

# **Brown Branch Stream Restoration – Project #53 Fifth Annual Monitoring Report**



Submitted to:

NCDENR-Ecosystem Enhancement Program  
1619 Mail Service Center  
Raleigh, NC 27699-1619



## **Table of Contents**

II.	Title Page	
III.	Table of Contents	Page 1
IV.	Executive Summary / Project Abstract	Page 2
V.	Project Background	Page 5
	1. Project Objectives	Page 6
	2. Project Structure	Page 6
	3. Location and Setting	Page 6
	4. Project History	Page 6
VI.	Project Condition and Monitoring Results	Page 10
	A. Vegetation Assessment	Page 10
	1. Vegetation Problem Areas	Page 11
	B. Stream Assessment	Page 10
	1. Procedural Items	pp 11-14
	2. Problem Areas Plan View Exhibit – Appendix D.	
	3. Problem Areas Table Summary	Page 14
	4. Numbered Issues Photo Section	Page 14
	5. Fixed Photo Stations	Page 14
	6. Stability Assessment	Page 15
	7. Quantitative Measures Tables (Morph and Hydro)	Page 15
	C. Wetland Assessment	Page 15
	1. Wetland Criteria Attainment (Not Applicable)	Page 15
VII.	Methodology Section	Page 19

## **TABLES**

Table I.	Project Structure Table	Page 6
Table II.	Project Objectives Table	Page 8
Table III.	Project Activity and Reporting History	Page 8
Table IV.	Project Contact Table	Page 9
Table V.	Verification of Bankfull Events	Page 12
Table VI.	BEHI and Sediment Export Estimates	Page 13
Table VII.	Categorical Stream Feature Visual Stability Assessment	Page 15
Table VIII.	Baseline Morphology and Hydraulic Summary	Page 16
Table IX.	Morphology and Hydraulic Monitoring Summary	Page 18
Table X.	Wetland Criteria Attainment (Not Applicable)	Page 18

## **Appendix A Vegetation Raw Data**

1. Vegetation Photo Log
2. Vegetation Problem Areas
3. Vegetation Survey Data Tables

## **Appendix B Geomorphologic Raw Data**

1. Stream Problem Areas Table B.1
2. Representative Stream Problem Areas Photos
3. Exhibit Table B.2 – Qualitative Visual Stability Assessment
4. Annual Overlays of Cross Section Plots (with Photos)
5. Annual Overlays of Longitudinal Plots
6. Annual Overlays of Pebble Count Frequency Distribution Plots

## **Appendix C Wetland Raw Data**

Not Applicable for this project.

## **Appendix D Integrated Problem Area Plan View**

#### **IV. Executive Summary/Project Abstract**

The North Carolina Wetland Restoration Program conducted a restoration on 5,100 linear feet of Brown Branch for the purpose of obtaining mitigation credit. Brown Branch, located in Caldwell County, is a tributary to Mulberry Creek within the Catawba River Basin of western North Carolina. The Brown Branch watershed comprises three square miles and is part of the Elk River drainage, eight-digit hydrologic unit code 06010103.

The project site is 3.5 miles east of U.S. Highway 321 at Happy Valley and 3.0 miles north of Olivette, NC. Brown Branch restoration reach is contained within the Anita-Alta 4H Camp and is the last mile of the creek before its confluence with Mulberry Creek. Prior to restoration the combination of an unstable channel with a featureless bed and a lack of riparian cover were contributing to poor water quality and lack of aquatic habitat. Goals of the Brown Branch restoration project include the establishment of a dynamically stable plan form; to create cross sectional and profile patterns that will enhance in-stream habitat and water quality, and to improve the functional and aesthetic value of the riparian corridor. The design increased the sinuosity of the channel and incorporated rock and log structures. Structures were put in place to decrease erosive stress on the banks and provide increased aquatic habitat. By creating a range of aquatic niches, the project intends to provide in-stream habitats that may support future trout populations.

#### **Results and Discussion**

A previous monitoring report, MY1, noted extensive channel damage due to heavy rains and high flows that occurred during the first year. Most of these noted problems are still apparent because they were not considered significant enough to result in a critical failure and lack of achieving project goals status. During year 2007, western North Carolina has undergone what some are calling a “100 year” drought. This drought has caused reduced base flows in creeks and rivers throughout the region. During the MY5 geomorphologic assessment it was apparent that Brown Branch has been subject to drought conditions. Evidence of drought conditions included low flow, vegetated bars, an abundance of surface fines and leaf detritus. Channel cross sections are consistent with previous measurements and appear stable. The channel bed, however, is showing signs of excessive fine materials at each cross-section and between cross-sections throughout the restoration project. Low water levels have allowed leaf material to accumulate and small debris dams to form in the stream channel. Typically surface fines combined with leaf detritus and small debris are washed away during high flow events. In the interim the silt and leaf material may provide for additional benthic macro-invertebrate habitat and forage. In addition, the low flow, drought condition, may have facilitated beaver dam construction located at station 51+00, 100 feet upstream of the Brown Branch confluence with Mulberry Creek. A five foot tall, 40 foot wide beaver dam had been constructed sometime during 2006 and was observed by MACTEC during MY4. The beaver dam has since been dismantled and the beavers trapped and relocated. During MY4 it was noted that water in Brown Branch had been backed up more than 150 feet. Effects of this backwater were evident during the MY5 assessment with the stream bank and adjacent riparian area virtually de-void of vegetation. However, MY5 vegetation monitoring showed that the overall vegetative success of the project was not affected by beaver activity.

