AS-BUILT MITIGATION PLAN
CANE CREEK RESTORATION SITE
RUTHERFORD COUNTY, NORTH CAROLINA

(CONTRACT #16-D06027-E)
FULL DELIVERY PROJECT
BROAD RIVER BASIN
CATALOGING UNIT 03050105

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
RALEIGH, NORTH CAROLINA

Prepared by:

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation

And

Axiom Environmental, Inc.

Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604

Axiom Environmental, Inc.
2126 Rowland Pond Drive
Willow Springs, North Carolina 27592

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CANE CREEK STREAM AND WETLAND RESTORATION SITE
AS-BUILT MITIGATION PLAN
RUTHERFORD COUNTY

EXECUTIVE SUMMARY

Restoration Systems, L.L.C. (Restoration Systems) has completed restoration of streams and wetlands at the Cane Creek Stream and Wetland Restoration Site (hereafter referred to as the "Site") to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling stream and wetland mitigation goals. The Site, located in north Rutherford County less than 0.2 mile south of the Rutherford/McDowell County line along the eastern edge of Highway 64, will provide 6748 stream mitigation units, 4.4 riverine wetland mitigation units, and 5.0 riverine wetland mitigation units. The Site is located in United States Geological Survey (USGS) Hydrologic Unit (HU) 03050105060020 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-08-02) of the Broad River Basin and will service the USGS 8-digit Cataloging Unit (CU) 03050105. The Site is not located in a Targeted Local Watershed.

A Detailed Stream and Wetland Restoration Plan was completed for the Site in May 2007. The plan outlined methods to complete stream and wetland restoration activities at the Site. An approximately 43.5-acre conservation easement was placed on the Site to incorporate all restoration activities. The Site contains 9.4 acres of hydric soil, Cane Creek, three unnamed tributaries to Cane Creek, and adjacent floodplains. An undisturbed preservation reach located on the upper extents of Tributary 1 within the Site was utilized as the reference reach. Prior to implementation, the Site was characterized by agricultural land utilized primarily for row crop and hay production. Riparian vegetation adjacent to Site streams was sparse and disturbed due to plowing and regular maintenance, and row crop areas were subject to broadcast application of various agricultural chemicals.

Restoration, enhancement, and preservation of Site streams and wetlands will result in positive benefits for water quality and biological diversity in the Cane Creek watershed. Targeted mitigation efforts focused on improving water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat and were accomplished by:

1. Removing nonpoint and point sources of pollution associated with agricultural practices including a) cessation of broadcasting fertilizer, pesticides, and other agricultural chemicals into and adjacent to the Site and b) provide a forested riparian buffer to treat surface runoff.
2. Reducing sedimentation within onsite and downstream receiving waters by a) reducing bank erosion associated with vegetation maintenance and agricultural plowing up to Site streams, and b) planting a forested riparian buffer adjacent to Site streams.
3. Reestablishing stream stability and the capacity to transport watershed flows and sediment loads by restoring a stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
4. Promoting floodwater attenuation by a) reconnecting bankfull stream flows to the abandoned floodplain terrace; b) restoring secondary, dredged, straightened, and entrenched tributaries, thereby reducing floodwater velocities within smaller catchment basins; and c) revegetating Site floodplains to increase frictional resistance on floodwaters.
5. Restoring onsite wetlands, thereby promoting flood storage, nutrient cycling, and aquatic wildlife habitat.
6. Improving aquatic habitat with bed variability and the use of in-stream structures.

7. Providing a terrestrial wildlife corridor and refuge in an area that is developed for agricultural and timber production.
8. Providing connectivity to a State Nature Preserve northeast of the Site.
9. Providing approximately 4.4 riverine WMUs.
10. Providing approximately 5.0 nonriverine WMUs.
11. Providing approximately 6748 SMUs.

As constructed, the Site restored historic stream and wetland functions, which existed onsite prior to channel straightening and dredging, agricultural impacts, and vegetation removal. Stream construction of meandering, E-type stream channel resulted in 4600 linear feet of stream restoration, 5078 linear feet of stream enhancement (level II), 1506 linear feet of stream preservation, 4.4 acres of riverine wetland restoration, and 5.0 acres of nonriverine wetland restoration.

TABLE OF CONTENTS

TABLES

APPENDICES

FIGURES and SHEETS

CANE CREEK STREAM AND WETLAND RESTORATION SITE
AS-BUILT MITIGATION PLAN
RUTHERFORD COUNTY

1.0 INTRODUCTION

Restoration Systems, L.L.C. (Restoration Systems) has completed restoration of streams and wetlands at the Cane Creek Stream and Wetland Restoration Site (hereafter referred to as the "Site") to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling stream and wetland mitigation goals. The Site, located in north Rutherford County less than 0.2 mile south of the Rutherford/McDowell County line along the eastern edge of Highway 64, will provide 6748 stream mitigation units, 4.4 riverine wetland mitigation units, and 5.0 riverine wetland mitigation units (Figure 1, Appendix A). The Site is located in United States Geological Survey (USGS) Hydrologic Unit (HU) 03050105060020 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-08-02) of the Broad River Basin and will service the USGS 8-digit Cataloging Unit (CU) 03050105 (Figure 2, Appendix A). The Site is not located in a Targeted Local Watershed (NCWRP 2003).

A Detailed Stream and Wetland Restoration Plan was completed for the Site in May 2007. The plan outlined methods to complete stream and wetland restoration activities at the Site. An approximately 43.5-acre conservation easement was placed on the Site to incorporate all restoration activities. The Site contains 9.4 acres of hydric soil, Cane Creek, three unnamed tributaries to Cane Creek, and adjacent floodplains, which represent the primary hydrologic features of the Site. The drainage basin size is approximately 8.7 square miles at the Site outfall. The Site watershed is characterized by forest, agricultural land, and sparse industrial/residential development; less than five percent of the upstream watershed is composed of impervious surface. An undisturbed preservation reach located on the upper extents of Tributary 1 within the Site was utilized as the reference reach.

Prior to implementation the Site was characterized by agricultural land utilized primarily for row crop and hay production (Figure 3, Appendix A). Riparian vegetation adjacent to Site streams was sparse and disturbed due to plowing and regular maintenance, and row crop areas were subject to broadcast application of various agricultural chemicals. In addition, stream channels had been straightened and dredged. These factors resulted in degraded water quality, unstable channel characteristics (stream entrenchment, erosion, and bank collapse), and decreased wetland function.

The following objectives were proposed to provide mitigation credit requested under the EEP Request For Proposal (RFP) #16-D06027 dated October 26, 2005.

- Provide 6748 stream mitigation units (SMUs)
- Provide 4.4 riverine wetland mitigation units (Riverine WMUs)
- Provide 5.0 nonriverine wetland mitigation units (Nonriverin WMUs)
- Reforest approximately 30.0 acres of the Site with native forest species.

Restoration, enhancement, and preservation of Site streams and wetlands will result in positive benefits for water quality and biological diversity in the Cane Creek watershed. Targeted mitigation efforts focused on improving water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat and were accomplished by:

1. Removing nonpoint and point sources of pollution associated with agricultural practices including a) cessation of broadcasting fertilizer, pesticides, and other agricultural chemicals into and adjacent to the Site and b) provide a forested riparian buffer to treat surface runoff.
2. Reducing sedimentation within onsite and downstream receiving waters by a) reducing bank erosion associated with vegetation maintenance and agricultural plowing up to Site streams, and b) planting a forested riparian buffer adjacent to Site streams.
3. Reestablising stream stability and the capacity to transport watershed flows and sediment loads by restoring a stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
4. Promoting floodwater attenuation by a) reconnecting bankfull stream flows to the abandoned floodplain terrace; b) restoring secondary, dredged, straightened, and entrenched tributaries, thereby reducing floodwater velocities within smaller catchment basins; and c) revegetating Site floodplains to increase frictional resistance on floodwaters.
5. Restoring onsite wetlands, thereby promoting flood storage, nutrient cycling, and aquatic wildlife habitat.
6. Improving aquatic habitat with bed variability and the use of in-stream structures.
7. Providing a terrestrial wildlife corridor and refuge in an area that is developed for agricultural and timber production.
8. Providing connectivity to a State Nature Preserve northeast of the Site.
9. Providing approximately 4.4 riverine WMUs.
10. Providing approximately 5.0 nonriverine WMUs.
11. Providing approximately 6748 SMUs.

As constructed, the Site restored historic stream and wetland functions, which existed onsite prior to channel straightening and dredging, agricultural impacts, and vegetation removal. Stream construction of meandering, E-type stream channel resulted in 4600 linear feet of stream restoration, 5078 linear feet of stream enhancement (level II), 1506 linear feet of stream preservation, 4.4 acres of riverine wetland restoration, and 5.0 acres of nonriverine wetland restoration.

2.0 SUMMARY

2.1 Preconstruction Conditions

Prior to construction, the majority of the Site was utilized for row crop and hay production (Figure 3, Appendix A). In order to maximize useable field acreage streams were channelized and riparian vegetation was removed. Site streams were subject to contamination from the broadcast application of agricultural chemicals. The agricultural practices of the Site were contributory factors to degraded water quality, unstable channel characteristics (stream entrenchment, erosion, and bank collapse), and decreased wetland function.

Streams

The Site encompasses Cane Creek and three unnamed tributary to Cane Creek (Tributaries 1-3) as well as the adjacent floodplain and hydric soils. The tributaries converge with Cane Creek onsite and drain an approximately 8.7-square mile watershed at the Site outfall. Cane Creek is a fourth-order, bank-to-bank stream system characterized by eroding banks, excessive sediment transport, and a disturbed riparian buffer. Three unnamed tributaries to Cane Creek (Tributaries 1-3) are first- and second-order streams that had been dredged, straightened, and rerouted within the Site.

Hydric Soils

Hydric soil limits were mapped in the field during January 2007 by a Licensed Soil Scientist and encompassed 9.4 acres of the Site. Wetland restoration areas of the Site are underlain by hydric Wehadkee soils (inclusions within areas mapped as the Chewacla soil series). Based on field surveys and groundwater models, jurisdictional wetlands had been significantly disturbed by compaction due to agricultural practices; relocation, dredging, straightening, and rerouting of Site streams; ditching of fields; and removal of vegetation and were effectively drained below jurisdictional wetland hydrology thresholds.

Areas of the Site targeted for riverine wetland restoration will receive hydrological inputs from periodic overbank flooding of the restored tributaries, groundwater migration into the wetlands, upland/stormwater runoff, and, to a lesser extent, direct precipitation.

Hydrology of areas targeted for nonriverine wetland restoration occur outside of the restored tributary floodplains and will primarily be driven by precipitation with additional inputs from upland/stormwater runoff and slope seepage. Cane Creek is a controlled flow stream; the existing Cane Creek floodplain is acting as a terrace; therefore, Cane Creek will not provide hydrological input to these areas.

Plant Communities

Distribution and composition of plant communities reflected landscape-level variations in topography, soils, hydrology, and past or present land use practices. The Site was characterized primarily by agricultural land that was regularly maintained and plowed for row crops and hay, leaving soils disturbed and exposed to the edges of Site stream banks. Riparian vegetation adjacent to Site streams was predominantly disturbed.

Drainage Area

This hydrophysiographic region is considered characteristic of the Eastern Blue Ridge Foothills ecoregion of North Carolina. The region is characterized by low mountains and rolling foothills, gently rounded to steep slopes, and moderate gradient streams with bedrock, boulder, cobble, and gravel substrates (Griffith 2002). The Site occurs within USGS 14-digit HU 03050105060020 (NCDWQ Subbasin 03-08-02) of the Broad River

The Site drainage area encompasses approximately 8.7 square miles of land at the downstream Site outfall. The upstream watershed is dominated by forest, agricultural land, and sparse industrial/residential development. Cane Creek and its tributaries have been assigned Stream Index Number 9-41-12-(0.3), a Best Usage Classification of **WS-V**, and is fully supporting its intended uses (NCDWQ 2005).

2.2 Project History

On June 16, 2006, the EEP entered into a contract with Restoration Systems to restore the Site. A Detailed Stream and Wetland Restoration Plan was completed for the project in May 2007. Upon completion of the detailed plan, construction schematics were developed and construction was initiated in January 2008. Backwater Environmental completed earthwork and grading at the Site in April 2008. Carolina Silvics planted the Site during March and April 2008.

Information on project managers, owners, and contractors follows:

Owner Information
Restoration Systems, LLC
George Howard and John Preyer
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
(919) 755-9490

Planting Contractor Information
Carolina Silvics
Dwight McKinney
908 Indian Trail Road
Edenton, North Carolina 27932
(919) 523-4375

Designer Information
Axiom Environmental, Inc.
W. Grant Lewis
2126 Rowland Pond Drive
Willow Spring, North Carolina 27592
(919) 215-1693

Earthwork Contractor Information
Backwater Environmental
Wes Newell
PO Box 1654
Pittsboro, North Carolina 27312
(919) 523-4375

3.0 RESTORATION ACTIVITIES

Primary activities at the Site included 1) stream restoration, 2) stream enhancement, 3) stream preservation, 4) wetland restoration, 5) soil scarification, and 6) plant community restoration. Restoration plans constructed 4600 linear feet of stream, enhanced (level II) 5078 linear feet of stream, preserved 1506 linear feet of stream, restored 4.4 acres of riverine wetland, and restored 5.0 acres of nonriverine wetland. In total the Site provides 6748 SMUs, 4.4 riverine WMUs, and 5.0 nonriverine WMUs (Sheets 1-8, Appendix A).

3.1 Stream Restoration

Tributaries 1-3 are located within a floodplain suitable for design channel excavation on new location. The streams were constructed on new location and the old dredged, straightened, and rerouted channels were abandoned and backfilled. Primary activities designed to restore the channels on new location included 1) belt-width preparation and grading, 2) floodplain bench excavation, 3) channel excavation, 4) installation of channel plugs, 5) backfilling of the abandoned channel, and 6) installation of in-stream structures.

3.1.1 Belt-width Preparation and Grading

The belt-width was prepared and graded; material excavated during grading was stockpiled immediately adjacent to channel segments to be abandoned and backfilled. These segments were backfilled after stream diversion was completed. After preparation of the corridor, the design channel and updated profile survey was developed and the location of each meander wavelength plotted and staked along the profile.

3.1.2 Floodplain Bench Excavation

A bankfull, floodplain bench was created to 1) remove eroding material and collapsing banks, 2) promote overbank flooding during bankfull flood events, 3) reduce the erosive potential of flood waters, and 4) increase the width of the active floodplain. Bankfull benches were created by excavating the adjacent floodplain to bankfull elevations or filling eroded/abandoned channel areas with suitable material. After excavation, or filling of the bench, a relatively level floodplain surface was stabilized with suitable erosion control measures. Planting of the bench with native floodplain vegetation occurred to reduce erosion of bench sediments, reduce flow velocities in flood waters, filter pollutants, and provide wildlife habitat.

3.1.3 Channel Excavation

The channel was constructed within the range of values depicted in the May 2007 Detailed Restoration Plan for the Site.

The stream banks and local belt-width area of constructed channels were planted with shrub and herbaceous vegetation. Deposition of shrub and woody debris into and/or overhanging the constructed channel was encouraged.

Particular attention was directed toward providing vegetative cover and root growth along the outer bends of each stream meander. Live willow stake revetments, available root mats, and/or biodegradable, erosion-control matting were embedded into the break-in-slope to promote more rapid development of an overhanging bank.

3.1.4 Channel Plugs

Impermeable plugs were installed along abandoned channel segments. The plugs consist of low-permeability materials designed to be of sufficient strength to withstand the erosive energy of surface flow events across the Site. Dense clays imported from off-site and existing material, compacted within the channel, were used for plug construction. The plugs were of sufficient width and depth to form an imbedded overlap in the existing banks and channel bed.

The design channel passed through several coarse alluvial lenses which piped flow away from the channel into the surrounding floodplain. Particularly vunerable areas included footers for structures which were installed deep within the floodplain substrate. Loosing reaches of channel were overexcavated, backfilled with impermeable material, and graded to proposed channel dimensions.

3.1.5 Channel Backfilling

After impermeable plugs were installed, the abandoned channels were backfilled. Backfilling was performed primarily by pushing stockpiled materials into the channel. The channels were filled to the extent that onsite material was available and compacted to maximize microtopographic variability, including ruts, ephemeral pools, and hummocks in the vicinity of the backfilled channel.

Borrow material was generated through excavation of groundwater storage depressions throughout the Site landscape. The primary purpose of these depressions was to provide suitable, low permeability material for ditch plugs and backfilling, to increase water storage potential within the wetland restoration area, and to increase potential for biological diversity within the complex.

3.1.6 In-Stream Structures

In-stream structures were used within the Site for bank stabilization, grade control, and habitat improvement. This included the installation of two J-hook vanes, six log vanes, two rock cross-vanes, three step-pool structures, and ten A-vanes (Figures 4A-4B, Appendix A).

<u>J-hook Vanes/Log Vanes</u>

J-hook vanes and log vanes were used to direct high velocity flows during bankfull events towards the center of the channel. J-hook vanes were constructed of boulders approximately 24 inches in minimum width. J-hook vane construction was initiated by imbedding footer rocks into the stream bed for stability to prevent undercutting of the structure. Header rocks were then placed atop the footer rocks at the design elevation. Footer and header rocks create an arm that slopes from the center of the channel upward at approximately 7 to 10 degrees, tying in at the bankfull floodplain elevation. Once the header and footer stones were in place, filter fabric was buried into a trench excavated around the upstream side of the J-hook vane arm. The filter fabric was then draped over the header rocks to force water over the vane. The upstream side of the structure was backfilled with suitable material to the elevation of the header stones.

Log vanes were constructed utilizing large tree trunks harvested from the Site. The tree stems harvested for log cross-vane arms were long enough to be imbedded into the stream channel and extend several feet into the floodplain. Logs create an arm that slopes from the center of the channel upward at approximately 5 to 7 degrees, tying in at the bankfull floodplain elevation. Logs extend from each stream bank at an angle of 20 to 30 degrees. A trench was dug into the stream channel that was deep enough for the head of the log to be at or below the channel invert. The trench was then extended into the floodplain and the log was set into the trench such that the log arm was below the floodplain elevation. Once the vane was in place, filter fabric was toed into a trench on the upstream side of the vane and draped over the structure to force water over the vane. The upstream side of the structure was then backfilled with suitable material.

Rock Cross-vanes

Rock cross-vanes were installed in the channel to 1) sustain bank stability, 2) direct high velocity flows during bankfull events toward the center of the channel, 3) maintain average pool depths throughout the reach, 4) preserve water surface elevations and reconnect bankfull stream flows with the adjacent floodplains, and 5) modify energy distributions through increases in channel roughness and local energy slopes during peak flows.

Rock cross-vanes were constructed of boulders approximately 24 inches in minimum width. Rock cross-vane construction was initiated by imbedding footer rocks into the stream bed for stability to prevent undercutting of the structure. Header rocks were then placed atop the footer rocks at the design elevation. Footer and header rocks create an arm that slopes from the center of the channel upward at approximately 7 to 10 degrees, tying in at the bankfull floodplain elevation. The cross-vane arms at both banks were tied into the bank with a sill to eliminate the possibility of water diverting around the structure. Once the header and footer stones were in place, filter fabric was buried into a trench excavated around the upstream side of the vane arms. The filter fabric was then draped over the header rocks to force water over the vane. The upstream side of the structure was backfilled with suitable material to the elevation of the header stones.

Step-Pool Structures/A-vanes

Step-pool structures and A-vanes were constructed to 1) sustain bank stability, 2) direct high velocity flows during bankfull events toward the center of the channel, 3) preserve water surface elevations and reconnect bankfull stream flows with the adjacent floodplains, and 4) modify energy distributions in steeper stream reaches through increases in channel roughness and local energy slopes during peak flows. Step-pool structures were installed at Tributaries 1-3 outfalls to Cane Creek to lower hydrology to the elevation of Cane Creek. Step-pool structures and A-vanes were constructed of boulders approximately 24 inches in minimum width. These structures were constructed similar to a series of rock cross-vanes as described above.

3.1.7 Forded Channel Crossing

Landowner constraints necessitated the installation of three channel fords to allow access to portions of the property isolated by the conservation easement and stream restoration activities. The location of the channel fords are depicted on Figure 4A (Appendix A). The fords were constructed of hydraulically stable rip-rap or suitable rock and are large enough to handle the weight of anticipated vehicular traffic.

Approach grades to the fords were at an approximate 15:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material, which is free of fines. The bed elevations of the fords are equal the floodplain elevation above and below the ford to reduce the risk of headcutting.

3.2 Stream Enhancement (Level II)

Stream enhancement (Level II) on Cane Creek entailed planting riparian buffers with native forest vegetation, removal of invasive species, and bank stabilization through the installation of coir matting and/or willow stakes, where necessary. Particular attention was directed toward providing vegetative cover and root growth along the outer bends of each stream meander. Riparian buffers will facilitate stream recovery and prevent further degradation of Site streams. In addition, water quality functions and aquatic and wildlife habitat associated with stable riparian corridors/streams will be improved.

3.3 Stream Preservation

The forested/upstream reach of Tributary 1 was preserved as part of this project. Based on preliminary analysis and field investigations, this reach is stable due to a lack of human-induced impacts and a well-developed riparian buffer. This reach was protected in perpetuity through the establishment of a conservation easement including a minimum 30-foot forested buffer adjacent to each bank of the stream. The easement provides a natural riparian corridor between the Site and a State Nature Preserve.

3.4 Wetland Restoration

Wetland restoration activities focused on 1) the reestablishment of historic water table elevations, 2) redirecting roadside drainage, 3) excavation and grading of elevated spoil and sediment embankments, 4) reestablishment of hydrophytic vegetation, and 5) reconstruction of stream corridors.

3.2.1 Reestablishment of Historic Groundwater Elevations

Preconstruction Tributaries 1-3 depths averaged 3-5 feet, while the constructed Tributaries 1-3 average approximately 0.6-1 foot. Hydric soils adjacent to the incised channels were drained due to 1) redirecting tributaries from flowing across hydric soil depressions to flow directly into Cane Creek, 2) lowering of the groundwater tables, and 3) a lateral drainage effect from preconstruction stream reaches. Historic flow patterns were restored across the floodplain and channel inverts were reestablished to rehydrate soils adjacent to Site streams, resulting in the restoration of jurisdictional hydrology to riverine wetlands.

In addition, preconstruction drainage ditches within the Site effectively removed wetland hydrology within the interstream flat. These ditches were filled to rehydrate hydric soils within the Site, resulting in the restoration of jurisdictional hydrology to nonriverine wetlands.

3.2.2 Redirecting Roadside Drainage

Roadside drainage from the adjacent US 64, which was captured and directed through a drainage network across the Site prior to construction, was redistributed through the Site to rehydrate nonriverine hydric soils, as well as treat potentially harmful, nonpoint pollutants prior to discharging into the water supply watershed.

3.2.3 Excavation and Grading of Elevated Spoil and Sediment Embankments

Spoil/sediment deposition adjacent to the preconstruction channel and area ditches were removed. Spoil materials were used to fill of onsite ditches, which represented a critical element of onsite wetland restoration.

3.2.4 Hydrophytic Vegetation

Onsite wetland areas endured significant disturbance from land use activities prior to construction such as land clearing and other anthropogenic maintenance. Wetland areas were revegetated with native vegetation typical of wetland communities in the region. Emphasis focused on developing a diverse plant assemblage. Plant Community Restoration is discussed in more detail in Section 4.0.

3.2.4 Reconstruction of Stream Corridors

The stream restoration plan involved the reconstruction of Tributaries 2-3 and the downstream reach of Tributary 1. Prior to construction, the tributaries were rerouted through the fields into Cane Creek; the tributary lengths were shortened by excavating a linear channel through the most direct path to Cane Creek. The tributaries were restored within the historic floodplain. Preconstruction channels were backfilled to restore the water table to historic conditions. However, some portions of the existing channels remain open for the creation of wetland "oxbow lake-like" features. These features were plugged on each side of the open channel and will function as open water systems. They are expected to provide habitat for a variety of wildlife as well as create open water/freshwater marsh within the Site.

4.0 PLANT COMMUNITY RESTORATION

The Site was planted with native tree species in March and April 2008. Onsite observations, reference forest, and pertinent community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) were used to develop the primary plant community association promoted during restoration efforts. Before plant community restoration was implemented, the entire Site was scarified. Scarification was performed as linear bands directed perpendicular to the land slope. Subsequently, community restoration was initiated on scarified surfaces. The Site was planted with species characteristic of Bottomland Forest and Nonriverine Wet Hardwoods communities within wetland areas, and a Piedmont/Low Mountain Alluvial Forest within the remainder of the Site. Fifteen tree species were planted at the Site; they are as shown in Table 1 (also in Figure 5, Appendix A).

Bare-root seedlings of canopy and understory tree species were planted within the Site at a density of approximately 2750 stems per acre within the stream-side assemblage and a density of approximately 610 stems per acre within the Bottomland Forest/Nonriverine Wet Hardwoods and Piedmont/Low Mountain Alluvial Forest communities. Bare-root seedlings were hand planted to minimize wetland soil disturbance. A total of 30,300 diagnostic tree and shrub seedlings were planted in support of Site restoration.

Table 1. Planted Tree Species

Vegetation Association	Bottomland Forest/Nonriverine Wet Hardwoods		Piedmont/Low Mountain Alluvial Forest		Stream-side Assemblage		TOTAL
Area (acres)	**6.7**		**17.7**		**5.6**		**30.0**
Species	**Number planted**	**% of total**	**Number planted**	**% of total**	**Number planted**	**% of total**	**Number planted**
Swamp chestnut oak (*Quercus michauxii*)	700	14.9	--	--	--	--	700
Cherrybark oak (*Quercus pagoda*)	700	14.9	--	--	--	--	700
Sycamore (*Platanus occidentalis*)	700	14.9	1200	11.8	--	--	1900
Hackberry (*Celtis laevigata*)	700	14.9	--	--	--	--	700
American elm (*Ulmus americana*)	700	14.9	--	--	--	--	700
Green ash (*Fraxinus pennsylvanica*)	500	10.6	--	--	--	--	500
Pawpaw (*Asimina triloba*)	400	8.5	1200	11.8	--	--	1600
Mockernut hickory (*Carya alba/tomentosa*)	--	--	1800	17.6	--	--	1800
Northern red oak (*Quercus rubra*)	--	--	1800	17.6	--	--	1800
White oak (*Quercus alba*)	--	--	1800	17.6	--	--	1800
Black cherry (*Prunus serotina*)	--	--	1200	11.8	--	--	1200
Persimmon (*Diospyros virginiana*)	--	--	1200	11.8	--	--	1200
Silky dogwood (*Cornus amomum*)	300	6.4	--	--	4600	29.8	4900
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	5400	35.1	5400
Elderberry (*Sambucus canadensis*)	--	--	--	--	5400	35.1	5400
TOTAL	**4700**	**100**	**10,200**	**100**	**15,400**	**100**	**30,300**

5.0 MONITORING PLAN

The Cane Creek Stream and Wetland Restoration Site monitoring plan will entail analysis of the stream channel, hydrology, and vegetation. Monitoring of restoration efforts will be performed for a minimum of 5 years or until success criteria are fulfilled. The detailed monitoring plan is depicted in Sheets 1-3 (Appendix A).

5.1 Stream

Five stream reaches were monitored for geometric activity on restoration reaches of Tributaries 1-3 (Sheets 1-3, Appendix A). Each stream reach extends for approximately 600 linear feet for a total monitoring length of 3000 linear feet along the restored channel. After completion of Site construction 20 stream cross-sections were established; two riffle cross-sections and two pool cross-sections were established on each stream monitoring reach.

Annual monitoring will include development of channel cross-sections on riffles and pools, and a water surface profile of the channel. The data will be presented in graphic and tabular format. Data to be presented will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, 5) width-to-depth ratio, 6) water surface slope, and 9) facet slope. The stream will subsequently be classified according to stream geometry and substrate (Rosgen 1996). Significant changes in channel morphology will be tracked and reported by comparing data in each successive monitoring year. A photographic record that will include preconstruction and post-construction pictures has been initiated (Appendix B).

Photographs of the enhancement (level II) reach will be taken for each year of the monitoring period and on the preservation reach in the first year.

Baseline/as-built measurements were performed in April 2008. As-built channels emulated the proposed channel morphology; cross-section and longitudinal profile plots can be found in Appendix C.

5.2 Hydrology

After hydrological modifications were completed at the Site, continuously recording, surficial monitoring gauges were installed in accordance with specifications in *Installing Monitoring Wells/Piezometers in Wetlands* (NCWRP 1993). Monitoring gauges were set to a depth of approximately 24 inches below the soil surface. Screened portions of each gauge were surrounded by filter fabric, buried in screened well sand, and sealed with a bentonite cap to prevent siltation and surface flow infiltration during floods.

Five monitoring gauges were installed in wetland restoration areas to provide representative coverage of the Site (Sheets 1-3, Appendix A). One additional gauge was placed in a reference wetland area adjacent to the stream preservation area north of Tributary 1 for comparison with onsite conditions. Hydrological sampling will be performed in restoration and reference areas during the growing season at daily intervals necessary to satisfy the hydrology success criteria within each physiographic landscape area (USEPA 1990).

5.3 Vegetation

Following Site planting, fifteen (10-meter by 10-meter or 20-meter by 5-meter) vegetation monitoring plots were established within the Site (Sheets 1-3, Appendix A). During the first year, vegetation will receive a cursory, visual evaluation on a periodic basis to ascertain the degree of overtopping of planted elements by nuisance species. Subsequently, quantitative sampling of vegetation will be performed each year using the CVS-EEP Protocol for Recording Vegetation Level 1-2 Plot Sampling Only (Version 4.0) (Lee et al. 2006) between June 1 and September 30 until the vegetation success criteria are achieved.

A photographic record of plant growth will be included in each annual monitoring report.

6.0 SUCCESS CRITERIA

6.1 Stream Success Criteria

Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996) and 2) channel variables indicative of a stable stream system. Annual monitoring will continue until success criteria are met and no less than two bankfull events have occurred, as determined by in situ crest gauge, otherwise monitoring will continue until the second bankfull event has occurred.

Visual assessment of in-stream structures will be conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure.

6.2 Hydrologic Success Criteria

Target hydrological characteristics include saturation or inundation for 5 to 12.5 percent of the growing season, during average climatic conditions. During growing seasons with atypical climatic conditions, groundwater gauges in reference wetlands may dictate threshold hydrology success criteria (75 percent of reference). These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed.

6.2 Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon density and growth of "Characteristic Tree Species." Characteristic Tree Species include planted species, species identified through inventory of a reference (relatively undisturbed) forest community used to orient the planting plan, and appropriate Schafale and Weakley (1990) community descriptions. All canopy tree species planted and identified in the reference forest will be utilized to define "Characteristic Tree Species" as termed in the success criteria.

