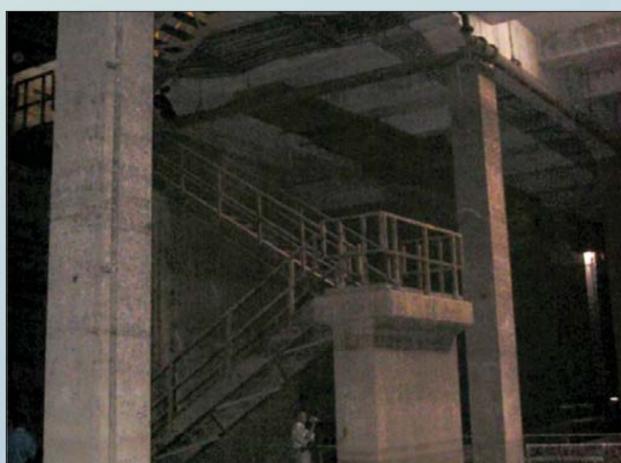


Surface features of a below-ground storage tank

(North Creek Storage Facility)
Bothell, WA



Typical section of buried storage tank

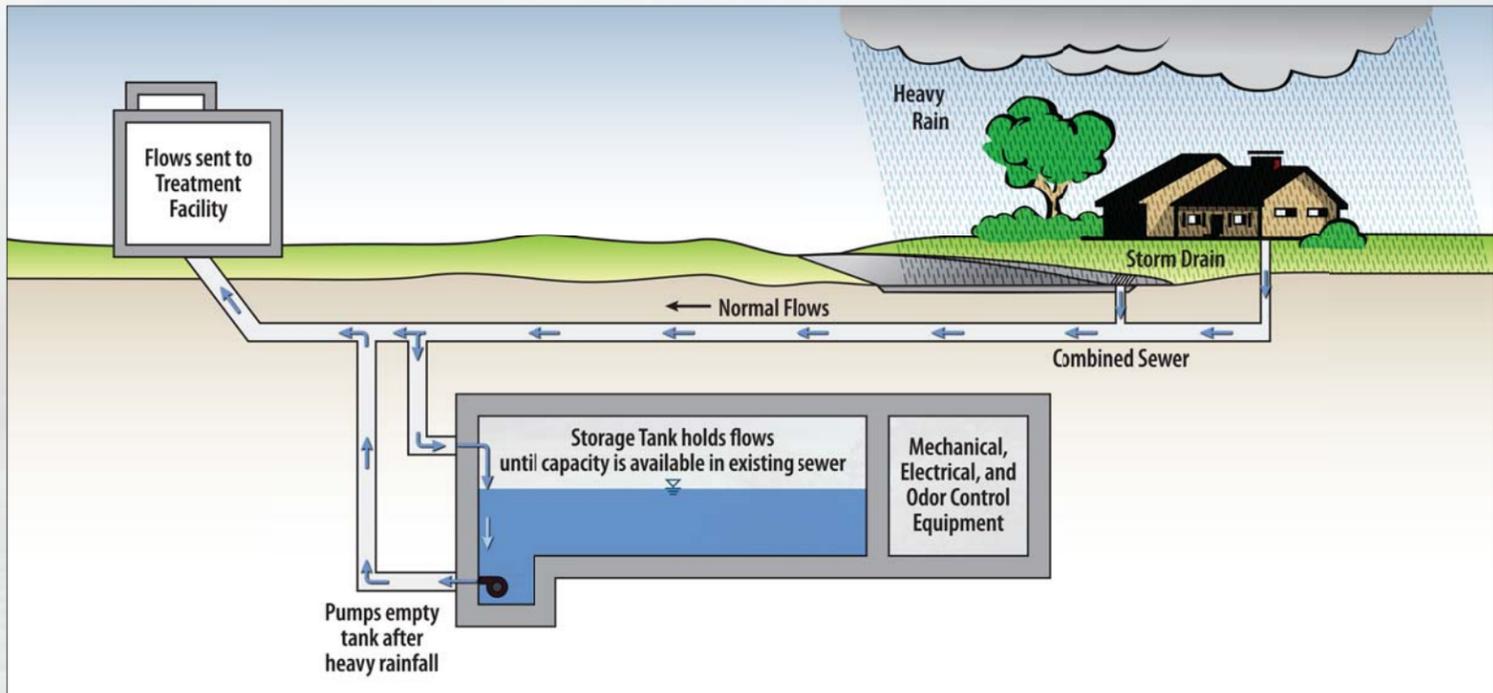


Below-ground storage tank

Detroit, MI

Storage for CSO Reduction

How Does Storage Work?



Storage Elements...



Flows are moved to off-line storage via new conveyance pipes, typically by a new diversion structure. (diversion could be via weir or gate)



Buried facilities vault houses odor control equipment



Tank is flushed with tipping buckets or flushing gate to remove sediment and reduce odors



Sump pump

Storage for CSO Reduction



What Would it Take to Build a Storage Tank?



