LID and BMP Selection and Effectiveness

4/17/2015

2015 SESWA Regional Stormwater Seminar

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Agenda

- Introduction
- LID/GI Site Selection Considerations
- Siting Case Study – Nashville, TN
- BMP Retrofits
- Project Case Studies – Atlanta, GA
- Summary

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Introduction

- Rapidly expanding regulations (NPDES, TMDLs, etc)
- Significant cost of compliance
  - *Chesapeake Bay Rules for VA - $10.5 billion*
  - *Numeric Nutrient Rules for FL - $3 billion*
- Limited areas for implementation
- Back for the buck

LOTS of Green Infrastructure Options!!

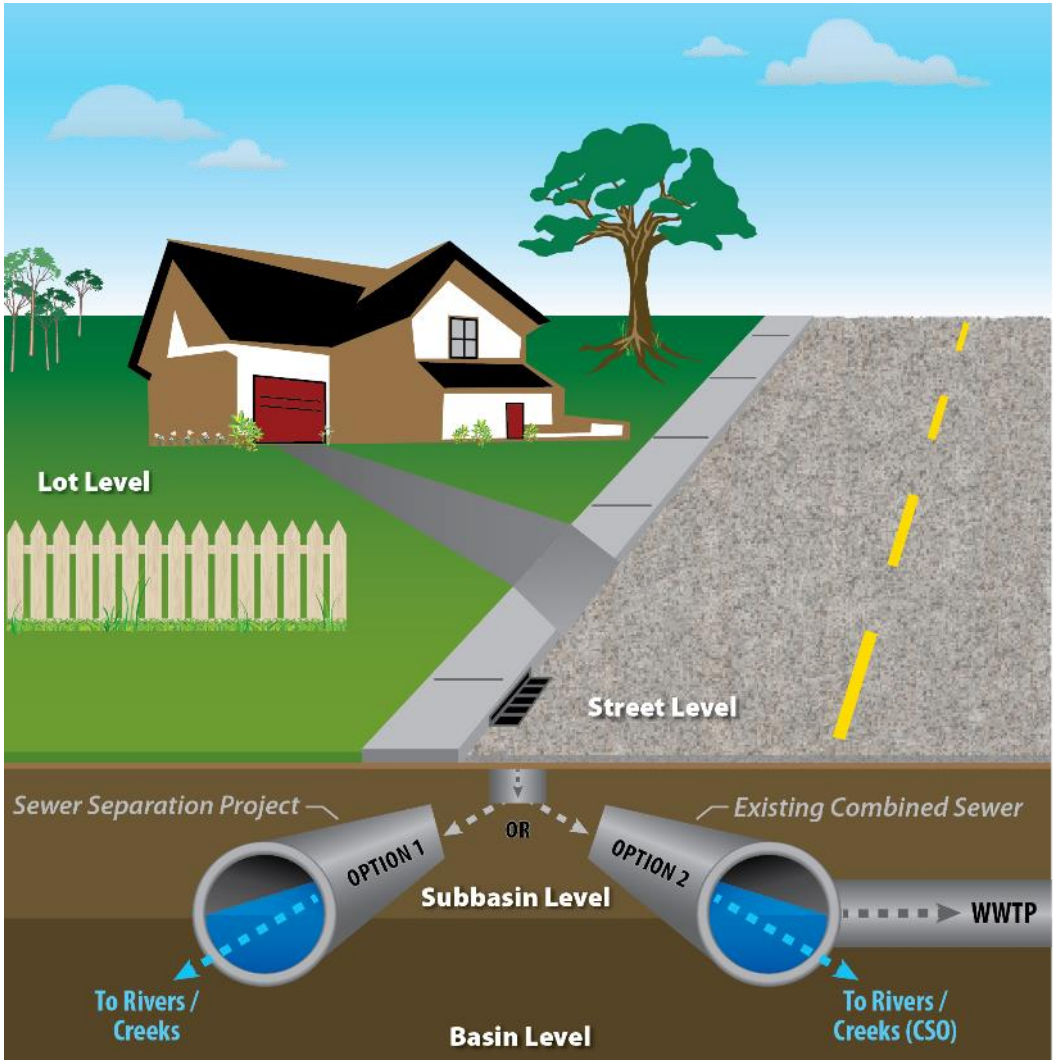
Green Infrastructure Scale

Distributive

- Lot Level
  - *Rain Barrels*
  - *Rain Gardens*
- Street Level
  - *Bioretention*
  - *Swales*

Centralized

- Subbasin Level
  - *Wet Pond*
  - *Wetland*
- Basin Level
  - *Restoration*



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Distributive Green Solutions

Benefits

- Uses existing pipes
- Mimic pre-develop hydrology
- Recharging groundwater
- Provides green spaces
- Enhance neighborhoods
- Public engagement
- Re-development standards

Challenges

- Capturing stormwater
- Requires lots of sites
- Needs to look good
- Requires maintenance
- Within ROW or on private property
- Micro designs

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Centralized Green Solutions

Benefits

- Creates water features
- Enhances public spaces
- Creates habitat
- Provides green spaces
- Enhances neighborhoods
- Increases public engagement
- Creates opportunity for multi-benefits between City departments

Challenges

- Sewer separation
- Requires large site in right location
- Needs to meet long range plan for the area
- Requires maintenance
- Requires more coordination
- Higher risk

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Consider Local Land Conditions

Land Use Cover

- *Public land*
- *Large impervious cover*
- *Large transportation corridor*
- *Vacant property*
- *Blighted areas*

Site Suitability Criteria

- *Community enhancements*
- *Re-development opportunities*
- *Connected with other CIP projects*
- *New infrastructure requirements*
- *Major utility conflicts*
- *Environmental issues*

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LID/GI Siting Case Study – Nashville, TN

- Citywide initiative for sustainability
  - *Green Ribbon Committee*
  - *Green Infrastructure Master Plan*
- National trends
  - *Green infrastructure requirements in consent decree programs*
  - *Voluntary implementation of green infrastructure for CSO control*

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What Can We Learn from Other Cities that Have Gone Down this Road?

