Wetland
Studies and Solutions, Inc.

NORTHERN VIRGINIA STREAM RESTORATION BANK
SNAKEDEN BRANCH WATERSHED

MITIGATION MONITORING REPORT

FIRST MONITORING SEASON (2009)

FAIRFAX COUNTY, VIRGINIA

Prepared For:

Northern Virginia Stream Restoration, L.C.
c/o Wetland Studies and Solutions, Inc.
5300 Wellington Branch, Suite 100
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WSSI Project No. 20003
Task I2

November 17, 2009

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Northern Virginia Stream Restoration Bank
Snakeden Branch Watershed
Mitigation Monitoring Report
First Monitoring Season
WSSI #20003, Task I2
November 17, 2009

Introduction

The Snakeden Branch Watershed restoration study area includes 20,263.80 linear feet of stream along Snakeden Branch and several unnamed tributaries of Snakeden Branch, as well as the adjacent riparian corridor. The study area is located southeast of Reston Parkway (Route 602) and immediately northwest of Lake Audubon in Fairfax County, Virginia (Exhibit 1: 38°55'59"N, 77°21'00"W). Restoration of Snakeden Branch and tributaries to Snakeden Branch occurred between February 2008 and March 2009 and between June 2009 and October 2009[1], in accordance with the Northern Virginia Stream Restoration Bank Mitigation Banking Instrument (MBI), dated February 17, 2006 (modified April 2007 and June 2009), the concept plan dated May 15, 2006[2], and the subsequent Nationwide Permit 27 verifications[3]. Periodic monitoring to evaluate the success of the stream restoration is required by the MBI. This monitoring report documents that all success criteria have been met at the Snakeden Branch Watershed restoration area during the first growing season, as set forth in the MBI and associated mitigation plans.

The Snakeden Branch Watershed portion of the Northern Virginia Stream Restoration Bank includes a total of 20,263.80 linear feet of stream restoration, resulting in a total of 158,704.60 Stream Condition Units per the As-Built Surveys for Reaches 1-4, 5-11, 12 and 14-17, and 13, dated December 3, 2008, December 3, 2008, March 26, 2009, and October 6, 2009, respectively.

Monitoring Success Criteria

According to the MBI (§V.E.2), the monitoring success criteria shall follow the guidelines below:

(a) Reforested Riparian Buffer Areas

(i) Plant density of at least 400 living woody stems (including volunteers) per acre of trees and shrubs must be achieved by the end of the first growing season following planting and maintained through the end of the monitoring period or until canopy coverage is greater than 30%.

(ii) Herbaceous plant coverage of at least 60% must be achieved by the end of the first growing season and at least 80% each monitoring year thereafter.

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1 *Reaches 1, 2, and 3 were completed and planted by March 30, 2008. Reaches 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, and 17 were completed and planted prior to March 30, 2009. Reach 13 (±814 lf) had been delayed due to an easement issue and was completed and planted between June 2009 and the first week of October 2009. Thus, this first monitoring report includes three reaches which have completed two growing seasons, one reach which has not completed an entire growing season, and the remaining which have completed one growing season. The MBRT Chair, Ron Stouffer, in a discussion with Michael Rolband concurred that it was desirable to do one monitoring report for all of the Snakeden Branch Watershed in this manner to minimize the number of reports, since we were willing to delay the release of credits to Reaches 1, 2, and 3 to off-set the release of credits from Reach 13.*

2 *The Concept Plan was approved by the COE and DEQ on June 22 and 30, 2009, respectively.*

3 *COE #2007-2790, dated 10/3/07; COE #2007-3620, dated January 16, 2008; COE #2007-4320, dated 1/16/08; COE #2007-4321, dated 1/16/08; COE #2007-4711, dated 1/17/8; COE #2008-1473, dated 1/26/08; COE #2008-207, dated 1/17/08; COE #2008-2556, dated 1/24/08; and COE #2008-2557, dated 1/24/08.*

(iii) Woody plant coverage (from live-stakes, tublings, container grown material, and volunteers) along stream banks shall achieve a density of at least 5 l.f./stem (i.e., 1 stem per 5 l.f.) by the end of the first growing season and for each monitoring year thereafter.

(b) Stream and Riparian System

(i) Dimension – The analysis of each permanent cross-section specified on the Stream Restoration Site Plan shall indicate that:
1) *The Width/Depth Ratio (defined as the width at bankfull divided by the mean riffle depth at bankfull) did not increase or decrease by an amount greater than 1.2 of the as-built cross section.*
2) *The bankfull Cross-Sectional Area did not increase or decrease by an amount greater than 20% of the as-built cross-section.*
3) *The Bank Height Ratio (defined as the low bank height divided by the maximum riffle depth) did not increase or decrease by an amount greater than 0.2 of the as-built cross section.*

(ii) Pattern – The analysis of the plan-view survey of field measurements shall indicate that:
1) *The Sinuosity of the stream (defined as the stream length along the thalweg divided by the valley length) did not increase or decrease by an amount greater than 0.2 of the as-built pattern.*
2) *The Radius of Curvature/Width ratio did not increase or decrease by an amount greater than 0.2 of the as-built condition.*

(iii) Profile – The analysis of the longitudinal profile shall indicate that the slope of the longitudinal profile did not increase or decrease by an amount greater than 0.3% of the as-built slope.

(iv) Structures – The analysis of each instream structure shall indicate that:
1) *The angle of any rock vane, j-hook, or cross vane did not increase or decrease by an amount greater than 3 degrees from the as-built angle, and remains between 20 and 30 degrees from the streambank.*
2) *The slope of any rock vane, j-hook, or cross vane did not increase or decrease by an amount greater than 2% from the as-built slope (i.e. if the design slope was 5%, than any slope from 3% to 7% would be acceptable) and remains between 2% to 7%.*

Methods

Monitoring field work was conducted between September 15, 2009 and October 19, 2009 by Jennifer D. Feese, PWS, PWD, CT, Sean D. Sipple, PWS, PWD, CT, CE, Benjamin N. Rosner, PWS, PWD, CT, CE, Lynn Straughan, PWS, PWD, CE, Beth Clements, CT, Ally St. Onge, CT Chelsea Trant, CT, Caitlin Kelliher and Caitlin Grotke, to collect vegetation data, take photographs, and conduct pebble counts/bar samples at riffle cross-sections. Field surveys to document the required dimension, pattern, profile and structure criteria were conducted between August 4, 2009 and October 14, 2009 by Brian Gottfried, SIT, Jeffrey Monaco, Eric Calladine, SIT, Jody Greene, Matthew Hazzard, SIT, Paul Szarowicz, and Brian Hollinger. The following general supporting documentation is included at the end of this report: Mitigation Monitoring Map (Exhibit 2); and representative site photographs (Exhibit 3). Additional supporting data is available in separate Appendices[4] including: site photographs (Appendix A); percent cover data (Appendix B); woody plant data (Appendix C); stream bank woody plant data (Appendix D); pebble count and bar sample data (Exhibit E); wildlife observations (Appendix F); letters supporting and commenting on the

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[4] *This information is included in separate Appendices due to report size limitations as set forth in COE Regulatory Guidance Letter 06-03.*

stream restoration (Appendix G); storm event monitoring reports (Appendix H) and survey data for dimension, pattern, profile and structure criteria, and bank pin and scour chain data (Appendix I).

Monitoring Results and Discussion

In accordance with the guidelines of §VI.B of the MBI, the 2009 monitoring program and results are as follows:

1. *With respect to the riparian buffer areas:*

    a. *Visual description – ground level photographs shall be taken at each monitoring station, an aerial photograph shall be taken the 3rd or 5th year following final grading.*

    Photographs were taken in four standard directions (upstream, downstream, left bank, right bank at irregularly shaped plots and north, south, east, west at 30 foot radius plots[5]) at each of the permanent monitoring stations during the 2009 monitoring field work. The representative photographs (Exhibit 3) demonstrate that herbaceous and woody vegetation is becoming established throughout the Snakeden Branch Watershed restoration reforestation areas. An aerial photograph of the restoration areas will be provided in year 3 or year 5. All photographs from the riparian monitoring plots are provided within Appendix A.

    b. *Vegetation – based on the reforestation site size, there shall be 2 sample plots/per acre, with a 30-foot radius for woody stems and 3 foot diameter for herbaceous plants. Vegetation data shall include: dominant species identification, coverage assessment, number of woody plant stems (total and #/acre), and indicator status.*

    The reforested area within the Snakeden Branch Watershed restoration is >5 acres, but <20 acres, thus a minimum of 2 vegetation monitoring plots/acre were established using a 3-foot diameter plot for herbaceous vegetation and a 30-foot radius plot (or irregularly shaped plots with the equivalent area) for woody stem density.[6]

    The average density of living woody stems (as measured by the number of stems per acre) is 4,056, with a median of 2,246. On individual plots, the number of stems per acre ranged from 462 to 21,385 (due in part to a high rate of volunteers). These results meet and exceed the success criteria [MBI §V.E.2(a)(i)] of 400 living woody stems per acre in reforested areas. Species are provided within Appendix C.

    The average percent cover by herbaceous vegetation was 93. This meets and exceeds the success criteria [MBI §V.E.2(a)(ii)] of 60 percent cover by the end of the first growing season. Dominant species and indicator status are provided within Appendix B.

2. *With respect to the stream and riparian system:*

    a. *Woody plant coverage shall be quantified by species and density (1 stem per 5 l.f. along the stream edge).*

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5 *Note that photographs were taken in two standard directions (upstream and downstream) at plots that only included stream-side vegetation monitoring.*

6 *Note that irregularly shaped supplemental plots with the equivalent area of a 15-foot radius plot were used in areas where the forested riparian zone was too narrow to establish a 30-foot radius plot. Furthermore, in areas with an extremely narrow reforested riparian zone, only stream-side plots were establish.*

The average density of woody stems along the streambanks was 3 stems per 5 linear feet of stream bank. On individual plots, the number of stems per 5 l.f. ranged from 1 to 5. These results meet and exceed the success criteria [MBI §V.E.2(a)(iii)] of 1 stem per 5 linear feet. Species are provided within Appendix D.

b. *Exposure of bank pins shall be quantified to provide an assessment of bank erosion.*

This data is provided within Appendix I.

c. *Scour chains shall be assessed to provide data on movement of sediment.*

This data is provided within Appendix I.

d. *Pebble counts and bar samples will be collected and analyzed to document changes in streambed material size.*

This data is provided within Appendix E.

e. *Each stream stabilization structure shall be surveyed, photographed and a narrative statement provided as to whether or not specific Success Criteria have been violated.*

All success criteria were met for the Dimension, Pattern, Profile, and Structures parameters [MBI §V.E.2(b)], except for 3 surveyed cross-sections. As noted in the survey monitoring report (Appendix I), 3 of the 23 surveyed cross-sections exceeded the 20% change in cross-sectional area criteria. All 3 were related to aggradation as fine sediments in the reinforced bed mix sort and migrate to form bars and other in-stream features. Some movement was anticipated and desirable as the newly constructed channel adjusts to the flow regime.

This restoration design includes placement of a reinforced bed mix, necessitated by the lack of a significant sediment influx from the watershed and/or upstream channel network and the in-situ particle size distribution relative to the high shear stress from the urban watershed (an urban watershed without stormwater management). The bed mix contains a significant amount of fine material (gravel, sand, and finer mineral materials, as well as organic fines) that has two basic functions: 1) to fill the voids of the larger riprap fraction of the mix (to serve as a growing medium and to maintain flow on the surface) and, 2) to provide an initial source of mobile particles to help "naturalize" the stream bed through the formation of bars and other bed features. While we configure the stream channels to a stable size and overall shape, this "fine tuning" is best accomplished through this process.

As this process occurs over the first several storms, some areas of the stream form depositional features as the fine particles "wash out" of the riffles, as is the case with the areas noted in this data. We are not concerned that this naturalization of the stream bed represents instability that requires corrective action as the features that must not move for stability (i.e. inverts of cross-vanes and pool headers) are all shown to be stable in the survey data. Furthermore, based on visual inspection and statistical analysis (on average, there was virtually no change in cross-sectional area throughout Snakeden Branch), the channels are in stable, dynamic equilibrium. Subsequent monitoring reports will continue to verify this.

See Appendix I for numerical survey data and photographs supporting the success criteria, including a narrative statement.

f. One cross section per 1,000 l.f. shall be provided, with a representative mix of riffles and pools.

Twenty cross sections have been provided within the Snakeden Branch Watershed restoration. See Appendix I for cross section location and details.

g. A surveyed profile of the stream shall be provided immediately following completion, and in years 1, 3, 5, and 10.
Provided within Appendix I.

h. Location of any riparian areas with excessive erosion that needs replanting or protection shall be identified.

No riparian areas with excessive erosion or that needed replanting were identified during this monitoring report preparation.

i. An assessment of biological conditions (habitat) shall be provided pre-restoration and in years 1, 5, and 10.

The Year 1 post-restoration results indicate that the habitat of the streams has increased following restoration. Benthic macroinvertebrate density and Percent Ephemeroptera (a sensitive taxa) have also increased following restoration; however, overall benthic macroinvertebrate condition has not improved. Note that the Year 1 Biological Conditions Assessments for the Snakeden Branch Watershed restoration are described in WSSI's October 2, 2009 report titled "Northern Virginia Stream Restoration Bank – Snakeden Branch Biological Monitoring Report #3 – Year 1 Monitoring".

j. Within one week after any storm event that exceeds 3.2 inches in 24 hours or 2.0 inches in 2 hours, the subject stream reach shall be visually inspected for damages. Any damage noted shall be reported to the Corps in writing.

k.

Three two-year storm events (meeting the criteria of §VI.B.2(j)) occurred during 2008 and 2009, and subsequent site inspections were documented in reports to the U.S. Army Corps of Engineers dated May 20, 2008, September 11, 2008, and June 3, 2009 (Appendix H). Some other corrective measures were required and implemented as a result of the 3rd, two-year event, as documented in the June 3, 2009 report.

Wildlife Observations

During the 2009 biomonitoring fieldwork, northern two-lined salamanders (*Eurycea bislineata*) and red-eared sliders (*Trachemys scripta elegans*) were observed along Snakeden Branch. During the 2009 vegetation monitoring fieldwork green frogs (*Rana clamitans melanota*), a northern watersnake (*Nerodia sipedon*), white-tailed deer (*Odocoileus virginianus*), a red fox (*Vulpes vulpes*), a raccoon (*Procyon lotor*), and gray squirrels (*Sciurus carolinensis*) were observed along Snakeden Branch. One-hundred eleven dragonflies (including seven species) were observed along Snakeden Branch during the June 19, 2009 Dragonfly Count Tally conducted by the Reston Association. Twenty-six bird species were observed along Snakeden Branch during the August 09, 2009 bird walk conducted by Reston Association, The Bird Feeder, and Audubon Society of Northern Virginia. Appendix F contains a complete list of wildlife species observed in 2009.

Maintenance Activities/Corrective Measures

In addition to the storm repairs noted above, only minor maintenance activities and corrective measures were undertaken in 2009. These activities include overseeding bare areas, minor erosion repairs, and planting of additional willow (*Salix nigra*) plugs in select areas downstream of outer cross-vane arms in June 2009. Furthermore, in July 2009, a waste cooking oil spill and a continuous diesel fuel leak were discovered in design Reach 2 in separate incidents. The incidents are currently being remediated by Fairfax County.

Mitigation Credit Analysis

The MBI requires a summary of credits created by the bank and the permits that have been debited against these credits. A credit ledger for the entire NVSRB is provided annually to the chair of the Mitigation Bank Review Team.

Summary

This investigation indicates the successful restoration of streams at the Northern Virginia Stream Restoration Bank – Snakeden Branch Watershed in its first growing season. Monitoring of these reaches confirms the successful reforestation/revegetation of riparian buffers and the successful establishment of a stable stream system.

Limitations

This study is based on examination of the vegetation and hydrology at the referenced site. Field indicators can change with variations in hydrology and other factors. Therefore, our conclusions may vary significantly from future observation by others. This report assesses the presence of hydrophytic vegetation and wetland hydrology at the site at the time of our review and does not address conditions prior to our review or at a given time in the future.

Our review and report have been prepared in accordance with the MBI and with generally accepted guidelines for the conduct of monitoring reports for created and restored wetlands.

WETLAND STUDIES AND SOLUTIONS, INC.

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Executive Vice President

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[7] *U.S. Army Corps of Engineers Wetland Delineator Certification #WDCP94MD0310114B. Professional Wetland Scientist #000462, Society of Wetlands Scientists Certification Program, Inc. VA Certified Professional Wetland Delineator #3402-000031, LEED® Accredited Professional, 2009.*

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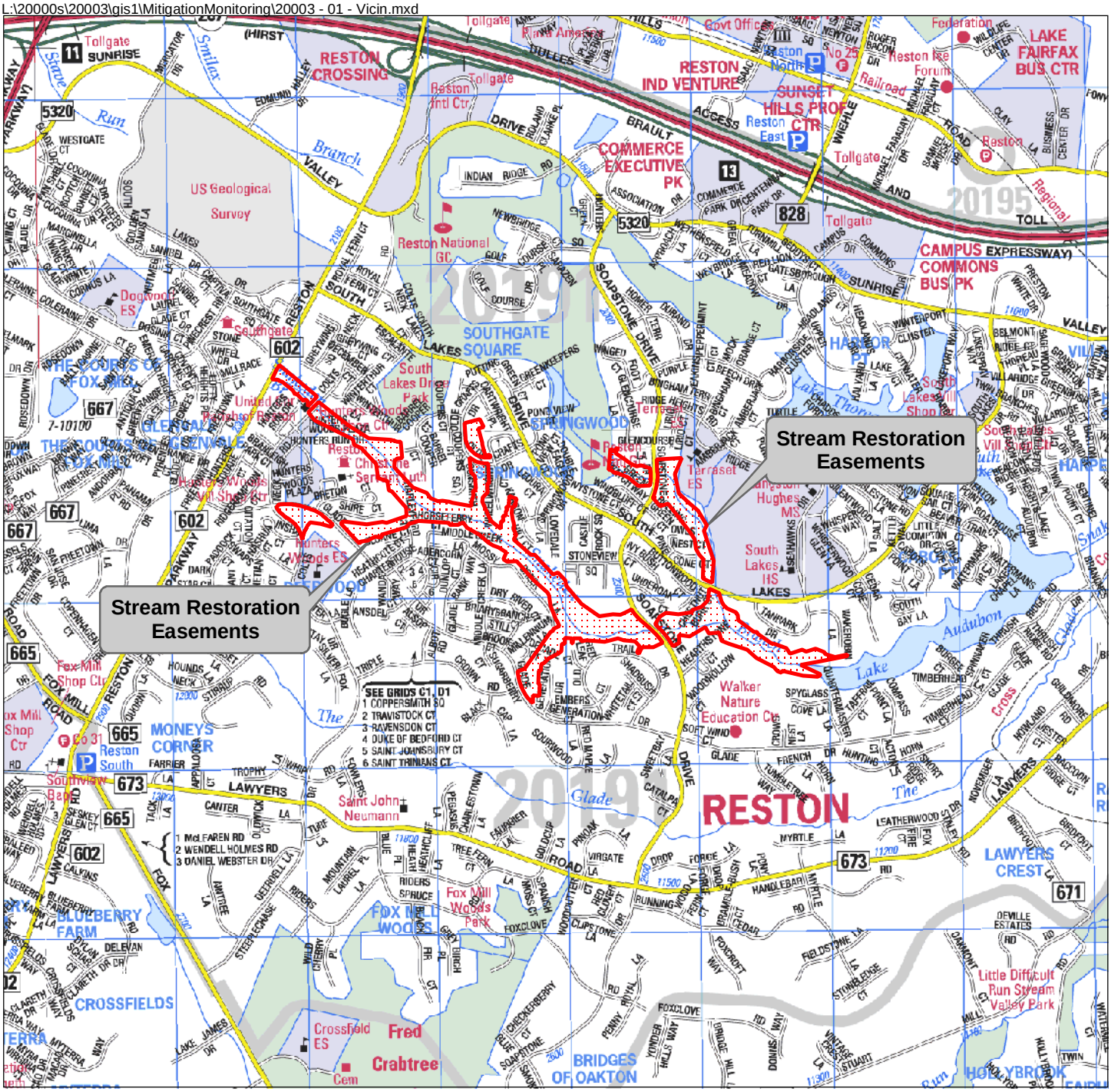
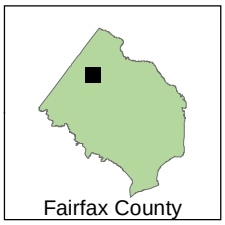
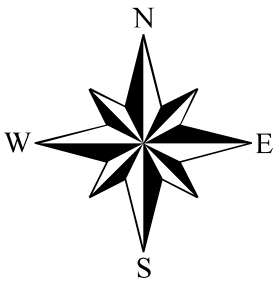


Vicinity Map
Snakeden Branch
WSSI #20003
Scale: 1" = 2000'





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Mitigation Monitoring Map 2009

Northern Virginia Stream Restoration Bank

Snakeden Branch Watershed

Reston, Virginia

77°21'45"W 77°21'30"W 77°21'15"W 77°21'0"W 77°20'45"W 77°20'30"W 77°20'15"W

38°56'15"N 38°56'0"N 38°55'45"N

Design Reach 1
1-1
2-1
Design Reach 2
3-1
3-2
Design Reach 3
3-3
Design Reach 4
4-1
4-2
4-3
Design Reach 5
5-1
5-2
6A-1
Design Reach 6
Design Reach 6A
6B-1
Design Reach 6B
7-1
Design Reach 7
Design Reach 8
Design Reach 8A
8A-1
9-1
9-2
Design Reach 9
9-3
9-4
Design Reach 10
10-1
11-1
11-2
Design Reach 11
11-3
Design Reach 12
12-1
12-2
12-3
13-1
Design Reach 13
14-1
Design Reach 14
15-1
15-2
15-3
15-4
15-5
Design Reach 15
16-1
Design Reach 16
17-1
17-2
17-3
Design Reach 17

Reston Parkway
Colts Neck Road
Glade Drive
Snakeden Branch
Soapstone Road
South Lakes Drive
Lake Thoreau
Lake Audubon

Legend

- Mitigation Monitoring Plots
- Restored Streams (Bankfull)
- Stream Restoration Easements

December 2008 Aerial Imagery Source: Aerials Express

Virginia Coordinate System of 1983
(VCS NAD 83), North Zone, U.S. Survey Foot

0 300 600 Feet

Scale 1" = 600'

Wetland Studies and Solutions, Inc.