(Oakwood RTB) Detroit, MI



(Oakwood RTB) Detroit, MI



(Oakwood RTB) Detroit, MI

What Would it Take to Build a Storage Tunnel?



(King Co./Henderson Tunnel) Seattle, WA



(King Co./Henderson Tunnel) Seattle, WA



(King Co./Henderson Tunnel) Seattle, WA

What Does it Take to Maintain and Operate it?



Vector truck



Storage Tank Inspection



Storage Pipe Inspection

Flow Transfers



What are Flow Transfer Alternatives?

Flow transfers route peak flows to another location by expanding the capacity of the combined sewer conveyance system. Increasing capacity by adding new pipe, replacing existing pipes or building new pump stations allows flows to be diverted to other parts of the system. All combined sewer flows must eventually be sent on to a treatment or storage facility.

Benefits

- Overflows can be transferred to locations where peak flows can be better managed

Constraints

- Construction is spread out over a wide area so impacts to neighborhoods, businesses and local streets could be extensive
- Moves flow from one location to another, but additional storage or treatment facilities are still needed

Relative Cost of This Option

Separation - \$\$

Storage - \$\$\$

Wet Weather Treatment - \$\$\$\$\$

Flow Transfer - \$\$\$\$

Common Elements...



Pipe Construction

*(Alki Forcemain)
Seattle, WA*



Pipe Construction

*(King Co./
Henderson CSO)
Seattle, WA*



Pump Station

*(Juanita Bay
Pump Station)
Kirkland, WA*



Diversion Structure

Flow Transfers

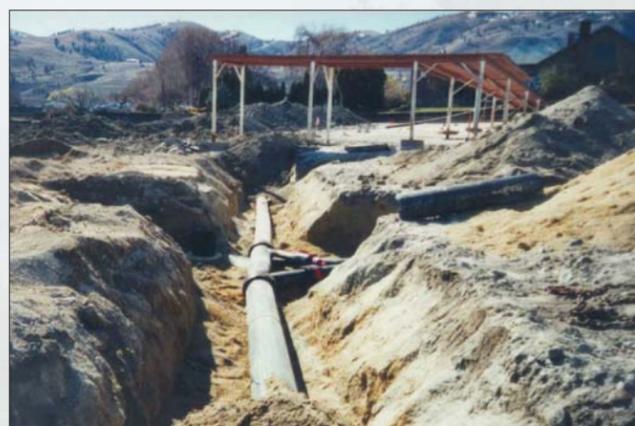


How do We Transfer Flows?

Flow transfers typically require increasing existing conveyance, or constructing new conveyance



(King Co./Henderson MLK CSO Conveyance)



(Chelan Sewer Rehabilitation)

When flows cannot be transferred by gravity, a pump station is needed



(City of Everett – Lift Station No. 7 & 8)



(Bremerton Pump Station)



(City of Kent – Lindental Pump Station)



(Henderson Pump Station)

Flow Transfers



Examples of Flow Transfers...



Transfer of flows in Henderson North area

Stormwater Separation & Green Stormwater Infrastructure



What is Stormwater Separation?

In a Combined Sewer System, both stormwater and sewer is conveyed in a single pipe. Rain falling on roofs, driveways, or streets rushes off quickly to the nearest combined sewer drain. In big storms, this excess “storm water” can cause sewer backups. Stormwater separation is the act of physically disconnecting sources of stormwater runoff, such as downspouts from residential rooftops, so that excess stormwater does not flow to combined sewers.

How Does it Work?

Stormwater separation only works in basins that are currently combined. To separate the stormwater a new conveyance system is constructed and sources of rainwater such as street runoff are connected to the new conveyance.



Construction of stormwater conveyance



Many of the Henderson North streets have been separated

Relative Cost of This Option

Separation - \$\$

Storage - \$\$\$

Wet Weather Treatment - \$\$\$\$\$

Flow Transfer - \$\$\$\$

What is Green Stormwater Infrastructure (GSI)?

Green Stormwater Infrastructure includes stormwater best management practices designed to reduce runoff from development using infiltration, evapotranspiration, and/or stormwater reuse. To be considered Green Stormwater Infrastructure, it must provide a function in addition to stormwater management such as water reuse, providing greenspace and/or habitat in the City. GSI techniques can be used by the City in Right-of-way approaches or voluntarily by property owners on private parcels. Right-of-Way GSI alternatives only work in basins that are currently combined.



