

Northern Virginia Stream Restoration Bank– Background And Status Report

Presented by Michael S. Rolband

P.E., P.W.S., P.W.D.

Wetland Studies and Solutions, Inc.
5300 Wellington Branch Drive · Suite 100 · Gainesville · Virginia 20155
www.wetlandstudies.com

Wetland Studies and Solutions, Inc.©

Wetland Studies And Solutions, Inc.

- Natural & Cultural Resource consulting firm
- 75 Staff
  - Archeology, Engineering, Environmental Science & Ecology, Environmental Technology, Compliance, GIS, Regulatory, Surveying, & Wildlife Biology

Wetland Studies And Solutions, Inc.

MITIGATION EXPERIENCE

- Developed 17 Mitigation Bank sites:
- ± 900 acres of wetlands
- 140,000 lf of stream

Loudoun County Wetlands and Stream Bank - Phase II
August 2008 (9 months after completion)

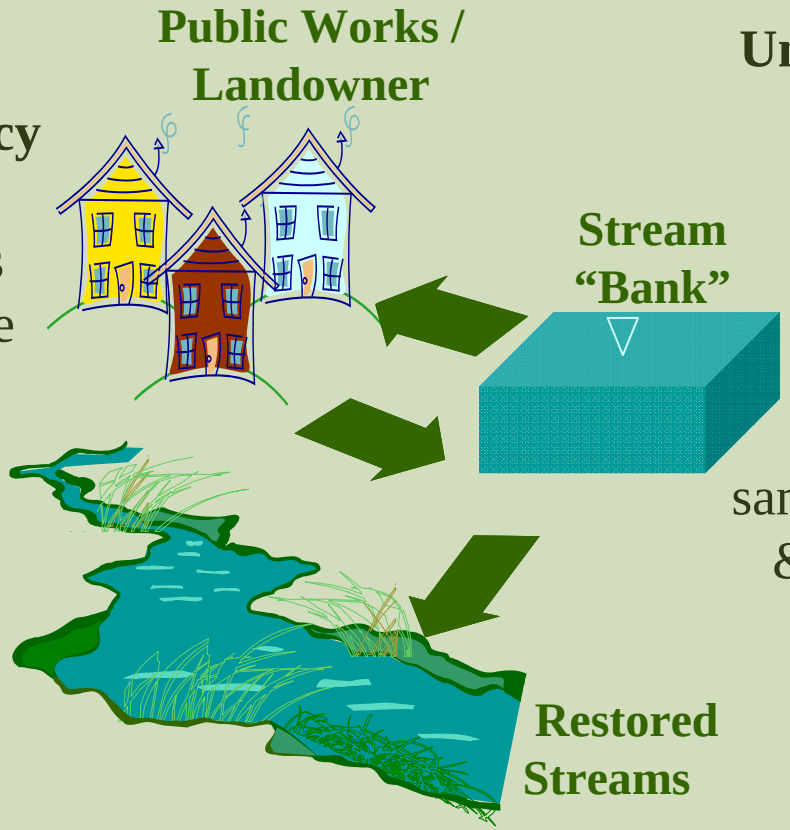
Snakeden Branch – Reach 3

Wetland Studies and Solutions, Inc.©

What is Mitigation Banking?

HOW IT WORKS

A Public Works Agency or private landowner needs to impact streams on their property. In the past, they would have had to restore streams as compensation, either on- or off-site.



Under the market-oriented system, they can go to a "bank" created by a Bank Sponsor who has obtained credit for restoring impaired streams elsewhere in the same portion of the rivershed & physiographic province.

By purchasing stream credits from the Bank Sponsor, the mitigation requirements of a permit for stream impacts is satisfied. Stream restorers use this pooled money to create much larger, well-designed, & ecologically valuable conservation projects.

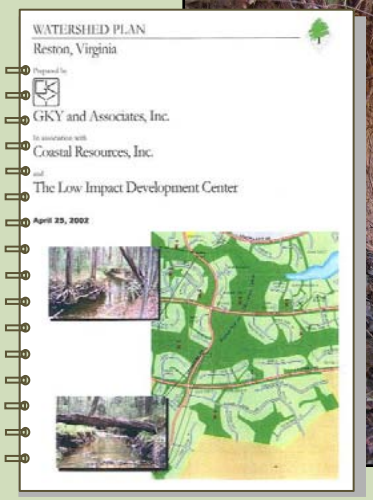
Adapted from The Washington Post, February 15, 1996

WHY A STREAM BANK IN RESTON ?

- Degrading streams are located in preserved corridors (without stormwater management) & mostly controlled by a single entity (Reston Association).

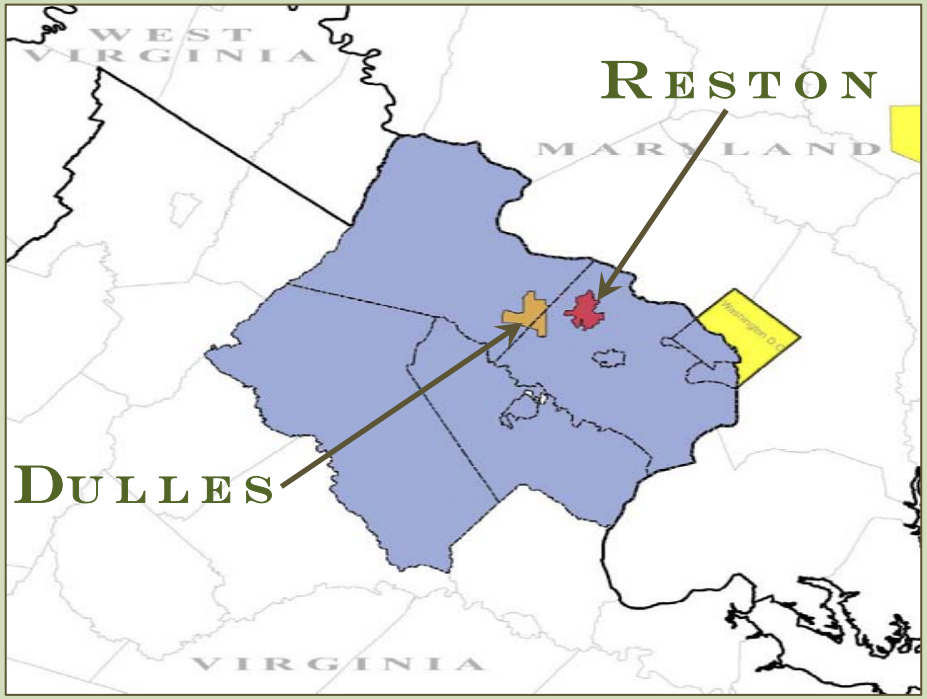
- Community members are actively involved in protecting local natural resources. Watershed Subcommittee of the Citizen's Advisory Committee for the Environment and Ecology publishes a white paper in 2000 - *"Reston's Watersheds: An Assessment of Conditions and Management Strategies"*

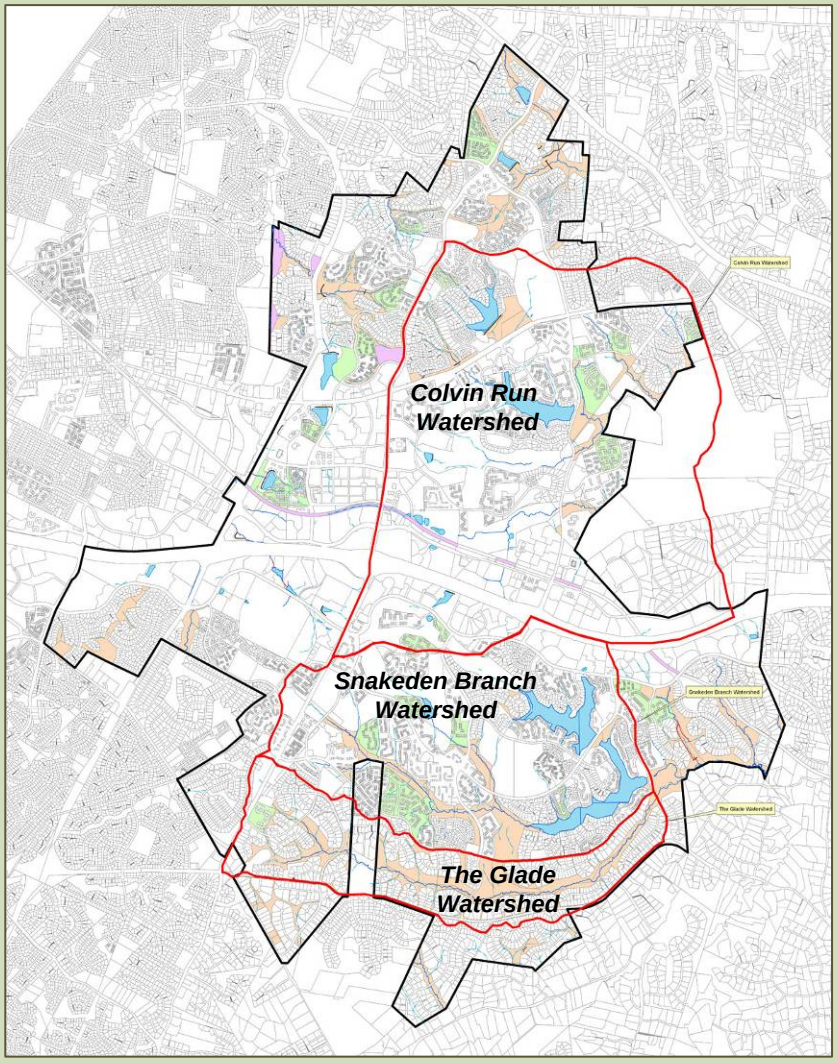
- Watershed Plan published in April 2002.



Why a Stream Bank in Reston?

- Community of Reston includes entire watersheds.
- There is a demand for stream mitigation in the region.





The Approval Process

Wetland Studies – Reston Association

July 2000

- Watershed white paper published (*identifies need to improve watersheds*).

March 2002

- Reston Watershed Plan published

October 2003

- Letter of Intent signed with Reston
- Mitigation Banking Review Team (MBRT) Meeting requested.

December 2003

- MOA signed
- $250,000 Donation for Reston

House

The Approval Process

Mitigation Banking Instrument

June 2004:

- Public Notice for Prospectus for the NVRSB.

October 2004 – February 2006:

- MBRT Review Process (COE, EPA, DEQ, & USFWS)
- VA State Law HB-2464 Approved: Defines "*Natural Channel Design Concepts*" in Code of Virginia.

