

Stormwater Best Management Practices (BMPs)

Naveen Kumar Devata and
Bhaskar Kura
University of New Orleans



Common Stormwater Pollution Sources

When it rains, water that is not absorbed into the ground, intercepted by vegetation, or evaporated flows into surface waters such as rivers, canals and coastal waters. This flow is called runoff. As the runoff flows over the roads and land, it picks up pollutants.

Roads are a source of pollution. Oils, grease, construction dirt, trash & cigarette butts wash off roads when it rains.



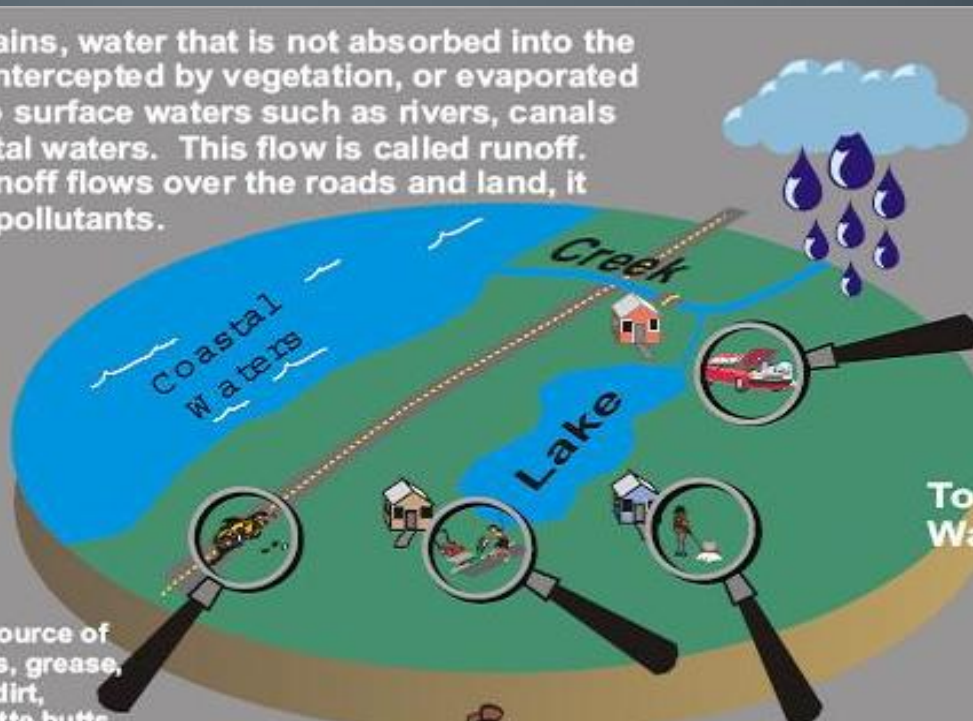
Excess fertilizers wash off lawns & gardens when it rains & flow into surface water.



Surface water can be polluted through groundwater.



Things put into stormdrains and on the street can end up in our rivers, canals, & coastal waters



Stormwater Management

Stormwater Management can be categorized into two parts:

- Routine Stormwater management (Industrial activities)
- Occasional Stormwater Management (From Constructional activities)

Regulations on Stormwater

- Clean Water Act has prohibited the discharge of any pollutant to water unless the discharge is authorized by National Pollutant Discharge Elimination System (NPDES)
- NPDES is designed to regulate point source discharges
- EPA adopted regulations requiring NPDES permits for stormwater discharges from certain industrial and construction sites:
 - Phase I for Large construction sites
 - Phase II for small construction sites
- Industrial facilities and construction sites are regulated by State Water Resources Control Board through general stormwater permits
- Cities and counties are regulated through permits issued by Regional Water Quality Control Boards

Stormwater Management for Construction Activities

- If the construction activity is spread over < 1 acre,
 - No permit required
 - Notice of Intent should be completed and kept on site (have to produce if inspected)
 - Stormwater Pollution Prevention Plan (SWPPP) should be on site (no submission required)
- If the construction activity is spread over > 1 acre,
 - Need permit
 - Need construction site erosion and stormwater management plan and/or SWPPP

Stormwater Best Management Practices

What are BMPs

- Techniques used to control the stormwater runoffs, sediment control and soil stabilization, as well as prevention of non-point source pollution
- *Technique, measure or structural control that is used in a given set of condition to manage the quantity and improve the quality of stormwater runoff in the most cost-effective manner - “EPA’s Definition”*

BMPs...

