Increased Storm Resiliency through the Application of Green Infrastructure BMPs

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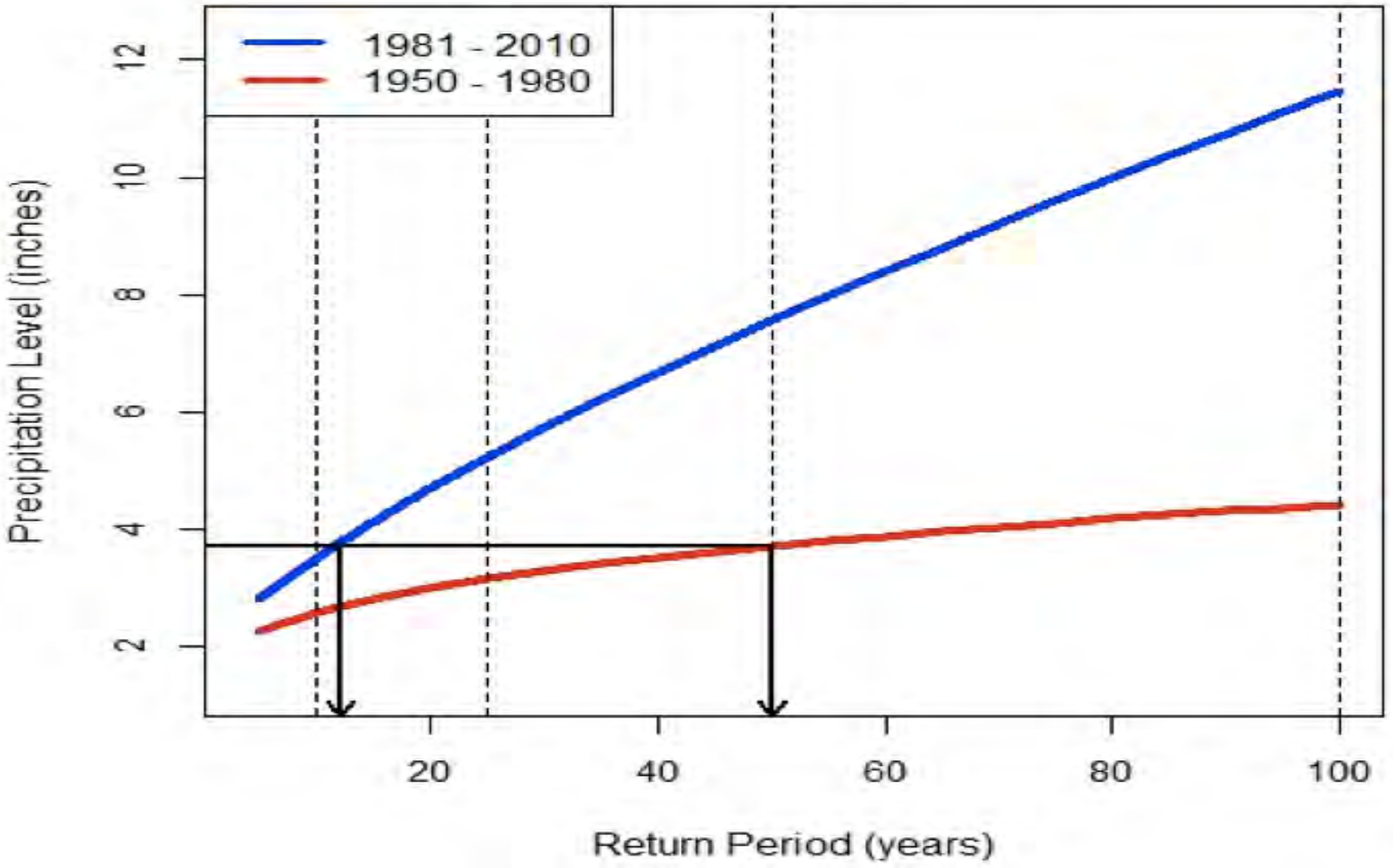
Extreme Rainfall Events

Increased Frequency of Extreme Events

- Severe storms occurring at a more common frequency
- Stress the need for the proper management of precipitation events
- This includes smaller, more frequently occurring storms that cause localized nuisance flooding

Increasing Storm Frequency



Flood Related Impacts

- Scour and erosion of waterways
- Increased sediment loading
- Increased nutrient loading
- Increased influx of contaminants
- Dam failures / Property damage
- Accelerated eutrophication
- Loss of ecological services and functions


SPEED LIMIT
15

Planning and Preparation

Resilient… "able to recoil or spring back"

AWRA … "a system's capacity to absorb or manage adverse situations"

Increasing Storm Resiliency with Green Infrastructure

- Can't typically manage all of the runoff from ≥100 yr storm
- But can lessen the impacts of more common storms that cause "nuisance flooding"
- Increased resiliency, lessens impacts and facilitates sustainability

