YEAR 2 (2009)
ANNUAL MONITORING REPORT
CANE CREEK RESTORATION SITE
RUTHERFORD COUNTY, NORTH CAROLINA

(CONTRACT 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:

And

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

Axiom Environmental, Inc.
20 Enterprise Street, Suite 7
Raleigh, North Carolina 27607

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EXECUTIVE SUMMARY

Restoration Systems has completed restoration of streams and wetlands at the Cane Creek Stream and Wetland Restoration Site to assist the North Carolina Ecosystem Enhancement Program in fulfilling stream and wetland mitigation goals. The Site is located in north Rutherford County less than 0.2 mile south of the Rutherford/McDowell County line along the eastern edge of Highway 64. The Site is located in United States Geological Survey Hydrologic Unit 03050105060020 (North Carolina Division of Water Quality 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. This report serves as the Year 2 (2009) annual monitoring report.

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. Project restoration efforts provide a minimum of 6748 Stream Mitigation Units, 4.4 riverine Wetland Mitigation Units, and 5.0 nonriverine Wetland Mitigation Units as outlined in the March 2006 Technical Proposal.

Fifteen vegetation plots (10 meters by 10 meters in size) were established and permanently monumented. These plots were surveyed in August 2009 for the Year 2 (2009) monitoring season. Vegetation sampling across the Site was above the required average density with 499 planted stems per acre surviving; two of the fifteen plots had no stems for the Year 2 (2009) monitoring season, apparently from accidental mowing by the adjacent farmer. These areas will be replanted in late 2009/early 2010 with species outlined within the 2007 Restoration Plan. In addition, Rutherford County was in an extreme drought for the entire Year 1 (2008) growing season, which negatively affected the viability of planted stems; therefore, the Site was replanted in early 2009 with an addition 15,250 stems of species outlined within the 2007 Restoration Plan. Active measures to control kudzu (*Pueraria montana*) in the northern portion of the Site and a few stems of multiflora rose (*Rosa multiflora*) and privet (*Ligustrum sinense*) in the southern portion of the Site, including spraying and manual removal to control invasive species, will continue as necessary.

Twenty cross-sections and longitudinal profiles within five 600-foot reaches (3000 linear feet total) were measured for the Year 2 (2009) monitoring period. As a whole, monitoring measurements indicate that there have been minimal changes in both longitudinal profile and cross-sections as compared to as-built data. The as-built channel geometry compares favorably with the emulated, stable E/C type stream reach as set forth in the detailed mitigation plan and construction plans. Current monitoring has demonstrated dimension, pattern, and profile were stable over the course of the monitoring period. No stream problem areas were noted within the Site during the Year 2 (2009) monitoring year.

None of the five monitored gauges within restoration areas or the reference gauge were inundated/saturated within 12 inches of the surface for greater than 5 percent of the growing season, which extends from April 4 to November 6 (217 days).

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1.0 PROJECT BACKGROUND

1.1 Location and Setting

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 is located in north Rutherford County less than 0.2 mile south of the Rutherford/McDowell County line along the eastern edge of Highway 64. 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 USGS 8-digit Cataloging Unit (CU) 03050105. The Site is not located in a Targeted Local Watershed.

Directions to the Site from Rutherfordton, North Carolina, are as follows:

- Travel northeast on Highway 64 for approximately 15 miles
- The Site is on the right ~ 0.2 miles south of the Rutherford and McDowell County lines.

1.2 Project Objectives

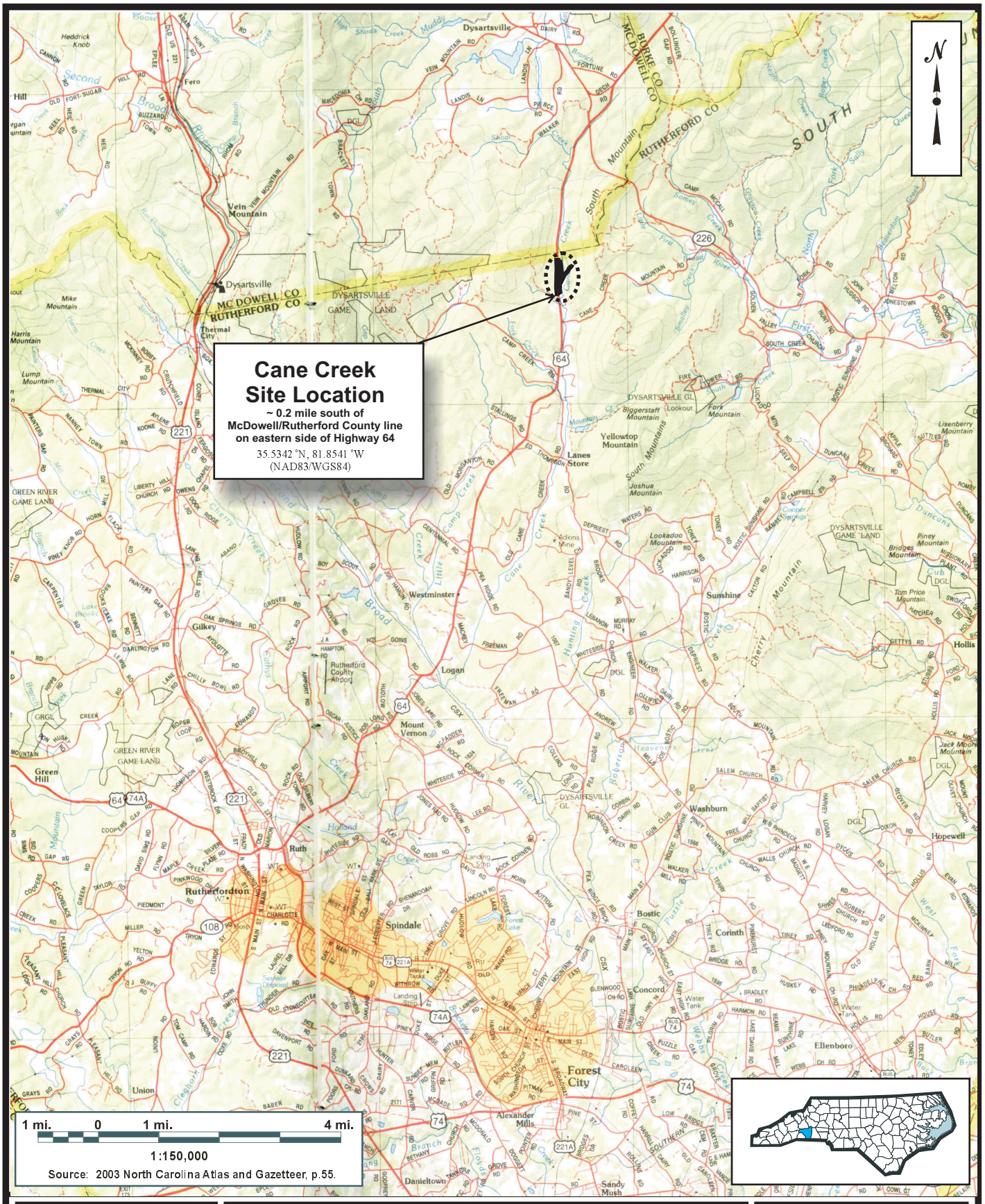
The primary components of the restoration project included 1) construction of a stable, riffle-pool stream channel; 2) enhancement of water quality functions within, upstream, and downstream of the Site; 3) creation of a natural vegetated buffer along restored stream channels; 4) restoration of jurisdictional riverine and nonriverine wetlands in the Site; 5) improvement of aquatic habitat and species diversity by enhancing stream bed variability; and 6) restoration of wildlife functions associated with a riparian corridor/stable stream.

1.3 Project Structure, Restoration Type, and Approach

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.



Axiom Environmental, Inc.
20 Enterprise Stree, Suite 7
Raleigh, NC 27607
(919) 215-1693

SITE LOCATION
CANE CREEK RESTORATION SITE
Rutherford County, North Carolina

Dwn. by: CLF	FIGURE 1
Date: April 2007	
Project: 06-022	

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.

Table 1 describes the Site restoration structures and objectives, which have provided a minimum of 6748 Stream Mitigation Units, 4.4 riverine Wetland Mitigation Units, and 5.0 nonriverine Wetland Mitigation Units as outlined in the March 2006 Technical Proposal as follows.

- Restoration of 4600 linear feet of stream within three UTs to Cane Creek by constructing meandering channels.
- Enhancement of (level II) 5708 linear feet of Cane Creek.
- Preservation of 1506 linear feet of the upper reaches of an unnamed tributary to Cane Creek.
- Restore 4.4 acres of jurisdictional riverine wetland by reestablishing historic water table elevations.
- Restore 5.0 acres of jurisdictional nonriverine wetland by filling ditches.
- Reforest approximately 30 acres of the Site with native forest species.

Table 1. Site Restoration Structures and Objectives

Restoration Segment/ Reach ID	Station Range	Restoration Type/Approach*	Designed Linear Footage/Acreage	SMU/WMUs
Tributary 1	10+00 – 19+25	Restoration/PI	925	925
Tributary 2	10+00 – 28+71	Restoration/PI	1871	1871
Tributary 3	10+00 – 17+96	Restoration/PI	1804	1804
Cane Creek	--	Enhancement II	5708	2283
Tributary 1	--	Preservation	1506	301
Riverine Wetlands	--	Restoration	4.4	4.4
Nonriverine Wetlands	--	Restoration	5.0	5.0
Mitigation Unit Summations				
Stream	**Riverine Wetland**	**Nonriverine Wetland**		
7184 SMU	4.4 WMU	5.0 WMU		

*PI=Priority 1

1.4 Project History and Background

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4.

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	April 2007	May 2007
Construction Completion	NA	April 2008
Site Planting	NA	April 2008
Mitigation Plan/As-builts	May 2008	July 2008
Year 1 Monitoring (2008)	November 2008	November 2008
Year 2 Monitoring (2009)	November 2009	October 2009

Table 3. Project Contacts Table

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 George Howard and John Preyer (919) 755-9490
Construction Contractor	Backwater Environmental PO Box 1654 Pittsboro, North Carolina 27312 Wes Newell (919) 523-4375
Planting Contractor	Carolina Silvics 908 Indian Trail Road Edenton, North Carolina 27932 Dwight McKinney (252) 482-8491
Designer and Monitoring Performer	Axiom Environmental, Inc. 20 Enterprise, Suite 7 Raleigh, North Carolina 27607 Grant Lewis (919) 215-1693

Table 4. Project Background Table

Project County	Rutherford County, North Carolina
Drainage Area	Cane Creek: 8.7 square miles Tributaries: 0.1-0.4 square mile
Drainage impervious cover estimate (%)	< 1
Stream Order	Cane Creek: Fourth Tributaries: First and Second
Physiographic Region	Mountains
Ecoregion	Eastern Blue Ridge Foothills
Rosgen Classification of As-built	E-/C-type
Dominant Soil Types	Chewacla, Wehadkee, Fannin, Skyuka
Reference Site ID	Tributary 1 Preservation Reach
USGS HUC	03050105
NCDWQ Subbasin	03-08-02
NCDWQ Classification	WS-V (Stream Index # 9-41-12-(0.3))
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	Not Applicable
% of project easement fenced	0%

1.5 Monitoring Plan View

Monitoring activities for the Site, including relevant structures and utilities, project features, specific project structures, and monitoring features are detailed in the monitoring plan view in Appendix D. Site features including vegetation, stream dimension (cross-sections), stream profile and pattern, wetland hydrology, and photographic documentation were monitored in Year 2 (2009).

2.0 PROJECT CONDITION AND MONITORING RESULTS

2.1 Vegetation Assessment

Following Site construction, fifteen plots (10 meters by 10 meters in size) were established and monumented with metal fence posts at all plot corners and PVC at each plot origin. Sampling was conducted as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (http://cvs.bio.unc.edu/methods.htm); results are included in Appendix A. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007). The locations of vegetation monitoring plots were placed to accurately represent the entire Site and are depicted on the monitoring plan view in Appendix D.

2.1.1 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 5 below outlines planted and reference forest species.

Table 5. Planted Species and Reference Forest Ecosystem

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/tomentosa*)
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*)	

Success criteria dictate that an average density of 320 stems per acre of Character Tree Species must be surviving in the first three monitoring years. Subsequently, 290 Character Tree Species per acre must be surviving in Year 4 and 260 Character Tree Species per acre in Year 5.

2.1.2 Vegetative Problem Areas

Vegetation sampling across the Site was above the required average density with 499 planted stems per acre surviving; two of the fifteen plots had no stems for the Year 2 (2009) monitoring season, apparently from accidental mowing by the adjacent farmer. The mowed area, along the northwest side of the Site, has been well marked by a series of fence posts. Signs identifying the area as a "Conservation Area" have been mounted on the posts. These areas will be replanted in late 2009/early 2010 with species outlined within the 2007 Restoration Plan. In addition, Rutherford County was in an extreme drought for the entire Year 1 (2008) growing season, which negatively affected the viability of planted stems; therefore, the Site was replanted in early 2009 with an addition 15,250 stems of species outlined within the 2007 Restoration Plan. Active measures to control kudzu (*Pueraria montana*) in the northern portion of the Site and a few stems of multiflora rose (*Rosa multiflora*) and privet (*Ligustrum sinense*) in the southern portion of the Site, including spraying and manual removal to control invasive species, will continue as necessary. All three invasive species were treated with the herbicide Milestone VM (aminopyralid) at a rate of seven ounces per acre.

2.2 Stream Assessment

Twenty permanent cross-sections within five 600-foot reaches were established after construction was completed. Measurements of each cross-section include points at all breaks in slope including top of bank, bankfull, and thalweg. Riffle cross-sections are classified using the Rosgen stream classification system. Longitudinal profile measurements of five 600-foot reaches include thalweg, water surface, and bankfull; with each measurement taken at the head of facets (i.e. riffle, run, pool, and glide) in addition to the maximum pool depth.

2.2.1 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.

2.2.2 Bankfull Events

One bankfull event was documented during the Year 2 (2009) monitoring period.

Table 6. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
March 12, 2009	March 2, 2009	A total of 3.65 inches of rain were documented to fall at the Site by an onsite rain gauge from February 27-March 2, 2009. In addition, wrack was observed adjacent to restored channels.	see below

2.2.3 Stream Problem Areas

No stream problem areas were noted within the Site during the Year 2 (2009) monitoring year.

2.2.4 Categorical Stream Feature Visual Stability Assessment

Each stream reach was visually inspected during the Year 2 (2009) monitoring period using eight feature categories and various metrics within each category. Assessment features included riffles, pools, thalweg, meanders, channel bed, structures, and root wads/boulders. Tables for semi-quantitative assessments of

each reach are included in Appendix B (Tables B1-B5). The mean percentage of performance for features within each reach are summarized in the tables below.

Structures within Reaches 1 and 2 appear to have sunk slightly lowering the structure elevation within the channel; however, no instability has occurred upstream or downstream of the structures. In addition, one structure within Reach 3 has a minor amount of observed scour/piping; however, the scour/piping is minimal and is not causing any channel instability. Structures will continued to be monitored; however, no proactive measures are recommended at this time. The issues are minimal and are not causing any stream problems at this time.

Table 7A. Categorical Stream Feature Visual Stability Assessment

Cane Creek (Reach 1)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%	100%			
B. Pools	100%	100%			
C. Thalweg	100%	100%			
D. Meanders	100%	100%			
E. Bed General	100%	100%			
F. Banks	99%	99%			
G. Vanes / J. Hooks, Etc.	75%	75%			
H. Wads and Boulders	NA	NA			

Table 7B. Categorical Stream Feature Visual Stability Assessment

Cane Creek (Reach 2)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%	100%			
B. Pools	97%	97%			
C. Thalweg	100%	100%			
D. Meanders	100%	100%			
E. Bed General	100%	100%			
F. Banks	100%	100%			
G. Vanes / J. Hooks, Etc.	75%	75%			
H. Wads and Boulders	NA	NA			

Table 7C. Categorical Stream Feature Visual Stability Assessment

Cane Creek (Reach 3)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%	100%			
B. Pools	100%	100%			
C. Thalweg	100%	100%			
D. Meanders	100%	100%			
E. Bed General	100%	100%			
F. Banks	100%	100%			
G. Vanes / J. Hooks, Etc.	75%	75%			
H. Wads and Boulders	NA	NA			

Table 7D. Categorical Stream Feature Visual Stability Assessment

Cane Creek (Reach 4)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%	100%			
B. Pools	100%	100%			
C. Thalweg	100%	100%			
D. Meanders	100%	100%			
E. Bed General	100%	100%			
F. Banks	100%	100%			
G. Vanes / J. Hooks, Etc.	100%	100%			
H. Wads and Boulders	NA	NA			

Table 7E. Categorical Stream Feature Visual Stability Assessment

Cane Creek (Reach 5)

Feature	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
A. Riffles	100%	100%			
B. Pools	100%	100%			
C. Thalweg	100%	100%			
D. Meanders	100%	100%			
E. Bed General	100%	100%			
F. Banks	100%	100%			
G. Vanes / J. Hooks, Etc.	100%	100%			
H. Wads and Boulders	NA	NA			

2.2.5 Quantitative Stream Measurements

During the Year 2 (2009) monitoring period 20 cross-sections and longitudinal profiles within five 600-foot reaches were measured. Permanent cross-sections and longitudinal profiles are included in Appendix B; each is graphically depicted for as-built through Year 2 (2009) for analysis. As a whole, monitoring measurements indicate minimal changes in both the longitudinal profile and cross-sections as compared to as-built data. The channel geometry compares favorably with the emulated, stable E/C type stream reach as set forth in the detailed mitigation plan and as constructed. Current monitoring has demonstrated dimension, pattern, and profile were stable over the course of the monitoring period. Tables for quantitative assessments are included below; these tables include data from previous years. In addition, visual assessments of the enhancement of Cane Creek were completed; photographs are included in Appendix B.

2.3 Wetland Assessment

Five groundwater monitoring gauges and one reference groundwater gauge were maintained and monitored throughout the Year 2 (2009) growing season. Graphs of groundwater hydrology and precipitation from an onsite rain gauge for the growing season are included in Appendix C.

2.3.1 Wetland 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.

2.3.2 Wetland Criteria Attainment

None of the five monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 5 percent of the growing season, which extends from April 4 to November 6 (217 days) (Table 10). Hydrographs containing groundwater and precipitation data for each gauge can be found in Appendix B.

Table 10. Wetland Criteria Attainment for Year 2 (2009)

Gauge ID	Hydrology Threshold Met?	Hydrophytic Vegetation Criteria Met?	Site Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Site Mean
1	No	Yes	0 %	1	Yes	87 %
2	No	Yes		2	No	
3	No	Yes		3	Yes	
4	No	Yes		4	No	
5	No	No		5	Yes	
				6	Yes	
				7	Yes	
				8	Yes	
				9	Yes	
				10	Yes	
				11	Yes	
				12	Yes	
				13	Yes	
				14	Yes	
				15	Yes	

Table 8A. Baseline Morphology and Hydraulic Summary
Cane Creek (Reach 1)

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
BF Width (ft)	USGS gage data is unavailable for this project			6.9	12	9.8	8.1	8.7	8.4	9.6	11.1	8.4	10.4	12.2	11.3
Floodprone Width (ft)				9	18	14.9	25	150	87.5	80	200	150			150
BF Cross Sectional Area (ft2)						10.3			8.5			10.3	9.3	11.3	10.3
BF Mean Depth (ft)				0.9	1.5	1.1	0.9	1.2	1.1	0.9	1.1	1	0.6	0.7	0.9
BF Max Depth (ft)				1.3	2.1	1.8	1.3	1.4	1.4	1.3	1.9	1.5	1.4	1.5	1.4
Width/Depth Ratio				4.6	14	9.6	7.1	9.7	8.4	10	16	14	11.7	13.2	12.5
Entrenchment Ratio				1.3	1.6	1.5	2.9	18.5	10.7	7.8	18.9	14.2	12.3	14.4	13.4
Bank Height Ratio				2.9	4.6	3.8			1			1			1
Wetted Perimeter(ft)						===			===			===			===
Hydraulic radius (ft)						===			===			===			===
Pattern															
Channel Beltwidth (ft)				No distinct repetitive pattern of riffles and pools			19	60	37	21	74	42	21	74	42
Radius of Curvature (ft)							7	29	12.9	21	42	23	21	42	23
Meander Wavelength (ft)							36.5	87.9	58.9	53	117	74	53	117	74
Meander Width ratio							2.3	7.1	4.4	2	7	4	2	7	4
Profile															
Riffle length (ft)				No distinct repetitive pattern of riffles and pools					===			===	8	36	16
Riffle slope (ft/ft)							1.48%	4.92%	2.84%	1.13%	3.39%	1.81%	0.80%	5.60%	2.40%
Pool length (ft)									===			===	8	58	33
Pool spacing (ft)							23.2	89.3	42.3	31	106	53	31	106	53
Substrate															
d50 (mm)						===			===			===			===
d84 (mm)						===			===			===			===
Additional Reach Parameters															
Valley Length (ft)						===			===			712			712
Channel Length (ft)						===			===			925			925
Sinuosity						1.1			1.5			1.3			1.3
Water Surface Slope (ft/ft)						1.12%			1.61%			1.13%			0.92%
BF slope (ft/ft)						===			===			===			===
Rosgen Classification						G4			E4			C/E4			C/E4

Table 8B. Baseline Morphology and Hydraulic Summary
Cane Creek (Reaches 2, 3, 4, and 5)

Parameter	USGS Gage Data			Pre-Existing Condition (Trib 2)			Pre-Existing Condition (Trib 3)			Project Reference Stream			Design			As-built		
Dimension	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
BF Width (ft)	USGS gage data is unavailable for this project			4.3	5.5	5	5.1	6	5.6	8.1	8.7	8.4	4.5	6.7	5	4.8	10.5	8.05
Floodprone Width (ft)				6	7	6.7	10	20	15	25	150	87.5	80	200	150			150
BF Cross Sectional Area (ft2)						4.8			3.2			8.5			4.1	2.1	6.3	4.3
BF Mean Depth (ft)				0.9	1.1	1	0.5	0.6	0.6	0.9	1.2	1.1	0.6	1	0.8	0.4	0.7	0.5
BF Max Depth (ft)				1.1	1.4	1.2	0.9	1.3	1.1	1.3	1.4	1.4	0.7	1.4	1.1	0.6	1.5	0.9
Width/Depth Ratio				3.8	6.3	5.2	8	11.2	9.6	7.1	9.7	8.4	12	16	14	11.0	21.9	14.7
Entrenchment Ratio				1.2	1.6	1.4	1.9	3.3	2.7	2.9	18.5	10.7	16	40	30	14.3	31.2	18.7
Bank Height Ratio				3.9	7.4	5.3	2.3	4.1	3.2			1			1			1
Wetted Perimeter(ft)						===			===			===			===			===
Hydraulic radius (ft)						===			===			===			===			===
Pattern																		
Channel Beltwidth (ft)				No distinct repetitive pattern of riffles and pools			No distinct repetitive pattern of riffles and pools			19	60	37	10	35	20	10	35	20
Radius of Curvature (ft)										7	29	12.9	10	20	11	10	20	11
Meander Wavelength (ft)										36.5	87.9	58.9	25	55	35	25	55	35
Meander Width ratio										2.3	7.1	4.4	2	7	4	2	7	4
Profile																		
Riffle length (ft)				No distinct repetitive pattern of riffles and pools			No distinct repetitive pattern of riffles and pools					===			===			===
Riffle slope (ft/ft)										1.48%	4.92%	2.84%	0.49%	1.47%	0.78%	NA*	NA*	NA*
Pool length (ft)												===			===			===
Pool spacing (ft)										23.2	89.3	42.3	15	50	25	15	50	25
Substrate																		
d50 (mm)						===			===			===			===			===
d84 (mm)						===			===			===			===			===
Additional Reach Parameters																		
Valley Length (ft)						===			===			===			===			===
Channel Length (ft)						===			===			===			===			===
Sinuosity						1.1			1			1.5			1.3			1.3
Water Surface Slope (ft/ft)						2.43%			2.44%			1.61%			0.49%			NA*
BF slope (ft/ft)						===			===			===			===			===
Rosgen Classification						G4			Eg4			E4			C/E4			C/E4

