Goose Creek (Greene Mitigation)
Stream Enhancement Project
Project No. 92709
2009 Monitoring Report: Year 1 of 5

November 2009

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EXECUTIVE SUMMARY

SECTION 1

EXECUTIVE SUMMARY

The Goose Creek (Greene Mitigation) Stream Enhancement Project (Site) is located in Mecklenburg County, North Carolina just south of the Town of Mint Hill (Appendix 1.1). The Site drains approximately 3.15 square miles to the Rocky River, within the Southern Outer Piedmont Physiographic Region of the Yadkin River Basin (HUC 3040105). The Site consisted of bank stabilization and habitat enhancement along 783 linear feet of Goose Creek. This project was conducted as a partial fulfillment of the off-site stream mitigation agreement between North Carolina Department of Transportation (NCDOT) and North Carolina Wildlife Resource Commission (NCWRC) for the I-485 outer loop project. The Site was constructed in February 2005 and transferred to Ecosystem Enhancement Program (EEP) for monitoring. This report serves as the first year of the five year monitoring plan for the Site.

1.1 Goals and Objectives

The Site runs through small farms containing pastures, forested areas, housing and commercial developments. The construction of I-485 has resulted in a shift from a rural to an urban land-use watershed. Poor riparian zone management in the upstream reaches of the watershed due to land disturbing activities such as clearcutting, overgrazing of streambanks, channelization, and development have had an adverse effect on the stability of the streambanks, in-stream habitat, and water quality. The Goose Creek watershed is one of two remaining North Carolina habitats of the federally endangered Carolina Heelsplitter mussel (*Lasmigona decorate*). As a result of concern for this species, the entire Rocky River watershed was designated as a priority area for conservation and protection.

The following goals were established for the Site.

1. Enhance 783 linear feet of Goose Creek by grading banks, planting a riparian buffer, and reducing bank erosion.
2. Enhance the riparian zone adjacent to the stream with native forest species.
3. Restore degraded in-stream habitat via in-stream structures such as log and rock vanes.

Streambanks and riparian areas were stabilized using bare-root plantings and temporary and permanent seed mixes. The Site was planted with native riparian vegetation. Enhancement of the stream areas will help to improve streambank stability, water quality, and increase local vegetative biodiversity. Appendix 2 provides more detailed project activity, history, contact information, and watershed/site background for this project.

1.2 Vegetative Assessment

Due to the lapse in time between construction and the first monitoring year, the vegetation plots previously established following construction in 2005 were not marked well enough to be re-located in 2009 and re-assess. Therefore, JJG established four new vegetation monitoring plots

100 m^2 (two 5m x 20m and one 10m x 10m) in size on-site within the enhancement areas in the approximate location of the original plots established by NCWRC. Planted stems were determined to be planted or volunteer in 2009 since the original flagging was missing. The largest trees were recorded as the planted specimens and the smaller stems were recorded as natural recruitment. Vegetation assessments were conducted following the NCEEP 2004 Stem Counting Protocol which consists of counting woody stems within the established vegetation plots. The vegetation success criteria stated in the mitigation plan calls for a total of 256 stems per acre at the end of year three based on approximately 0.8 acres of land was disturbed during construction. However, since JJG re-established 4 vegetation plots (0.0247 acres) in lieu of monitoring the previous plots due to the reasons previously stated, the following planted stems per acre requirements will be followed to determine vegetation success at the end of each monitoring year (USACE 2003).

- 320 stems per acre years 1 through 3
- 288 stems per acre year 4
- 260 stems per acre year 5

The 2009 vegetation monitoring indicated an average survivability of 1,673 stems per acre, which is greater than the required vegetation survival criteria of 320 stems per acre surviving after the third growing season. MY-2009 was the first year of monitoring for the planted vegetation; however, the Site was planted in 2005 and therefore is in the fourth growing season. The survival rate for the planted woody vegetation monitored for 2009 is 100%. The monitoring data indicates an average of 41 stems per plot.

All the vegetation plots met the vegetation success threshold for the 2009 monitoring year (MY-1). In conclusion, the riparian restoration project meets the requirements per the success criterion for the 2009 monitoring year. Please refer to Appendix 3 for vegetation photos and raw data tables.

1.3 Stream Assessment

Results from the 2009 stream monitoring effort indicate that stream pattern, profile, and dimension of Goose Creek is maintaining vertical and lateral stability with minimal problem areas. Areas along the stream enhancement reach noted with bare banks appear to be stabilized by the roots of larger trees growing on the banks. These areas will continue to be monitored closely for significant adjustments in the bank, bed features, and channel thalweg.

Stream dimension, pattern, profile, and substrate were evaluated within 688 linear feet of the Site. The average bankfull width (33.91 ft) of the surveyed cross-sections is within the range of the as-built widths reported (32-44 ft), and the average surveyed mean bankfull depth is 3.2 ft compared to the as-built typical (2.9 ft). The surveyed bankfull widths and depths lead to an average Width/Depth ratio of 11.3 and a sinuosity of 1.2, which typifies a Rosgen C/E-type stream. The upper section of the enhancement project based was classified as B4c and the lower section of the project was classified as a C4e. The channel's profile appears to be stable, and was characterized by well-defined riffle and pool features. The average water surface slope and the average bankfull slope were very similar for the surveyed reach, 0.0065 ft/ft and 0.0069 ft/ft,

respectively. The substrate analysis illustrates a diverse and stable substrate material and available habitat with little to no fine deposition occurring.

A crest gauge is not located on-stie, therefore JJG referenced a local USGS gauge (station 0212467451) located downstream of the Site with a similar drainage area (8.5 sq.mi.) to determine bankfull event occurrences. According to the USGS gauge, more than one bankfull event or greater was recorded within the Goose Creek watershed during the 2009 monitoring year. Other indicators such as old wrack lines and staining were observed at the bankfull and greater elevations within the Site.

Overall, the Site appears to be maintaining vertical and lateral stability with minimal bank erosion and has met the success criteria for MY-2009. Please refer to Appendix 4 for more detailed stream data tables and plots and Appendix 1.2 for the location of the longitudinal profile stations, cross-section stations, vegetation plots, photo points, and gauges.

1.5 Annual Monitoring Summary

In summary, the Site has met the stream and vegetation mitigation goals for monitoring year 1. The 2009 vegetation plot monitoring results indicate that the planted and naturally recruited vegetation is doing well at the site. The pattern, profile, and dimension of the enhancement channel appear to be maintaining vertical and lateral stability with minimal bank erosion. A few problem areas were observed, such as poor streambank cover. However, these areas of stream instability do not appear to be advancing and have roots from larger trees growing along the bank that are assisting in the bank stability. These areas will continue to be monitored closely for shifts in stability.

The background information provided in this report is referenced from the mitigation plan prepared by NCWRC (2005). Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

SECTION 2
METHODOLOGY

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METHODOLOGY

2.1 Methodology

Methods employed for the Site were a combination of those established by standard regulatory guidance and procedures documents as well as previous monitoring reports completed by NCWRC. Geomorphic and stream assessments were performed following guidelines outlined in the Stream Channel Reference Sites: An Illustrated Guide to Field Techniques (Harrelson et al., 1994) and in the Stream Restoration a Natural Channel Design Handbook (Doll et al, 2003). Vegetation assessments were conducted following the NCEEP 2004 Stem Counting Protocol which consists of counting woody stems within the established vegetation plots. JJG used the *Flora of the Carolinas, Virginia, Georgia, and surrounding areas* by Alan S. Weakley as the taxonomic standard for vegetation nomenclature for this report. Off-site bankfull events were documented using the USGS station 0212467451, Goose Creek at SR 1542 Near Indian Trail, NC.

SECTION 3
REFERENCES

SECTION 3
REFERENCES

Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E., 2003. Stream Restoration A Natural Channel Design Handbook.

Harrelson, Cheryl C; Rawlins, C.L.; Potyondy, John P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique.* Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

North Carolina Wildlife Resource Commission. 2005. As-Built Report for the Greene Mitigation on Goose Creek Mecklenburg County. Raleigh, NC.

Rosgen, D L. 1996. Applied River Morphology. Wildland Hydrology Books, Pagosa Springs, CO.

US Army Corps of Engineers-Wilmington District, US Environmental Protection Agency, NC Wildlife Resource Commission, and NC Division of Water Quality. 2003. Stream Mitigation Guidelines. Wilmington, NC.

Weakley, A.S. 2008. *Flora of the Carolinas, Virginia, Georgia, Northern Florida, and Surrounding Areas* (Draft April 2008). University of North Carolina at Chapel Hill: Chapel Hill, NC.