July 2005:

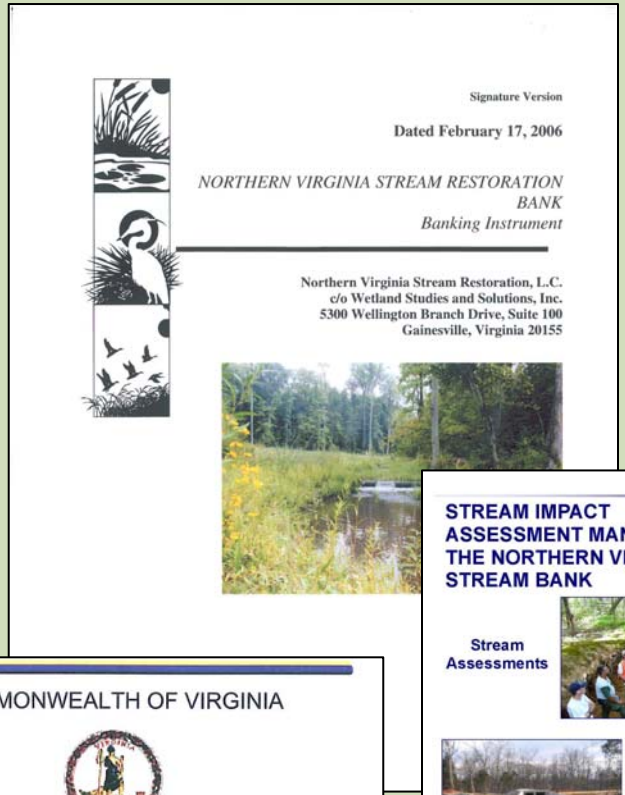
- Executive Order 90 Issued – *"Improving Stream Health and Water Quality by Restoring Streams Throughout the Commonwealth"*

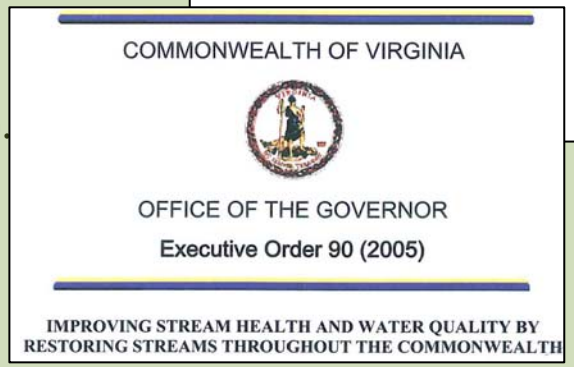
February 2006:

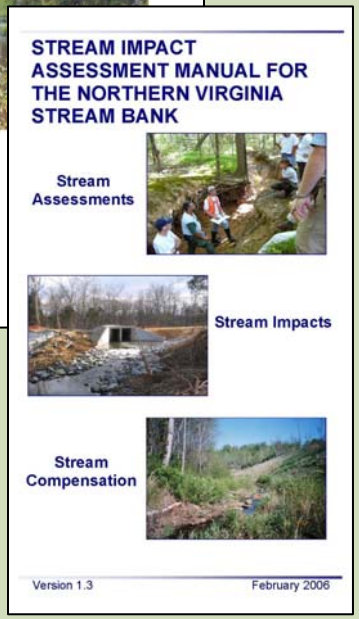
- DEQ & COE sign MBI for Phase I (~14 miles).
- Phase II approximately 15 additional miles.

June 2006:

- Concept Plan Approved by DEQ & COE

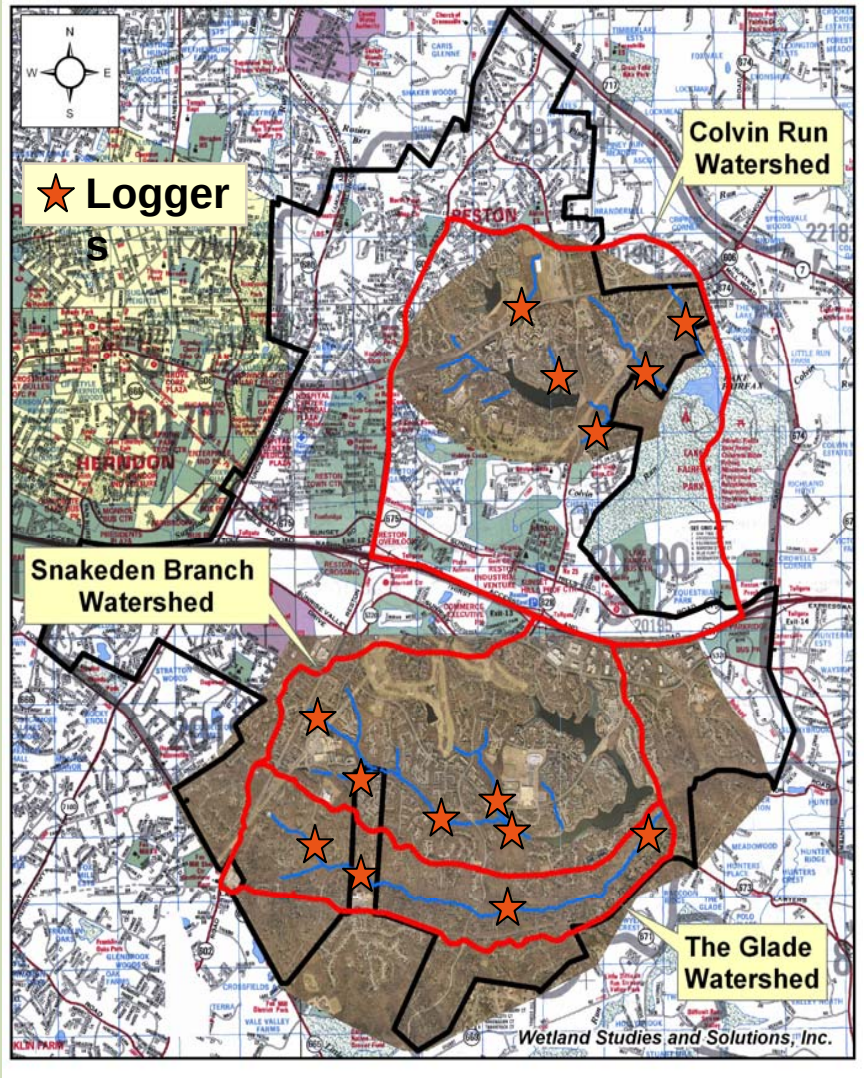






Data Collection

- Obtained aerial photography and topography of Phase I watersheds.
- Investigated stream valleys for potential archeological sites.
- Survey located & tagged nearly 30,000 trees (≥ 4” dbh) *so far!*
- Surveyed channel profile and cross-sections.
- Performed geomorphic analyses.
- Performed wetland delineations and obtained Jurisdictional Determinations (JD’s).
- Installed water level and rain gages to aid in design.



Data Collection

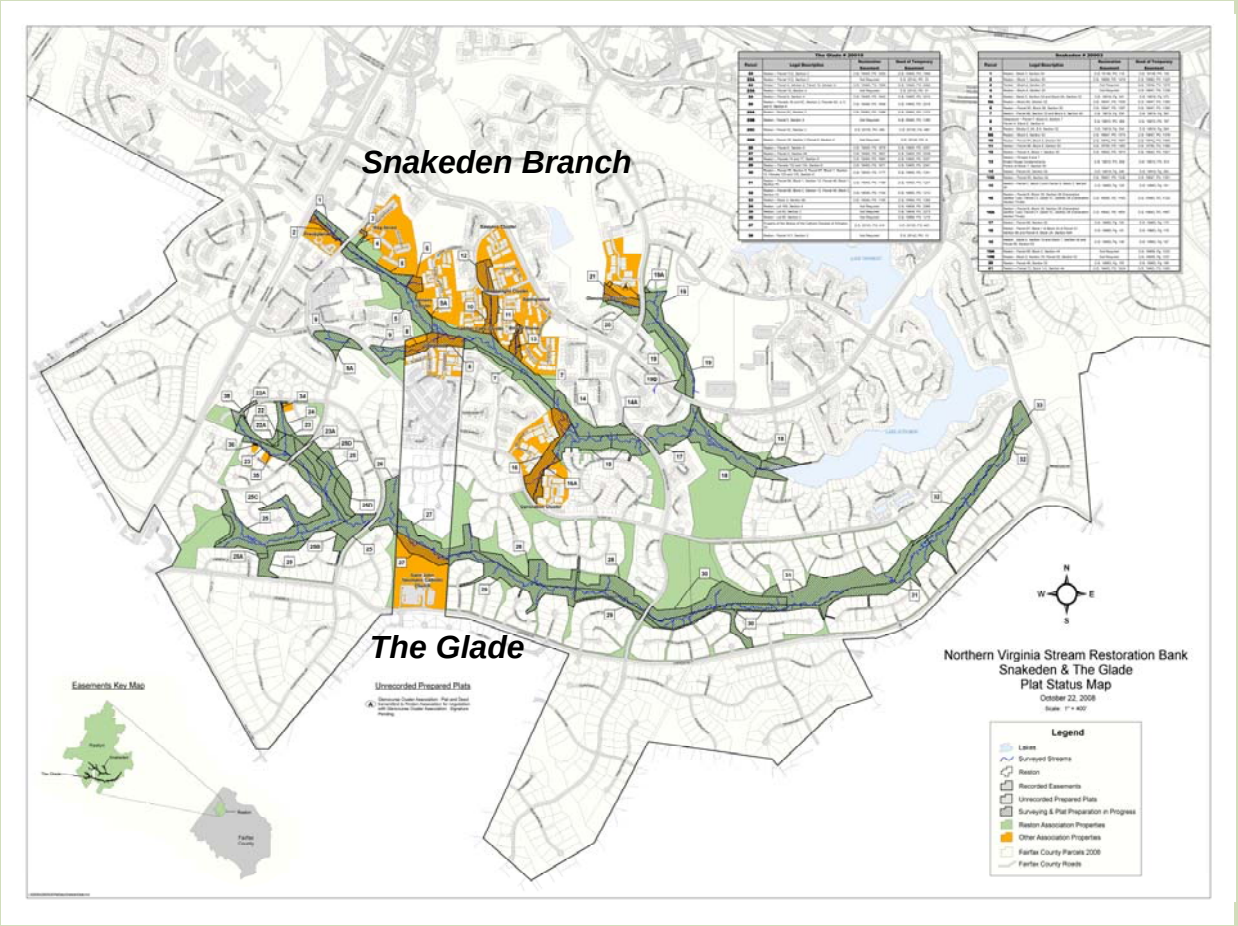
Easements

Two Types Required

1. *Deed of Temporary Easement* – to allow for construction access and 10-yrs of monitoring and maintenance.

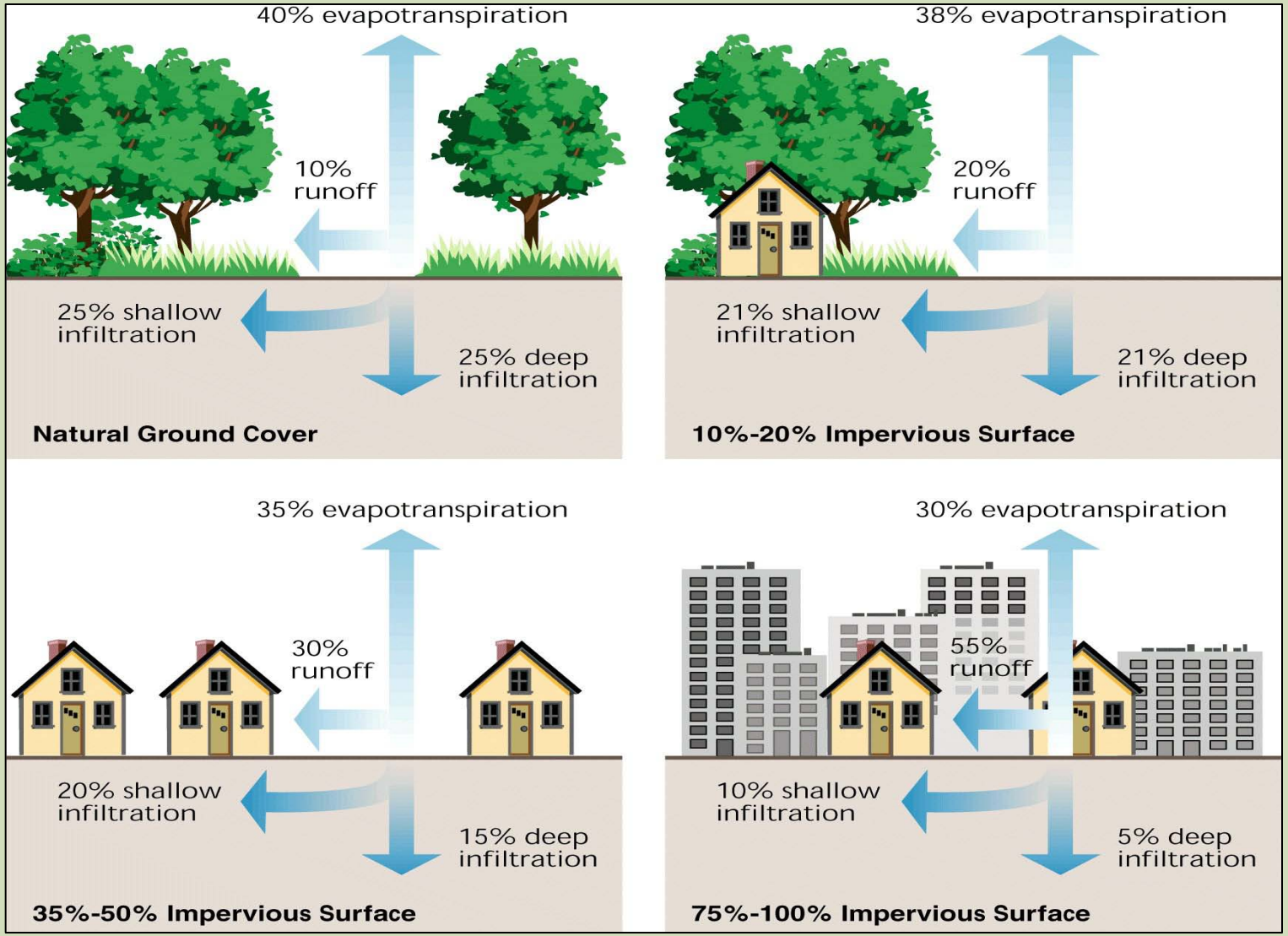
2. *Restoration Easement* – to protect the stream and buffer in perpetuity.

