

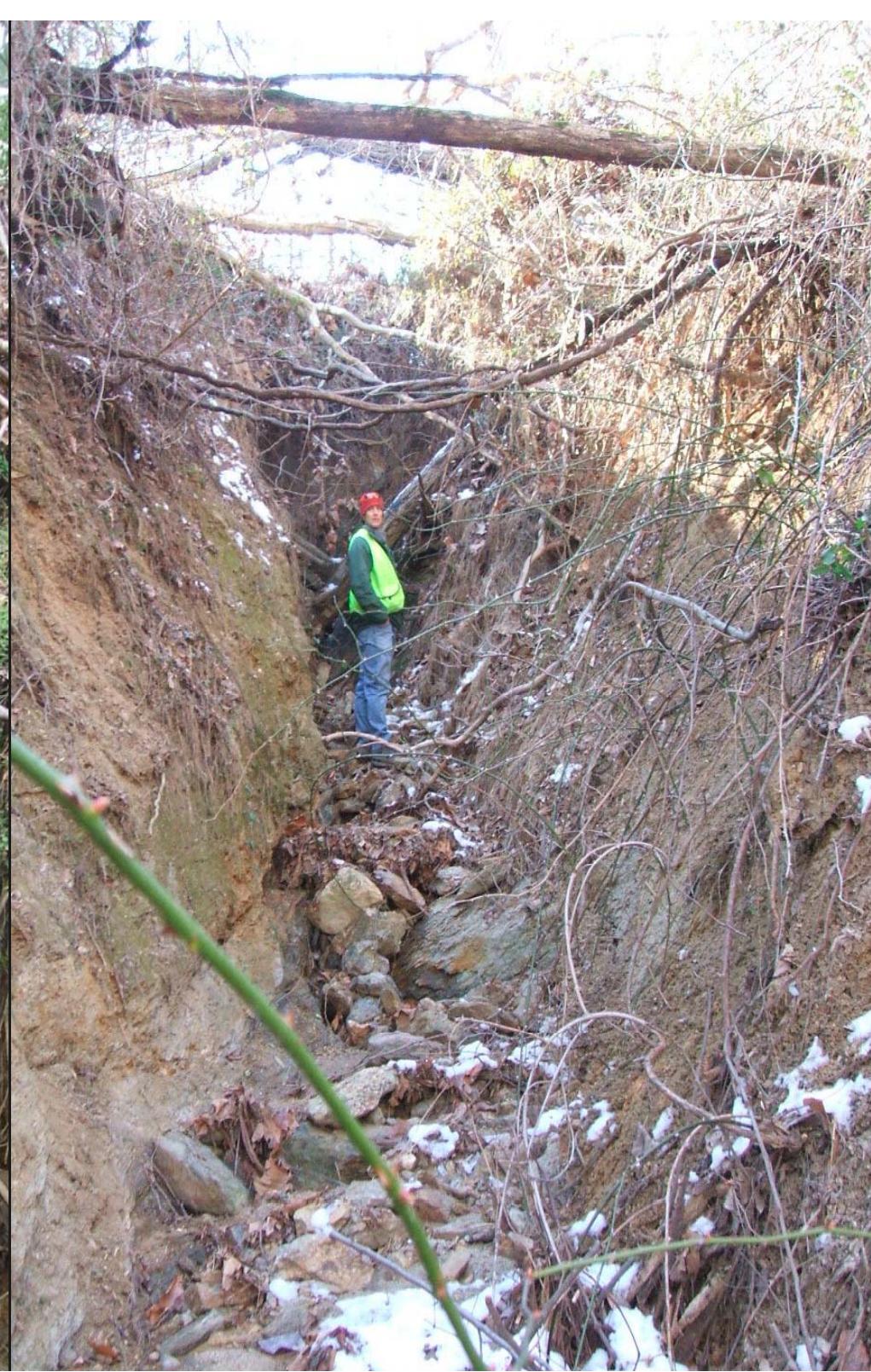


# Applications for Regenerative Design on Ephemeral through Perennial Urban Streams:

## Design and Environmental Benefit

Joe Berg  
Biohabitats, Inc.