SECTION 4
APPENDICES

Appendix 1 - General Figures and Plan Views

Appendix 2 - General Project Tables

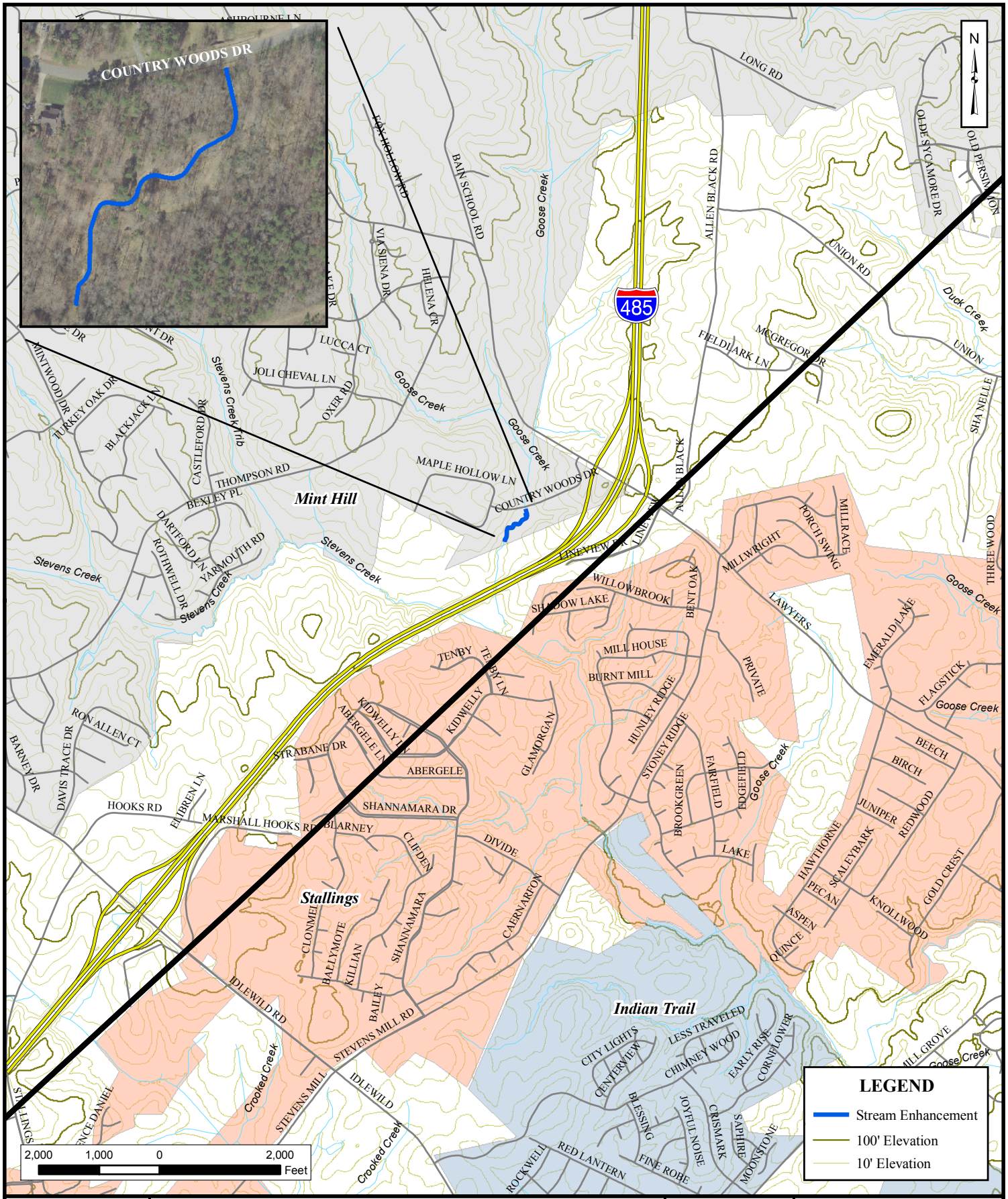
Appendix 3 - Vegetation Assessment Data

Appendix 4 – Stream Assessment Data

APPENDIX 1
GENERAL FIGURES AND PLAN VIEWS

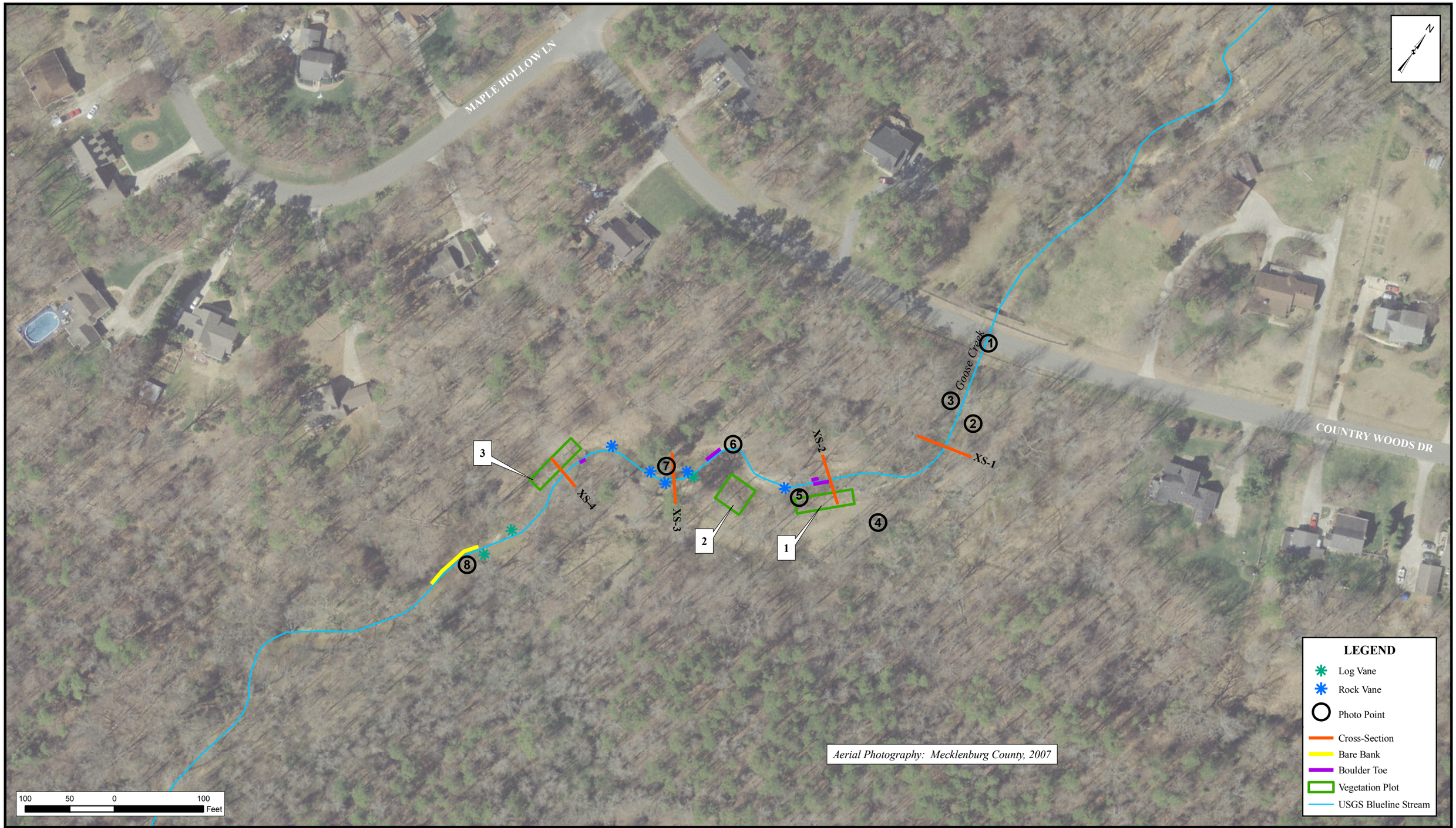
1. Project Location Map

2. Current Condition Plan View



APPENDIX 1.1 PROJECT LOCATION MAP
GOOSE CREEK (GREENE MITIGATION SITE)
MECKLENBURG COUNTY, NORTH CAROLINA
YEAR 1 OF 5

Date: November 2009
Scale: 1" = 2,000'