- Identify national and regional best practices for green infrastructure implementation
- Perform a literature review and interview staff from “best in class” programs

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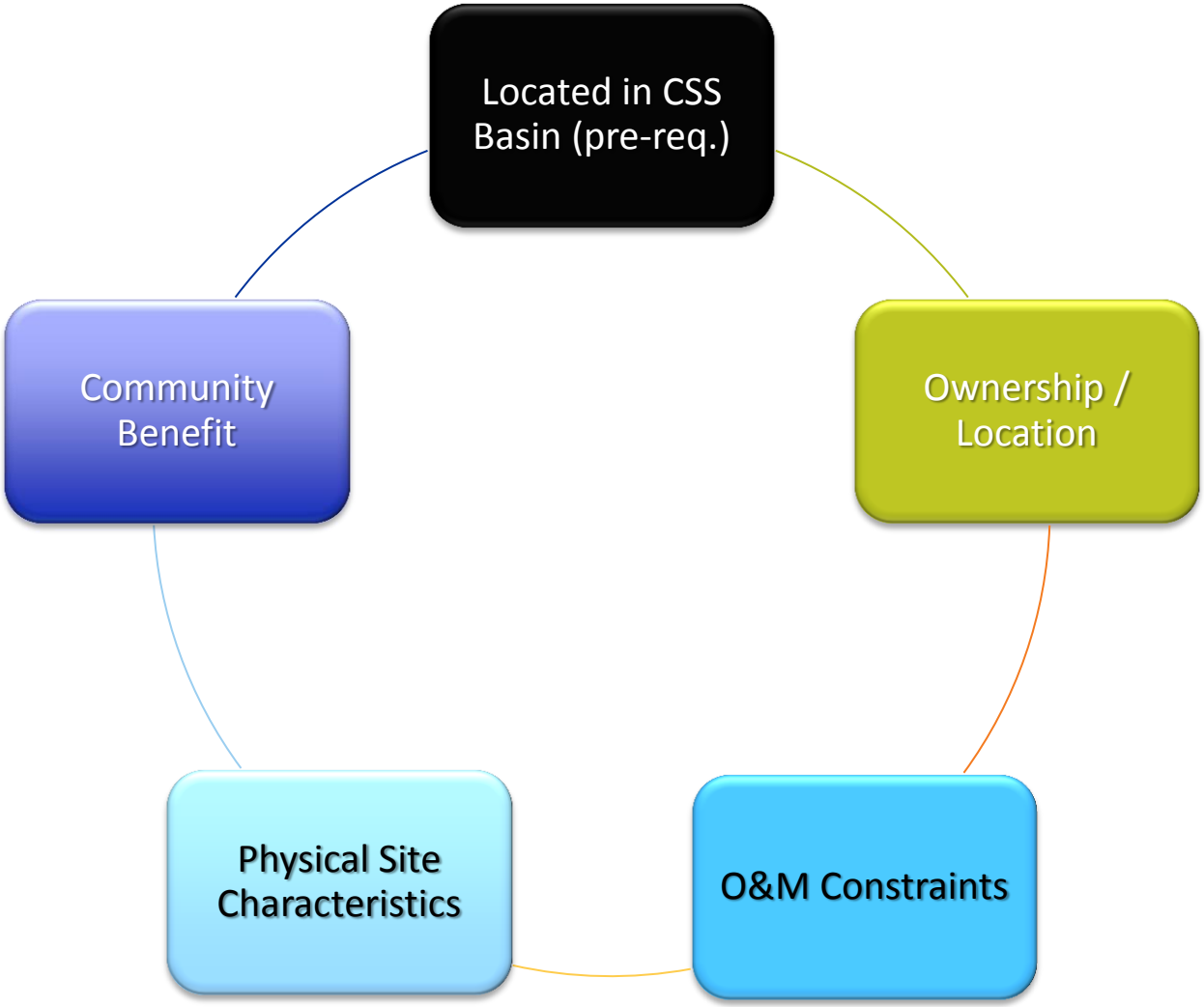
The Results Were Discussed via a Workshop of City Stakeholders

- Some Key Lessons Learned:
  - *Begin with the end in mind*
  - *Need to identify responsible party for maintenance*
  - *Easier to piggyback on existing project vs funding a new project*
  - *Need to identify funding sources and legal issues*

