

# ***YEAR 4 MONITORING REPORT***

## **ADKIN BRANCH STREAM RESTORATION PROJECT PHASE 1 – WASHINGTON AVE. TO LINCOLN ST.**

Lenoir County, North Carolina  
EEP IMS No. 7



Submitted to:



**NCDENR-Ecosystem Enhancement Program**  
217 West Jones Street, Suite 3000A  
Raleigh, North Carolina 27603

Construction Completed: April 2011  
Morphology Data Collected: April 2014  
Vegetation Data Collected: July 2014  
Submitted: February 2015

Prepared by:



&

Axiom Environmental, Inc.  
218 Snow Avenue  
Raleigh, North Carolina 27603

Design Firm:

**ICA Engineering, Inc.**  
**5121 Kingdom Way, Suite 100**  
**Raleigh, North Carolina 27607**  
919.851.6066  
919.851.6846 (fax)

I HEREBY CERTIFY THAT THE DOCUMENTS CONTAINED HEREIN, ADKIN BRANCH YEAR 4 MONITORING REPORT WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

SIGNED, SEALED AND DATED THIS 4<sup>TH</sup> DAY OF FEBRUARY 2015.



A handwritten signature in blue ink, appearing to read "Chris L. Smith", written over a horizontal line.

Chris L. Smith, PE

**TABLE OF CONTENTS**

<b><u>SECTION</u></b>	<b><u>PAGE</u></b>
<b>1.0 EXECUTIVE SUMMARY.....</b>	<b>1</b>
1.1 GOALS AND OBJECTIVES.....	1
1.2 VEGETATION.....	2
1.3 STREAM STABILITY.....	4
1.4 WETLANDS.....	8
1.5 NOTE.....	8
<b>2.0 METHODOLOGY.....</b>	<b>9</b>
2.1 VEGETATION.....	9
2.2 STREAMS.....	9
2.3 WETLANDS.....	9
2.4 STORMWATER BMP.....	9
<b>3.0 REFERENCES.....</b>	<b>10</b>
APPENDIX A. PROJECT VICINITY MAP AND BACKGROUND TABLES.....	11
APPENDIX B. VISUAL ASSESSMENT DATA.....	18
APPENDIX C. VEGETATION PLOT DATA.....	49
APPENDIX D. STREAM SURVEY DATA.....	60
APPENDIX E. HYDROLOGIC DATA.....	91
APPENDIX F. CREDIT CALCULATION FIGURES.....	92
APPENDIX G. FINAL RECORD DRAWINGS.....	98

**LIST OF FIGURES**

<b><u>FIGURE</u></b>	<b><u>PAGE</u></b>
Figure 1. Vicinity Map.....	12
Figures 2.0-2.12. Current Condition Plan View.....	19
Figures 3.1-3.32. Vegetation Plot Photos and Problem Areas.....	39
Figure 3a. Supplemental Planting Map.....	57
Figures 4.1-4.17. Cross Section Plots and Photos.....	61
Figures 5.1-5.3. Longitudinal Profile Plots.....	79
Figures 6.1 & 6.2 April 2014 Crest Gauge Photos.....	91
Figures 7.1-7.5 Credit Calculation Figures.....	92

**LIST OF TABLES**

<b><u>TABLE</u></b>	<b><u>PAGE</u></b>
Table 1. Project Components and Mitigation Credits.....	14
Table 2. Project Activity and Reporting History .....	15
Table 3. Project Contacts Table .....	16
Table 4. Project Attributes Table .....	17
Table 5.1-5.3. Visual Stream Morphology Stability Assessment.....	33
Table 6. Vegetation Condition Assessment .....	37
Table 7. Vegetation Plot Criteria Attainment .....	50
Table 8. CVS Vegetation Plot Metadata.....	51
Table 9 CVS Stem Count Total and Planted by Plot and Species .....	52
Table 10.1-10.3. Baseline Stream Data Summary .....	83
Table 11. Monitoring Data - Dimensional Morphology Summary .....	86
Table 12.1-12.3. Monitoring Data - Stream Reach Data Summary.....	88
Table 13. Verification of Bankfull Events .....	91



## 1.0 EXECUTIVE SUMMARY

The following report summarizes the vegetation establishment and stream stability for Year 4 monitoring for Phase 1 of the Adkin Branch Stream Restoration Project (Site) in Lenoir County, North Carolina.

### 1.1 Goals and Objectives

The primary goals of the Adkin Branch Stream Restoration Project focus on:

- Restoring a stable dimension, pattern, and profile to Adkin Branch and UT to Adkin Branch (UT)
- Improving water quality
- Decreasing floodwater levels
- Restoring aquatic and riparian habitat
- Implementing best management practices (BMPs) for stormwater quality and retention

These goals will be achieved through the following objectives:

- Reducing sediment input to Adkin Branch by restoring 7,579 linear feet of stream to a stable dimension, pattern, and profile, and establishing a vegetated stream bank, floodplain, and terrace forest. Forest vegetation species were selected by studying a Reference Forest Ecosystem located directly upstream of the Project and reviewing species listed in *Classification of the Natural Communities of North Carolina: Third Approximation* (Schafale and Weakley 1990) for a Coastal Plain Levee Forest. A total of 31.92 acres of the conservation easement were reforested.
- Promoting floodwater attenuation and decreasing floodwater levels by excavating a gently sloping floodplain that begins at the bankfull discharge elevation and slopes up to the terrace elevation, in addition to increasing roughness in the floodplain by establishing a vegetated riparian buffer.
- Improving aquatic habitat by enhancing stream bed variability (ripple-pool sequence), and introducing woody debris in the form of rootwads, log vanes, and log sills. A ripple-pool sequence and woody debris structures will provide places for forage, cover, and reproduction for fauna and flora.
- Improving terrestrial habitat by restoring a forested riparian corridor through a highly urbanized environment, which has historically experienced vegetation maintenance and forest segmentation. This corridor will provide a diversity of habitats such as mature forest, early successional forest, riparian wetlands and uplands.
- Reducing nonpoint source pollution associated with urban land uses (i.e. maintained ball fields, roadways, residential communities, etc.) by providing a vegetated riparian buffer adjacent to streams to treat surface runoff. Reforestation of the Project resulted in a total of 1,171,272 sq. ft. (26.89 acres) of Neuse River Riparian Buffers (area within 200' of top of bank of channel that is at least 50' wide).
- Improving water quality by creating 0.69 acres of riparian stormwater wetland adjacent to the UT, implementing six (6) sand filter device BMPs along Adkin Branch for

stormwater runoff to retain sediments and nutrients prior to entering Adkin Branch, and removing creosote timber retaining walls throughout the project.

## 1.2 Vegetation

### Stream Vegetation Success Criteria

According to 15A NCAC 02B .0295 Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers vegetation will be considered successful for stream mitigation credit if at least 260 stems/acre (trees and shrubs), both, volunteer and planted, are surviving at the end of five years. The interim measure of vegetative success for the site will be the survival of at least 320 3-year old stems per acre at the end of year three of the monitoring period and 280 4-year old stems per acre at the end of year four of the monitoring period (USACE et al. 2003).

### Riparian Buffer Vegetation Success Criteria

Vegetation monitoring will be considered successful for riparian buffer mitigation credit if at least 320 native planted hardwood stems/acre (trees only) are surviving at the end of year five. Planted vegetation must include a minimum of at least two planted native hardwood tree species. There is no interim measure of vegetative success for riparian buffers.

### Monitoring Results

#### *Year 1 (2011)*

In general, vegetation within the Site was doing poorly in Year 1 (2011) and many of the planted trees had died over the summer of 2011 as the result of extreme hot, dry conditions followed by Hurricane Irene. Due to poor planted stem survivability in Year 1, vegetation warranty Site assessments were conducted in September 2011 by EEP and Axiom Environmental, Inc. (Axiom) as described in the EEP letter to Fluvial Solutions, Inc. dated January 25, 2012 (Appendix C). The results of the Site assessment required Fluvial Solutions, Inc. to replant bare root seedlings in four areas as depicted on the Supplemental Planting Map provided in Appendix B. A total of 11 ball and burlap trees were also replanted. Fluvial Solutions, Inc. contracted Bruton Natural Systems, Inc. to replant the Site. Replanting was completed on March 8, 2012. The list of species replanted at the Site is provided in Tables C4 and C5 (Appendix C).

#### *Year 2 (2012)*

Despite replanting the Site in 2012, planted tree growth within the Site remained poor during the Year 2 (2012) monitoring period. Based on the number of stems counted, average densities were measured at 491 planted stems per acre (excluding livestakes) surviving. The dominant species identified at the Site were planted stems of silky dogwood (*Cornus amomum*), river birch (*Betula nigra*), and southern red oak (*Quercus falcata*). Fourteen of the twenty-two individual vegetation plots met success criteria when counting planted stems alone. Three plots (Plots 9, 10, and 11) did not meet success criteria based on planted stems alone; however, when including appropriate naturally recruited stems of hickory (*Carya* sp.), these plots were well-above success criteria. In addition, a large pecan tree fell within Plot 11 contributing to numerous missing planted stems. Lespedeza is dominating the floodplain in the vicinity of Plots 7 and 8, making it difficult for planted stems to survive. Several small areas along stream benches were

characterized by exposed soils with little vegetation in Year 1; however, herbaceous vegetation was beginning to fill in these areas. Several small areas of invasive species occurred within the Site including Chinese privet, Johnson grass, and Japanese honeysuckle. Lespedeza was dominating the left and right floodplain between stations 90+00 and 96+00 and was out-competing planted woody vegetation. It was recommended that an herbicide approved for use in or near aquatic sites be applied to this area to control lespedeza. Plant coverage within the stormwater BMP was greater than 95 percent.

#### *Year 3 (2013)*

Based on the number of stems counted, average densities were measured at 495 planted stems per acre (excluding livestakes) surviving in Year 3 (2013). The dominant species identified at the Site were planted stems of silky dogwood (*Cornus amomum*), river birch (*Betula nigra*), and southern red oak (*Quercus falcata*).

Fifteen of the twenty-two individual vegetation plots met success criteria when counting planted stems alone. Plot 9 was not sampled because it was destroyed by construction equipment during stream repair efforts in July 2013. The site received supplemental planting in areas with low stem densities and those areas disturbed by construction activities in 2013. The areas that were replanted include the staging and stockpile locations, haul road and any other area within the easement that were impacted by construction equipment. Three plots (Plots 6, 10, and 11) did not meet success criteria based on planted stems alone; however, when including appropriate naturally recruited stems of hickory (*Carya* sp.) and American elm (*Ulmus americana*), these plots exceeded success criteria. Herbaceous vegetation has continued to fill in stream bench areas that were bare in Year 1 (2011). Planted tree growth within the Site, in general, is poor. Several small areas of invasive species occurred within the Site including Chinese privet, Johnson grass, lespedeza, and Japanese honeysuckle as depicted on the CCPV (Appendix B).

The plant coverage within the stormwater BMP was greater than 95 percent.

#### *Year 4 (2014)*

Based on the number of stems counted, average densities were measured at 498 planted stems per acre (excluding livestakes) surviving in Year 4 (2014). The dominant species identified at the Site were planted stems of silky dogwood (*Cornus amomum*), river birch (*Betula nigra*), and southern red oak (*Quercus falcata*).

Sixteen of the twenty-two individual vegetation plots met success criteria when counting planted stems alone. Vegetation in Plot 9 was damaged by construction equipment during stream repair efforts in July-September 2013; several planted stems have resprouted but overall the area around this plot is sparse. Five plots (Plots 7, 10, 11, 16, and 18) didn't meet success criteria based on planted stems alone; however, when including appropriate naturally recruited stems of hickory (*Carya* sp.) and American elm (*Ulmus americana*), these plots exceeded success criteria.

The site received supplemental planting in areas disturbed by construction activities in 2013. The areas that were replanted include the staging and stockpile locations, haul road and any other area within the easement that were impacted by construction equipment. Supplemental planting with 1060 containerized trees (1-gallon and 3-gallon) and 3000 livestakes occurred in early 2014 as found in tables C1-C3. The majority of containerized trees are doing well. Supplemental planting can be seen in Appendix C.

Several areas of invasive species occur within the Site including Chinese privet, Johnson grass, lespedeza, and Japanese honeysuckle as depicted in the CCPV (Figures 2.6-2.7 and 2.9-2.11). Invasive species were treated in March 2014. EEP is currently contracted with a firm to manage *Ailanthus altissima*, *Ligustrum sinensis*, *Ligustrum japonica*, *Melia azedarach*, *Sorghum halepense*, and *Wysteria sp.*

Currently plant coverage within the stormwater BMP is greater than 95 percent.

### **1.3 Stream Stability**

#### *Year 1 (2011)*

Year 1 monitoring surveys along Adkin Branch and its UT occurred in October, 2011.

Reach 1: Significant stream bed scour was observed from station 41+00 to 46+00. This scour likely occurred during the storm events associated with Hurricane Irene in late August, 2011. Several of the existing pools deepened and/or lengthened as a result of the storm events, but the log structures maintained grade control and the overall stability of the channel was not compromised. Only minor shifting of pools and riffles was observed throughout the remainder of the profile, which is expected in a sand bed system. The majority of stream banks and structures throughout the project were stable and functioning as intended. There was no evidence of trends toward significant change in channel pattern. Cross sectional data indicated that the channel width to depth ratio was lowering as the channel matured. This change is expected as detailed in the proposed success criteria from the Baseline Monitoring Document (NCDENR, 2011).

Reach 2: Significant stream bed scour was observed from station 68+71 to 74+64. Based on an overall visual assessment of the channel, Reach 2 appeared to contain the majority of the problem areas on the Site. Twelve riffle segments were noted as unstable in Reach 2 as a result of the scour from large storm events, most notably, events associated with Hurricane Irene. Twelve bank segments were noted as eroding in Reach 2, due to a lack of vegetation along the stream banks. One log cross vane had been compromised in Reach 2 as a result of stream bank erosion around the vane arm. Six log structures were experiencing erosion on greater than 15 percent of the streambanks within their extent of influence and three log structures exhibited minor erosion around the vane arms. A Repair Plan was developed to correct these problem areas, which included the use of soil lifts, bank grading, and erosion control matting.

The soil lifts that were installed in January and February, 2011 are stable with well-established willow cuttings along the stream banks.

Reach 3: Reach 3 was performing as expected.

Crest gauges installed on-site were inspected on 26 October, 2011. Crest Gauge 2 near station 75+25 was damaged during Hurricane Irene. The remaining crest gauges revealed that a bankfull event occurred at least once during 2011 (Table 13). Additional overbank evidence included debris lines, and vegetation bent in the downstream direction.

*Year 2 (2012)*

Year 2 monitoring surveys occurred in October and November, 2012.

Reach 1: Reach 1 experienced little change from Year 1 except between stations 39+00 to 41+00 where the pools became deeper and longer. Log structures were stable through this section and continued to maintain grade control.

Reach 2: The profile along Reach 2 provides evidence of the fluctuating nature of a sand bed system. Some pools became deeper and longer (station 65+00 to 69+00) while others filled in and shortened (station 82+50 to 86+00). Overall, Reach 2 was somewhat unstable due to erosion along approximately 45 percent of the stream banks within the Reach. Erosion was attributed to a lack of vegetation and several large storm events, including Hurricane Irene, that have resulted in severe shear stress along the exposed sandy banks. A Repair Plan was developed to correct the eroded stream banks which included the use of soil lifts, bank grading, and erosion control matting. The Repair Plan was implemented in the Spring/Summer of 2013. Fluctuation in channel bed features is expected to continue throughout the monitoring period; however, the overall stream reach should stabilize once woody vegetation establishes along the stream banks. A beaver dam was observed at Station 69+60 and appears to have formed on top of rip rap that was placed in the channel by local residents. Rip rap was also observed in the channel near station 81+25. The soil lifts that were installed in January and February, 2011 are stable with well-established willow cuttings along the stream banks.

Reach 3: Reach 3 experienced aggradation between Stations 10+00 and 12+35 due to dense herbaceous vegetation forming in the channel and trapping sediment. However, the stream remains stable and flood waters are accessing the adjacent stormwater wetlands as intended. Only minor shifting of pools and riffles was observed throughout the remainder of the profile, which is expected in a sand bed system. The majority of stream banks and structures throughout the project were stable and functioning as intended. There was no evidence of trends toward significant change in channel pattern. Cross sectional data indicated that the channel width to depth ratio was lowering as the channel matures.

Crest Gauge 2 near station 75+25 was damaged during Hurricane Irene, but was reinstalled on November 8, 2012. The remaining crest gauges revealed that a bankfull event occurred at least

---



once during 2012 (Table 13). Additional overbank evidence includes debris lines, and vegetation bent in the downstream direction. Evidence of bankfull events can be found in Appendix E.

### *Year 3 (2013)*

Year 3 monitoring surveys occurred in July and August, 2013.

Reach 1: Reach 1 experienced little change from Year 2 with the log structures remaining stable through this section and continuing to maintain grade control.

Reach 2: The profile along Reach 2 provides evidence of the fluctuating nature of a sand bed system. Some pools became deeper and longer while others filled in and shortened. In general, the unstable sections of Reach 2 that were documented in the Year 2 Monitoring Report were repaired as part of construction activities completed in September of 2013. The majority of the plans consisted of installed soil lifts along eroded banks, which are now shown in the CCPV. Fluctuation in channel bed features is expected to continue throughout the monitoring period, but the overall stream reach should stabilize once woody vegetation establishes along the stream banks.

The Year 2 monitoring report discussed various bank reaches that exhibited different levels of erosion. The majority of the eroded banks were repaired during the Hurricane Irene repairs that were completed in September of 2013. The eroding banks have been stabilized through bank grading with matting or with the installation of soil lifts. All repaired sections were planted with live stakes and should remain stable as long as the newly planted vegetation continues to thrive. Some moderate scour has developed behind the vane arm of the log cross vane at station 64+80 which can be seen in the cross section 6 data. However, multiple black willow trees are continuing to grow and stabilize the bank around the scour which should aid in the long term stability of the right bank. It is recommended that observation of this section continues throughout the upcoming monitoring periods to determine whether the condition necessitates repair in the future. Cross section 7 displayed changes in geometry due to the installation of soil lifts as part of the Hurricane Irene repair plan. The repaired banks have been restored to the geometry recorded in the baseline report.

Sandfilter BMP #6 was taken offline and filled during the Hurricane Irene repairs. The BMP was planted as a part of 2014 supplemental planting. The remaining sandfilter BMPs received maintenance mowing in 2014.

Reach 3: Reach 3 experienced some aggradation from station 10+50 to 11+75 and deepening of pools from approximately station 22+00 to station 25+00. However, the stream remains stable and flood waters are accessing the adjacent stormwater wetlands as intended.

Only minor shifting of pools and riffles was observed throughout the remainder of the profile, which is expected in a sand bed system. The majority of stream banks and structures throughout

---

the project are stable and functioning as intended. There was no evidence of trends toward significant change in channel pattern. Cross-sectional data indicated that the channel width to depth ratio is lowering as the channel matures.

EEP contracted with US Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) to control beavers on site in February of 2013. Eight beaver dams were observed within the project reach and EEP contacted US Department of Agriculture in February of 2013 to begin removing the dams. After removal of the dams, additional erosion was observed, and these areas were added to the repair plans which were conducted in summer 2013.

The site experienced at least one bankfull flow in July, 2013. Additional overbank evidence includes debris lines, and vegetation bent in the downstream direction.

#### *Year 4 (2014)*

Year 4 monitoring surveys occurred in April 2014.

Reach 1: Reach 1 profile experienced minor scouring near station 52+00, however this change in profile depth is expected in a sand bed system. All structures appear to be maintaining grade control. An area around station 53+00 is experiencing major erosion along the right bank and may require repairs if erosion continues. Moderate bank erosion is also occurring in three areas downstream of station 58+00. Four areas between stations 42+00 and 47+00 are experiencing minor erosion along the banks (Figure 3.21). Bank widening is also occurring between station 55+50 and 58+00 (Figure 3.27). Areas of minor bank erosion and bank widening should be watched closely in future monitoring years.

A beaver dam was observed near Station 40+80 on April 4, 2014. EEP contacted APHIS and the dam was removed by chainsaw on April 14, 2014. The area where the dam was removed should be watched for signs of stream instability. Photos of the beaver dam can be seen in Figures 3.25 and 3.26.

Reach 2: The profile of Reach 2 continues to fluctuate as is expected with a sand bed system. Several of the pools have scoured while others have filled. In general, the changes to the profile are not significant and similar changes are expected to continue throughout the monitoring period.

Unstable sections repaired during September 2013 can be seen in the CCPV and are functioning as intended. Vegetation along the banks continues to mature and aid in bank stabilization. Soil lifts installed during the 2013 repairs can be seen in the cross section photos (Figure 4.7, 4.8, 4.10, 4.12) and are also contributing to the overall stabilization of banks. Moderate scour observed during Year 3 monitoring at Cross Section 6 continues to be an area of concern for the stream (Figure 3.23). Cross Section survey data shows the area to the right of the log vane continuing to scour. Woody vegetation growing on the banks is slowing the scouring, however, the area should still be closely observed during monitoring. Similar erosion is occurring at the

right of the log vane at Cross Section 8 (Figure 3.24). Notably less vegetation is present in this area and therefore this area should be watched closely as monitoring continues. The geometry of Cross Section 7 remains similar to Year 3 monitoring after soil lifts were installed in 2013. The soil lifts are performing as intended and are aiding in the stabilization of this section of the channel. Cross sections 9, 10 and 11 revealed notable increase in bankfull width and area due to stream bank erosion when surveyed on 4/1/2014. A Major rain event occurred on 12/24/2013 accumulating 2.05 inches of precipitation, which coupled with sandy soils and sparse vegetation likely led to the bank erosion. Cross sections were re-surveyed 8/9/2014 and showed minimal change since the April surveys. Another rain event on 7/4/2014 totaled 4.17 inches of rain, however, this storm did not affect channel dimension.

Severe erosion is also occurring in the channels entering the stream below Cross Section 11 from the stormwater BMP (Figure 3.27-3.29). EEP installed live stakes in this area and it should be monitored to see if the plantings are having a significant impact on bank and channel. Other areas experiencing bank erosion and widening can be seen in the CCPV.

Reach 3: Reach 3 experienced some minor scouring and filling of the stream bed at the upstream end of the reach. Most of the changes occur between section 10+00 and 11+75, as observed at Cross Section 13. The channel profile shows no significant changes through the majority of the reach (Station 11+75 through 21+00. Cross Sections 14, 16, and 17 do not show signs of serious erosion and have retained similar geometry to the previous monitoring year. Cross Section 15 was not surveyed due to a fallen tree over the channel.

No bank erosion appears to be occurring in Reach 3. Reach 3 observations can be seen in the CCPV and in Figure 3.30.

The site experienced at least one bankfull flow in March 2014 (Table 13). Additional overbank evidence was seen in debris lines and bent vegetation in the downstream direction. Evidence of bankfull events can be seen in Appendix E.

#### **1.4 Wetlands**

No wetland monitoring areas were established for this project report.

#### **1.5 Note**

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the 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. Credit Calculation Figures are provided in Appendix F.

EEP is currently evaluating feasibility and benefits of implementing repairs and supplemental planting to eroding areas of concern.

## **2.0 METHODOLOGY**

### **2.1 Vegetation**

Vegetation was measured at twenty-two sample vegetation plots (10-meter by 10-meter) within the Site in July 2014 for Year 4 (2014) monitoring per guidelines established in *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008). The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2006). Vegetation plots are permanently monumented with 4-foot metal garden posts at each corner. In each sample plot, vegetation parameters monitored included species composition and species density. Visual observations of the percent cover of shrub and herbaceous species were documented by photograph. Photographs and vegetation plot information can be found in Appendices B and C.

### **2.2 Streams**

The Year 4 (2014) Monitoring survey was completed using a Total Station. Each cross section was marked with two rebar monuments at their beginning and ending points. The rebar has been located vertically and horizontally in NAD 83-State Plane. Surveying these monuments throughout the Site ensured proper orientation. The survey data was imported into MicroStation for verification. The longitudinal stationing was developed from total station data and compared with previous year's data to ensure consistent beginning and ending points. RIVERMorph was used to analyze the profile and cross section data. Tables and figures were created using Microsoft Excel. The channel is entirely a sand bed system; therefore, a pebble count was not conducted.

### **2.3 Wetlands**

No wetland monitoring areas were established for this project report.

### **2.4 Sand Filter BMPs and Stormwater Wetlands**

Sand filter BMP devices will be monitored and maintained periodically, as necessary, to ensure the life of the devices. The City of Kinston has agreed to provide maintenance for the sand filter BMP devices for the life of the BMPs (30 years). A maintenance guideline manual was provided to the City of Kinston by EEP.

There is no maintenance required on the stormwater wetland. Plant coverage within the stormwater wetlands should be assessed and documented each growing season. If a minimum of 70 percent coverage is not achieved after the second growing season, supplemental planting should be completed. Plant coverage of 90 to 95 percent is desirable.

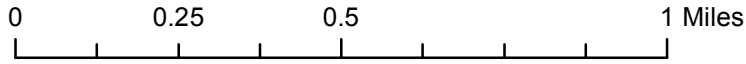
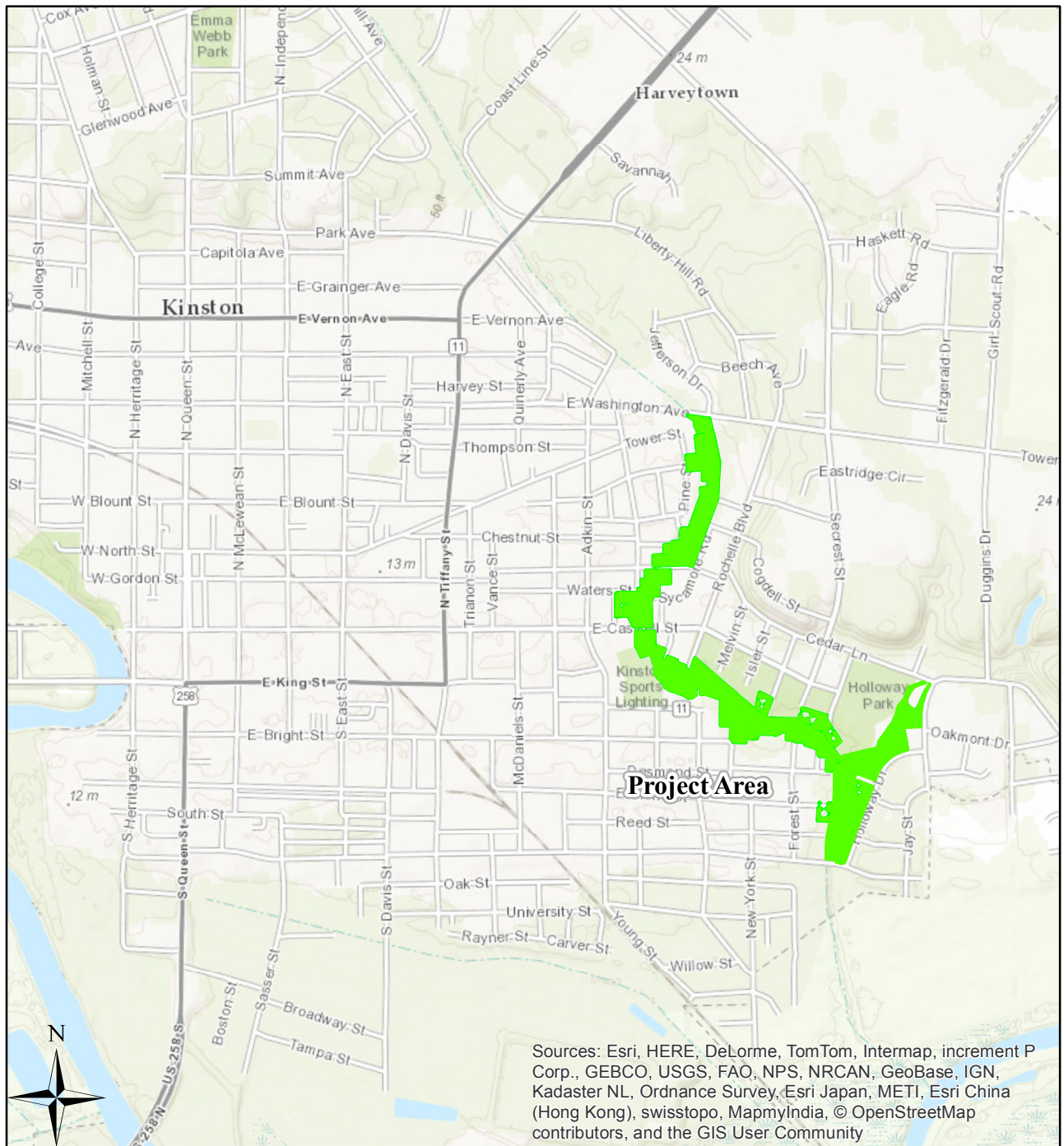
### 3.0 REFERENCES

- Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.
- NCDENR-Ecosystem Enhancement Program. 2011. Baseline Monitoring Document and As-Built Baseline Report, Adkin Branch Stream Restoration Project, Phase 1 – Washington Ave. to Lincoln St., Lenoir County, North Carolina.
- Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.
- United States Army Corps of Engineers, United States Environmental Protection Agency, North Carolina Wildlife Resources Commission, North Carolina Division of Water Quality (USACE et al.). 2003. Stream Mitigation Guidelines.
- Weakley, Alan S. 2006. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas (online). Available: [http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora\\_2006-Jan.pdf](http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2006-Jan.pdf) [January 6, 2006]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.



APPENDICES

**Appendix A. Project Vicinity Map and Background Tables**



Vicinity Map  
 Adkin Branch  
 ERTR  
 Lenoir County, North Carolina

ICA Engineering, INC  
 5121 Kingdom Way, Suite 100 Raleigh, NC 27607  
 (919) 851-6066

February 2015

Figure 1

## **Project Location and Directions**

The Project is located on the southeast side of the City of Kinston, in Lenoir County, North Carolina and includes Adkin Branch and an unnamed tributary (UT) to Adkin Branch (Figure 1, Appendix A). Phase I of the Project begins at Washington Ave. and ends at Lincoln Street.

### Directions to the Site:

- From Raleigh, North Carolina take I-40 east for approximately 6.5 miles to US Highway 70 east.
- Take US 70 east for approximately 68.5 miles to NC Highways 11 and 55.
- Take a left turn and travel northeast on NC 11/55 through Kinston for 2.6 miles to the intersection with Adkin Branch.
- The project study area is southeast of NC 11/55.

