UT to Little Hunting Creek (Johnson Site) Stream Restoration

EEP Project No. 197
DENR Contract No. D09078S
2012 Final Monitoring Report: Year 4 of 5

Construction Completed: November 2007
Submission Date: February 2013

Submitted to: NCDENR-EEP
1652 Mail Service Center
Raleigh, NC 27699-1652

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Appendix D – Stream Survey Data

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SECTION 1
EXECUTIVE SUMMARY

SECTION 1
EXECUTIVE SUMMARY

The unnamed tributary to Little Hunting Creek (UTLHC) Stream Restoration Project (Site) is located west of Harmony Highway (NC 21) and north of Hunting Creek Road (SR 1111) in Iredell County, North Carolina (Appendix 1.1). The Site lies within the 197 acre parcel owned by Mr. Allen D. Johnson. UTLHC is a first order perennial stream located in the Northern Inner Piedmont ecoregion in the Yadkin River Basin (USGS HUC 03040102). The stream restoration plan was designed by KCI Associates of North Carolina. Construction and seeding activities were completed in the fall of 2007.

The previous report for the third year (MY3) was completed in 2010. Monitoring activities were not conducted in CY2011 due to significant supplemental planting. This report serves as the fourth year (MY4) in 2012 of the five year monitoring plan for the Site.

1.1 Goals and Objectives

UTLHC is an active dairy farm with several structures located on the property for housing livestock and storing farm machinery. The primary land uses on the site are dairy operation, rangeland, agriculture (small grain), and forest. A private residence is located on the northeastern section of the property. The following goals and objectives were established for the Site.

Restoration Goals

1. Restore a stable channel that is capable of moving the flows and sediment provided by its watershed.
2. Improve water quality and reduce land and riparian vegetation loss resulting from lateral erosion and bed degradation.
3. Enhance aquatic and terrestrial habitat.

Restoration Objectives

1. Build an appropriate B4c type channel with stable dimensions.
2. Plant a riparian buffer of native trees and shrubs.
3. Install in-stream structures that will promote bed feature diversity and prevent vertical instability.
4. Exclude livestock from the riparian buffer.

Project streams were restored primarily using a Priority III restoration approach. UTLHC's main channel was designed and constructed as a B4c type channel. The restoration reach was restored using native vegetation and in-stream structures, such as cross-vanes and rock sill grade controls. Riparian areas were planted with native

bare root seedlings and herbaceous cover to enhance the riparian areas and stabilize streambanks. Construction of the restoration project was completed in the fall of 2007. Appendix A provides more detailed project activity, history, contact information, and watershed/site background information for this project.

1.2 Vegetation Assessment

JJG conducted the MY4 (year 4 of 5) vegetative assessment and vegetative plot analysis in June 2012. Vegetation assessments were conducted following the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2006). The success criteria for vegetation establishment requires that the planted woody stem count must meet a minimum density of 320 stems/acre after three years, 288 stems/acre after four years, and 260 stems/acre after five years.

Considering planted stems alone, the mean for the sites 7 vegetation plots is 254 stems per acre with 5 of the plots exhibiting densities below the MY4 criterion. However, with the exception of plot 6, all exhibited planted densities $\geq$200 stems/acre indicating that although planted densities did not quite meet the criterion, the deficit isn't large or widespread. In addition, when natural recruitment is considered, the plot mean is 1,475 stems/acre with all plots exhibiting densities well above the criterion. For certain plots, much of this increase was the result of box elder and red maple seedlings, but the diversity of natural recruits was generally good. In general, the site appears to demonstrate a trend for adequate density and diversity.

1.3 Stream Assessment

A total of five cross-sections and 2,156 linear feet of longitudinal profile were monitored within the main reach of UTLHC. The site exhibited general stability of the dimension and profile. Bed deposition and some in-channel vegetation noted in prior monitoring years has been largely mobilized out of the reach by flows. This has increased bedform diversity and variation. There is one area of the bed near the top of the project, which has demonstrated some deposition from local agricultural practices and a 200 foot section at the bottom of the project, which has appeared to downcut somewhat, but the overall project slope has remained consistent. There have been slight changes in W/D ratios, but the cross-sectional area has been maintained over the reach as a whole and entrenchment ratios typical of the B type stream targets have been maintained (mean 1.97). The stream structures appear to be in good condition and continue to maintain grade. Substrate assessments indicated most cross sections either maintained or increased the median particle size. Local USGS gauge data (USGS 02118500) on the main channel of Hunting Creek near Harmony, NC suggest that three bankfull or greater events occurred within the Site since MY3. Overall, the Site met the stream success criteria for MY4. Please refer to Appendix 2 for the current conditions and Appendix 4 for morphological plots and data tables.

SECTION 2
METHODOLOGY

SECTION 2
METHODOLOGY

3.1 Methodology

Methods employed for the Site were a combination of those established by standard regulatory guidance and procedure documents as well as previous monitoring reports completed by KCI. 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 performed following the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2006). 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. Precipitation data for the bankfull verification was obtained from an off-site resource. Off-site daily precipitation was obtained from the USGS raingage 355037080393045 at the South Yadkin River near Mocksville, NC (the closest location offering daily precipitation data), USGS:URLhttp://waterdata.usgs.gov/nc/nwis/uv/?site_no=355037080393045&agency_cd=USGS. Precipitation data was previously collected from USGS gauge station number 02118500 on Hunting Creek near Harmony, NC, but this site last collected precipitation data on February 16, 2010 – the reason is unknown.

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.

KCI Associates of NC. 2008. Johnson Site Stream Restoration Mitigation Plan and As-Built Report (2008). Raleigh, NC.

Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. (2006). CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved from http://www.nceep.net/business/monitoring/veg/datasheets.htm.

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

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 A – Project Vicinity Map and Background Tables

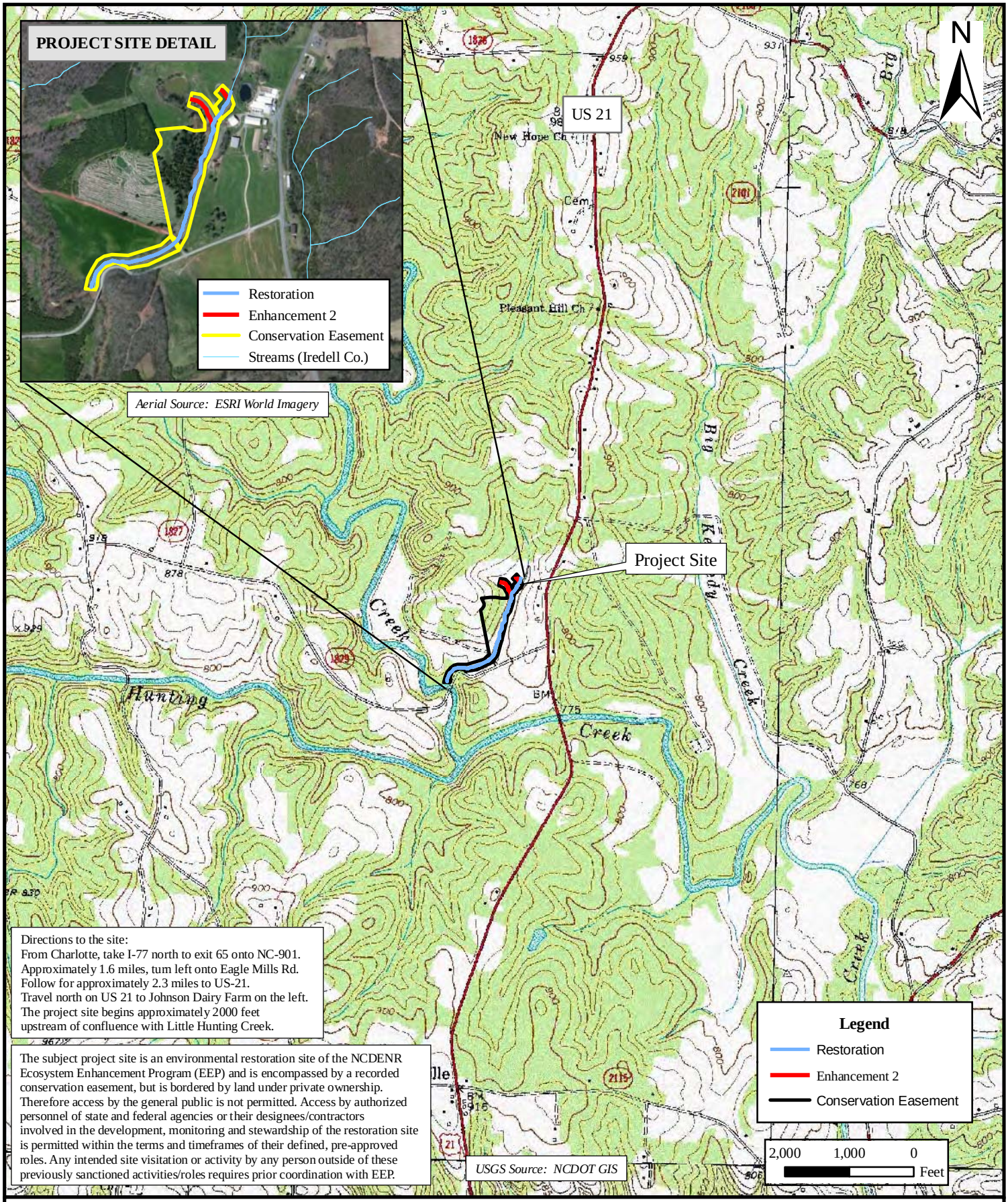
Appendix B – Visual Assessment Data

Appendix C – Vegetation Plot Data

Appendix D – Stream Survey Data

Appendix E – Hydrologic Data

APPENDIX A
PROJECT VICINITY MAP AND BACKGROUND TABLES



Appendix A: Project Vicinity Map and Background Tables
Figure 1 Project Vicinity Map and Directions
Johnson Site Stream Restoration/EEP Project No. 197 Iredell County, NC
Monitoring Year 4 of 5
Submittal Date: February 2013

Appendix A - Project Vicinity Map and Background Tables
Table 1: Project Restoration Components
UT to Little Hunting Creek (Johnson Site)/ EEP Project No. 197
Monitoring Year 4 of 5

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE	N/A	N/A	N/A
Totals	2,209	167	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Project Components						
Project Component	**Stationing/Location**	**Existing Feet/Acres**	**Approach**	**Restoration -or- Restoration Equivalent**	**Restoration Footage or Acres**	**Mitigation Ratio**
UTLHC	10+00 - 32+09	2209 lf	P3	Restoration	2,209	1
UT1		117 lf	E2	Enhancement	117	2.5:1
UT2		300 lf	E2	Enhancement	300	2.5:1

Component Summation						
Restoration Level	**Stream (lf)**	**Riparian Wetland (ac)**		**Non-Riparian Wetland (ac)**	**Buffer (sq ft)**	**Upland (ac)**
		Riverine	**Non-Riverine**			
Restoration (R)	2,209	N/A	N/A	N/A	N/A	N/A
Enhancement II (E)	417	N/A	N/A	N/A	N/A	N/A
Totals	**2,626**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

BMP Elements			
Element	**Location**	**Purpose/Function**	**Notes**
N/A	N/A	N/A	N/A

BMP Elements
BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP= Dry Detention Pond; FS = Filter Strip;
S= Grass Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer
SMU = Stream Mitigation Unit; WMU = Wetland Mitigation Mitigation Unit

Appendix A - Project Vicinity Map and Background Tables
Table 2: Project Activity and Reporting History
UT to Little Hunting Creek (Johnson Site) Stream Restoration/ EEP Project No. 197
Monitoring Year 4 of 5

Elapsed Time Since Grading Complete: 5 Year 1 Months
Elapsed Time Since Planting Complete: 5 Year 1 Months
Number of Reporting Years: 4

Activity or Report	Data Collection Completed	Actual Completion or Delivery
Mitigation Plan	Nov-05	Feb-06
Final Design - Construction Plans	Nov-05	Feb-06
Construction	N/A	Nov-07
Temporary S&E mix applied to entire project area	N/A	Nov-07
Permanent seed mix applied to reach/segments	N/A	Nov-07
B&B plantings for reach/segments	N/A	Nov-07
Bare root and livestake plantings for reach/segments	N/A	Nov-07
Baseline Monitoring Document (Year 0 Monitoring - baseline)	Dec-07	Jun-08
Year 1 Monitoring	Jan-09	Feb-09
Year 2 Monitoring	Jun-09	Dec-09
Year 3 Monitoring	Oct-10	Jan-11
Year 4 Monitoring	Jun-12	Dec-12
Year 5 Monitoring	2013	2013

Appendix A - Project Vicinity Map and Background Tables
Table 3: Project Contacts Table
UT to Little Hunting Creek (Johnson Site)/ EEP Project No. 197
Monitoring Year 4 of 5

Designer	KCI Associates of North Carolina, P.A. Landmark Center II, Suite 220 4601 Six Forks Road Raleigh, NC 27609
Construction Contractor	Quartermaster Environmental Inc. P.O. Drawer 400 Shelby, NC 28150
Planting Contractor	Carolina Wetland Services 550 E. Westinghouse Boulevard Charlotte, NC 28273
Seeding Contractor	Quartermaster Environmental Inc. P.O. Drawer 400 Shelby, NC 28150
Monitoring Performers	Jordan, Jones and Goulding, Inc. 6801 Governors Lake Parkway Norcross, GA 30071
Stream Monitoring, POC	Alison Nichols, 704-301-7563
Vegetation Monitoring, POC	

Appendix A - Project Vicinity Map and Background Tables
Table 4: Project Attribute Table
UT to Little Hunting Creek (Johnson Site) Stream Restoration/ EEP Project No. 197
Monitoring Year 4 of 5

Project Information			
Project Name	UT to Little Hunting Creek (Johnson Site) Stream Restoration		
Project County	Iredell County, NC		
Project Area (acres)	10.1		
Project Coordinates	80d 45' 52.582" W, 36d 1' 19.619" N		
Project Watershed Summary Information			
Physiographic Region	Piedmont		
Project River Basin	Yadkin		
USGS HUC for Project (8 digit)	03040102		
NCDWQ Sub-basin for Project and Reference	03-07-06		
Project Drainage Area (acres)	108.8		
Project Drainage Area Percentage of Impervious Area	3		
CGIA Land Use Classification	-		
Reach Summary Information*			
Parameters			
Length of reach (linear feet)	2,626		
Valley classification	N/A		
Drainage area (acres)	57.6		
NCDWQ stream identification score	12-108-16-6 (Little Hunting Creek)		
NCDWQ Water Quality Classification	WS-III		
Morphological Description (stream type)	Perennial		
Evolutionaly trend	F5/F6 to B4/5c		
Underlying mapped soils	Chewalca, Colfax Sandy Loam, Various Cecil Series		
Drainage Class	-		
Soil Hydric status	N/A		
Slope	2.2000		
FEMA classification	Zones A and C		
Native vegetation community	U		
Percent composition of exotic invasive vegetation	-		
Wetland Summary Information**			
Parameters			
Size of Wetland (acres)			
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)			
Mapped Soil Series			
Drainage class			
Soil Hydric Status			
Source of Hydrology			
Hydrologic impairment			
Native vegetation community			
Percent composition of exotic invasive vegetation			
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	Yes	Yes	N/A
Waters of the United States - Section 401	Yes	Yes	N/A
Endangered Species Act	No	N/A	N/A
Historic Preservation Act	No	N/A	N/A
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