Ecosystem Enhancement PROGRAM

PROJECT NO. 92709
MECKLENBURG COUNTY, NORTH CAROLINA
MONITORING YEAR 1 OF 5

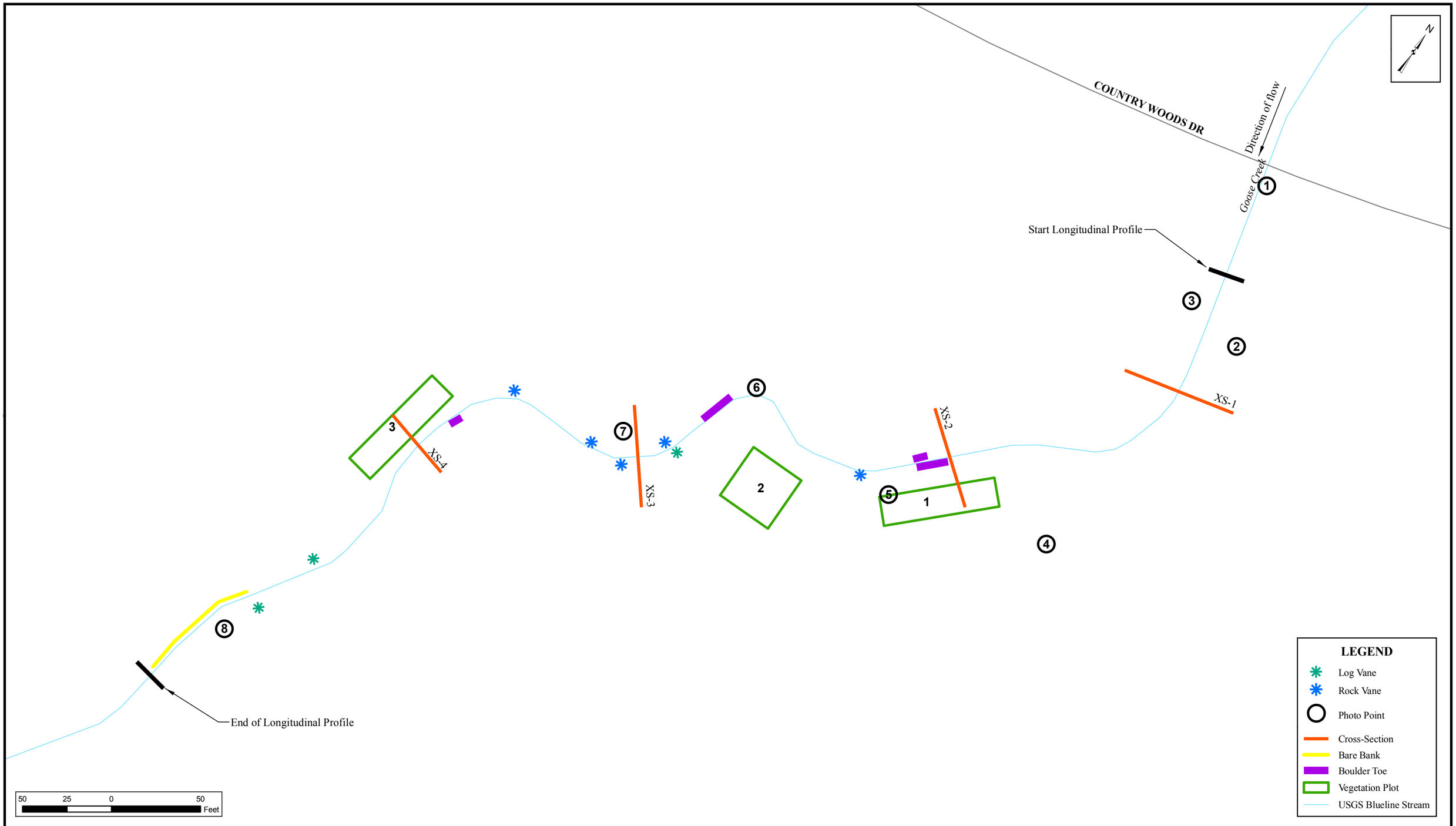
JJG

NC ECOSYSTEM ENHANCEMENT PROGRAM
GOOSE CREEK (GREENE MITIGATION SITE)

APPENDIX 1.2
CURRENT CONDITION PLAN VIEW

November 2009
Scale: 1" = 100'

Figure KEY



Ecosystem Enhancement PROGRAM	**PROJECT NO. 92709** **MECKLENBURG COUNTY, NORTH CAROLINA** **MONITORING YEAR 1 OF 5**	JJG	**NC ECOSYSTEM ENHANCEMENT PROGRAM** **GOOSE CREEK (GREENE MITIGATION SITE)** **APPENDIX 1.2** **CURRENT CONDITION PLAN VIEW**	November 2009 Scale: 1" = 50' Figure 1 OF 1

APPENDIX 2
GENERAL PROJECT TABLES

1. **Project Mitigation Structure and Objectives**
2. **Project Activity and Reporting History**
3. **Project Contacts**
4. **Project Background**

Segment/Reach	Mitigation Type	Approach	Linear Footage or Acres	Stationing (ft)*	Comments
Goose Creek	Enhancement	Level 1	783 lf	0+00-7+83	Channel enhancement with use of grade control and bank protection structures.

Component Summations						
		Wetland (ac)				
Restoration Level	Stream (lf)	Riparian	Non-Riparian	Upland (ac)	Buffer (ac)	BMP
Restoration (R)	N/A	N/A	N/A	N/A	N/A	N/A
Enhancement (E)	N/A	N/A	N/A	N/A	7.8	N/A
Enhancement I (E)	783	N/A	N/A	N/A	N/A	N/A
Enhancement II (E)	N/A	N/A	N/A	N/A	N/A	N/A
Creation (C)	N/A	N/A	N/A	N/A	N/A	N/A
Preservation (P)	N/A	N/A	N/A	N/A	N/A	N/A
HQ Preservation (P)	N/A	N/A	N/A	N/A	N/A	N/A
Totals	**783**	**N/A**	**N/A**	**N/A**	**7.8**	**N/A**

Activity or Report	Data Collection Completed	Actual Completion or Delivery
Restoration Plan	N/A	2003
Final Design-90%	N/A	N/A
Construction	N/A	Feb-05
Temporary S&E mix applied to entire project area*	N/A	Feb-05
Permanent seed mix applied to reach	N/A	Feb-05
Mitigation Plan/ As-Built (Year 0 Monitoring)	N/A	Mar-05
Year 1 Monitoring	Nov-09	Dec-09
Year 2 Monitoring	TBD	TBD
Year 3 Monitoring	TBD	TBD
Year 4 Monitoring	TBD	TBD
Year 5 Monitoring	TBD	TBD

*Seed and mulch are added as each section of construction is completed.

Designer	NCWRC-Division of Inland Fisheries 1721 Mail Service Center Raleigh, NC 27699
Contractor's Name	Todd Hodges Construction Patterson, NC
Planting Contractor	Unknown
Seeding Contractor	Unknown
Monitoring Performers	Jordan, Jones & Goulding 9101 Southern Pine Blvd., Suite 160 Charlotte, NC 28273
Stream Monitoring, POC	Kirsten Young, 704-527-4106 ext.246
Vegetation Monitoring, POC	

Project County	Mecklenburg, North Carolina
Drainage Area	3.15 sq. mi
Drainage impervious cover estimate	5%
Stream Order	3rd
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Rosgen Classification of As-built	B4c/C4
Cowardin Classification	N/A
Dominant soil types	Monacan, Lignum gravelly silt loam, Georgeville silt loam
Reference site ID	UT to Reedy Creek
USGS HUC for Project and Reference	3040105
NCDWQ Sub-basin for Project and Reference	03-07-12
NCDWQ classification for Project and Reference	C
Any portion of any project segment 303d list?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reason for 303d listing or stressor?	N/A
% of project easement fenced?	0%

APPENDIX 3
VEGETATION ASSESSMENT DATA

1. **Vegetation Plot Mitigation Success**

2. **Vegetation Monitoring Plot Photos**

3. **Vegetation Plot Summary Data Table**

Vegetation Plot ID	Vegetation Survival Threshold Met (Y/N)
Plot 1	Y
Plot 2	Y
Plot 3	Y

Monitoring Plot 1 (10/2009)

Monitoring Plot 2 (10/2009)

Monitoring Plot 3 (10/2009)

Prepared For:	Goose Creek (Greene Mitigation) Stream Enhancement Year 1 of 5	Date: November 2009 Project No.: 92709
	Appendix 3.2 Vegetation Monitoring Plot Photos	

Goose Creek (Greene Mitigation Site)
Stem Counts for Planted Species

			Current Data (MY1-2009)						Annual Means			
			Plot 1		Plot 2		Plot 3		Current Mean		MY1-2005*	
Species	**Common Name**	**Type**	P	T	P	T	P	T	**P**	**T**	**P**	**T**
Acer negundo	boxelder	T		4	1	2		3	**1**	**3**		
Acer rubrum	red maple	T	1	4	2	2		4	**2**	**3**	**3**	**3**
Alnus serrulata	tag alder	T	9	12	14	16	8	9	**10**	**12**	**27**	**27**
Baccharis halimifolia	groundsel tree	T		1								
Betula nigra	river birch	T	1	1								
Carpinus caroliniana	american hornbeam	T	2	26	6	29	9	29	**6**	**28**	**2**	**2**
Carya ovata	shagbark hickory	T		1								
Cephalanthus occidentalis	buttonbush	S									**6**	**6**
Cornus amomum	silky dogwood	S			1	1	2	2	**2**	**2**	**43**	**43**
Fagus grandifolia	american beech	T									**9**	**9**
Fraxinus pennsylvanica	green ash	T	2	3			1	2	**2**	**3**		
Juglans nigra	black walnut	T									**25**	**25**
Juniperus virginiana	eastern red cedar	T	1	6		2	1	1	**1**	**3**	**3**	**3**
Lindera benzoin	spicebush	S		11		1		5				
Lirodendron tulipifera	tulip poplar	T		3		3	6	16			**3**	**3**
Liquidambar styraciflua	sweet gum	T		9		30		20		**20**		
Morus rubra	red mulberry	T						4				
Platanus occidentalis	sycamore	T	3	4	15	20	1	1	**6**	**8**		
Pinus taeda	loblolly pine	T		14				5		**10**		
Pinus sp.	pine species	T									**7**	**7**
Prunus serotina	black cherry	T					2	3			**1**	**1**
Quercus alba	white oak	T					1	7	**1**	**7**		
Quercus lyrata	overcup oak	T					2	2	**2**	**2**		
Quercus palustris	pin oak	T									**1**	**1**
Quercus phellos	willow oak	T		4	2	2	1	3				
Quercus sp.	oak species	T									**2**	**2**
Rhus glabra	smooth sumac	S		1								
Salix nigra	black willow	S	15	15					**15**	**15**	**1**	**1**
Salix sericea	silky willow	S	3	3	5	5	4	4			**54**	**54**
Sambucus canadensis	elderberry	S					2	2	**2**	**2**	**3**	**3**
Ulmus alata	winged elm	T		6		1		11				
Unknown sp.							1	1			**4**	**4**
Plot Area (acres)			**0.0247**								******	
Species Count			**9**	**19**	**8**	**13**	**14**	**21**	**10**	**18**	**17**	
Stem Count			**37**	**128**	**46**	**114**	**41**	**134**	**41**	**125**	**195**	
Stems per Acre			**1498**	**5182**	**1862**	**4615**	**1660**	**5425**	**1673**	**5074**	**2324**	

Type=**S**hrub or **T**ree
P = Planted
T = Total
*Data was collected by another monitoring firm-no volunteer stems were included in data
**Plot sizes varied from 0.017 acre to 0.040 acre

APPENDIX 4
STREAM ASSESSMENT DATA

1. **Stream Station Photos**
2. **Stream Cross-Section Photos**
3. **Qualitative Visual Stability Assessment**
4. **Verification of Bankfull Events**
5. **Cross-Section Plots and Raw Data Tables***
6. **Longitudinal Plots and Raw Data Tables***
7. **Pebble Count Plots and Raw Data Tables***

*Raw data tables have been provided electronically.

