

Low Impact Development

Retrofitting Existing Structures and Watersheds

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How did we get here?



Poor Development

(Buildings & Roads)

- Excessive Runoff (Increase in Velocity & Quantity)
 - Overwhelms the system (Flooding)
 - Increase in Loss of Land (Erosion)
 - Increased contact with pollutants
 - Increase in sediment, nutrients, metals, toxins in Streams & Rivers
 - » Reduced Water Quality, Increased Cost for Treatment
 - » Loss of Infrastructure, Habitat, Recreational Opportunities



What can we do to change the existing situation?

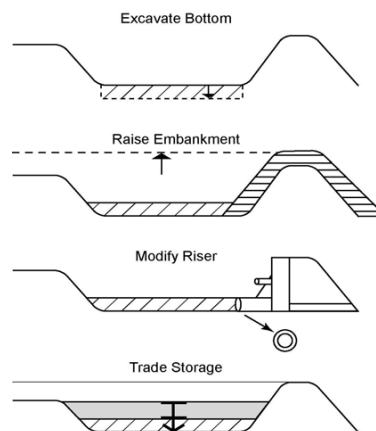
- I. Reduce, capture, store, retain, infiltrate, reuse or treat more runoff *before* it enters the stormwater system. (*Onsite*)
- II. Capture, store, retain, infiltrate, or treat more runoff *within* the stormwater system. (*Offsite*)

Different Types of Retrofits

- Increase Storage in Existing Ponds
- Bioretention
- Green Roofs
- Permeable Pavers / Porous Paving
- Rain Barrels / Cisterns
- Tree Wells / Filters
- Grassed Swales
- Constructed Wetlands
- Stream Restoration

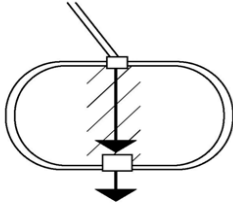
Existing Pond Retrofits

- Increasing Storage
 - Excavate Bottom
 - Raise Embankment
 - Decrease Outlet Size
 - Raise Outlet

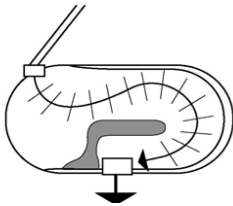


Existing Pond Retrofits

- Changing the Geometry or Layout
 - Increased Dropout Time



Change Geometry



Pond Retrofit Example

BEFORE



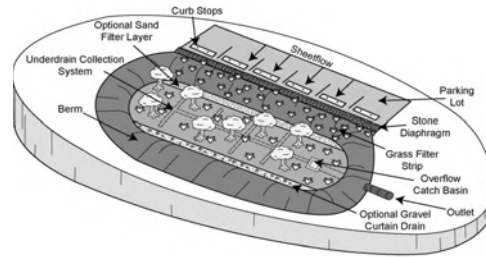
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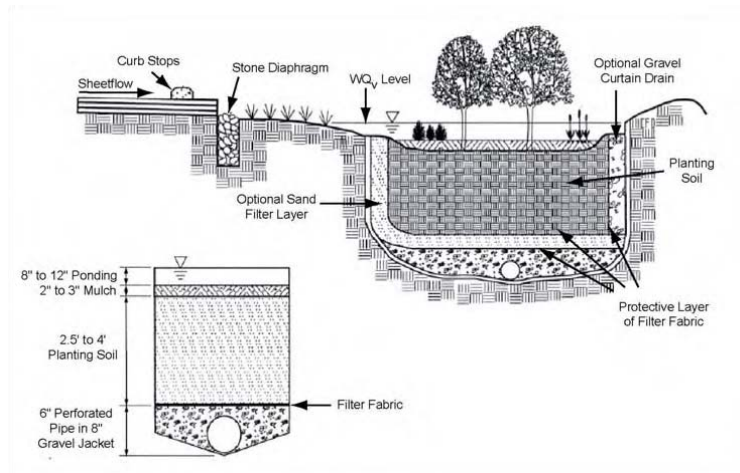
CITY OF VESTAVIA HILLS STORMWATER POND RETROFIT

Bioretention

- Is a landscape feature that is designed to treat runoff from small areas
 - Filter for Pollutants
 - Ideal use within parking lots and around paved surfaces



