

**FINAL  
ANNUAL MONITORING REPORT  
YEAR 5 (2014)  
MCINTYRE CREEK RESTORATION SITE  
AT HORNETS NEST PARK  
MECKLENBURG COUNTY, NORTH CAROLINA  
(EEP Project No. 243, Contract No. 004499)**



Submitted to:  
North Carolina Department of Environment and Natural Resources  
Ecosystem Enhancement Program  
Raleigh, North Carolina



December 2014

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Submitted to:  
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December 2014

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## 1.0 EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (NCEEP) has completed restoration of 5178 linear feet of stream at the McIntyre Creek Restoration Site (hereafter referred to as the “Site”) to assist in fulfilling stream and wetland mitigation goals in the area. This report (compiled based on EEP’s *Procedural Guidance and Content Requirements for EEP Monitoring Reports* Version 1.4 dated 11/7/11) summarizes data for year 5 (2014) monitoring.

The goals and objectives of this project focus on improving local water quality, habitat, and stream stability. These goals were accomplished by the following.

1. Restoring stable channel morphology capable of moving flows and sediments provided by the watershed.
2. Improving water quality by reducing soil and riparian vegetation loss resulting from lateral erosion and bed degradation.
3. Improving aquatic habitat with bed variability and the use of in-stream structures.
4. Stabilizing tributaries draining into McIntyre Creek.
5. Providing educational opportunities through Mecklenburg County.
6. Improving the natural aesthetics of Hornets Nest Park.
7. Enhancing vegetation to provide habitat/food sources, shade the stream, filter overland runoff, and remove soil particles and other nutrients from stormwater.
8. Protecting a Site identified in a watershed listed as impaired for elevated levels of copper and turbidity (NCDWQ 2010).

The Site is located in Hornets Nest Park on the northern side of the City of Charlotte in Mecklenburg County. The Site is located in United States Geological Survey (USGS) Hydrologic Unit 03050101170020 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-08-34) of the Catawba River Basin and will service USGS 8-digit Cataloging Unit (CU) 03050101. The Site is located in NCEEP Targeted Local Watershed within the Long Creek watershed targeted for restoration. Waters in the Site drain approximately 2.5 miles into Long Creek (NCDWQ No. 11-120-[2.5]), which is listed as impaired for elevated levels of copper and turbidity negatively affecting aquatic life (NCDWQ 2010).

Prior to construction, the Site contained a degraded stream channel with a disturbed riparian buffer located within Hornets Nest Park. Site streams were characterized by eroding banks, channel widening, high sediment inputs from construction occurring in the upstream watershed and onsite bank erosion, and channel incision as indicated by bank-height-ratios ranging from 1.4 to 1.9. Surrounding land uses include commercial and residential areas with narrow riparian corridors adjacent to streams. At least 50 percent of the contributing watershed had been cleared and developed.

Project construction was completed between March 2007-May 2008 and remediation construction to repair structures, stabilize banks, provide grade control, and dissipate stormwater energy was completed between August 2009-January 2010. The project restored 5178 linear feet of stream using Priority I restoration by constructing a new meandering channel within the McIntyre Creek floodplain, incorporating in-stream structures, installing grade control structures at the confluence with two tributaries, and planting native forest species. Site activities provide 5129 Stream Mitigation Units (49 linear feet of the restored channel is located within a utility easement and therefore was not included in the available mitigation credit). The Site is protected by a permanent conservation easement held by the State of North Carolina.

Success criteria for stream restoration will be assessed using measurements of stream dimension, pattern, and profile; site photographs; visual assessments; and vegetation sampling. Cross-section measurements should show little or no change from the as-built cross-sections. If changes occur, evaluations will be completed to determine whether changes are minor adjustments trending towards a more stable channel or if changes indicate movement towards an unstable condition. Annual measurements should indicate stable bed form features with little change from the as-built survey. Pools are expected to maintain depth with lower water surface slope and riffles are expected to remain shallower with steeper water surface slopes. Substrate measurements should indicate maintenance of distributions from the design phase and baseline measurements. In addition, there should be an absence of any significant aggradation or degradation of the stream channel.

There are areas of bank erosion located throughout the site, with those at the bottom of the project (Monitoring reach 1) being the most concerning in that they represent active mass wasting. As a result, EEP is engaging in a repair of these areas in monitoring reach 1 early in 2015. The areas in reach 2 and 3 are less concerning in that they are dominated by surficial scour as opposed to mass wasting. Additionally, these features developed earlier in the project, but have not advanced in recent years. The bank erosion percentages within these reaches have either remained the same or improved slightly compared to prior years, but will continue to be monitored. Erosion was also observed in pool cross sections 1 and 4 earlier in the projects history, but these cross section have not demonstrated any appreciable change even when exposed to multiple storm flows. The watershed is extremely flashy due to the extensive amount of impervious surface in the contributing watershed and floods quickly even during modest rain events. Therefore, as per EEP, these areas will continue to be monitored, but given the lack of change within the last 3 years, the repair will focus on the bottom reach (Monitoring reach 1) thereby avoiding unnecessary disturbance of sections that appear to have equilibrated.

Success criteria for stream restoration will include documentation of two bankfull channel events during the monitoring period. In the event that less than two bankfull events occur during the first five years, monitoring will continue until the second event is documented. In addition, bankfull events must occur during separate monitoring years. A crest gauge is located within the Site to assist with documentation of bankfull events (Figures 2-2A, Appendix B). Two bankfull events were documented during the year 5 (2014) monitoring season for a total of five documented bankfull events within the five-year monitoring period. Additionally, precipitation data indicates that one geomorphologically relevant flow event occurred onsite during the year five (2014) monitoring season for a total of at least nine such flows occurring over the five year monitoring period.

Vegetation success criteria dictate that an average density of 320 stems per acre must be surviving in the first three monitoring years. Subsequently, 290 stems per acre must be surviving in year 4 and 260 stems per acre in year 5. Stem counts will be based on an average of the evaluated vegetation plots. Based on the number of stems counted, average densities were measured at 477 planted stems per acre (excluding livestakes) surviving in year 5 (2014). The dominant species identified at the Site were planted stems of river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), cherrybark oak (*Quercus pagoda*), and silky dogwood (*Cornus amomum*). The vegetation plots also included between 6 and 12 native woody species with 25 observed in the plot data site wide. Nine of the ten individual plots met success criteria based on planted stems alone. Plot 4 was below success criteria based on planted stems alone; however, when including naturally recruited stems of appropriate species such as green ash (*Fraxinus pennsylvanica*) and box elder (*Acer negundo*) plot 4 is well-above 260 stems per acre. Planted stems and natural recruits are growing well throughout the Site; in general vegetation is vigorous.

Vegetation areas of concern within the Site include several small patches of multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), and Japanese honeysuckle (*Lonicera japonica*).

Additionally, several large patches of Kudzu (*Pueraria lobata*) were observed within the Site (depicted on Figures 2A-2B, Appendix B). A treatment of all invasive species occurred in late October 2013 and again in early 2014; these treatments initially appeared to be successful, however, several areas of kudzu have spread during the 2014 growing season resulting in some tree mortality. EEP will continue to treat invasive species within the Site as needed.

Two groundwater gauges (Gauges 2 and 3) were installed within the Site within wetland areas created as the result of stream restoration activities. An additional gauge (Gauge 1) was placed just outside of delineated wetland areas created as the result of stream restoration activities. Success criteria for wetland groundwater hydrology at the Site requires inundation or saturation within 12 inches of the ground surface for a consecutive period of 10 percent of the growing season or greater than 23 consecutive days (the growing season in Mecklenburg County begins March 22 and ends November 11 [233 days]). Gauges 2 and 3 exceeded success criteria for year 5 (2014) and Gauge 1 was just short of success being inundated for 16 days or 6.8 percent of the growing season.

Beaver activity observed on the Site during previous monitoring years had lessened due to proactive measurements taken by EEP. Abundant signs of beaver activity were observed throughout the Site during monitoring year 5 (2014); at the time of the site visit one beaver dam was located (Figure 2A, Appendix B). Proactive measures to control beaver are recommended to continue as necessary.

Summary information and 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 tables and figures within this report's 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.

## **2.0 METHODOLOGY**

### **2.1 Vegetation Assessment**

Ten vegetation plots were established and marked after construction with four foot metal U-bar post demarking the corners with a ten foot, three-quarter inch PVC at the origin. The plots are 10 meters square and are located randomly within the Site. These plots were surveyed using the *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) (<http://cvs.bio.unc.edu/methods.htm>); results are included in Appendix C. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007).

### **2.2 Stream Assessment**

Annual stream monitoring will be conducted following procedures established in the USDA Forest Service Manual, *Stream Channel Reference Sites* (Harrelson et. al 1994) and methodologies utilized in the Rosgen stream assessment and classification system (Rosgen 1994 and 1996). Four permanent cross-sections, two riffle and two pool, were established and will be used to evaluate stream dimension; locations are depicted on Figures 2 and 2A-2B (Appendix B). Cross-sections are permanently monumented with 4-foot metal garden posts at each end point. Cross-sections will be surveyed to provide a detailed measurement of the stream and banks including points on the adjacent floodplain, top of bank, bankfull, breaks in slope, edge of water, and thalweg. Data will be used to calculate width-depth ratios, entrenchment ratios, and bank height ratios for each cross-section. In addition, photographs will be taken and pebble counts will be conducted at each permanent cross-section location annually.

Three approximately 1000-linear foot monitoring reaches were established and will be used to evaluate stream pattern and longitudinal profile; locations are depicted on Figures 2 and 2A-2B (Appendix B).

Measurements of channel pattern included belt-width, meander length, and radius of curvature (only in year one). Subsequently, data was used to calculate meander-width ratios. Longitudinal profile measurements will include average water surface slopes and facet slopes and pool-to-pool spacing. Ten permanent photo points were established throughout the restoration reach; locations are depicted on Figures 2 and 2A-2B (Appendix B) and plots are included in Appendix B. In addition, visual stream morphology stability assessments will be completed in each of the three monitoring reaches annually to assess the channel bed, banks, and in-stream structures.

### 2.3 Wetland Assessment

Three groundwater monitoring gauges were installed at the Site in February 2011 and have been maintained and monitored throughout growing season. Two gauges (Gauges 2 and 3) are located within delineated wetlands created by stream restoration activities and one gauge (Gauge 1) is located within a marginal area not in the delineated wetlands to assist with making a determination in marginal areas. Graphs of groundwater hydrology and precipitation are included in Appendix E.

### 3.0 REFERENCES

- Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2. (online). Available: <http://cvs.bio.unc.edu/methods.htm>.
- National Oceanic and Atmospheric Administration (NOAA). 2004. Climatography of the United States No. 20; Monthly Station Climate Summaries, 1971-2000. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Asheville, North Carolina.
- North Carolina Division of Water Quality (NCDWQ). 2010. Final North Carolina 2010 Integrated Report Category 4 and 5 (303(d) List EPA Approved August 31, 2010) (online). Available: [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=8ff0bb29-62c2-4b33-810c-2eee5afa75e9&groupId=38364](http://portal.ncdenr.org/c/document_library/get_file?uuid=8ff0bb29-62c2-4b33-810c-2eee5afa75e9&groupId=38364) [December 1, 2010]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.
- North Carolina Ecosystem Enhancement Program (NCEEP). 2007. Catawba River Basin Restoration Priorities. Available: <http://www.nceep.net/services/restplans/RBRPCatawba2007.pdf> [June 2010]. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.
- Weakley, Alan S. 2007. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas (online). Available: <http://www.herbarium.unc.edu/WeakleysFlora.pdf> [February 1, 2008]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.
- Weather Underground. 2014. Station at Charlotte Douglas International Airport (KCLT) in Charlotte, North Carolina. (online). Available: <http://www.wunderground.com/history/airport/KCLT/2014/11/10/CustomHistory.html> [November 10, 2014].

## APPENDIX A

### PROJECT VICINITY MAP AND BACKGROUND TABLES

Figure 1. Vicinity Map

Table 1. Project Components and Mitigation Credits

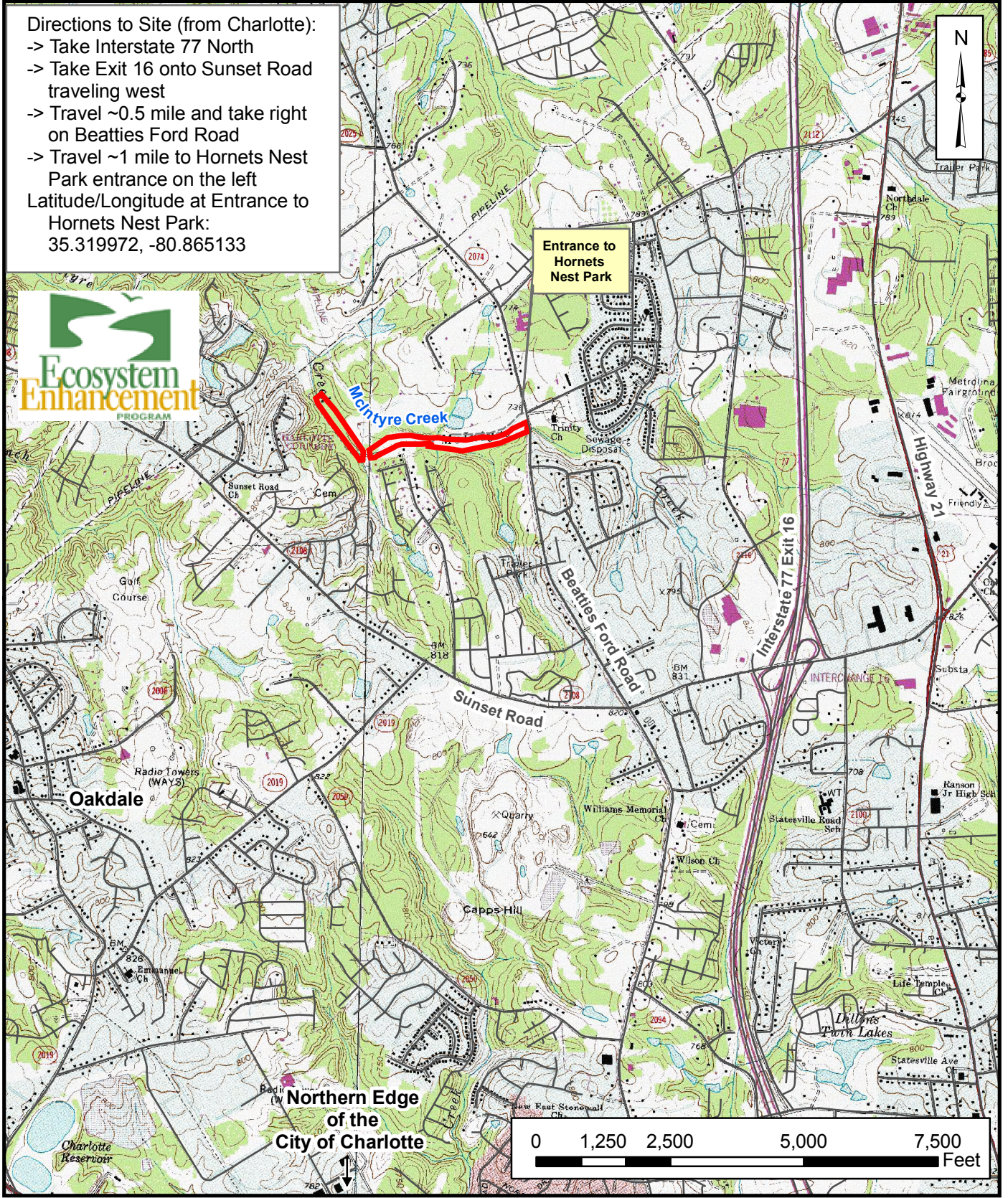
Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes



Directions to Site (from Charlotte):  
 -> Take Interstate 77 North  
 -> Take Exit 16 onto Sunset Road traveling west  
 -> Travel ~0.5 mile and take right on Beatties Ford Road  
 -> Travel ~1 mile to Hornets Nest Park entrance on the left  
 Latitude/Longitude at Entrance to Hornets Nest Park:  
 35.319972, -80.865133




20 Enterprise Street  
 Suite 7  
 Raleigh, NC 27607  
 (919) 215-1693

VICINITY MAP  
 MCINTYRE CREEK RESTORATION SITE  
 AT HORNETS NEST PARK  
 Mecklenburg County, North Carolina

Dwn. by:	CLF	FIGURE <b>1</b>
Date:	Nov 2010	
Project:	10-009	



**Table 1. Project Components and Mitigation Credits**  
**McIntyre Creek Restoration Site at Hornets Nest Park (EEP Project Number 243)**

Mitigation Credits								
Stream				Riparian Wetland				
Type	Restoration		Restoration Equivalent		Restoration		Restoration Equivalent	
<b>Totals</b>	<b>5129*</b>		--		--		<b>0.57</b>	
Projects Components								
Project Component/ Reach ID	Station Range	Existing Linear Footage/ Acreage	Priority Approach	Restoration/ Restoration Equivalent	Restoration Linear Footage/ Acreage	Mitigation Ratio	Comment	
McIntyre Creek	--	~5000	I	Restoration	5178*	1:1	Priority I stream restoration along the entire project, installation of in-stream structures, stabilizing the confluence of two incoming tributaries, and planting with native forest vegetation.	
Wetland	--	0	--	Creation	1.71	3:1	--	
Component Summation								
Restoration Level				Stream (linear footage)		Riparian Wetland (acres)		
Restoration				5178		--		
Creation				--		1.71		
<b>Totals</b>				<b>5178</b>		<b>1.71</b>		
<b>Mitigation Units</b>				<b>5129 SMUs*</b>		<b>0.57</b>		

\*Site activities restored 5178 linear feet of stream; however, 49 linear feet is located within a utility easement and is not included in the SMU calculation.