Photo Point 1: View Downstream Left Bank (11/2009)

Photo Point 1: View Downstream Right Bank (11/2009)

Photo Point 2: View Upstream (11/2009)

Photo Point 2: View Downstream (11/2009)

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	Appendix 4.1 Stream Station Photos	JJG

Photo Point 3: View Upstream (11/2009)

Photo Point 3: View Downstream (11/2009)

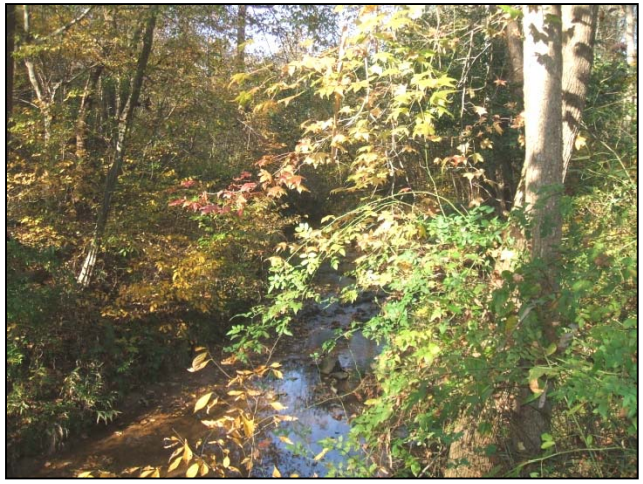

Photo Point 4: View Upstream (11/2009)

Photo Point 4: View Downstream (11/2009)

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	Appendix 4.1 Stream Station Photos	JJG

Photo Point 5: View Upstream (11/2009)

Photo Point 5: View Downstream (11/2009)

Photo Point 6: View Upstream (11/2009)

Photo Point 6: View Downstream (11/2009)

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	Appendix 4.1 Stream Station Photos	JJG

Photo Point 7: View Upstream (11/2009)

Photo Point 7: View Downstream (11/2009)

Photo Point 8: View Upstream (11/2009)

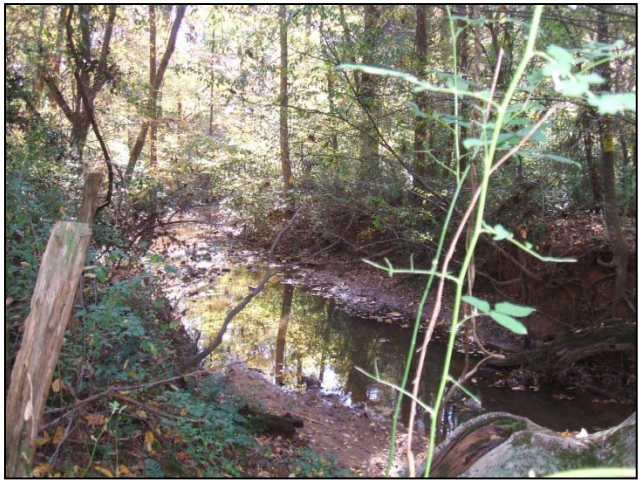

Photo Point 8: View Downstream (11/2009)

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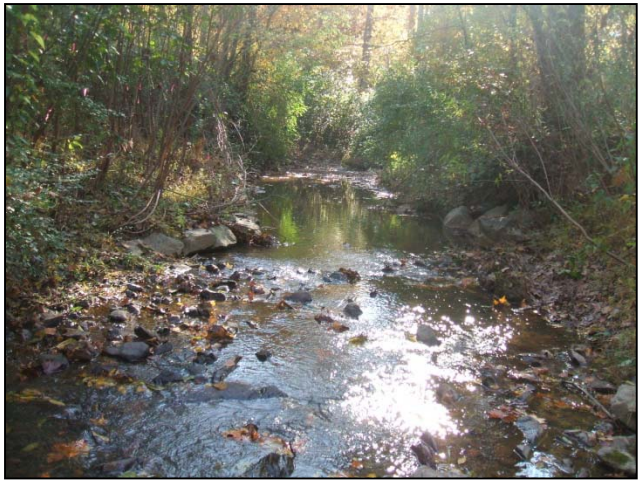
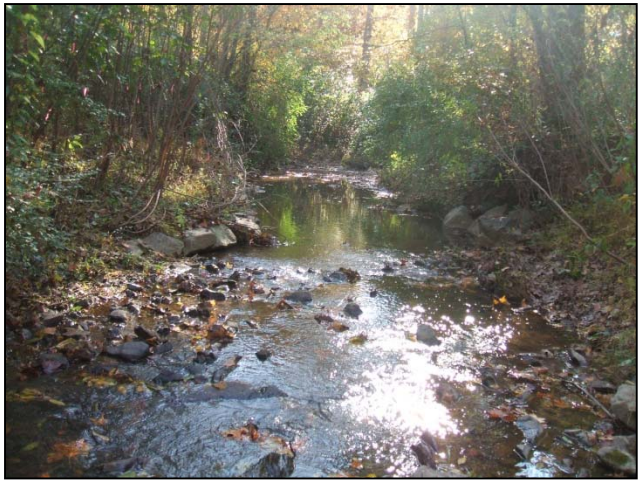
	Appendix 4.1 Stream Station Photos	JJG

Cross-Section 1: View Upstream (11/2009)



Cross-Section 1: View Downstream (11/2009)

Cross-Section 2: View Upstream (11/2009)



Cross-Section 2: View Downstream (11/2009)

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	Appendix 4.2 Stream Cross-Section Photos	JJG

Cross-Section 3: View Upstream (11/2009)

Cross-Section 3: View Downstream (11/2009)

Cross-Section 4: View Upstream (11/2009)

Cross-Section 4: View Downstream (11/2009)

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	Appendix 4.2 Stream Cross-Section Photos	JJG