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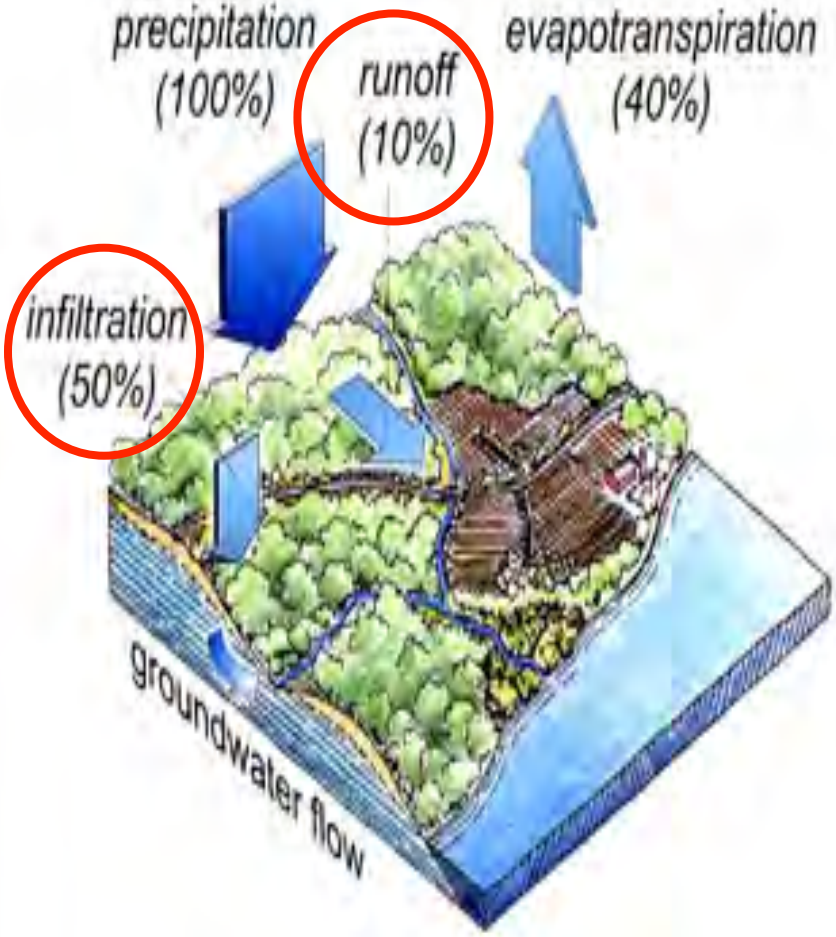