- Most land in stream valleys owned by RA.



Green Areas – RA Property
Orange Areas – Private Property

The Urban Watershed Problem



Source: USDA

URBAN STREAM SYNDROME (USS)

- Total Phosphorus (TP), Total Nitrogen (TN), and Total Suspended Solids (TSS) flows downstream

Eroding meander bend adjacent to Wiehle Ave in Reston

Exposed sewer manhole – Reach 12 in Snakeden

Wetland Studies and Solutions, Inc.©

Correcting the Problem

Option 1: Watershed Improvements- remove impervious areas

- Retrofit hard surfaces with pervious pavements- pervious concrete or pavers
- Retrofit buildings with green roofs

A reduction in impervious area results in a reduction in runoff

Green roof at WSSI

Pervious concrete at WSSI

GravelPave2 infiltrating a large rainstorm at WSSI

Pervious pavers at WSSI

Correcting the Problem

Option 2: Watershed Improvements – stormwater management

- Provide conventional stormwater management facilities throughout the watershed
- Install low-impact development features- swales, rain gardens, green roofs, and pervious pavements

Conventional dry pond in Fairfax County

Green roof at WSSI

Water quality swale at WSSI

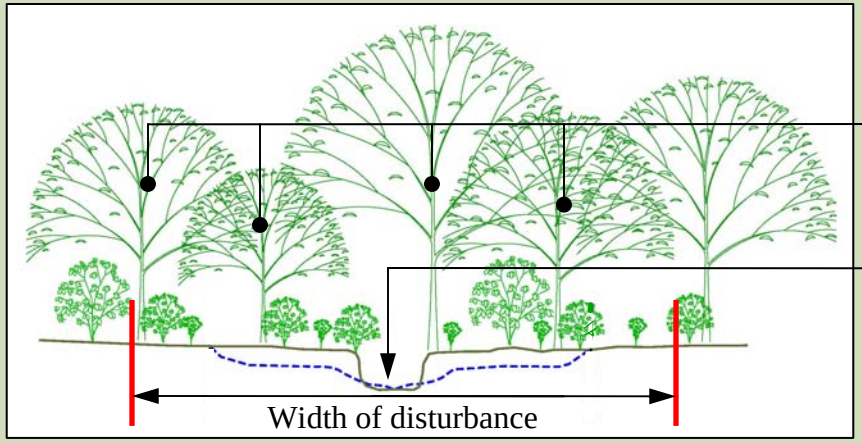
Rain Garden at WSSI

Wetland Studies and Solutions, Inc.

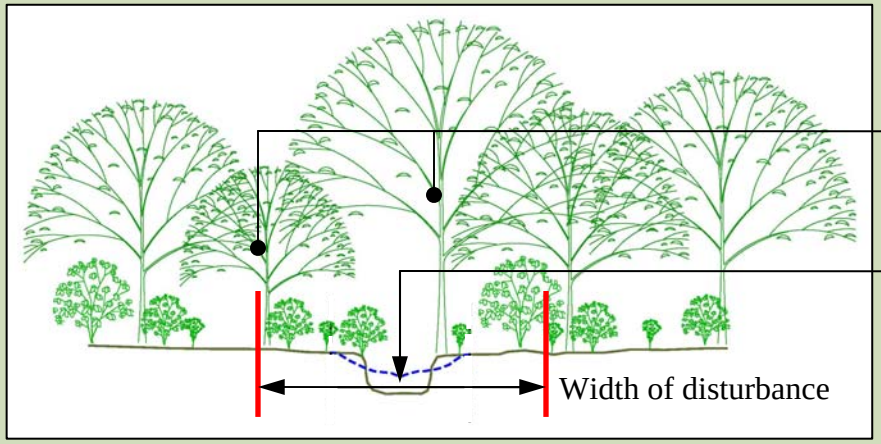
Correcting the Problem

Option 2: Restore streams to handle these flowrates

Lowering the floodplain results in a larger project area



Raising the bed is much less disruptive.



Conventional Stormwater Scenario

Assumptions:

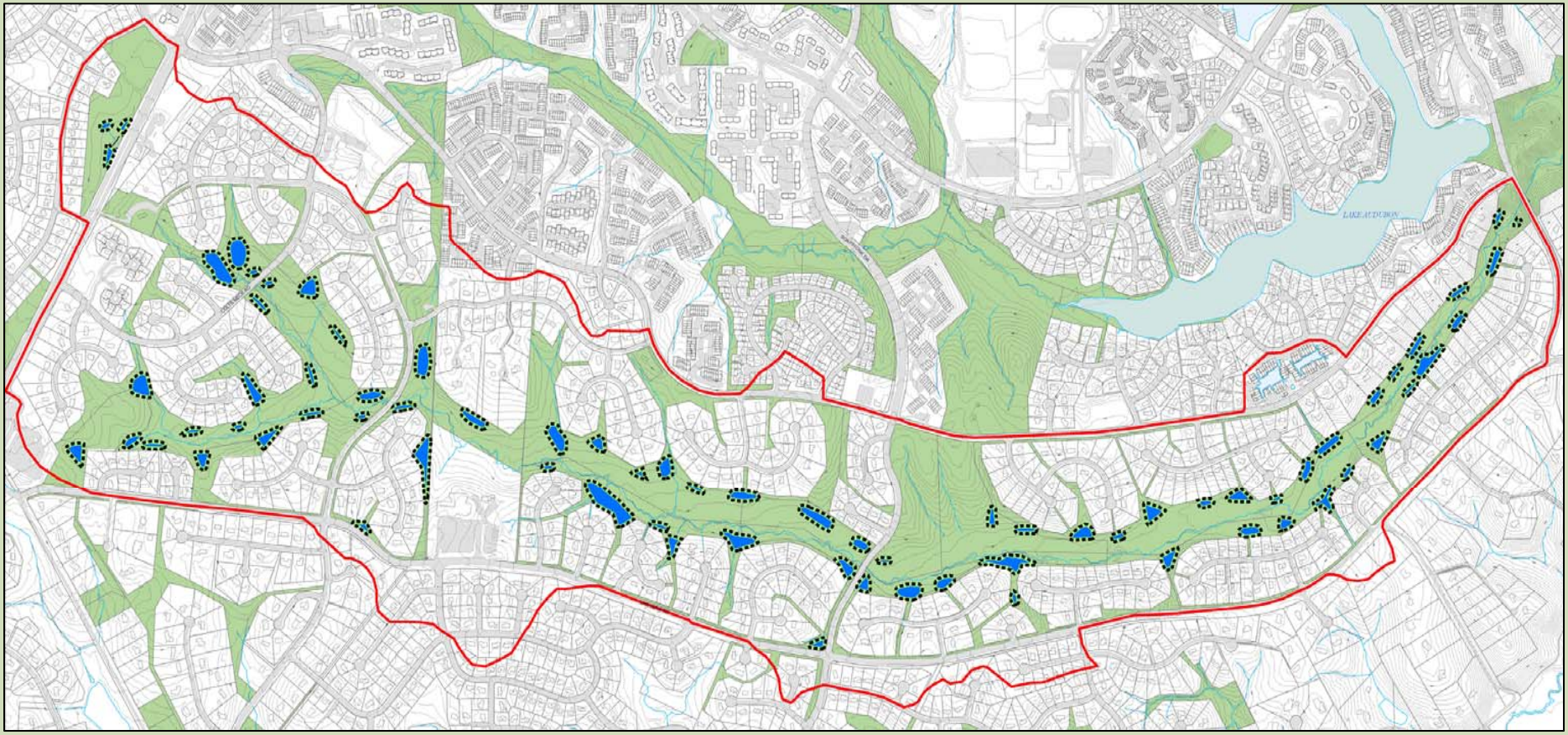
- Storage volume based on 3,000 cubic ft per developed acre (1 yr, 24-hr release / 2 & 10 yr control)
- Average depth of 3 feet
- 20 foot grading/dam outside storage area

Dry Ponds in Fairfax County

Conventional Stormwater Scenario

Results

- 75 ponds
- 29.3 acres disturbance from grading



Bio-Retention Scenario

Assumptions:

- WQ Storage volume based on capturing ½ inch of run-off per impervious area
- Underground detention for quantity control
- Maximum ponding depth of 6 inches
- Maximum drainage area of 1 acre
- Average drainage area of ⅔ acre (developed)
- 10 foot grading/berm outside of storage area

Rain Garden at Mike Rolband's House

Bio-Retention Scenario

Results

- 830 Bio-retention facilities
- 36.7 acres disturbance from grading

Wetland Studies and Solutions, Inc.©

WHY RESTORE ?

Reconnect to the existing floodplain to:

- Slow velocities
- Increase evapotranspiration
- Remove pollutants (TP, TN, and TSS)
- Improve riparian habitat
- Restore groundwater levels