**Table 2. Project Activity and Reporting History**  
**McIntyre Creek Restoration Site at Hornets Nest Park (EEP Project Number 243)**

**Elapsed Time Since Grading Complete: 6.5 years**

**Elapsed Time Since Planting Complete: 6.5 year**

**Number of Reporting Years: 5**

<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Restoration Plan	--	December 2002
Construction Plans	--	March 2005
Site Construction and Planting	--	May 2008
As-built Construction Drawings	--	February 2008
Remediation Construction	--	January 2010
As-built Remediation Construction Drawings	--	November 2009
As-built Record Drawings	--	February 2010
Baseline Monitoring Document	July 2010	December 2010
Year 1 (2010) Monitoring Document	December 2010	December 2010
Year 2 (2011) Monitoring Document	November 2011	December 2011
Year 3 (2012) Monitoring Document	November 2012	November 2012
Beaver Management	--	Ongoing
Invasive Species Management	--	October 2013
Year 4 (2013) Monitoring Document	November 2013	December 2013
Year 5 (2014) Monitoring Document	November 2014	December 2014

**Table 3. Project Contacts Table**  
**McIntyre Creek Restoration Site at Hornets Nest Park (EEP Project Number 243)**

<b>Designer</b>	KCI Associates of North Carolina, P.A. Landmark Center I, Suite 220 4601 Six Forks Road Raleigh, NC 27609 Gary Mryncza 919-783-9214
<b>Construction and Planting Contractor</b>	United Construction, Inc. 6000 Old Pineville Road Charlotte, NC 28217 704-679-9229
<b>As-built Surveyor</b>	CSC of NC PC 4455 Morris Park Drive, Suite F Charlotte, NC 28227 Mohammad Zamani 704-573-0112
<b>Baseline Data Collection and Monitoring Performers</b>	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693



**Table 4. Project Baseline Information and Attributes  
McIntyre Creek Restoration Site at Hornets Nest Park (EEP Project Number 243)**

<b>Project Information</b>	
Project Name	McIntyre Creek Restoration Site
Project County	Mecklenburg County, North Carolina
Project Area	17 acres
Project Coordinates	35.319972, -80.865133
<b>Project Watershed Summary Information</b>	
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Project River Basin	Catawba
USGS 8-digit HUC	03050101
USGS 14-digit HUC	03050101170020
NCDWQ Subbasin	03-08-34
Project Drainage Area	2.55 square miles
Project Drainage Area Impervious Surface	>50%
CGIA Land Use Classification	Urban High
<b>Reach Summary Information</b>	
Restored length	5178 linear feet
Drainage Area	2.55 square miles
NCDWQ Index Number	11-120-3-(1)
NCDWQ Classification	C
Valley Type/Morphological Description	VIII/E5
Dominant Soil Series	Monacan
Drainage Class	Moderately well-somewhat poorly
Soil Hydric Status	Contains 5% hydric Wehadkee soils
Slope	0.0033
FEMA Classification	100-Year Floodzone
Native Vegetation Community	Bottomland Hardwood Forest
Percent Composition of Exotic Invasives	5.9%
<b>Regulatory Considerations</b>	
<b>Regulation</b>	<b>Applicable</b>
Waters of the U.S. –Sections 404 and 401	Yes-Received Appropriate Permits
Endangered Species Act	No
Historic Preservation Act	No
CZMA/CAMA	No
FEMA Floodplain Compliance	Yes-Received a No Rise Certification
Essential Fisheries Habitat	No

## APPENDIX B

### VISUAL ASSESSMENT DATA

Figures 2 and 2A-2B. Current Conditions Plan View

Tables 5A-5C. Visual Stream Morphology Stability Assessment Tables

Table 6. Vegetation Condition Assessment Table

Stream Fixed-Station Photos

Vegetation Monitoring Plot Photos



### Legend

- Conservation Easement
- Wetlands
- Cross-sections
- Monitoring Reaches
- ★ Stream Fixed-Station Photo Points
- ☆ Groundwater Gauges
- ★ Crest Gauge
- Structures
- Streams
- Vegetation Plots
  - Met Success Criteria Based on Planted Stems
  - Did Not Meet Success Criteria Based on Planted Stems Alone\*

\*\*Based on planted stems alone, plot 4 doesn't meet success criteria in year 5 (2014); however, when including naturally recruited stems of appropriate species such as box elder (*Acer negundo*) and green ash (*Fraxinus pennsylvanica*), plot four was well-above 260 stems per acre.

Photo Point	Bearing	Latitude	Longitude
1	154	35.32065	-80.87796
2	140	35.32022	-80.87791
3	324	35.31867	-80.87613
4	188	35.31823	-80.87550
5	135	35.31823	-80.87550
6	78	35.31802	-80.87389
7	90	35.31835	-80.87224
8	120	35.31841	-80.86887
9	90	35.31839	-80.86747
10	~260	35.31927	-80.86491

Feature	Latitude	Longitude
plot 1 origin	35.31901	-80.87667
plot 2 origin	35.31859	-80.87602
plot 3 origin	35.31784	-80.87533
plot 4 origin	35.31792	-80.87444
plot 5 origin	35.31851	-80.87234
plot 6 origin	35.31847	-80.87068
plot 7 origin	35.31824	-80.86931
plot 8 origin	35.31837	-80.86792
plot 9 origin	35.31873	-80.86621
plot 10 origin	35.31895	-80.86570
xsect 2 right bank	35.31820	-80.87568
xsect 2 left bank	35.31816	-80.87581
xsect 1 left bank	35.31922	-80.87688
xsect 1 right bank	35.31929	-80.87679
xsect 3 right bank	35.31859	-80.86774
xsect 3 left bank	35.31849	-80.86773
xsect 4 left bank	35.31893	-80.86579
xsect 4 right bank	35.31901	-80.86584



Prepared for:

Ecosystem Enhancement PROGRAM

Project:

**MCINTYRE CREEK RESTORATION SITE @ HORNETS NEST PARK**

Mecklenburg County, NC

Title:

**CURRENT CONDITIONS PLAN VIEW**

Drawn by: CLF/KRJ

Date: NOV 2014

Scale: 1:3600

Project No.: 12-004.03

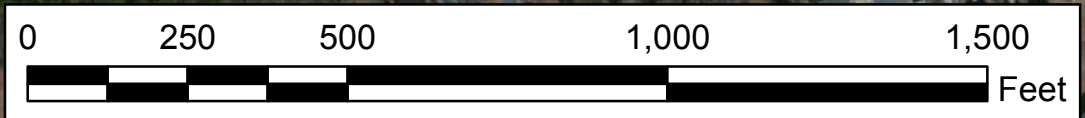


Figure 2A

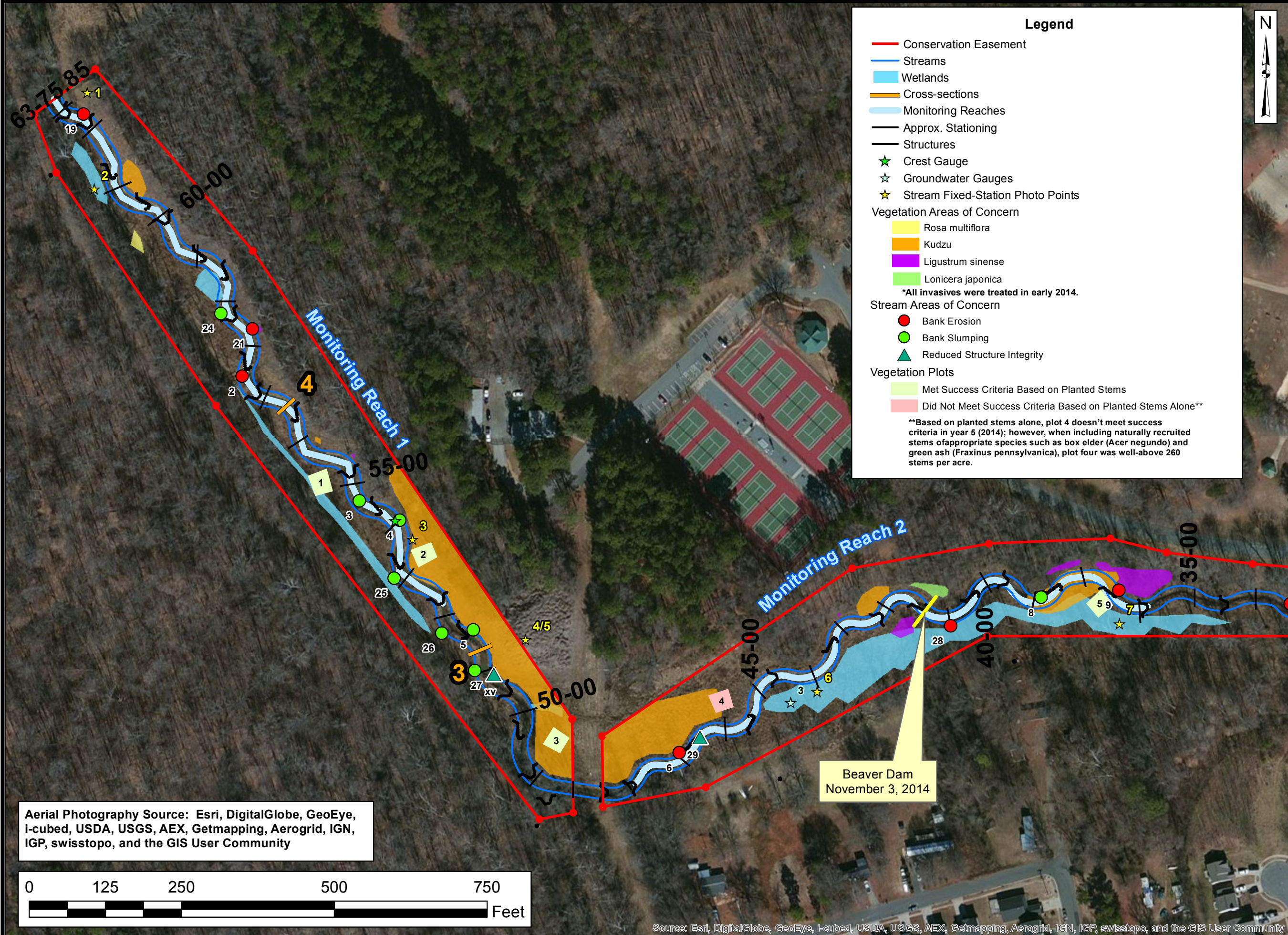


Figure 2B

Aerial Photography Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community







**Legend**

- Conservation Easement
- Streams
- Wetlands
- Cross-sections
- Monitoring Reaches
- Approx. Stationing
- Structures
- ★ Crest Gauge
- ☆ Groundwater Gauges
- ★ Stream Fixed-Station Photo Points

**Vegetation Areas of Concern**

- Rosa multiflora
- Kudzu
- Ligustrum sinense
- Lonicera japonica

*\*All invasives were treated in early 2014.*

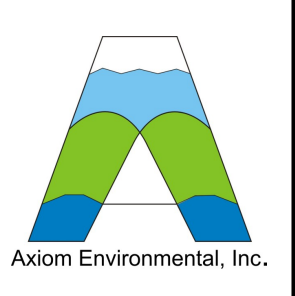
**Stream Areas of Concern**

- Bank Erosion
- Bank Slumping
- ▲ Reduced Structure Integrity

**Vegetation Plots**

- Met Success Criteria Based on Planted Stems
- Did Not Meet Success Criteria Based on Planted Stems Alone\*\*

**\*\*Based on planted stems alone, plot 4 doesn't meet success criteria in year 5 (2014); however, when including naturally recruited stems of appropriate species such as box elder (*Acer negundo*) and green ash (*Fraxinus pennsylvanica*), plot four was well-above 260 stems per acre.**



Project:

**MCINTYRE CREEK RESTORATION SITE @ HORNETS NEST PARK**

Mecklenburg County, NC

Title:

**CURRENT CONDITIONS PLAN VIEW**

Drawn by: CLF/KRJ

Date: NOV 2014

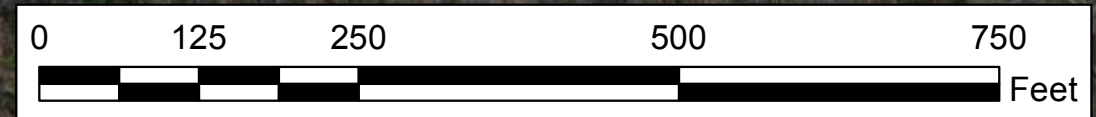
Scale: 1:1800

Project No.: 12-004.03

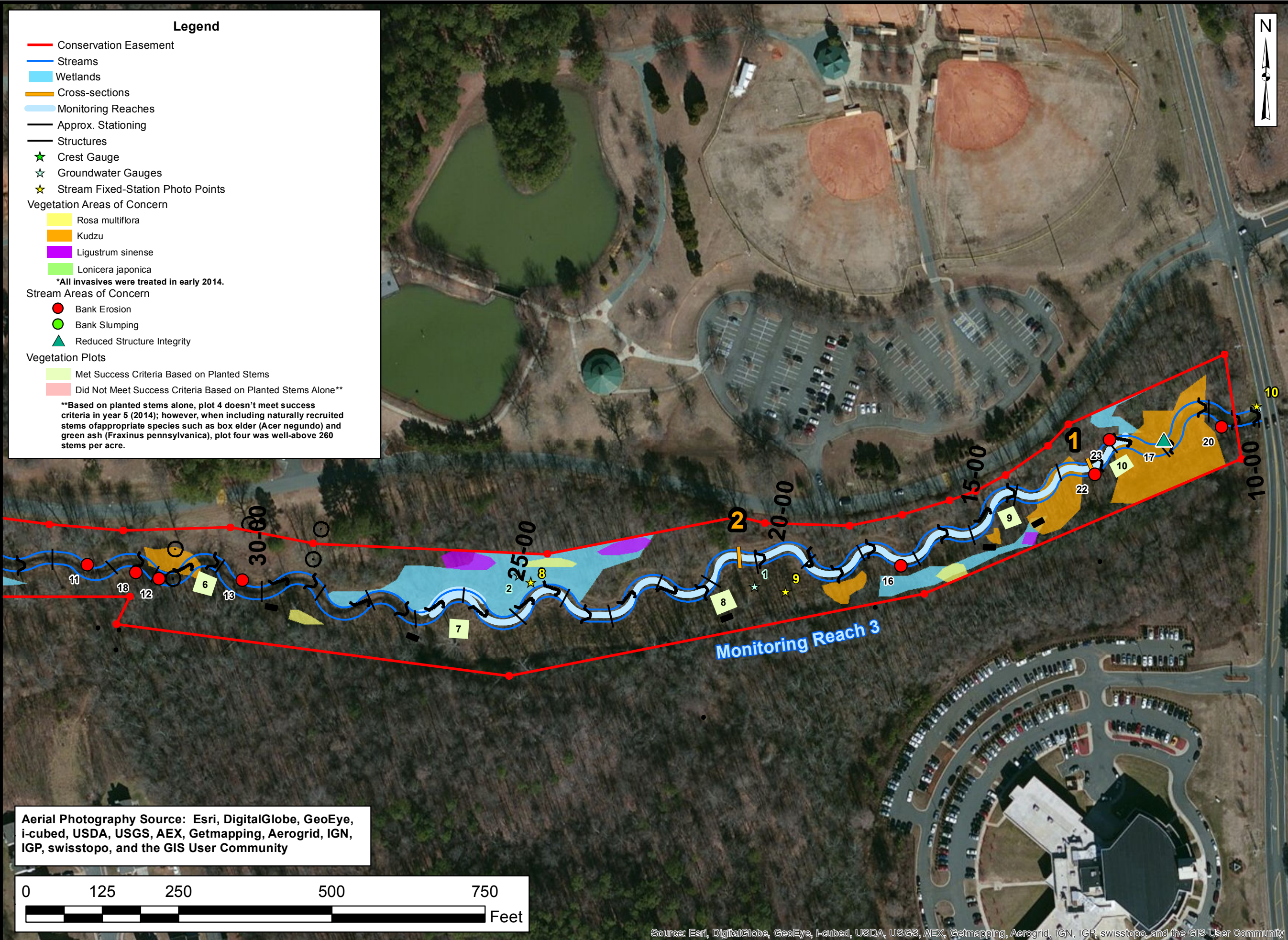
FIGURE

**2A**

Aerial Photography Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community







**Legend**

- Conservation Easement
- Streams
- Wetlands
- Cross-sections
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Mecklenburg County, NC

Title:

**CURRENT CONDITIONS PLAN VIEW**

Drawn by: CLF/KRJ

Date: NOV 2014

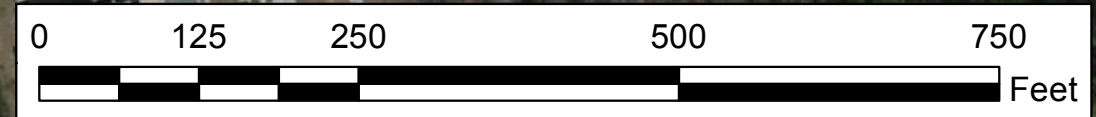
Scale: 1:1800

Project No.: 12-004.03

FIGURE

**2B**

Aerial Photography Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community





**Table 5A. Visual Stream Morphology Stability Assessment**  
**McIntyre Creek Restoration Site at Hornets Nest Park (EEP Project Number 243)**