The objective of vegetation monitoring is to provide an accurate and rapid assessment of the survival and growth of woody plant restoration and regeneration as an integral component of the Brown Branch stream restoration project. Planted trees, shrubs, and vegetative cover along the riparian area of Brown Branch appears to be meeting established successful criteria based on compiled vegetation monitoring data. Brown Branch vegetation monitoring was conducted using protocols specified in the CVS-EEP Protocol for Recording Vegetation Version 4.1 (Lee et al. 2007). *The Brown Branch Stream Restoration: Post*

*Construction Mitigation Plan* outlined vegetation success criteria as survival of a minimum of 260 stems per acre for trees after MY5, with at least six planted species represented as surviving species. Survival of planted woody species compiled from MY5 vegetation data is approximately 415 stems per acre with at least six species present that were originally included in the as-built, post-planting plans. Survival of planted woody species compiled from MY5 vegetation data is slightly less than survival estimated from MY4 vegetation data (415 stems per acre versus 438 stems per acre). A moderate amount of vine strangulation was observed in vegetation plot BBP-12 due to an unknown vine, presumed to be in the Family *Fabaceae*. This same vine was also observed sporadically within a few other vegetation plots. An area of concern, an active beaver dam in the downstream portion of Brown Branch, was observed with water backed up adjacent to vegetation plot BBP-9 upstream to BBP-7. Additional observation of the beaver-influenced area is recommended, and removal of the beaver dam is warranted to ensure existing vegetation survival. Additional observation of vegetation plots for invasive plant species is also recommended.

## **Summary**

All though MY5 revealed areas of concern and areas that could use additional observation it was evident that Brown Branch has experience both fluvial geomorphic and vegetative success over the past five years. The majority of the stream appears to be functioning and holding grade. Table B.2 shows a summary of monitoring measurement results (Appendix B). The stream classifies as a C4b. Channel dimension and pattern are similar to as-built conditions with the exception of six mid-channel bars. Mid-channel bars are prevalent in areas where due to an over widening of the channel, sediment has been deposited. The stream flow in each of these areas appears to be flowing primarily along one side of the mid-channel bar. Some rock structures have lost function in the stream channel. However, in most cases these do not appear to be causing problems in the stream. Placed structures throughout most of the reach are holding grade and functioning appropriately, with the exception of some localized erosion on single rock vane near station 26+00. Vegetation showed to be experiencing moderate to good success despite MY5 drought conditions. In addition, most vegetation identified throughout the riparian buffer appears to be of natural recruitment origin. The remnant effect of a partially removed beaver dam may require some future action.

## **V. Project Background**

### *1. Project Objectives*

The restoration of Brown Branch, located within the Anita Alta 4-H Camp, was conducted to correct identified system deficiencies to 5,100-linear feet of stream, using a Priority 1 restoration approach. Additional objectives of the project were to establish a riparian zone along the stream, improve the aquatic habitat within the channel and the riparian area, and incorporation of this project into a watershed-wide management plan.

### *2. Project Structure*

A Priority 1 stream restoration design was implemented for 5,100 lf of stream channel and riparian buffer. The project involved channel dimension adjustments, pattern alterations, in-stream structures (rock vanes, root wads, rock and log vanes, and woody debris) to provide grade control and channel stability, and riparian buffer restoration which included the replanting of woody vegetation, construction of floodplain wetland depressions, and fencing for exclusion of farm animals.

**Exhibit Table I. Project Restoration Components  
Brown Branch - Project #53**

<b>Project Segment or Reach ID</b>	<b>Existing Length (Lf)</b>	<b>Type</b>	<b>Approach</b>	<b>Restored Length (Lf)</b>	<b>Mitigation Ratio</b>	<b>Mitigation Units</b>	<b>Stationing</b>	<b>Comment</b>
Reach 1	5,100 lf	R	P1	5,100	1	5,100	0+00 - 51+00	Includes 5,100 lf riparian buffer restoration

*3. Location and Setting*

The project consisted of 1.1 square mile portion of the Brown Branch watershed (located within USGS Hydrologic Unit Code 03050101, NCDWQ Sub-basin 11-38-32-13 Upper Catawba River Basin) located just north of the city limits of Lenoir, North Carolina in Caldwell County. The project is contained within the boundaries of the Anita-Alta 4-H camp in the Mulberry Community (Figure 1). To access the site from I-40, travel north on US 321 to Lenoir and continue north towards Boone. Turn left onto US 321-Alternate traveling south for approximately 0.3-miles before turning right onto NC 90/Collettsville Road. Travel west for approximately 4 miles and turn left onto Mulberry Creek Road. Travel north about 3.5 miles to the Anita-Alta 4-H camp located east of Mulberry Creek Road. Turn into a gravel drive and cross a small bridge preceding the caretaker’s two-story house. Brown Branch flows along the southern portion of the property along the edge of the valley.