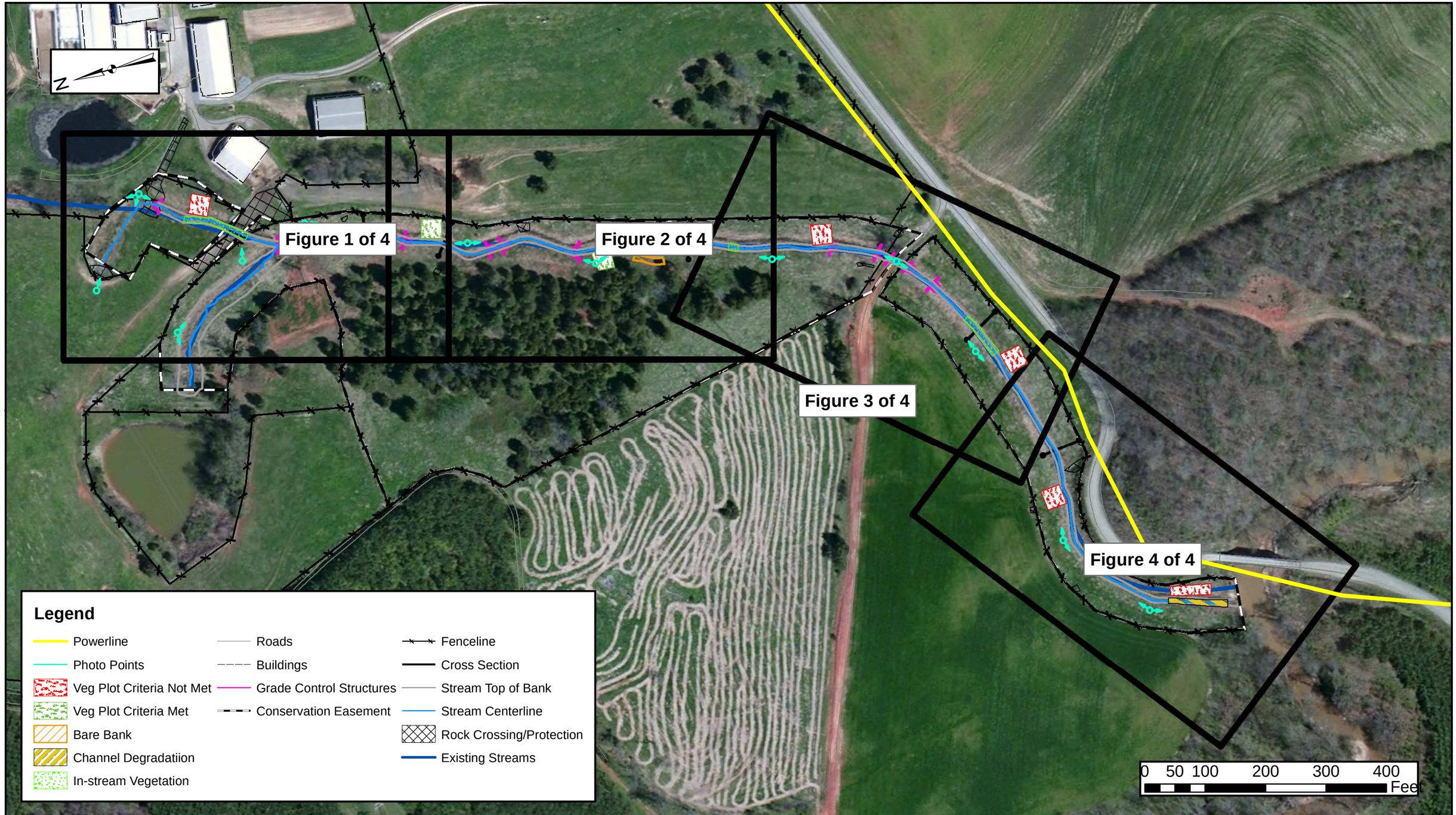
*This site is not within an EEP planning area but is in a Targeted Local Watershed

**Wetland mitigation was not included for this restoration project.

"N/A": items do not apply / "-" Items are not available / "U" Items are unknown

APPENDIX B
VISUAL ASSESSMENT DATA

Figure 2	**Current Condition Plan View (CCPV)**
Table 5	**Visual Stream Morphology Stability Assessment Table**
Table 6	**Vegetation Condition Assessment Table**
Photos	**Stream Station Photos**
Photos	**Vegetation Plot Photos**



NOTES:
1. GENERAL SITE DATA ARE PROVIDED BY NCEEP.
2. ALL LOCATIONS ARE APPROXIMATE

EEP PROJECT NO. 197
IREDELL COUNTY
NORTH CAROLINA
MONITORING YEAR 4 OF 5

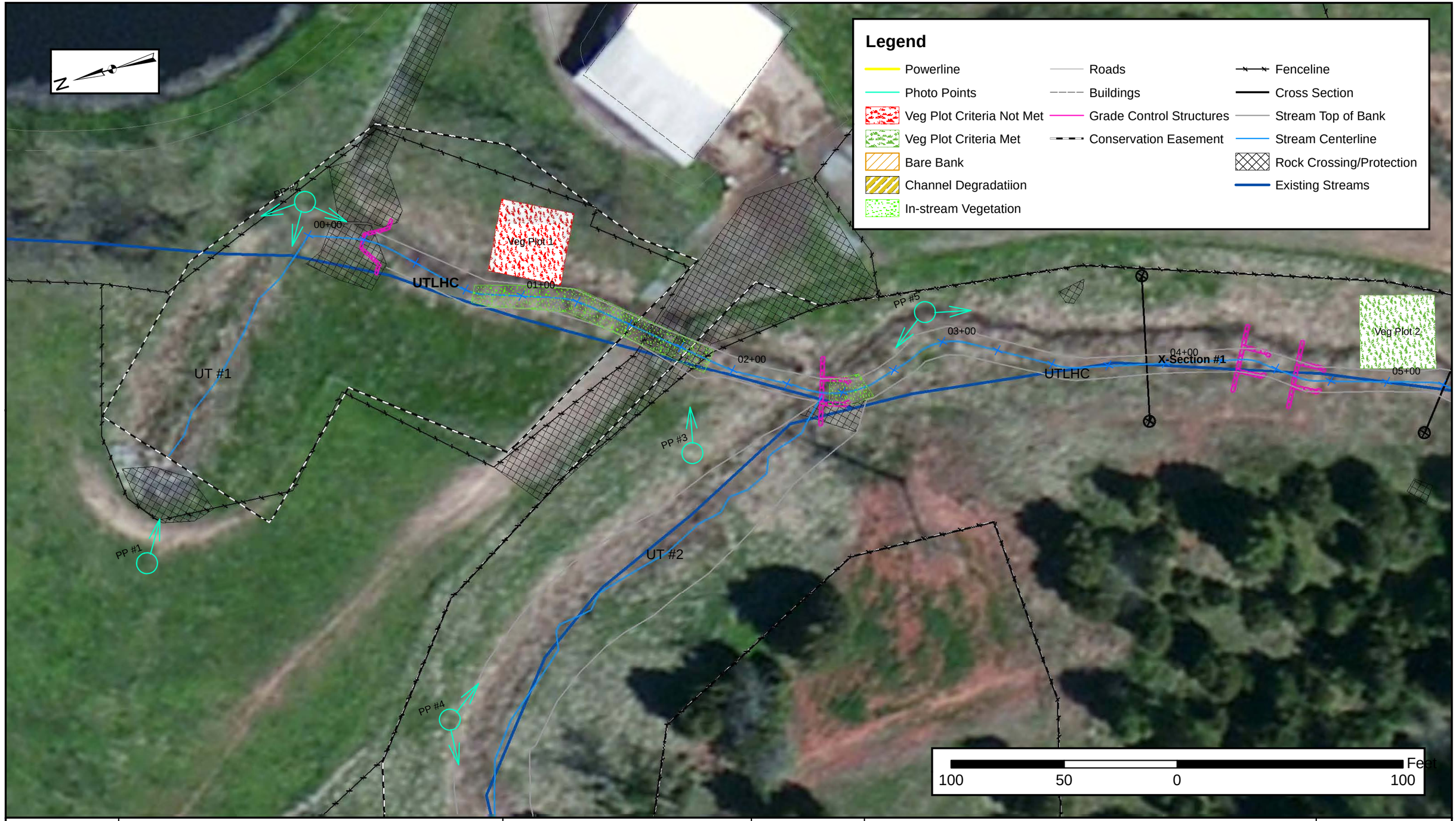
NC ECOSYSTEM ENHANCEMENT PROGRAM
UT TO LITTLE HUNTING CREEK

CURRENT CONDITION PLAN VIEW

DATE: APRIL 2012
JOB NO.: JJX31100

FIGURE INDEX

Aerial Source: ESRI World Imagery



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EEP PROJECT NO. 197
IREDELL COUNTY
NORTH CAROLINA
MONITORING YEAR 4 OF 5

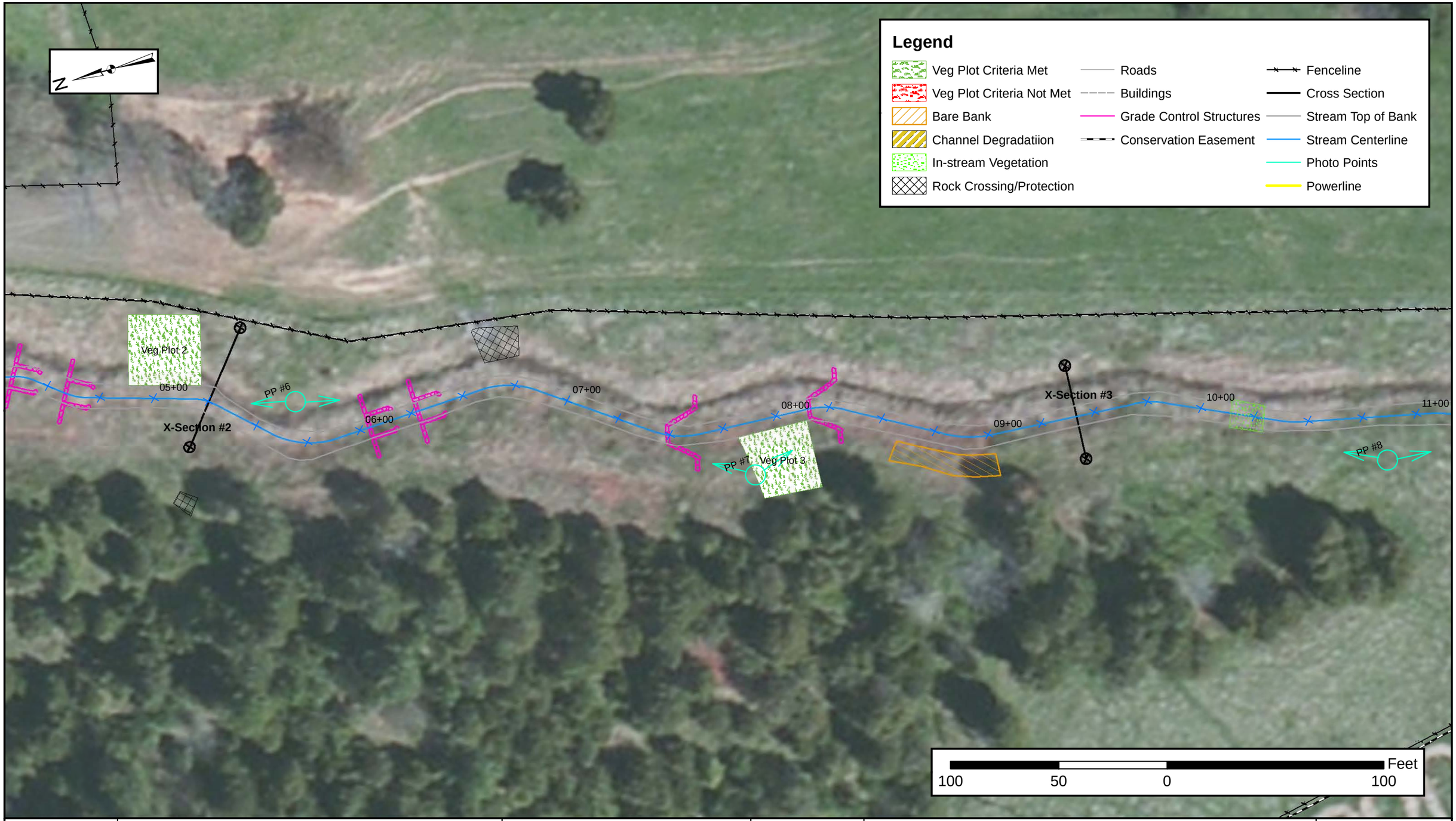
NC ECOSYSTEM ENHANCEMENT PROGRAM
UT TO LITTLE HUNTING CREEK

CURRENT CONDITION PLAN VIEW

DATE: APRIL 2012
JOB NO.: JJX31100

FIGURE 1 of 4

Aerial Source: ESRI World Imagery



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EEP PROJECT NO. 197
IREDELL COUNTY
NORTH CAROLINA
MONITORING YEAR 4 OF 5

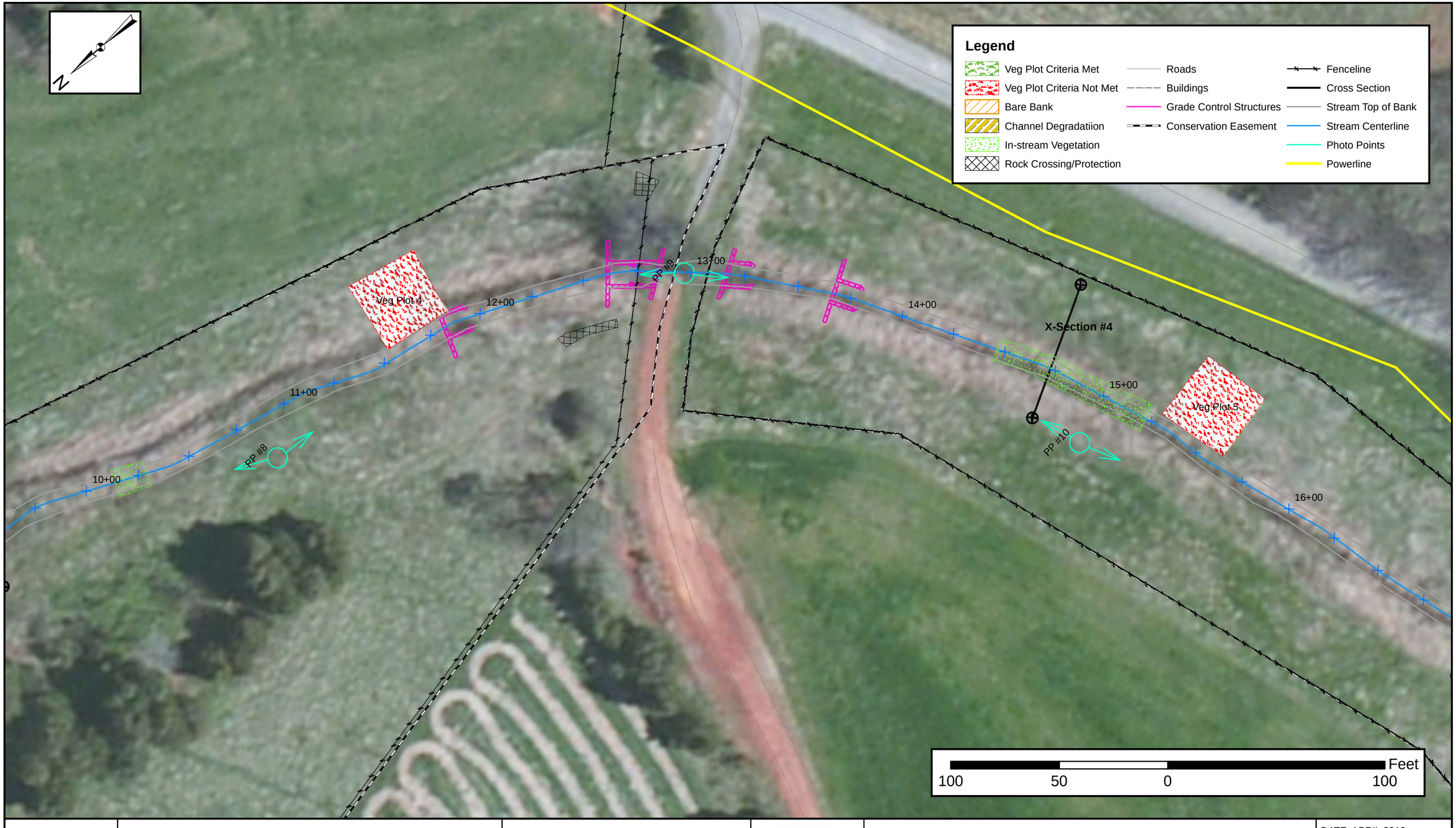
NC ECOSYSTEM ENHANCEMENT PROGRAM
UT TO LITTLE HUNTING CREEK

CURRENT CONDITION PLAN VIEW

DATE: APRIL 2012
JOB NO.: JJX31100

FIGURE 2 of 4

Aerial Source: ESRI World Imagery



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EEP PROJECT NO. 197
IREDELL COUNTY
NORTH CAROLINA
MONITORING YEAR 4 OF 5