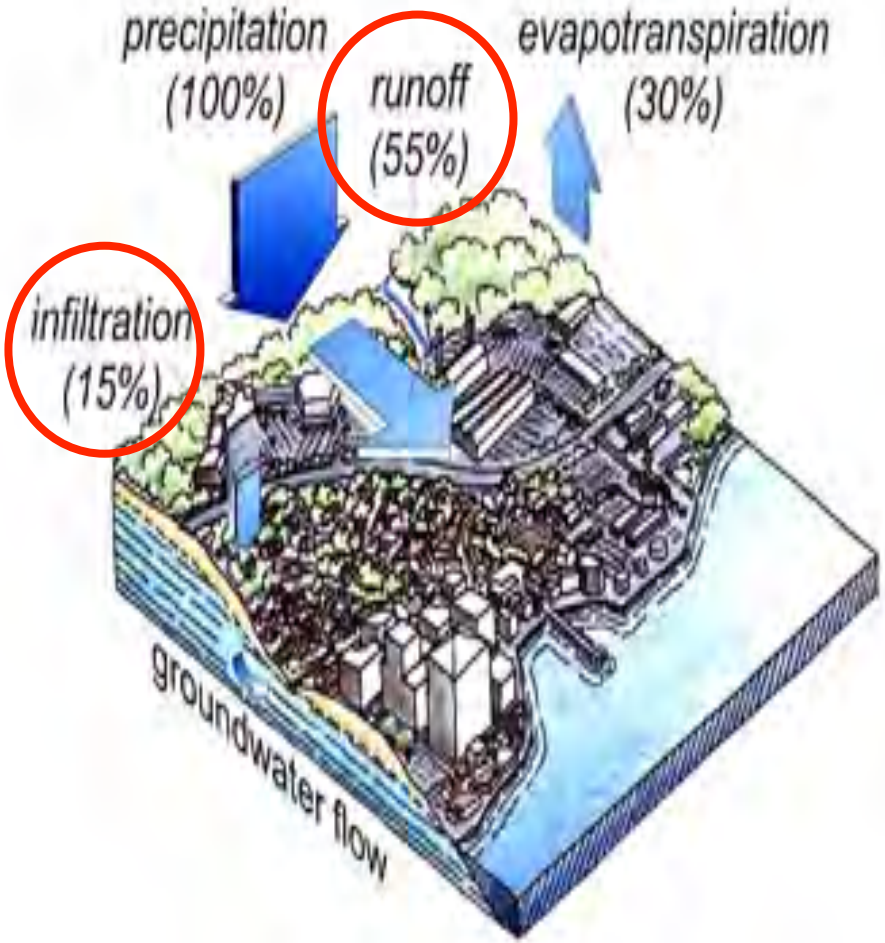
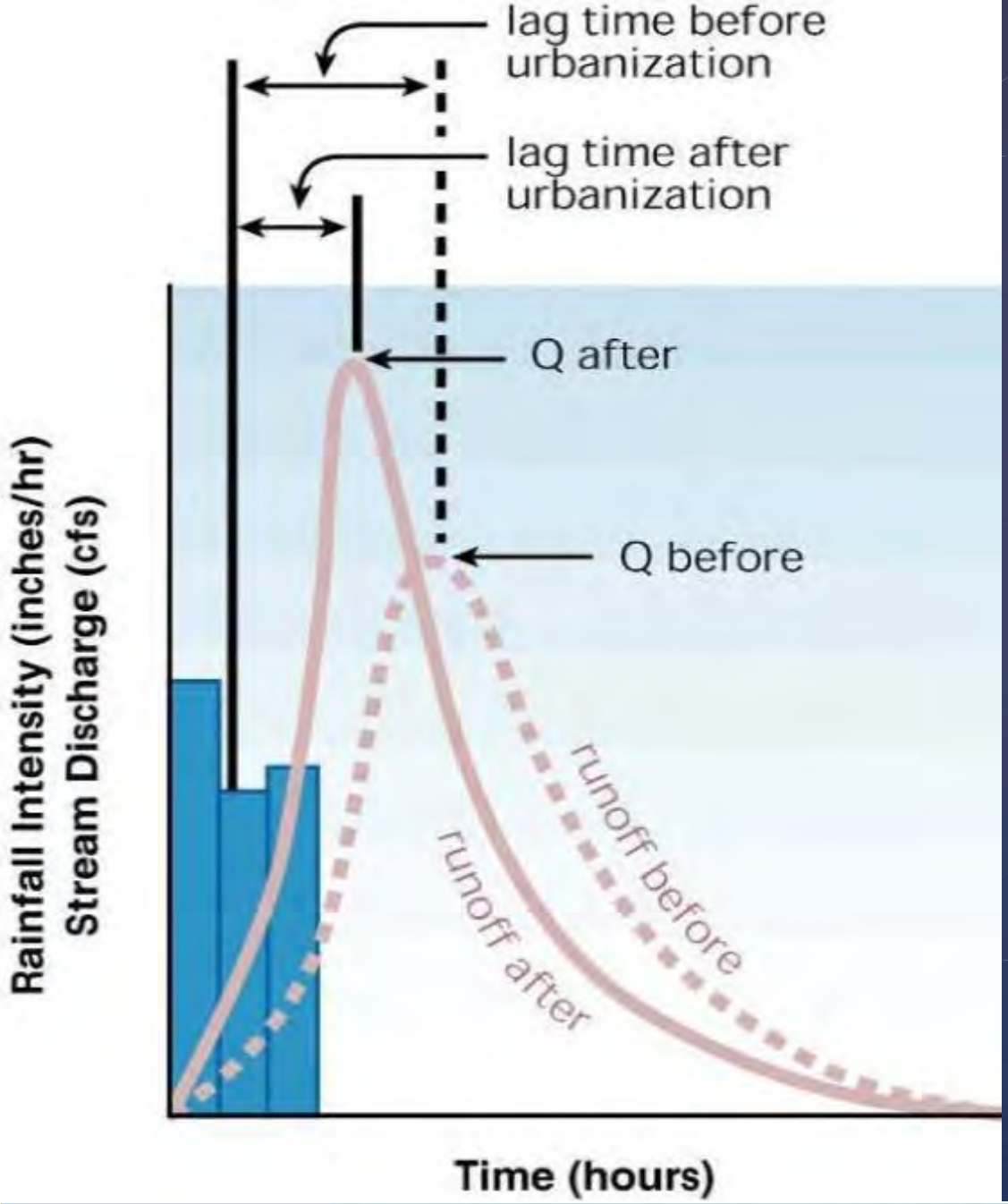
More Runoff and Less Recharge