- Measures or controls used to reduce pollutants at the source to prevent the pollution of stormwater runoff
- Divert runoffs away from the areas of exposure to the pollutants
- Direct the polluted runoffs to natural or other types of treatment
- Manage stormwater before it is discharged to the storm drain
- Implies regulations on various industries in storing and handling their products
- These regulations reduce pollution of other media to an extent

Need for BMPs

- Stormwater is a major source (about 60%) of water pollution and a considerable source for polluting other medias.
- Pollutants runoff impervious surfaces
- Higher concentrations and more types of pollutants in stormwater
- Increased loads of pollutants in receiving waters

Why Bother?

- Stormwater runoff can degrade the quality of wetlands, surface water and groundwater
- This impacts the ecological, recreational and aesthetic attributes of these resources
- Degraded surface and groundwater can cause or lead to human health impacts

Commonly known Stormwater Pollutants

- Sediment- Land disturbance and erosion
- Nutrients-Fertilizer application and decomposing plant material
- Heavy Metals- Automobiles and metal pipes
- Mercury- Atmospheric deposition and improper disposal
- Lead- Fuels, paints and automotive parts
- Copper- Break pad wear and roofing materials
- Zinc- Tire wear and galvanized sheeting and fencing
- Dioxins- Combustion
- Petroleum Hydrocarbons- Leaking automobiles and minor spills
- Microbial Pathogens- Sewer leaks and overflows, pet wastes, failing domestic wastewater systems
- Pesticides- Over application, spills
- Litter

Stormwater BMPs

Two Types:

- Structural Type- Engineered to control both quantity and quality of stormwater
- Non Structural
 - Educational
 - Policy Changing
 - Pollution Prevention

BMPs to reduce Non-Point Source Pollution

- **Structural** (Examples: Wet/ Dry Basins, Stormwater wetlands, etc.)
 - Stormwater management basins
 - Silt Fences
- **Non-structural** (Examples: Vegetation Swales, Rain Gardens, etc.)
 - Minimize impervious cover
 - Minimize disturbance
 - Maximize vegetation and Minimize Lawns
 - Minimize vegetation that needs fertilizers

Household BMPs

- Limit impervious surfaces
- Low impact development
- Green Landscaping
- Water Conservation
- Proper use, storage and management of chemicals
- Proper septic management
- Stormwater control measures

Stormwater BMPs for Industrial Facilities

- Prevent water from contacting working areas
- Manage stormwater before it is discharged to the storm drain
- Keep pollutants off surfaces that come into contact with water

A Few Commonly Used Stormwater BMPs

Wet Detention Basins

- Permanent pools of water, much like natural ponds
- Excess runoff is stored above the permanent pools and discharged at controlled rate through an outlet
- More effective when native plants are added to the slopes and bottom
- Higher pollutant removing capacity
- Pollution suspension is very less during a storm
- Also serves as aesthetic or recreational amenity

Wet Detention Basin



Stormwater wetland Detention

- A small permanent pool of water
- Relatively shallow pools that support conditions suitable for growth of wetland plants
- Bottom and slopes are planted with native plants that provide pollutant filtering capabilities
- Remove a wide range of stormwater pollutants from land development sites
- Provide a natural method of shoreline protection against wave action compared to the placement of rock riprap
- Have less biodiversity when compared to natural wetlands
- Offer water quality benefits and natural habitat
- Require less maintenance

Stormwater Wetlands





Dry Detention Basins

- Temporarily hold stormwater
- Discharge off this stored runoff through infiltration into the surrounding soils
- Helps in improving water quality
- Prior to mid 1980's dry basins were most common type of water management facility

