

Northern Virginia Stream Restoration Bank

"Everything You Want to Know About Stream Restoration North of the Toll Road"

Presented by Michael S. Rolband
P.E., P.W.S., P.W.D.

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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

North Fork Wetland Mitigation Bank

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

Snakeden Branch – Reach 3

Agenda

- Mitigation Banking and Why Reston?
- The Urban Watershed Problem and Solutions
- Urban Stream Restoration Methodology
- Colvin Run Watershed – Existing Conditions
- Data Collection and Design
- Construction and Plantings
- Technical Review, Monitoring, and Maintenance
- Summary
- Questions

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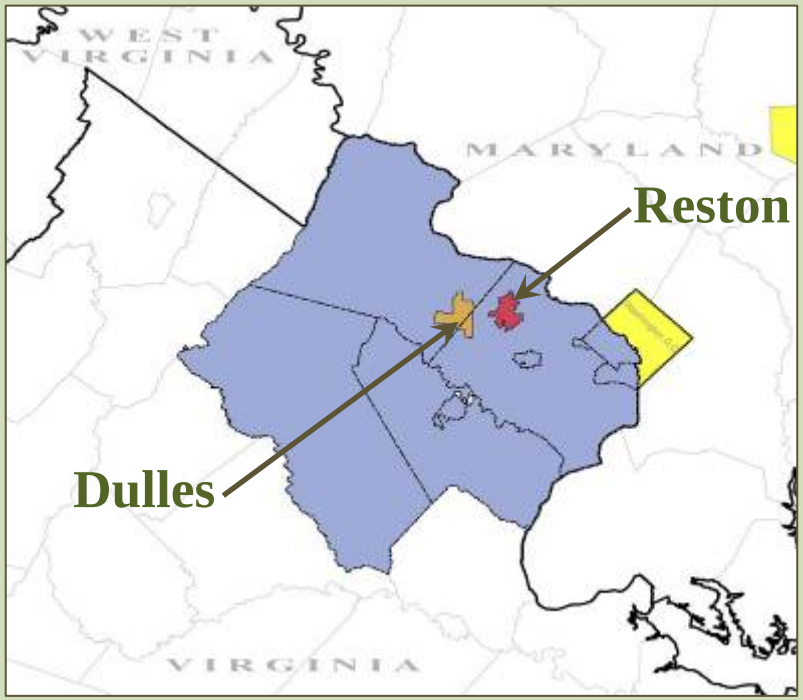
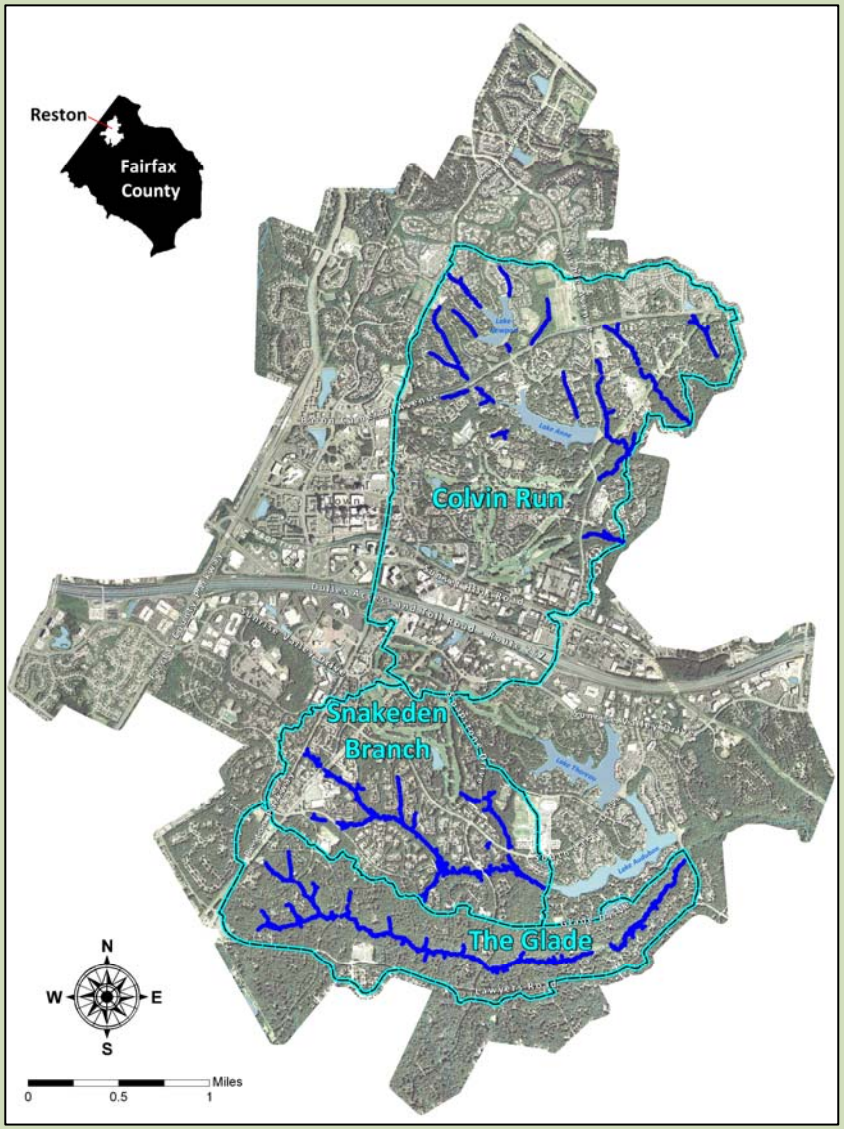
WHY A STREAM BANK IN RESTON ?

- Community members are actively involved in protecting local natural resources
  - They recognized the degraded state of the streams
  - Watershed Subcommittee of the Citizen's Advisory Committee for the Environment and Ecology published 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?

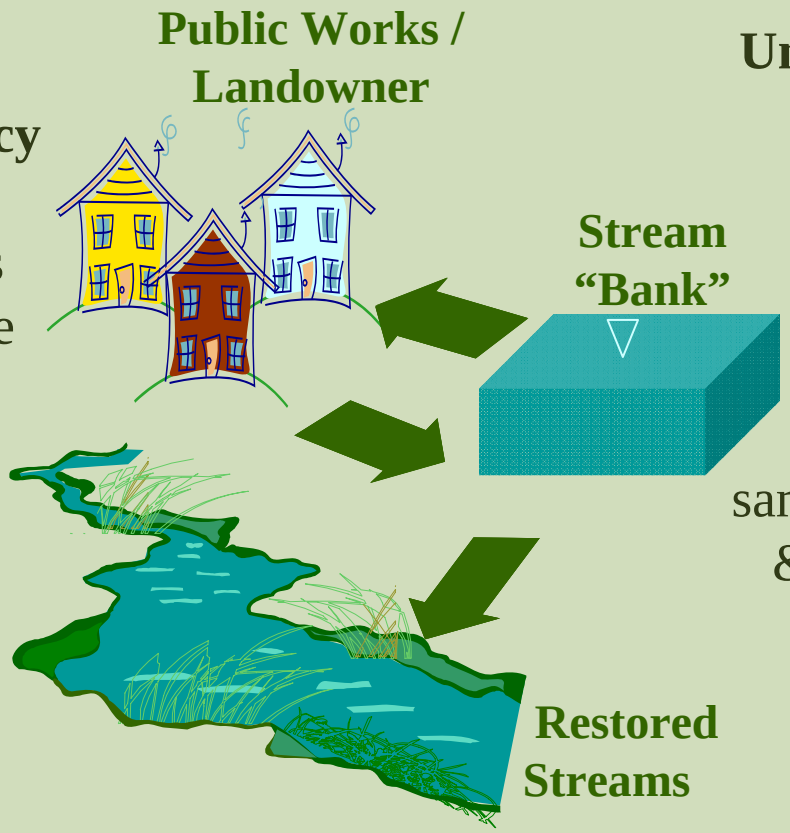
- Degrading streams are located in preserved corridors (without stormwater management)
- Mostly controlled by a single entity (Reston Association).
- Community of Reston includes entire watersheds.
- There is a demand for stream mitigation in the region (funding source)





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

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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

Reston Association

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:

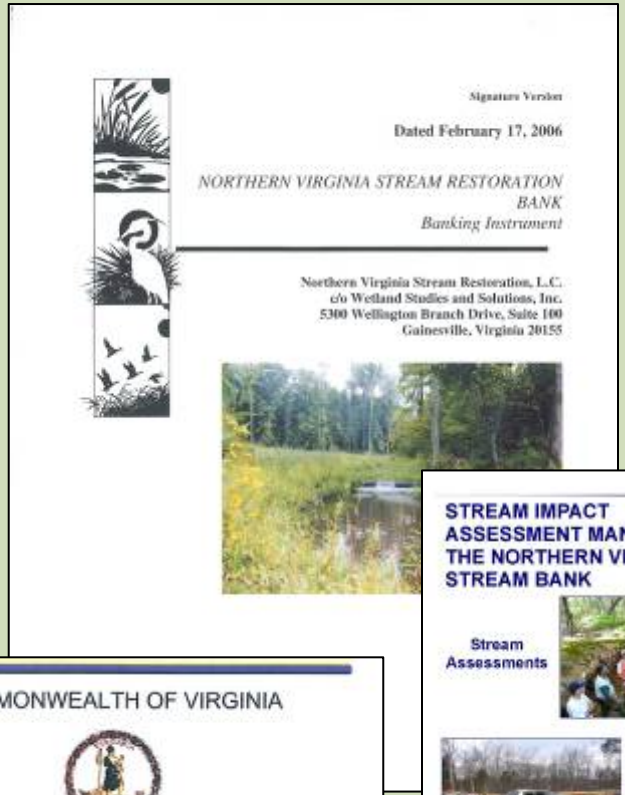
- Executive Order 90 Issued – *"Improving Stream Health and Water Quality by Restoring Streams Throughout the Commonwealth"*