jberg@biohabitats.com





22-ft incised



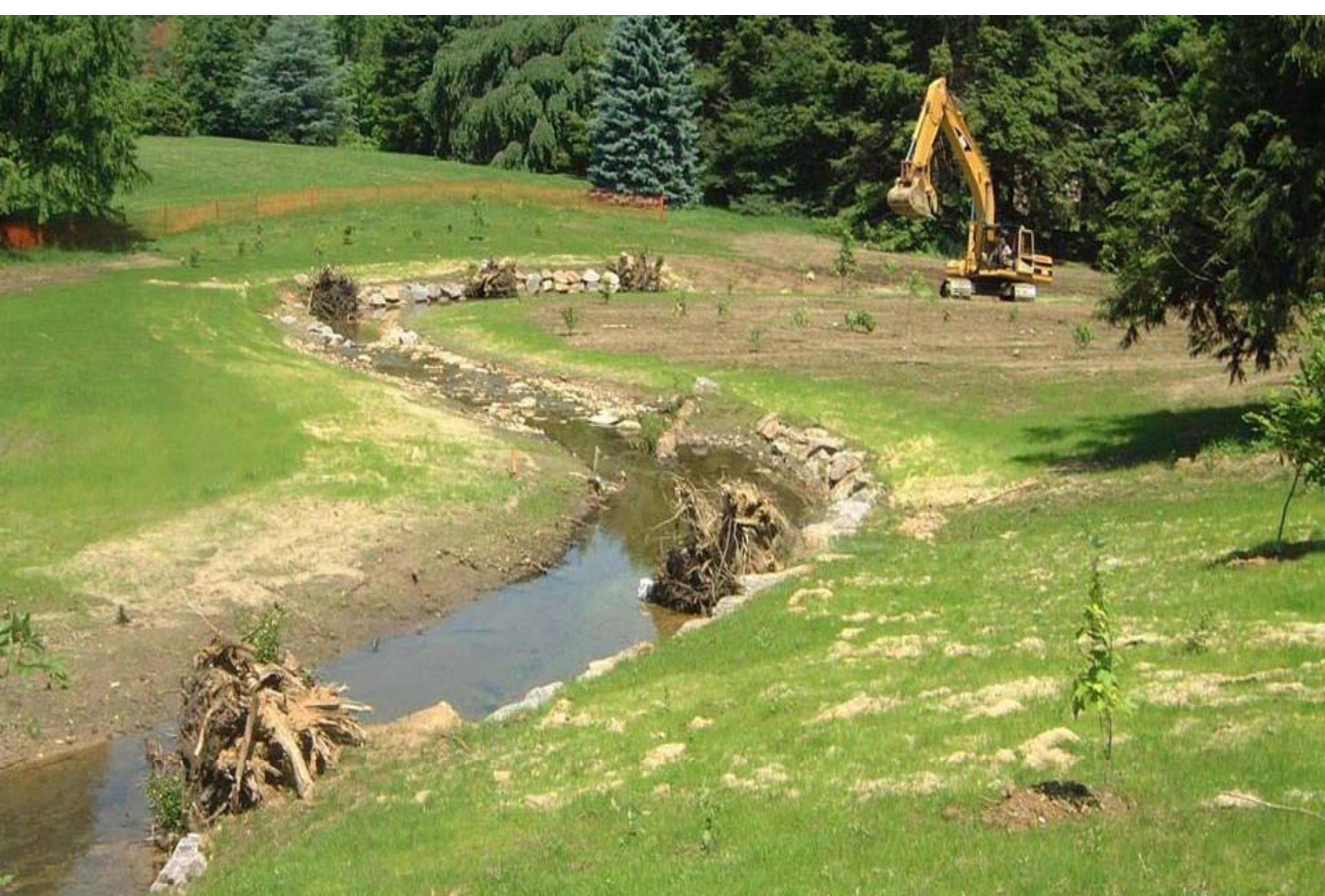






12/17/00





No storage on the landscape, all conveyance

# Regenerative Stream Channel Design



# Make Opportunities for Storage

A photograph of a wetland area. The foreground is filled with shallow water, with several small, young trees standing in it. Some of these trees have small pink flags attached to them. In the background, there is a dense line of mature trees and shrubs. The sky above is blue with scattered white clouds.

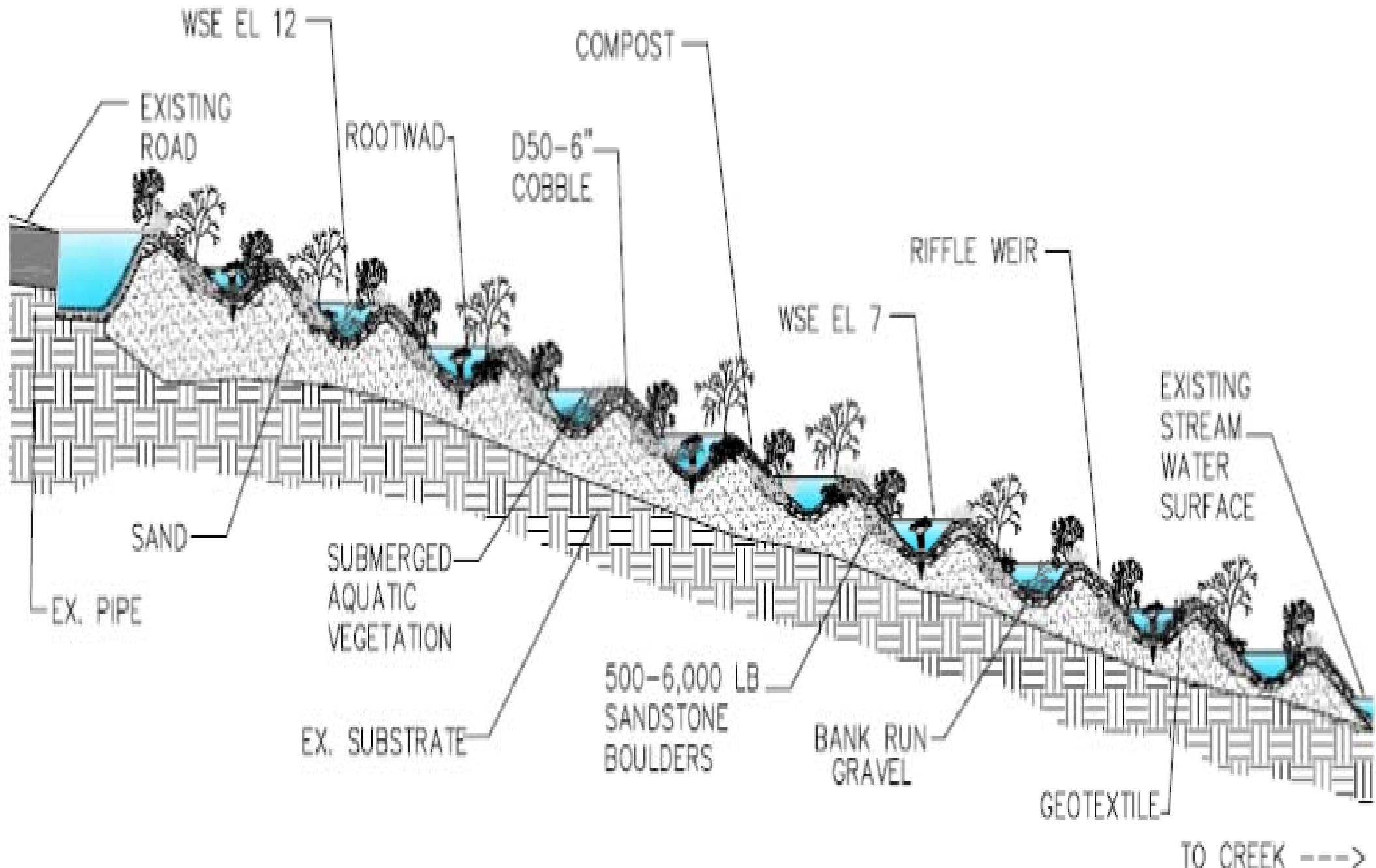
Integrated Stream and Wetland

A photograph of a wetland landscape. A small stream or creek flows from the background towards the foreground, surrounded by lush green vegetation, including tall grasses and aquatic plants like water lilies. The water is shallow and reflects the surrounding environment. In the background, there is a dense forest of trees under a clear sky.