Reach ID Reach 1  
 Assessed Length 1152

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	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	17	17		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	17	17		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	17	17		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	17	17		100%				
		2. Thalweg centering at downstream of meander (Glide)	17	17		100%				
	<b>Totals</b>					<b>10</b>	<b>345</b>			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	60	97%	2	40	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			1	25	99%	1	10	99%
	3. Mass Wasting	Bank slumping, calving, or collapse			7	260	89%	3	100	93%
<b>Totals</b>					<b>10</b>	<b>345</b>	<b>85%</b>	<b>6</b>	<b>150</b>	<b>92%</b>
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	6	7			86%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	6	7			86%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	6	7			86%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	6	7			86%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.	7	7			100%			

**Table 5B. Visual Stream Morphology Stability Assessment**  
**McIntyre Creek Restoration Site at Hornets Nest Park (EEP Project Number 243)**

Reach ID                      Reach 2  
 Assessed Length        1113

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	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	17	18			94%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	18	18			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	17	18			94%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	18	18			100%			
		2. Thalweg centering at downstream of meander (Glide)	18	18			100%			
	<b>Totals</b>					<b>6</b>	<b>210</b>			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			3	85	96%	0	0	96%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <b>NOT</b> include undercuts that are modest, appear sustainable and are providing habitat.			2	75	97%	1	10	97%
	3. Mass Wasting	Bank slumping, calving, or collapse			1	50	98%	1	20	99%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	8	8			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	6	8			75%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.	8	8			100%			

**Table 5C. Visual Stream Morphology Stability Assessment**  
**McIntyre Creek Restoration Site at Hornets Nest Park (EEP Project Number 243)**

Reach ID                      Reach 3  
 Assessed Length        1172

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	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	16	17			94%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	16	16			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	15	16			94%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	16	16			100%			
		2. Thalweg centering at downstream of meander (Glide)	17	17			100%			
	<b>Totals</b>					<b>6</b>	<b>235</b>			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			4	120	95%	2	35	96%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			1	65	97%	1	25	98%
	3. Mass Wasting	Bank slumping, calving, or collapse			1	50	98%	0	0	98%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	5	6			83%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	6			83%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	5	6			83%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	3	6			50%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.	6	6			100%			



**Table 6** **Vegetation Condition Assessment**  
**McIntyre Creek Restoration Site (EEP Project 243)**

Planted Acreage<sup>1</sup> 17

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	NA	None	NA	0	0.00	0.0%
2. Low Stem Density Areas	NA	NA	NA	0	0.00	0.0%
<b>Total</b>				0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	NA	NA	NA	0	0.00	0.0%
<b>Cumulative Total</b>				0	0.00	0.0%

Easement Acreage<sup>2</sup> 17

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern <sup>4</sup>	Several large patches of kudzu ( <i>Pueraria lobata</i> ) throughout the Site, as well as scattered smaller patches of multiflora rose ( <i>Rosa multiflora</i> ), Chinese privet ( <i>Ligustrum sinense</i> ), and Japanese honeysuckle ( <i>Lonicera japonica</i> ).	20 SF	Yellow, orange, purple, and green	25	2.34	13.8%
5. Easement Encroachment Areas <sup>3</sup>	NA	NA	NA	0	0.00	0.0%

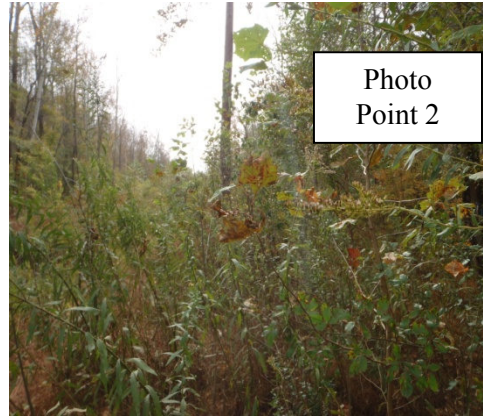
<sup>1</sup> = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

<sup>2</sup> = The acreage within the easement boundaries.

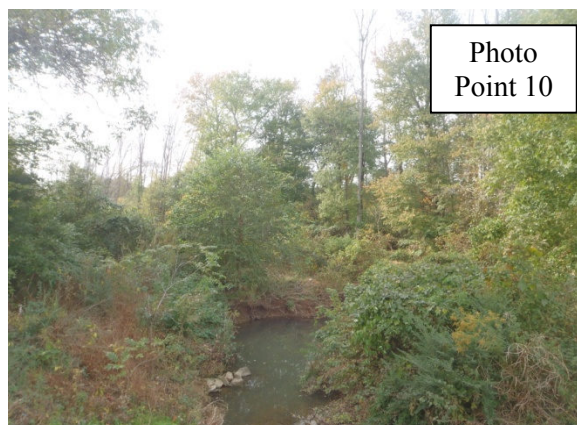
<sup>3</sup> = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

<sup>4</sup> = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern species are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likely trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly early in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolizing invasives polygons, particularly for situations where the condition for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

**McIntyre Creek  
Stream Fixed-Station Photographs  
Taken November 2014**



**McIntyre Creek  
Stream Fixed-Station Photographs  
Taken November 2014  
(continued)**



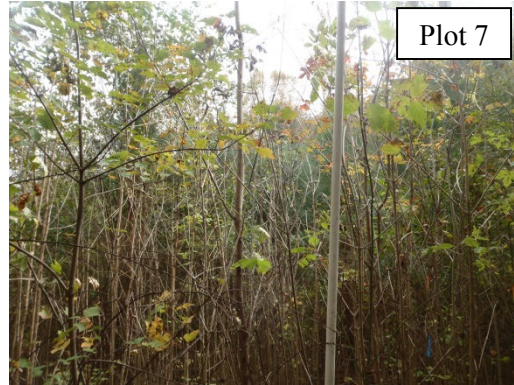


**McIntyre Creek  
Vegetation Monitoring Photographs  
Taken November 2014**





McIntyre Creek  
Vegetation Monitoring Photographs  
Taken November 2014  
(continued)



APPENDIX C  
VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment

Table 8. CVS Vegetation Plot Metadata

Table 9A. 2014 (Year 5) Total and Planted Stems by Plot and Species

Table 9B. Annual Totals and Planted Stems by Species

**Table 7. Vegetation Plot Criteria Attainment  
McIntyre Creek Restoration Site (EEP Project Number 234)**

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	90%
2	Yes	
3	Yes	
4	No*	
5	Yes	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	

\*Based on planted stems alone, plot 4 doesn't meet success criteria; however, when including naturally recruited stems of appropriate species such as green ash (*Fraxinus pennsylvanica*) and box elder (*Acer negundo*) plot 4 was well-above 260 stems per acre.

**Table 8. CVS Vegetation Plot Metadata  
McIntyre Creek Restoration Site (EEP Project Number 234)**

<b>Report Prepared By</b>	Corri Faquin
<b>Date Prepared</b>	11/6/2014 12:07
<b>database name</b>	Axiom-EEP-2014-A-v2.3.1.mdb
<b>database location</b>	S:\CVS database\2014
<b>computer name</b>	PHILLIP-PC
<b>file size</b>	75567104
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----</b>	
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Proj, planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Proj, total stems</b>	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.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>ALL Stems by Plot and spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
<b>PROJECT SUMMARY-----</b>	
<b>Project Code</b>	243
<b>project Name</b>	McIntyre Creek @ Hornets Nest Park
<b>Description</b>	stream restoration
<b>River Basin</b>	Catawba
<b>length(ft)</b>	5178
<b>stream-to-edge width (ft)</b>	130
<b>area (sq m)</b>	63120
<b>Required Plots</b>	NA
<b>Sampled Plots</b>	10



Table 9A. 2014 (Year 5) Total Planted and Natural Recruits Stems by Plot and Species

McIntyre Creek			Current Plot Data (MY5 2014)																																
Scientific Name	Common Name	Species Type	E243-AXE-0001			E243-AXE-0002			E243-AXE-0003			E243-AXE-0004			E243-AXE-0005			E243-AXE-0006			E243-AXE-0007			E243-AXE-0008			E243-AXE-0009			E243-AXE-0010					
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T			
Acer negundo	boxelder	Tree			8			5	2	2	37			20			13			11			16			12			16			7			
Acer rubrum	red maple	Tree																					4												
Acer saccharinum	silver maple	Tree																				2													
Alnus serrulata	hazel alder	Shrub													2	2	2	2	2	2	1	1	1	2	2	2									
Asimina triloba	pawpaw	Tree	1	1	3																														
Baccharis halimifolia	eastern baccharis	Shrub																																	
Betula nigra	river birch	Tree	1	1	1	1	1	1	1	1	1				2	2	2	13	13	15	4	4	4	4	4	4	2	2	2	4	4	4			
Carya	hickory	Tree			1																														
Catalpa bignonioides	southern catalpa	Tree																																	
Cornus amomum	silky dogwood	Shrub				1	1	1	1	1	1				3	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1			
Cornus florida	flowering dogwood	Tree																																	
Diospyros virginiana	common persimmon	Tree																																	
Euonymus alatus		Exotic																																	
Fraxinus pennsylvanica	green ash	Tree	2	2	5	3	3	10	7	7	20			66			89	3	3	41			130			12	4	4	8	6	6	12			
Juglans nigra	black walnut	Tree																																	
Juniperus virginiana	eastern redcedar	Tree									4																								
Lindera benzoin	northern spicebush	Shrub	2	2	4																														
Liquidambar styraciflua	sweetgum	Tree			7						2			4			4									5					20				
Liriodendron tulipifera	tuliptree	Tree	1	1	7			11										4	4	4						1			1	1	1				
Morella	bayberry	shrub																																	
Morella cerifera	wax myrtle	shrub																													1				
Morus	mulberry	Tree												1																					
Morus rubra	red mulberry	Tree																																	
Nyssa	tupelo	Tree																																	
Pinus taeda	loblolly pine	Tree			1			1			1									2						36			3						
Platanus occidentalis	American sycamore	Tree	1	1	2	1	1	1																											
Populus deltoides	eastern cottonwood	Tree																																	
Populus heterophylla	swamp cottonwood	Tree																																	
Prunus serotina	black cherry	Tree																																	
Quercus	oak	Tree																																	
Quercus lyrata	overcup oak	Tree																																	
Quercus michauxii	swamp chestnut oak	Tree																				1	1	1											
Quercus pagoda	cherrybark oak	Tree	4	4	4				2	2	2	1	1	1	2	2	2	1	1	1					3	3	3	1	1	1					
Quercus phellos	willow oak	Tree	3	3	3				1	1	1	4	4	4	1	1	1																		
Quercus rubra	northern red oak	Tree																																	
Salix	willow	Shrub or Tree																																	
Salix nigra	black willow	Tree															2																		
Ulmus	elm	Tree	2	2	2																														
Ulmus alata	winged elm	Tree							3	3	3																								
Ulmus americana	American elm	Tree	1	1	2	1	1	1																											
<b>Stem count</b>			18	18	50	7	7	31	17	17	72	5	5	100	10	10	118	25	25	82	7	7	159	10	10	76	8	8	31	11	11	45			
<b>size (ares)</b>			1			1			1			1			1			1			1			1			1			1			1		
<b>size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
<b>Species count</b>			10	10	14	5	5	8	7	7	10	2	2	8	5	5	9	6	6	9	4	4	8	4	4	9	4	4	6	3	3	6			
<b>Stems per ACRE</b>			728.4	728.4	2023	283.3	283.3	1255	688	688	2914	202.3	202.3	4047	404.7	404.7	4775	1012	1012	3318	283.3	283.3	6435	404.7	404.7	3076	323.7	323.7	1255	445.2	445.2	1821			

**Color for Density**  
Exceeds requirements by 10%  
Exceeds requirements, but by less than 10%  
Fails to meet requirements, by less than 10%  
Fails to meet requirements by more than 10%

PnoLS = Planted stems excluding livestakes  
P-all= Planted stems including livestakes  
T = Planted stems and natural recruits  
Total includes stems of natural recruits

Table 9B. Annual Total Planted and Natural Recruits Stems by Species

McIntyre Creek

Scientific Name	Common Name	Species Type	Annual Means																	
			MY5 (2014)			MY4 (2013)			MY3 (2012)			MY2 (2011)			MY1 (2010)			MY0 (2010)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree	2	2	145	3	3	60	3	3	55	3	3	156	3	3	58	3	3	127
Acer rubrum	red maple	Tree			4			4			40			16						50
Acer saccharinum	silver maple	Tree			2															
Alnus serrulata	hazel alder	Shrub	7	7	7	7	7	7	7	7	7	7	7	7	6	6	9	6	6	7
Asimina triloba	pawpaw	Tree	1	1	3	1	1	3	1	1	1	1	1	1	1	1	1	1	1	18
Baccharis halimifolia	eastern baccharis	Shrub			3			4			6			13			8			22
Betula nigra	river birch	Tree	32	32	34	33	33	42	33	33	36	35	35	55	13	13	29	14	14	67
Carya	hickory	Tree			1	1	1	3	1	1	6	1	1	1	1	1	1	1	1	1
Catalpa bignonioides	southern catalpa	Tree																		2
Cornus amomum	silky dogwood	Shrub	10	10	10	10	10	10	10	10	11	10	10	10	9	9	9	9	9	9
Cornus florida	flowering dogwood	Tree																		2
Diospyros virginiana	common persimmon	Tree																		5
Euonymus alatus		Exotic																1	1	1
Fraxinus pennsylvanica	green ash	Tree	25	25	393	25	25	296	25	25	397	27	27	513	27	27	278	25	25	1513
Juglans nigra	black walnut	Tree												1						3
Juniperus virginiana	eastern redcedar	Tree			4			1						1						3
Lindera benzoin	northern spicebush	Shrub	2	2	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Liquidambar styraciflua	sweetgum	Tree			42			87			102			57			43			82
Liriodendron tulipifera	tuliptree	Tree	6	6	24	6	6	19	8	8	19	9	9	16	9	9	19	9	9	25
Morella	bayberry	shrub															1			
Morella cerifera	wax myrtle	shrub			1															2
Morus	mulberry	Tree			1															
Morus rubra	red mulberry	Tree																		5
Nyssa	tupelo	Tree																		3
Pinus taeda	loblolly pine	Tree			44			11			57			54			40			76
Platanus occidentalis	American sycamore	Tree	2	2	3	2	2	3	2	2	2	1	1	7	1	1	6	1	1	8
Populus deltoides	eastern cottonwood	Tree						2			13			26						35
Populus heterophylla	swamp cottonwood	Tree																		4
Prunus serotina	black cherry	Tree												4						4
Quercus	oak	Tree				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Quercus lyrata	overcup oak	Tree				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Quercus pagoda	cherrybark oak	Tree	14	14	14	14	14	14	15	15	15	15	15	15	13	13	13	14	14	14
Quercus phellos	willow oak	Tree	9	9	9	9	9	9	9	9	9	9	9	9	10	10	10	10	10	10
Quercus rubra	northern red oak	Tree				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Salix	willow	Shrub or Tree																		1
Salix nigra	black willow	Tree			6						2			1						
Ulmus	elm	Tree	2	2	2	2	2	8	3	3	4	5	5	6	4	4	4	5	5	9
Ulmus alata	winged elm	Tree	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3			2
Ulmus americana	American elm	Tree	2	2	4	2	2	2	1	1	1									
<b>Stem count</b>			118	118	764	124	124	594	127	127	792	132	132	978	106	106	538	104	104	2115
<b>size (ares)</b>			10			10			10			10			10			10		
<b>size (ACRES)</b>			0.25			0.25			0.25			0.25			0.25			0.25		
<b>Species count</b>			15	15	25	19	19	25	19	19	25	18	18	27	18	18	22	17	17	34
<b>Stems per ACRE</b>			477.5	477.5	3092	501.8	501.8	2404	514	514	3205	534.2	534.2	3958	429	429	2177	420.9	420.9	8559

**Color for Density**  
Exceeds requirements by 10%  
Exceeds requirements, but by less than 10%  
Fails to meet requirements, by less than 10%  
Fails to meet requirements by more than 10%

PnoLS = Planted stems excluding livestakes  
P-all= Planted stems including livestakes  
T = Planted stems and natural recruits  
Total includes stems of natural recruits

APPENDIX D  
STREAM SURVEY DATA

Cross-section Plots

Longitudinal Profile Plots

Substrate Plots

Tables 10a-b. Baseline Stream Data Summary

Tables 11a-b. Monitoring Data

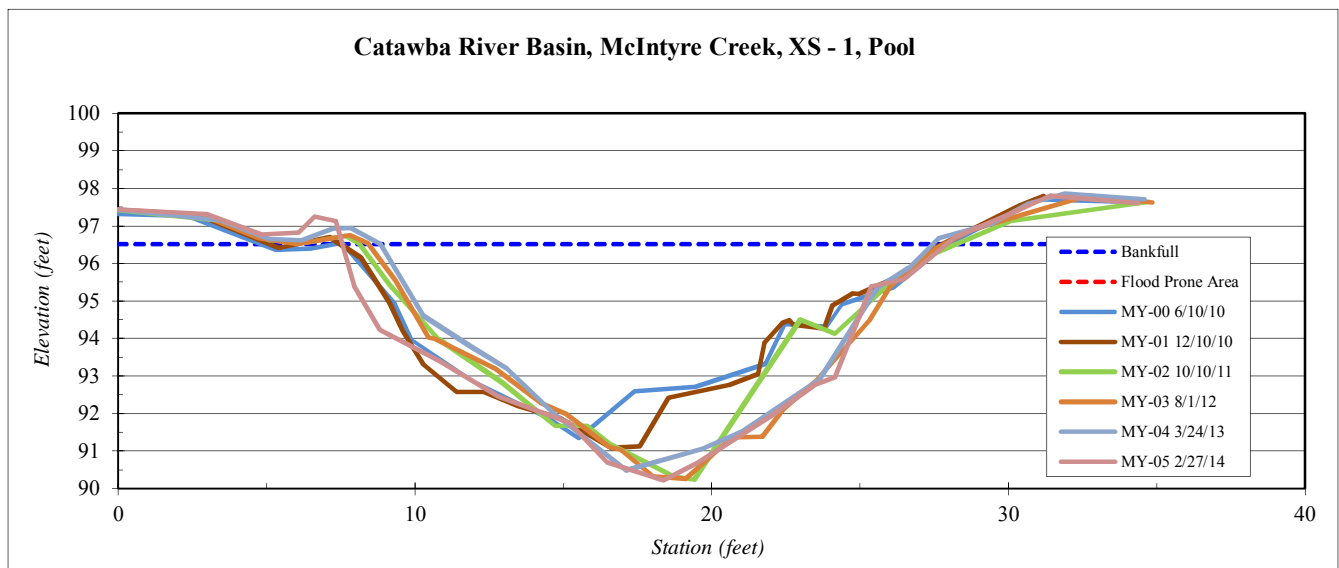
<b>River Basin:</b>	Catawba
<b>Watershed:</b>	McIntyre Creek
<b>XS ID</b>	XS - 1, Pool
<b>Feature</b>	Pool
<b>Date:</b>	2/27/2014
<b>Field Crew:</b>	Perkinson, Jernigan