Dry Detention Basin



Vegetated Swales

- Most commonly used BMPs
- They are used along highways, parking lots, residential streets, and in between homes to convey waters
- They are designated to infiltrate and treat stormwater runoff
- Low construction and maintenance costs
- Elimination of curbs and gutters which collect and deliver pollutants to receiving waters

Vegetated Swales



Vegetated Swales



Beckman Frigate courtyard with infiltration garden

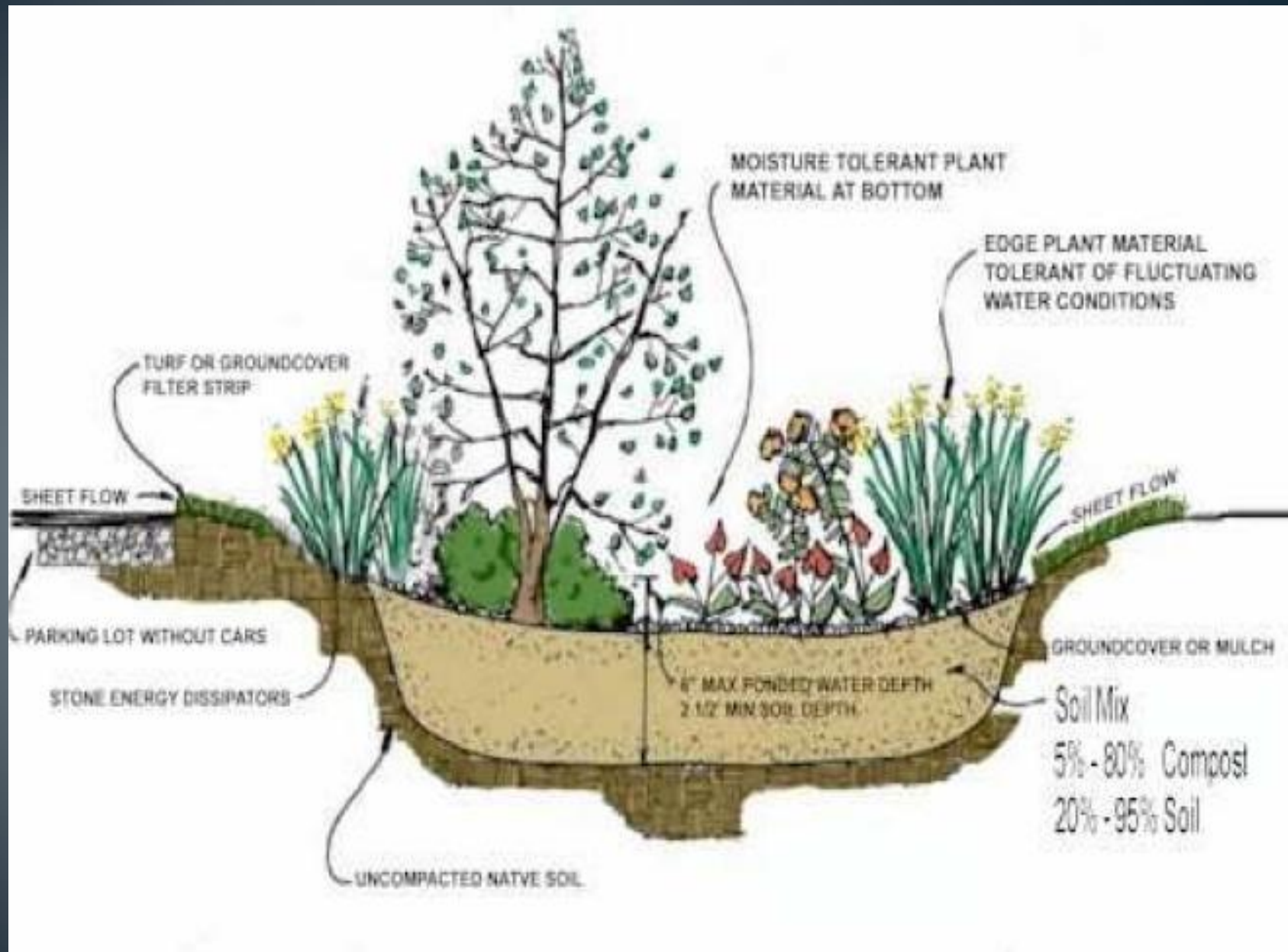


Bio-retention or Rain Gardens

- Can be placed in areas around home landscape to capture rainfall, roof and impervious runoff
- Native plants that are climate and water tolerant are used
- Help control of stormwater and non-point source pollution
- Stormwater runoff entering the system is filtered first through vegetation and then the sand/ soil mixture before conveyed downstream
- They can be installed in lawns, median strips, parking lots, unused lot areas and certain easements
- They are intended to receive stormwater runoff from both impervious areas and lawns

Your Rain Garden is composed of woody plants (trees and shrubs) and herbaceous species (flowers, grasses, and ground covers) planted in three wetness zones.





Rain Gardens

Pollutant Removal Mechanisms:

- Absorption to soil particles – Dissolved metals and soluble phosphorous
- Plant take up- Removes small amounts of nutrients
- Microbial Process- Removes organics and pathogens
- Exposure to sunlight and Dryness- Removes pathogens
- Infiltration of runoff- Provide flood control, groundwater recharge and nutrient removal
- Sedimentation and filtration- Remove TSS, floating debris, trash, soil bound phosphorous, and some soil bound pathogens

Bio-retention or Rain Gardens



Sand Filters

- Designed to handle frequent storm events
- Removes sediments and microbial pollutants
- Can be used effectively at the places of spatial constraints
- Very effective in removing the common pollutants found in urban stormwater runoff
- Also removes pollutants in particulate form
- Can be used in large parking areas and other larger sites
- Helps in water quality enhancement

Sand Filters



Permeable Pavements

- Infiltration through porous asphalt or concrete
- Allow water to seep into the ground
- Helps in recharging groundwater
- Efficient land use when compared to swales, wet/dry detention basins, etc.
- Pervious pavement is well suited in for parking lots, walking paths, sidewalks, playgrounds, plazas, tennis courts, etc.