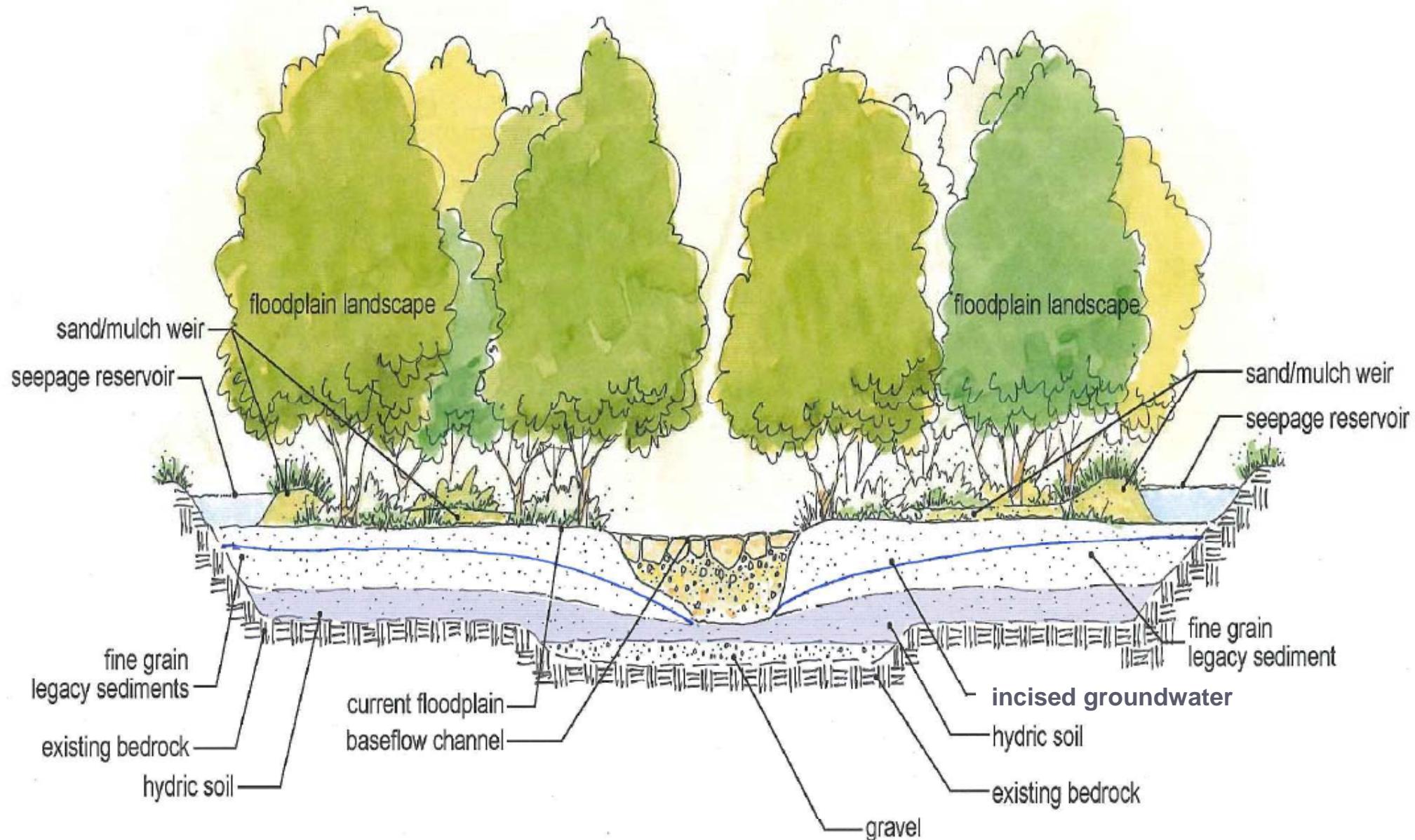
Set riffles to retain water on landscape