Station	Elevation
0.0	97.43
3.0	97.31
4.8	96.77
6.1	96.82
6.6	97.24
7.3	97.14
8.0	95.39
8.8	94.22
10.8	93.41
12.8	92.45
15.2	91.76
16.5	90.71
18.4	90.22
19.5	90.67
22.1	92.00
23.5	92.76
24.2	92.98
25.4	95.38
26.5	95.58
28.2	96.71
30.0	97.3
31.4	97.8
34.4	97.6

SUMMARY DATA	
<b>Bankfull Elevation:</b>	96.5
<b>Bankfull Cross-Sectional Area:</b>	76.1
<b>Bankfull Width:</b>	20.3
<b>Flood Prone Area Elevation:</b>	NA
<b>Flood Prone Width:</b>	NA
<b>Max Depth at Bankfull:</b>	6.3
<b>Mean Depth at Bankfull:</b>	3.7
<b>W / D Ratio:</b>	NA
<b>Entrenchment Ratio:</b>	NA
<b>Bank Height Ratio:</b>	1.0

<b>Stream Type</b>	E
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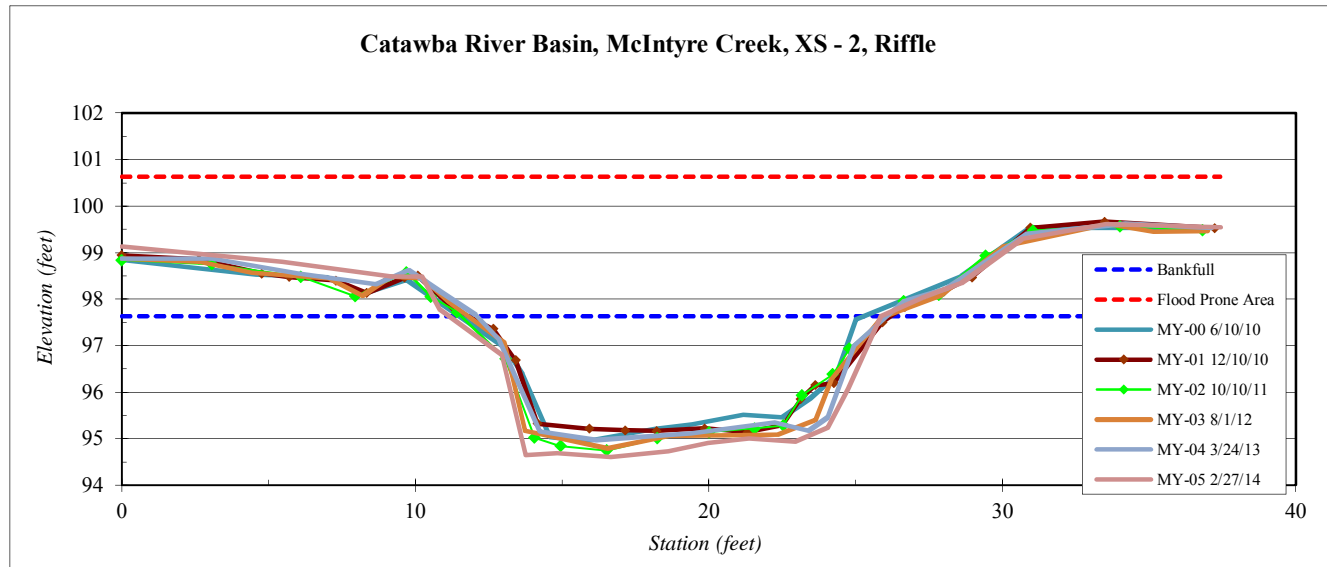
<b>River Basin:</b>	Catawba
<b>Watershed:</b>	McIntyre Creek
<b>XS ID</b>	XS - 2, Riffle
<b>Feature</b>	Riffle
<b>Date:</b>	2/27/2014
<b>Field Crew:</b>	Perkinson, Jernigan



Station	Elevation
0.00	99.13
5.47	98.80
9.21	98.49
10.22	98.48
10.85	97.76
11.98	97.25
12.95	96.79
13.76	94.64
14.83	94.69
16.65	94.60
18.63	94.72
19.97	94.91
21.37	95.00
22.93	94.94
24.05	95.24
24.8	96.07
25.9	97.63
27.3	98.04
28.6	98.35
30.7	99.29
33.5	99.61
37.4	99.54

SUMMARY DATA	
<b>Bankfull Elevation:</b>	97.6
<b>Bankfull Cross-Sectional Area:</b>	33.6
<b>Bankfull Width:</b>	14.7
<b>Flood Prone Area Elevation:</b>	100.6
<b>Flood Prone Width:</b>	150.0
<b>Max Depth at Bankfull:</b>	3.0
<b>Mean Depth at Bankfull:</b>	2.3
<b>W / D Ratio:</b>	6.4
<b>Entrenchment Ratio:</b>	10.2
<b>Bank Height Ratio:</b>	1.0

<b>Stream Type</b>	E
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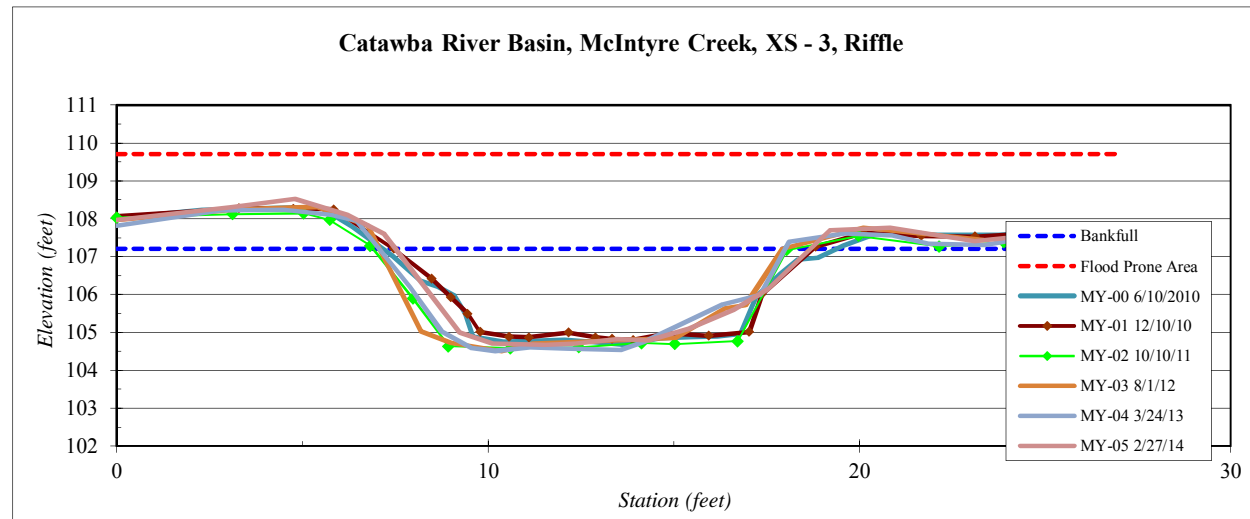
<b>River Basin:</b>	Catawba
<b>Watershed:</b>	McIntyre Creek
<b>XS ID</b>	XS - 3, Riffle
<b>Feature</b>	Riffle
<b>Date:</b>	2/27/2014
<b>Field Crew:</b>	Perkinson, Jernigan

Station	Elevation
0.00	107.97
3.07	108.30
4.80	108.52
6.21	108.11
7.22	107.60
9.24	105.00
10.13	104.70
11.54	104.67
12.37	104.71
13.48	104.83
14.33	104.80
15.41	105.10
16.62	105.61
17.53	106.15
19.2	107.70
20.8	107.77
23.1	107.4
24.6	107.6
26.9	107.5

SUMMARY DATA	
<b>Bankfull Elevation:</b>	107.2
<b>Bankfull Cross-Sectional Area:</b>	20.9
<b>Bankfull Width:</b>	11.2
<b>Flood Prone Area Elevation:</b>	109.7
<b>Flood Prone Width:</b>	150.0
<b>Max Depth at Bankfull:</b>	2.5
<b>Mean Depth at Bankfull:</b>	1.9
<b>W / D Ratio:</b>	6.0
<b>Entrenchment Ratio:</b>	13.4
<b>Bank Height Ratio:</b>	1.0



<b>Stream Type</b>	E
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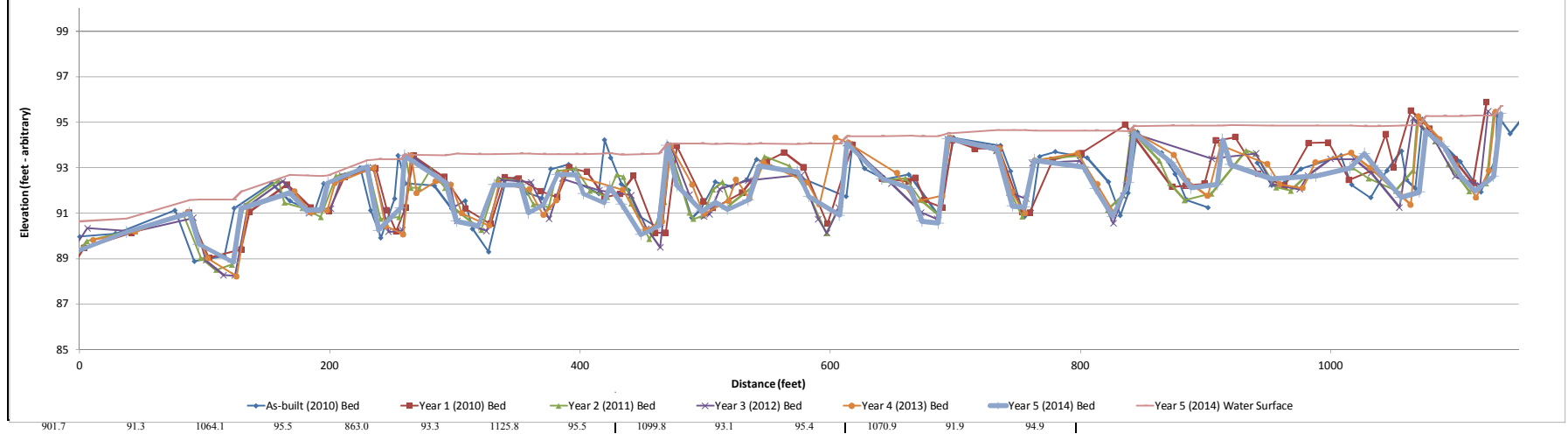


**Project Name** McIntyre Creek - Year 5 (2014) Profile  
**Reach** Reach 1 (00+00 - 11+50)  
**Feature** Profile  
**Date** 2/27/14  
**Crew** Parkinson, Jernigan

2010 As-built Survey		2010 Year 1 Monitoring /Survey		2011 Year 2 Monitoring /Survey		2012 Year 3 Monitoring /Survey		2013 Year 4 Monitoring /Survey			2014 Year 5 Monitoring /Survey		
Station	Bed Elevation	Station	Bed Elevation	Station	Bed Elevation	Station	Bed Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	90.0	-13.1	88.0	-23.8	88.0	-19.1	88.6	10.6	89.8	90.7	-4.0	89.3	90.6
28.8	90.1	3.4	89.5	-17.1	88.0	-11.7	88.9	44.5	90.2	91.0	37.4	90.2	90.8
76.2	91.1	41.8	90.1	5.8	89.8	6.2	90.3	86.5	91.1	91.6	87.8	91.0	91.6
91.6	88.9	87.6	91.0	41.5	90.2	44.1	90.2	102.3	89.0	91.6	95.3	89.6	91.6
115.6	89.1	103.3	89.0	82.6	91.0	90.8	90.8	125.4	88.2	91.7	122.8	88.8	91.6
123.7	91.2	129.2	89.4	96.7	89.0	101.0	88.9	134.9	91.3	92.1	129.2	91.2	92.0
153.3	92.3	135.8	91.1	109.1	88.5	115.1	88.3	171.7	91.9	92.7	167.8	91.9	92.7
168.2	91.5	165.9	92.3	121.6	88.7	124.0	88.3	184.5	91.0	92.8	181.0	91.1	92.7
187.5	91.1	184.9	91.2	121.7	88.7	134.6	91.3	197.8	91.1	92.8	193.0	91.1	92.6
195.2	92.3	199.3	91.1	131.5	91.3	162.5	92.4	204.1	92.3	92.7	198.5	92.3	92.7
207.4	92.5	211.6	92.6	159.1	92.4	183.6	91.0	235.1	93.0	93.4	229.6	93.1	93.3
224.3	93.0	236.6	93.0	163.6	91.5	200.6	91.2	244.6	90.4	93.5	239.1	90.2	93.4
232.6	91.1	245.6	91.1	178.1	91.2	209.9	92.6	258.5	90.1	93.5	256.7	91.2	93.4
240.7	89.9	253.0	90.2	192.7	90.8	234.5	90.8	264.8	93.5	93.8	259.7	93.5	93.6
251.7	91.6	260.6	91.2	205.0	92.6	246.9	90.2	269.3	91.9	93.8	292.5	92.3	93.5
254.7	93.5	266.9	93.5	230.6	93.0	258.2	90.2	284.6	92.4	93.8	301.2	90.6	93.6
260.4	92.3	291.4	92.6	240.6	90.7	264.8	93.5	296.7	92.3	93.8	318.6	90.4	93.6
283.4	92.2	308.8	91.2	255.5	90.8	296.4	92.2	305.5	91.0	93.8	331.2	92.3	93.6
297.3	91.2	328.6	90.5	260.4	93.5	301.9	90.7	327.4	90.4	93.8	352.5	92.2	93.6
308.1	91.5	340.0	92.6	265.0	92.1	325.2	90.2	335.0	92.3	93.8	358.7	91.0	93.6
314.1	90.3	350.9	92.5	271.5	92.1	337.2	92.5	359.5	92.0	93.8	370.6	91.4	93.6
326.8	89.3	368.3	92.0	280.4	92.9	360.9	92.4	370.6	90.9	93.8	381.9	92.7	93.6
341.2	92.5	381.8	91.7	292.1	92.1	375.2	90.7	381.0	91.6	93.9	396.9	92.7	93.6
347.8	92.5	391.3	93.0	300.6	91.2	385.8	92.5	387.5	92.8	93.8	402.7	91.9	93.6
357.9	91.9	405.4	92.8	320.9	90.3	415.4	92.0	434.4	92.0	93.8	419.4	91.5	93.6
369.2	91.7	419.6	91.7	334.3	92.5	440.7	91.8	451.9	90.3	93.8	423.9	92.1	93.6
376.7	92.9	431.8	91.8	352.8	92.4	453.1	90.3	465.6	90.6	93.8	433.5	91.4	93.6

	As-built	2010	2011	2012	2013	2014
Avg. Water Surface Slope	0.0035	0.0042	0.0041	0.0043	0.0046	0.0045
Rifle Length	32	26	27	34	34	36
Avg. Rifle Slope	0.0042	0.0047	0.0023	0.0034	0.0040	0.0048
Pool Length	16	19	20	18	17	25
Avg. Pool Slope	76	76	0.0023	0.0033	0.0008	0.0003

McIntyre Creek Year 5 (2014) Profile - Reach 00+00 to 11+50



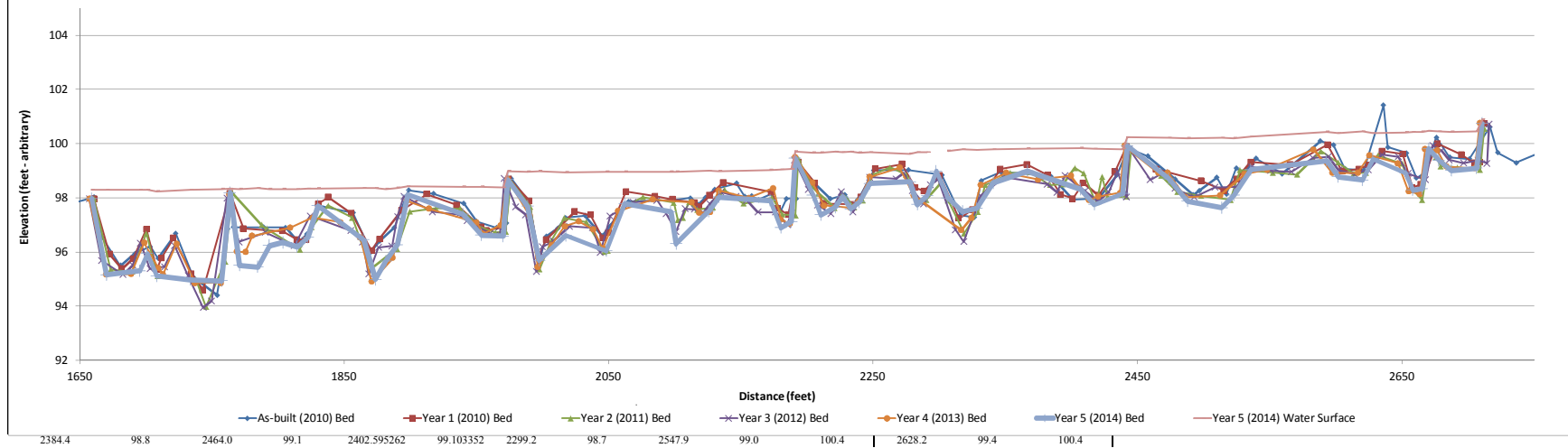


**Project Name** McIntyre Creek - Year 5 (2014) Profile  
**Reach** Reach 2 (16+50 - 27+50)  
**Feature** Profile  
**Date** 2/27/14  
**Crew** Parkinson, Jernigan