City Right-of-way roadside rain garden



City Right-of-way green alley



Private parcel roadside rain garden

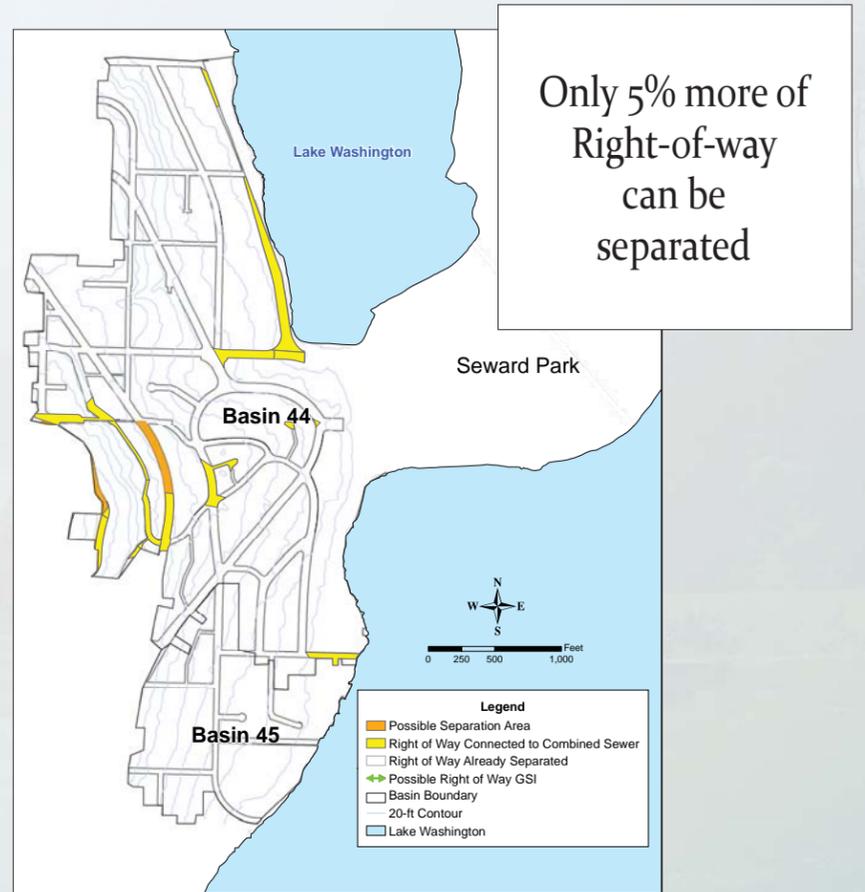
Stormwater Separation & Green Stormwater Infrastructure



How Effective Would Stormwater Separation be in the North Henderson Area?

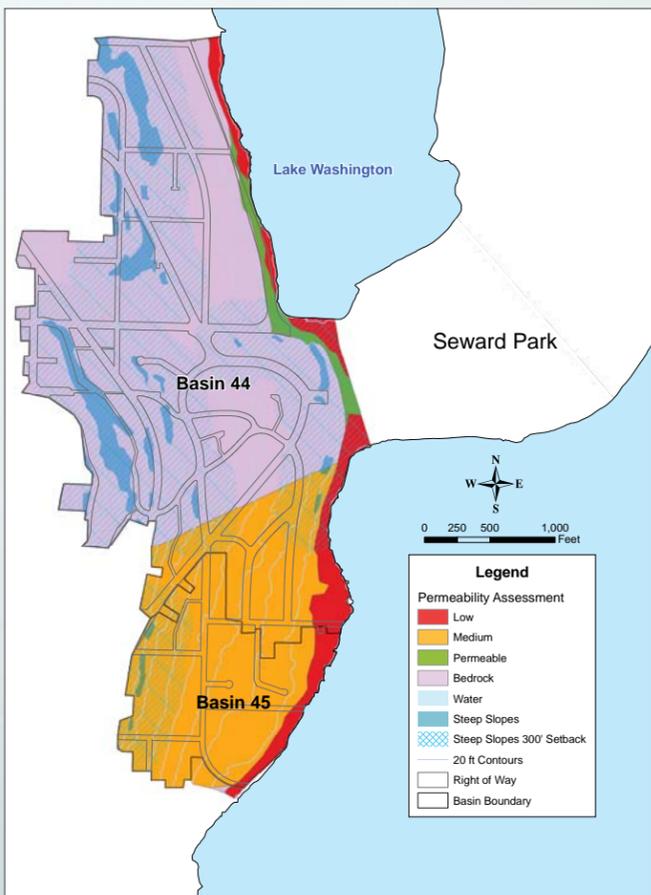


Separated and Combined areas in North Henderson



Possible areas for Stormwater Separation and GSI

How Effective Would RainWise be in the North Henderson Area?



GSI on private property is only effective in areas with soils that can infiltrate well

RainWise rain gardens are not appropriate at all locations. Technical limitations include the following:

- Areas where infiltration is restricted (e.g., steep slopes and setbacks)
- Setbacks from rockery walls and basements
- Sites with slowly draining soils

Technical limitations of RainWise cisterns include the following:

- Overflow to landscaping is restricted (can overflow to side sewer)
- Cisterns cannot be placed where ingress/egress will be blocked or hindered

Stormwater Separation & Green Stormwater Infrastructure



What Can You Do to Help?

Participate
in RainWise!



Improve your soil with compost and mulch



Reduce paved area



Install a cistern



Install a rain garden where infiltration is feasible