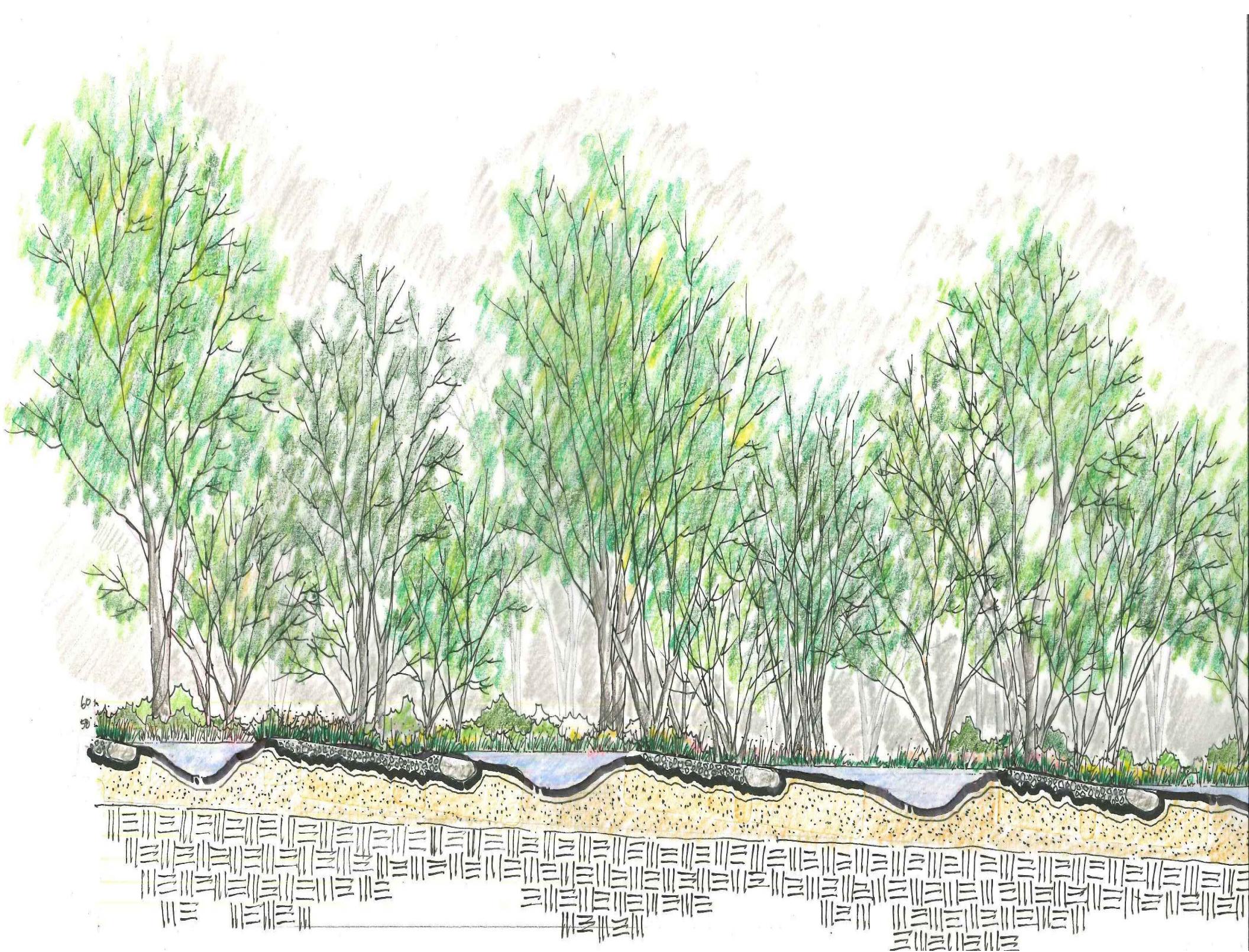


These systems are designed to mimic beaver dams



# Groundwater Restoration





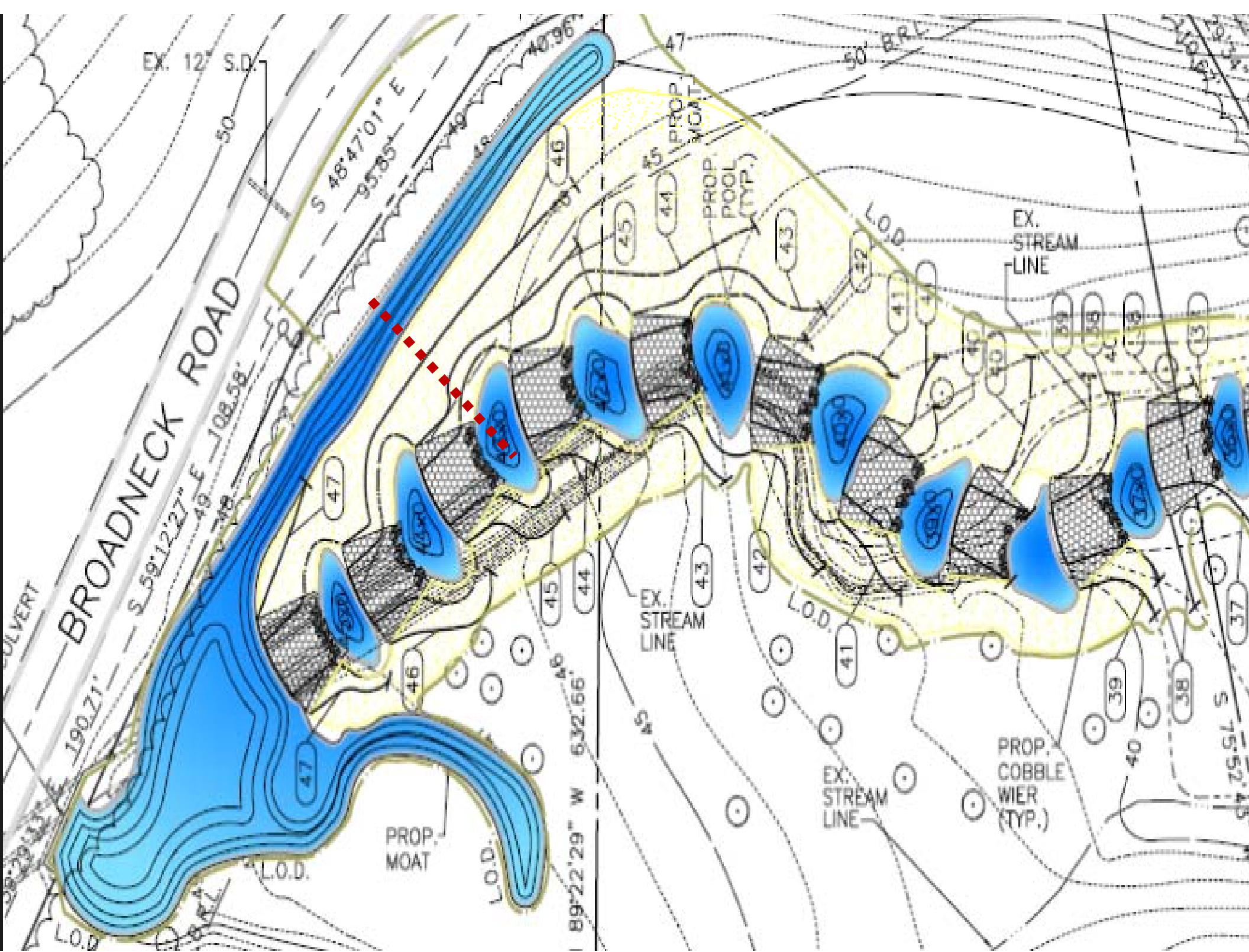
# Reconnect Stream

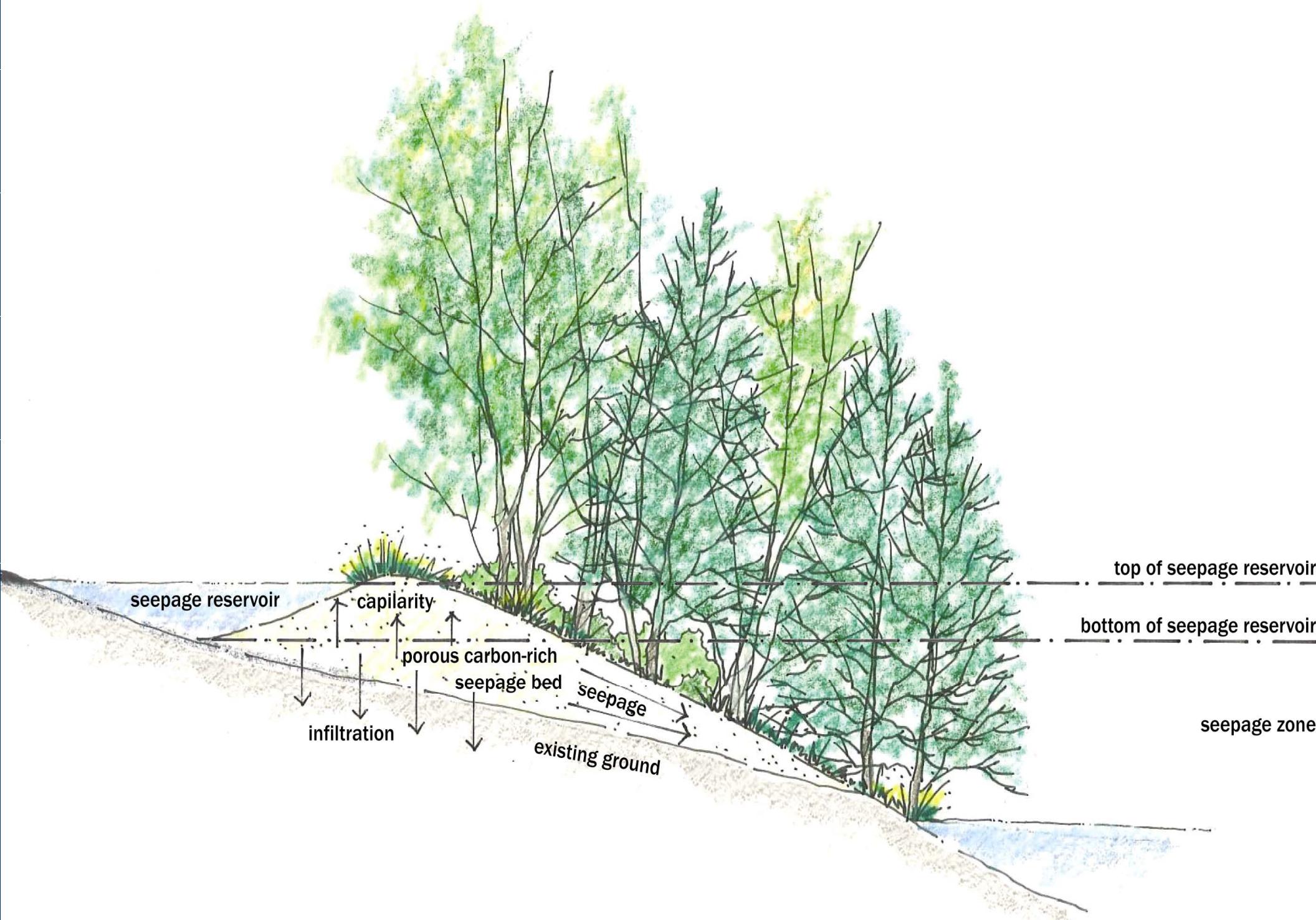


Raising groundwater elevation to near top  
of bank would store  
8.5 ac-ft of water

Estimated to extend baseflow by 19 days

Significant benefits to  
Stream hydrograph, shears, instream-  
habitat, adjacent wetland hydrology, etc.