Table 2. Characteristic Tree Species

PLANTED SPECIES	REFERENCE SPECIES
Pawpaw (*Asimina triloba*)	Red maple (*Acer rubrum*)
Mockernut hickory (*Carya alba/tomentosa*)	Ironwood (*Carpinus caroliniana*)
Hackberry (*Celtis laevigata*)	Mockernut hickory (*Carya alba*)
Buttonbush(*Cephalanthus occidentalis*)	Hickory (*Carya* sp.)
Silky dogwood(*Cornus amomum*)	Dogwood (*Cornus florida*)
Persimmon (*Diospyros virginiana*)	Persimmon (*Diospyros virginiana*)
Green ash (*Fraxinus pennsylvanica*)	American beech (*Fagus grandifolia*)
Sycamore (*Platanus occidentalis*)	Eastern red cedar (*Juniperus virginiana*)
Black cherry (*Prunus serotina*)	Mountain laurel (*Kalmia latifolia*)
White oak (*Quercus alba*)	Doghobble (*Leucothoe fontanesiana*)
Swamp chestnut oak (*Quercus michauxii*)	Sycamore (*Platanus occidentalis*)
Cherrybark oak (*Quercus pagoda*)	Black cherry (*Prunus serotina*)
Northern red oak (*Quercus rubra*)	White oak (*Quercus alba*)
Elderberry(*Sambucus canadensis*)	Northern red oak (Q*uercus rubra*)
American elm (*Ulmus americana*)	

An average density of 320 stems per acre of Characteristic Tree Species must be surviving at the end of the third monitoring year. Subsequently, 290 Characteristic Tree Species per acre must be surviving at the end of year 4 and 260 Characteristic Tree Species per acre at the end of year 5.

If vegetation success criteria are not achieved, based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

7.0 MONITORING REPORT SUBMITTAL

An Annual Stream and Wetland Monitoring Report will be prepared at the end of each monitoring year (growing season). The monitoring report will depict the sample plot and quadrant locations and include photographs which illustrate Site conditions. Data compilation and analyses will be presented including graphic and tabular format, where practicable.

8.0 CONTINGENCY

In the event that success criteria are not fulfilled, a mechanism for contingency will be implemented.

Stream

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented. Stream contingency may include, but may not be limited to 1) structure installation; 2) repair of dimension, pattern, and/or profile variables; and 3) bank stabilization. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success include 1) headcut migration through the Site, and/or 2) bank erosion.

Headcut Migration Through the Site

In the event that a headcut occurs within the Site (identified visually or through onsite measurements [i.e. bank-height ratios exceeding 1.4]), provisions for impeding headcut migration and repairing damage caused by the headcut will be implemented. Headcut migration may be impeded through the installation of in-stream grade control structures (rip-rap sill and/or log cross-vane weir) and/or restoring stream geometry variables until channel stability is achieved. Channel repairs to stream geometry may include channel backfill with coarse material and stabilizing the material with erosion control matting, vegetative transplants, and/or willow stakes.

Bank Erosion

In the event that severe bank erosion occurs at the Site resulting in elevated width-to-depth ratios, contingency measures to reduce bank erosion and width-to-depth ratio will be implemented. Bank erosion contingency measures may include the installation of cross-vane weirs and/or other bank stabilization measures. If the resultant bank erosion induces shoot cutoffs or channel abandonment, a channel may be excavated which will reduce shear stress to stable values.

Hydrology

Hydrological contingency will require consultation with hydrologists and regulatory agencies if wetland hydrology enhancement is not achieved. Floodplain surface modifications, including construction of ephemeral pools, represent a likely mechanism to increase the floodplain area in support of jurisdictional wetlands. Recommendations for contingency to establish wetland hydrology will be implemented and monitored until Hydrology Success Criteria are achieved.

Vegetation

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

9.0 REFERENCES

Griffith, G.E. 2002. Ecoregions of North and South Carolina. Reston Virginia. U.S. Geological Society (map scale 1:1,500,000).

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

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Rosgen D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

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 Environmental Protection Agency (USEPA). 1990. Mitigation Site Type Classification (MiST). USEPA Workshop, August 13-15, 1989. USEPA Region IV and Hardwood Research Cooperative, NCSU, Raleigh, North Carolina.

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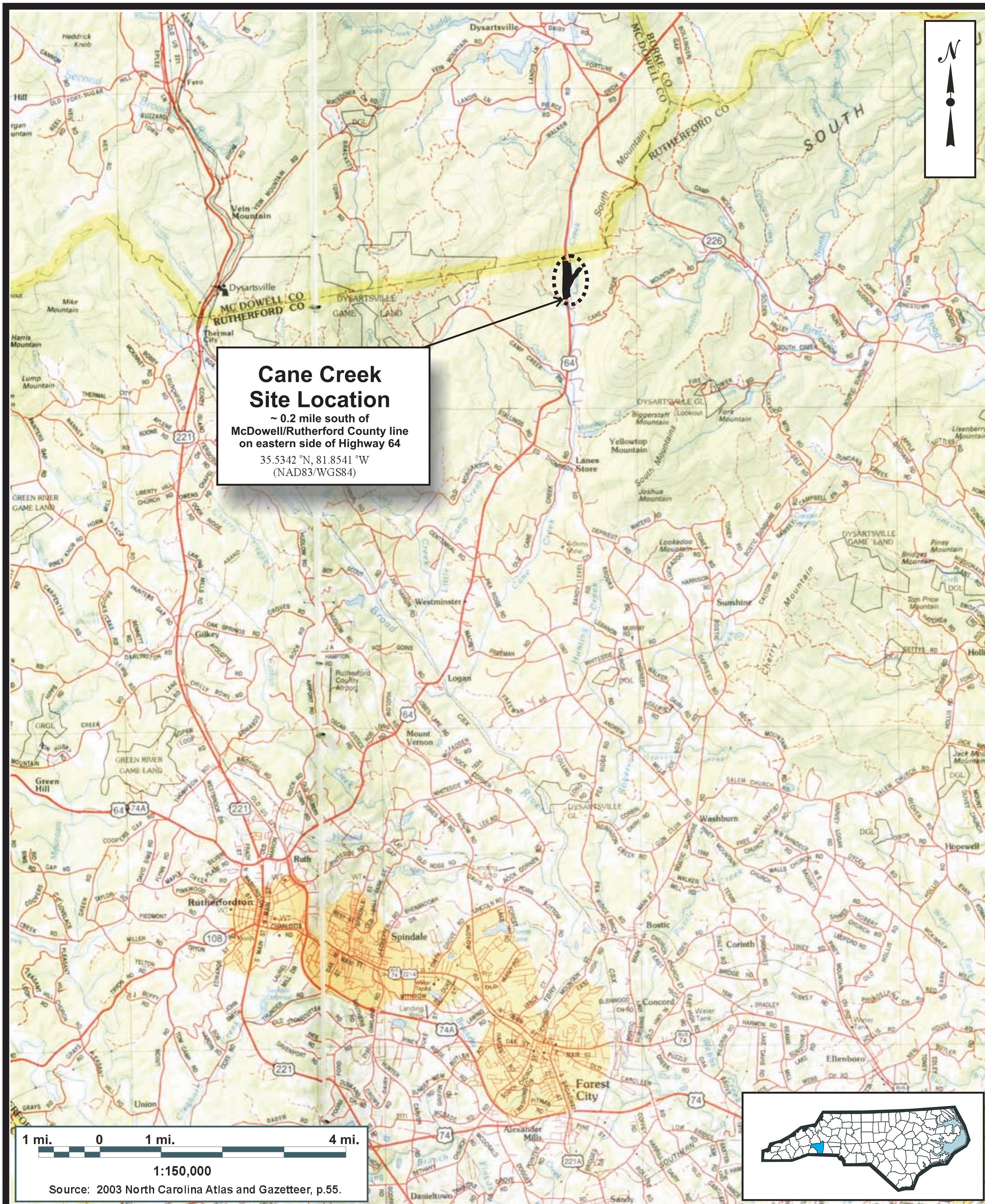
Appendix A.
Figures and As-built Construction Sheets



Axiom Environmental, Inc.
2126 Rowland Pond Drive
Willow Spring, NC 27529
(919) 215-1693
(919) 341-3839 fax

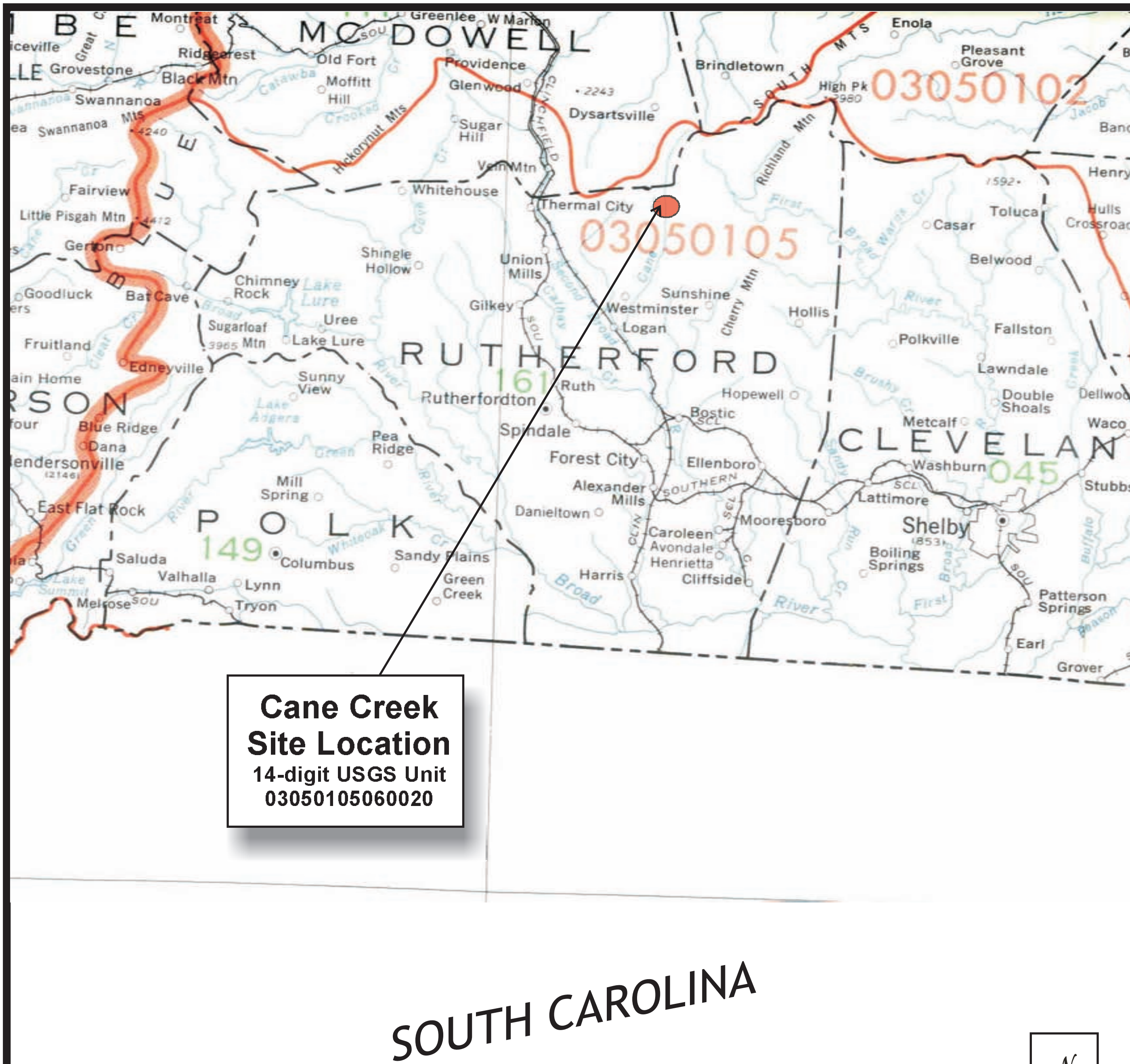
SITE LOCATION
CANE CREEK RESTORATION SITE
Rutherford County, North Carolina

Dwn. by: CLF

Date: April 2007

Project: 06-022

FIGURE 1

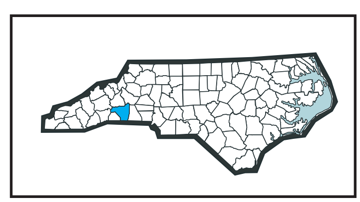


N

5 mi. 0 5 mi. 15 mi.

1:625,000

Source: Hydrologic Unit Map - 1974 State of North Carolina



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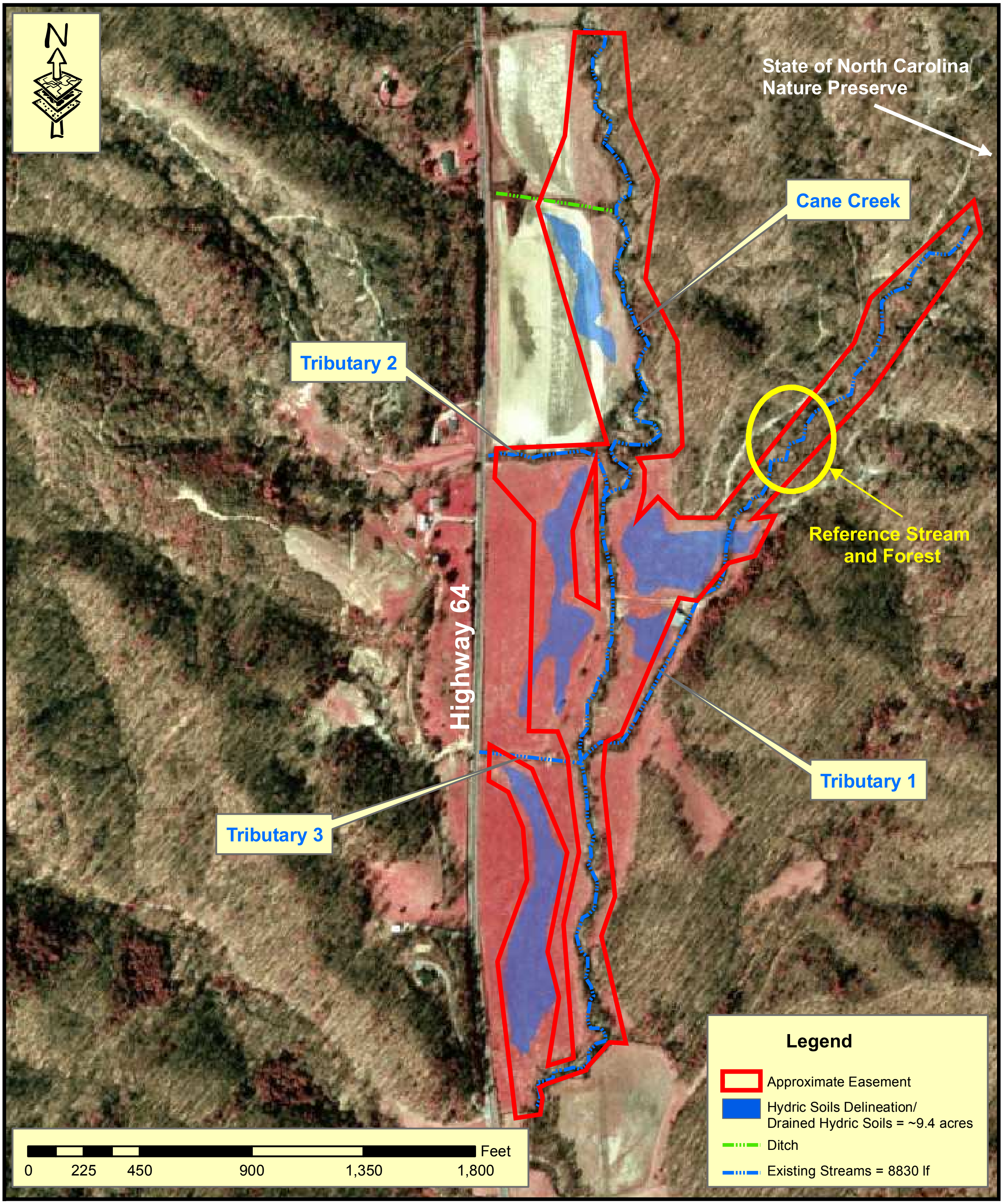
(919) 341-3839 fax

USGS HYDROLOGIC UNIT MAP
CANE CREEK RESTORATION SITE
Rutherford County, North Carolina

Dwn. by: CLF	FIGURE
Date: April 2007	2
Project: 06-002	



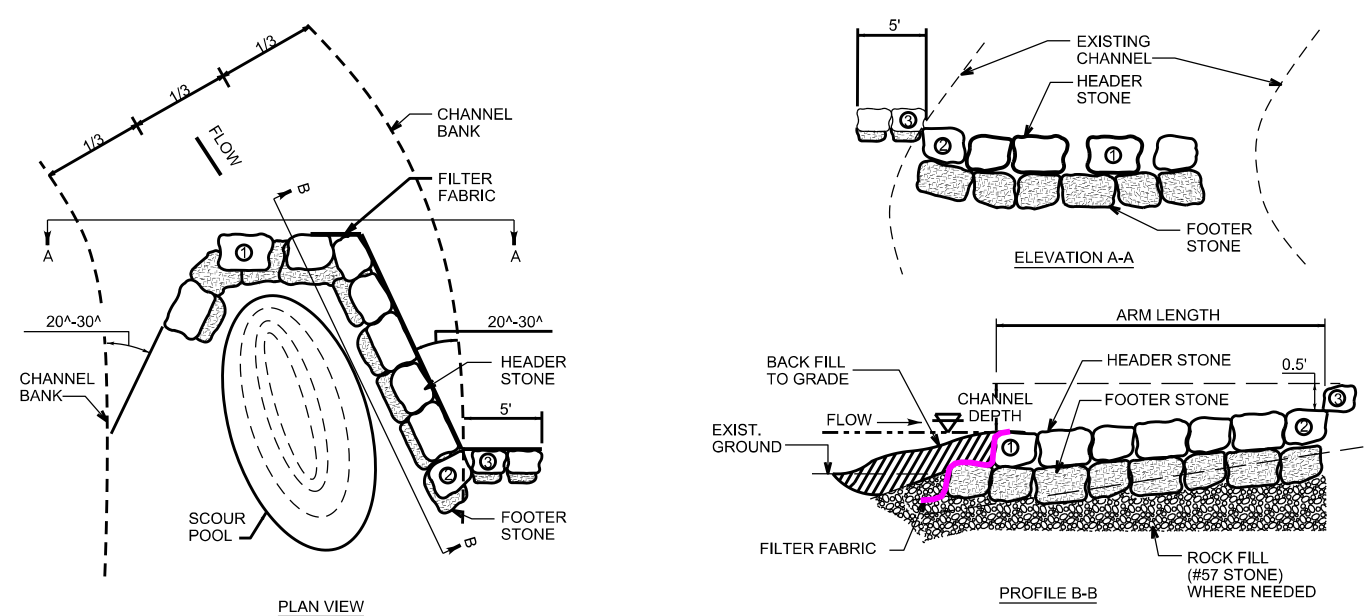
Axiom Environmental, Inc.
2126 Rowland Pond Drive
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax
Axiom Environmental, Inc.

PRECONSTRUCTION CONDITIONS
CANE CREEK RESTORATION SITE
Rutherford County, North Carolina

Dwn. by: CLF
Date: May 2008
Project: 06-022

FIGURE 3

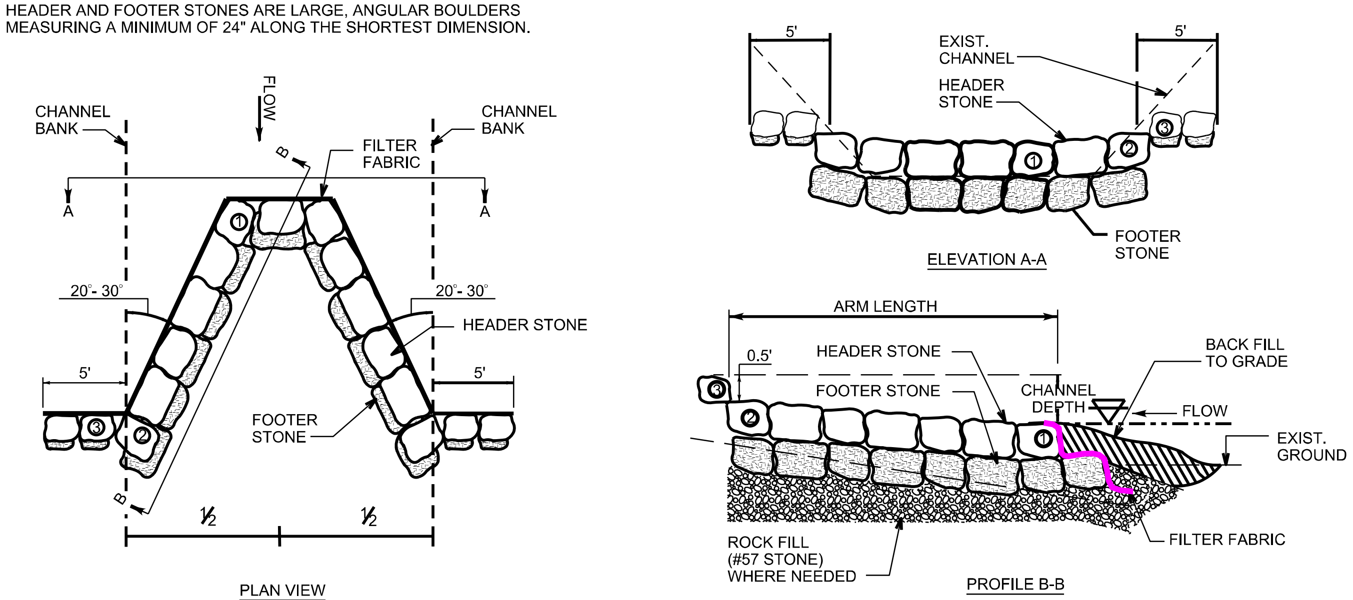
NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 24" ALONG THE SHORTEST DIMENSION.



TYPICAL J-HOOK VANE

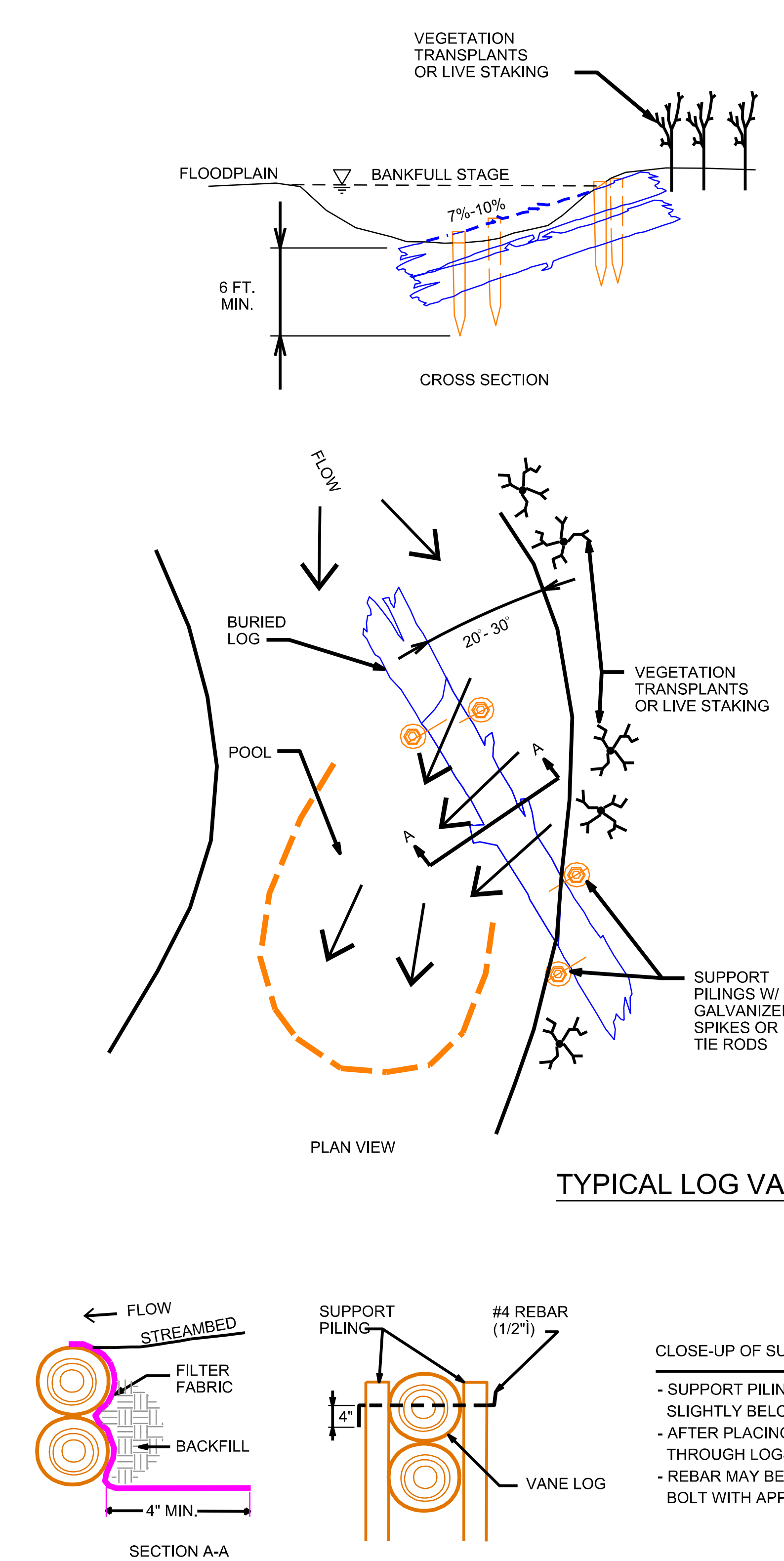
REACH	ARM LENGTH (FT.)	CHANNEL DEPTH (FT.)
TRIBUTARY 1	10.0	1.5
TRIBUTARIES 2 AND 3	7.0	0.8

NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 24" ALONG THE SHORTEST DIMENSION.



TYPICAL CROSS-VANE

NOTES:
1. EXPOSED VANE OCCUPIES 1/3 OF THE BANKFULL WIDTH OF THE CHANNEL.
2. SUPPORT PILINGS SHALL BE PENCIL SHARPENED, UNTREATED, PEELED, A MINIMUM OF 4 INCHES IN TOP DIAMETER, AND 8 FEET LONG.
3. LOGS SHALL CONSIST OF NATIVE HARDWOOD SPECIES, RELATIVELY STRAIGHT WITH A MINIMUM DIAMETER OF 15 INCHES AND APPROXIMATELY 35 FEET IN LENGTH.
4. USE FILTER FABRIC TO SEAL GAPS BETWEEN LOGS.



CLOSE-UP OF SUPPORT PILING
- SUPPORT PILINGS SHOULD BE CUT SLIGHTLY BELOW THE TOP LOG.
- AFTER PLACING LOGS, DRIVE REBAR THROUGH LOGS AND BEND ENDS.
- REBAR MAY BE REPLACED WITH LAG BOLT WITH APPROVAL OF THE ENGINEER.

Axiom Environmental, Inc.

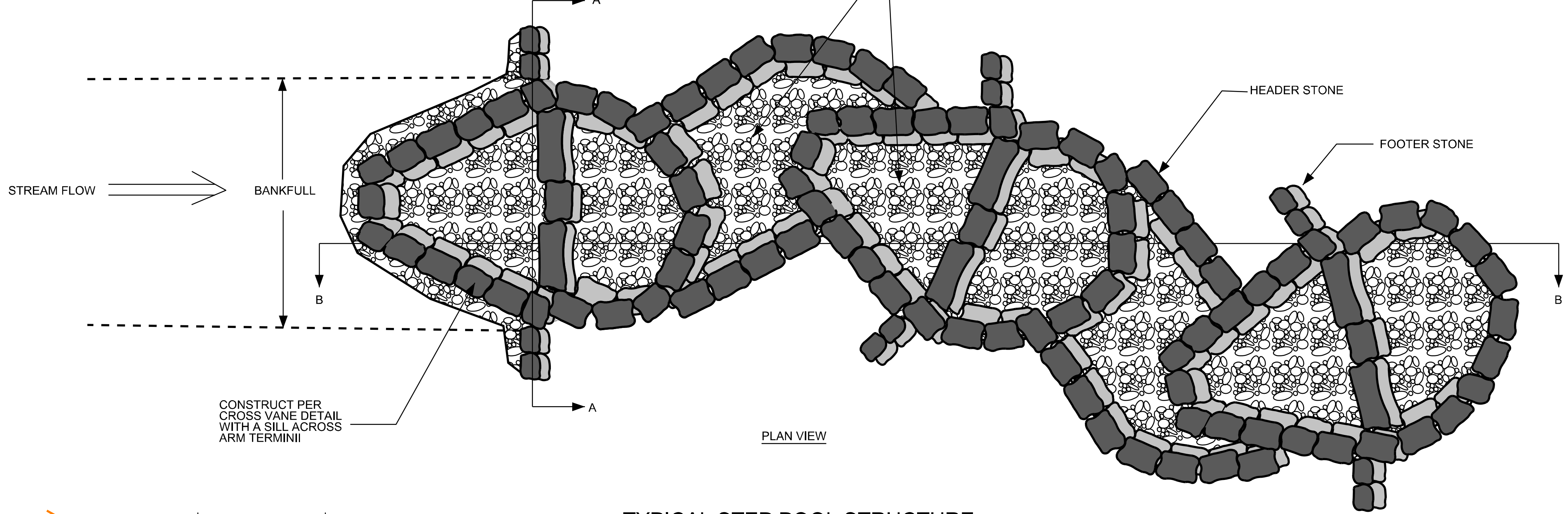
NOTES/REVISIONS

Project:
Cane Creek Restoration Site
Rutherford County North Carolina

Title:
TYPICAL STRUCTURE DETAILS

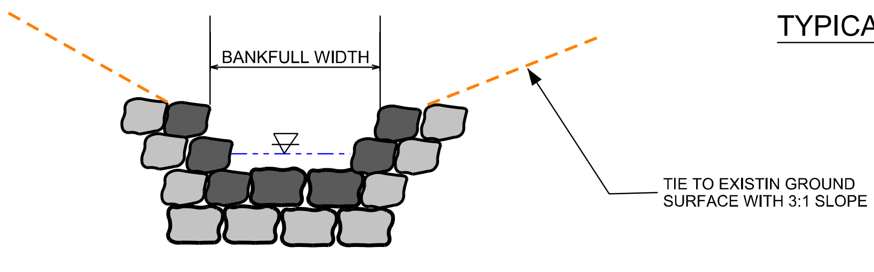
Scale: NO SCALE
Date: July 2008
Project No.: 06-022
FIGURE NO. 4A

NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 32" ALONG THE SHORTEST DIMENSION.