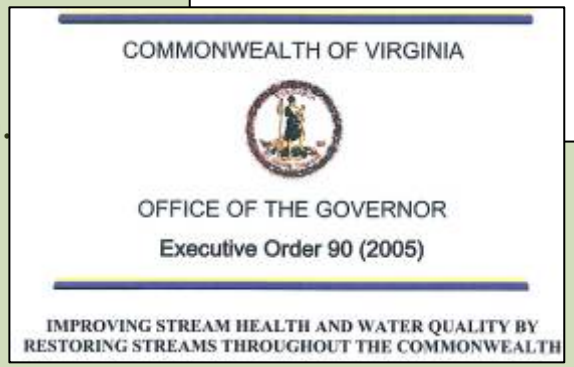
February 2006:

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

June 2006:

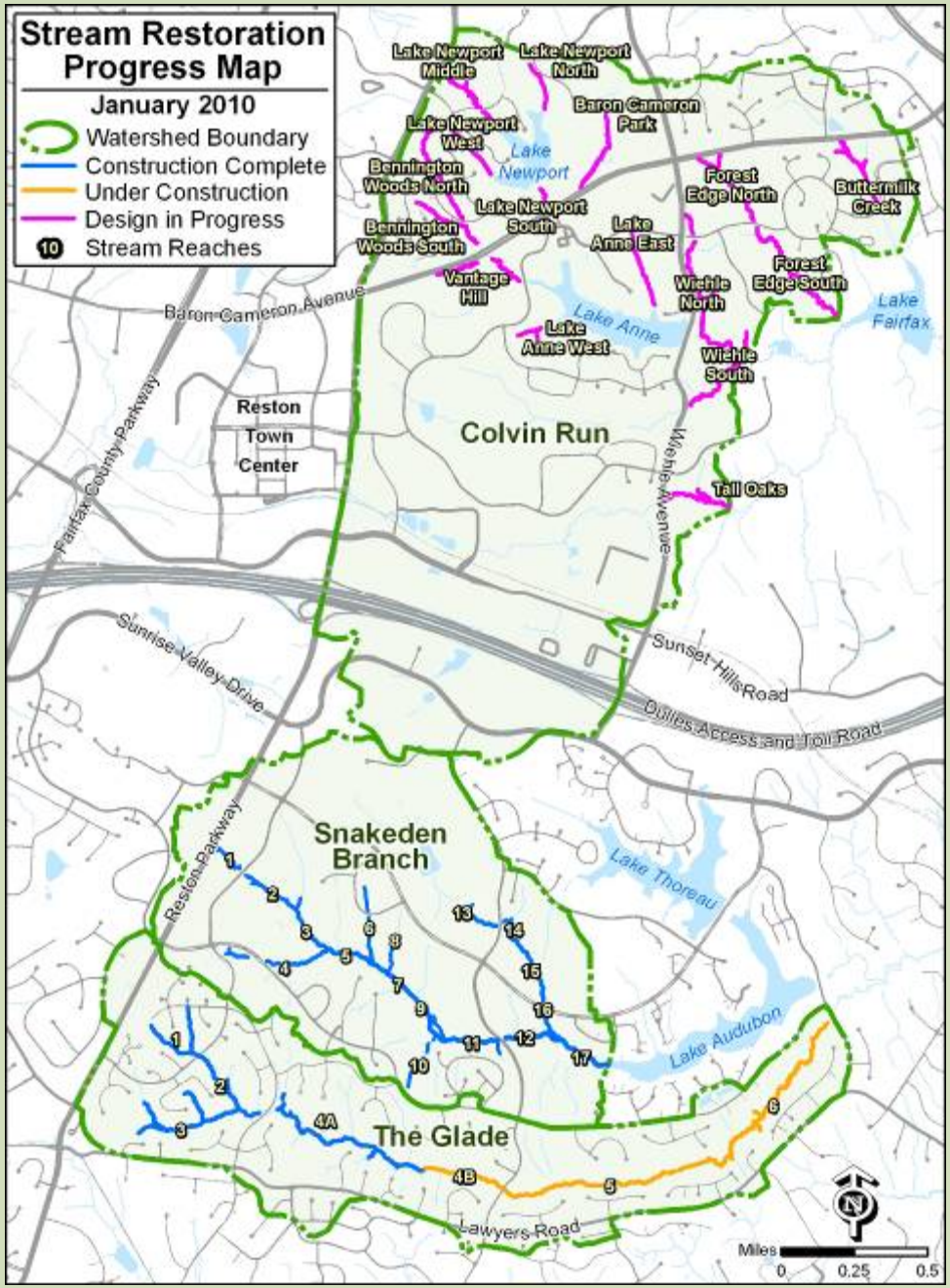
- Concept Plan Approved by DEQ & COE





Restoration Progress

- Since February 2008, over 30,000 lf of restoration completed
  - Snakeden
  - The Glade, Reaches 1-4A
  - Portion of The Glade, Reach 4B



Restoration Progress – Reach 13

Pre-Construction
(March 2008)

Post-Construction
(October 2009)

Restoration Progress – Reach 4A

Pre-Construction
(September 2009)

Post-Construction
(November 2009)

Restoration Progress – Reach 4A

Pre-Construction
(September 2009)

Post-Construction
(November 2009)

Restoration Progress – Tributary to Reach 4A

Pre-Construction
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Post-Construction
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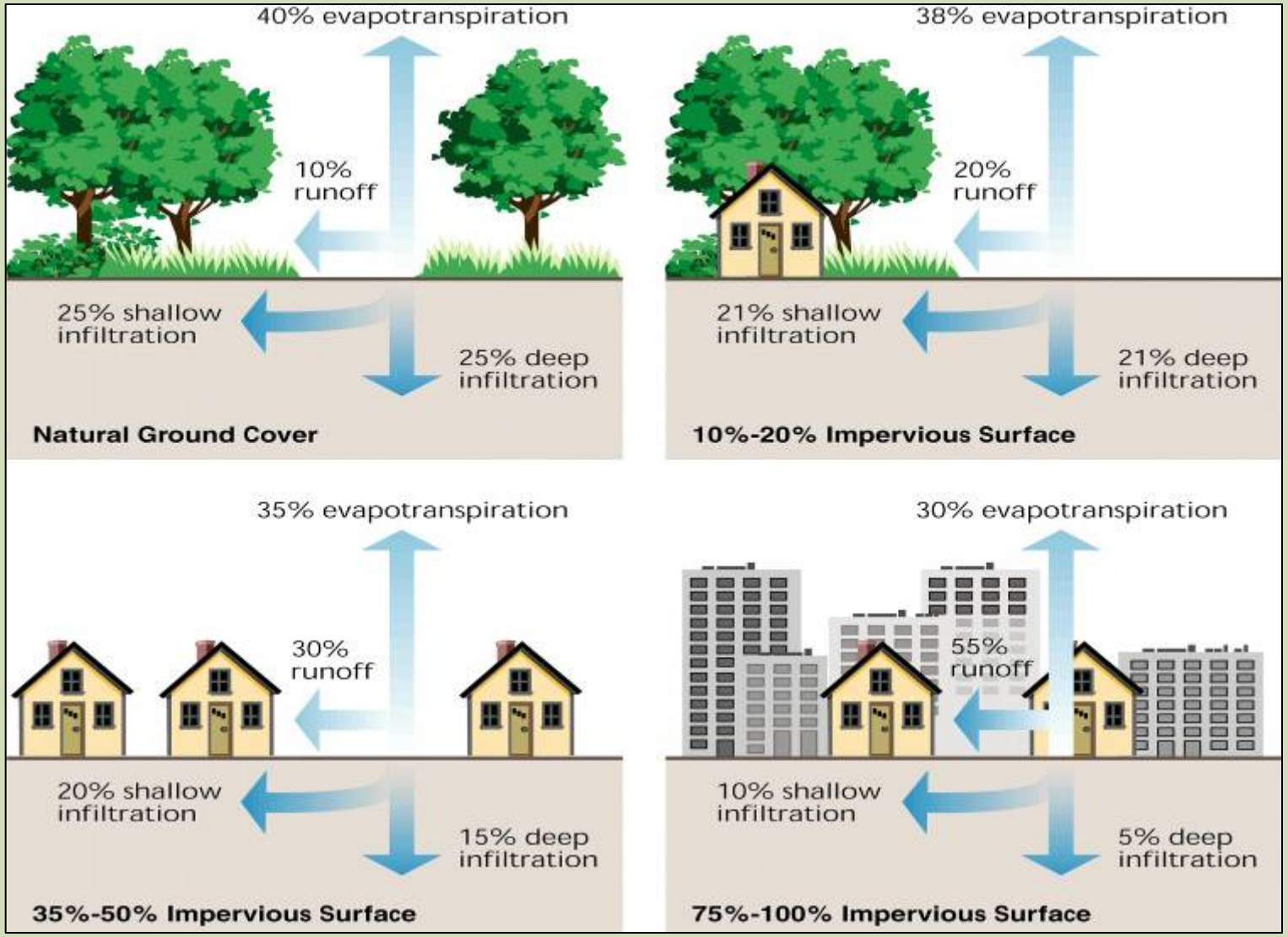
The Urban Watershed Problem