2010 As-built Survey		2010 Year 1 Monitoring /Survey		2011 Year 2 Monitoring /Survey		2012 Year 3 Monitoring /Survey		2013 Year 4 Monitoring /Survey			2014 Year 5 Monitoring /Survey		
Station	Bed Elevation	Station	Bed Elevation	Station	Bed Elevation	Station	Bed Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
1639.0	97.7	1660.7	98.0	1660.7	98.0	1657.2	98.0	1657.2	98.0	98.4	1659.2	98.0	98.3
1660.7	98.0	1672.6	95.9	1673.5	95.4	1666.5	95.7	1670.0	95.2	98.4	1670.4	95.2	98.3
1667.1	96.5	1681.9	95.4	1689.6	95.3	1683.0	95.2	1688.8	95.2	98.3	1695.5	95.3	98.3
1680.9	95.5	1700.6	96.8	1708.4	96.7	1690.0	95.5	1698.9	96.3	98.3	1701.2	95.9	98.3
1681.2	95.5	1700.6	96.8	1708.9	95.1	1696.0	96.3	1709.5	95.4	98.2	1708.4	95.1	98.2
1691.8	95.9	1708.4	95.3	1737.9	95.0	1703.1	95.4	1713.1	95.2	98.3	1733.9	95.0	98.3
1703.4	96.2	1712.0	95.8	1745.7	94.0	1714.1	95.4	1723.2	96.3	98.3	1757.4	94.9	98.3
1709.4	95.8	1720.9	96.5	1760.1	95.6	1721.9	96.2	1737.0	94.9	98.3	1763.8	98.2	98.3
1722.7	96.7	1734.4	95.2	1765.4	98.2	1732.2	95.1	1756.8	94.9	98.3	1771.0	95.5	98.3
1735.8	95.1	1743.2	94.6	1787.6	97.0	1743.5	93.9	1763.4	98.1	98.4	1784.9	95.4	98.4
1754.1	94.4	1763.9	98.2	1791.8	96.9	1749.7	94.2	1769.0	96.0	98.4	1793.5	96.2	98.3
1762.1	96.8	1773.9	96.9	1816.4	96.1	1761.5	98.0	1775.4	96.0	98.4	1803.9	96.3	98.3
1764.9	98.2	1803.7	96.8	1825.5	96.9	1770.5	96.4	1780.5	96.6	98.4	1814.6	96.2	98.3
1766.3	96.9	1814.3	96.5	1837.9	97.7	1790.5	96.7	1809.0	96.9	98.5	1822.7	96.5	98.3
1789.2	96.9	1821.3	96.5	1856.1	97.3	1812.3	96.2	1826.0	97.3	98.4	1830.3	97.7	98.3
1805.7	96.9	1830.5	97.8	1870.2	95.4	1824.4	97.3	1847.2	97.1	98.4	1864.8	96.4	98.4
1815.7	96.3	1838.1	98.0	1890.0	96.1	1855.3	96.8	1862.1	96.5	98.4	1873.8	95.0	98.4
1822.0	96.7	1855.6	97.4	1899.6	97.5	1863.9	96.4	1870.8	94.9	98.4	1881.7	95.7	98.3
1829.8	97.7	1870.8	96.1	1919.2	97.6	1868.7	95.2	1886.8	95.8	98.4	1890.1	96.3	98.4
1856.8	97.4	1876.9	96.5	1937.6	97.6	1876.0	96.2	1897.4	97.9	98.5	1898.1	98.1	98.4
1870.4	96.0	1893.7	97.5	1951.4	96.9	1886.3	96.2	1914.0	97.6	98.5	1940.2	97.4	98.4
1876.9	96.4	1912.5	98.1	1964.5	96.7	1890.5	97.3	1949.9	97.1	98.6	1954.0	96.6	98.4
1888.1	96.9	1935.1	97.7	1972.2	96.8	1895.3	98.1	1955.5	96.7	98.5	1970.3	96.6	98.4
1898.7	98.3	1953.4	96.9	1975.9	98.6	1917.0	97.5	1968.4	97.0	98.6	1973.9	98.7	99.0
1917.7	98.2	1990.9	96.8	1990.9	97.7	1937.0	97.4	1973.5	98.7	99.0	1989.0	97.7	99.0
1940.5	97.8	1971.0	96.9	1997.7	95.4	1942.9	97.2	1990.1	97.4	99.1	1997.6	95.7	99.0
1950.2	97.1	1974.6	98.7	2006.5	96.4	1960.4	96.7	1996.4	95.4	99.1	2017.8	96.6	98.9

	As-built	2010	2011	2012	2013	2014
Avg. Water Surface Slope	0.0035	0.0022	0.0020	0.0026	0.0025	0.0021
Rifle Length	32	30	25	28	38	31
Avg. Rifle Slope	0.0042	0.0010	0.0010	0.0012	0.0014	0.0005
Pool Length	16	15	10	15	17	20
Avg. Pool Slope	76	76	0.0000	0.0011	0.0018	0.0013

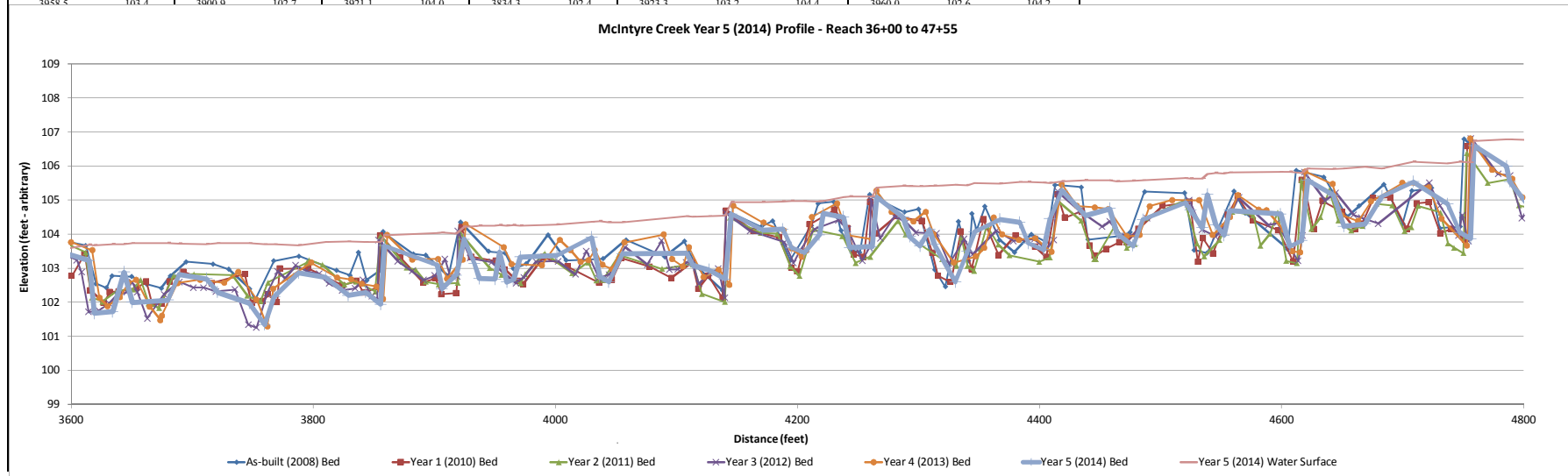
McIntyre Creek Year 5 (2014) Profile - Reach 16+50 to 27+50



**Project Name** McIntyre Creek - Year 5 (2014) Profile  
**Reach** Reach 3 (36+00 - 47+55)  
**Feature** Profile  
**Date** 2/27/14  
**Crew** Parkinson, Jernigan

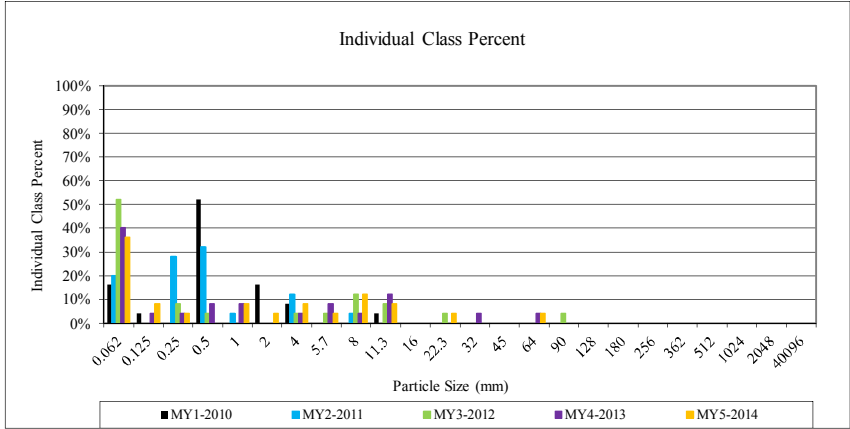
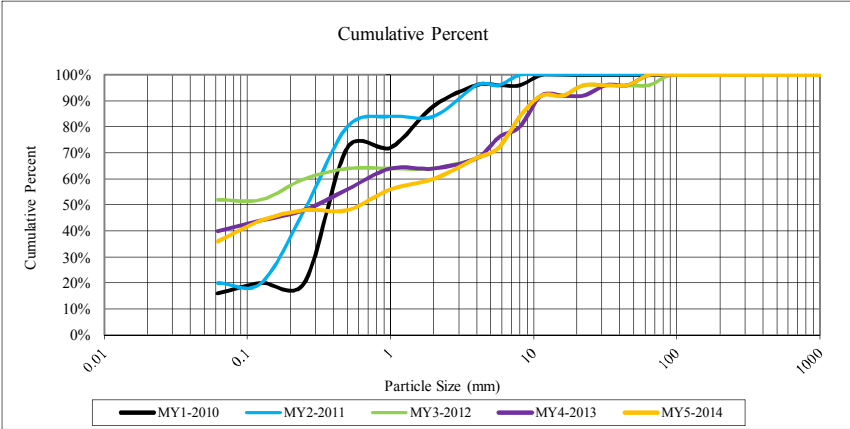
2010 As-built Survey			2010 Year 1 Monitoring /Survey			2011 Year 2 Monitoring /Survey			2012 Year 3 Monitoring /Survey			2013 Year 4 Monitoring /Survey			2014 Year 5 Monitoring /Survey		
Station	Bed Elevation		Station	Bed Elevation		Station	Bed Elevation		Station	Bed Elevation		Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
3595.8	103.8		3600.4	102.8		3594.1	103.8		3588.8	103.5		3600.0	103.8	103.9	3596.0	103.4	103.6
3612.0	103.7		3611.1	103.4		3611.8	103.5		3604.6	103.2		3617.3	103.5	104.1	3614.7	103.2	103.7
3620.2	102.5		3615.7	102.3		3616.8	102.1		3608.6	102.9		3623.4	102.1	104.0	3619.1	101.7	103.7
3629.0	102.4		3626.9	102.0		3625.8	102.0		3614.2	101.7		3630.1	101.9	104.1	3634.2	101.7	103.7
3633.6	102.8		3632.0	102.3		3638.2	102.3		3622.9	101.8		3640.3	102.1	104.1	3643.8	102.9	103.7
3650.1	102.7		3639.3	102.3		3651.1	102.4		3631.1	102.0		3647.1	102.6	104.1	3650.6	102.0	103.7
3662.4	102.5		3654.0	102.4		3657.4	102.7		3638.1	102.2		3653.7	102.6	104.1	3680.0	102.1	103.7
3674.4	102.4		3662.0	102.6		3663.9	102.0		3645.6	102.3		3664.9	101.9	104.1	3689.3	102.8	103.7
3681.7	102.8		3666.8	101.9		3672.5	101.8		3650.3	102.6		3673.7	101.5	104.1	3712.0	102.7	103.7
3695.1	103.2		3674.6	102.0		3684.6	102.8		3654.7	102.3		3674.9	101.6	104.1	3720.9	102.3	103.7
3717.0	103.1		3681.6	102.6		3701.3	102.8		3662.8	101.5		3687.9	102.6	104.1	3747.0	102.0	103.7
3730.2	103.0		3692.8	102.9		3733.0	102.8		3676.6	102.2		3706.3	102.7	104.1	3759.8	101.3	103.7
3747.3	102.4		3716.4	102.6		3745.5	102.2		3689.4	102.6		3726.2	102.6	104.1	3768.1	102.2	103.7
3751.6	102.1		3743.5	102.8		3756.5	102.0		3700.7	102.4		3737.8	102.9	104.1	3788.0	102.9	103.7
3767.3	103.2		3749.0	102.0		3762.5	102.6		3709.4	102.4		3752.8	102.1	104.1	3810.2	102.7	103.8
3788.1	103.4		3757.9	102.0		3794.4	103.2		3719.2	102.3		3762.0	101.3	104.1	3829.0	102.2	103.8
3819.3	102.9		3762.6	102.2		3796.5	103.2		3735.4	102.4		3766.8	102.4	104.1	3843.3	102.3	103.8
3830.3	102.8		3770.2	102.0		3807.6	103.1		3746.3	101.3		3798.1	103.2	104.1	3855.6	101.9	103.8
3837.4	103.5		3772.2	103.0		3825.6	102.5		3752.9	101.3		3819.4	102.7	104.1	3858.9	103.7	104.0
3844.1	102.6		3795.8	103.0		3835.2	102.6		3761.7	102.3		3831.2	102.7	104.1	3902.6	103.1	104.0
3855.3	102.9		3823.8	102.5		3851.0	102.3		3770.6	102.9		3840.1	102.5	104.1	3906.5	102.4	104.0
3857.4	104.1		3836.0	102.6		3855.4	103.9		3776.9	102.7		3852.0	102.5	104.1	3918.1	102.8	104.0
3882.6	103.4		3841.7	102.3		3877.3	103.0		3785.3	103.1		3857.8	102.1	104.1	3924.6	103.8	104.2
3893.1	103.4		3853.8	102.4		3884.3	103.0		3794.4	102.9		3861.0	104.0	104.2	3933.1	103.1	104.2
3911.6	102.8		3855.4	104.0		3892.8	102.6		3804.7	102.8		3881.7	103.3	104.3	3937.2	102.7	104.2
3921.5	104.4		3871.7	103.3		3903.4	102.5		3812.9	102.6		3903.0	103.3	104.3	3950.2	102.7	104.2
3944.6	103.5		3890.9	102.6		3919.5	102.6		3823.7	102.4		3910.5	102.7	104.3	3954.1	103.5	104.3
3958.8	103.4		3900.0	103.7		3931.1	104.0		3833.3	103.4		3923.3	103.3	104.4	3960.0	103.6	104.3

	As-built	2010	2011	2012	2013	2014
Avg. Water Surface Slope	0.0035	0.0020	0.0025	0.0029	0.0027	0.0027
Rifle Length	32	35	28	29	30	37
Avg. Rifle Slope	0.0042	0.0027	0.0003	0.0022	0.0021	0.0022
Pool Length	16	12	16	16	17	17
Pool to Pool Spacing	76	76	0.0005	0.0018	0.0014	0.0006

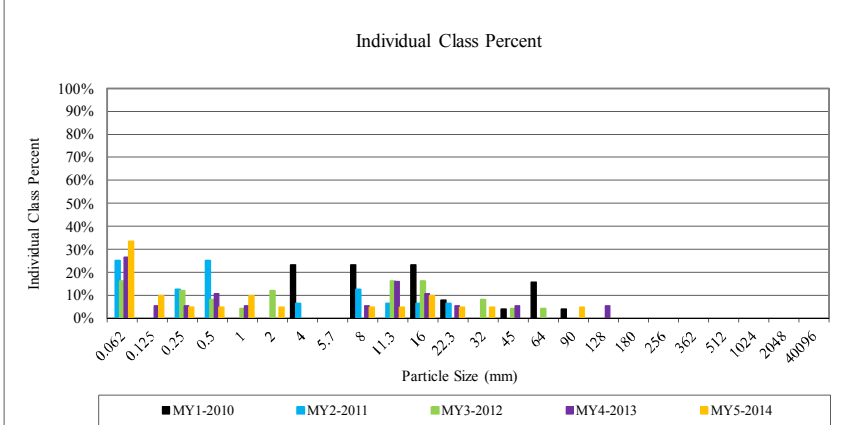
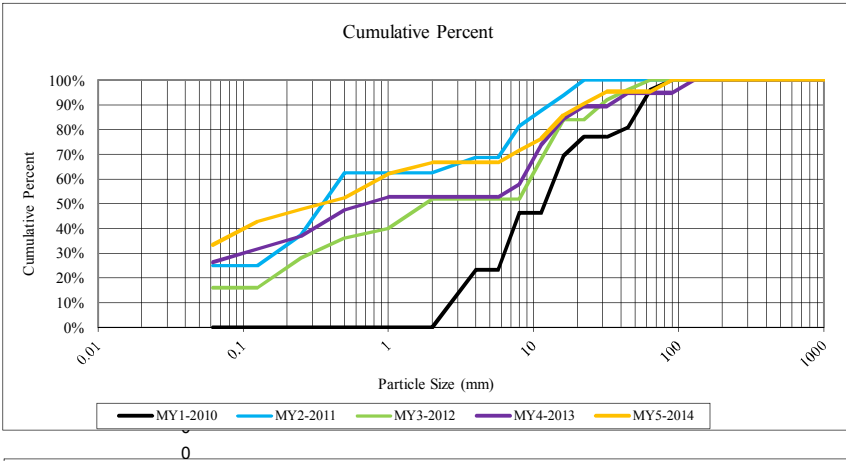