Table 9A. Morphology and Hydraulic Monitoring Summary
Cane Creek
Reach 1 (Tributary 1 - Sta. 17+50 to 10+60)

Parameter	Cross Section 1 Pool						Cross Section 2 Riffle						Cross Section 3 Riffle						Cross Section 4 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	10.1	10.2					10.4	9.3					12.2	13.8					13.9	13.9				
Floodprone Width (ft) (approx)	150.0						150.0						150.0						150.0					
BF Cross Sectional Area (ft^2)	10.9	111.1					9.3	7.8					11.3	12.5					16.3	16.6				
BF Mean Depth (ft)	1.1	1.1					0.9	0.8					0.9	0.9					1.2	1.2				
BF Max Depth (ft)	2.3	2.3					1.4	1.3					1.5	1.6					2.6	2.7				
Width/Depth Ratio	NA	NA					11.7	11.1					13.2	15.1					NA	NA				
Entrenchment Ratio	NA	NA					14.4	16.1					12.3	10.9					NA	NA				
Bank Height Ratio	NA	NA					1.0	1.0					1.0	1.0					NA	NA				
Wetted Perimeter(ft)	11.4	11.5					10.9	9.9					12.7	14.2					15.0	15.0				
Hydraulic radius (ft)	1.0	1.0					0.8	0.8					0.9	0.9					1.1	1.1				
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)		66						0.1						0.1						66				
d84 (mm)		107						1						1						107				

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	21	74	42	21	74	42												
Radius of Curvature (ft)	21	42	23	21	42	23												
Meander Wavelength (ft)	53	117	74	53	117	74												
Meander Width ratio	2.0	7.0	4.0	2.0	7.0	4.0												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	8	36	16	8	38	20												
Riffle slope (ft/ft)	0.8%	5.6%	2.4%	0.8%	5.8%	2.2%												
Pool length (ft)	8	58	33	13	48	24												
Pool spacing (ft)	31	106	53	31	106	53												

Additional Reach Parameters	MY-01 (2008)	MY-02 (2009)	MY-03 (2010)	MY-04 (2011)	MY-05 (2012)	MY+
Valley Length (ft)	551	551				
Channel Length (ft)	716	716				
Sinuosity	1.3	1.3				
Water Surface Slope (ft/ft)	0.92%	0.92%				
BF slope (ft/ft)	– – –	– – –				
Rosgen Classification	C/E type	C/E type				
Number of Bankfull Events	0	1				

Table 9B. Morphology and Hydraulic Monitoring Summary
Cane Creek
Reach 2 (Tributary 2 - Sta. 14+10 to 19+50)

Parameter	Cross Section 1 Pool						Cross Section 2 Riffle						Cross Section 3 Pool						Cross Section 4 Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	13.0	13.6					9.3	13.3					11.2	10.5					10.5	10.3				
Floodprone Width (ft) (approx)	150.0						150.0						150.0						150.0					
BF Cross Sectional Area (ft^2)	8.6	6.7					6.3	5.9					9.8	9.8					5.0	5.0				
BF Mean Depth (ft)	0.7	0.5					0.7	0.4					0.9	0.9					0.5	0.5				
BF Max Depth (ft)	1.4	1.3					1.5	1.2					2.0	2.0					0.9	0.9				
Width/Depth Ratio	NA	NA					13.7	29.9					NA	NA					21.9	21.2				
Entrenchment Ratio	NA	NA					16.2	11.2					NA	NA					14.3	14.6				
Bank Height Ratio	NA	NA					1.0	1.0					NA	NA					1.0	1.0				
Wetted Perimeter(ft)	13.4	14.0					9.8	13.7					12.0	11.5					10.7	10.6				
Hydraulic radius (ft)	0.6	0.5					0.6	0.4					0.8	0.9					0.5	0.5				
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)		NA						60						NA						60				
d84 (mm)		NA						98						NA						98				

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	10	35	20	10	35	20												
Radius of Curvature (ft)	10	20	11	10	20	11												
Meander Wavelength (ft)	25	55	35	25	55	35												
Meander Width ratio	2.0	7.0	4.0	2.0	7.0	4.0												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	8	26	15	6	35	13												
Riffle slope (ft/ft)	NA*	NA*	NA*	NA*	NA*	NA*												
Pool length (ft)	15	23	18	6	40	11												
Pool spacing (ft)	15	50	25	15	50	25												

Additional Reach Parameters	MY-01 (2008)	MY-02 (2009)	MY-03 (2010)	MY-04 (2011)	MY-05 (2012)	MY+
Valley Length (ft)	415	415				
Channel Length (ft)	540	542				
Sinuosity	1.3	1.3				
Water Surface Slope (ft/ft)	NA*	NA*				
BF slope (ft/ft)	– – –	– – –				
Rosgen Classification	C type	C type				
Number of Bankfull Events	0	1				

Table 9C. Morphology and Hydraulic Monitoring Summary
Cane Creek
Reach 3 (Tributary 2 - Sta.19+84 to 26+10)

Parameter	Cross Section 5 Pool						Cross Section 6 Riffle						Cross Section 7 Riffle						Cross Section 8 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	7.8	8.1					4.8	5.0					7.4	8.8					11.8	9.8				
Floodprone Width (ft) (approx)	150.0						150.0						150.0						150.0					
BF Cross Sectional Area (ft^2)	5.8	5.8					2.1	2.2					3.5	3.4					11.2	9.2				
BF Mean Depth (ft)	0.7	0.7					0.4	0.4					0.5	0.4					0.9	0.9				
BF Max Depth (ft)	1.3	1.4					0.8	0.8					0.9	0.9					1.7	1.9				
Width/Depth Ratio	NA	NA					11.0	11.1					15.6	22.9					NA	NA				
Entrenchment Ratio	NA	NA					31.2	30.1					20.1	17.1					NA	NA				
Bank Height Ratio	NA	NA					1.0	1.0					1.0	1.0					NA	NA				
Wetted Perimeter(ft)	8.5	8.7					5.1	5.3					7.7	9.0					12.3	10.5				
Hydraulic radius (ft)	0.7	0.7					0.8	0.4					0.4	0.4					0.9	0.9				
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)		NA						48						48						NA				
d84 (mm)		NA						98						98						NA				

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	10	35	20	10	35	20												
Radius of Curvature (ft)	10	20	11	10	20	11												
Meander Wavelength (ft)	25	55	35	25	55	35												
Meander Width ratio	2.0	7.0	4.0	2.0	7.0	4.0												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	12	27	15	5	16	10												
Riffle slope (ft/ft)	NA*	NA*	NA*	NA*	NA*	NA*												
Pool length (ft)	18	33	21	12	30	18												
Pool spacing (ft)	15	50	25	15	50	25												

Additional Reach Parameters	MY-01 (2008)	MY-02 (2009)	MY-03 (2010)	MY-04 (2011)	MY-05 (2012)	MY+
Valley Length (ft)	482	485				
Channel Length (ft)	626	631				
Sinuosity	1.3	1.3				
Water Surface Slope (ft/ft)	NA*	NA*				
BF slope (ft/ft)	– – –	– – –				
Rosgen Classification	C/E type	C/E type				
Number of Bankfull Events	0	1				

Table 9D. Morphology and Hydraulic Monitoring Summary
Cane Creek
Reach 4 (Tributary 3 - Sta. 14+45 to 20+40)

Parameter	Cross Section 1 Riffle						Cross Section 2 Riffle						Cross Section 3 Pool						Cross Section 4 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	9.1	9.0					7.5	10.5					11.8	10.7					9.1	9.8				
Floodprone Width (ft) (approx)	150.0						150.0						150.0						150.0					
BF Cross Sectional Area (ft^2)	5.2	5.2					3.1	4.7					10.3	9.7					8.3	8.7				
BF Mean Depth (ft)	0.6	0.6					0.4	0.4					0.9	0.9					0.9	0.9				
BF Max Depth (ft)	1.1	1.1					0.6	0.8					1.7	1.7					1.8	11.8				
Width/Depth Ratio	16.1	15.4					18.5	23.3					NA	NA					NA	NA				
Entrenchment Ratio	16.5	16.8					19.9	14.3					NA	NA					NA	NA				
Bank Height Ratio	1.0	1.0					1.0	1.0					NA	NA					NA	NA				
Wetted Perimeter(ft)	9.4	9.2					7.7	10.7					12.4	11.3					9.8	10.6				
Hydraulic radius (ft)	0.5	0.6					0.4	0.4					0.8	0.9					0.8	0.8				
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)		57						57						NA						NA				
d84 (mm)		90						90						NA						NA				

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	10	35	20	10	35	20												
Radius of Curvature (ft)	10	20	35	10	20	35												
Meander Wavelength (ft)	25	55	35	25	55	35												
Meander Width ratio	2.0	7.0	4.0	2.0	7.0	4.0												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	5	17	11	6	19	13												
Riffle slope (ft/ft)	NA*	NA*	NA*	NA*	NA*	NA*												
Pool length (ft)	9	33	21	8	33	17												
Pool spacing (ft)	15	50	25	15	50	25												

Additional Reach Parameters	MY-01 (2008)	MY-02 (2009)	MY-03 (2010)	MY-04 (2011)	MY-05 (2012)	MY+
Valley Length (ft)	457	472				
Channel Length (ft)	594	613				
Sinuosity	1.3	1.3				
Water Surface Slope (ft/ft)	NA*	NA*				
BF slope (ft/ft)	– – –	– – –				
Rosgen Classification	C type	C type				
Number of Bankfull Events	0	1				

* No water in channel due to drought conditions.

Table 9E. Morphology and Hydraulic Monitoring Summary
Cane Creek
Reach 5 (Tributary 3 - Sta. 20+68 to 26+60)

Parameter	Cross Section 5 Riffle						Cross Section 6 Pool						Cross Section 7 Pool						Cross Section 8 Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	8.6	9.3					12.1	11.6					12.5	13.2					6.8	7.6				
Floodprone Width (ft) (approx)	150.0						150.0						150.0						150.0					
BF Cross Sectional Area (ft^2)	5.5	5.9					10.9	10.2					11.2	12.5					3.6	3.8				
BF Mean Depth (ft)	0.6	0.6					0.9	0.9					0.9	1.0					0.5	0.5				
BF Max Depth (ft)	1.1	1.1					1.8	1.8					1.9	2.0					0.8	0.8				
Width/Depth Ratio	13.4	14.5					NA	NA					NA	NA					13.1	15.2				
Entrenchment Ratio	17.4	16.2					NA	NA					NA	NA					21.9	19.8				
Bank Height Ratio	1.0	1.0					NA	NA					NA	NA					1.0	1.0				
Wetted Perimeter(ft)	8.9	9.6					12.7	12.2					13.3	13.8					7.2	7.8				
Hydraulic radius (ft)	0.6	0.6					0.9	0.8					0.8	0.9					0.5	0.5				
Substrate	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
d50 (mm)		54						NA						NA						54				
d84 (mm)		80						NA						NA						80				

Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	10	35	20	10	35	20												
Radius of Curvature (ft)	10	20	35	10	20	35												
Meander Wavelength (ft)	25	55	35	25	55	35												
Meander Width ratio	2.0	7.0	4.0	2.0	7.0	4.0												
Profile	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Riffle length (ft)	13	22	18	6	14	9												
Riffle slope (ft/ft)	NA*	NA*	NA*	NA*	NA*	NA*												
Pool length (ft)	15	42	24	10	31	16												
Pool spacing (ft)	15	50	25	15	50	25												

Additional Reach Parameters	MY-01 (2008)	MY-02 (2009)	MY-03 (2010)	MY-04 (2011)	MY-05 (2012)	MY+
Valley Length (ft)	456	480				
Channel Length (ft)	593	624				
Sinuosity	1.3	1.3				
Water Surface Slope (ft/ft)	NA*	NA*				
BF slope (ft/ft)	– – –	– – –				
Rosgen Classification	C type	C type				
Number of Bankfull Events	0	1				

3.0 CONCLUSIONS

None of the five monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 5 percent of the growing season. A summary of groundwater gauge data for the is included in Table 11.

Table 11. Summary of Groundwater Gauge Results

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
1	No/0 days (0 percent)	No/0 days (0 percent)			
2	No/0 days (0 percent)	No/0 days (0 percent)			
3	No/0 days (0 percent)	No/0 days (0 percent)			
4	No/1 days (0.5 percent)	No/4 days (1.8 percent)			
5	Yes/4 days (1.8 percent)	No/6 days (2.8 percent)			
Ref 1	Yes/2 days (0.9 percent)	No/3 days (1.4 percent)			

Vegetation sampling across the Site was above the required average density with 499 planted stems per acre surviving; two of the fifteen plots had low densities for the Year 2 (2009) monitoring season (Table 12).

Table 12. Summary of Planted Vegetation Plot Results

Plot	Planted Stems/Acre Counting Towards Success Criteria				
	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)	Year 4 (2011)	Year 5 (2012)
1	0	121			
2	0	0			
3	324	486			
4	0	0			
5	243	1012			
6	162	850			
7	526	931			
8	486	688			
9	162	567			
10	202	526			
11	162	526			
12	486	810			
13	162	162			
14	243	486			
15	40	324			
Average of All Plots (1-15)	**213**	**499**			

4.0 REFERENCES

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APPENDIX A
VEGETATION DATA

1. **Vegetation Survey Data Tables**
2. **Vegetation Monitoring Plot Photos**

Report Prepared By	Corri Faquin
Date Prepared	10/1/2009 17:02

database name	RestorationSystems-2009-A-v2.2.7.mdb
database location	C:\Axiom\Business\CVS database
computer name	CORRILAPTOP
file size	59428864

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------

Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------

Project Code	Cane
project Name	Cane Creek Restoration Site
Description	Stream and Wetland Restoration Site in Rutherford County
Sampled Plots	15

Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.

Project Code	Project Name	River Basin	Year 2
Cane	Cane Creek Restoration Site	Broad	499.11

Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:

Project Code	Project Name	River Basin	Year 2
Cane	Cane Creek Restoration Site	Broad	1184.379982

Plot Info (Datum for Lat/Long NAD83/WGS84)

plot	Latitude	Longitude	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
1	35.5393324	-81.855151	3	3	0	6	9	9	121	121	243	364	364	1
2	35.538196	-81.855381	0	0	0	28	28	28			1133	1133	1133	0
3	35.536784	-81.855210	12	12	1	11	23	23	486	486	445	931	931	3
4	35.535790	-81.854678	0	0	0	18	18	18			728	728	728	0
5	35.534646	-81.855299	25	25	0	7	32	32	1012	1012	283	1295	1295	6
6	35.533794	-81.855261	21	21	0	0	21	21	850	850	0	850	850	5
7	35.533174	-81.855107	23	23	1	8	31	31	931	931	324	1255	1255	8
8	35.532462	-81.855102	17	17	0	60	77	77	688	688	2428	3116	3116	7
9	35.53146	-81.85548	14	14	1	1	15	15	567	567	40	607	607	4
10	35.530742	-81.855395	13	13	0	3	16	16	526	526	121	647	647	6
11	35.529558	-81.855346	13	13	0	2	15	15	526	526	81	607	607	4
12	35.528784	-81.855327	20	20	1	8	28	28	809	809	324	1133	1133	7
13	35.529052	-81.854852	4	4	0	62	66	66	162	162	2509	2671	2671	1
14	35.532373	-81.854268	12	12	0	25	37	37	486	486	1012	1497	1497	5
15	35.533568	-81.853962	8	8	0	15	23	23	324	324	607	931	931	4

Vigor

vigor	Count	Percent
0	1	0.5
2	14	7.4
3	94	49.7
4	77	40.7
Missing	3	1.6

Vigor by Species

Species	CommonName	4	3	2	1	0	Missing	Unknown
Asimina triloba	pawpaw			2				
Cephalanthus occidentalis	common buttonbush	2	20	1				
Cornus amomum	silky dogwood	19	21	1			2	
Diospyros virginiana	common persimmon		2					
Fraxinus pennsylvanica	green ash	7	3					
Quercus alba	white oak	21	4	1				
Quercus pagoda	cherrybark oak		3	1				
Sambucus canadensis	Common Elderberry	5	4	2				
Cornus	dogwood		1					
Cercis canadensis	eastern redbud	4	1					
Quercus	oak			1				
Quercus rubra	northern red oak	8	9	2		1		
Carya	hickory		9					
Nyssa	tupelo		1	2				
Fraxinus	ash	1	4	1			1	
Platanus occidentalis	American sycamore	7	5					
Ulmus	elm	3	7					
17	**17**	**77**	**94**	**14**		**1**	**3**	

Damage

Damage	Count	Percent Of Stems
(no damage)	149	78.8
Deer	16	8.5
Unknown	11	5.8
Insects	9	4.8
Other/Unknown Animal	2	1.1
Rodents	1	0.5
(other damage)	1	0.5

Damage by Species

Species	Common Name	Count of Damage Categories	(no damage)	Deer	Insects	Other/ Unknown Animal	Rodents	Unknown	(other damage)
Asimina triloba	pawpaw	2						2	
Carya	hickory	5	4	4		1			
Cephalanthus occidentalis	common buttonbush	2	21					2	
Cercis canadensis	eastern redbud	0	5						
Cornus	dogwood	0	1						
Cornus amomum	silky dogwood	8	35	7				1	
Diospyros virginiana	common persimmon	0	2						
Fraxinus	ash	2	5					2	
Fraxinus pennsylvanica	green ash	0	10						
Nyssa	tupelo	3		1	2				
Platanus occidentalis	American sycamore	1	11					1	
Quercus	oak	1			1				
Quercus alba	white oak	2	24			1		1	
Quercus pagoda	cherrybark oak	1	3					1	
Quercus rubra	northern red oak	8	12	1	5		1		1
Sambucus canadensis	Common Elderberry	1	10					1	
Ulmus	elm	4	6	3	1				
17	**17**	**40**	**149**	**16**	**9**	**2**	**1**	**11**	**1**

Damage by Plot

plot	Count of Damage Categories	(no damage)	(no stems on plot)	Deer	Insects	Other/Unknown Animal	Rodents	Unknown	(other damage)
1	0	3							
2			1						
3	7	6		1	5			1	
4			1						
5	6	19		5			1		
6	3	18		2		1			
7	4	20		2	1			1	
8	3	14		2	1				
9	1	14						1	
10	2	11				1		1	
11	2	11						2	
12	3	18		1				2	
13	1	3		1					
14	7	5		2	2			2	1
15	1	7						1	
15	**40**	**149**	**2**	**16**	**9**	**2**	**1**	**11**	**1**

Planted Stems by Plot and Species

Species	CommonName	Total Planted Stems	# plots	avg# stems	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Asimina triloba	pawpaw	2	1	2												2			
Carya	hickory	9	5	1.8					3	3	1	1						1	
Cephalanthus occidentalis	common buttonbush	23	9	2.56					5	2	3	5	2	2	1	2			1
Cercis canadensis	eastern redbud	5	3	1.67					1	2	2								
Cornus	dogwood	1	1	1										1					
Cornus amomum	silky dogwood	41	8	5.12					8	12		2	6	1		6	4	2	
Diospyros virginiana	common persimmon	2	1	2															2
Fraxinus	ash	6	3	2							4					1			1
Fraxinus pennsylvanica	green ash	10	3	3.33									1	6		3			
Nyssa	tupelo	3	1	3														3	
Platanus occidentalis	American sycamore	12	5	2.4	3		1				3				1			4	
Quercus	oak	1	1	1								1							
Quercus alba	white oak	26	6	4.33						2			5	2	9	4			4
Quercus pagoda	cherrybark oak	4	1	4			4												
Quercus rubra	northern red oak	19	5	3.8			7		5		3	2						2	
Sambucus canadensis	Common Elderberry	11	6	1.83					3		1	2		1	2	2			
Ulmus	elm	10	2	5							6	4							
17	**17**	**185**	**18**		**3**	**0**	**12**	**0**	**25**	**21**	**23**	**17**	**14**	**13**	**13**	**20**	**4**	**12**	**8**

All Stems by Plot and Species

Species	Common Name	Total Stems	# plots	avg# stems	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Acer negundo	boxelder	117	11	10.64			1		4		8	56	1	2	2	5	11	23	4
Acer rubrum	red maple	8	2	4								2							6
Albizia julibrissin	silktree	2	2	1			1										1		
Asimina triloba	pawpaw	3	2	1.5										1		2			
Carya	hickory	10	6	1.67				1	3	3	1	1						1	
Cephalanthus occidentalis	common buttonbush	24	9	2.67					6	2	3	5	2	2	1	2			1
Cercis canadensis	eastern redbud	6	3	2					2	2	2								
Cornus	dogwood	1	1	1										1					
Cornus amomum	silky dogwood	42	8	5.25					9	12		2	6	1		6	4	2	
Diospyros virginiana	common persimmon	19	3	6.33				2									14		3
Fraxinus	ash	18	4	4.5				11			4					1			2
Fraxinus pennsylvanica	green ash	10	3	3.33									1	6		3			
Juglans nigra	black walnut	34	2	17													32	2	
Liriodendron tulipifera	tuliptree	2	2	1				1									1		
Morus rubra	red mulberry	1	1	1													1		
Nyssa	tupelo	3	1	3														3	
Pinus	pine	5	1	5			5												
Pinus taeda	loblolly pine	2	1	2		2													
Platanus occidentalis	American sycamore	51	8	6.38	9	25	5	3			3				1		1	4	
Prunus serotina	black cherry	3	1	3												3			
Quercus	oak	1	1	1								1							
Quercus alba	white oak	26	6	4.33						2			5	2	9	4			4
Quercus pagoda	cherrybark oak	4	1	4			4												
Quercus rubra	northern red oak	20	5	4			8		5		3	2						2	
Rhus glabra	smooth sumac	1	1	1		1													
Sambucus canadensis	Common Elderberry	16	8	2					3		1	3		1	2	2	1		3
Ulmus	elm	11	2	5.5							6	5							
27	**27**	**440**	**27**		**9**	**28**	**24**	**18**	**32**	**21**	**31**	**77**	**15**	**16**	**15**	**28**	**66**	**37**	**23**

Cane Creek Stream and Wetland Restoration Site
Year 2 (2009) Annual Monitoring
Vegetation Plot Photos
Taken August 2009

Cane Creek Stream and Wetland Restoration Site
Year 2 (2009) Annual Monitoring
Vegetation Plot Photos
Taken August 2009
(continued)