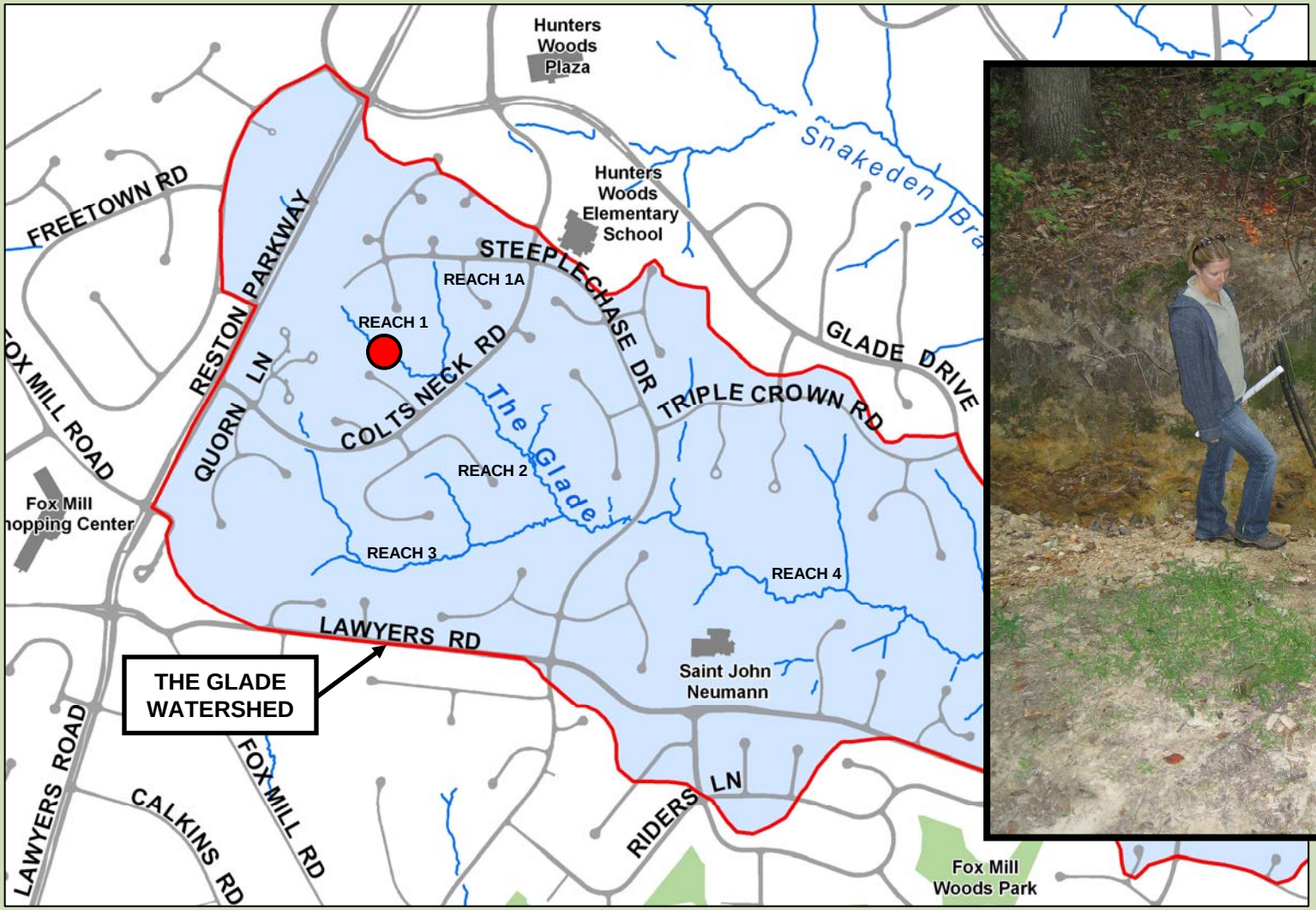
Stream relocation - 1999

UVA Research Park – Charlottesville, VA

After planting

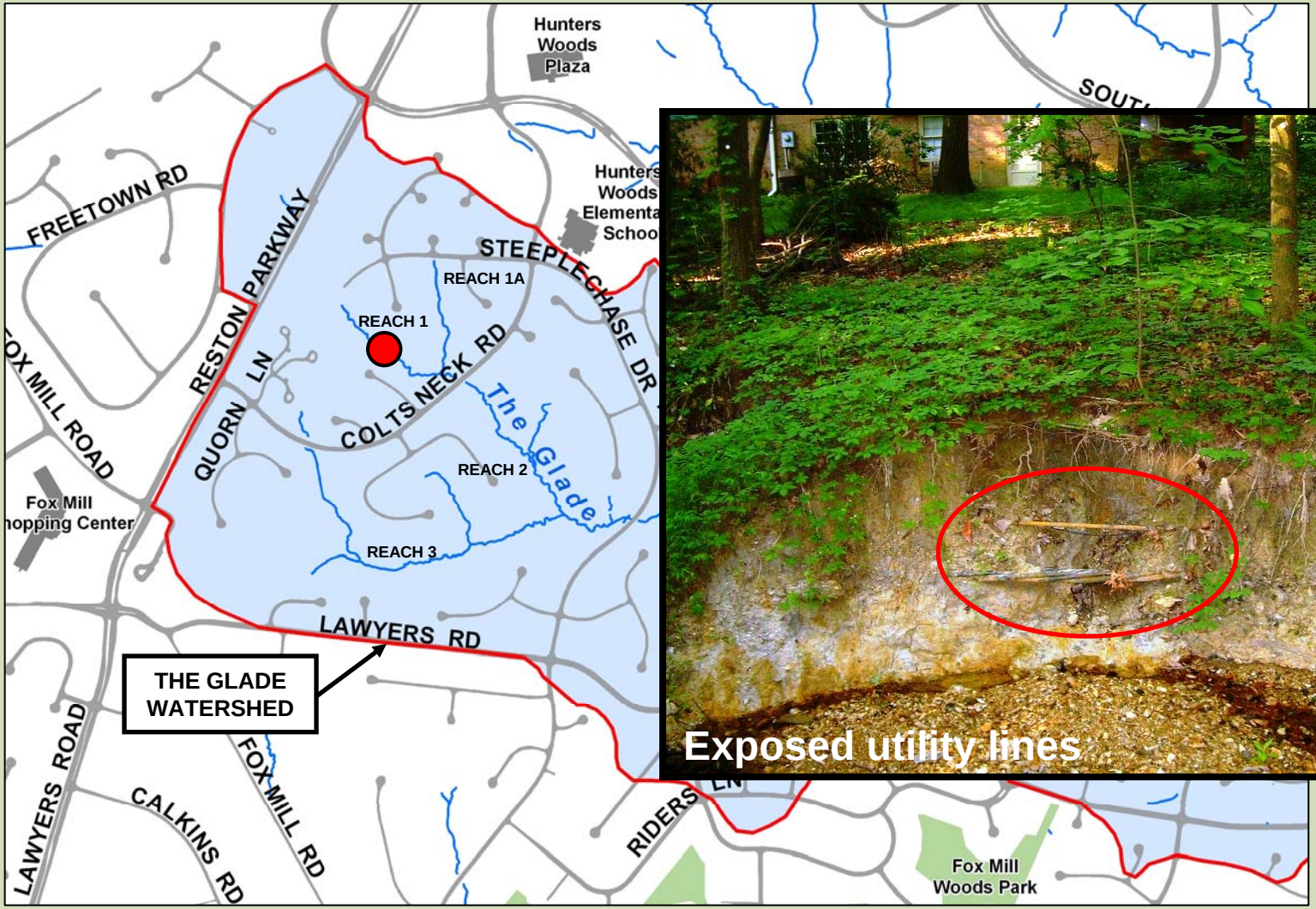
Same stream - 2007

Existing Conditions In The Glade



Reach 1

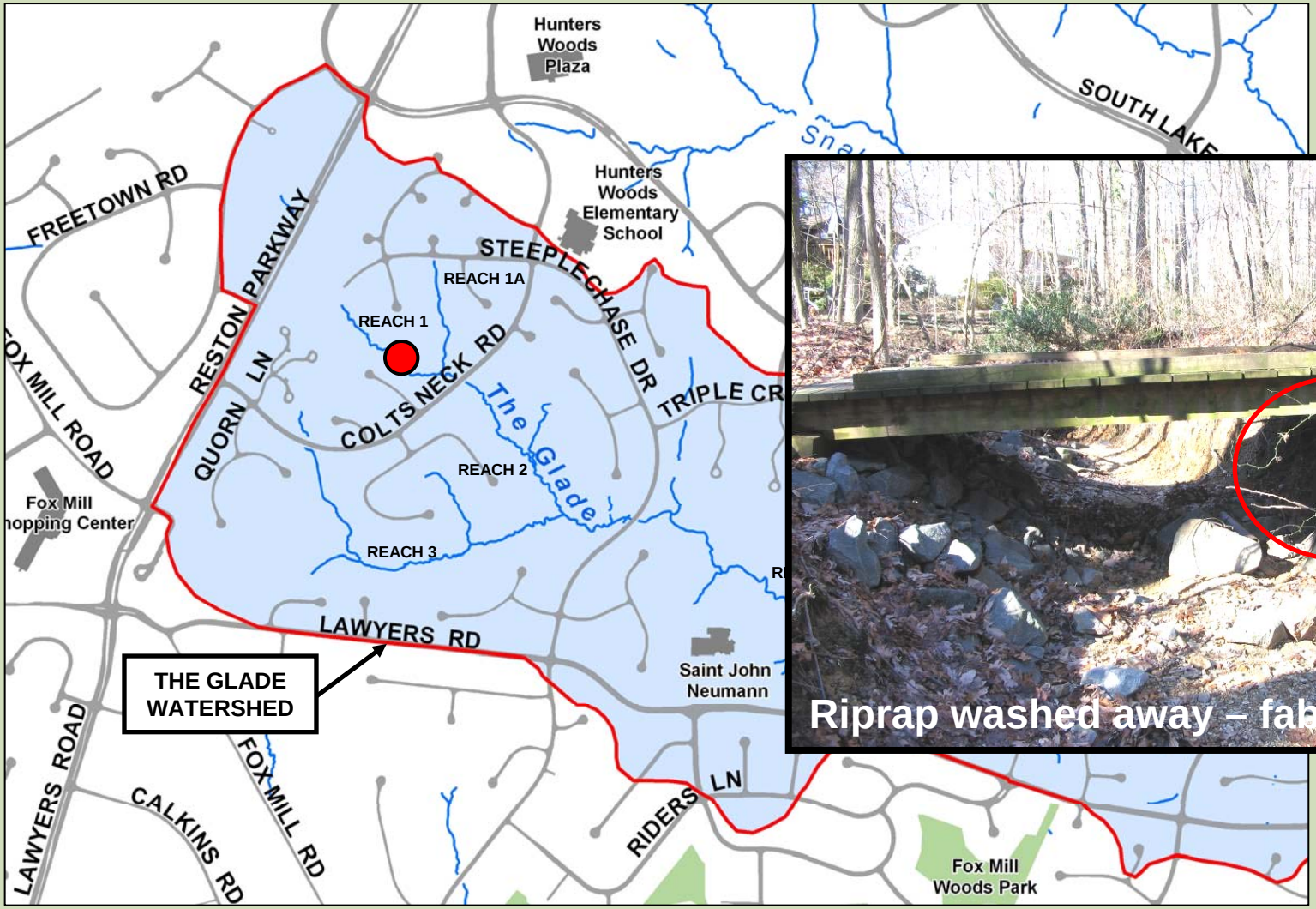
Existing Conditions In The Glade



Reach 1

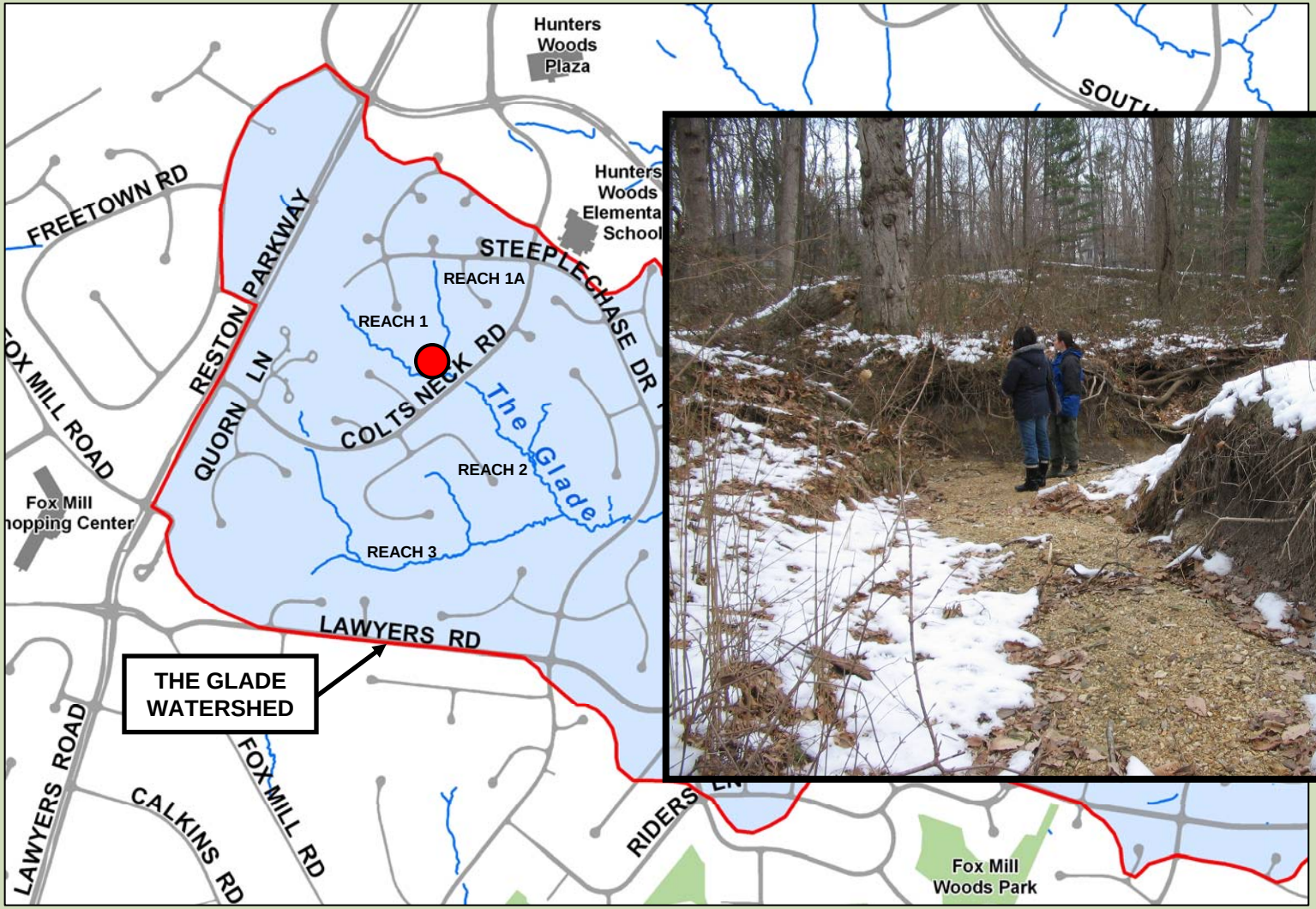
Wetland Studies and Solutions, Inc.