Weighted Pebble Count											
Percent Riffle:		50		Percent Run:							
Percent Pool:		50		Percent Glide:		Pebble Count,					
Material		Size Range (mm)		Total #		McIntyre Creek					
silt/clay		0 0.062		39.0		Catawba					
						---					
						Note: Total					
very fine sand	0.062	0.13	7.0	#	#						
fine sand	0.13	0.25	8.0	#	#						
medium sand	0.25	0.5	2.0	#	#						
coarse sand	0.5	1	7.0	#	#						
very coarse sand	1	2	4.0	#	#						
very fine gravel	2	4	6.0	#	#						
fine gravel	4	6	2.0	#	#						
fine gravel	6	8	6.0	#	#						
medium gravel	8	11	3.0	#	#						
medium gravel	11	16	3.0	#	#						
coarse gravel	16	22	5.0	#	#						
coarse gravel	22	32	1.0	#	#						
very coarse gravel	32	45	0.0	#	#						
very coarse gravel	45	64	2.0	#	#						
small cobble	64	90	1.0	#	#						
medium cobble	90	128	0.0	#	#						
large cobble	128	180	0.0	#	#						
very large cobble	180	256	0.0	#	#						
small boulder	256	362	0.0	#	#						
small boulder	362	512	0.0	#	#						
medium boulder	512	1024	0.0	#	#						
large boulder	1024	2048	0.0	#	#						
very large boulder	2048	4096	0.0	#	#						
bedrock			4.0	#	#						
Weighted Count:				100							
True Total Particle Count:				100							
Size percent less than (mm)						Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock	
#N/A	#N/A	0.1	8	21	39%	28%	28%	1%	0%	4%	

Project Name: McIntire Creek Reach 3					
Cross-Section: 1					
Feature: Pool					
		2014			
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	36	36%	36%
Sand	very fine sand	0.125	8	8%	44%
	fine sand	0.250	4	4%	48%
	medium sand	0.50	0	0%	48%
	coarse sand	1.00	8	8%	56%
	very coarse sand	2.0	4	4%	60%
Gravel	very fine gravel	4.0	8	8%	68%
	fine gravel	5.7	4	4%	72%
	fine gravel	8.0	12	12%	84%
	medium gravel	11.3	8	8%	92%
	medium gravel	16.0	0	0%	92%
	course gravel	22.3	4	4%	96%
	course gravel	32.0	0	0%	96%
	very coarse gravel	45	0	0%	96%
	very coarse gravel	64	4	4%	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%
<b>TOTAL % of whole count</b>			100	100%	100%
Summary Data					
D50	0.6				
D84	8				
D95	20				

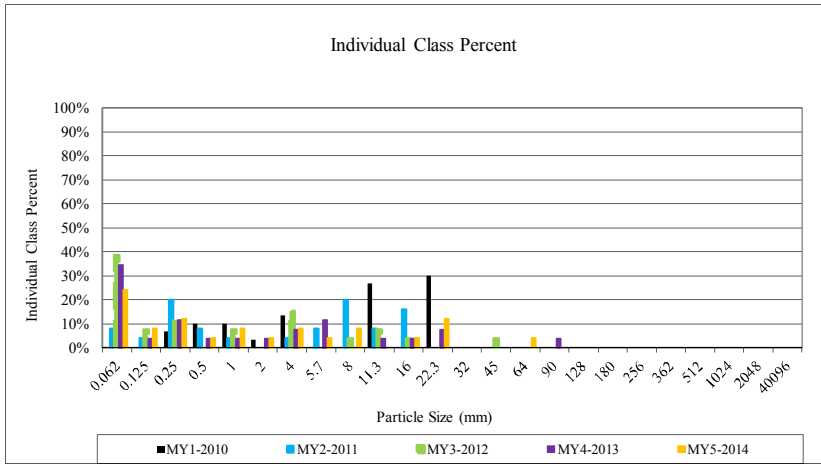
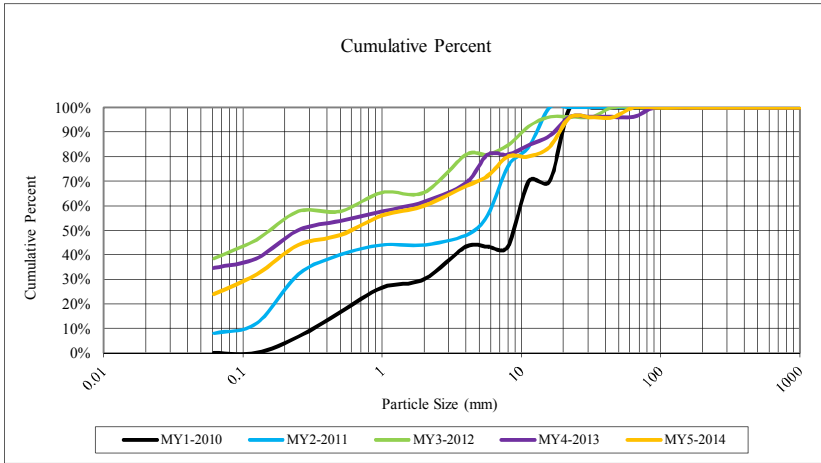


Project Name: McIntire Creek Reach 3					
Cross-Section: 2					
Feature: Riffle					
			2014		
Description	Material	Size (mm)	Total #	Item %	Cum %
<b>Silt/Clay</b>	silt/clay	0.062	28	33%	33%
<b>Sand</b>	very fine sand	0.125	8	10%	43%
	fine sand	0.250	4	5%	48%
	medium sand	0.50	4	5%	52%
	coarse sand	1.00	8	10%	62%
	very coarse sand	2.0	4	5%	67%
<b>Gravel</b>	very fine gravel	4.0	0	0%	67%
	fine gravel	5.7	0	0%	67%
	fine gravel	8.0	4	5%	71%
	medium gravel	11.3	4	5%	76%
	medium gravel	16.0	8	10%	86%
	course gravel	22.3	4	5%	90%
	course gravel	32.0	4	5%	95%
	very coarse gravel	45	0	0%	95%
	very coarse gravel	64	0	0%	95%
	<b>Cobble</b>	small cobble	90	4	5%
medium cobble		128	0	0%	100%
large cobble		180	0	0%	100%
very large cobble		256	0	0%	100%
<b>Boulder</b>	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
<b>Bedrock</b>	bedrock	40096	0	0%	100%
<b>TOTAL % of whole count</b>			84	100%	100%
Summary Data					
D50	0.4				
D84	15				
D95	31				





Project Name: McIntire Creek Reach 1					
Cross-Section: 3					
Feature: Riffle					
			2014		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	24	24%	24%
Sand	very fine sand	0.125	8	8%	32%
	fine sand	0.250	12	12%	44%
	medium sand	0.50	4	4%	48%
	coarse sand	1.00	8	8%	56%
	very coarse sand	2.0	4	4%	60%
Gravel	very fine gravel	4.0	8	8%	68%
	fine gravel	5.7	4	4%	72%
	fine gravel	8.0	8	8%	80%
	medium gravel	11.3	0	0%	80%
	medium gravel	16.0	4	4%	84%
	course gravel	22.3	12	12%	96%
	course gravel	32.0	0	0%	96%
	very coarse gravel	45	0	0%	96%
	very coarse gravel	64	4	4%	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%
<b>TOTAL % of whole count</b>			100	100%	100%
Summary Data					
D50	0.6				
D84	16				
D95	21				



Project Name: McIntire Creek Reach 1					
Cross-Section: 4					
Feature: Pool					
			2014		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	68	68%	68%
Sand	very fine sand	0.125	4	4%	72%
	fine sand	0.250	12	12%	84%
	medium sand	0.50	0	0%	84%
	coarse sand	1.00	4	4%	88%
	very coarse sand	2.0	4	4%	92%
Gravel	very fine gravel	4.0	8	8%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	course gravel	22.3	0	0%	100%
	course gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
	Cobble	small cobble	90	0	0%
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%
<b>TOTAL % of whole count</b>			100	100%	100%
Summary Data					
D50	NA				
D84	0				
D95	3				

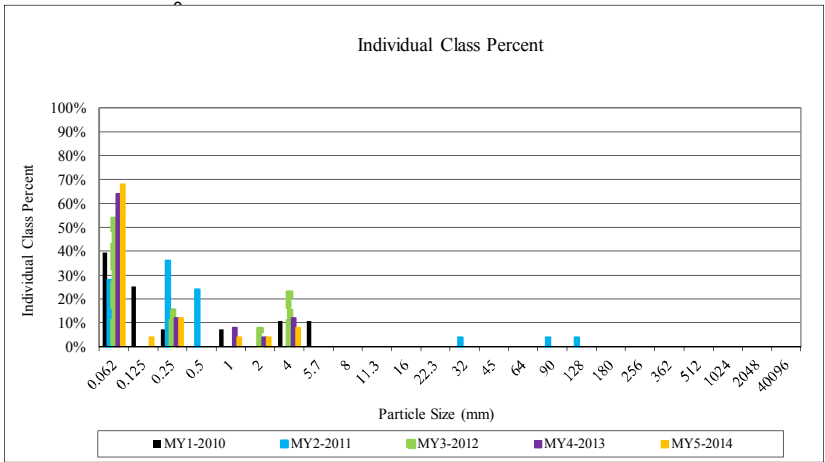
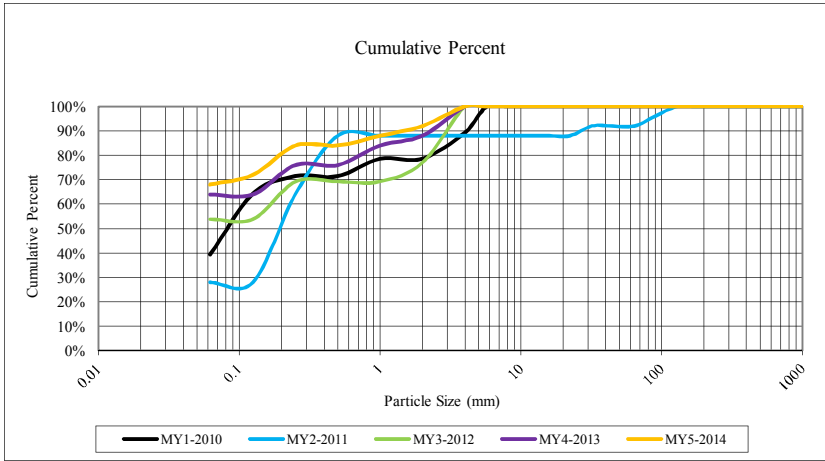




Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)

McIntyre Creek at Hornets Nest Park (EEP Project Number 243)

Parameter	Cross Section 1							Cross Section 2							Cross Section 3							Cross Section 4						
	Pool							Riffle							Riffle							Pool						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	20.0	19.6	19.4	19.4	18.6	20.3		16.7	17.0	15.9	16.1	15.2	14.7		17.6	17.0	11.1	10.9	10.9	11.2		15.5	15.5	13.7	13.1	13.5	14.7	
Floodprone Width (ft) (approx)	NA	NA	NA	NA	NA	NA		150.0	150.0	150.0	150.0	150.0	150.0		150.0	150.0	150.0	150.0	150.0	150.0		NA	NA	NA	NA	NA	NA	
BF Mean Depth (ft)	2.8	3.0	3.2	3.6	3.6	3.7		2.0	2.0	2.1	2.1	2.1	2.3		1.5	1.5	2.1	2.1	2.0	1.9		3.1	3.0	3.3	3.5	3.5	3.4	
BF Max Depth (ft)	5.0	5.3	6.1	6.3	6.0	6.3		3.2	3.0	3.2	3.1	3.0	3.0		2.9	2.8	2.6	2.7	2.7	2.5		5.3	5.2	4.1	4.8	4.8	5.2	
BF Cross Sectional Area (ft <sup>2</sup> )	55.4	58.5	61.3	70.0	66.5	76.1		32.9	33.8	33.5	33.8	32.6	33.6		26.4	25.2	23.8	22.4	21.9	20.9		48.1	47.0	45.2	46.2	47.6	50.1	
Width/Depth Ratio	NA	NA	NA	NA	NA	NA		8.5	8.6	7.5	7.7	7.1	6.5		11.7	11.4	5.2	5.3	5.5	6.0		NA	NA	NA	NA	NA	NA	
Entrenchment Ratio	NA	NA	NA	NA	NA	NA		9.0	8.8	9.4	9.3	9.9	10.2		8.5	8.8	13.5	13.8	13.7	13.4		NA	NA	NA	NA	NA	NA	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	
d50 (mm)	3.1	0.4	0.3	NA	0.3	0.6		15.6	11.7	0.4	1.8	0.7	0.4		13.6	8.7	4.4	0.2	0.3	0.6		6.3	0.1	0.2	NA	NA	NA	

Table 11b. Monitoring Data - Stream Reach Data Summary

McIntyre Creek at Hornets Nest Park (EEP Project Number 243)

Parameter	Baseline					MY-1					MY-2					MY-3					MY-4					MY-5					
	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	
<b>Dimension and Substrate - Riffle Only</b>																															
BF Width (ft)	16.7			17.6		17.0			17		11.1			15.9		10.9			16.1		10.9			15.2		11.2			14.7		
Floodprone Width (ft)	150			150		150			150		150			150		150			150		150			150		150			150		
BF Mean Depth (ft)	1.5			2.0		1.5			2.0		2.1			2.1		2.1			2.1		2.0			2.1		1.9			2.3		
BF Max Depth (ft)	2.9			3.2		2.8			3.0		2.6			3.2		2.7			3.1		2.7			3.0		2.5			3.0		
BF Cross Sectional Area (ft <sup>2</sup> )	26.4			32.9		25.2			33.8		23.8			33.5		22.4			33.8		21.9			32.6		20.9			33.6		
Width/Depth Ratio	8.5			11.7		8.6			11.4		5.2			7.5		5.3			7.7		5.5			7.1		6.0			6.5		
Entrenchment Ratio	8.5			9.0		8.8			8.8		9.4			13.5		9.3			13.8		9.9			13.7		10.2			13.4		
Bank Height Ratio	1.0			1.0		1.0			1.0		1.0			1.0		1.0			1.0		1.0			1.0		1.0			1.0		
<b>Profile - Reach 1</b>																															
Riffle length (ft)	10.1	32.1	32.8	91.7		10.9	25.9	24.5	50.5		7.4	27	21.1	76.8		15	41.2	33.8	99.3	25.7	12.1	33.8	34.4	75.9	15.1	14.6	36.3	32	91.8	20.4	
Riffle slope (ft/ft)	0.0000	0.0012	0.0042	0.0313		0.0000	0.0047	0.0008	0.0296		0.0000	0.0023	0.0007	0.0126		0.0000	0.0034	0.0001	0.0221	0.01	0.0000	0.0040	0.0006	0.0201	0.0068	0.0000	0.0048	0.0008	0.0211	0.0076	
Pool length (ft)	4.3	17.3	15.6	59.6		6.4	19.6	19.3	35.8		10.4	20.7	20.3	35.9		4.3	17.9	18.5	29.0	6.7	4.6	17.3	16.0	32.1	7.1	9.5	24.6	19.9	95.2	19.4	
Pool Max depth (ft)	5.0			5.3		5.2			5.3		4.1			6.1		4.8			6.3		4.8			6.0		5.2			6.3		
Pool spacing (ft)	48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		
<b>Profile - Reach 2</b>																															
Riffle length (ft)	10.1	32.1	32.8	91.7		11.9	30.1	30.1	58.2		4.7	24.7	22.4	61.2		5.9	28	19.4	102.5	25.2	9.1	37.6	32.7	81.7	22.9	7.7	31.3	31.5	65.9	17.5	
Riffle slope (ft/ft)	0.0000	0.0012	0.0042	0.0313		0.0000	0.0100	0.0001	0.0061		0.0000	0.0014	0.0010	0.0046		0.0000	0.0012	0.0005	0.0050	0.00	0.0000	0.0014	0.0008	0.0076	0.0020	0.0000	0.0005	0.0000	0.0032	0.0009	
Pool length (ft)	4.3	17.3	15.6	59.6		4.0	14.7	9.5	43.3		2.5	10.7	9.9	22.2		4.2	14.6	13.1	32.1	8.7	3.6	17.1	18.8	43.7	9.9	6.3	20.0	17.3	50.9	13.3	
Pool Max depth (ft)	5.0			5.3		5.2			5.3		4.1			6.1		4.1			6.1		4.8			6.0		5.2			6.3		
Pool spacing (ft)	48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		
<b>Profile - Reach 3</b>																															
Riffle length (ft)	10.1	32.1	32.8	91.7		9.7	34.6	34.7	63.7		7.5	28	27	61.1		5.5	27.3	28.6	48.4	11.7	6.6	30.2	29.4	64.4	14.2	8.6	36.8	39.7	65.3	16.1	
Riffle slope (ft/ft)	0.0000	0.0012	0.0042	0.0313		0.0010	0.0027	0.0011	0.0150		0.0000	0.0007	0.0003	0.0041		0.0000	0.0022	0.0008	0.0089	0.00	0.0000	0.0021	0.0012	0.0124	0.0029	0.0000	0.0022	0.0013	0.0078	0.0027	
Pool length (ft)	4.3	17.3	15.6	59.6		4.5	12.2	12.1	21.2		1.3	15.5	11.5	42.2		5.1	15.9	15.6	33.7	8.0	6.7	17.3	13.9	41.7	9.7	5.3	16.6	14.2	38.9	8.8	
Pool Max depth (ft)	5.0			5.3		5.2			5.3		4.1			6.1		4.1			6.1		4.8			6.0		5.2			6.3		
Pool spacing (ft)	48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		48.0	77.0	76.0	169.0		
<b>Pattern</b>																															
Channel Beltwidth (ft)	19	45	41	107																											
Radius of Curvature (ft)	24	49	40	246																											
Rc:Bankfull width (ft/ft)	1.4	2.8	2.3	14.3																											
Meander Wavelength (ft)	88	132	128	220																											
Meander Width ratio	1.1	2.6	2.4	6.2																											
<b>Additional Reach Parameters</b>																															
Rosgen Classification	E-type					E-type					E-type					E-type					E-type										
Channel Thalweg Length (ft)	5178					5178					5178					5178					5178										
Sinuosity	1.4					1.4					1.4					1.4					1.4										
Water Surface Slope (Channel) (ft/ft)	0.0035					0.0020 - 0.0042					0.0002 - 0.0041					0.0026 - 0.0043					0.0025 - 0.0046					0.0021 - 0.0045					
BF slope (ft/ft)	----					----					----					----					----										
Ri%/RU%P%G%/S%	45	14	25	15		41	17	22	20		38	21	24	17		45	13	26	16		45	12	27	16		43	11	32	14		
SC%/SA%/G%/C%/B%BE%																															
d16/d35/d50/d84/d95											NA	0.18	0.3	7	15	NA	NA	0.2	9	25	NA	NA	0.2	9	24	NA	NA	0.1	8	21	
% of Reach with Eroding Banks																															
Channel Stability or Habitat Metric																															
Biological or Other																															