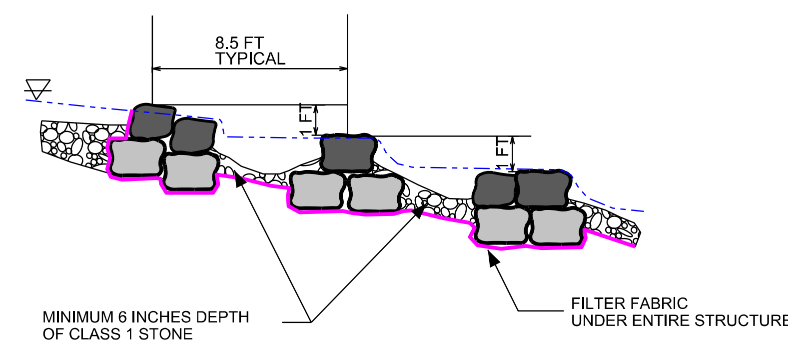


PLAN VIEW

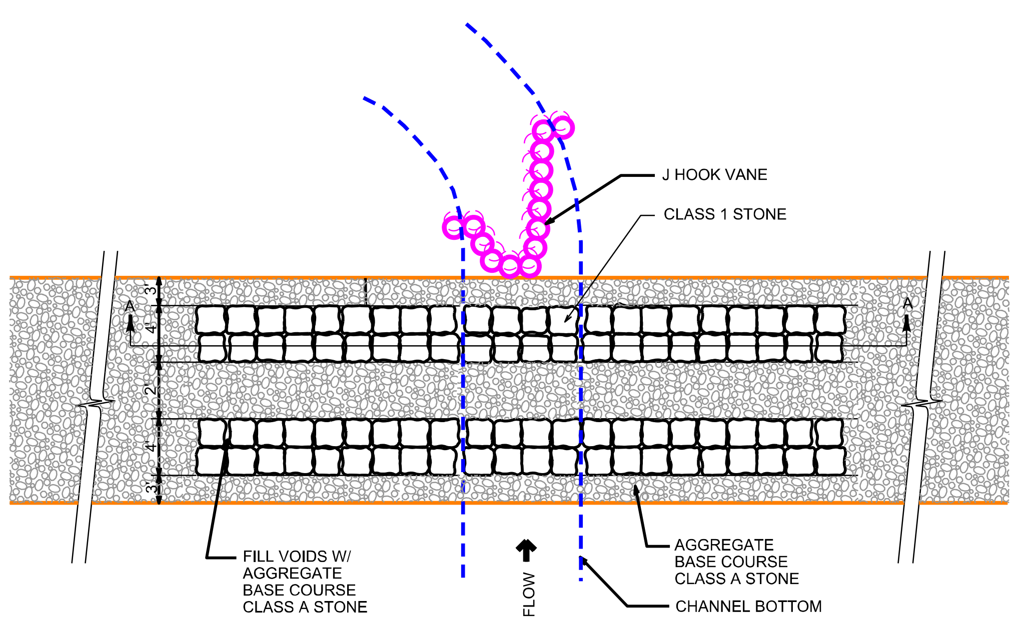
TYPICAL STEP POOL STRUCTURE



CROSS SECTION A-A

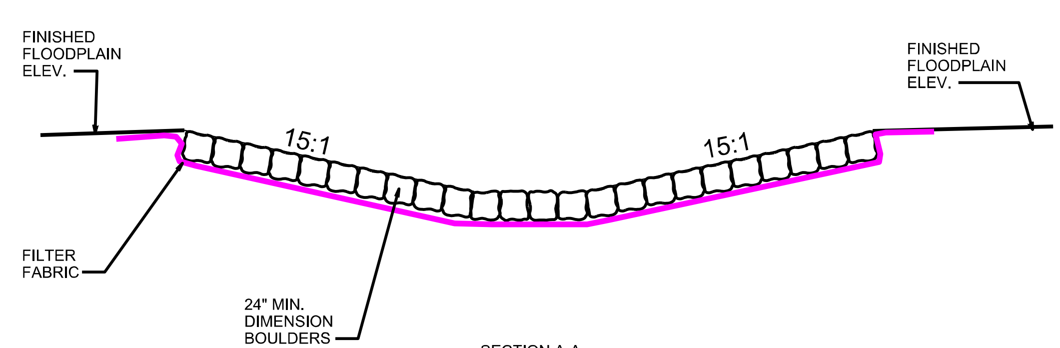


PROFILE B-B



PLAN VIEW

PERMANENT CHANNEL FORD DETAIL



SECTION A-A

PERMANENT CHANNEL FORD DETAIL

NOTES:

1. KEEP FORD CROSS FALL WITHIN 1-2% OF STREAM GRADIENT.

2. FILL VOIDS BETWEEN 24" MININUM DIMENSION BOULDERS W/ AGGREGATE BASE COURSE CLASS A TO CREATE DRIVEABLE SURFACE.

Axiom Environmental, Inc.

NOTES/REVISIONS

Project:

Cane Creek Restoration Site

Rutherford County North Carolina

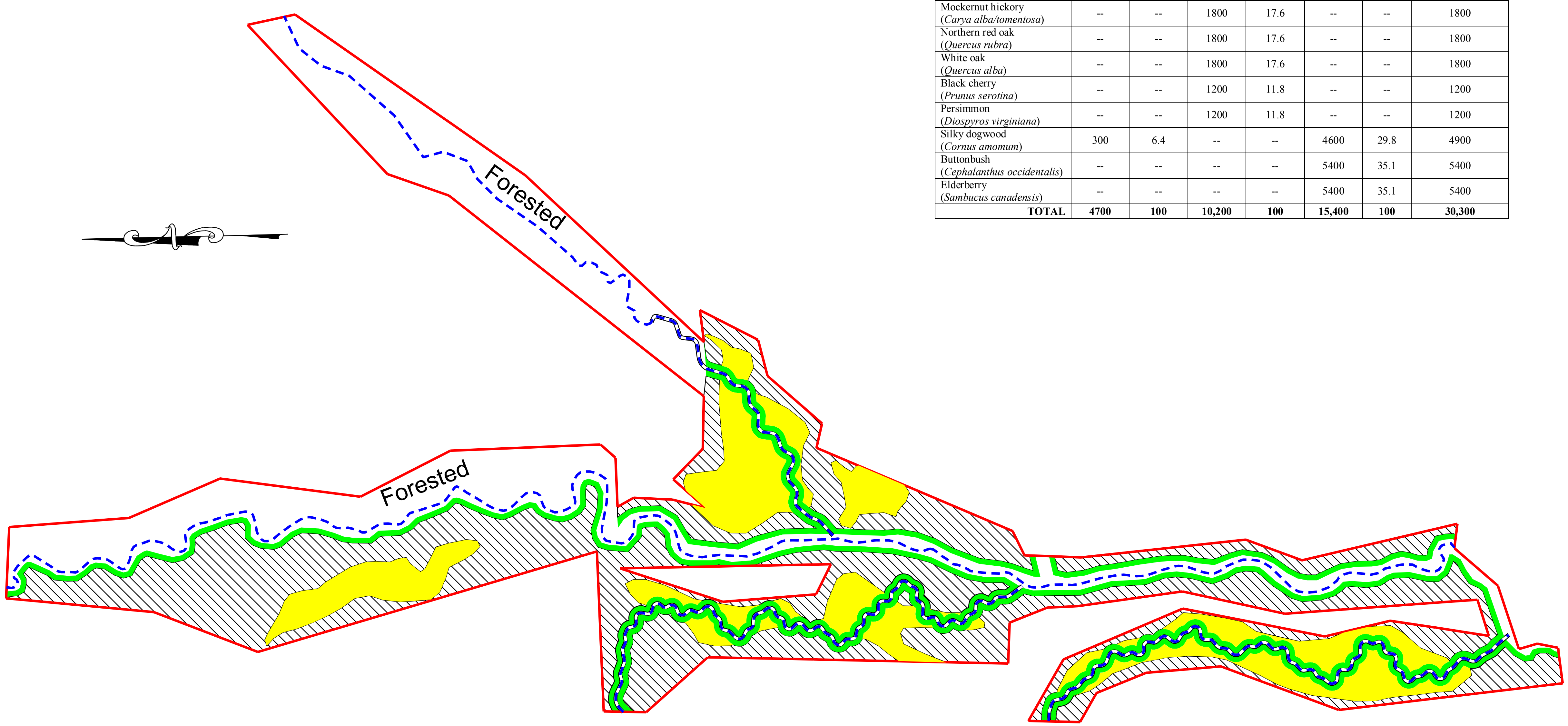
Title:

TYPICAL STRUCTURE DETAILS

Scale: NO SCALE	FIGURE NO.
Date: July 2008	4B
Project No.: 06-022	

Planting Plan Legend

Easement Boundary		48.3 ac
On-Site Streams		
Streamside Assemblage		5.6 ac
Piedmont / Mountain Bottomland Hardwood Forest		6.7 ac
Piedmont / Low Mountain Alluvial Forest		17.7 ac



Vegetation Association	Bottomland Forest/Nonriverine Wet Hardwoods		Piedmont/Low Mountain Alluvial Forest		Stream-side Assemblage		TOTAL
Area (acres)	6.7		17.7		5.6		30.0
Species	Number planted	% of total	Number planted	% of total	Number planted	% of total	Number planted
Swamp chestnut oak (*Quercus michauxii*)	700	14.9	--	--	--	--	700
Cherrybark oak (*Quercus pagoda*)	700	14.9	--	--	--	--	700
Sycamore (*Platanus occidentalis*)	700	14.9	1200	11.8	--	--	1900
Hackberry (*Celtis laevigata*)	700	14.9	--	--	--	--	700
American elm (*Ulmus americana*)	700	14.9	--	--	--	--	700
Green ash (*Fraxinus pennsylvanica*)	500	10.6	--	--	--	--	500
Pawpaw (*Asimina triloba*)	400	8.5	1200	11.8	--	--	1600
Mockernut hickory (*Carya alba/tomentosa*)	--	--	1800	17.6	--	--	1800
Northern red oak (*Quercus rubra*)	--	--	1800	17.6	--	--	1800
White oak (*Quercus alba*)	--	--	1800	17.6	--	--	1800
Black cherry (*Prunus serotina*)	--	--	1200	11.8	--	--	1200
Persimmon (*Diospyros virginiana*)	--	--	1200	11.8	--	--	1200
Silky dogwood (*Cornus amomum*)	300	6.4	--	--	4600	29.8	4900
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	5400	35.1	5400
Elderberry (*Sambucus canadensis*)	--	--	--	--	5400	35.1	5400
TOTAL	4700	100	10,200	100	15,400	100	30,300

0 300 600
SCALE IN FEET

Axiom Environmental, Inc.

NOTES/REVISIONS

Project:

Cane Creek Restoration Site

Rutherford County North Carolina

Title:

Planting Plan

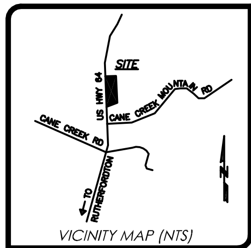
Scale: 1 in. = 345 ft.

Date: July 2008

Project No.: 06-022

FIGURE NO.

5



LEGEND:

- EIS – Existing Iron Stake
- EIP – Existing Iron Pipe
- NMC – Non Monumented Corner
- ECM – Existing Concrete Monument
- R/W – Right–Of–Way
- B/C – Back–Of–Curb
- UP – Utility Pole
- MBL – Minimum Building Line
- EOP – Edge Of Pavement
- N/F – Now or Formerly
- ECRM – Existing Concrete R/W Monument
- MH – Sanitary Sewer Manhole
- EPK – Existing PK Nail
- PKS – PK Nail Set
- IPS – Iron Pipe Set (1" O.D.)
- ECM – Existing Concrete Monument
- ERRS – Existing Railroad Spike
- CC – Control Corner
- D.B. – Deed Book
- PG. – Page
- NCDOT – North Carolina Department of Transportation
- CMU – Concrete Masonry Unit
- NCSR – North Carolina Secondary Road
- HWY – Highway
- R – Radius
- BRG. – Bearing
- UP – Utility Pole
- FEMA – Federal Emergency Management Agency
- ℄ – Center Line
- 50' Riprarian Buffer
- PPS – Pump Pipe Set (3" O.D.)
- ERWM – Existing Concrete R/W Marker
- MNS – Mag Nail Set
- P/L – Property Line
- MH – Sanitary Sewer Manhole
- ○ – Non–Monumented Corner Unless Otherwise Noted
- • – Iron Stake Set (No. 5 Rebar with Plastic Cap) unless Otherwise Noted
- New Property Line
- CROSS–SECTION
- GW GROUNDWATER GAUGES
- VEG VEG PLOT AREA
- RIVERINE WELAND RESTORATION
- NONRIVERINE WETLAND RESTORATION
- MONITORING REACH
- ACCESS EASEMENT

GENERAL NOTES:

1) NO ABSTRACT TITLE, NOR TITLE COMMITMENT, NOR RESULTS OF TITLE SEARCH WERE FURNISHED TO THE SURVEYOR. ALL DOCUMENTS OF RECORD REVIEWED ARE NOTED HEREON (SEE REFERENCES). THERE MAY EXIST OTHER DOCUMENTS OF RECORD THAT MAY AFFECT THIS SURVEYED PARCEL.

2) THIS PLAT SHOWS THE CONSTRUCTED CENTERLINE OF THE NEW CHANNEL AS FIELD LOCATED JULY 10–15, 2008.

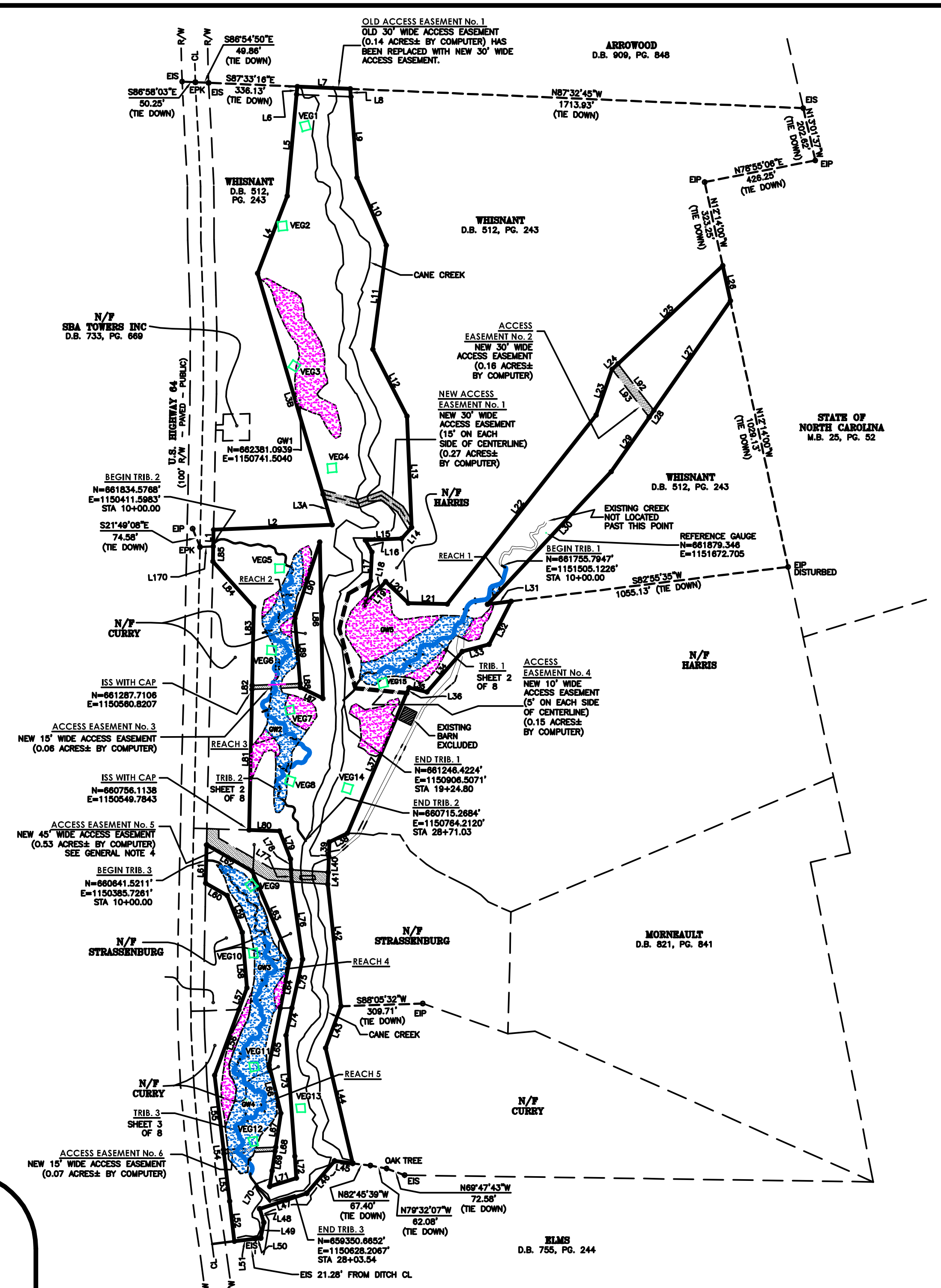
3) CROSS–SECTION ELEVATIONS ARE ASSUMED.

4) CROSS–SECTION ELEVATIONS ARE ALL RELATIVE TO EACH OTHER.

5) ALL DISTANCES SHOWN ARE HORIZONTAL GROUND DISTANCES UNLESS OTHERWISE NOTED.

6) FOR COMPLETE BOUNDARY INFORMATION SEE PLAT RECORDED IN M.B. 28, PG.'S 145–147 BY K2 DESIGN GROUP, P.A.

7) ALL WETLAND RIVERINE AND NONRIVERINE RESTORATION AREAS INFORMATION WERE OBTAINED AND IDENTIFIED FROM AXIOM ENVIRONMENTAL, INC.



THE AREA REPRESENTED BY THIS PLAT IS LOCATED IN A FLOOD HAZARD BOUNDARY ACCORDING TO FEMA MAP NUMBER(S) 370217 0003 A, ZONE(S): A, DATED: SEPTEMBER 1, 1978 (CONVERTED BY LETTER JUNE 1, 1987).

ACREAGE DATA:

THE AREA OF THE CONSERVATION EASEMENT INCLUDING ALL NEW ACCESS EASEMENTS AND EXCLUDING U.S. HWY. 64 RIGHT–OF–WAY IS 44.35 ACRES± BY COMPUTER

THE AREA OF THE CONSERVATION EASEMENT EXCLUDING ALL NEW ACCESS EASEMENTS AND EXCLUDING U.S. HWY. 64 RIGHT–OF–WAY IS 43.50 ACRES± BY COMPUTER

LINE DATA ALONG CONSERVATION EASEMENT

LINE	LENGTH	BEARING
L1	62.86'	N01°12'56"E
L2	448.91'	N87°36'18"E
L3A	120.85'	N16°30'50"W
L3B	871.16'	N16°30'50"W
L4	312.37'	N20°58'26"E
L5	386.01'	N05°18'31"E
L6	29.75'	N05°18'31"E
L7	200.35'	S87°33'16"E
L8	29.96'	S04°17'54"E
L9	306.32'	S04°17'54"E
L10	279.05'	S23°24'36"E
L11	396.74'	S07°22'21"W
L12	283.52'	S27°04'29"E
L13	420.81'	S02°21'15"E
L14	56.37'	S41°29'24"W
L15	137.73'	S87°36'18"W
L16	51.68'	S29°16'29"E
L17	109.02'	S02°43'42"W
L18	96.22'	S14°02'45"W
L19	121.27'	N41°33'07"E
L20	118.79'	S46°05'41"E
L21	147.36'	S88°48'04"E
L22	909.48'	N38°13'00"E
L23	183.23'	N19°18'36"E
L24	30.13'	N46°52'06"E
L25	543.14'	N46°52'06"E
L26	136.14'	S12°14'00"E
L27	504.82'	S34°55'38"W
L28	31.42'	S34°55'38"W
L29	251.37'	S34°55'38"W
L30	685.26'	S43°00'56"W
L31	90.07'	N82°55'35"E
L32	182.73'	S27°03'34"W
L33	105.13'	S75°10'54"W
L34	202.77'	S41°01'34"W
L35	69.74'	N76°51'41"W
L36	21.89'	S22°58'45"W
L37	575.32'	S22°58'45"W
L38	76.39'	N63°48'55"E
L39	54.46'	S02°04'15"W
L40	59.94'	S02°04'15"W
L41	45.03'	S02°04'15"W
L42	463.96'	S06°08'19"E
L43	168.20'	S20°06'33"W
L44	447.62'	S13°15'49"E
L45	69.27'	N82°45'39"W
L46	161.06'	S40°46'10"W
L47	187.26'	S71°36'34"W
L48	53.67'	S16°30'35"E
L49	59.67'	S11°18'20"W
L50	21.28'	S82°45'56"W
L51	79.06'	S82°45'56"W
L52	153.01'	N06°46'18"W
L53	181.19'	N06°46'18"W
L54	15.04'	N06°46'18"W
L55	282.96'	N06°46'18"W
L56	264.24'	N20°15'00"E
L57	87.73'	N20°15'00"E
L58	210.56'	N04°49'02"W
L59	150.57'	N22°12'11"W
L60	93.71'	N60°13'18"W
L61	144.80'	N01°17'20"E
L62	198.57'	S60°13'18"E
L63	363.86'	S23°03'55"E
L64	187.70'	S11°04'18"W
L65	218.02'	S11°04'18"W
L66	188.23'	S13°29'15"E
L67	129.55'	S08°38'40"W
L68	15.29'	S08°38'40"W
L69	74.58'	S08°38'40"W
L70	60.59'	S08°38'40"W
L71	105.92'	N72°26'45"E
L72	82.54'	N04°09'32"W
L73	458.91'	N04°09'32"W
L74	105.75'	N12°14'58"E
L75	188.19'	N12°14'58"E
L76	296.05'	N07°55'24"W
L77	45.33'	N02°50'49"W
L78	40.17'	N02°50'49"W
L79	114.23'	N21°39'24"W
L80	114.71'	N88°10'38"W
L81	531.71'	N01°11'22"E
L82	15.03'	N01°11'22"E
L83	296.48'	N01°11'22"E
L84	231.47'	N41°50'32"W
L85	56.59'	N01°17'20"E
L86	591.68'	S01°07'24"E
L87	94.44'	N63°52'28"W
L88	15.01'	N04°29'57"W
L89	247.75'	N04°29'57"W
L90	302.92'	N18°02'17"E

SHEET ONE OF ELEVEN

AS–BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

CANE CREEK RESTORATION SITE

Restoration & Conservation Natural Resources

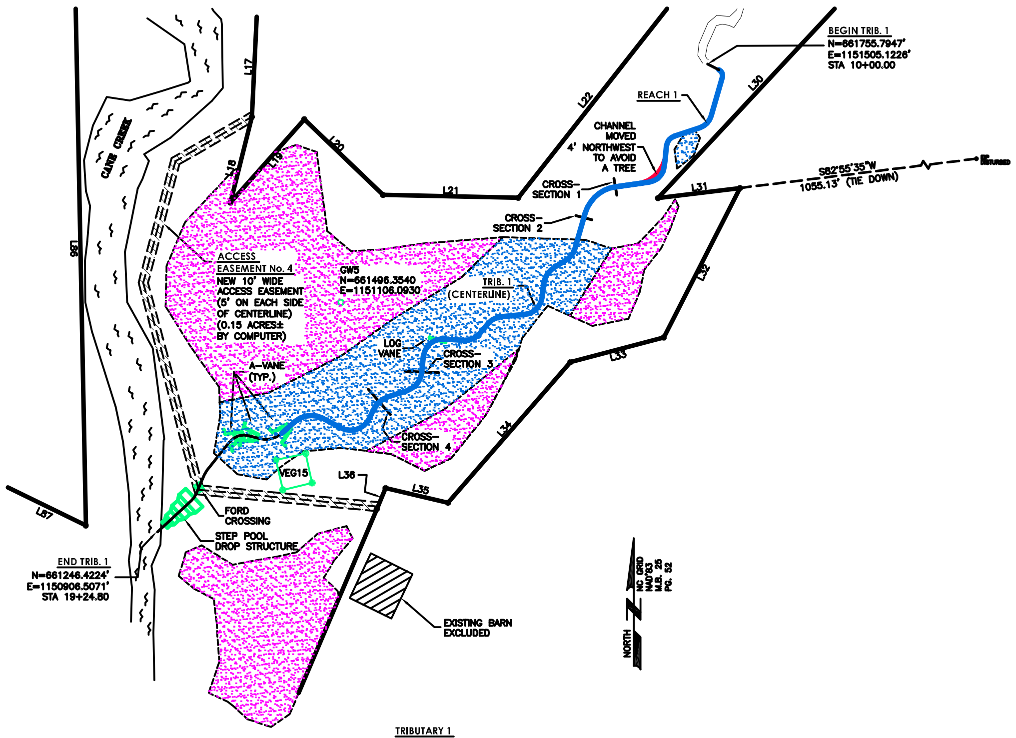
LOGAN STORE TOWNSHIP RUTHERFORD COUNTY NORTH CAROLINA

300 150 0 300 600 900

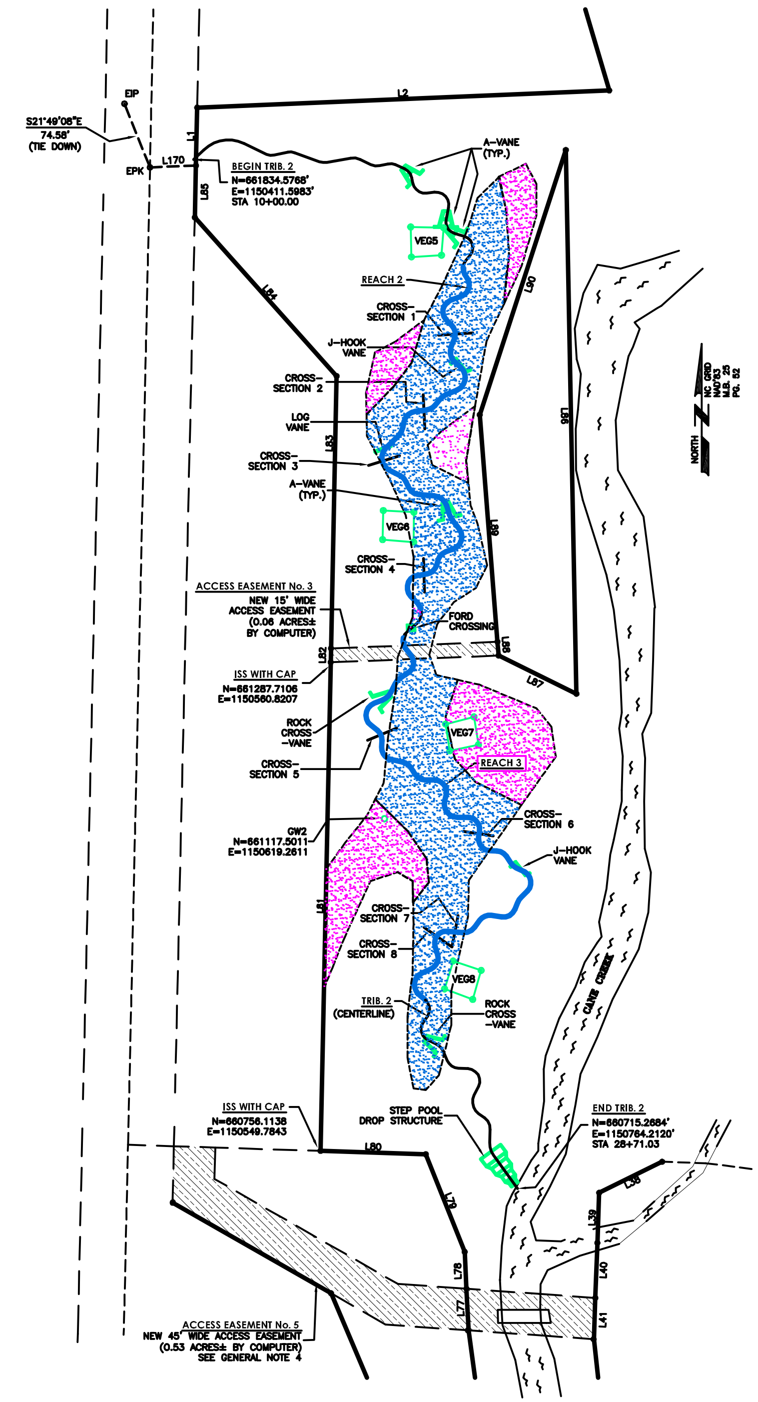
GRAPHIC SCALE 1" = 300'

DRAWN BY: FGR
DATE: 07/14/08
DWG. NO.: RSS922AB_08
SURVEYED BY: J.A.R.