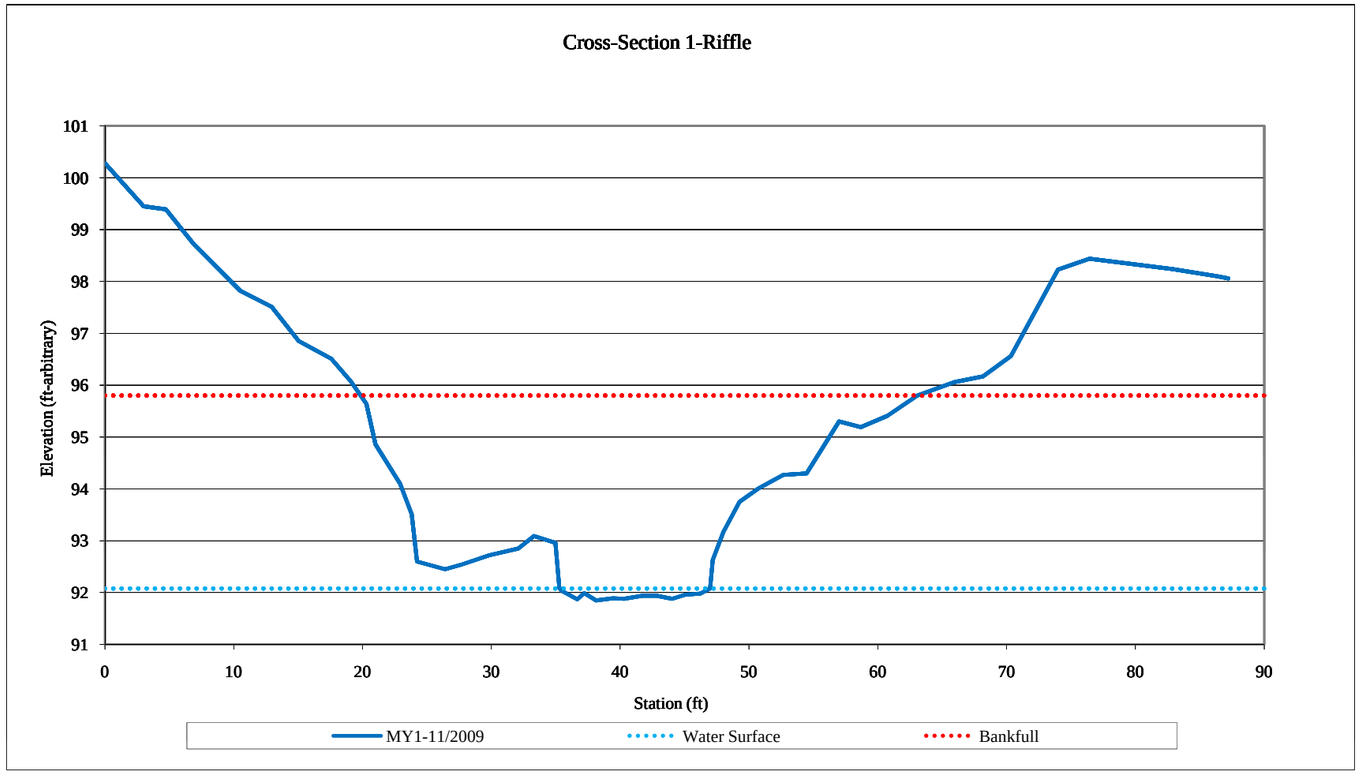
Goose Creek 783 linear feet

Feature Category		(# Stable) Number Performing as Intended	Total Number assessed per as-built survey	Total Number/ feet in unstable state	% Perform in Stable Condition	Feature Perform Mean or Total
A. Riffles	1. Present?	8	8	N/A	100%	**100%**
	2. Armor Stable?	8			100%	
	3. Facet grade appears stable?	8			100%	
	4. Minimal evidence of embedding/fining?	8			100%	
	5. Length appropriate?	8			-	
B. Pools	1. Present?	6	6	N/A	100%	**94%**
	2. Sufficiently deep?	5			83%	
	3. Length Appropriate?	6			100%	
C. Thalweg	1. Upstream of meander bend centering?	6	6	N/A	100%	**100%**
	2. Downstream of meander centering?	6			100%	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	6	6	N/A	100%	**100%**
	2. Of those eroding, # w/concomitant point bar formation?	6			100%	
	3. Apparent Rc within spec?	-			-	
	4. Sufficient floodplain access and relief?	6			100%	
E. Bed General	1. General channel bed aggradation areas (bar formation)?	N/A		0	100%	**100%**
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?			0	100%	
F. Bank Performance	1. Actively eroding, wasting, or slumping bank	N/A		0	100%	**100%**
G. Vanes/J-Hooks, etc	1. Free of back or arm scour?	8	8	N/A	100%	**75%**
	2. Height appropriate?	8			100%	
	3. Angle and geometry appear appropriate?	0			0%	
	4. Free of piping or other structural failures?	8			100%	
H. Wads/ Boulders	1. Free of scour?	4	4	N/A	100%	**100%**
	2. Footing stable?	4			100%	

Date of Collection	Date of Occurrence	Method	Photo # (if available)
11/18/09	11/11/2009-11/12/2009	Visual/USGS	N/A

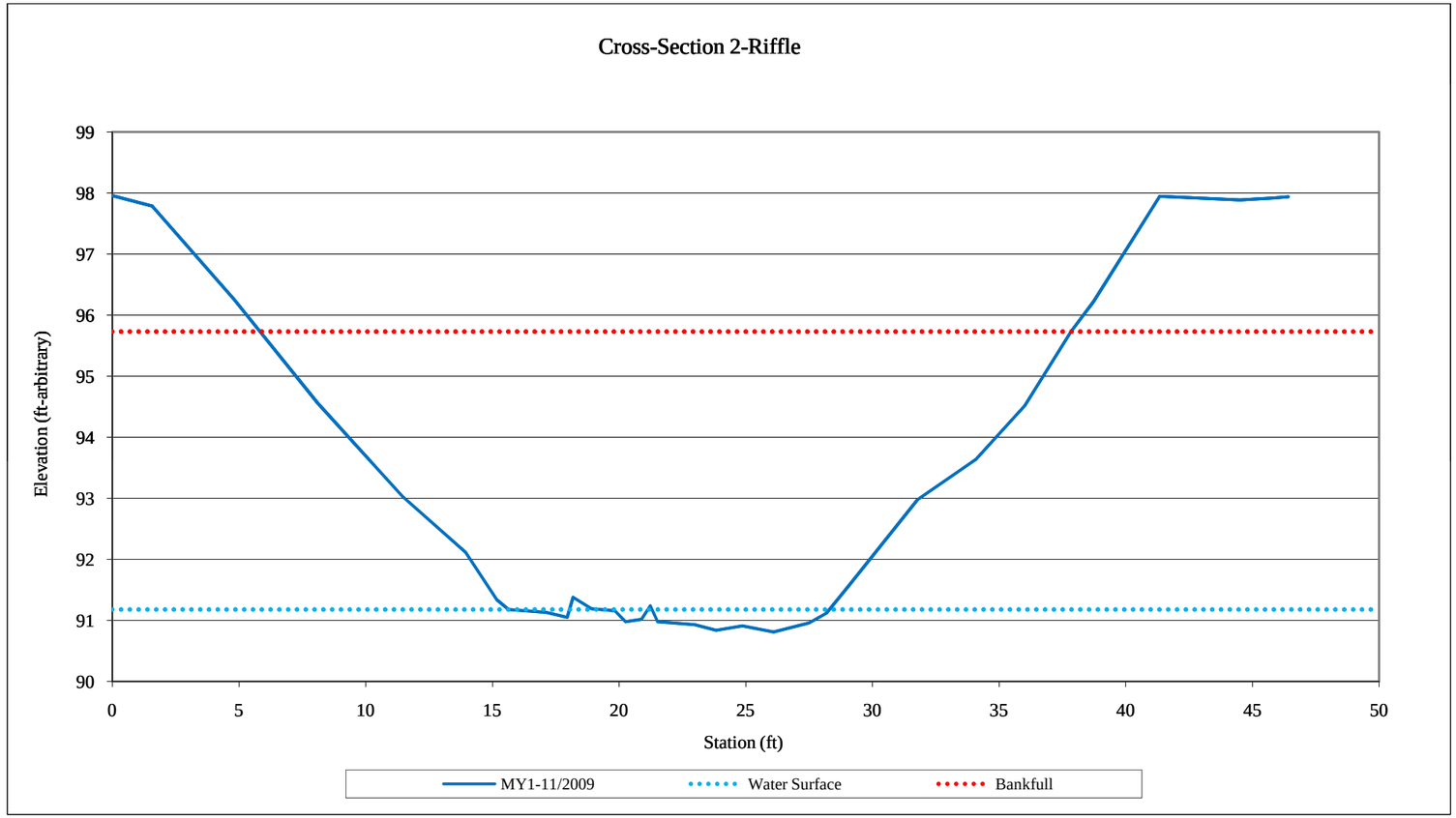
Stream Name: Goose Creek					
Cross-Section: 1					
Feature: Riffle					
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0	100.28	lpt	46.98	92.08	rew
0.83	100.05	x1	47.19	92.63	x1
3	99.45	x1	48.01	93.17	x1
4.73	99.39	x1	49.27	93.75	x1
6.9	98.72	x1	50.74	94.01	x1
10.5	97.82	x1	52.66	94.27	x1
12.94	97.51	x1	54.47	94.3	x1
15.04	96.85	x1	56.99	95.3	x1
17.57	96.51	x1	58.68	95.19	x1
19.07	96.08	x1	60.75	95.41	x1
20.3	95.64	x1	63.06	95.8	x1-bkf
21	94.86	x1	65.95	96.06	x1
22.91	94.1	x1	68.17	96.17	x1
23.82	93.51	x1	70.33	96.56	x1
24.23	92.6	x1	73.99	98.23	x1
26.4	92.45	x1	76.43	98.44	x1
27.69	92.54	x1	82.87	98.24	x1
29.85	92.72	x1	86.35	98.1	x1
32.09	92.85	x1	87.21	98.06	rpt
33.31	93.09	x1			
34.97	92.96	x1			
35.28	92.09	x1			
35.43	92.04	lew			
36.67	91.87	x1-tw			
37.21	91.99	x1			
38.13	91.85	x1			
39.43	91.89	x1			
40.3	91.88	x1			
41.73	91.94	x1			
42.83	91.94	x1			
44.03	91.88	x1			
45.08	91.96	x1			
46.22	91.98	x1			

Summary Data	
Bankfull Cross-sectional Area (ft^2)	104.53
Bankfull Width (ft)	43.12
Bankfull Mean Depth (ft)	2.42
Bankfull Max Depth (ft)	3.94
Width/Depth Ratio	17.82
Entrenchment Ratio	1.98