Existing Conditions In The Glade



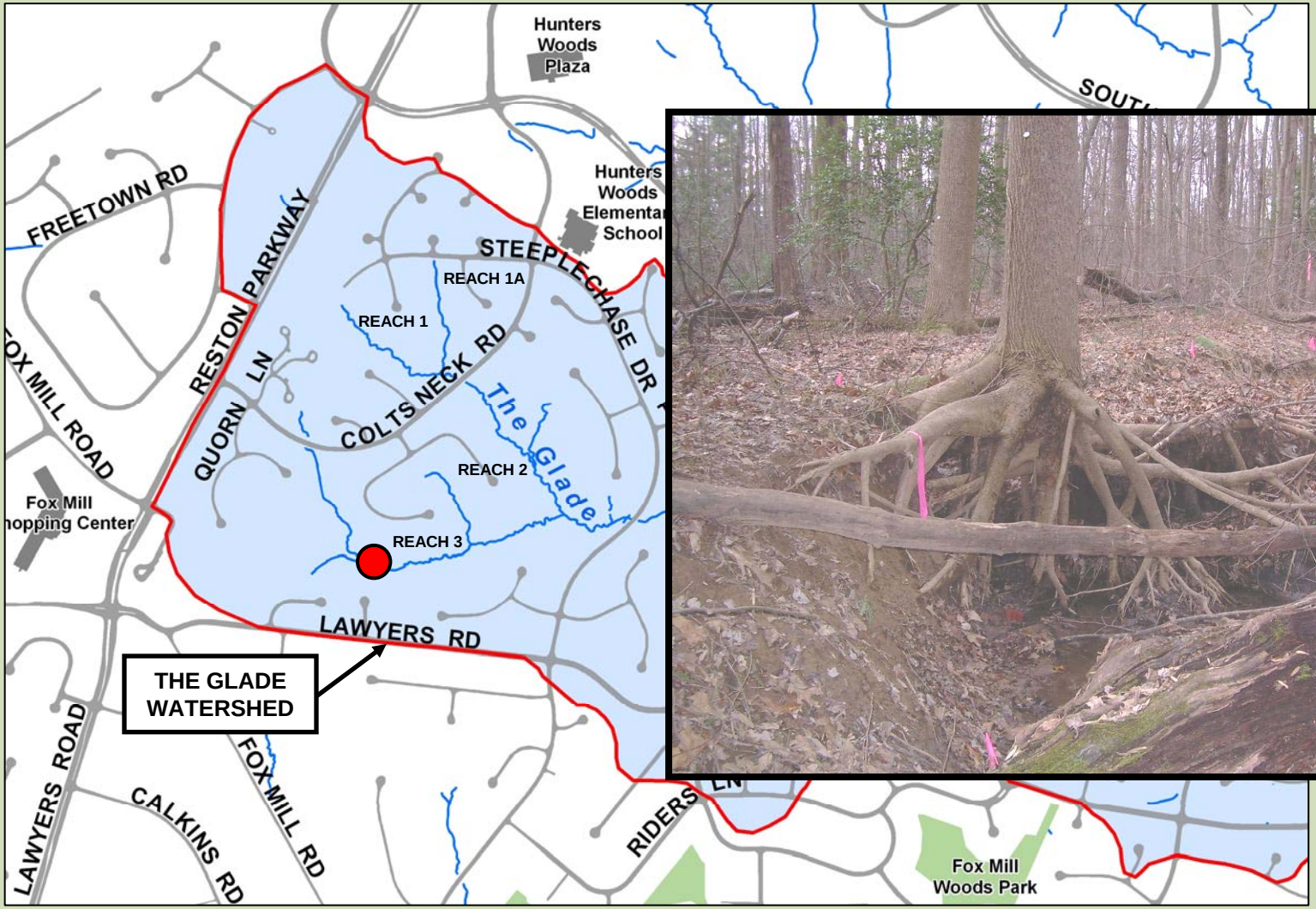
Reach 1

Existing Conditions In The Glade



Reach 1

Existing Conditions In The Glade



Reach 3

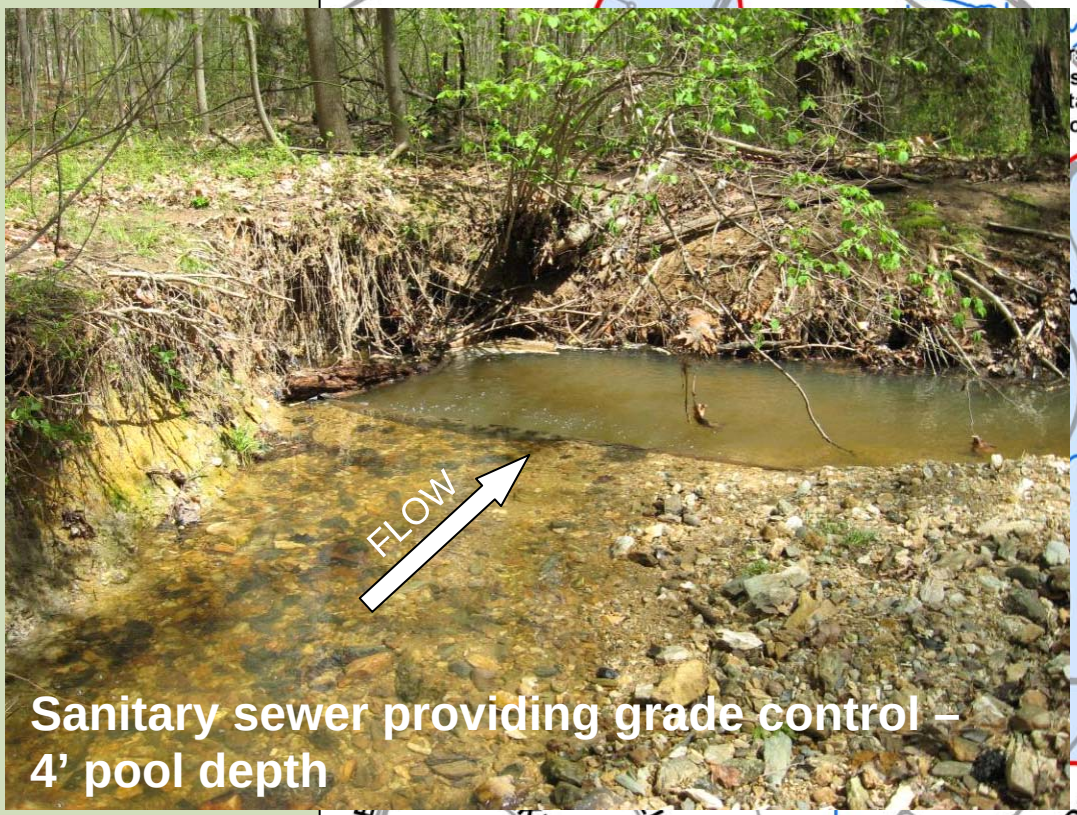
Wetland Studies and Solutions, Inc.

Existing Conditions In The Glade

Reach 4A

Existing Conditions In The Glade

Reach 4A



Existing Conditions In The Glade

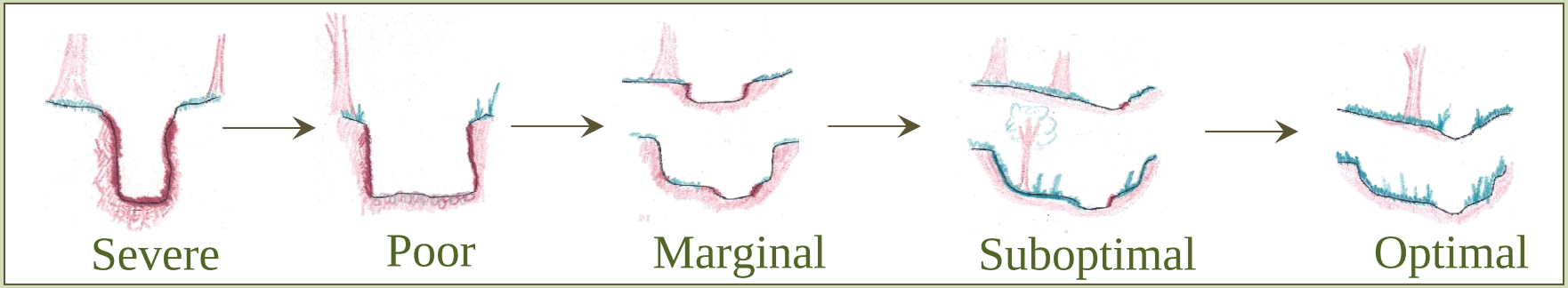
Reach 4A

Existing Conditions In The Glade

Reach 4B

Design Methodology for Urban Streams
- Natural Channel Evolution -

Evolutionary process considers the channel's incision, bank stability, & sedimentation load (aggrading or degrading)



South Lakes High School

Severe
Channel Condition

Optimal
Channel Condition

Elanore Lawrence Park

URBAN STREAM - DESIGN REALITIES

1. Significantly more flow than rural streams.
2. Significantly more "*bankfull*" events than in rural watersheds.
3. Given site constraints, reinforcement is necessary.
    - Rock structures – using native diabase rock
    - Reinforced bed
    - Heavy planting densities – native vegetation only

Snakeden Branch – Reach 3 (after 6 months)

McLean Place (after 4.5 yrs)