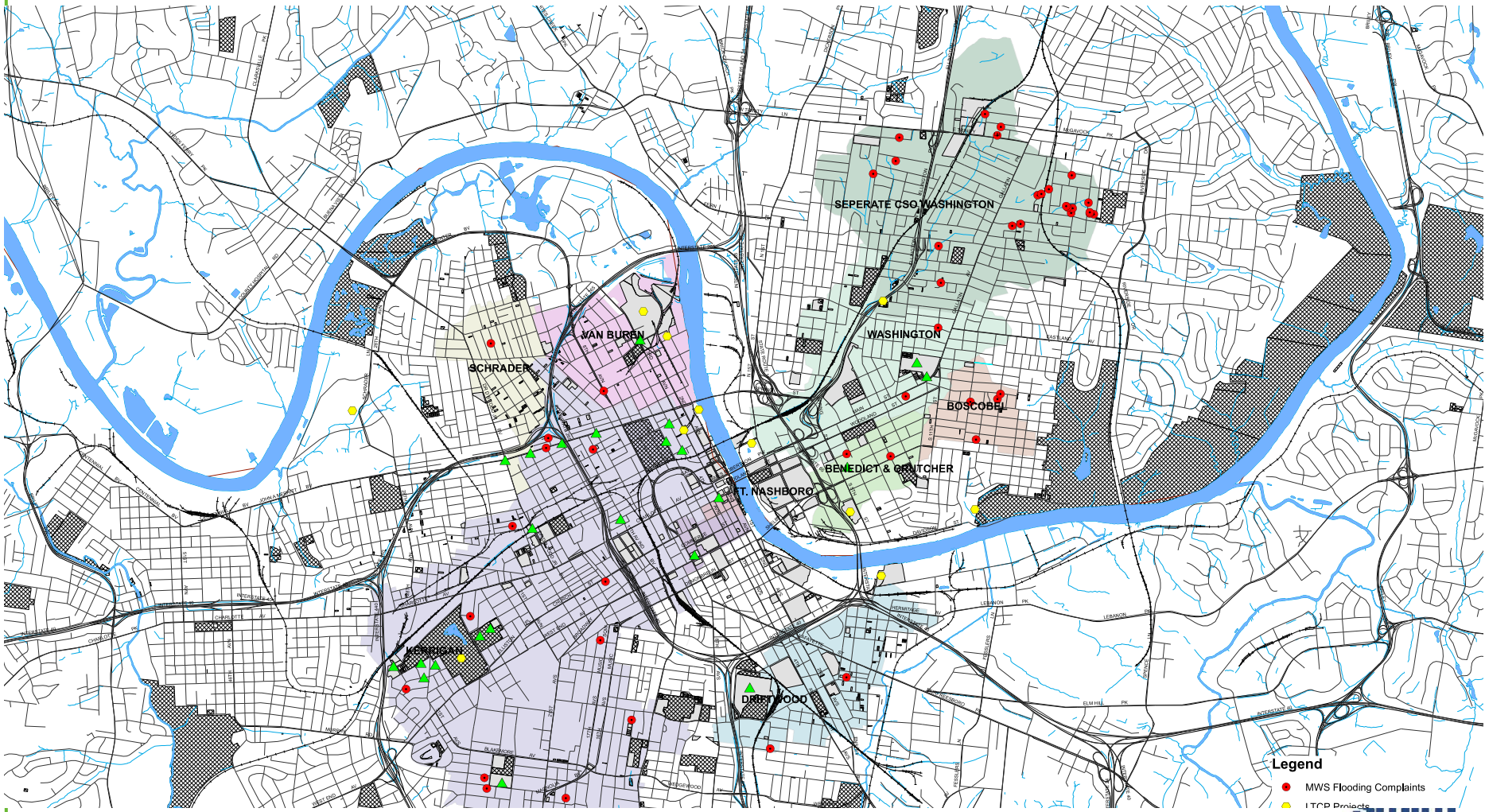
How Will We Identify Projects for Implementation?

1. *Development of selection criteria*
2. *Identification of projects for consideration*
3. *Vetting of projects through the use of a matrix*
4. *Final pilot project selection*