Exhibit 2

EXHIBIT 3
NORTHERN VIRGINIA STREAM RESTORATION BANK – SNAKEDEN BRANCH WATERSHED
REPRESENTATIVE MONITORING PHOTOGRAPHS
PHOTOS TAKEN BETWEEN AUGUST 31 AND OCTOBER 19, 2009


Plot 1-1 North


Plot 2-1 North


Plot 3-1 Downstream


Plot 3-2 Upstream


Plot 3-3 Upstream


Plot 4-1 Downstream


Plot 4-2 Upstream


Plot 4-3 Upstream


Plot 5-1 Upstream


Plot 5-2 Upstream


Plot 6A-1 Downstream


Plot 6B-1 Upstream


Plot 7-1 Upstream


Plot 8A-1 Downstream


Plot 9-1 Upstream


Plot 9-2 Upstream


Plot 9-3 Upstream


Plot 9-4 Upstream


Plot 10-1 Downstream


Plot 11-1 North

EXHIBIT 3
NORTHERN VIRGINIA STREAM RESTORATION BANK – SNAKEDEN BRANCH WATERSHED
REPRESENTATIVE MONITORING PHOTOGRAPHS
PHOTOS TAKEN BETWEEN AUGUST 31 AND OCTOBER 19, 2009


Plot 11-2 Upstream


Plot 11-3 Upstream


Plot 12-1 Upstream


Plot 12-2 Upstream


Plot 12-3 Upstream


Plot 13-1 Upstream


Plot 14-1 North


Plot 15-1 Upstream


Plot 15-2 Upstream


Plot 15-3 Downstream


Plot 15-4 Upstream


Plot 15-5 Upstream


Plot 16-1 Upstream


Plot 17-1 Upstream


Plot 17-2 Upstream


Plot 17-3 Upstream

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NORTHERN VIRGINIA STREAM RESTORATION BANK
SNAKEDEN BRANCH WATERSHED

MITIGATION MONITORING REPORT

FIRST GROWING SEASON (2009)

FAIRFAX COUNTY, VIRGINIA

WSSI # 20003

TASK I2

APPENDIX

A. SITE PHOTOGRAPHS

B. PERCENT COVER DATA

C. WOODY PLANT DATA

D. STREAM BANK WOODY PLANT DATA

E. PEBBLE COUNT AND BAR SAMPLE DATA

F. WILDLIFE OBSERVATIONS

G. LETTERS OF SUPPORT

H. STORM EVENT MONITORING REPORTS

I. FIRST YEAR STREAM SURVEY DATA

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MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

1. Monitoring station 1-1: Looking north.

2. Monitoring station 1-1: Looking east.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

3. Monitoring station 1-1: Looking south.

4. Monitoring station 1-1: Looking west.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

5. Monitoring station 2-1: Looking north.

6. Monitoring station 2-1: Looking east.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

7. Monitoring station 2-1: Looking south.

8. Monitoring station 2-1: Looking west.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

9. Monitoring station 3-1: Looking downstream.

10. Monitoring station 3-1: Looking upstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

11. Monitoring station 3-2: Looking downstream.

12. Monitoring station 3-2: Looking upstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

13. Monitoring station 3-3: Looking upstream.

14. Monitoring station 3-3: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

15. Monitoring station 3-3: Looking at the left bank.

16. Monitoring station 3-3: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

17. Monitoring station 4-1: Looking downstream.

18. Monitoring station 4-1: Looking upstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

19. Monitoring station 4-2: Looking upstream.

20. Monitoring station 4-2: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

21. Monitoring station 4-2: Looking at the right bank.

22. Monitoring station 4-2: Looking upgradient from the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

23. Monitoring station 4-3: Looking upstream.

24. Monitoring station 4-3: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

25. Monitoring station 4-3: Looking at the left bank.

26. Monitoring station 4-3: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

27. Monitoring station 5-1: Looking upstream.

28. Monitoring station 5-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

29. Monitoring station 5-1: Looking at the left bank.

30. Monitoring station 5-1: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

31. Monitoring station 5-2: Looking upstream.

32. Monitoring station 5-2: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

33. Monitoring station 5-2: Looking at the left bank.

34. Monitoring station 5-2: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

35. Monitoring station 6a-1: Looking downstream.

36. Monitoring station 6a-1: Looking upstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

37. Monitoring station 6B-1: Looking upstream.

38. Monitoring station 6B-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

39. Monitoring station 6B-1: Looking at the left bank.

40. Monitoring station 6B-1: Looking upgradient from the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

41. Monitoring station 7-1: Looking upstream.

42. Monitoring station 7-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

43. Monitoring station 7-1: Looking at the left bank.

44. Monitoring station 7-1: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

45. Monitoring station 8a-1: Looking downstream.

46. Monitoring station 8a-1: Looking upstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

47. Monitoring station 9-1: Looking upstream.

48. Monitoring station 9-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

49. Monitoring station 9-2: Looking upstream.

50. Monitoring station 9-2: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

51. Monitoring station 9-3: Looking upstream.

52. Monitoring station 9-3: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

53. Monitoring station 9-3: Looking at the left bank.

54. Monitoring station 9-3: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

55. Monitoring station 9-4: Looking downstream.

56. Monitoring station 9-4: Looking upstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

57. Monitoring station 9-4: Looking at the left bank.

58. Monitoring station 9-4: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

59. Monitoring station 10-1: Looking upstream.

60. Monitoring station 10-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

61. Monitoring station 11-1: Looking upstream.

62. Monitoring station 11-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

63. Monitoring station 11-1: Looking at the left bank.

64. Monitoring station 11-1: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

65. Monitoring station 11-2: Looking upstream.

66. Monitoring station 11-2: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

67. Monitoring station 11-2: Looking at the left bank.

68. Monitoring station 11-2: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

69. Monitoring station 11-3: Looking north.

70. Monitoring station 11-3: Looking east.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

71. Monitoring station 11-3: Looking south.

72. Monitoring station 11-3: Looking west.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

73. Monitoring station 12-1: Looking upstream.

74. Monitoring station 12-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

75. Monitoring station 12-1: Looking at the right bank.

76. Monitoring station 12-1: Looking at the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

77. Monitoring station 12-2: Looking upstream.

78. Monitoring station 12-2: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

79. Monitoring station 12-2: Looking at the left bank.

80. Monitoring station 12-2: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

81. Monitoring station 12-3: Looking upstream.

82. Monitoring station 12-3: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

83. Monitoring station 12-3: Looking at the right bank.

84. Monitoring station 12-3: Looking at the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

85. Monitoring station 13-1: Looking upstream.

86. Monitoring station 13-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

87. Monitoring station 13-1: Looking at the right bank.

88. Monitoring station 13-1: Looking at the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

89. Monitoring station 14-1: Looking north.

90. Monitoring station 14-1: Looking east.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

91. Monitoring station 14-1: Looking south.

92. Monitoring station 14-1: Looking west.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

93. Monitoring station 15-1: Looking downstream.

94. Monitoring station 15-1: Looking upstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

95. Monitoring station 15-1: Looking at the right bank.

96. Monitoring station 15-1: Looking upgradient from the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

97. Monitoring station 15-2: Looking downstream.

98. Monitoring station 15-2: Looking upstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

99. Monitoring station 15-2: Looking at the right bank.

100. Monitoring station 15-2: Looking upgradient from the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

101. Monitoring station 15-3: Looking upstream.

102. Monitoring station 15-3: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

103. Monitoring station 15-4: Looking upstream.

104. Monitoring station 15-4: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

105. Monitoring station 15-4: Looking at the left bank.

106. Monitoring station 15-4: Looking upgradient from the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

107. Monitoring station 15-5: Looking downstream.

108. Monitoring station 15-5: Looking upstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

109. Monitoring station 15-5: Looking at the right bank.

110. Monitoring station 15-5: Looking upgradient from the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

111. Monitoring station 16-1: Looking upstream.

112. Monitoring station 16-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

113. Monitoring station 16-1: Looking at the left bank.

114. Monitoring station 16-1: Looking at the right bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

115. Monitoring station 17-1: Looking upstream.

116. Monitoring station 17-1: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

117. Monitoring station 17-1: Looking at the right bank.

118. Monitoring station 17-1: Looking at the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

119. Monitoring station 17-2: Looking upstream.

120. Monitoring station 17-2: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

121. Monitoring station 17-2: Looking at the right bank.

122. Monitoring station 17-2: Looking at the left bank.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

123. Monitoring station 17-3: Looking upstream.

124. Monitoring station 17-3: Looking downstream.

MONITORING STATION PHOTOGRAPHS
SNAKEDEN BRANCH WATERSHED
FIRST GROWING SEASON PHOTOGRAPHS
WSSI #20003

125. Monitoring station 17-3: Looking at the left bank.

126. Monitoring station 17-3: Looking at the right bank.

NORTHERN VIRGINIA STREAM RESTORATION BANK- SNAKEDEN WATERSHED
FIRST GROWING SEASON (2009)
STREAM RESTORATION BUFFER
PERCENT COVER DATA

Data Site #		1-1	2-1	3-3	4-2	4-3	5-1	5-2	6B-1	7-1	9-1	9-2	9-3	9-4	11-1	11-2	11-3	12-1	12-2	12-3	13-1	14-1	15-1	15-2	15-4	15-5	16-1	17-1	17-2	17-3	AVERAGE
PERCENT COVER																															
Overall % Cover		100	100	100	100	100	70	90	70	95	70	100	100	95	100	80	100	95	98	100	95	70	100	100	100	100	100	100	99	75	93.17
% Bare Ground		0	0	0	0	0	10	10	30	5	30	0	0	5	0	20	0	5	2	0	5	30	0	0	0	0	0	0	1	25	6.14
SPECIES COMPOSITION	**R1 IND**																														
*Acalypha rhomboidea**	FACU-	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.48
Acer rubrum	FAC	5	0	0	0	0	0	0	0	5	1	0	10	10	1	1	1	0	0	0	0	1	0	15	10	0	5	5	0	0	2.92
Acer negundo	FAC+	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50
Alnus serrulata	OBL	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.19
*Ambrosia artemisiifolia**	FACU	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00
*Arthraxon hispidus**	NI	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.71
Aster sp.	NI***	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.30
Betula nigra	FACW	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03
*Bidens frondosa**	FACW	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	2.75
*Boehmeria cylindrica**	FACW+	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25
*Carex lurida**	OBL	0	80	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.62
Carex sp.	NI***	0	0	0	0	5	0	15	0	0	0	0	0	40	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.77
*Carex vulpinoidea**	OBL	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	2.65
*Cassia fasciculata**	FACU	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0.25
Cephalanthus occidentalis	OBL	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03
Cornus amomum	FACW	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25
*Cyperus strigosus**	FACW	15	10	20	0	0	0	0	0	0	15	10	0	0	0	0	0	0	0	5	0	40	0	90	20	30	20	20	0	0	13.41
*Dichanthelium clandestinum**	FAC+	0	5	10	0	0	0	0	0	2	0	0	0	0	0	0	15	0	15	0	0	0	0	0	0	0	5	10	0	0	2.70
Dichanthelium sp.	NI***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
*Digitaria sanguinalis**	FACU-	0	0	0	0	0	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.30
*Dipsacus sylvestris**	NI	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0	0	1.30
*Echinochloa crusgalli**	FACU**	20	0	10	0	0	25	0	0	0	30	5	0	10	0	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	5.83
*Eclipta alba**	FAC	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.10
*Erechtites hieraciifolia**	FACU	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.10
*Eulalia viminea**	FAC	0	60	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	4.00
Eupatorium perfoliatum	FACW+	0	0	5	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	1.00
Euphorbia sp.*	NI***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.07
Euthamia graminifolia	FAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0.52
*Festuca pratensis**	FACU-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	0	2.76
*Juncus accuminatus**	OBL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	0	0	0	0	0	0	10	0	0	0	0	0	0	1.19
*Juncus effusus**	FACW+	0	0	0	0	0	0	0	0	0	0	0	15	0	0	10	25	5	10	10	0	0	0	0	0	0	5	10	0	0	4.29
Juncus sp.	NI***	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0.69
*Holcus lanatus**	FACU	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25
*Hypericum mutilum**	FACW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.03
*Lespedeza cuneata**	NI	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.25
Lespedeza sp.	NI***	0	0	40	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	10	0	0	0	0	4.05
*Liriodendron tulipifera**	FACU	0	0	0	0	0	0	0	0	5	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.43
Lolium multiflorum	UPL	0	0	0	0	90	0	80	65	90	10	0	70	80	100	0	0	90	0	95	95	0	0	0	85	0	90	80	99	70	56.04
*Ludwigia palustris**	OBL	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25
Lycopus sp.	NI***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0.17
*Lycopus virginicus**	OBL	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25
*Muhlenbergia schreberi**	FAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0.52
Oxalis sp.*	NI***	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.32
*Penthorum sedoides**	OBL	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.19
*Plantago lanceolata**	UPL	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25
Poaceae*	NI***	0	0	0	35	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	3.75
Poa sp.*	NI***	0	0	0	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.28
*Polygonum hydropiper**	OBL	0	0	0	0	0	0	0	0	0	45	0	0	0	0	0	0	0	10	0	0	0	0	5	0	0	0	0	0	20	2.76
*Polygonum persicaria**	FACW	0	0	5	0	0	0	0	0	0	10	60	5	0	0	0	15	0	0	2	0	0	5	5	0	5	5	0	0	10	6.05
*Polygonum perfoliatum**	FAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0.17
Polygonum sp.	NI***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.03
Quercus palustris	FACW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	15	0	0	0	0	0	0.69
Quercus phellos	FAC+	0	0	0	0	3	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.40
*Rosa multiflora**	FACU	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.52
Rubus sp.*	NI***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.03
Rudbeckia fulgida	FAC	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	5	15	1.75
*Rumex crispus**	FACU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.07
*Scirpus atrovirens**	OBL	0	0	0	0	0	0	0	0	0	0	0	30	0	0	55	50	20	15	0	0	0	0	0	0	0	0	0	0	0	8.10
*Secale cereale**	UPL	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25
Setaria italica	FACU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	2	1.79
*Taraxacum officinale**	FACU-	80	0	0	0	0	0	0	0	0	5	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.35
*Trifolium pratense**	FACU-	0	0	0	0	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.75
*Trifolium repens**	FACU-	10	0	0	0	0	0	0	0	0	0	0	0	0	10	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	1.05
Trifolium sp.	NI***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	0	5	20	0	0	0	0	2.41
*Verbena hastata**	FACW+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	10	0	0	0.65
Viburnum dentatum	FAC	0	0	0	0	0	2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.57
Total % Cover		165	245	205	130	173	70	111	70	133	103	121	142	143	132	96	141	129	120	113	100	118	106	132	135	135	132	150	104	123	130.24
% Overlap		65	145	105	30	73	0	21	0	38	33	21	42	48	32	16	41	34	22	13	5	48	6	32	35	35	32	50	5	48	37.07

*indicates volunteer species.
** per correspondence with Porter B. Reed, USFWS, 10/31/00.
***This taxa was unable to be identified to species, thus it was given an NI rating
NI indicates that insufficient information is available to determine an indicator status
Cells containing percent cover data have been shaded gray for contrast.

NORTHERN VIRGINIA STREAM RESTORATION BANK - SNAKEDEN WATERSHED
FIRST GROWING SEASON (2009)
STREAM RESTORATION BUFFER
WOODY STEM DENSITY DATA

Data Site #		1-1	2-1	3-3	4-2	4-3	5-1	5-2	6B-1	7-1	9-1***	9-2***	9-3	9-4	11-1	11-2	11-3	12-1	12-2	12-3	13-1	14-1	15-1	15-2	15-4	15-5	16-1	17-1	17-2	17-3	TOTAL STEMS
# STEMS																															
TREES	**R1 IND**																														
Acer negundo	FAC+	0	0	0	0	0	2	0	0	2	0	1	0	0	0	1	2	0	0	1	0	1	1	1	0	1	3	0	0	0	16
Acer rubrum	FAC	56	4	8	8	3	45	66	7	442	30	8	1288	736	412	76	28	66	4	75	11	139	3	158	114	90	185	816	21	218	5117
Alnus serrulata	OBL	0	0	0	0	3	3	8	1	1	0	0	2	0	0	3	2	6	5	2	0	0	0	0	0	0	8	5	6	5	60
Amelanchier arborea	FAC-	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
*Aralia spinosa**	FAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
Betula nigra	FACW	7	1	1	0	0	0	0	1	0	6	1	0	0	1	0	0	0	0	0	4	0	4	2	0	3	0	0	0	0	31
Carpinus caroliniana	FAC	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	5
*Celastrus orbiculata**	FACU-	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cercis canadensis	FACU-	1	0	0	0	0	4	1	0	1	0	0	0	0	0	0	3	3	0	0	4	0	0	0	0	0	0	4	1	0	22
*Corylus americana**	FACU-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
*Fraxinus pennsylvanica**	FACW	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	1	0	0	1	2	0	0	0	1	2	0	0	0	0	18
Ilex opaca	FACU+	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	13	0	0	1	2	0	0	0	0	0	21
Liquidambar styraciflua	FAC	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	3	0	0	0	2	0	0	0	0	0	0	4	0	0	11
*Liriodendron tulipifera**	FACU	4	0	12	3	0	8	40	0	114	43	6	83	66	15	53	107	5	51	41	1	12	5	9	3	17	142	74	2	0	916
*Morus alba**	UPL	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Nyssa sylvatica	FAC	0	1	0	0	3	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	10
Platanus occidentalis	FACW-	0	0	0	1	1	3	0	0	0	0	0	0	0	1	0	0	5	4	7	2	1	3	6	2	0	3	6	8	7	60
*Populus deltoides**	FAC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
*Prunus avium**	UPL	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
*Prunus serotina**	FACU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Quercus bicolor	FACW+	1	0	0	1	1	4	6	0	3	1	2	0	1	0	4	1	3	4	9	3	3	6	2	7	3	6	0	5	1	77
Quercus palustris	FACW	0	0	0	1	0	3	5	2	3	1	0	0	4	0	0	0	1	0	0	12	0	4	5	5	3	4	0	0	0	53
Quercus phellos	FAC+	0	0	0	9	6	3	3	34	2	2	0	0	1	1	0	0	0	1	2	12	0	0	0	0	0	0	0	0	0	76
Quercus rubra	FACU-	11	0	5	0	0	0	0	3	0	1	0	8	0	3	5	4	0	0	5	5	0	0	2	1	1	0	0	0	0	54
Quercus sp.*	NI**	0	0	3	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	3	2	1	0	3	0	0	0	0	17
*Robinia pseudoacacia**	FACU-	1	0	1	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	11	0	6	0	0	0	0	23
Salix nigra	FACW+	3	17	0	1	3	4	1	0	1	0	0	0	3	0	0	0	1	2	3	0	0	0	2	2	0	14	0	18	2	77
Sambucus canadensis	FACW-	4	0	1	1	2	6	1	0	4	1	1	1	3	0	0	0	1	8	3	27	0	1	5	2	3	6	0	1	1	83
SHRUBS																															
Cephalanthus occidentalis	OBL	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Cornus amomum	FACW	26	43	5	16	9	14	3	3	7	3	2	3	6	0	9	8	5	10	14	0	3	12	10	8	5	23	14	11	15	287
Ilex verticulata	FACW+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	1	0	0	0	0	0	0	0	0	25
Lindera benzoin	FACW-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2	0	0	7
*Rosa multiflora**	FACU	6	14	1	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	44
Viburnum dentatum	FAC	6	11	3	2	3	9	6	1	6	6	7	4	6	2	5	6	6	1	2	40	0	1	1	1	5	4	1	3	9	157
*Viburnum lentago**	FAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Viburnum prunifolium	FACU	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	1	0	0	0	0	10
																															AVERAGE
# STEMS		131	100	40	44	34	108	144	70	598	116	30	1390	827	436	156	165	102	90	165	167	165	45	216	163	146	398	926	76	258	245
# STEMS/ACRE		2015	1538	615	677	523	1662	2215	1077	9200	1785	462	21385	12723	6708	2400	2538	1569	1385	2538	2569	2538	692	3323	2508	2246	6123	14246	1169	3969	3763

* Indicates volunteer species
**This taxa was unable to be identified to species, thus it was given an NI rating
*** Supplemental plots with the equivalent area of a 15-foot radius plot were used in these areas where the forested riparian zone was too narrow to establish a 30-foot radius plot.
Cells containing woody stem data have been shaded gray for contrast.