Construction – Reach 1

Wetland Studies and Solutions, Inc.©

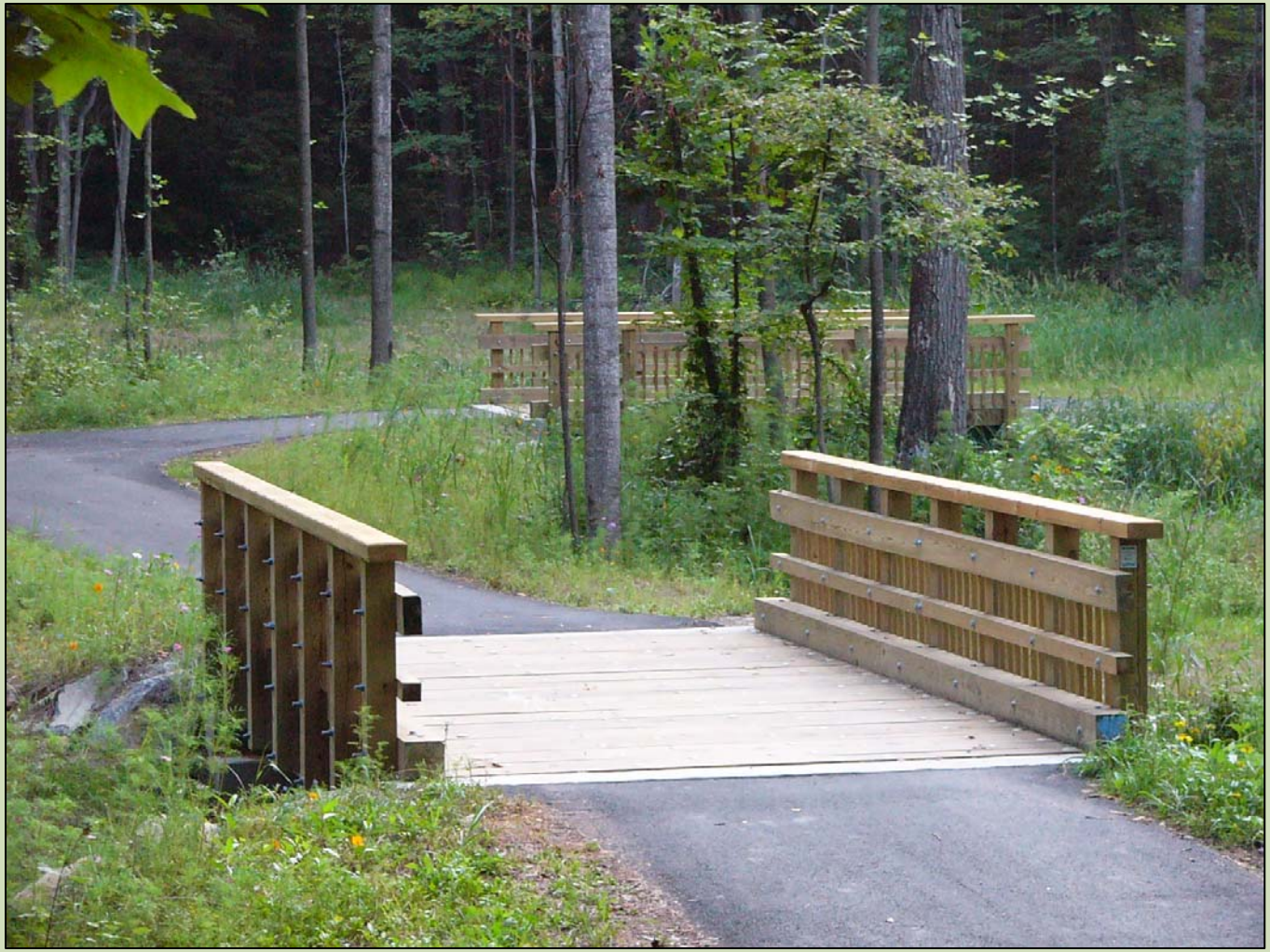
Construction – Reach 2

Wetland Studies and Solutions, Inc.©

Construction – Reach 2

Construction – Reach 3

Snakeden Bridges – Reach 3



Construction – Reach 12

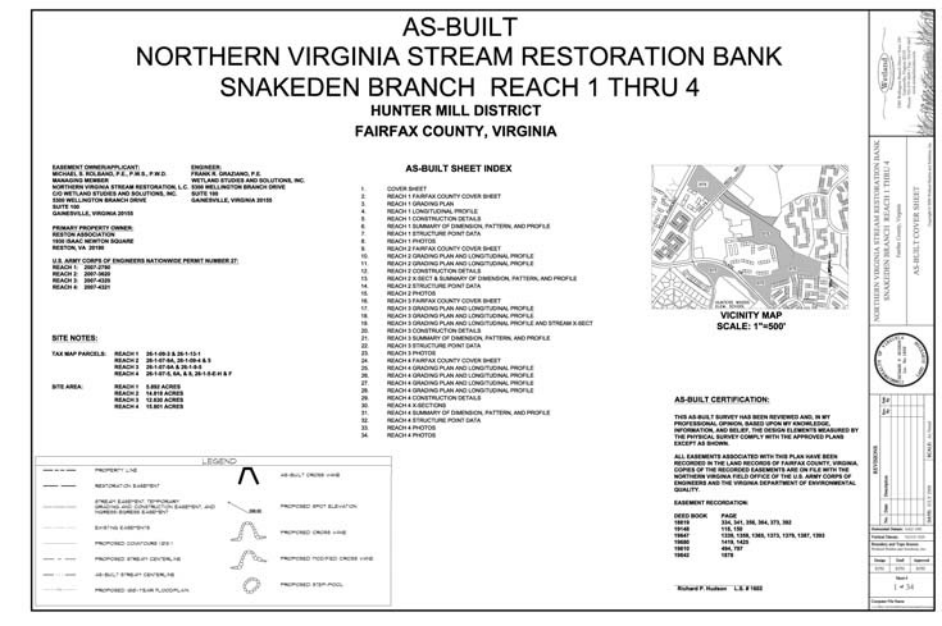
Tropical Storm Hanna (9/06/08)

100-YR EVENT (6.22" IN 9 HOURS)

Tropical Storm Hanna

2 - DAYS LATER

Monitoring and Maintenance


AS-BUILT
NORTHERN VIRGINIA STREAM RESTORATION BANK
SNAKEDEN BRANCH REACH 1 THRU 4
HUNTER MILL DISTRICT
FAIRFAX COUNTY, VIRGINIA

AS-BUILT SHEET INDEX

VICINITY MAP
SCALE: 1"=500'

AS-BUILT CERTIFICATION:

10-year monitoring program

- Streambed surveys
- Structure surveys
- Vegetation surveys
- Biological Surveys
- As-built for Reaches 1- 4 has been approved.

Must meet success criteria outlined in MBI – or fix!

Monitoring / Maintenance and Catastrophic Event Fund

How is it funded?

Catastrophic Event

- 5% of all sale proceeds placed in interest bearing account.
- $5 million, plus interest.
- Available for RA use after 10-yr monitoring period.
- Currently ***no funds*** available unless paid with RA dues.

Monitoring and Maintenance

- 15% of all sales proceeds ($15 million value).
- 1/10 released per year if stream criteria achieved.

Sizes of Streams

Vary by % I.C. and D.A.

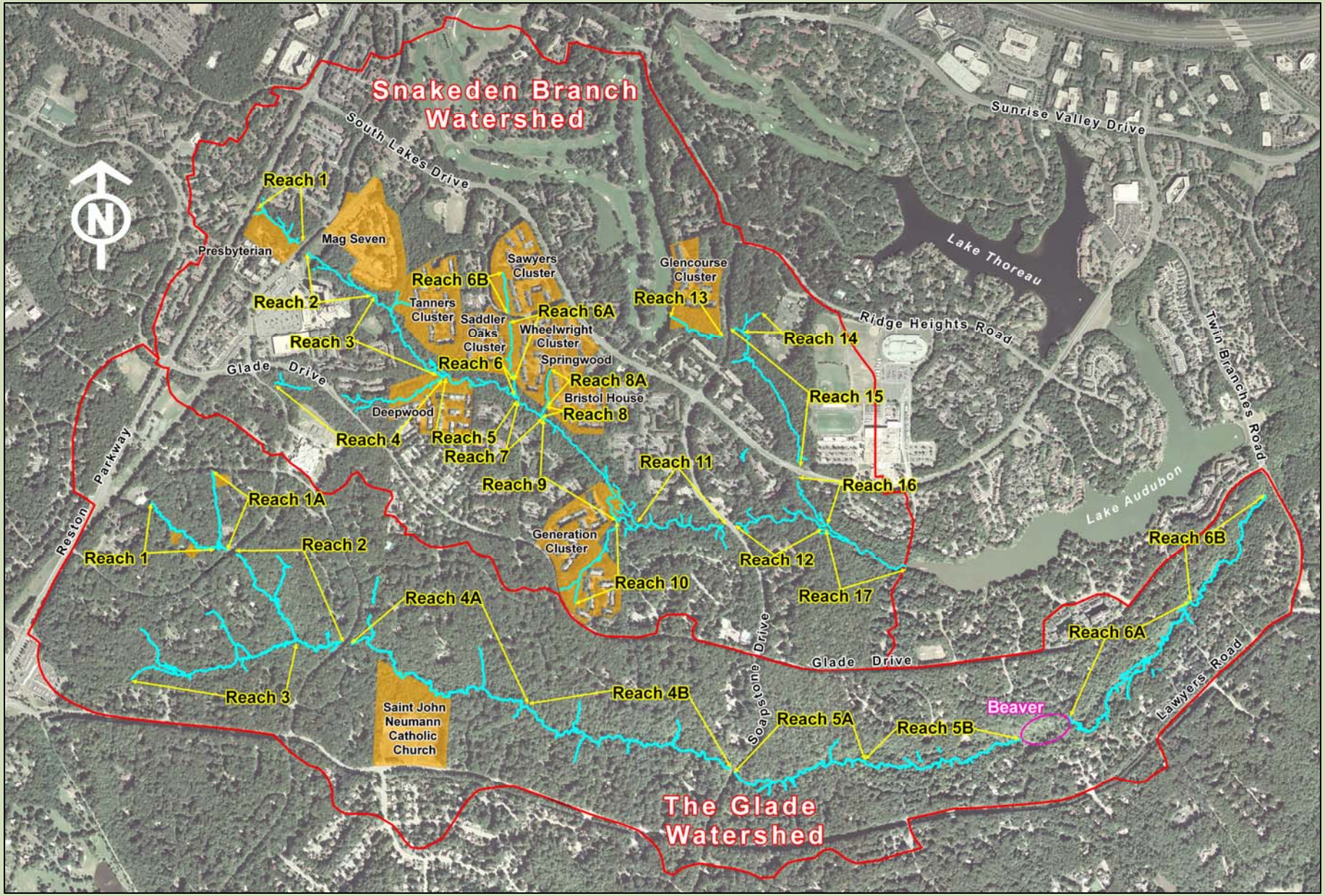
Bankfull Width (ft)

Snakeden Branch (38%,863 ac)

Reach	Width (ft)	Locator
1	14	Top of Snakeden
2	16 - 17.5	
3	17.5 - 22.5	
4	14 - 18	Deepwood Cluster Trib
5	28	
6	14	Tribs to Snakeden
6A	10	
6B	9	
7	28	
8	8.5	
8A	8.5	
9	30	
10	6 - 8.5	
11	32	Above Soapstone Dr
12	34	Below Soapstone Dr
13	20	South Lakes Trib
14	9	
15	22	
16	26	
17	36	Above Lake Audubon

The Glade (15%, 780 ac)

Reach	Width (ft)	Locator
1	10	Steeplechase to Colts Neck
1A	8.5	Trib to Reach 1
2	13 - 18	Colts Neck to Steeplechase
3	6 - 11	Joins Reach 2 at Steeplechase
4A	16 - 19	Below Steeplechase


Snakeden Branch Watershed
The Glade Watershed
South Lakes Drive
Sunrise Valley Drive
Lake Thoreau
Ridge Heights Road
Twin Branches Road
Lake Audubon
Glade Drive
Reston Parkway
Soapstone Drive
Lawyers Road
Presbyterian
Mag Seven
Tanners Cluster
Saddler Oaks Cluster
Sawyers Cluster
Wheelwright Cluster
Springwood
Glencourse Cluster
Bristol House
Deepwood
Generation Cluster
Saint John Neumann Catholic Church
Beaver
Reach 1
Reach 2
Reach 3
Reach 4
Reach 5
Reach 6
Reach 6A
Reach 6B
Reach 7
Reach 8
Reach 8A
Reach 9
Reach 10
Reach 11
Reach 12
Reach 13
Reach 14
Reach 15
Reach 16
Reach 17
Reach 1A
Reach 4A
Reach 4B
Reach 5A
Reach 5B

Stream Restoration Design & Minimizing Tree Impacts

EXISTING CONDITIONS

Survey and walk existing stream corridor, including infrastructure and trees.