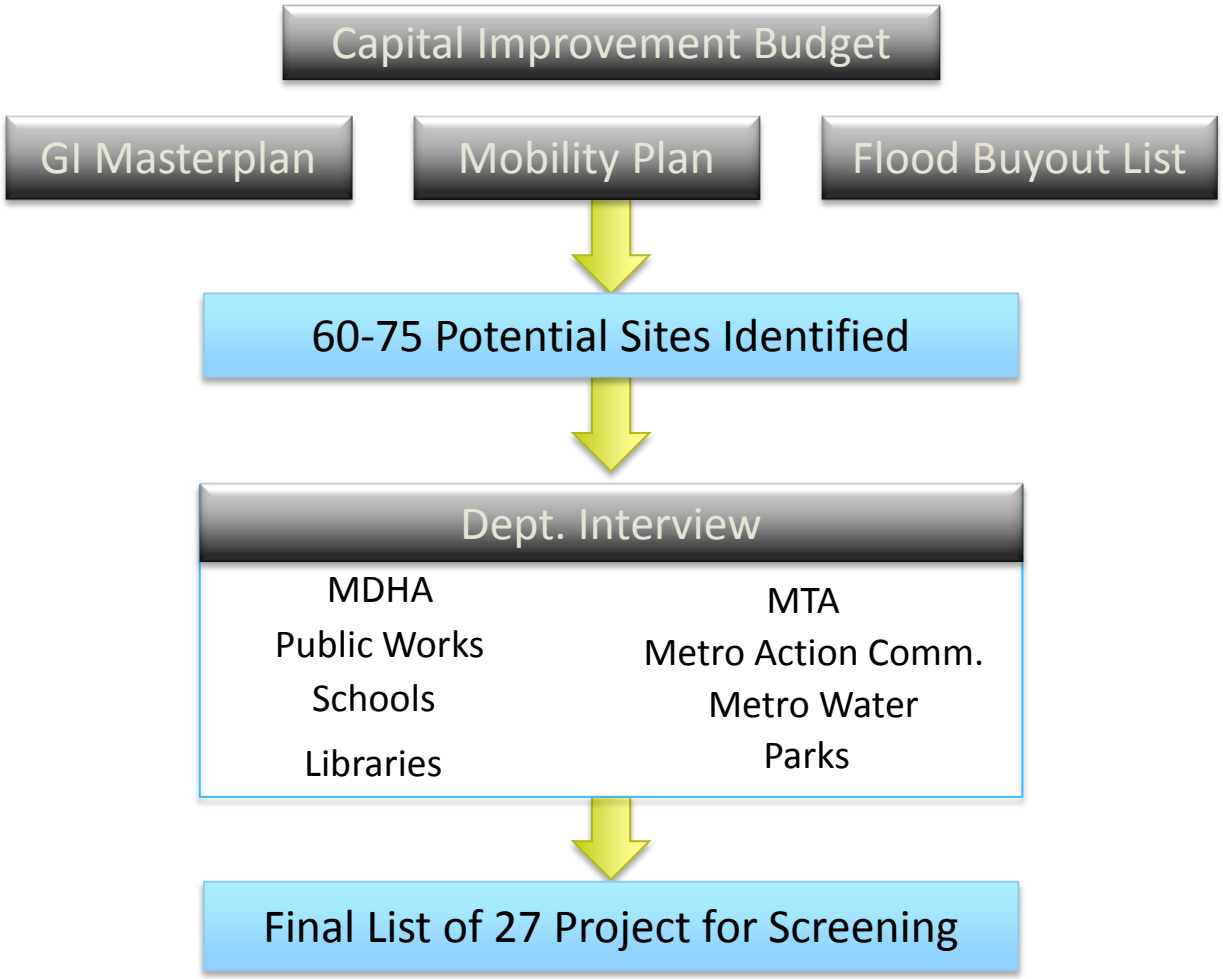
Criteria Development



Building Off of Previous Efforts & Staff Knowledge



Project Identification & Screening Process



Using the Matrix to Evaluate the Project Sites

TIER	Criteria	Weighting Potential	GIMP (Shovel Ready) Projects		Construction Currently In Progress*		
			Hume Fogg Green Roof	Parks Admin Complex	Harrison St. @ Sulphur Dell	Jackson St. @ Sulphur Dell	North Gulch Streetscape
	Identifying Department	n/a	Schools	Parks	Planning/PW	Planning/PW	Planning
1	**Pre-requisite**						
	Located in CSS Basin	3	3	3	3	3	3
	Basin Name	n/a	Kerrigan	Kerrigan	Kerrigan	Kerrigan	Kerrigan
2	**Prioritization**						
	A Ownership / Location (for items 2-4 select only one option)						
	1 Funding Raised or Actively Pursued**	0, 2, or 4	2	2	4	4	4
	2 Design concept in place or under development	0 or 4	4	4	4	4	4
	3 Implementation Timeline	0, 2, or 4	2	2	2	2	2
	4 Owned by Metro Water Service	3	0	0	0	0	0
	5 Owned by Other Metro Dept.	2	2	2	2	2	2
	6 Owned by State; parcel/ROW/etc.	1	0	0	0	0	0
	7 Upstream of Defined Problem Area***	2	2	0	2	2	0

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B	Operations and Maintenance						
8A	Construction Access	0 or 1	0	1	1	1	1
8B	Maintenance Access	0 or 1	1	1	1	1	1
9	Proximity to Existing Infrastructure	0 or 1	1	1	1	1	1
C	Physical Site Characteristics						
10	Existing Land Cover	0, 1, or 2	2	2	2	2	2
11	Soil Suitability	0 or 1	0	0	1	1	1
12	Site Topography	0, 1, or 2	2	2	2	2	2
13	CSO Priority	0 or 2	0	0	0	0	0
D	Community Benefit						
14	Environmental Justice Area	0 or 1	1	0	1	1	0
SUBTOTAL			**22**	**20**	**26**	**26**	**23**

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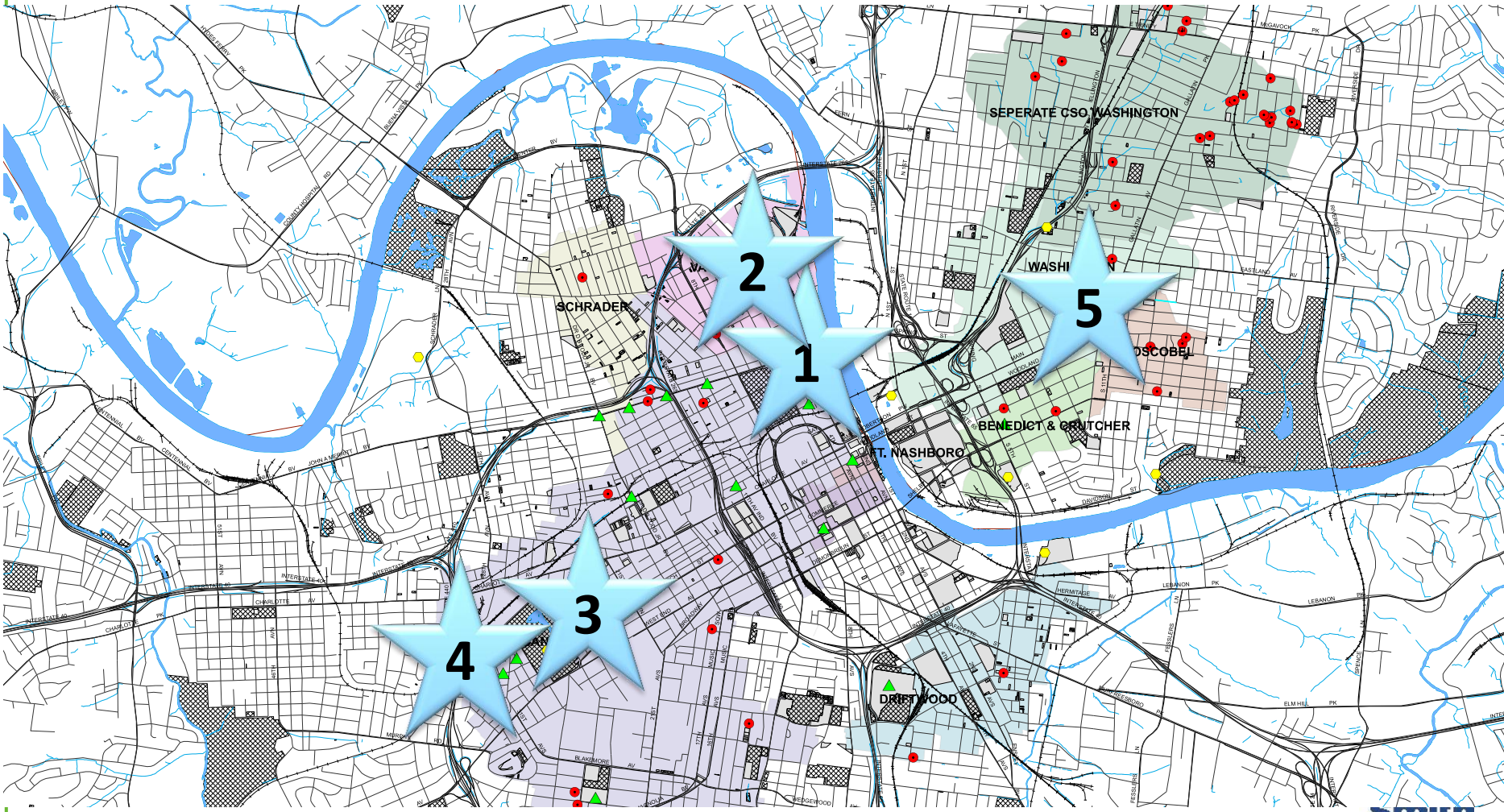
Developed Concept Plans for 5 Highest Rated Sites