Source: The Federal Interagency Stream Restoration Working Group

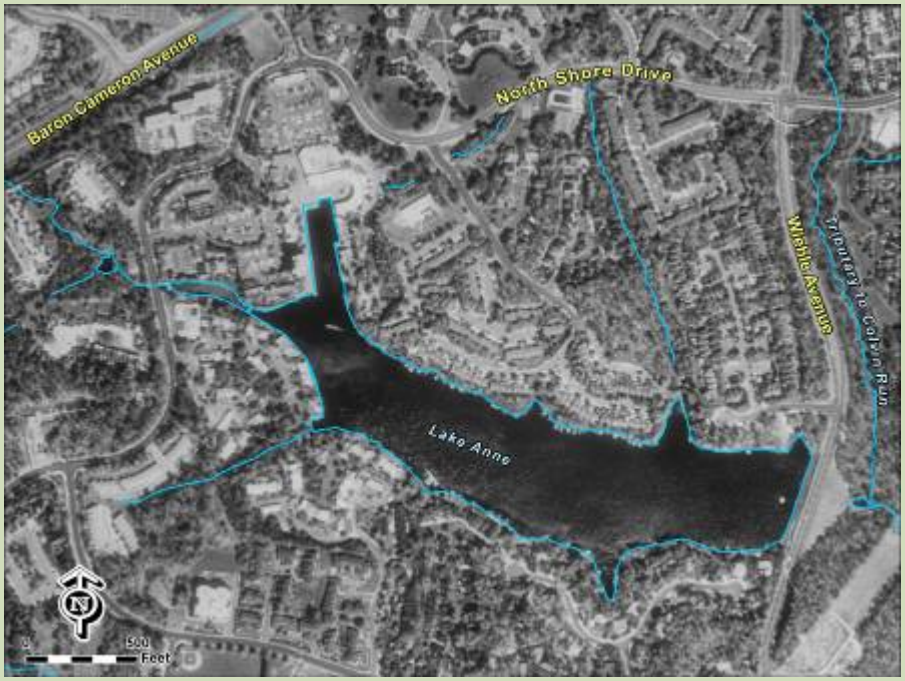
The Urban Watershed Problem In Reston

1954 - Northeast Reston

1988 - Northeast Reston

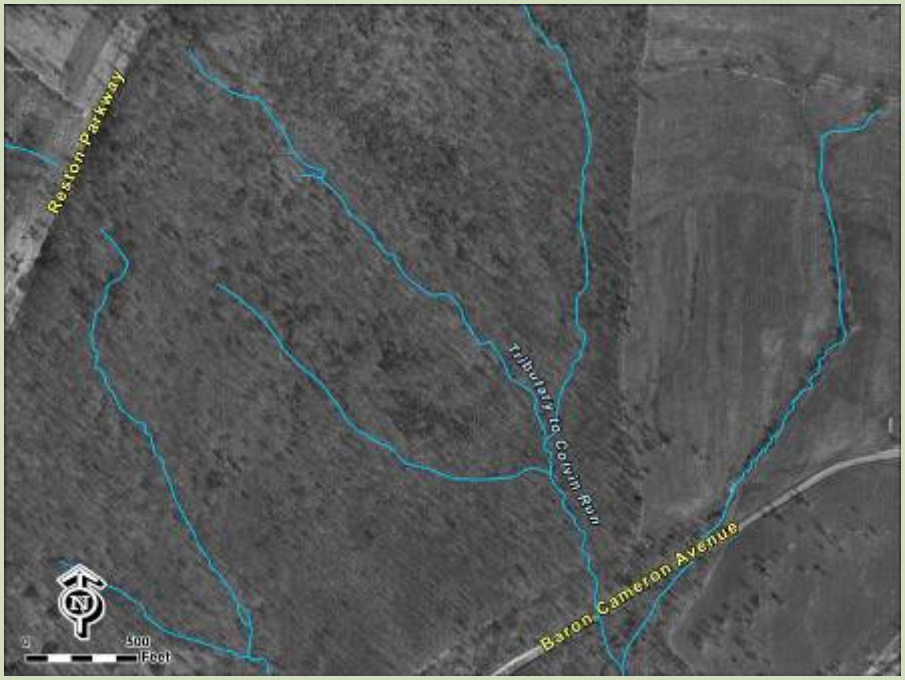
The Urban Watershed Problem In Reston

1954 – Lake Anne Area



1988 – Lake Anne Area

The Urban Watershed Problem In Reston

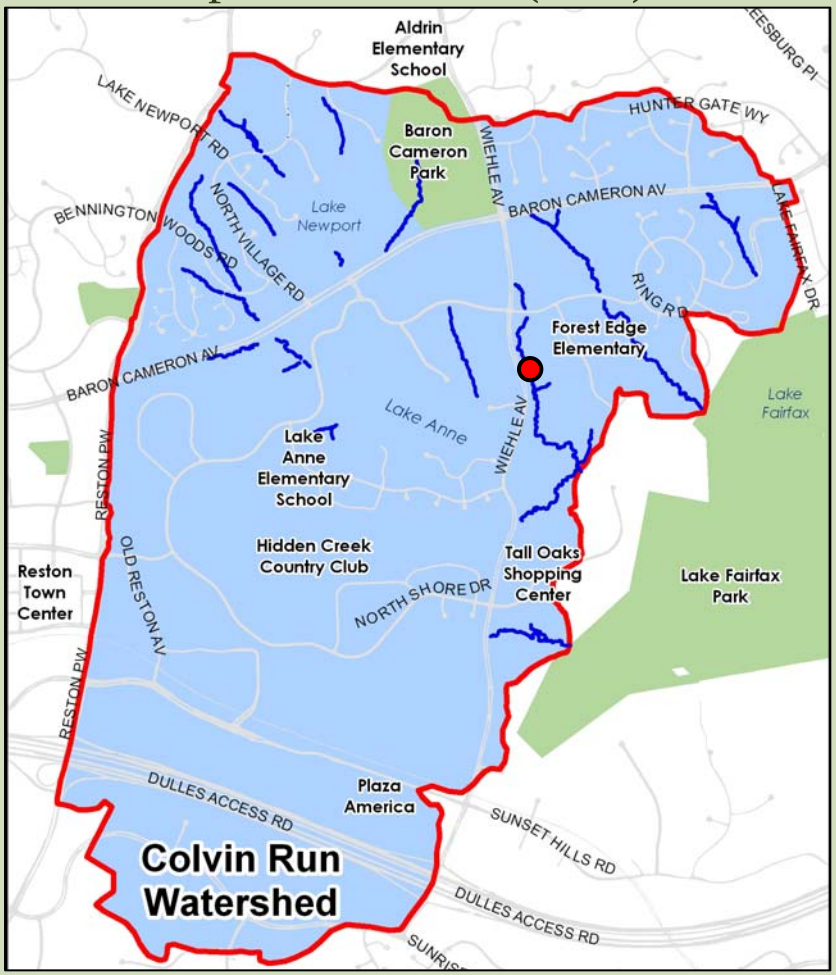


1954 – Lake Newport Area

2000 – Lake Newport Area

Problem: 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

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 during a large rain storm 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

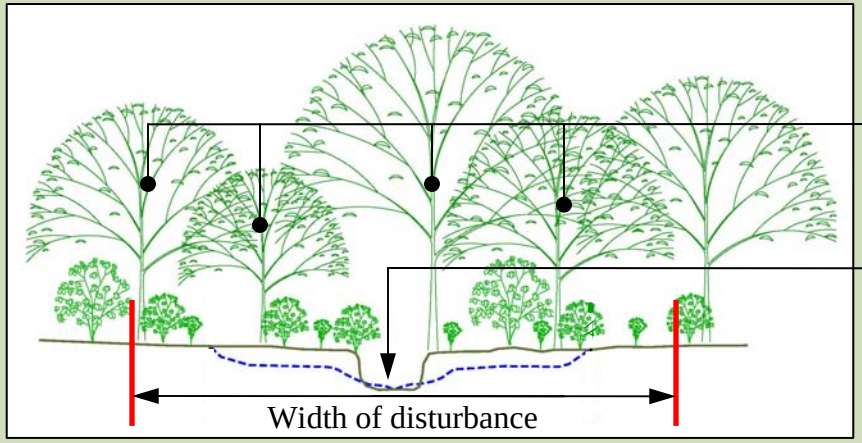
Water quality swale at WSSI

Rain Garden at WSSI

Correcting the Problem

Option 3: Restore streams to handle these flowrates

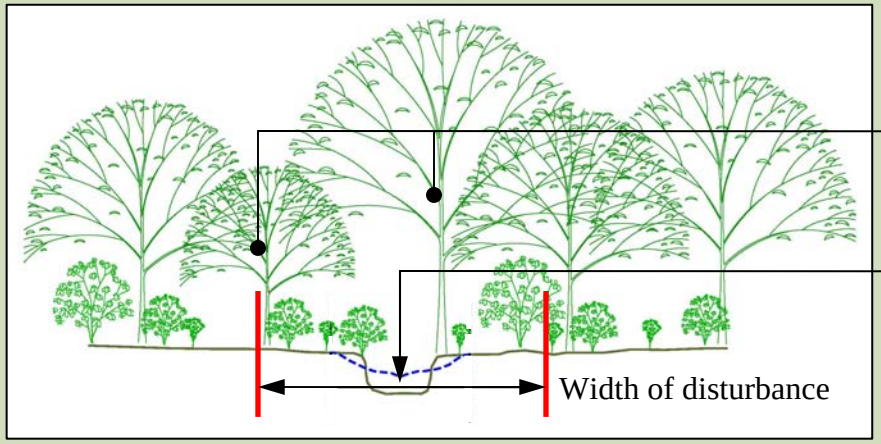
Lowering the floodplain results in a larger project area



Many trees removed

Large cut volumes result in waste material

Raising the bed is much less disruptive.