www.mass.gov



Effect of Watershed Urbanization On Storm Hydrograph

Source: USDA/NRCS – Stream Restoration Handbook

Turn Down the Volume !!

- Reduce total runoff volume
- Volume control leads to better management of rate, amount of runoff and quality of runoff discharged from site

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NJDEP's Take on Green Infrastructure

- Reduce volume, flow rates and pollutant characteristics of wet weather flows.
- Promote stormwater infiltration, treatment and reuse.
- Examples - pervious pavement, bioretention basins, vegetated swales, rain gardens, green roof and cisterns.

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USEPA's Take on Green Infrastructure

- Green infrastructure - an adaptable term
- Use of engineered systems to mimic natural stormwater management processes.
- Combination of vegetation, soils, and natural processes to infiltrate, evapotranspirate, and/or recycle stormwater runoff and create healthier environments.

Control Smaller Frequent Events

- 1yr-24 hr storm = 2.75”
- 2yr -24 hr storm = 3.3”
  (https://www.nrcs.usda.gov)
- Capture and retain entire runoff volume of 1 and 2 year events
- Eliminates runoff generated by 93-95% of all storms occurring annually

1 yr event over a 15% impervious 1-acre lot generates ~10,000 gallons of runoff

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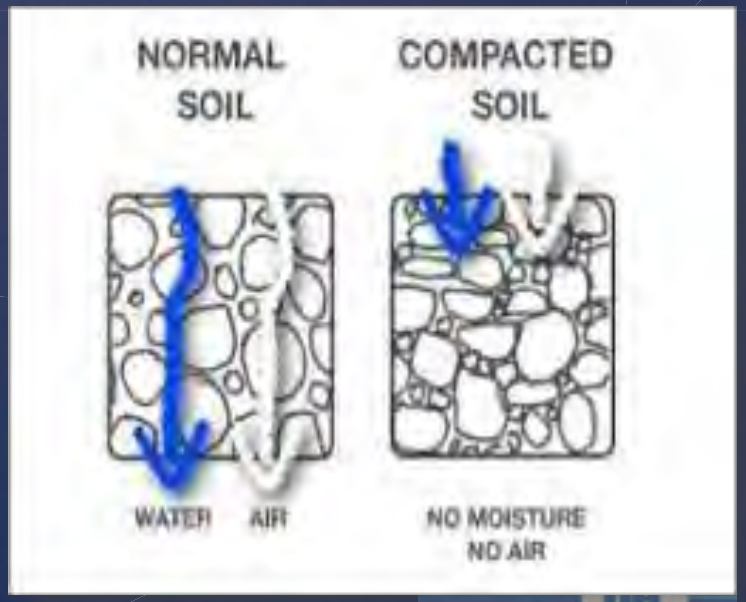
Retain Runoff

- Lessens hydrologic and hydraulic impacts
- Reduces stream bank erosion
- Sustains groundwater recharge and interflow
- Significantly reduces nutrient loading
- Reduces nuisance flooding

Maintain Soil Health

Healthy soils have good porosity…

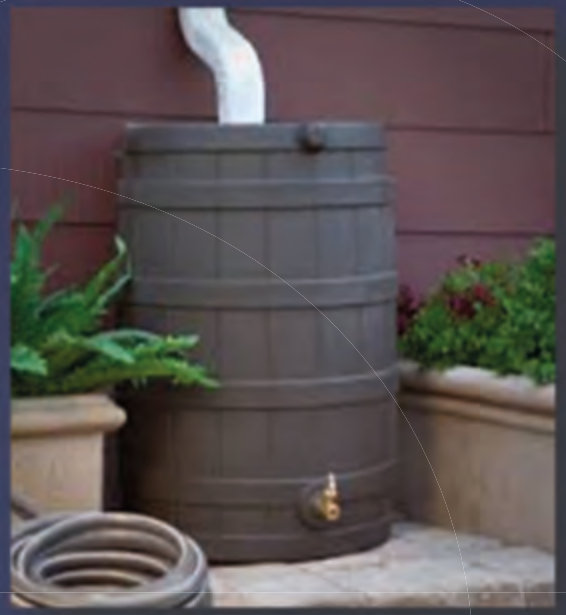
- Green doesn't mean good
- Less runoff = less flooding and less pollutant loading
- Decreases size of receiving BMPs
- Helps mitigate drought



Trees and Alternative Landscaping

- Lawns tend to be compacted and generate runoff volumes similar to blacktop
- Lawn grass has shallow root system
  - Doesn't promote soil porosity
  - Doesn't promote soil stability
  - Water "hog"
- Trees provide above ground, at ground and below ground benefits....reduce runoff and increase recharge