*The subject project is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP.*

Table 1. Project Components and Mitigation Credits

Mitigation Credits												
Type	Stream*	Riparian Wetland		Non-riparian Wetland		Riparian Buffer**				Nitrogen Nutrient Offset		
		R	RE	R	RE	<20'	20-29'	30-100'	101-200'	Pound Reduction	Buffer Restoration	
Totals	7,522	N/A	N/A	N/A	N/A	0	0.18	25.26	1,382,729.44	3,990	0	31,751
Project Components												
Project Component -or- Reach ID	Stationing/Location			Existing Footage/ Acreage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio				
Reach 1	Washington Ave. to Gordon St.			1,680	PII	R	1,720	1:1				
Reach 2	Gordon St. to Lincoln St.			4,224	PII	R	4,220	1:1				
Reach 3	UT to Adkin Branch.			1,200	PII	R	1,582	1:1				
Riparian Buffers	<20'			31.92	-	R	0.11	0				
	20-29'				-	R	0.24	0.75:1				
	30-100'				-	R	25.26	1:1				
	101-200'				-	R	6.1631***	1:1				
Component Summation												
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)		Buffer (square ft.)	Upland (acres)					
		Riverine	Non-Riverine									
Restoration	7,522	N/A	N/A	N/A		1,382,729	N/A					
Enhancement		N/A	N/A	N/A		N/A	N/A					
Enhancement II	N/A											
Enhancement II	N/A											
Creation		N/A	N/A	N/A								
Preservation	N/A	N/A	N/A	N/A								
High Quality Preservation	N/A	N/A	N/A	N/A								
BMP Elements												
Element	Location	Purpose/Function		30 yr. Total Nitrogen Reduction (lbs)				Notes				
Stormwater Wetland	UT Adkin	Water Quality / Nutrient Uptake		N/A				-				
BMP #4 - Sand Filter	Miller St.	Water Quality / Infiltration		300				-				
BMP #5 - Sand Filter	Dover St.	Water Quality / Infiltration		750				-				
BMP #6 - Sand Filter	Seacrest St.	Water Quality / Infiltration		1,170				Removed				
BMP #7 - Sand Filter	Myrtle Ave.	Water Quality / Infiltration		600				-				
BMP #8 - Sand Filter	Holloway Dr.	Water Quality / Infiltration		180				-				
BMP #9 - Sand Filter	Shine St.	Water Quality / Infiltration		990				-				
* - Stream Buffer Mitigation Credit numbers were adjusted based on proposed 2003 Stream Mitigation Guidelines. Riparian Buffer Mitigation Credit Numbers were adjusted based on the 15A NCAC 02B .0295 Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers Temporary Rule effective October 24, 2014.												
**Riparian Buffer areas may be used for stream and wetland mitigation, streams and riparian buffer mitigation, or nutrient offset credit (Estimating/Calculating Riparian Buffer Credits, EEP PPPM Section 8.3.1.2)												
***Adkin Branch is a Grandfathered buffer project												

**Table 2. Project Activity and Reporting History**

<b>Activity or Report</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Restoration Plan		March 2007
Final Design – Construction Plans		May 2007
Bid Opening		October 2008
Begin Construction		March 2009
<i>Tropical Storm Ida</i>	<i>November 2009</i>	
Article 29 declared on original contractor		January 2010
Surety Contractor Begin Construction		June 2010
Tropical Storm Repairs Bid Opening		September 2010
<i>Tropical Storm Nicole</i>	<i>October 2010</i>	
Begin Tropical Storm Repairs Construction		December 2010
Construction Complete		April 2011
Baseline Monitoring Document	March 2011	July 2011
<i>Hurricane Irene</i>	<i>August 2011</i>	
Year 1 Monitoring	October 2011	November 2011
Year 2 Monitoring	November 2012	January 2013
Year 3 Monitoring	August 2013	November 2013
Hurricane Irene Repairs		September 2013
Year 4 Monitoring	April 2014	February 2015
Year 5 Monitoring		



**Table 3. Project Contacts Table**

<b>Designer</b>	ICA Engineering, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Kevin Williams (919) 851-6066
<b>Original Contractor</b>	Appalachian Environmental Services 1165 W. Main St. Sylva, NC 28779 Mickey B. Henson
<b>Surety Contractor</b>	Environmental Quality Resources, LLC 1405 Benson Court, Suite C Baltimore, MD 21227 John Talley (443) 304-3310
<b>Repair Contractor (2010)</b>	Fluvial Solutions P.O. Box 28749 Raleigh, NC 27611 Peter Jelenevsky (919) 821-4300
<b>Repair Contractor (2013)</b>	Carolina Environmental Contracting PO Box 1905 Mount Airy, NC 27030 Joanne Cheatham (336) 320-3849
<b>Planting Contractor</b>	Bruton Natural Systems (Fluvial Solutions Sub-contractor) PO Box 1197 Fremont, NC 27830 Charlie Bruton (919) 242-6555
<b>Seeding Contractor</b>	See Original Contractor, Surety Contractor, & Repair Contractor above.
Nursery Stock Suppliers	1) ArborGen - South Carolina SuperTree Nursery 2) Evergreen Partners of Raleigh 3) NC Division of Forest Resources
<b>Monitoring Performers</b>	
Stream Monitoring	ICA Engineering, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ryan Smith (919) 851-6066
Vegetation Monitoring	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, North Carolina 27603 Corri Faquin (919) 414-2471

**Table 4. Project Attributes Table**

<b>Project Information</b>				
Project Name		Adkin Branch Stream Restoration Project – Phase I		
County		Lenoir		
Project Area (acres)		36		
Project Coordinates		035° 15' 13" N, 77° 33' 36" W (@ Lincoln St.)		
<b>Project Watershed Summary Information</b>				
Physiographic Province		Coastal Plain		
River Basin		Neuse		
USGS 8-digit HUC	3020202		USGS 14-digit HUC	3020202060030
NCDWQ Subbasin		03-04-05		
Project Drainage Area		5.46 sq. mi (at Lincoln St.)		
Watershed Land Use		Urban Land	76%	Agricultural Land
		Mixed Forest / Disturbed Forest	7%	Evergreen Forest
				13%
				4%
<b>Reach Summary Information</b>				
Parameters	Adkin Branch			UT to Adkin
	Washington Ave. to Gordon St.	Gordon St. to Lincoln St.		
Length of reach (linear ft)	1727	4270		1582
Valley Classification	VIII			VIII
Drainage Area (acres)	3220	3495		78
NCDWQ stream ID score	39.5			27
NCDWQ Classification	C			C
Pre-Existing Stream Type	G5	B5c		E5
As-built Stream Type	B5c	B5c		C/E5
Underlying mapped soils	Bibb			Kenansville
Drainage Class	Poorly Drained			Well-drained
Soil Hydric Status	Hydric			Non-Hydric
Slope	0.0016	0.0014		0.0022
FEMA Classification	AE			
Native Vegetation Community	Coastal Plain Levee Forest / Streamside Assemblage			
Percent composition of exotic invasive vegetation	5%	10%		5%
<b>Wetland Summary Information</b>				
N/A				
<b>Regulatory Considerations</b>				
Regulation	Applicable	Resolved	Supporting Documentation	
Waters of the U.S. –Sections 404 and 401	Yes	Yes	Restoration Plan	
Endangered Species Act	Yes	Yes	Restoration Plan	
Historic Preservation Act	Yes	Yes	Restoration Plan	
CZMA/CAMA	No	--	--	
FEMA Floodplain Compliance	Yes	Yes	Restoration Plan	
Essential Fisheries Habitat	No	--	--	

## **Appendix B. Visual Assessment Data**

**Figures 2.0-2.12. Current Condition Plan View**

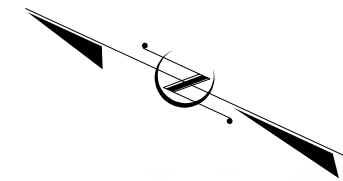


**CURRENT CONDITIONS PLAN VIEW (CCPV)  
OVERVIEW**

PROJECT REFERENCE NO. ADKIN BRANCH	FIGURE NO. 2.0
---------------------------------------	-------------------

**ICA** Engineering  
5121 Kingdom Way,  
Suite 100  
Raleigh, NC 27607  
NC License No: P-0258

**NOT TO SCALE**

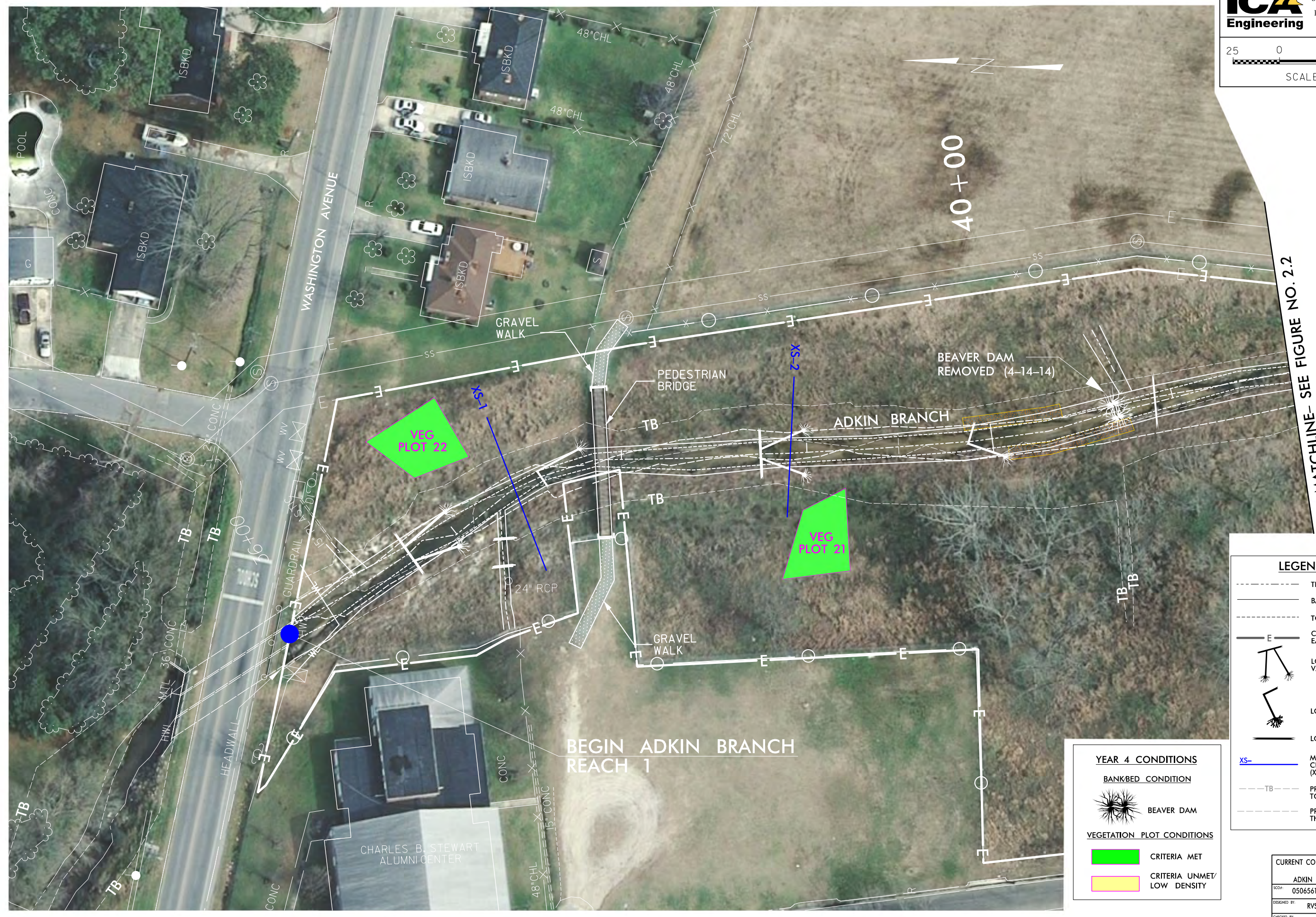


2/4/2015 S:\Adkin\_Branch\Stream\Proj\Monitoring\CCPV\_Year 4\AdkinBranch\_Monitoring\YR4\_psh\_2.0.dgn ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)	
ADKIN BRANCH (YR4)	
SCOP: 050656101	COUNTY: LENOIR
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 10/14



# CURRENT CONDITIONS PLAN VIEW (CCPV)



-MATCHLINE- SEE FIGURE NO. 2.2

### LEGEND

- THALWEG
- BANKFULL
- TOE OF SLOPE
- CONSERVATION EASEMENT LINE
- LOG CROSS VANE
- LOG VANE
- LOG SILL
- MONITORING CROSS SECTION (XS-)
- PRE-CONSTRUCTION TOP OF BANK
- PRE-CONSTRUCTION THALWEG

### YEAR 4 CONDITIONS

#### BANKBED CONDITION

- BEAVER DAM

#### VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET/ LOW DENSITY

### CURRENT CONDITIONS PLAN VIEW (CCPV)

ADKIN BRANCH (YR4)

SCOPE: 050656101 COUNTY: LENOIR

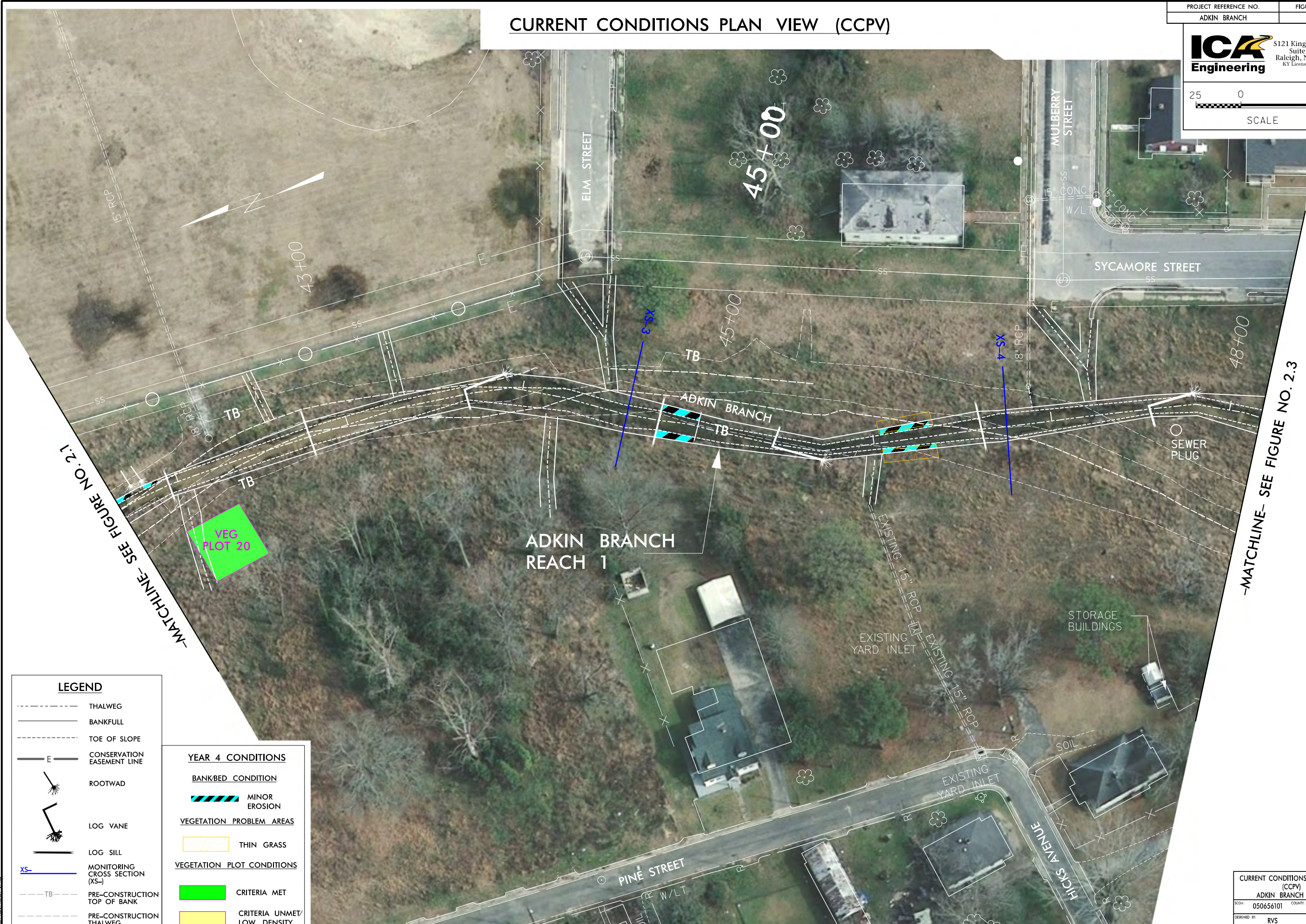
DESIGNED BY: RVS

CHECKED BY: RKW DATE: 1014

2/4/2015 8:54:10 AM C:\AdkinBranch\Monitoring\CCPV\_Yr4\AdkinBranch\_Monitoring\YR4\_psh\_2.1.dgn ICA Engineering



# CURRENT CONDITIONS PLAN VIEW (CCPV)



-MATCHLINE- SEE FIGURE NO. 2.1

-MATCHLINE- SEE FIGURE NO. 2.3

LEGEND	
	THALWEG
	BANKFULL
	TOE OF SLOPE
	CONSERVATION EASEMENT LINE
	ROOTWAD
	LOG VANE
	LOG SILL
	MONITORING CROSS SECTION (XS-)
	PRE-CONSTRUCTION TOP OF BANK
	PRE-CONSTRUCTION THALWEG

YEAR 4 CONDITIONS	
<b>BANKBED CONDITION</b>	
	MINOR EROSION
<b>VEGETATION PROBLEM AREAS</b>	
	THIN GRASS
<b>VEGETATION PLOT CONDITIONS</b>	
	CRITERIA MET
	CRITERIA UNMET/ LOW DENSITY

2/4/2015 2:44:00 PM S:\AdkinBranch\Stream\Proj\Monitoring\CCPV\_Year 4\AdkinBranch\_Monitoring\IR4\_psh\_2.2.dgn  
 ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)	
ADKIN BRANCH (YR4)	
SCALE: 050656101	COUNTY: LENOIR
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 10/14



# CURRENT CONDITIONS PLAN VIEW (CCPV)

PROJECT REFERENCE NO.	FIGURE NO.
ADKIN BRANCH	2.3

**ICA Engineering**  
 5121 Kingdom Way, Suite 100  
 Raleigh, NC 27607  
 KY License No: 153

25 0 50  
 SCALE



-MATCHLINE- SEE FIGURE NO. 2.2

-MATCHLINE- SEE FIGURE NO. 2.4

**LEGEND**

- THALWEG
- BANKFULL
- - - TOE OF SLOPE
- - - CONSERVATION EASEMENT LINE
- E — EASEMENT LINE
- LOG CROSS VANE
- LOG VANE
- LOG SILL
- XS- MONITORING CROSS SECTION (XS-)
- - - TB - - - PRE-CONSTRUCTION TOP OF BANK
- - - THALWEG

**YEAR 4 CONDITIONS**

**BANK/BED CONDITION**

- MAJOR EROSION
- BEAVER DAM
- BANK WIDENING

**VEGETATION PLOT CONDITIONS**

- CRITERIA MET
- CRITERIA UNMET/ LOW DENSITY

END ADKIN BRANCH REACH 1

CURRENT CONDITIONS PLAN VIEW (CCPV)  
 ADKIN BRANCH (YR4)

SCALE: 050656101 COUNTY: LENOIR

DESIGNED BY: RVS  
 CHECKED BY: RKW DATE: 1014

2/4/2015 S:\Adkin\_Branch\Stream\Proj\Monitoring\CCPV\_Year 4\AdkinBranch\_Monitoring\R4\_psh\_2.3.dgn ICA Engineering









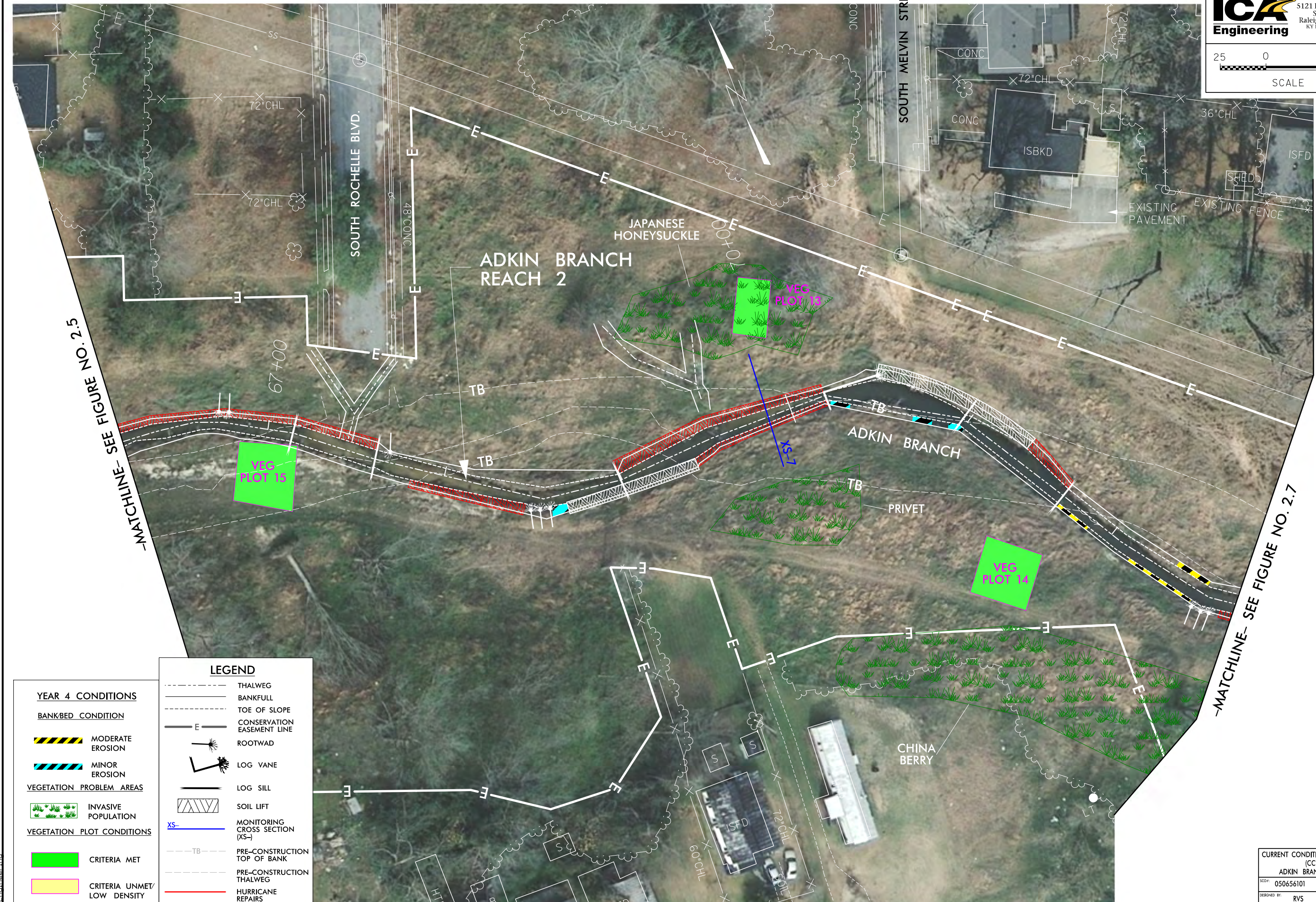


# CURRENT CONDITIONS PLAN VIEW (CCPV)

PROJECT REFERENCE NO.	FIGURE NO.
ADKIN BRANCH	2.6

**ICA Engineering**  
 5121 Kingdom Way,  
 Suite 100  
 Raleigh, NC 27607  
 KY License No. 158

25 0 50  
 SCALE



YEAR 4 CONDITIONS	
	MODERATE EROSION
	MINOR EROSION
VEGETATION PROBLEM AREAS	
	INVASIVE POPULATION
VEGETATION PLOT CONDITIONS	
	CRITERIA MET
	CRITERIA UNMET/ LOW DENSITY



LEGEND	
	THALWEG
	BANKFULL
	TOE OF SLOPE
	CONSERVATION EASEMENT LINE
	ROOTWAD
	LOG VANE
	LOG SILL
	SOIL LIFT
	MONITORING CROSS SECTION (XS-)
	PRE-CONSTRUCTION TOP OF BANK
	PRE-CONSTRUCTION THALWEG
	HURRICANE REPAIRS

2/4/2015  
 S:\Adkin\_Branch\Stream\Proj\Monitoring\CCPV\_Year 4\AdkinBranch\_Monitoring\TR4\_psh\_2.6.dgn  
 ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)	
ADKIN BRANCH (YR4)	
SCOF: 050656101	COUNTY: LENOIR
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 1014



# CURRENT CONDITIONS PLAN VIEW (CCPV)

PROJECT REFERENCE NO. ADKIN BRANCH	FIGURE NO. 2.7
 5121 Kingdom Way, Suite 100 Raleigh, NC 27607 KY License No. 158	
 SCALE	

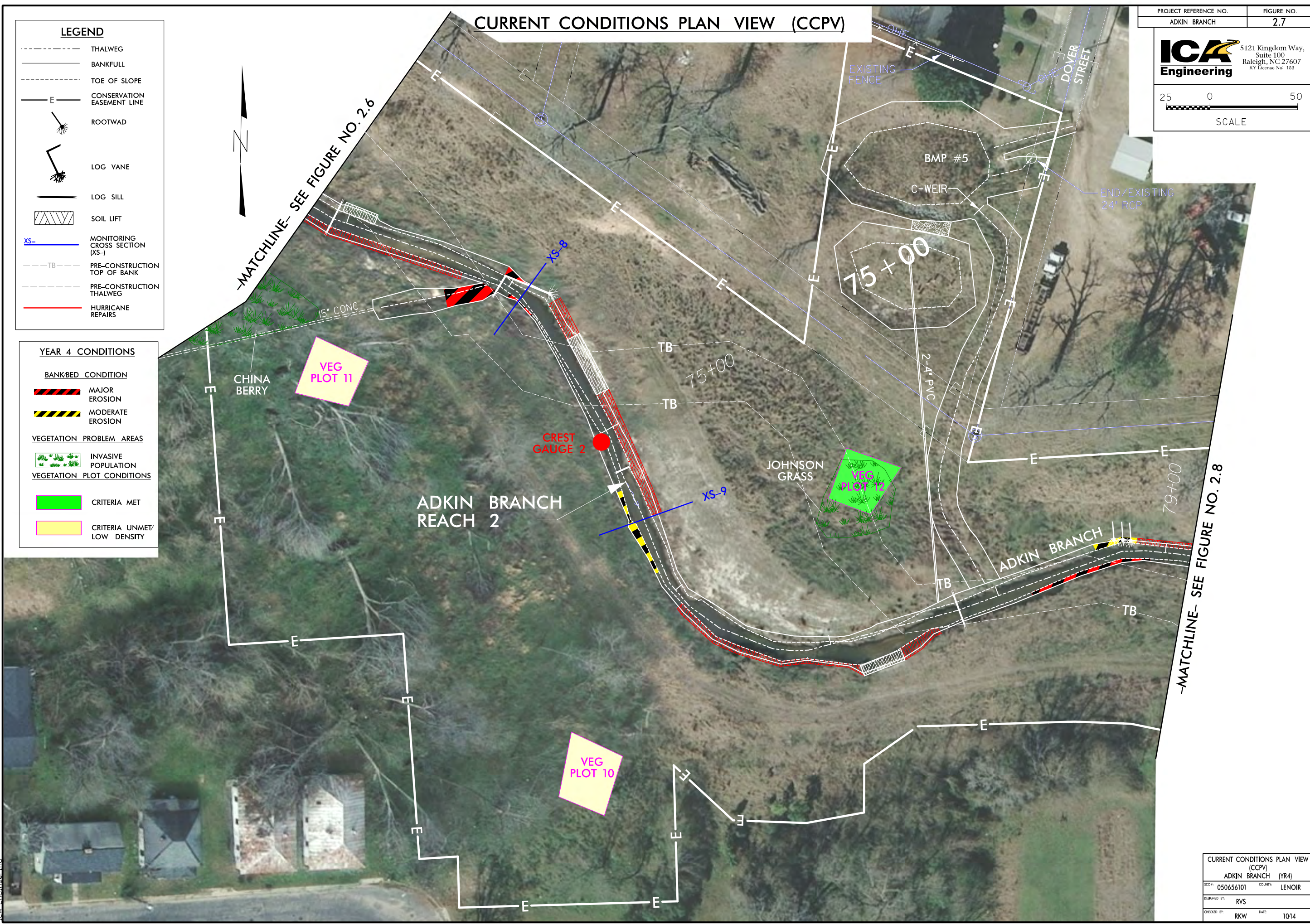
### LEGEND

- THALWEG
- BANKFULL
- TOE OF SLOPE
- CONSERVATION EASEMENT LINE
- ROOTWAD
- LOG VANE
- LOG SILL
- SOIL LIFT
- MONITORING CROSS SECTION (XS-)
- PRE-CONSTRUCTION TOP OF BANK
- PRE-CONSTRUCTION THALWEG
- HURRICANE REPAIRS

### YEAR 4 CONDITIONS

- BANKBED CONDITION**
  - MAJOR EROSION
  - MODERATE EROSION
- VEGETATION PROBLEM AREAS**
  - INVASIVE POPULATION
- VEGETATION PLOT CONDITIONS**
  - CRITERIA MET
  - CRITERIA UNMET/ LOW DENSITY

2/4/2015 S:\Adkin\_Stream\Project\Monitoring\CCPV\_Year 4\AdkinBranch\_Monitoring\YR4\_psh\_2.7.dgn ICA Engineering

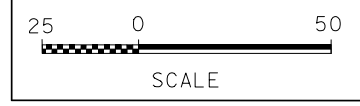


-MATCHLINE- SEE FIGURE NO. 2.8

-MATCHLINE- SEE FIGURE NO. 2.6

CURRENT CONDITIONS PLAN VIEW (CCPV)	
ADKIN BRANCH (YR4)	
SCOF: 050656101	COUNTY: LENOIR
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 10/14





### CURRENT CONDITIONS PLAN VIEW (CCPV)

LEGEND	
	THALWEG
	BANKFULL
	TOE OF SLOPE
	CONSERVATION EASEMENT LINE
	ROOTWAD
	LOG CROSS VANE
	LOG SILL
	SOIL LIFT
	MONITORING CROSS SECTION (XS-)
	PRE-CONSTRUCTION TOP OF BANK
	PRE-CONSTRUCTION THALWEG
	HURRICANE REPAIRS



-MATCHLINE- SEE FIGURE NO. 2.7

-MATCHLINE- SEE FIGURE NO. 2.9

YEAR 4 CONDITIONS	
<b>BANKBED CONDITION</b>	
	MAJOR EROSION
	MODERATE EROSION
<b>IN-STREAM STRUCTURE CONDITION</b>	
	STRESSED
<b>VEGETATION PLOT CONDITIONS</b>	
	CRITERIA MET
	CRITERIA UNMET/ LOW DENSITY

CURRENT CONDITIONS PLAN VIEW (CCPV)	
ADKIN BRANCH (YR4)	
SCOPE: 050656101	COUNTY: LENOIR
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 1014

2/4/2015 S:\Adkin\_Branch\Stream\Proj\Monitoring\CCPV\_Year 4\AdkinBranch\_Monitoring\YR4\_psh\_2.8.dgn ICA Engineering



# CURRENT CONDITIONS PLAN VIEW (CCPV)

PROJECT REFERENCE NO.	FIGURE NO.
ADKIN BRANCH	2.9

**ICA Engineering**  
 5121 Kingdom Way,  
 Suite 100  
 Raleigh, NC 27607  
 KY License No. 153

25 0 50  
 SCALE

**LEGEND**

- THALWEG
- BANKFULL
- TOE OF SLOPE
- CONSERVATION EASEMENT LINE
- ROOTWAD
- LOG CROSS VANE
- LOG VANE
- LOG SILL
- SOIL LIFT
- FLOODPLAIN INTERCEPTOR (FPI)
- MONITORING CROSS SECTION (XS-)
- PRE-CONSTRUCTION TOP OF BANK
- PRE-CONSTRUCTION THALWEG
- HURRICANE REPAIRS