NORTHERN VIRGINIA STREAM RESTORATION BANK - SNAKEDEN WATERSHED
FIRST GROWING SEASON (2009)
STREAM BANK WOODY STEM DENSITY DATA

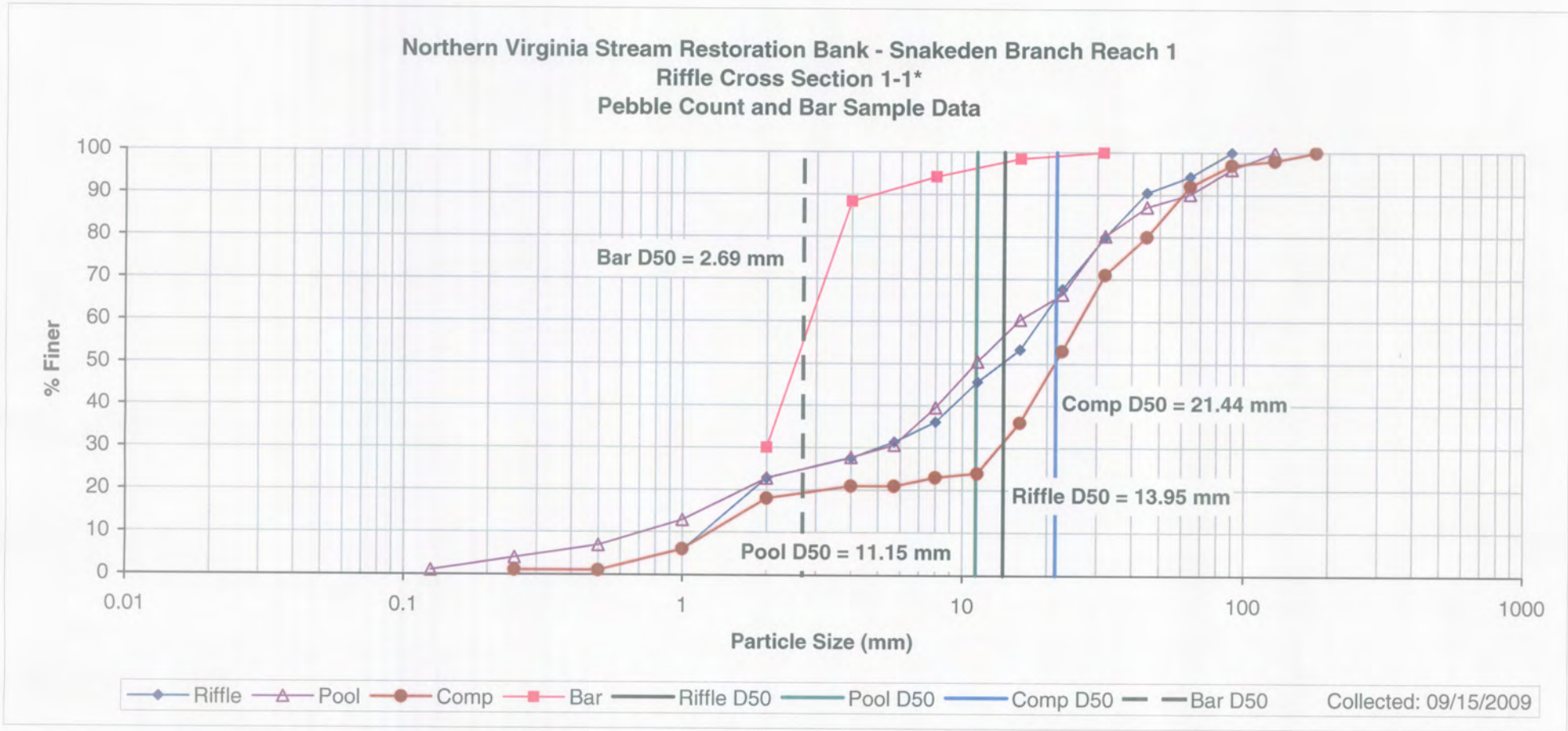
Data Site #[1]		1-1	2-1	3-1	3-2	3-3	4-1	4-2	4-3	5-1	5-2	6A-1	6B-1	7-1	8A-1	9-1	9-2	9-3	9-4	10-1	11-1	11-2	11-3	12-1	12-2	12-3	13-1	14-1	15-1	15-2	15-3	15-4	15-5	16-1	17-1	17-2	17-3	SUMMARY
																																						TOTAL STEMS
# STEMS LIVING TREES	**R1 IND**																																					
Acer rubrum	FAC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Alnus serrulata	OBL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	3
*Fraxinus pennsylvanica**	FACW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
*Liriodendron tulipifera**	FACU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Morus sp.*	NI	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Platanus occidentalis	FACW-	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Salix nigra	FACW+	5	22	14	16	10	18	12	16	22	27	13	8	12	11	21	46	23	36	11	28	29	25	12	49	41	33	30	36	22	38	25	21	24	29	10	32	827
Sambucus canadensis	FACW-	3	6	1	0	3	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	2	0	3	2	0	0	1	2	4	0	0	3	0	1	1	35
SHRUBS																																						
Cornus amomum	FACW	5	2	0	3	6	16	8	21	15	9	20	19	7	2	2	11	1	0	0	1	1	6	2	0	2	1	1	0	2	0	0	0	6	6	3	2	180
Viburnum dentatum	FAC	2	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	9
																																					AVERAGE
# STEMS LIVING		15	31	15	19	19	35	20	38	39	36	33	30	19	13	23	57	24	36	11	29	31	33	16	54	45	37	31	37	26	43	25	22	33	35	14	35	31
# STEMS LIVING / 5 LF		2	3	2	2	2	4	2	4	4	4	3	3	2	1	2	6	2	4	1	3	3	3	2	5	5	4	3	4	3	4	3	2	3	4	1	4	3

[1] Transect length was 50 feet adjacent to the plot location.

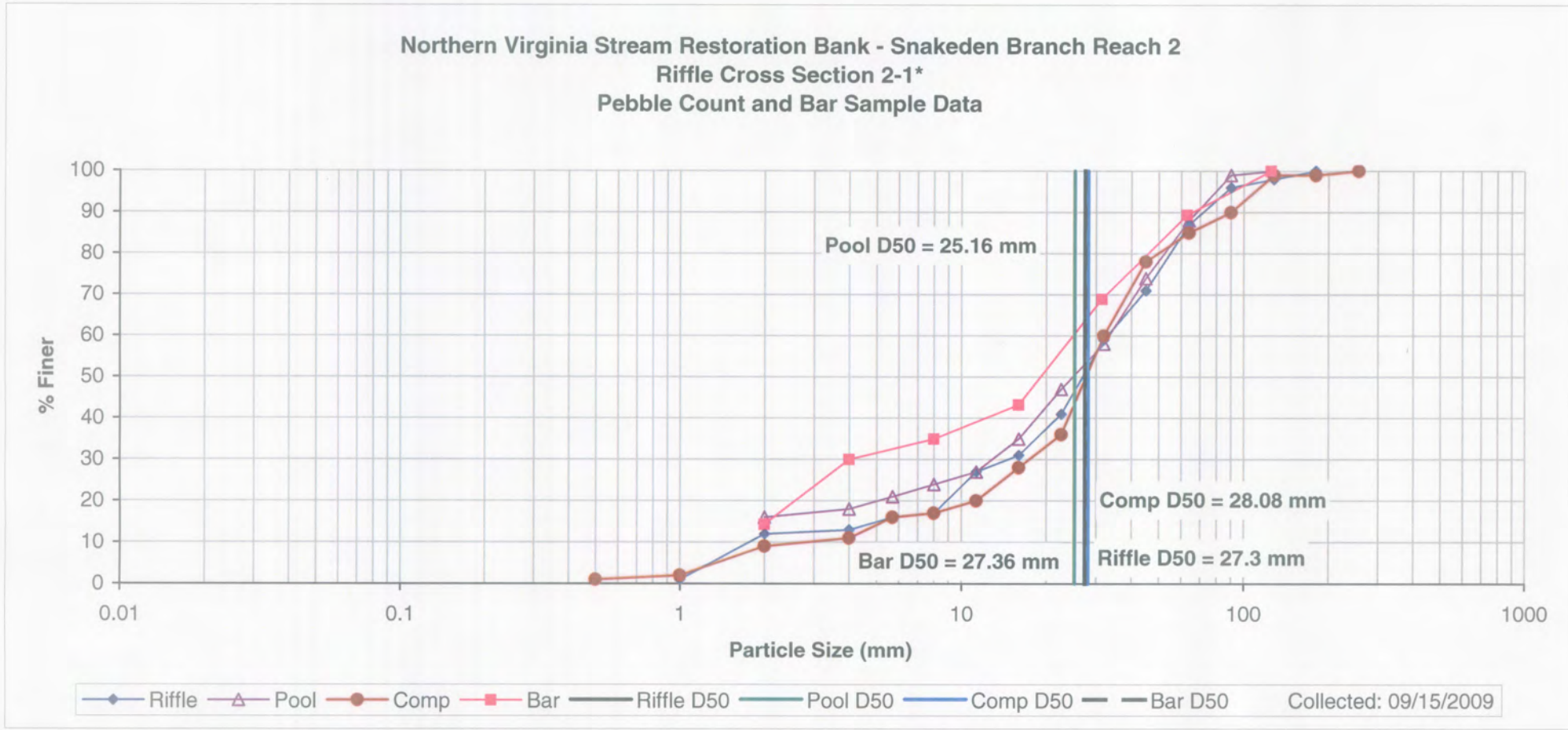
*Indicates a volunteer species

**This taxa was unable to be identified to species, thus it was given an NI rating

Cells containing woody stem data have been shaded gray for contrast.



*Note that the riffle pebble count was conducted along the riffle cross section, the pool pebble count and bar sample were conducted along the adjacent pool, and the reach wide pebble count was conducted along an adjacent reach equal to two meander lengths.



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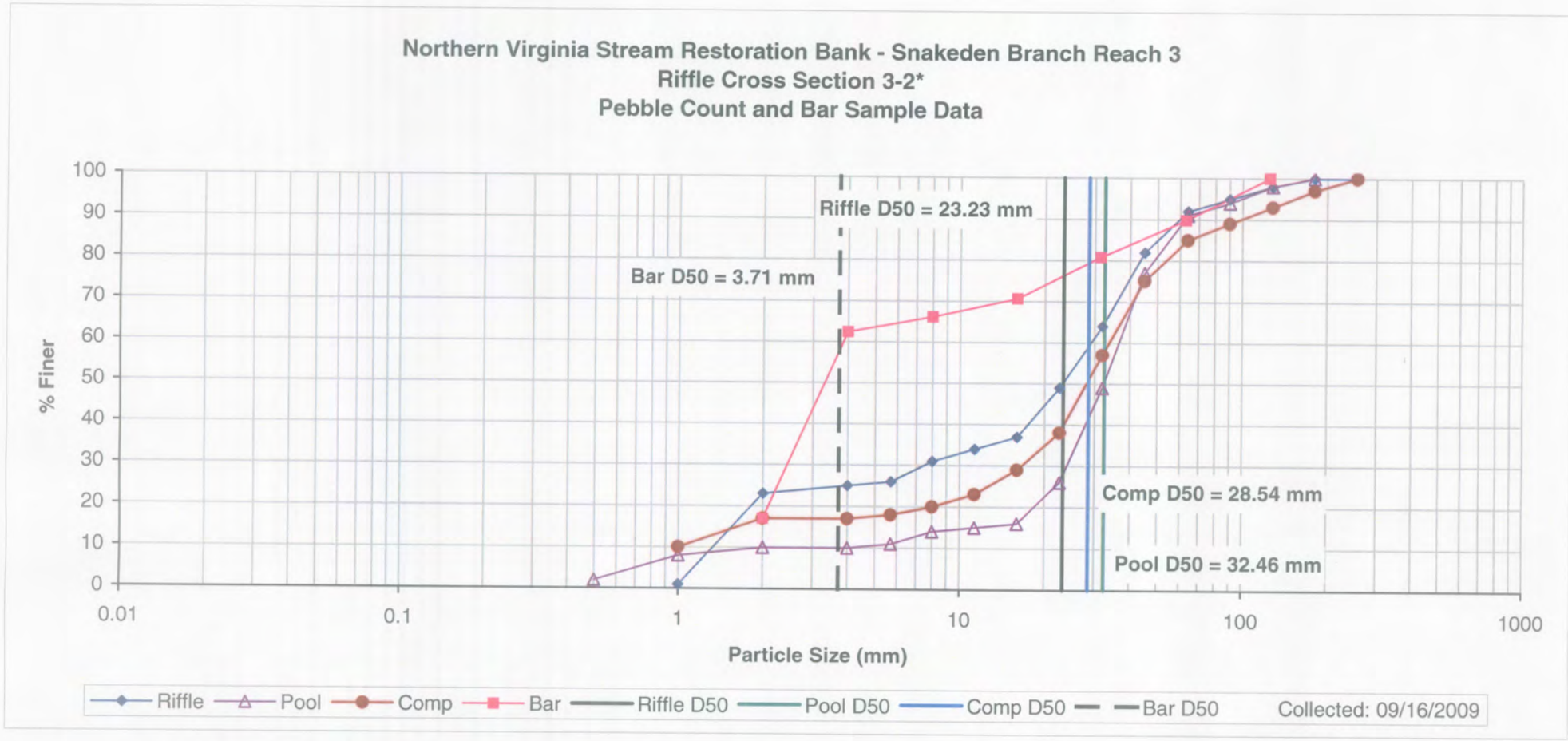

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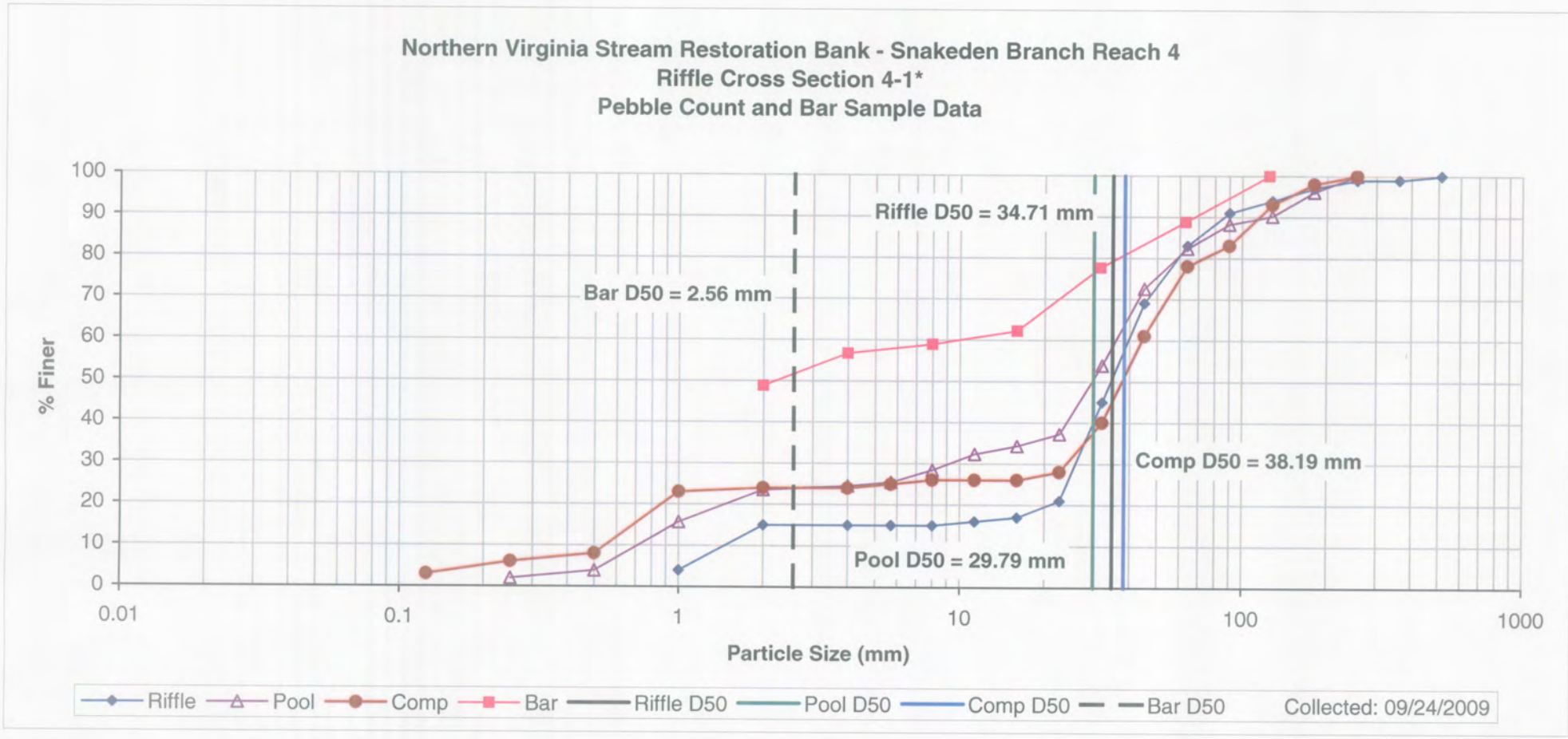
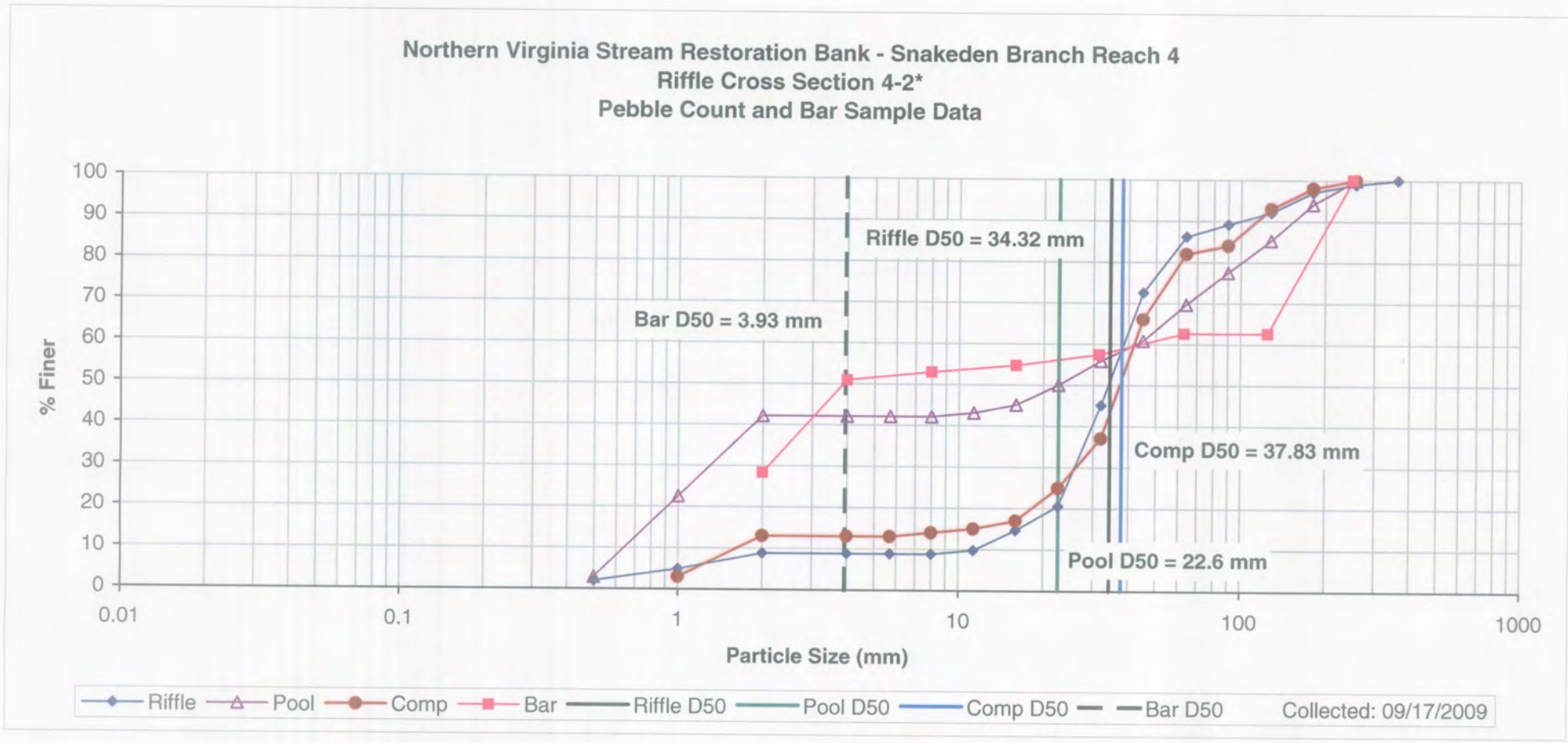