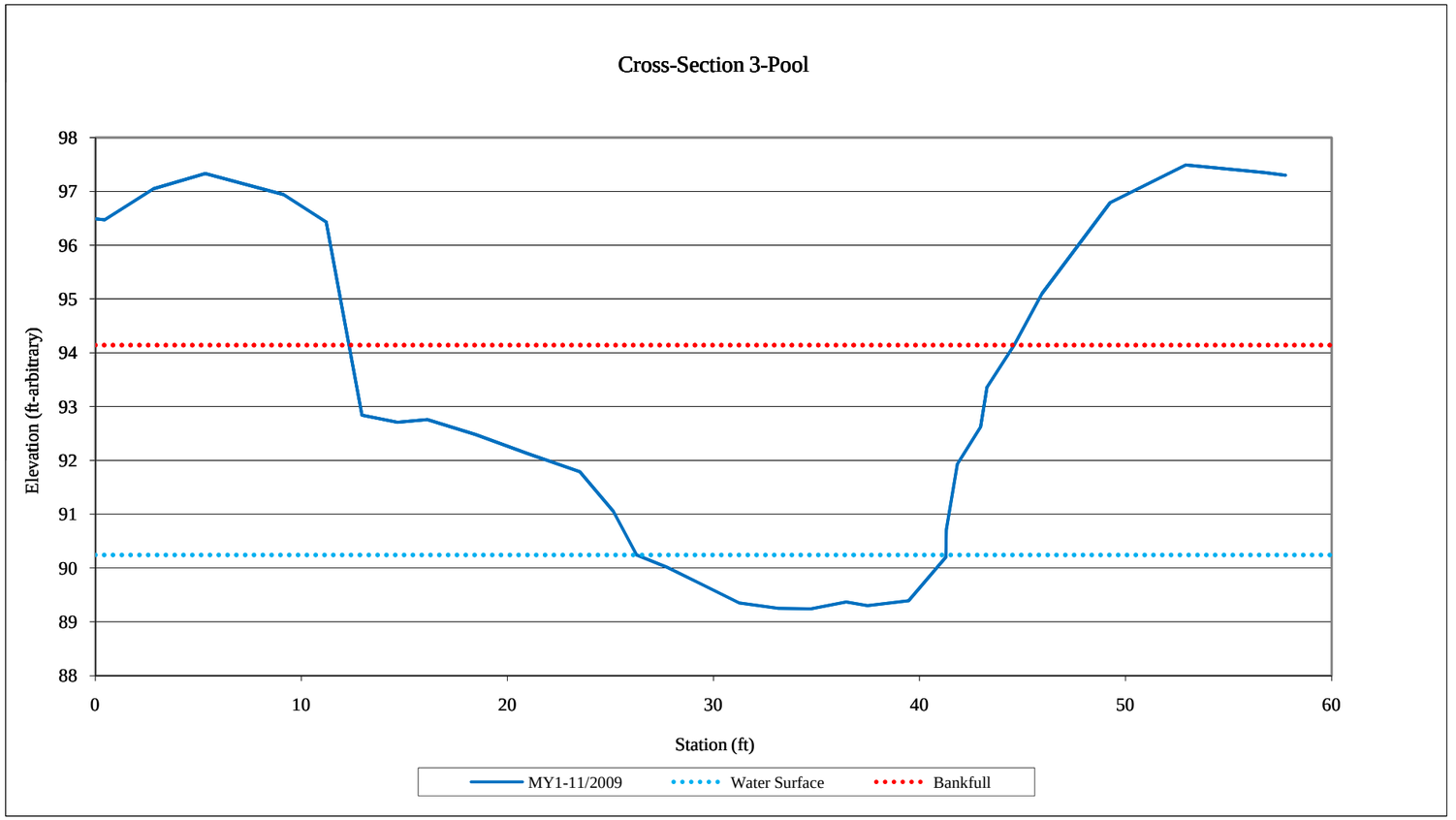
Stream Name: Goose Creek					
Cross-Section: 2					
Feature: Riffle					
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0	97.96	x2-lpt	28.18	91.12	x2-rew
1.58	97.79	x2	29.11	91.59	x2
4.81	96.26	x2	31.78	92.98	x2
8.11	94.56	x2	34.08	93.64	x2
11.45	93.03	x2	36.01	94.52	x2
13.95	92.11	x2	37.84	95.73	x2-bkf
15.17	91.34	x2	38.73	96.23	x2
15.64	91.18	x2-lew	41.34	97.95	x2
17.13	91.13	x2	44.51	97.89	x2
17.95	91.05	x2	45.82	97.92	x2
18.18	91.38	x2	46.41	97.94	x2-rpt
18.92	91.19	x2			
19.83	91.16	x2			
20.26	90.98	x2			
20.88	91.02	x2			
21.23	91.24	x2			
21.52	90.98	x2			
22.99	90.93	x2-tw			
23.83	90.84	x2			
24.87	90.91	x2			
26.10	90.81	x2			
27.50	90.96	x2			

Summary Data	
Bankfull Cross-sectional Area (ft^2)	104.90
Bankfull Width (ft)	32.03
Bankfull Mean Depth (ft)	3.28
Bankfull Max Depth (ft)	4.92
Width/Depth Ratio	9.77
Entrenchment Ratio	2.2+



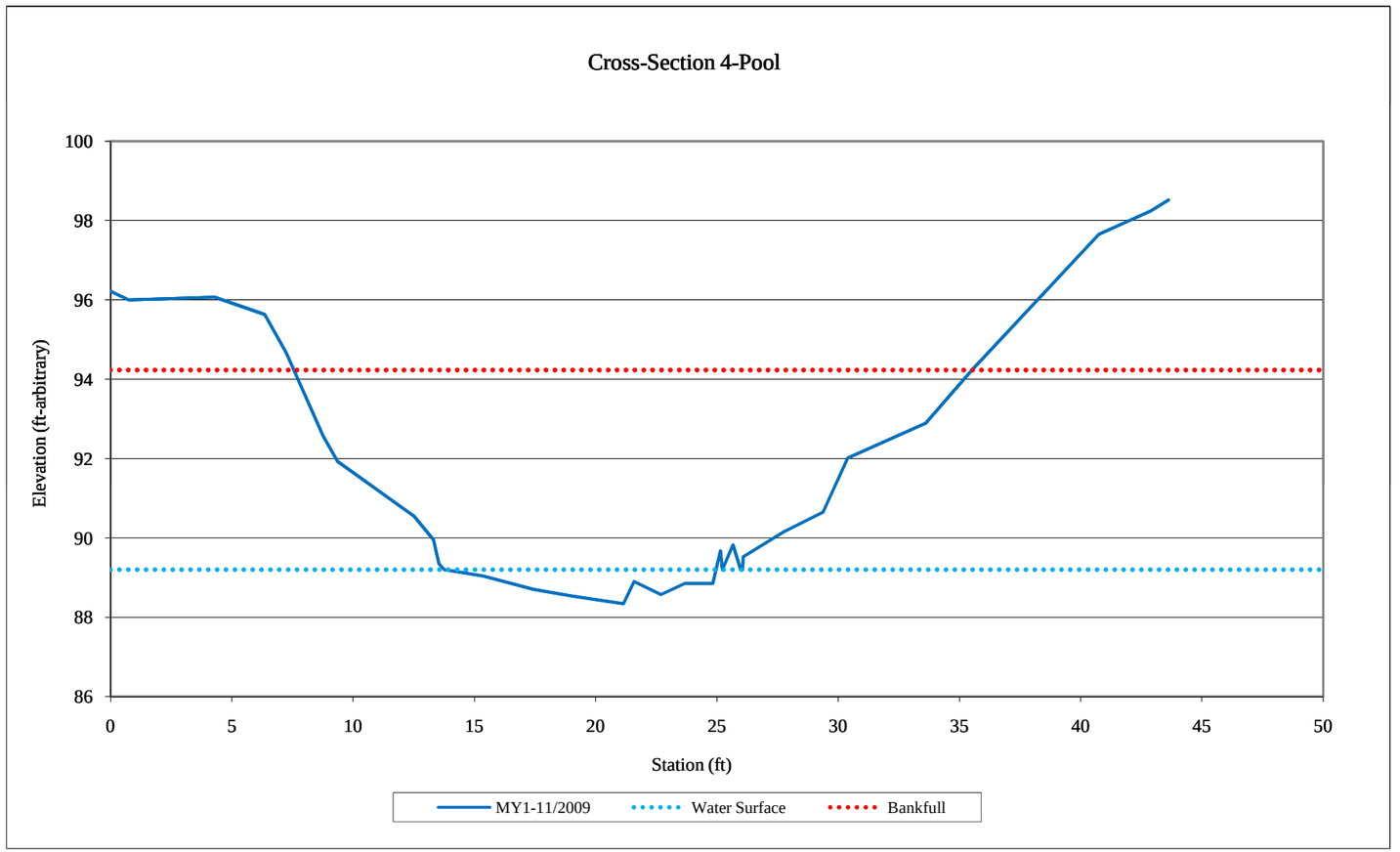
Stream Name: Goose Creek					
Cross-Section: 3					
Feature: Pool					
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0	96.49	x3-lpt	37.48	89.3	x3
0.46	96.47	x3	39.47	89.39	x3
2.83	97.05	x3	41.28	90.2	x3-rew
5.34	97.33	x3	41.3	90.71	x3
9.14	96.94	x3	41.84	91.93	x3
11.21	96.43	x3	42.97	92.62	x3
12.94	92.84	x3	44.6	94.14	x3-bkf
14.67	92.71	x3	43.28	93.36	x3
16.12	92.76	x3	45.95	95.1	x3
18.45	92.48	x3	49.25	96.79	x3
21.02	92.12	x3	52.92	97.49	x3
23.52	91.79	x3	56.75	97.35	x3-rpt
25.15	91.05	x3	57.76	97.3	x3
26.27	90.24	x3-lew			
27.77	90.01	x3			
29.51	89.68	x3			
31.25	89.35	x3			
33.15	89.25	x3			
34.73	89.24	x3-tw			
36.45	89.37	x3			

Summary Data	
Bankfull Cross-sectional Area (ft^2)	100.89
Bankfull Width (ft)	32.29
Bankfull Mean Depth (ft)	3.12
Bankfull Max Depth (ft)	4.90
Width/Depth Ratio	10.35
Entrenchment Ratio	2.2+