Fewer trees removed

Balanced cut and fill volumes result in less waste

Correcting the Problem
Conventional Stormwater Scenario
(Example in the Glade)

Assumptions:

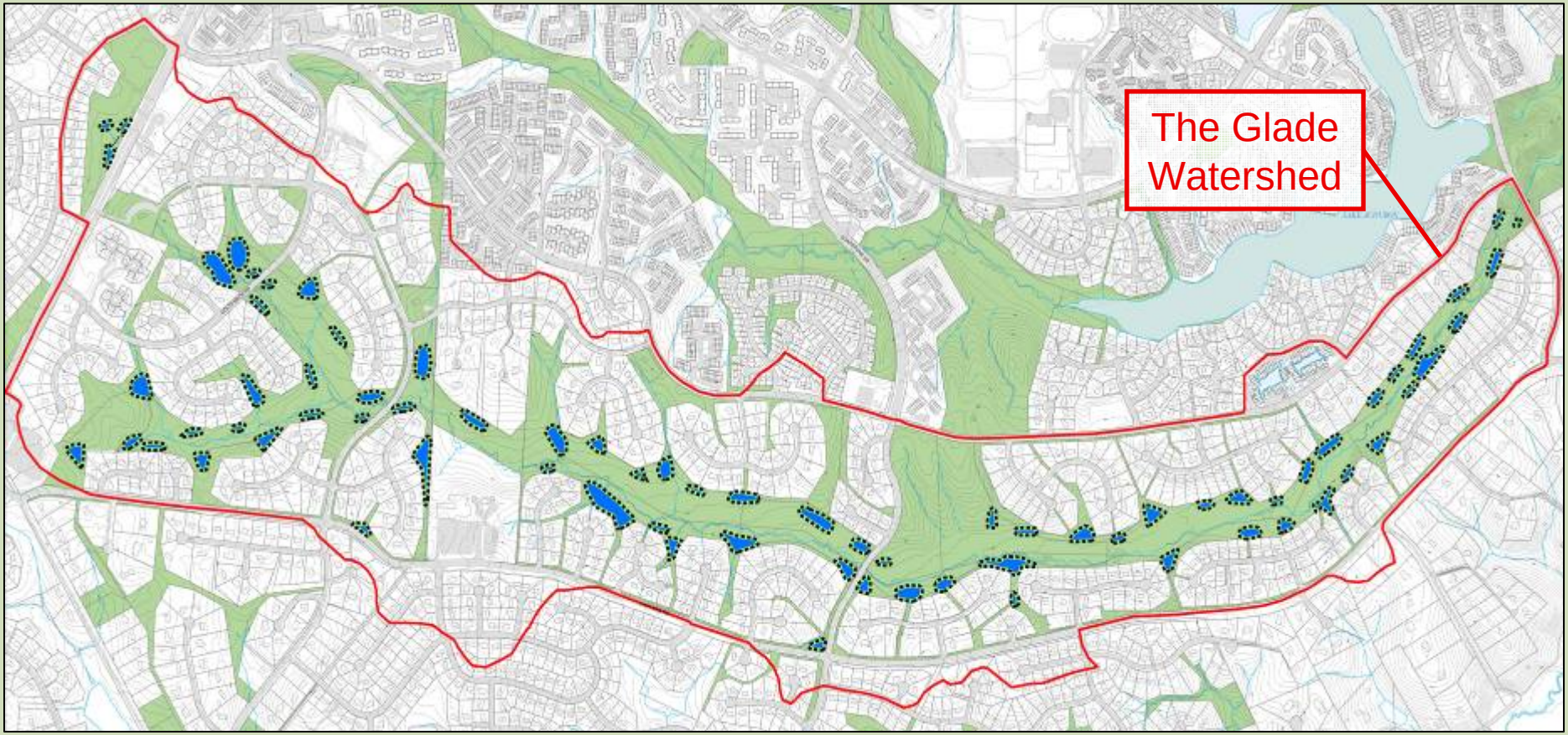
- Storage volume based on 3,000 cubic ft per developed acre (1 yr, 24-hr release / 2 & 10 yr control)
- Average depth of 3 feet
- 20 foot grading/dam outside storage area

Dry Ponds in Fairfax County

Correcting the Problem
Conventional Stormwater Scenario

Results
(The Glade)

- 75 ponds
- 29.3 acres disturbance from grading



Correcting the Problem
Bio-Retention Scenario
(Example in the Glade)

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

Correcting the Problem
Bio-Retention Scenario

Results
(The Glade)

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

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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 - 1999

2007

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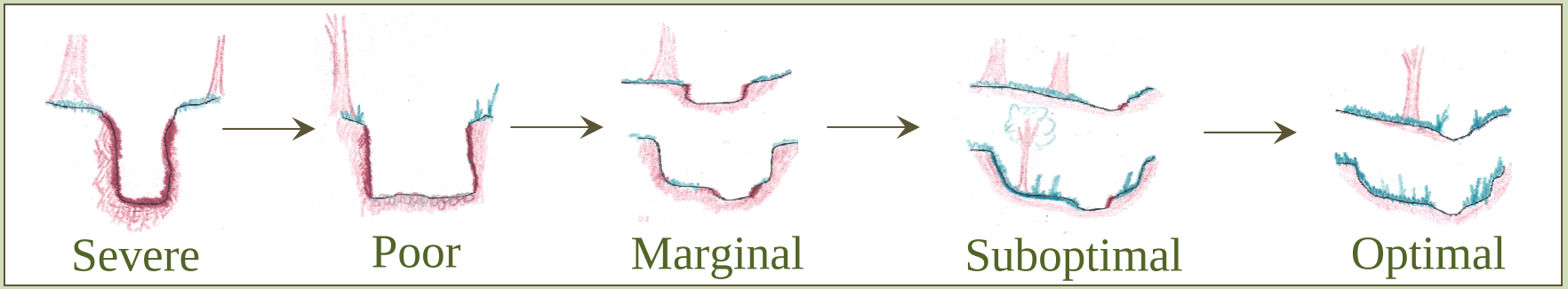
Design Methodology for Urban Streams
- Natural Channel Evolution -

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



South Lakes High School

Severe
Channel Condition

Optimal
Channel Condition

Ellanore Lawrence Park

URBAN STREAM - DESIGN REALITIES

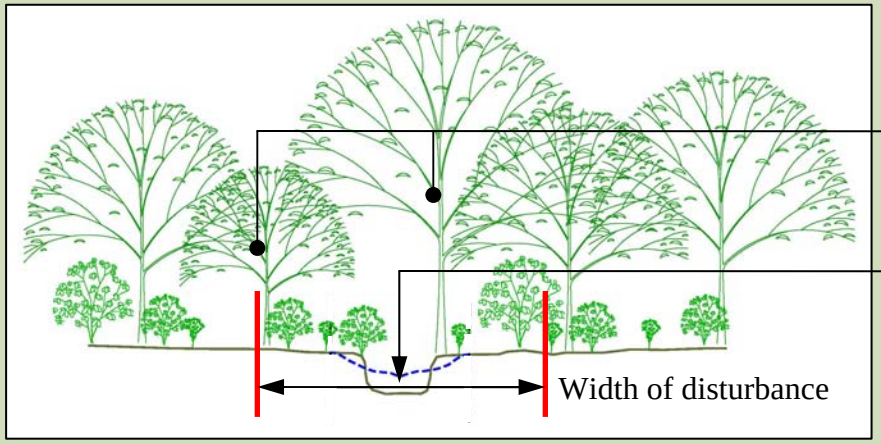
1. Significantly more flow than rural streams.
2. Significantly more "*bankfull*" events than in rural watersheds.
3. Given site constraints, reinforcement is necessary.
    - Rock structures – using native diabase rock
    - Reinforced bed
    - Heavy planting densities – native vegetation only

Snakeden Branch – Reach 3 (after 16 months)

McLean Place (after 4.5 yrs)

Restoration Approaches

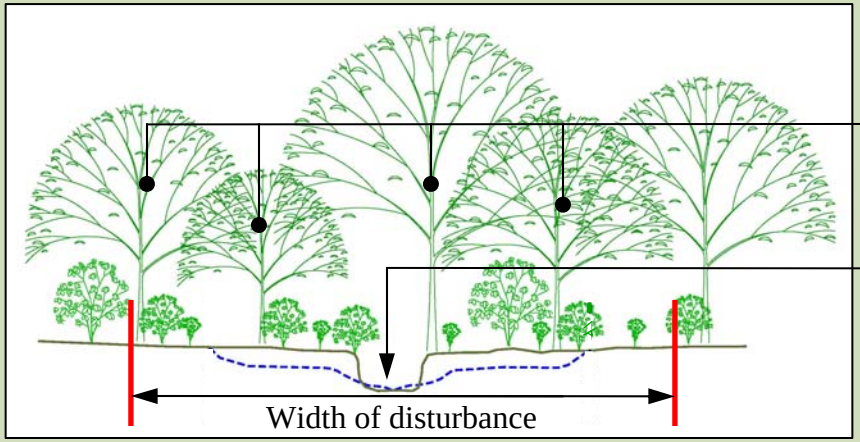
Priority 1 Restoration - Raise stream to reconnect with the floodplain.