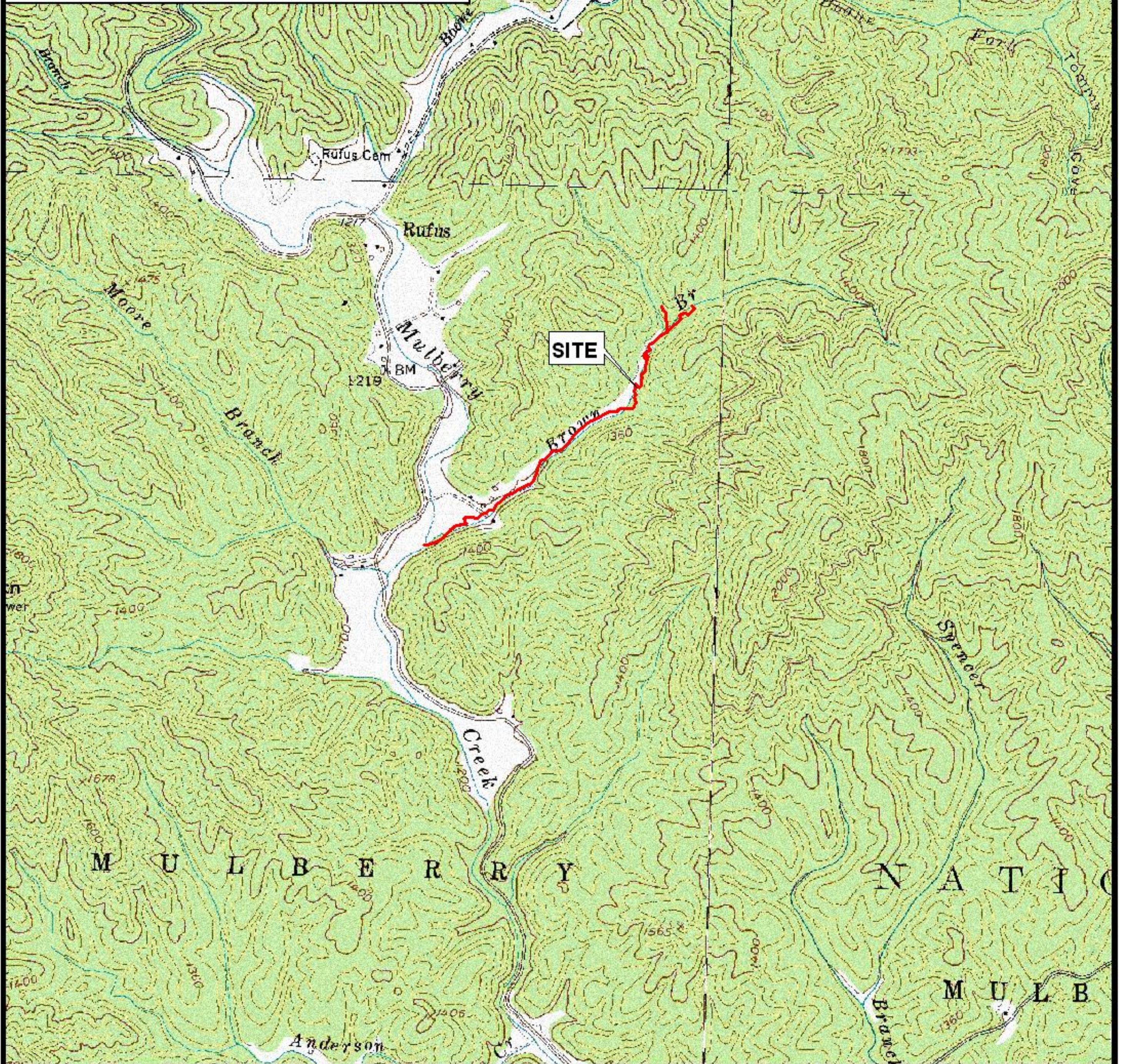
*4. History*

Project planning was initiated for the Brown Branch Stream Restoration in 2002 for the implementation of a stream restoration project in Mulberry, North Carolina, located in Caldwell County. (Figure 1). Following coordination with local leaders, the Wetlands Restoration Program and citizens groups, the project was initiated and focused on the restoration of approximately 5,100 linear feet of degraded stream within the Anita Alta 4-H Camp. Detailed environmental assessments and engineering studies were conducted and design plans and documents were prepared to facilitate the stream and riparian buffer restoration. Biohabitats, Inc. provided a mitigation plan dated March 2003. Implementation of the project was completed by September 2003. The restoration of this portion of Brown Branch was conducted to correct identified system deficiencies including severe bank erosion, channel widening, and the loss of aquatic habitat resulting from stream channelization, the loss of riparian vegetation, and watershed development.

### DIRECTIONS TO SITE:

From US-321 ALT/N MAIN ST in Lenoir NC:

LEFT onto NC-90/VALWAY RD NW  
Continue on NC-90/VALWAY RD NW 1.3mi  
LEFT onto NC-90/COLLETTSVILLE RD.  
Continue on NC-90/COLLETTSVILLE RD 4.0mi  
RIGHT onto MULBERRY CREEK RD.  
Continue on MULBERRY CREEK RD 3.5mi  
RIGHT into ANITA ALTA 4-H CAMP. BROWN BRANCH on RIGHT



Scale: 1" = 2,000'

Source: EEP, NCDOT, USGS (Collettsville, NC Topographic Quadrangle)

Prepared/Date: A. Davis/12-28-07

Checked/Date: R. Sain/12-28-07

2007 Annual Monitoring (MY5)  
Brown Branch Stream Restoration  
Caldwell County, North Carolina

Prepared For:



Prepared By:



Vicinity Map

Project: 6470-06-1410

Figure 1

<b>Table II. Project Activity and Reporting History</b>		
<b>Project Number and Name: 279 (Brown Branch)</b>		
<b>Activity or Report</b>	<b>Calendar Year of Completion or Planned Completion</b>	<b>Actual Completion Date</b>
Restoration Plan	*	*
Mitigation Plan	March 2003	March 2003
Construction	September 2003	September 2003
Temporary S&E mix applied to entire project area	*	*
As-Built report	October-03	October-03
Permanent seed mix applied to reach	N/A*	N/A*
Structural maintenance (Bank repair and revegetation)	N/A*	N/A*
Initial – Year 1 monitoring	June-03	October -03
Year 2 Monitoring	June-04	October -04
Year 3 Monitoring	June-05	October-05
Year 4 Monitoring	June-06	October-06
Year 5 Monitoring	June-07	December-07

<b>Table III. Project Contact Table</b>	
<b>Project Number and Name: 279 (Brown Branch )</b>	
<b>Designer</b> Primary project design POC	Biohabitats Inc. 15 West Aylesbury Road Timonium, MD 21093  Mr. Tim Burkette
<b>Construction Contractor</b> Construction contractor POC	Shamrock Environmental Corporation 503 Patton Avenue Greensboro, NC 27406 Bill Wright
<b>Planting Contractor</b> Planting contractor POC	*
<b>Seeding Contractor</b> Planting contractor point of contact	*
Seed Mix Sources	Ernst Conservation Seed, 9006 Mercer Pike, Meadville, Pennsylvania 16335 (814) 336-2404
Nursery Stock Suppliers	N/A*
<b>Monitoring Performers</b>	MACTEC Engineering and Consulting, Inc. 3301 Atlantic Avenue Raleigh, North Carolina 27604 (919) 876-0416
Stream Monitoring POC	Robert Sain (828) 252-8130
Vegetation Monitoring POC	James Cutler (336) 294-4221

\* Historical project documents reviewed did not provide these data.