Bioretention



Bioretention Retrofit Example

- Removal of 6 parking spaces allowed for installation of this bioretention area



Bioretention Retrofit Example

- Removal of Riprap channel to stream; creation of linear bioretention cell



ASHLEY WOODS HOMEOWNERS ASSOC. OUTFALL RETROFIT,
VESTAVIA HILLS

Permeable Pavers / Porous Paving

- Allows for infiltration of stormwater
 - Can be used in a variety of situations
 - Parking Lots, Overflow Parking, Fire Lanes, Pedestrian Connections



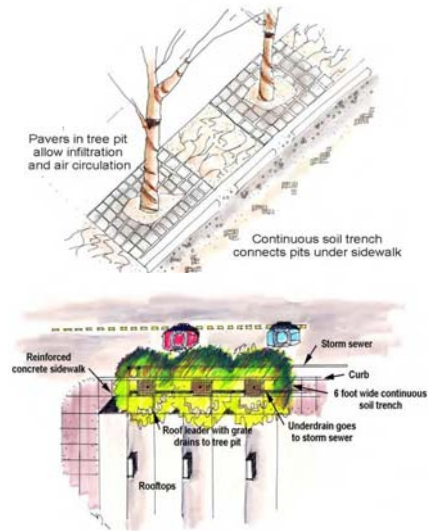
Rain Barrels / Cisterns

- Used to capture stormwater before it enters the conveyance system
 - Easy to Install
 - Monetary Benefit
 - Can be used on Residential, Commercial & Industrial Sites



Tree Wells / Filters

- Allows for uptake of stormwater and some infiltration along paved surfaces



Grassed Swales

- Swales utilize the conveyance system to provide treatment
 - Limited to Moderate pollutant removal through soil filters
 - Reduce Runoff Volume
 - Allow for groundwater recharge



Constructed Wetlands

- Shallow depressional areas that allow for long detention time
 - Ideal for pollutant removal
 - Typically less than 1' in depth



CITY OF VESTAVIA HILLS STORMWATER POND RETROFIT

Stream Restoration

- Reconstructs stream to natural pattern and profile to eliminate soil erosion
 - Benefit to Water Quality, Habitat, Recreational Opportunities



LITTLE SHADES CREEK STREAM RESTORATION, VESTAVIA HILLS

Stormwater Retrofits for Specific Locations

Transport of Right of Ways
Large Parking Areas
Small Parking Areas
Urban Hardscapes
Streetscapes

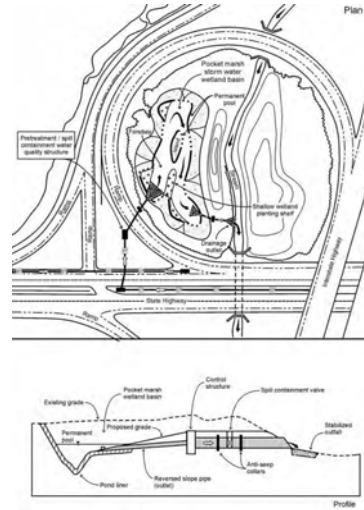
Storage in Transport Right of Ways

- Highway ROW is an underused area of land. Retrofits are ideal because their runoff pollution is high.
- Agencies have stronger incentives to retrofit and comply with emerging requirements
- Agencies are good maintainers and see retrofits as a way to reduce maintenance



Common Retrofits for ROW

- The most common retrofits for ROWs are constructed wetlands and ponds.
- Bioretention and Swales may be feasible in wider medians and ROW.



Difficult ROW Retrofits

- Sites that are to be widened or expanded in the future
- Steep slopes with guard rails
- Areas that require lane closure for construction or maintenance access
- Areas slated to be used as staging area for future road construction



Reforestation may be a viable option if a retrofit is not feasible.

Large Parking Lot Retrofits

Large parking lots are a good opportunity to treat runoff quality. They include regional malls, stadiums, airports, big box stores, schools, corporate campuses and hospitals.



Common Solutions for Large Parking Areas

- Extended Detention
- Ponds
- Constructed Wetlands
- Large Bioretention



Down gradient open land reserved in setbacks is ideal for treatment.

Difficult Sites for Retrofit

- Older lots in highly urban areas, such as downtown central business districts
- Parking lots that discharge directly to waterfronts or waterways



Large parking lots and potential off-site treatment areas are easy to find on aerial photos.