*Note that the riffle pebble count was conducted along the riffle cross section, the pool pebble count and bar sample were conducted along the adjacent pool, and the reach wide pebble count was conducted along an adjacent reach equal to two meander lengths.



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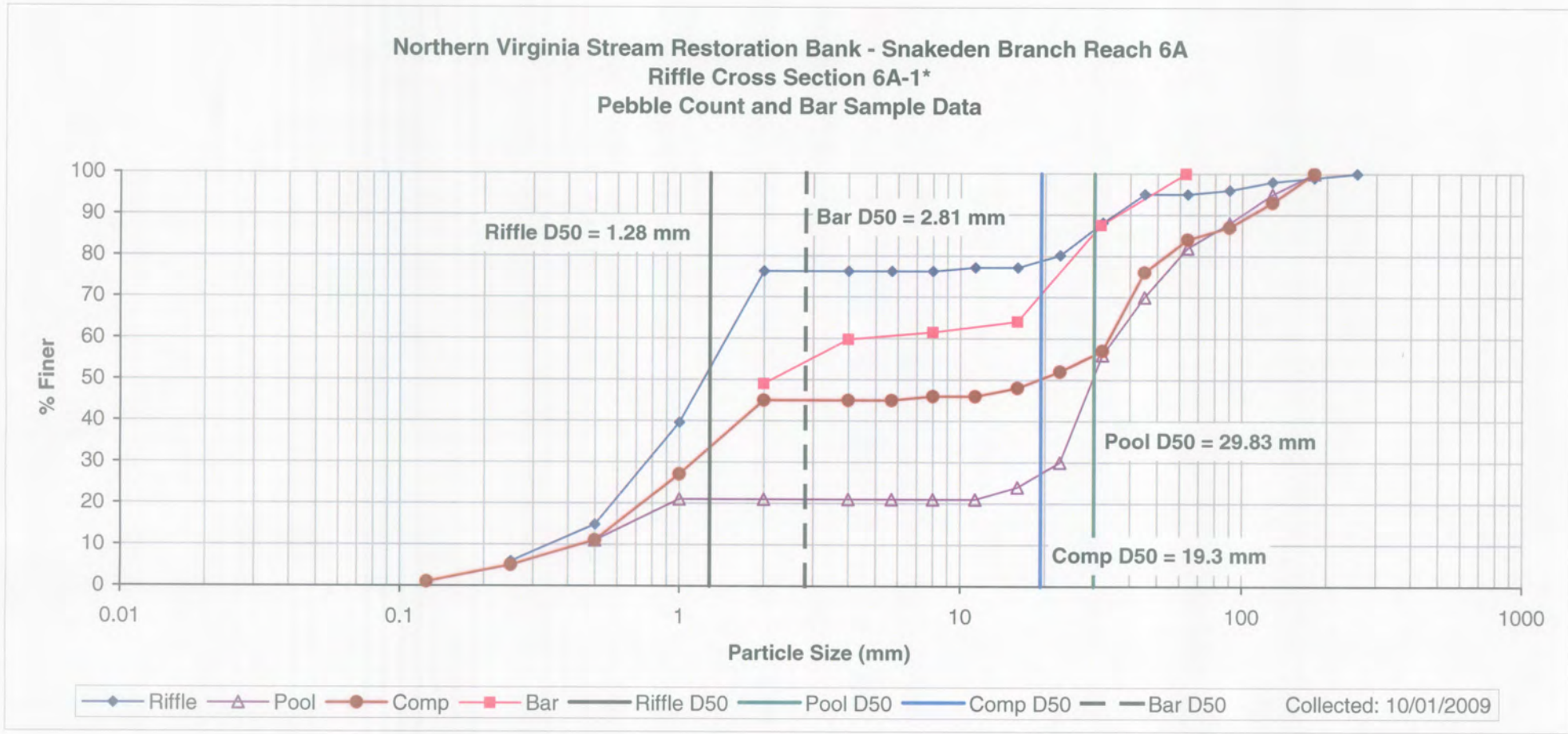

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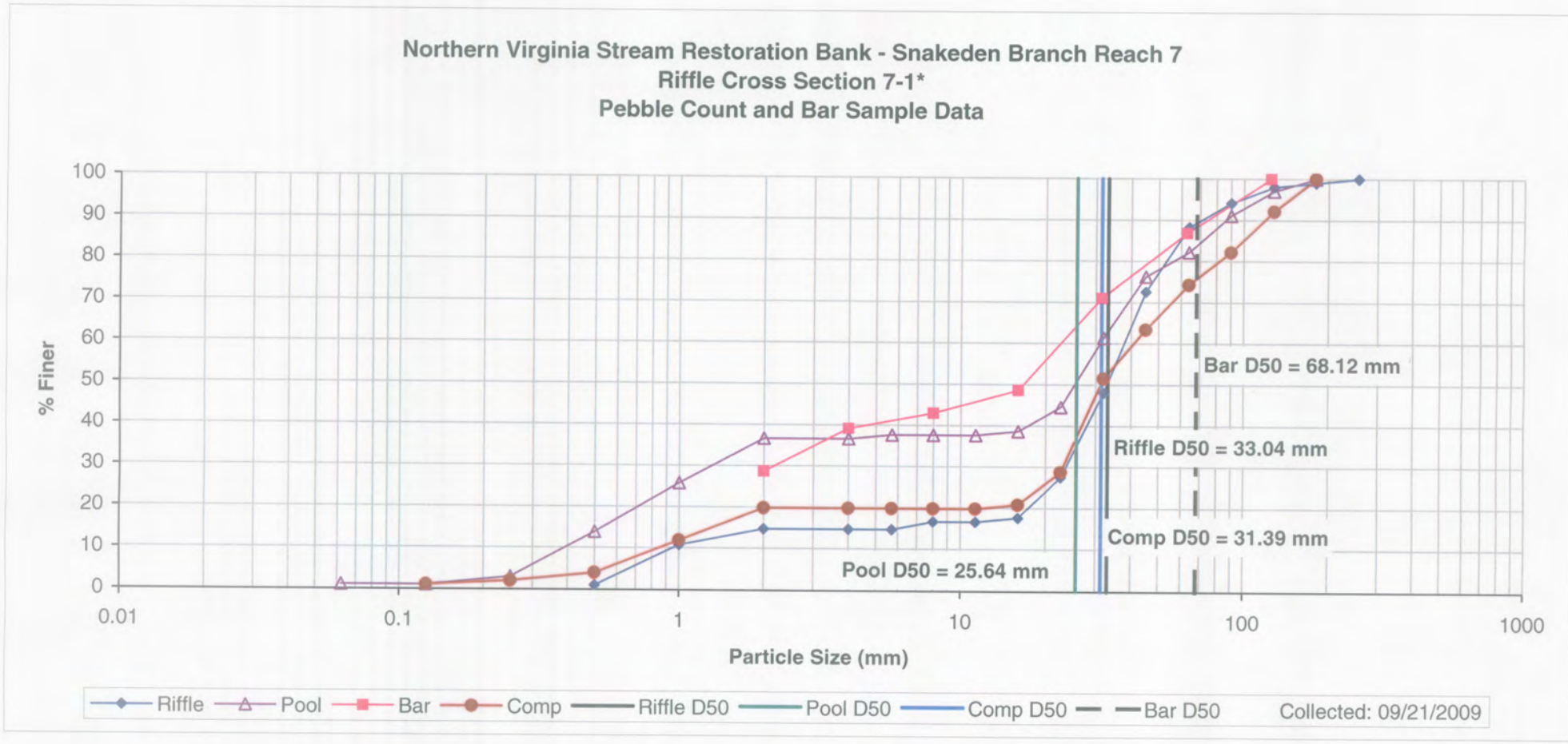

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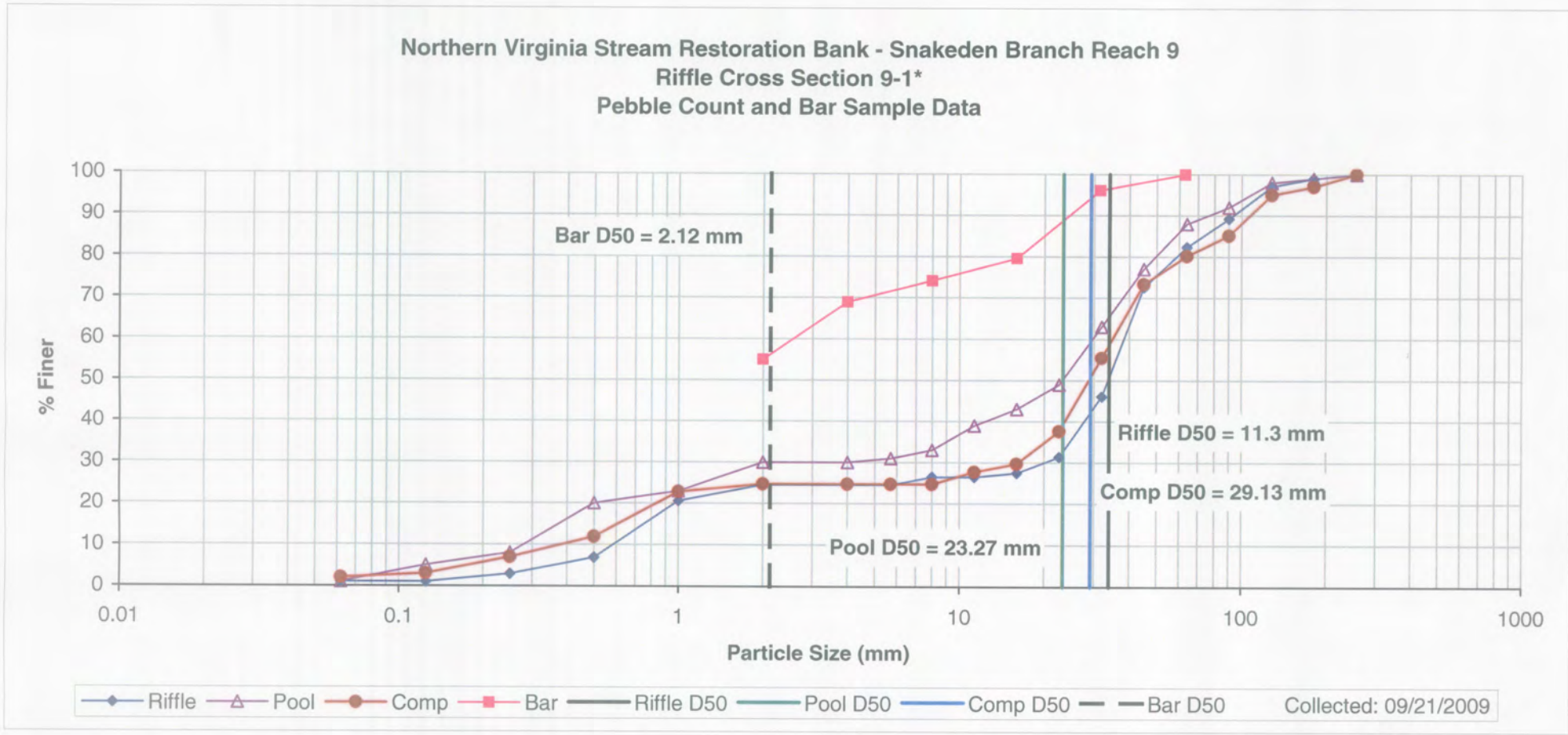

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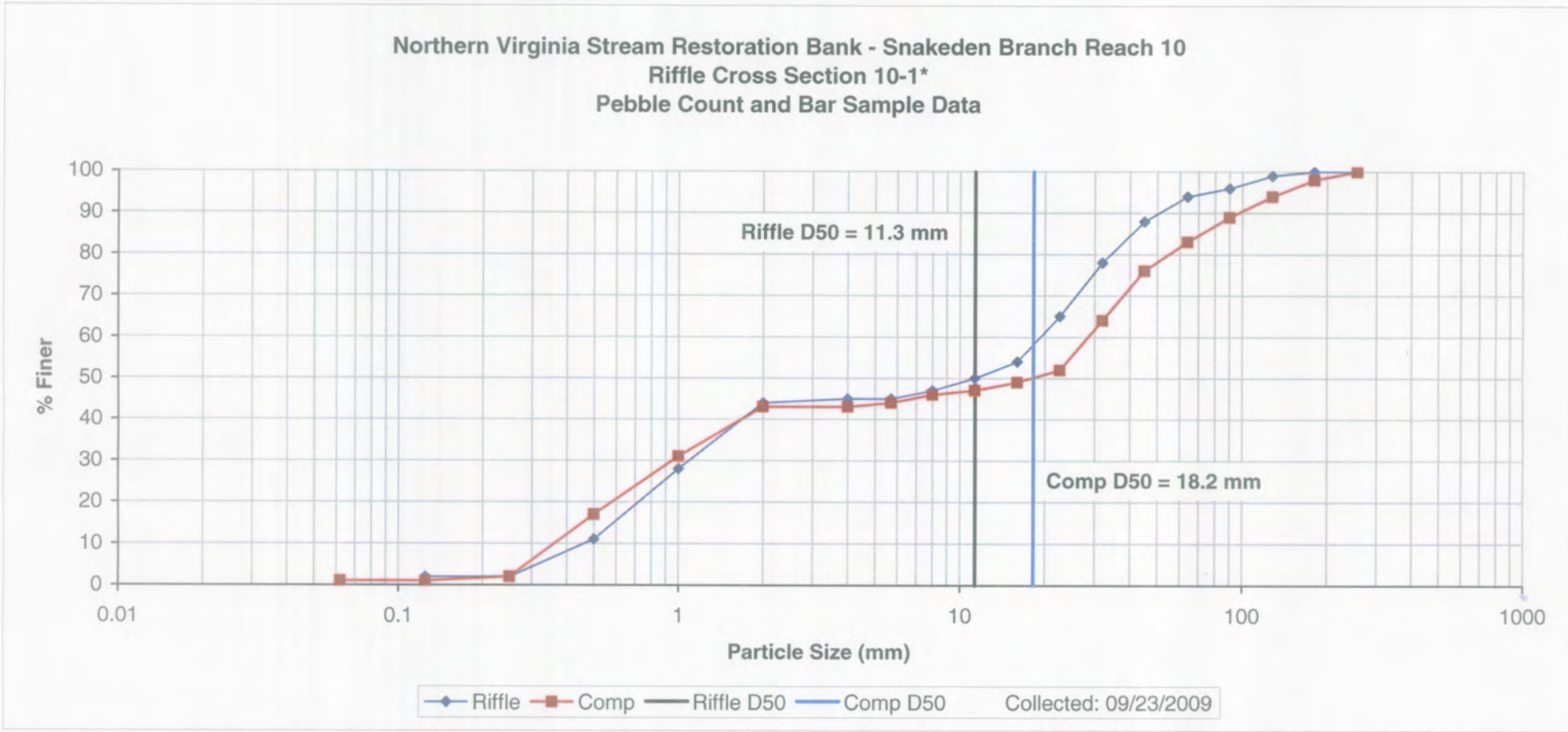

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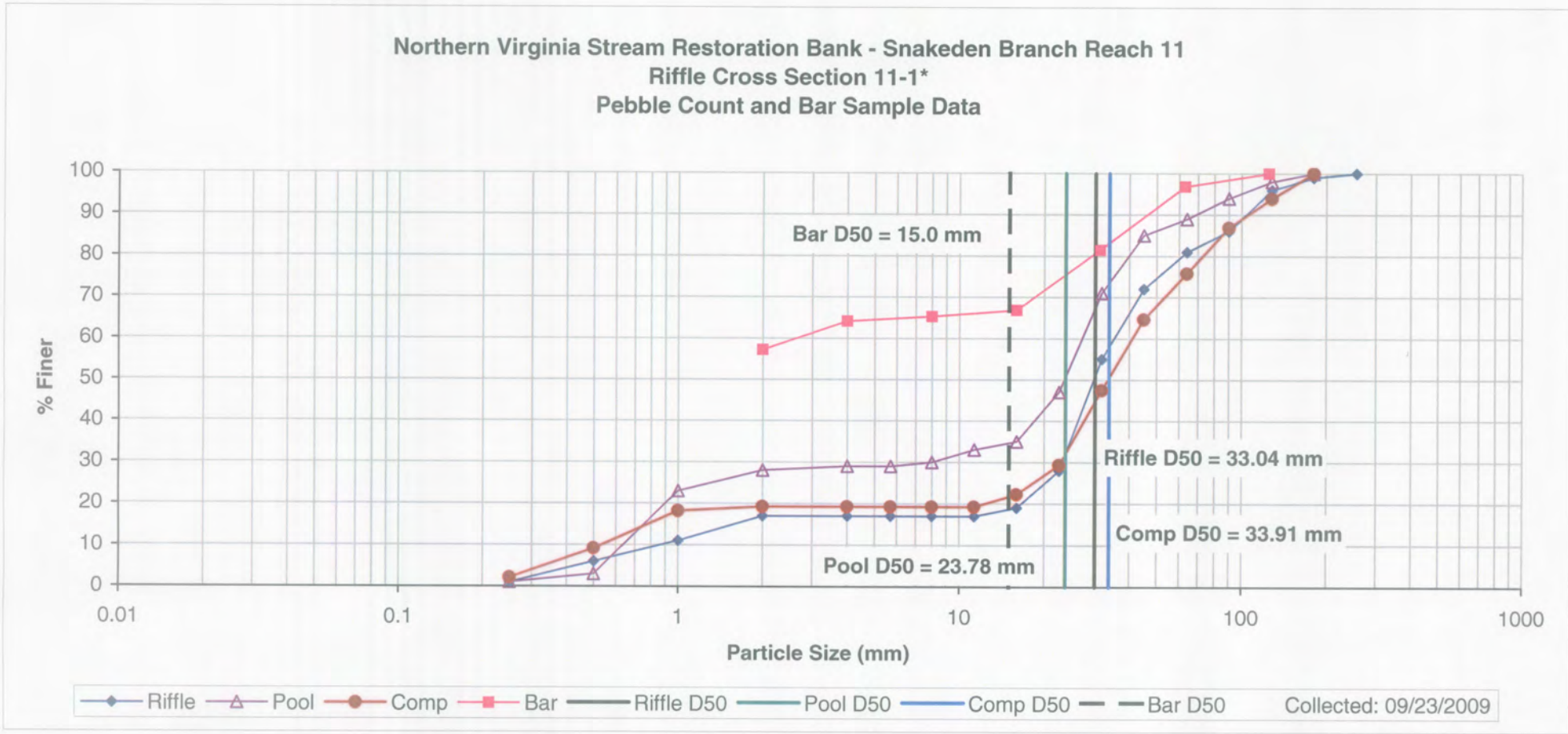