APPENDIX B
GEOMORPHOLOGIC DATA

1. **Tables B1-B5. Qualitative Visual Stability Assessment**
2. **Cross-section Plots and Tables**
3. **Longitudinal Profile Plots**
4. **Representative Structure Photographs**
5. **Enhancement Reach Photographs**

Table B1. Visual Morphological Stability Assessment
Cane Creek
Reach 1 (Tributary 1 - Sta. 17+50 to 10+60) August 2009

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	16	16	NA	100%	
	2. Armor stable (e.g. no displacement)?	16	16	NA	100%	
	3. Facet grade appears stable?	16	16	NA	100%	
	4. Minimal evidence of embedding / fining?	16	16	NA	100%	
A. Riffles	5. Length appropriate?	16	16	NA	100%	100%
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	21	21	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	21	21	NA	100%	
B. Pools	3. Length appropriate?	21	21	NA	100%	100%
	1. Upstream of meander bend (run/inflection) centering?	21	21	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	21	21	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	21	21	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	NA	100%	
	3. Apparent Rc within spec?	21	21	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	21	21	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	10	98.5%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	99%
	1. Free of back or arm scour?	2	2	NA	100%	
	2. Height appropriate?	0	2	NA	0%	
	3. Angle and geometry appear appropriate?	2	2	NA	100%	
F. Vanes	4. Free of piping or other structural failures?	2	2	NA	100%	75%
	1. Free of scour?	NA	NA	NA	NA	
G. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Table B2. Visual Morphological Stability Assessment
Cane Creek
Reach 2 (Tributary 2 - Sta. 14+10 to 19+50) August 2009

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	19	19	NA	100%	
	2. Armor stable (e.g. no displacement)?	19	19	NA	100%	
	3. Facet grade appears stable?	19	19	NA	100%	
	4. Minimal evidence of embedding / fining?	19	19	NA	100%	
A. Riffles	5. Length appropriate?	19	19	NA	100%	100%
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	23	23	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	21	23	NA	91%	
B. Pools	3. Length appropriate?	23	23	NA	100%	97%
	1. Upstream of meander bend (run/inflection) centering?	23	23	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	23	23	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	23	28	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	0	0	NA	100%	
	3. Apparent Rc within spec?	23	23	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	23	23	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	100%
	1. Free of back or arm scour?	2	2	NA	100%	
	2. Height appropriate?	0	2	NA	0%	
	3. Angle and geometry appear appropriate?	2	2	NA	100%	
F. Vanes	4. Free of piping or other structural failures?	2	2	NA	100%	75%
	1. Free of scour?	NA	NA	NA	NA	
G. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Table B3. Visual Morphological Stability Assessment
Cane Creek
Reach 3 (Tributary 2 - Sta.19+84 to 26+10) August 2009

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	20	20	NA	100%	
	2. Armor stable (e.g. no displacement)?	20	20	NA	100%	
	3. Facet grade appears stable?	20	20	NA	100%	
	4. Minimal evidence of embedding / fining?	20	20	NA	100%	
A. Riffles	5. Length appropriate?	20	20	NA	100%	100%
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	28	28	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	28	28	NA	100%	
B. Pools	3. Length appropriate?	28	28	NA	100%	100%
	1. Upstream of meander bend (run/inflection) centering?	28	28	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	28	28	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	28	28	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	0	0	NA	100%	
	3. Apparent Rc within spec?	28	28	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	28	28	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	100%
	1. Free of back or arm scour?	1	2	NA	50%	
	2. Height appropriate?	2	2	NA	100%	
	3. Angle and geometry appear appropriate?	2	2	NA	100%	
F. Vanes	4. Free of piping or other structural failures?	1	2	NA	50%	75%
	1. Free of scour?	NA	NA	NA	NA	
G. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Table B4. Visual Morphological Stability Assessment
Cane Creek
Reach 4 (Tributary 3 - Sta. 14+45 to 20+40) August 2009

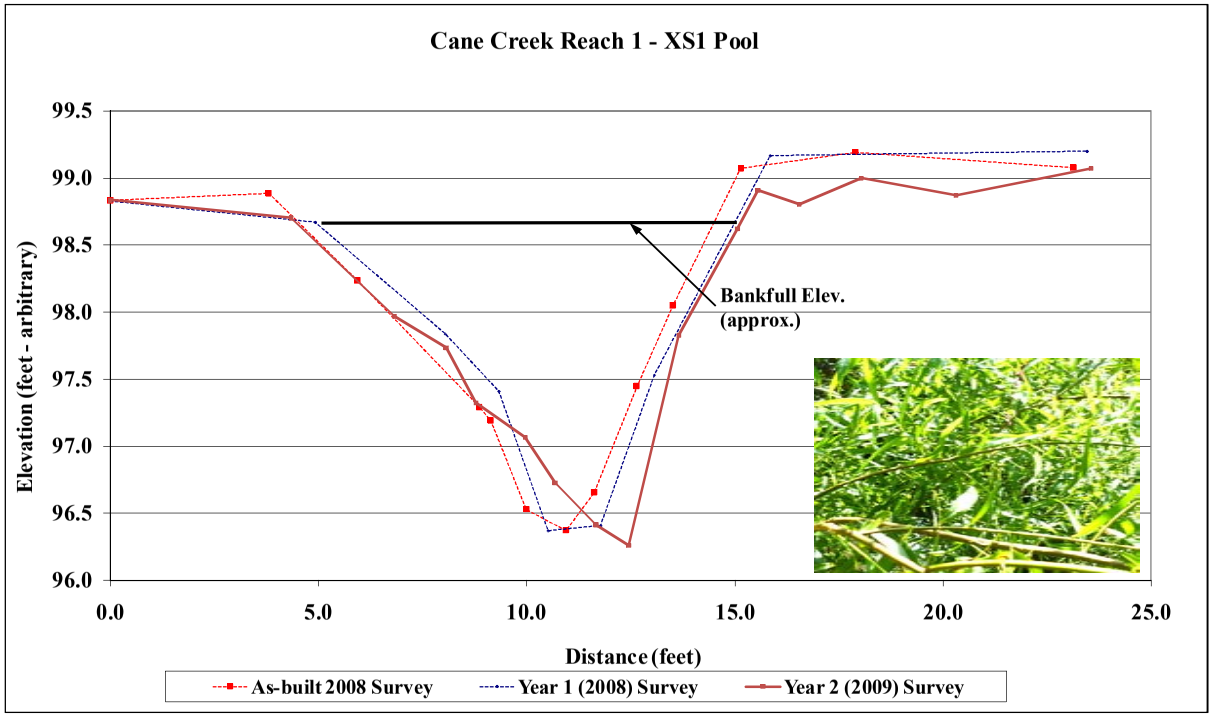
Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	19	19	NA	100%	
	2. Armor stable (e.g. no displacement)?	19	19	NA	100%	
	3. Facet grade appears stable?	19	19	NA	100%	
	4. Minimal evidence of embedding / fining?	19	19	NA	100%	
A. Riffles	5. Length appropriate?	19	19	NA	100%	100%
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	26	26	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	26	26	NA	100%	
B. Pools	3. Length appropriate?	26	26	NA	100%	100%
	1. Upstream of meander bend (run/inflection) centering?	26	26	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	26	26	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	26	26	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	0	0	NA	100%	
	3. Apparent Rc within spec?	26	26	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	26	26	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	100%
	1. Free of back or arm scour?	2	2	NA	100%	
	2. Height appropriate?	2	2	NA	100%	
	3. Angle and geometry appear appropriate?	2	2	NA	100%	
F. Vanes	4. Free of piping or other structural failures?	2	2	NA	100%	100%
	1. Free of scour?	NA	NA	NA	NA	
G. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Table B5. Visual Morphological Stability Assessment
Cane Creek
Reach 5 (Tributary 3 - Sta. 20+68 to 26+60) August 2009

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
	1. Present	20	20	NA	100%	
	2. Armor stable (e.g. no displacement)?	20	20	NA	100%	
	3. Facet grade appears stable?	20	20	NA	100%	
	4. Minimal evidence of embedding / fining?	20	20	NA	100%	
A. Riffles	5. Length appropriate?	20	20	NA	100%	100%
	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	30	30	NA	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	30	30	NA	100%	
B. Pools	3. Length appropriate?	30	30	NA	100%	100%
	1. Upstream of meander bend (run/inflection) centering?	30	30	NA	100%	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?	30	30	NA	100%	100%
	1. Outer bend in state of limited/controlled erosion?	30	30	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	0	0	NA	100%	
	3. Apparent Rc within spec?	30	30	NA	100%	
D. Meanders	4. Sufficient floodplain access and relief?	30	30	NA	100%	100%
	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	
E. Bed General	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	100%
	1. Free of back or arm scour?	3	3	NA	100%	
	2. Height appropriate?	3	3	NA	100%	
	3. Angle and geometry appear appropriate?	3	3	NA	100%	
F. Vanes	4. Free of piping or other structural failures?	3	3	NA	100%	100%
	1. Free of scour?	NA	NA	NA	NA	
G. Wads / Boulders	2. Footing stable?	NA	NA	NA	NA	NA

Project Name	Cane Creek
Cross Section	R1-XS1
Feature	Pool
Date	8/18/09
Crew	Adasme, Perkinson, Dean

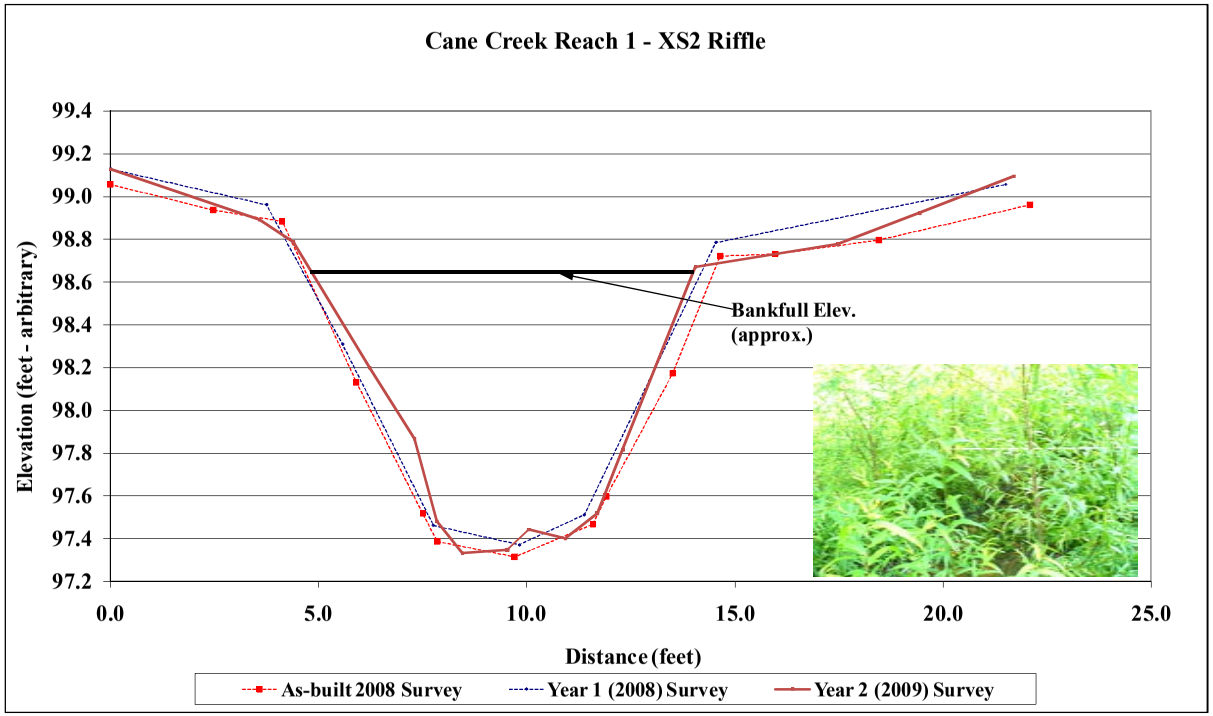
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	98.8	0.0	98.8	0.0	98.8		
3.8	98.9	4.9	98.7	4.3	98.7		
5.9	98.2	8.0	97.8	6.8	98.0		
8.9	97.3	9.3	97.4	8.1	97.7		
9.1	97.2	10.5	96.4	8.8	97.3		
10.0	96.5	11.8	96.4	10.0	97.1		
10.9	96.4	13.1	97.5	10.7	96.7		
11.6	96.7	15.8	99.2	11.7	96.4		
12.6	97.4	23.5	99.2	12.4	96.3		
13.5	98.0			13.7	97.8		
15.1	99.1			15.1	98.6		
17.9	99.2			15.6	98.9		
23.1	99.1			16.5	98.8		
				18.0	99.0		
				20.3	98.9		
				23.6	99.1		



	As-built	2008	2009	2010
Area	13.5	10.9	11.1	
Width	11.0	10.1	10.2	
Mean Depth	1.2	1.1	1.1	
Max Depth	2.5	2.3	2.3	
W/D Ratio	NA	NA	NA	

Project Name	Cane Creek
Cross Section	R1-XS2
Feature	Riffle
Date	8/18/09
Crew	Adasme, Perkinson, Dean

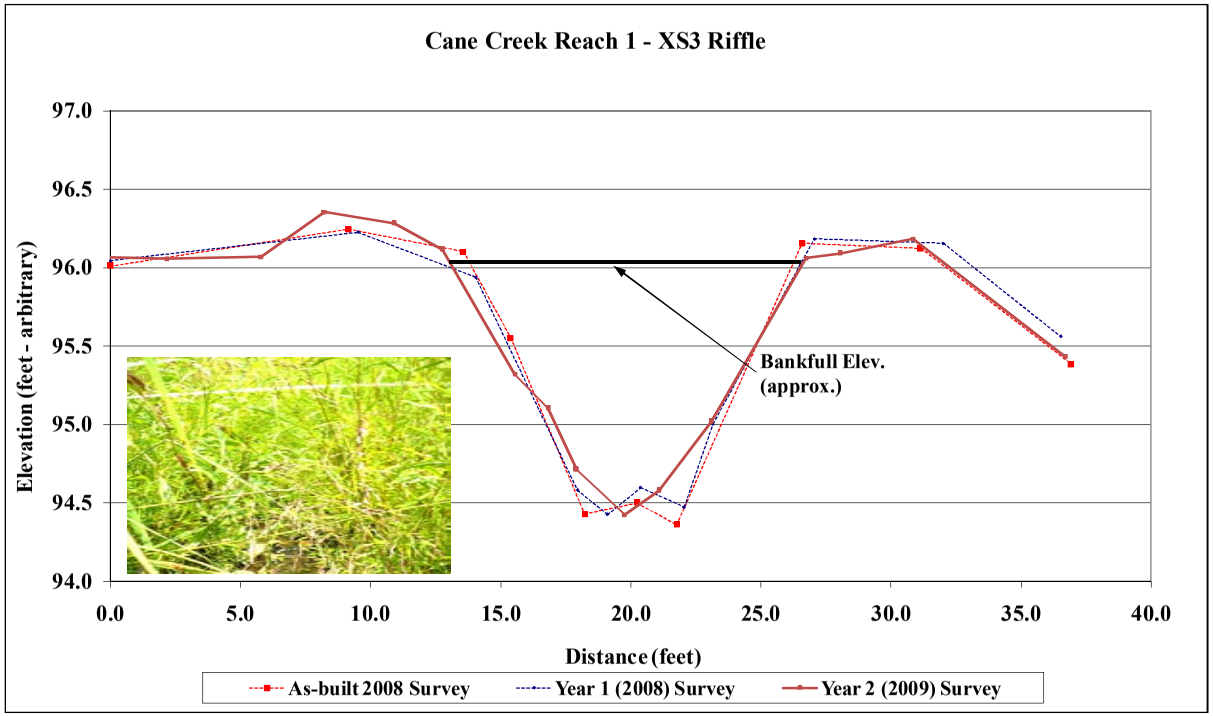
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	99.1	0.0	99.1	0.0	99.1		
2.5	98.9	3.8	99.0	3.6	98.9		
4.1	98.9	5.6	98.3	4.4	98.8		
5.9	98.1	7.8	97.5	6.2	98.2		
7.5	97.5	9.8	97.4	7.3	97.9		
7.9	97.4	11.4	97.5	7.8	97.5		
9.7	97.3	14.5	98.8	8.5	97.3		
11.6	97.5	21.5	99.1	9.5	97.3		
11.9	97.6			10.0	97.4		
13.5	98.2			10.9	97.4		
14.7	98.7			11.7	97.5		
16.0	98.7			12.3	97.8		
18.5	98.8			14.1	98.7		
22.1	99.0			17.5	98.8		
				19.4	98.9		
				21.7	99.1		



	As-built	2008	2009	2010
Area	9.4	9.3	7.8	
Width	10.1	10.4	9.3	
Mean Depth	0.9	0.9	0.8	
Max Depth	1.4	1.4	1.3	
W/D Ratio	11.0	11.7	11.1	

Project Name	Cane Creek
Cross Section	R1-XS3
Feature	Riffle
Date	8/18/09
Crew	Adasme, Perkinson, Dean

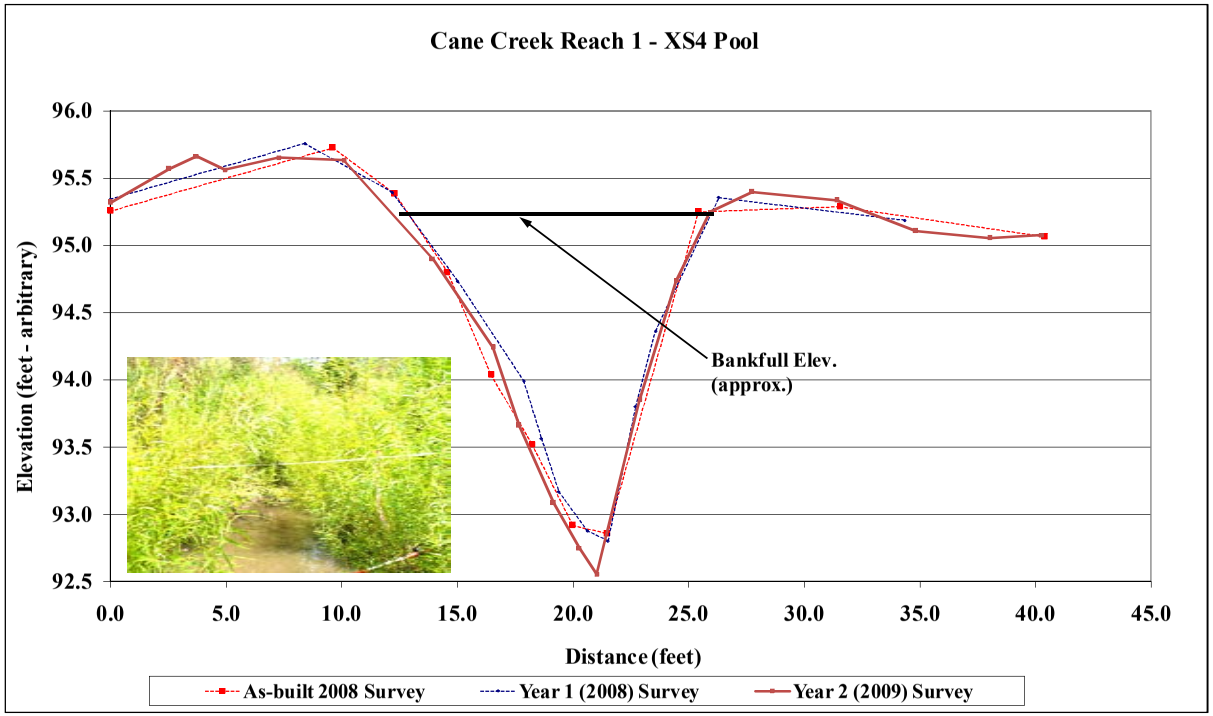
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	96.0	0.0	96.0	-1.0	96.1		
9.1	96.2	9.5	96.2	2.2	96.1		
13.6	96.1	14.0	95.9	5.8	96.1		
15.4	95.5	18.0	94.6	8.2	96.4		
18.2	94.4	19.1	94.4	10.9	96.3		
20.2	94.5	20.4	94.6	12.8	96.1		
21.8	94.4	22.1	94.5	15.5	95.3		
26.6	96.2	23.2	95.0	16.8	95.1		
31.1	96.1	27.1	96.2	17.9	94.7		
36.9	95.4	32.0	96.2	19.8	94.4		
		36.5	95.6	21.1	94.6		
				23.1	95.0		
				26.7	96.1		
				28.0	96.1		
				30.8	96.2		
				36.7	95.4		



	As-built	2008	2009	2010
Area	13.6	11.3	12.5	
Width	12.9	12.2	13.8	
Mean Depth	1.1	0.9	0.9	
Max Depth	1.7	1.5	1.6	
W/D Ratio	12.2	13.3	15.1	

Project Name	Cane Creek
Cross Section	R1-XS4
Feature	Pool
Date	8/18/09
Crew	Adasme, Perkinson, Dean

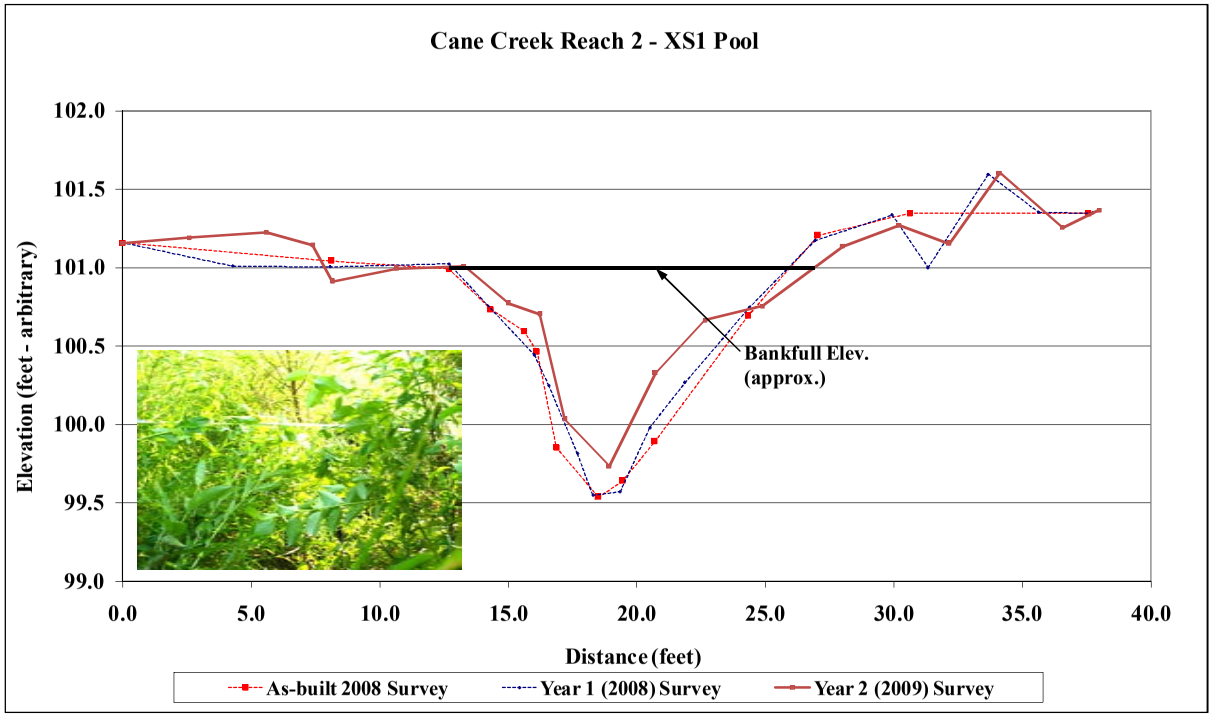
As-built 2008 Survey		2008 Survey		2009 Survey		2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	95.3	0.0	95.3	0.0	95.3		
9.6	95.7	8.4	95.8	2.5	95.6		
12.3	95.4	12.2	95.4	3.7	95.7		
14.6	94.8	15.0	94.7	5.0	95.6		
16.5	94.0	17.9	94.0	7.3	95.7		
18.2	93.5	18.6	93.6	10.1	95.6		
20.0	92.9	19.4	93.2	13.9	94.9		
21.5	92.9	20.6	92.9	16.6	94.2		
25.4	95.3	21.5	92.8	17.7	93.7		
31.5	95.3	22.7	93.8	19.2	93.1		
40.4	95.1	23.6	94.4	20.3	92.7		
		26.3	95.4	21.0	92.6		
		34.3	95.2	22.9	93.9		
				24.5	94.7		
				25.9	95.2		
				27.7	95.4		
				31.4	95.3		
				34.8	95.1		
				38.0	95.1		
				40.3	95.1		