<b>Table IV. Project Background Table</b>	
<b>Project Number and Name: 279 (Brown Branch )</b>	
Project County	Caldwell, North Carolina
Drainage Area	1.1 sq. mi.
Drainage impervious cover estimate (%)	Estimated at <5%
Stream Order	2nd order
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont (45b)
Rosgen Classification of As-built	C4-Stream Type
Cowardin Classification	Not applicable
Dominant soil types	Congaree, Chewada, and Chestnut
Reference site ID	*
USGS HUC for Project and Reference	3050101
NCDWQ Sub-basin for Project and Reference	11-38-32-13 Upper Catawba River Basin
NCDWQ classification for Project and Reference	C
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	N/A
% of project easement fenced	100%

\* Historical project documents reviewed did not provide these data.

## **VI. Project Condition and Monitoring Results**

In a review of the historical project documents (i.e.: Mitigation Plan) provided by EEP, data gaps were revealed including morphological data from previous Monitoring Years, historical data, and accurate survey datum point locations. These data gaps were reported to the EEP prior to field monitoring efforts. Historical review revealed that the As-Built survey was conducted by Bio-Habitats, MY2 by North Carolina State University, MY3 by EcoLogic Associates, MY4 and MY5 by MACTEC. MACTEC was able to obtain previous stream data via the EEP from NCSU Stream Restoration Institute and from Bio-Habitats. Additional Bio-habitats data recently surfaced and was provided by the EEP to MACTEC on November 27, 2007. These data, including an as-built longitudinal profile have been added for this years monitoring year 5 (MY5) report.

In an attempt to survey the longitudinal profile and cross sections of Brown Branch only two previously established datum locations and the permanent bench mark were identified and located using the information gathered from the EEP. MACTEC personnel made multiple attempts to locate previously reported cross sections and other monumented stream features. This resulted in the identification of six cross sections. Of these six cross sections four were poorly marked and two were missing markers.

MACTEC, in order to correct the missing survey points, re-established datum locations and recorded previously established survey locations when available. During MY5 Brown Branch was initially evaluated in May 2007 and appeared to be functioning as designed. Subsequent evaluations in May, July and December 2007 revealed, in general, that the design is functioning successfully.

### **A. Vegetation Assessment**

Using the protocols specified in the CVS-EEP Protocol for Recording Vegetation Version 4.1, 12 vegetation monitoring plots established during MY5 were surveyed on July 17 and July 18, 2007 within the riparian buffer of the Brown Branch project area (Lee et al. 2007).

Vegetation monitoring data collected appears to be meeting established success criteria. According to North Carolina's Stream Mitigation Guidelines, survival of planted woody species at mitigation sites should be at least 260 stems per acre through monitoring year five (MY5). Survival of planted woody species compiled from MY5 vegetation data is approximately 415 stems per acre with at least six species present that were originally included in the as-built/post-planting plans. A moderate amount of vine strangulation was observed in vegetation plot BBP-12 due to an unknown vine, presumed to be in the Family *Fabacae*. This same vine was also observed sporadically within a few other vegetation plots.

Vegetation monitoring data collected appears to be meeting established success criteria. According to the *Brown Branch Stream Restoration: Post Construction Mitigation Plan*, vegetation success criteria is achieved with survival of a minimum of 260 stems per acre for trees after MY5, with at least six planted species represented as surviving species. This year's vegetation monitoring determined that the survival of planted woody species was approximately 415 stems per acre. Overall, nearly 95 percent of species observed during MY4 are represented as surviving species for MY5. At least six planted woody species are represented as surviving species from the initial post-construction planting in February 2003. In addition this projects planted woody stem density has met and exceeded the success criteria set forth by the mitigation plan. *Betula* species dominate the woody stem count with a total of 74 stems within the 12 plots. Vegetation vigor was rated good-excellent for over 98 percent of woody stems previously-observed during MY4. The most abundant damage

type observed were holes on plant leaves presumed to be due to insects. The vegetation plot data is summarized in Tables 1 through 5 in Appendix A.

## 1. Vegetative Problem Areas

Problem areas, as defined in EEP's *Content, Format, and Data Requirements for EEP Monitoring Reports*, are areas either lacking vegetation or containing exotic vegetation, and are categorized as Bare Bank, Bare Bench, Bare Floodplain, or Invasive Population. Invasive species were infrequent at the site, although a moderate amount of vine strangulation was observed in vegetation plot BBP-12 due to an unknown vine, presumed to be in the Family *Fabaceae*. This same vine was also observed sporadically within a few other vegetation plots. An area of concern, an active beaver dam in the downstream portion of Brown Branch, was observed with water backed up adjacent to vegetation plot BBP-9 upstream to BBP-7. Additional observation of the beaver-influenced area is recommended, and removal of the beaver dam is warranted to ensure existing vegetation survival. Additional observation of vegetation plots for invasive plant species is also recommended.

## 2. Vegetative Problem Area Plan View

The vegetation plan view drawings depicting the vegetation plot locations and potential problem area (BBP-12) are included in the Integrated Problem Area Plan View, Appendix D.