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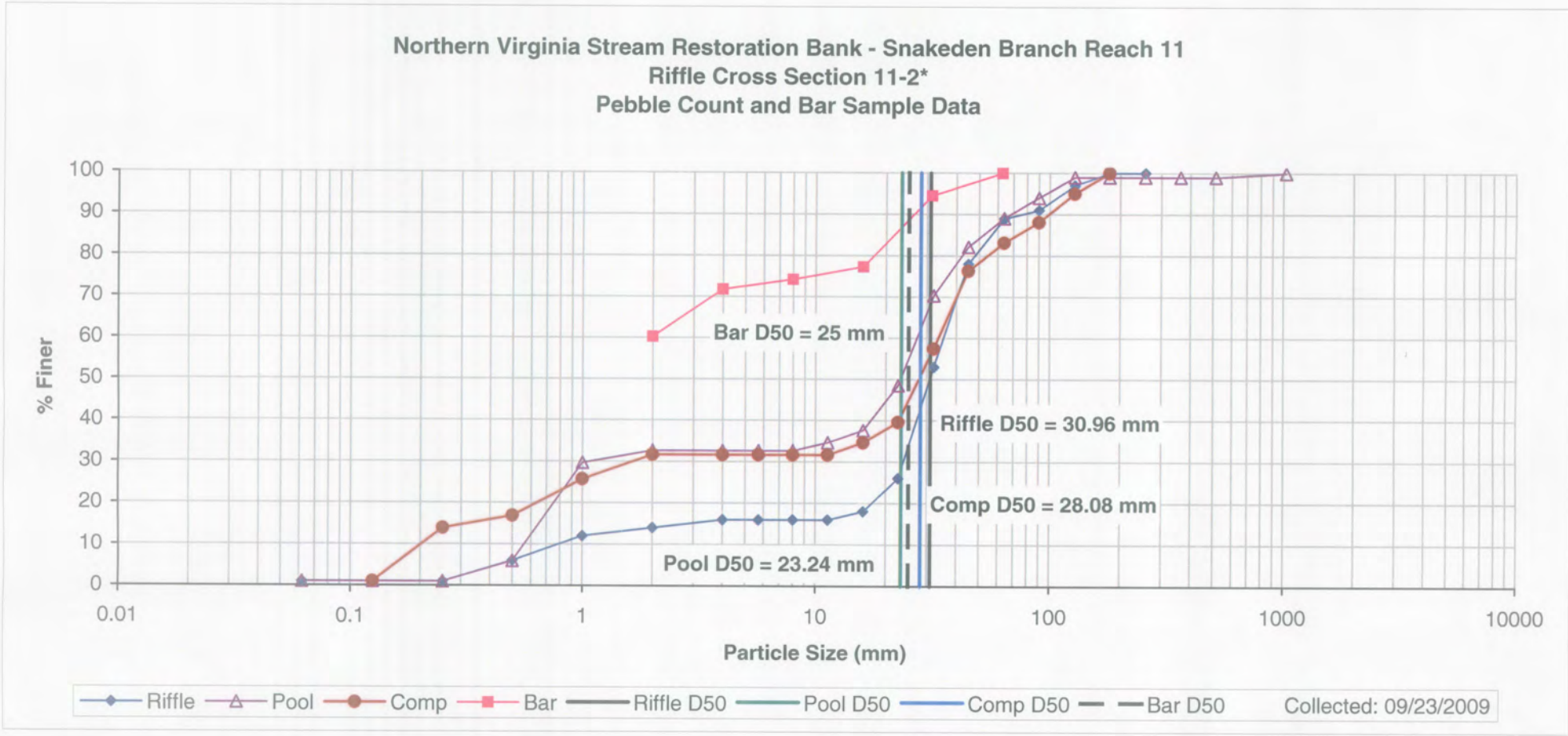

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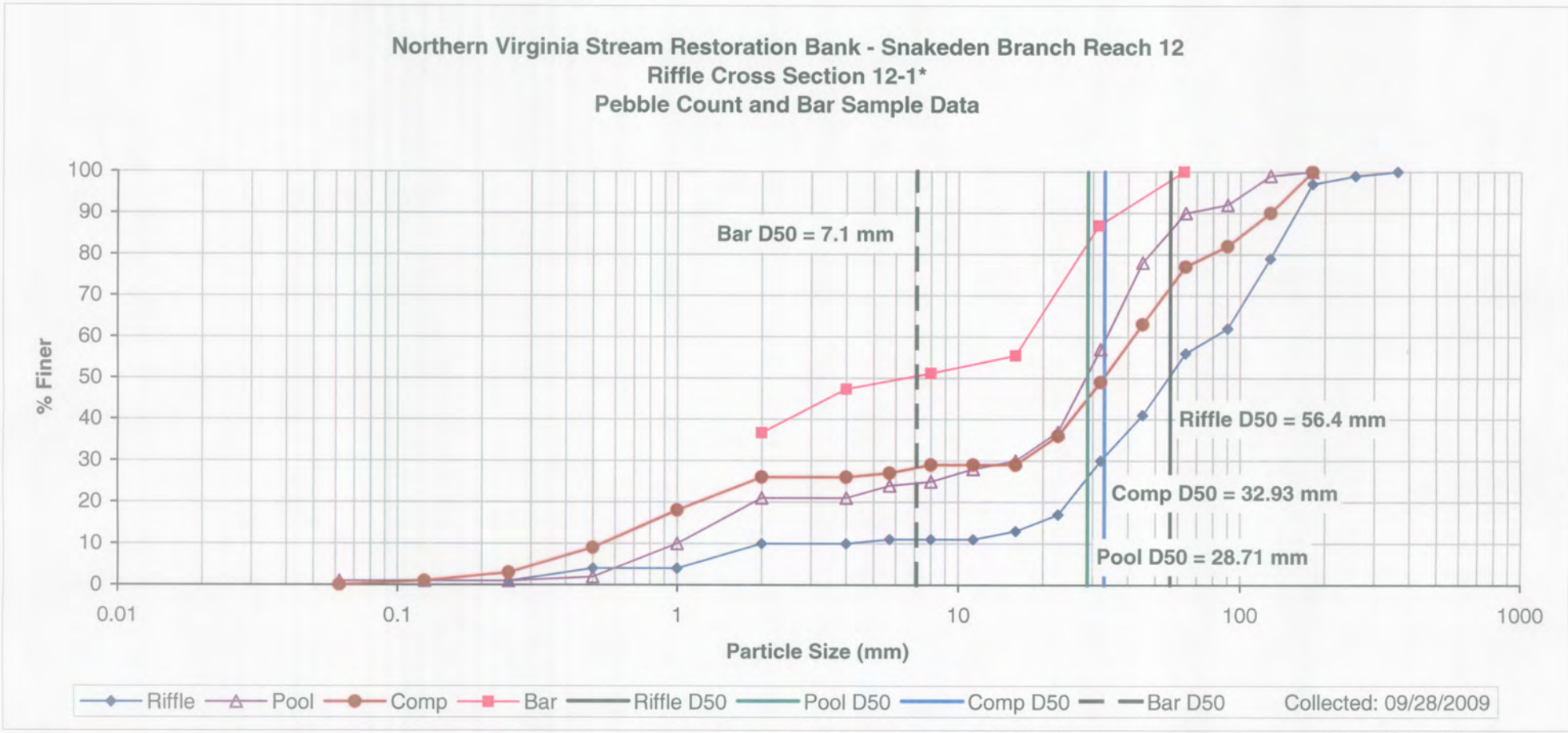

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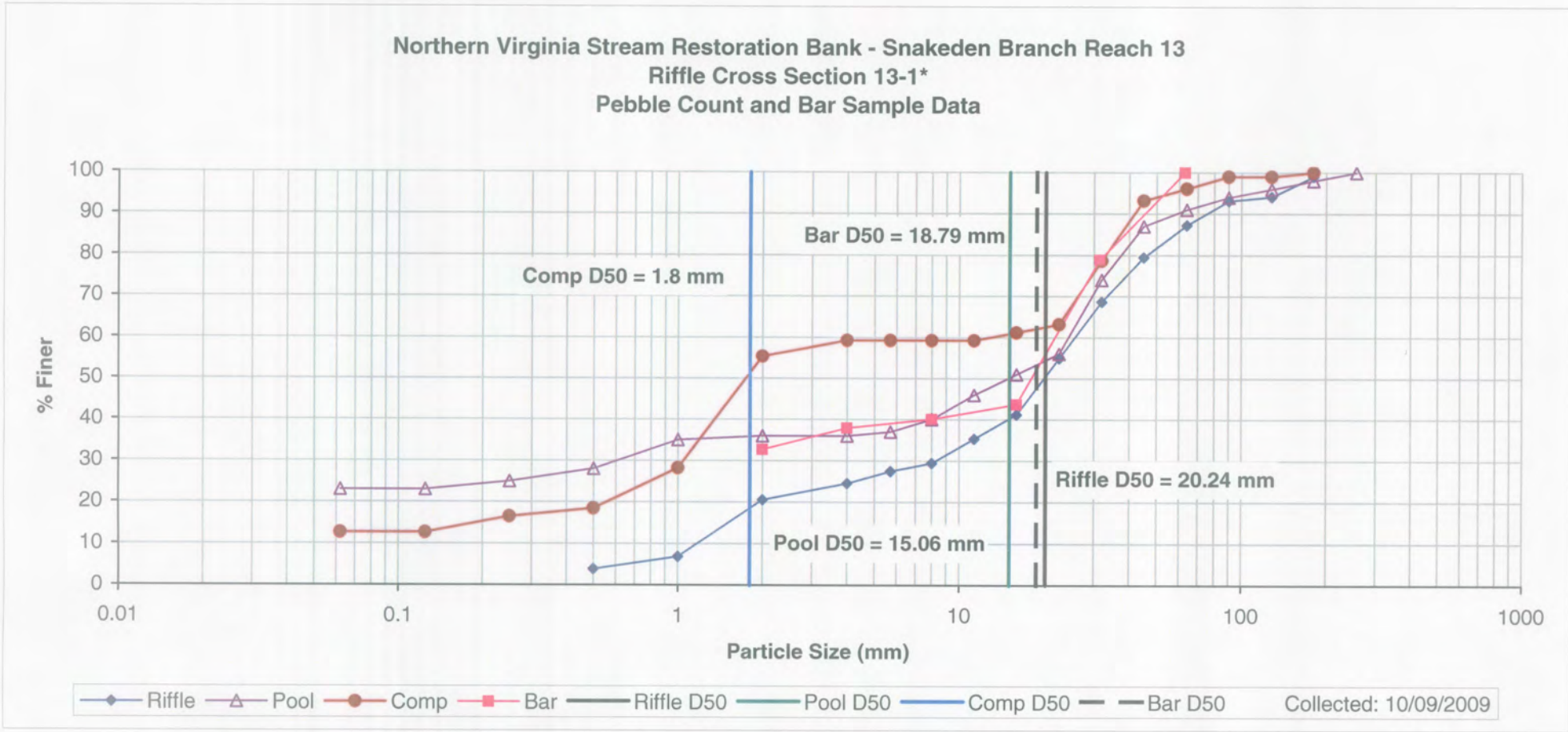

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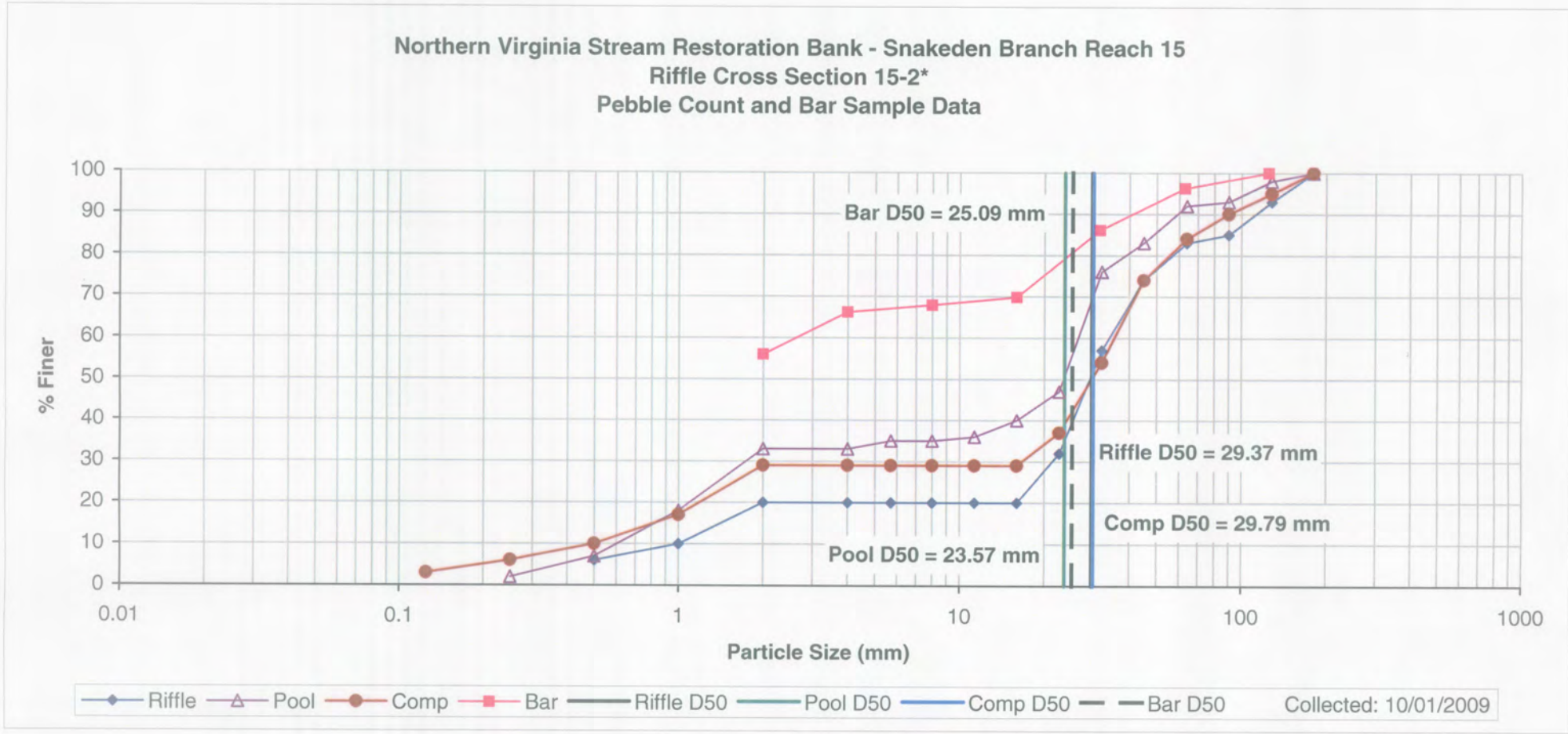

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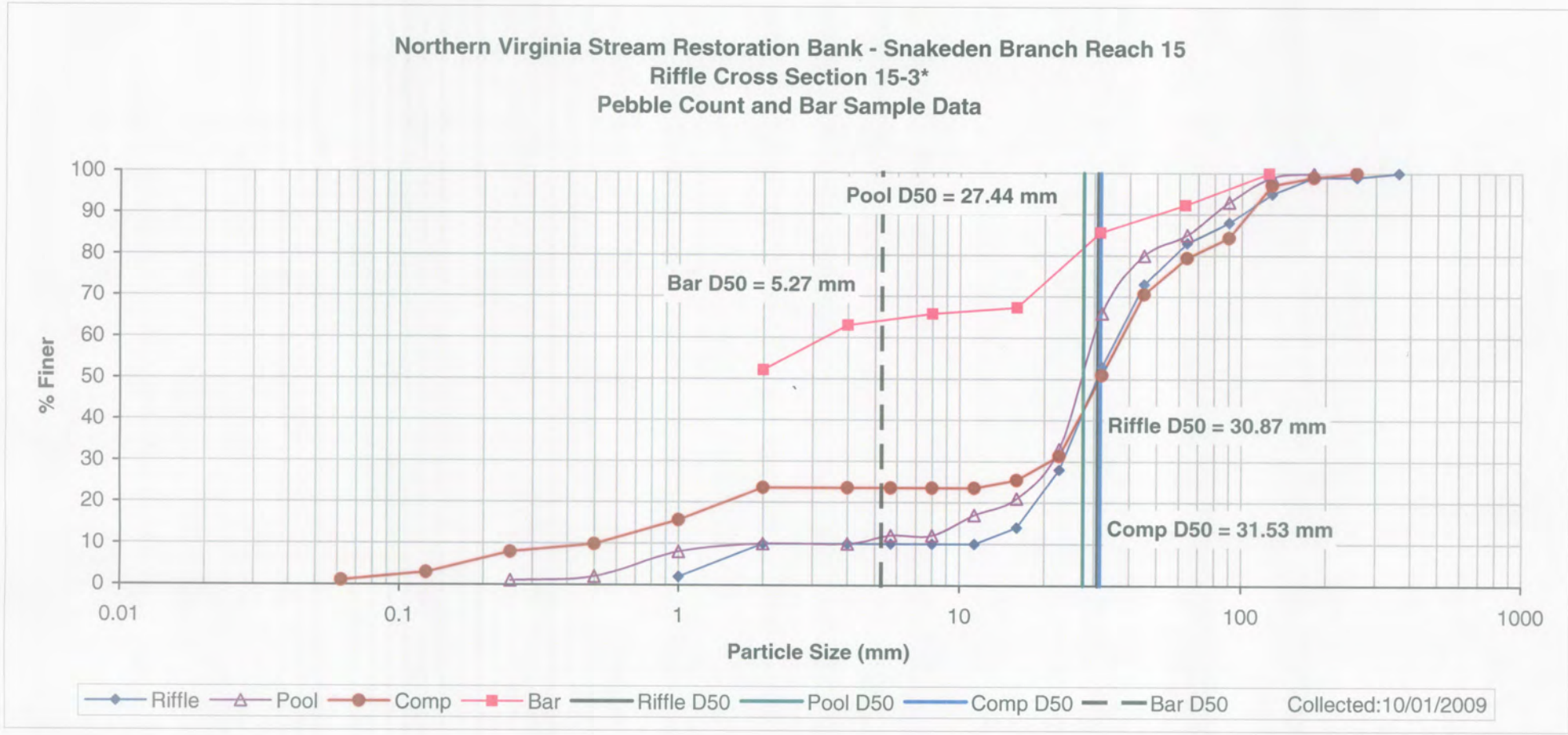