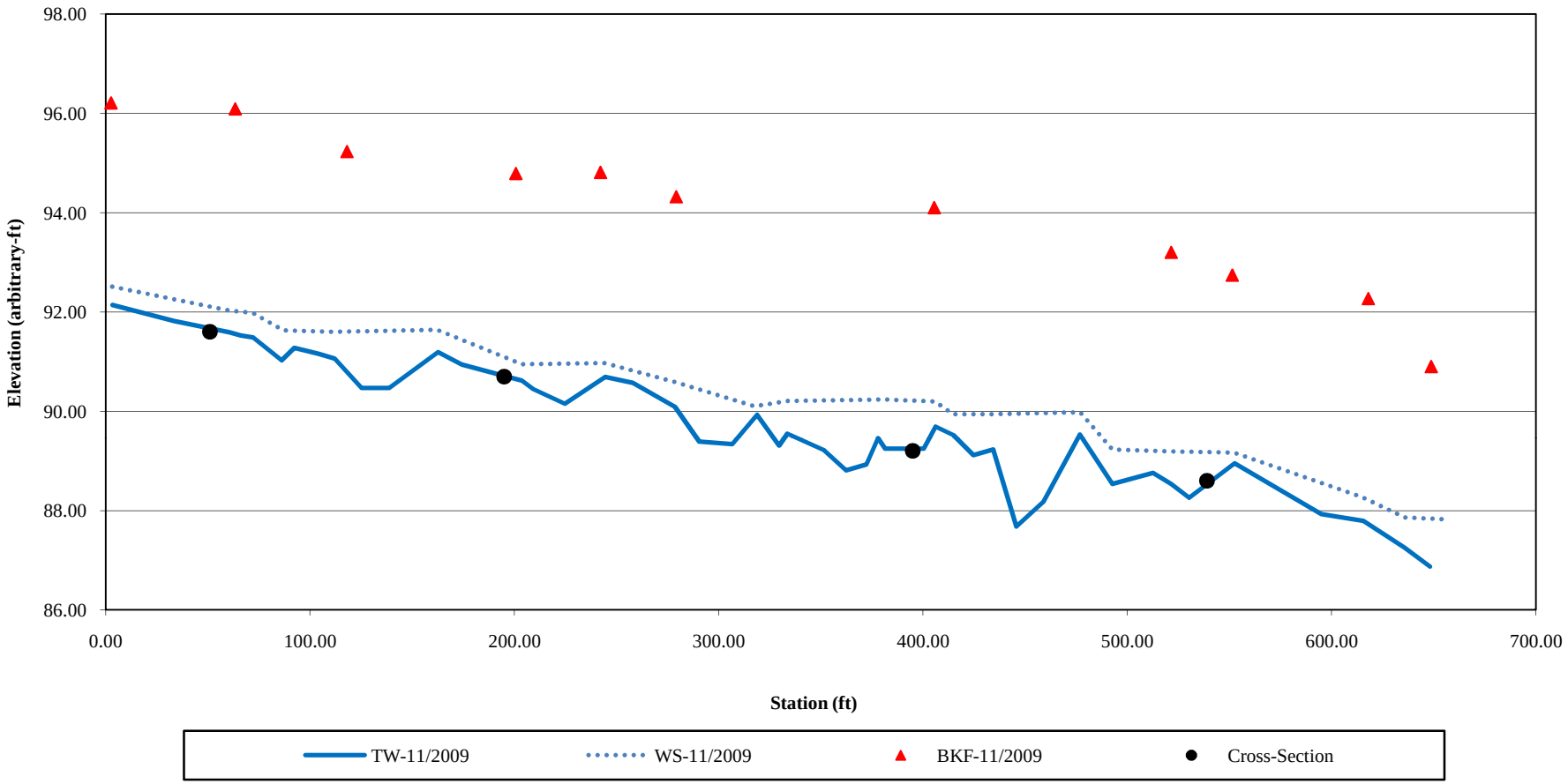
Stream Name: Goose Creek					
Cross-Section: 4					
Feature: Pool					
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0	96.22	x4-lpt	26.06	89.2	x4
0.75	96	x4	26.08	89.52	x4
4.29	96.07	x4	27.77	90.16	x4
6.36	95.63	x4	29.38	90.65	x4
7.24	94.67	x4	30.40	92.01	x4
8.77	92.57	x4	33.61	92.89	x4
9.36	91.93	x4	35.52	94.23	x4-bkf
12.51	90.55	x4	40.74	97.65	x4
13.31	89.95	x4	42.89	98.24	x4
13.54	89.35	x4	43.62	98.52	x4-rpt
13.76	89.2	lew			
15.37	89.04	x4			
17.44	88.7	x4			
19.03	88.53	x4			
20.04	88.44	x4			
21.15	88.34	x4-tw			
21.59	88.9	x4			
22.69	88.57	x4			
23.68	88.85	x4			
24.83	88.85	x4			
25.15	89.67	x4			
25.23	89.19	rew			
25.67	89.82	x4			
25.98	89.2	x4			

Summary Data	
Bankfull Cross-sectional Area (ft^2)	107.15
Bankfull Width (ft)	27.96
Bankfull Mean Depth (ft)	3.83
Bankfull Max Depth (ft)	5.89
Width/Depth Ratio	7.30
Entrenchment Ratio	2.2+



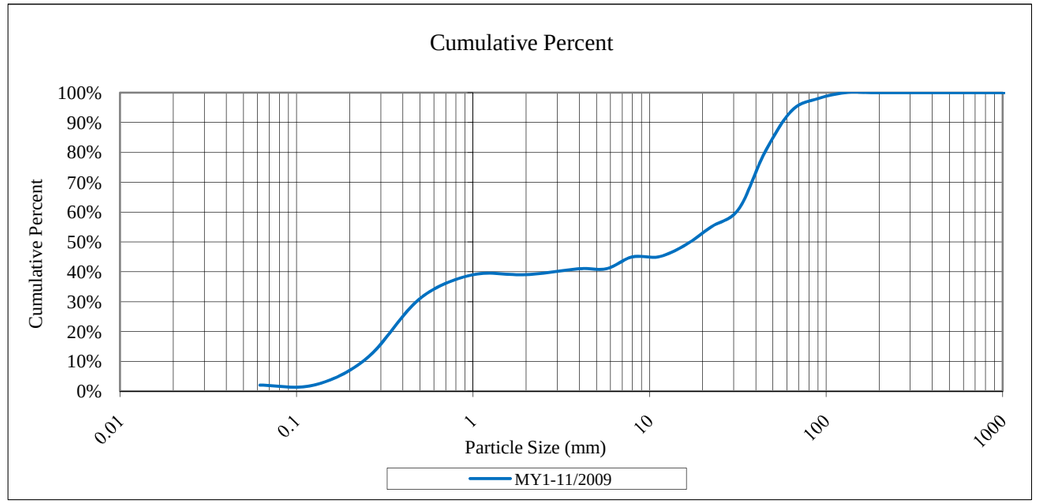
Goose Creek
Longitudinal Profile
2009 Monitoring Year

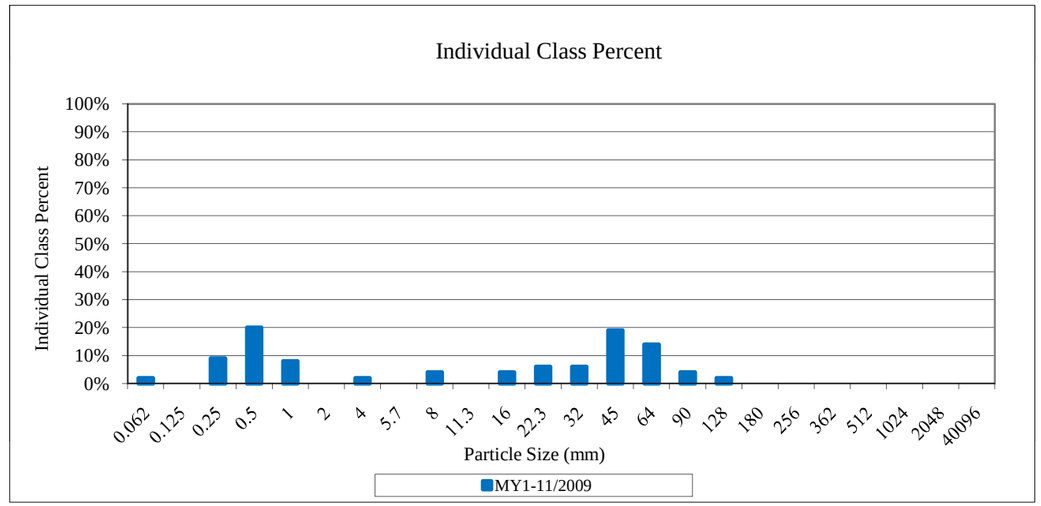
Bankfull/Top of Bank = -0.0069*STA + 96.36
Water Surface = -0.0065*STA + 92.477



Project Name: Goose Creek					
Cross-Section: 1					
Feature: Riffle					
			2009		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	2	2%	2%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	9	9%	9%
	medium sand	0.50	20	20%	20%
	coarse sand	1.00	8	8%	8%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	2	2%	2%
	fine gravel	5.7	0	0%	0%
	fine gravel	8.0	4	4%	4%
	medium gravel	11.3	0	0%	0%
	medium gravel	16.0	4	4%	4%
	course gravel	22.3	6	6%	6%
	course gravel	32.0	6	6%	6%
	very coarse gravel	45	19	19%	19%
	very coarse gravel	64	14	14%	14%
Cobble	small cobble	90	4	4%	4%
	medium cobble	128	2	2%	2%
	large cobble	180	0	0%	0%
	very large cobble	256	0	0%	0%
Boulder	small boulder	362	0	0%	0%
	small boulder	512	0	0%	0%
	medium boulder	1024	0	0%	0%
	large boulder	2048	0	0%	0%
Bedrock	bedrock	40096	0	0%	0%
TOTAL % of whole count			100	100%	100%