## B. Stream Assessment

Overall, the majority of the stream is functioning well and seems to be holding grade. Table 2 shows a summary of monitoring measurement results. The stream classifies as a C4b. Channel dimension and pattern are similar to as-built conditions with the exception of some limited areas of bank erosion. Throughout the reach the majority of the pools have incurred some sedimentation from the bank scour encountered soon after the construction effort was completed. Minor bank scour was primarily occurring behind root wads and on a few meander-bends along the outside portion of the bend. As reported previously, six locations along the reach have mid-channel bars. During the MY4 assessment only two mid-channel bars were observed. The MY5 observation of four additional bars may be attributed, in part, to drought conditions. These bars are prevalent in areas where the channel appears to have experienced some over-widening, where sediment has likely dropped out and become vegetated do to low flow conditions. The stream in these areas has taken a preferential flow to one side of each mid-channel bar, flowing primarily along the outer bank.

### 1. *Procedural Items*

#### a. Morphometric Criteria

MACTEC staff evaluated the Brown Branch site during May, July and December 2007. This project appears to be maintaining a stable dimension, pattern, and profile.

MACTEC staff collected MY5 quantitative geomorphologic data for six cross-sections and 5,100 linear feet of stream during May and December 2007, respectively. Photo station locations could have been estimated and photos taken, but the direction or degrees of each photo would vary such that year to year comparison would have been arbitrary at best. MACTEC photographs were taken at cross sections and for potential problem areas.

Problem areas consisted of bank erosion, structure sloughing, mid-channel bars and beaver damage. Other areas of concern consisted of a rock cross-vane that has a vertical drop of about two feet; this structure may be acting as a fish migration barrier. Several large tree falls were reported to be causing significant erosion and scour during the stream profile survey in May 2007. However, during a follow up pebble count survey in December, these tree falls did not appear to be causing significant problems. Also, noted was the presence of two beaver dams located in the upper reach of Brown Branch above the restoration area. These beaver dams were not observed during the MY5 assessment. Nor was there any sign of previous beaver activity in the upper reach of Brown Branch.

The MY5 assessment did reveal the remnants of a large beaver dam located at station 51+00 (see Representative Stream Problem Areas, Photos 11 and 12, Appendix B). This beaver dam was partially dismantled during 2007, the beavers trapped and relocated according to the Anita 4H camp superintendent on December 21, 2007. While fully constructed this beaver dam caused a backwater pool to form. This pool acted as a silt trap and caused approximately 150 feet of channel aggradation. A steep riffle located at the breach of the partially dismantled dam provides further evidence of this aggradation. According to the Anita 4H camp superintendent this beaver dam may have been intact for more than six months during 2006. It is recommended that this partially dismantled beaver dam be fully removed in the near future. Once dismantled the stream should be given the opportunity to naturally wash the accumulated silt from the bed and to re-vegetate. If morphological and vegetative qualities do not improve over-time, restoration of this 150 foot long section of stream should be considered.

b. Hydrologic Criteria

A high flow event was observed on December 8, 2006—the flow in the stream was observed to reach the floodplain during this event. Using the rural piedmont regional curve, bankfull height was estimated to be around 1.5 feet. Approximate depth of the floodplain measured was about 1.5 feet which corresponded to the estimate of bankfull depth from the rural piedmont regional curves. Drift lines, downed herbaceous and woody vegetation were also observed on the floodplain providing further evidence that a bankfull event had taken place. The high flow event observed on December 8, 2006 is the only approximate bankfull event known for MY4.

Field work took place during the months of May, June, and December during the MY5 assessment. During these site visits no evidence of a bankfull event was observed.

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
12/8/2006	12/8/2006	On-site observation and high water indicators observed.	Not Available

c. Bank Stability Assessments

Exhibit Table VI. BEHI and Sediment Export Estimates															
Brown Branch - Project #53															
Time Point	Segment Reach	Linear Footage	Extreme 2 Feet/ yr.		Very high 0.9 Ft/ yr.		High 0.6 Ft/ yr.		Moderate 0.08 Ft/ yr.		Low 0.03 Ft/ yr.		Very Low 0.002 Ft/ yr.		Sediment Export
			Ft.	Ht.	Ft.	Ht.	Ft.	Ht.	Ft.	Ht.	Ft.	Ht.	Ft.	Ht.	
Pre-Const	*	*													*
Post-Const															
MY5	1	170											170	1.4	0.47
MY 5	2	120											120	1.5	0.39
MY 5	3	100									15	4	85	1.5	2.04
MY 5	4	250							15	4.5			235	1.7	6.18
MY 5	5	50											50	1	.10
MY 5	6	325							25	1.3			300	1.2	3.32
MY 5	7	150									50	1.4	100	1.2	2.34
MY 5	8	75											75	1.2	0.18
MY 5	9	300											300	1.2	0.72
MY 5	10	130							30	1.3			100	1.3	3.38
MY 5	11	170											170	1.2	0.41
MY 5	12	150											150	1.2	0.36
MY 5	13	170									20	1.5	150	1.4	1.32
MY 5	14	175											100	1.3	0.26
MY 5	15	100											100	1.2	0.24
MY 5	16	150											150	1.3	0.39
MY 5	17	100									20	2	80	1.4	1.42
MY 5	18	100											100	1.2	0.24
MY 5	19	175											175	1.3	0.46
MY 5	20	150									25	1.2	125	1.1	1.18
MY 5	21	70											70	1.1	0.15
MY 5	22	100											100	1.2	0.24
MY 5	23	125											125	1.3	0.33
MY 5	24	100											100	1.3	0.26
MY 5	25	50											50	1.2	0.12
MY 5	26	50											50	1.3	0.13
MY 5	27	125											125	1.4	0.35
MY 5	28	175											175	1.3	0.46
MY 5	29	100											100	1.2	0.24
MY 5	30	150							20	1.3			130	1.5	2.44
MY 5	31	150							30	1.3			120	2	3.60
MY 5	32	170							10	1.3			160	3	1.94
MY 5	33	150							50	1.3			100	1.5	5.50
MY 5	34	75											75	2.5	0.38
MY 5	35	175											175	2.1	0.32
MY 5	36	225									150	2	75	2.1	9.32
Project	Total	5100 lf													<b>2.5 tons/ year</b>

\* = Data Gap. Historical data not supplied.