	As-built	2008	2009	2010
Area	16.4	16.3	16.6	
Width	12.6	13.9	13.9	
Mean Depth	1.3	1.2	1.2	
Max Depth	2.4	2.6	2.7	
W/D Ratio	NA	NA	NA	

Project Name	Cane Creek
Cross Section	R2-XS1
Feature	Pool
Date	8/18/09
Crew	Adasme, Perkinson, Dean

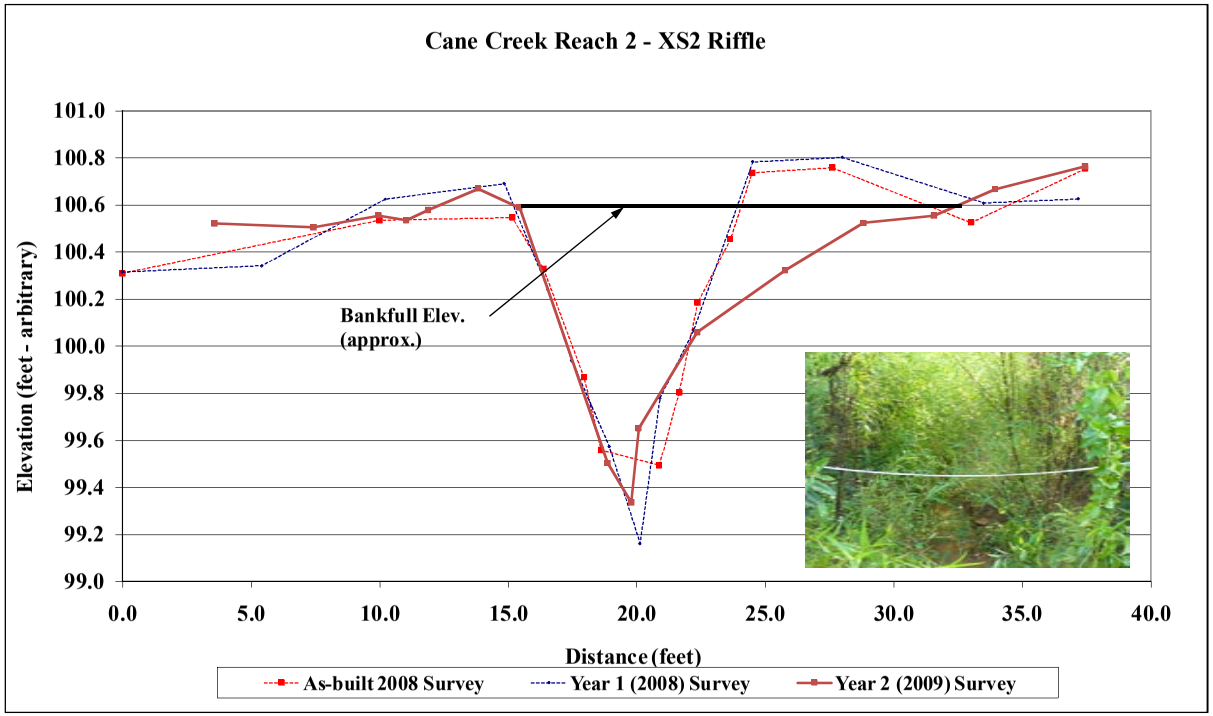
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	101.2	0.0	101.2	0.0	101.2		
8.1	101.0	4.3	101.0	2.6	101.2		
12.7	101.0	8.1	101.0	5.6	101.2		
14.3	100.7	12.7	101.0	7.4	101.1		
15.6	100.6	16.0	100.4	8.2	100.9		
16.1	100.5	16.6	100.2	10.7	101.0		
16.9	99.9	17.7	99.8	13.3	101.0		
18.5	99.5	18.3	99.5	15.0	100.8		
19.4	99.6	19.4	99.6	16.2	100.7		
20.7	99.9	20.5	100.0	17.2	100.0		
24.3	100.7	21.9	100.3	18.9	99.7		
27.0	101.2	24.4	100.7	20.7	100.3		
30.6	101.3	26.9	101.2	22.6	100.7		
37.6	101.3	29.9	101.3	24.9	100.8		
		31.3	101.0	28.0	101.1		
		33.7	101.6	30.2	101.3		
		35.6	101.4	32.1	101.2		
		37.7	101.3	34.1	101.6		
				36.5	101.3		
				38.0	101.4		



	As-built	2008	2009	2010
Area	9.3	8.6	6.7	
Width	13.4	13.0	13.6	
Mean Depth	0.7	0.7	0.5	
Max Depth	1.5	1.4	1.3	
W/D Ratio	N/A	NA	NA	

Project Name	Cane Creek
Cross Section	R2-XS2
Feature	Riffle
Date	8/18/09
Crew	Adasme, Perkinson, Dean

As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	100.3	0.0	100.3	3.6	100.5		
10.0	100.5	5.4	100.3	7.4	100.5		
15.2	100.5	10.2	100.6	10.0	100.6		
16.4	100.3	14.8	100.7	11.0	100.5		
17.9	99.9	16.5	100.2	11.9	100.6		
18.6	99.6	17.5	99.9	13.8	100.7		
20.9	99.5	18.2	99.7	15.4	100.6		
21.7	99.8	18.9	99.6	18.9	99.5		
22.4	100.2	20.1	99.2	19.8	99.3		
23.6	100.5	20.9	99.8	20.1	99.7		
24.5	100.7	22.2	100.1	22.3	100.1		
27.6	100.8	24.5	100.8	25.8	100.3		
33.0	100.5	28.0	100.8	28.8	100.5		
37.4	100.8	33.5	100.6	31.5	100.6		
		37.2	100.6	33.9	100.7		
				37.4	100.8		

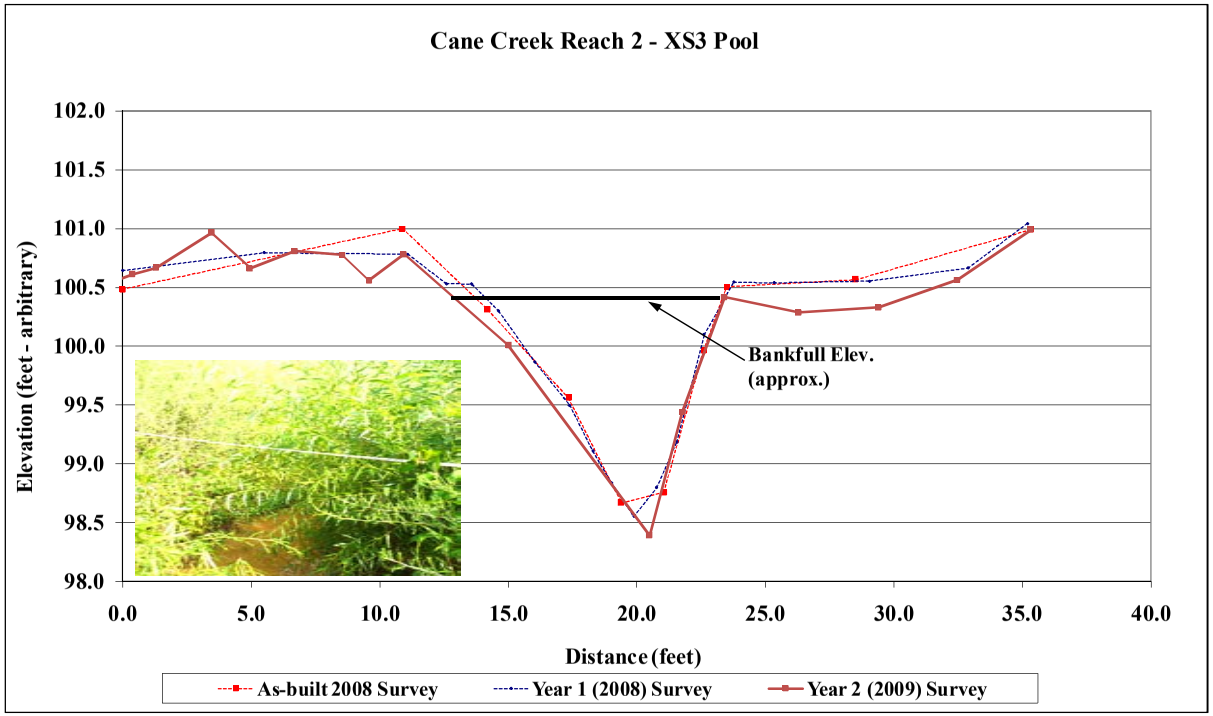


	As-built	2008	2009	2010
Area	5.1	6.3	5.9*	
Width	9.2	9.3	13.3*	
Mean Depth	0.6	0.7	0.4*	
Max Depth	1.1	1.5	1.2*	
W/D Ratio	16.5	13.6	29.9*	

* Note: One cross section end point could not be located.

Project Name	Cane Creek
Cross Section	R2-XS3
Feature	Pool
Date	8/18/09
Crew	Adasme, Perkinson, Dean

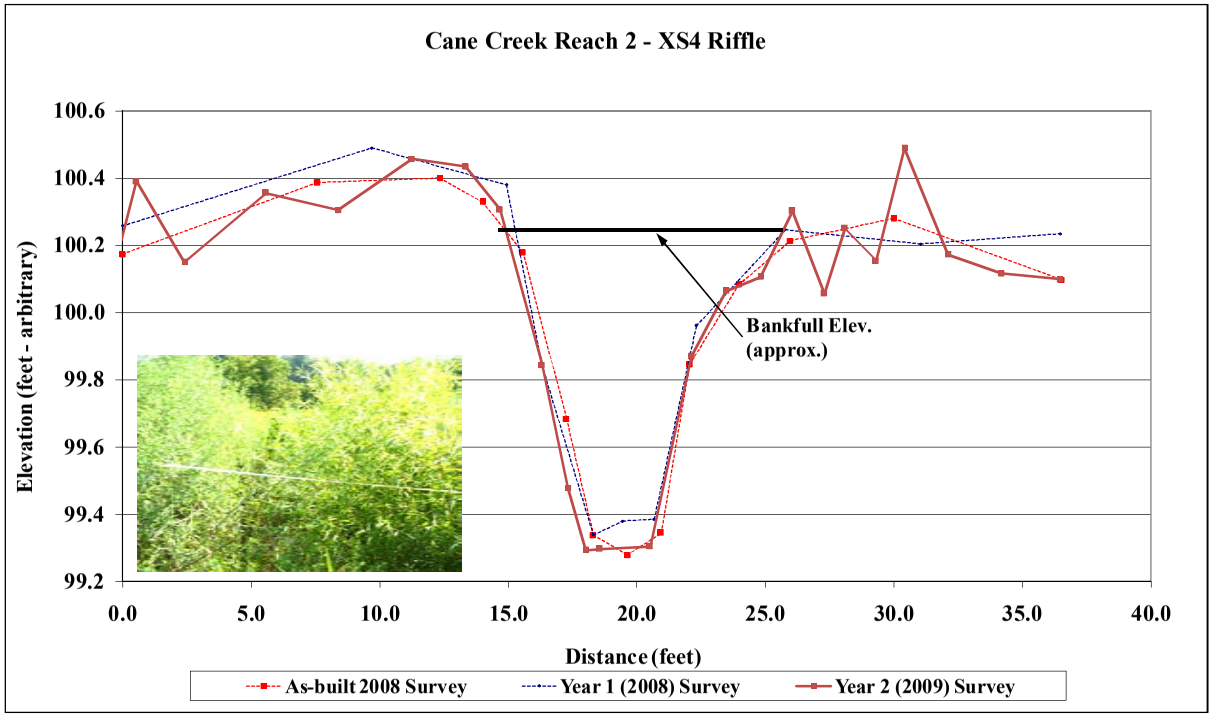
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	100.5	0.0	100.6	-0.5	100.5		
10.9	101.0	5.5	100.8	0.4	100.6		
14.2	100.3	11.1	100.8	1.3	100.7		
17.3	99.6	12.6	100.5	3.5	101.0		
19.4	98.7	13.6	100.5	5.0	100.7		
21.1	98.8	14.6	100.3	6.7	100.8		
22.6	100.0	16.0	99.9	8.5	100.8		
23.5	100.5	17.4	99.5	9.6	100.6		
28.5	100.6	18.3	99.1	10.9	100.8		
35.3	101.0	19.0	98.8	15.0	100.0		
		19.9	98.6	20.5	98.4		
		20.8	98.8	21.8	99.4		
		21.6	99.2	23.4	100.4		
		22.6	100.1	26.3	100.3		
		23.8	100.5	29.4	100.3		
		25.3	100.5	32.5	100.6		
		29.1	100.6	35.3	101.0		
		32.9	100.7				
		35.2	101.0				



	As-built	2008	2009	2010
Area	9.7	9.8	9.8	
Width	10.2	11.2	10.5	
Mean Depth	1.0	0.9	0.9	
Max Depth	1.8	2.0	2.0	
W/D Ratio	N/A	NA	NA	

Project Name	Cane Creek
Cross Section	R2-XS4
Feature	Riffle
Date	8/18/09
Crew	Adasme, Perkinson, Dean

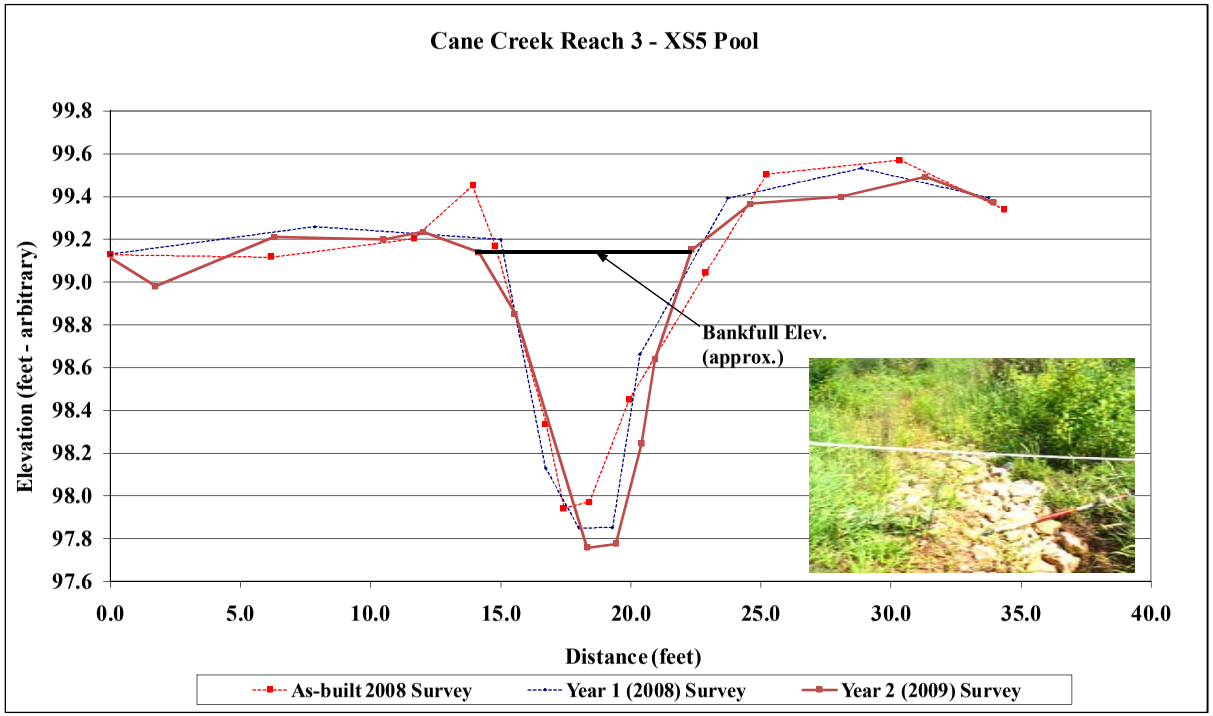
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	100.2	0.0	100.3	-4.0	100.2		
7.6	100.4	9.7	100.5	-1.7	100.3		
12.3	100.4	14.9	100.4	-0.1	100.2		
14.0	100.3	16.3	99.8	0.5	100.4		
15.6	100.2	18.3	99.3	2.4	100.1		
17.3	99.7	19.5	99.4	5.6	100.4		
18.3	99.3	20.7	99.4	8.4	100.3		
19.6	99.3	22.3	100.0	11.3	100.5		
20.9	99.3	25.8	100.2	13.3	100.4		
22.0	99.8	31.0	100.2	14.7	100.3		
24.0	100.1	36.5	100.2	16.3	99.8		
26.0	100.2			17.3	99.5		
30.0	100.3			18.0	99.3		
36.5	100.1			18.6	99.3		
				20.5	99.3		
				22.1	99.9		
				23.5	100.1		
				24.8	100.1		
				26.0	100.3		
				27.3	100.1		
				28.1	100.3		
				29.3	100.2		
				30.4	100.5		
				32.1	100.2		
				34.2	100.1		
				36.5	100.1		



	As-built	2008	2009	2010
Area	3.7	5.0	5.0	
Width	8.1	10.5	10.3	
Mean Depth	0.5	0.5	0.5	
Max Depth	0.8	0.9	0.9	
W/D Ratio	17.8	21.9	21.2	

Project Name	Cane Creek
Cross Section	R3-XS5
Feature	Pool
Date	8/18/09
Crew	Adasme, Perkinson, Dean

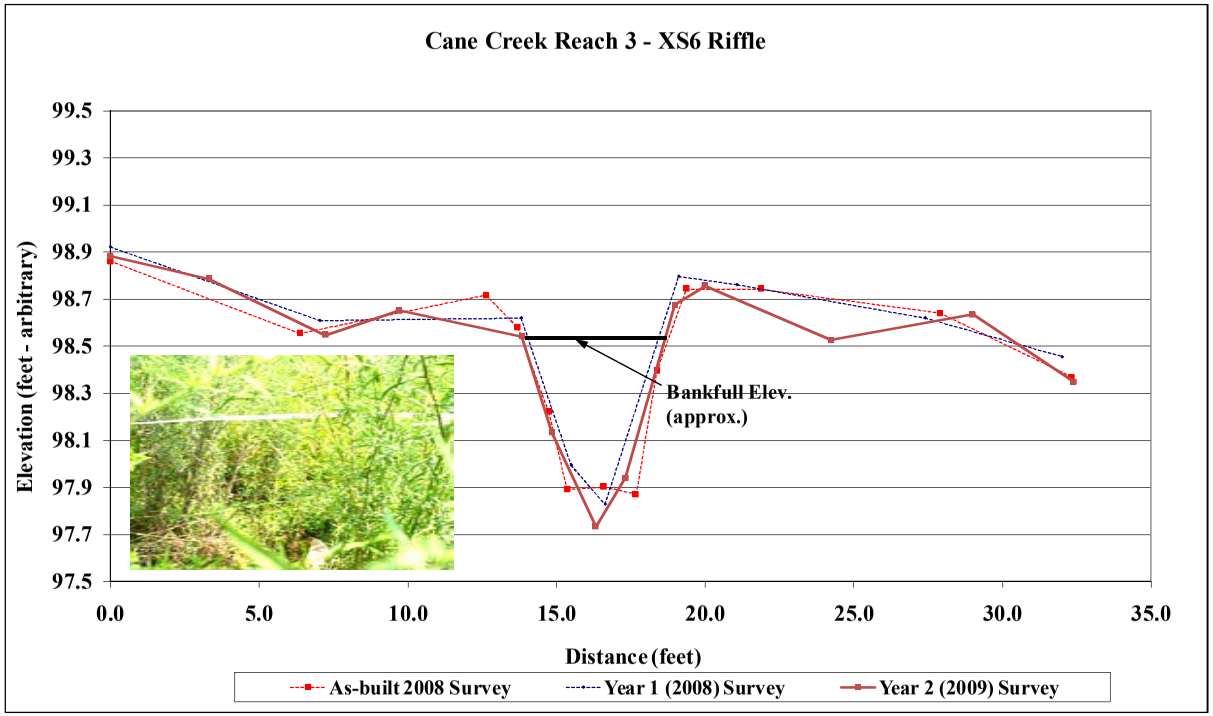
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	99.1	0.0	99.1	-0.2	99.1		
6.2	99.1	7.9	99.3	1.7	99.0		
11.7	99.2	15.0	99.2	6.3	99.2		
13.9	99.5	16.7	98.1	10.5	99.2		
14.8	99.2	18.0	97.8	12.0	99.2		
16.7	98.3	19.3	97.9	14.2	99.1		
17.4	97.9	20.4	98.7	15.6	98.9		
18.4	98.0	23.7	99.4	18.3	97.8		
19.9	98.4	28.9	99.5	19.4	97.8		
22.9	99.0	33.8	99.4	20.4	98.2		
25.2	99.5			20.9	98.6		
30.3	99.6			22.3	99.1		
34.3	99.3			24.6	99.4		
				28.1	99.4		
				31.3	99.5		
				33.9	99.4		



	As-built	2008	2009	2010
Area	5.4	5.8	5.8	
Width	8.7	7.8	8.1	
Mean Depth	0.6	0.7	0.7	
Max Depth	1.2	1.3	1.4	
W/D Ratio	N/A	NA	NA	

Project Name	Cane Creek
Cross Section	R3-XS6
Feature	Riffle
Date	8/18/09
Crew	Adasme, Perkinson, Dean