Harvest Rainwater



Rain Garden

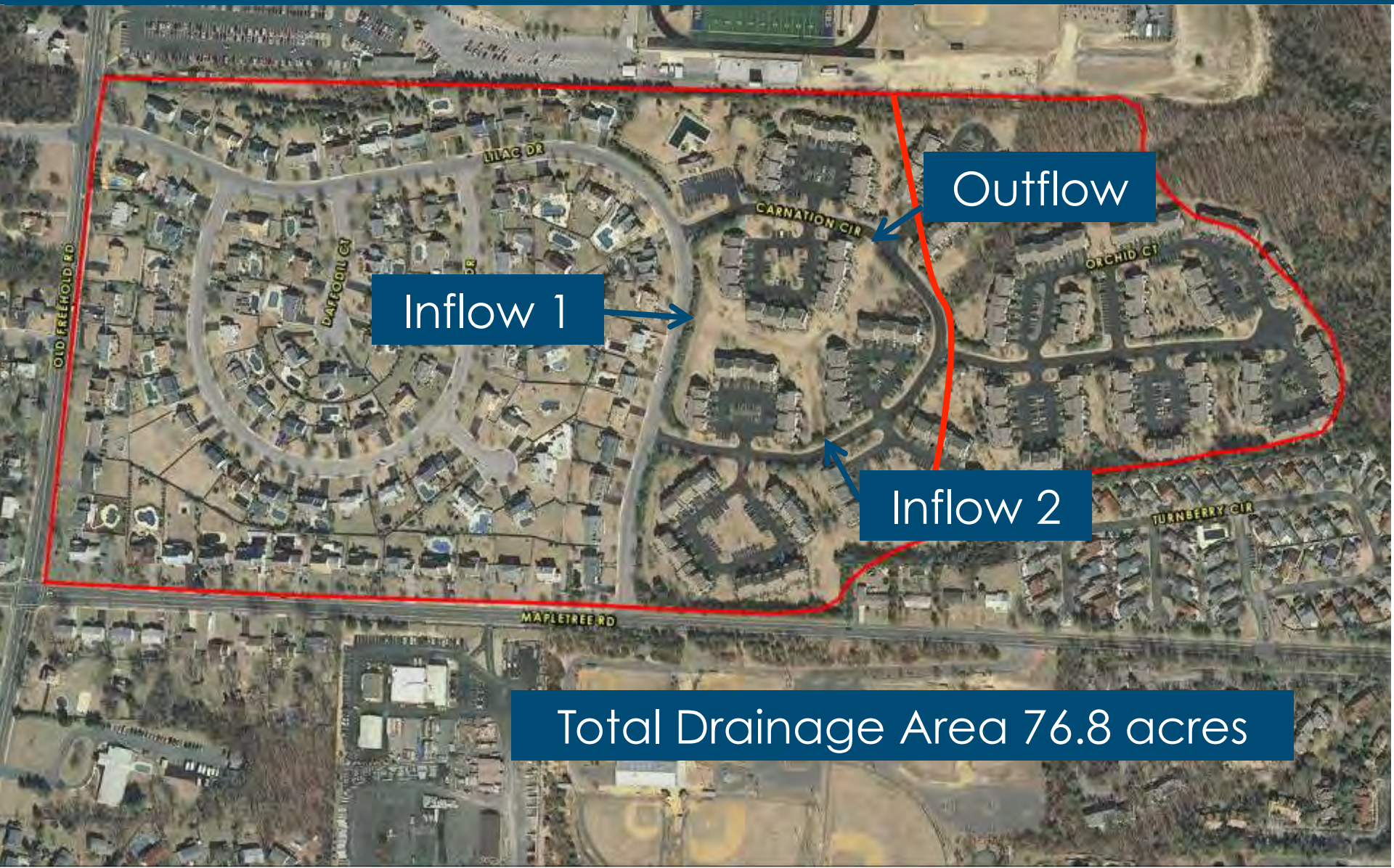
Tree Box

Bio-Retention

Naturalized Basin

Floodplain Reconnection

Example 1- Laurel Commons, Toms River
Carnation Circle Basin Retrofit



Site Preparation

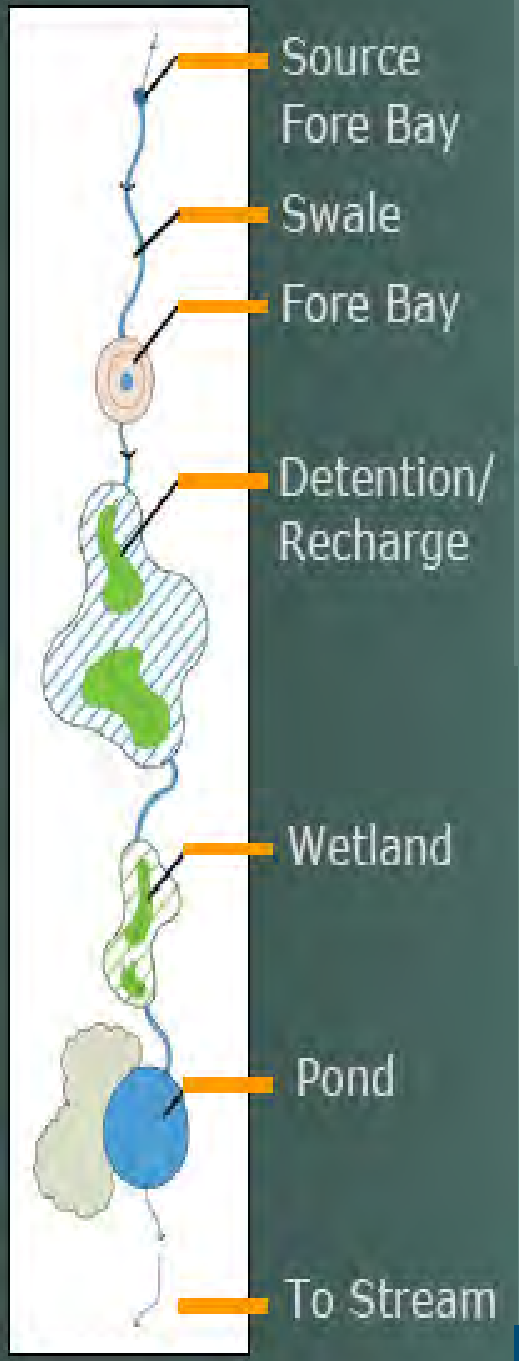
Post-Construction – Pre-Planting

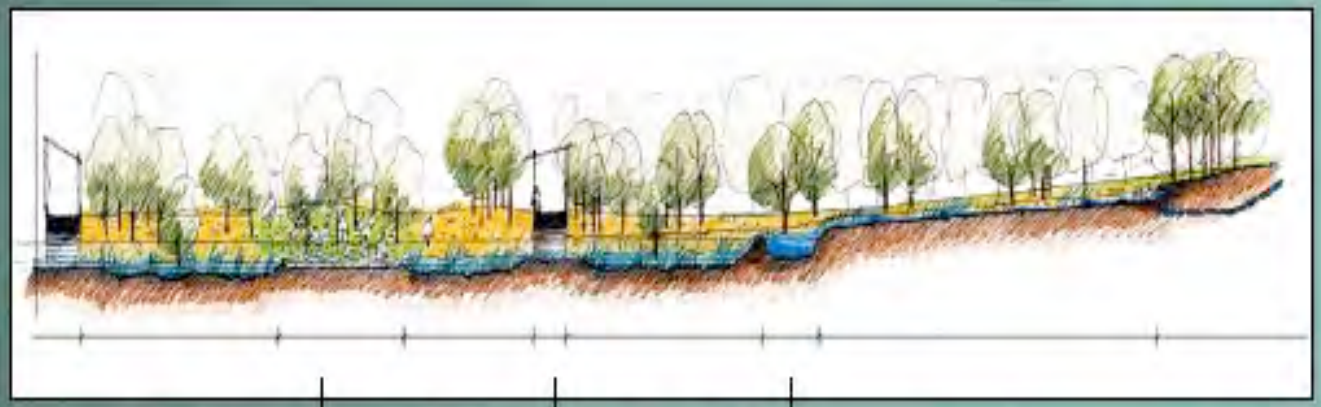
August 2016

Example 2 - Pennswood Village, Middletown, PA

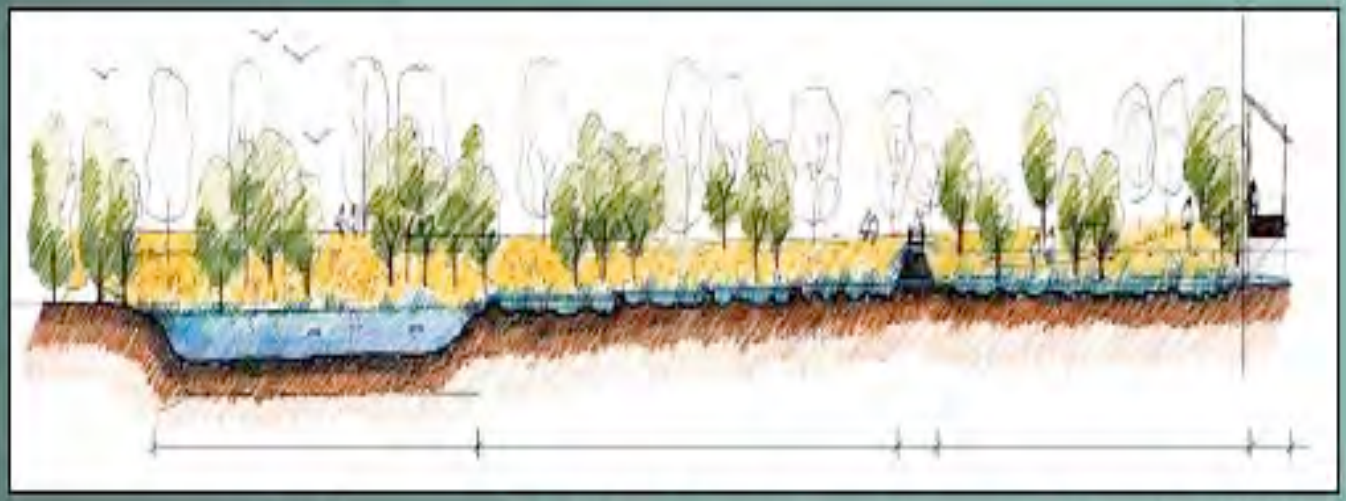
- Located in Neshaminy Creek watershed
- Drainage area ~180 acres combination of impervious cover and farmland...no SW mgmt
- Runoff conveyed to site by four 36" pipes draining off of Rte 413
- Long history of flooding problems affecting Pennswood Village properties and adjacent neighborhoods
- Goal - Create a bioretention system that functions like riparian corridor / floodplain; Contain runoff and relieve flooding impacts

Inflow From Rte 413





Bridge | Det. Basin Wetland | Amphitheater Wetland | Det. Basin Wetland | Bridge | Det. Basin Wetland | Fore Bay | Swale | Water Source/ Springs