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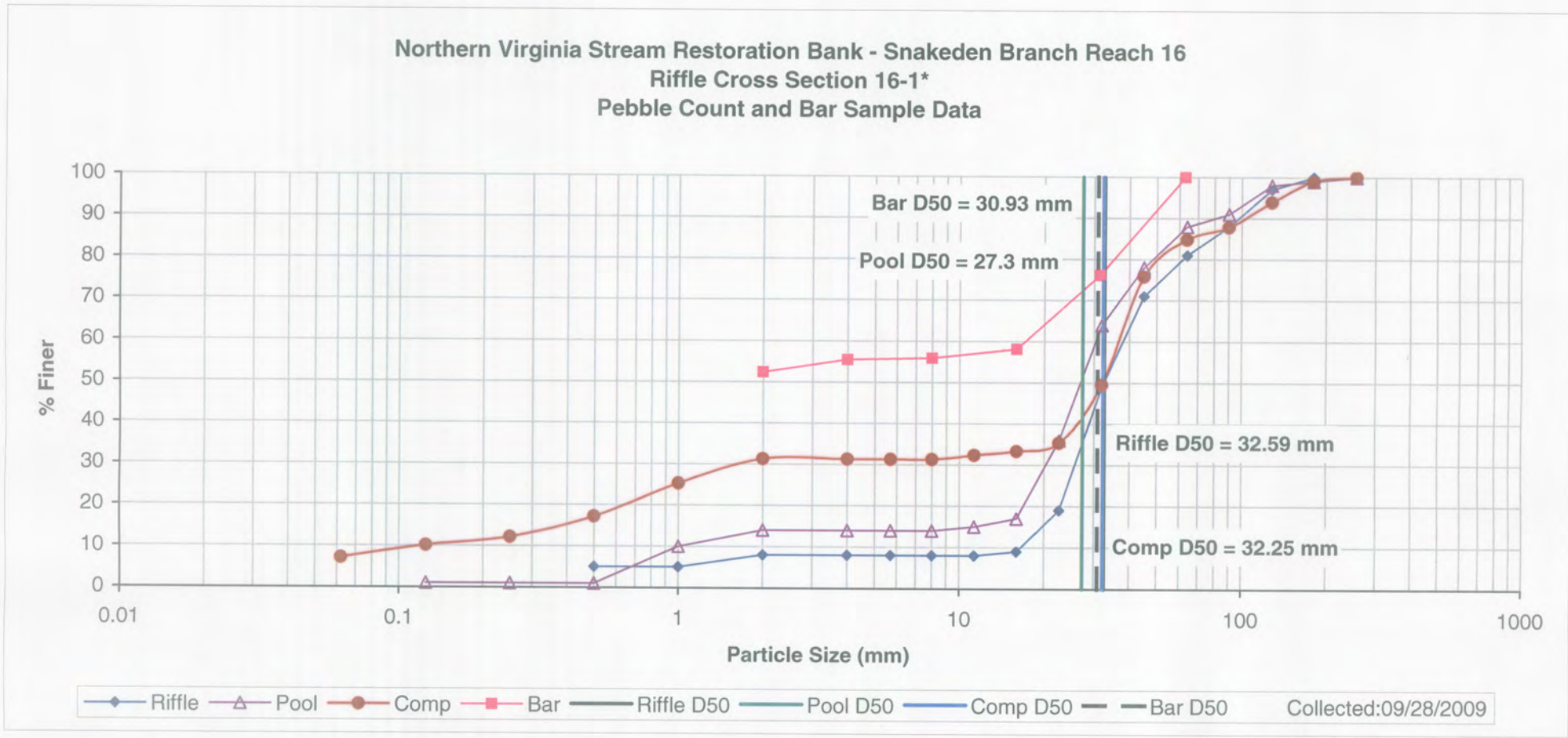

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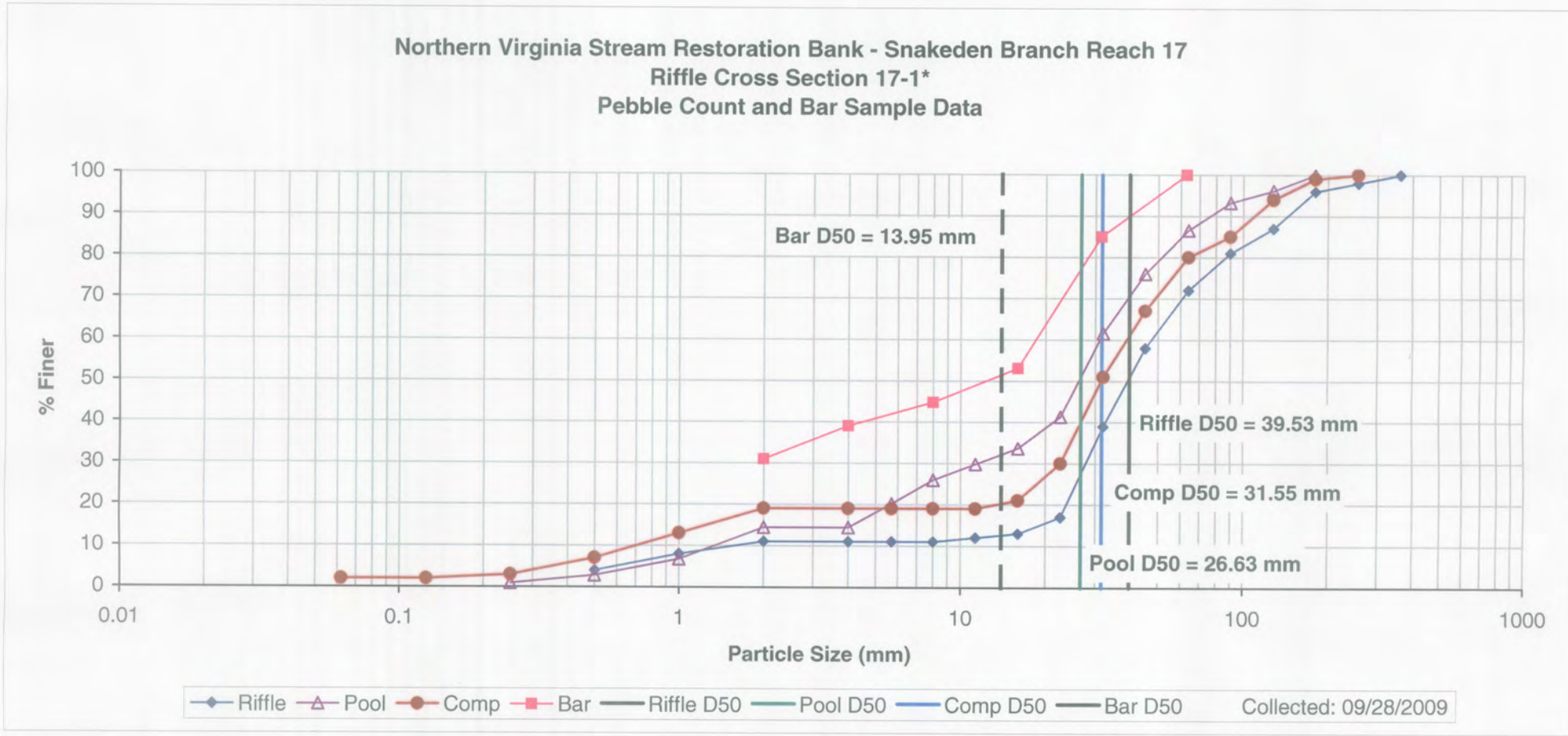

*Note that the riffle pebble count was conducted along the riffle cross section, the pool pebble count and bar sample were conducted along the adjacent pool, and the reach wide pebble count was conducted along an adjacent reach equal to two meander lengths.

Wildlife Snakeden Branch Watershed During 2009	
Scientific Name	**Common Name**
Birds	
Anas platyrhynchos	Mallard
Archilochus colubris	Ruby-throated Hummingbird
Ardea herodias	Great Blue Heron
Baeolophus bicolor	Tufted Titmouse
Butorides virescens	Green Heron
Cardinalis cardinalis	Northern Cardinal
Carduelis tristis	American Goldfinch
Carpodacus mexicanus	House Finch
Colaptes auratus	Northern Flicker
Contopus virens	Eastern Wood Pewee – Heard
Corvus brachyrhynchos	American Crow
Corvus ossifragus	Fish Crow – Heard
Cyanocitta cristata	Blue Jay
Dumetella carolinensis	Gray Catbird
Melanerpes carolinus	Red-bellied Woodpecker
Melospiza melodia	Song Sparrow
Passer domesticus	House Sparrow
Picoides pubescens	Downy Woodpecker
Picoides villosus	Hairy Woodpecker
Poecile carolinensis	Carolina Chickadee
Sitta carolinensis	White-breasted Nuthatch
Thryothorus ludovicianus	Carolina Wren
Troglodytes aedon	House Wren
Turdus migratorius	American Robin
Zenaida macroura	Mourning Dove
Invertebrates	
Dromogomphus spinosus	Black-shouldered Spineyleg
Epitheca princeps	Prince Baskettail
Libellula incesta	Slaty Skimmer
Libellula luctuosa	Widow Skimmer
Pachydiplax longipennis	Blue Dasher
Perithemis tenera	Eastern Amberwing
Plathemis lydia	Common Whitetail
	Unidentified Striped Emerald
Reptiles and Amphibians	
Eurycea bislineata	Northern Two-lined Salamander
Nerodia sipedon	Northern Watersnake
Rana clamitans melanota	Greenfrog
Trachemys scripta elegans	Red-eared Slider
Mammals	
Odocoileus virginianus	White-tailed Deer
Procyon lotor	Raccoon
Sciurus carolinensis	Gray Squirrel
Vulpes lotor	Red Fox

FRIENDS of RESTON

December 16, 2008

Dear Design Review Board Members:

We are writing to express our strong support for the continuation of the stream restoration work performed by the Northern Virginia Stream Restoration Bank/Wetland Studies and Solutions. Friends of Reston for Community Projects is organized to aid Reston Association in performing charitable, scientific and educational purposes. Our mission includes but is not limited to the:

- conservation of natural resources, improvements, buildings, facilities, and the environmental education programs of the Walker Nature Education Center
- maintenance and enhancement of the 1,300 acres of open space, including pathways, bridges, lakes, shorelines, watersheds, streams and stream restoration

As a supporting 501c3 organization, Friends of Reston strives to help Reston Association obtain funding for beneficial projects that fall outside of the RA budget. The severe degradation of Reston's streams has been well documented for over 10 years. The damage caused by stormwater from surrounding neighborhoods, roads, shopping plazas and other areas with impervious surfaces over the last several decades is indisputable. In the stream valleys, we have witnessed the deepening of our stream channels, the undercutting and toppling of mature trees as well as diminished water quality and biodiversity. Costly dredging of Reston's lakes is occurring on an increasingly frequent basis. Further, the integrity of our pathways, bridges, and sewer lines are being undermined.

Friends of Reston was pleased to play a role in bringing together the parties (Reston Association, Wetland Studies & Solutions, and The Peterson Companies) that were necessary to form the partnership which could address, fund and accomplish Reston-wide stream restoration. We have studied background material, attended presentations and walked stretches of pre and post restoration areas. Although the restoration requires initial disturbance, we believe it is consistent with the scope of problem. We are also confident that the long-term benefits of the restoration will outweigh the short-term disturbance. Healthy streams are the foundation of a healthy ecosystem, capable of supporting the flora and fauna which our community so deeply values.

Looking to the future, the terms of the stream restoration project include revegetation with native plants and ten years of oversight by Wetland Studies and Solutions to ensure the success of their engineering and planting. A catastrophic event fund (valued at approximately $5 million) will be in place, and Reston Association and Friends of Reston are receiving linear foot fees (valued at $450,000 and $950,000 respectively).

We are grateful for the support that the DRB gave to the first phase of work in Snakeden Branch and urge you to continue your support in The Glade and future reaches of restoration.

Sincerely,

President, Board of Directors

Friends of Reston for Community Projects, Inc.
1930 Isaac Newton Square, Reston VA 20190-5093
www.reston.org

CHESAPEAKE BAY FOUNDATION
Saving a National Treasure

December 16, 2008

Michael S. Rolband
Wetland Studies and Solutions, Inc.
5300 Wellington Branch Drive, Suite 100
Gainesville, VA 20155

Dear Mr. Rolband:

Thank you for the opportunity you provided the Chesapeake Bay Foundation (CBF) to review the work of Wetland Studies and Solutions, Inc. (WSSI) in Reston, Virginia. CBF has had our Virginia Watershed Restoration Scientist view the stream restoration work done to date on December 16th. We have also reviewed the plans proposed for continued restoration work for Snakeden Branch and the Glade.

Development of the Reston community over a number of decades has resulted in large areas of impervious surfaces, changes in runoff patterns, and consequently, declining stream health. Restoration of streams is an important component of the urban retrofits we must pursue if we are to reduce pollution and improve local and downstream water quality, fish and wildlife habitat, flood control, and the overall health of our waters.

Stream restoration activities often require considerable work within the waterway and floodplain. When working in these areas, it is important to not only ensure the construction activities address erosion and sedimentation controls but also minimize, as much as possible, clearing of vegetation and earthwork. Our review of the work to date and plans for future work indicate that WSSI has paid significant and close attention to these critical parameters of stream restoration. Ultimately, these short-term construction activities will lead to many long-term environmental and public benefits.

CBF supports and appreciates the work of WSSI, in partnership with the Reston Association, to undertake these urban stream restoration projects. While difficult and not inexpensive, restoration projects of this high quality must be pursued throughout the Chesapeake Bay watershed in order to restore the Bay's living resources.

Thank you again for providing CBF with an opportunity to see and review this work. Also, congratulations on receiving the 2008 Fairfax County Land Conservation Award in the Linear Project Category for protection of

downstream properties and natural resources. This award is reflective of the high quality of work you and WSSI are conducting in Reston and are known for.

Please keep in touch as the project moves into additional phases.

Sincerely,

Ann F. Jennings
Virginia Executive Director

cc: Mr. Milton W. Matthews, Chief Executive Officer, Reston Association
Libby Norris, Virginia Watershed Restoration Scientist

Northern Virginia Soil and Water Conservation District

BOARD OF DIRECTORS
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16 DEC 2008

Michael S. Rolband, P.E., P.W.S., P.W.D.
Roy Van Houten, CPESC, CESSWI, CISEC
Wetland Studies and Solutions, Inc.
5300 Wellington Branch Drive, Suite 100
Gainesville, VA 20155

Dear Mike & Roy,

Thank you for asking me to look at the Northern Virginia Stream Restoration Bank – Snakeden Stream Restoration project with Roy this morning. I am very favorably impressed with the work you are doing. In over 50 years in this business, I don't believe I have seen a project of this nature that was more carefully designed and concerned with having the least adverse impact on the environment. From ensuring that the stream bottom and banks were stable, to removing the least amount of woody vegetation necessary, to revegetating and replanting trees, I commend WSSI for an outstanding job. This project must have been one of the reasons WSSI will be honored by Fairfax County and our No. VA SWCD with a 2008 Land Conservation Award. I also had the chance to talk with technical specialists from our No. VA SWCD who were familiar with your work on this project. They too were impressed with your work. Our No. VA SWCD had also been involved with the Reston Association on some earlier restoration work.

Stream restoration & stabilization projects do help restore and enhance the environment. A well-designed and properly constructed stream restoration is well worth the cost and initial loss of vegetation. Introducing the appropriate stream geometry (dimension, pattern and profile) does require removal of some established trees that had been in place before the stream responded to the change in its hydrology (i.e. started widening and incising) due to development in the contributing watershed. The need to introduce the much needed meanders, the need for ingress and egress of construction equipment, the need to 'lay back' portions of the banks of an incised channel are but a few of the reasons why trees & vegetation are removed during restoration. The channel reaches I looked at had degraded 10-12 feet in some places before your restoration work. WSSI's engineers and other technical specialists obviously understand loose boundary hydraulics and stream regime.

It is important for people to know that the cleared areas were replanted with select, diverse vegetation which in a few years will grow to become the basis of a new riparian corridor, stabilizing the banks, providing diverse habitats and inviting more wildlife. Your replanted trees are strategically placed

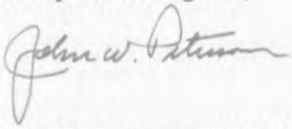
to provide appropriate canopy shading the stream. They are also better positioned to minimize toppling-over during storm events.

Through constant discussion and education, people may become more open-minded and willing to look down the road 10- 15 years from now, and accept that the work is an investment that will pay environmental dividends. Depending on the situation, doing nothing is a recipe for irreparable riparian zone deterioration, disaster. That stream would continue to degrade impacting roads, bridges, sewer systems, etc. The Reston Association made a wise decision in asking WSSI to plan this restoration.

Another good example is our No. VA SWCD Kingstown Stream Restoration Project. Today, it is stable, and it's hard to believe that most of its original vegetation was removed during its restoration.

Thank you again for asking me to look at this work. Seeing it reinforces my belief that WSSI is one of the most respected and competent natural & cultural resource consulting firms in the Mid-Atlantic area.

Best personal regards,



John W. Peterson, PE, CPESC
[Director (Vice Chair – Treasurer) Northern Virginia Soil & Water Conservation District]
President/CEO
KEMPS Consultants, Inc.
Consultants in natural resources public policy, water resources, erosion and sediment control
9304 Lundy Court
Burke, VA 22015-3431 USA

CHESAPEAKE BAY FOUNDATION
Saving a National Treasure

January 13, 2009

Senator Janet D. Howell
Senate of Virginia
General Assembly Building, Room 321
P.O. Box 396
Richmond, VA 23218

Delegate Kenneth R. Plum
Virginia House of Delegates
General Assembly Building, Room 401
P.O. Box 406
Richmond, VA 23218

Dear Senator Howell and Delegate Plum:

Thank you for your letter of January 8th regarding the Reston Association's community stream restoration project.

The Chesapeake Bay Foundation's (CBF) Virginia Watershed Restoration Scientist reviewed the stream restoration work done to date on December 16, 2008 and reviewed the plans proposed for continued restoration of Snakeden Branch and the Glade section. CBF found this restoration project to be of the highest standard in terms of best management practices and utilizing the latest scientific and engineering principles for stream restoration.

Development of the Reston community over a number of decades has resulted in large areas of impervious surface, changes in runoff patterns, and unfortunately, declining stream health. Restoration of streams is an important component of the urban retrofits Virginia must pursue to reduce pollution and improve local and downstream water quality, fish and wildlife habitat, flood control, and the overall health of the Commonwealth's waters.

Stream restoration activities often require considerable work within the waterway and floodplain. When working in these areas, it is important to not only ensure the construction activities address erosion and sedimentation controls but also minimize, as much as possible, clearing of vegetation and earthwork. Our review of the restoration work to date in December and plans for future restoration indicate that the Reston Association's contractor, Wetland Studies and Solutions, Inc. (WSSI), has paid significant and close attention to these critical parameters of stream restoration. Many of WSSI's methodologies and techniques

being utilized on this project are state of the art and are recognized by other stream restoration professionals as the best standards for urban stream restoration.

Thank you for the opportunity to share our comments regarding the Reston Association's stream restoration project. Restoration projects of this high quality must be pursued throughout the Chesapeake Bay watershed in order to restore the Bay's living resources. Once completed, this project will serve as an excellent example for other localities to follow and will lead to many long-term environmental and public benefits.

Please feel free to contact me at (804) 780-1392 if CBF can be of any further assistance.

Sincerely,

Ann F. Jennings
Virginia Executive Director

potomac conservancy

8601 Georgia Avenue • Suite 612 • Silver Spring, MD 20910 • 301.608.1188 • Fax: 301.608.1144

www.potomac.org

Via U.S. Mail and E-mail: RNarch@comcast.net

January 14, 2009

Mr. Richard Newlon, Chairman
Reston Design Review Board
Reston Association
1930 Isaac Newton Square
Reston, VA 20190

Dear Mr. Newlon:

Thank you for the opportunity to comment on the ongoing stream restoration project at Snakeden Branch in Reston, Virginia. Potomac Conservancy is dedicated to improving the health, beauty and enjoyment of the Potomac River watershed. Degraded water quality and stream health—particularly in heavily developed areas like Reston—is a tremendous and worsening problem in the watershed. Stream restoration projects like the ongoing work in Snakeden Branch and the proposed work in The Glade and Colvin Run are an important part of the solution.