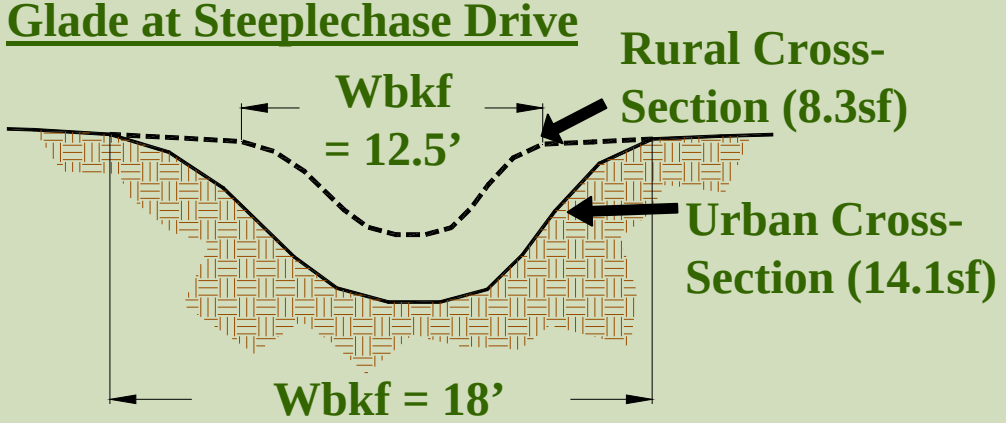
THE DESIGN PROCESS

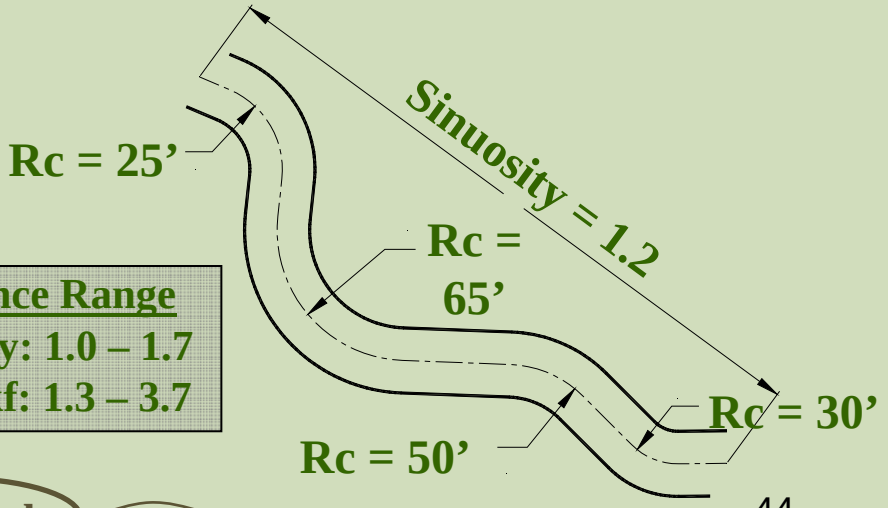
Determine Bankfull Width and Bankfull Area to convey current flows.

Apply Bankfull Width to reference ranges of sinuosity and meander radii.

(Continued)

Glade at Steeplechase Drive





Reference Range
Sinuosity: 1.0 – 1.7
Rc/Wbkf: 1.3 – 3.7

Stream Restoration Design & Minimizing Tree Impacts

THE DESIGN PROCESS, CONTINUED

Layout initial design and avoid high value trees and existing infrastructure (utilities, trails, etc.).

Revise restoration design to further minimize tree impacts (typically several iterations).

Arborist and contractor field review to make final avoidance assessment.

Also, determine access - preferably by existing trails and sewers to minimize impacts.

Stream Restoration Design & Minimizing Tree Impacts





TREE IMPACT CONSIDERATIONS

Ecological / Habitat Value

- Size / Diameter
- Higher - Climax species: Oaks, Hickory, Holly (*mast producers, long-lived;* ***12%*** *of existing*).
- Lower – Early successional species: Maples, Poplar (*fast-growing, short-lived;* ***65%*** *of existing species*).

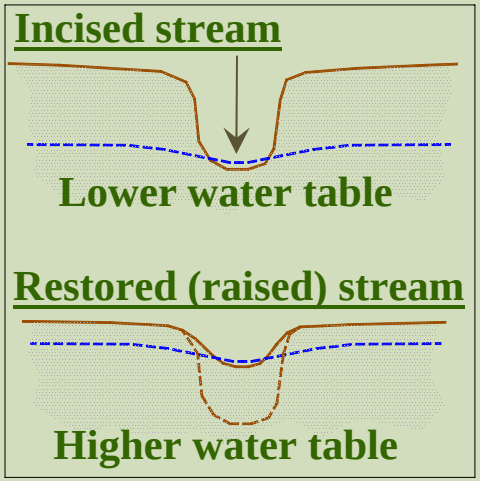
Existing Condition

- Undercut by stream, high proportion of exposed roots, short life expectancy
- Dead, dying, diseased, or damaged trees that pose a human safety hazard
- Impacting or pending impact to infrastructure (*utilities, roads, trails, etc.*)

Proposed Condition

- Drip line heavily impacted during restoration, minimal chance of survival, AND
- Human safety hazard to trails, houses, bridges, etc.

Stream Restoration Design & Minimizing Tree Impacts



SHORT TERM IMPACT FOR LONG TERM BENEFIT

- **Cleared trees "recycled"** as in-stream habitat, grade control, wood-chip trails, habitat "brush" piles, timber products
- **Restoration raises the water table,** (raises stream bed) which increases stream access to floodplain and nutrient delivery to roots.
- **Healthier ecosystem will develop** with the density and species variety of replacement plantings
  - Mosquito population control via predator habitat
  - Dense streambank planting will provide shade, reduce water temperatures, increase oxygenation, increase fish survivability
  - Dragonfly larva molting access via heavily planted streambank with shallower slope
- **Canopy loss will close** as remaining trees adjust and react to increased sunlight, growing to fill in openings

FEWER TREES CUT = LOWER RESTORATION COST

- **Tree-climbing removal method** vs. traditional forestry timbering (*minimize impacts to neighboring trees*) is expensive.

Wetland Studies and Solutions, Inc.

Restoration Area Plantings

- Seed mix includes 6 grass, 21 forb, 5 shrub and 5 tree species
- Plantings include 8 tree and 10 shrub species
- Riparian Forest: 640 trees/shrubs per acre
- Streamside:
  - 1 gallon container 3’ O.C.
  - live stake/tubling 1’ O.C.
- Increased sunlight on forest floor
- Edge effect established

Oxeye Sunflower

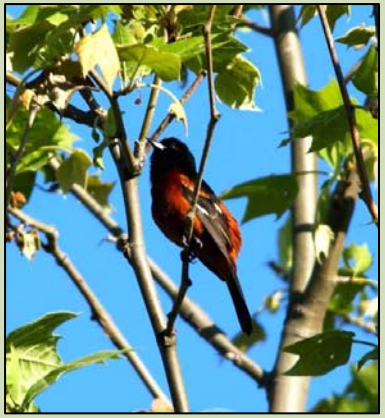
Eastern Redbud

Greater Wildlife Species Richness

- Mature forest continues to provide habitat for raptors, wood peckers, bats and deer
- Recently planted areas provide habitat for small mammals, song birds, fox and deer
- All species benefit from the “edge effect”
- Restored stream allows detrital input to be processed, thus increasing stream health and function

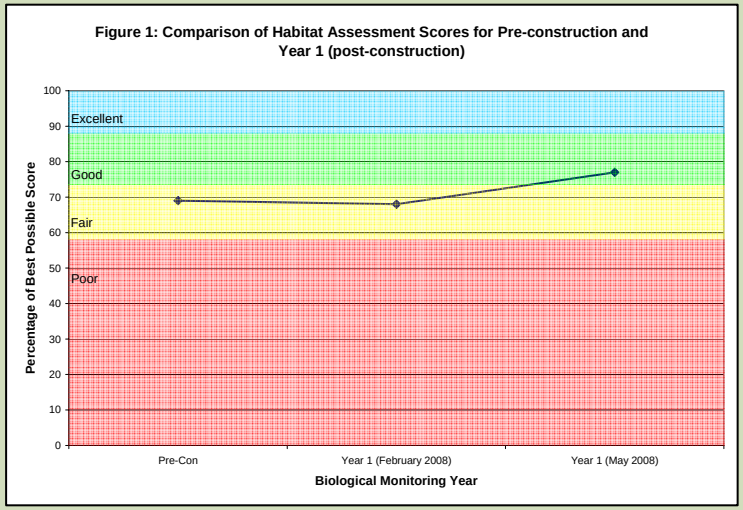
Red-shouldered Hawk


Cottontail Rabbit


Orchard Oriole

Improved Aquatic Habitat Value

- 1,423 linear feet of Sycolin Creek were restored - summer and fall of 2007.
- Long-term biological stream monitoring - habitat and benthic macroinvertebrates.
- 2008 Results - stream habitat and the benthic macroinvertebrates have improved since restoration - attributed to the establishment of riparian vegetation, the stability of the bioengineered banks, and improved geomorphology.