**YEAR 4 CONDITIONS**

**BANKBED CONDITION**

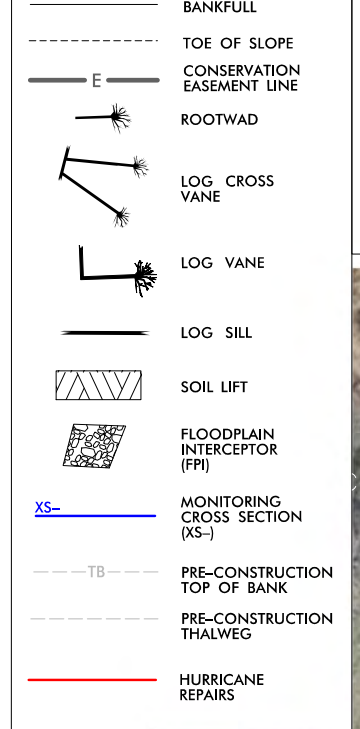
- MODERATE EROSION

**VEGETATION PROBLEM AREAS**

- INVASIVE POPULATION

**VEGETATION PLOT CONDITIONS**

- CRITERIA MET
- CRITERIA UNMET/ LOW DENSITY



2/4/2015  
 S:\Adkin\_Branch\_Stream\Proj\Monitoring\CCPV\_Year 4\AdkinBranch\_Monitoring\RR4\_psh\_2.9.dgn  
 ICA Engineering

CURRENT CONDITIONS PLAN VIEW (CCPV)	
ADKIN BRANCH	(YR4)
SCOP: 050656101	COUNTY: LENOIR
DESIGNED BY: RVS	
CHECKED BY: RKW	DATE: 10/14



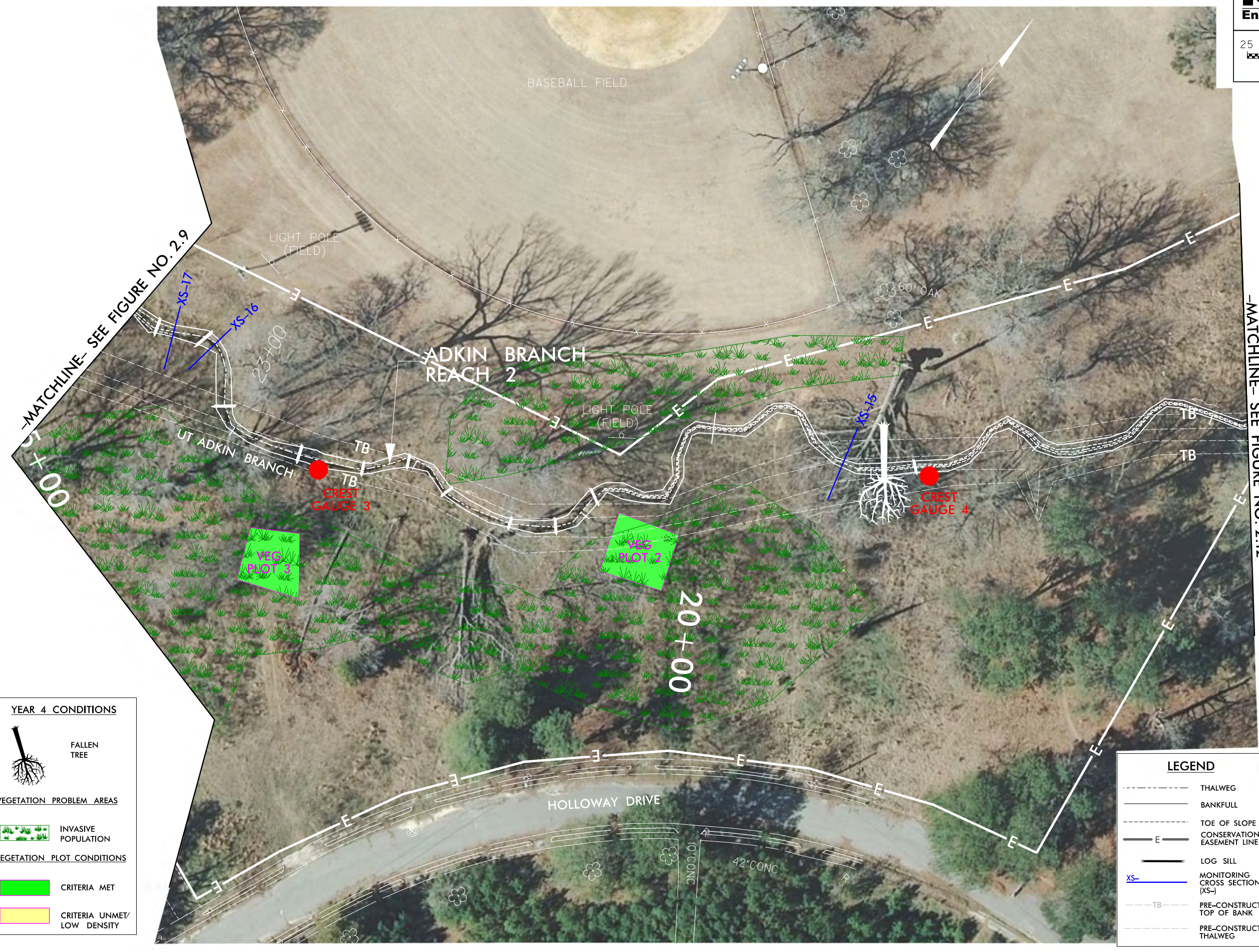
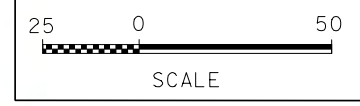




# CURRENT CONDITIONS PLAN VIEW (CCPV)

PROJECT REFERENCE NO. ADKIN BRANCH  
FIGURE NO. 2.11

**ICA Engineering**  
5121 Kingdom Way,  
Suite 100  
Raleigh, NC 27607  
KY License No. 153



MATCHLINE- SEE FIGURE NO. 2.9

MATCHLINE- SEE FIGURE NO. 2.12

**YEAR 4 CONDITIONS**

- FALLEN TREE
- VEGETATION PROBLEM AREAS**
  - INVASIVE POPULATION
- VEGETATION PLOT CONDITIONS**
  - CRITERIA MET
  - CRITERIA UNMET/ LOW DENSITY

**LEGEND**

- THALWEG
- BANKFULL
- TOE OF SLOPE
- CONSERVATION EASEMENT LINE
- LOG SILL
- MONITORING CROSS SECTION (XS-)
- PRE-CONSTRUCTION TOP OF BANK
- PRE-CONSTRUCTION THALWEG

CURRENT CONDITIONS PLAN VIEW (CCPV)	
ADKIN BRANCH (YR4)	
SCOPE: 050656101	COUNTY: LENOIR
DESIGNED BY: RVS	CHECKED BY: RKW
DATE:	1014

2/4/2015 S:\Adkin\_Branch\Stream\Project\Monitoring\CCPV\_Year 4\AdkinBranch\_Monitoring\YR4\_psh\_2.11.dgn ICA Engineering







**Table 5.1-5.3. Visual Stream Morphology Stability Assessment**

Table 5.1 Visual Stream Morphology Stability Assessment										
Adkin Branch Stream Restoration Project, Phase I, EEP IMS No. 7										
Adkin Branch Reach 1 - Washington Ave. to Gordon St. - 1,750 feet assessed										
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 (Rifle 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			2	110	94%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarse substrate	All	N/A			100%			
		3. <u>Meander Pool Condition</u>	1. <u>Depth</u> Sufficient	9	9			100%		
		2. <u>Length</u> appropriate	9	9			100%			
	4. <u>Thalweg Position</u>	1. Thalweg centering at upstream of meander bend (Run)	All	N/A			100%			
		2. Thalweg centering at downstream of meander (Glide)	All	N/A			100%			
2. Bank	1. <u>Scoured/Eroding</u>	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			8	174	95%	N/A	N/A	N/A
	2. <u>Undercut</u>	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%	N/A	N/A	N/A
	3. <u>Mass Wasting</u>	Bank slumping, calving, or collapse			1	22	99%	N/A	N/A	N/A
					9	196	98%	N/A	N/A	N/A
			<b>Totals</b>							
3. Engineered Structures	1. <u>Overall Integrity</u>	Structures physically intact with no dislodged boulders or logs	17	17			100%			
	2. <u>Grade Control</u>	Grade control structures exhibiting maintenance of grade across the sill.	17	17			100%			
	2a. <u>Piping</u>	Structures lacking any substantial flow underneath sills or arms.	17	17			100%			
	3. <u>Bank Protection</u>	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	17	17			100%			
4. <u>Habitat</u>	Pool forming structures maintaining – Max Pool Depth; Mean Bankfull Depth ratio > 1.6 Rootwads/logs providing some cover at base-flow.	18	18			100%				

Table 5.2 Visual Stream Morphology Stability Assessment										
Adkin Branch Stream Restoration Project, Phase I, EEP IMS No. 7										
Adkin Branch Reach 2 - Gordon St. - 3,081 feet assessed (4,270 ft. total reach length)										
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 (Rifle 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			4	285	91%			
	2. Rifle Condition	1. <u>Texture/Substrate</u> - Rifle maintains coarse substrate	N/A	N/A			100%			
		1. <u>Depth Sufficient</u>	14	14			100%			
3. Meander Pool Condition		2. <u>Length appropriate</u>	14	14			100%			
		1. <u>Thalweg centering at upstream of meander bend (Run)</u>	All	N/A			100%			
4. Thalweg Position		2. <u>Thalweg centering at downstream of meander (Glide)</u>	All	N/A			100%			
2. Bank	1. <u>Scoured/Eroding</u>	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			13	342	94%	0%	0%	94%
	2. <u>Undercut</u>	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%	N/A	N/A	N/A
	3. <u>Mass Wasting</u>	Bank slumping, calving, or collapse			4	77	98%	0%	0%	98%
			<b>Totals</b>		17	419	97%	0%	0%	97%
3. Engineered Structures	1. <u>Overall Integrity</u>	Structures physically intact with no dislodged boulders or logs	29	29*			100%			
	2. <u>Grade Control</u>	Grade control structures exhibiting maintenance of grade across the sill.	29	29*			100%			
	2a. <u>Piping</u>	Structures lacking any substantial flow underneath sills or arms.	29	29*			100%			
	3. <u>Bank Protection</u>	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	29	29*			100%			
	4. <u>Habitat</u>	Pool forming structures maintaining -- Max Pool Depth; Mean Bankfull Depth ratio > 1.6 Rootwads/logs providing some cover at base-flow.	29	29*			100%			

\* Two structures (log vanes at sta 76+25 and 77+00) have been removed as part of repair contract which is reflected in updated As-Built and CCPV.

**Table 5.3 Visual Stream Morphology Stability Assessment**  
**Adkin Branch Stream Restoration Project, Phase I, EEP IMS No. 7**  
**UT to Adkin Branch: 1,561 feet assessed**

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	
<b>1. Bed</b>	<b>1. Vertical Stability</b> (Rifle 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%				
	<b>2. Rifle Condition</b>	1. <u>Texture/Substrate</u> - Rifle maintains coarse substrate	All	N/A				100%			
		1. <u>Depth Sufficient</u>	26	28				93%			
	<b>3. Meander Pool Condition</b>	2. <u>Length appropriate</u>	26	28				93%			
		1. <u>Thalweg centering at upstream of meander bend (Run)</u>	All	N/A				100%			
	<b>4. Thalweg Position</b>	2. <u>Thalweg centering at downstream of meander (Glide)</u>	All	N/A				100%			
	<b>2. Bank</b>	<b>1. Scoured/Eroding</b>	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	N/A	N/A	N/A
		<b>2. Undercut</b>	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%	N/A	N/A	N/A
<b>3. Mass Wasting</b>		Bank slumping, calving, or collapse			0	0	100%	N/A	N/A	N/A	
			<b>Totals</b>			0	0	N/A	N/A	N/A	
<b>3. Engineered Structures</b>	<b>1. Overall Integrity</b>	Structures physically intact with no dislodged boulders or logs	16	16			100%				
	<b>2. Grade Control</b>	Grade control structures exhibiting maintenance of grade across the sill.	16	16			100%				
	<b>2a. Piping</b>	Structures lacking any substantial flow underneath sills or arms.	16	16			100%				
	<b>3. Bank Protection</b>	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	16	16			100%				
	<b>4. Habitat</b>	Pool forming structures maintaining – Max Pool Depth; Mean Bankfull Depth ratio > 1.6 Rootwads/logs providing some cover at base-flow.	14	16			88%				

**Table 6. Vegetation Condition Assessment**

**Table 6**  
**Vegetation Condition Assessment**  
**Adkin Branch Restoration Site (EEP Project 7)**

Planted Acreage<sup>1</sup> 33

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	A few small areas along stream benches throughout the Site have exposed soils with very little vegetative cover.	All areas were mapped	See legend on CCPV (includes thin grass, no grass, and minor wash areas).	10	0.02	0.1%
2. Low Stem Density Areas	Stem densities throughout the Site are low due to death of planted seedlings as the result of extreme dry, hot temperatures over the summer and subsequently Hurricane Irene.	All areas were mapped	See legend on CCPV	6	0.18	0.5%
<b>Total</b>				16	1212.00	3672.7%
3. Areas of Poor Growth Rates or Vigor	Vegetation growth throughout the Site in general is poor.	None	NA	0	0.00	0.0%
<b>Cumulative Total</b>				16	0.20	0.6%

**Easement Acreage<sup>2</sup> 40.5**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern <sup>4</sup>	Several small areas of invasives including Chinese privet, Johnson grass, lespedeza, and Japanese honeysuckle.	0.02	NA	7	3.32	8.2%
5. Easement Encroachment Areas <sup>5</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 invasive 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.



**Figures 3.1-3.32. Vegetation Plot Photos and Problem Areas**

Photo 3.1-3.20 taken July 2014

Photo 3.21-3.30 Taken April 2014

Photo 3.31-3.32 Taken October 2014



**3.1 Vegetation Plot 1**



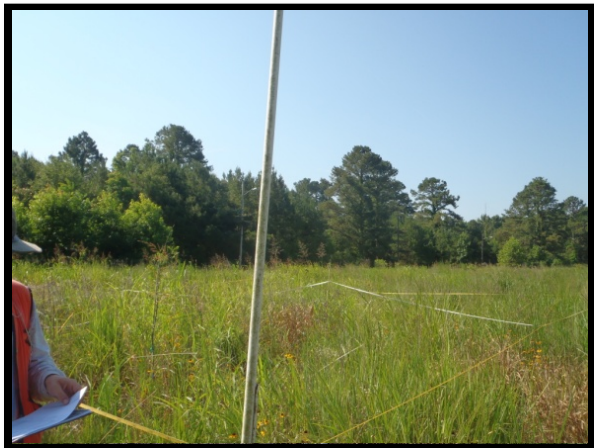
**3.2 Vegetation Plot 2**



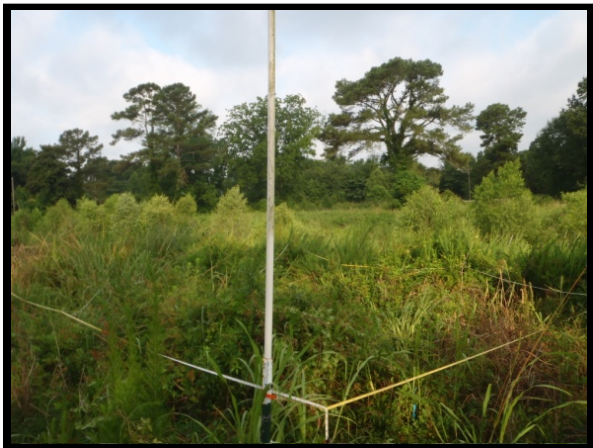
**3.3 Vegetation Plot 3**



**3.4 Vegetation Plot 4**



**3.5 Vegetation Plot 5**



**3.6 Vegetation Plot 6**



**3.7 Vegetation Plot 7**



**3.8 Vegetation Plot 8**





**3.9 Vegetation Plot 9**



**3.10 Vegetation Plot 10**



**3.11 Vegetation Plot 11**



**3.12 Vegetation Plot 12**



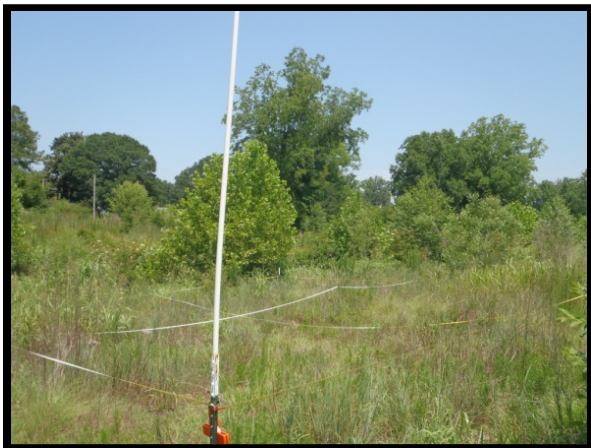
**3.13 Vegetation Plot 13**



**3.14 Vegetation Plot 14**



**3.15 Vegetation Plot 15**

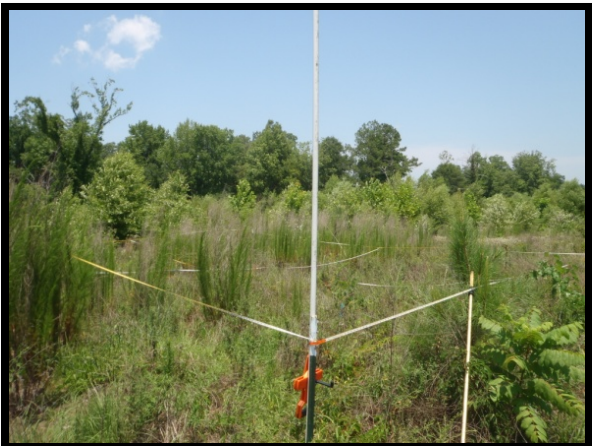


**3.16 Vegetation Plot 16**





**3.17 Vegetation Plot 17**



**3.18 Vegetation Plot 18**



**3.19 Vegetation Plot 19**



**3.20 Vegetation Plot 20**





**3.19 Vegetation Plot 21**



**3.20 Vegetation Plot 22**



**3.21 Minor erosion near 45+00**



**3.22 Thin grass/bare on right bank of cross section 5**



**3.23 Scouring on log vane XS 6**



**3.24 Scouring on log vane XS 8**



**3.25 and 3.26 Site of Beaver Dam Near Station 40+80**





**3.27 Bank Widening**



**3.28 Scouring at XS 9**



**3.29 Scouring at XS 10**



**3.30 Scouring at XS 11**





**3.27 Live Stakes on BMP Channel**



**3.28 Live Stakes on BMP Channel**



**3.29 Live Stakes on BMP Channel**



**3.30 Reach 3 XS 14**



**3.31 Looking Upstream at Washington St**



**3.32 Looking Downstream at Holloway Park**



## Appendix C. Vegetation Plot Data

**Table 7. Vegetation Plot Criteria Attainment**

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	73%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	No*	
8	Yes	
9	No**	
10	No*	
11	No*	
12	Yes	
13	Yes	
14	Yes	
15	Yes	
16	No*	
17	Yes	
18	No*	
19	Yes	
20	Yes	
21	Yes	
22	Yes	

\*Based on planted stems alone, these plots don't meet success criteria; however, when including naturally recruited stems of appropriate species such as hickory (*Carya* sp.) and American elm (*Ulmus americana*) these plots exceed 320 stems per acre.

\*\*Plot 9 was destroyed in construction before the third monitoring year

**Table 8. CVS Vegetation Plot Metadata**

<b>Report Prepared By</b>	Corri Faquin
<b>Date Prepared</b>	7/29/2014 12:12
<b>database name</b>	Axiom-EEP-2014-A-v2.3.1.mdb
<b>database location</b>	\\AE-SBS\RedirectedFolders\KJernigan\Desktop
<b>computer name</b>	KEENAN-PC
<b>file size</b>	65142784
<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>Planted 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>ALL Stems by Plot and spp</b>	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.
<b>PROJECT SUMMARY-----</b>	
<b>Project Code</b>	7
<b>project Name</b>	Adkins Branch
<b>Description</b>	
<b>River Basin</b>	
<b>length(ft)</b>	
<b>stream-to-edge width (ft)</b>	
<b>area (sq m)</b>	
<b>Required Plots (calculated)</b>	
<b>Sampled Plots</b>	22



**Table 9 CVS Stem Count Total and Planted by Plot and Species**







January 25, 2012

Mr. Peter Jelenevsky  
 Fluvial Solutions, Inc.  
 P.O. Box 28749  
 Raleigh, NC 27611

Re: Vegetation Warranty Site Assessment Findings  
 Adkin Branch Tropical Storm Repairs  
 SCO # 05-06561-01B

Mr. Jelenevsky:

As stated in the January 25, 2012 letter from Ed Hajnos, a significant portion the Adkin Branch project site did not meet the vegetation warranty criteria as stated in contract documents. As per SCO contract 05-06561-01B, Special Provision Section 6.0, bare roots were to survive at a rate of 80%. Subsequently, Change Order No.1 allowed the addition of eighty-six (86) Ball and Burlap plantings (at Holloway Park) which are also under the 80% survival rate. The warranty period began 4/1/2011 and will expire 4/1/2012.

Planted vegetation at the Adkin Branch site was assessed in September 2011 by the project design firm's subconsultant, Axiom Environmental, Inc. (Axiom). Data collected during the sampling efforts report significantly higher plant mortality than contractually permissible. Warranty replant numbers are based on the data collected. Field methodology and data are described below.

### **September 2011 Vegetation Inspection**

Twenty-two (22) CVS vegetation plots were established, each 1,076 sq ft (10m x 10m). All planted bare roots present within the plot were counted towards the warranty criteria, including those that were top-dead but were re-sprouting at their base. The spatial location of the 22 CVS plots is shown on the attached Vegetation Inspection Map.

The Ball and Burlap trees planted along the tributary at Holloway Park were also inspected while on site for viability.

### **Results**

In Coastal Plain Levee Forest Planting Zones, 680 stems were required to be planted per acre. In order to satisfy the 80% warranty survival rate, 544 stems per acre are required to survive the warranty period, which is equivalent to 12 living stems per inspection plot.

*Restoring... Enhancing... Protecting Our State*

North Carolina Ecosystem Enhancement Program, 1652 Mail Service Center, Raleigh, NC 27699-1652 / 919-715-0476 / [www.nceep.net](http://www.nceep.net)





Of the 22 inspection plots, 15 did not meet the 80% survival warranty. A total of twenty-eight (28) of the 86 Ball and Burlap trees have died or appear to be in poor health.

### Coastal Plain Levee Forest Planting Zone - CVS Inspection plot results

Plot	Living bare roots and shrubs	Required stems per plot	Warranty met	Supplemental planting density/acre needed to meet warranty
1	70	12	Yes	None
2	12	12	Yes	None
3	18	12	Yes	None
4	15	12	Yes	None
5	15	12	Yes	None
6	9	12	No	131
7	4	12	No	348
8	4	12	No	348
9	1	12	No	479
10	6	12	No	261
11	4	12	No	348
12	5	12	No	305
13	11	12	No	44
14	1	12	No	479
15	20	12	Yes	None
16	3	12	No	392
17	8	12	No	174
18	7	12	No	218
19	11	12	No	44
20	11	12	No	44
21	12	12	Yes	None
22	7	12	No	218

### Coastal Plain Levee Forest Planting Zone – Warranty Inspection plot results

Twenty (20) warranty inspection plots (non-CVS vegetation data) were established by Axiom, each 1,612 sq feet (25m x 6m). All planted bare roots present within the plot were counted towards the warranty criteria, including those that were top-dead but were re-sprouting at their base. Given 680 stems were planted per acre, 544 per acre were required to survive 1 year, or 20 per plot to meet the 80% warranty. None of the 20 sample plots met the survival criteria (Vegetation Inspection Map attached).

Plot	Living bare roots and shrubs	Required stems per plot	Warranty met	Supplemental planting density/acre needed to meet warranty
1	4	20	No	432
2	9	20	No	297
3	3	20	No	459
4	4	20	No	432
5	14	20	No	162
6	1	20	No	513
7	7	20	No	351
8	2	20	No	486
9	4	20	No	432
10	5	20	No	405
11	7	20	No	351
12	5	20	No	405
13	10	20	No	270
14	9	20	No	297
15	10	20	No	270
16	11	20	No	243
17	10	20	No	270
18	5	20	No	405
19	10	20	No	270
20	4	20	No	432

### Supplemental Planting

The table below shows the number of stems needed to be planted in 4 areas. These areas are also depicted on the Supplemental Planting Map (attached). The planting zone for each is Coastal Plain Levee Forest (CPLF). The number of stems needed in each area was calculated by multiplying the average number of stems needed to meet warranty per plot by the acreage of the given area. Areas 1-4 were sectioned off due to similar plant deficiencies or a topographic break and are shown on the attached Supplemental Planting Map. A total of 11 Ball and Burlap trees also need to be replanted to meet the warranty.

*Restoring... Enhancing... Protecting Our State*





### Bare Root – Supplemental Planting

Area	Station (Looking Downstream)	Planting Zone	Average stems/ac needed	Acres	Total plants needed	Approximate stem spacing
Area 1	Washington St. to East Gordon Street	CPLF	226	6.21	1403	13 ft
Area 2	East Gordon St to STA 65+20	CPLF	333	4.97	1655	11 ft
Area 3	STA 67+65 to STA 81+20	CPLF	338	6.30	2129	11 ft
Area 4	STA 81+20 to Lincoln St.	CPLF	344	8.52	2931	11 ft
				<b>26</b>	<b>8,118</b>	

### Instructions

- The Supplemental Planting effort needs to be coordinated with EEP so we can arrange to be on site.
- All replant materials must conform to the original project specification (dormant season planting, species composition, size, vigor, etc.).
- The Supplemental Planting effort must take place in the dormant season for Lenoir County; November 15th – March 15th
- ATVs and trucks will be permitted to be used during the replant; however, vehicles are to be driven in upland areas only where no bare roots, shrubs or Ball and Burlap trees were planted.
- Dead trees need to be removed from the site.

Although the warranty for this project doesn't expire until April 1, 2012, EEP does not intend to reassess this site for additional warranty compliance. Plants installed during the warranty replant will not themselves have a warranty placed on them. Once Fluvial Solutions, Inc. complies with this replanting, an Article 27 Satisfaction Letter will be awarded.

As stated in Ed Hajnos's January 25, 2012 letter, please call me at your earliest convenience with questions regarding the supplemental planting at Adkin Branch. My contact information can be found below.

Thank you,

*Kristie F. Corson*

Kristie Corson

NC Department of Environment and Natural Resources  
Ecosystem Enhancement Program  
Eastern Project Manager  
Raleigh, NC  
Office (919) 715-1954  
Cell (919) 218-1373  
Kristie.Corson@ncdenr.gov

cc: Bobbi D. Pendleton, Attorney In Fact, Western Surety Company  
Clyde Carl, SCO Project Monitor  
Jeff Jurek, EEP  
Jeff Schaffer, EEP  
Ed Hajnos, EEP  
Lin Xu, EEP Review Coordinator

*Restoring... Enhancing... Protecting Our State*





Figure 3a. Bare Root Supplemental Planting Map



**Table C1. 1-Gallon Containerized Trees Planted January, 2014**

Common Name	Scientific Name	Number Planted
River birch	Betula nigra	164
Pignut hickory	Carya glabra	180
Green ash	Fraxinus pennsylvanica	20
Black gum	Nyssa sylvatica	17
Sycamore	Platanus occidentalis	52
Willow oak	Quercus phellos	29
Northern red oak	Quercus rubra	49
Schumard oak	Quercus schumardii	186
	<b>Total</b>	<b>697</b>

**Table C2. 3-Gallon Containerized Trees Planted January, 2014**

Common Name	Scientific Name	Number Planted
River birch	Betula nigra	2
Tulip poplar	Liriodendron tulipifera	22
Black gum	Nyssa sylvatica	39
Water oak	Quercus nigra	80
Willow oak	Quercus phellos	25
Northern red oak	Quercus rubra	45
Persimmon	Diospyros virginiana	150
	<b>Total</b>	<b>363</b>

**Table C3. Livestakes Planted January, 2014**

Common Name	Scientific Name	Number Planted
Silky dogwood	Cornus amomum	1500
Black willow	Salix nigra	1500
	<b>Total</b>	<b>3000</b>



**Table C4. Bare Root Species Replanted at Adkin Branch (March 8, 2012)**

Common Name	Scientific Name	Number Planted
Black Cherry	Prunus Seotina	1,000
Ironwood	Carpinus caroliniana	1,000
Mockernut Hickory	Carya tomentosa	1,000
Riverbirch	Betula nigra	1,118
Slippery Elm	Ulmus rubra	1,000
Southern Red Oak	Quercus falcate	1,000
Water oak	Quercus nigra	1,000
Winged Elm	Ulmus alata	1,000
	<b>Total</b>	<b>8,118</b>

**Table C5. Ball and Burlap Species Replanted at Adkin Branch (March 8, 2012)**

Common Name	Scientific Name	Number Planted
Green Ash	Fraxinus pennsylvanica	3
Riverbirch	Betula nigra	3
Sycamore	Platanus occidentalis	3
Willow Oak	Quercus phellos	2
	<b>Total</b>	<b>11</b>

**Appendix D. Stream Survey Data**



**Figures 4.1-4.17. Cross Section Plots and Photos**

Figure 4.1 XS-1 Riffle, Sta. 37+42

Baseline		MV1		MV2		MV3		MV4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	36.38	0.00	36.37	0.00	36.37	0.00	36.47	0.00	36.37
9.86	34.88	7.34	35.19	4.36	35.78	8.79	35.09	7.40	35.18
16.62	33.21	11.50	34.38	10.66	34.59	17.55	33.34	14.53	33.61
24.51	32.12	16.09	33.34	15.70	33.40	23.41	32.55	21.15	32.88
25.95	32.31	22.92	32.75	19.48	33.14	27.48	32.19	24.45	32.25
27.26	31.91	28.30	32.23	23.80	32.55	30.80	32.21	30.53	31.92
29.31	31.89	30.00	32.00	29.16	32.23	33.42	31.71	32.38	30.57
31.49	31.34	32.35	31.56	32.15	31.62	35.21	30.00	34.72	29.17
33.99	31.05	33.78	31.27	33.84	31.32	34.66	28.06	36.04	28.03
35.11	30.06	35.08	30.30	34.52	30.99	36.17	27.97	37.43	27.70
36.12	28.42	36.45	27.99	35.08	30.04	38.47	27.49	40.95	27.39
36.41	28.32	37.87	27.71	35.05	27.96	40.28	27.43	43.90	28.20
37.29	27.83	40.95	27.74	37.28	27.61	43.14	27.56	45.89	28.48
38.32	27.76	42.41	27.91	39.61	27.76	45.47	27.76	49.71	31.50
41.02	27.67	43.87	27.90	41.91	27.58	46.34	28.82	52.33	32.08
42.56	27.78	46.09	29.85	42.76	27.78	46.78	29.12	56.36	31.62
43.94	28.17	46.85	29.93	44.16	27.82	47.24	30.12	59.98	31.77
44.35	29.19	47.15	30.18	45.12	27.64	47.67	31.18	61.32	32.28
45.81	29.62	48.83	30.49	45.93	28.04	51.92	31.36	65.36	32.29
47.84	30.09	51.70	31.01	46.14	29.29	54.22	31.89	71.25	33.13
49.03	30.44	54.46	31.52	47.49	30.28	56.53	31.69	79.28	34.22
51.68	30.46	55.03	31.46	48.32	31.01	58.37	31.62	87.47	35.43
54.61	31.10	56.16	31.09	51.93	31.18	62.13	31.89		
61.87	31.23	59.51	31.32	54.76	31.64	70.41	32.85		
65.51	31.78	64.40	32.12	57.30	31.37	78.25	34.18		
76.01	33.81	69.56	32.78	61.23	31.71	86.42	35.06		
88.18	35.44	76.64	34.02	66.79	32.31	86.39	34.98		
		83.37	34.75	73.26	33.41	87.77	35.46		
		88.23	35.45	81.76	34.51				
				88.35	35.43				