BEHI (Bank Erosion Hazard Index) and NBS (Near Bank Stress) assessments were performed for Brown Branch as part of the MY5. Stream banks were categorized, lengths and heights measured then estimates per category per length were calculated. The calculations used a relationship of BEHI and NBS to estimate Bank Erosion Rates (ft/yr). Bank heights and lengths were used to calculate and area (ft<sup>2</sup>); bank areas were multiplied by the NBS rated, bank erosion rate (ft/yr) to provide cubic feet/ year/ length of bank. Cubic feet/ year/ bank length were summed and converted to tons/ year for the entire length of the project. The relationship of BEHI was published by Dave Rosgen using data collected by the USDA forest service for streams found in sedimentary and/ or metamorphic geology (Rosgen, D.L. 2006, pg 5-79 and 5-80).

The BEHI resulted in an estimated 2.5 tons per year using Colorado and Yellowstone curves (Rosgen, D.L. 2006, pg 5-79 and 5-80). Note that six mid-channel bars and one erosive bank were included in the “moderate” category. Mid-channel bars are typically classified in the “High” to “Extreme” category but due to well established root density and depth were bumped down to the “Moderate” category. Also note the beaver dam activity was included as “low” in reach 36, see Table VI. Also, please note that no historical (pre-existing) BEHI estimate was available for comparison.

## *2. Problems Areas Plan View (stream)*

Provided in Appendix D provides categorical feature issues by station and type, the suspected cause, and denotes number of a representative photo of the condition included in Appendix B.

## *3. Problem Areas Summary Table*

Exhibit Problem Areas Summary Table is provided in Appendix B.

## *4. Numbered Issues Photo Stations*

Problem area photos are provided in Appendix B.

## *5. Fixed Photo Station Photos*

Fixed photo stations were identified and labeled by station number in the MY1 report however no permanent or fixed photos were taken for MY4 or for MY5 by MACTEC. MACTEC found that, although, locations were identified by station number in the MY1 report actual fixed photo station coordinates were not available.

## *6. Stability Assessment (Exhibit Table VII)*

The channel profile of Brown Branch remained in close approximation to the As-built survey. The longitudinal profile indicates pool depths in the first 400 feet of channel have increased slightly during the last five years. Natural and planted vegetation dominating the channel banks appears to be maintaining stability throughout the reach.

Channel Cross-Sections have shifted slightly since the as-built survey in 2003 but remain stable. Cross sections 1 through 5 show some minor lateral migration but dense vegetation along the channel bank appears to be helping maintain stability. Cross sectional area decreased slightly for cross sections 1 through 4, and increased for cross sections 5 and 6. In addition channel mean and max depths have decreased slightly and the cross-sectional area has decreased since last year. Cross section 6 has tightened up in area since the As-built and the 2003 monitoring periods. A change in

area from 26.13 to 17.95 square feet was indicated by the survey. This change appears to indicate that the stream may be narrowing in this area to a more stable bankfull width. Maximum depth is consistent to as-built conditions. Cross section #5 is a riffle located at STA 43+00 that formed a mid-channel bar between MY3 and MY4. This mid-channel bar has continued to develop with a more pronounced thalweg near the outer, right bank. Both mean and max depths have increased for cross section 5.

The d16, d35 and d50 of the riffle channel materials have fined over the past year while the D84 and D95 seem to have coarsened. Gravel covered with a fine layer of silt is dominant throughout the reach. The d16, d35 and d50 of the pool channel materials have coarsened over the past year. The channel appears to be have a lot more silt and wash load material than measured during MY4. This may be attributed to drought conditions with slower base flow velocities over the past year.

Channel pattern appears to have been maintained since construction. Dense vegetation has established along the channel banks. This vegetation is providing an excellent root mass to stabilize the banks. There are no areas of visible meander migrations throughout this reach and areas of bank scour have re-vegetated and appear to have stabilized. Some rock structures have lost function in the stream channel. Placed structures throughout most of the reach are holding grade and functioning appropriately.

<b>Exhibit Table VII. Categorical Stream Feature Visual Stability Assessment</b>						
Brown Branch - Project #53						
<b>Feature</b>	<b>Initial</b>	<b>MY-01</b>	<b>MY-02</b>	<b>MY-03</b>	<b>MY-04</b>	<b>MY-05</b>
A. Riffles	100%	*	*	*	85%	80%
B. Pools	100%	*	*	*	85%	96%
C. Thalweg	100%	*	*	*	90%	100%
D. Meanders	100%	*	*	*	95%	99%
E. Bed General	100%	*	*	*	95%	92%
F. Bank Condition	100%	*	*	*	90%	99%
G. Vanes / J Hooks, etc.	100%	*	*	*	80%	96%
H. Wads and Boulders	100%	*	*	*	80%	75%

\* = Data Gap. Historical data not supplied.

### 7. *Quantitative Measures Tables (Morph and Hydro)*

Baseline morphology and Summary morphology data are located in tables VII and VIII, respectively. Data gaps in the following tables are due to a lack of data from previous monitoring events. Attempts were made to locate and populate data tables with previously recorded data.

#### C. Wetland Assessment

Please note that Table X (Wetland Criteria Attainment) is not included because this restoration project does not have a wetlands component.