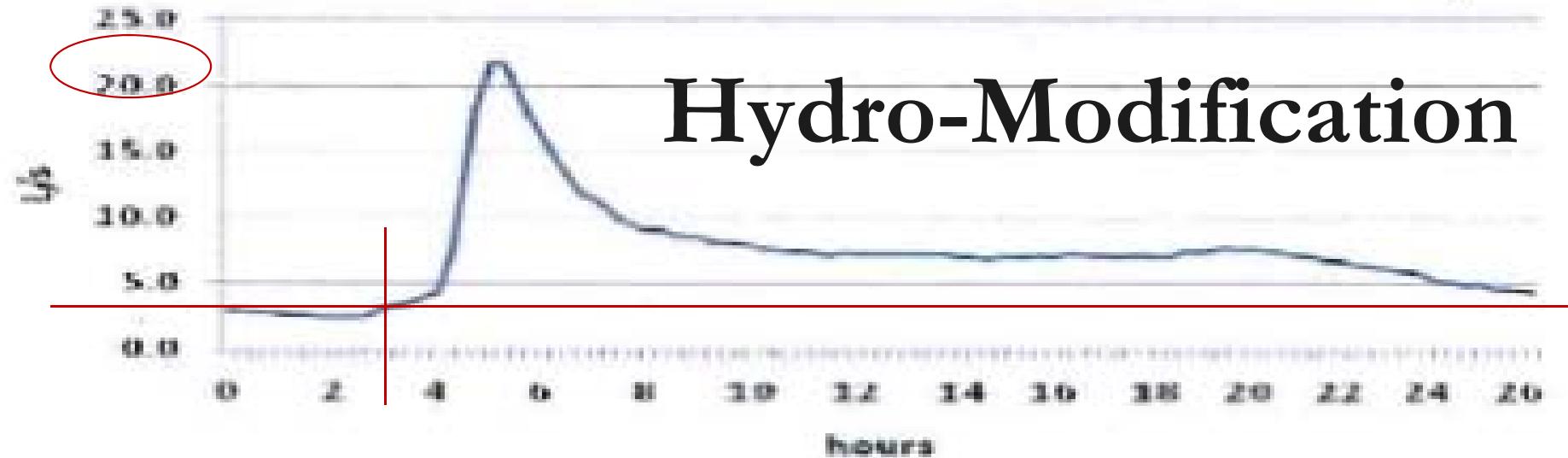






# Wilhelminor Stream (WIL)

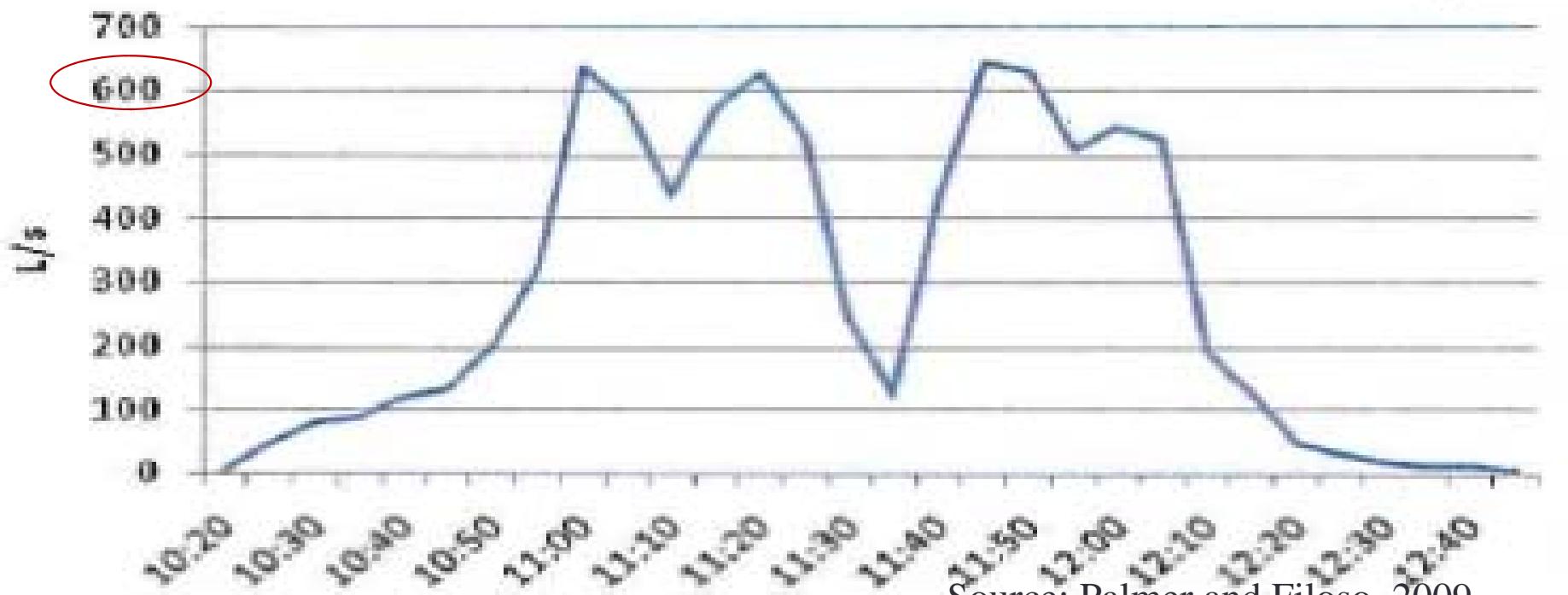
A



## Hydro-Modification

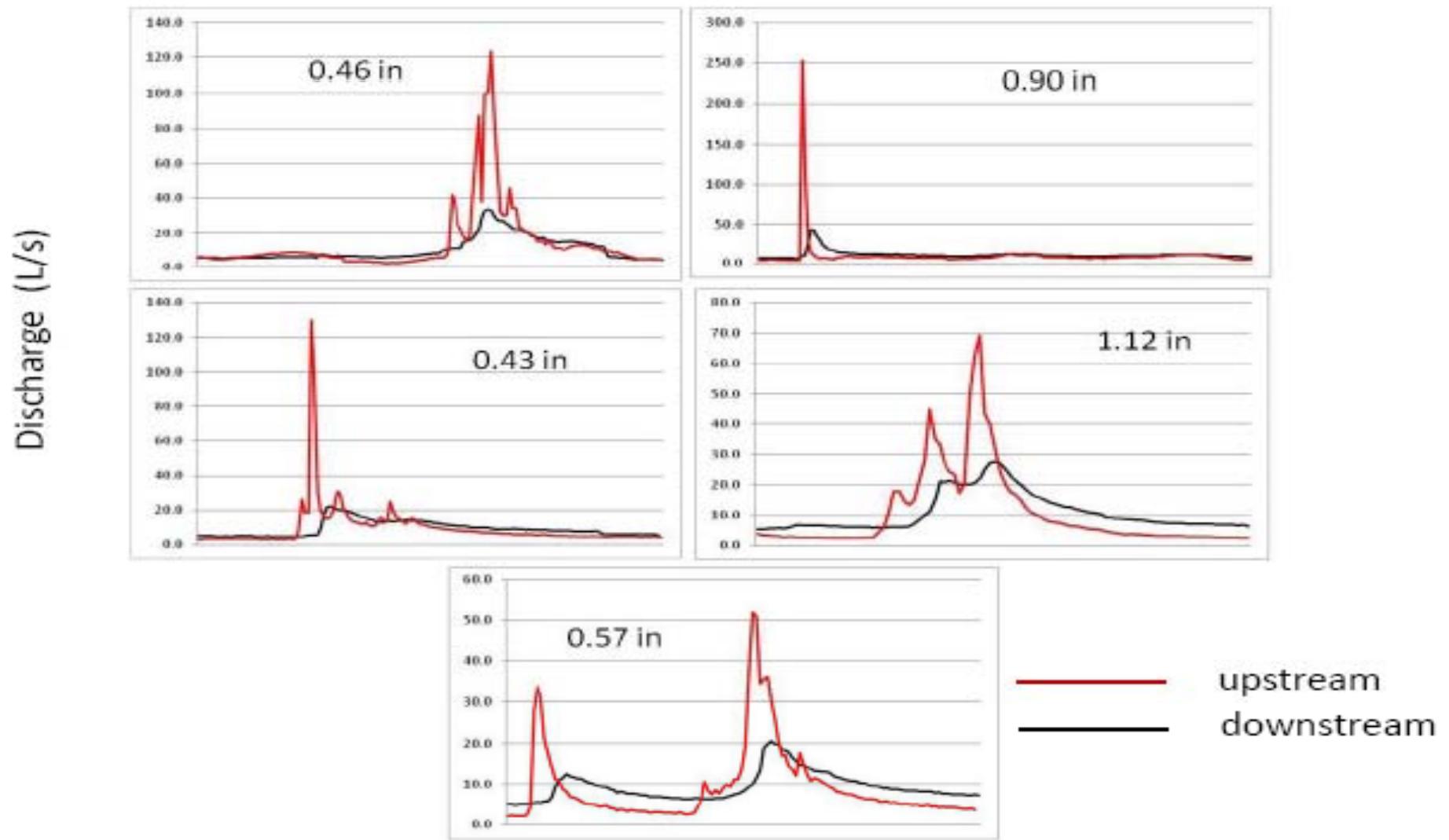