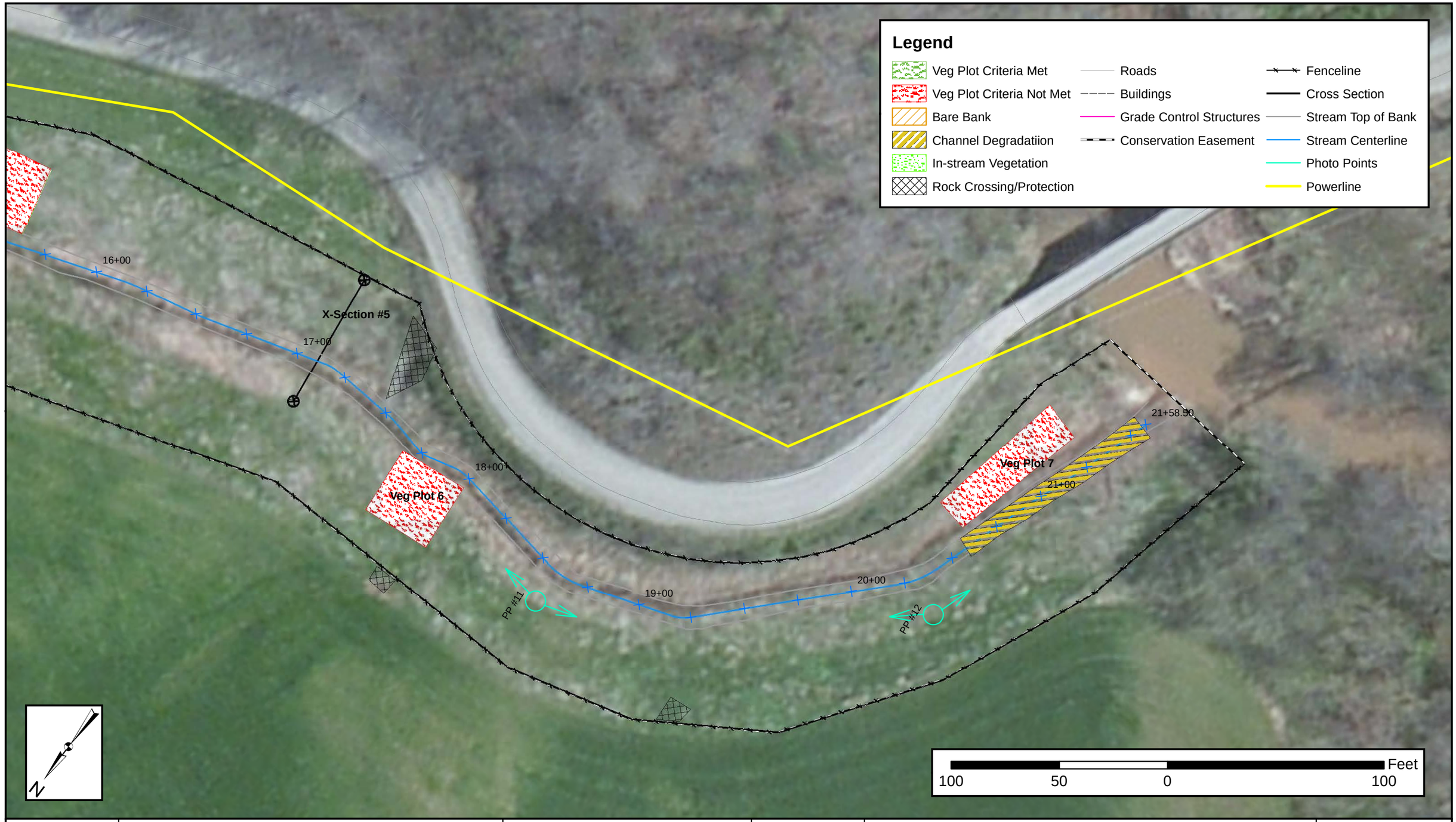
NC ECOSYSTEM ENHANCEMENT PROGRAM
UT TO LITTLE HUNTING CREEK

CURRENT CONDITION PLAN VIEW

DATE: APRIL 2012
JOB NO.: JJX31100

FIGURE 3 of 4

Aerial Source: ESRI World Imagery



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EEP PROJECT NO. 197
IREDELL COUNTY
NORTH CAROLINA
MONITORING YEAR 4 OF 5

NC ECOSYSTEM ENHANCEMENT PROGRAM
UT TO LITTLE HUNTING CREEK

CURRENT CONDITION PLAN VIEW

DATE: APRIL 2012
JOB NO.: JJX31100

FIGURE 4 of 4

Aerial Source: ESRI World Imagery

Appendix B - Visual Assessment Data
Table 5: Visual Stream Morphology Stability Assessment Table
UT to Little Hunting Creek (Johnson Site)/ EEP Project 197 - Main Channel (2,209 lf)
Monitoring Year 4 of 5

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	32	32			100%			
	3. Meander Pool Condition	Depth Sufficient	22	22			100%			
		Length Appropriate	22	22			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	22	22			100%			
		Thalweg centering at downstream of meander bend (Glide)	22	22			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	50	98%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	11	11			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	11	11			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	11	11			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	11	11			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	11	11			100%			

Appendix B - Visual Assessment Data
Table 6: Vegetation Condition Assessment Table
UT to Little Hunting Creek (Johnson Site) Stream Restoration/EEP Project 197
Monitoring Year 4 of 5

Planted Acreage* **9.8**

Vegetation Category	Definitions	Mapping Threshold (acres)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	0	0	0.00%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	0	0	0%
		Total	**0**	**0**	**0.00%**
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0	0	0	0.00%

Easement Acreage* **10.1**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Planted Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1000	0	0	0%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	0	0	0%

Photo Point 1 -
MY 1 – January 2009

Photo Point 1 -
MY 4 – June 2012

Photo Point 2 - View North
MY 1 – January 2009

Photo Point 2 - View North
MY 4 – June 2012

Photo Point 2 - View West
MY 1 – January 2009

Photo Point 2 - View West
MY 4 – June 2012

Photo Point 2 - View South
MY 1 – January 2009

Photo Point 2 - View South
MY 4 – June 2012

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Ecosystem Enhancement Program

Appendix B - Visual Assessment Data
Stream Photo Point Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
Monitoring Year 4 of 5
Submittal Date: February 2013

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Photo Point 3 -
MY 1 – January 2009

Photo Point 3 -
MY 4 – June 2012

Photo Point 4 - View Upstream Tributary
MY 1 – January 2009

Photo Point 4 - View Upstream Tributary
MY 4 – June 2012

Photo Point 4 – View Downstream Tributary
MY 1 – January 2009

Photo Point 4 – View Downstream Tributary
MY 4 – June 2012

Photo Point 5 - View Upstream
MY 1 – January 2009

Photo Point 5 - View Upstream
MY 4 – June 2012

Photo Point 5 – View Downstream
MY 1 – January 2009

Photo Point 5 – View Downstream
MY 4 – June 2012

Photo Point 6 - View Upstream
MY 1 – January 2009

Photo Point 6 - View Upstream
MY 4 – June 2012

Photo Point 6 – View Downstream
MY 1 – January 2009

Photo Point 6 – View Downstream
MY 4 – June 2012

Photo Point 7 - View Upstream
MY 1 – January 2009

Photo Point 7 - View Upstream
MY 4 – June 2012

Photo Point 7 – View Downstream
MY 1 – January 2009

Photo Point 7 – View Downstream
MY 4 – June 2012

Photo Point 8 - View Upstream
MY 1 – January 2009

Photo Point 8 - View Upstream
MY 4 – June 2012

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Appendix B - Visual Assessment Data
Stream Photo Point Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
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Submittal Date: February 2013

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Photo Point 8 – View Downstream
MY 1 – January 2009

Photo Point 8 – View Downstream
MY 4 – June 2012

Photo Point 9 - View Upstream
MY 1 – January 2009

Photo Point 9 - View Upstream
MY 4 – June 2012

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Appendix B - Visual Assessment Data
Stream Photo Point Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
Monitoring Year 4 of 5
Submittal Date: February 2013

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Photo Point 9 – View Downstream
MY 1 – January 2009

Photo Point 9 – View Downstream
MY 4 – June 2012

Photo Point 10 - View Upstream
MY 1 – January 2009

Photo Point 10 - View Upstream
MY 4 – June 2012

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Appendix B - Visual Assessment Data
Stream Photo Point Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
Monitoring Year 4 of 5
Submittal Date: February 2013

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Photo Point 10 – View Downstream
MY 1 – January 2009

Photo Point 10 – View Downstream
MY 4 – June 2012

Photo Point 11 - View Upstream
MY 1 – January 2009

Photo Point 11 - View Upstream
MY 4 – June 2012

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Ecosystem Enhancement Program

Appendix B - Visual Assessment Data
Stream Photo Point Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
Monitoring Year 4 of 5
Submittal Date: February 2013

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Photo Point 11 – View Downstream
MY 1 – January 2009

Photo Point 11 – View Downstream
MY 4 – June 2012

Photo Point 12 - View Upstream
MY 1 – January 2009

Photo Point 12 - View Upstream
MY 4 – June 2012

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Ecosystem Enhancement Program

Appendix B - Visual Assessment Data
Stream Photo Point Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
Monitoring Year 4 of 5
Submittal Date: February 2013

Prepared For:

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Photo Point 12 – View Downstream
MY 1 – January 2009

Photo Point 12 – View Downstream
MY 4 – June 2012

Cross Section 1
MY 1 – January 2009

Cross Section 1
MY 4 – June 2012

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Appendix B - Visual Assessment Data
Stream Photo Point Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
Monitoring Year 4 of 5
Submittal Date: February 2013

Prepared For:

JJG

Cross Section 2
MY 1 – January 2009

Cross Section 2
MY 4 – June 2012

Cross Section 3
MY 1 – January 2009

Cross Section 3
MY 4 – June 2012

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Ecosystem Enhancement Program

Appendix B - Visual Assessment Data
Stream Photo Point Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
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Cross Section 4
MY 1 – January 2009

Cross Section 4
MY 4 – June 2012

Cross Section 5
MY 1 – January 2009

Cross Section 5
MY 4 – June 2012

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Appendix B - Visual Assessment Data
Stream Photo Point Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
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Vegetation Plot 1
(MY2-6/2009)

Vegetation Plot 1
(MY4-6/2012)

Vegetation Plot 2
(MY2-6/2009)

Vegetation Plot 2
(MY4-6/2012)

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Ecosystem Enhancement Program

Appendix B - Visual Assessment Data
Vegetation Plot Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
Monitoring Year 4 of 5
Submittal Date: February 2013

Prepared By:

JJG

Vegetation Plot 3
(MY2-6/2009)

Vegetation Plot 3
(MY4-6/2012)

Vegetation Plot 4
(MY2-6/2009)

Vegetation Plot 4
(MY4-6/2012)

Prepared For:	Appendix B - Visual Assessment Data Vegetation Plot Photos UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197 Monitoring Year 4 of 5 Submittal Date: February 2013	Prepared By:

Vegetation Plot 5
(MY2-6/2009)

Vegetation Plot 5
(MY4-6/2012)

Vegetation Plot 6
(MY2-6/2009)

Vegetation Plot 6
(MY4-6/2012)

Prepared For:

Ecosystem Enhancement Program

Appendix B - Visual Assessment Data
Vegetation Plot Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
Monitoring Year 4 of 5
Submittal Date: February 2013

Prepared By:

JJG

Vegetation Plot 7
(MY2-6/2009)

Vegetation Plot 7
(MY4-6/2012)

Prepared For:

Ecosystem Enhancement Program

Appendix B - Visual Assessment Data
Vegetation Plot Photos
UT to Little Hunting Creek (Johnson Site)/EEP Project No. 197
Monitoring Year 4 of 5
Submittal Date: February 2013

Prepared By:

JJG

APPENDIX C
VEGETATION PLOT DATA

Appendix C - Vegetation Plot Data
Table 7: Vegetation Plot Mitigation Success Summary Table
UT to Little Hunting Creek (Johnson Site) Stream Restoration/EEP Project 197
Monitoring Year 4 of 5

Vegetation Plot ID	Vegetation Survival Threshold Met* (Y/N)
Plot 1	N
Plot 2	Y
Plot 3	Y
Plot 4	N
Plot 5	N
Plot 6	N
Plot 7	N

* Based on planted stems only.

Appendix C - Vegetation Plot Data
Table 8: CVS Vegetation Metadata Table
UT to Little Hunting Creek (Johnson Site) Stream Restoration/EEP Project 197
Monitoring Year 4 of 5

Report Prepared By	Jennifer Mathis	
Date Prepared	12/6/2012 11:29	
database name	Database1.mdb	
database location	\\Charlotte-nc\JegProjects\JJX31100\M5-Field Monitoring Data\MY 2012\Vegetation\Hunting Creek	
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------		
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.	
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.	
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.	
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).	
Vigor	Frequency distribution of vigor classes for stems for all plots.	
Vigor by Spp	Frequency distribution of vigor classes listed by species.	
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.	
Damage by Spp	Damage values tallied by type for each species.	
Damage by Plot	Damage values tallied by type for each plot.	
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.	
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.	
PROJECT SUMMARY----------		
Project Code	197	
project Name	Bishop Site Stream and Wetland Restoration	
Description	Stream and wetland restoration/enhancement in Anson County	
length(ft)	2200	
stream-to-edge width (ft)	50	
area (sq m)	20436.6	
Required Plots (calculated)	7	
Sampled Plots	7	

Appendix C - Vegetation Plot Data
Table 9: CVS Stem Count Total and Planted by Plot and Species
UT to Little Hunting Creek (Johnson Site) Stream Restoration
Monitoring Year 4 of 5

			Current Data (MY4-2012)														Annual Means							
Species	**Common Name**	**Type**	**Plot 1**		**Plot 2**		**Plot 3**		**Plot 4**		**Plot 5**		**Plot 6**		**Plot 7**		**Current Mean**		**As Built**		**MY2 -2009**		**MY3 -2010**	
			P	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**0**	**1**	**0**	**1**
Acer negundo	box elder	T	0	25	0	0	0	0	0	0	0	5	0	6	0	46	0	12	0	0	1	1	0	10
Betula nigra	river birch	T	1	2	1	3	1	2	1	3	1	1	0	2	0	4	1	2	1	1	2	2	1	2
Cornus amomum	silky dogwood	S	1	1	3	3	3	5	2	2	2	2	2	8	0	0	2	3	2	2	0	0	1	2
Diospyros virginiana	common persimmon	T	1	3	2	3	0	1	0	1	0	0	1	1	1	5	1	2	0	0	1	1	1	1
Fraxinus pennsylvanica	green ash	T	2	3	1	1	1	1	1	1	0	0	1	1	1	3	1	1	1	1	0	0	1	1
Liquidambar styraciflua	sweetgum	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0
Liriodendron tulipifera	tuliptree	T	1	5	1	2	1	1	0	1	0	3	0	0	0	1	0	2	1	1	0	0	0	1
Pinus taeda	loblolly pine	T	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0	2	2	0	0
Platanus occidentalis	american sycamore	T	0	0	0	0	2	3	1	6	2	3	0	1	1	2	1	2	1	1	2	2	1	2
Quercus falcata	southern red oak	T	0	0	1	1	1	1	0	0	0	0	0	0	3	3	1	1	2	2	1	2	1	1
Acer rubrum	red maple	T	0	37	0	3	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
Eastern baccharis	eastern baccharis	S	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salix nigra	black willow	T	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juniperus virginiana	red cedar	T	0	2	0	3	0	14	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0
Quercus nigra	water oak	T	0	0	0	3	0	4	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Quercus phellos	willow oak	T	0	0	0	0	0	0	0	2	0	2	0	1	0	1	0	1	0	0	0	0	0	0
Sambucus canadensis	elderberry	S	0	0	0	0	0	0	0	0	0	2	0	0	0	3	0	1	0	0	0	0	0	0
Asimina triloba	paw paw	T	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unknown sp	unknown		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Plot Area (acres)			**0.0247**																					
Species Count			**5**	**9**	**6**	**8**	**6**	**9**	**4**	**9**	**3**	**5**	**3**	**7**	**4**	**8**	**6**	**13**	**7**	**6**	**7**	**7**	**6**	**8**
Stem Count			**6**	**80**	**9**	**22**	**9**	**40**	**5**	**20**	**5**	**18**	**4**	**20**	**6**	**68**	**6**	**38**	**9**	**8**	**10**	**12**	**6**	**22**
Stems per Acre			**243**	**3239**	**364**	**891**	**364**	**1619**	**202**	**810**	**202**	**729**	**162**	**810**	**243**	**2753**	**254**	**1550**	**364**	**324**	**405**	**486**	**256**	**911**