APPENDIX E  
HYDROLOGY DATA

Table 12. Verification of Bankfull Events

2014 (Year 5) Groundwater Gauge Graphs

Figure 3. Annual Climatic Data vs. 30-year Historic Data

Table 13. Wetland Hydrology Criteria Attainment Summary



**Table 12. Verification of Bankfull Events****McIntyre Creek Restoration Site (EEP Project Number 243)**

<b>Date of Data Collection</b>	<b>Date of Occurrence</b>	<b>Method</b>	<b>Photo (if available)</b>
September 23, 2010	July 12, 2010	Total of 2.14 inches* of rain reported to fall over 2 days (July 11-12, 2010), in addition to large wrack/debris piles and evidence of overbank flows within the adjacent floodplain.	1-2
September 23, 2010	August 19, 2010	Total of 1.1 inches* of rain reported to fall over 2 days (August 18-19, 2010) after a total of 4.43 inches* of rain the preceding 4 weeks, in addition to laid back vegetation and evidence of recent standing water within the floodplain.	3
October 18, 2010	September 29, 2010	Overbank event likely occurred after a total of 4.04 inches* of rain reported to fall over 6 days (September 25-30, 2010).	---
October 21, 2011	August 5, 2011	Overbank event likely occurred after a total of 2.50 inches* of rain reported to fall on August 5, 2011.	4
August 6, 2012	May 8, 2012	Overbank event likely occurred after a total of 2.77 inches* of rain reported to fall on May 8-9, 2012.	--
August 6, 2012	May 16, 2012	Overbank event likely occurred after a total of 2.71 inches* of rain reported to fall on May 13-16, 2012.	--
February 21, 2013	January 17, 2013	Debris, wrack, and laid back vegetation observed on the floodplain after a total of 2.38 inches* of rain reported to fall on January 17, 2013.	5-6
November 18, 2013	April 28, 2013	Overbank event likely occurred after a total of 2.73 inches* of rain reported to fall on April 27-29, 2013.	--
November 18, 2013	May 6, 2013	Overbank event likely occurred after a total of 2.13 inches* of rain reported to fall on May 5-6, 2013.	--
November 18, 2013	June 3, 2013	Overbank event likely occurred after a total of 2.52 inches* of rain reported to fall on June 2-3, 2013 with an additional 3.10 on June 4-13, 2013.	--
November 18, 2013	July 4, 2013	Overbank event likely occurred after a total of 4.23 inches* of rain reported to fall on July 4-11, 2013 with numerous small rain events (0.1-0.9 inches) in the proceeding and following days.	--
May 7, 2014	April 19, 2014	Wrack and laid back vegetation observed on the floodplain after a total of 2.80 inches* of rain reported to fall on April 18-19, 2014.	--
November 10, 2014	May 15, 2014	Overbank event likely occurred after a total of 2.11 inches* of rain reported to fall on May 15, 2014	--
November 3, 2014	August 1, 2014	Wrack and laid back vegetation observed on the floodplain after a total of 3.84 inches* of rain reported to fall July 31-August 1, 2014	--

\* Reported at KCLT Weather Station at the Charlotte Airport (Weatherunderground 2014).

Photos 1-2: Evidence of overbank including flow within adjacent floodplain, laid back vegetation, and large debris/wrack piles.



Photo 3: Evidence of overbank including laid back vegetation and recent standing water within the floodplain.

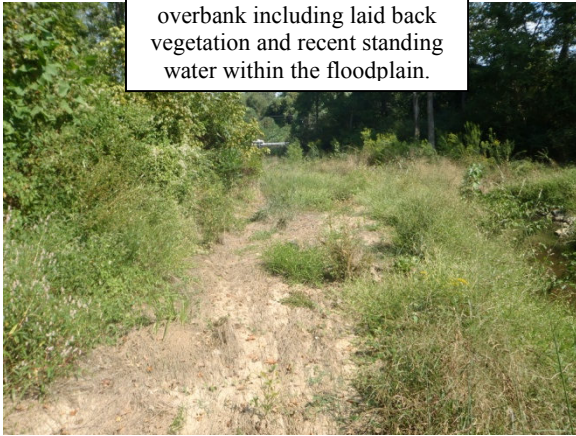


Photo 4: Evidence of overbank including wrack within the floodplain.



Photo 5: Evidence of overbank including wrack and laid back vegetation in the floodplain.

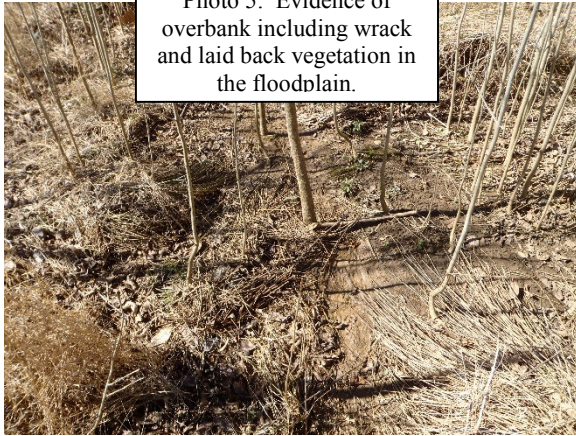
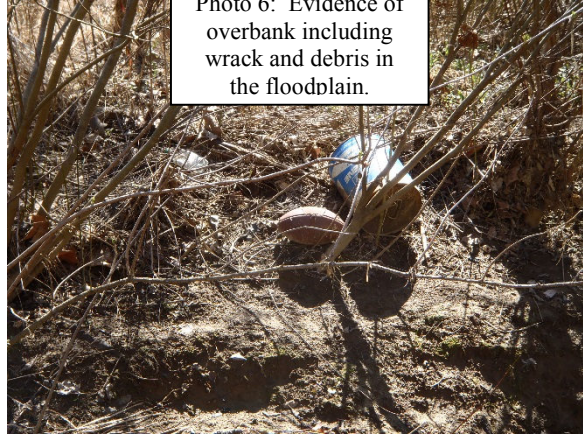
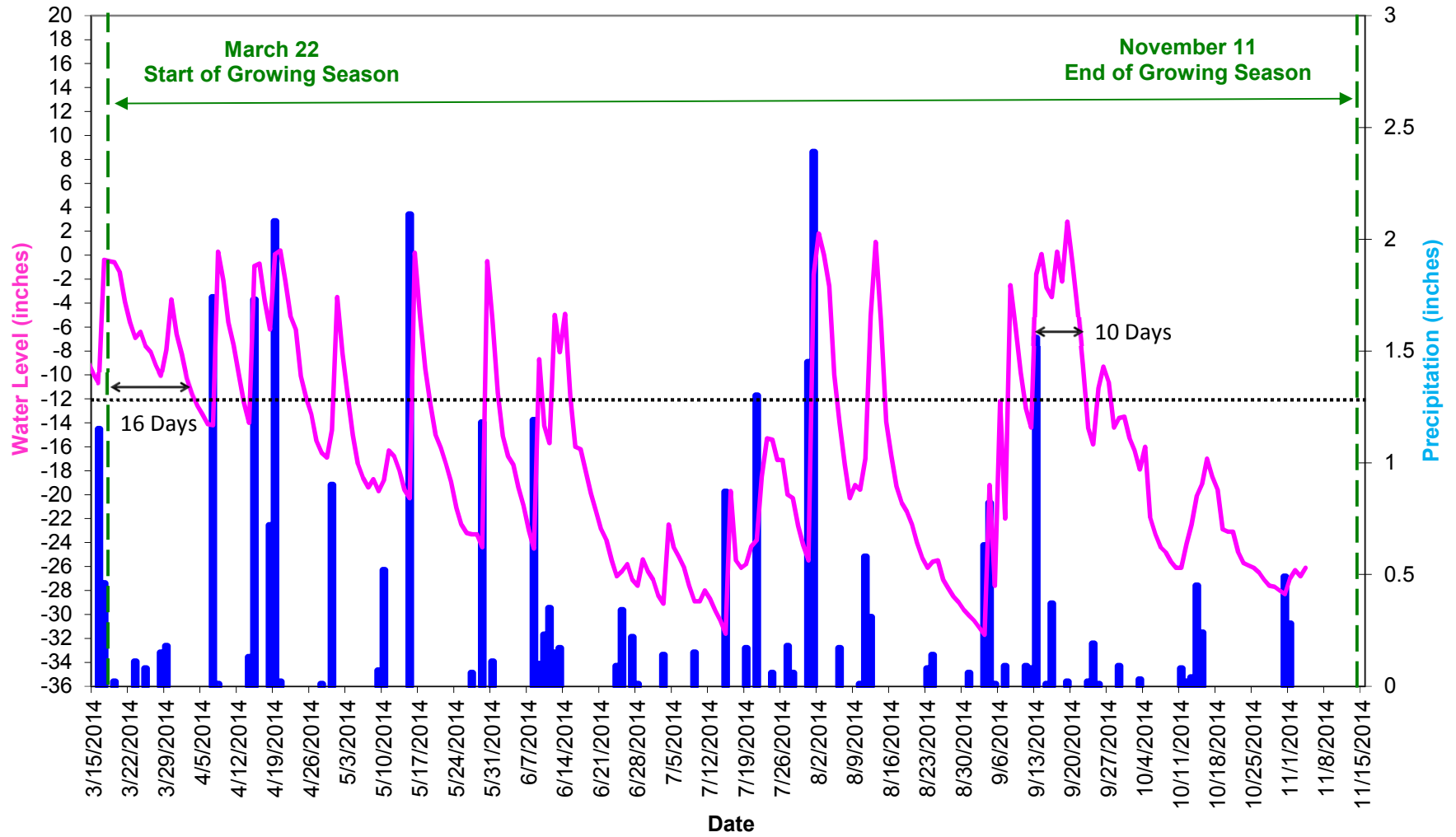


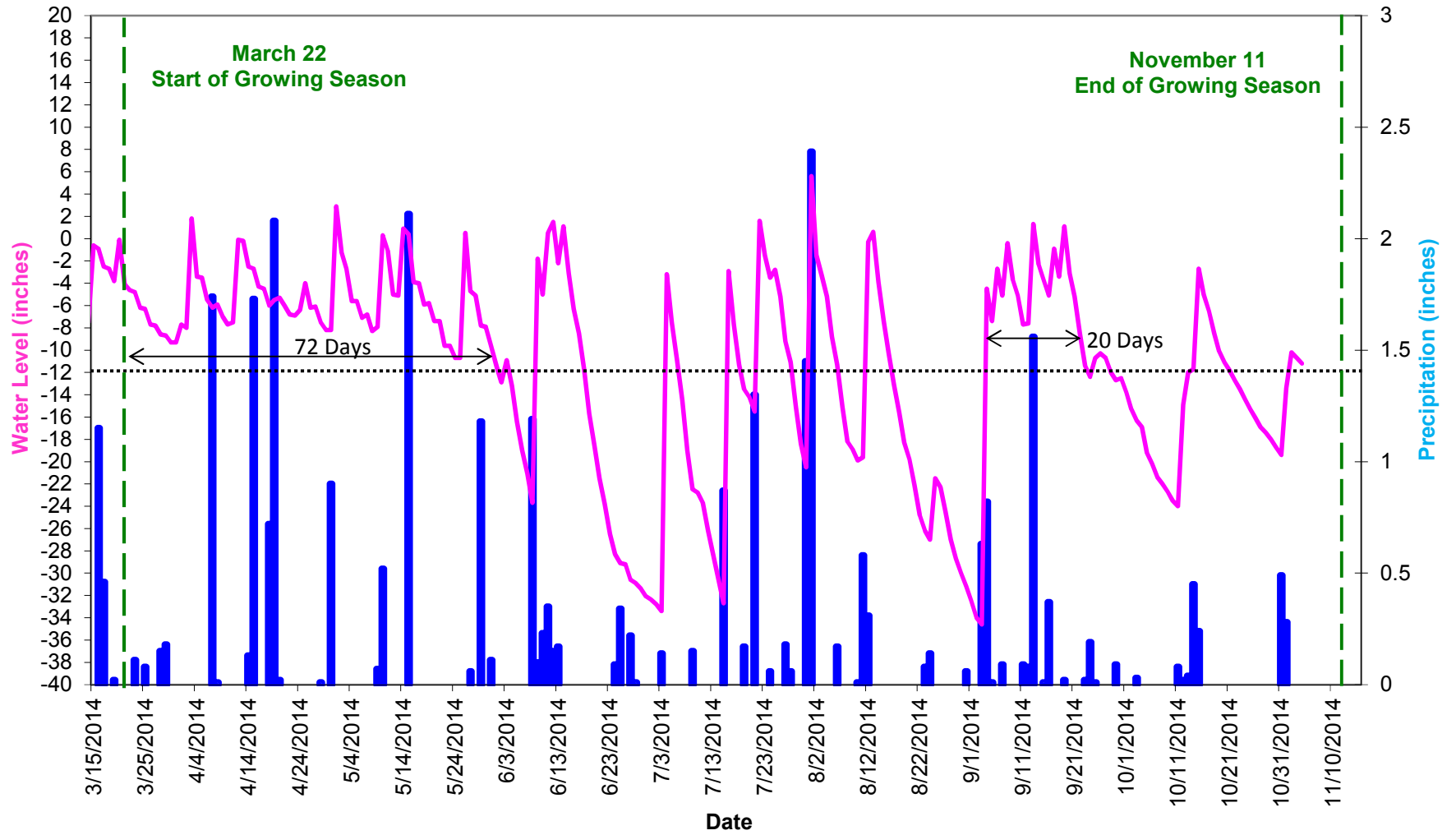
Photo 6: Evidence of overbank including wrack and debris in the floodplain.