**Exhibit Table VIII. Baseline Morphology and Hydraulic Summary  
Brown Branch - Project #53 (5100 feet)**

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
<b>Dimension</b>																		
BF Width (ft)	*	*	*	*	*	*	*	*	28	*	*	52	*	*	22	10	16.8	13.4
Floodprone Width (ft)	*	*	*	*	*	*	*	*	300	*	*	NA	*	*	300	*	*	*
BF Cross Sectional Area (ft <sup>2</sup> )	*	*	*	*	*	*	*	*	41	*	*	169	*	*	35	11.4	29.9	20.65
BF Mean Depth (ft)	*	*	*	*	*	*	*	*	1.4	*	*	3.2	*	*	1.6	0.73	1.1	0.92
BF Max Depth (ft)	*	*	*	*	*	*	*	*	2.9	*	*	NA	*	*	2.3	0.94	1.8	1.37
Width/Depth Ratio	*	*	*	*	*	*	*	*	20	*	*	16	*	*	13	*	*	*
Entrenchment Ratio	*	*	*	*	*	*	*	*	11	*	*	*	*	*	14	*	*	*
Wetted Perimeter(ft)	*	*	*	*	*	*	*	*	23.3	*	*	*	*	*	24.7	*	*	*
Hydraulic radius (ft)	*	*	*	*	*	*	*	*	1.4	*	*	*	*	*	1.5	*	*	*
<b>Pattern</b>																		
Channel Beltwidth (ft)	*	*	*	*	*	*	*	*	<120	192	300	*	*	*	*	*	*	*
Radius of Curvature (ft)	*	*	*	*	*	*	*	*	100	42	69	*	*	*	*	*	*	*
Meander Wavelength (ft)	*	*	*	*	*	*	*	*	600	60	112	*	*	*	*	*	*	*
Meander Width ratio	*	*	*	*	*	*	*	*	*	3.7	5.7	*	*	*	*	*	*	*
<b>Profile</b>																		
Riffle length (ft)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	22	71	31
Riffle slope (ft/ft)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0.006	0.45	0.014
Pool length (ft)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	9	62	35.5
Pool spacing (ft)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	35	65	50
<b>Substrate</b>																		
d50 (mm)	*	*	*	*	*	*	*	*	30	*	*	*	*	*	*	*	*	*
d84 (mm)	*	*	*	*	*	*	*	*	52	*	*	*	*	*	*	*	*	*
<b>Additional Reach Parameters</b>																		
Valley Length (ft)		*			*				1687		*			1687		3400		
Channel Length (ft)		*			*				1826		*			2808		5100		
Sinuosity		*			*				1.4		*			1.5		1.5		
Water Surface Slope (ft/ft)		*			*				*		*			0.005		*		
BF slope (ft/ft)		*			*				0.006		*			*		0.009		
Rosgen Classification		*			*				C4		*			C4		C4		
Number of Bankfull Events		*			*				*		*			*		*		
Extent of BF floodplain (acres)		*			*				*		*			300		300		
*BEHI		*			*				*		*			*		*		
*Habitat Index		*			*				*		*			*		*		
*Macro-benthos		*			*				*		*			*		*		

\* = Data Gap. Historical data not supplied.



<b>Table VIII Parameters (continued)</b>	MY-01 (2003)			MY-02 (2004)			MY-03 (2005)			MY-04 (2006)			MY-05 (2007)		
<b>Pattern</b>	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	57	230	120	24	56	33	*	*	*	22	59	40.5	40	230	113
Radius of Curvature (ft)	26	86	55	28	87	66	*	*	*	29	86	66	44	143	66
Meander Wavelength (ft)	170	350	202.5	83	104	100	*	*	*	86	106	96	180	360	240
Meander Width ratio	1.62	6.57	3.42	*	*	*	*	*	*	1.3	3.47	2.38	2.1	11	4.7
<b>Profile</b>															
Riffle length (ft)	15.8	97	15	22	71	31	*	*	*	9	22	15.5	15	80	23
Riffle slope (ft/ft)	0.0051	0.0028	0.001	0.006	0.0045	0.0014	*	*	*	0.0025	0.065	0.0139	0.002	0.01	0.004
Pool length (ft)	13.2	97	43.5	9	62	18	*	*	*	5	28	16.5	8	85	25
Pool spacing (ft)	44	211	112	35	65	61	*	*	*	26.3	196.4	75.5	30	200	90
<b>Additional Reach Parameters</b>	MY1			MY2			MY3			MY4			MY5		
Valley Length (ft)	3700			*			*			3700			3700		
Channel Length (ft)	5185			*			*			5100			5000		
Sinuosity	1.4			*			*			1.5			1.3		
Water Surface Slope (ft/ft)	0.009			*			*			0.009			0.009		
BF slope (ft/ft)	0.0089			*			*			0.0091			0.0089		
Rosgen Classification	C4			C4			C4			C4			C4b		
Number of Bankfull Events	*			*			*			1			0		
Extent of BF floodplain (area)	*			*			*			*			*		

\* = Data Gap. Historical data not supplied.