K2 DESIGN GROUP, P.A.
5688 U.S. Hwy. 70 East
Goldsboro, NC 27534
Tel.: (919) 751-0075
Fax: (919) 778-9087
k2design@suddenlink.net



TRIBUTARY 1
1"=100'



TRIBUTARY 2
1"=100'

LEGEND

- STEP POOL DROP STRUCTURE
- CROSS-SECTION
- A-VANE
- LOG VANE
- FORD CROSSING
- ROCK CROSS-VANE
- GW GROUNDWATER GAUGES
- NOT CONSTRUCTED
- MODIFIED CHANNEL
- ADDED LOG VANE
- VEG VEG PLOT AREA
- RIVERINE WELAND RESTORATION
- NONRIVERINE WETLAND RESTORATION
- MONITORING REACH
- ACCESS EASEMENT

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

7/14/07

SHEET TWO OF ELEVEN

AS-BUILT FOR TRIB. 1 & TRIB. 2

FOR

RESTORATION SYSTEMS, LLC

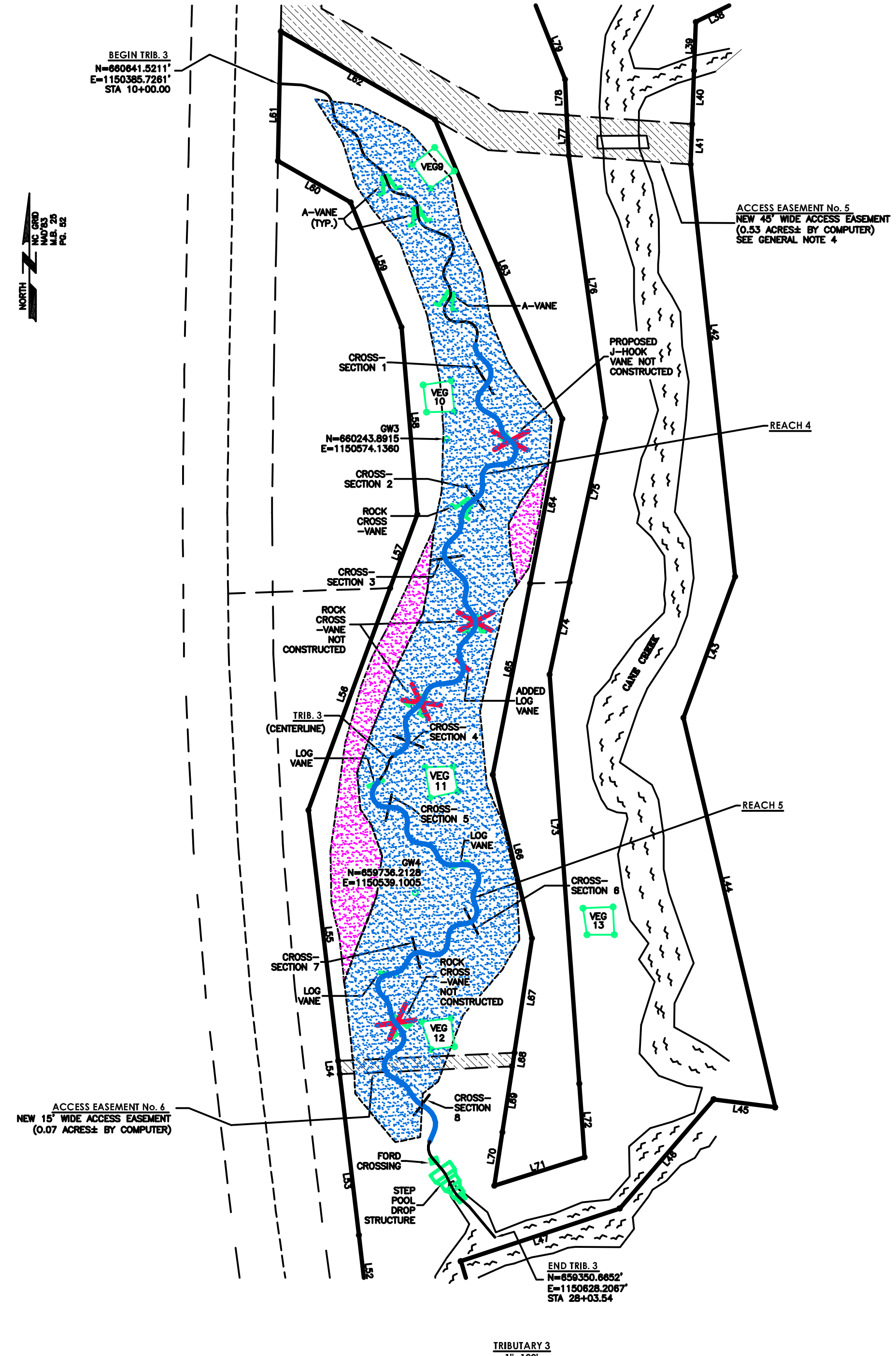
CANE CREEK RESTORATION SITE

Restoration & Conservation Natural Resources

LOGAN STORE TOWNSHIP RUTHERFORD COUNTY NORTH CAROLINA

100 50 0 100 200 300

GRAPHIC SCALE 1" = 100'



LEGEND

- STEP POOL DROP STRUCTURE
- CROSS-SECTION
- A-VANE
- LOG VANE
- FORD CROSSING
- ROCK CROSS-VANE
- GW GROUNDWATER GAUGES
- NOT CONSTRUCTED
- MODIFIED CHANNEL
- ADDED LOG VANE
- VEG PLOT AREA
- RIVERINE WELAND RESTORATION
- NONRIVERINE WETLAND RESTORATION
- MONITORING REACH
- ACCESS EASEMENT

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

7/14/07

SHEET THREE OF ELEVEN

AS-BUILT FOR TRIB. 3

FOR

RESTORATION SYSTEMS, LLC

CANE CREEK RESTORATION SITE

Restoration & Conservation Natural Resources

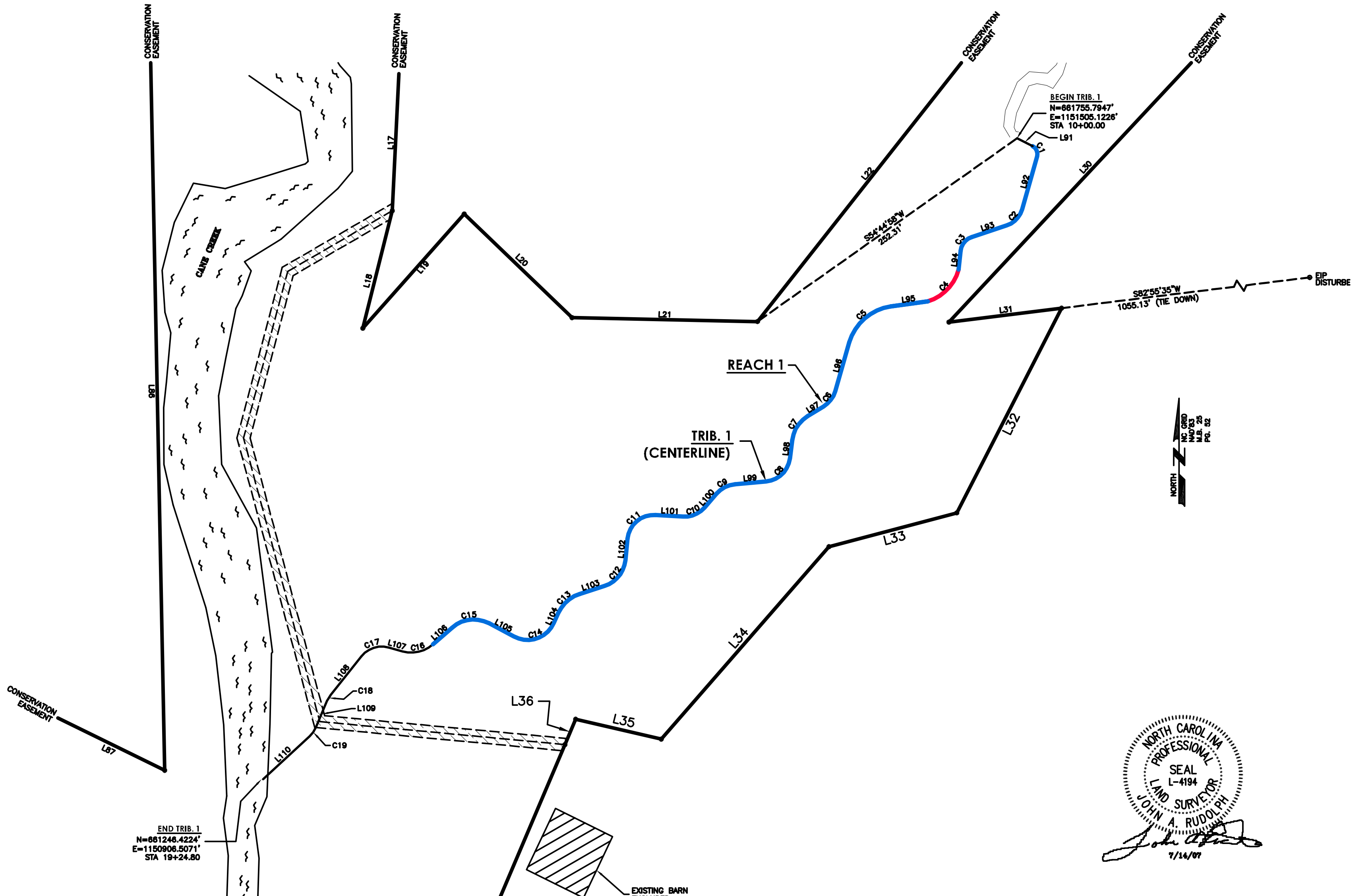
LOGAN STORE TOWNSHIP RUTHERFORD COUNTY NORTH CAROLINA

100 50 0 100 200 300

GRAPHIC SCALE 1" = 100'

LEGEND:

EIS – Existing Iron Stake
EIP – Existing Iron Pipe
NMC – Non Monumented Corner
ECM – Existing Concrete Monument
R/W – Right-Of-Way
B/C – Back-Of-Curb
UP – Utility Pole
MBL – Minimum Building Line
EOP – Edge Of Pavement
N/F – Now or Formerly
ECRM – Existing Concrete R/W Monument
MH – Sanitary Sewer Manhole
EPK – Existing PK Nail
PKS – PK Nail Set
IPS – Iron Pipe Set (1" O.D.)
ECM – Existing Concrete Monument
ERRS – Existing Railroad Spike
CC – Control Corner
D.B. – Deed Book
PG. – Page
NCDOT – North Carolina Department of Transportation
CMU – Concrete Masonry Unit
NCSR – North Carolina Secondary Road
HWY – Highway
R – Radius
BRG. – Bearing
UP Utility Pole
FEMA – Federal Emergency Management Agency
℄ Center Line
PPS – Pump Pipe Set (3" O.D.)
ERWM – Existing Concrete R/W Marker
MNS – Mag Nail Set
P/L – Property Line
MH – Sanitary Sewer Manhole
o – Non-Monumented Corner Unless Otherwise Noted
• – Iron Stake Set (No. 5 Rebar with Plastic Cap) unless Otherwise Noted
ACCESS EASEMENT



LINE DATA ALONG TRIBUTARY 1

LINE	LENGTH	BEARING
L91	13.84'	S63°29'25"E
L92	43.70'	S15°51'11"W
L93	29.19'	S71°39'55"W
L94	15.00'	S06°07'20"W
L95	29.68'	S81°58'38"W
L96	40.50'	S16°08'36"W
L97	14.90'	S58°28'54"W
L98	14.63'	S07°06'03"W
L99	24.74'	S84°57'10"W
L100	14.52'	S40°46'31"W
L101	21.82'	N86°34'14"W
L102	17.15'	S05°43'30"W
L103	20.75'	S72°10'18"W
L104	8.87'	S24°30'21"W
L105	22.25'	N61°54'48"W
L106	19.97'	S48°31'27"W
L107	11.07'	N74°14'24"W
L108	39.01'	S38°24'50"W
L109	22.61'	S23°01'36"W
L110	50.20'	S47°14'44"W

CURVE DATA ALONG TRIBUTARY 1

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C1	79°20'37"	7.00	S23°49'07"E	8.94
C2	55°48'44"	19.00	S43°45'33"W	17.78
C3	65°32'35"	13.00	S38°53'38"W	14.07
C4	58°53'41"	35.78	S44°08'48"W	35.18
C5	65°50'02"	40.00	S49°03'37"W	43.47
C6	42°20'18"	21.00	S37°18'45"W	15.17
C7	51°22'51"	26.00	S32°47'28"W	22.54
C8	77°51'07"	21.00	S46°01'37"W	26.39
C9	44°10'40"	22.00	S62°51'50"W	16.55
C10	52°39'16"	21.00	S67°06'08"W	18.63
C11	87°42'16"	21.00	S49°34'38"W	29.10
C12	66°26'48"	24.00	S38°56'54"W	26.30
C13	47°39'57"	28.00	S48°20'20"W	22.63
C14	93°34'51"	23.00	S71°17'47"W	33.53
C15	69°33'45"	26.00	S83°18'20"W	29.66
C16	57°14'09"	26.00	S77°08'32"W	24.91
C17	67°20'47"	21.00	S72°05'13"W	23.29
C18	15°23'14"	21.00	S30°43'13"W	5.62
C19	24°13'08"	21.00	S35°08'10"W	8.81

TRIBUTARY 1
1"=60'

SHEET FOUR OF ELEVEN

STREAM ALIGNMENT OF TRIB. 1

FOR

RESTORATION SYSTEMS, LLC

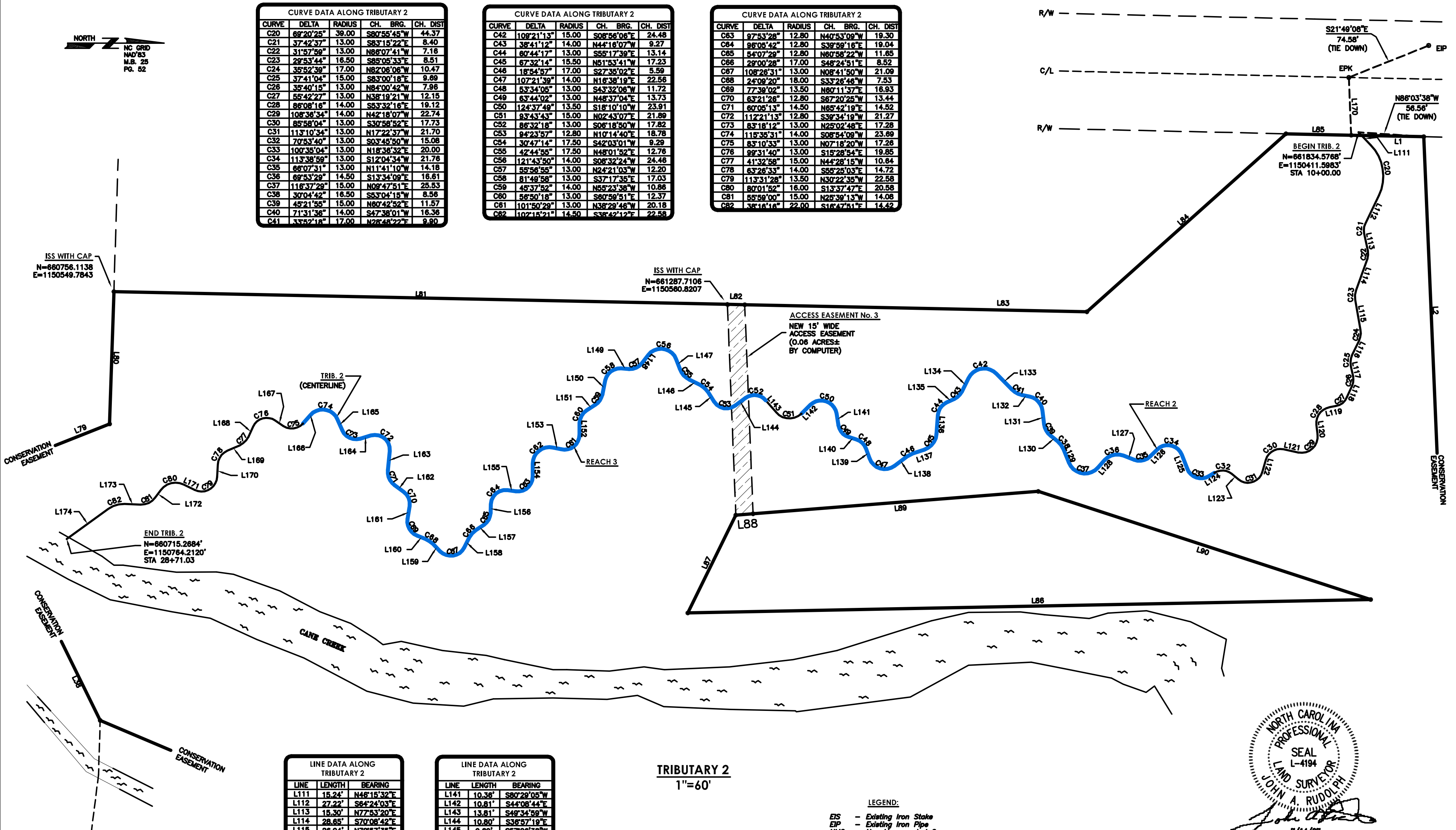
CANE CREEK RESTORATION SITE

Restoration & Conservation Natural Resources

LOGAN STORE TOWNSHIP RUTHERFORD COUNTY NORTH CAROLINA

60 30 0 60 120 180

GRAPHIC SCALE 1" = 60'



CURVE DATA ALONG TRIBUTARY 2				
CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C20	69°20'25"	39.00	S80°55'45"W	44.37
C21	37°42'37"	13.00	S83°15'22"E	8.40
C22	31°57'59"	13.00	N86°07'41"W	7.16
C23	29°53'44"	16.50	S85°05'33"E	8.51
C24	35°52'39"	17.00	N82°06'06"W	10.47
C25	37°41'04"	15.00	S83°00'18"E	9.69
C26	35°40'15"	13.00	N84°00'42"W	7.96
C27	55°42'27"	13.00	N38°19'21"W	12.15
C28	86°08'16"	14.00	S53°32'16"E	19.12
C29	108°36'34"	14.00	N42°18'07"W	22.74
C30	85°58'04"	13.00	S30°58'52"E	17.73
C31	113°10'34"	13.00	N17°22'37"W	21.70
C32	70°53'40"	13.00	S03°45'50"W	15.08
C33	100°35'04"	13.00	N18°36'32"E	20.00
C34	113°38'59"	13.00	S12°04'34"W	21.76
C35	66°07'31"	13.00	N11°41'10"W	14.18
C36	69°53'29"	14.50	S13°34'09"E	16.61
C37	116°37'29"	15.00	N09°47'51"E	25.53
C38	30°04'42"	16.50	S53°04'15"W	8.56
C39	45°21'55"	15.00	N60°42'52"E	11.57
C40	71°31'36"	14.00	S47°38'01"W	16.36
C41	33°52'18"	17.00	N28°48'22"E	9.90

CURVE DATA ALONG TRIBUTARY 2				
CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C42	109°21'13"	15.00	S08°56'06"E	24.48
C43	38°41'12"	14.00	N44°16'07"W	9.27
C44	60°44'17"	13.00	S55°17'39"E	13.14
C45	67°32'14"	15.50	N51°53'41"W	17.23
C46	18°54'57"	17.00	S27°35'02"E	5.59
C47	107°21'39"	14.00	N16°38'19"E	22.56
C48	53°34'05"	13.00	S43°32'06"W	11.72
C49	63°44'02"	13.00	N48°37'04"E	13.73
C50	124°37'49"	13.50	S18°10'10"W	23.91
C51	93°43'43"	15.00	N02°43'07"E	21.89
C52	86°32'18"	13.00	S06°18'50"W	17.82
C53	94°23'57"	12.80	N10°14'40"E	18.78
C54	30°47'14"	17.50	S42°03'01"W	9.29
C55	42°44'55"	17.50	N48°01'52"E	12.76
C56	121°43'50"	14.00	S08°32'24"W	24.46
C57	55°56'55"	13.00	N24°21'03"W	12.20
C58	81°49'58"	13.00	S37°17'35"E	17.03
C59	45°37'52"	14.00	N55°23'38"W	10.86
C60	56°50'18"	13.00	S60°59'51"E	12.37
C61	101°50'29"	13.00	N38°29'46"W	20.18
C62	102°15'21"	14.50	S38°42'12"E	22.58

CURVE DATA ALONG TRIBUTARY 2				
CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C63	97°53'28"	12.80	N40°53'09"W	19.30
C64	96°05'42"	12.80	S39°59'16"E	19.04
C65	54°07'29"	12.80	N60°58'22"W	11.65
C66	29°00'28"	17.00	S48°24'51"E	8.52
C67	108°26'31"	13.00	N08°41'50"W	21.09
C68	24°09'20"	18.00	S33°26'46"W	7.53
C69	77°39'02"	13.50	N60°11'37"E	16.93
C70	63°21'26"	12.80	S67°20'25"W	13.44
C71	60°05'13"	14.50	N65°42'19"E	14.52
C72	112°21'13"	12.80	S39°34'19"W	21.27
C73	83°18'12"	13.00	N25°02'48"E	17.28
C74	115°35'31"	14.00	S08°54'09"W	23.69
C75	83°10'33"	13.00	N07°18'20"W	17.26
C76	99°31'40"	13.00	S15°28'54"E	19.85
C77	41°32'58"	15.00	N44°28'15"W	10.64
C78	63°26'33"	14.00	S55°25'03"E	14.72
C79	113°31'28"	13.50	N30°22'35"W	22.58
C80	80°01'52"	16.00	S13°37'47"E	20.58
C81	55°59'00"	15.00	N25°39'13"W	14.08
C82	38°16'16"	22.00	S16°47'51"E	14.42

TRIBUTARY 2
1"=60'

LINE DATA ALONG TRIBUTARY 2		
LINE	LENGTH	BEARING
L111	15.24'	N46°15'32"E
L112	27.22'	S64°24'03"E
L113	15.30'	N77°53'20"E
L114	28.65'	S70°08'42"E
L115	26.04'	N79°57'35"E
L116	12.98'	S64°09'46"E
L117	9.29'	N78°09'10"E
L118	11.20'	S66°10'35"E
L119	5.55'	S10°28'08"E
L120	8.55'	N83°23'36"E
L121	13.09'	S12°00'10"W
L122	10.97'	S73°57'54"E
L123	7.58'	S39°12'40"W
L124	5.40'	S31°41'00"E
L125	12.93'	S68°54'04"W
L126	8.61'	S44°44'55"E
L127	10.10'	S21°22'36"W
L128	8.77'	S48°30'53"E
L129	12.59'	S68°06'36"W
L130	7.72'	S38°01'54"W
L131	11.84'	S83°23'49"W
L132	6.92'	S11°52'13"W
L133	19.13'	S45°44'31"W
L134	12.97'	S63°36'42"E
L135	7.31'	S24°55'31"E
L136	16.60'	S85°39'48"E
L137	10.39'	S18°07'34"E
L138	13.65'	S37°02'30"E
L139	8.96'	S70°19'08"W
L140	6.59'	S16°45'03"W

LINE DATA ALONG TRIBUTARY 2		
LINE	LENGTH	BEARING
L141	10.36'	S80°29'05"W
L142	10.81'	S44°08'44"E
L143	13.81'	S49°34'59"W
L144	10.80'	S36°57'19"E
L145	9.69'	S57°26'38"W
L146	10.16'	S26°39'24"W
L147	8.96'	S69°24'19"W
L148	8.90'	S52°19'31"E
L149	7.10'	S03°37'24"W
L150	12.63'	S78°12'34"E
L151	8.92'	S32°34'42"E
L152	10.35'	S89°25'00"E
L153	7.31'	S12°25'29"W
L154	11.17'	S89°49'53"E
L155	7.15'	S08°03'35"W
L156	7.59'	S88°02'07"E
L157	8.41'	S33°54'37"E
L158	9.87'	S62°55'05"E
L159	9.11'	S45°31'26"W
L160	7.66'	S21°22'06"W
L161	11.26'	N80°58'52"W
L162	9.49'	S35°39'42"W
L163	16.51'	N84°15'05"W
L164	9.56'	S16°36'18"E
L165	10.31'	S66°41'54"W
L166	9.71'	S48°53'37"E
L167	8.55'	S34°16'56"W
L168	9.76'	S65°14'44"E
L169	11.58'	S23°41'46"E
L170	10.43'	S87°08'19"E
L171	10.50'	S26°23'08"W
L172	8.02'	S53°38'43"E
L173	14.04'	S02°20'17"W
L174	44.66'	S35°55'59"E

LEGEND:

- EIS – Existing Iron Stake
- EIP – Existing Iron Pipe
- NMC – Non Monumented Corner
- ECM – Existing Concrete Monument
- R/W – Right–Of–Way
- B/C – Back–Of–Curb
- UP – Utility Pole
- MBL – Minimum Building Line
- EOP – Edge Of Pavement
- N/F – Now or Formerly
- ECRM – Existing Concrete R/W Monument
- MH – Sanitary Sewer Manhole
- EPK – Existing PK Nail
- PKS – PK Nail Set
- IPS – Iron Pipe Set (1" O.D.)
- ECM – Existing Concrete Monument
- ERRS – Existing Railroad Spike
- ℄ Center Line
- 50' Riprarian Buffer
- PPS – Pump Pipe Set (3" O.D.)
- ERWM – Existing Concrete R/W Marker
- MNS – Mag Nail Set
- P/L – Property Line
- MH – Sanitary Sewer Manhole
- ○ – Non–Monumented Corner Unless Otherwise Noted
- • – Iron Stake Set (No. 5 Rebar with Plastic Cap) unless Otherwise Noted
- ACCESS EASEMENT

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

7/14/07

SHEET FIVE OF ELEVEN

STREAM ALIGNMENT FOR TRIB. 2

FOR

RESTORATION SYSTEMS, LLC

CANE CREEK RESTORATION SITE

Restoration & Conservation
Natural Resources

LOGAN STORE TOWNSHIP RUTHERFORD COUNTY NORTH CAROLINA

60 30 0 60 120 180

GRAPHIC SCALE 1" = 60'

LINE	LENGTH	BEARING
L175	25.38'	S86°48'27"E
L176	19.18'	S71°18'13"E
L177	12.71'	S09°26'23"E
L178	12.52'	S60°30'15"E
L179	12.78'	S17°40'33"E
L180	17.21'	S50°55'00"E
L181	11.48'	S21°18'44"E
L182	10.92'	S78°44'29"E
L183	7.10'	S01°41'11"E
L184	17.26'	S69°47'00"E
L185	14.92'	S29°42'20"W
L186	10.60'	S29°11'16"E
L187	5.14'	S34°11'18"W
L188	10.21'	N89°05'09"E
L189	10.90'	S09°35'51"W
L190	13.79'	S43°32'34"E
L191	14.54'	S38°06'49"W
L192	13.04'	S59°53'42"E
L193	9.48'	S18°37'04"E
L194	6.76'	S50°48'18"E
L195	12.89'	S84°16'34"W
L196	10.39'	S02°26'20"E
L197	13.24'	S52°17'49"W
L198	10.41'	S04°30'20"W
L199	11.07'	S46°49'48"W
L200	19.54'	S46°35'10"E
L201	7.79'	S11°40'39"W
L202	11.00'	S37°23'37"E
L203	17.59'	S41°29'31"W
L204	9.71'	S19°40'08"E
L205	15.56'	S83°40'17"W

LINE DATA ALONG TRIBUTARY 3

LINE	LENGTH	BEARING
L206	6.70'	S22°50'17"W
L207	11.66'	S48°32'04"W
L208	11.83'	S11°54'26"E
L209	11.37'	S57°39'22"W
L210	8.75'	S17°26'04"W
L211	17.74'	S36°29'00"W
L212	12.16'	S85°31'59"E
L213	6.45'	S05°59'57"W
L214	9.00'	S80°58'19"E
L215	10.37'	S28°56'40"E
L216	16.20'	N89°02'52"E
L217	7.82'	S26°39'43"W
L218	9.40'	S19°31'16"E
L219	10.58'	S80°15'40"W
L220	9.20'	S05°35'16"W
L221	12.23'	N78°47'14"W
L222	12.10'	S31°32'18"W
L223	11.71'	S76°25'36"W
L224	9.60'	S42°05'49"E
L225	9.42'	S10°57'04"E
L226	10.59'	S40°38'11"E
L227	10.53'	S56°22'40"W
L228	13.85'	S60°27'19"E
L229	10.30'	S31°24'53"E
L230	13.34'	S54°13'30"E
L231	11.28'	S24°42'42"W
L232	18.57'	S40°38'15"E
L233	20.20'	S27°02'09"E
L234	16.71'	S46°49'55"E
L235	3.15'	S43°17'20"E
L236	41.68'	S39°44'44"E

LINE DATA ALONG TRIBUTARY 3

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C83	15°30'14"	20.50	S79°03'20"E	5.53
C84	61°51'50"	17.00	S40°22'18"E	17.48
C85	51°03'52"	18.00	S34°58'19"E	15.52
C86	42°49'42"	18.00	S39°05'24"E	13.14
C87	33°14'27"	19.50	S34°17'46"E	11.16
C88	29°36'16"	18.00	S36°06'52"E	9.20
C89	57°25'45"	15.00	S50°01'36"E	14.41
C90	77°03'18"	13.00	S40°12'50"E	16.20
C91	68°05'50"	20.00	S35°44'05"E	22.40
C92	99°29'20"	16.50	S20°02'20"E	25.18
C93	58°53'36"	13.00	S00°15'32"W	12.78
C94	63°22'34"	13.00	S02°30'01"W	13.66
C95	125°06'09"	13.50	S28°21'46"E	23.96
C96	100°30'41"	13.00	S40°39'30"E	19.99
C97	53°08'25"	13.00	S16°58'22"E	11.63
C98	81°39'24"	16.00	S02°42'52"E	20.92
C99	98°00'31"	13.00	S10°53'26"E	19.62
C100	41°16'38"	16.00	S39°15'23"E	11.28
C101	32°11'14"	14.00	S34°42'41"E	7.76
C102	135°04'52"	14.50	S16°44'08"W	26.80
C103	86°42'54"	13.00	S40°55'07"W	17.85
C104	54°44'09"	14.00	S24°55'44"W	12.87
C105	47°47'29"	20.00	S28°24'04"W	16.20
C106	42°19'29"	15.00	S25°40'04"W	10.83
C107	93°24'58"	18.00	S00°07'19"W	26.20
C108	58°15'48"	16.00	S17°27'15"E	15.58
C109	49°04'16"	13.00	S12°51'29"E	10.80
C110	78°53'07"	15.50	S02°02'57"W	19.69
C111	61°09'38"	14.00	S10°54'41"W	14.24
C112	103°20'25"	15.50	S32°00'05"W	24.32
C113	60°50'01"	15.50	S53°15'17"W	15.69
C114	25°41'48"	24.50	S35°41'10"W	10.90