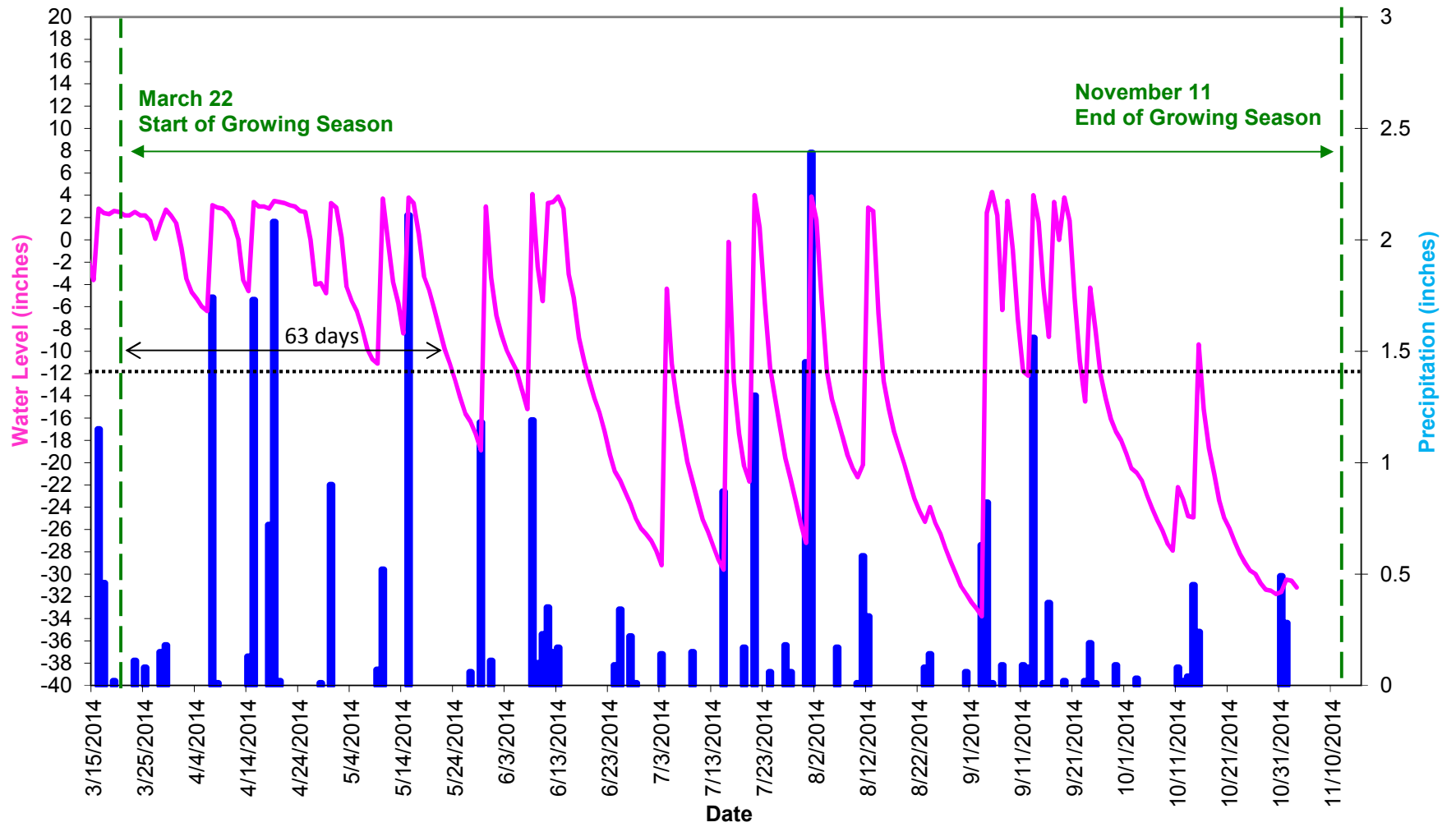
### McIntyre Creek Gauge 1 Year 5 (2014 Data)



### McIntyre Creek Gauge 2 Year 5 (2014 Data)



### McIntyre Creek Gauge 3 Year 5 (2014 Data)

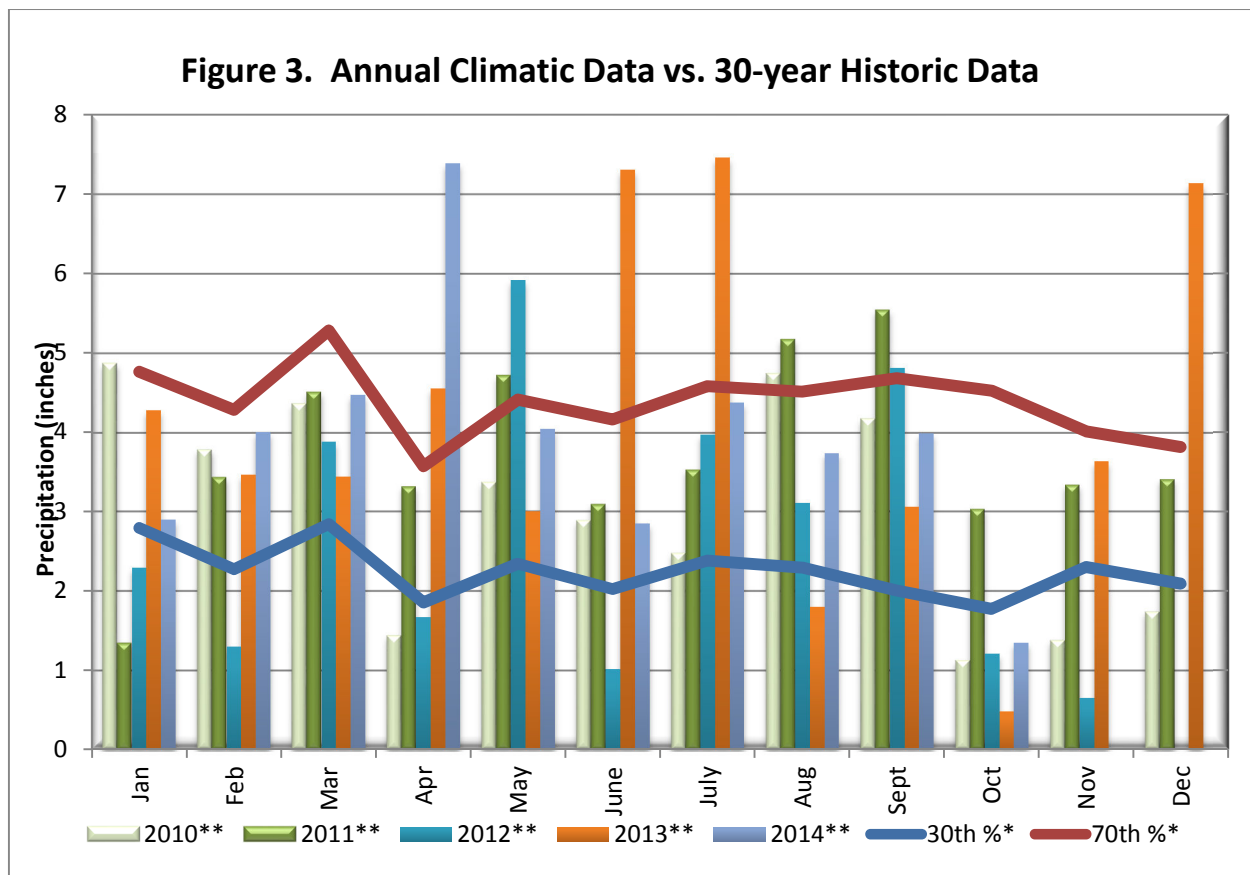




Month	30th %*	70th %*	2010**	2011**	2012**	2013**	2014**
Jan	2.79	4.76	4.88	1.36	2.29	4.28	2.9
Feb	2.27	4.28	3.79	3.44	1.30	3.46	4.01
Mar	2.84	5.28	4.37	4.52	3.89	3.44	4.48
Apr	1.85	3.57	1.44	3.32	1.67	4.56	7.39
May	2.34	4.41	3.37	4.73	5.92	3.00	4.05
June	2.02	4.16	2.89	3.10	1.02	7.31	2.85
July	2.38	4.58	2.48	3.53	3.98	7.46	4.38
Aug	2.29	4.51	4.75	5.18	3.11	1.80	3.74
Sept	2	4.68	4.18	5.55	4.82	3.06	3.99
Oct	1.77	4.52	1.13	3.04	1.21	0.48	1.35
Nov	2.3	4.01	1.38	3.34	0.65	3.63	
Dec	2.09	3.81	1.74	3.41	3.84	7.14	

\*Charlotte Douglas International Airport 30-year historic data (NOAA 2004)

\*\*Charlotte Douglas International Airport rainfall data (Weatherunderground 2014)



**Table 13. Wetland Hydrology Criteria Attainment Summary  
McIntyre Creek Restoration Site (EEP Project Number 243)**

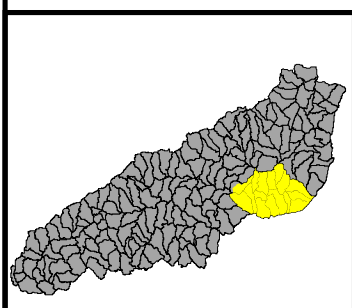
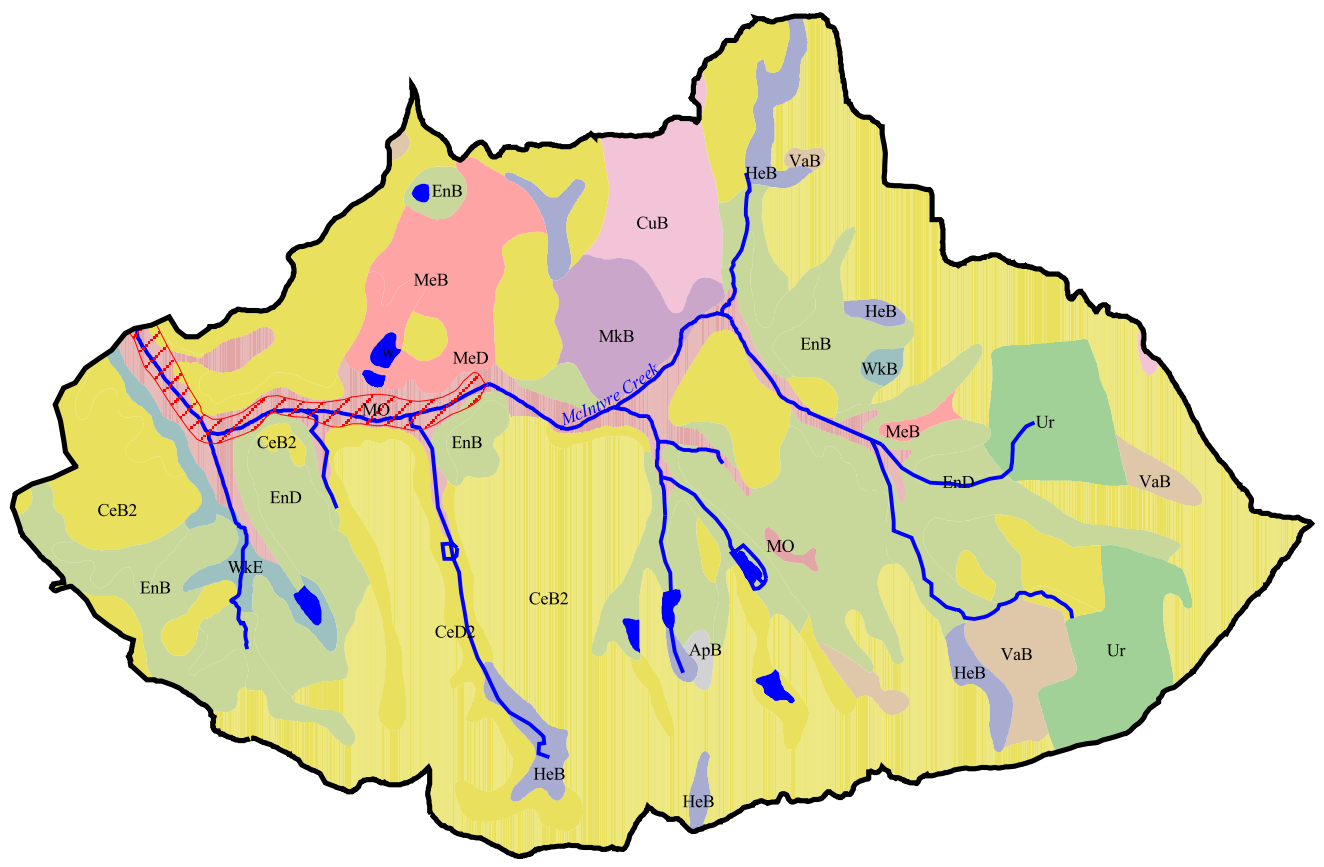
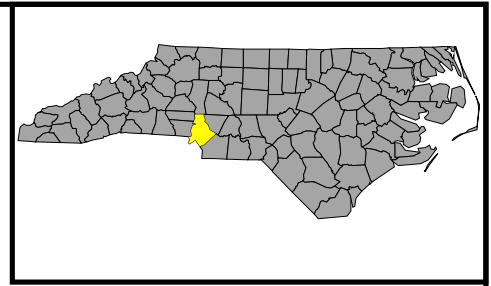
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2010)*	Year 2 (2011)*	Year 3 (2012)	Year 4 (2013)	Year 5 (2014)
1	--	No/7 day (3.0 %)	No/8 day (3.4 %)	Yes/23 day (10.0 %)	No/16 days (6.8%)
2	--	Yes/38 day (16.3 %)	Yes/23 day (10 %)	Yes/34 day (15.2 %)	Yes/72 Days (30.6%)
3	--	Yes/41 day (17.6 %)	No/22 day (9.4 %)	Yes/36 day (16.1 %)	Yes/63 Days (26.8%)

\* Note that gauges were installed in 2011 and no data is available for baseline, or year 1 (2012) monitoring periods.

APPENDIX F  
ADDITIONAL SITE DATA

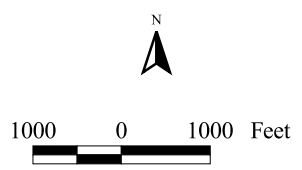
Restoration Plan Figure 3. Watershed Soils

Restoration Plan Figure 5. Watershed 1999 Aerial  
Preconstruction Photographs


















Long Creek Local Watershed

Source: Center for Geographic Information and Analysis



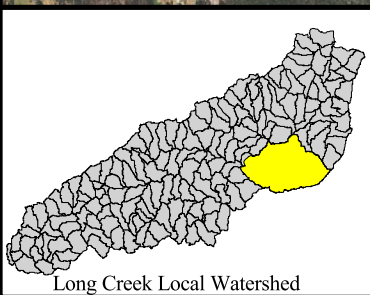
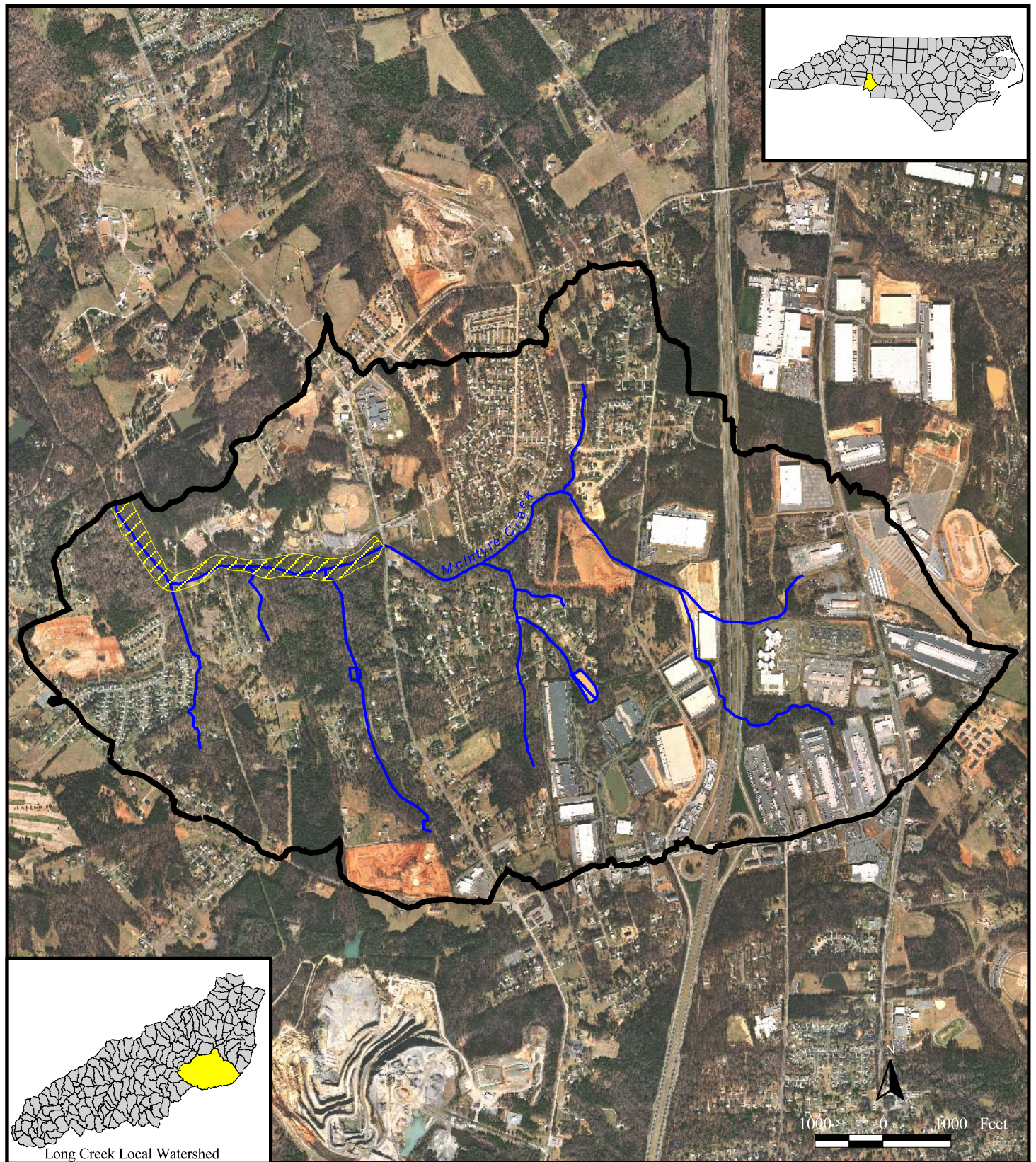
### Figure 3: Watershed Soils

	Appling sandy loam (ApB)		Urban land (Ur)
	Cecil sandy clay loam (CeB, CeD)		Vance sandy loam (VaB)
	Cecil urban land complex (CuB)		Wilkes loam (WkB, WkE)
	Enon (EnB, EnD)		Water (w)
	Helena sandy loam (HeB)		Streams
	Mecklenburg (MeB, MeD)		Project Reach
	Mecklenburg urban land (MkB)		Project Reach Drainage
	Monacan loam (MO)		






N.C. Wetlands Restoration Program





**Figure 5. Watershed 1999 Aerial**

-  Project Reach
  -  Streams
  -  Project Reach Drainage
- Watershed Area: 2.97 sq. miles



Source: Mecklenburg County Engineering and Building Standards Department Mapping/GIS Services Division



**McIntyre Creek  
Preconstruction Photographs**



APPENDIX G  
WATERSHED PLANNING SUMMARY

APPENDIX H  
LAND OWNERSHIP AND PROTECTION



APPENDIX I  
JURISDICTIONAL DETERMINATION 404/401 PERMITS  
AND RELATED COORESPONDENCE

APPENDIX J  
PROJECT DEBIT LEDGER