### Upstream of restoration - WIL

B

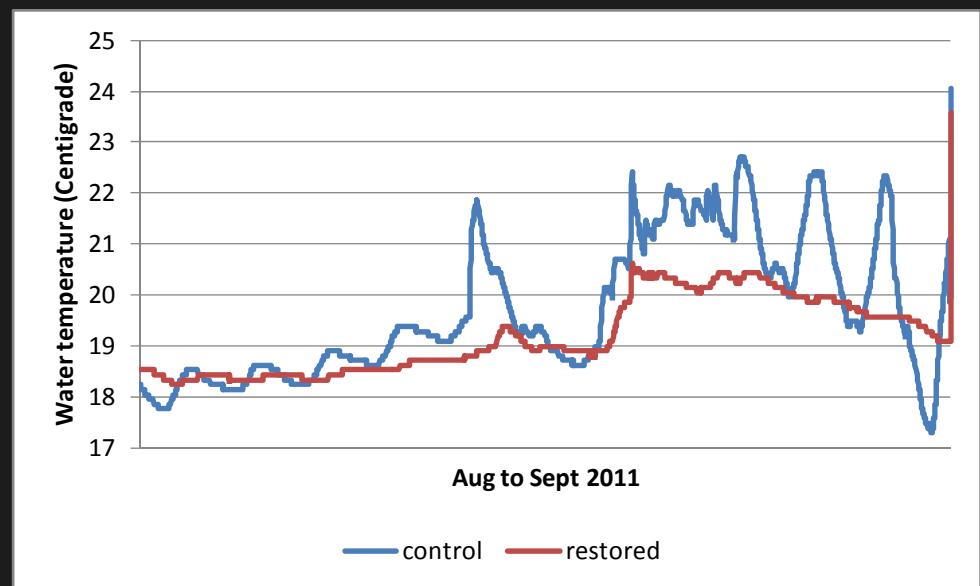
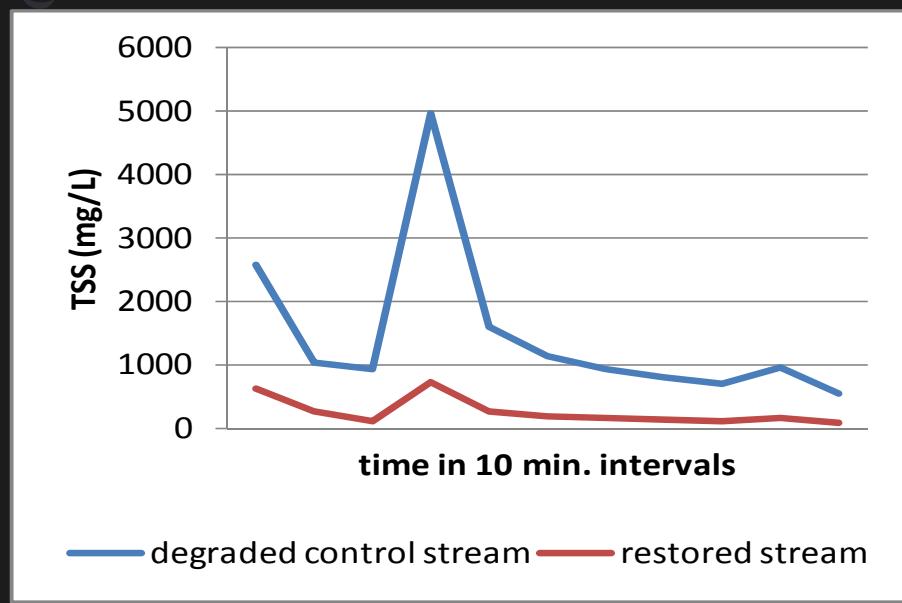
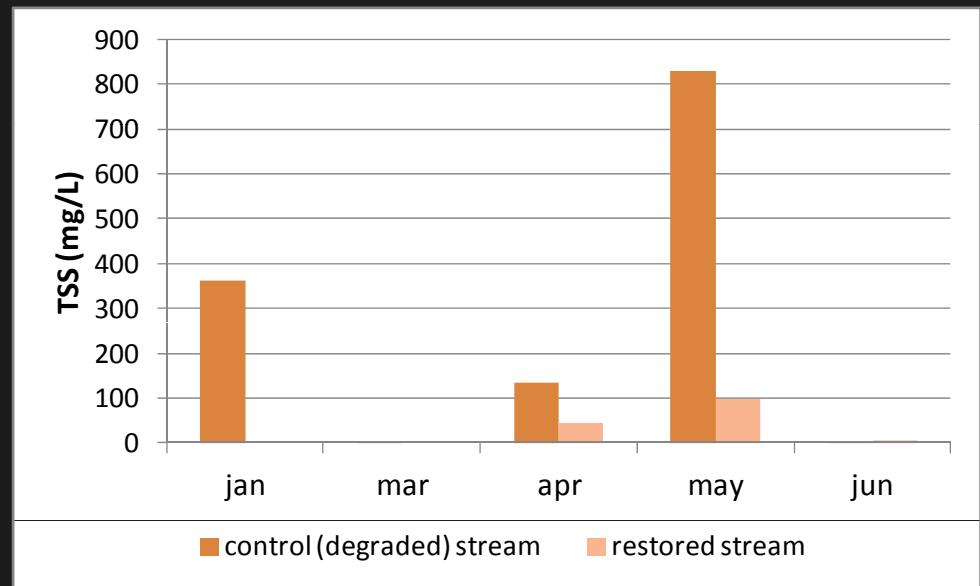
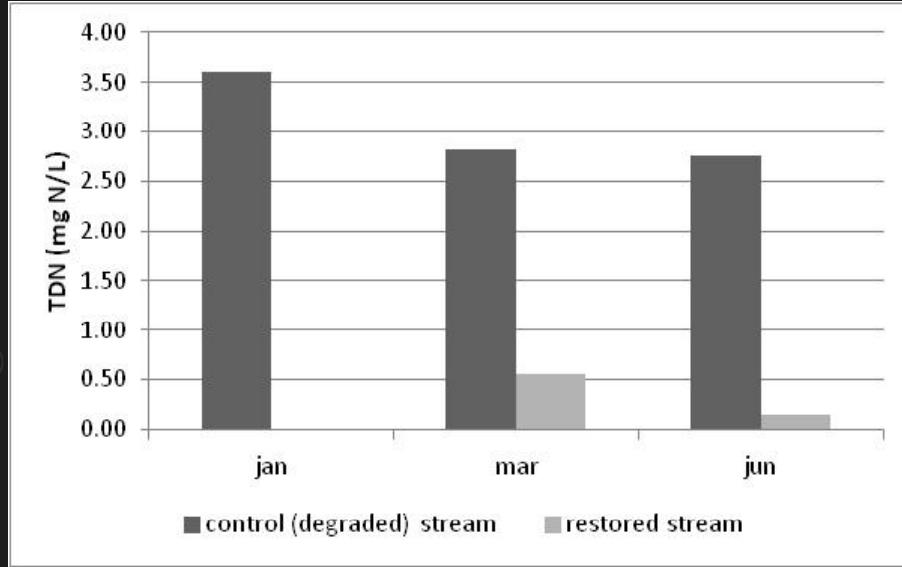