Type=**S**hrub or **T**ree
P = Planted
T = Total

Appendix D. Stream Survey Data
Figure 3a: Cross-sections with Annual Overlays
UT to Little Hunting Creek Stream Restoration/EEP Project No. 197
Monitoring Year 4 of 5

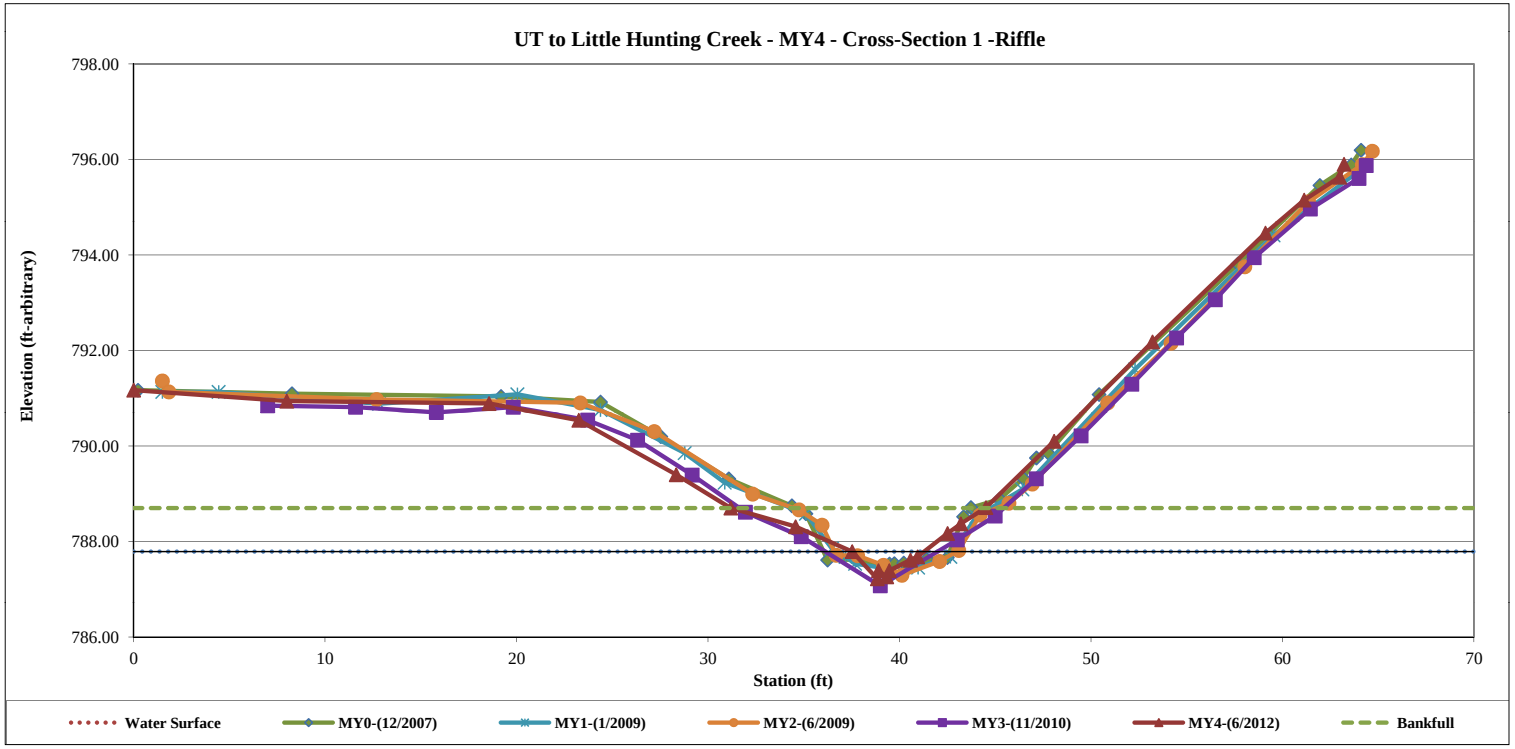
Project Name	**UT to Hunting Creek**
EEP Project Number	**197**
Cross-Section ID	**XS-1, Riffle, 3+92**
Survey Date	**6/2012**

SUMMARY DATA	
Bankfull Elevation (ft)	788.70
Bankfull Cross-Sectional Area (ft^2)	8.35
Bankfull Width (ft)	13.28
Flood Prone Area Elevation (ft)	790.18
Flood Prone Width (ft)	23.41
Bankfull Mean Depth (ft)	0.63
Bankfull Max Depth (ft)	1.48
W/D Ratio	21.08
Entrenchment Ratio	1.76
Bank Height Ratio	2.45

XS-1: View Upstream

XS-1: View Downstream

Station	Elevation	Notes
0.00	791.17	xs1-ltop
8.00	790.94	xs1
18.56	790.89	xs1-ltob
23.25	790.54	xs1
28.34	789.40	xs1
31.19	788.70	xs1-bkf
34.57	788.31	xs1
37.53	787.79	xs1-lew
38.84	787.22	xs1
38.90	787.39	xs1
39.33	787.26	xs1-twg
39.47	787.39	xs1
40.57	787.61	xs1
40.95	787.79	xs1-rew
42.51	788.17	xs1
43.20	788.37	xs1
44.51	788.71	xs1
48.07	790.10	xs1
53.21	792.18	xs1-rtob
59.11	794.46	xs1
61.13	795.15	xs1
62.99	795.63	xs1
63.21	795.90	xs1-rtop



APPENDIX D
STREAM SURVEY DATA

Figures 3a-3e	**Cross-sections with Annual Overlays**
Figure 4	**Longitudinal Profiles with Annual Overlays**
Figures 5a-5e	**Pebble Count Plots with Annual Overlays**
Tables 10a&b	**Baseline – Stream Data Summary Tables**
Table 11a	**Monitoring – Cross-Section Morphology Data Table**
Table 11b	**Monitoring – Stream Reach Morphology Data Table**

Appendix D. Stream Survey Data
Figure 3b: Cross-sections with Annual Overlays
UT to Little Hunting Creek Stream Restoration/EEP Project No. 197
Monitoring Year 4 of 5

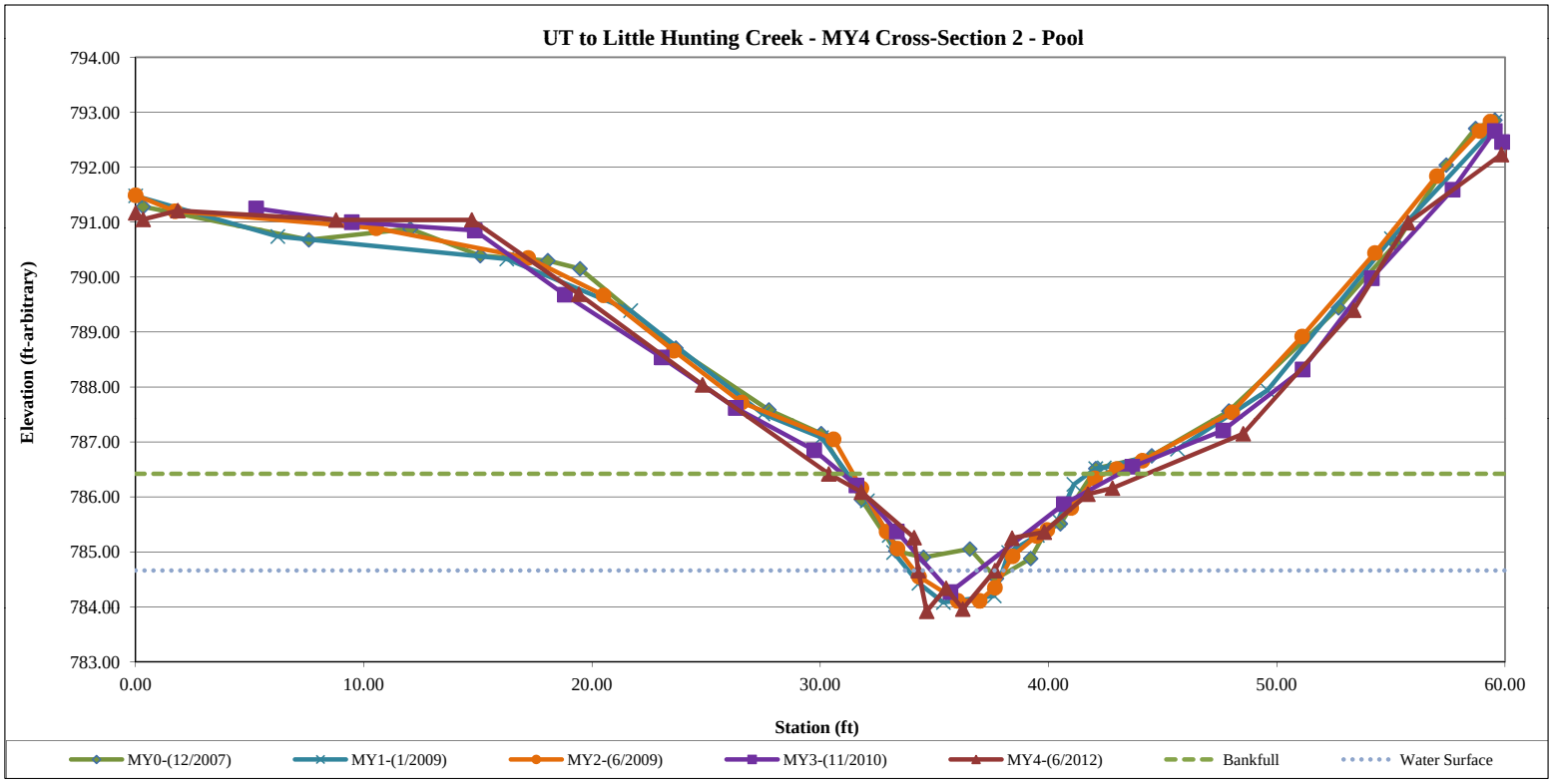
Project Name	**UT to Little Hunting Creek**
EEP Project Number	**197**
Cross-Section ID	**XS-2, Pool, 5+25**
Survey Date	**6/2012**

SUMMARY DATA	
Bankfull Elevation (ft)	786.42
Bankfull Cross-Sectional Area (ft^2)	14.16
Bankfull Width (ft)	13.93
Flood Prone Area Elevation (ft)	788.92
Flood Prone Width (ft)	30.39
Bankfull Mean Depth (ft)	1.02
Bankfull Max Depth (ft)	2.50
W/D Ratio	13.66
Entrenchment Ratio	2.18
Bank Height Ratio	2.80

XS-2: View Upstream

XS-2: View Downstream

Station	Elevation	Notes
0.00	791.17	xs2-ltop
0.33	791.05	xs2
1.85	791.21	xs2
8.78	791.04	xs2-ltob
14.73	791.04	xs2
19.42	789.69	xs2
24.84	788.04	xs2
30.37	786.42	xs2-bkf
31.80	786.09	xs2
34.11	785.26	xs2
34.29	784.66	xs2-lew
34.66	783.92	xs2-twg
35.51	784.34	xs2
36.24	783.96	xs2
37.65	784.66	xs2-rew
38.40	785.25	xs2
39.81	785.36	xs2
41.72	786.05	xs2
42.80	786.16	xs2
48.53	787.15	xs2
53.37	789.4	xs2
55.75	790.99	xs2-rtob
59.84	792.23	xs2
60.10	792.15	xs2
60.12	792.29	xs2 rtop



Appendix D. Stream Survey Data
Figure 3c: Cross-sections with Annual Overlays
UT to Little Hunting Creek Stream Restoration/EEP Project No. 197
Monitoring Year 4 of 5

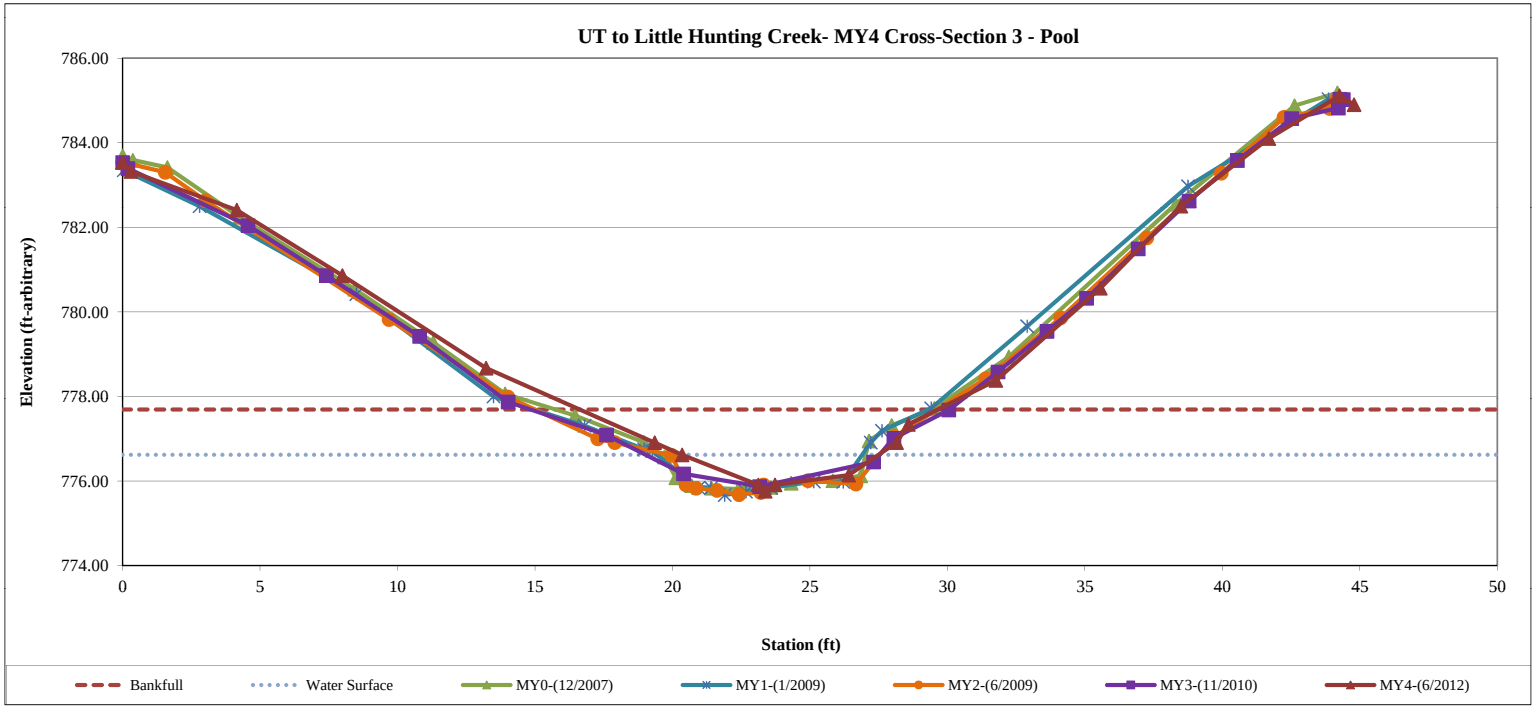
Project Name	**UT to Little Hunting Creek**
EEP Project Number	**197**
Cross-Section ID	**XS-3, Pool, 9+41**
Survey Date	**6/2012**