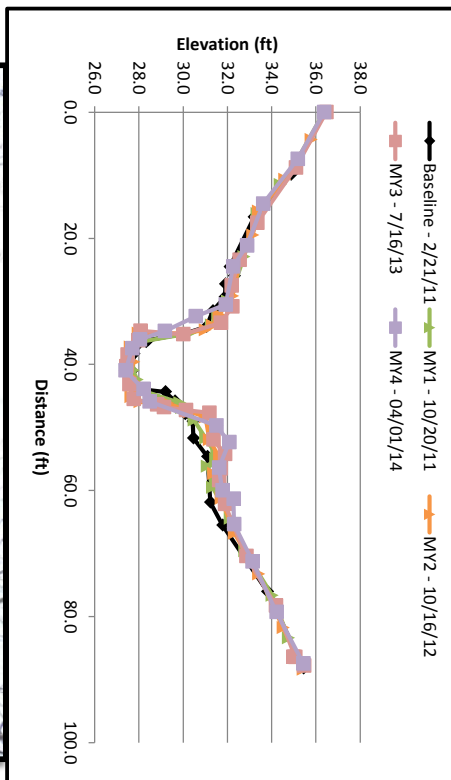




Figure 4.2 XS-2 Pool, Sta. 38+94

Baseline		MV1		NV2		MV3		MV4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	34.25	0.00	34.25	0.00	34.23	0.00	34.24	0.00	34.24
8.48	33.22	7.85	33.40	6.14	33.64	4.54	33.88	5.78	33.75
17.26	32.07	15.07	32.32	12.34	32.87	10.08	33.10	11.36	33.11
23.59	31.03	21.85	31.54	17.29	32.27	15.28	32.03	17.42	32.27
24.98	30.53	25.29	30.76	23.27	31.37	22.22	31.35	22.02	31.63
28.19	30.53	27.97	30.78	27.98	30.84	26.81	30.96	25.52	31.04
29.98	30.03	30.68	30.60	30.81	30.24	28.27	30.95	28.91	30.34
32.23	29.44	31.72	29.57	31.65	29.91	28.96	30.21	32.48	30.14
33.36	27.87	33.17	28.37	33.30	29.80	34.21	27.05	34.09	27.35
35.19	27.83	34.15	27.78	34.23	27.42	35.33	26.63	35.46	26.82
37.22	27.51	37.13	27.55	38.14	26.71	37.94	26.20	37.71	27.10
40.78	27.20	41.68	27.30	39.77	26.48	40.59	26.45	40.75	26.74
43.31	27.42	46.75	27.74	42.39	26.41	41.24	27.92	41.96	26.71
45.59	27.62	48.16	29.58	42.48	26.63	45.86	28.35	43.70	27.13
46.73	27.99	49.13	30.60	42.70	26.10	49.41	30.70	44.72	27.74
47.22	28.30	50.42	31.25	46.16	26.66	53.00	31.49	47.23	28.17
48.68	30.06	54.76	31.31	47.93	27.15	57.91	31.52	48.87	30.29
49.68	30.87	60.32	32.07	47.96	30.32	65.33	32.62	49.64	31.35
52.71	31.19	69.40	32.89	50.90	31.43	70.68	33.08	50.65	31.58
54.58	31.01	75.04	33.37	55.87	31.39	75.20	33.41	51.83	31.33
59.11	31.81			60.73	32.12			64.47	32.58
66.89	32.70			65.44	32.61			71.39	33.05
75.41	33.42			71.35	33.03			78.94	33.74
				75.65	33.41				

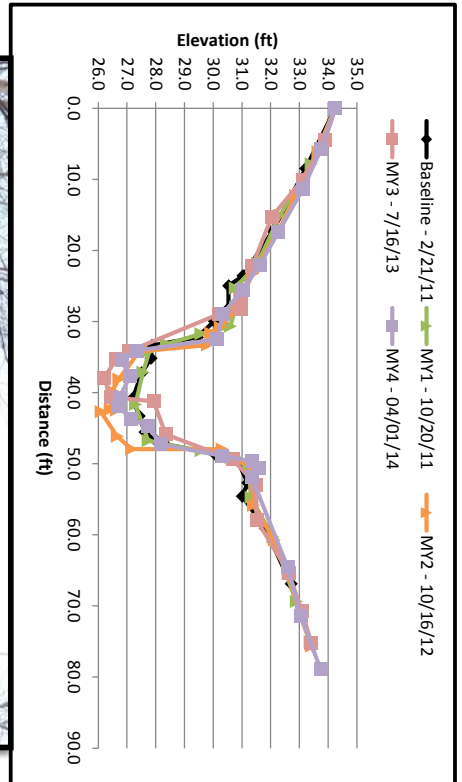


Figure 4.3 XS-3 Riffle, Sta. 44+67

Baseline		MY1		MY2		MY3		MY4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	34.68	0.00	34.65	0.00	34.67	0.00	34.67	0.00	34.72
5.04	33.96	9.47	33.04	2.59	34.50	6.41	33.67	8.98	33.12
13.96	32.14	17.77	31.45	9.13	33.23	12.52	32.54	16.73	31.54
22.51	30.31	23.88	30.25	16.91	31.54	17.75	31.25	21.79	30.66
27.04	29.77	28.88	29.69	22.05	30.66	22.62	30.29	24.90	30.57
31.37	28.98	32.78	28.80	26.70	26.71	30.23	28.81	30.35	
32.48	28.31	34.56	28.24	29.50	30.15	30.18	29.71	31.04	29.16
33.27	28.11	35.32	27.29	31.29	29.69	32.88	29.01	32.99	28.55
34.34	27.84	38.06	26.72	35.26	28.94	34.13	28.52	33.55	28.14
35.11	27.51	41.20	26.81	35.81	27.59	34.54	27.00	34.06	27.35
36.05	27.31	42.66	27.07	36.77	27.06	37.95	26.66	36.63	26.90
37.20	26.90	44.87	27.40	38.35	26.75	39.65	26.63	37.50	26.80
40.71	26.93	46.91	28.74	40.72	26.90	39.93	26.02	41.09	26.95
43.22	26.96	49.53	29.48	43.31	26.97	44.82	27.60	45.02	27.02
44.45	27.35	53.45	29.45	45.18	27.19	48.39	29.49	46.22	28.68
46.78	27.91	56.69	30.43	45.98	28.40	51.61	29.51	47.29	29.51
49.43	28.97	62.83	31.49	49.44	29.49	58.88	30.93	52.71	29.55
51.83	29.32	67.46	32.44	51.30	29.49	65.95	32.40	57.40	30.48
52.60	29.12	71.00	33.27	54.31	29.83	70.40	33.19	65.99	32.01
57.19	30.42			57.50	30.50			70.57	33.31
64.81	31.73			61.07	31.28				
71.17	33.27			65.47	31.99				
				67.99	32.52				
				69.31	32.83				
				71.61	33.28				

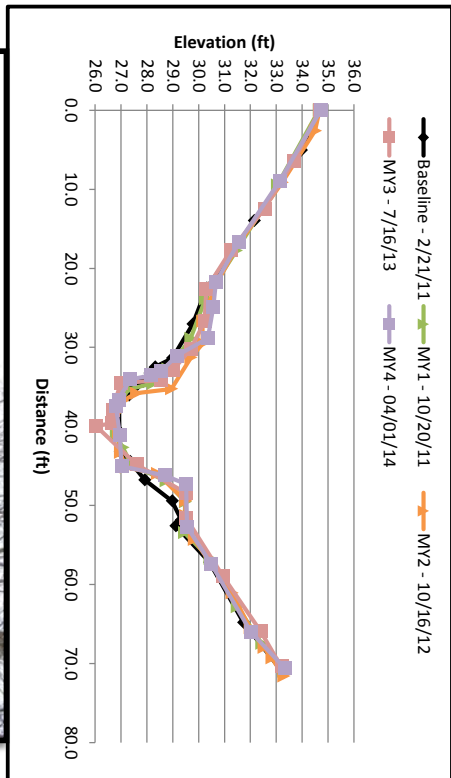




Figure 4.4 XS-4 Pool, Sta. 46+81

Baseline		MV1		MV2		MV3		MV4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	33.26	0.00	33.25	0.00	33.27	0.00	33.19	0.00	33.27
6.80	31.49	4.64	32.15	4.11	32.34	8.11	31.33	7.51	31.52
9.47	31.14	10.74	31.01	7.10	31.51	17.51	30.37	13.99	30.67
21.52	28.84	16.16	29.97	12.04	30.95	21.84	29.74	19.31	30.04
24.22	28.46	20.27	29.21	16.69	29.92	25.26	29.28	22.06	29.42
25.32	27.87	23.29	29.03	20.99	29.35	25.41	28.83	25.10	28.75
26.50	27.73	25.51	28.82	24.36	29.38	27.15	28.27	27.55	27.74
27.87	27.05	25.89	28.32	26.13	28.86	26.95	27.26	28.83	26.42
29.15	26.40	26.84	27.40	26.79	26.64	29.75	25.91	29.53	26.14
31.16	26.69	28.01	26.90	29.16	25.81	32.79	25.55	32.65	26.27
35.70	26.65	29.61	27.03	31.36	25.62	34.39	25.35	36.05	25.95
38.06	26.48	32.56	26.47	33.76	25.58	39.00	25.78	38.28	25.95
39.91	27.10	34.68	26.88	34.58	25.63	41.59	26.11	40.39	26.54
40.99	27.77	36.07	26.81	35.81	25.57	42.38	28.83	42.43	29.86
41.64	28.45	38.75	26.99	38.50	26.12	45.90	29.49	47.57	30.28
45.49	29.36	40.21	27.14	39.36	26.80	51.56	30.13	53.32	30.92
49.30	30.12	41.73	28.64	39.70	28.38	55.98	30.93	62.68	31.81
59.69	31.31	43.87	29.13	40.96	29.18	64.97	31.78	71.39	32.39
71.76	32.43	45.81	29.32	44.20	29.46	72.26	32.29		
		46.83	29.84	46.45	29.94				
		53.19	30.66	49.79	30.39				
		59.66	31.43	54.67	30.83				
		66.17	32.13	61.07	31.57				
		71.22	32.40	67.43	32.26				
				71.92	32.39				

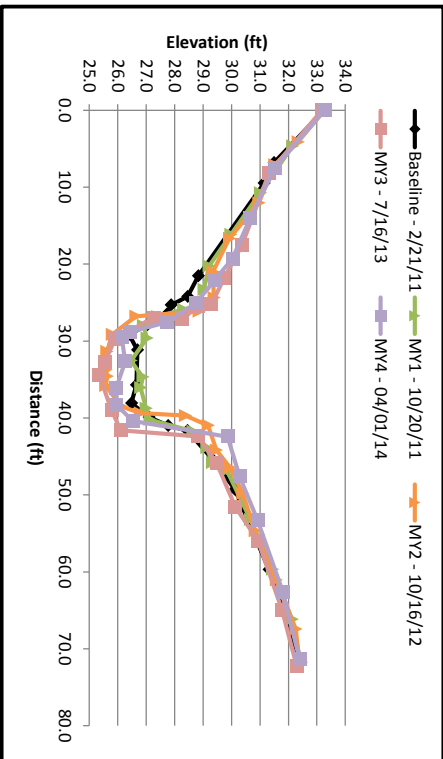


Figure 4.5 XS-5 Riffle, Sta. 51+47

Baseline		MY1		MY2		MY3		MY4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	31.97	0.00	31.94	0.00	31.95	0.00	31.95	0.00	31.98
9.93	30.85	10.41	30.71	7.99	30.98	9.96	30.94	9.16	31.04
19.77	29.78	20.29	29.67	13.92	30.51	17.92	29.87	18.38	30.09
25.24	28.98	26.27	28.51	19.27	29.87	25.01	29.14	26.43	28.66
28.26	28.18	30.50	27.53	23.25	29.33	27.24	28.56	30.16	28.19
29.51	27.58	32.79	27.20	24.24	29.07	28.13	27.98	32.25	27.46
30.76	27.26	33.94	26.70	25.25	28.50	29.39	27.23	33.24	26.40
32.09	26.91	34.66	25.68	26.82	28.23	35.84	25.73	35.86	25.54
33.29	26.29	35.74	25.16	28.34	27.74	38.30	25.32	40.59	25.64
34.40	25.91	38.34	25.69	31.18	27.71	39.83	25.38	45.07	25.70
35.72	25.88	39.54	26.90	32.01	27.42	44.94	25.30	45.41	26.21
36.05	26.21	41.60	26.25	34.67	25.71	44.36	27.75	46.72	28.10
37.13	26.13	42.45	26.47	36.25	25.69	49.71	27.99	49.41	28.53
37.42	25.81	43.86	26.86	37.08	25.19	56.61	29.24	55.05	29.10
38.94	25.78	45.98	27.71	37.86	25.47	70.16	30.80	68.08	30.86
39.65	25.96	50.73	28.33	39.84	25.58	75.55	31.14	76.48	31.54
41.28	26.38	56.05	29.10	40.90	25.43				
43.58	26.75	68.09	30.73	41.13	25.69				
45.04	26.82	76.66	31.44	42.55	26.43				
45.66	27.28			43.22	27.17				
47.79	27.86			45.69	27.34				
53.02	28.51			47.32	28.15				
62.00	30.27			52.26	28.37				
77.07	31.48			56.82	29.38				
				67.74	30.71				
				77.13	31.42				

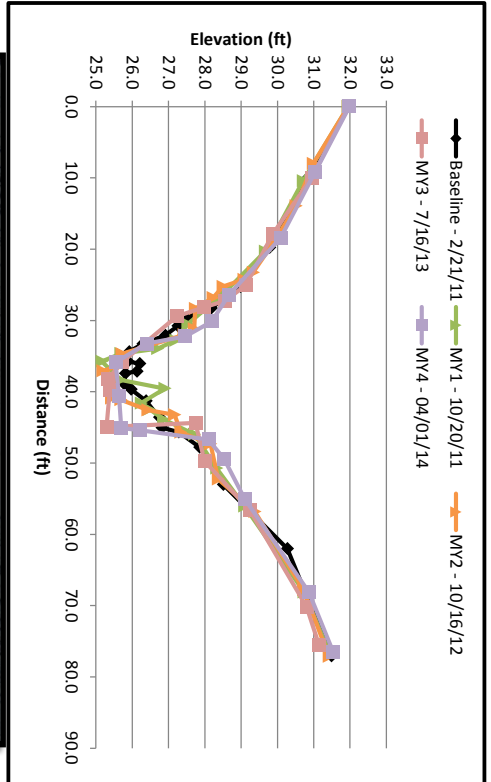




Figure 4.6 XS-6 Pool, Sta. 64+81

Baseline		MV1		MV2		MV3		MV4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	28.96	0.00	28.97	0.00	28.89	0.00	29	0.00	28.90
7.02	28.18	6.82	28.17	6.19	28.11	11.00	27.5	4.99	28.23
11.82	27.13	8.32	27.81	10.58	27.3	16.00	26.76	7.60	28.08
13.15	26.66	10.62	27.39	13.33	26.93	18.00	25.96	9.32	27.65
17.98	26.08	12.11	27.21	14.82	26.55	19.00	24.99	13.63	27.19
18.99	26.23	14.48	26.61	16.62	26.44	20.00	24.76	16.24	26.65
20.64	26.63	17.51	26.27	17.76	25.6	21.00	23.11	17.82	25.18
23.57	26.31	18.95	26.5	18.76	25.08	23.50	21.93	19.49	23.98
24.13	25.60	20.94	26.6	20.49	23.92	24.50	21.13	20.96	22.85
24.68	25.28	22.30	25.41	21.56	23.24	33.50	20.12	22.12	22.14
24.68	23.77	23.66	23.77	23.30	20.8	35.50	22.67	26.65	20.26
27.84	22.22	24.43	22.89	27.43	20.3	36.00	24.9	28.74	20.08
30.39	21.92	25.79	22.12	29.26	20.55	37.00	25.36	33.83	21.09
31.86	22.19	27.26	21.75	32.69	20.88	37.50	23.34	35.21	22.59
33.54	22.48	28.97	21.87	35.59	21.4	39.50	23.9	35.71	24.79
35.54	23.06	30.95	22.19	36.97	25.69	41.50	25.69	36.26	24.98
35.50	24.22	32.79	22.9	38.62	26.78	42.50	27.69	37.14	22.70
36.01	25.11	35.54	23.17	40.38	27.27	45.75	28.25	40.72	23.26
37.14	25.43	36.52	25.33	43.12	27.67	50.83	28.11	41.09	25.31
37.75	25.99	37.51	25.72	44.92	28.1	54.06	28.57	42.13	25.68
41.07	27.13	39.90	27.15	50.22	28.02	55.53	28.81	42.70	26.67
43.93	27.64	44.55	27.92	56.48	28.87			43.54	27.74
46.39	28.20	47.08	27.69					45.09	28.32
46.83	27.64	53.27	28.35					47.23	28.16
53.08	28.32	57.49	28.84					52.75	28.33
57.39	28.93							56.75	28.89

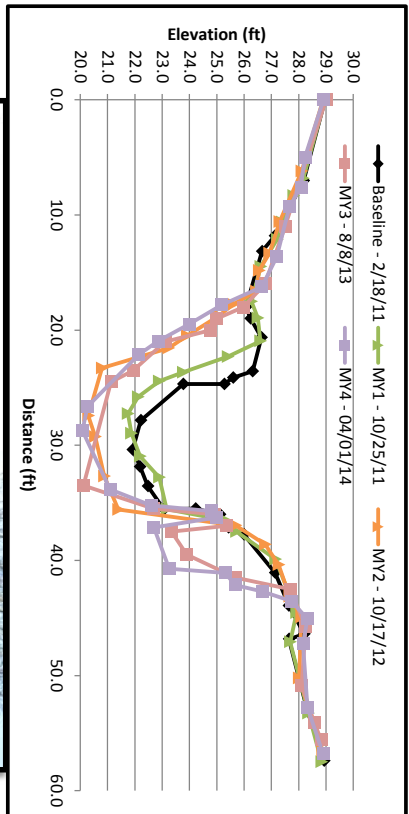


Figure 4.7 XS-7 Riffle, Sta. 70+00

Baseline		MY1		MY2		MY3		MY4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	28.97	0.00	28.94	0.00	28.84	0.00	28.84	0.00	28.63
10.03	27.78	5.37	28.42	6.08	28.29	5.07	28.09	11.23	27.30
19.73	26.44	12.29	27.57	9.86	27.71	10.84	27.61	17.61	27.14
23.60	26.43	14.97	27.11	14.30	27.38	14.71	27.29	23.85	26.81
25.40	24.69	19.28	26.39	16.24	27.08	18.96	27.33	24.49	26.01
27.14	23.81	23.36	26.20	18.59	26.61	22.94	27.01	24.94	25.86
28.16	22.91	24.78	25.12	22.54	26.07	23.18	27.01	25.03	24.82
31.71	22.99	26.93	23.31	23.49	25.85	24.09	26.04	25.64	24.47
35.41	22.94	27.76	22.57	24.92	24.85	24.89	24.68	25.74	23.42
37.91	23.17	29.58	21.63	25.76	24.11	25.90	23.71	25.94	22.47
38.15	23.50	32.22	21.34	26.57	22.74	28.78	22.55	29.44	22.36
38.72	24.10	34.49	21.00	28.70	22.27	29.61	22.54	32.13	22.73
39.07	24.73	35.67	21.14	30.00	22.29	32.51	22.93	37.09	22.64
40.37	25.16	36.86	21.85	33.07	22.69	37.10	22.51	39.88	22.67
42.38	25.59	37.72	23.15	35.58	22.67	38.59	22.54	40.58	23.41
43.48	25.59	39.28	23.28	39.40	22.21	38.74	23.67	40.52	24.42
44.04	25.73	40.25	24.11	40.75	23.22	38.19	24.65	41.56	24.69
44.71	25.88	40.75	25.26	42.31	23.90	42.14	25.81	41.60	25.43
45.38	26.12	44.21	25.94	44.32	26.08	44.05	26.75	41.92	25.66
47.07	26.24	45.80	26.40	49.59	26.69	46.08	26.56	42.29	26.55
49.69	26.73	51.40	26.82	57.67	27.47	49.23	26.16	47.88	26.41
51.10	26.64	56.41	27.29	64.27	28.28	51.53	26.50	58.38	27.31
52.80	27.04	61.50	28.09			55.28	27.04	64.15	28.29
56.19	27.27	64.23	28.34			57.54	27.75		
64.14	28.37					59.64	27.92		
						62.94	28.46		

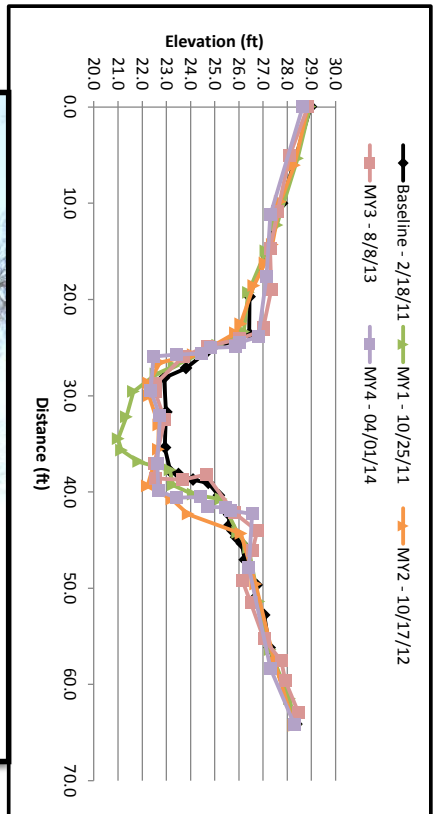




Figure 4.8 XS-8 Pool, Sta. 74+30

Baseline		MV1		MV2		MV3		MV4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	26.81	0.00	26.71	0.00	26.74	0.00	26.68	0.00	26.68
3.48	26.81	5.61	26.62	5.91	26.53	3.15	26.53	4.30	26.59
5.42	26.72	8.41	26.01	9.04	25.70	7.16	26.31	7.45	26.24
7.59	26.33	11.70	25.23	12.72	25.02	10.24	25.62	11.00	25.54
10.42	25.65	13.96	24.83	15.54	24.69	11.85	24.92	13.65	25.07
13.75	24.87	15.46	24.90	17.44	24.08	15.76	24.00	15.01	24.39
15.67	24.76	16.73	24.35	18.52	23.52	18.05	23.54	16.12	24.24
16.46	24.22	17.51	24.04	19.24	19.54	18.26	19.91	16.92	23.30
17.26	24.03	18.78	23.26	21.28	19.35	25.95	19.60	18.34	23.17
17.55	23.77	19.50	21.10	24.89	19.55	28.73	20.56	20.57	19.72
18.71	23.53	21.17	20.96	26.79	20.17	30.29	21.94	24.04	18.63
19.12	22.31	23.49	20.22	29.35	21.50	31.18	23.99	29.58	18.86
20.33	21.48	25.14	19.92	30.53	22.22	36.16	24.39	31.09	19.87
21.79	21.04	26.70	20.33	31.33	24.37	38.88	24.42	33.61	21.57
23.56	21.08	28.88	23.07	32.63	25.04	42.15	24.91	35.36	22.52
25.70	21.38	29.83	24.31	33.97	25.06	45.55	26.03	35.50	24.45
26.90	21.83	31.43	24.81	35.16	24.66	48.19	25.99	39.50	24.51
27.19	22.03	34.36	24.75	42.05	24.69	49.37	26.07	42.46	25.06
27.84	22.62	35.54	24.29	46.23	25.88		45.95	45.95	26.09
28.51	23.54	40.92	24.51	50.41	25.89		49.90	49.90	26.04
29.74	24.08	42.66	24.75						
31.02	24.29	44.89	25.74						
32.55	24.55	47.75	25.93						
34.42	24.39	50.57	26.10						
36.00	24.05								
39.62	24.20								
41.26	24.48								
42.56	24.69								
44.07	25.09								
45.16	25.92								
47.95	26.05								
50.57	26.19								

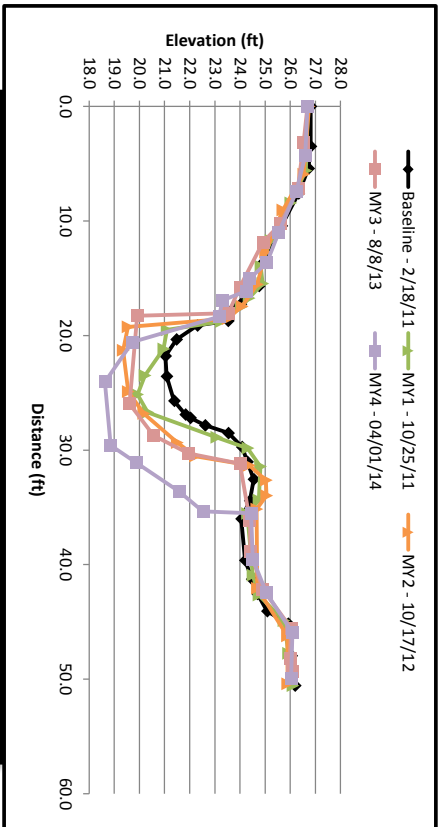


Figure 4.9 XS-9 Riffle, Sta. 75+78

Baseline		MV1		MV2		MV3		MV4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	25.93	0.00	25.85	0.00	25.85	0.00	25.77	0.00	25.81
7.66	25.57	9.82	25.57	10.20	25.63	3.67	25.59	8.69	25.72
17.12	25.22	18.42	25.31	13.67	25.53	7.63	25.64	14.67	25.64
19.27	24.81	21.37	25.10	15.45	25.84	11.83	25.76	16.78	25.21
21.25	24.71	23.69	23.98	18.37	25.91	14.92	25.48	19.98	25.47
22.90	23.68	24.36	22.91	19.00	25.67	18.61	25.51	20.68	24.62
24.09	22.76	24.84	22.08	21.73	24.03	19.94	24.39	21.07	24.43
25.35	22.18	25.48	21.43	23.26	22.43	20.71	23.20	21.51	23.57
26.15	21.99	27.92	21.72	26.86	22.07	21.22	22.12	22.06	23.27
28.07	22.10	30.41	21.44	31.47	21.37	23.48	21.27	22.38	22.33
30.42	22.06	32.18	21.30	33.42	21.36	26.04	20.96	23.31	21.97
32.76	22.03	33.76	21.47	35.76	21.41	31.00	21.01	24.00	21.24
34.84	22.18	34.93	21.83	36.25	22.03	34.41	21.35	25.02	20.57
35.40	22.48	36.29	22.99	39.00	24.43	35.55	21.77	31.61	21.25
36.25	22.93	39.05	24.14	43.19	25.12	37.23	23.49	35.99	21.16
37.35	23.46	41.47	24.68	49.01	26.12	41.56	25.12	38.73	22.00
37.90	23.96	46.43	25.70	53.24	26.48	47.43	26.09	42.21	22.71
38.87	24.20	50.70	26.30	56.68		50.49	26.36	46.83	25.73
40.34	24.53	56.70	26.47			50.41	26.35	52.80	26.51
44.53	25.45					55.08	26.41	56.89	26.44
47.94	26.17								
53.57	26.57								
56.49	26.59								

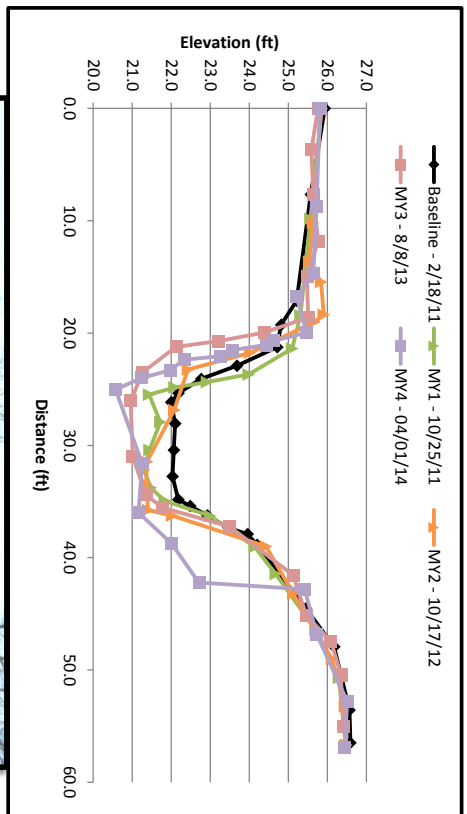




Figure 4.10 XS-10 Riffle, Sta. 79+82

Baseline		MV1		MV2		MV3		MV4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	27.66	0.00	27.60	0.00	27.62	0.00	27.50	0.00	27.57
4.16	27.29	5.62	27.04	4.93	27.14	4.09	27.13	7.67	26.70
9.94	26.38	10.79	26.16	9.84	26.30	7.81	26.46	15.15	25.19
13.82	25.77	15.97	25.05	13.95	25.75	12.51	25.63	20.04	24.80
14.67	25.38	18.44	24.69	15.40	25.03	17.19	24.79	23.11	24.55
16.45	25.02	22.19	24.05	20.49	24.57	22.16	24.38	24.35	23.18
18.00	24.75	24.47	23.63	23.69	24.35	24.44	23.66	25.61	21.35
19.93	24.67	26.19	23.10	25.76	23.52	26.78	23.08	26.67	20.52
22.47	23.84	27.45	22.55	27.28	22.91	26.85	20.71	28.93	20.35
23.45	23.72	29.13	22.55	28.04	21.03	32.02	20.78	34.19	20.56
24.08	23.30	30.09	21.94	29.83	20.67	39.36	21.06	38.45	20.41
25.81	23.30	30.88	21.49	33.12	20.55	39.64	21.70	41.12	20.76
27.52	22.08	32.29	21.17	35.97	20.77	41.43	23.87	42.46	22.33
29.35	21.92	33.79	21.02	38.56	20.96	41.42	23.76	44.42	24.81
31.31	21.71	36.21	20.79	40.06	21.23	45.60	24.06	47.45	24.25
32.90	21.51	38.21	20.82	41.80	23.63	49.77	24.52	51.12	24.54
36.04	21.37	39.77	21.19	43.92	23.78	53.97	24.52	59.64	24.64
36.87	21.00	40.99	22.64	46.43	24.23	56.10	24.57	62.91	24.62
38.52	21.10	42.97	23.39	54.27	24.62	57.91	24.57		
39.08	21.33	45.15	24.00	59.85	24.60	61.89	24.55		
39.74	21.90	48.55	24.39	62.98	24.60				
42.09	23.26	57.04	24.64						
43.46	23.61	63.22	24.61						
45.42	24.02								
48.91	24.55								
57.40	24.68								
62.89	24.70								