Source: Palmer and Filoso, 2009

# Hydrographs during individual storms WILELINOR

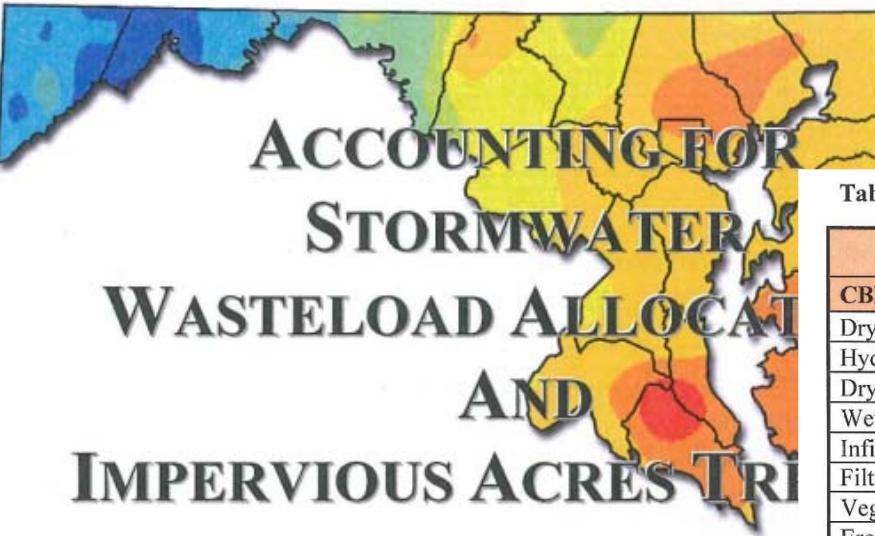


Source: Solange Filoso, University of Maryland



Carriage Hills,

Source: Solange Filoso, University of Maryland Center for Environmental Science,  
Chesapeake Biological Laboratory



## GUIDANCE FOR NATIONAL POLLUTANT DISCHARGE ELIMINATION STORMWATER PERMITS

JUNE (DRAFT) 2011



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MARTIN O'MALLEY, GOVERNOR | ANTHONY G. BROWN, LT. GOVERNOR | ROBERT M.