Example GI Concept Plan

ANNUAL REDUCTION

2,192,000 gal.

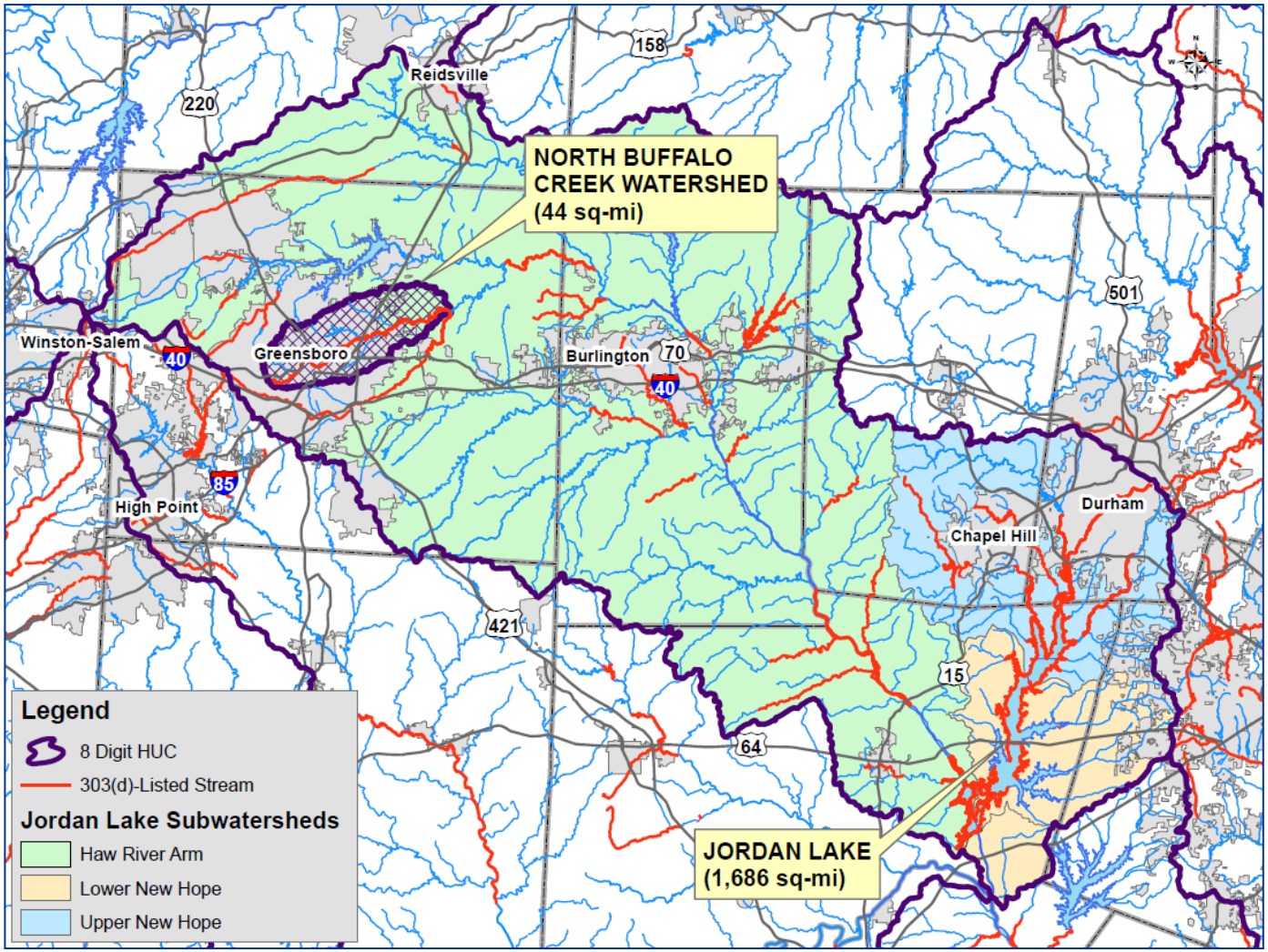
PRELIMINARY COST EST.