Mayfly Larvae

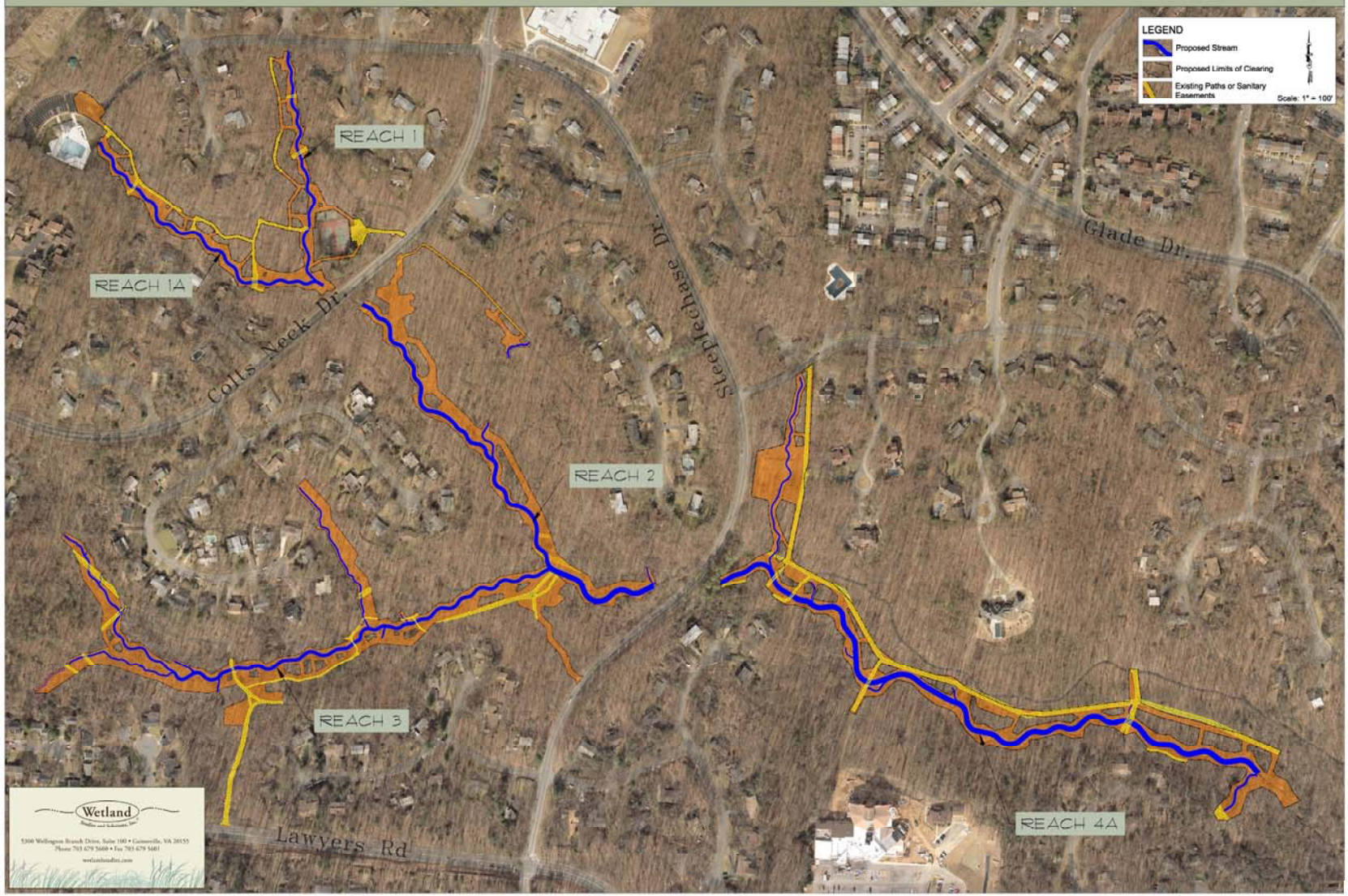
Tree Summary

The Glade Watershed		
Reston Association Area	208.4	acres
Church Easement Area	9.06	acres
Total Area	217.5	acres
Estimated Number of Trees	25,259	trees
(based on total area tree density)		
Acres in Tree Survey	82.4	acres
Number of Trees	9,573	trees
Tree Density	116	trees/acre
Limits of Clearing 1-3, 4A (LOC)	17.19	acres
Total Trees Within LOC	1,848	trees

Snakeden Watershed		
Reston Association Area	117.1	acres
Cluster Easement Area	52.6	acres
Total Area	169.72	acres
Estimated Number of Trees	28,876	trees
(based on total area tree density)		
Acres in Tree Survey	63.8	acres
Number of Trees	10,852	trees
Tree Density	170	trees/acre
Limits of Clearing	28.9	acres
Total Trees Within LOC	3,264	trees

Snakeden Post Construction Results					
Reach	Area (Ac.)	Trees	Density (trees/ac.)	Number of Trees Taken	% of Trees Taken
6A	0.47	71	150	43	61%
8A	0.48	78	161	19	24%
Totals	0.96	149	155	62	42%

THE GLADE - PROPOSED LIMITS OF CLEARING REACHES 1-4A AND TRIBUTARIES



Old Horse Arena
Existing Conditions

Upstream Inlet

Downstream Outlet

Wetland Studies and Solutions, Inc.

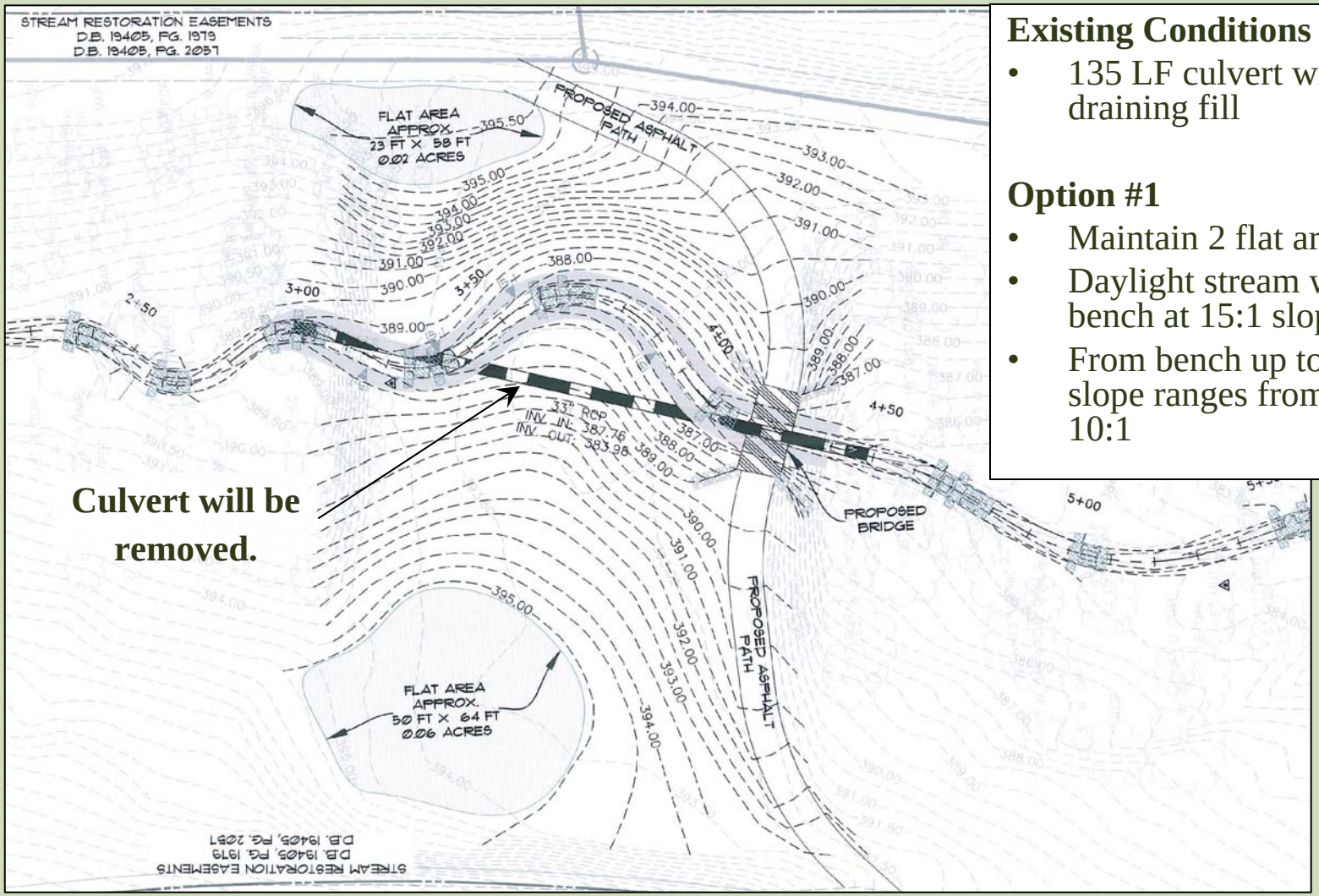
Old Horse Arena
Existing Conditions

Looking Downstream

Looking Toward
Steeplechase Drive

Wetland Studies and Solutions, Inc.

Old Horse Arena - Option #1



Culvert will be removed.

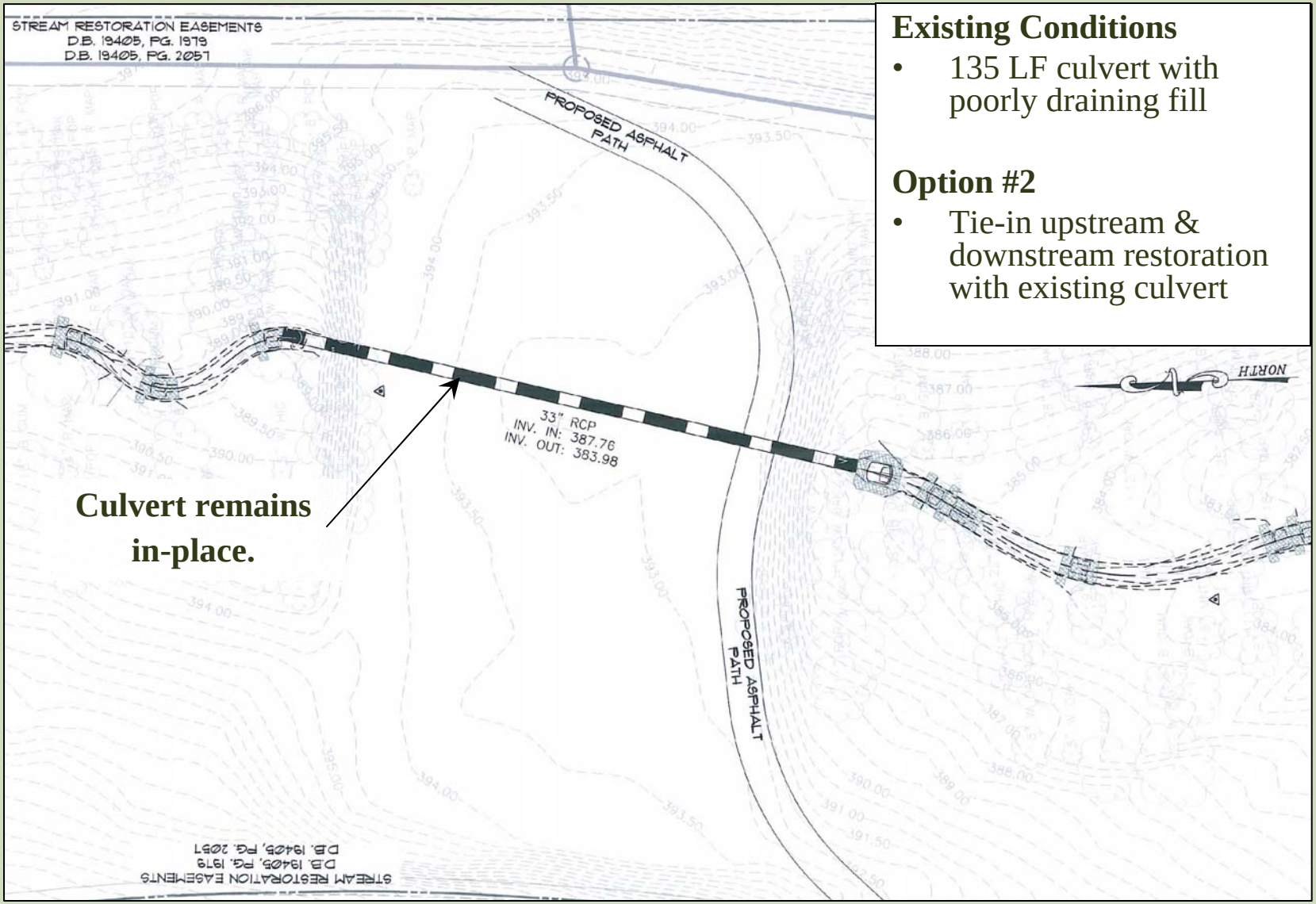
Existing Conditions

- 135 LF culvert with poorly draining fill

Option #1

- Maintain 2 flat areas
- Daylight stream with a 3-ft bench at 15:1 slope
- From bench up to existing grade slope ranges from 4:1 up to 10:1

Old Horse Arena - Option #2



Existing Conditions

- 135 LF culvert with poorly draining fill

Option #2

- Tie-in upstream & downstream restoration with existing culvert

Wetland Studies and Solutions, Inc.

Conclusion

1. Reston streams are seriously degraded due to urbanization – a situation made even worse by a lack of stormwater management. An ideal place to establish the NVSRB.

2. Fully restored streams will provide long-term stability & financial benefits to the community:
   - Phase I: $70 million Restoration
   - $450,000 to Reston Association
   - $950,000 to Friends of Reston
   - $3 million of new bridges for Reston
   - Reduced dredging costs for RA lakes
   - $5 million Catastrophic Event Fund
3. Short-term construction disturbance will provide long-term societal and ecological benefits to a heavily used, urban stream valley network.

QUESTIONS ?