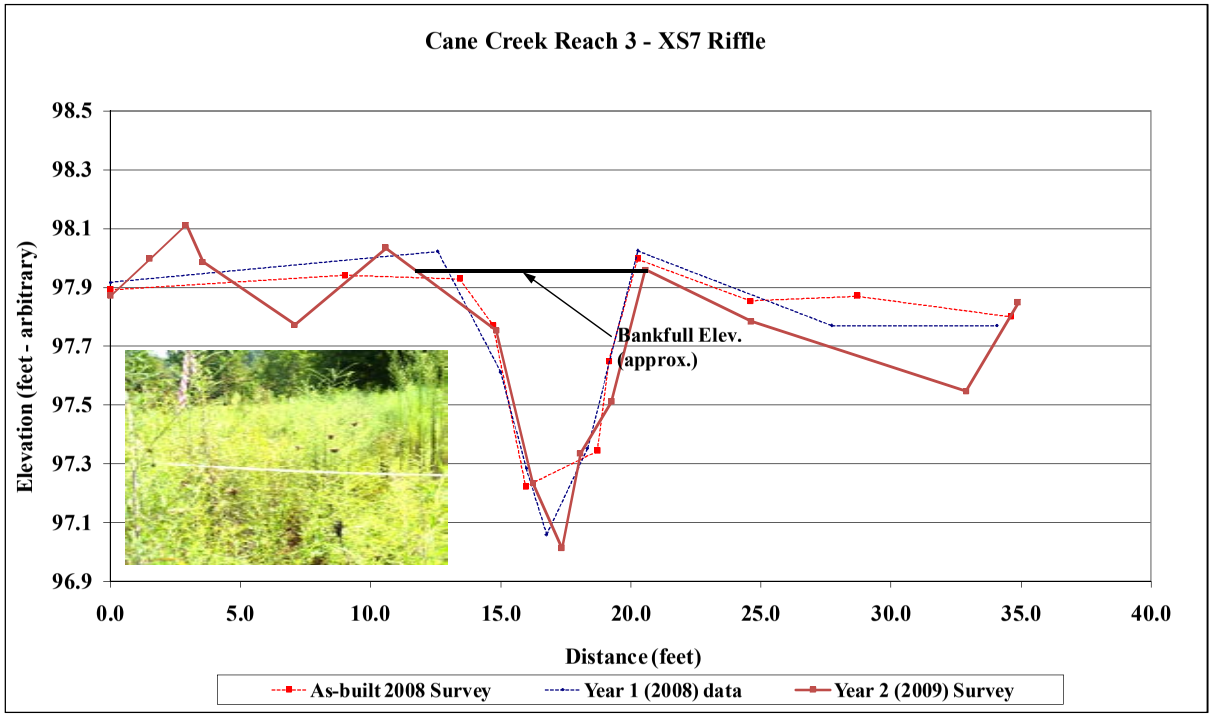
As-built 2007 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	98.9	0.0	98.9	0.0	98.9		
6.4	98.6	7.1	98.6	3.3	98.8		
12.6	98.7	13.8	98.6	7.2	98.5		
13.7	98.6	15.5	98.0	9.7	98.7		
14.7	98.2	16.6	97.8	13.8	98.5		
15.4	97.9	19.1	98.8	14.8	98.1		
16.6	97.9	21.1	98.8	16.3	97.7		
17.7	97.9	27.4	98.6	17.3	97.9		
18.4	98.4	32.0	98.5	19.0	98.7		
19.4	98.7			20.0	98.8		
21.9	98.7			24.2	98.5		
27.9	98.6			29.0	98.6		
32.3	98.4			32.4	98.3		



	As-built	2008	2009	2010
Area	3.3	2.1	2.2	
Width	6.6	4.8	5.0	
Mean Depth	0.5	0.4	0.4	
Max Depth	0.8	0.8	0.8	
W/D Ratio	13.5	11.0	11.1	

Project Name	Cane Creek
Cross Section	R3-XS7
Feature	Riffle
Date	8/18/09
Crew	Adasme, Perkinson, Dean

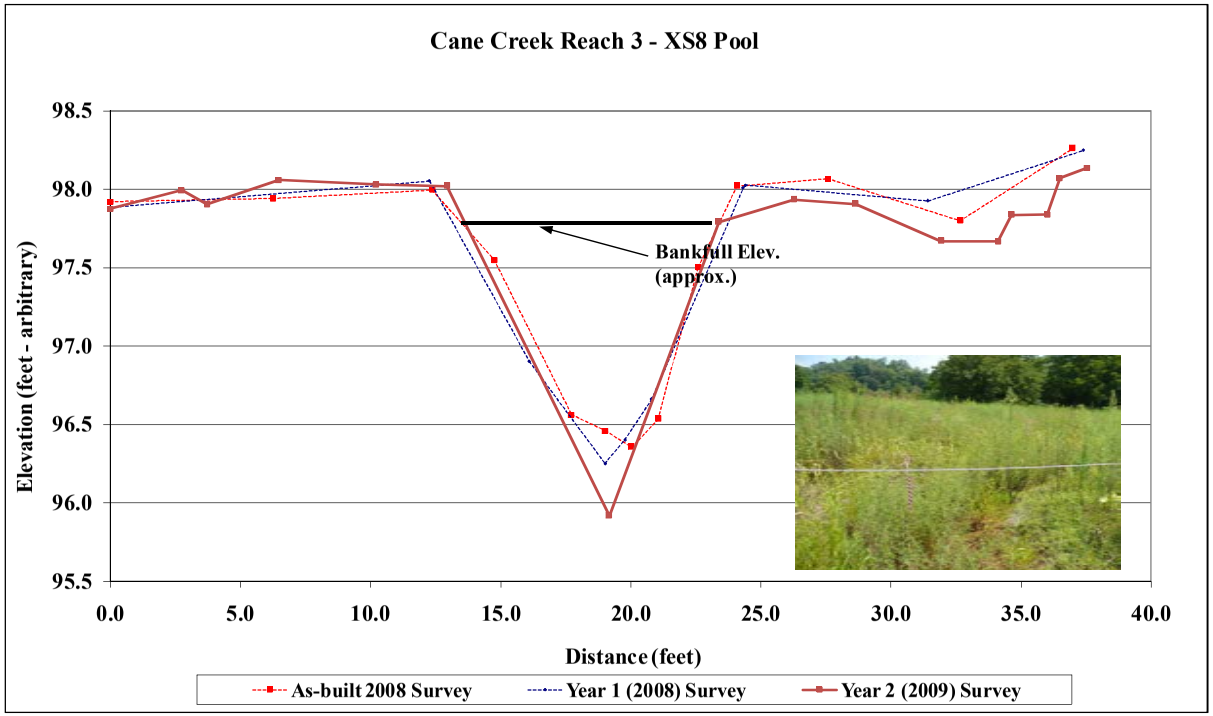
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.9	0.0	97.9	0.0	97.9		
9.0	97.9	12.6	98.0	1.5	98.0		
13.4	97.9	15.0	97.6	2.9	98.1		
14.7	97.8	16.0	97.3	3.6	98.0		
16.0	97.2	16.8	97.1	7.1	97.8		
18.7	97.3	18.3	97.4	10.6	98.0		
19.2	97.6	20.3	98.0	14.8	97.8		
20.3	98.0	27.7	97.8	16.2	97.2		
24.6	97.9	34.1	97.8	17.4	97.0		
28.7	97.9			18.1	97.3		
34.6	97.8			19.3	97.5		
				20.6	98.0		
				24.6	97.8		
				32.9	97.5		
				34.9	97.8		



	As-built	2008	2009	2010
Area	2.7	3.5	3.4	
Width	6.6	7.4	8.8	
Mean Depth	0.4	0.5	0.4	
Max Depth	0.7	0.9	0.9	
W/D Ratio	16.0	16.1	22.9	

Project Name	Cane Creek
Cross Section	R3-XS8
Feature	Pool
Date	8/18/09
Crew	Adasme, Perkinson, Dean

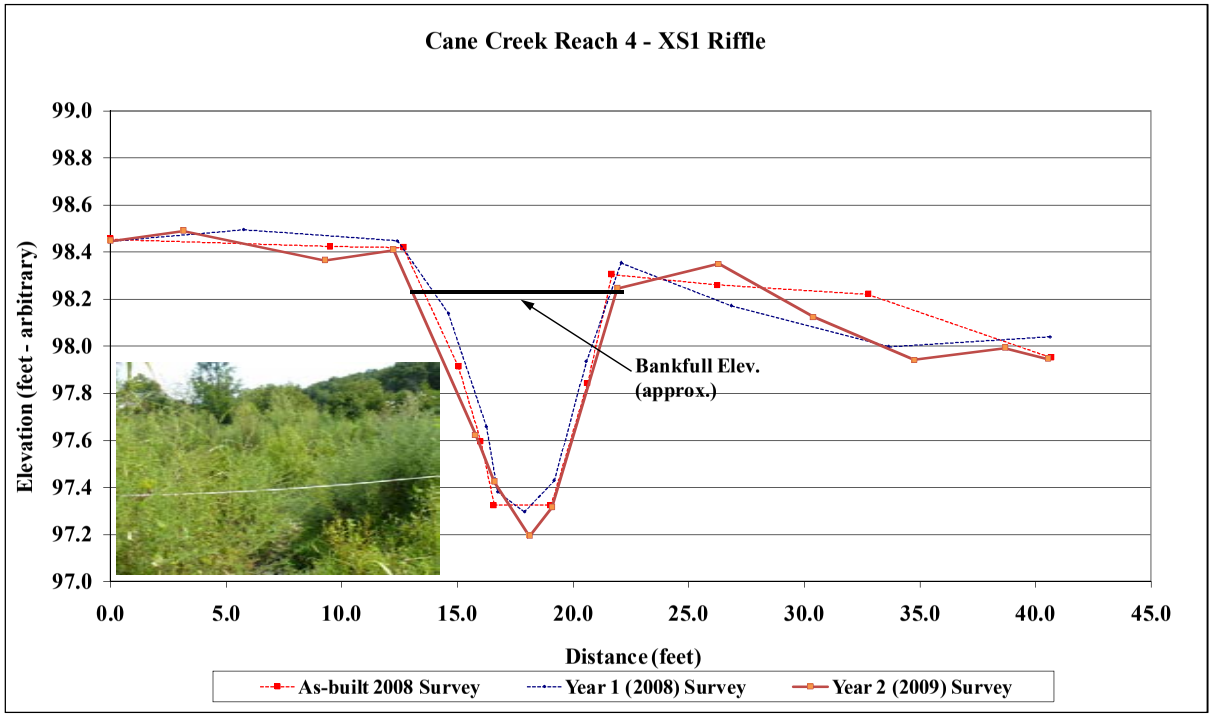
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.9	0.0	97.9	0.0	97.9		
6.3	97.9	12.3	98.1	2.7	98.0		
12.4	98.0	16.1	96.9	3.7	97.9		
14.8	97.5	19.0	96.3	6.5	98.1		
17.7	96.6	19.8	96.4	10.2	98.0		
19.0	96.5	20.8	96.7	12.9	98.0		
20.0	96.4	24.3	98.0	19.2	95.9		
21.1	96.5	24.4	98.0	23.4	97.8		
22.6	97.5	31.4	97.9	26.3	97.9		
24.1	98.0	37.4	98.2	28.6	97.9		
27.6	98.1			31.9	97.7		
32.7	97.8			34.1	97.7		
37.0	98.3			34.6	97.8		
				36.0	97.8		
				36.5	98.1		
				37.5	98.1		



	As-built	2008	2009	2010
Area	10.3	11.2	9.2	
Width	11.6	11.8	9.8	
Mean Depth	0.9	0.9	0.9	
Max Depth	1.6	1.7	1.9	
W/D Ratio	N/A	NA	NA	

Project Name	Cane Creek
Cross Section	R4-XS1
Feature	Riffle
Date	8/6/09
Crew	Adasme, Perkinson, Dean

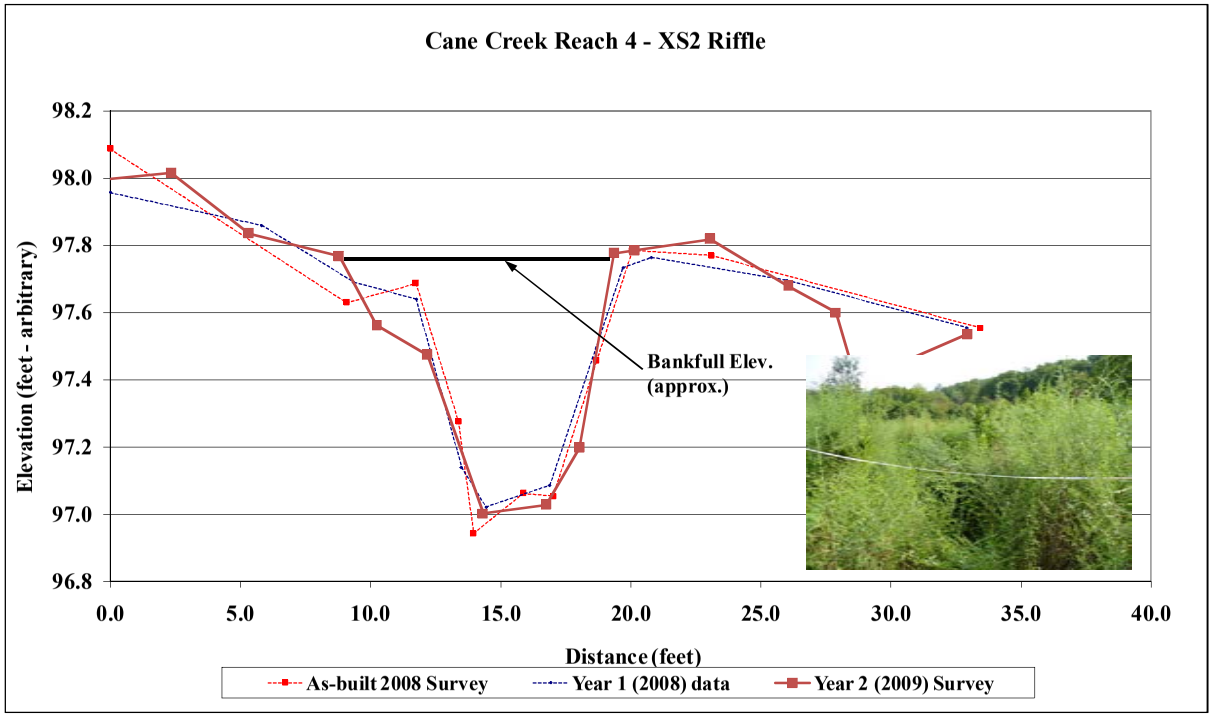
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	98.5	0.0	98.4	0.0	98.4		
9.5	98.4	5.8	98.5	3.2	98.5		
12.7	98.4	12.4	98.4	9.3	98.4		
15.1	97.9	14.6	98.1	12.3	98.4		
16.0	97.6	16.3	97.7	15.8	97.6		
16.6	97.3	16.7	97.4	16.6	97.4		
19.0	97.3	17.9	97.3	18.1	97.2		
20.6	97.8	19.2	97.4	19.1	97.3		
21.7	98.3	20.6	97.9	21.9	98.2		
26.2	98.3	22.1	98.4	26.3	98.3		
32.8	98.2	26.9	98.2	30.4	98.1		
40.7	98.0	33.7	98.0	34.8	97.9		
		40.6	98.0	38.7	98.0		
				40.5	97.9		



	As-built	2008	2009	2010
Area	5.2	5.2	5.2	
Width	8.5	9.1	9.0	
Mean Depth	0.6	0.6	0.6	
Max Depth	1.0	1.1	1.1	
W/D Ratio	13.8	16.1	15.4	

Project Name	Cane Creek
Cross Section	R4-XS2
Feature	Riffle
Date	8/6/09
Crew	Adasme, Perkinson, Dean

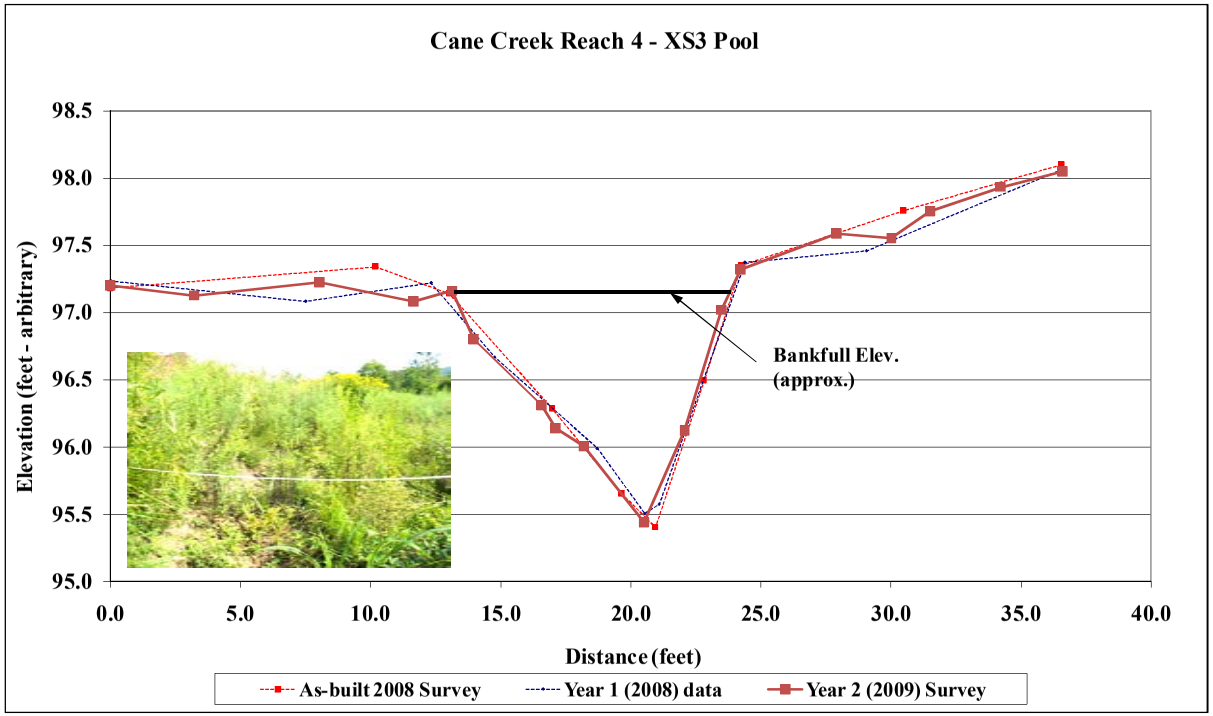
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	98.1	0.0	98.0	-0.6	98.0		
9.1	97.6	5.8	97.9	2.3	98.0		
11.7	97.7	9.4	97.7	5.3	97.8		
13.4	97.3	11.8	97.6	8.8	97.8		
14.0	96.9	13.5	97.1	10.2	97.6		
15.9	97.1	14.4	97.0	12.2	97.5		
17.0	97.1	16.9	97.1	14.3	97.0		
18.7	97.5	19.7	97.7	16.7	97.0		
20.1	97.8	20.8	97.8	18.0	97.2		
23.1	97.8	26.0	97.7	19.4	97.8		
33.4	97.6	32.9	97.6	20.2	97.8		
				23.1	97.8		
				26.0	97.7		
				27.9	97.6		
				28.7	97.4		
				32.9	97.5		



	As-built	2008	2009	2010
Area	3.5	3.1	4.7	
Width	7.9	7.5	10.5	
Mean Depth	0.4	0.4	0.4	
Max Depth	0.7	0.6	0.8	
W/D Ratio	17.7	18.5	23.3	

Project Name	Cane Creek
Cross Section	R4-XS3
Feature	Pool
Date	8/6/09
Crew	Adasme, Perkinson, Dean

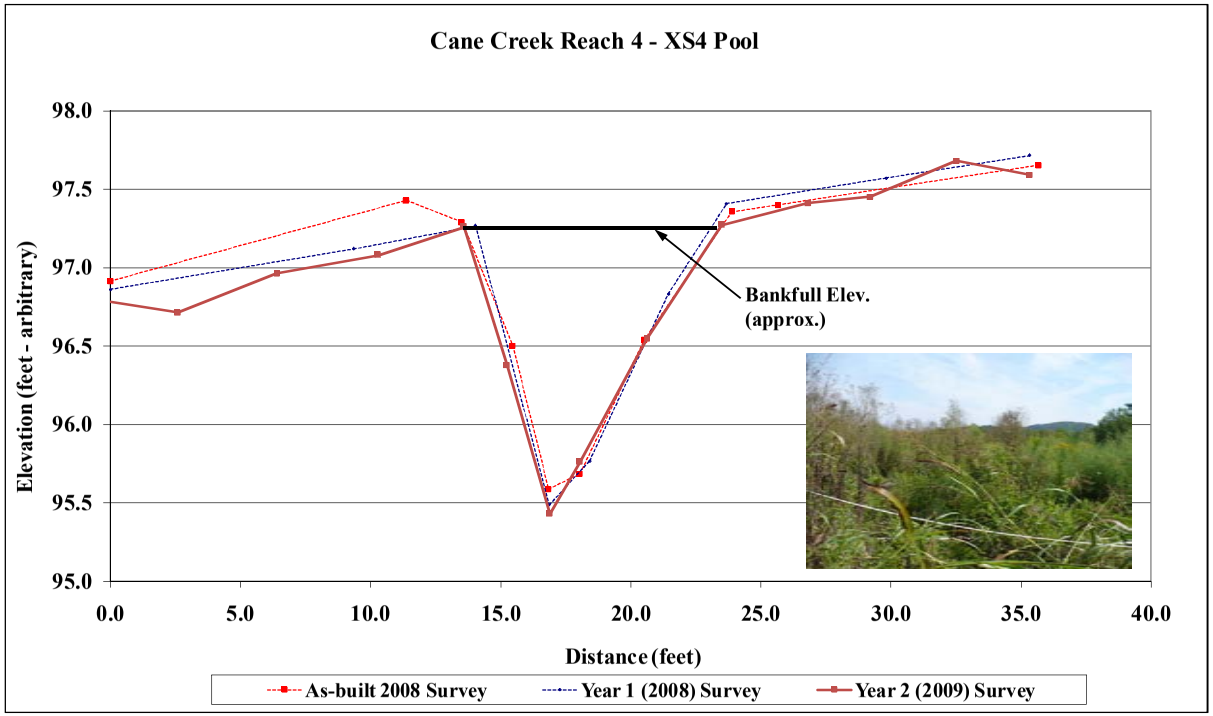
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.2	0.0	97.2	0.0	97.2		
10.2	97.3	7.5	97.1	3.2	97.1		
13.0	97.1	12.3	97.2	8.0	97.2		
17.0	96.3	14.8	96.7	11.7	97.1		
19.7	95.7	18.7	96.0	13.1	97.2		
21.0	95.4	20.5	95.5	14.0	96.8		
22.8	96.5	21.1	95.6	16.6	96.3		
24.2	97.3	24.4	97.4	17.1	96.1		
30.5	97.8	29.1	97.5	18.2	96.0		
36.6	98.1	36.6	98.1	20.5	95.4		
				22.1	96.1		
				23.5	97.0		
				24.2	97.3		
				27.9	97.6		
				30.0	97.6		
				31.5	97.8		
				34.2	97.9		
				36.6	98.1		



	As-built	2008	2009	2010
Area	9.5	10.3	9.7	
Width	10.9	11.8	10.7	
Mean Depth	0.9	0.9	0.9	
Max Depth	1.7	1.7	1.7	
W/D Ratio	N/A	NA	NA	

Project Name	Cane Creek
Cross Section	R4-XS4
Feature	Pool
Date	8/6/09
Crew	Adasme, Perkinson, Dean