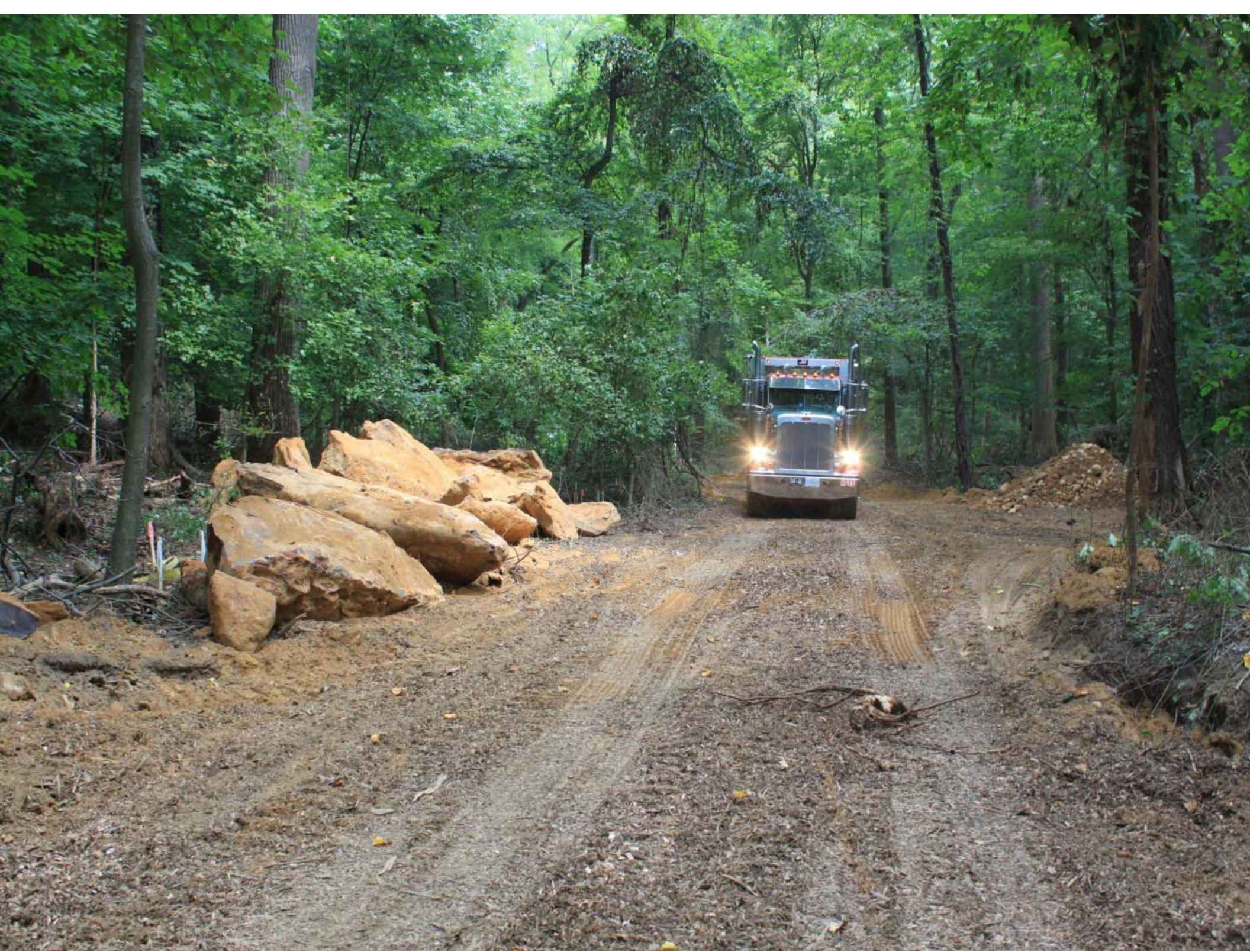
Table 4. Structural BMP Retrofit Matrix

BMP Practice	TN	TP	TSS
<b>CBP Structural BMPs</b>			
Dry Detention Ponds	5%	10%	10%
Hydrodynamic Structures	5%	10%	10%
Dry Extended Detention Ponds	20%	20%	60%
Wet Ponds and Wetlands	20%	45%	60%
Infiltration Practices	80%	85%	95%
Filtering Practices	40%	60%	80%
Vegetated Open Channels	45%	45%	70%
Erosion and Sediment Control	25%	40%	40%
<b>Stormwater Management by Era</b>			
Development Between 1985 - 2002	17%	30%	40%
Urban BMP Retrofit	25%	35%	65%
Development Between 2002 and 2010	30%	40%	80%
Development After 2010	50%	60%	90%
<b>ESD to the MEP from the Manual</b>			
Green Roofs	50%	60%	90%
Permeable Pavements	50%	60%	90%
Reinforced Turf	50%	60%	90%
Disconnection of Rooftop Runoff	50%	60%	90%
Disconnection of Non-Rooftop Runoff	50%	60%	90%
Sheetflow to Conservation Areas	50%	60%	90%
Rainwater Harvesting	50%	60%	90%
Submerged Gravel Wetlands	50%	60%	90%
Landscape Infiltration	50%	60%	90%
Infiltration Berms	50%	60%	90%
Dry Wells	50%	60%	90%
Micro-Bioretention	50%	60%	90%
Rain Gardens	50%	60%	90%
Grass, Wet, or Bio-Swale	50%	60%	90%
Enhanced Filters	50%	60%	90%
<b>Additional Structural BMP Guidance</b>			
Redevelopment (MDE)	50%	60%	90%
Existing Roadway Disconnect (MDE)	50%	60%	90%
Step Pool Storm Conveyance (MDE)	50%	60%	90%

A photograph of a wire fence in a forest setting. The ground is covered with fallen autumn leaves in shades of orange, yellow, and brown. A large tree trunk lies across the fence on the left. In the background, there are more trees and bushes, some with green leaves and others with autumn colors. The fence is made of vertical posts and horizontal wires.

# Before and After at Milkhouse

























# Before and After at Bingham











# Mount Vernon









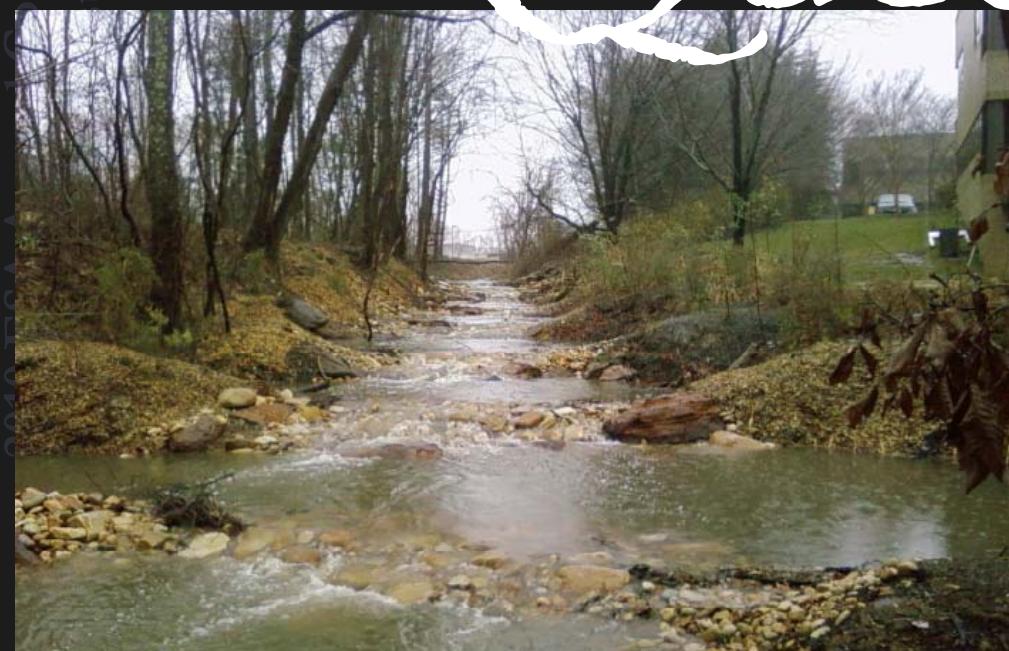








Questions?



Source of Photos: Underwood & Associates