Last week, I toured some of the completed restoration areas and as well as portions of these streams that are severely degraded. The streams in Reston are all suffering from "urban stream syndrome." For urban streams like Snakeden Branch, The Glade, and Colvin Run, increases in impervious surfaces and "capture-and-pipe" stormwater management collude to create a stream system that no longer functions correctly. Symptoms include: increased flash floods; elevated concentrations of nutrients and contaminants; altered stream morphology, including incised channels that cut off vegetation from its water source; increased sedimentation from eroded streambanks; and reduced ecological diversity, with an influx of more tolerant species to counter the loss of more sensitive species.

Restoring degraded streams like Snakeden Branch, The Glade, and Colvin Run, can contribute significantly to the health of the Potomac River and the Bay. Recent research estimates that "reconnecting" the streambanks to the stream using stream restoration techniques can double nitrogen removal rates by microbes and reduce nitrogen levels in groundwater by 40%, thereby lowering nitrogen levels in the stream (*Science Daily,* May 6, 2008). Nitrogen is one of the major causes of "dead zones" in the Chesapeake Bay. Research also indicates that a significant portion of the sediment pollution in the Bay comes from in-stream sedimentation caused by eroded streambanks. Preventing further streambank erosion through restoration efforts therefore aids in the reduction of sediment pollution in the Potomac and the Bay. Other benefits of stream restorations include creating sustainable aquatic communities and streamside vegetation.

While the long term benefits of stream restoration projects are a critical component of improving our overall watershed health, we recognize that the near term impacts of these projects are less desirable. No one wants to see trees removed or bulldozers working in floodplains. Unfortunately, these impacts are a necessary and temporary setback. We believe the intended long-term result of this stream restoration project—more resilient streams that supports improved water quality, vibrant aquatic life, and healthy streamside trees—is worth this short term sacrifice.

Thank you again for the opportunity to comment on this important issue, and please don't hesitate to contact us if you have any questions.

Best regards,

Hedrick Belin
President

Cc: Michael S. Rolband – Via E-mail: mrolband@wetlandstudies.com

Northern Virginia Chapter, Trout Unlimited
~~PO Box 81~~ P.O. Box 12182
~~Vienna, Virginia 22183-0081~~
Burke, VA. 22009

January 15, 2009

Reston Association Design Review Board
c/o Nicki Foremsky
Watershed Manager
Reston Association
12250 Sunset Hills Road
Reston, VA 20190
Nicki@Reston.org

Dear Board Members:

The Northern Virginia Chapter of Trout Unlimited has examined ongoing work on Snake Den Branch and planned work on The Glade stream. In our opinion, based on several decades of work on regional stream remediation, the degradation caused by storm water runoff has severely impaired the habitat for fish in The Glade.

On The Glade, the intermittent nature of flows (storm surges followed by dewatering as a result of channelization) strands fish. Macroinvertebrates, necessary for a healthy stream to provide food for fish are smothered by silt. Overheating during low water periods depletes dissolved oxygen and stresses fish.

The nearly completed Snake Den Branch remediation is a model of a healthy stream with alternating plunge pools, runs and riffles, as well as heavy riparian plantings. It should provide excellent spawning habitat for bass and other fish moving out of Lake Audubon.

We understand some Restonians are concerned about the loss of trees. However, many of these trees are undercut by the rush of water from storms, increasing erosion and the likelihood these trees will succumb. The origin of the storm water is runoff from the area's lawns, roofs, streets and parking areas. It does not appear that this runoff will be any less in the future.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
TDD (804) 698-4021
www.deq.virginia.gov

L. Preston Bryant, Jr.
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

January 20, 2009

The Honorable Janet D. Howell
Senate of Virginia
P.O. Box 2608
Reston, Virginia 20195

The Honorable Kenneth R. Plum
Member, Virginia House of Delegates
2073 Cobblestone Lane
Reston, Virginia 20191

Dear Senator Howell and Mr. Plum:

Thank you for your letter to Joe Maroon and me with your questions regarding the street restoration project being undertaken by the Reston Association.

This project, which is known as the Northern Virginia Stream Restoration Bank (or "Reston Stream Bank"), is actually an approved stream mitigation bank under which the banker provides compensation in advance of permitted impacts. Applicants for state and federal wetland/stream permits can purchase credits from these approved mitigation banks when the permitting agencies agree that the approved bank provides ecologically acceptable compensation for the proposed impact. Proposals for such banks are reviewed by an Interagency Review Team (IRT), which is chaired by the U.S. Army Corps of Engineers-Norfolk District. The Department of Environmental Quality serves as a co-signatory to the banking agreements, and the U.S. EPA - Region III, the U.S. Fish & Wildlife Service-Virginia Field Office, and often the Virginia Department of Game and Inland Fisheries participate.

You asked if the project is being conducted within appropriate federal and state laws and regulations, and with the necessary permits; the answer is yes. The Reston Stream Bank, sponsored by a private group of developers and consultants who obtained easements from the Reston Association and private property owners, was approved through the review team process under the 1995 federal mitigation bank guidelines (these guidelines have since been

replaced by the federal mitigation rule in 2008). The guidelines required a detailed process for approval that included a prospectus from the bank sponsor, field reviews by the participating agencies, a public notice by the Corps, preparation of a mitigation banking instrument, review of conceptual plans for the project, and a review of detailed final plans for each phase of the project. The MBI is an agreement between the parties that describes in detail the legal, financial and technical components of the bank; how the bank will be established, constructed and operated; and how the bank will be maintained and monitored in the future to determine its success. The sponsor of the Reston Stream Bank followed all of the state and federal requirements for the approval process. I also understand that the bank sponsors have obtained all the necessary permits for construction as each phase is undertaken and are complying with these permits.

You also asked if the project is following best management practices and the latest scientific and engineering principles. Again, the answer is yes. The purpose of the Reston Stream Bank is to provide mitigation credits by correcting stream instability and stream bank erosion, and reducing sedimentation in the middle Potomac River watershed. First, the sponsor identified the causes of these problems, and then developed a plan to correct them, using the most advanced stream restoration techniques available, as confirmed by experienced practitioners, environmental groups and state and federal agency review. Although there are different ways to correct erosion and sedimentation problems depending on their source and location, the agencies believe that the sponsor has taken the appropriate actions that will correct these problems and result in improved habitat and water quality. The bank sponsor has taken particular care to minimize temporary construction impacts, such as using smaller equipment and carefully field surveying large trees and avoiding their removal for construction access when at all possible. In addition, it is my understanding that they are employing effective best management practices to address construction storm water and have received favorable inspection reports from the Department of Conservation and Recreation, which is monitoring the project along with DEQ.

Finally, you ask if there are other methodologies and techniques available that would accomplish the same purpose and how they rank compared to the chosen approach. Several engineering methods could be employed to correct the erosion and sedimentation problem within the stream network of this area. For instance, the surrounding area could be retrofitted with additional storm water management controls, such as a series of storm water ponds throughout the watershed, to reduce runoff. The stream banks could be armored with riprap to decrease further erosion. However, such methods, often used in the past, have been found to be ineffective and have greater environmental impacts. We believe that the sponsor has chosen a method that is practical for the urban environment and will not only reduce the existing erosion and sedimentation problems but will also provide long-term stability to the stream network. We agree that projects of this type are not aesthetically pleasing during construction and for the first few years after

construction, but they will, over time, solve water quality problems, become visually pleasing as the trees and vegetation return to the stream banks, and provide improved habitat.

In summary, we believe that the sponsor of the Reston Stream Bank has complied with all appropriate requirements, has used the most innovative and effective options to improve water quality and reduce erosion and sedimentation problems in the watershed, and has used appropriate design and construction methods to minimize further environmental impacts while achieving the project purpose. Thank you for your inquiry and please feel free to contact DEQ's Water Quality Division Director, Ellen Gilinsky, at 804 698-4375, or egilinsky@deq.virginia.gov, or me with further questions.

Sincerely,

David K. Paylor

David K. Paylor

c: Mr. Joseph H. Maroon
Ms. Angie Jenkins - DEQ
Ellen Gilinsky, Ph.D. - DEQ

DKP:dlm

L. Preston Bryant, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION
203 Governor Street, Suite 302
Richmond, Virginia 23219-2010
(804) 786-6124 Fax: (804) 786-6141

January 21, 2009

The Honorable Janet D. Howell
Member, Senate of Virginia
Post Office Box 2608
Reston, Virginia 20195

The Honorable Kenneth R. Plum
Member, Virginia House of Delegates
2073 Cobblestone Lane
Reston, Virginia 20191

Dear Senator Howell and Delegate Plum:

Thank you for your letter of January 8, 2009, concerning the stream restoration project in Reston. In general, streams located in the Northern Virginia region are in poor condition due to increased stormwater flows from local land development. The increased flow causes erosion of streambeds and banks. Not only does this erosion damage the streams, it also results in sediment that causes water quality problems downstream including adverse impacts to the Chesapeake Bay. Restoration projects that stabilize the streams are often undertaken in a way that limits the amount of future streambank erosion.

In the specific case you inquired about, the Northern Virginia Stream Restorations, LC, which is managed by Wetlands Studies and Solutions, Inc., is conducting the project on behalf of the Reston Association. The work is being funded by the Northern Virginia Stream Restoration Bank, with the cooperation of the Reston Association. As specified in Section *62.1-44.15.23,* of the *Code of Virginia*, the stream mitigation bank creates a mechanism whereby credits can be purchased to offset impacts to other steams in the area.

This project has met all of the requirements of the Department of Conservation and Recreation (DCR). As allowed in Section *10.1-563.E,* of the *Code of Virginia*, Wetlands Studies and Solutions, Inc. has filed general erosion and sediment control specifications with DCR on an annual basis in lieu

of specific erosion and sediment control plans for the project. As part of this arrangement, DCR conducts site inspections. Recent site inspections results indicate that the erosion and sediment controls are being constructed and maintained as specified in the annual specifications.

DCR has issued a Virginia Stormwater Management Permit for the project. This permit requires that the site contractor manage the stormwater runoff pollution in a manner that limits adverse impact to surface waters.

I appreciate you contacting DCR regarding this issue and hope this information is helpful. If you have additional questions, please feel free to contact me.

Sincerely,

Joseph H. Maroon
Director

c: Ann F. Jennings, Virginia Executive Director, Chesapeake Bay Foundation
David K. Paylor, Director, Department of Environmental Quality
Kelly Vanover, Regional Manager, DCR Warrenton Regional Office

County of Fairfax, Virginia

MEMORANDUM

DATE: FEB 17 2009

TO: Board of Supervisors

FROM: Anthony H. Griffin
County Executive

SUBJECT: Stream Restoration Activities in Reston's Glade and Snakeden Branches, Board Matter 4c, January 12, 2009

As requested by the Board of Supervisors (Board) on January 12, 2009, staff has re-evaluated the construction plans for the Glade Stream Restoration Project with an emphasis on preserving, to the extent possible, the existing vegetation in and around the construction site. Since the completion of the Snakeden Branch restoration activities, there has been a heightened awareness among the local citizens with regard to the removal of existing mature trees within the stream valley corridor. While it's generally understood that the restoration project will necessarily cause some trees to be lost, the citizens have expressed concerns that more could be done to limit the magnitude of the disturbance within the stream valley

To date, a total of 23 reaches of the stream restoration project have been permitted by the County. The Department of Public Works and Environmental Services (DPWES) has worked in partnership with the developer, Wetland Studies and Solutions Inc. (WSSI) and the Reston Association (RA) to assure that every effort is being made to conserve as many trees as possible. As a part of the technical review of the stream restoration plans, staff from the Department of Land Development Services is looking closely at the areas that are to be cleared with a focus on limiting the loss of existing vegetation wherever possible.

As part of the design of the plans, the developer is taking advantage of areas within the stream valley that have already been cleared of trees, like existing trails and public utility easements, in order for the construction activities to have as little impact as possible. Where it has been necessary to remove existing vegetation, every effort is being made to preserve as many trees as is practical through a transplanting program. Smaller caliper trees up to 3" in diameter are being removed with a tree spade and relocated to areas of the stream valley that are outside of the limits of construction. To date, over 200 trees have been relocated through this program.

With much of the work on Snakeden Branch having recently been completed, attention has now shifted to The Glade where the first three reaches to be restored have been approved both by the County as well as the Reston Design Review Board. With far greater public interest having been focused on the work to be done on The Glade, the final design of these three

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reaches has, in part, been a product of much public outreach within the community. Through a series of public plan review sessions and several "Stream Walks" where the local citizens have been invited to walk these first reaches with representatives from WSSI and RA, the citizens concerns and input have factored into the final design of the project. The developer is now preparing to move forward with work on The Glade and, working with the County's Urban Forestry and Site Review staff, have completed a visual inspection of the specific areas impacted by the work and identified those areas through the installation of protective construction fencing. As a result of these field inspections, staff is now comfortable that the developer's design has made the best use of existing cleared areas within The Glade and preserved, where practical, as much of the existing vegetation as possible.

Staff in DPWES will be working closely with the developer and the Reston Association to assure that the plans that are ultimately permitted for construction represent the best design possible with regard to tree preservation.

cc: Robert A. Stalzer, Deputy County Executive
Jimmie D. Jenkins, Director, Department of Public Works and Environmental Services (DPWES)
Howard S. Guba, Deputy Director, DPWES
James W. Patteson, Director, Land Development Services, DPWES

VirginiaTech
College of Agriculture and Life Sciences
College of Engineering

Biological Systems Engineering Department
200 Seitz Hall (0303)
Blacksburg, Virginia 24061
540/231-6615 Fax: 540/231-3199

15 August 2009

Michael S. Rolband
Wetland Studies and Solutions, Inc.
5300 Wellington Branch Drive, Suite 100
Gainesville, VA 20155

Dear Mike:

I am writing regarding my professional impressions of the Snakeden Branch stream restoration project. My feedback is based on my review of the design drawings, as well as site tours prior to and during restoration construction (4 May 2007 and 17 July 2009).

My initial impressions of Snakeden Branch prior to the stream restoration was that it was highly impacted by upstream urbanization. Increases in stormwater runoff volume, rate, and frequency had obviously caused extensive channel downcutting to bedrock. This channel downcutting likely lowered the local groundwater table, impacting riparian habitat. Since the channel had reached a more resistant bedrock layer, it is likely the channel would have widened in the future, despite the mature riparian forest adjacent to the channel. This would have resulted in undercutting and toppling of these trees and continued channel erosion. This sequence of channel degradation is commonly observed in urbanized areas, due to the increase in paved areas and the associated stormwater management systems. While stream channels will eventually adjust to such dramatic changes in watershed hydrology, the process typically takes decades to centuries to complete.

The underlying goals of stream restoration are to balance sediment and energy within the channel, considering constraints such as buildings and transportation infrastructure. In urban stream systems, these considerations require providing a channel bed that will not erode and maximizing energy dissipation while utilizing as many natural materials as possible.

While I have not reviewed your design calculations in detail, I have developed an understanding of your design approach based on the construction drawings and our conversations regarding the project. Unlike many stream restoration designs, which would have consisted primarily of reconstructing the channel at the degraded streambed elevation, your design approach was to construct a "threshold" channel at the historic streambed elevation by rebuilding the channel with a gravel mixture. I believe this approach will provide the most ecological benefits to the stream for multiple reasons. Given that the watershed hydrology is permanently altered and that the stream cannot migrate extensively without jeopardizing urban infrastructure (bridges,

roads, etc.), a threshold channel bed that will not erode is the only practical design option. While the channel bed elevations will likely change little, the gravel mixture placed in the channel bed will allow better hyporheic exchange between local groundwater and the stream. This exchange will encourage the development of a healthy biological community within the stream and will improve water quality. Additionally, by raising the stream channel, the water table elevations in the adjacent floodplain will also increase, enhancing wetlands and further improving water quality. My observations on our site visit in July confirm that this increase in groundwater elevations is occurring. I was particularly impressed during our site visit that natural stream processes were already occurring. I observed the development of stable vertical and undercut banks, which provide wonderful habitat. I also observed extensive sediment sorting and alternating bar development. By providing the stream a base sediment layer with a range of sediment sizes, you have given the stream the "blocks" to rebuild itself.

Typical methods for dissipating hydraulic energy are to increase boundary roughness (dense vegetation), increase the channel wetted perimeter by providing the stream ready access to the floodplain, decrease channels slope by increasing channel meandering, and utilize step-pool structures to safely reduce the streambed elevation. Your restoration design utilizes all of these approaches. I was impressed by the amount of vegetation growth that had occurred during the past two years. This dense vegetation will greatly increase channel stability and will enhance aquatic habitat. While my personal preference is to minimize the number of "hard" structures in stream restoration designs, given the steep valley slopes, the high hydraulic energy of the stream system, and the desire to minimize the removal of mature riparian trees, I believe your extensive use of step-pool structures is appropriate. I am hopeful this project will provide the stream engineering community with much needed design guidance for these types of structures. As we have discussed, my colleagues and I at Virginia Tech are currently seeking funding from the National Science Foundation to develop a full scale stream laboratory to improve our theoretical understanding of stream structures and stream restoration techniques. Unfortunately, stream restoration science has not yet been able to keep pace with stream restoration practice.

In conclusion, based on my observations of the construction drawings and the site itself, I believe your design techniques are not only sound, but cutting-edge. I intend to use your design as an example in the graduate-level stream restoration design course Dr. Hession and I will teach next spring semester. Good luck with the rest of the project.

Sincerely,

Tess Wynn, PhD
Assistant Professor

Audubon Society of Northern Virginia
4022 Hummer Road, Annandale, VA 22003
Phone: (703) 256-6895 • Fax: (703) 256-2060
www.audubonva.org email: info@audubonva.org

October 27, 2009

Milton W. Matthews
CEO, Reston Association
1930 Isaac Newton Square
Reston, VA 20190-5093

Dear Mr. Matthews,

The Audubon Society of Northern Virginia (ASNV) is supportive of the Reston Association's Stream Restoration project and wishes to thank the association's staff, Ms. Claudia Thompson-Deahl and Ms. Nicki Foremsky for the time spent over several visits, at different times of the year, in explaining to ASNV representatives the rationale, methodology, and long-range planning involved in the project.

Ms. Thompson-Deahl and her associates also arranged for on-site discussions with engineers from Wetland Studies and Solutions, Inc., the principal contractor, who outlined the environmental safeguards that are a part of the overall engineering plan. ASNV members have also discussed the scope of the project on separate occasions with Mike Rolband and Mark Headly, president and executive vice president respectively of Wetland Studies and Solutions, who were able to elaborate on and add detail to the environmental breadth of the project.

Reston is a unique urban environment and home to many species of birds and other wildlife and while there will inevitably be some disruption of wildlife habitat in this type of project, ASNV is quite satisfied that Ms. Thompson-Deahl, and the staff of Wetland Studies and Solutions, have taken every step possible to ensure as minimal a disruption as possible particularly as that pertains to birds during the breeding season. From our point of view, the "before and after" visits have assured us beyond doubt that this project will in fact enhance the habitat for birds and other wildlife and that it is a model of the environmentally sound way to restore streams to their natural setting.

Pollution of streams found throughout Fairfax County is a problem of increasing environmental concern and county officials engaged in TMDL studies of the Accotink and other watersheds in the county would do well to study the successes found in the Reston Stream Restoration Project.

Sincerely,

Bruce Johnson
President

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH

The Nature Conservancy in Virginia
530 E. Main Street, Suite 800
Richmond, VA 23219

tel [804] 644.5800
fax [804] 644.1685
nature.org

September 29, 2009

Mike Rolband
Wetland Studies and Solutions, Inc.
5300 Wellington Branch Drive, Suite 100
Gainesville, VA 20155

Dear Mike,

Thank you for the opportunity to discuss the ongoing stream restoration project you are undertaking in Reston, Virginia. I am pleased that I had an opportunity to visit and see the improvements your project is making at Snakeden Branch. I am impressed with the magnitude and scale of this ambitious restoration project, and the before and after results you have demonstrated. This work has already provided many ecological benefits, not only for the Reston community and the Potomac River, but the Chesapeake Bay as well.

The Nature Conservancy has long been committed to our mission of preserving plants, animals, and natural communities through protection of the lands and waters needed to ensure their survival. Your Northern Virginia Stream Restoration Bank addresses both the protection *and* restoration of land and water.

The Conservancy is dedicated to protecting and improving the ecologically unique Chesapeake Bay watershed. We have been successful in our efforts through large scale land protection, aquatic resource restoration, and partnerships. Some recently publicized efforts include the purchase of over 4,000 acres along Dragon Run, partnership with state and county to acquire nearly 3,000 acres at Crow's Nest, and recent efforts with a private landowner to restore streams and wetlands along Bolling Branch.