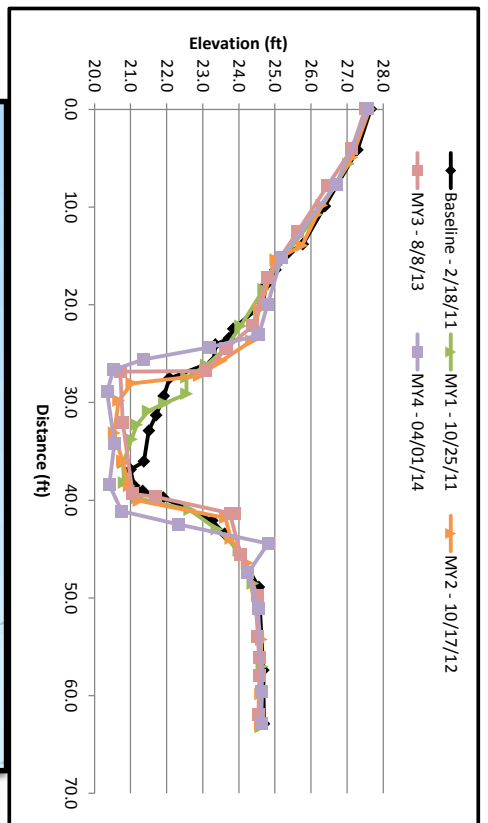


Figure 4.11 XS-11 Pool, Sta. 82+30

Baseline		MV1		MV2		MV3		MV4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	25.95	0.00	25.92	0.00	25.98	0.00	25.34	0.00	25.46
7.89	25.57	5.93	25.63	6.64	25.54	2.48	25.77	2.29	25.35
13.55	24.56	11.34	24.82	11.63	24.84	4.76	25.64	4.50	26.34
16.93	23.93	16.52	23.83	15.21	24.25	9.05	25.24	5.78	25.45
20.82	23.23	19.62	23.35	17.91	23.99	11.97	24.63	13.09	24.68
21.95	23.23	22.66	23.43	19.97	23.79	15.55	24.07	16.16	24.16
23.29	23.19	23.72	20.27	23.46	23.39	18.36	23.51	17.45	23.82
23.99	22.17	26.17	19.31	24.51	22.21	19.39	22.80	19.51	22.38
24.66	22.05	29.54	18.51	25.90	19.73	21.90	22.61	20.45	21.60
24.81	19.95	33.82	18.00	27.02	19.72	25.52	19.87	21.25	22.03
26.88	19.74	35.36	18.53	29.73	19.54	28.40	19.92	22.29	19.87
27.90	19.03	37.52	22.69	32.10	19.42	31.87	19.50	24.22	18.38
32.61	18.48	41.20	23.56	33.92	18.95	34.14	19.27	27.27	17.75
34.85	19.10	43.95	24.40	35.78	19.17	34.29	20.52	31.02	18.10
36.94	20.18	55.09	25.09	38.40	23.04	39.79	23.06	33.83	18.69
37.83	22.98	65.84	26.02	42.09	22.99	42.81	24.00	36.01	18.95
39.80	23.21	73.06	26.48	49.73	24.69	47.14	24.66	37.10	21.18
40.88	23.62								
43.90	24.42			60.56	25.28	59.28	25.38	41.60	23.62
55.95	25.20			72.92	26.48	65.28	26.00	44.29	24.65
63.52	25.89					69.52	26.41	54.95	25.12
72.56	26.58					71.92	26.53	64.02	25.85
								72.15	26.45

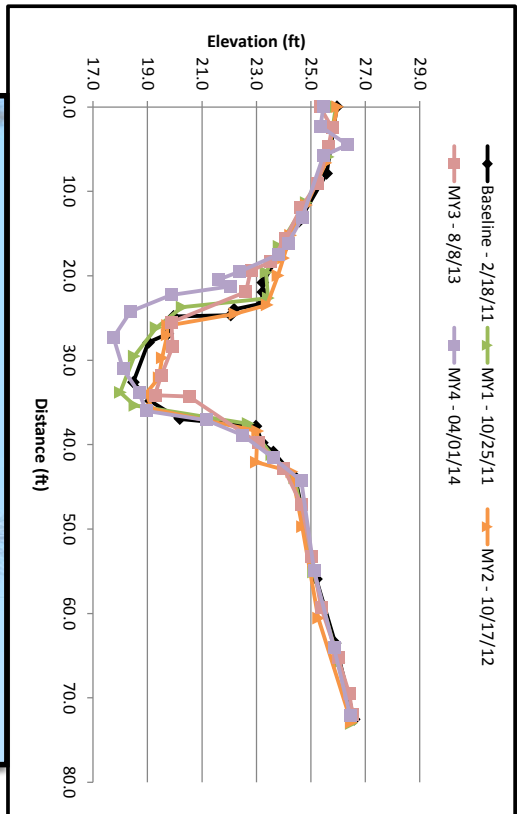




Figure 4.12 XS-12 Pool, Sta. 85+88

Baseline		MY1		MY2		MY3		MY4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	26.87	0.00	26.82	0.00	26.77	0.00	26.66	0.00	26.16
9.90	26.42	10.23	26.34	11.26	26.33	3.92	25.78	13.17	25.33
20.27	25.71	18.48	25.77	24.13	25.29	8.73	25.64	27.17	24.56
25.17	25.13	24.44	25.21	29.25	24.31	12.63	25.57	33.99	24.24
27.75	24.59	28.45	24.37	32.91	23.67	17.09	25.38	35.90	23.13
30.14	24.11	31.61	23.79	35.58	23.20	22.13	25.06	36.56	22.73
32.91	23.61	33.25	23.30	36.88	22.66	27.00	24.64	37.42	22.21
36.16	22.23	35.04	22.71	38.31	21.91	32.05	24.43	38.30	21.87
38.20	21.28	37.43	22.37	38.65	20.47	35.37	24.30	37.40	20.74
39.57	20.54	37.80	21.92	40.61	19.61	36.26	22.84	37.72	19.97
39.96	19.63	38.37	20.91	46.71	18.91	38.02	21.61	39.01	18.86
41.51	18.93	39.67	18.07	49.92	19.72	38.78	20.30	44.84	19.32
44.70	19.29	41.51	17.63	52.91	20.16	41.14	19.65	48.64	19.32
47.63	19.85	52.49	18.04	55.11	20.87	44.29	20.01	52.28	19.70
50.43	20.45	52.66	19.66	56.75	21.69	48.82	20.21	52.87	20.92
51.78	20.71	53.28	20.09	58.01	23.72	52.38	20.14	53.57	21.15
53.07	21.65	54.79	21.05	59.25	24.20	52.42	21.10	54.10	21.97
54.55	22.44	54.89	23.33	63.34	24.71	52.58	22.01	54.73	22.23
56.58	23.61	55.80	23.61	71.74	25.66	54.45	22.98	55.22	22.93
61.64	24.50	58.85	24.03	82.69	26.87	57.23	24.49	55.37	23.12
64.51	25.16	62.90	24.53			61.38	24.56	56.49	24.49
75.28	26.09	64.20	25.13			68.25	25.12	66.38	25.15
82.52	26.90	72.54	25.85			72.54	25.49	70.35	25.27
		79.36	26.51			76.10	25.73	80.44	26.65
		82.77	26.83			81.98	26.68		

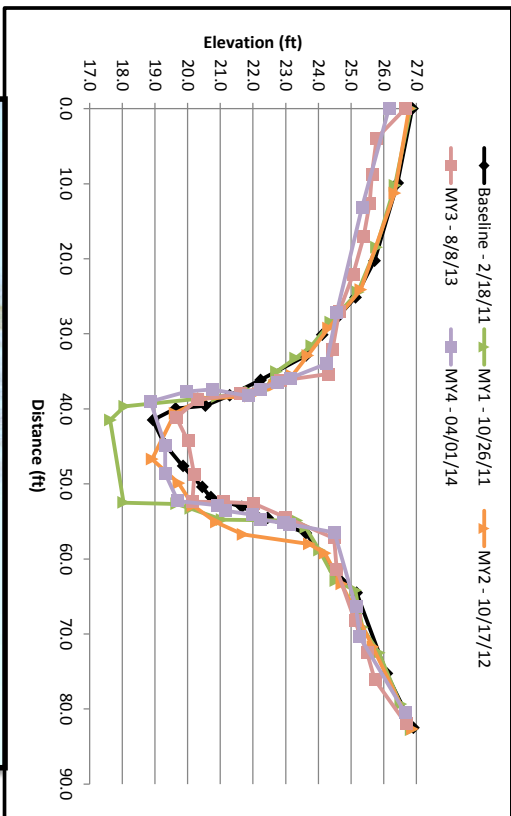


Figure 4.13 XS-13 Pool, Sta. 11+64

Baseline		MY1		MY2		MY3		MY4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	31.88	0.00	31.86	0.00	31.94	0.00	31.84	0.00	31.87
1.96	31.88	5.27	31.88	0.35	32.09	3.29	31.79	2.51	32.02
2.82	31.88	8.53	31.81	3.86	32.10	6.78	31.87	3.60	32.02
4.88	31.82	10.08	32.07	7.54	31.97	8.86	31.88	5.83	31.90
7.13	31.90	11.50	31.63	10.99	31.93	12.62	31.67	6.94	32.06
9.06	31.90	12.45	31.50	11.94	31.72	14.84	31.76	9.44	32.04
9.86	31.87	13.28	31.37	13.19	31.61	19.01	32.06	10.18	31.94
10.37	31.74	13.88	31.30	13.92	31.74	23.79	32.08	11.20	31.95
11.06	31.67	14.37	31.45	14.65	31.96			12.90	31.76
12.03	31.61	14.95	31.61	18.14	31.96			14.07	31.55
12.62	31.53	16.18	31.97	24.23	32.06			14.63	31.73
13.17	31.34	18.97	32.00					14.88	32.15
13.88	31.16	24.40	32.05					20.17	32.08
14.36	31.40							24.62	32.01
15.15	31.72								
15.65	31.85								
16.41	32.00								
19.34	31.99								
21.87	31.99								
24.27	31.98								
24.44	32.04								

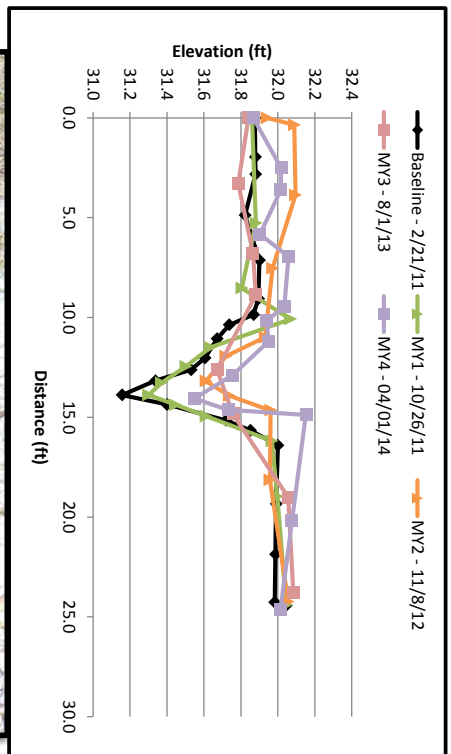




Figure 4.14 XS-14 Riffle, Sta. 14+89

Baseline		MY1		MY2		MY3		MY4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	31.64	0.00	31.61	0.00	31.56	0.00	31.60	0.00	31.62
1.38	31.49	3.27	31.38	5.45	31.35	2.54	31.38	4.93	31.34
2.83	31.36	5.60	31.29	8.56	31.17	6.95	31.32	8.72	31.17
4.92	31.33	8.34	31.22	10.03	31.12	9.83	31.21	9.59	31.06
6.91	31.28	9.34	31.11	11.05	30.69	11.13	30.90	10.03	30.68
8.50	31.24	10.53	30.92	11.64	30.54	13.81	30.53	10.38	30.55
9.40	31.12	11.01	30.67	12.21	30.58	15.93	31.14	11.99	30.55
10.03	31.02	11.83	30.55	14.08	30.82	21.82	31.29	12.90	30.70
10.44	30.86	12.72	30.63	14.94	31.06	25.67	31.20	13.45	30.83
10.60	30.80	13.61	30.74	18.46	31.29			13.92	31.01
10.71	30.71	14.38	30.90	22.74	31.25			14.44	31.15
11.02	30.66	15.92	31.22	24.83	31.22			15.89	31.15
11.21	30.58	17.64	31.29					20.25	31.26
11.58	30.63	21.76	31.26					24.06	31.23
12.11	30.59	25.05	31.24						
12.54	30.52								
12.93	30.68								
13.48	30.79								
13.97	30.89								
14.38	30.88								
15.13	31.11								
16.12	31.24								
18.44	31.31								
22.90	31.30								
25.11	31.27								

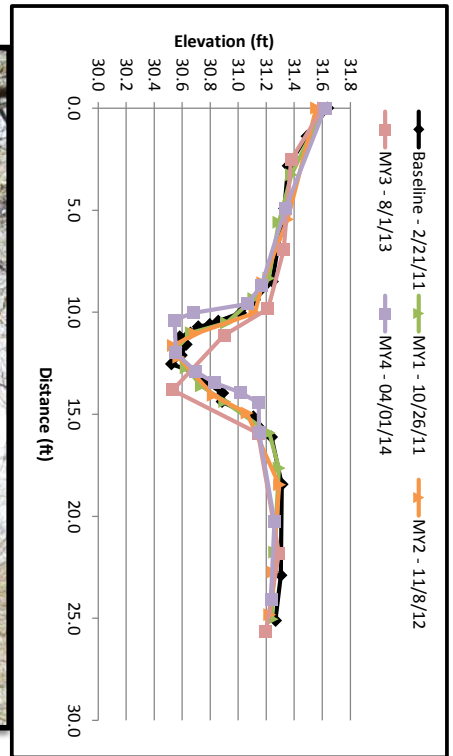


Figure 4.15 XS-15 Riffle, Sta. 19+28

Baseline		MY1		MY2		MY3		MY4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	30.666	No Data - Fallen Tree over Channel							
3.30	30.56								
8.61	30.26								
13.27	30.23								
16.31	30.25								
17.22	30.22								
17.98	29.94								
18.60	29.73								
18.81	29.70								
19.03	29.59								
19.26	29.32								
19.86	29.33								
20.39	29.47								
20.64	29.66								
20.90	29.87								
21.92	30.01								
23.19	30.22								
25.19	30.49								
28.07	30.62								
32.50	30.92								
35.34	31.18								
38.62	31.46								
40.05	31.60								

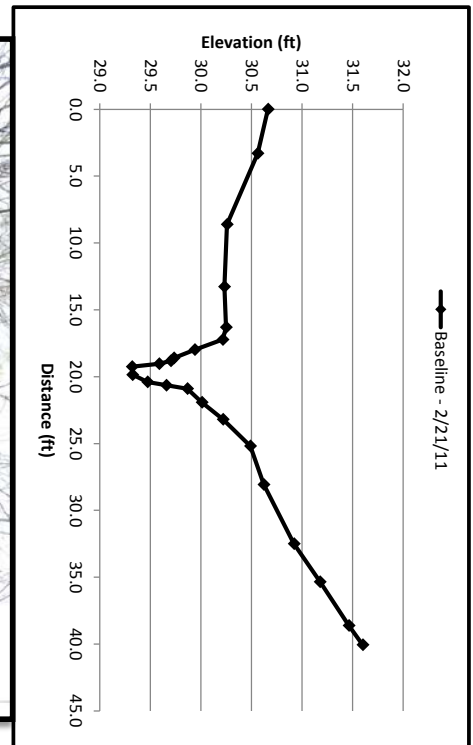




Figure 4.16 XS-16 Pool, Sta.23+64

Baseline		MY1		MY2		MY3		MY4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	25.98	0.00	25.98	0.00	25.89	0.00	25.98	0.00	26.01
4.96	25.72	6.84	25.58	6.52	25.52	5.28	25.76	5.44	25.75
10.01	25.44	13.28	25.18	12.56	25.23	8.79	25.49	10.04	25.50
13.01	25.18	15.96	24.85	14.97	24.92	13.42	25.19	14.92	25.17
14.66	24.95	16.79	24.74	16.97	24.60	16.93	24.78	15.91	24.87
16.29	24.81	17.94	24.69	18.66	24.34	18.49	24.64	16.93	24.72
18.05	24.63	18.70	24.33	19.64	24.04	19.55	24.19	18.13	24.78
18.59	24.33	19.22	24.27	20.67	24.32	22.06	24.76	18.89	24.33
18.86	24.19	19.92	24.12	23.35	25.04	25.38	25.23	19.43	24.14
19.43	24.13	20.71	24.34	27.00	25.21	28.67	25.60	19.93	24.15
19.97	24.09	21.69	24.69	30.23	25.78	30.40	25.82	19.88	24.35
20.33	24.25	22.47	24.82					21.55	24.69
21.01	24.44	23.20	25.08					23.13	24.99
21.98	24.77	25.85	25.20					24.60	25.24
23.04	25.05	27.47	25.36					28.00	25.38
23.97	25.20	30.40	25.86					30.28	25.87
26.34	25.22								
27.54	25.34								
28.93	25.73								
30.42	25.82								

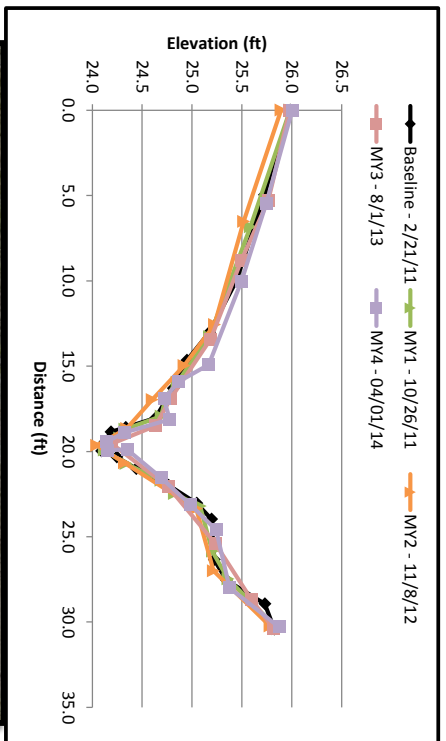
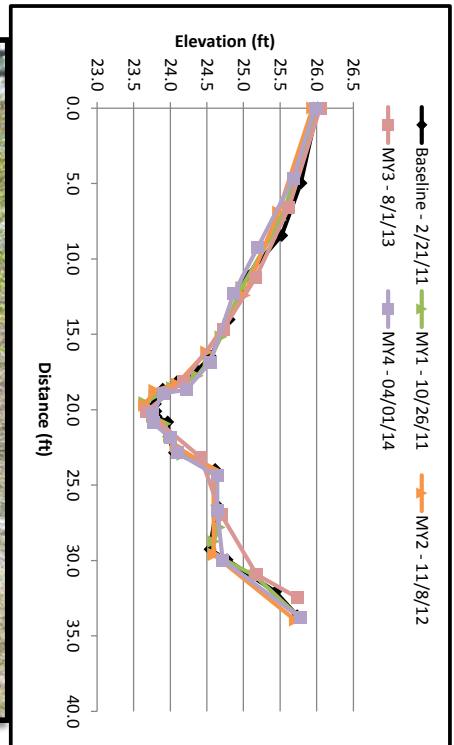


Figure 4.17 XS-17 Riffle, Sta. 23+87

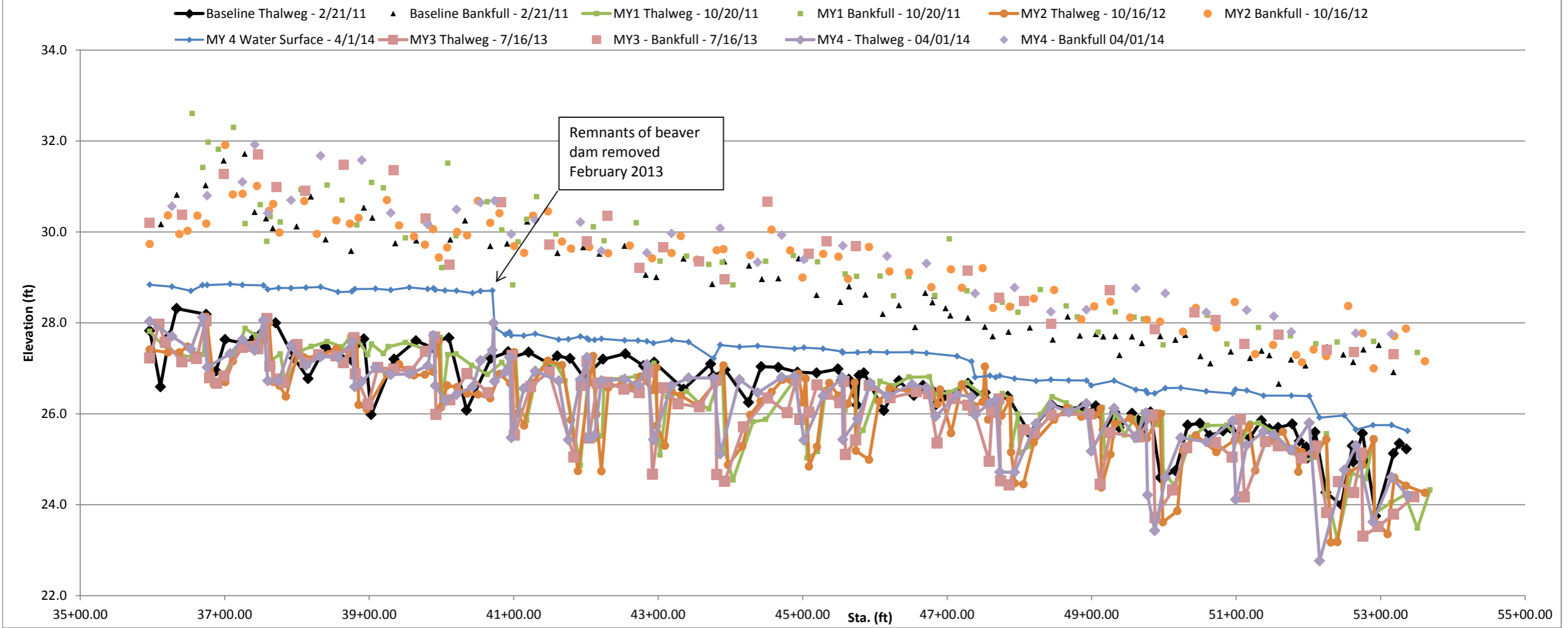
Baseline		MY1		MY2		MY3		MY4	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.00	26.01	0.00	26.03	0.00	25.94	0.00	26.05	0.00	25.98
4.97	25.78	7.42	25.51	6.91	25.48	6.62	25.62	4.69	25.68
8.45	25.52	11.90	24.98	12.42	25.01	11.24	25.17	9.25	25.19
11.09	25.05	15.17	24.69	16.18	24.50	14.66	24.72	12.31	24.86
14.03	24.80	16.79	24.53	18.29	24.09	18.11	24.18	16.84	24.55
16.48	24.55	17.76	24.37	18.72	23.79	20.11	24.22	18.68	24.22
17.40	24.37	18.54	24.03	19.71	23.65	23.16	24.41	18.90	23.90
18.15	24.09	19.07	23.79	20.81	23.84	26.93	24.70	20.23	23.76
18.64	23.89	19.53	23.65	22.43	24.08	30.92	25.18	20.88	23.76
19.05	23.83	20.46	23.76	23.95	24.59	32.46	25.73	21.84	24.00
19.61	23.79	20.94	23.93	29.61	24.60			22.87	24.10
20.10	23.80	21.78	23.99	33.95	25.71			24.39	24.64
20.44	23.80	22.97	24.17					26.68	24.64
20.81	23.96	24.01	24.59					29.98	24.72
21.79	23.98	27.80	24.67					33.77	25.77
22.85	24.06	28.74	24.59						
23.96	24.61	29.57	24.59						
26.35	24.64	31.01	25.16						
29.26	24.54	33.77	25.77						
29.95	24.77								
32.07	25.44								
33.67	25.73								





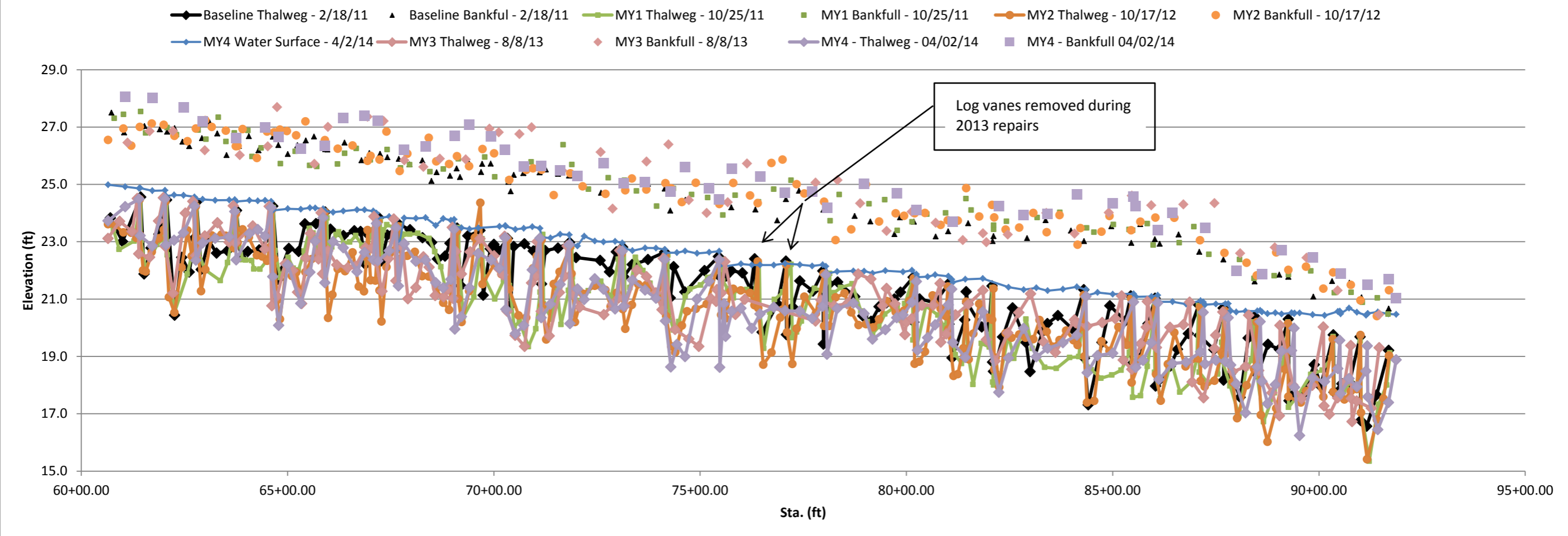
**Figures 5.1-5.3. Longitudinal Profile Plots**

**Figure 5.1 Reach 1 (Washington Ave. to Gordon St.) - Longitudinal Profile**

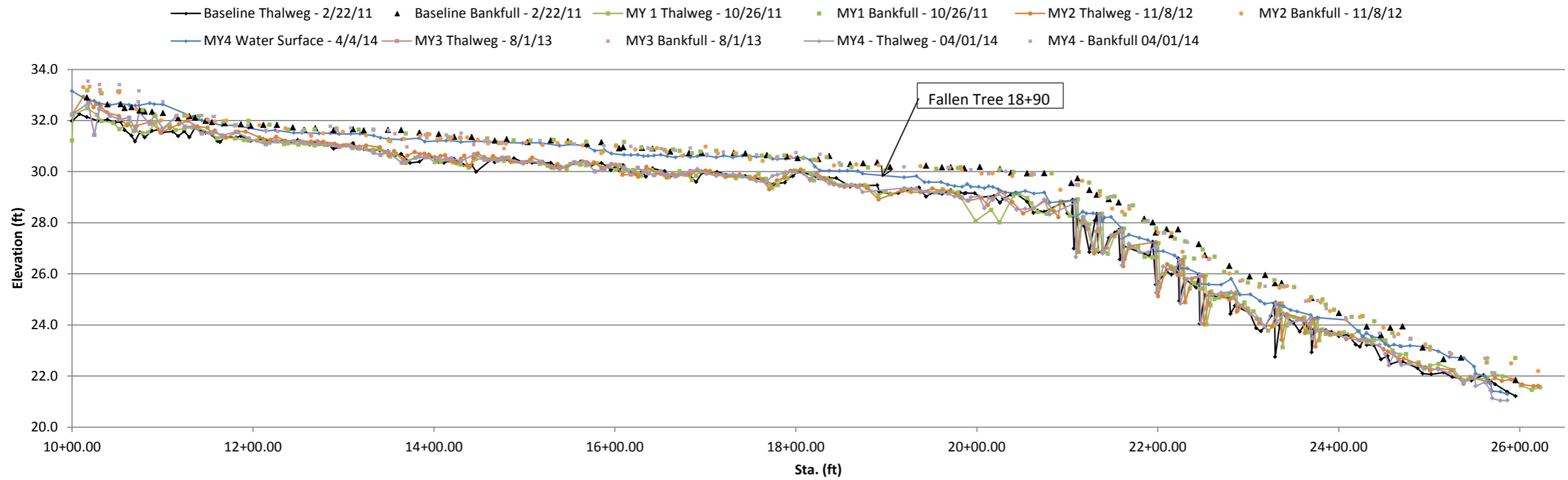




**Figure 5.2 Reach 2 (Gordon St. to Lincoln St.) - Longitudinal Profile**



**Figure 5.3 Reach 3 (UT to Adkin Branch) - Longitudinal Profile**





**Table 10.1-10.3. Baseline Stream Data Summary**

**Table 10.1 Baseline Stream Data Summary**  
**Adkin Branch Stream Restoration Project - Phase I - Contract No. 070708001**

**Reach 1**

Parameter	Existing Condition (Wash Ave. to Gordon)	Reference Reach (Johnson Mill)	Proposed (Wash Ave. to Gordon)	Reach 1 Baseline (Washington Ave. to Gordon St.)					
				Min	Mean	Med	Max	SD	n
<b>Dimension and Substrate - Riffle</b>									
	Mean	Mean	Mean						
Bankfull Width (ft)	20.90	21.20	22.00	14.84	15.95	14.99	18.03	1.80	3
Floodprone Width (ft)	29.40	34.90	40.00	28.45	42.14	41.72	56.25	13.90	3
Bankfull Mean Depth (ft)	1.95	2.25	1.38	0.92	1.35	1.42	1.70	0.40	3
Bankfull Max Depth (ft)	2.26	2.42	1.65	1.50	2.11	2.07	2.77	0.64	3
Bankfull Cross Sectional Area (ft <sup>2</sup> )	40.90	47.60	30.30	13.78	21.57	25.23	25.69	6.75	3
Width/Depth Ratio	10.70	9.40	16.00	8.73	12.57	12.70	16.29	3.78	3
Entrenchment Ratio	1.40	1.60	1.80	1.90	2.67	2.31	3.79	0.99	3
Bank Height Ratio	-	-	-	1.00	1.00	1.00	1.00	0.00	3
d50 (mm)	-	-	-						
<b>Profile</b>									
Riffle Length (ft)	-	-	-	13.69	88.32	82.84	173.90	51.83	14
Riffle Slope (ft/ft)	0.0012	0.00001	0.0026	0.0002	0.0016	0.0013	0.0062	0.0016	14
Pool Length (ft)	-	-	-	11.36	24.52	24.15	46.88	8.60	19
Pool Max depth (ft)	3.18	3.56	3.44	2.11	2.99	2.86	4.33	0.72	19
Pool Spacing (ft)	183 - 231	91.1 - 130.0	88 - 132	22.73	95.81	94.46	180.40	41.64	18
<b>Pattern</b>									
Channel Beltwidth (ft)	30 - 50	50 - 1500	44 - 176						
Radius of Curvature (ft)	150 - 320	43 - 235	66 - 110						
Rc: Bankfull Width (ft/ft)	7.2 - 15.3	2.0 - 11.1	3.0 - 5.0						
Meander Wavelength (ft)	175 - 400	250 - 400	264 - 418						
Meander Width Ratio	1.43 - 2.39	2.4 - 70.9	2.0 - 8.0						
<b>Substrate, bed and transport parameters</b>									
Ri% / P%	-	-	-	73% / 27%					
SC% / Sa% / G% / C% / B% / Be%	-	-	-						
d16 / d35 / d50 / d84 / d95 / di <sup>90</sup> / di <sup>95</sup> (mm)	-	-	-						
Reach Shear Stress (competency) lb/ft <sup>2</sup>	N/A		N/A	N/A					
Max part size (mm) mobilized at bankfull	-		-	-					
Unit Stream Power (transport capacity) lbs/ft.s	0.075	0.197	0.220	0.325					
<b>Additional Reach Parameters</b>									
Drainage Area (SM)	4.60	13.50	5.03						
Impervious cover estimate (%)	-	-	-						
Rosgen Classification	G5	B5c	B5c	B5c					
Bankfull Velocity (fps)	1.20	1.70	1.70	1.95					
Bankfull Discharge (cfs)	50.00	80.90	50.00						
Valley length (ft)	-	-	1685	1685					
Channel Thalweg length (ft)	-	-	1750	1727					
Sinuosity (ft)	1.04	1.10	1.04	1.03					
Water Surface Slope (Channel) (ft/ft)	0.0005	0.0010	0.0016	0.00166					
BF slope (ft/ft)	-	-	-	0.00240					
Bankfull Floodplain Area (acres)	-	-	-						
Proportion over wide (%)	-	-	-						
Entrenchment Class (ER Range)	-	-	-						
Incision Class (BHR Range)	-	-	-						
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-						
Channel Stability or Habitat Metric	-	-	-						
Biological or Other	-	-	-						

It should be noted that As-built conditions were completed at the end of construction. Many storm events had occurred between beginning of construction and end of construction that naturally modified constructed parameters.