$969,000.00

1st YEAR COST

$0.44 per GAL.

Traditional BMPs Can Still Play a Role



N. Buffalo Creek
303(d) listed for Poor Bioclassification; Fecal Coliform; Zinc; and Copper

Jordan Lake
TMDL for Total Nitrogen and Total Phosphorus

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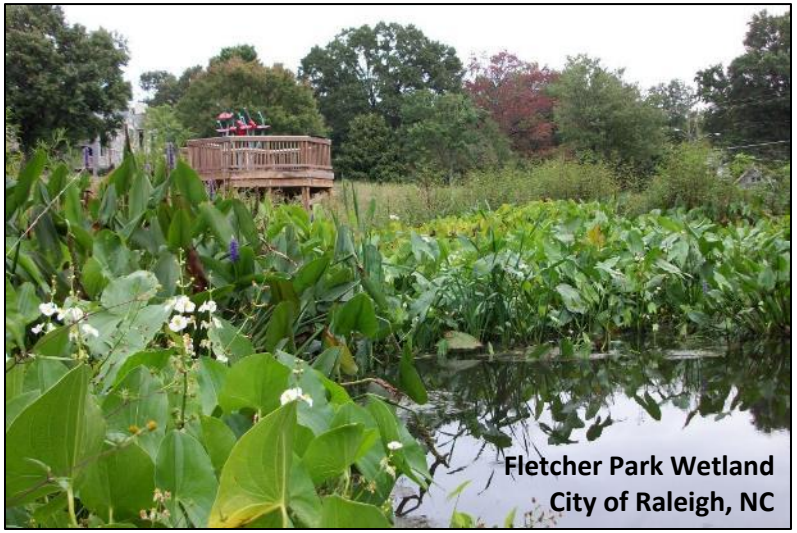
Explored Opportunities to Retrofit Existing Developed Areas

- *Wet Ponds*
- *Wetlands*
- *Bioretention Areas*
- *Stream/Buffer Restoration*
- *Curb cuts/Level Spreaders*

Shade Valley Wet Pond Design
City of Charlotte, NC (*image from Google)*

Big Warrior Creek Stream Restoration
Wilkes County, NC



Fletcher Park Wetland
City of Raleigh, NC

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Which BMPs are Most Efficient for Total Nitrogen and Total Phosphorus Removal?

BMP Type	% Nitrogen Removal[1]	Requirement to Achieve 8% and 5% Nutrient Reduction	
		% of Watershed Area Treated[2]	# of BMPs[3,4]
Wet Pond	25	32%	360
Bioretention	35	23%	1,300

Notes:

1.) Based on NC Division of Water Quality Stormwater BMP Manual.

2.) North Buffalo Creek watershed area is ~44 square miles (28,160 acres)

3.) Wet Pond based on 0.5 acre surface area and 2% SA/DA ratio. Wetlands based on 0.5 acre surface area and surface area that is 10% of drainage area. Bioretention areas based on 5 acre drainage area.

4.) Number of BMPs by type required to achieve nutrient reduction target (assuming one type of BMP only).

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Siting Criteria is Similar for GI and Traditional BMPs

- Identify candidate site locations downstream of existing developed areas utilizing:
  - *Minimum drainage area*
  - *Storm sewer inventory*
  - *Hydrography*
  - *City staff known opportunities*
  - *Past studies*
- Identify Minimum Siting Criteria
  - *Utilities*
  - *Topography*
  - *Stream length*
  - *Existing structures*
  - *Environmental impacts*

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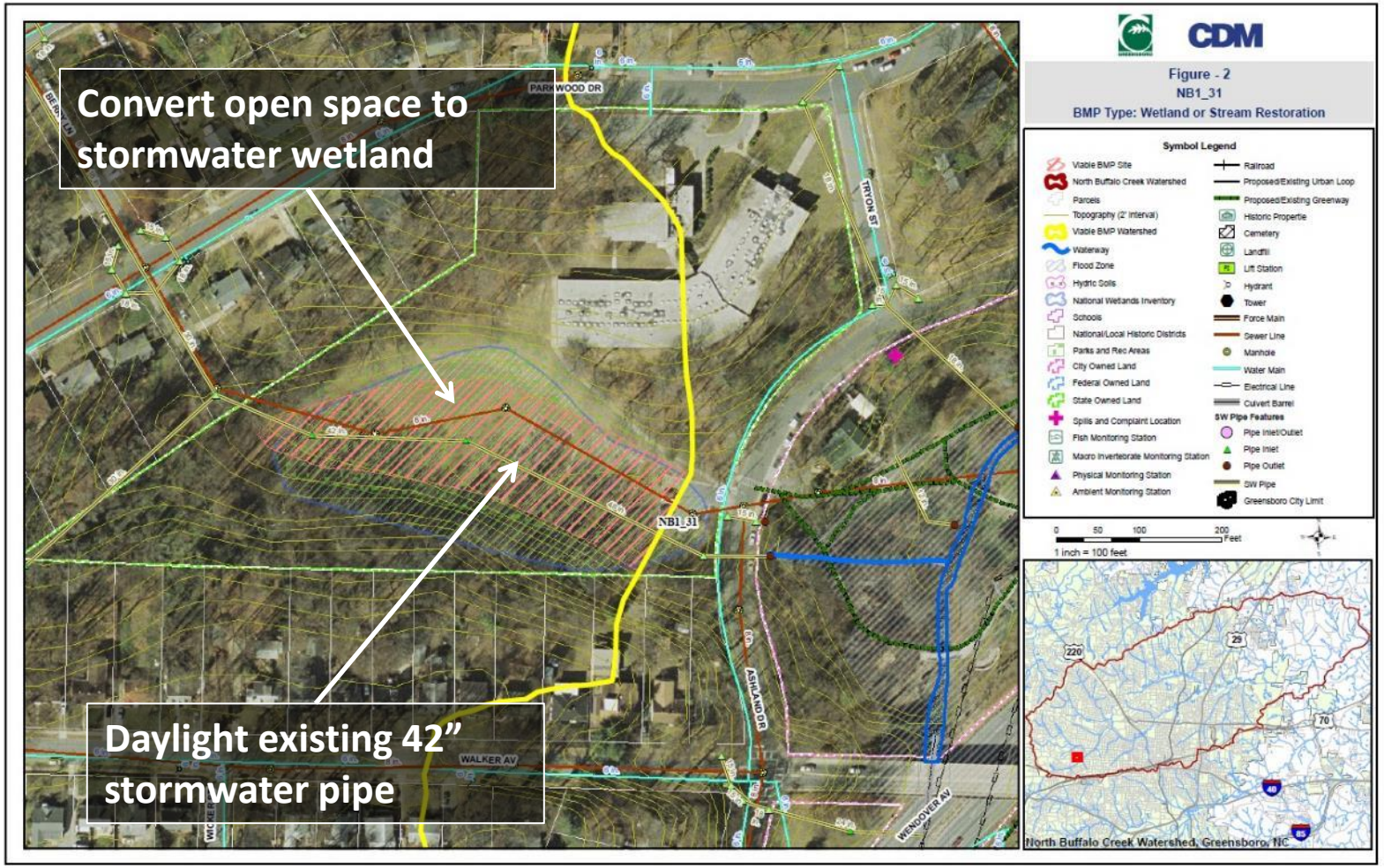
Example Candidate Site – Proposed Stormwater Wetland