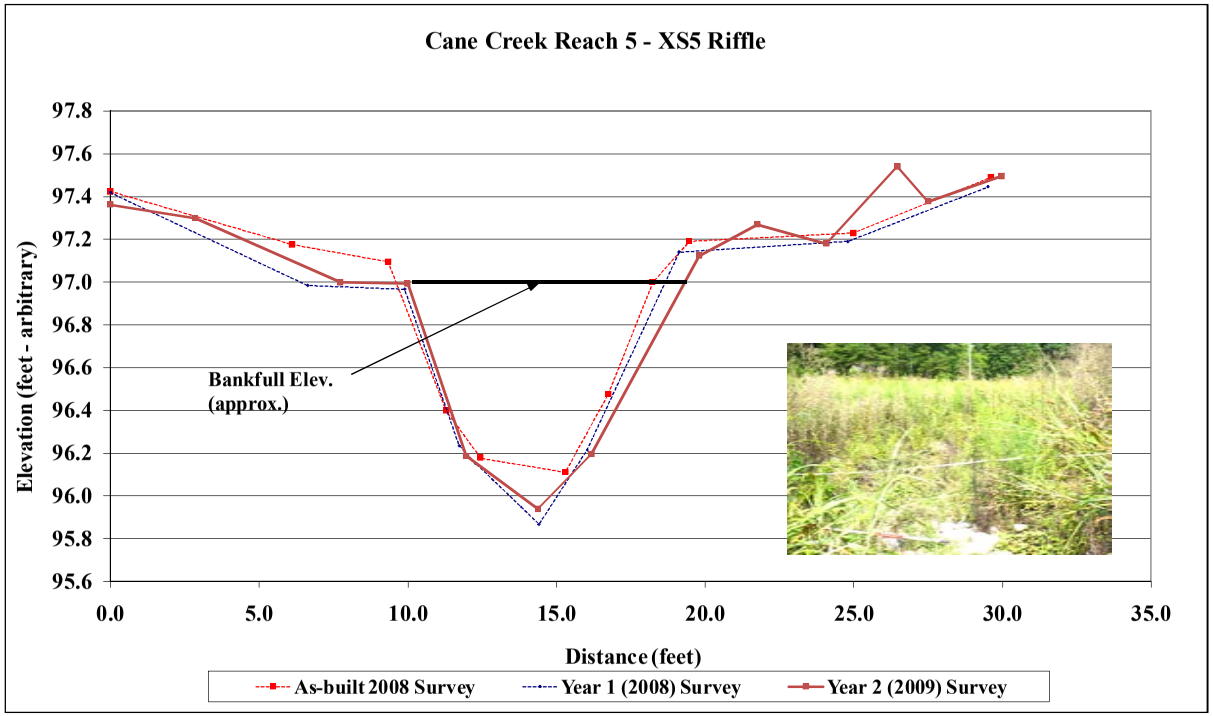
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	96.9	0.0	96.9	-0.5	96.8		
11.4	97.4	9.4	97.1	2.6	96.7		
13.5	97.3	14.0	97.3	6.4	97.0		
15.5	96.5	16.9	95.5	10.3	97.1		
16.8	95.6	18.4	95.8	13.6	97.3		
18.0	95.7	21.4	96.8	15.2	96.4		
20.5	96.5	23.7	97.4	16.9	95.4		
23.9	97.4	29.8	97.6	18.0	95.8		
25.7	97.4	35.3	97.7	20.6	96.5		
35.7	97.7			23.5	97.3		
				26.8	97.4		
				29.2	97.5		
				32.5	97.7		
				35.3	97.6		



	As-built	2008	2009	2010
Area	8.5	8.3	8.7	
Width	10.1	9.1	9.8	
Mean Depth	0.8	0.9	0.9	
Max Depth	1.7	1.8	1.8	
W/D Ratio	NA	NA	NA	

Project Name	Cane Creek
Cross Section	R5-XS5
Feature	Riffle
Date	8/6/09
Crew	Adasme, Perkinson, Dean

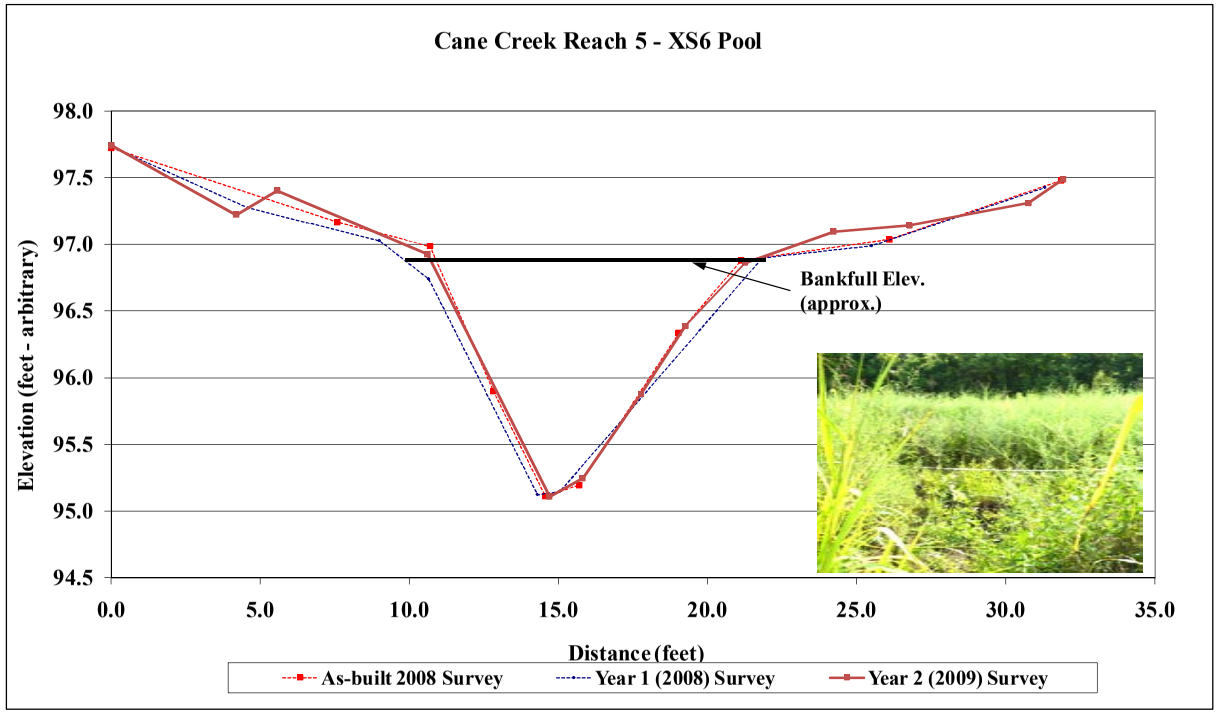
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.4	0.0	97.4	0.0	97.4		
6.1	97.2	6.6	97.0	2.9	97.3		
9.3	97.1	9.9	97.0	7.7	97.0		
11.3	96.4	11.7	96.2	10.0	97.0		
12.5	96.2	12.3	96.2	12.0	96.2		
15.3	96.1	13.8	95.9	14.4	95.9		
16.7	96.5	14.4	95.9	16.2	96.2		
18.2	97.0	16.0	96.2	19.8	97.1		
19.5	97.2	19.1	97.1	21.8	97.3		
25.0	97.2	24.8	97.2	24.1	97.2		
29.6	97.5	29.5	97.4	26.5	97.5		
				27.5	97.4		
				30.0	97.5		



	As-built	2008	2009	2010
Area	6.0	5.5	5.9	
Width	9.4	8.6	9.3	
Mean Depth	0.6	0.6	0.6	
Max Depth	1.0	1.1	1.1	
W/D Ratio	14.9	13.4	14.5	

Project Name	Cane Creek
Cross Section	R5-XS6
Feature	Pool
Date	8/6/09
Crew	Adasme, Perkinson, Dean

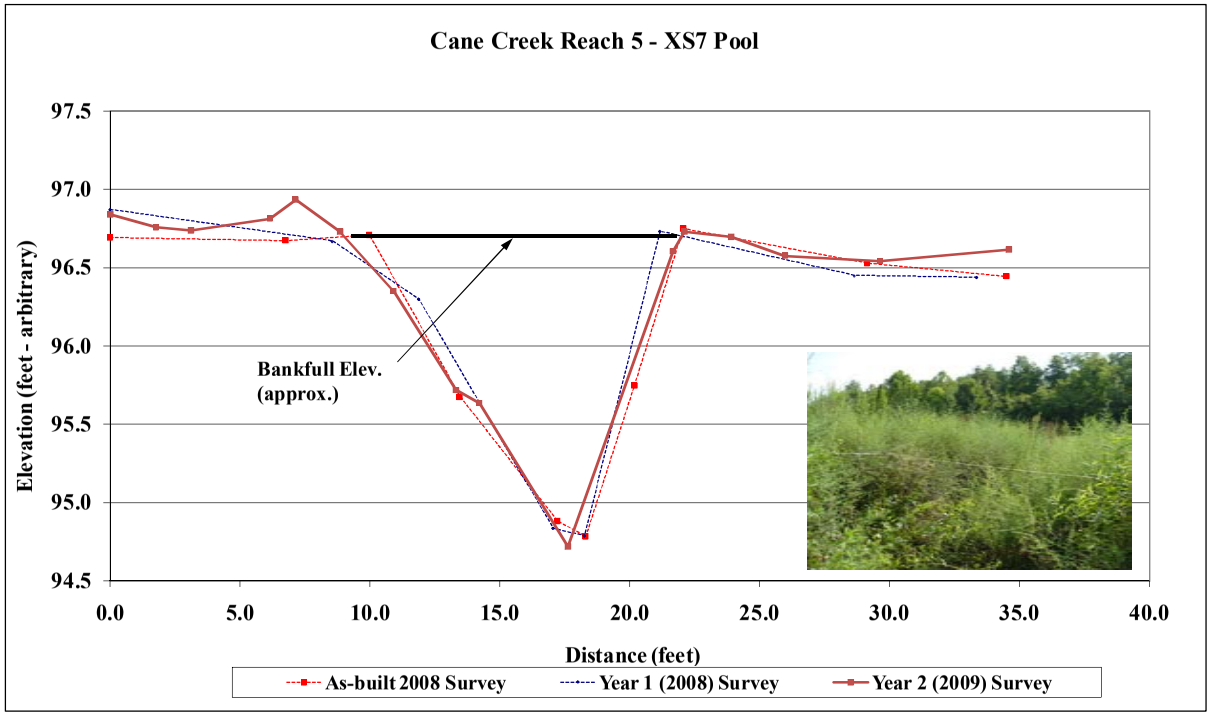
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	97.7	0.0	97.7	0.0	97.7		
7.6	97.2	4.6	97.3	4.2	97.2		
10.7	97.0	9.0	97.0	5.6	97.4		
12.8	95.9	10.6	96.7	10.6	96.9		
14.6	95.1	14.3	95.1	14.7	95.1		
15.7	95.2	15.0	95.1	15.8	95.2		
19.0	96.3	21.8	96.9	17.8	95.9		
21.1	96.9	25.5	97.0	19.2	96.4		
26.1	97.0	31.3	97.4	21.3	96.9		
31.9	97.5			24.2	97.1		
				26.8	97.1		
				30.8	97.3		
				31.9	97.5		



	As-built	2008	2009	2010
Area	8.5	10.9	10.2	
Width	9.6	12.1	11.6	
Mean Depth	0.9	0.9	0.9	
Max Depth	1.7	1.8	1.8	
W/D Ratio	NA	NA	NA	

Project Name	Cane Creek
Cross Section	R5-XS7
Feature	Pool
Date	8/6/09
Crew	Adasme, Perkinson, Dean

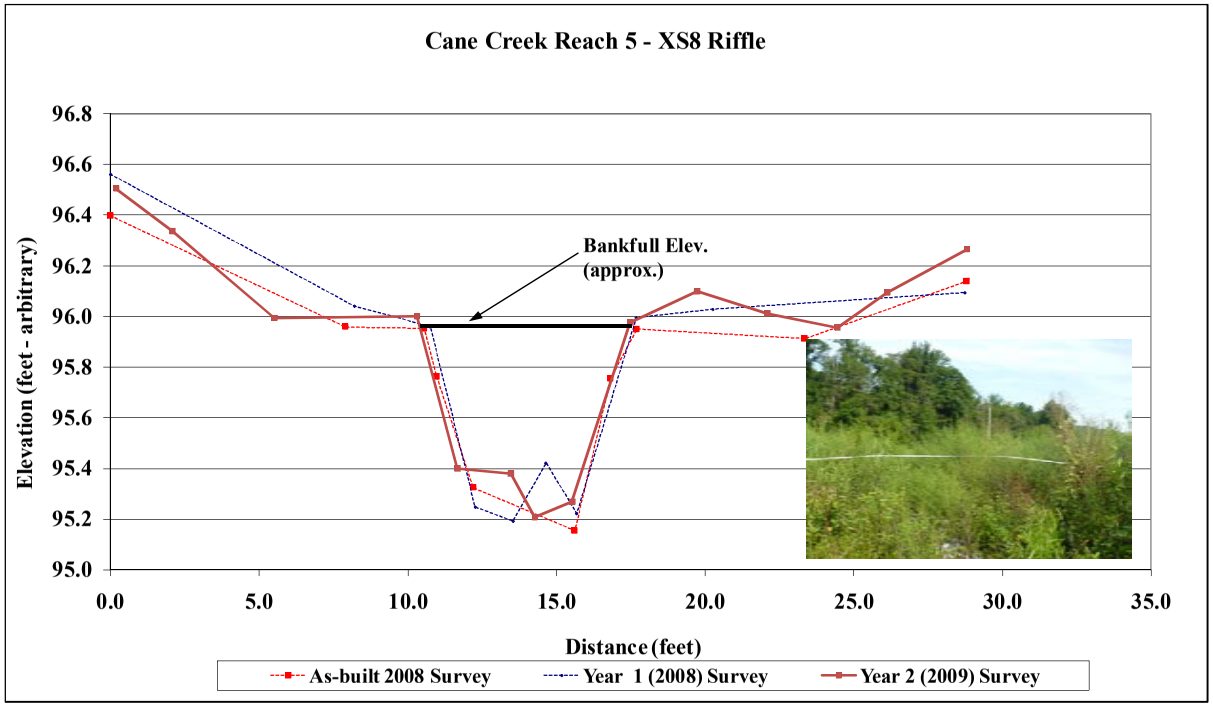
As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	96.7	0.0	96.9	0.0	96.8		
6.8	96.7	8.5	96.7	1.8	96.8		
10.0	96.7	11.9	96.3	3.1	96.7		
13.5	95.7	17.0	94.8	6.1	96.8		
17.2	94.9	18.3	94.8	7.1	96.9		
18.3	94.8	21.2	96.7	8.9	96.7		
20.2	95.7	28.6	96.4	10.9	96.3		
22.1	96.7	33.4	96.4	13.3	95.7		
29.1	96.5			14.2	95.6		
34.5	96.4			17.6	94.7		
				21.6	96.6		
				22.1	96.7		
				23.9	96.7		
				26.0	96.6		
				29.6	96.5		
				34.6	96.6		



	As-built	2008	2009	2010
Area	12.3	11.2	12.5	
Width	11.8	12.5	13.2	
Mean Depth	1.0	0.9	1.0	
Max Depth	1.9	1.9	2.0	
W/D Ratio	N/A	NA	NA	

Project Name	Cane Creek
Cross Section	R5-XS8
Feature	Riffle
Date	8/6/09
Crew	Adasme, Perkinson, Dean

As-built 2008 Survey		2008 2008 Survey		2009 2009 Survey		2010 2010 Survey	
Station	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**	**Station**	**Elevation**
0.0	96.4	0.0	96.6	0.2	96.5		
7.9	96.0	8.2	96.0	2.1	96.3		
10.6	96.0	10.7	96.0	5.5	96.0		
11.0	95.8	12.3	95.2	10.3	96.0		
12.2	95.3	13.5	95.2	11.7	95.4		
15.6	95.2	14.6	95.4	13.5	95.4		
16.8	95.8	15.7	95.2	14.3	95.2		
17.7	96.0	17.7	96.0	15.5	95.3		
23.4	95.9	20.3	96.0	17.5	96.0		
28.8	96.1	28.7	96.1	19.7	96.1		
				22.1	96.0		
				24.5	96.0		
				26.1	96.1		
				28.8	96.3		

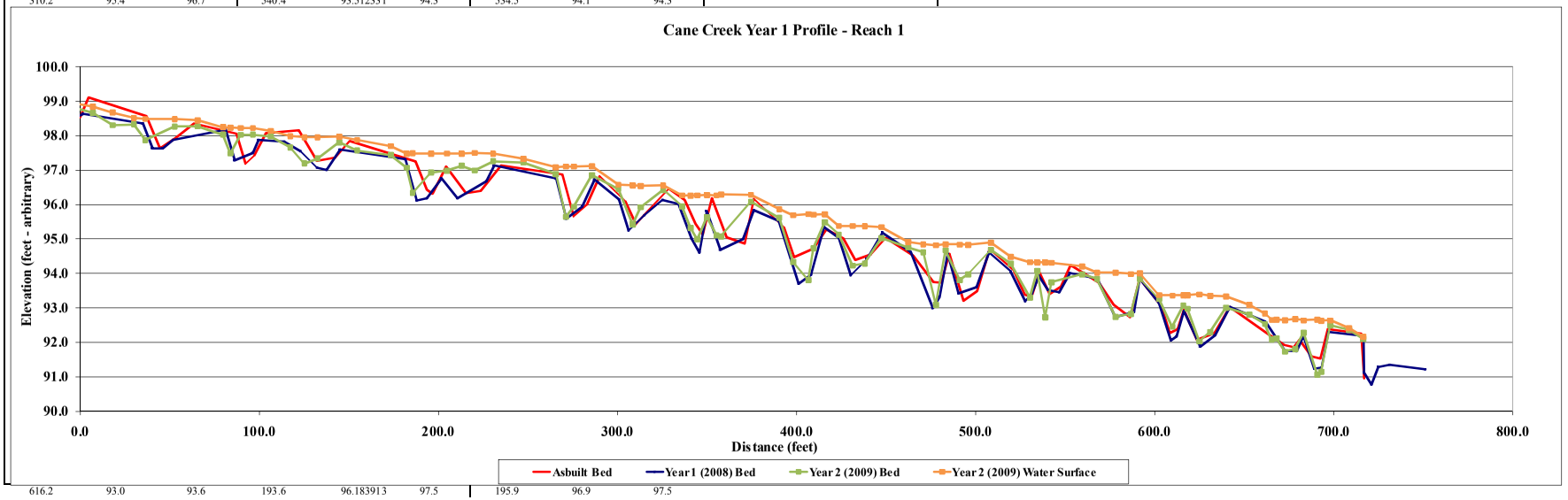


	As-built	2008	2009	2010
Area	3.6	3.6	3.8	
Width	7.1	6.8	7.6	
Mean Depth	0.5	0.5	0.5	
Max Depth	0.8	0.8	0.8	
W/D Ratio	13.9	13.1	15.2	

Project Name	Cane Creek AsBuilt
Reach	1
Feature	Profile
Date	8/18/09
Crew	Adasme, Perkinson, Dean

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	98.5	99.2	751.1	91.219091		716.4	92.1	92.2			
4.9	99.1	99.2	731.3	91.353937		708.5	92.4	92.4			
36.9	98.6	98.8	725.0	91.283216		698.1	92.5	92.6			
44.7	97.6	98.7	720.9	90.775187		692.9	91.2	92.6			
53.1	97.9	98.7	717.0	91.128378		690.6	91.1	92.7			
63.7	98.3	98.7	716.6	92.191518	92.3	683.1	92.3	92.6			
87.2	98.1	98.4	697.0	92.297308	92.7	678.5	91.8	92.7			
92.3	97.2	98.4	693.3	91.263752	92.7	672.7	91.7	92.6			
97.2	97.4	98.4	689.2	91.236319	92.7	668.0	92.1	92.7			
103.9	98.1	98.4	683.0	92.185082	92.7	665.3	92.1	92.7			
122.1	98.2	98.2	679.4	91.752028	92.7	661.4	92.5	92.8			
132.4	97.3	98.2	672.5	91.766258	92.7	652.8	92.8	93.1			
142.7	97.4	98.2	661.7	92.602691	92.7	639.8	93.0	93.3			
150.6	97.8	98.1	642.0	93.020865	93.4	630.9	92.3	93.4			
187.3	97.2	97.7	633.6	92.205385	93.4	624.9	92.0	93.4			
193.7	96.4	97.6	625.3	91.879143	93.4	618.4	93.0	93.4			
196.9	96.3	97.6	616.2	92.914578	93.4	615.9	93.1	93.4			
204.3	97.1	97.7	612.1	92.17362	93.4	609.9	92.5	93.4			
215.4	96.3	97.6	609.1	92.06128	93.4	602.5	93.3	93.4			
223.8	96.4	97.6	602.5	93.148882	93.5	591.6	93.9	94.0			
235.1	97.1	97.6	591.6	93.854825	94.1	586.6	92.8	94.0			
269.3	96.9	97.2	588.4	92.879869	94.1	578.1	92.7	94.0			
275.4	95.7	97.2	578.0	92.736512	94.1	567.8	93.9	94.0			
282.8	96.0	97.2	568.0	93.851672	94.1	559.5	94.0	94.2			
290.0	96.8	97.2	552.5	94.008568	94.4	542.3	93.7	94.3			
304.4	96.1	96.7	546.7	93.447631	94.3	538.9	92.7	94.3			
310.2	95.4	96.7	540.4	93.512331	94.3	534.5	94.1	94.3			
616.2	93.0	93.6	193.6	96.183913	97.5	195.9	96.9	97.5			

	AsBuilt	2008	2009	2010
Avg. Water Surface Slope	0.0092	0.0092	0.0092	
Riffle Length		19.7	19.6	
Avg. Riffle Slope		0.0263	0.0220	
Pool Length		33.9	23.9	
Avg. Pool Slope		0.0017	0.0018	

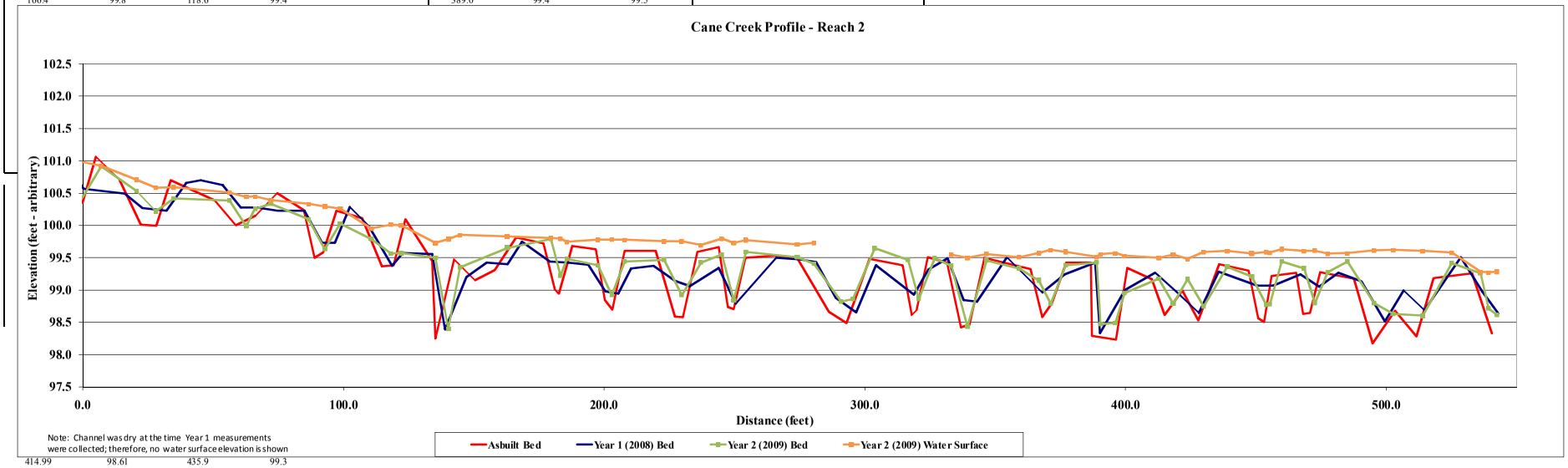


Project Name	Cane Creek AsBuilt
Reach	2
Feature	Profile
Date	8/18/09
Crew	Adasme, Perkinson, Dean