**Table 10.2 Baseline Stream Data Summary**  
**Adkin Branch Stream Restoration Project - Phase I - Contract No. 070708001**

**Reach 2**

Parameter	Existing Condition (Gordon to Lincoln)	Reference Reach (Johnson Mill)	Proposed (Gordon to Lincoln)	Reach 2 Baseline (Gordon St. to Lincoln St.)					
				Min	Mean	Med	Max	SD	n
<b>Dimension and Substrate - Riffle</b>									
Bankfull Width (ft)	23.60	21.20	22.00	16.23	16.98	16.81	17.91	0.85	3
Floodprone Width (ft)	45.00	34.90	40.00	48.33	52.40	51.29	57.58	4.72	3
Bankfull Mean Depth (ft)	1.83	2.25	1.47	1.46	1.66	1.64	1.88	0.21	3
Bankfull Max Depth (ft)	2.98	2.42	1.76	2.21	2.38	2.26	2.68	0.26	3
Bankfull Cross Sectional Area (ft <sup>2</sup> )	43.30	47.60	32.30	23.68	28.32	27.58	33.70	5.05	3
Width/Depth Ratio	12.90	9.40	15.00	9.53	10.30	10.25	11.12	0.80	3
Entrenchment Ratio	1.90	1.60	1.80	2.99	3.09	3.05	3.22	0.12	3
Bank Height Ratio	-	-	-	1.00	1.00	1.00	1.00	0.00	3
d50 (mm)	-	-	-	-	-	-	-	-	-
<b>Profile</b>									
Riffle Length (ft)	-	-	-	27.43	62.71	62.38	93.27	19.56	10
Riffle Slope (ft/ft)	0.0024	0.00001	0.0031	0.0002	0.0013	0.0010	0.0039	0.0013	10
Pool Length (ft)	-	-	-	14.20	56.38	56.82	113.64	27.38	39
Pool Max depth (ft)	4.14	3.56	3.67	2.74	4.23	4.22	6.48	0.76	39
Pool Spacing (ft)	59.62 - 117.86	91.1 - 130.0	88.0 - 132.0	17.05	73.45	69.60	164.78	32.96	38
<b>Pattern</b>									
Channel Beltwidth (ft)	75 - 120	50 - 1500	44.0 - 176.0						
Radius of Curvature (ft)	40 - 146	43 - 235	66.0 - 110.0						
Rc: Bankfull Width (ft/ft)	1.7 - 6.2	2.0 - 11.1	3.0 - 5.0						
Meander Wavelength (ft)	224 - 260	250 - 400	264.0 - 418.0						
Meander Width Ratio	3.18 - 5.08	2.4 - 70.9	2.0 - 8.0						
<b>Substrate, bed and transport parameters</b>									
Ri% / P%	-	-	-	29% / 71% *					
SC% / Sa% / G% / C% / B% / Be%	-	-	-						
d16 / d35 / d50 / d84 / d95/ di <sup>p</sup> / di <sup>sp</sup> (mm)	-	-	-						
Reach Shear Stress (competency) lb/ft <sup>2</sup>	N/A		N/A	N/A					
Max part size (mm) mobilized at bankfull	-		-	-					
Unit Stream Power (transport capacity) lbs/ft.s	0.106	0.197	0.230	0.321					
<b>Additional Reach Parameters</b>									
Drainage Area (SM)	5.30	13.50	5.50						
Impervious cover estimate (%)	-	-	-						
Rosgen Classification	B5	B5c	B5c	B5c					
Bankfull Velocity (fps)	1.30	1.70	1.80	1.99					
Bankfull Discharge (cfs)	55.00	80.90	55.00						
Valley length (ft)	-	-	4106	4106					
Channel Thalweg length (ft)	-	-	4246	4270					
Sinuosity (ft)	1.12	1.10	1.03	1.04					
Water Surface Slope (Channel) (ft/ft)	0.0007	0.0010	0.0014	0.0016					
BF slope (ft/ft)	-	-	-	0.0018					
Bankfull Floodplain Area (acres)	-	-	-						
Proportion over wide (%)	-	-	-						
Entrenchment Class (ER Range)	-	-	-						
Incision Class (BHR Range)	-	-	-						
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-						
Channel Stability or Habitat Metric	-	-	-						
Biological or Other	-	-	-						

It should be noted that As-built conditions were completed at the end of construction. Many storm events had occurred between beginning of construction and end of construction that naturally modified constructed parameters.

\* Reach 2 is a predominately pool system due to need to drop grade at the lower end of the project.

**Table 10.3 Baseline Stream Data Summary**  
**Adkin Branch Stream Restoration Project - Phase I - Contract No. 070708001**

**Reach 3**

Parameter	Existing Condition (UT to Adkin Branch)	Refernce Reach (UT to Wildcat Branch)	Proposed (UT to Adkin Branch)	Reach 3 Baseline (UT to Adkin Branch)					
	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
<b>Dimension and Substrate - Riffle</b>									
Bankfull Width (ft)	3.60	7.70	6.00	6.06	7.27	7.69	8.06	1.06	3
Floodprone Width (ft)	8.30	130.00	15.00	23.07	27.62	25.11	34.69	6.20	3
Bankfull Mean Depth (ft)	0.47	1.03	0.55	0.35	0.42	0.40	0.50	0.08	3
Bankfull Max Depth (ft)	3.40	1.56	0.85	0.72	0.81	0.82	0.90	0.09	3
Bankfull Cross Sectional Area (ft <sup>2</sup> )	1.70	7.90	3.30	2.43	3.04	2.68	4.00	0.84	3
Width/Depth Ratio	7.60	7.50	11.00	15.15	17.75	16.12	21.97	3.69	3
Entrenchment Ratio	2.30	16.90	2.50	2.86	3.95	3.26	5.72	1.55	3
Bank Height Ratio	-	-	-	1.00	1.00	1.00	1.00	0.00	3
d50 (mm)	-	-	-						
<b>Profile</b>									
Riffle Length (ft)	-	-	-	9.59	34.33	26.34	165.84	30.38	28
Riffle Slope (ft/ft)	0.0002	0.0021	0.0032	0.0012	0.0051	0.0044	0.0121	0.0031	28
Pool Length (ft)	-	-	-	4.26	21.38	23.26	52.81	12.04	32
Pool Max depth (ft)	1.45	1.90	1.36	0.64	1.59	1.32	2.95	0.70	32
Pool Spacing (ft)	21.63	14.0 - 16.6	12.0 - 36.0	13.49	42.26	37.22	93.07	20.82	30
<b>Pattern</b>									
Channel Beltwidth (ft)	50.00	13.8 - 19.4	12.0 - 36.0						
Radius of Curvature (ft)	93 - 105	10.9 - 15.3	12.0 - 18.0						
Rc: Bankfull Width (ft/ft)	26.0 - 29.3	1.4 - 2.0	2.0 - 3.0						
Meander Wavelength (ft)	212 - 517	22.5 - 29.0	18.0 - 48.0						
Meander Width Ratio	13.97	1.8 - 2.5	2.0 - 6.0						
<b>Substrate, bed and transport parameters</b>									
Ri% / P%	-	-	-	58% / 42%					
SC% / Sa% / G% / C% / B% / Be%	-	-	-						
d16 / d35 / d50 / d84 / d95 / di <sup>90</sup> / di <sup>95</sup> (mm)	-	-	-						
Reach Shear Stress (competency) lb/ft <sup>2</sup>	N/A		N/A	N/A					
Max part size (mm) mobilized at bankfull	-		-	-					
Unit Stream Power (transport capacity) lbs/ft.s	0.007	0.140	0.080	0.083					
<b>Additional Reach Parameters</b>									
Drainage Area (SM)	0.12	0.44	0.12						
Impervious cover estimate (%)	-	-	-						
Rosgen Classification	E5	E5	E5	E5					
Bankfull Velocity (fps)	2.10	1.20	1.10	1.44					
Bankfull Discharge (cfs)	3.50	9.20	3.50						
Valley length (ft)	1200	-	1200	1200					
Channel Thalweg length (ft)	1200	-	1615	1582					
Sinuosity (ft)	1.00	1.15	1.35	1.32					
Water Surface Slope (Channel) (ft/ft)	0.0001	0.0024	0.0022	0.0028					
BF slope (ft/ft)	-	-	-	0.0030					
Bankfull Floodplain Area (acres)	-	-	-						
Proportion over wide (%)	-	-	-						
Entrenchment Class (ER Range)	-	-	-						
Incision Class (BHR Range)	-	-	-						
BEHI VL% / L% / M% / H% / VH% / E%	-	-	-						
Channel Stability or Habitat Metric	-	-	-						
Biological or Other	-	-	-						

It should be noted that As-built conditions were completed at the end of construction. Many storm events had occurred between beginning of construction and end of construction that naturally modified constructed parameters.



**Table 11. Monitoring Data - Dimensional Morphology Summary**

**Table 11. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Section)**  
**Adkin Branch Stream Restoration Project - Phase I**  
**Contract No. 070708001**

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Riffle)						
Dimension and substrate <sup>1</sup>	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	14.84	12	12.55	12.16	21.09			24.28	18.49	17.14	12.97	16.36			18.03	19.72	17.07	17.39	16.91			17.42	16.08	15.95	16.96	19.55			14.99	16.25	10.88	15.84	16.69		
Floodprone Width (ft)	56.25	44.63	50.14	48.69	87.47			72.2	71.85	75.65	70.24	69.73			41.72	52.82	52.88	58.89	53.3			39.81	42.63	69.79	63.88	68.85			28.45	49.93	31.85	49.42	55.18		
Bankfull Mean Depth (ft)	1.7	1.85	2.29	2.34	2.78			1.97	2.57	2.98	3.36	2.62			1.42	1.61	1.66	1.92	1.96			1.46	1.59	2.76	2.65	2.31			0.92	1.16	1.29	1.84	1.96		
Bankfull Max Depth (ft)	2.77	2.47	2.70	2.69	4.53			3.33	3.89	4.14	4.75	3.43			2.07	2.76	2.74	3.47	2.71			2.05	2.17	3.61	3.47	3.36			1.5	2.55	1.98	2.45	2.6		
Bankfull Cross Sectional Area (ft <sup>2</sup> )	25.23	22.2	28.71	28.51	58.56			47.75	47.44	51.08	43.63	42.89			25.69	31.85	28.32	33.39	33.19			25.48	25.55	44.04	44.92	25.2			13.78	18.8	14.06	29.10	32.73		
Bankfull Width/Depth Ratio	8.73	6.49	5.48	5.19	7.59			12.32	7.19	5.75	3.86	6.24			12.7	12.25	10.28	9.05	8.63			11.93	10.11	5.78	6.41	8.46			16.29	14.01	8.43	8.62	8.52		
Bankfull Entrenchment Ratio	3.79	3.72	4.00	4.00	4.15			2.97	3.89	4.41	5.42	4.26			2.31	2.68	3.1	3.39	3.15			2.29	2.65	4.38	3.77	3.52			1.9	3.07	2.93	3.12	3.31		
Bankfull Bank Height Ratio	1	1	1	1	1			1	1	1	1	1			1	1	1	1	1			1	1	1	1	1			1	1	1	1	1		
	Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section 8 (Pool)							Cross Section 9 (Riffle)							Cross Section 10 (Riffle)						
Dimension and substrate <sup>1</sup>	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	15.1	18.04	21.48	22.51	26.65			17.91	16.15	21.82	18.51	18.23			16.57	15.76	15.61	15.37	17.07			16.81	15.69	17.96	16.71	22.8			16.23	17.72	16.32	16.82	21.1		
Floodprone Width (ft)	57.39	57.49	56.48	55.53	56.75			57.58	64.23	64.27	62.94	64.15			50.57	50.57	50.41	49.37	49.9			51.29	56.7	56.68	47.17	56.89			48.33	51.64	55.58	54.89	62.91		
Bankfull Mean Depth (ft)	2.94	3.16	4.21	3.09	4.17			1.88	2.85	2.81	2.50	3.48			1.93	2.76	3.49	3.23	3.29			1.64	2.01	2.23	2.07	3.67			1.46	1.61	2.35	2.27	3.43		
Bankfull Max Depth (ft)	4.39	4.85	6.14	5.24	6.57			2.68	4.26	3.87	3.53	4.19			3.51	4.89	5.18	4.39	4.54			2.21	2.84	3.07	2.53	4.85			2.26	2.6	3.08	2.95	4.2		
Bankfull Cross Sectional Area (ft <sup>2</sup> )	44.41	57.01	90.46	69.65	110.4			33.7	45.98	61.35	46.34	63.44			31.92	43.57	54.47	49.60	56.13			27.58	31.55	40.05	34.51	83.63			23.68	28.48	38.34	38.18	72.29		
Bankfull Width/Depth Ratio	5.14	5.71	5.1	7.28	6.35			9.53	5.67	7.77	7.39	5.24			8.59	5.71	4.47	4.76	5.19			10.25	7.81	8.05	8.09	6.21			11.12	11.01	6.94	7.41	21.24		
Bankfull Entrenchment Ratio	3.8	3.19	2.63	2.47	2.14			3.22	3.98	2.95	3.40	3.52			3.05	3.21	3.23	3.21	2.92			3.05	3.61	3.16	2.82	2.49			2.99	2.91	3.41	3.26	2.98		
Bankfull Bank Height Ratio	1	1	1	1	1			1	1	1	1	1			1	1	1	1	1			1	1	1	1	1			1	1	1	1	1		
	Cross Section 11 (Pool)							Cross Section 12 (Pool)							Cross Section 13 (Pool)							Cross Section 14 (Riffle)							Cross Section 15 (Riffle)						
Dimension and substrate <sup>1</sup>	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	16.31	17.99	14.96	17.00	24.69			23.66	17.42	22.13	21.52	22.29			5.89	5.97	3.55	7.70	3.55			7.69	7.63	5.82	5.81	7.04			6.06	N/A	N/A	N/A	N/A		
Floodprone Width (ft)	72.56	73.06	72.92	71.92	72.15			82.52	82.77	82.69	81.98	80.44			24.44	24.4	24.23	23.79	24.62			25.11	25.05	24.83	25.67	24.06			34.69	N/A	N/A	N/A	N/A		
Bankfull Mean Depth (ft)	3.19	3.51	2.94	1.82	3.74			2.72	3.87	2.92	3.27	3.81			0.31	0.35	0.19	0.11	0.2			0.35	0.34	0.31	0.33	0.31			0.4	N/A	N/A	N/A	N/A		
Bankfull Max Depth (ft)	4.71	5.43	4.09	4.25	6.07			4.68	4.74	4.29	4.65	5.38			0.71	0.67	0.32	0.21	0.4			0.72	0.67	0.58	0.61	0.6			0.9	N/A	N/A	N/A	N/A		
Bankfull Cross Sectional Area (ft <sup>2</sup> )	52.00	63.18	44.06	70.35	92.44			64.42	67.38	64.51	70.35	85			1.81	2.09	0.68	0.87	0.7			2.68	2.60	1.80	1.91	2.15			2.43	N/A	N/A	N/A	N/A		
Bankfull Width/Depth Ratio	5.11	5.13	5.09	6.58	6.6			8.7	4.5	7.58	6.58	5.85			19	17.06	18.68	68.19	17.75			21.97	22.44	18.77	17.64	22.71			15.15	N/A	N/A	N/A	N/A		
Bankfull Entrenchment Ratio	4.45	4.06	4.87	3.81	2.92			3.49	4.75	3.74	3.81	3.61			4.15	4.09	6.82	3.09	6.93			3.26	3.28	4.27	4.42	3.42			5.72	N/A	N/A	N/A	N/A		
Bankfull Bank Height Ratio	1	1	1	1	1			1	1	1	1	1			1	1	1	1	1			1	1	1	1	1			1	N/A	N/A	N/A	N/A		
	Cross Section 16 (Pool)							Cross Section 17 (Riffle)							<p align="center"><b>NOTE:</b></p> <p><b>Reach 1 - Washington Ave. to Gordon St. - Cross-Sections 1 through 5</b></p> <p><b>Reach 2 - Gordon St. to Lincoln St. - Cross-Sections 6 - 12</b></p> <p><b>Reach 3 - UT to Adkin Branch - Cross-Sections 13-17</b></p> <p><b>Cross-section 15: Not able to survey due to fallen tree across cross-section</b></p>																				
Dimension and substrate <sup>1</sup>	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+															Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	11.59	9.14	9.32	11.65	7.13			8.06	7.82	8.93	6.55	8.2																							
Floodprone Width (ft)	30.42	30.4	30.23	30.40	23.63			23.07	25.58	27.18	19.41	21.05																							
Bankfull Mean Depth (ft)	0.46	0.43	0.46	0.40	0.31			0.5	0.48	0.46	0.35	0.49																							
Bankfull Max Depth (ft)	1.11	0.96	1.00	0.99	0.79			0.82	0.94	0.94	0.74	0.88																							
Bankfull Cross Sectional Area (ft <sup>2</sup> )	5.34	3.91	4.25	4.70	2.22			4	3.76	4.14	2.29	4.02																							
Bankfull Width/Depth Ratio	25.2	21.26	20.26	28.86	23			16.12	16.29	19.41	18.71	16.73																							
Bankfull Entrenchment Ratio	2.62	3.33	3.24	2.61	3.31			2.86	3.27	3.04	2.96	2.57																							
Bankfull Bank Height Ratio	1	1	1	1	1			1	1	1	1	1																							

<sup>1</sup> = Based on current bankfull elevation, determined by field indicators of bankfull.



**Table 12.1-12.3. Monitoring Data - Stream Reach Data Summary**





**Table 12.2 Monitoring Data - Stream Reach Data Summary**  
**Admin Branch Stream Restoration Project - Phase 1 - Contract No. 070708001**  
**Reach 2 (Caswell St. to Lincoln St.)**

Parameter	Baseline			MY-1			MY-2			MY-3			MY-4			MY-5									
	Min	Mean	Max	SD	n	Min	Mean	Max	SD	n	Min	Mean	Max	SD	n	Min	Mean	Max	SD	n					
<b>Dimension and substrate - Riffle only</b>																									
Bankfull Width (ft)	16.23	16.98	16.81	17.91	0.85	3	15.69	16.52	16.15	17.72	1.06	3	16.32	18.70	17.96	21.82	2.82	3	18.23	20.71	21.10	22.80	2.31	3	
Floodprone Width (ft)	48.33	52.40	51.29	57.58	4.72	3	51.64	57.52	56.70	64.23	6.34	3	55.58	58.84	56.68	64.27	4.73	3	47.17	55.00	54.89	62.94	7.89	3	
Bankfull Mean Depth (ft)	1.46	1.66	1.64	1.88	0.21	3	1.61	2.16	2.01	2.85	0.63	3	2.23	2.46	2.35	2.81	0.31	3	2.07	2.28	2.27	2.50	0.22	3	
Bankfull Max Depth (ft)	2.21	2.38	2.26	2.68	0.26	3	2.60	3.23	2.84	4.26	0.90	3	3.07	3.34	3.08	3.87	0.46	3	2.53	3.00	2.95	3.53	0.50	3	
Bankfull Cross Sectional Area (ft <sup>2</sup> )	23.68	28.32	27.58	33.70	5.05	3	28.48	35.34	31.55	45.98	9.34	3	38.34	46.58	40.05	61.35	12.82	3	34.51	39.68	38.18	46.34	6.06	3	
Width:Depth Ratio	9.53	10.30	10.25	11.12	0.80	3	5.69	8.16	7.81	11.01	2.69	3	6.94	7.59	7.77	8.05	0.58	3	7.39	7.63	7.41	8.09	0.40	3	
Entrenchment Ratio	2.99	3.09	3.05	3.22	0.12	3	2.91	3.50	3.61	3.98	0.54	3	2.95	3.17	3.16	3.41	0.23	3	2.82	3.16	3.26	3.40	0.30	3	
Bank Height Ratio	1	1	1	1	0	3	1	1	1	1	0	3	1	1	1	1	1	1	1	1	1	1	0	3	
<b>Profile</b>																									
Riffle Length (ft)	27.43	62.71	62.38	95.27	19.56	10	5.23	34.74	35.95	61.27	16.12	11	14.79	33.08	24.52	69.01	16.99	18	10.36	45.72	32.00	162.02	44.19	27	
Riffle Slope (ft/ft)	0.0002	0.0013	0.0010	0.0039	0.0013	10	0.0003	0.0029	0.0015	0.0132	0.0039	11	0.0001	0.0002	0.0002	0.0008	0.0002	18	0.0000	0.0003	0.0000	0.0013	0.0004	27	
Pool Length (ft)	14.20	56.38	56.82	113.64	27.38	39	7.56	65.31	61.25	157.78	33.20	45	15.05	42.46	40.28	85.81	17.24	45	6.29	49.82	49.86	120.65	27.85	30	
Pool Max Depth (ft)	2.74	4.23	4.22	6.48	0.76	39	2.60	4.80	4.97	6.54	0.89	45	2.00	4.39	4.40	6.61	1.01	45	3.47	4.86	4.80	6.62	0.78	29	
Pool Spacing (ft)	17.05	73.45	69.60	164.78	32.96	38	11.36	63.92	56.82	139.21	28.40	44	25.91	67.24	67.02	130.53	23.07	44	16.43	100.34	89.39	241.03	51.87	30	
<b>Pattern</b>																									
Channel Bedwidth (ft)																									
Radius of Curvature (ft)																									
Re:Bankfull Width (ft/ft)																									
Meander Wavelength (ft)																									
Meander Width Ratio																									
<b>Additional Reach Parameters</b>																									
Rosen Classification	B5c																								
Channel Thalgweg length (ft)	3096																								
Sinuosity (ft)	1.04																								
Water Surface Slope (Channel) (ft/ft)	0.0016																								
BF slope (ft/ft)	0.0018																								
* R% / P%	29% / 71%																								
SC% / St% / G% / C% / D% / Be%																									
d16 / d35 / d50 / d84 / d95																									
% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.  
 \* Reach 2 is a predominantly pool system due to need to drop grade at the lower end of the project.  
 1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.  
 2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table  
 3 = Riffle, Run, Pool, Glide, Step, Silt/Clay, Sand, Gravel, Boulder, Bedrock, dip = max pave, dip = max subpave





**Appendix E. Hydrologic Data**

**Table 13. Verification of Bankfull Events**

Date	Crest Gauge Info		Gauge Reading (ft)	Gauge Elevation (ft)	Crest Elevation (ft)	Bankfull Elevation (ft)	Height above Bankfull (ft)	Photo
	Site	Sta.						
4/1/2014	1	Adkin Branch Sta. 54+00 LT	4	25.27	29.27	27.03	2.24	6.2
4/1/2014	2	Adkin Branch Sta. 75+25 RT	1.14	23.60	24.74	24.43	0.31	6.1
4/1/2014	3	UT Adkin Sta. 22+65 LT	1.52	25.51	27.03	26.07	0.96	6.3
4/1/2014	4	UT Adkin Sta. 18+80 LT	1.97	29.47	31.44	30.16	1.28	6.4

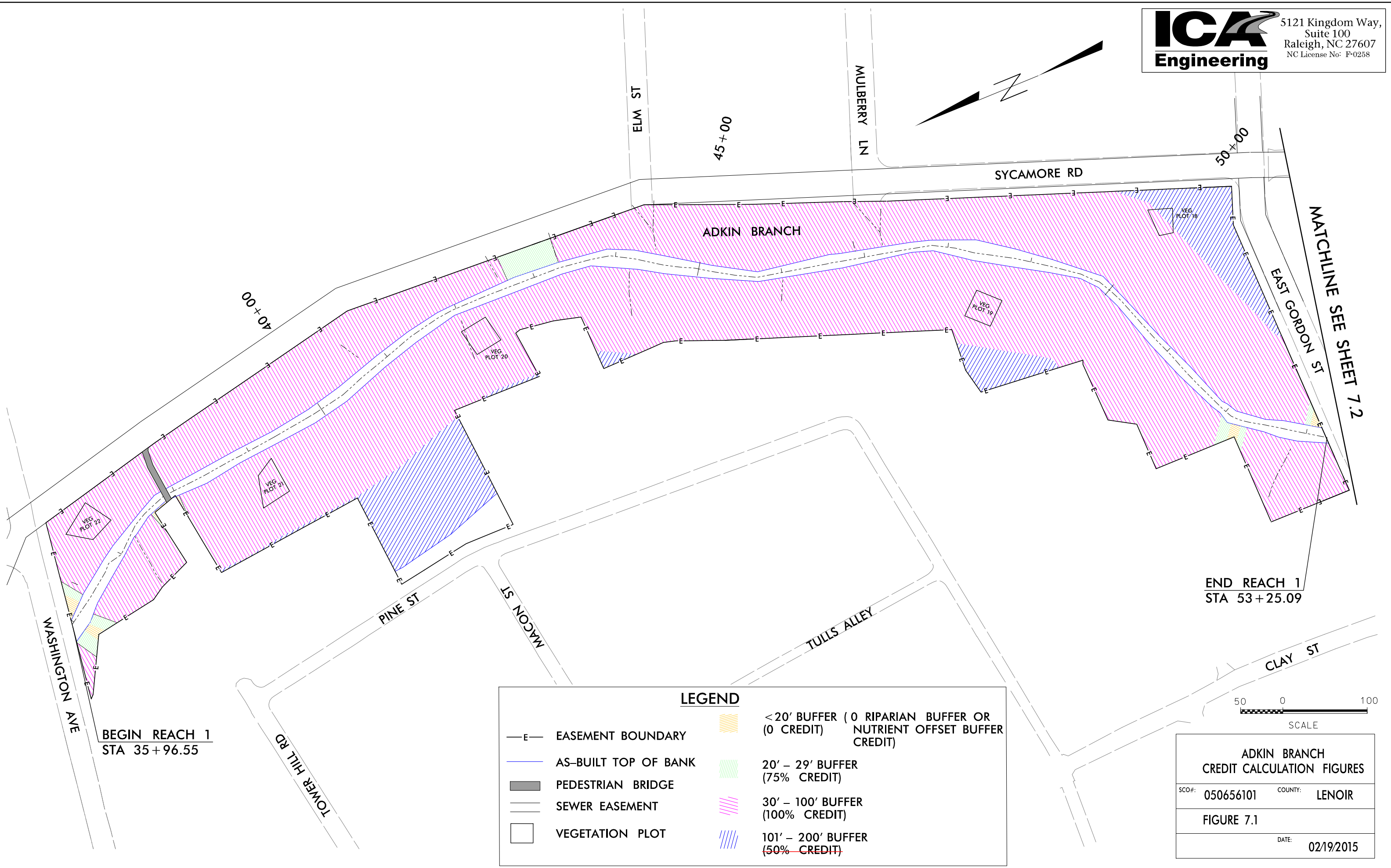
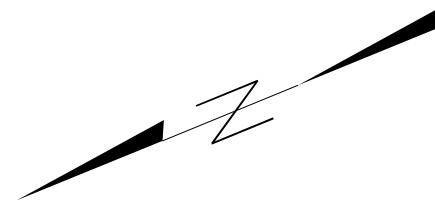


**Figures 6.1-6.4 April 2014 Crest Gauge Photos**

## Appendix F. Credit Calculation Figures

Figure 7.1 – 7.5, Credit Calculation Figures





BEGIN REACH 1  
 STA 35+96.55

END REACH 1  
 STA 53+25.09

MATCHLINE SEE SHEET 7.2

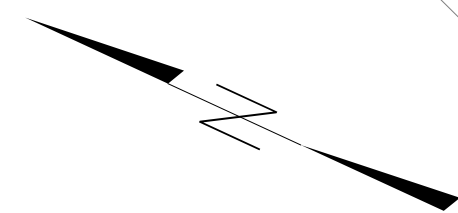
LEGEND	
	EASEMENT BOUNDARY
	AS-BUILT TOP OF BANK
	PEDESTRIAN BRIDGE
	SEWER EASEMENT
	VEGETATION PLOT
	<20' BUFFER (0 RIPARIAN BUFFER OR 0 CREDIT) NUTRIENT OFFSET BUFFER CREDIT)
	20' - 29' BUFFER (75% CREDIT)
	30' - 100' BUFFER (100% CREDIT)
	101' - 200' BUFFER (50% CREDIT)



ADKIN BRANCH CREDIT CALCULATION FIGURES	
SCO#:	050656101
COUNTY:	LENOIR
FIGURE 7.1	
DATE:	02/19/2015

**LEGEND**

- E— EASEMENT BOUNDARY
- AS-BUILT TOP OF BANK
- SEWER EASEMENT
- VEGETATION PLOT
- <20' BUFFER (0 RIPARIAN BUFFER OR NUTRIENT OFFSET BUFFER CREDIT)
- 20' - 29' BUFFER (75% CREDIT)
- 30' - 100' BUFFER (100% CREDIT)
- 101' - 200' BUFFER (50% CREDIT)