LINE DATA ALONG TRIBUTARY 3

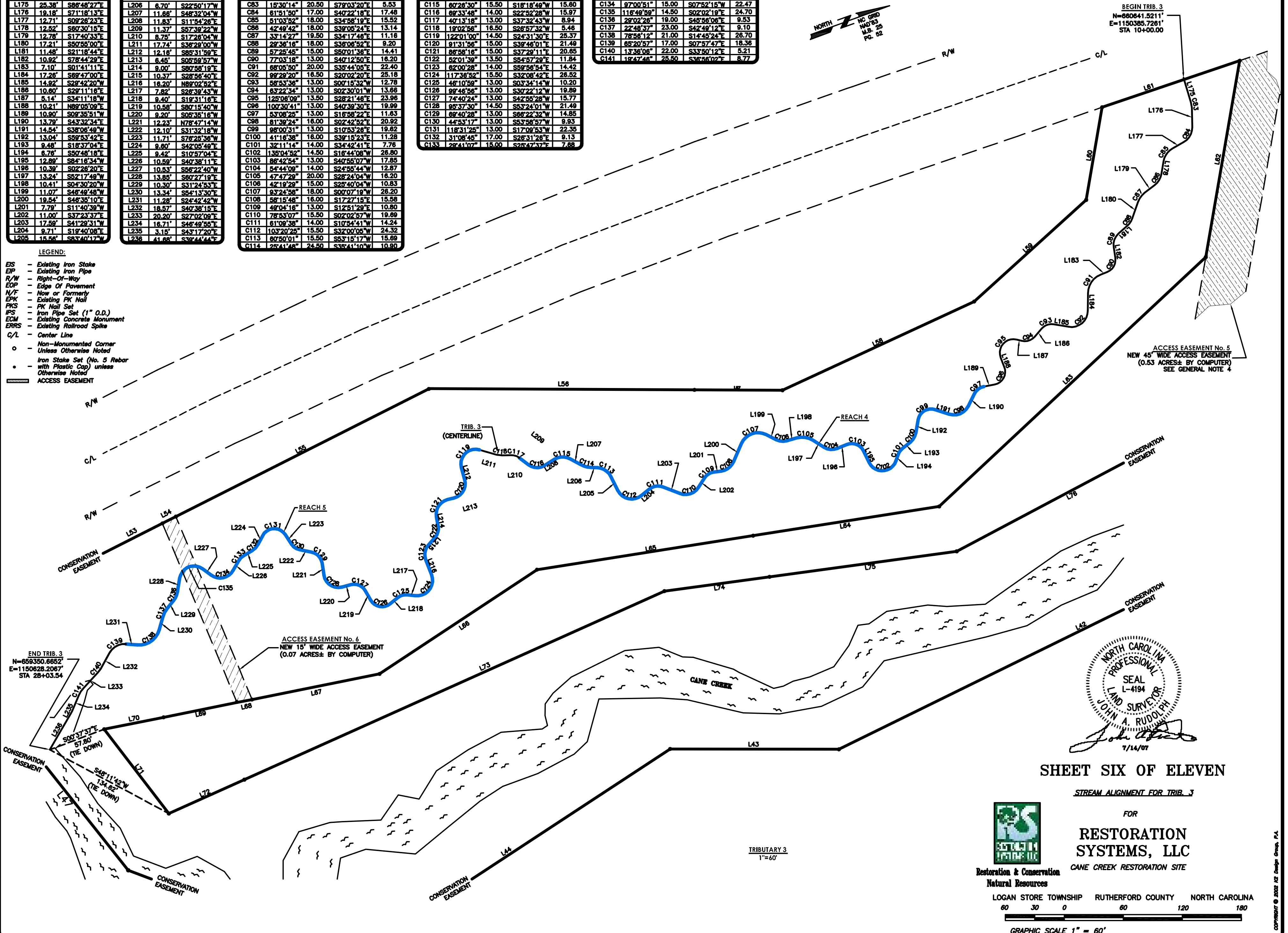
CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C115	60°26'30"	15.50	S18°18'49"W	15.60
C116	69°33'48"	14.00	S22°52'28"W	15.97
C117	40°13'18"	13.00	S37°32'43"W	8.94
C118	19°02'56"	16.50	S26°57'32"W	5.46
C119	122°01'00"	14.50	S24°31'30"E	25.37
C120	91°31'56"	15.00	S39°46'01"E	21.49
C121	86°58'16"	15.00	S37°29'11"E	20.65
C122	52°01'39"	13.50	S54°57'29"E	11.84
C123	62°00'28"	14.00	S59°56'54"E	14.42
C124	117°36'52"	15.50	S32°08'42"E	26.52
C125	46°10'59"	13.00	S03°34'14"W	10.20
C126	99°46'56"	13.00	S30°22'12"W	19.89
C127	74°40'24"	13.00	S42°55'28"W	15.77
C128	95°37'30"	14.50	S53°24'01"W	21.49
C129	69°40'28"	13.00	S66°22'32"W	14.85
C130	44°53'17"	13.00	S53°58'57"W	9.93
C131	118°31'25"	13.00	S17°09'53"W	22.35
C132	31°08'45"	17.00	S26°31'26"E	9.13
C133	29°41'07"	15.00	S25°47'37"E	7.68

LINE DATA ALONG TRIBUTARY 3

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C134	97°00'51"	15.00	S07°52'15"W	22.47
C135	116°49'59"	14.50	S02°02'19"E	24.70
C136	29°02'26"	19.00	S45°56'06"E	9.53
C137	22°48'37"	23.00	S42°49'12"E	9.10
C138	78°56'12"	21.00	S14°45'24"E	26.70
C139	65°20'57"	17.00	S07°57'47"E	18.36
C140	13°36'06"	22.00	S33°50'12"E	5.21
C141	19°47'46"	25.50	S36°56'02"E	8.77

LEGEND:

- EIS – Existing Iron Stake
- EIP – Existing Iron Pipe
- R/W – Right-Of-Way
- EOP – Edge Of Pavement
- N/F – Now or Formerly
- EPK – Existing PK Nail
- PKS – PK Nail Set
- IPS – Iron Pipe Set (1" O.D.)
- ECM – Existing Concrete Monument
- ERRS – Existing Railroad Spike
- C/L – Center Line
- ○ – Non-Monumented Corner Unless Otherwise Noted
- • – Iron Stake Set (No. 5 Rebar with Plastic Cap) unless Otherwise Noted
- ACCESS EASEMENT



NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

7/14/07

SHEET SIX OF ELEVEN

STREAM ALIGNMENT FOR TRIB. 3

FOR

RESTORATION SYSTEMS, LLC

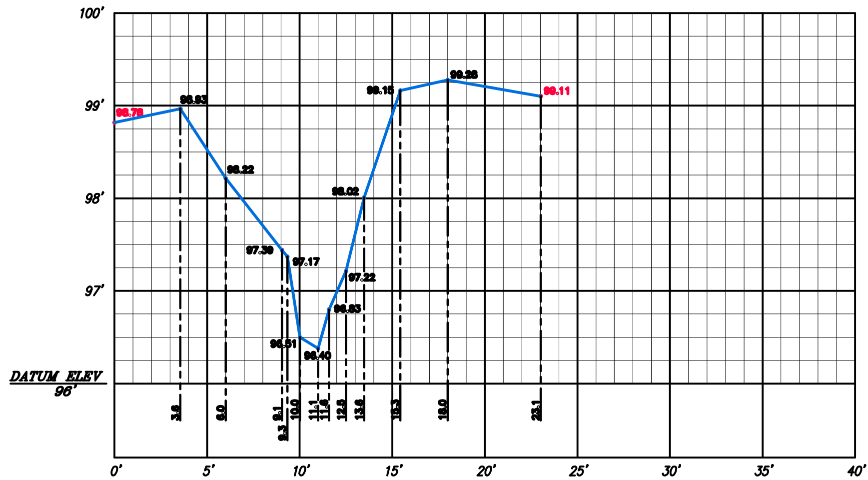
CANE CREEK RESTORATION SITE

Restoration & Conservation Natural Resources

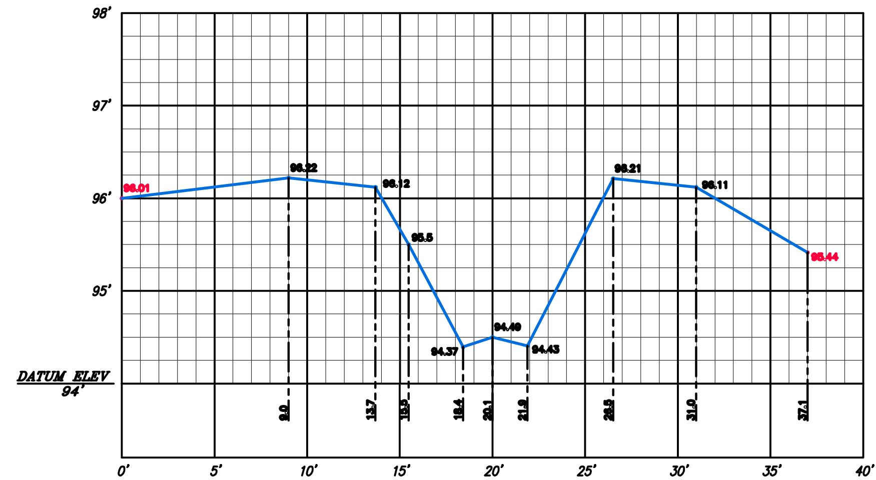
LOGAN STORE TOWNSHIP RUTHERFORD COUNTY NORTH CAROLINA

60 30 0 60 120 180

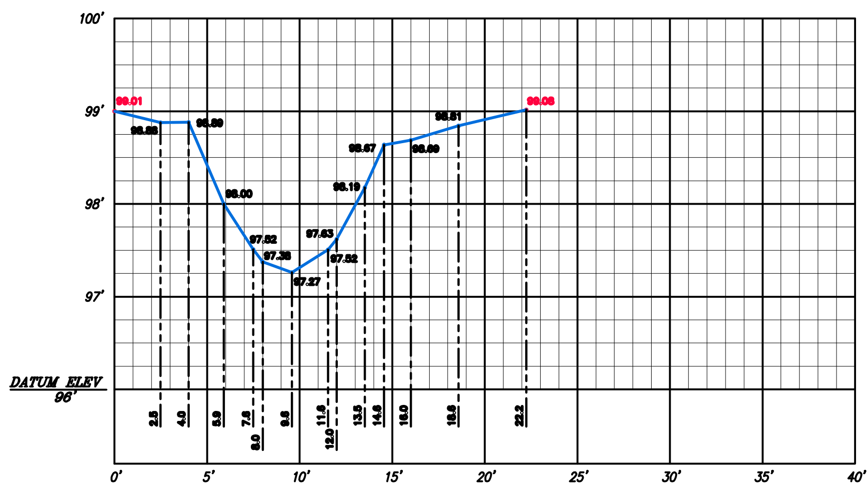
GRAPHIC SCALE 1" = 60'



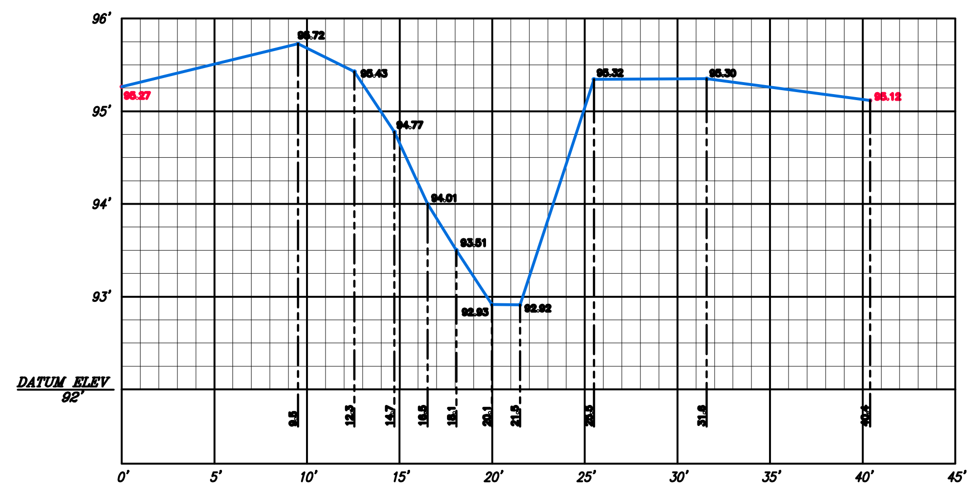
TRIB. 1 - CROSS-SECTION 1
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 1 - CROSS-SECTION 3
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 1 - CROSS-SECTION 2
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 1 - CROSS-SECTION 4
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

SHEET SEVEN OF ELEVEN

CROSS-SECTIONS FOR TRIB. 1

FOR

RESTORATION SYSTEMS, LLC

CANE CREEK RESTORATION SITE

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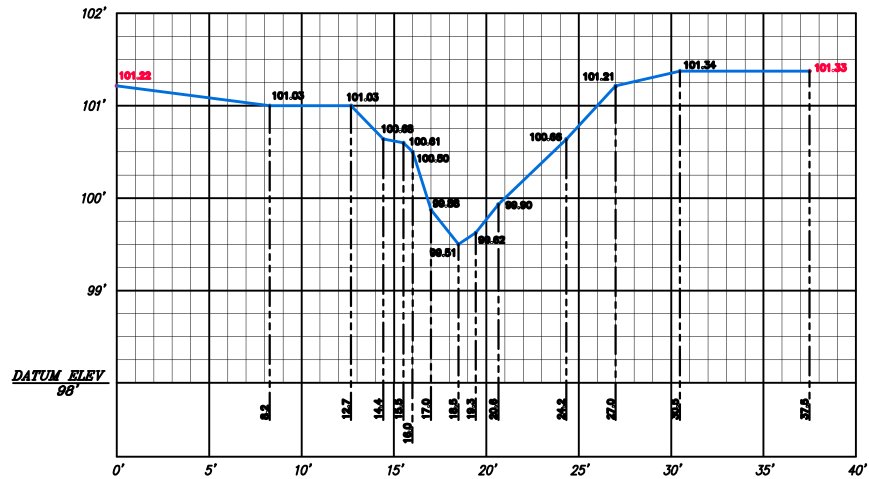
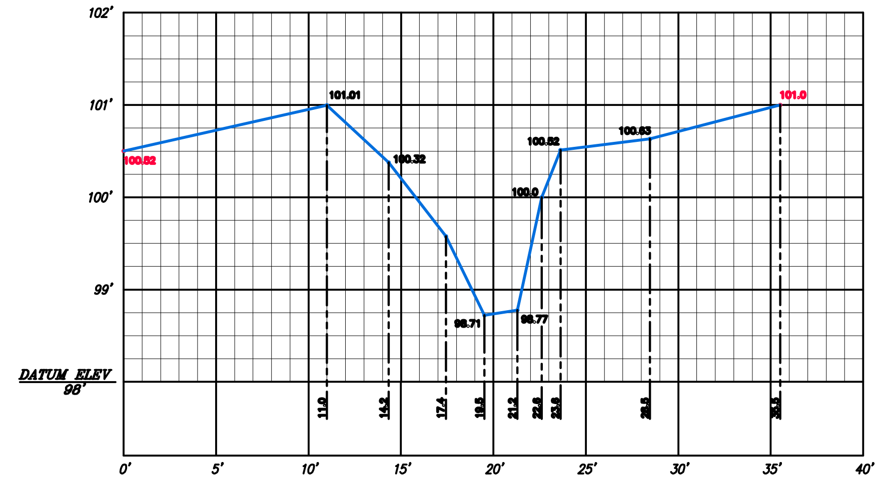
LOGAN STORE TOWNSHIP RUTHERFORD COUNTY NORTH CAROLINA

LEGEND

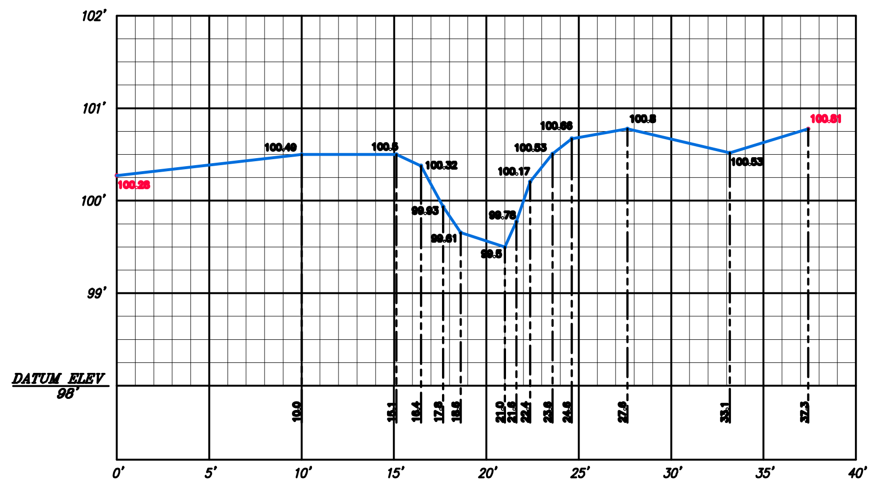
XX' TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE (ASSUMED ELEVATION)



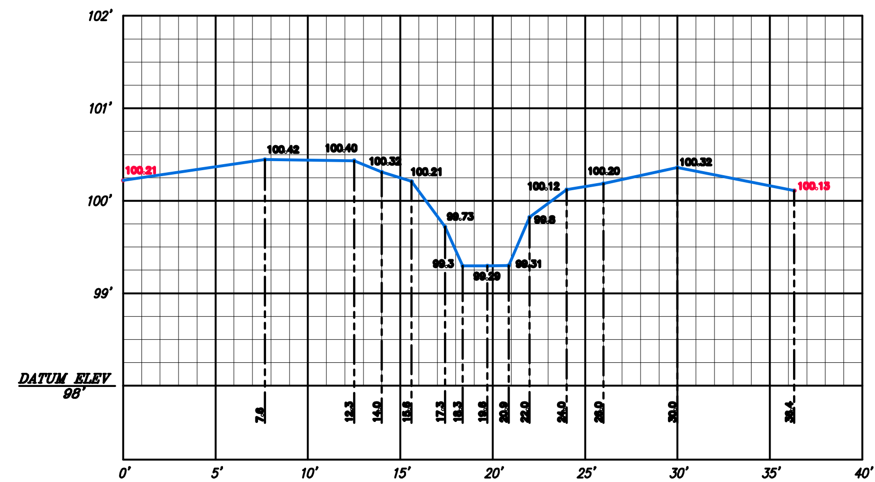
TRIB. 2 - CROSS-SECTION 1
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 2 - CROSS-SECTION 3
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 2 - CROSS-SECTION 2
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 2 - CROSS-SECTION 4
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

SHEET EIGHT OF ELEVEN

CROSS-SECTIONS FOR TRIB 2

FOR

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Natural Resources

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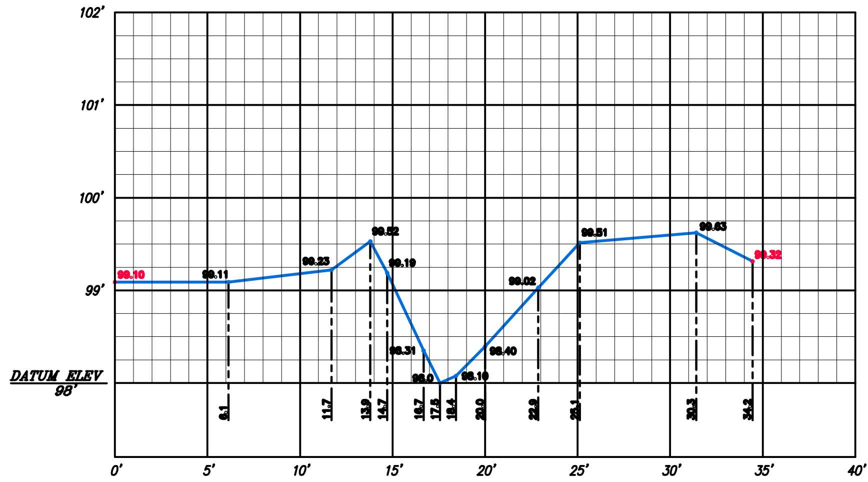
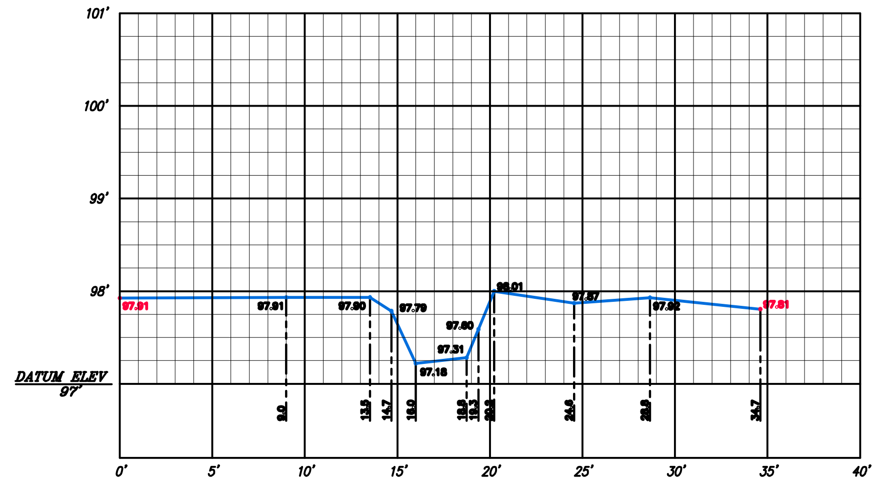
LEGEND

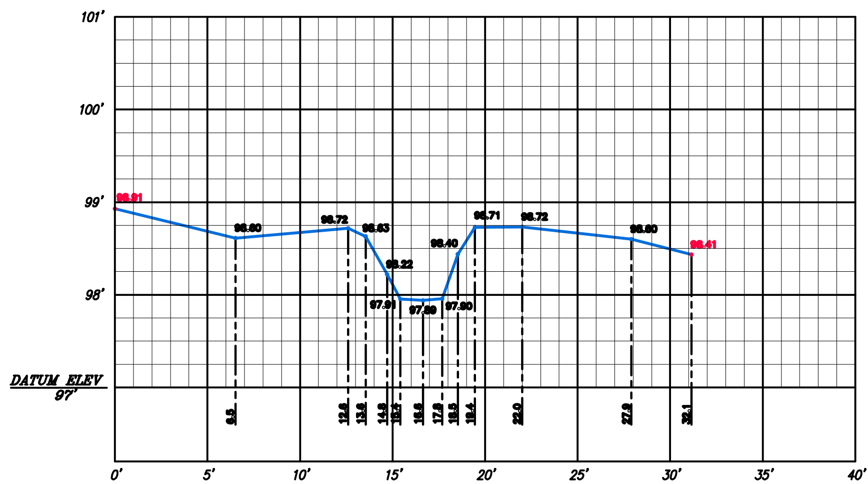
XX' TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE (ASSUMED ELEVATION)



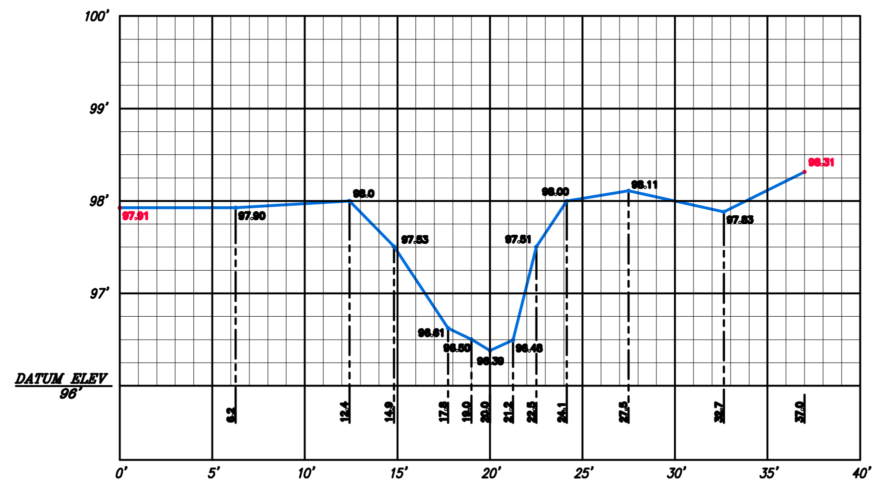
TRIB. 2 - CROSS-SECTION 5
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 2 - CROSS-SECTION 7
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 2 - CROSS-SECTION 6
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 2 - CROSS-SECTION 8
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

SHEET NINE OF ELEVEN

CROSS-SECTIONS FOR TRIB. 2

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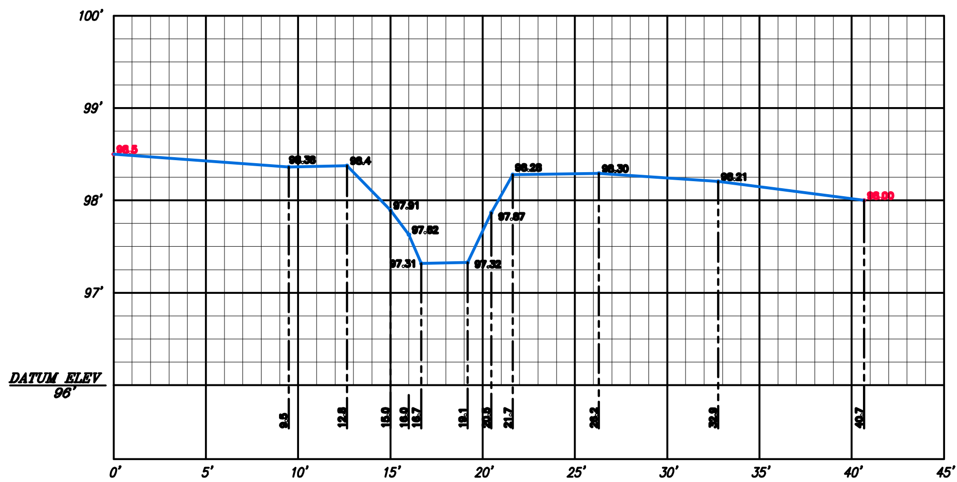
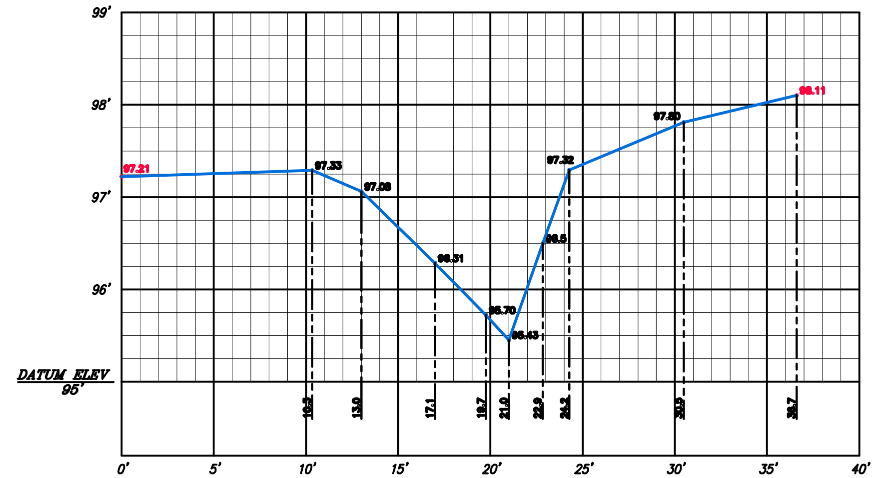
LEGEND

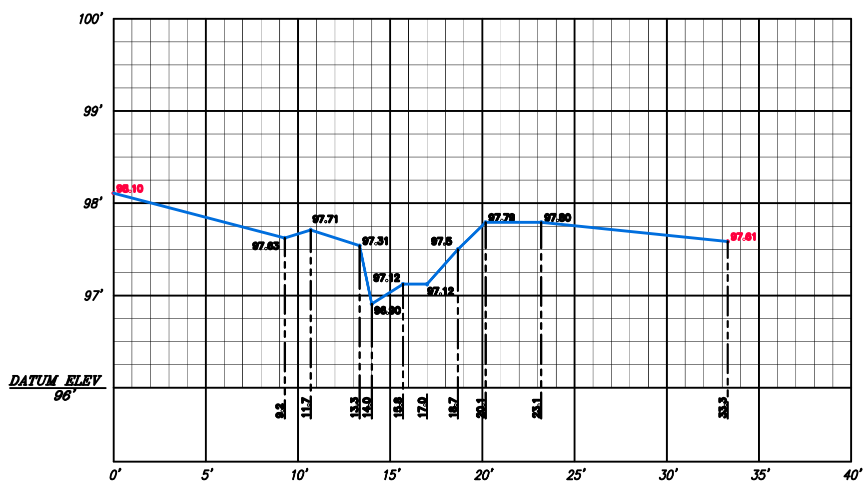
TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE (ASSUMED ELEVATION)



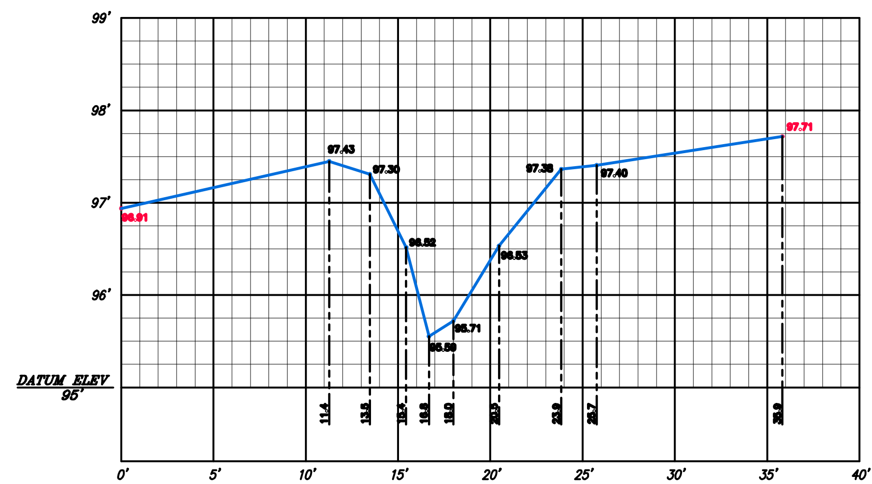
TRIB. 3 - CROSS-SECTION 1
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 3 - CROSS-SECTION 3
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 3 - CROSS-SECTION 2
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 3 - CROSS-SECTION 4
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

SHEET TEN OF ELEVEN

CROSS-SECTIONS FOR TRIB. 3

FOR

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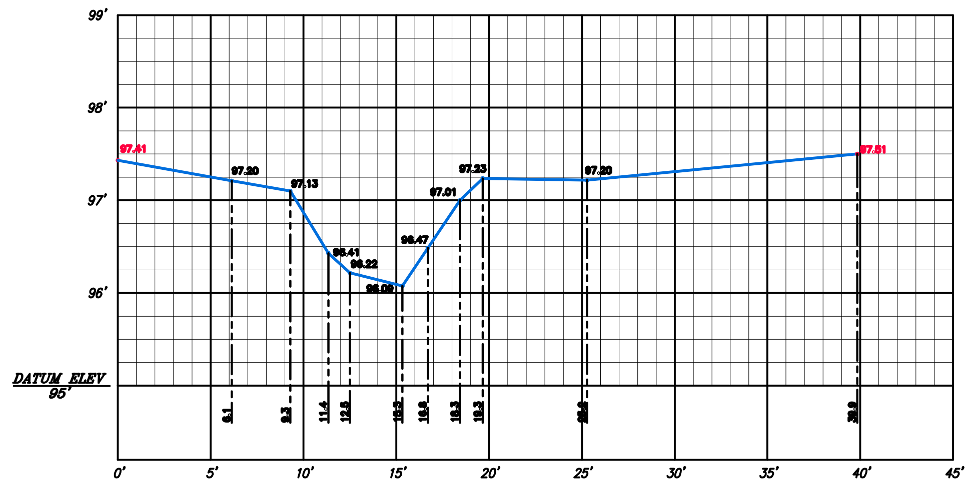
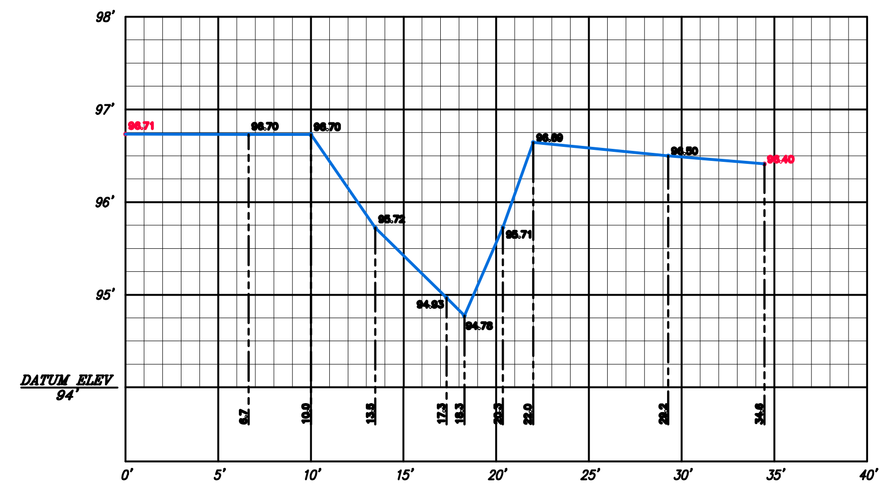
LEGEND