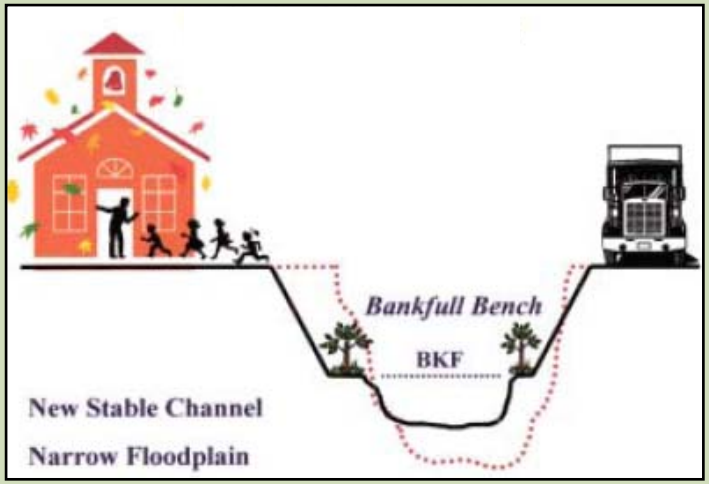


Snakeden Branch Reach 2 – Priority 1 Restoration

Restoration Approaches

Priority 2 Restoration – Excavate floodplain at lower elevation.





Priority 3 Restoration – Confined stream valleys.

Restoration Approaches

Priority 4 Restoration – Stabilize in-place

Snakeden Branch Reach 2 (2003, by others) –

Long-term stability not achieved using this approach.

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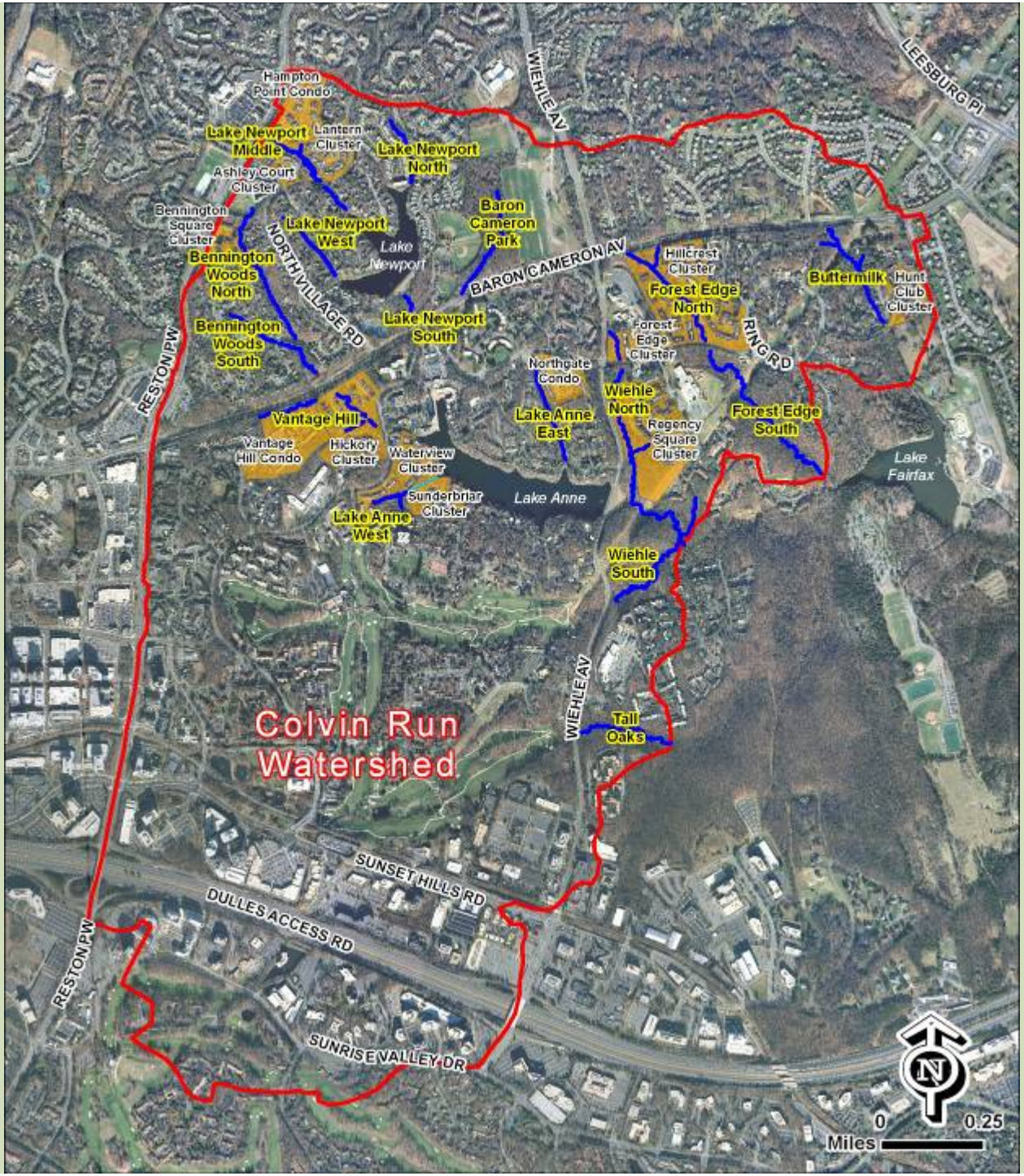
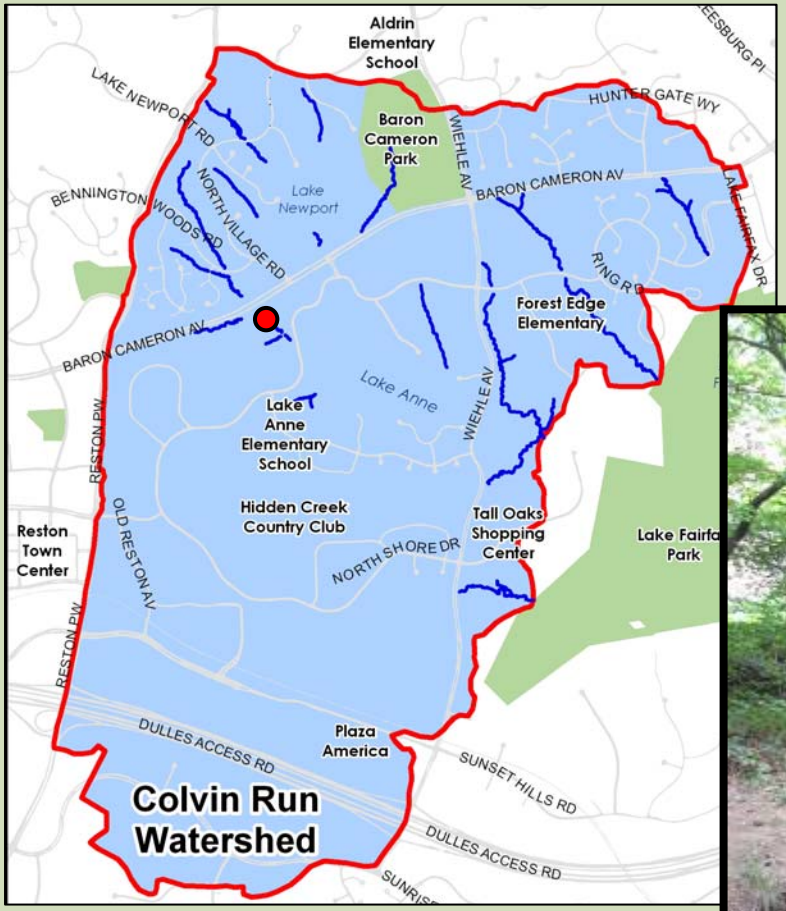

Colvin Run Watershed
Hampton Point Condo
Lake Newport Middle
Lantern Cluster
Lake Newport North
Ashley Court Cluster
Bennington Square Cluster
Lake Newport West
Lake Newport
Baron Cameron Park
Bennington Woods North
Bennington Woods South
Lake Newport South
Hillcrest Cluster
Forest Edge North
Buttermilk
Hunt Club Cluster
Forest Edge Cluster
Northgate Condo
Wiehle North
Lake Anne East
Forest Edge South
Regency Square Cluster
Vantage Hill
Vantage Hill Condo
Hickory Cluster
Waterview Cluster
Lake Anne
Lake Fairfax
Sunderbriar Cluster
Lake Anne West
Wiehle South
Tall Oaks
WIEHLE AV
LEESBURG PI
NORTH VILLAGE RD
BARON CAMERON AV
RING RD
RESTON PW
SUNSET HILLS RD
DULLES ACCESS RD
SUNRISE VALLEY DR
N
0
0.25
Miles