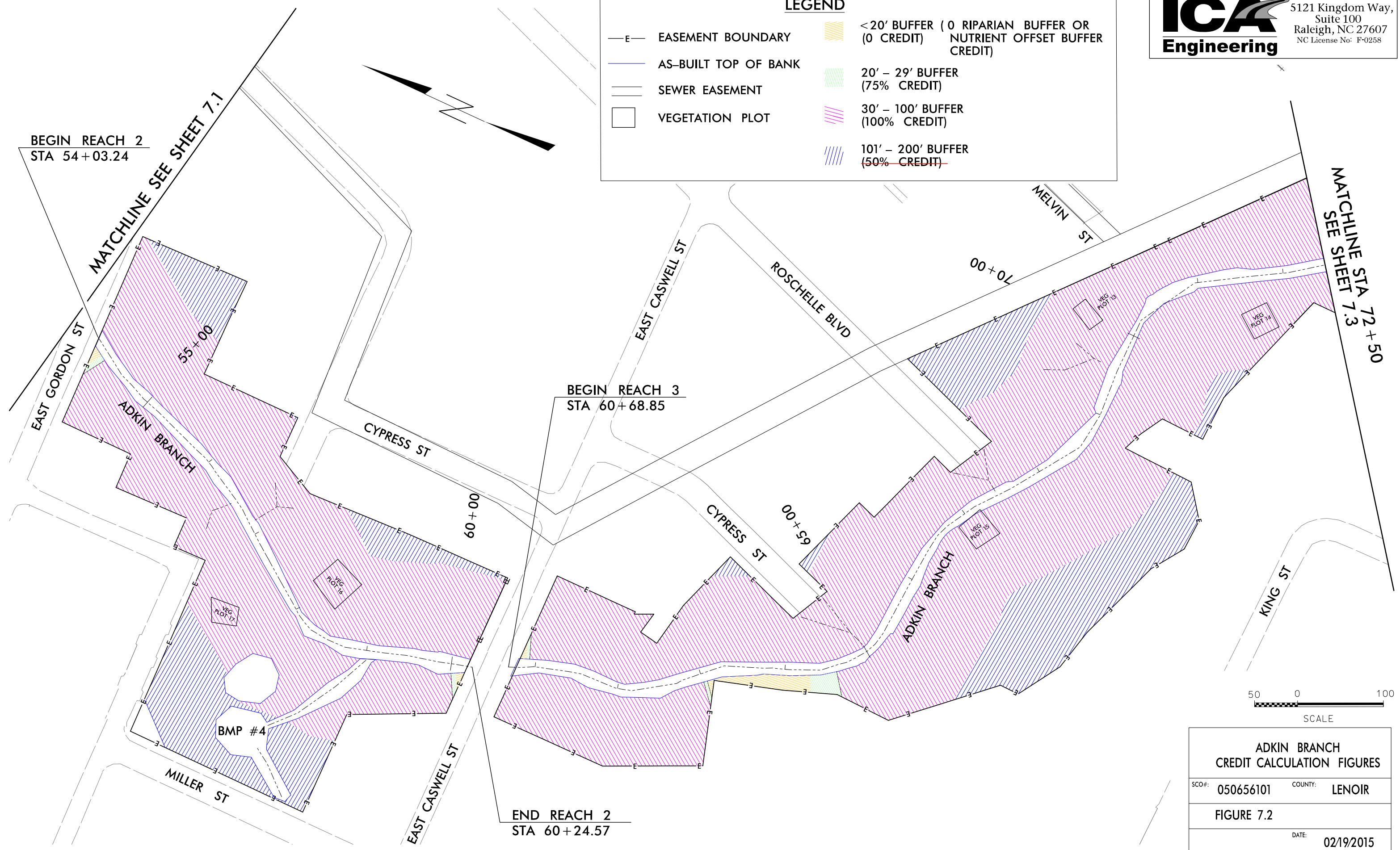
BEGIN REACH 2  
 STA 54+03.24

MATCHLINE SEE SHEET 7.1

MATCHLINE STA 72+50  
 SEE SHEET 7.3

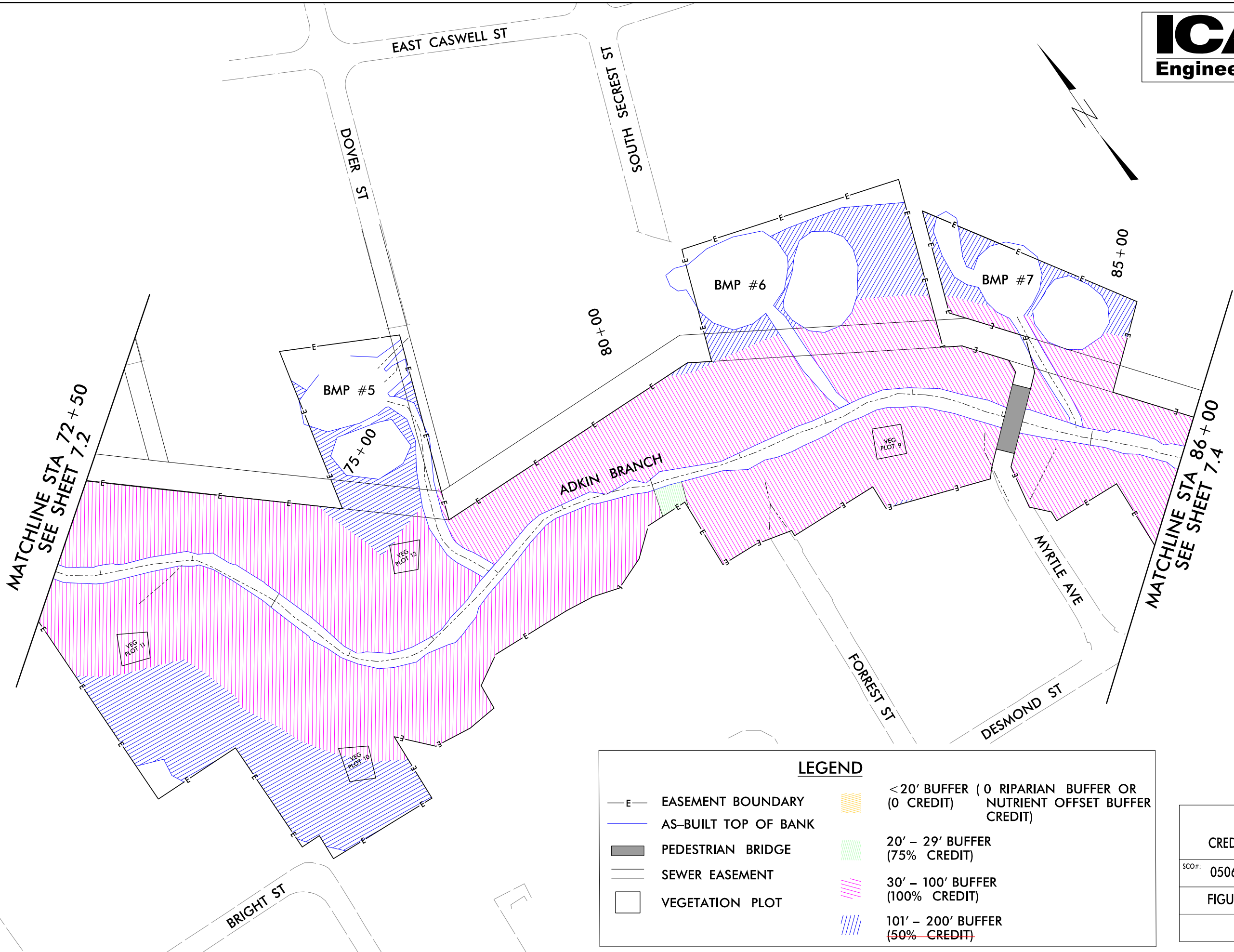
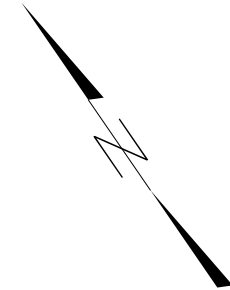
BEGIN REACH 3  
 STA 60+68.85

END REACH 2  
 STA 60+24.57



ADKIN BRANCH CREDIT CALCULATION FIGURES	
SCO#: 050656101	COUNTY: LENOIR
FIGURE 7.2	
DATE: 02/19/2015	





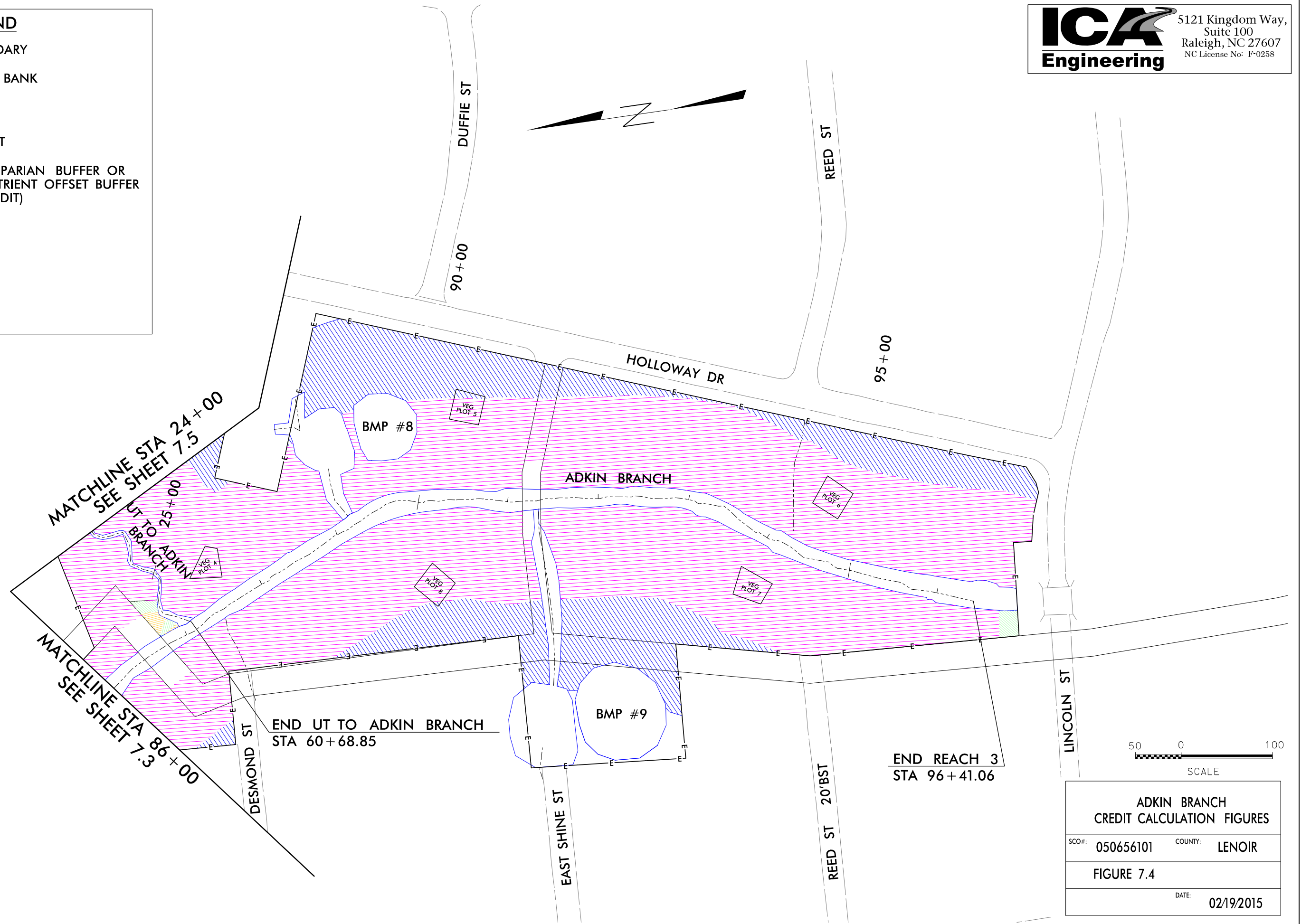
LEGEND	
	EASEMENT BOUNDARY
	AS-BUILT TOP OF BANK
	PEDESTRIAN BRIDGE
	SEWER EASEMENT
	VEGETATION PLOT
	<20' BUFFER (0 RIPARIAN BUFFER OR NUTRIENT OFFSET BUFFER CREDIT)
	20' - 29' BUFFER (75% CREDIT)
	30' - 100' BUFFER (100% CREDIT)
	101' - 200' BUFFER (50% CREDIT)



<b>ADKIN BRANCH CREDIT CALCULATION FIGURES</b>	
SCO#: 050656101	COUNTY: LENOIR
FIGURE 7.3	
DATE: 02/19/2015	

**LEGEND**

- E— EASEMENT BOUNDARY
- AS-BUILT TOP OF BANK
- SEWER EASEMENT
- VEGETATION PLOT
- ▨ < 20' BUFFER (0 RIPARIAN BUFFER OR NUTRIENT OFFSET BUFFER CREDIT)
- ▨ 20' – 29' BUFFER (75% CREDIT)
- ▨ 30' – 100' BUFFER (100% CREDIT)
- ▨ 101' – 200' BUFFER (50% CREDIT)

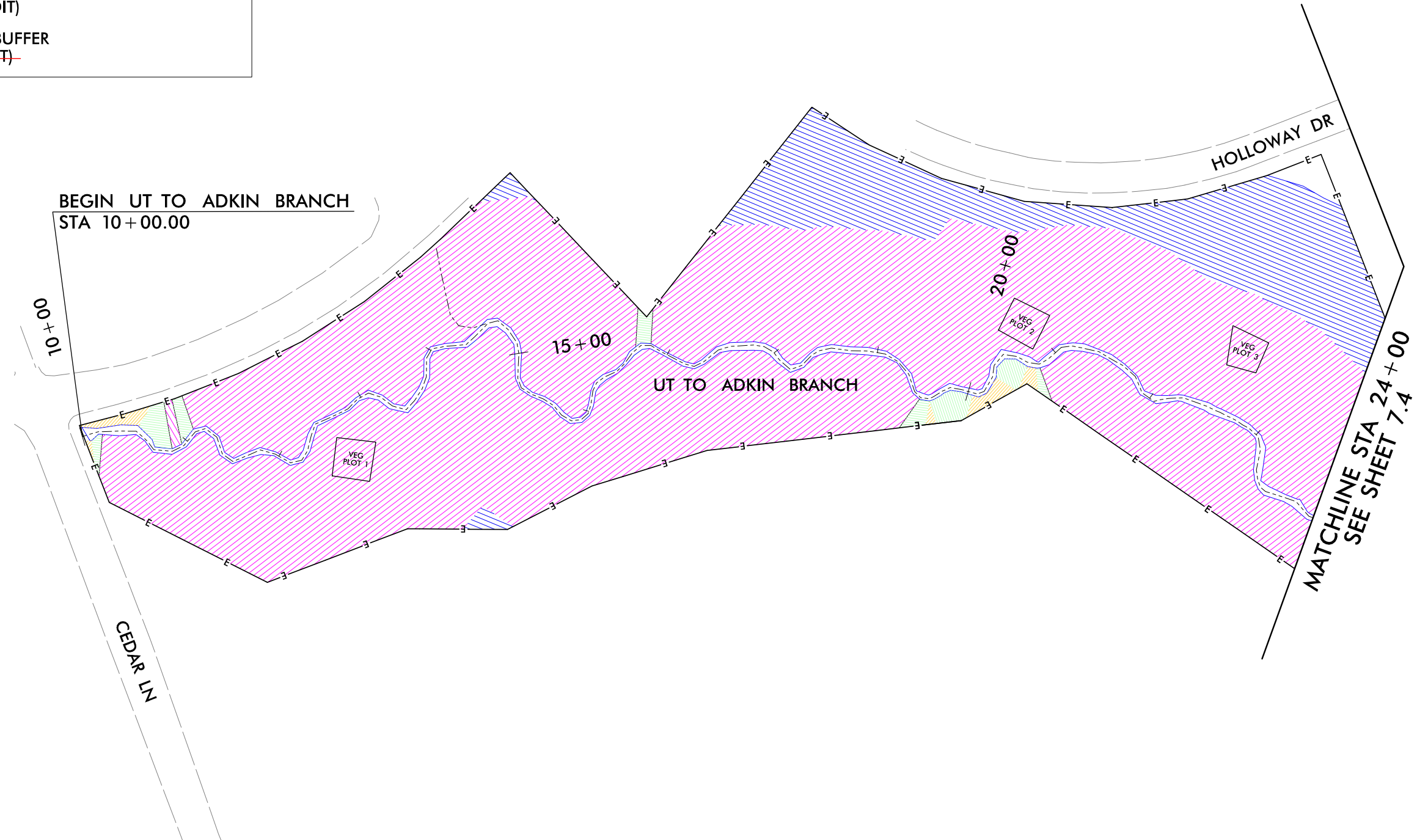
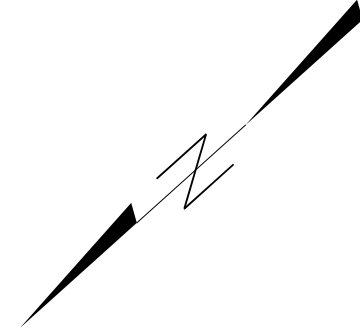


<b>ADKIN BRANCH CREDIT CALCULATION FIGURES</b>	
SCO#: 050656101	COUNTY: LENOIR
FIGURE 7.4	
DATE: 02/19/2015	



**LEGEND**

- E— EASEMENT BOUNDARY
- AS-BUILT TOP OF BANK
- SEWER EASEMENT
- VEGETATION PLOT
- ▨ <20' BUFFER (0 RIPARIAN BUFFER OR 0 CREDIT) NUTRIENT OFFSET BUFFER CREDIT
- ▨ 20' – 29' BUFFER (75% CREDIT)
- ▨ 30' – 100' BUFFER (100% CREDIT)
- ▨ 101' – 200' BUFFER (50% CREDIT)



<b>ADKIN BRANCH CREDIT CALCULATION FIGURES</b>	
SCO#: 050656101	COUNTY: LENOIR
FIGURE 7.5	
DATE: 02/19/2015	

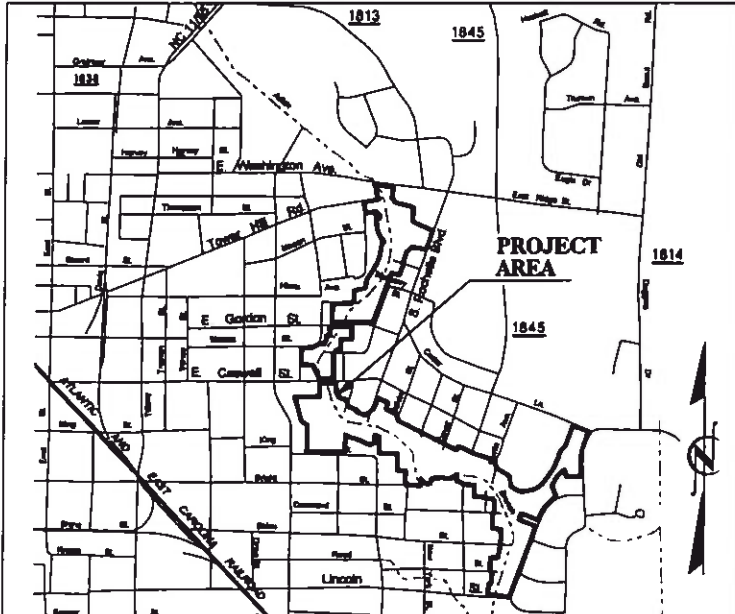
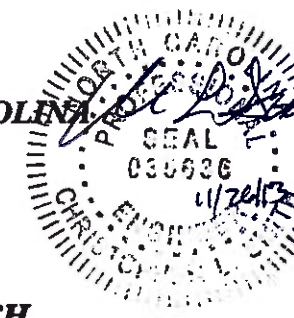
**Appendix G. Final Record Drawings**



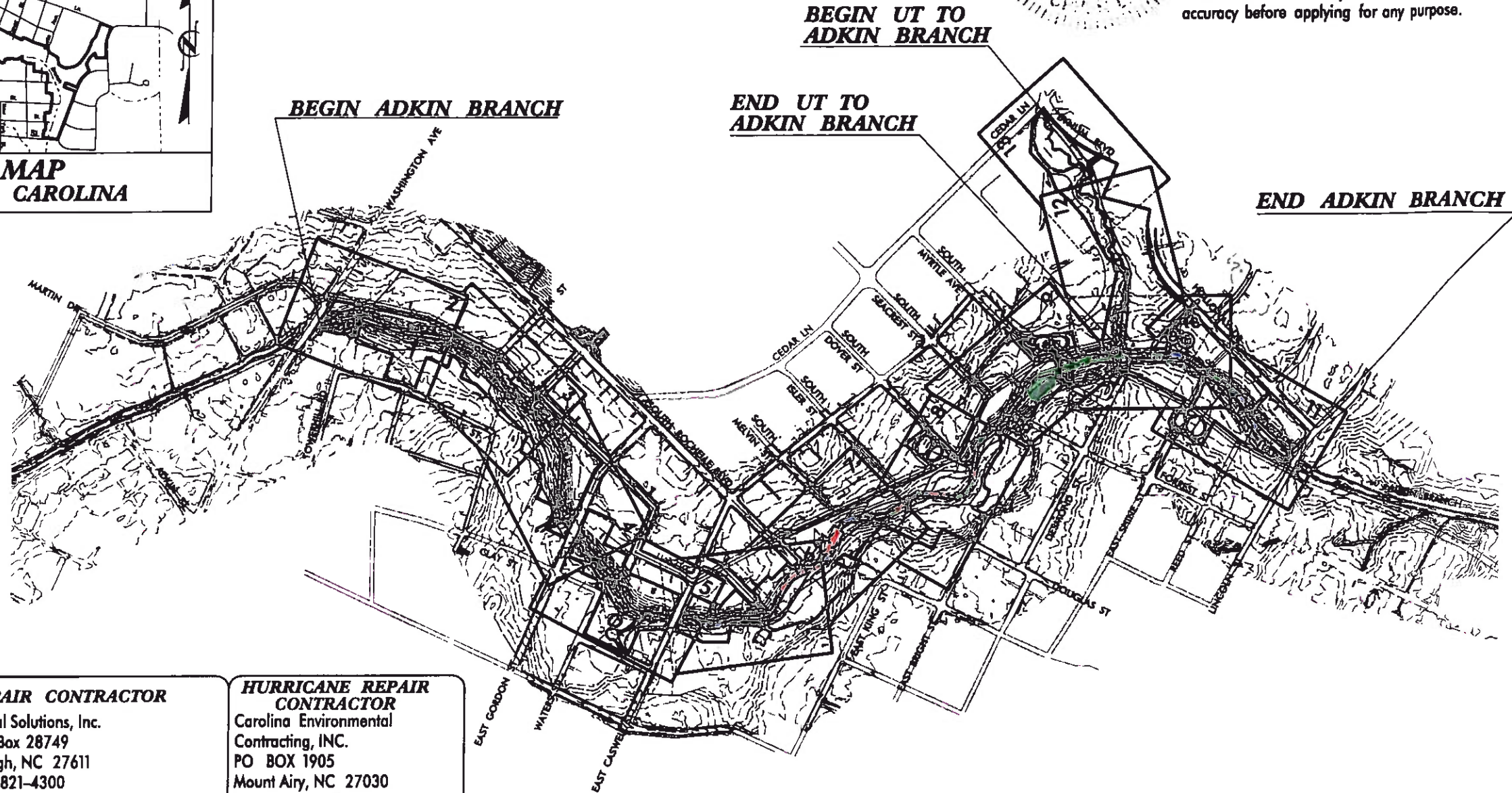
# ADKIN BRANCH STREAM RESTORATION RECORD DRAWINGS

**LOCATION: KINSTON (LENOIR COUNTY), NORTH CAROLINA**  
**LAT: 35°15'42.5" N      LONG: 77°33'55.6" W**

**RECORD DRAWINGS**  
This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.



**VICINITY MAP  
KINSTON, NORTH CAROLINA**

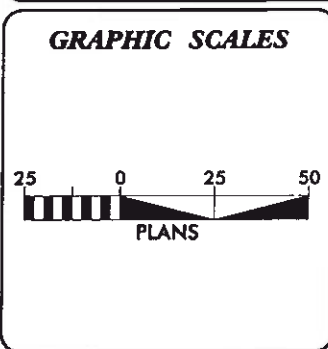


**ORIGINAL CONTRACTOR**  
Appalachian Environmental Services  
1165 W. Main Street  
Shya, NC 28779

**SURETY CONTRACTOR**  
Environmental Quality Resources, LLC  
1405 Benson Court, Suite C  
Arbutus, MD 21227  
(443) 304-3310

**REPAIR CONTRACTOR**  
Fluvial Solutions, Inc.  
PO Box 28749  
Raleigh, NC 27611  
(919) 821-4300

**HURRICANE REPAIR CONTRACTOR**  
Carolina Environmental Contracting, INC.  
PO BOX 1905  
Mount Airy, NC 27030  
(336) 320-3849



**INDEX OF SHEETS**

TITLE SHEET.....	1
PLAN SHEETS.....	2 - 13

**DISTURBED AREA = 49.86 Ac.**

PROJECT LENGTH		
EXISTING STREAM LENGTH	=	8,392 FT      1,200 FT
CONSTRUCTED STREAM LENGTH	=	5,922 FT      1,582 FT
<b>OWNER CONTACT:</b>		
KRISTIE CORSON EEP PROJECT MANAGER		
LIN XU REVIEW COORDINATOR		

Prepared In the Office of:

5121 Kingdom Way,  
Suite 100  
Raleigh, NC 27607  
NC License No: P-0258

---

**R. KEVIN WILLIAMS**  
PROJECT ENGINEER

---

**RYAN V. SMITH**  
PROJECT DESIGNER

11/26/2013  
P:\Constr\action\Combined\_Record\Drawings\AdkinBranch\adkin\_cr0\_psh.dgn  
Florence & Hutcheson, Inc.

**CONTRACT: ADKIN BRANCH      SCO: 050656101**

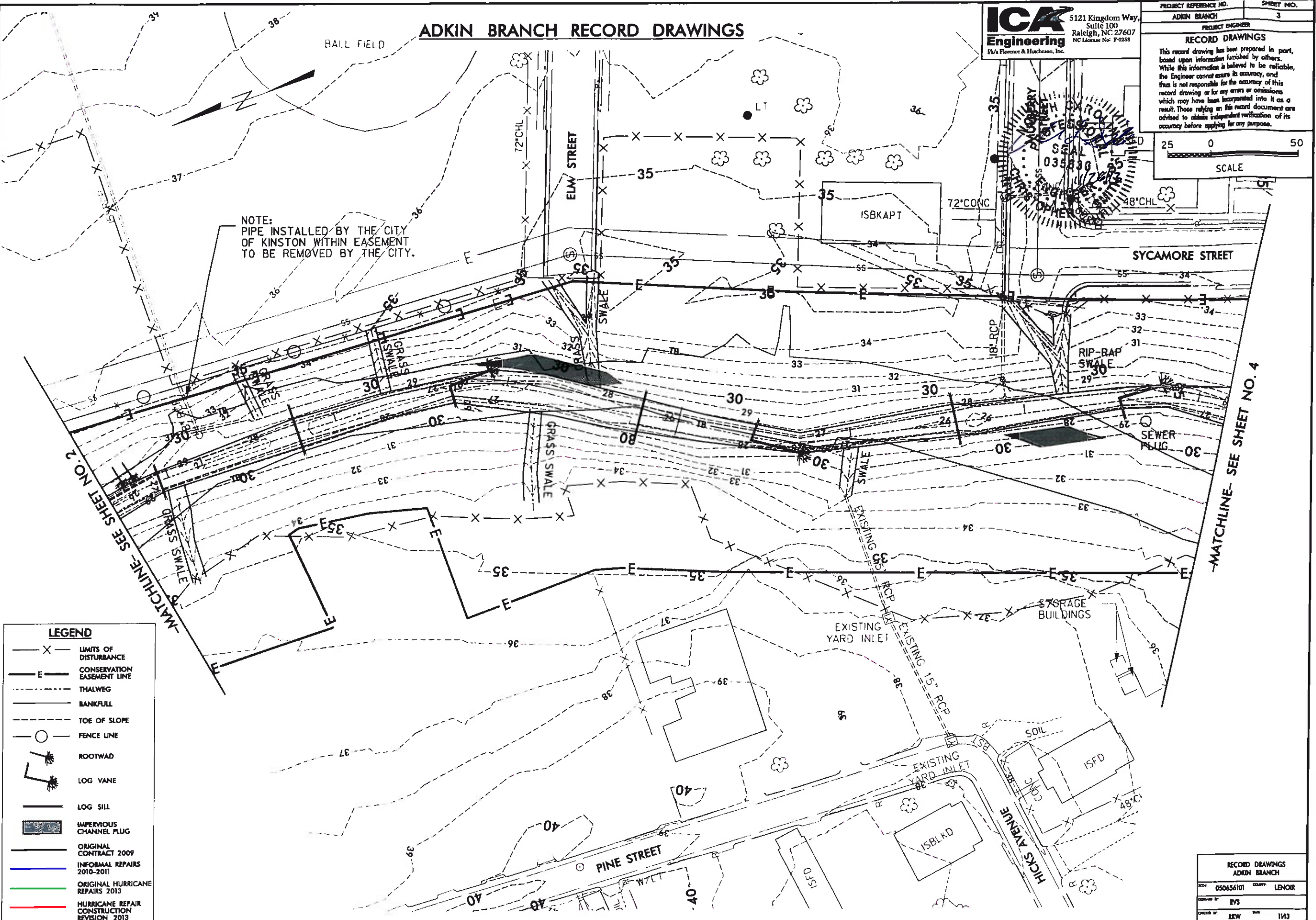


# ADKIN BRANCH RECORD DRAWINGS

**ICA Engineering**  
 5121 Kingdom Way,  
 Suite 100  
 Raleigh, NC 27607  
 NC License No: P-0258  
 D/A Florence & Hutchison, Inc.

PROJECT REFERENCE NO.	SHEET NO.
ADKIN BRANCH	3
PROJECT ENGINEER	
RECORD DRAWINGS	
This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.	
25 0 50 SCALE	

NOTE:  
 PIPE INSTALLED BY THE CITY OF KINSTON WITHIN EASEMENT TO BE REMOVED BY THE CITY.