SUMMARY DATA	
Bankfull Elevation (ft)	777.69
Bankfull Cross-Sectional Area (ft^2)	9.43
Bankfull Width (ft)	9.18
Flood Prone Area Elevation (ft)	779.40
Flood Prone Width (ft)	22.67
Bankfull Mean Depth (ft)	1.03
Bankfull Max Depth (ft)	1.71
W/D Ratio	8.91
Entrenchment Ratio	2.47
Bank Height Ratio	5.33

XS-3: View Upstream

XS-3: View Downstream

Station	Elevation	Notes
0.00	783.53	xs3-ltop
0.30	783.32	xs3-ltob
4.15	782.41	xs3
7.99	780.86	xs3
13.22	778.21	xs3
19.35	777.75	xs3
20.35	776.62	xs3-lew
23.12	776.51	xs3
23.37	775.98	xs3-twg
23.73	776.42	xs3
26.41	776.62	xs3-rew
28.15	776.91	xs3
28.58	777.69	xs3-bkf
31.76	778.38	xs3
35.56	780.56	xs3
38.49	782.50	xs3
41.69	784.10	xs3
44.26	785.11	xs3-rtob
44.26	785.85	xs3-rtop



Appendix D. Stream Survey Data
Figure 3d: Cross-sections with Annual Overlays
UT to Little Hunting Creek Stream Restoration/EEP Project No. 197
Monitoring Year 4 of 5

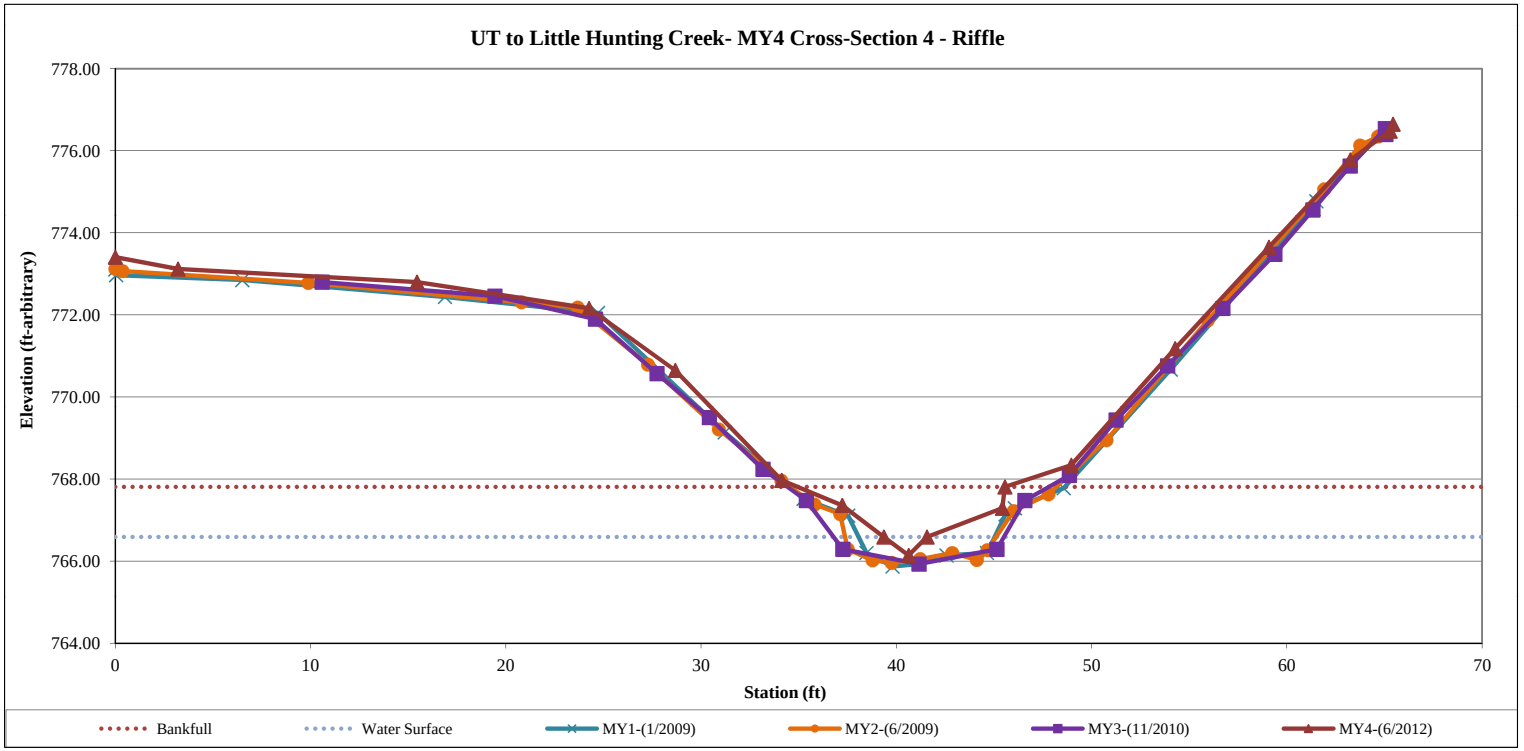
Project Name	**UT to Little Hunting Creek**
EEP Project Number	**197**
Cross-Section ID	**XS-4, Riffle, 14+72**
Survey Date	**6/2012**

SUMMARY DATA	
Bankfull Elevation (ft)	767.81
Bankfull Cross-Sectional Area (ft^2)	8.88
Bankfull Width (ft)	10.62
Flood Prone Area Elevation (ft)	769.48
Flood Prone Width (ft)	20.04
Bankfull Mean Depth (ft)	0.84
Bankfull Max Depth (ft)	1.67
W/D Ratio	12.64
Entrenchment Ratio	1.89
Bank Height Ratio	4.49

XS-4: View Upstream

XS-4: View Downstream

Station	Elevation	Notes
0.00	773.41	xs4-ltop
3.21	773.12	xs4
15.45	772.80	xs4
24.26	772.16	xs4-ltob
28.68	770.65	xs4
34.13	767.97	xs4
37.23	767.36	xs4
39.36	766.59	xs4-lew
40.63	766.14	xs4-twg
41.57	766.59	xs4-rew
45.43	767.29	xs4
45.56	767.81	xs4-bkf
48.96	768.34	xs4
54.28	771.18	xs4
59.08	773.65	xs4-rtob
63.25	775.78	xs4
65.29	776.48	xs4
65.44	776.65	xs4-rtop



Appendix D. Stream Survey Data
Figure 3e: Cross-sections with Annual Overlays
UT to Little Hunting Creek Stream Restoration/EEP Project No. 197
Monitoring Year 4 of 5

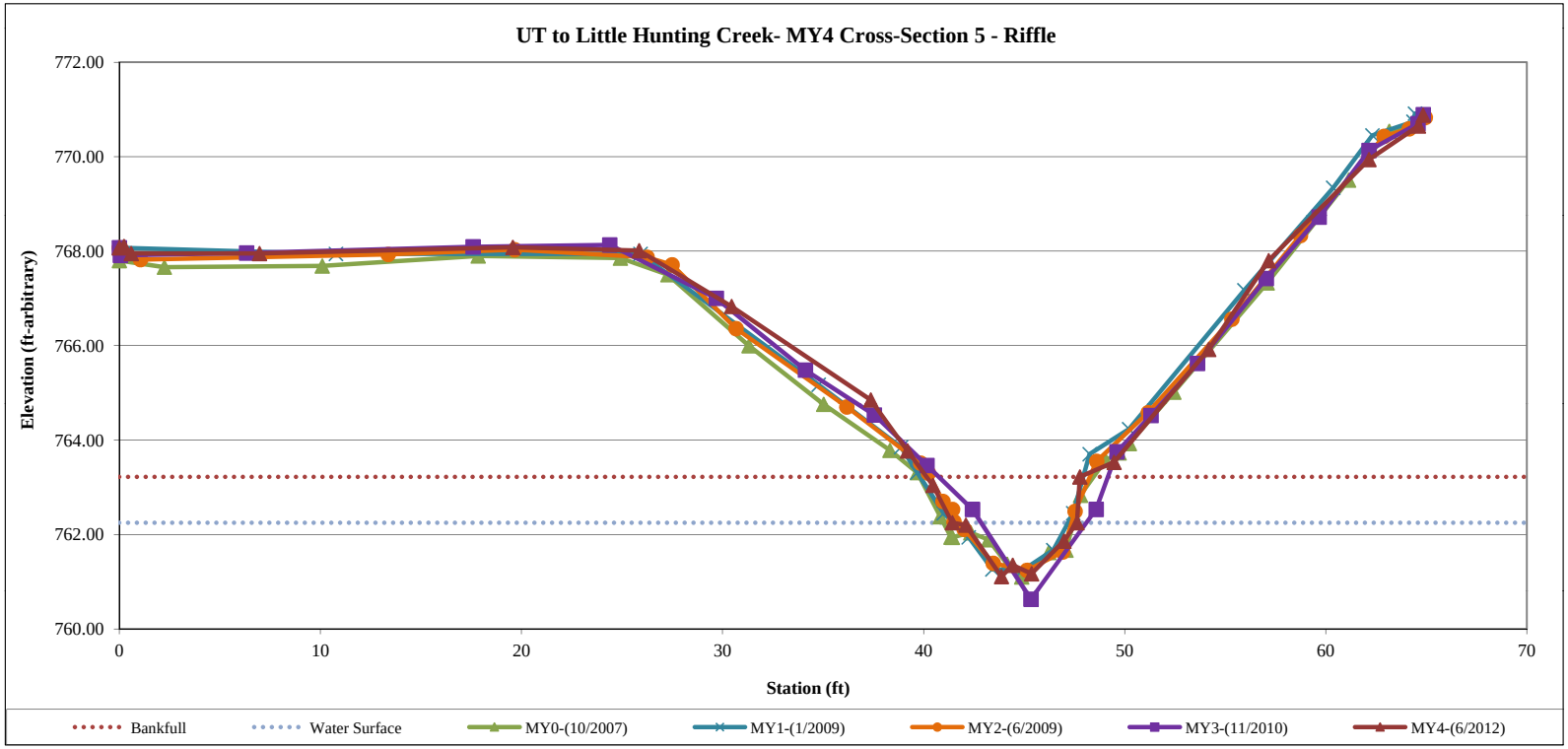
Project Name	**UT to Little Hunting Creek**
EEP Project Number	**197**
Cross-Section ID	**XS-5, Riffle, 17+10**
Survey Date	**6/2012**

SUMMARY DATA	
Bankfull Elevation (ft)	763.22
Bankfull Cross-Sectional Area (ft^2)	10.55
Bankfull Width (ft)	7.62
Flood Prone Area Elevation (ft)	765.33
Flood Prone Width (ft)	17.32
Bankfull Mean Depth (ft)	1.38
Bankfull Max Depth (ft)	2.11
W/D Ratio	5.52
Entrenchment Ratio	2.27
Bank Height Ratio	2.71

XS-5: View Upstream

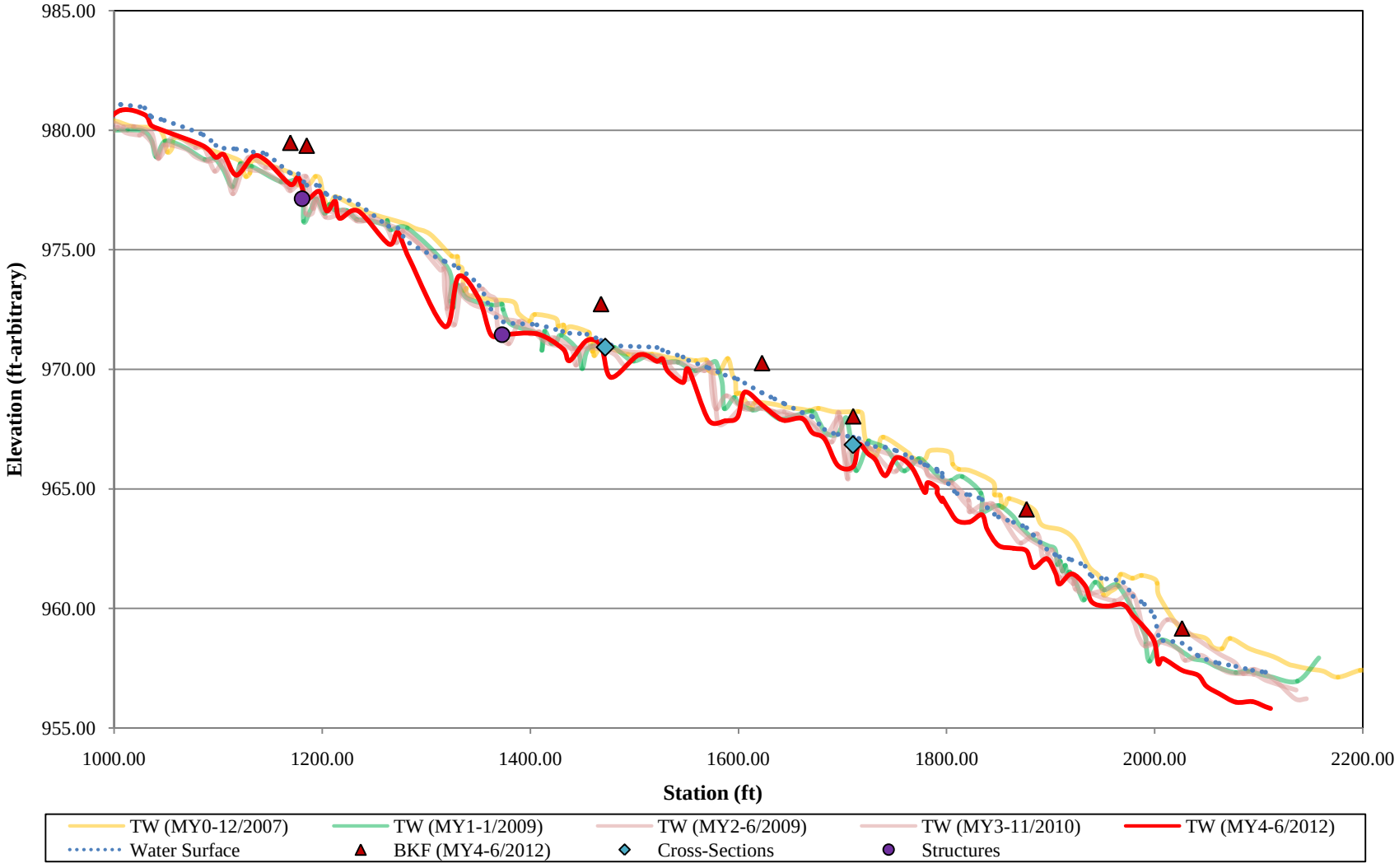
XS-5: View Downstream

Station	Elevation	Notes
0.00	768.07	xs5-ltop
0.23	768.10	xs5
0.59	767.95	xs5
6.97	767.95	xs5
19.57	768.08	xs5
25.85	768.01	xs5
30.45	766.83	xs5-ltob
37.37	764.85	xs5
39.20	763.77	xs5
40.46	763.04	xs5
41.43	762.25	xs5-lew
42.10	762.20	xs5
43.87	761.11	xs5-twg
44.43	761.35	xs5
45.37	761.17	xs5
46.98	761.86	xs5
47.63	762.25	xs5-rew
47.77	763.22	xs5-bkf
49.47	763.53	xs5
54.18	765.92	xs5
57.16	767.80	xs5-rtob
62.15	769.94	xs5
64.61	770.65	xs5
64.84	770.88	xs5-rtop