Existing Conditions In Colvin Run

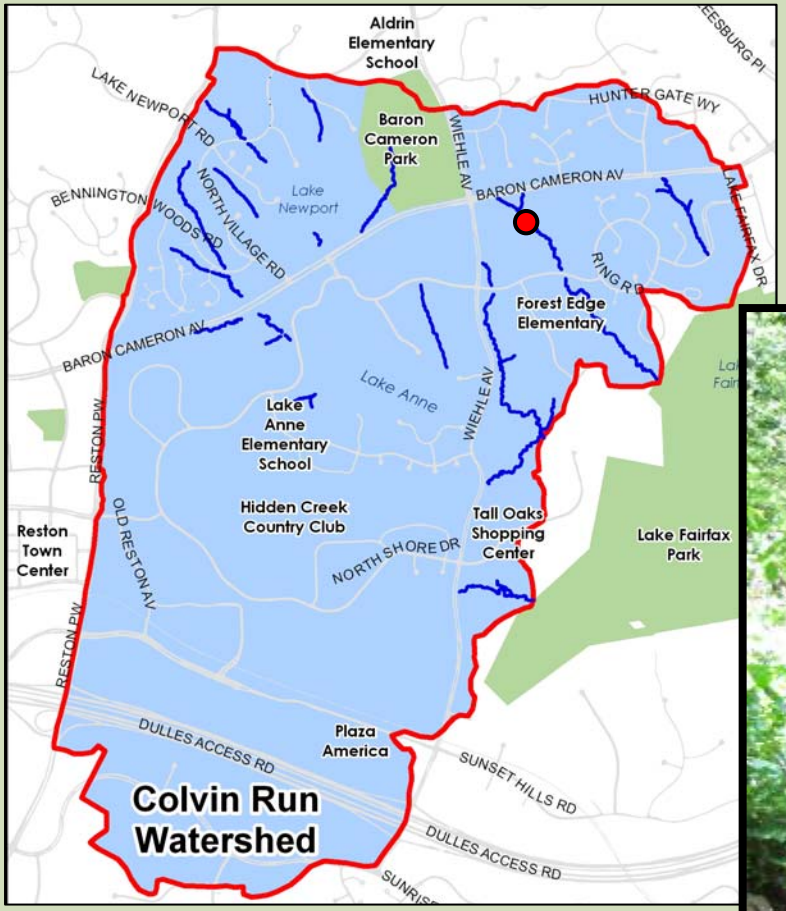
Bennington Woods South

Existing Conditions In Colvin Run



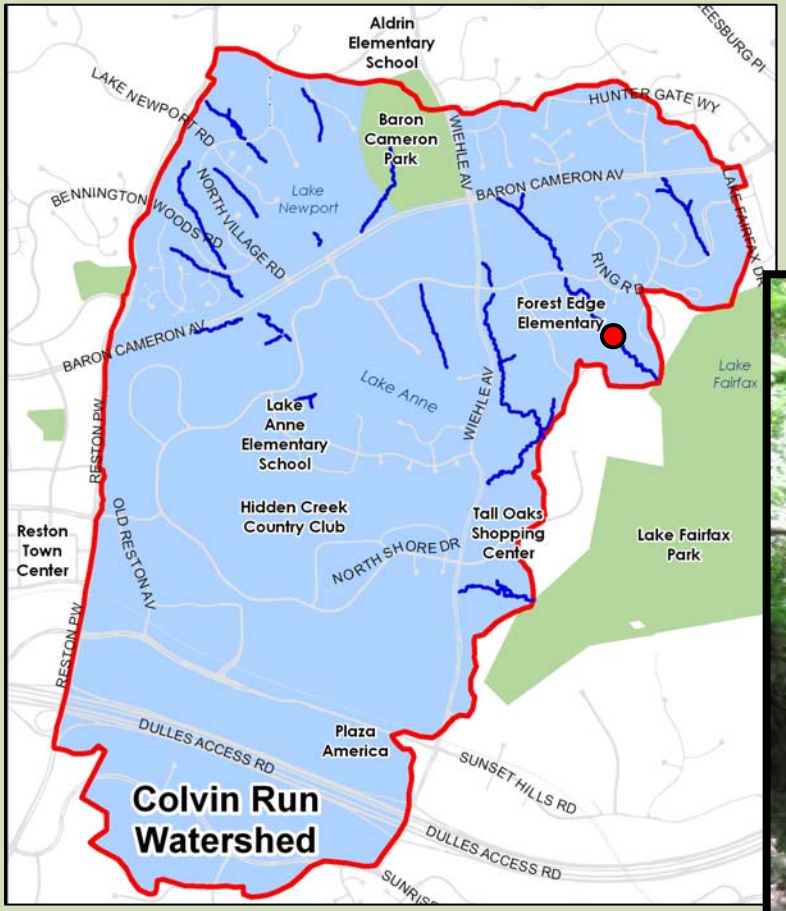
Vantage Hill

Existing Conditions In Colvin Run



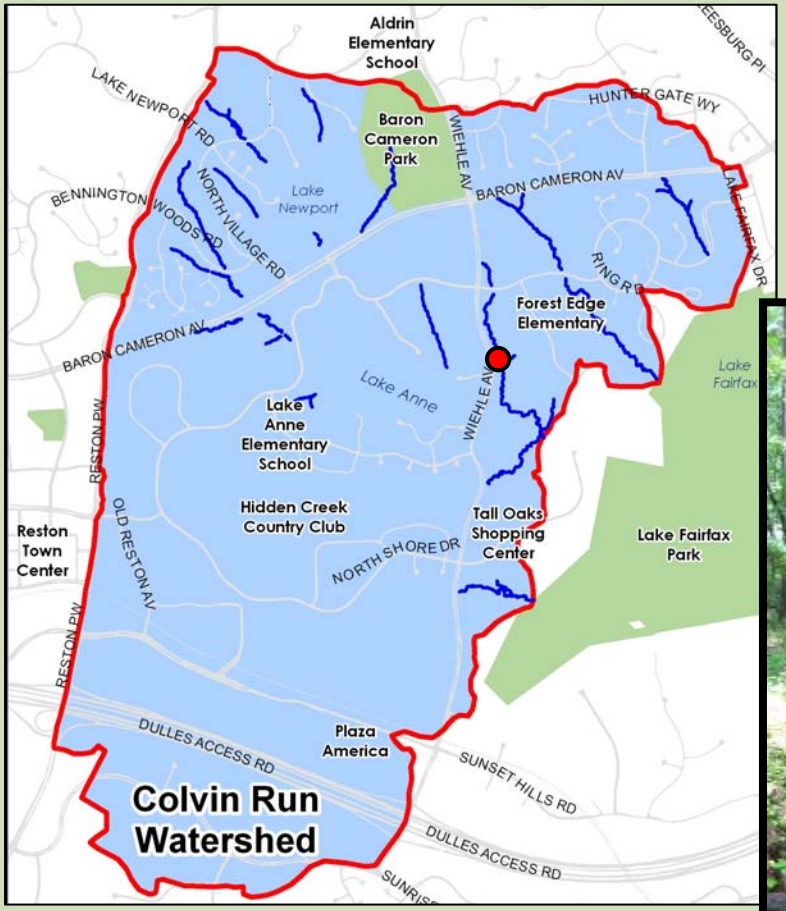
Forest Edge North

Existing Conditions In Colvin Run



Forest Edge South

Existing Conditions In Colvin Run



Wiehle North

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Colvin Run Restoration Priorities

Priority **Reach Name and Adjacent Clusters**

1
- Forest Edge (North, South)
  - Hillcrest Cluster
  - Forest Edge Cluster

2
- Vantage Hill
  - Hickory Cluster
  - Vantage Hill Condo
- Bennington Woods (North, South)
  - Bennington Square Cluster

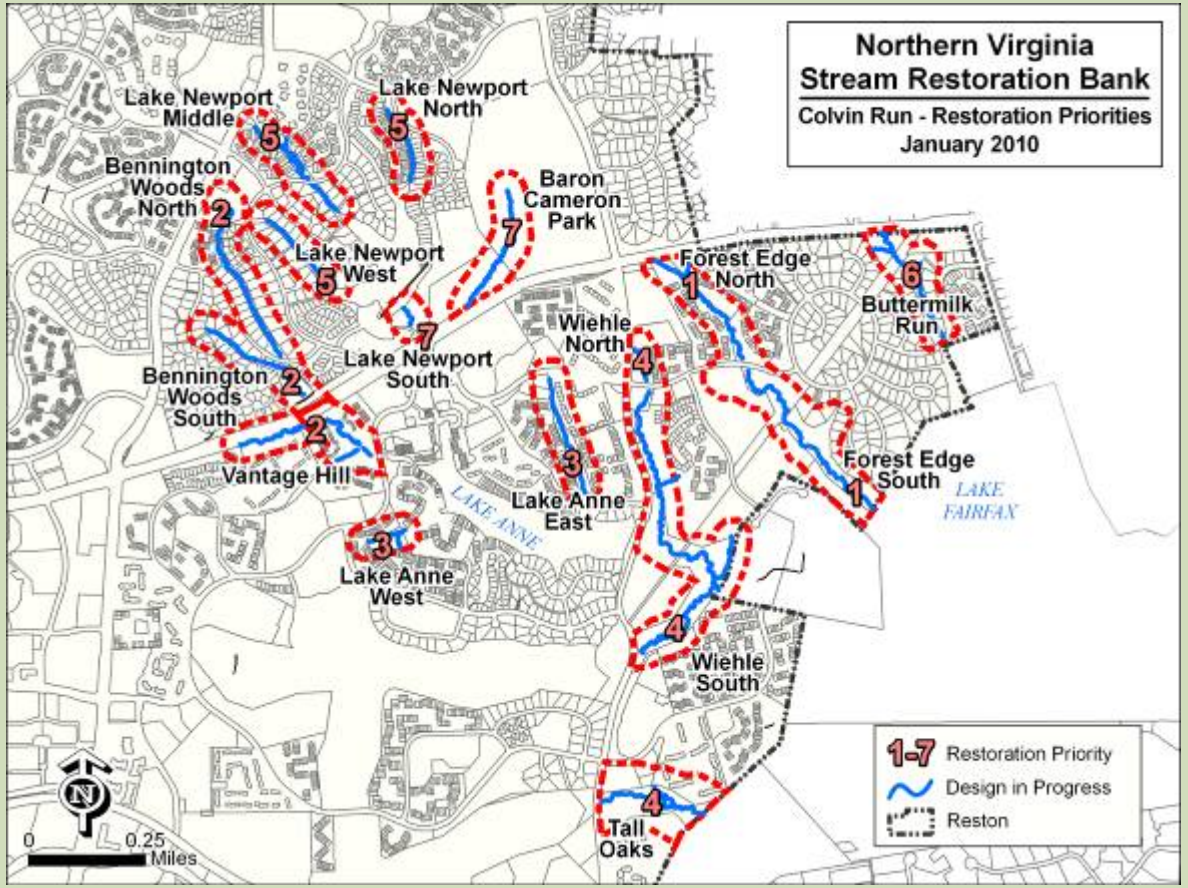
3
- Lake Anne (East, West)
  - Waterview Cluster
  - Sunderbriar Cluster
  - Northgate Condo