Permeable Pavements



Comparison of Standard Asphalt to Porous Asphalt



Green Roofs



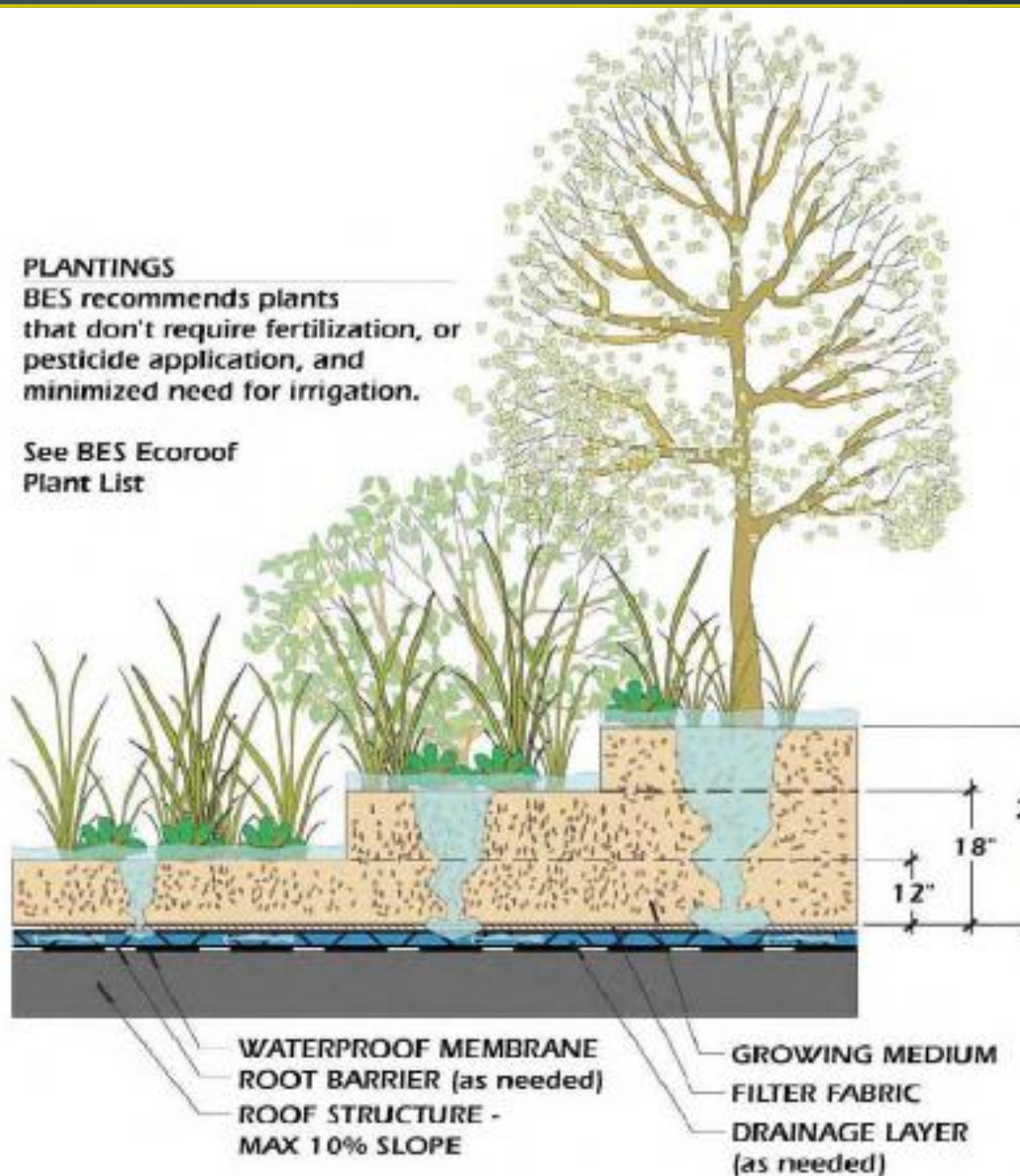
Green Roofs



PLANTINGS

BES recommends plants that don't require fertilization, or pesticide application, and minimized need for irrigation.