**LEGEND**

- X — LIMITS OF DISTURBANCE
- E — CONSERVATION EASEMENT LINE
- THALWEG
- BANKFULL
- TOE OF SLOPE
- — FENCE LINE
- ROOTWAD
- LOG VANE
- LOG SILL
- IMPERVIOUS CHANNEL PLUG
- ORIGINAL CONTRACT 2009
- INFORMAL REPAIRS 2010-2011
- ORIGINAL HURRICANE REPAIRS 2013
- HURRICANE REPAIR CONSTRUCTION REVISION 2013

RECORD DRAWINGS	
ADKIN BRANCH	
NO. 050454101	REVISION LENCOR
DESIGNED BY RVS	
DRAWN BY BKW	DATE 11/13

11/26/2013 C:\Users\jcor\Documents\Record Drawings\AdkinBranch\AdkinBranch.dwg



# ADKIN BRANCH RECORD DRAWINGS

**ICA Engineering**  
 5121 Kingdom Way,  
 Suite 100  
 Raleigh, NC 27607  
 NC License No. P-6258

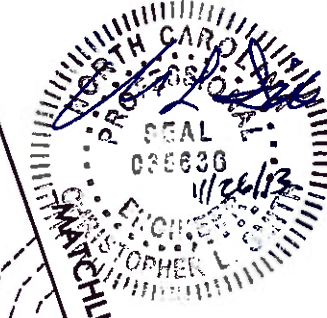
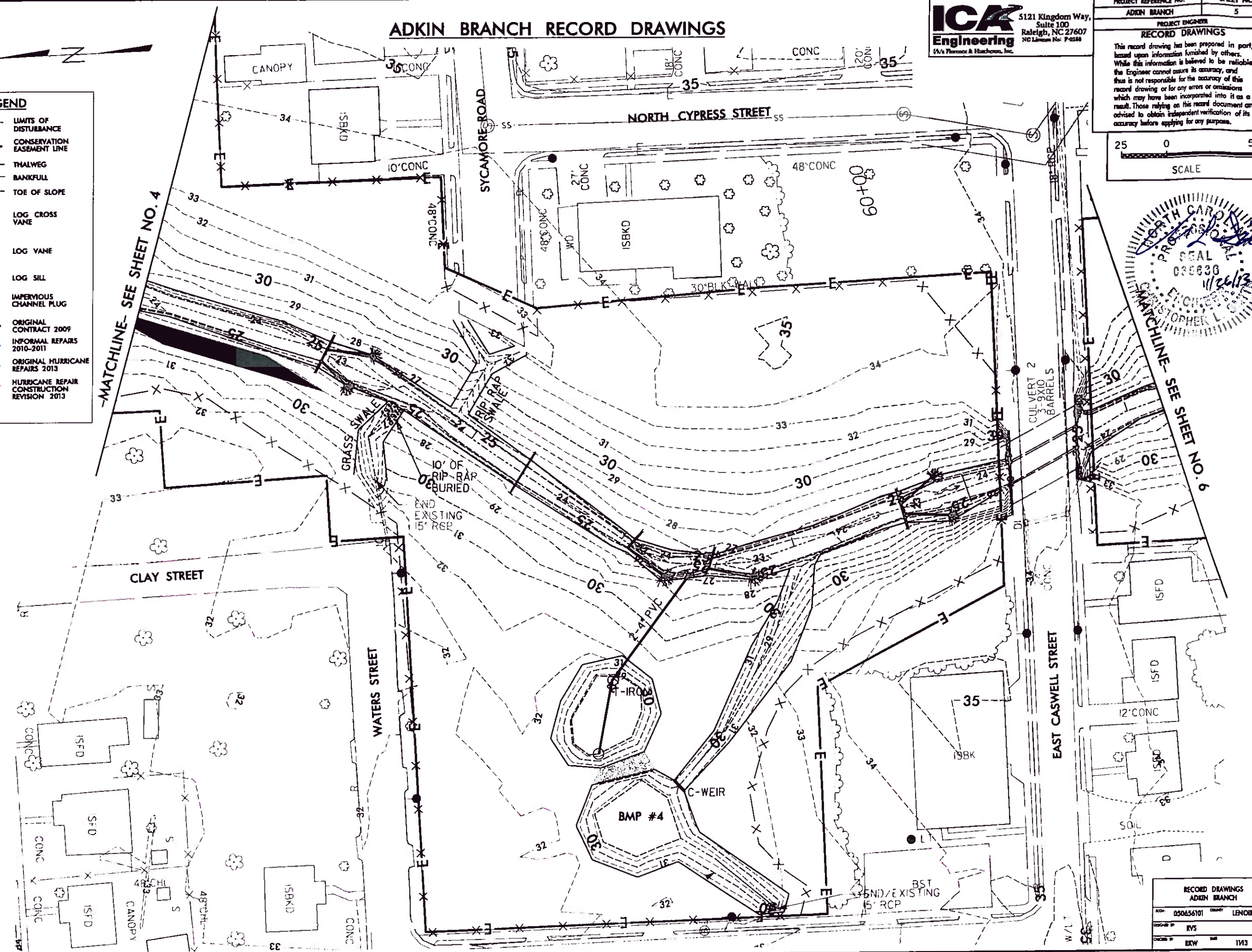
PROJECT REFERENCE NO. ADKIN BRANCH SHEET NO. 5

## RECORD DRAWINGS

This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.



LEGEND	
— X —	LIMITS OF DISTURBANCE
— E —	CONSERVATION EASEMENT LINE
---	THALWEG
---	BANKFULL
---	TOE OF SLOPE
— V —	LOG CROSS VANE
— V —	LOG VANE
— S —	LOG SILL
■	IMPERVIOUS CHANNEL PLUG
—	ORIGINAL CONTRACT 2009
—	INFORMAL REPAIRS 2010-2011
—	ORIGINAL HURRICANE REPAIRS 2013
—	HURRICANE REPAIR CONSTRUCTION REVISION 2013



MATCHLINE- SEE SHEET NO. 4

MATCHLINE- SEE SHEET NO. 6

1/26/2013 2:41 PM Construction\Combined Record Drawings\AdkinBranch.CRD\_pah\_5.dgn ICA Engineering, Inc.

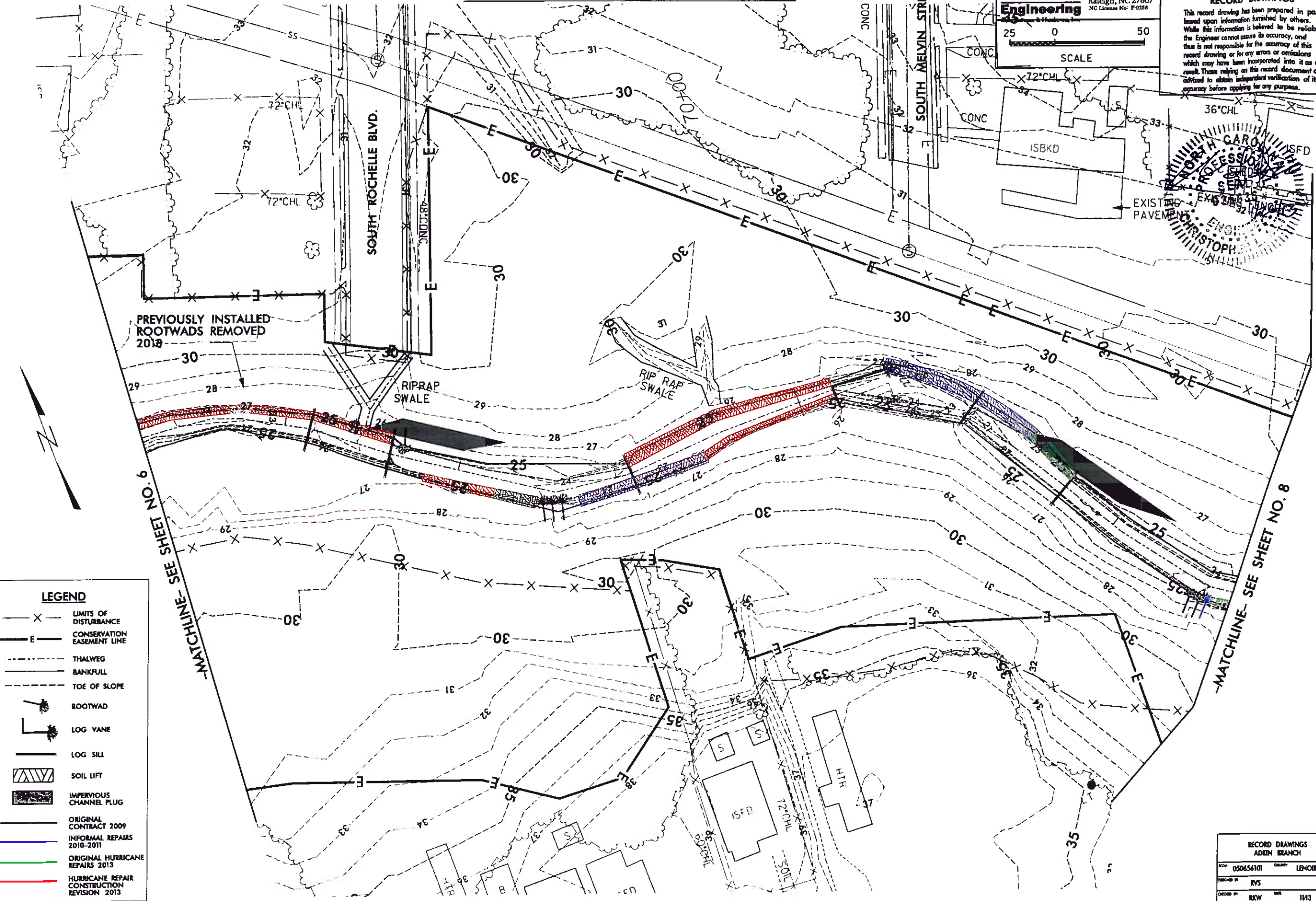
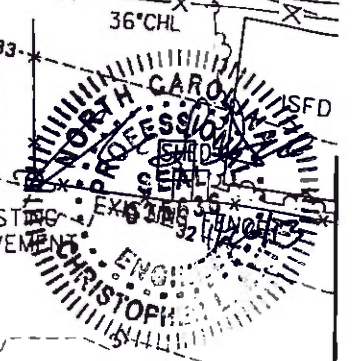
RECORD DRAWINGS	
ADKIN BRANCH	
NO. 050656101	DATE LENDER
DESIGNED BY RVS	
CHECKED BY BRW	DATE 1/13

# ADKIN BRANCH RECORD DRAWINGS

**ICA Engineering**  
 5121 Kingdom Way,  
 Suite 100  
 Raleigh, NC 27607  
 NC License No. P-0258

SCALE  
 25 0 50

PROJECT REFERENCE NO.	SHEET NO.
ADKIN BRANCH	7
PROJECT ENGINEER	
RECORD DRAWINGS	
This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.	



PREVIOUSLY INSTALLED  
 ROOTWADS REMOVED  
 2018

**LEGEND**

	LIMITS OF DISTURBANCE
	CONSERVATION EASEMENT LINE
	THALWEG
	BANKFULL
	TOE OF SLOPE
	ROOTWAD
	LOG VANE
	LOG SILL
	SOIL LIFT
	IMPERVIOUS CHANNEL PLUG
	ORIGINAL CONTRACT 2009
	INFORMAL REPAIRS 2010-2011
	ORIGINAL HURRICANE REPAIRS 2013
	HURRICANE REPAIR CONSTRUCTION REVISION 2013

MATCHLINE-SEE SHEET NO. 6

MATCHLINE-SEE SHEET NO. 8

K:\267\2013\Construction\Combined\_Record\_Drawings\AdkinBranch\_CRD\_psh\_7.dgn  
 Date: 11/13/13  
 Author: RJKW

RECORD DRAWINGS	
ADKIN BRANCH	
SCALE: 050656101	CITY: LENOR
DESIGNED BY: RYS	
DRAWN BY: RJKW	DATE: 11/13



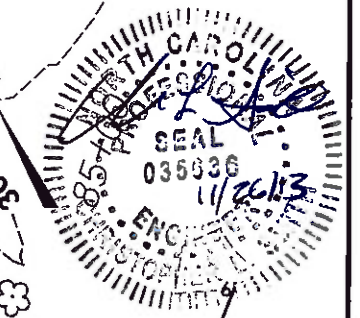
# ADKIN BRANCH RECORD DRAWINGS

**ICA Engineering**  
 5121 Kingdom Way,  
 Suite 100  
 Raleigh, NC 27607  
 NC License No: P-0268

PROJECT REFERENCE NO. SHEET NO.  
 ADKIN BRANCH 9

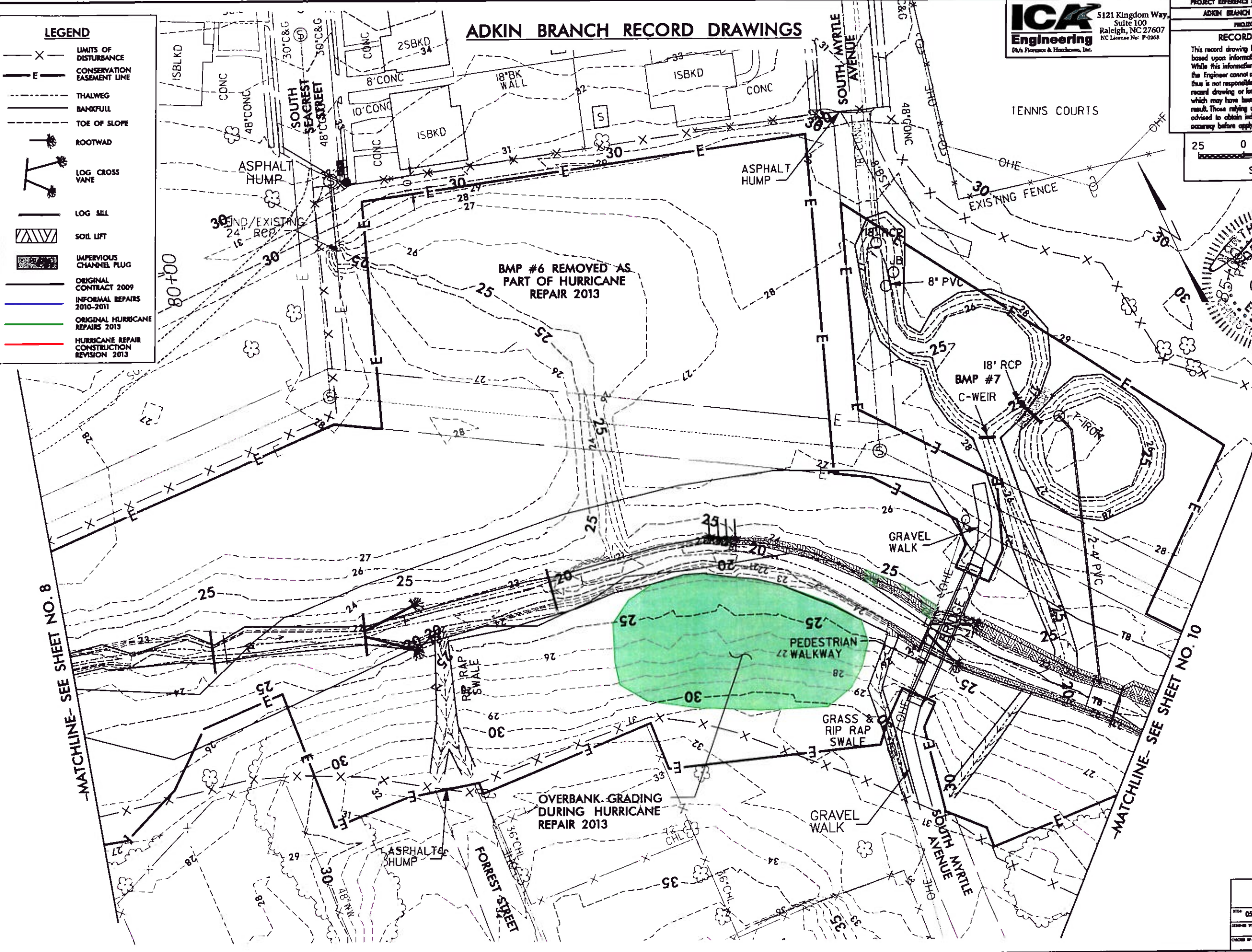
### RECORD DRAWINGS

This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.



**LEGEND**

- X LIMITS OF DISTURBANCE
- E CONSERVATION EASEMENT LINE
- - - THALWEG
- - - BANKFULL
- - - TOE OF SLOPE
- ROOTWAD
- LOG CROSS VANE
- LOG SILL
- SOIL LIFT
- IMPERVIOUS CHANNEL PLUG
- ORIGINAL CONTRACT 2009
- INFORMAL REPAIRS 2010-2011
- ORIGINAL HURRICANE REPAIRS 2013
- HURRICANE REPAIR CONSTRUCTION REVISION 2013



11/25/2013  
 Construction\Combined Record Drawings\AdkinBranch\_CRD\_psh\_9.dgn  
 ICA Engineering, Inc.

RECORD DRAWINGS	
ADKIN BRANCH	
DATE: 05/06/2010	DESIGNER: LENOR
DRAWN BY: RYS	
CHECKED BY: RKW	DATE: 11/13



# ADKIN BRANCH RECORD DRAWINGS

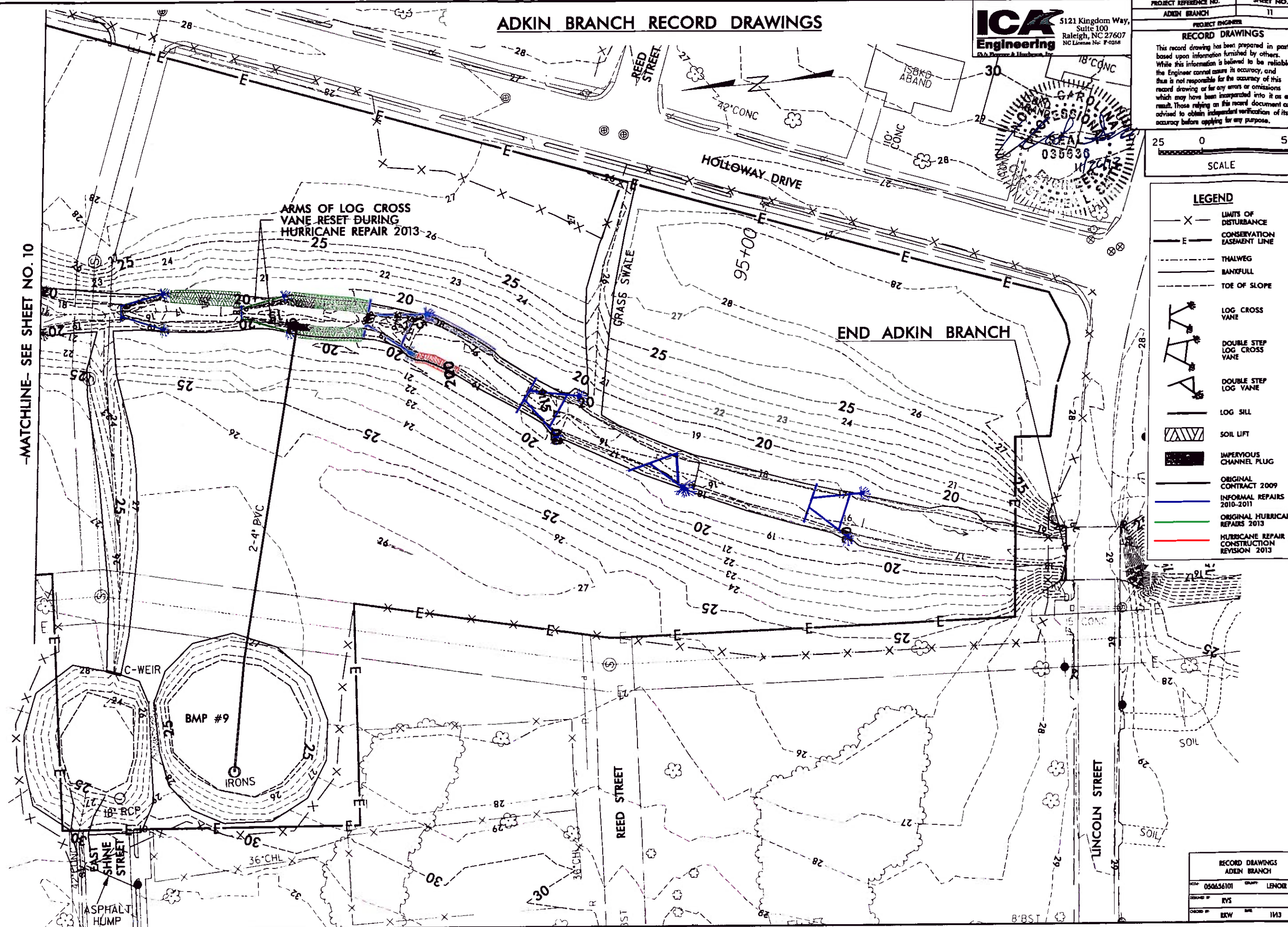
**ICA Engineering**  
 5121 Kingdom Way,  
 Suite 100  
 Raleigh, NC 27607  
 NC License No. F-0268

PROJECT REFERENCE NO.	SHEET NO.
ADKIN BRANCH	11
PROJECT ENGINEER	
RECORD DRAWINGS	
This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assume its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.	
 SCALE	

**LEGEND**

- LIMITS OF DISTURBANCE
- CONSERVATION EASEMENT LINE
- THALWEG
- BANKFULL
- TOE OF SLOPE
- LOG CROSS VANE
- DOUBLE STEP LOG CROSS VANE
- DOUBLE STEP LOG VANE
- LOG SILL
- SOIL LIFT
- IMPERVIOUS CHANNEL PLUG
- ORIGINAL CONTRACT 2009
- INFORMAL REPAIRS 2010-2011
- ORIGINAL HURRICANE REPAIRS 2013
- HURRICANE REPAIR CONSTRUCTION REVISION 2013

-MATCHLINE- SEE SHEET NO. 10



8/28/2013  
 License: 050656101  
 Location: C:\Users\lca\Documents\Record Drawings\AdkinBranch\adkin\_branch\_CRD\_psh\_11.dgn  
 File: adkin\_branch\_CRD\_psh\_11.dgn

RECORD DRAWINGS	
ADKIN BRANCH	
NO. 050656101	DATE: LENOIR
DESIGNED BY: RYS	
CHECKED BY: BJV	DATE: 1/13

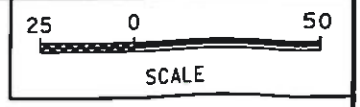


# ADKIN BRANCH RECORD DRAWINGS

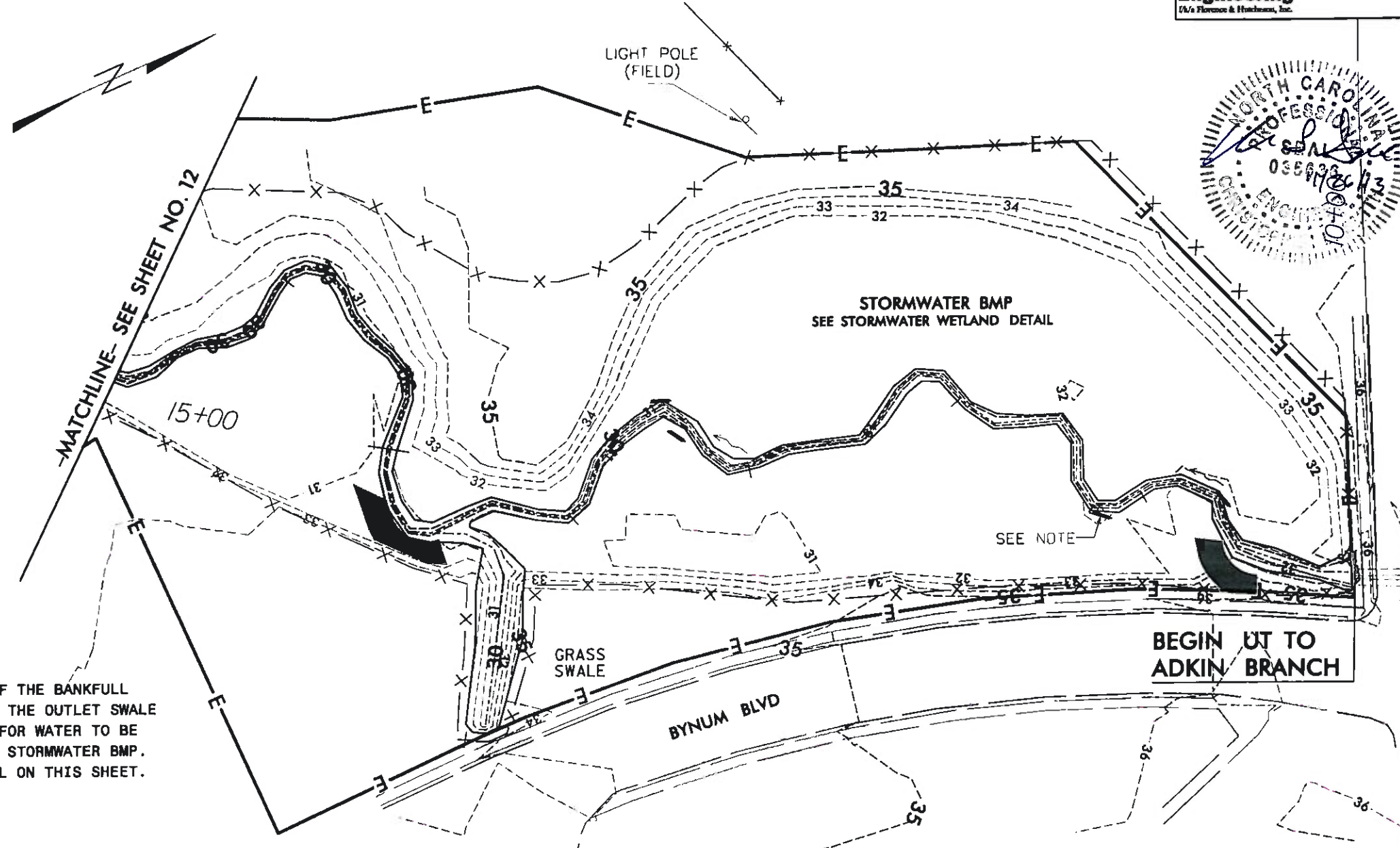
**ICA Engineering**  
 5121 Kingdom Way,  
 Suite 100  
 Raleigh, NC 27607  
 NC License No. P-0258  
 U/A Florence & Huchness, Inc.

PROJECT REFERENCE NO. ADKIN BRANCH SHEET NO. 13

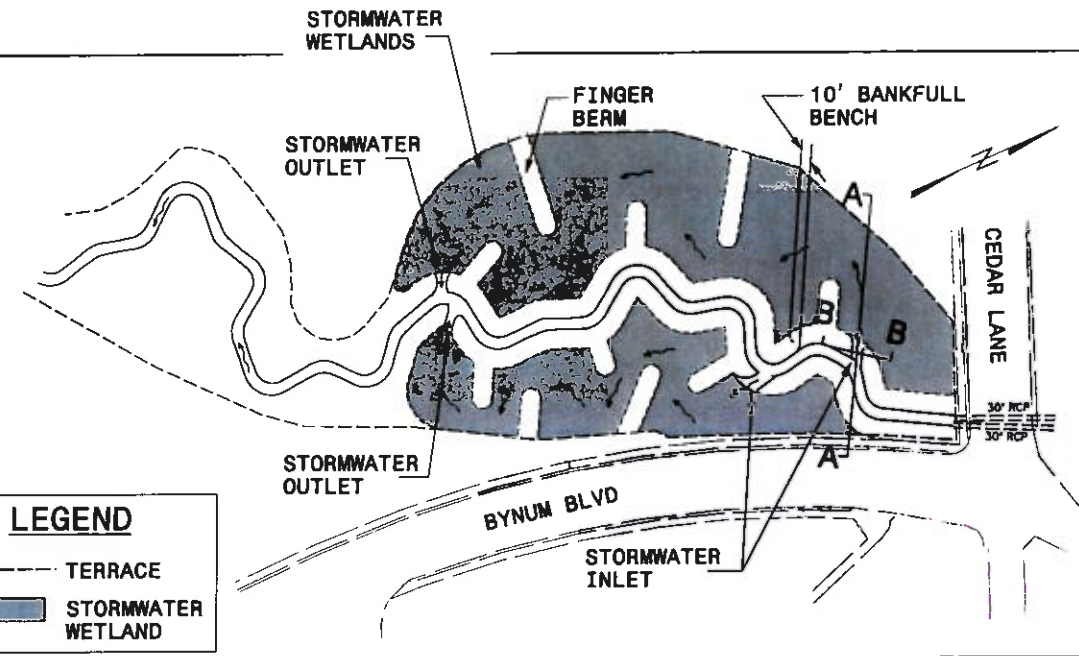
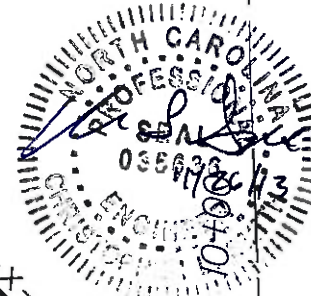
**RECORD DRAWINGS**  
 This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.



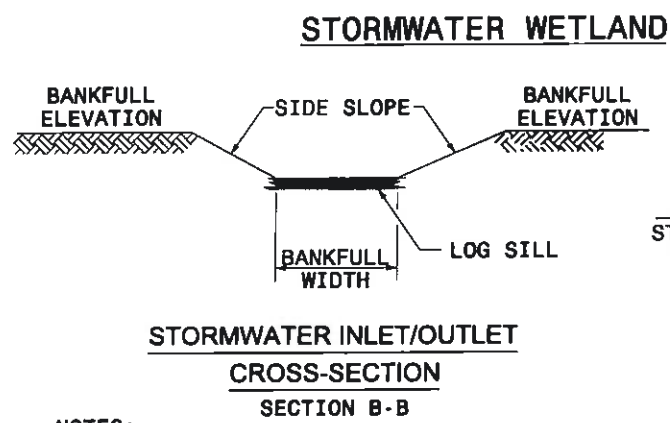
- LEGEND**
- X — LIMITS OF DISTURBANCE
  - E — CONSERVATION EASEMENT LINE
  - - - THALWEG
  - — — BANKFULL
  - - - TOE OF SLOPE
  - — — LOG SILL
  - IMPERVIOUS CHANNEL PLUG
  - ORIGINAL CONTRACT 2009
  - INFORMAL REPAIRS 2010-2011
  - ORIGINAL HURRICANE REPAIRS 2013
  - HURRICANE REPAIR CONSTRUCTION REVISION 2013



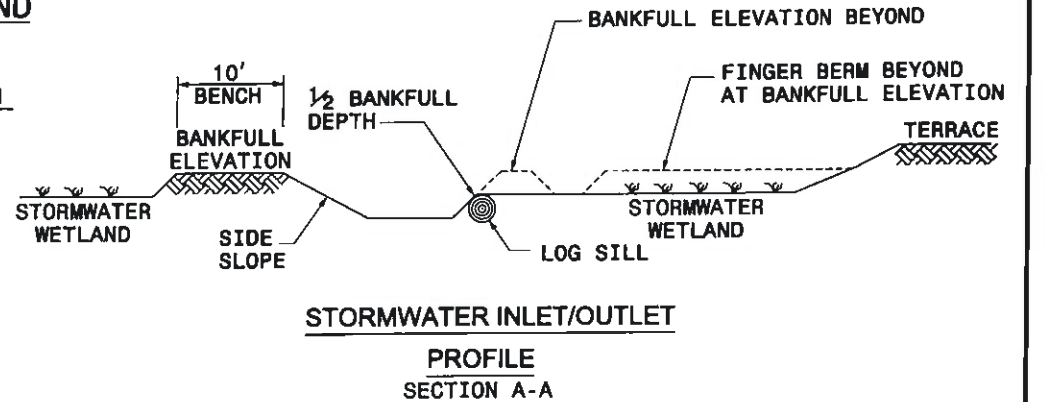
**NOTE:**  
 LOG SILLS PLACED OUTSIDE OF THE BANKFULL CHANNEL MAINTAIN GRADE FOR THE OUTLET SWALE AT HALF BANKFULL TO ALLOW FOR WATER TO BE DISTRIBUTED THROUGHOUT THE STORMWATER BMP. SEE THE CONSTRUCTION DETAIL ON THIS SHEET.



- LEGEND**
- - - TERRACE
  - STORMWATER WETLAND



- NOTES:**
1. INVERT SET AT 1/2 BANKFULL DEPTH.
  2. LOG SILL SET AT INVERT TO PROTECT FROM SCOUR.
  3. BASE WIDTH SHALL BE 1/2 BANKFULL CHANNEL BASE WIDTH. SIDE SLOPES SHALL BE BUILT AT A 3:1 SLOPE.



- NOTES:**
1. STORMWATER WETLAND'S ELEVATION SHALL BE SET AT 1/2 THE BANKFULL DEPTH UP FROM CHANNEL INVERT.

RECORD DRAWINGS	
ADKIN BRANCH	
DATE: 05/05/10	SCALE: LENOR
DESIGNED BY: RYS	
CHECKED BY: NKW	DATE: 1/13

K:\26\2013\Construction\Combined\_Record\_Drawings\AdkinBranch\_CRD\_psh\_13.dgn  
 ICA Engineering, Inc.