The ecological stressors and threats associated with urban environments are multiplied in stream systems. Development greatly impacts the health of these systems both on land and in the stream itself. Wooded buffers are critical to maintaining a healthy stream system.

The stream restoration efforts you are undertaking at Reston are based on an understanding of the science and engineering that create stable stream systems within urban environments. Your restoration will restore natural flow to the stream and decrease the threats of flood. Water quality will be improved on many fronts, including decreased erosion and sediment load within the watershed, improved dissolved oxygen, and stable, lower water temperatures. The improvements to both water quality and aquatic habitat will be lasting and far reaching, affecting not only the immediate stream reaches you work on, but for miles downstream.

Efforts such as the stream restoration at Reston are critical if we are to improve the health of the Bay. Your project is an amazing example of public-private partnership that benefits the community and the environment. I commend you on your actions and support you in your continued efforts.

Best Regards,

Michael L. Lipford

Michael L. Lipford
Virginia Executive Director

We also understand that exposed and leaking sewer pipes are near the stream. These present an obvious health hazard both to fish and humans. We hope that Reston Association will look to the needs of future generations and do its share to protect your downstream neighbors, including those bordering the Potomac and the Chesapeake.

Sincerely,

Jay Lovering
President
Northern Virginia Chapter
Trout Unlimited

Wetland
Studies and Solutions, Inc.

May 20, 2008

VIA Email: ron.h.stouffer@usace.army.mil

Mr. Ron Stouffer, Jr.
U.S. Army Corps of Engineers
Northern VA Field Office
18139 Triangle Shopping Plaza
Suite 213
Dumfries, VA 22026

Re: Northern Virginia Stream Restoration Bank
Monitoring Report for First 2-yr Storm Event
WSSI #20003

Dear Mr. Stouffer:

Pursuant to Section VI.B.(j) of the Northern Virginia Stream Restoration Bank, this letter serves as the monitoring report to document the performance of the completed stream restoration reaches following the rain event of May 11-12, 2008. The region experienced well over the 3.2" threshold for a 2-yr storm (4.5" at Dulles Airport) and bankfull levels were reached in the restored streams (Reaches 1, 2, and 3).

The visual inspection was performed on the 12th during the event and also on the 13th after water levels had dropped. The channels held up very well, with only 1 area cited for remediation. Details are provided below:

Reach 1

The affected area was in a riffle in Reach 1 (see attached sketch) where the reinforced bed material had been improperly installed, enabling a small head-cut to develop. When this section of the reach was being constructed, there was a field change performed to lower the channel (to correct for some errors in the aerial topography). In the process, the proper amount of reinforced bed material had not been replaced, leaving this section vulnerable. This had been noted in previous inspections conducted after other rain events (events that resulted in bankfull conditions, but did not meet the 2-yr storm criteria). The decision was made to replace the proper amount of reinforced bed material, which was completed on May 16th. Photos of both the pre and post remediation conditions are attached.

Given the amount of rainfall that has been received over the past 6 weeks since the channels have been completed, there has been very little impact on the reinforced bed, structures, and vegetation that has been planted. Although admittedly very early, we are very pleased with the performance of the restored reaches and do not anticipate significant problems in the future.

Please feel free to contact me (703-679-5651 or *fgraziano@wetlandstudies.com*) if you have any questions or concerns regarding this first 2-yr event monitoring report. Thank you.

Sincerely,
WETLAND STUDIES AND SOLUTIONS, INC.

Frank R. Graziano, P.E.
Senior Engineer

Enclosures

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NVSRB PHOTOGRAPHS – REACH 1
FIRST 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

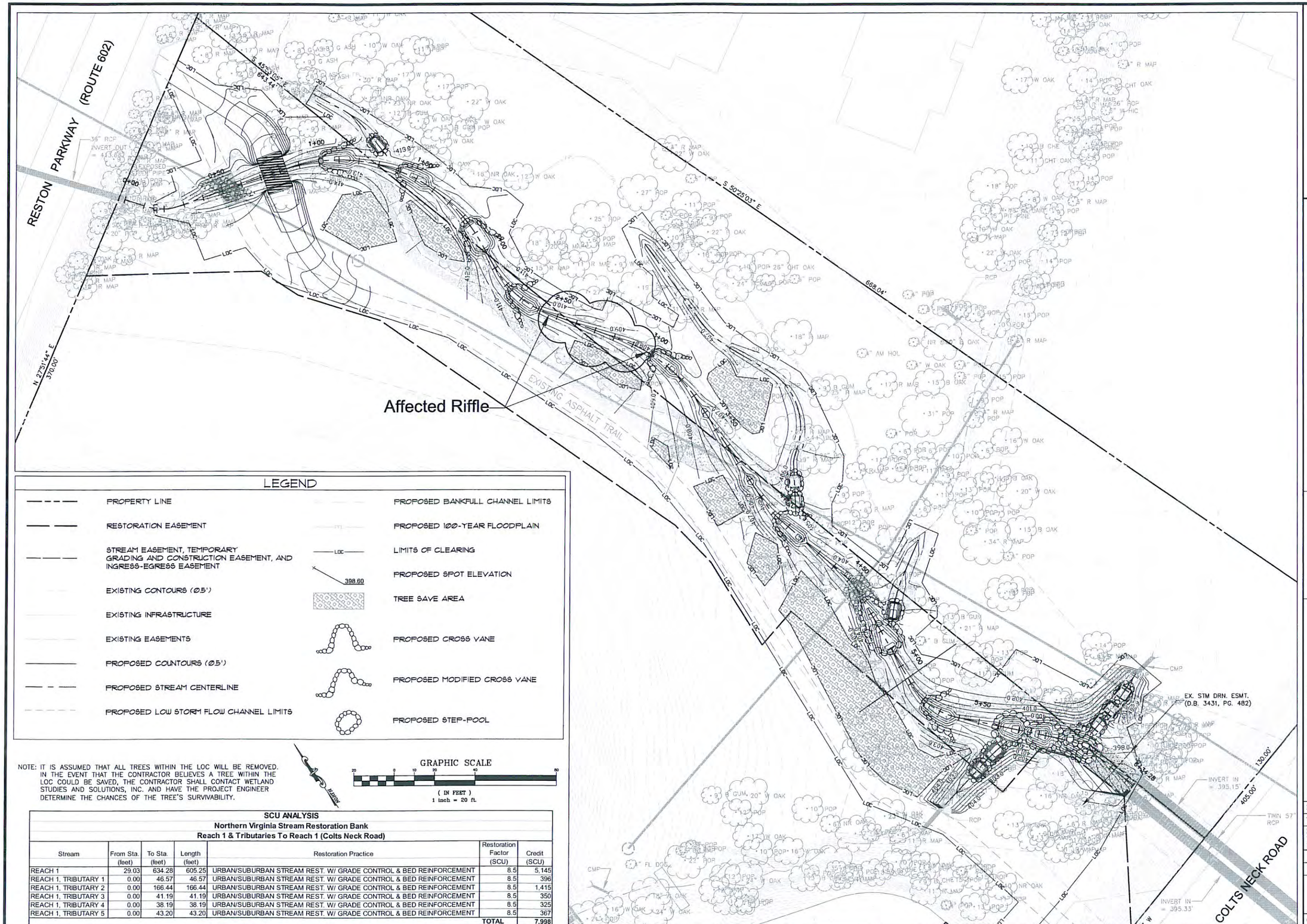
Photo 1 – Looking upstream at affected riffle prior to repair. Small head-cut is visible toward the top of the riffle.

Photo 2 – Looking downstream at affected riffle prior to repair, just above small head-cut.

NVSRB PHOTOGRAPHS – REACH 1
FIRST 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 3 – Looking upstream at affected riffle after repair and additional rain event of approximately 0.75". Bed remained stable.

Photo 4 – Looking upstream at previous head-cut after repair and additional rain event of approximately 0.75". Bed remained stable.



LEGEND

- PROPERTY LINE
- RESTORATION EASEMENT
- STREAM EASEMENT, TEMPORARY GRADING AND CONSTRUCTION EASEMENT, AND INGRESS-EGRESS EASEMENT
- EXISTING CONTOURS (Ø.5')
- EXISTING INFRASTRUCTURE
- EXISTING EASEMENTS
- PROPOSED COUNTOURS (Ø.5')
- PROPOSED STREAM CENTERLINE
- PROPOSED LOW STORM FLOW CHANNEL LIMITS
- PROPOSED BANKFULL CHANNEL LIMITS
- PROPOSED 100-YEAR FLOODPLAIN
- LOC — LIMITS OF CLEARING
- 398.60 — PROPOSED SPOT ELEVATION
- TREE SAVE AREA
- PROPOSED CROSS VANE
- PROPOSED MODIFIED CROSS VANE
- PROPOSED STEP-POOL

NOTE: IT IS ASSUMED THAT ALL TREES WITHIN THE LOC WILL BE REMOVED. IN THE EVENT THAT THE CONTRACTOR BELIEVES A TREE WITHIN THE LOC COULD BE SAVED, THE CONTRACTOR SHALL CONTACT WETLAND STUDIES AND SOLUTIONS, INC. AND HAVE THE PROJECT ENGINEER DETERMINE THE CHANCES OF THE TREE'S SURVIVABILITY.

NORTH

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

SCU ANALYSIS
Northern Virginia Stream Restoration Bank
Reach 1 & Tributaries To Reach 1 (Colts Neck Road)

Stream	From Sta. (feet)	To Sta. (feet)	Length (feet)	Restoration Practice	Restoration Factor (SCU)	Credit (SCU)
REACH 1	29.03	634.28	605.25	URBAN/SUBURBAN STREAM REST. W/ GRADE CONTROL & BED REINFORCEMENT	8.5	5,145
REACH 1, TRIBUTARY 1	0.00	46.57	46.57	URBAN/SUBURBAN STREAM REST. W/ GRADE CONTROL & BED REINFORCEMENT	8.5	396
REACH 1, TRIBUTARY 2	0.00	166.44	166.44	URBAN/SUBURBAN STREAM REST. W/ GRADE CONTROL & BED REINFORCEMENT	8.5	1,415
REACH 1, TRIBUTARY 3	0.00	41.19	41.19	URBAN/SUBURBAN STREAM REST. W/ GRADE CONTROL & BED REINFORCEMENT	8.5	350
REACH 1, TRIBUTARY 4	0.00	38.19	38.19	URBAN/SUBURBAN STREAM REST. W/ GRADE CONTROL & BED REINFORCEMENT	8.5	325
REACH 1, TRIBUTARY 5	0.00	43.20	43.20	URBAN/SUBURBAN STREAM REST. W/ GRADE CONTROL & BED REINFORCEMENT	8.5	367
					TOTAL	7,998

Wetland Studies and Solutions, Inc.
5300 Wellington Branch Drive • Suite 100
Gainesville, Virginia 20155
Phone: 703-679-5600 • Fax: 703-679-5601
www.wetlandstudies.com

Northern Virginia Stream Restoration Bank
Snakeden Branch - Reach 1 (Colts Neck Road)
Fairfax County, Virginia

Grading Plan

COMMONWEALTH OF VIRGINIA
PROFESSIONAL ENGINEER
DAWN R. GRAZIANO
Lic. No.032099

REVISIONS

No.	Date	Description	Rev. By	App. By

SCALE: 1" = 20'

DATE: MAY 2007

Horizontal Datum: NAD 83

Vertical Datum: NGVD 29

Boundary and Topo Source: WSSI, Air Survey Corp., & Fairfax County Digital Data

Design	Draft	Approved
SRP	SRP	FRG

Sheet # 12 of 35

Computer File Name:
L:\20003.01\cadd\04-ENGR\12_Grading.dwg

Wetland
Studies and Solutions, Inc.

September 11, 2008

VIA Email: ron.h.stouffer@usace.army.mil

Mr. Ron Stouffer, Jr.
U.S. Army Corps of Engineers
Northern VA Field Office
18139 Triangle Shopping Plaza
Suite 213
Dumfries, VA 22026

Re: Northern Virginia Stream Restoration Bank
Monitoring Report for the Second 2-yr Storm Event (Tropical Storm Hannah)
WSSI #20003

Dear Mr. Stouffer:

Pursuant to Section VI.B.(j) of the Northern Virginia Stream Restoration Bank, this letter serves as the monitoring report to document the performance of the completed stream restoration reaches following the rain event of September 6, 2008. Tropical Storm Hannah dumped 6.2 inches over a nine hour period in Reston (a 100-yr, 12-hr event) – other parts of Fairfax County received over 10 inches. Needless to say, this resulted in a bankfull event!

The visual inspection was performed during the storm and also on each of the following 2 days (Sunday and Monday). Even with the extended duration of this event, the restored channels held up extremely well and require no remediation. Photos of the storm flows and aftermath are attached.

Please feel free to contact me (703-679-5651 or *fgraziano@wetlandstudies.com*) if you have any questions or concerns regarding this second 2-yr event monitoring report. Thank you.

Sincerely,
WETLAND STUDIES AND SOLUTIONS, INC.

Frank R. Graziano, P.E.
Senior Engineer

Enclosures

I:\20000s\20003\admin\04-engr\monitoring for mbi\091108 storm #2 monitoring.doc

NVSRB PHOTOGRAPHS – TROPICAL STORM HANNAH
SECOND 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 1 – Lower end of a recently completed section.

Photo 2 – Looking downstream in Reach 3 at a structure.

NVSRB PHOTOGRAPHS – TROPICAL STORM HANNAH
FIRST 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 3 – Reach 2 double cross-vane.

Photo 4 – Looking upstream in Reach 1.

NVSRB PHOTOGRAPHS – TROPICAL STORM HANNAH
FIRST 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 5 – Reach 3. High Water mark is evident.

Photo 6 – Reach 3 cross-vane.

NVSRB PHOTOGRAPHS – TROPICAL STORM HANNAH
FIRST 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 7 – Reach 3 riffle.

Photo 8 – Reach 1 cross-vane.

Wetland
Studies and Solutions, Inc.

June 12, 2009

VIA Email: ron.h.stouffer@usace.army.mil

Mr. Ron Stouffer, Jr.
U.S. Army Corps of Engineers
Northern VA Field Office
18139 Triangle Shopping Plaza
Suite 213
Dumfries, VA 22026

Re: Northern Virginia Stream Restoration Bank
Monitoring Report for the Third 2-yr Storm Event
WSSI #20003

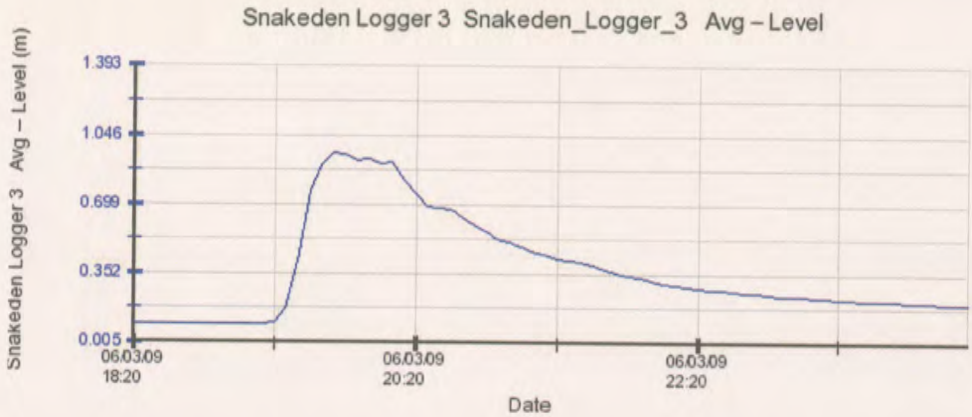
Dear Mr. Stouffer:

Pursuant to Section VI.B.(j) of the Northern Virginia Stream Restoration Bank, this letter serves as the monitoring report to document the performance of the completed stream restoration reaches following several major rain events over the past couple of weeks (graphs represent flow depths in Reach 9 – bankfull depth equals 3 ft, or 0.91 m):

- May 26, 2009 - 3.68" over approximately a 9 hr period (between a 5 and 10 year storm)

- Friday, May 29th - less than 0.49" over a 2 hour period, but was of sufficient intensity to produce another bankfull event.

- Wednesday, June 3 – 2.71 in 2 hours, of which 2.46" fell in 45 minutes (1.04" in 15 minutes). This was the equivalent of another 5-10 yr event.



Inspections were conducted on May 26th during the first event and afterwards on May 27th (the same day you inspected the project), on May 29th (during the second bankfull event) and again on June 1st, then also after the largest event (in terms of flow depths) on June 4th. In total, the restored streams performed very well, with only 3 very small areas (approximately 100 ft out of +/- 22,000 lf completed) that will require some minor maintenance activities. Each is discussed in more detail below and is depicted in the first 3 photos attached to this report. The remainder of the photos (4-17) depict representative areas from throughout the completed reaches in Snakeden Branch and The Glade[1].

- **Last structure in Reach 17 (XS 17-07) -** The first is the movement of structure rocks in the second step of the two-step cross-vane located right at Lake Audubon. This second step was included as an extra measure of protection should the lake level ever drop – the invert was placed at the normal pool elevation. It appears, however, that several of the rocks were displaced (see photo #1) as a result of the step being located too close to the invert of the structure. After some discussion, it was decided to remove the second step completely and place the rocks up against the invert of the structure to provide additional protection in this area.

- **Third rock structure up from Lake Audubon in Reach 17 (XS 17-04)** – As shown in photo #2, there has been some bank erosion just below the structure. It appears as though the original was such that it constricted the channel in this area, resulting in the erosion. The repair will consist of grading back the bank to increase the channel capacity, along with placement of facines and brush mattresses to provide additional stabilization.

---

[1] *Note that a thunderstorm moved through the area just prior to the photos being taken. Much of the fine sediment evident in the photos was observed entering the stream from overland areas.*

- **Tributary to Reach 9** – There is substantial overland flow entering Reach 9 through the tributary shown in photo #3, resulting in the washout of the reinforced bed material. To break up the slope and provide an opportunity for willows to take hold, facine check dams will be installed, along with replacement of the bed material.

Other than these very minor issues, the nearly 22,000 lf of stream channel and hundreds of structures that have been constructed to date handled these storm events extremely well – this includes the reaches in The Glade that have either just recently been completed or are currently under construction. The remaining photos (4-6) are a few other restored areas that remained stable after these latest bankfull events.

Please feel free to contact me (703-679-5651 or *fgraziano@wetlandstudies.com*) if you have any questions or concerns regarding this third 2-yr event monitoring report. Thank you.

Sincerely,

WETLAND STUDIES AND SOLUTIONS, INC.

Frank R. Graziano, P.E.
VP-Engineering

cc: Mike Rolband, WSSI
John Connelly, WSSI

Enclosures

I:\20000s\20003\admin\04-engr\monitoring for mbi\060309 storm #3 monitoring.doc

NVSRB PHOTOGRAPHS
THIRD 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 1 – Rocks displaced in the second step.

Photo 2 – Erosion along left bank below structure, likely due to improper grading.

NVSRB PHOTOGRAPHS
THIRD 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 3 – Small tributary to Reach 9 requiring additional stabilization.

Photo 4 – Reach 17.

Photo 5 – Confluence of Snakeden Reaches 12 and 16.

Photo 6 – Snakeden Reach 12.

Photo 7 – Snakeden Reach 16.

Photo 8 – Snakeden Reach 15.

NVSRB PHOTOGRAPHS
THIRD 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 9 – Snakeden Reach 11.

Photo 10 – Snakeden Reach 9.

NVSRB PHOTOGRAPHS
THIRD 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 11 – Snakeden Reach 7.

Photo 12 – Snakeden Reach 5.

NVSRB PHOTOGRAPHS
THIRD 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 13 – Snakeden Reach 4.

Photo 14 – Snakeden Reach 3.

NVSRB PHOTOGRAPHS
THIRD 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 13 – Snakeden Reach 2.

Photo 14 – Snakeden Reach 1.

NVSRB PHOTOGRAPHS
THIRD 2-YR STORM EVENT MONITORING REPORT
WSSI #20003

Photo 15 – The Glade Reach 1.

Photo 16 – The Glade Reach 1A.

Photo 17 – The Glade Reach 2.