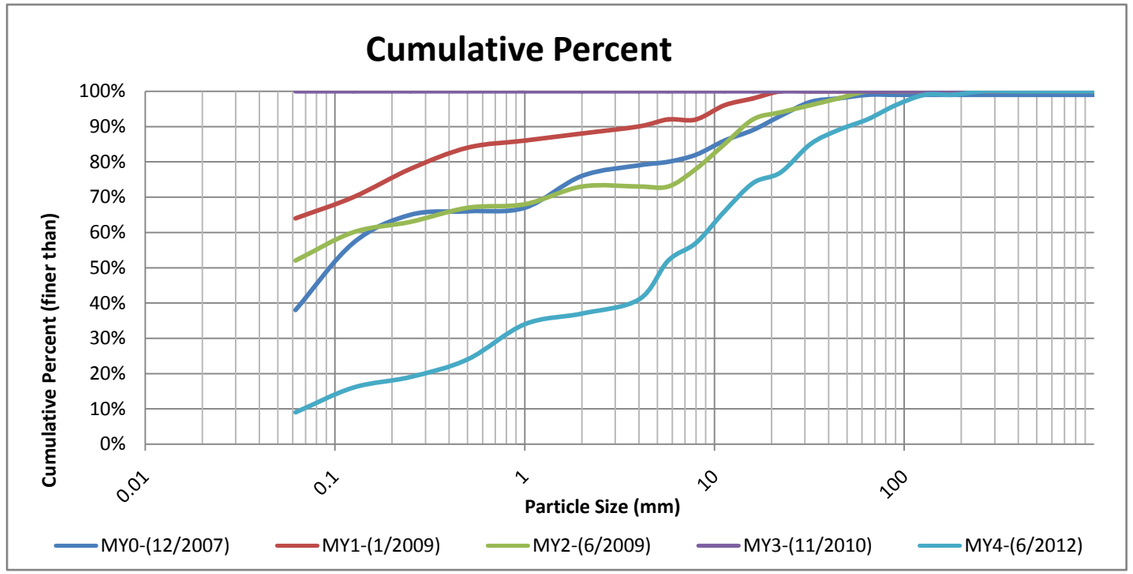
Appendix D - Stream Survey Data
Figure 4a: Longitudinal Profiles with Annual Overlays
UT to Little Hunting Creek (Johnson Site) Stream Restoration/EEP Project No. 197
2012 Monitoring Year - Monitoring Year 4 of 5

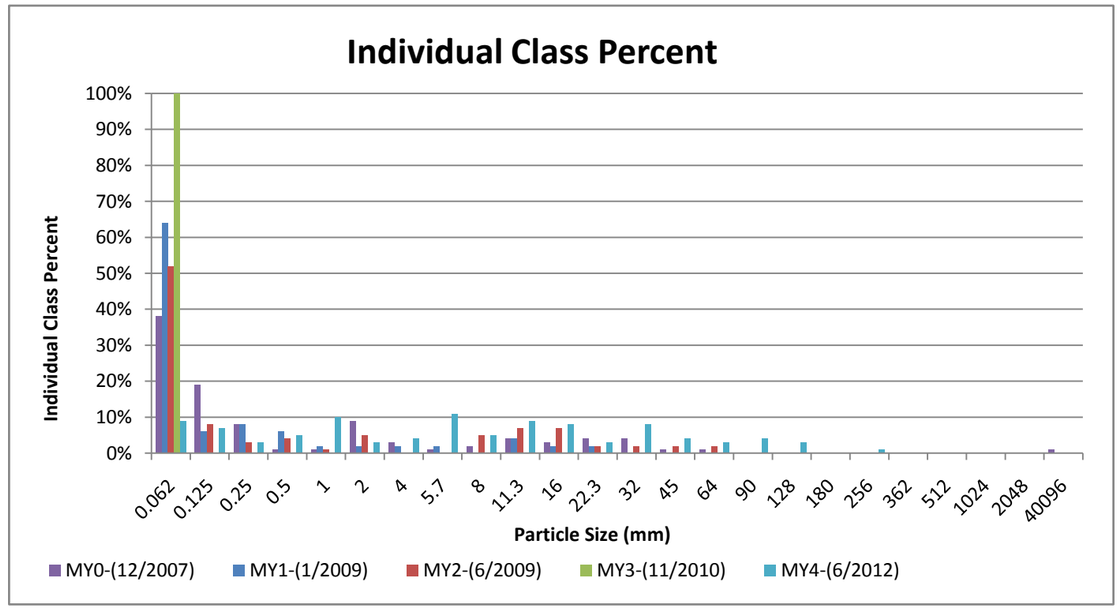
Appendix D - Stream Survey Data
Figure 4b: Longitudinal Profiles with Annual Overlays
UT to Little Hunting Creek (Johnson Site) Stream Restoration/EEP Project No. 197
2012 Monitoring Year - Monitoring Year 4 of 5



Project Name: UT to Little Hunting Creek (Johnson Site)					
Figure 5a, Cross-Section: 1					
Feature: Riffle					
			MY4-(6/2012)		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	9	9%	9%
Sand	very fine sand	0.125	7	7%	16%
	fine sand	0.250	3	3%	19%
	medium sand	0.50	5	5%	24%
	coarse sand	1.00	10	10%	34%
	very coarse sand	2.0	3	3%	37%
Gravel	very fine gravel	4.0	4	4%	41%
	fine gravel	5.7	11	11%	52%
	fine gravel	8.0	5	5%	57%
	medium gravel	11.3	9	9%	66%
	medium gravel	16.0	8	8%	74%
	course gravel	22.3	3	3%	77%
	course gravel	32.0	8	8%	85%
	very coarse gravel	45	4	4%	89%
	very coarse gravel	64	3	3%	92%
Cobble	small cobble	90	4	4%	96%
	medium cobble	128	3	3%	99%
	large cobble	180	0	0%	99%
	very large cobble	256	1	1%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			100	100%	100%

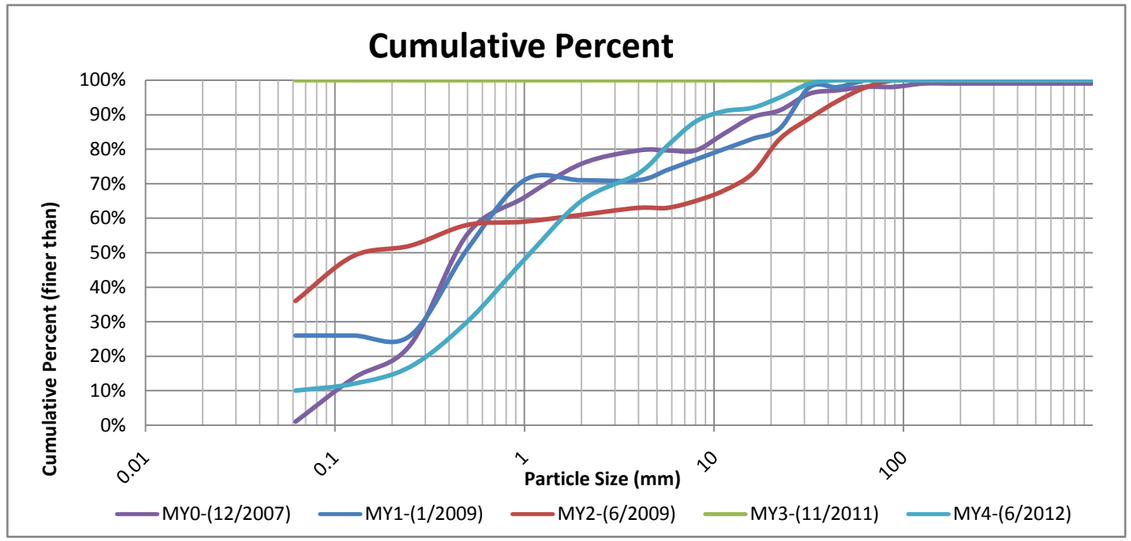
Summary Data	
D50	5.39
D84	30.83
D95	83.50

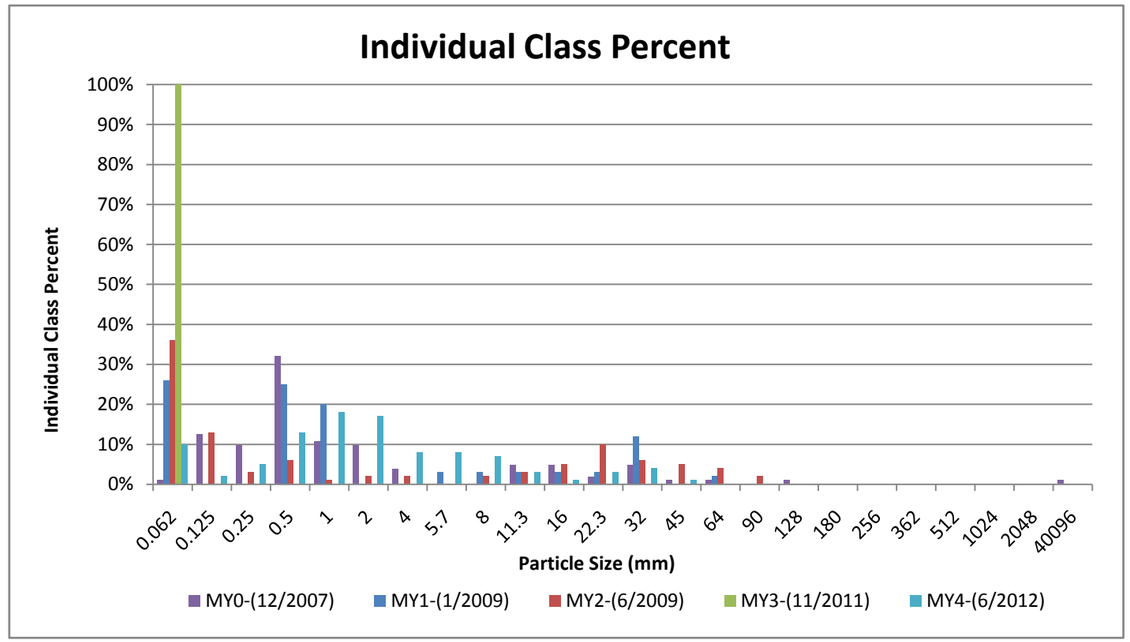




Project Name: UT to Little Hunting Creek (Johnson Site)					
Figure 5b, Cross-Section: 2					
Feature: Pool					
			MY4-(6/2012)		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	10	10%	10%
Sand	very fine sand	0.125	2	2%	12%
	fine sand	0.250	5	5%	17%
	medium sand	0.50	13	13%	30%
	coarse sand	1.00	18	18%	48%
	very coarse sand	2.0	17	17%	65%
Gravel	very fine gravel	4.0	8	8%	73%
	fine gravel	5.7	8	8%	81%
	fine gravel	8.0	7	7%	88%
	medium gravel	11.3	3	3%	91%
	medium gravel	16.0	1	1%	92%
	course gravel	22.3	3	3%	95%
	course gravel	32.0	4	4%	99%
	very coarse gravel	45	1	1%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			100	100%	100%

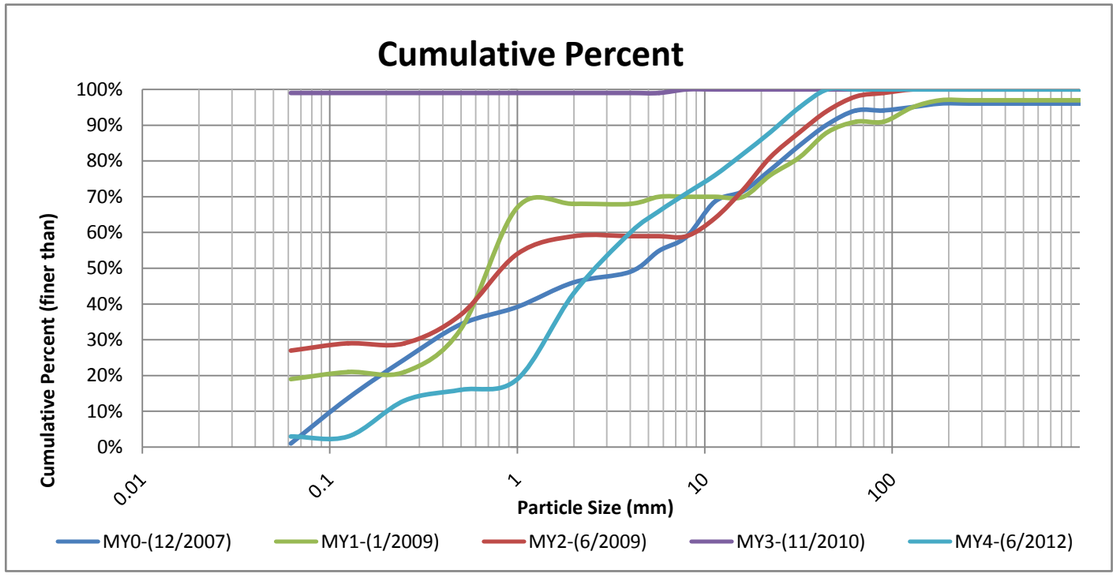
Summary Data	
D50	1.12
D84	6.69
D95	22.6

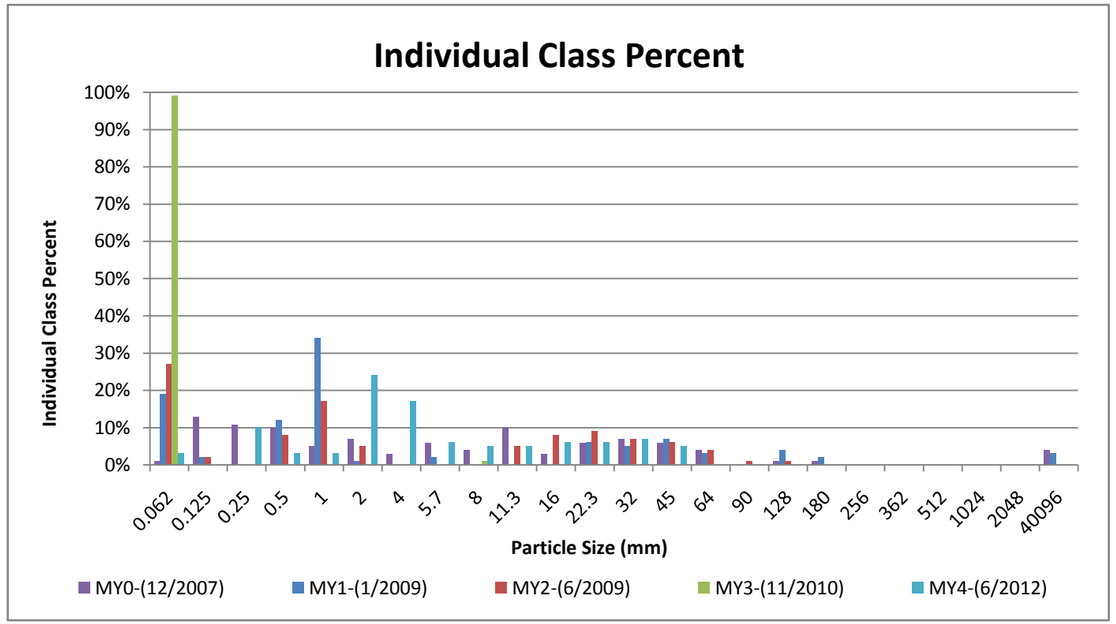




Project Name: UT to Little Hunting Creek (Johnson Site)					
Figure 5c, Cross-Section: 3					
Feature: Pool					
			MY4-(6/2012)		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	3	3%	3%
Sand	very fine sand	0.125	0	0%	3%
	fine sand	0.250	10	10%	13%
	medium sand	0.50	3	3%	16%
	coarse sand	1.00	3	3%	19%
	very coarse sand	2.0	24	24%	43%
Gravel	very fine gravel	4.0	17	17%	60%
	fine gravel	5.7	6	6%	66%
	fine gravel	8.0	5	5%	71%
	medium gravel	11.3	5	5%	76%
	medium gravel	16.0	6	6%	82%
	course gravel	22.3	6	6%	88%
	course gravel	32.0	7	7%	95%
	very coarse gravel	45	5	5%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			100	100%	100%