4
- Wiehle (North, South)
  - Forest Edge Cluster
  - Regency Square Cluster
- Tall Oaks

5
- Lake Newport (North, Middle, West)
  - Hampton Point Condo
  - Ashley Court Cluster
  - Lantern Cluster

6
- Buttermilk
  - Hunt Club Cluster

7
- Baron Cameron
- Lake Newport (South)



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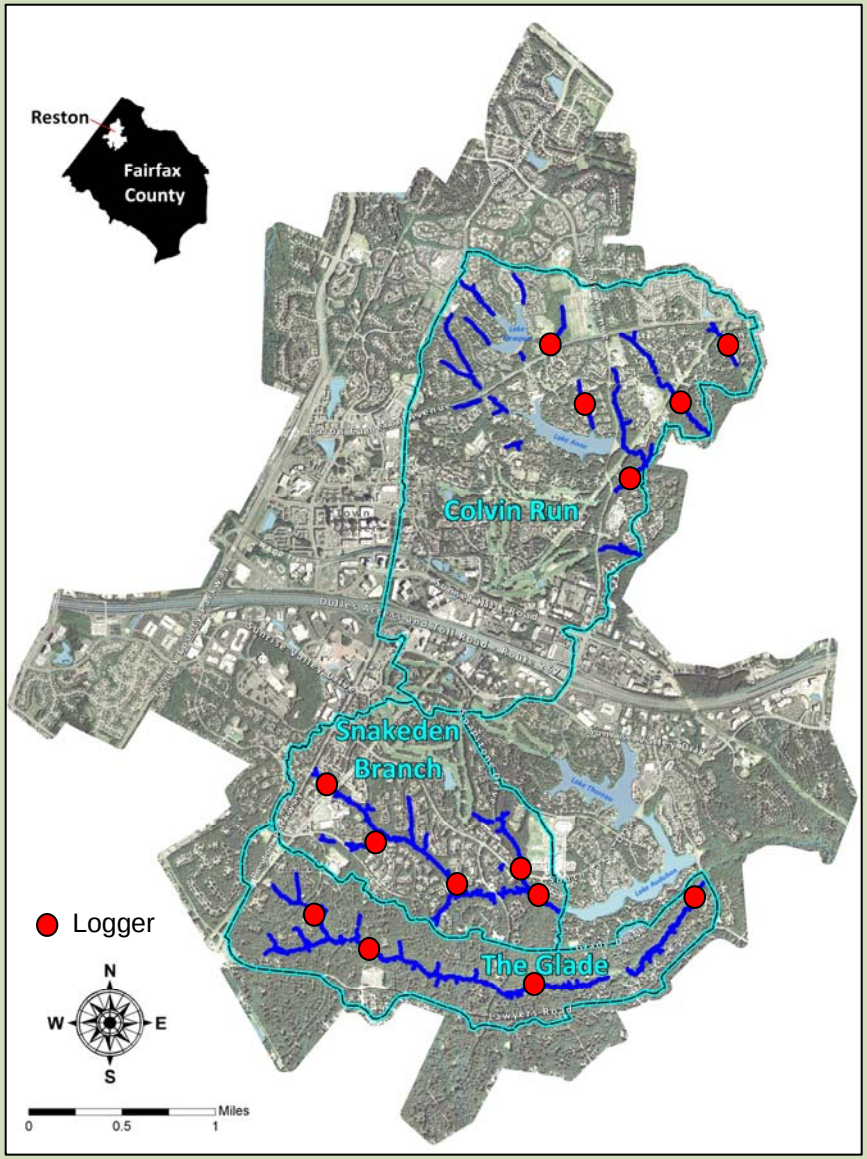
Data Collection

- Obtained aerial photography and topography of Phase I watersheds.
- Investigated stream valleys for potential archeological sites.
- Survey located & tagged nearly 35,000 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.

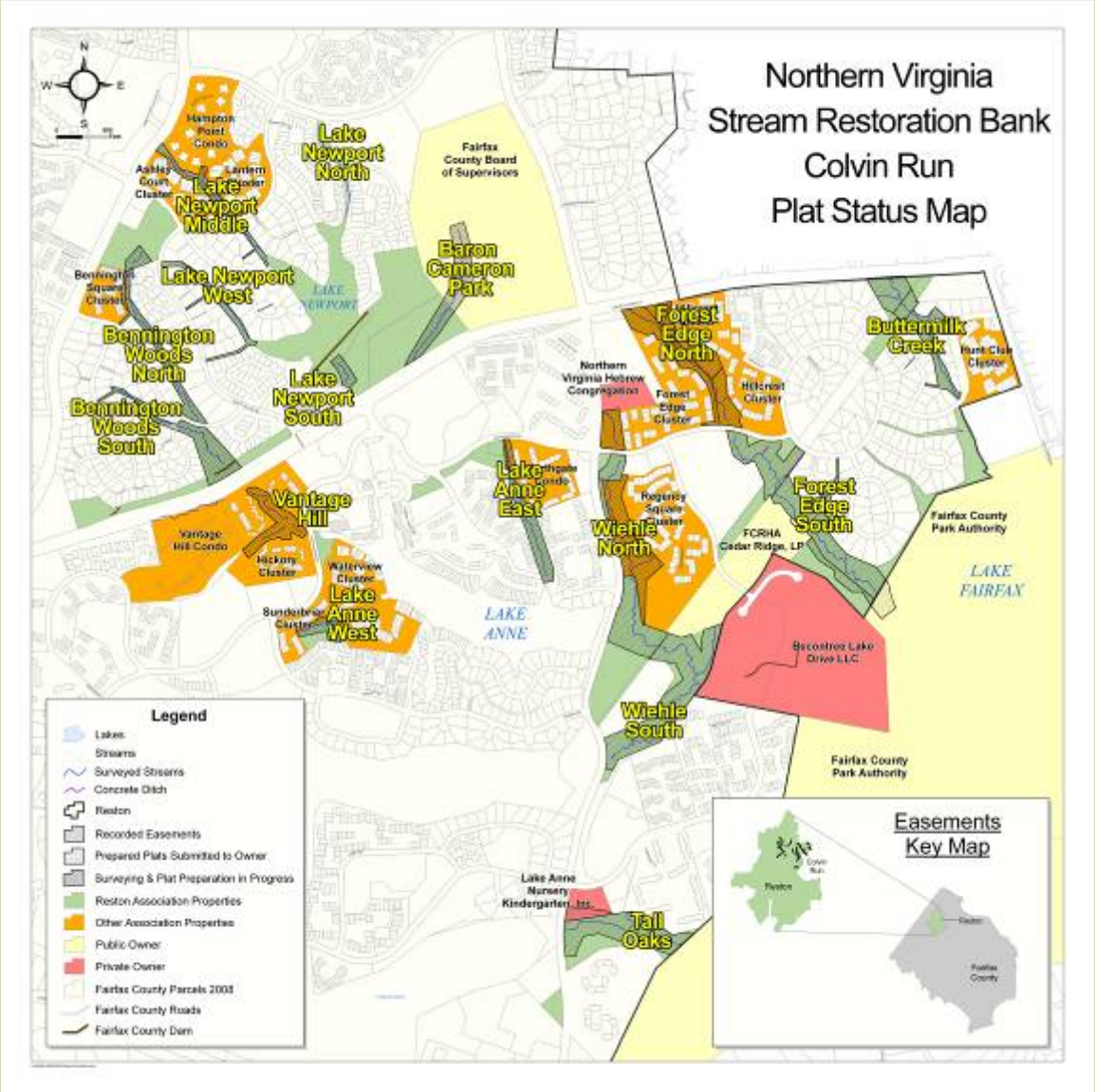


Data Collection - Easements

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.