Parking Lot Retrofits should Consider

Parking lots generate a lot of trash. Planning for trash, sediment and debris removal is prudent. Accessible and oversized pretreatment areas or forebays should be utilized for ease of maintenance.



A two cell design with forebay would have worked better for this site.

Large Retrofit Design

- Design support may include the following tasks.
 - Secure as built drawings of the original parking lot design or request a survey.
 - Research zoning, easement, and plat records to determine ownership and future development
 - Evaluate parking needs to meet current demands
 - Delineate any forest or wetlands that may be present in the proposed area.

Small Parking Lot Retrofits

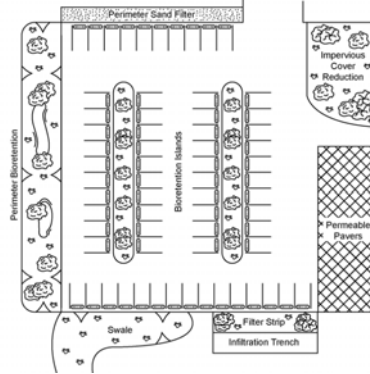
- Small areas treat parking lots of less than 5 acres. Surface retrofits can be installed within the parking lot, along the perimeter, or in adjacent pervious areas.



A wide range of treatment options can be used for this retrofit.

Small Parking Lot Retrofits

- Options
 - Permeable Pavers
 - Bioretention Islands
 - Perimeter Bioretention
 - Perimeter Sand Filter
 - Infiltration
 - Dry Swales



Small Parking Lot Retrofits



Bioretention with Trees



Grass Swale



Bioretention



Bioretention with Rock Swale

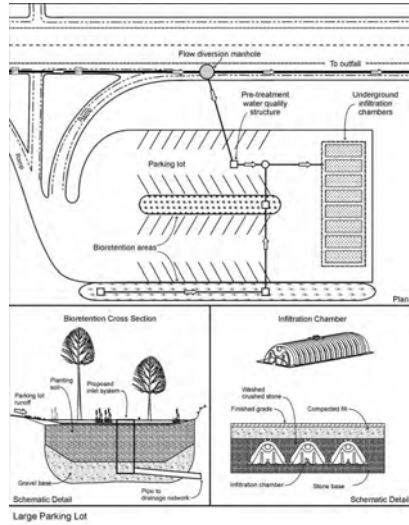


Dry rock Swale

Small Parking Lot Retrofits



Underground Infiltration



Retrofits in Urban-Hardscapes

- Retrofits in highly urban areas are a good demonstration opportunity with high visibility and also reduce heat island effect include:
 - Plazas
 - Parks
 - Pocket Parks
 - Waterfronts
 - Urban streetscapes



Chattanooga, TN

Retrofits in Hardscapes

- The following items can be featured in the urban hardscape
 - Water Features
 - Pervious Paving
 - Bioretention
 - Green Roofs
 - Expanded Tree Pits
 - Rainwater Harvesting



Stormwater as a Water Feature

Retrofits in Hardscapes



Green Roof



Water Feature



Water Feature with Bioretention



Pervious Paving



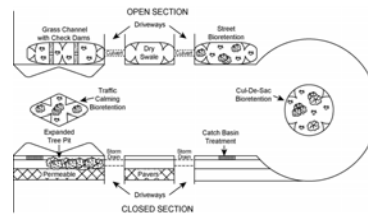
Irrigation by Rainwater



Retrofits for Streetscapes



Bioretention in Traffic Calming Islands and along the street at wide ROWs.



Watershed Case Study

- Vestavia Hills, AL
 - Little Shades Creek
 - Highly developed Urban Area
 - Commercial, Single Family and Multi-Family Residential, Office
 - Excessive Runoff, Erosion of Land, Sedimentation



Watershed Case Study

- Vestavia Hills, AL
 - Little Shades Creek
 - Completed to Date
 - ADEM 319 Grant
 - Constructed Wetland
 - Bioretention
 - Stream Restoration



Watershed Case Study

- Vestavia Hills, AL
 - Little Shades Creek
 - What could still be done?
 - Bioretention
 - Permeable pavers
 - Expanded Detention
 - Cisterns
 - Reforestation
 - Additional Stream Restoration