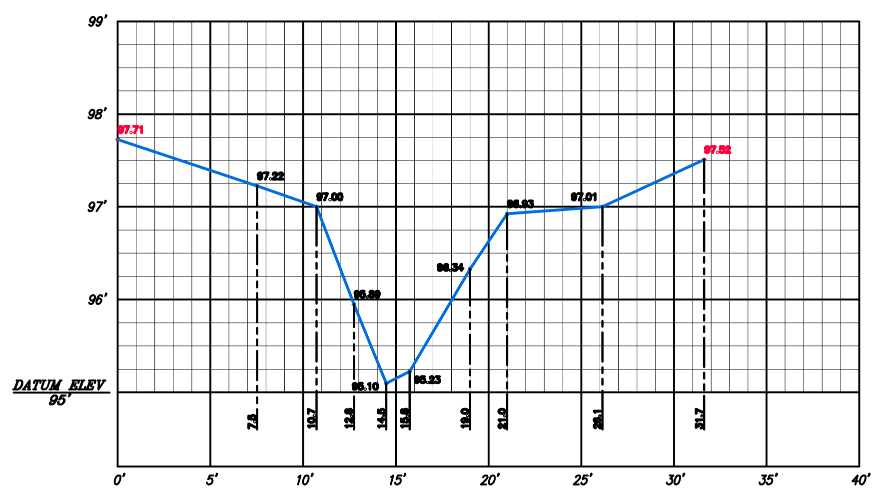
XX' TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE (ASSUMED ELEVATION)



TRIB. 3 - CROSS-SECTION 5
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 3 - CROSS-SECTION 7
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



TRIB. 3 - CROSS-SECTION 6
(EAST BANK TO WEST BANK)
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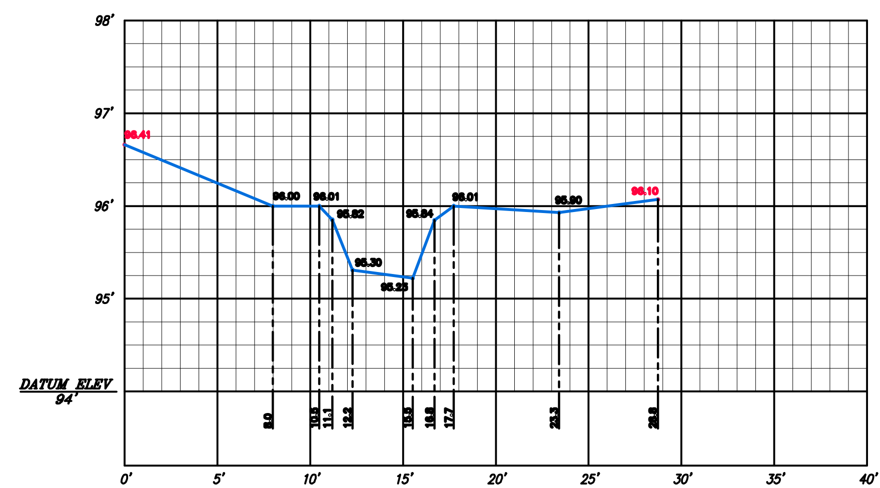

TRIB. 3 - CROSS-SECTION 8
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

SHEET ELEVEN OF ELEVEN

CROSS-SECTIONS FOR TRIB. 3

FOR

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CANE CREEK RESTORATION SITE

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LOGAN STORE TOWNSHIP RUTHERFORD COUNTY NORTH CAROLINA

LEGEND

XX' TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE (ASSUMED ELEVATION)

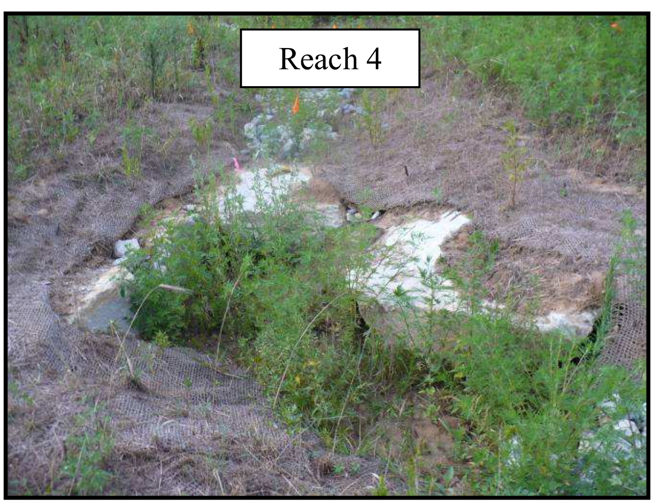
Appendix B.
Preconstruction and
Construction Photographs

Cane Creek Preconstruction Conditions
Taken March 2007

Cane Creek During Construction
Taken April 2008

Appendix C.
Baseline Stream Photographs and Stream Measurements

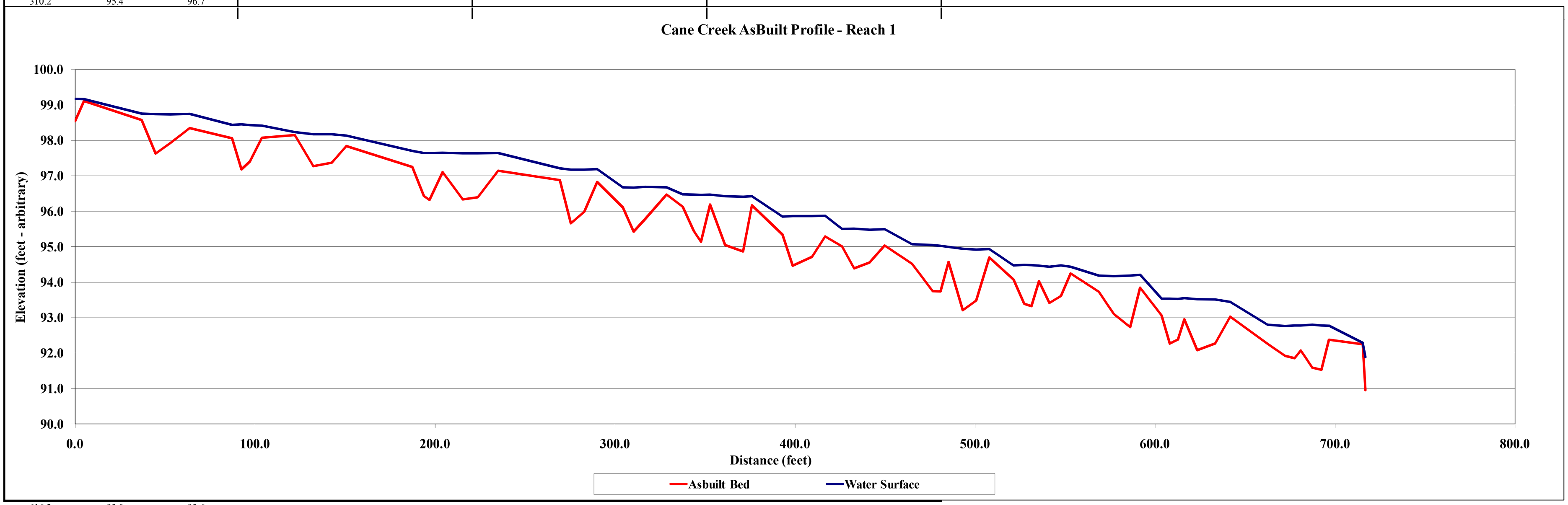
Cane Creek
Baseline Stream Structure Photographs taken July 2008



Project Name	Cane Creek AsBuilt
Reach	1
Feature	Profile
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey Station	Bed Elevation	Water Elevation	2008 2008 Survey Station	Bed Elevation	Water Elevation	2009 2009 Survey Station	Bed Elevation	Water Elevation	2010 2010 Survey Station	Bed Elevation	Water Elevation
0.0	98.5	99.2									
4.9	99.1	99.2									
36.9	98.6	98.8									
44.7	97.6	98.7									
53.1	97.9	98.7									
63.7	98.3	98.7									
87.2	98.1	98.4									
92.3	97.2	98.4									
97.2	97.4	98.4									
103.9	98.1	98.4									
122.1	98.2	98.2									
132.4	97.3	98.2									
142.7	97.4	98.2									
150.6	97.8	98.1									
187.3	97.2	97.7									
193.7	96.4	97.6									
196.9	96.3	97.6									
204.3	97.1	97.7									
215.4	96.3	97.6									
223.8	96.4	97.6									
235.1	97.1	97.6									
269.3	96.9	97.2									
275.4	95.7	97.2									
282.8	96.0	97.2									
290.0	96.8	97.2									
304.4	96.1	96.7									
310.2	95.4	96.7									

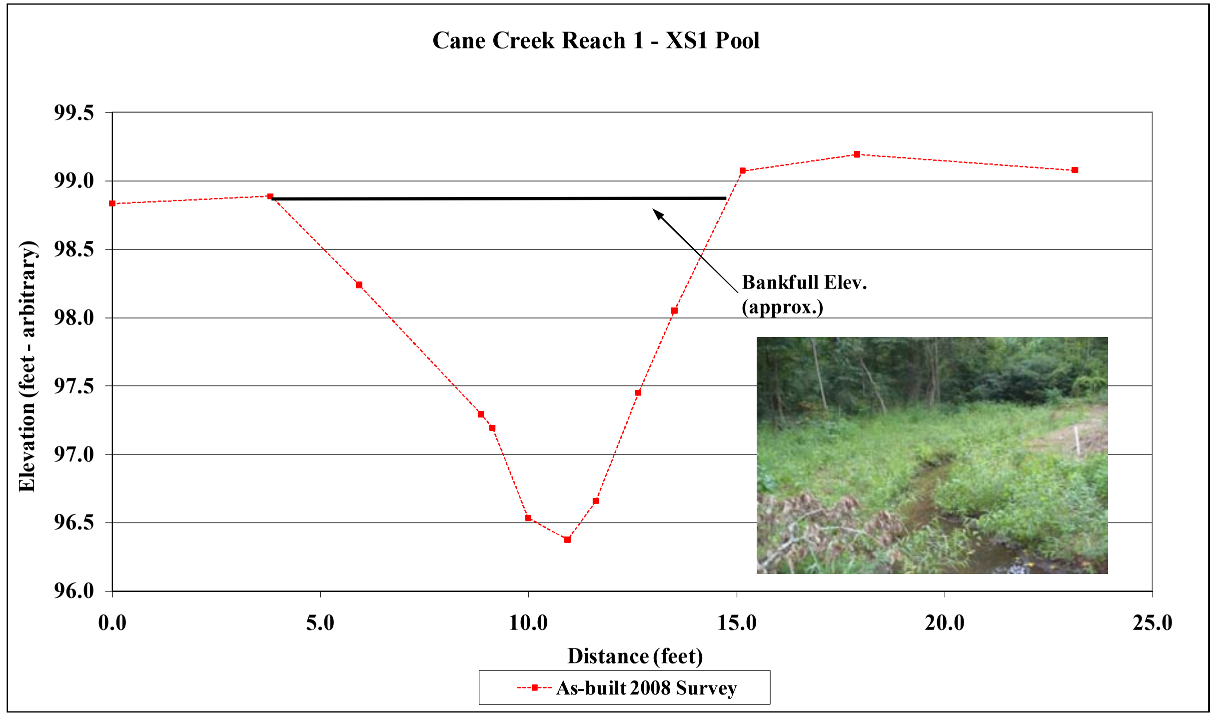
	AsBuilt	2008	2009	2010
Avg. Water Surface Slope	0.0092			
Avg. Riffle Slope				
Avg. Pool Slope				
Avg. Run Slope				
Avg. Glide Slope				



616.2	93.0	93.6

Project Name	Cane Creek
Cross Section	R1-XS1
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

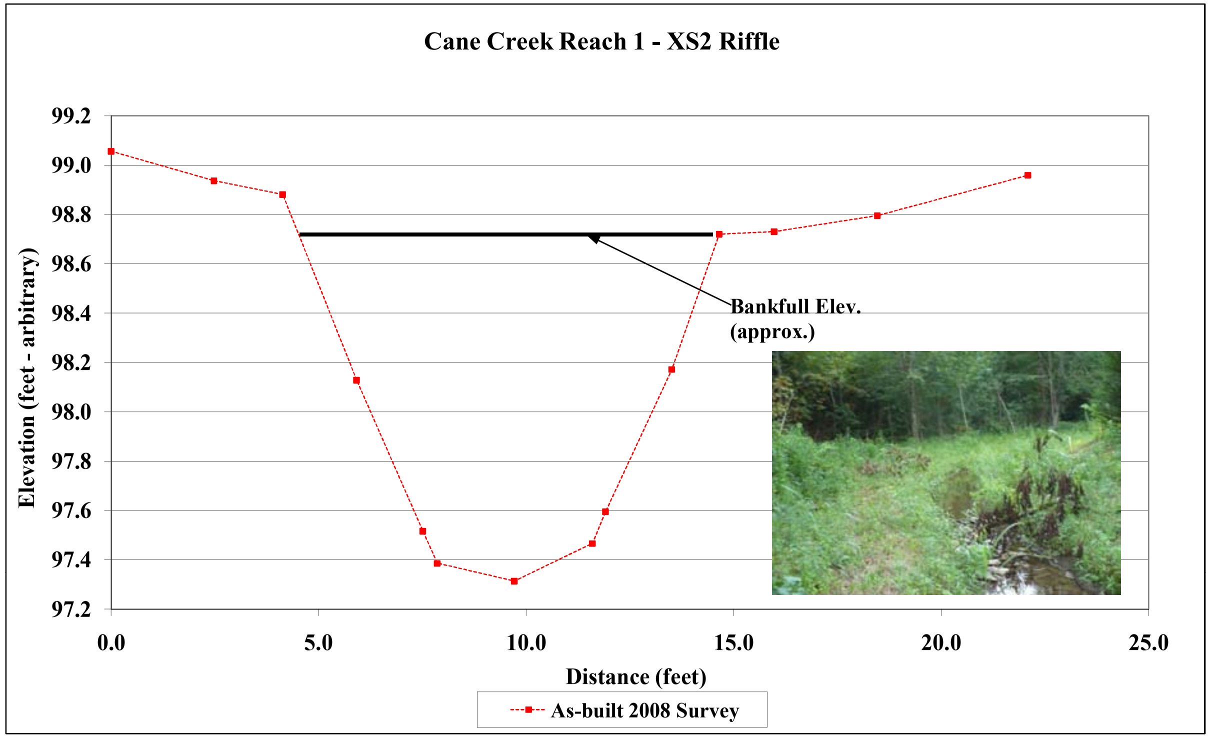
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	98.8						
3.8	98.9						
5.9	98.2						
8.9	97.3						
9.1	97.2						
10.0	96.5						
10.9	96.4						
11.6	96.7						
12.6	97.4						
13.5	98.0						
15.1	99.1						
17.9	99.2						
23.1	99.1						



	As-built	2008	2009	2010
Area	13.5			
Width	11.0			
Mean Depth	1.2			
Max Depth	2.5			
W/D Ratio	NA			

Project Name	Cane Creek
Cross Section	R1-XS2
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

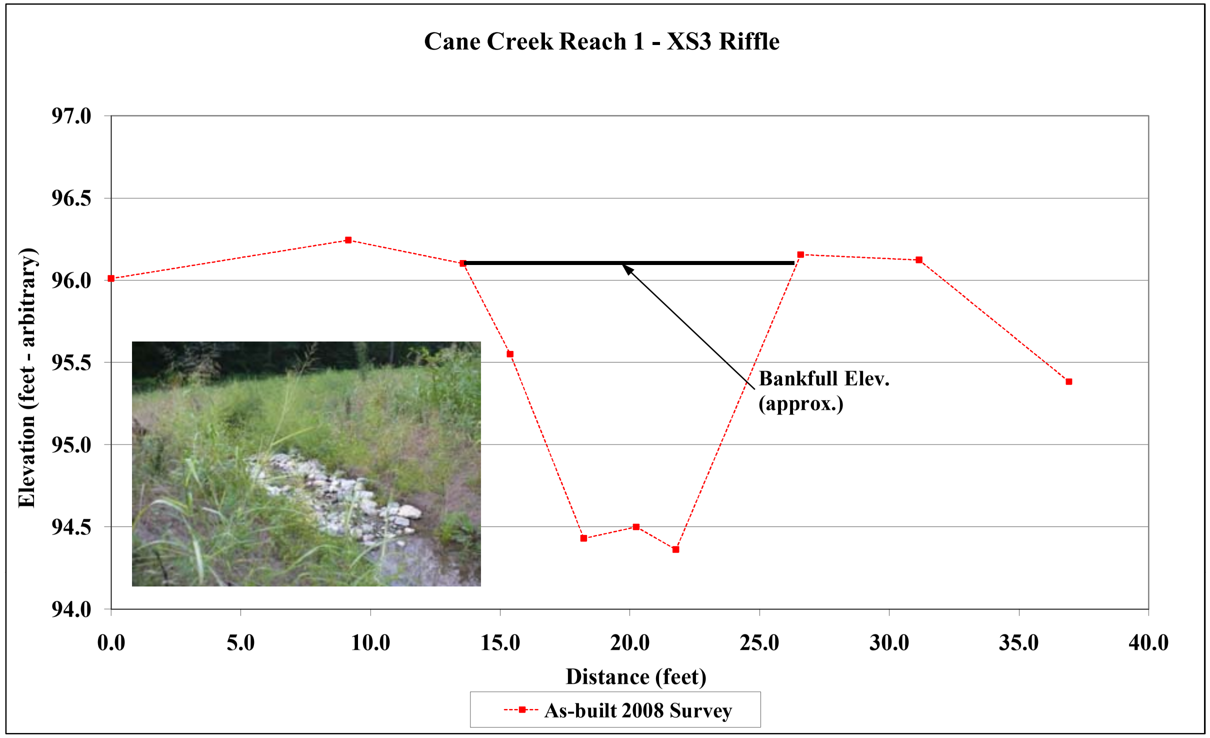
As-built 2008 Survey Station	As-built 2008 Survey Elevation	2008 2008 Survey Station	2008 2008 Survey Elevation	2009 2009 Survey Station	2009 2009 Survey Elevation	2010 2010 Survey Station	2010 2010 Survey Elevation
0.0	99.1						
2.5	98.9						
4.1	98.9						
5.9	98.1						
7.5	97.5						
7.9	97.4						
9.7	97.3						
11.6	97.5						
11.9	97.6						
13.5	98.2						
14.7	98.7						
16.0	98.7						
18.5	98.8						
22.1	99.0						



	As-built	2008	2009	2010
Area	9.4			
Width	10.1			
Mean Depth	0.9			
Max Depth	1.4			
W/D Ratio	11.0			

Project Name	Cane Creek
Cross Section	R1-XS3
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

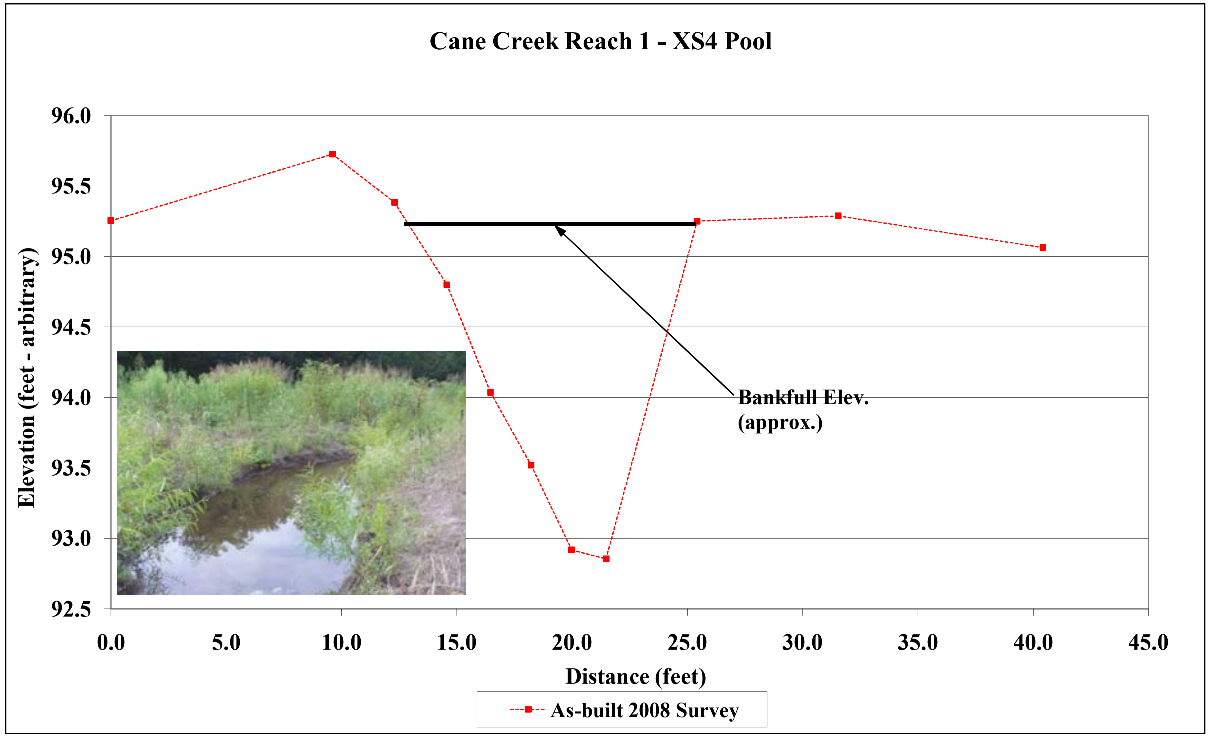
As-built 2008 Survey Station	As-built 2008 Survey Elevation	2008 2008 Survey Station	2008 2008 Survey Elevation	2009 2009 Survey Station	2009 2009 Survey Elevation	2010 2010 Survey Station	2010 2010 Survey Elevation
0.0	96.0						
9.1	96.2						
13.6	96.1						
15.4	95.5						
18.2	94.4						
20.2	94.5						
21.8	94.4						
26.6	96.2						
31.1	96.1						
36.9	95.4						



	As-built	2008	2009	2010
Area	13.6			
Width	12.9			
Mean Depth	1.1			
Max Depth	1.7			
W/D Ratio	12.2			

Project Name	Cane Creek
Cross Section	R1-XS4
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey Station	As-built 2008 Survey Elevation	2008 2008 Survey Station	2008 2008 Survey Elevation	2009 2009 Survey Station	2009 2009 Survey Elevation	2010 2010 Survey Station	2010 2010 Survey Elevation
0.0	95.3						
9.6	95.7						
12.3	95.4						
14.6	94.8						
16.5	94.0						
18.2	93.5						
20.0	92.9						
21.5	92.9						
25.4	95.3						
31.5	95.3						
40.4	95.1						

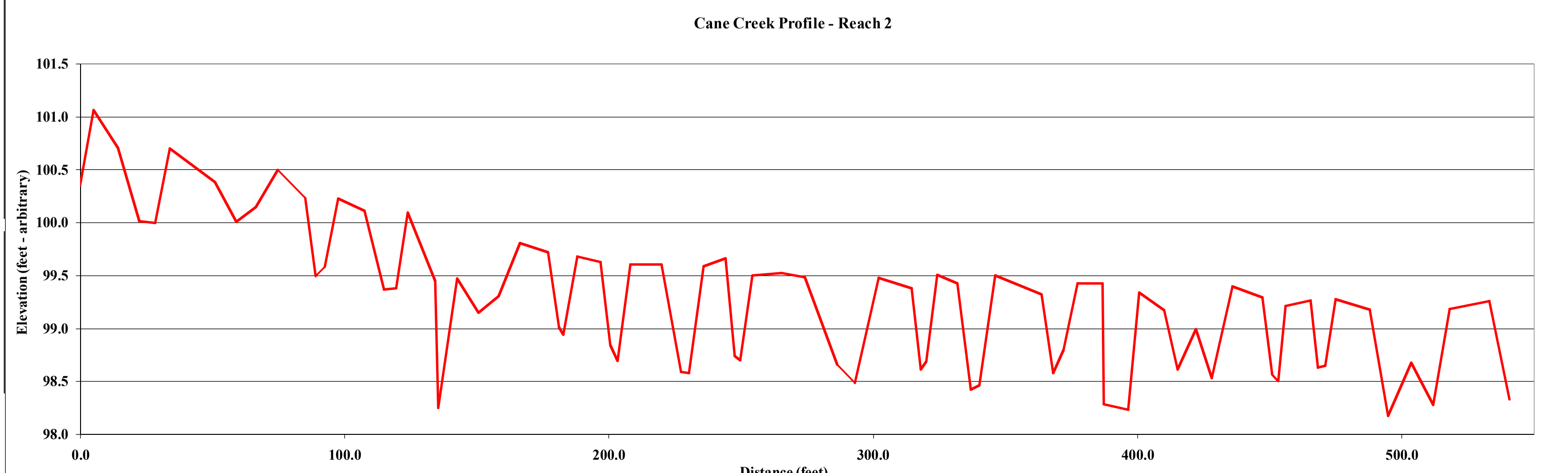


	As-built	2008	2009	2010
Area	16.4			
Width	12.6			
Mean Depth	1.3			
Max Depth	2.4			
W/D Ratio	NA			

Project Name	Cane Creek AsBuilt
Reach	2
Feature	Profile
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey		2008 2008 Survey			2009 2009 Survey			2010 2010 Survey		
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	100.4									
5.1	101.1									
14.2	100.7									
22.3	100.0									
28.3	100.0									
33.9	100.7									
50.9	100.4									
58.9	100.0									
66.5	100.1									
74.6	100.5									
85.0	100.2									
89.0	99.5									
92.4	99.6									
97.4	100.2									
107.3	100.1									
114.9	99.4									
119.5	99.4									
123.9	100.1									
134.1	99.5									
135.3	98.2									
142.6	99.5									
150.6	99.1									

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0036			
Avg. Riffle Slope				
Avg. Pool Slope				
Avg. Run Slope				
Avg. Glide Slope				

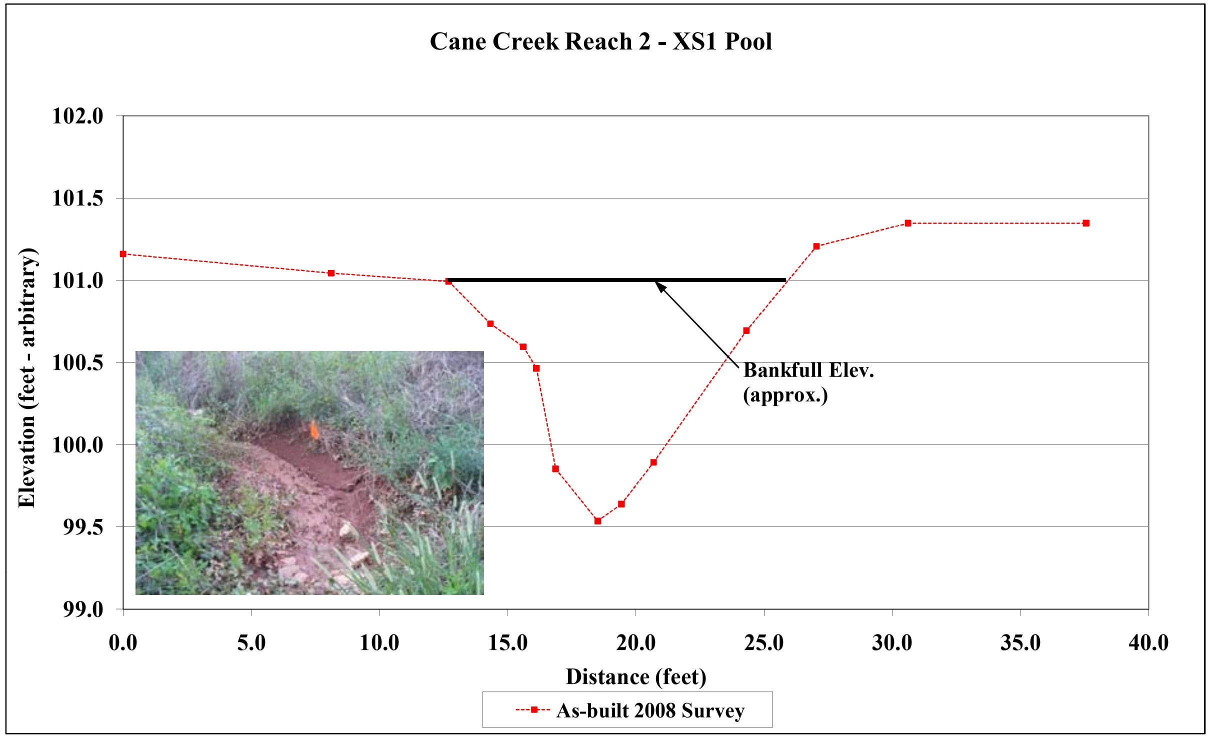


Note: Channel was dry at the time asbuilt measurements were collected; therefore, no water surface elevation is shown

400.64	99.34
410.10	99.17
414.99	98.61
421.94	98.99
428.00	98.53
435.96	99.40
447.17	99.29
450.99	98.56
453.17	98.50
456.03	99.21
465.45	99.26
468.15	98.63
470.85	98.64
474.84	99.27
487.74	99.18
494.76	98.17
503.48	98.67
511.72	98.28
518.13	99.18
533.02	99.26
540.58	98.33

Project Name	Cane Creek
Cross Section	R2-XS1
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