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	-65.3	102.2		542.6	98.6	99.3			
5.1	101.1	-62.7	100.8		539.3	98.7	99.3			
14.2	100.7	-51.8	100.2		536.1	99.3	99.3			
22.3	100.0	-41.6	101.4		525.1	99.4	99.6			
28.3	100.0	-34.2	100.7		514.0	98.6	99.6			
33.9	100.7	-26.3	100.1		502.9	98.6	99.6			
50.9	100.4	-18.4	101.1		495.4	98.8	99.6			
58.9	100.0	-7.4	101.0		485.2	99.4	99.6			
66.5	100.1	0.3	100.6		477.5	99.3	99.6			
74.6	100.5	16.0	100.5		472.7	98.8	99.6			
85.0	100.2	22.9	100.3		468.5	99.3	99.6			
89.0	99.5	32.2	100.2		459.9	99.4	99.6			
92.4	99.6	39.7	100.7		455.5	98.8	99.6			
97.4	100.2	45.3	100.7		454.0	98.8	99.6			
107.3	100.1	53.8	100.6		448.5	99.2	99.6			
114.9	99.4	60.6	100.3		439.1	99.4	99.6			
119.5	99.4	66.9	100.3		430.1	98.7	99.6			
123.9	100.1	74.8	100.2		423.8	99.2	99.5			
134.1	99.5	85.1	100.2		418.4	98.8	99.5			
135.3	98.2	91.8	99.7		412.9	99.2	99.5			
142.6	99.5	96.7	99.7		399.6	99.0	99.5			
150.6	99.1	102.5	100.3		396.1	98.5	99.6			
158.2	99.3	109.6	100.0		390.4	98.5	99.6			
166.4	99.8	118.6	99.4		389.0	99.4	99.5			
414.99	98.61	435.9	99.3							
421.94	98.99	450.7	99.1							

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0036	0.0058	0.0028	
Riffle Length		15	13	
Avg. Riffle Slope		*NA	0.0036	
Pool Length		18	11	
Avg. Pool Slope		*NA	0.0002	

* No water in channel due to drought conditions



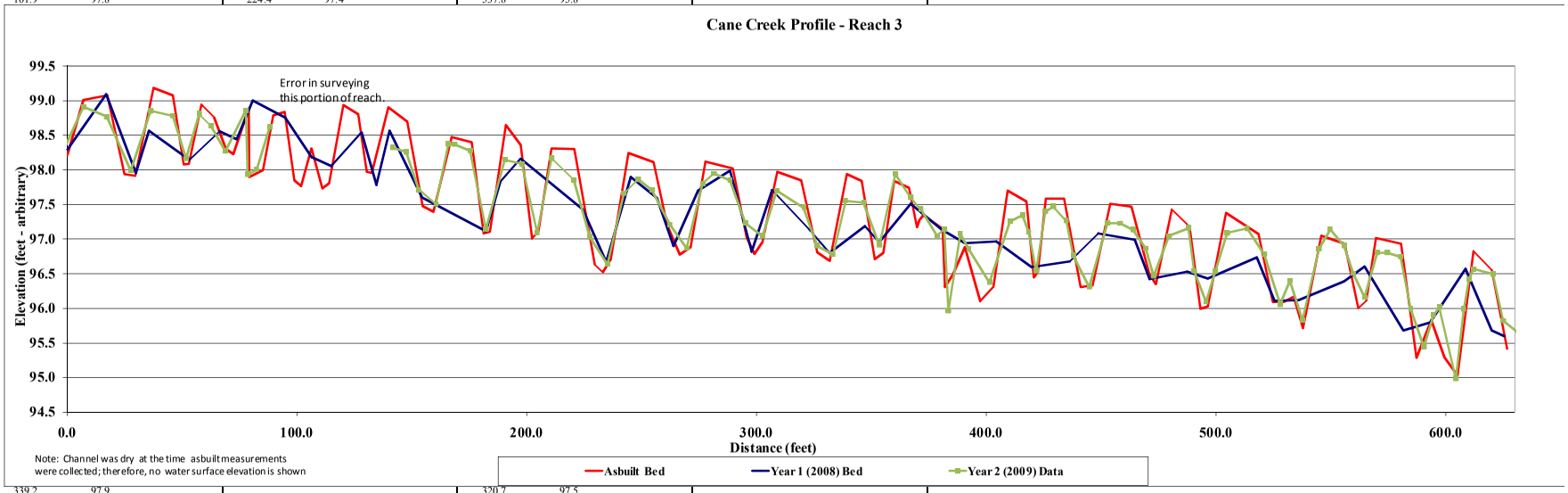
Note: Channel was dry at the time Year 1 measurements were collected; therefore, no water surface elevation is shown

Project Name	Cane Creek AsBuilt
Reach	3
Feature	Profile
Date	8/18/09
Crew	Adasme, Perkinson, Dean

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		0.0	98.3		631.1	95.7				
6.9	99.0		16.8	99.1		625.2	95.8				
17.5	99.1		29.9	98.0		620.7	96.5				
24.7	97.9		35.6	98.6		612.2	96.6				
29.5	97.9		53.1	98.1		610.2	96.4				
37.4	99.2		66.2	98.6		607.9	96.0				
45.9	99.1		73.7	98.4		604.6	95.0				
50.5	98.1		80.7	99.0		597.4	96.0				
52.9	98.1		94.9	98.8		594.7	95.9				
58.4	98.9		106.2	98.2		590.7	95.4				
63.9	98.8		115.0	98.1		584.9	96.0				
69.0	98.3		128.1	98.5		580.5	96.7				
72.2	98.2		134.6	97.8		574.8	96.8				
78.9	98.9		140.2	98.6		570.2	96.8				
79.3	97.9		154.3	97.6		564.9	96.2				
85.1	98.0		182.2	97.1		559.9	96.5				
89.6	98.8		188.5	97.8		555.9	96.9				
94.6	98.8		197.4	98.2		549.8	97.1				
98.7	97.8		208.0	97.9		545.0	96.9				
101.9	97.8		224.4	97.4		537.8	95.8				
339.2	97.9					320.7	97.5				
345.6	97.8					308.8	97.7				

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0036	0.0043	0.0041	
Riffle Length		15	10	
Avg. Riffle Slope		*NA	*NA	
Pool Length		21	18	
Avg. Pool Slope		*NA	*NA	

* No water in channel due to drought conditions

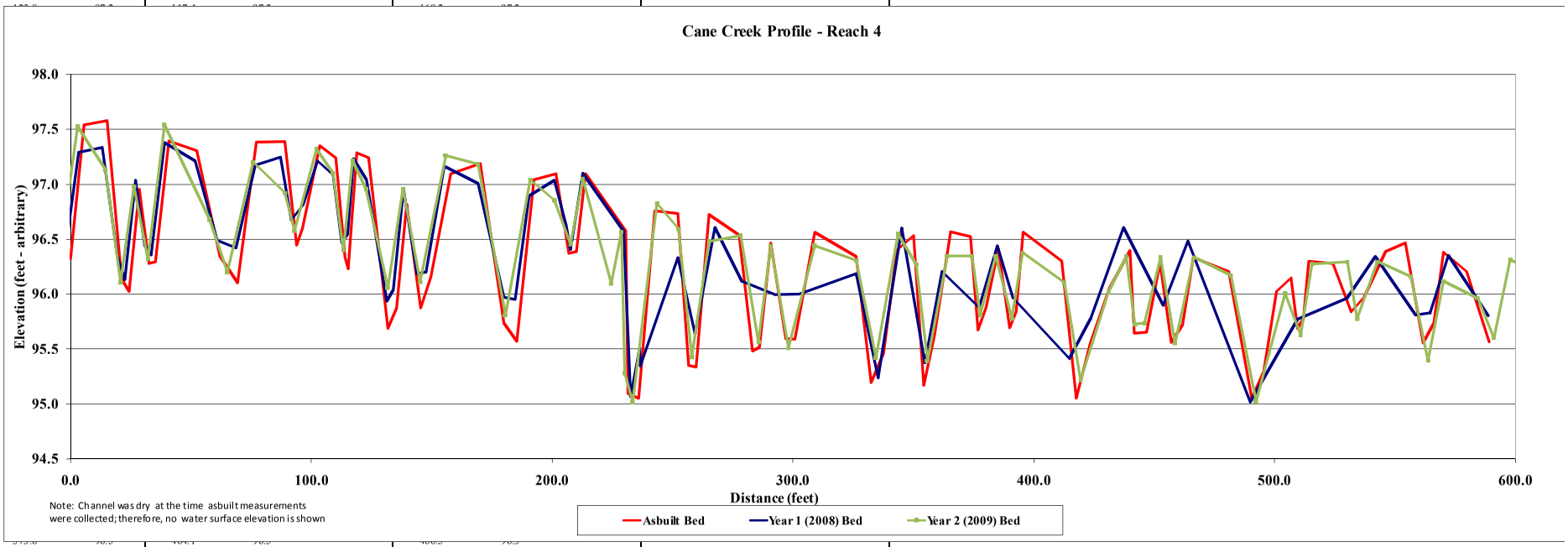


Project Name	Cane Creek AsBuilt
Reach	4
Feature	Profile
Date	8/18/09
Crew	Adasme, Perkinson, Dean

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	-5.2	96.5		-4.4	96.4				
5.6	97.5	-1.6	96.5		3.0	97.5				
15.2	97.6	3.3	97.3		14.6	97.1				
21.2	96.1	13.0	97.3		20.9	96.1				
24.3	96.0	19.3	96.3		26.4	97.0				
28.6	97.0	22.5	96.1		32.1	96.3				
32.6	96.3	26.8	97.0		39.0	97.5				
35.3	96.3	30.7	96.4		57.7	96.7				
40.9	97.4	33.5	96.4		65.1	96.2				
52.4	97.3	38.9	97.4		75.8	97.2				
61.9	96.3	51.6	97.2		89.1	96.9				
69.3	96.1	60.7	96.5		92.9	96.6				
77.3	97.4	68.6	96.4		102.1	97.3				
88.9	97.4	76.6	97.2		109.0	97.1				
93.9	96.4	87.1	97.2		113.3	96.4				
96.4	96.6	91.7	96.7		117.2	97.2				
103.4	97.3	96.4	96.8		122.7	97.0				
110.1	97.2	102.5	97.2		131.8	96.1				
114.0	96.3	108.9	97.1		138.1	97.0				
115.4	96.2	112.6	96.5		145.3	96.1				
118.9	97.3	115.0	96.5		155.8	97.3				
376.8	95.7	489.9	95.0		481.8	96.2				
380.2	95.9	509.7	95.8		492.3	95.0				

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0020	0.0011	0.0020	
Riffle Length		11	13	
Avg. Riffle Slope		*NA	*NA	
Pool Length		21	17	
Avg. Pool Slope		*NA	*NA	

* No water in channel due to drought conditions

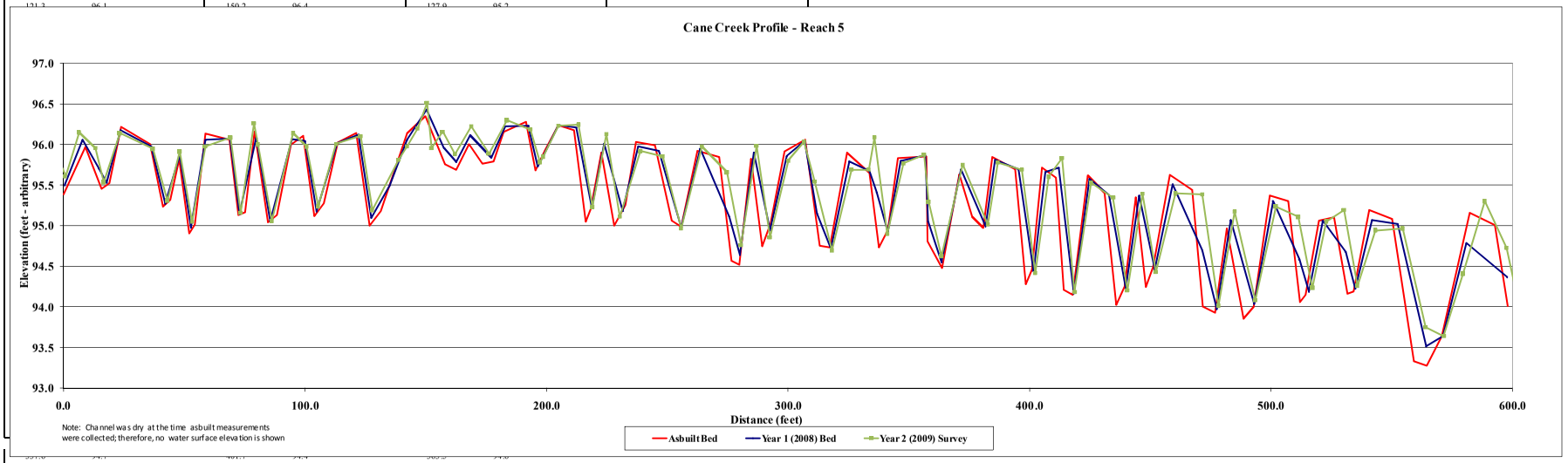


Project Name	Cane Creek
Reach	5
Feature	Profile
Date	8/18/09
Crew	Adasme, Perkinson, Dean

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	95.4		0.4	95.5		-16.3	96.3				
8.9	96.0		7.7	96.1		-10.0	96.7				
15.7	95.5		14.5	95.7		-8.1	96.2				
19.0	95.5		17.8	95.5		0.7	95.6				
23.7	96.2		23.5	96.2		6.5	96.1				
35.8	96.0		36.3	96.0		13.2	96.0				
41.1	95.2		42.0	95.3		16.5	95.5				
44.1	95.3		47.9	95.9		23.3	96.1				
47.9	95.8		52.6	95.0		36.8	95.9				
52.0	94.9		58.7	96.1		42.8	95.3				
54.4	95.0		68.8	96.1		48.0	95.9				
58.8	96.1		72.9	95.1		53.1	95.1				
68.7	96.1		76.9	95.7		58.6	96.0				
72.5	95.1		79.8	96.1		69.0	96.1				
75.1	95.2		85.5	95.1		73.2	95.2				
79.2	96.2		94.6	96.1		78.8	96.3				
84.7	95.0		99.9	96.0		80.4	96.0				
88.3	95.1		104.7	95.2		86.2	95.1				
94.1	96.0		113.3	96.0		95.1	96.1				
99.1	96.1		122.1	96.1		100.6	96.0				
103.9	95.1		127.3	95.1		105.4	95.2				
107.7	95.3		134.9	95.5		112.8	96.0				
113.7	96.0		142.2	96.1		122.9	96.1				
341.3	95.0		406.6	95.7		372.3	95.8				
345.4	95.8		412.2	95.7		382.8	95.0				

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0014	0.0030	0.0031	
Riffle Length		18	9	
Avg. Riffle Slope		*NA	*NA	
Pool Length		24	16	
Avg. Pool Slope		*NA	*NA	

* No water in channel due to drought conditions



Cane Creek Stream and Wetland Restoration Site
Year 2 (2009) Annual Monitoring
Representative Structure Photos
Taken August 2009

Reach 1

Reach 2

Reach 3

Reach 4

Reach 5

Cane Creek Stream and Wetland Restoration Site
Year 2 (2009) Annual Monitoring
Enhancement Reach Photos
Taken August 2009

Photo 1
Brush Mattress

Photos 2-3
Stabilization and staking of left and right banks, respectively, adjacent to ford

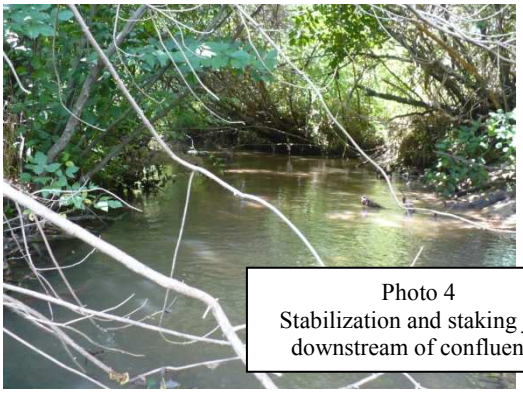
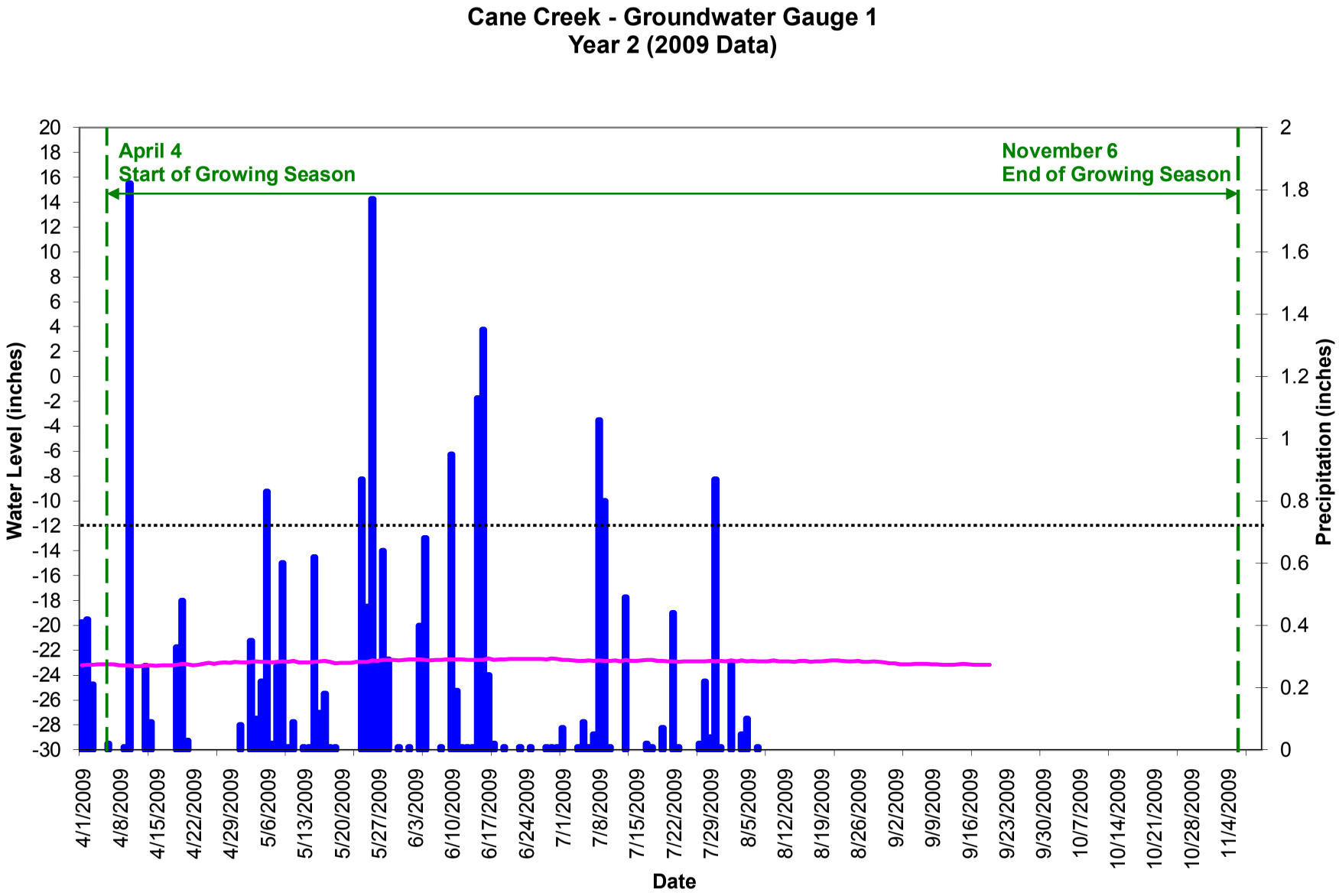


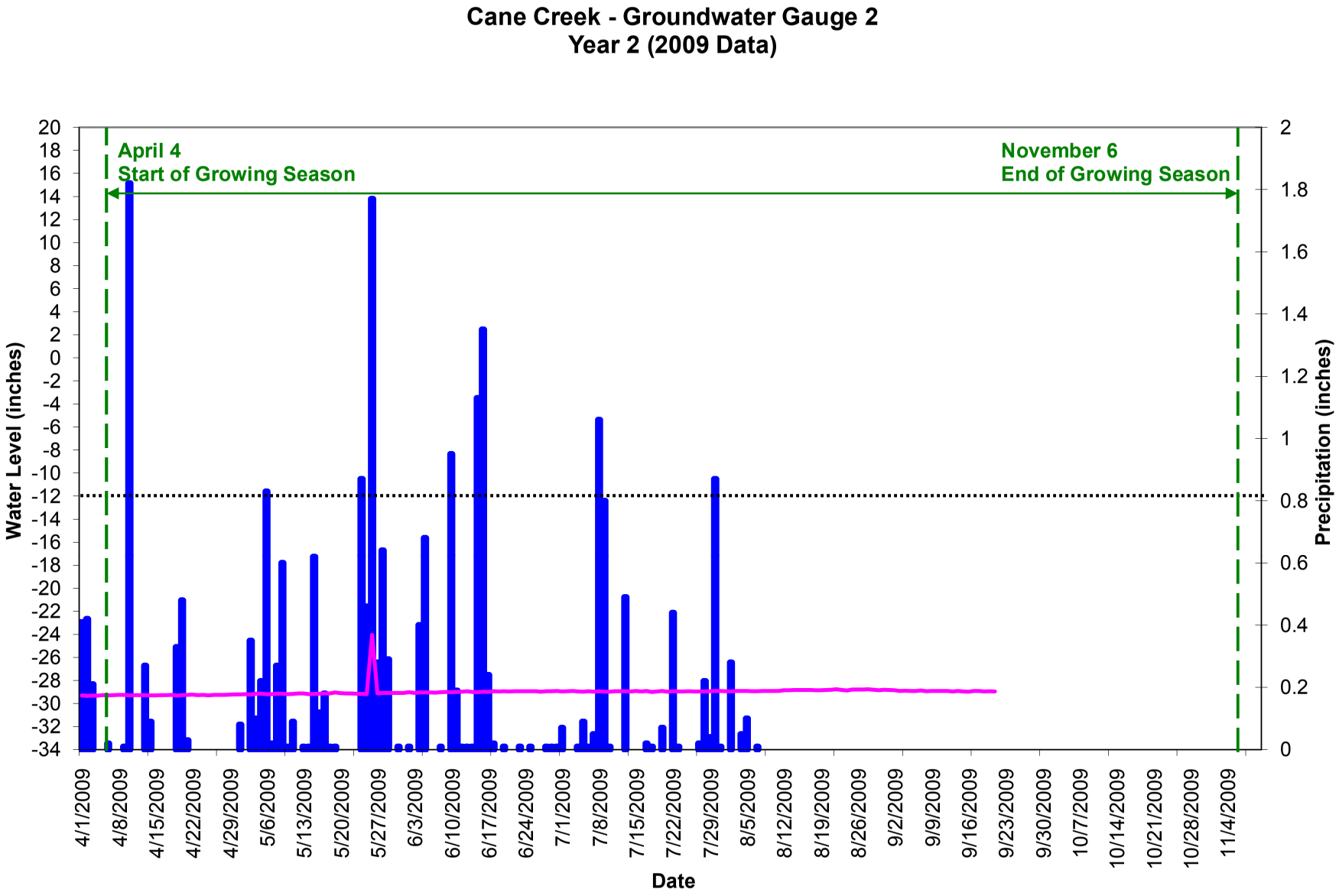
Photo 4
Stabilization and staking just downstream of confluence