See BES Ecoroof Plant List

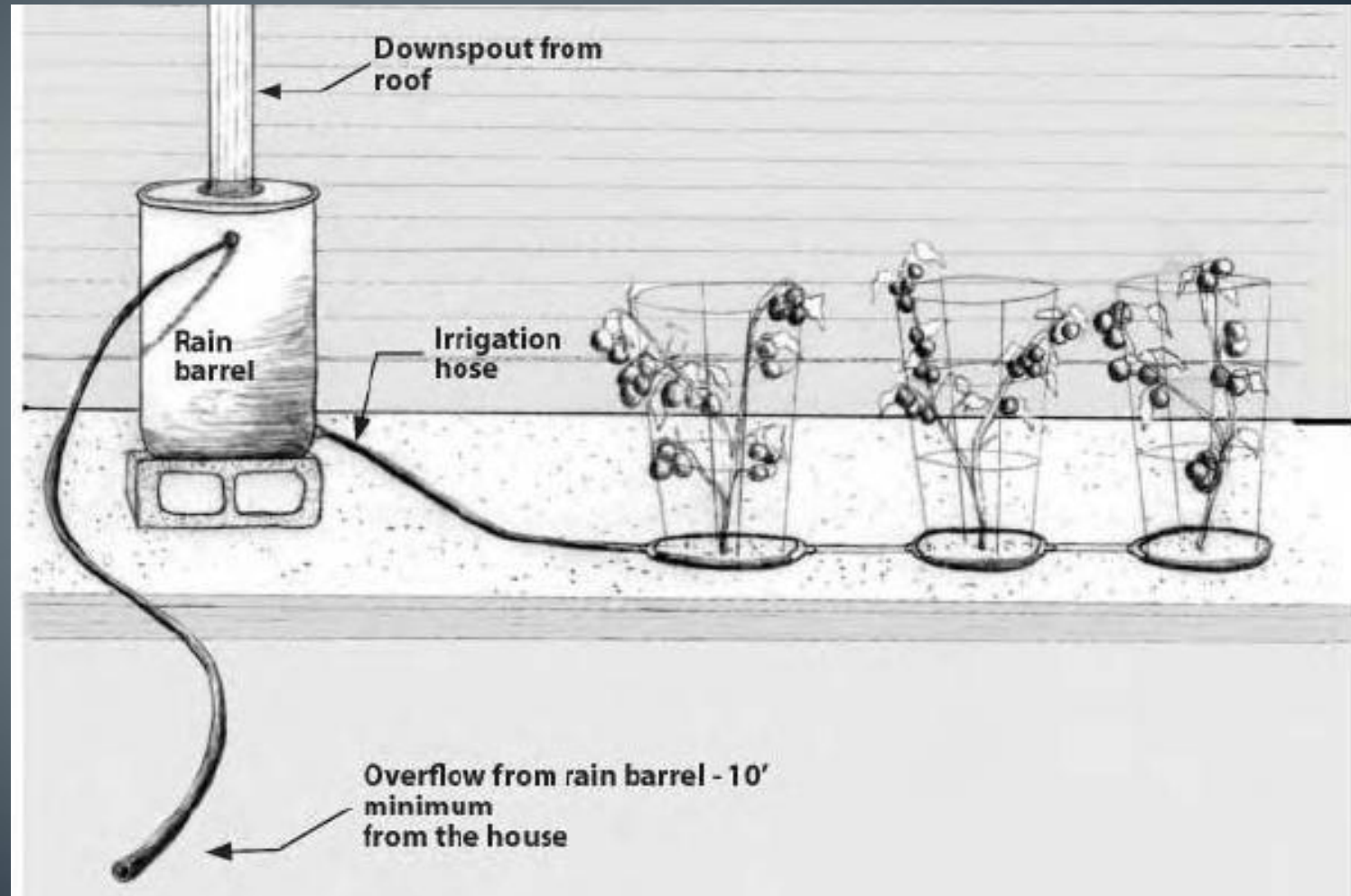




Rain water Barrels



Rain water Barrels



BMPs at Construction Sites

- Cleaning, grading and other activities in construction sites remove vegetation and compact the soil increasing both runoff and erosion
- Construction Stormwater BMPs are actions taken before, during and after construction that control erosion and sedimentation and protect water quality
- Effective erosion and sedimentation control can be achieved by following:
 - Protect the land surface from erosion
 - Manage runoff and keep the velocities low
 - Capture sediments near the source
 - Inspect and maintain erosion and sediment control system

BMPs at Construction Sites

Basic Structural Construction stormwater BMPs include:

- Construction entrance or exit stabilization
- Temporary sediment traps/filters
- Riparian buffers and filter strips
- Storm drain inlet and outlet protection
- Temporary sediment basins
- Sediment barriers

Maintaining BMPs

Signs of Degraded BMPs



References

- A Citizens Guide to Maintaining Stormwater BMPs, Stormwater Management Commission, Lake County, Illinois.
- Stormwater BMPs, Division of Water Quality, North Carolina Department of Environment and Natural Resources. 1999.
- EPA Stormwater Program (NPDES)
- Recommended BMPs for Stormwater Discharges, DEQ, State of Oregon. August 1997.
- BMPs for Industrial Stormwater Pollution Control, Sacramento Stormwater management program
- Understanding the new Stormwater Regulations, Stephen. J. Souza, Princeton Hydro, LCC.
- Stormwater BMPs, Christopher C. Obropta, Rutgers Cooperative Research and Extension, Feb 2008.

Selective Definitions

- Vegetated Swales: A open channel drainage way used along residential streets and highways to convey stormwater and filter pollutants instead of conventional storm sewer
- Native Plants: The species that provide long root system that can help stabilize stream banks, and can provide pollutant filtering capabilities
- Bio-Retention: It is the water quantity and quality control practice using chemical, physical and biological properties of plants, microbes and soil for removal of pollutants.

Thank you...