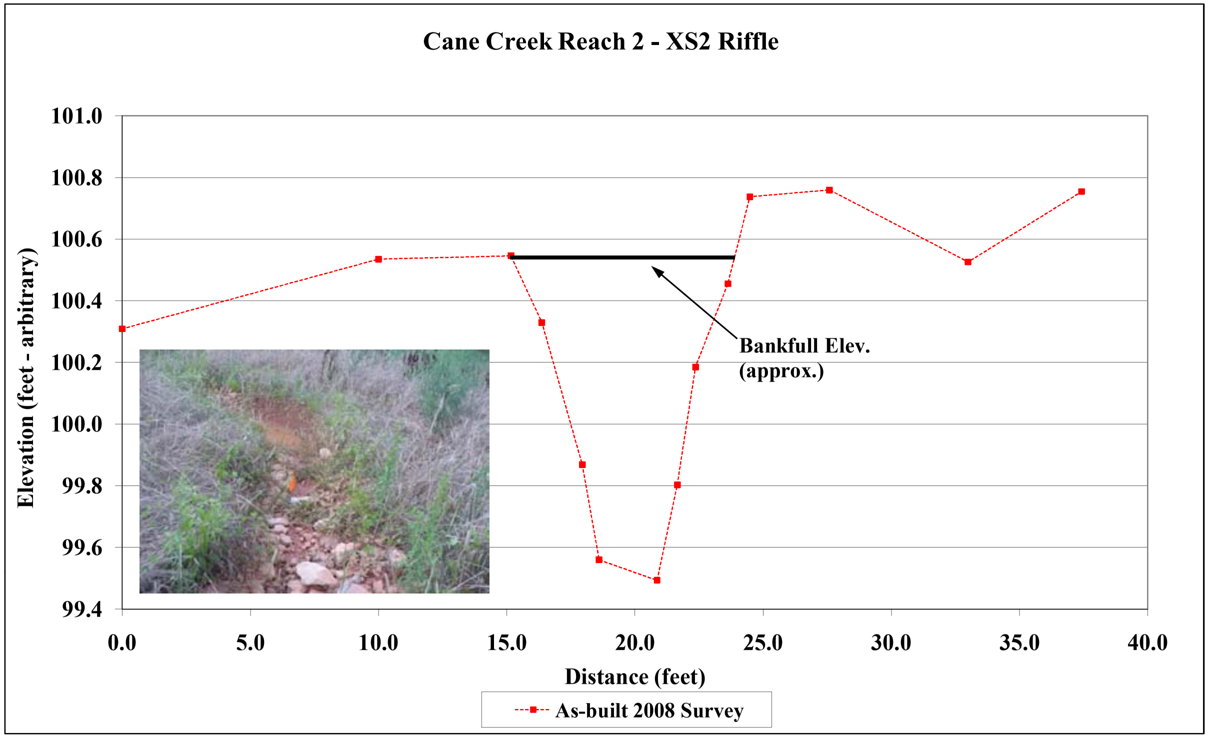
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	101.2						
8.1	101.0						
12.7	101.0						
14.3	100.7						
15.6	100.6						
16.1	100.5						
16.9	99.9						
18.5	99.5						
19.4	99.6						
20.7	99.9						
24.3	100.7						
27.0	101.2						
30.6	101.3						
37.6	101.3						



	As-built	2008	2009	2010
Area	9.3			
Width	13.4			
Mean Depth	0.7			
Max Depth	1.5			
W/D Ratio	N/A			

Project Name	Cane Creek
Cross Section	R2-XS2
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

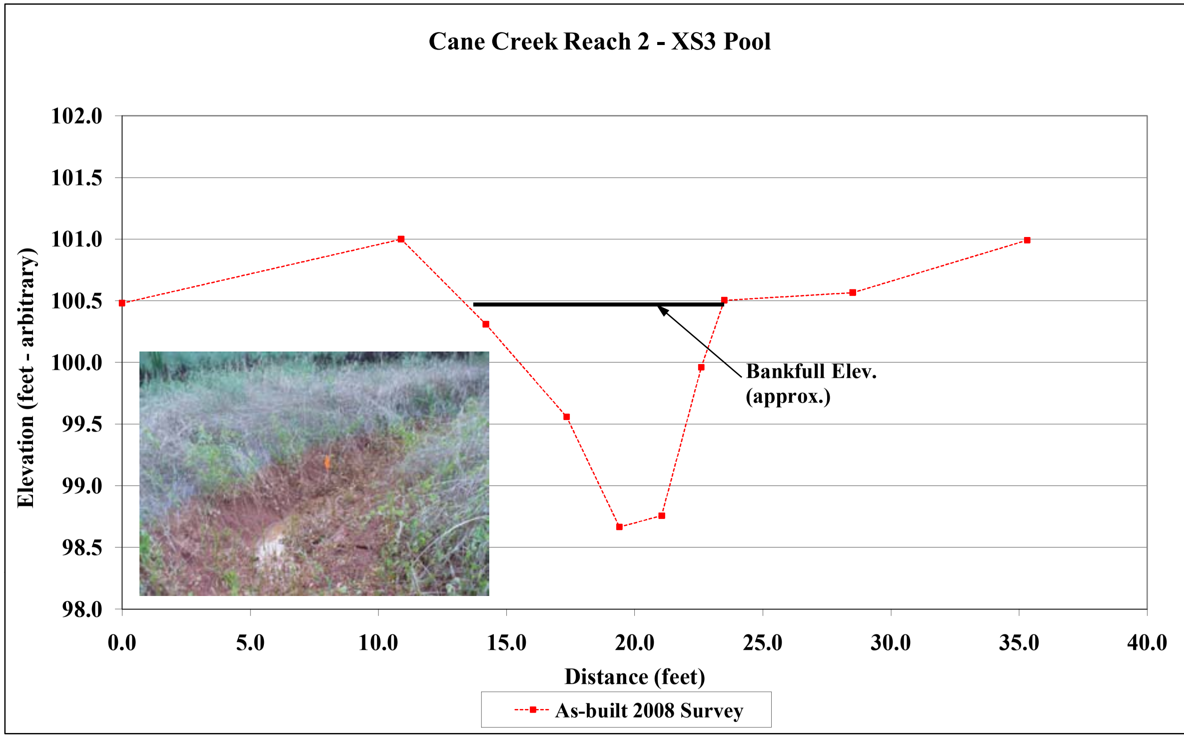
As-built 2008 Survey Station	As-built 2008 Survey Elevation	2008 2008 Survey Station	2008 2008 Survey Elevation	2009 2009 Survey Station	2009 2009 Survey Elevation	2010 2010 Survey Station	2010 2010 Survey Elevation
0.0	100.3						
10.0	100.5						
15.2	100.5						
16.4	100.3						
17.9	99.9						
18.6	99.6						
20.9	99.5						
21.7	99.8						
22.4	100.2						
23.6	100.5						
24.5	100.7						
27.6	100.8						
33.0	100.5						
37.4	100.8						



	As-built	2008	2009	2010
Area	5.1			
Width	9.2			
Mean Depth	0.6			
Max Depth	1.1			
W/D Ratio	16.5			

Project Name	Cane Creek
Cross Section	R2-XS3
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

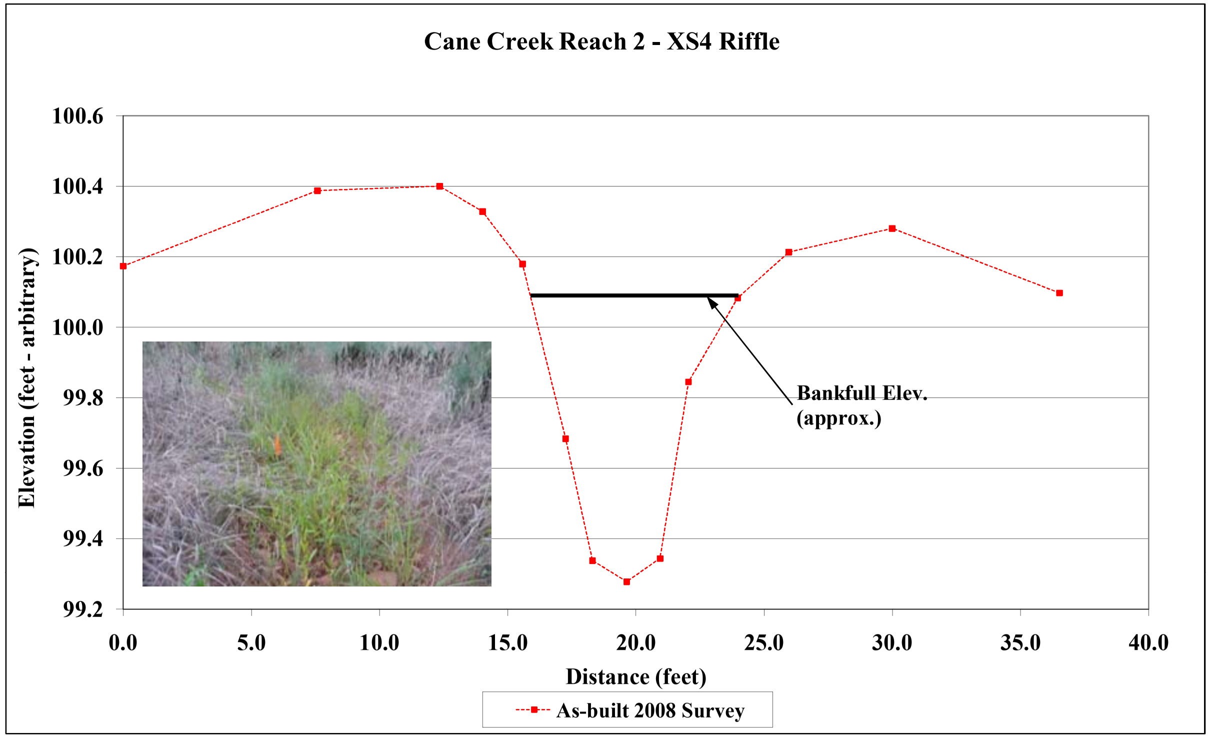
As-built		2008		2009		2010	
2008 Survey		2008 Survey		2009 Survey		2010 Survey	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
0.0	100.5						
10.9	101.0						
14.2	100.3						
17.3	99.6						
19.4	98.7						
21.1	98.8						
22.6	100.0						
23.5	100.5						
28.5	100.6						
35.3	101.0						



	As-built	2008	2009	2010
Area	9.7			
Width	10.2			
Mean Depth	1.0			
Max Depth	1.8			
W/D Ratio	N/A			

Project Name	Cane Creek
Cross Section	R2-XS4
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
0.0	100.2						
7.6	100.4						
12.3	100.4						
14.0	100.3						
15.6	100.2						
17.3	99.7						
18.3	99.3						
19.6	99.3						
20.9	99.3						
22.0	99.8						
24.0	100.1						
26.0	100.2						
30.0	100.3						
36.5	100.1						

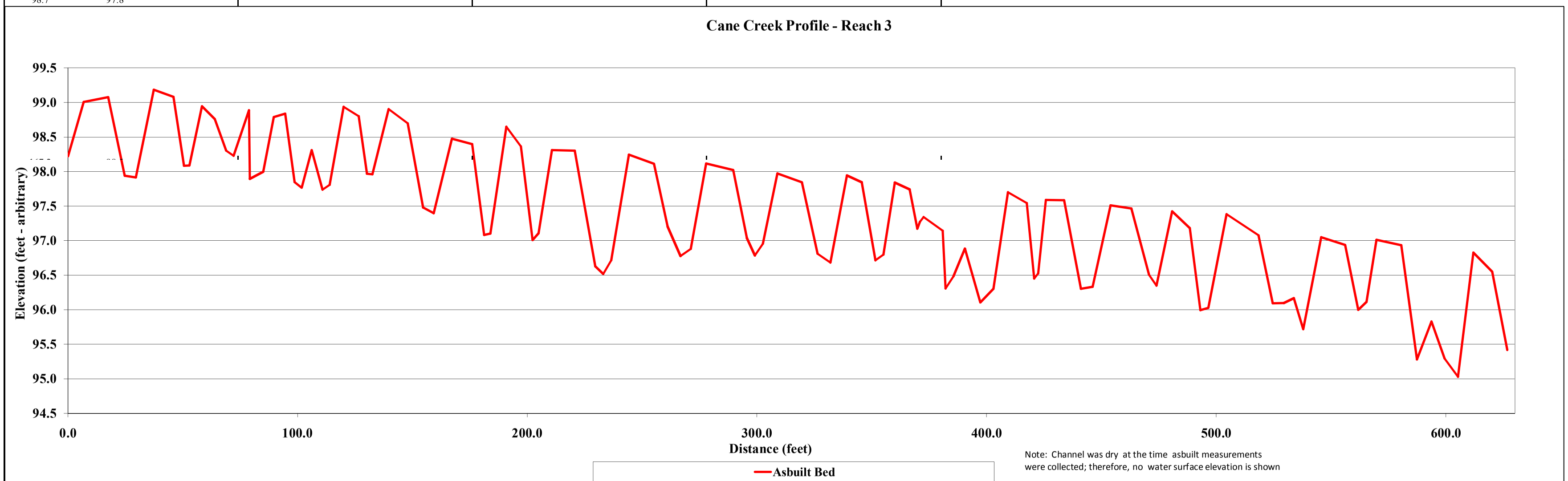


	As-built	2008	2009	2010
Area	3.7			
Width	8.1			
Mean Depth	0.5			
Max Depth	0.8			
W/D Ratio	17.8			

Project Name Cane Creek AsBuilt
Reach 3
Feature Profile
Date 5/6/08
Crew Adasme, Jeffers

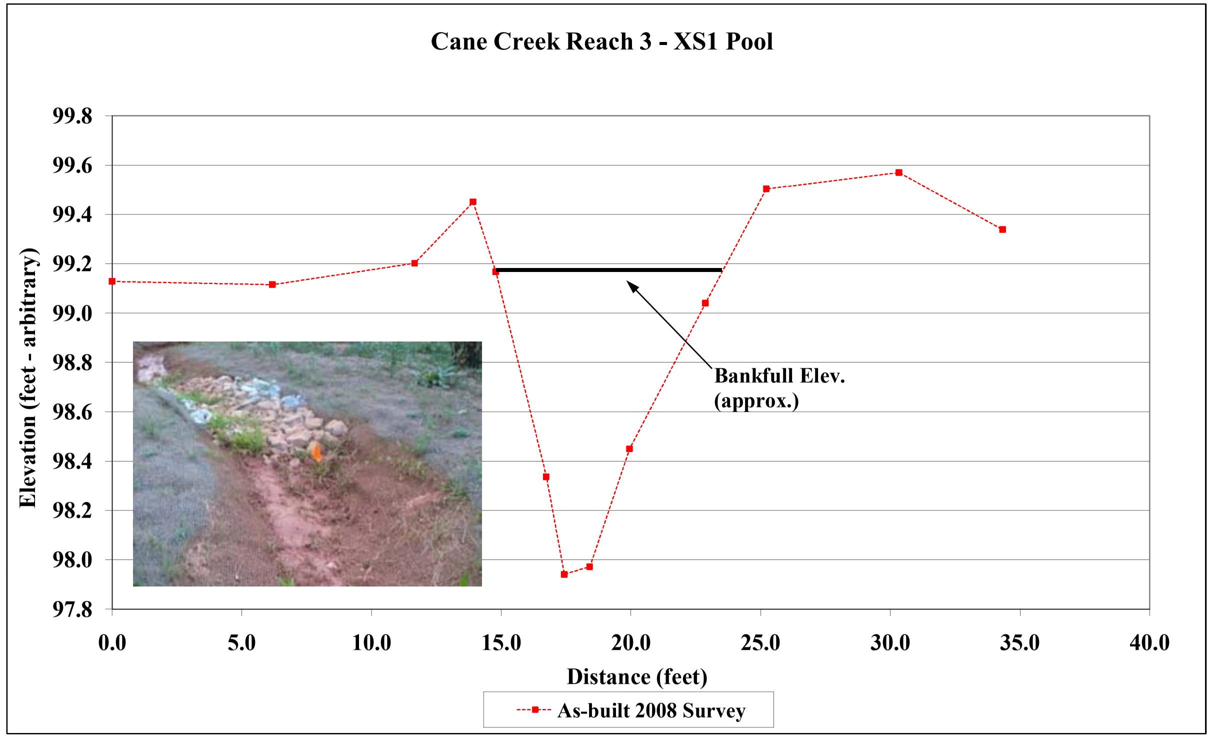
As-built 2008 Survey			2008 2008 Survey			2009 2009 Survey			2010 2010 Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	98.2										
6.9	99.0										
17.5	99.1										
24.7	97.9										
29.5	97.9										
37.4	99.2										
45.9	99.1										
50.5	98.1										
52.9	98.1										
58.4	98.9										
63.9	98.8										
69.0	98.3										
72.2	98.2										
78.9	98.9										
79.3	97.9										
85.1	98.0										
89.6	98.8										
94.6	98.8										
98.7	97.8										
332.0	96.7										
339.2	97.9										
345.6	97.8										
351.6	96.7										
355.1	96.8										
360.0	97.8										
366.5	97.7										
369.9	97.2										
370.9	97.3										
372.6	97.3										
380.9	97.1										
382.1	96.3										
385.5	96.5										
390.6	96.9										
397.3	96.1										
403.0	96.3										
409.3	97.7										
417.5	97.5										
420.7	96.4										
422.5	96.5										

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0036			
Avg. Riffle Slope				
Avg. Pool Slope				
Avg. Run Slope				
Avg. Glide Slope				



Project Name	Cane Creek
Cross Section	R3-XS1
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

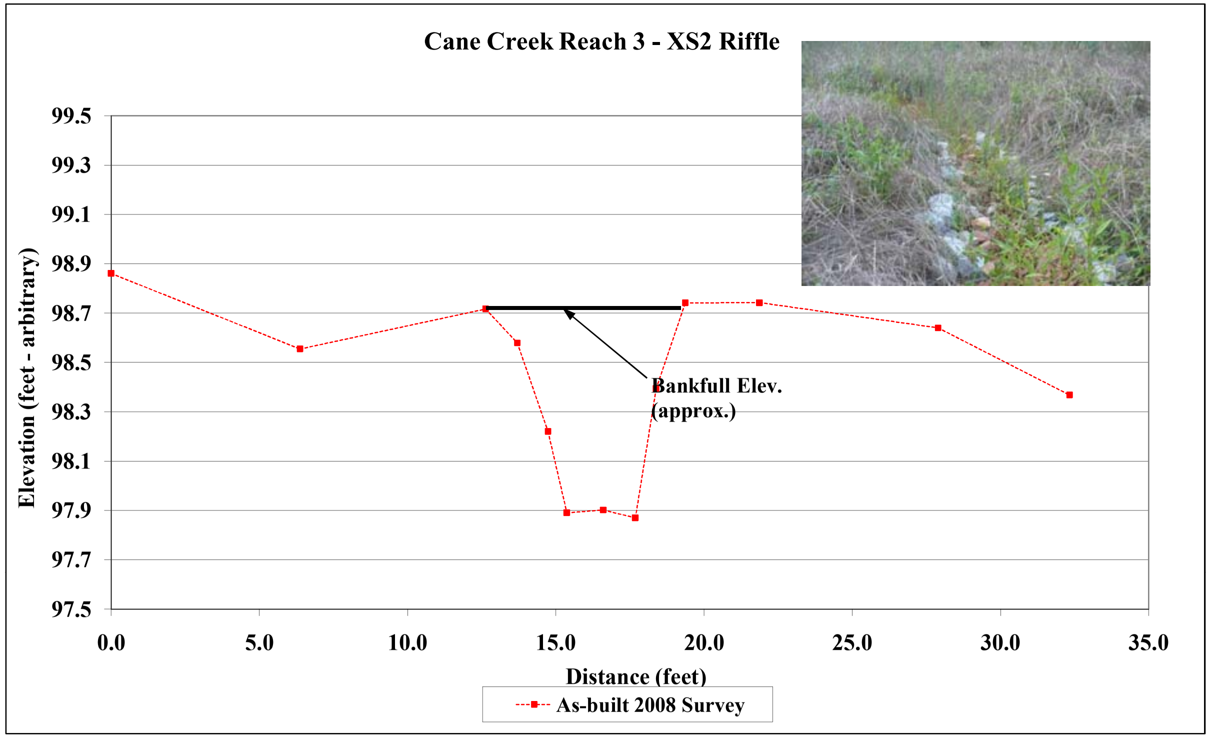
As-built 2008 Survey Station	As-built 2008 Survey Elevation	2008 Survey Station	2008 Survey Elevation	2009 Survey Station	2009 Survey Elevation	2010 Survey Station	2010 Survey Elevation
0.0	99.1						
6.2	99.1						
11.7	99.2						
13.9	99.5						
14.8	99.2						
16.7	98.3						
17.4	97.9						
18.4	98.0						
19.9	98.4						
22.9	99.0						
25.2	99.5						
30.3	99.6						
34.3	99.3						



	As-built	2008	2009	2010
Area	5.4			
Width	8.7			
Mean Depth	0.6			
Max Depth	1.2			
W/D Ratio	N/A			

Project Name	Cane Creek
Cross Section	R3-XS2
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

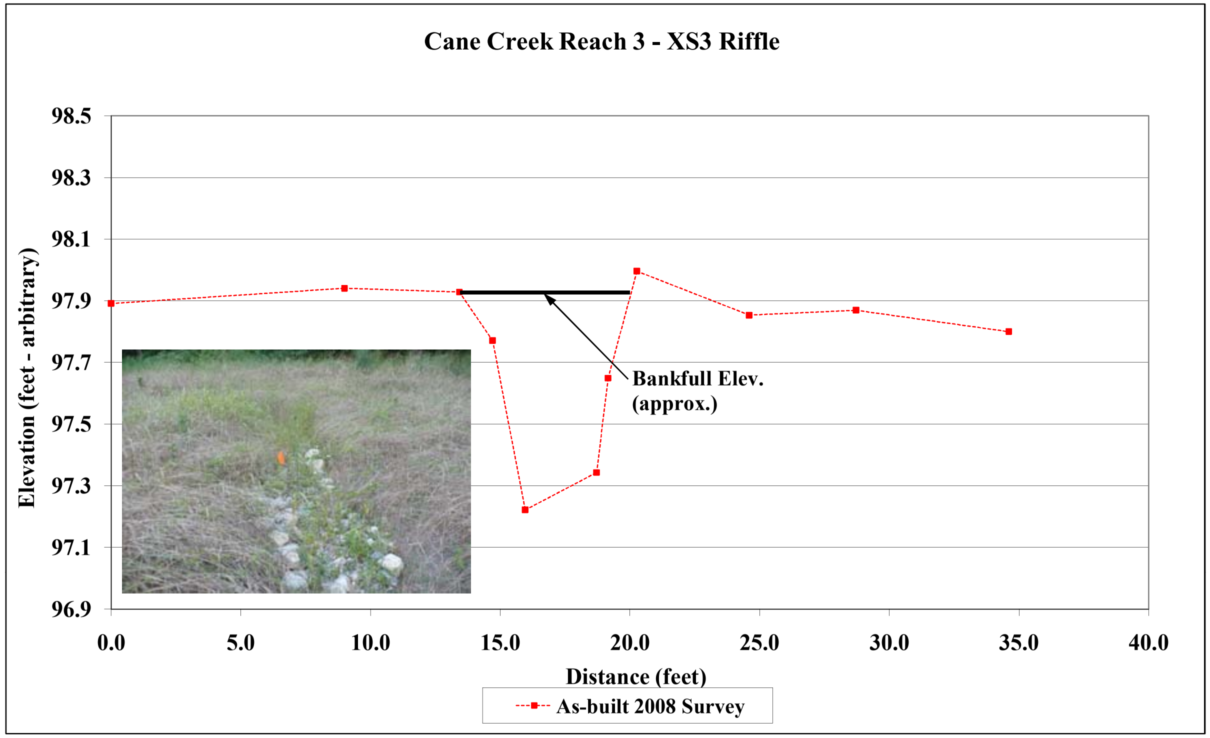
As-built 2007 Survey Station	As-built 2007 Survey Elevation	2008 2008 Survey Station	2008 2008 Survey Elevation	2009 2009 Survey Station	2009 2009 Survey Elevation	2010 2010 Survey Station	2010 2010 Survey Elevation
0.0	98.9						
6.4	98.6						
12.6	98.7						
13.7	98.6						
14.7	98.2						
15.4	97.9						
16.6	97.9						
17.7	97.9						
18.4	98.4						
19.4	98.7						
21.9	98.7						
27.9	98.6						
32.3	98.4						



	As-built	2008	2009	2010
Area	3.3			
Width	6.6			
Mean Depth	0.5			
Max Depth	0.8			
W/D Ratio	13.5			

Project Name	Cane Creek
Cross Section	R3-XS3
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

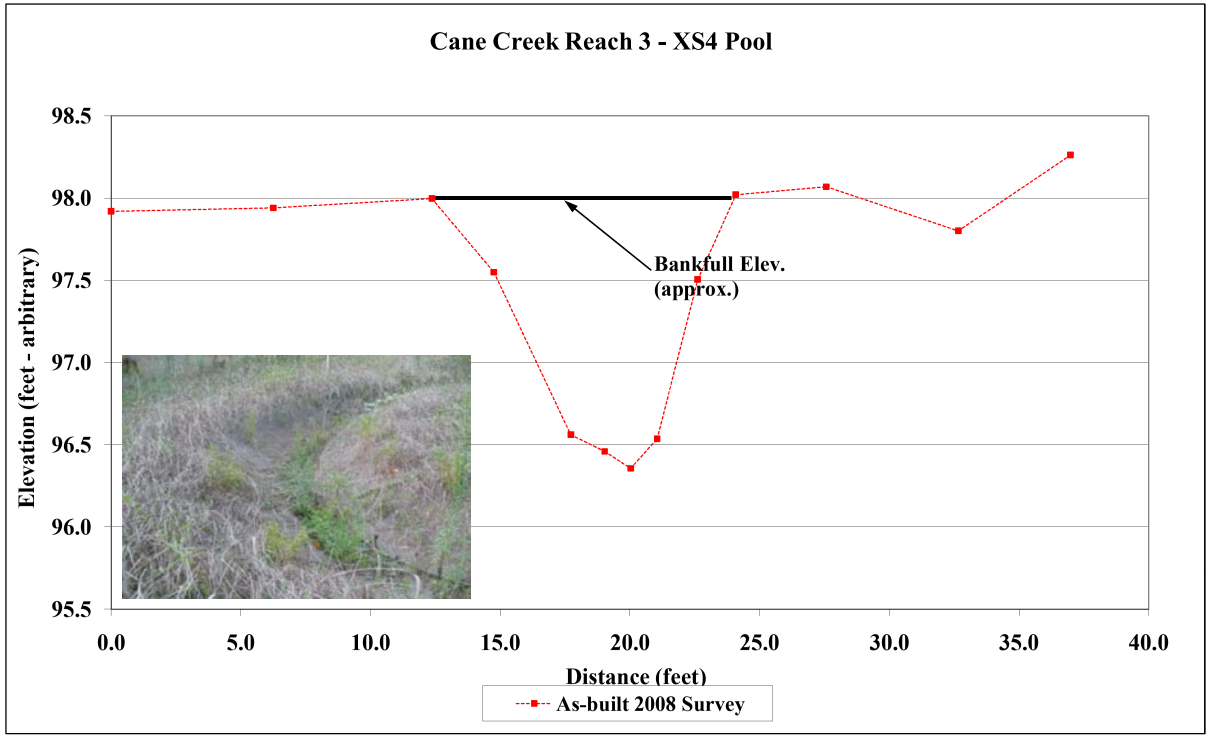
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.9						
9.0	97.9						
13.4	97.9						
14.7	97.8						
16.0	97.2						
18.7	97.3						
19.2	97.6						
20.3	98.0						
24.6	97.9						
28.7	97.9						
34.6	97.8						



	As-built	2008	2009	2010
Area	2.7			
Width	6.6			
Mean Depth	0.4			
Max Depth	0.7			
W/D Ratio	16.0			

Project Name	Cane Creek
Cross Section	R3-XS4
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.9						
6.3	97.9						
12.4	98.0						
14.8	97.5						
17.7	96.6						
19.0	96.5						
20.0	96.4						
21.1	96.5						
22.6	97.5						
24.1	98.0						
27.6	98.1						
32.7	97.8						
37.0	98.3						



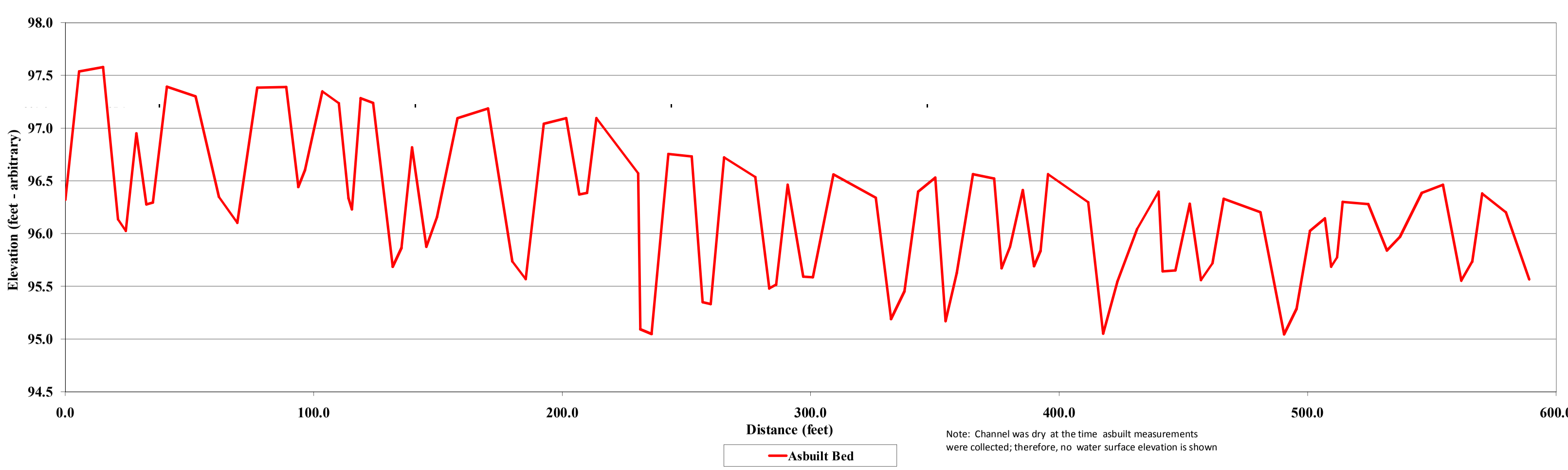
	As-built	2008	2009	2010
Area	10.3			
Width	11.6			
Mean Depth	0.9			
Max Depth	1.6			
W/D Ratio	N/A			

Project Name	Cane Creek AsBuilt
Reach	4
Feature	Profile
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey		2008 2008 Survey			2009 2009 Survey			2010 2010 Survey		
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	96.3									
5.6	97.5									
15.2	97.6									
21.2	96.1									
24.3	96.0									
28.6	97.0									
32.6	96.3									
35.3	96.3									
40.9	97.4									
52.4	97.3									
61.9	96.3									
69.3	96.1									
77.3	97.4									
88.9	97.4									
93.9	96.4									
96.4	96.6									
103.4	97.3									
110.1	97.2									
114.0	96.3									
115.4	96.2									
118.9	97.3									
373.8	96.5									
376.8	95.7									
380.2	95.9									
385.4	96.4									
389.9	95.7									
392.6	95.8									
395.6	96.6									
411.7	96.3									
417.7	95.1									
423.4	95.5									
431.3	96.0									
440.0	96.4									
441.7	95.6									
446.8	95.7									
452.5	96.3									
457.0	95.6									
461.7	95.7									
466.2	96.3									
481.0	96.2									
490.5	95.0									
495.5	95.3									
500.9	96.0									
506.9	96.1									
509.4	95.7									
511.8	95.8									

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0020			
Avg. Riffle Slope				
Avg. Pool Slope				
Avg. Run Slope				
Avg. Glide Slope				