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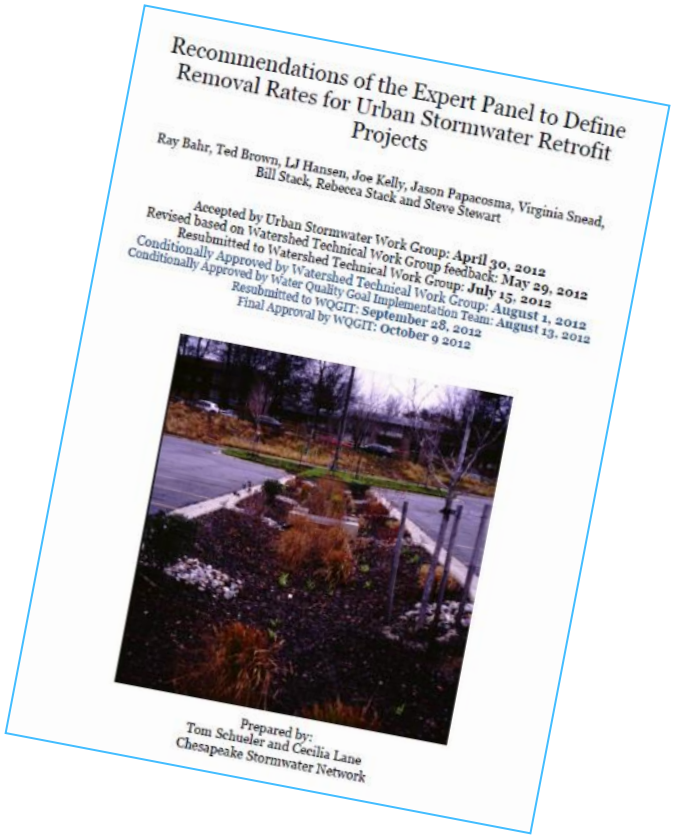
Don’t Forget Retrofits of Existing BMPs

Conversion	• Converted to a different BMP with a more effective treatment mechanism
Enhancement	• Increase treatment volume or retention time
Restoration	• Renew performance through major maintenance, upgrade or replacement


Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects

Ray Bahr, Ted Brown, LJ Hansen, Joe Kelly, Jason Papacosma, Virginia Snead, Bill Stack, Rebecca Stack and Steve Stewart

Accepted by Urban Stormwater Work Group: April 30, 2012
Revised based on Watershed Technical Work Group feedback: May 29, 2012
Resubmitted to Watershed Technical Work Group: July 15, 2012
Conditionally Approved by Watershed Technical Work Group: August 1, 2012
Conditionally Approved by Water Quality Goal Implementation Team: August 13, 2012
Resubmitted to WQGIT: September 28, 2012
Final Approval by WQGIT: October 9 2012

Prepared by:
Tom Schueler and Cecilia Lane
Chesapeake Stormwater Network

Schueler, T, C. Lane, 2012. Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects. Chesapeake Stormwater Network. Baltimore, MD.