Pond
Waterfowl Habitat | Wetland Terraces | Dam | Det. Basin Wetland | Bridge

Courtesy - Wells-Appel Land Strategies

Stormwater Backed Up At Road Crossings

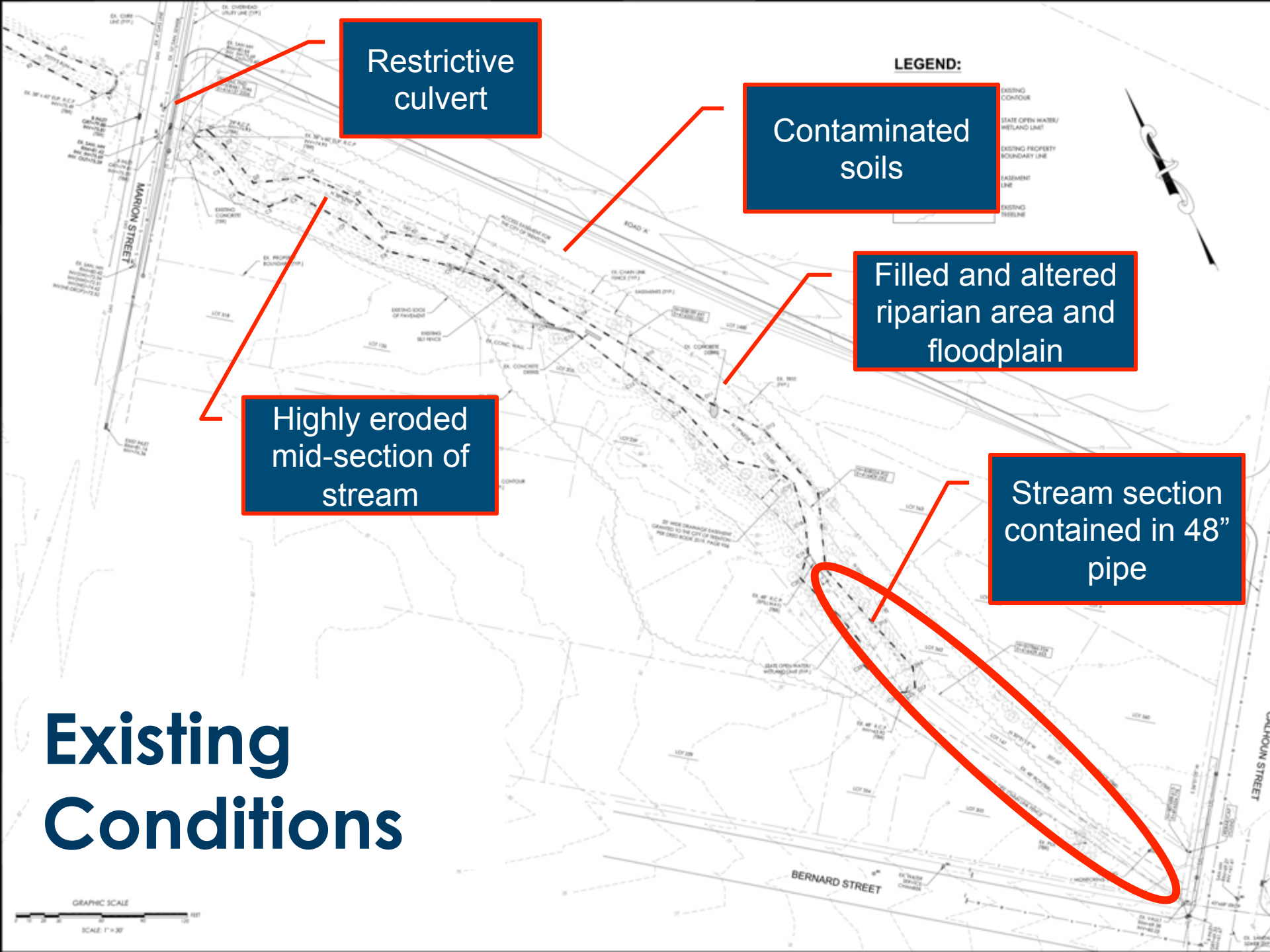
Functions As A Riparian Corridor

Riparian Corridor and Lower Wet Pond / Wetland Area

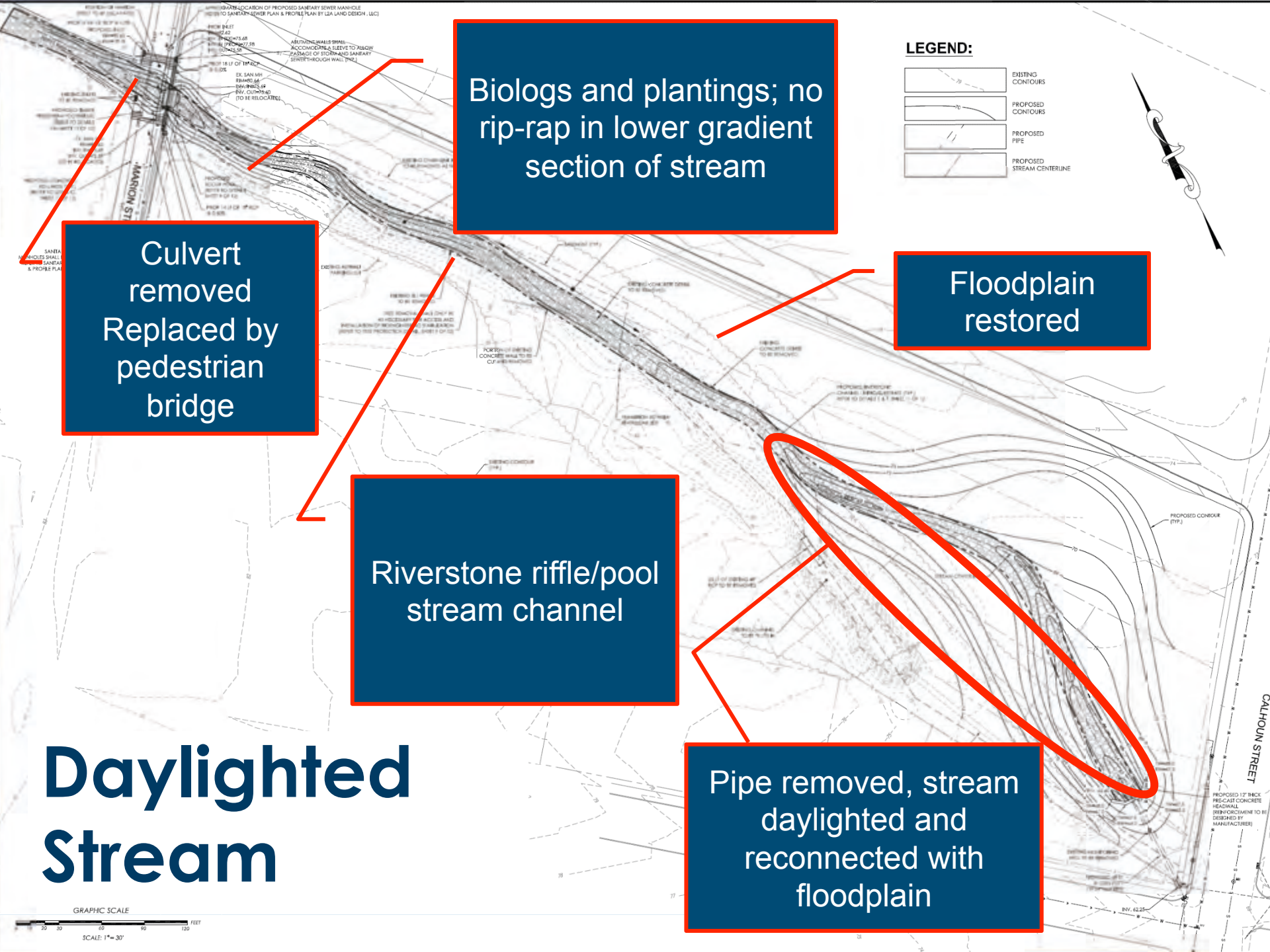
Overall system manages in full storms up to and including 100 yr event...no discharge and no flooding

Example 3 – Petty's Run, Trenton, NJ

- Floodplain area created to assimilate storm flows, recharge groundwater, decrease pollutant loads, and relieve local flooding
- Remove restrictive upstream culvert
- Daylight of 250' of piped stream
- Restore stream channel and restore/create adjacent riparian area and floodplain
- Winner of 2011 Phoenix Award for Brownfield Redevelopment and a 2013 Bowman's Hill Land Ethics Award.



Existing Conditions



Daylighted Stream

- Culvert removed
- Banks stabilized
- Series of interlinked step pools
  - Erosive force of storm flows reduced
  - Runoff "spread" into adjoining, reconnected floodplain.

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- Stream “daylighted
- Floodplain created
- Stream reconnected with floodplain

Petty's Run Restored Floodplain

Summary

- Climate change causing increase in frequency of extreme storm events
- Although can't always fully mitigate impacts of extreme storms can improve resiliency and lessen impacts of "nuisance flooding"
- Can be accomplished with green infrastructure
- Focus on retaining and recharging runoff onsite

Summary

- Know your site
  - Hydrology…how much runoff originating from where
  - Hydraulics…how quickly runoff gets from point "A" to point "B"
  - Soil properties…infiltration capabilities
- Identify opportunities to collect, manage and reuse runoff as close to point of origin as possible

Summary

- Green infrastructure increases storm resiliency
- "Turn Down the Volume" - Emphasize volume control not peak flow attenuation
- Treat stormwater as a "resource" not as a "waste"...retain as much on site as possible
- Make use of "natural" systems to lessen generation of runoff
  - Maintain soil health
  - Preserve natural flow paths
  - Think alternative ground covers

Thank you! ...Questions?

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