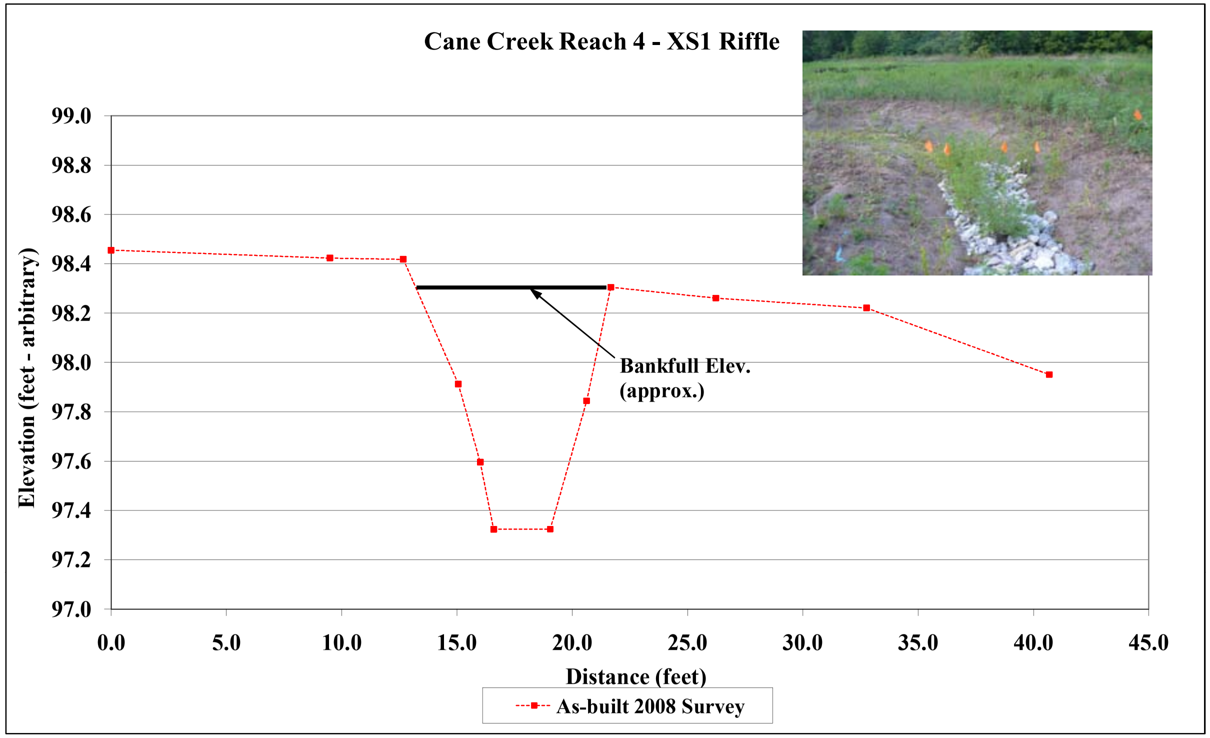
Cane Creek Profile - Reach 4



Note: Channel was dry at the time asbuilt measurements were collected; therefore, no water surface elevation is shown

Project Name	Cane Creek
Cross Section	R4-XS1
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

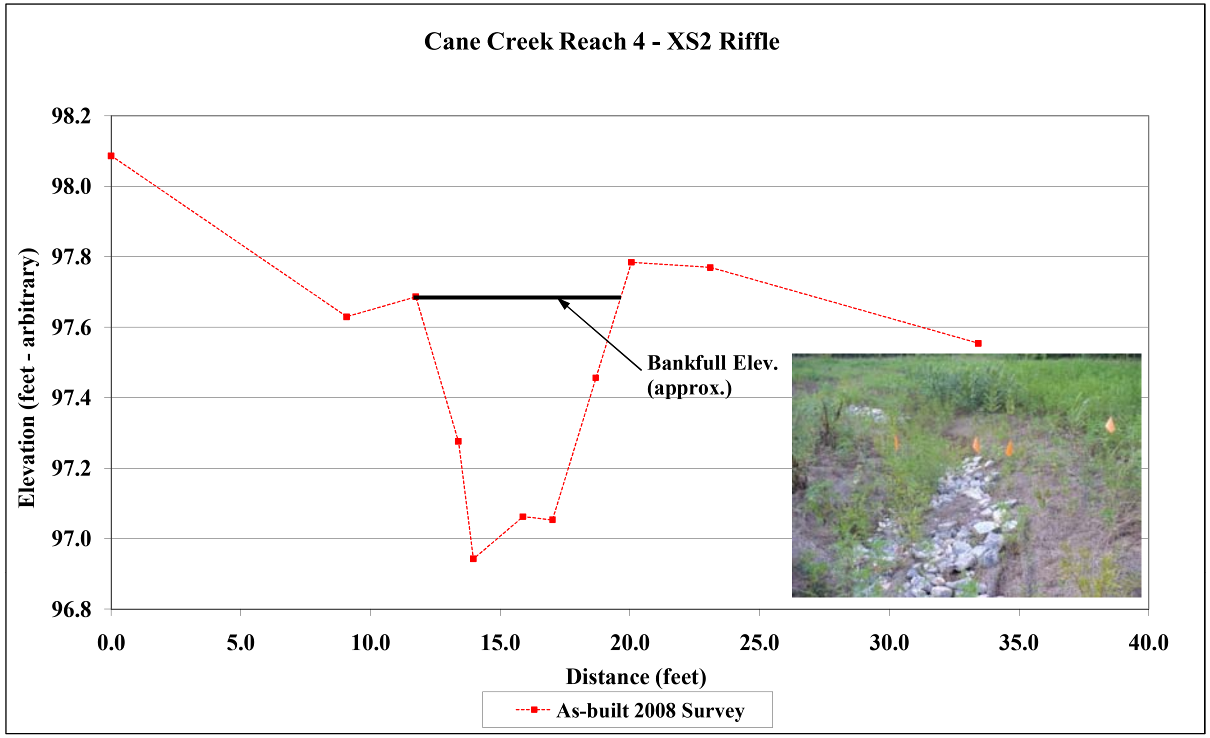
As-built 2008 Survey Station	**As-built 2008 Survey Elevation**	**2008 Survey Station**	**2008 Survey Elevation**	**2009 Survey Station**	**2009 Survey Elevation**	**2010 Survey Station**	**2010 Survey Elevation**
0.0	98.5						
9.5	98.4						
12.7	98.4						
15.1	97.9						
16.0	97.6						
16.6	97.3						
19.0	97.3						
20.6	97.8						
21.7	98.3						
26.2	98.3						
32.8	98.2						
40.7	98.0						



	As-built	2008	2009	2010
Area	5.2			
Width	8.5			
Mean Depth	0.6			
Max Depth	1.0			
W/D Ratio	13.8			

Project Name	Cane Creek
Cross Section	R4-XS2
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

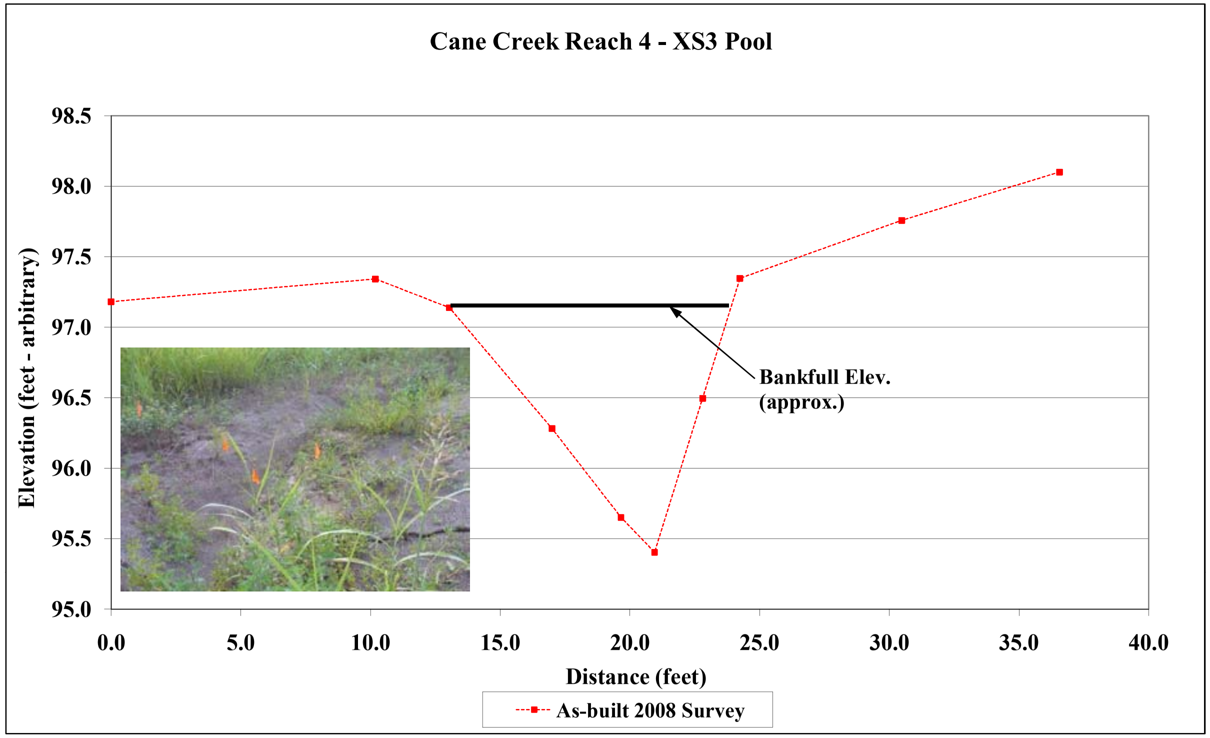
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	98.1						
9.1	97.6						
11.7	97.7						
13.4	97.3						
14.0	96.9						
15.9	97.1						
17.0	97.1						
18.7	97.5						
20.1	97.8						
23.1	97.8						
33.4	97.6						



	As-built	2008	2009	2010
Area	3.5			
Width	7.9			
Mean Depth	0.4			
Max Depth	0.7			
W/D Ratio	17.7			

Project Name	Cane Creek
Cross Section	R4-XS3
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

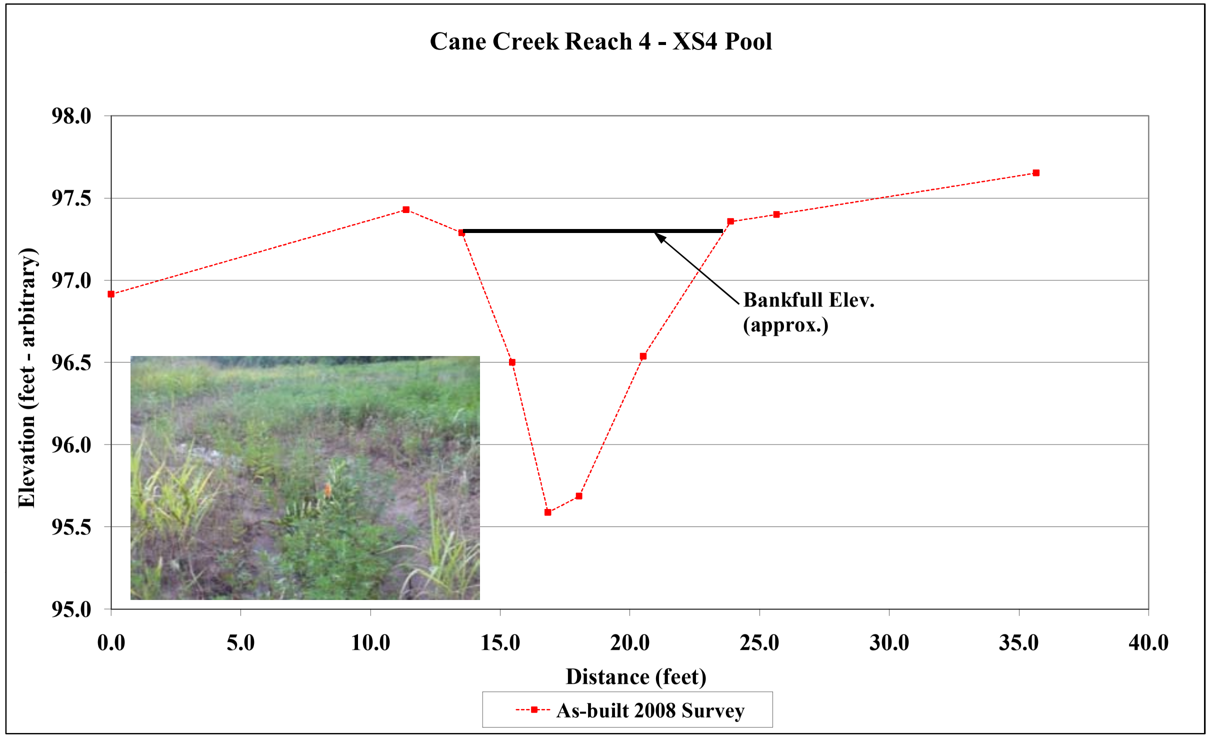
As-built 2008 Survey Station	As-built 2008 Survey Elevation	2008 2008 Survey Station	2008 2008 Survey Elevation	2009 2009 Survey Station	2009 2009 Survey Elevation	2010 2010 Survey Station	2010 2010 Survey Elevation
0.0	97.2						
10.2	97.3						
13.0	97.1						
17.0	96.3						
19.7	95.7						
21.0	95.4						
22.8	96.5						
24.2	97.3						
30.5	97.8						
36.6	98.1						



	As-built	2008	2009	2010
Area	9.5			
Width	10.9			
Mean Depth	0.9			
Max Depth	1.7			
W/D Ratio	N/A			

Project Name	Cane Creek
Cross Section	R4-XS4
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey Station	As-built 2008 Survey Elevation	2008 2008 Survey Station	2008 2008 Survey Elevation	2009 2009 Survey Station	2009 2009 Survey Elevation	2010 2010 Survey Station	2010 2010 Survey Elevation
0.0	96.9						
11.4	97.4						
13.5	97.3						
15.5	96.5						
16.8	95.6						
18.0	95.7						
20.5	96.5						
23.9	97.4						
25.7	97.4						
35.7	97.7						

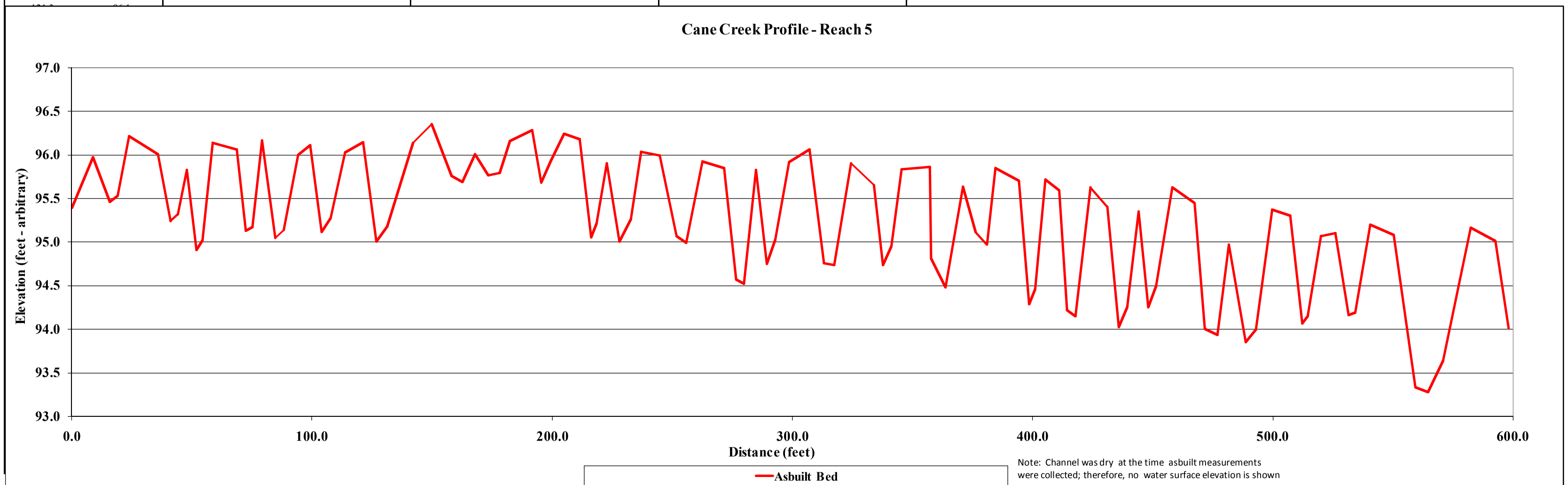


	As-built	2008	2009	2010
Area	8.5			
Width	10.1			
Mean Depth	0.8			
Max Depth	1.7			
W/D Ratio	NA			

Project Name	Cane Creek
Reach	5
Feature	Profile
Date	10/24/07
Crew	Adasme, Jeffers

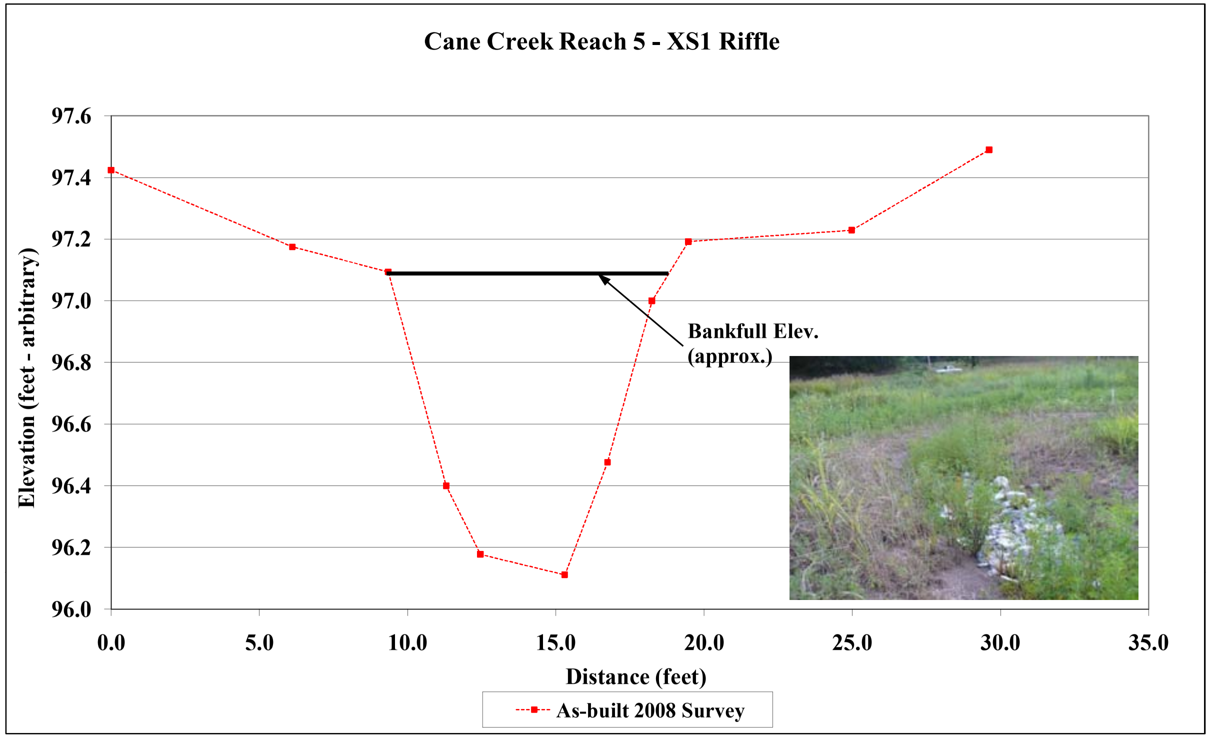
As-built 2008 Survey		2008 2008 Survey			2009 2009 Survey			2010 2010 Survey		
Station	**Bed Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	95.4									
8.9	96.0									
15.7	95.5									
19.0	95.5									
23.7	96.2									
35.8	96.0									
41.1	95.2									
44.1	95.3									
47.9	95.8									
52.0	94.9									
54.4	95.0									
58.8	96.1									
68.7	96.1									
72.5	95.1									
75.1	95.2									
79.2	96.2									
84.7	95.0									
88.3	95.1									
94.1	96.0									
99.1	96.1									
103.9	95.1									
107.7	95.3									
113.7	96.0									
341.3	95.0									
345.4	95.8									
357.3	95.9									
357.8	94.8									
363.8	94.5									
370.9	95.6									
376.3	95.1									
381.0	95.0									
384.6	95.8									
394.2	95.7									
398.5	94.3									
401.0	94.5									
405.26	95.72									
411.00	95.60									
414.30	94.22									
417.90	94.15									
424.22	95.63									
431.23	95.41									
435.88	94.03									
439.45	94.25									
444.09	95.35									
448.26	94.25									

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0014			
Avg. Riffle Slope				
Avg. Pool Slope				
Avg. Run Slope				
Avg. Glide Slope				



Project Name	Cane Creek
Cross Section	R5-XS1
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey		**2008 2008 Survey**		**2009 2009 Survey**		**2010 2010 Survey**	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.4						
6.1	97.2						
9.3	97.1						
11.3	96.4						
12.5	96.2						
15.3	96.1						
16.7	96.5						
18.2	97.0						
19.5	97.2						
25.0	97.2						
29.6	97.5						

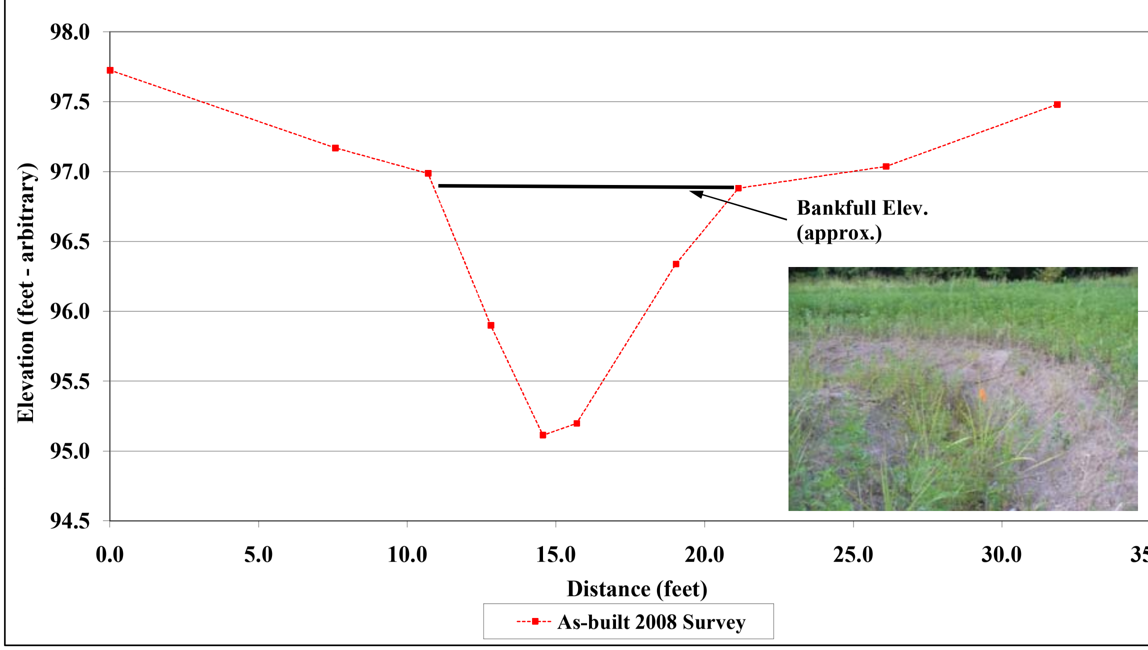


	As-built	**2008**	**2009**	**2010**
Area	6.0			
Width	9.4			
Mean Depth	0.6			
Max Depth	1.0			
W/D Ratio	14.9			

Project Name	Cane Creek
Cross Section	R5-XS2
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation
0.0	97.7						
7.6	97.2						
10.7	97.0						
12.8	95.9						
14.6	95.1						
15.7	95.2						
19.0	96.3						
21.1	96.9						
26.1	97.0						
31.9	97.5						

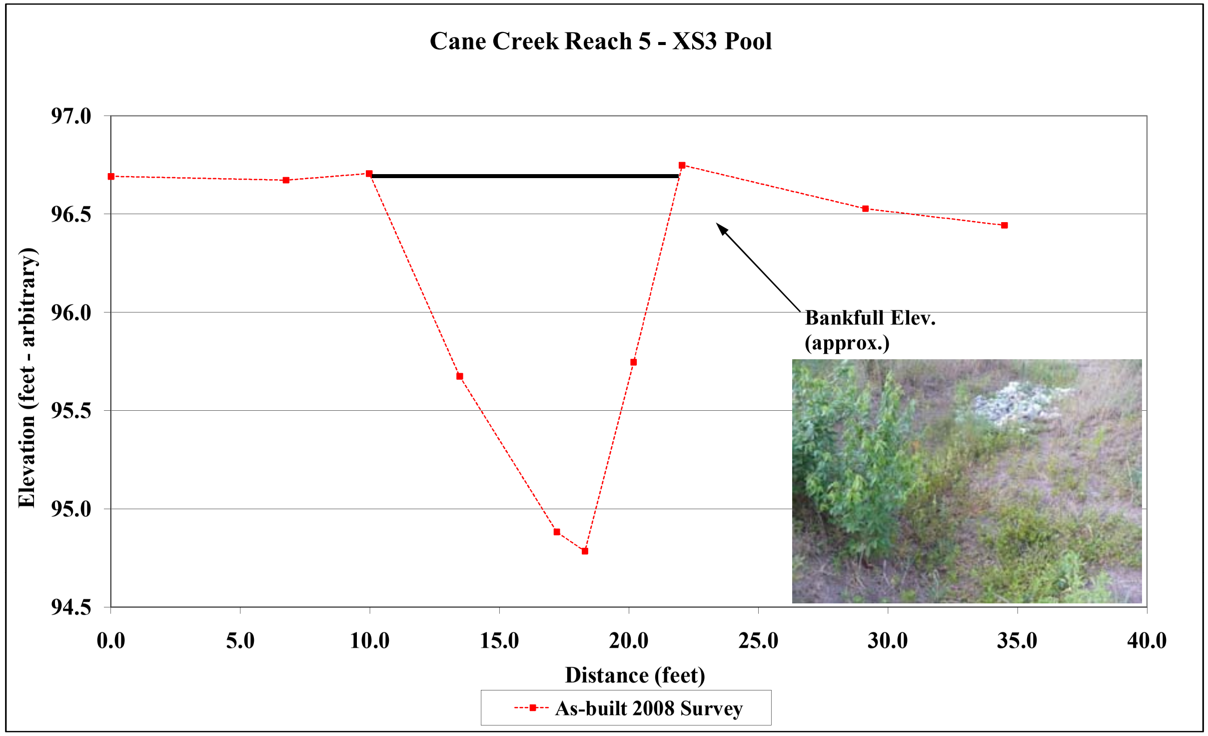
Cane Creek Reach 5 - XS2 Pool



	As-built	2008	2009	2010
Area	8.5			
Width	9.6			
Mean Depth	0.9			
Max Depth	1.7			
W/D Ratio	NA			

Project Name	Cane Creek
Cross Section	R5-XS3
Feature	Pool
Date	5/6/08
Crew	Adasme, Jeffers

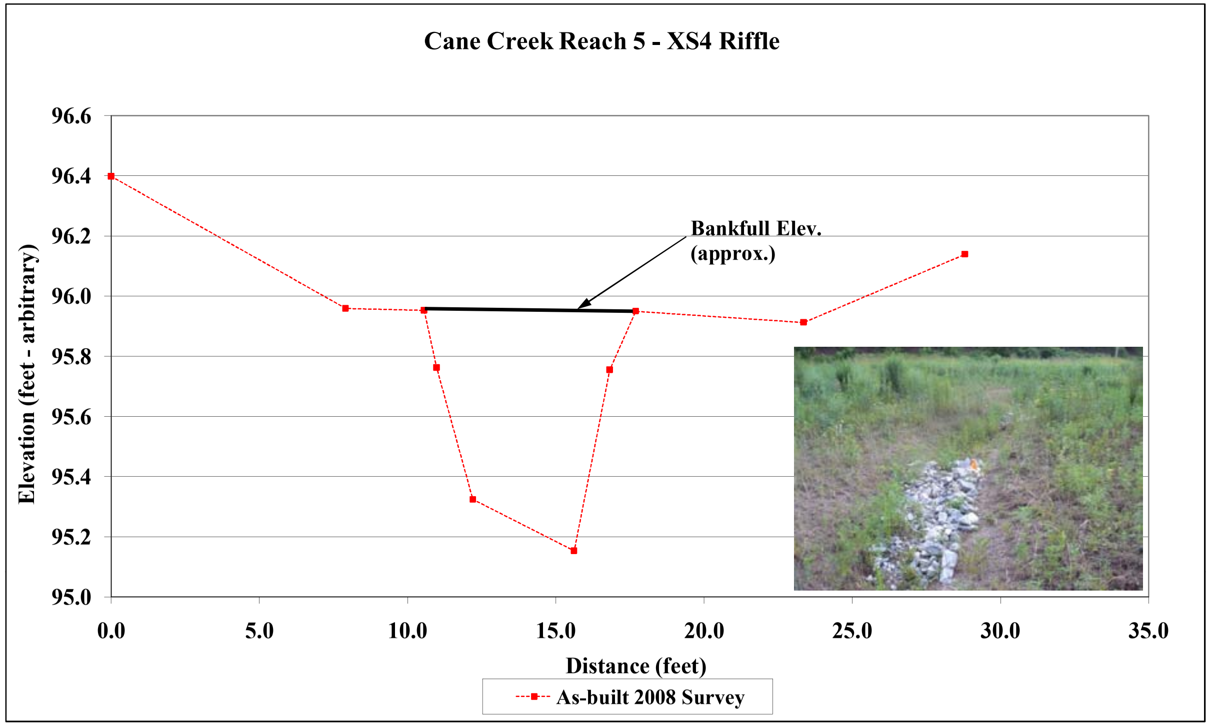
As-built		**2008**		**2009**		**2010**	
2008 Survey		**2008 Survey**		**2009 Survey**		**2010 Survey**	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	96.7						
6.8	96.7						
10.0	96.7						
13.5	95.7						
17.2	94.9						
18.3	94.8						
20.2	95.7						
22.1	96.7						
29.1	96.5						
34.5	96.4						



	As-built	**2008**	**2009**	**2010**
Area	12.3			
Width	11.8			
Mean Depth	1.0			
Max Depth	1.9			
W/D Ratio	N/A			

Project Name	Cane Creek
Cross Section	R5-XS4
Feature	Riffle
Date	5/6/08
Crew	Adasme, Jeffers

As-built 2008 Survey Station	As-built 2008 Survey Elevation	2008 2008 Survey Station	2008 2008 Survey Elevation	2009 2009 Survey Station	2009 2009 Survey Elevation	2010 2010 Survey Station	2010 2010 Survey Elevation
0.0	96.4						
7.9	96.0						
10.6	96.0						
11.0	95.8						
12.2	95.3						
15.6	95.2						
16.8	95.8						
17.7	96.0						
23.4	95.9						
28.8	96.1						



	As-built	2008	2009	2010
Area	3.6			
Width	7.1			
Mean Depth	0.5			
Max Depth	0.8			
W/D Ratio	13.9			