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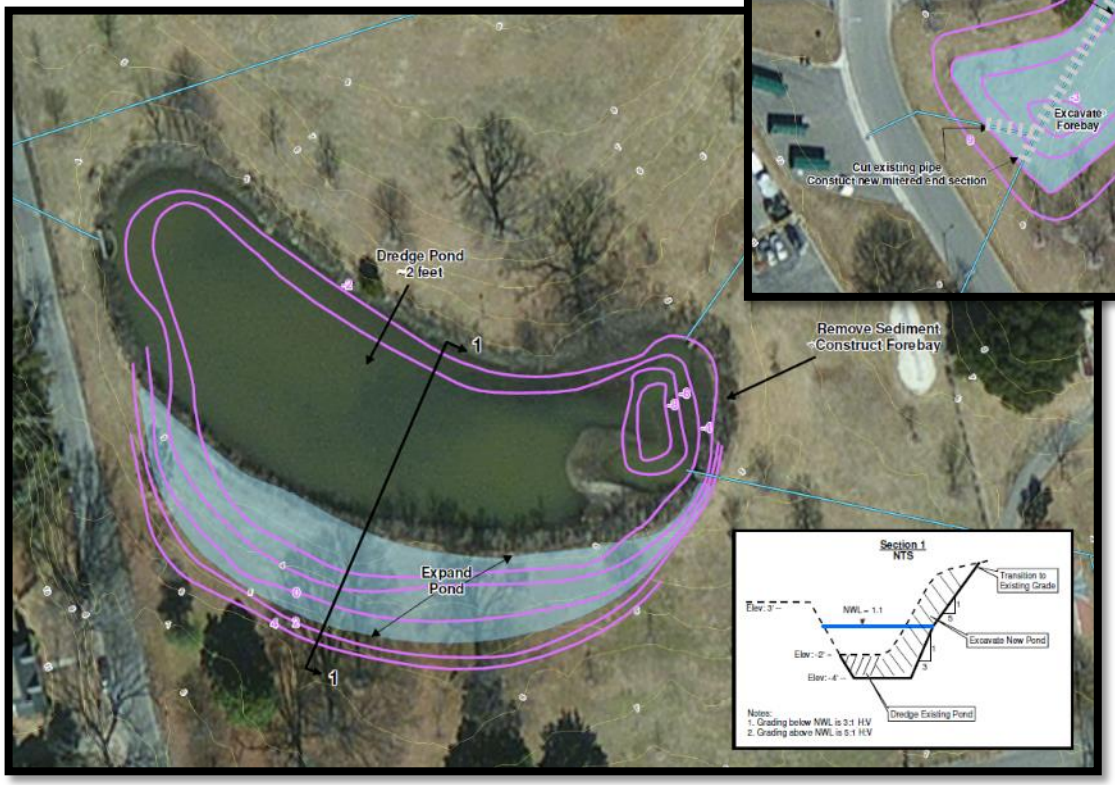
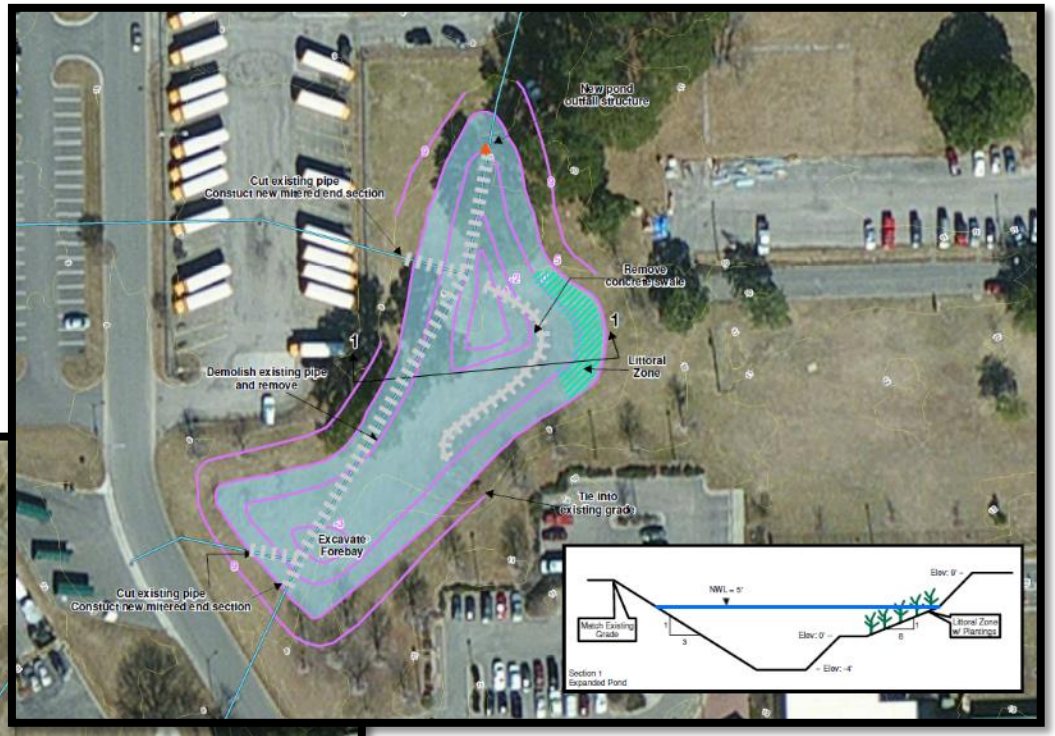
Example Retrofit Sites – Norfolk, VA

Existing Wet Pond Enhancement





Dry Pond to Wet Pond Conversion

Summary of Retrofit Benefits and Costs

Site	Pollutant	Δ Removal (lbs)	Total Project Cost	Cost per Impervious Acre
Example 1 (Enhance)	TN	140	$360,000	$3,030
	TP	30		
	TSS	11,300		
Example 2 (Convert)	TN	90	$260,000	$8,500
	TP	20		
	TSS	7,900		

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Considerations for Retrofit Projects

- Screen retrofit options to identify feasible projects
- Impervious tributary area is key
- Conversions can be top performers
- Look for opportunities to increase tributary area
- Prioritize with cost effectiveness
- Differentiate planning and site specific preliminary design

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Summary of Siting Considerations

- Consider all tools in the toolbox
- Leverage existing information (prior plans and staff knowledge)
- Perform initial screening at desktop with GIS
- Use field investigations to identify “red flags” for implementation
- Quantify what you can (volume reduction, pollutant removal)
- Prioritize based on most beneficial criteria

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