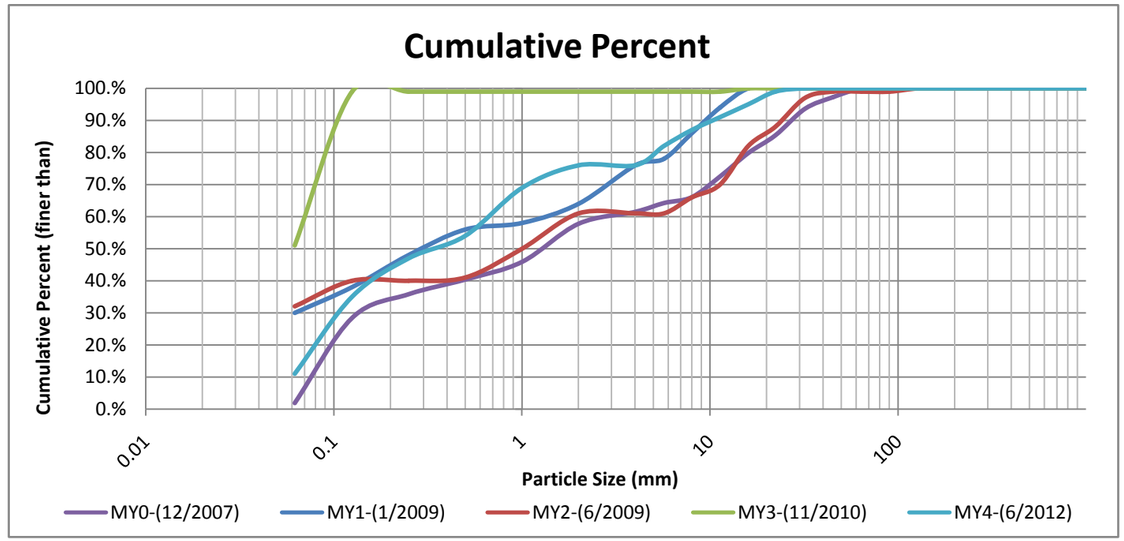
Summary Data	
D50	2.82
D84	18.2
D95	32

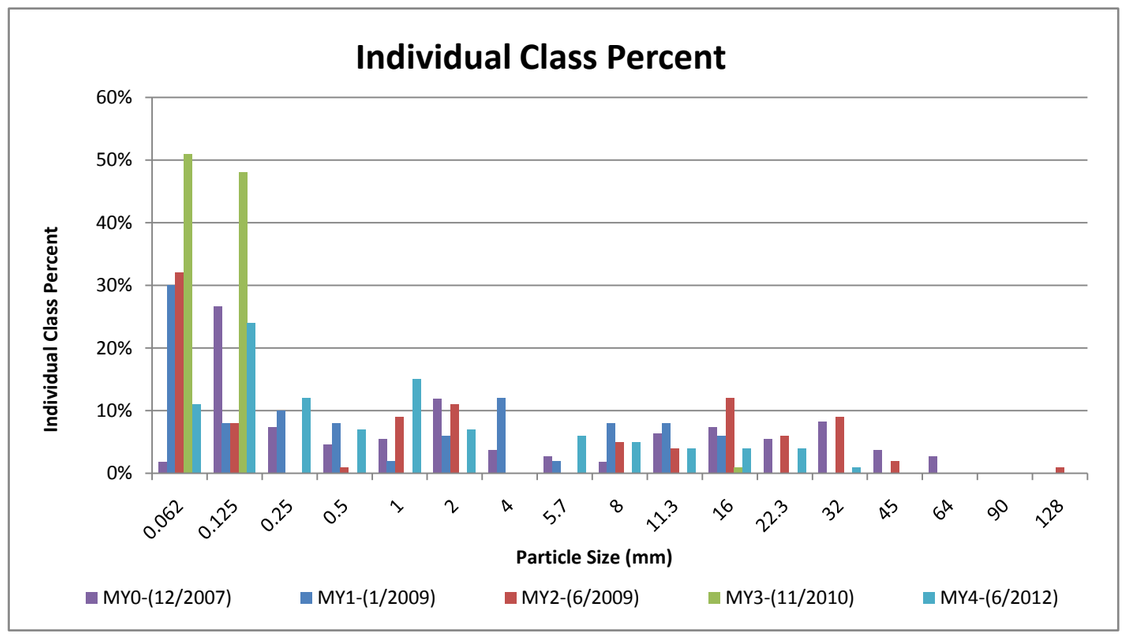




Project Name: UT to Little Hunting Creek (Johnson Site)					
Figure 5d, Cross-Section: 4					
Feature: Riffle					
			MY4-(6/2012)		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	11	11%	11%
Sand	very fine sand	0.125	24	24%	35%
	fine sand	0.250	12	12%	47%
	medium sand	0.50	7	7%	54%
	coarse sand	1.00	15	15%	69%
	very coarse sand	2.0	7	7%	76%
Gravel	very fine gravel	4.0	0	0%	76%
	fine gravel	5.7	6	6%	82%
	fine gravel	8.0	5	5%	87%
	medium gravel	11.3	4	4%	91%
	medium gravel	16.0	4	4%	95%
	course gravel	22.3	4	4%	99%
	course gravel	32.0	1	1%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			100	100%	100%

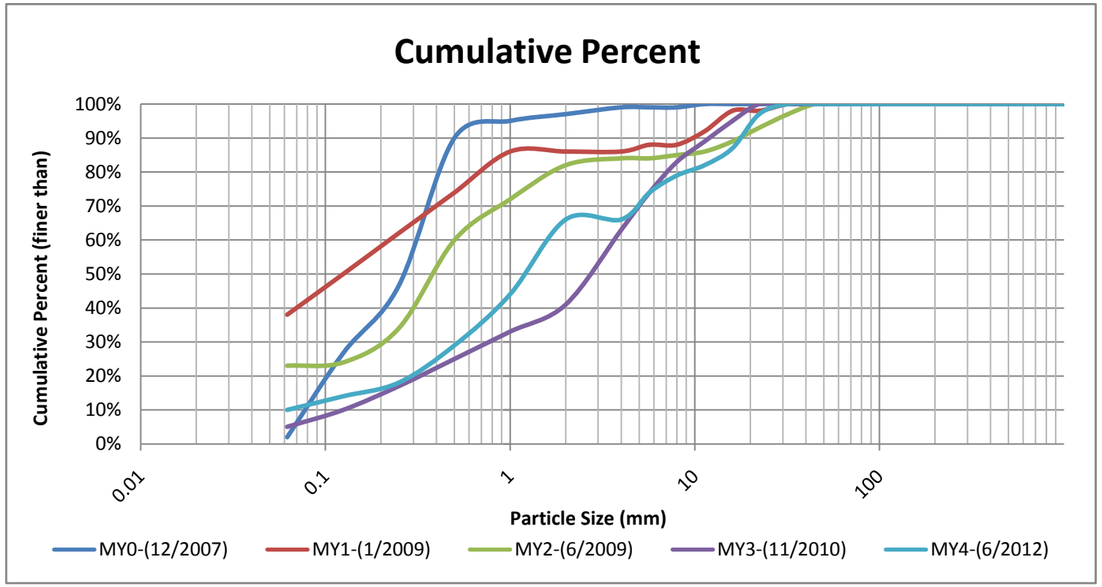
Summary Data	
D50	0.36
D84	6.62
D95	16.0

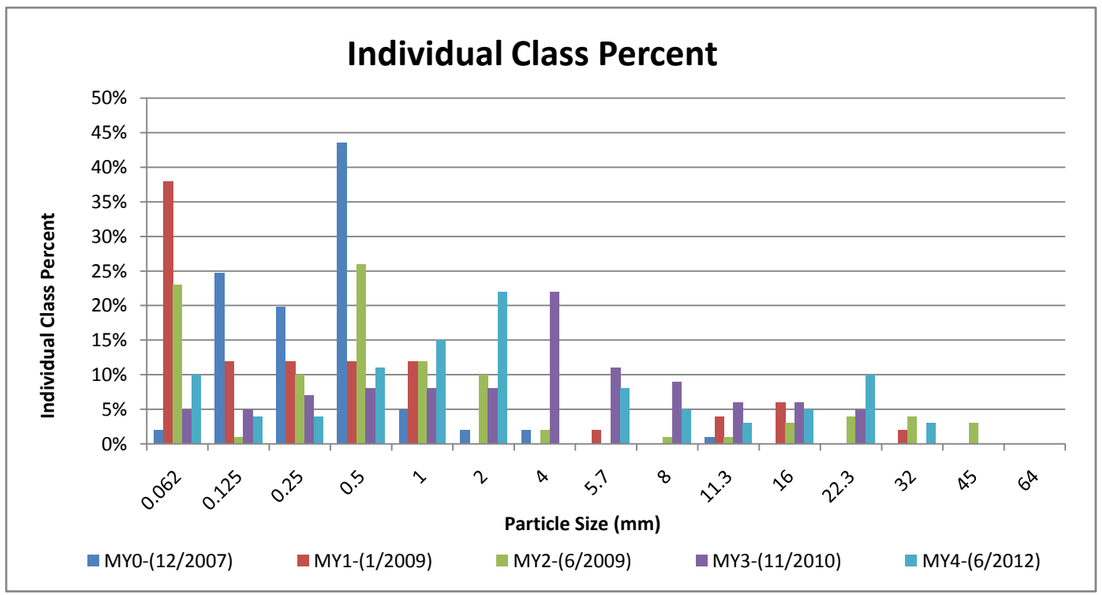




Project Name: UT to Little Hunting Creek (Johnson Site)					
Figure 5e, Cross-Section: 5					
Feature: Riffle					
			MY4-(6/2012)		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	10	10%	10%
Sand	very fine sand	0.125	4	4%	14%
	fine sand	0.250	4	4%	18%
	medium sand	0.50	11	11%	29%
	coarse sand	1.00	15	15%	44%
	very coarse sand	2.0	22	22%	66%
Gravel	very fine gravel	4.0	0	0%	66%
	fine gravel	5.7	8	8%	74%
	fine gravel	8.0	5	5%	79%
	medium gravel	11.3	3	3%	82%
	medium gravel	16.0	5	5%	87%
	course gravel	22.3	10	10%	97%
	course gravel	32.0	3	3%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			100	100%	100%

Summary Data	
D50	1.27
D84	13.18
D95	21.28





Appendix D - Stream Survey Data

Table 10a: Baseline Stream Data Summary

UT to Little Hunting Creek (Johnson Site)/ EEP Project: 197

Monitoring Year 4 of 5

Parameter	Gauge	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle	-	**LL**	**UL**	**Eq.**	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	-	-	-		4.0	9.4	8.4	15.0		6	9.0	9.5	N/A	10.0		2	8.4		N/A	8.2	8.5	8.7	8.7	-	3
Floodprone Width (ft)					7.0	13.0	12.0	21.0		6	13.0	17.0	N/A	21.0		2	10.0		11.0	15.0	17.0	18.0	18.0	-	3
Bankfull Mean Depth (ft)	-	-	-		0.5	0.8	0.8	1.0		6	1.1	1.2	N/A	1.2		2	0.8		N/A	0.9	1.0	0.9	1.1	-	3
Bankfull Max Depth (ft)	-				0.7	1.2	1.2	1.7		6	1.3	1.4	N/A	1.5		2	0.9		1.0	1.1	1.2	1.1	1.4	-	3
Bankfull Cross-Sectional Area (ft^2)	-	-	-		3.5	6.7	6.5	7.4		6	10.4	10.6	N/A	10.7		2	7.0		N/A	7.2	8.2	7.6	9.7	-	3
Width/Depth Ratio	-				4.2	14.3	10.7	30.1		6	8.0	10.0	N/A	12.0		2	10.0		2.3	7.7	9.0	9.4	10.0	-	3
Entrenchment Ratio	-				1.1	1.4	1.3	5.4		6	1.3	1.8	N/A	2.3		2	1.3		N/A	2.0	2.0	2.0	2.1	-	3
Bank Height Ratio	-				2.6	5.2	5.1	9.1		6	0.9	1.5	N/A	2.1		2	1.0		3.6	1.0	1.0	1.0	1.0	-	3
Pattern																									
Channel Beltwidth (ft)						30.0						45					38		42	16	26.0	23	39	-	9
Radius of Curvature (ft)					11			20			13			42			11		37	16	27.0	28	41	-	14
Rc:Bankfull width (ft/ft)					0.7			5			1.3			4.4			1.3		4.4	1.9	3.2	3.3	4.8	-	14
Meander Wavelength (ft)					40			140			93			136			76		126	47	69.0	70	97	-	10
Meander Width Ratio					2			705			4.5			5			4.5		5.0	1.9	3.1	2.7	4.6	-	9
Profile																									
Riffle Length (ft)					-	-	-	-	-	-	-	-	-	-	-	-				16	44.0	43	86	-	32
Riffle Slope (ft/ft)					0.007			0.0860*			0.0130			0.0280			0.0100		0.0220	0.0025	0.0198	0.0170	0.0888*	-	32
Pool Length (ft)					2	-	-	15	-	-	3	-	-	25	-	-	3		21	3	9.0	8	36	-	22
Pool Max Depth (ft)					N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pool Spacing (ft)					15	-	-	132	-	-	30	-	-	59	-	-	28		59	18	102.0	68	364	-	22
Transport Parameters																									
Reach Shear Stress (competency) lb/ft^2					-	-	-		-	-	-	-	-		-	-	0.95			1.01					
Max part size (mm) mobilized at bankful					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m^2					-	-	-		-	-	-	-	-		-	-	-	-		-	-	-	-	-	-
Additional Reach Parameters																									
Rosgen Classification	-				f5/B5c/G5c						B4c						B4c			B4c					
Bankful Velocity (fps)	-	-	-	-	-						-						-			1.62					
Bankful Discharge (cfs)	-	-	-	-	22						44						22			22					
Valley Length (ft)					-						-						-			1,939					
Channel Thalweg Length (ft)					2,260												2,156			2,158					
Sinuosity (ft)					1.1						1.2						1.1			1.11					
Water Surface Slope (ft/ft)	-				0.018						0.013						0.019			0.018					
BF slope (ft/ft)	-				0.019						0.016						0.019			0.019					
Bankful Floodplain Area (acres)					-												-			-					
% of Reach with Eroding Banks					-						-						-			-					
Channel Stability or Habitat Metric					-						-						-			-					
Biological or Other					-						-						-			-					

Appendix D - Stream Survey Data
Table 10b: Baseline Stream Data Summary (Substrate, Bed, Bank and Hydrologic Containment Parameter Distributions)
UT to Little Hunting Creek (Johnson Site) Stream Restoration/EEP Project No. 197
Monitoring Year 4 of 5

Parameter	Pre-Existing Condition	Reference Reach Data	Design	As-built/Baseline
Ri%/Ru%/P%/G%/S%	-	-	-	-
SC% / Sa% / G% / C% / B% / Be%	26% / 39% / 30% / 2% / - / 3%	0.5% / 18.5% / 77% / 4% / - / -	N/A	13.7% / 46.3% / 37.7% / 0.7% / - / 1.7%
d16 / d35 / d50 / d84 / d95 (mm)	<0.062 / 0.15 / 0.31 / 12.1 / 48 / - / -	1.6 /4.0 / 6.7 /34 /60 / - / -	-	0.1 /0.2 /1.3 / 20 /37 / - / -
Entrenchment Class<1.5/1.5-1.99/2.0-4.9/5.0-9.9/>10	100% <1.5 (1.13)	100% > 10 (15.66)	100% > 10 (16.67)	5.0 < 100% < 9.9 (5.35, 6.30)
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0	(2.53) 100% > 2.0	1.2=(1.2) 100% <1.49	(1.0) 100%< 1.2	(1.0) 100%< 1.2

Appendix D - Stream Survey Data
Table 11a: Monitoring - Cross-Section Morphology Data Table
UT to Little Hunting Creek (Johnson Site) Stream Restoration/EEP Project Number 197
Monitoring Year 4 of 5

PARAMETER	Cross-Section 1 (Riffle)					Cross-Section 2 (Pool)				
DIMENSION	MY1-2008	MY2-2009	MY3-2010	MY4-2012	MY5-2013	MY1-2008	MY2-2009	MY3-2010	MY4-2012	MY5-2013
Bankfull Width (ft)	9.15	9.04	13.01	13.28	N/A	11.04	11.67	12.78	13.93	N/A
Floodprone Width (ft)	19.36	19.23	22.73	23.41	N/A	28.58	28.27	29.65	30.39	N/A
Bankfull Mean Depth	0.84	0.80	0.73	0.63	N/A	0.84	0.80	1.05	1.02	N/A
Bankfull Max Depth (ft)	1.26	0.80	1.51	1.48	N/A	2.44	2.40	2.24	2.50	N/A
Bankfull Cross-sectional Area (ft^2)	7.72	7.27	9.50	8.45	N/A	15.67	15.63	13.44	14.16	N/A
Bankfull Width/Depth Ratio	10.89	11.30	17.82	21.08	N/A	7.77	8.71	12.17	13.66	N/A
Bankfull Entrenchment Ratio	2.11	2.13	1.75	1.76	N/A	2.59	2.42	2.32	2.18	N/A
Bankfull Bankheight Ratio	2.76	2.76	2.48	2.45	N/A	2.52	2.52	2.94	2.8	N/A
Cross Sectional Area between end pins (ft^2)	66.00	66.00	66.00	66.00	N/A	165.00	165.00	165.00	165.00	N/A
d50 (mm)	0.05	0.06	0.03	5.39	N/A	0.49	0.17	0.05	1.12	N/A