Stream Restoration Design & Minimizing Tree Impacts

EXISTING CONDITIONS

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

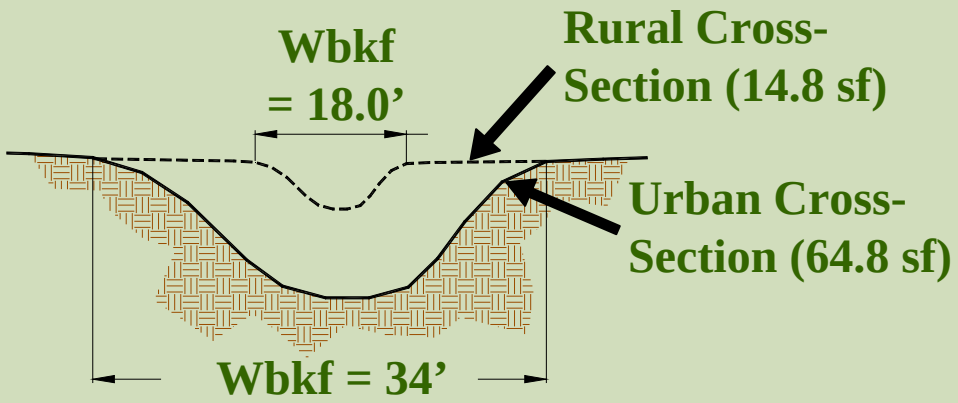
THE DESIGN PROCESS

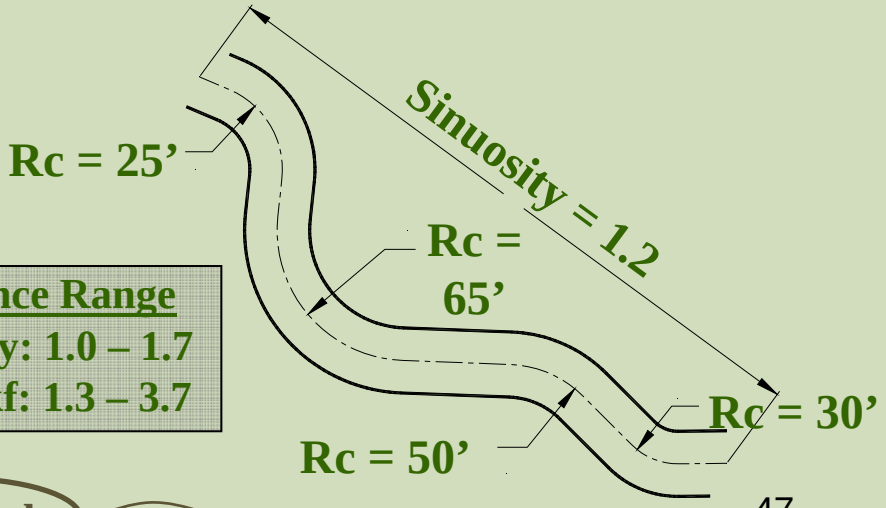
Determine Bankfull Width and Bankfull Area to convey current flows.

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

(Continued)

Snakeden at Soapstone Drive





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

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Stream Restoration Design & Minimizing Tree Impacts

THE DESIGN PROCESS, CONTINUED

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

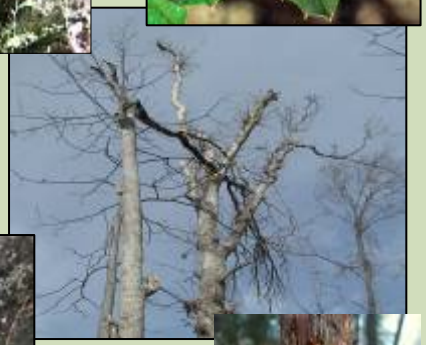
Revise restoration design to further minimize tree impacts (typically several iterations).

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*).

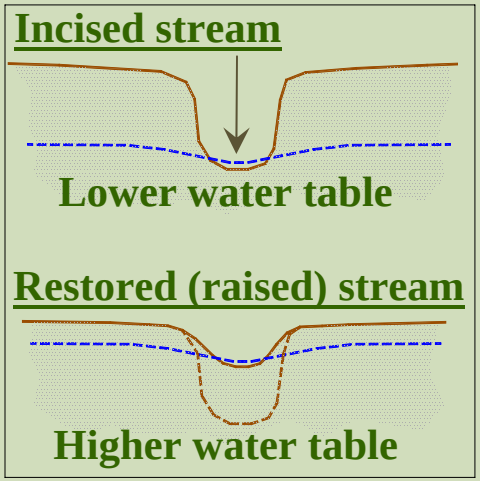
Existing Condition

- 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, firewood
- **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.

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Construction – The Glade Reach 4A

Pre-Construction (August 2009)

Construction (October 2009)

Construction – The Glade Reach 4A

Pre-Construction
(September 2009)

Construction
(October 2009)

Construction – The Glade Reach 4A

Pre-Construction
(August 2009)

Construction
(October 2009)

Snakeden Reach 1

Snakeden Reach 2

Snakeden Reach 2

Snakeden Reach 3

Snakeden Reach 3

15 Months After Construction

The Glade Reach 1

Wetland Studies and Solutions, Inc.©

The Glade Bridges

Planting – Trees & Shrubs

Split into 2 planting zones:

- Riparian
  - 1 gallon containers (planted at 640 plants/acre)
  - Both trees & shrubs
- Streamside
  - live stakes/tubelings (planted 1ft o.c.)
  - shrubs (planted 3 ft o.c.)

EXAMPLE TOTAL PLANTINGS:

Glade, Reach 1 (1939 lf) - 2,371 Trees, 3,296 Shrubs
Glade, Reach 2 (1901 lf) - 2,215 Trees, 3,013 Shrubs
Glade, Reach 3 (3576 lf) - 4,168 Trees, 6,077 Shrubs

- ***Tree Species:*** Pin Oak, Willow Oak, White Oak, Swamp White Oak, Northern Red Oak, Sweet Gum, Black Gum, River Birch, Sycamore, Red Maple, Box Elder, and Black Willow.

- ***Shrub Species:*** Silky Dogwood, Southern Arrowwood, American Holly, Service-Berry, Black-Haw, Eastern Redbud, Elderberry, Flowering Dogwood, and Brookside Alder, Hazelnut, Northern Spicebush, Black-Haw, Winterberry.

Eastern Redbud

Planting - Riparian Seed Mix

- Applied at a rate of 125 lbs/acre
- Custom mix
- Consists of native species found in a healthy, diverse NOVA ecosystem:

- **Tree Species**
  - Musclewood
  - Black Gum
  - American Sycamore
  - Red Maple
  - Eastern Redbud
  - Flowering Dogwood

- **Forbs**
  - Oxeye Sunflower
  - Joe-Pye Weed
  - Grass Leaved Goldenrod
  - PLUS 24 additional species!

- **Shrub Species**
  - Witch Hazel
  - Winterberry
  - Southern Arrow Wood
  - Northern Spicebush
  - Canadian Serviceberry
  - Black Chokeberry
  - Black-Haw

- **Grass Species**
  - Squarrose Sedge
  - Riverbank Wild Rye
  - Foxtail Millet
  - PLUS 8 additional species!

Greater Wildlife Species Richness

- Mature forest continues to provide habitat for raptors, woodpeckers, 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

AGENDA

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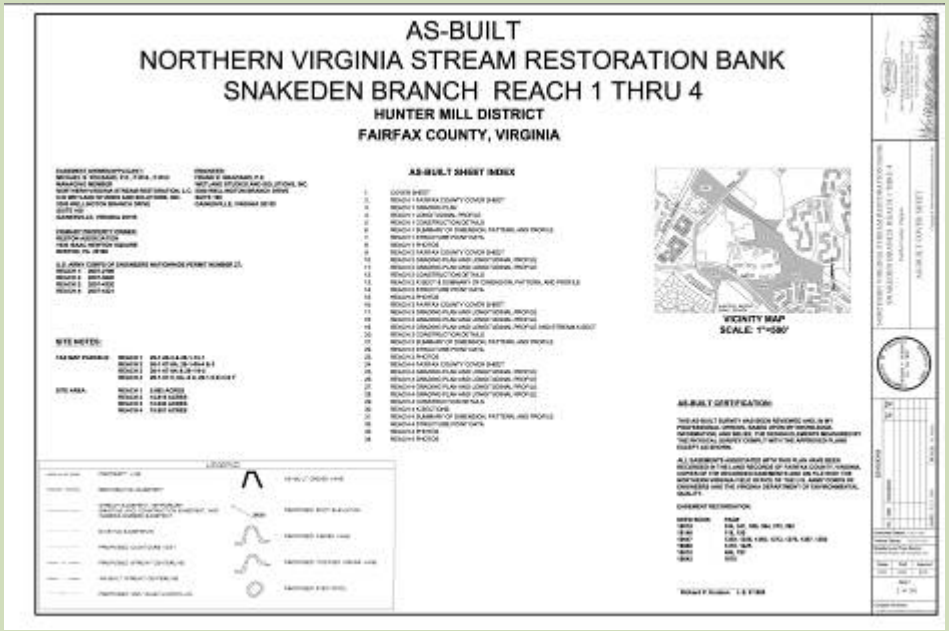
Technical Review

- **US Army Corps of Engineers**
- **Virginia Department of Environmental Quality**
- **Virginia Department of Conservation and Recreation (for E&S)**
- **Fairfax County Department of Public Works and Environmental Services**
- **Camp Dresser McKee (Monthly Inspections for Lender)**
  - Internationally recognized environmental engineering firm with approximately 4,000 employees and over 100 offices worldwide

Monitoring and Maintenance


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

10-Year Monitoring Program

- Streambed surveys
- Structure surveys
- Vegetation surveys
- Biological Surveys
- *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.

TROPICAL STORM HANNA (9/06/08)

100-YR EVENT (6.22" IN 9 HOURS)

Tropical Storm Hanna

2 - DAYS LATER

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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.

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