Photo 5
Removal of fallen tree from Cane Creek

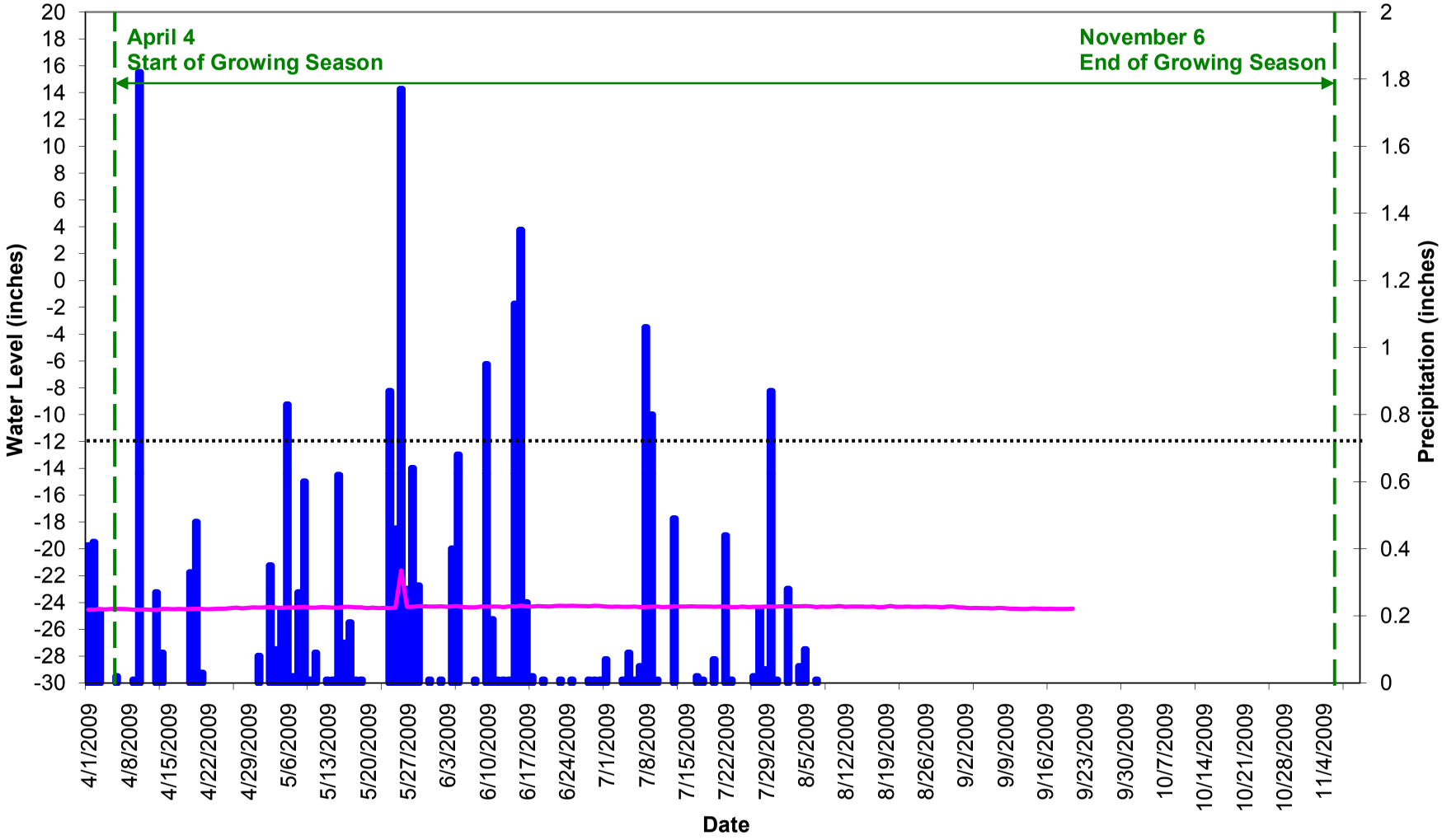
Photos 6-7
Stabilization and staking near downstream end of left and right banks, respectively

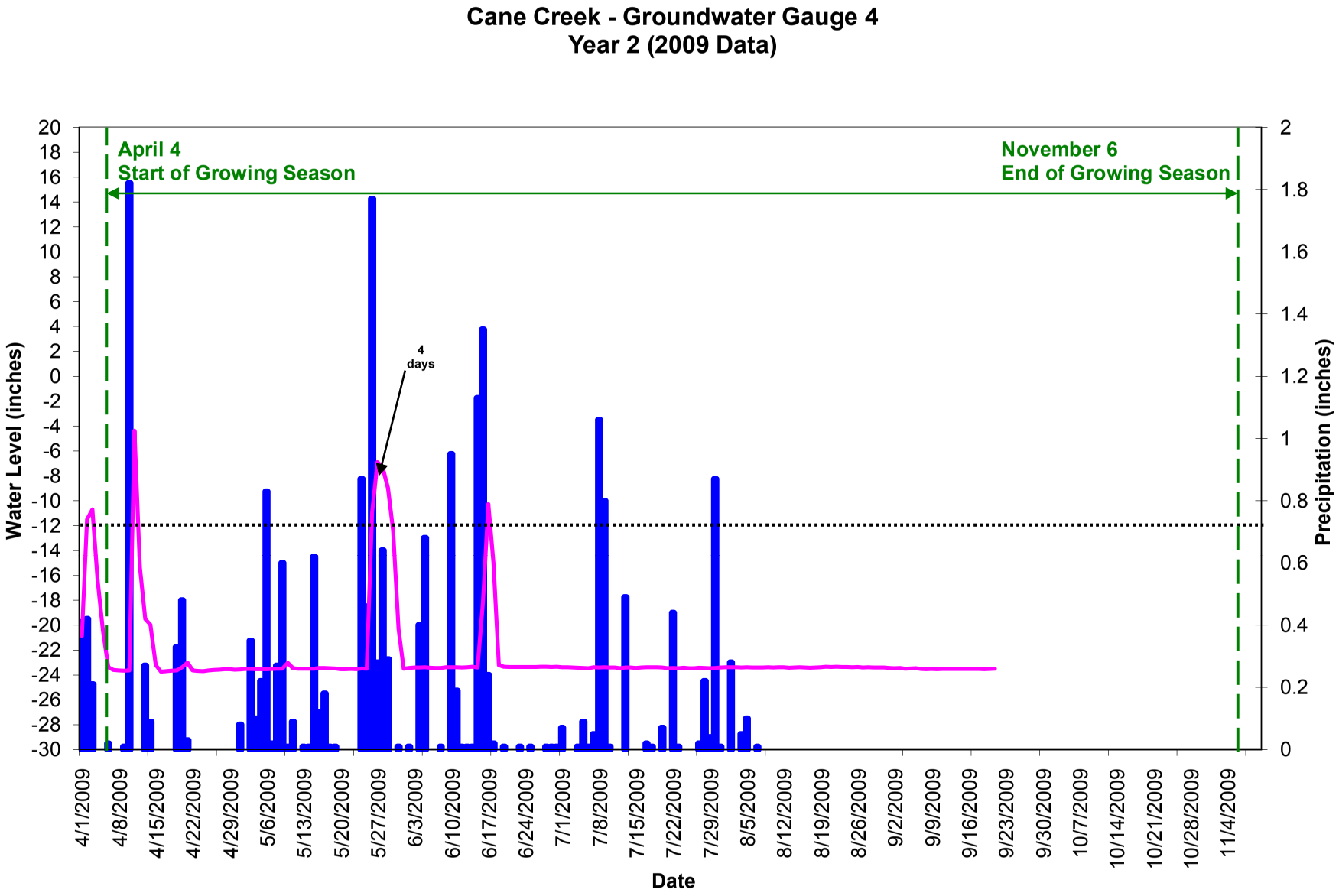
APPENDIX C
HYDROLOGY DATA
2009 Groundwater Gauge Graphs


Cane Creek - Groundwater Gauge 1
Year 2 (2009 Data)
April 4
Start of Growing Season
November 6
End of Growing Season
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
4/1/2009
4/8/2009
4/15/2009
4/22/2009
4/29/2009
5/6/2009
5/13/2009
5/20/2009
5/27/2009
6/3/2009
6/10/2009
6/17/2009
6/24/2009
7/1/2009
7/8/2009
7/15/2009
7/22/2009
7/29/2009
8/5/2009
8/12/2009
8/19/2009
8/26/2009
9/2/2009
9/9/2009
9/16/2009
9/23/2009
9/30/2009
10/7/2009
10/14/2009
10/21/2009
10/28/2009
11/4/2009

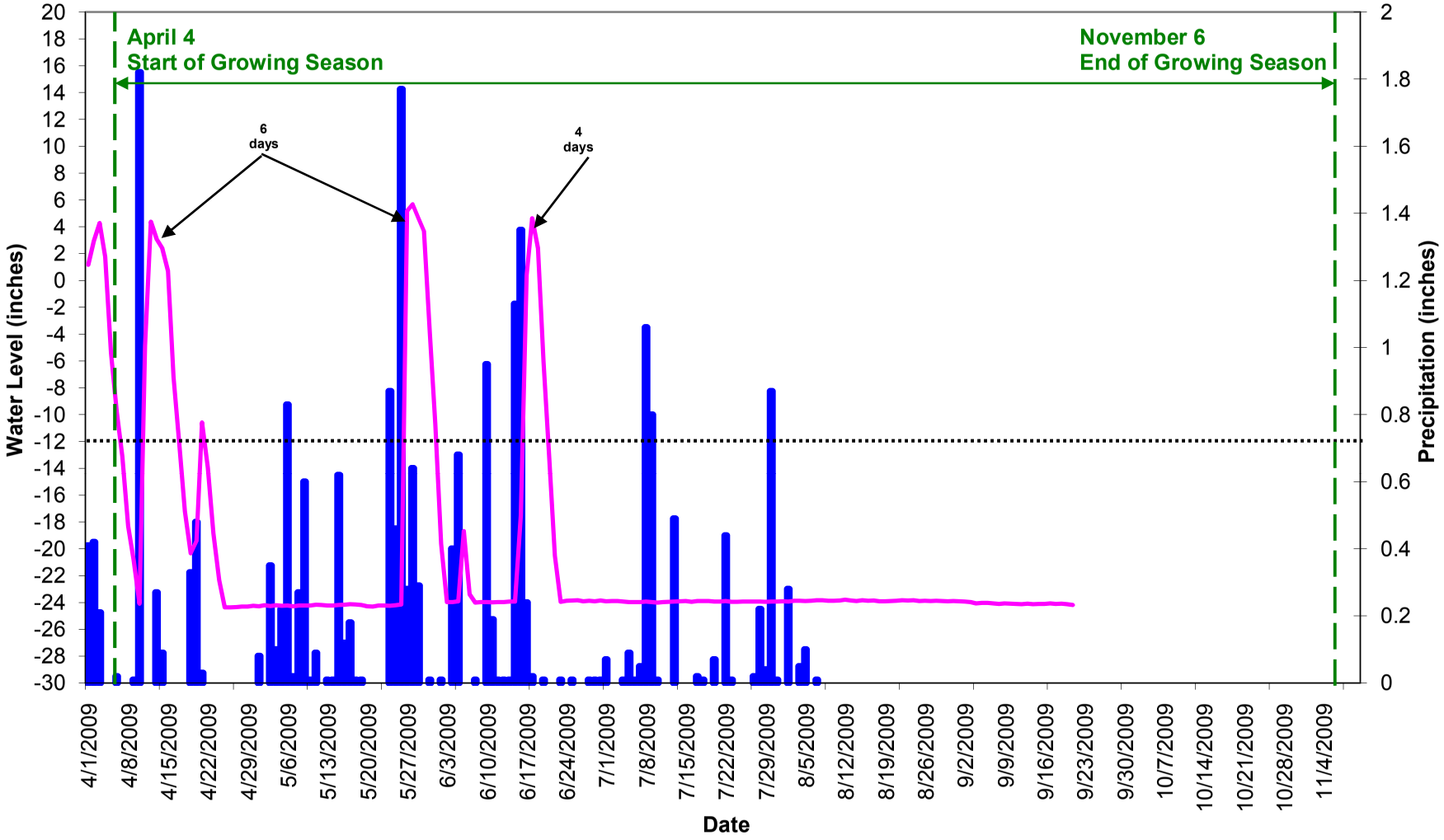

Cane Creek - Groundwater Gauge 2
Year 2 (2009 Data)
April 4
Start of Growing Season
November 6
End of Growing Season
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
4/1/2009
4/8/2009
4/15/2009
4/22/2009
4/29/2009
5/6/2009
5/13/2009
5/20/2009
5/27/2009
6/3/2009
6/10/2009
6/17/2009
6/24/2009
7/1/2009
7/8/2009
7/15/2009
7/22/2009
7/29/2009
8/5/2009
8/12/2009
8/19/2009
8/26/2009
9/2/2009
9/9/2009
9/16/2009
9/23/2009
9/30/2009
10/7/2009
10/14/2009
10/21/2009
10/28/2009
11/4/2009

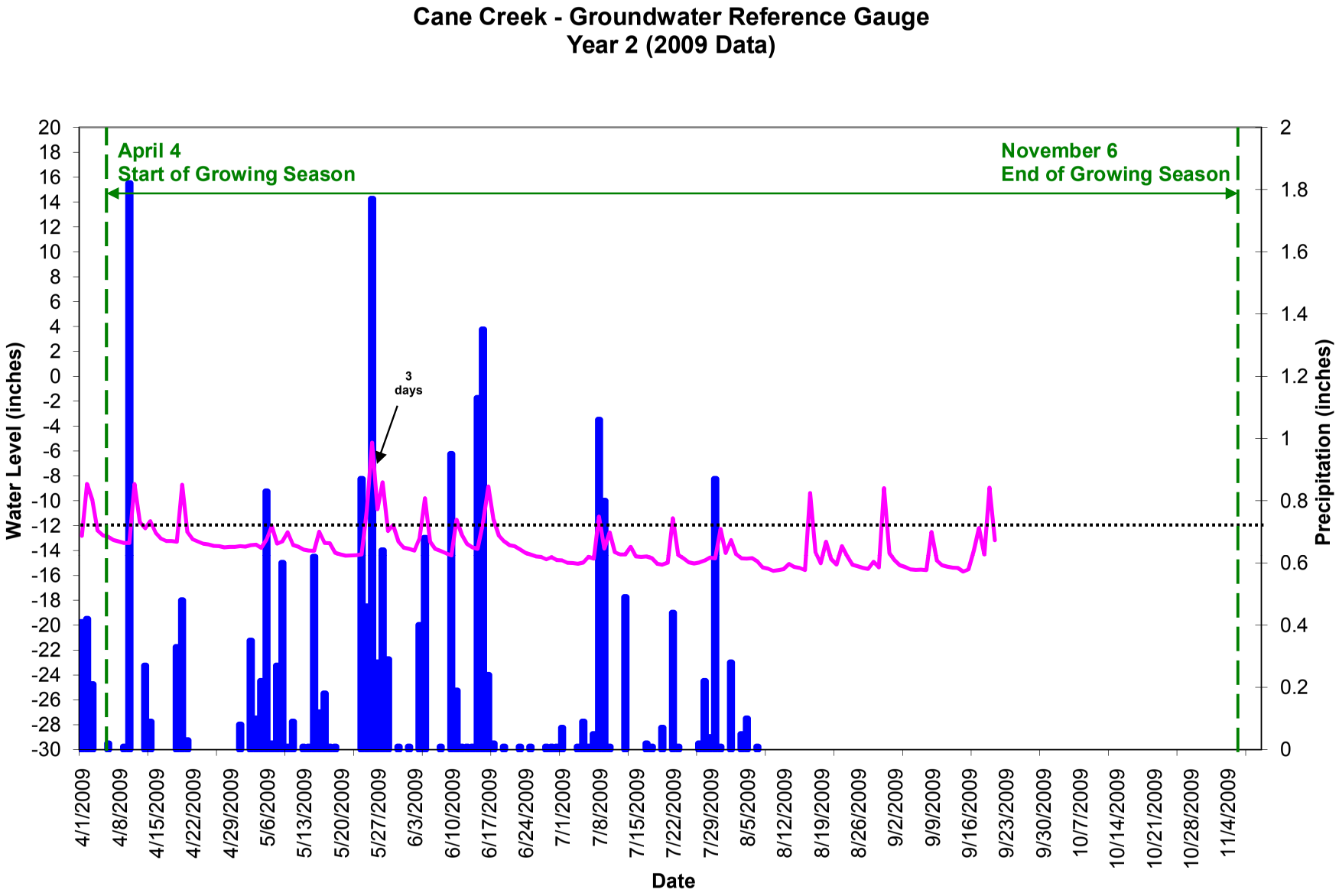
Cane Creek - Groundwater Gauge 3
Year 2 (2009 Data)



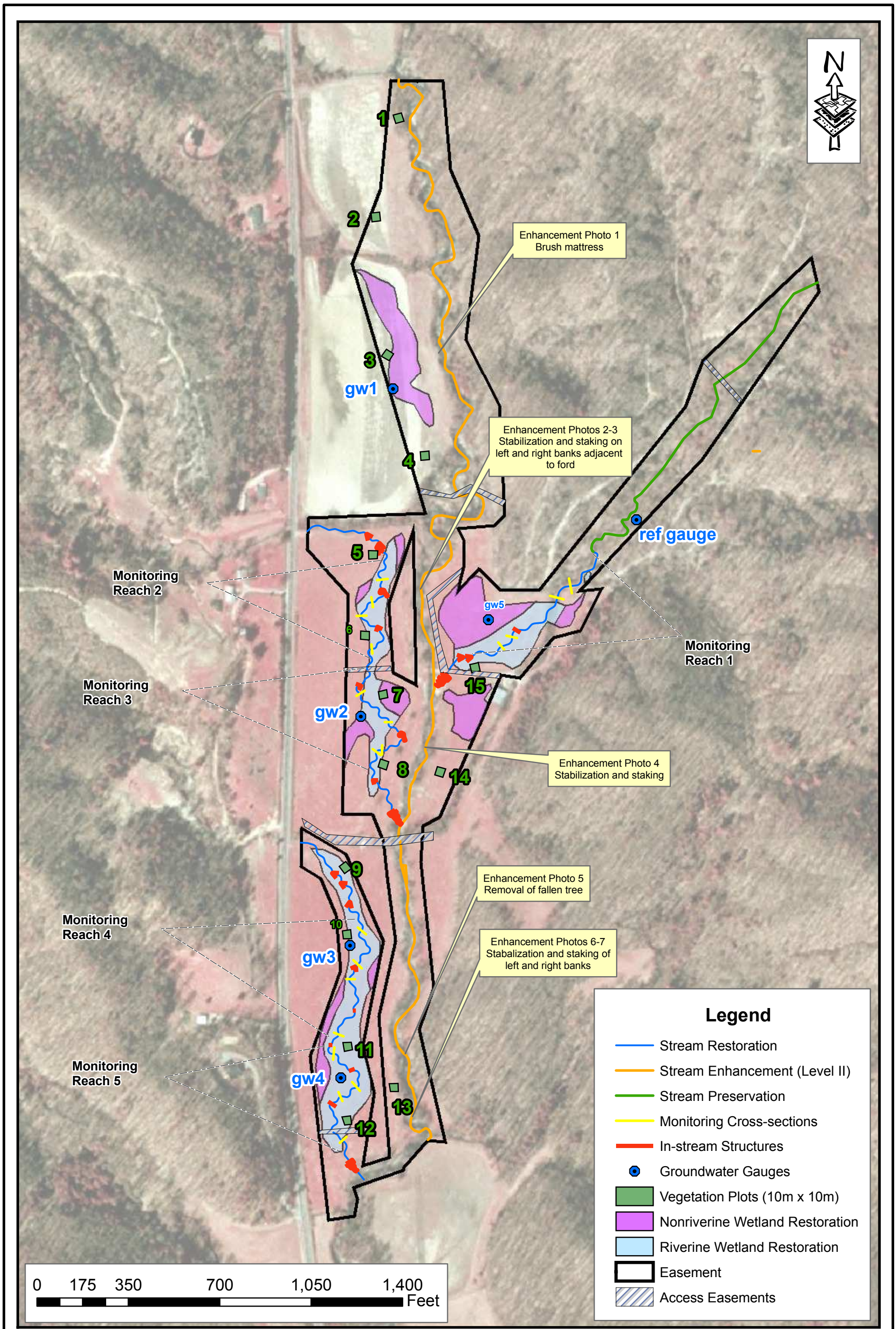

Cane Creek - Groundwater Gauge 4
Year 2 (2009 Data)
April 4
Start of Growing Season
November 6
End of Growing Season
4
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
4/1/2009
4/8/2009
4/15/2009
4/22/2009
4/29/2009
5/6/2009
5/13/2009
5/20/2009
5/27/2009
6/3/2009
6/10/2009
6/17/2009
6/24/2009
7/1/2009
7/8/2009
7/15/2009
7/22/2009
7/29/2009
8/5/2009
8/12/2009
8/19/2009
8/26/2009
9/2/2009
9/9/2009
9/16/2009
9/23/2009
9/30/2009
10/7/2009
10/14/2009
10/21/2009
10/28/2009
11/4/2009

Cane Creek - Groundwater Gauge 5
Year 2 (2009 Data)




Cane Creek - Groundwater Reference Gauge
Year 2 (2009 Data)
April 4
Start of Growing Season
November 6
End of Growing Season
3
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
4/1/2009
4/8/2009
4/15/2009
4/22/2009
4/29/2009
5/6/2009
5/13/2009
5/20/2009
5/27/2009
6/3/2009
6/10/2009
6/17/2009
6/24/2009
7/1/2009
7/8/2009
7/15/2009
7/22/2009
7/29/2009
8/5/2009
8/12/2009
8/19/2009
8/26/2009
9/2/2009
9/9/2009
9/16/2009
9/23/2009
9/30/2009
10/7/2009
10/14/2009
10/21/2009
10/28/2009
11/4/2009

APPENDIX D
MONITORING PLAN VIEW



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

MONITORING PLAN VIEW
CANE CREEK RESTORATION SITE
Rutherford County, North Carolina

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

FIGURE
D-1