PARAMETER	Cross-Section 3 (Pool)					Cross-Section 4 (Riffle)				
DIMENSION	MY1-2008	MY2-2009	MY3-2010	MY4-2012	MY5-2013	MY1-2008	MY2-2009	MY3-2010	MY4-2012	MY5-2013
Bankfull Width (ft)	10.00	*	9.77	9.18	N/A	8.23	8.78	9.92	10.62	N/A
Floodprone Width (ft)	17.09	*	16.73	22.67	N/A	16.73	16.25	16.39	20.04	N/A
Bankfull Mean Depth	0.77	*	0.67	1.03	N/A	0.93	0.95	0.75	0.84	N/A
Bankfull Max Depth (ft)	1.23	*	1.04	1.71	N/A	1.27	1.19	1.21	1.67	N/A
Bankfull Cross-sectional Area (ft^2)	7.66	*	6.54	9.43	N/A	7.63	8.31	7.48	8.88	N/A
Bankfull Width/Depth Ratio	12.99	*	14.58	8.91	N/A	8.85	9.24	13.23	12.64	N/A
Bankfull Entrenchment Ratio	1.71	*	1.71	2.47	N/A	2.03	1.85	1.65	1.89	N/A
Bankfull Bankheight Ratio	6.20	6.20	7.36	5.33	N/A	5.20	5.20	4.93	4.49	N/A
Cross Sectional Area between end pins (ft^2)	180.00	180.00	180.00	180.00	N/A	128.00	128.00	128.00	128.00	N/A
d50 (mm)	0.75	0.88	0.03	2.82	N/A	0.31	1.00	0.06	0.36	N/A

* Data was not provided

PARAMETER	Cross-Section 5 (Riffle)				
DIMENSION	MY1-2008	MY2-2009	MY3-2010	MY4-2012	MY5-2013
Bankfull Width (ft)	8.32	8.12	7.97	7.62	N/A
Floodprone Width (ft)	18.40	18.82	21.58	17.32	N/A
Bankfull Mean Depth	1.37	1.37	1.27	1.38	N/A
Bankfull Max Depth (ft)	2.08	2.06	2.67	2.11	N/A
Bankfull Cross-sectional Area (ft^2)	11.39	11.15	10.10	10.55	N/A
Bankfull Width/Depth Ratio	6.07	5.93	6.28	5.52	N/A
Bankfull Entrenchment Ratio	2.21	2.32	2.71	2.27	N/A
Bankfull Bankheight Ratio	3.14	3.14	2.81	2.71	N/A
Cross Sectional Area between end pins (ft^2)	108.00	108.00	108.00	108.00	N/A
d50 (mm)	0.13	0.40	2.82	1.27	N/A

Parameter	Baseline						MY 1 2008						MY 2 2009					
DIMENSION	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	8.2	8.5	8.7	8.7	-	3	8.23	8.57	8.32	9.15	-	3	8.12	9.40	8.91	11.67	-	3
Floodprone Width (ft)	15.0	17.0	18.0	18.0	-	3	16.73	18.16	18.40	19.36	-	3	16.25	20.64	19.03	28.27	-	3
Bankfull Mean Depth (ft)	0.9	1.0	0.9	1.1	-	3	0.84	1.05	0.93	1.37	-	3	0.80	0.98	0.88	1.37	-	3
Bankfull Max Depth (ft)	1.1	1.2	1.1	1.4	-	3	1.26	1.54	1.27	2.08	-	3	0.80	1.61	1.63	2.40	-	3
Bankfull Cross Sectional Area (ft2)	7.2	8.2	7.6	9.7	-	3	7.63	8.91	7.72	11.39	-	3	7.27	10.59	9.73	15.63	-	3
Width/Depth Ratio	7.7	9.0	9.4	10.0	-	3	6.07	8.60	8.85	10.89	-	3	5.93	8.80	8.98	11.30	-	3
Entrenchment Ratio	2.0	2.0	2.0	2.1	-	3	2.03	2.12	2.11	2.21	-	3	1.86	2.18	2.23	2.42	-	3
Bank Height Ratio	1.0	1.0	1.0	1.0	-	3	2.76	3.70	3.14	5.20	-	3	2.52	3.96	3.14	6.20	-	3
Bankfull Velocity (fps)	0.09	1.62	0.5	4.22	-	3	0.10	0.63	0.17	1.61	-	3	0.79	2.40	2.45	3.96	-	3
PROFILE																		
Riffle Length (ft)	16	44.0	43	86	-	32	6.97	-	22.44	74.22	-	32	4.26	-	12.07	58.23	-	32
Riffle Slope (ft/ft)	0.0025	0.0198	0.0170	0.0888*	-	32	0.0024	-	0.0226	0.0867	-	32	0.0084	-	0.0327	0.1544	-	32
Pool Length (ft)	3	9.0	8	36	-	22	9.06	-	16.71	33.77	-	22	6.43	-	12.11	31.25	-	22
Pool Max depth	N/A	N/A	N/A	N/A	-	-	N/A	-	N/A	N/A	-	-	N/A	-	N/A	N/A	-	-
Pool Spacing (ft)	18	102.0	68	364	-	22	19.99	-	73.45	156.17	-	22	22.79	-	83.18	224.51	-	22
PATTERN																		
Channel Beltwidth (ft)	16	26.0	23	39	-	9	16	26.0	23	39	-	9	16	26.0	23	39	-	9
Radius of Curvature (ft)	16	27.0	28	41	-	14	16	27.0	28	41	-	14	16	27.0	28	41	-	14
Meander Wavelength (ft)	47	69.0	70	97	-	10	47	69.0	70	97	-	10	47	69.0	70	97	-	10
Meander Width Ratio	1.9	3.1	2.7	4.6	-\	9	1.9	3.1	2.7	4.6	-	9	1.9	3.1	2.7	4.6	-	9
ADDITIONAL REACH PARAMETERS																		
Rosgen Classification	B4c						B5c						B5c					
Channel Thalweg length (ft)	2,209						2,158						2,158					
Sinuosity (ft)	1.11						1.11						1.11					
Water Surface Slope (Channel) (ft/ft)	0.018						0.018						0.019					
BF slope (ft/ft)	0.019						0.018						0.019					
Ri%/Ru%/P%/G%/S%	27.00	27.00	18.00	18.00	7.00	117	27.00	27.00	18.00	18.00	7.00	117	27.00	27.00	18.00	18.00	7.00	117
SC%/Sa%/G%/C%/B%/Be%	13.7	46.30	37.70	0.7	-	1.7	35.4	40.00	22.80	6	-	3	34	33.20	31.80	1.66	-	-
d16 / d35 / d50 / d84 / d95	0.1	0.20	1.30	20	37	5	0.034	0.21	0.34	12.92	38.17	-	0.032	0.17	0.51	16.76	33.56	-
% of reach with eroding banks	-						1.08						23					
Channel Stability or Habitat Metric	-						-						-					
Biological or Other	-						-						-					

Parameter	MY 3 2010						MY 4 2012						MY 5 2013					
DIMENSION	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	7.97	10.69	9.92	13.01	-	3	7.62	10.51	10.62	13.28	-	3						
Floodprone Width (ft)	16.39	21.42	21.58	29.65	-	3	17.32	20.26	20.04	23.41	-	3						
Bankfull Mean Depth (ft)	0.67	0.89	0.75	1.27	-	3	0.63	0.95	0.84	1.38	-	3						
Bankfull Max Depth (ft)	1.04	1.73	1.51	2.67	-	3	1.48	1.75	1.67	2.11	-	3						
Bankfull Cross Sectional Area (ft2)	6.54	9.41	9.50	13.44	-	3	8.45	9.29	8.88	10.55	-	3						
Width/Depth Ratio	6.28	12.82	13.23	17.82	-	3	5.52	13.08	12.64	21.08	-	3						
Entrenchment Ratio	1.65	2.03	1.75	2.71	-	3	1.76	1.97	1.89	2.27	-	3						
Bank Height Ratio	2.48	4.10	2.94	7.36	-	3	2.45	3.22	2.71	4.49	-	3						
Bankfull Velocity (fps)	0.01	0.59	0.03	1.74	-	3	1.49	3.95	2.63	7.74	-	3						
PROFILE																		
Riffle Length (ft)	12.50	-	35.54	67.54	-	32	11.97	-	37.87	67.25	-	32						
Riffle Slope (ft/ft)	0.0128	-	0.0321	0.0810	-	32	0.01504	-	0.0301	0.1152	-	32						
Pool Length (ft)	13.01	-	23.49	42.37	-	22	24.45	-	38.43	58.52	-	22						
Pool Max depth	0.39	-	1.43	2.71	-	22	0.66	-	1.31	2.92	-	22						
Pool Spacing (ft)	20.63	-	76.93	205.69	-	22	42.75	-	122.09	233.19	-	22						
PATTERN																		
Channel Beltwidth (ft)	16	26.0	23	39	-	9	16	26.0	23	39	-	9						
Radius of Curvature (ft)	16	27.0	28	41	-	14	16	27.0	28	41	-	14						
Meander Wavelength (ft)	47	69.0	70	97	-	10	47	69.0	70	97	-	10						
Meander Width Ratio	1.9	3.1	2.7	4.6	-	9	1.9	3.1	2.7	4.6	-	9						
ADDITIONAL REACH PARAMETERS																		
Rosgen Classification	B6c						B5c											
Channel Thalweg length (ft)	2,158						2,156											
Sinuosity (ft)	1.11						1.11											
Water Surface Slope (Channel) (ft/ft)	0.019						0.019											
BF slope (ft/ft)	0.019						0.020											
Ri%/Ru%/P%/G%/S%	27.00	27.00	18.00	18.00	7.00	117	27.00	27.00	18.00	18.00	7.00	117						
SC%/Sa%/G%/C%/B%/Be%	71	28.30	30.00			-	8.6	48.80	41.00	8	-	-						
d16 / d35 / d50 / d84 / d95	0.05	0.27	0.59	1.76	3.26	-	0.26	0.89	2.19	15.1	35.07	-						
% of reach with eroding banks	5.3						2.8											
Channel Stability or Habitat Metric	-						-											
Biological or Other	-						-											

*Insufficient water in channel to estimate an approximate value

APPENDIX E
HYDROLOGIC DATA

Table 12 **Verification of Bankfull Events**

Figure 6 **Monthly Rainfall Data**

Appendix E - Hydrologic Data

Table 12: Verification of Bankfull Events

UT to Little Hunting Creek (Johnson Site) Stream Restoration/EEP Project No. 197

Monitoring Year 4 of 5

Date of Collection	Date of Occurrence	Method	Photo # (if available)
Unknown 2008	Unknown	Land Owner Confirmation	N/A
2009	Unknown	USGS Data	N/A
2010	Unknown	USGS Data	N/A

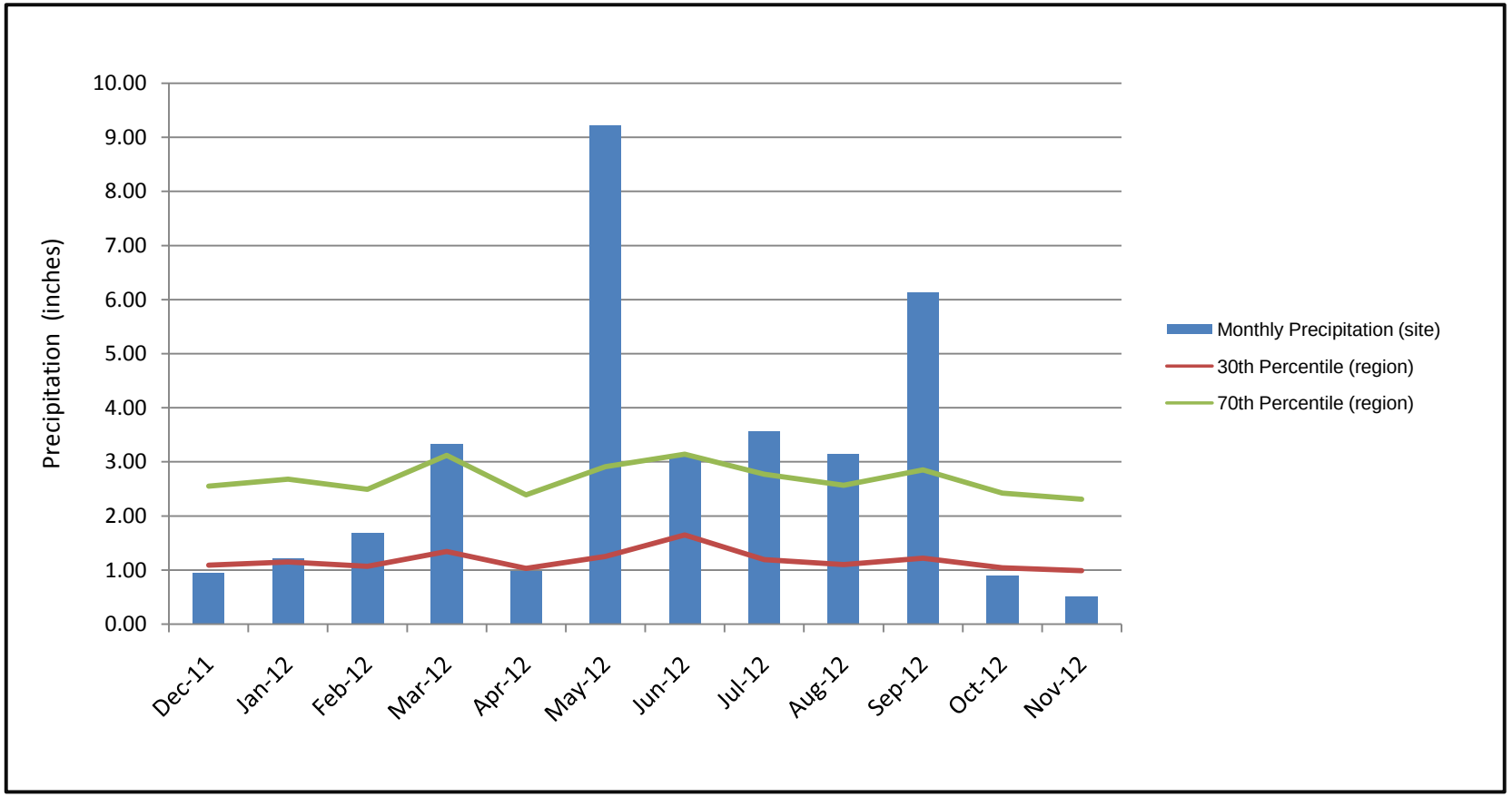
Date of Rainfall	Amount (inches)	USGS Approved (A) or Provisional (P) Data
8/26/2008	1.6	A
8/27/2008	2.96	A
12/10/2008	1.06	P
12/11/2008	2.04	P
1/6/2009-1/7/2009	2.55	A
6/3/2009-6/5/2009	4.59	P
1/24/2010-1/25/2010	2.56	P
2/05/2010-2/06/10	2.33	P
5/16/2010-5/17/2010	5.41	P
9/26/2010-9/28/2010	4.41	P
10/27/2010-10/28/2010	5.69	P
5/14/2012-5/16/2012	5.1	P

Appendix E - Hydrologic Data

UT to Little Hunting Creek (Johnson Site) Stream Restoration/EEP Project No. 197

Monitoring Year 4 of 5

Appendix E - Hydrologic Data
Figure 6: Monthly Rainfall Data
UT to Little Hunting Creek (Johnson Site) Stream Restoration Project/EEP Project No. 197
Monitoring Year 4 of 5



*Regional rainfall data referenced from NC Cronos Database Divisonal Data for Iredell County - Data Period 1971-2011. Monthly precipitation referenced from the NC CRONOS database, Station NC-IR-2, December 2011 through November 2012.