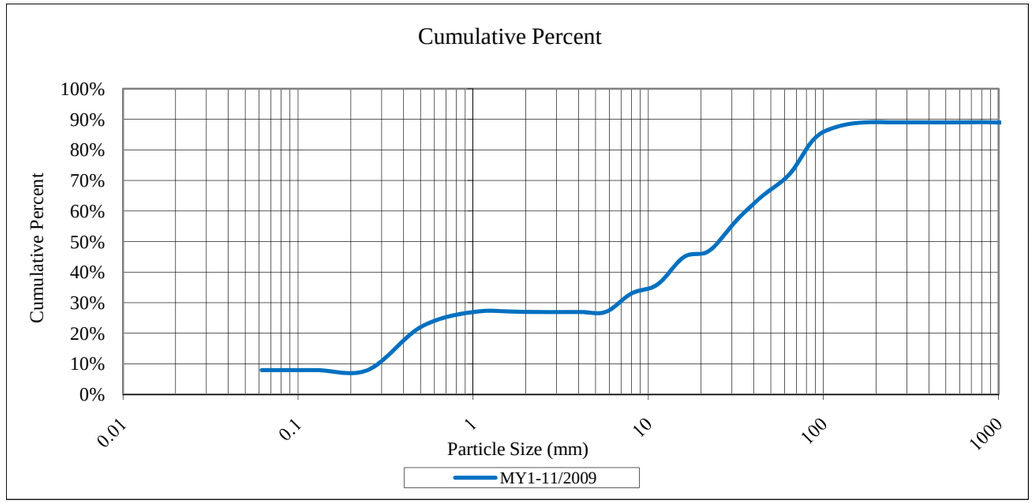
Summary Data	
D50	17.1
D84	50.43
D95	70.5

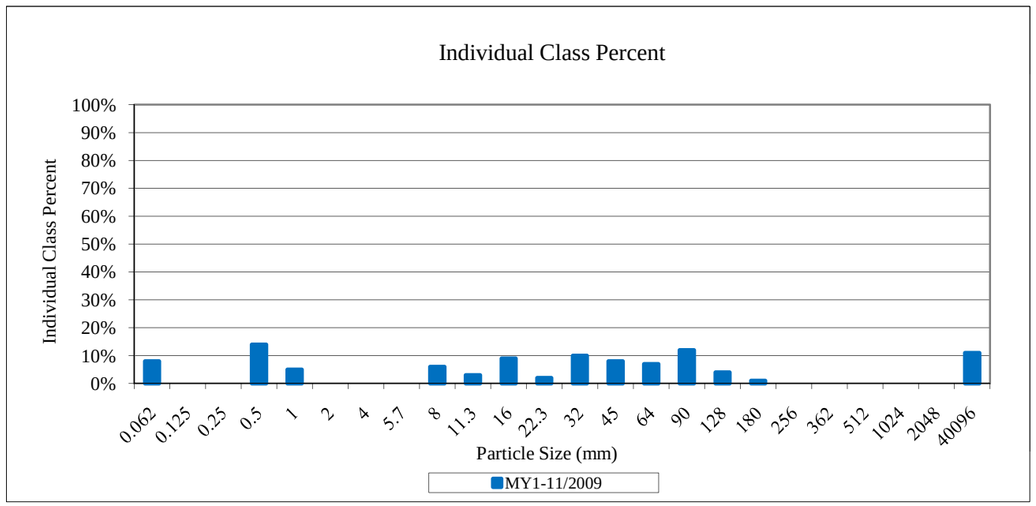




Project Name: Goose Creek					
Cross-Section: 2					
Feature: Riffle					
			2009		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	8	8%	8%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	14	14%	14%
	coarse sand	1.00	5	5%	5%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	0	0%	0%
	fine gravel	5.7	0	0%	0%
	fine gravel	8.0	6	6%	6%
	medium gravel	11.3	3	3%	3%
	medium gravel	16.0	9	9%	9%
	course gravel	22.3	2	2%	2%
	course gravel	32.0	10	10%	10%
	very coarse gravel	45	8	8%	8%
	very coarse gravel	64	7	7%	7%
Cobble	small cobble	90	12	12%	12%
	medium cobble	128	4	4%	4%
	large cobble	180	1	1%	1%
	very large cobble	256	0	0%	0%
Boulder	small boulder	362	0	0%	0%
	small boulder	512	0	0%	0%
	medium boulder	1024	0	0%	0%
	large boulder	2048	0	0%	0%
Bedrock	bedrock	40096	11	11%	11%
TOTAL % of whole count			100	100%	100%

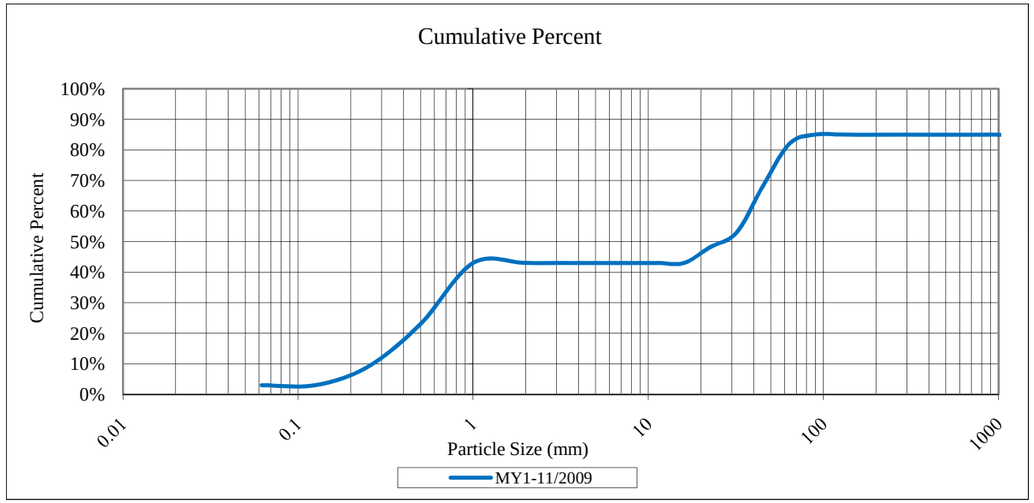
Summary Data	
D50	20.62
D84	72.31
D95	1619.91

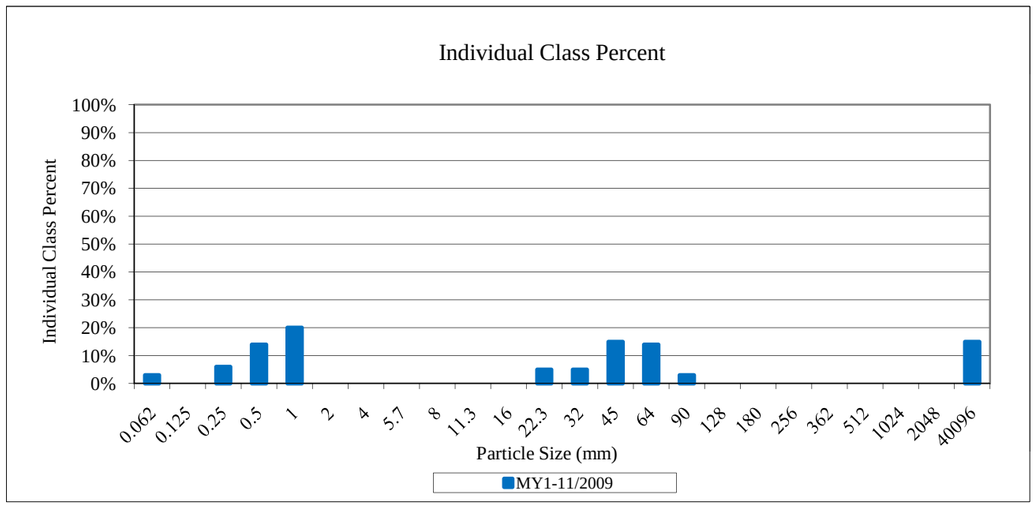




Project Name: Goose Creek					
Cross-Section: 3					
Feature: Pool					
			2009		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	3	3%	3%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	6	6%	6%
	medium sand	0.50	14	14%	14%
	coarse sand	1.00	20	20%	20%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	0	0%	0%
	fine gravel	5.7	0	0%	0%
	fine gravel	8.0	0	0%	0%
	medium gravel	11.3	0	0%	0%
	medium gravel	16.0	0	0%	0%
	course gravel	22.3	5	5%	5%
	course gravel	32.0	5	5%	5%
	very coarse gravel	45	15	15%	15%
	very coarse gravel	64	14	14%	14%
Cobble	small cobble	90	3	3%	3%
	medium cobble	128	0	0%	0%
	large cobble	180	0	0%	0%
	very large cobble	256	0	0%	0%
Boulder	small boulder	362	0	0%	0%
	small boulder	512	0	0%	0%
	medium boulder	1024	0	0%	0%
	large boulder	2048	0	0%	0%
Bedrock	bedrock	40096	15	15%	15%
TOTAL % of whole count			100	100%	100%

Summary Data	
D50	26.36
D84	81.33
D95	Bedrock





Project Name: Goose Creek					
Cross-Section: 4					
Feature: Pool					
			2009		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	6	8%	8%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	10	13%	13%
	coarse sand	1.00	25	32%	32%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	0	0%	0%
	fine gravel	5.7	0	0%	0%
	fine gravel	8.0	0	0%	0%
	medium gravel	11.3	4	5%	5%
	medium gravel	16.0	2	3%	3%
	course gravel	22.3	0	0%	0%
	course gravel	32.0	10	13%	13%
	very coarse gravel	45	2	3%	3%
	very coarse gravel	64	4	5%	5%
Cobble	small cobble	90	4	5%	5%
	medium cobble	128	5	6%	6%
	large cobble	180	3	4%	4%
	very large cobble	256	2	3%	3%
Boulder	small boulder	362	1	1%	1%
	small boulder	512	0	0%	0%
	medium boulder	1024	0	0%	0%
	large boulder	2048	0	0%	0%
Bedrock	bedrock	40096	0	0%	0%
TOTAL % of whole count			78	100%	100%

Summary Data	
D50	0.96
D84	80.37
D95	164.43