**Exhibit Table IX. Morphology and Hydraulic Monitoring Summary**

**Project Number #53**

**Segment/Reach: Brown Branch (5,100 feet)**

Parameter	Cross Section 1 Riffle					Cross Section 2 Pool					Cross Section 3 Riffle					Cross Section 4 Pool					Cross Section 5 Riffle					Cross Section 6 Pool				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	16.5	15.2	*	16.5	17.7	24.2	36.3	*	34.3	26.6	11.9	11.9	*	14.9	14.6	25.8	32.7	*	20.9	29.9	16.1	20.4	*	17.9	17.5	28.9	26.1	*	20.6	21
Floodprone Width (ft)	>100	>100	*	>100	>100	>100	>100	*	>100	>100	>100	>100	*	>100	>100	>100	>100	*	>100	>100	>100	>100	*	>100	>100	45	52	*	50	55
BF Cross Sectional Area (ft <sup>2</sup> )	26.2	21.3	*	26.2	21.35	24.1	21.4	*	21.8	19	16	14.2	*	14.7	14.02	23.8	26.7	*	36.1	31.4	14.9	15.1	*	11.54	15.9	26.1	26.6	*	16.5	18
BF Mean Depth (ft)	1.6	1.4	*	1.6	1.2	1	0.6	*	0.6	0.7	1.3	1.2	*	1	0.96	0.9	0.8	*	1.7	1	0.9	0.7	*	0.6	0.9	0.9	1	*	0.8	0.9
BF Max Depth (ft)	2.3	2.2	*	2.3	2.3	1.7	1.9	*	1.6	1.7	1.7	1.8	*	1.8	1.9	1.9	1.9	*	3.2	3.1	1.5	1.5	*	1.1	1.6	1.8	1.8	*	1.6	1.7
Width/Depth Ratio	10.3	10.9	*	10.4	14.7	24.2	60.5	*	57.2	38.0	9.2	9.9	*	14.9	14.8	28.7	40.9	*	12.3	29.9	17.4	27.5	*	27.8	19.3	32.11	26.1	*	25.75	23.33
Entrenchment Ratio	6.1	6.6	*	6.1	5.6	*	*	*	*	*	8.4	8.4	*	6.7	6.9	*	*	*	*	*	6.2	4.9	*	5.6	5.7	*	*	*	*	*
Wetted Perimeter(ft)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Hydraulic radius (ft)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Substrate																														
d50 (mm)	*	14.5	*	10.7	4.9	*	0.11	*	0.5	1.5	*	0.09	*	11.4	3.6	*	3.37	*	8.83	6.4	*	1.38	*	9.8	8.1	*	1.46	*	1.42	4.4
d84 (mm)	*	18.9	*	36	40.4	*	0.7	*	5.5	20.4	*	15.1	*	23.8	23.4	*	15.43	*	18	29.9	*	12.15	*	23.56	57.7	*	38.5	*	16	13.7

Table X: Wetland Criteria Attainment (not applicable for this project).

## **VII. Methodology Section**

Monitoring methods used are based on US Army Corps of Engineers and NC Division of Water Quality Guidelines as referenced below.

### **References:**

Biohabitats. 2003. *Brown Branch Stream Restoration: Post Construction Mitigation Plan*. Prepared For: Wetlands Restoration Program, Division of Water Quality. Timonium, Maryland.

DENR (2006). *Content, Format, and Data Requirements for EEP Monitoring Reports*, Version 1.2. Raleigh, North Carolina.

Lee, Michael T. , R.K. Peet, S.D. Roberts, T.R. Wentworth. (2007). *CVS –EEP Protocol for Recording Vegetation, Level 1-3 Plot Sampling Only*, Version 4.1 (<http://cvs.bio.unc.edu/methods.htm> ).

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

Rosgen, D L. (2006) *Watershed Assessment of River Stability and Sediment Supply (WARSSS)*. Wildland Hydrology Books, Fort Collins, CO.

USACE (2003) *Stream Mitigation Guidelines*. USACE, USEPA, NCWRC, NCDENR-DWQ

## APPENDIX A

### Vegetation Data

1. Vegetation Photo Log
2. Vegetation Problem Area Photo Log
3. Vegetation Survey Data Tables

**North Carolina Ecosystem Enhancement Program (NC EEP)**  
**Caldwell County, North Carolina**  
 Vegetation Photo Point Images – Brown Branch – NC EEP #53



<b>VEGETATION PLOT PHOTOS</b>
Site: Brown Branch Plot ID: BBP-1
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 1
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.



Site: Brown Branch Plot ID: BBP-2
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 2
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.

**North Carolina Ecosystem Enhancement Program (NC EEP)**  
**Caldwell County, North Carolina**  
 Vegetation Photo Point Images – Brown Branch – NC EEP #53



<b>VEGETATION PLOT PHOTOS</b>
Site: Brown Branch Plot ID: BBP-3
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 3
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.



Site: Brown Branch Plot ID: BBP-4
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 4
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.

**North Carolina Ecosystem Enhancement Program (NC EEP)**  
**Caldwell County, North Carolina**  
 Vegetation Photo Point Images – Brown Branch – NC EEP #53



<b>VEGETATION PLOT PHOTOS</b>
Site: Brown Branch
Plot ID: BBP-5
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 5
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.



Site: Brown Branch
Plot ID: BBP-6
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 6
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.

**North Carolina Ecosystem Enhancement Program (NC EEP)**  
**Caldwell County, North Carolina**  
 Vegetation Photo Point Images – Brown Branch – NC EEP #53



<b>VEGETATION PLOT PHOTOS</b>
Site: Brown Branch Plot ID: BBP-7
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 7
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.



Site: Brown Branch Plot ID: BBP-8
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 8
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.



**North Carolina Ecosystem Enhancement Program (NC EEP)**  
**Caldwell County, North Carolina**  
 Vegetation Photo Point Images – Brown Branch – NC EEP #53



<b>VEGETATION PLOT PHOTOS</b>
Site: Brown Branch Plot ID: BBP-9
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 9
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.



Site: Brown Branch Plot ID: BBP-10
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 10
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.

**North Carolina Ecosystem Enhancement Program (NC EEP)**  
**Caldwell County, North Carolina**  
 Vegetation Photo Point Images – Brown Branch – NC EEP #53



<b>VEGETATION PLOT PHOTOS</b>
Site: Brown Branch Plot ID: BBP-11
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 11
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.



Site: Brown Branch Plot ID: BBP-12
Caldwell County, North Carolina
Project No: 6470-06-1410.02
Date: July 2007
Photo #: 12
Photographed by: L.B. Saal
Description:  Photo taken from plot origin toward diagonally opposite corner.

North Carolina Ecosystem Enhancement Program (NC EEP)  
Caldwell County, North Carolina  
Vegetation Problem Area – Brown Branch – NC EEP #53



**VEGETATION PROBLEM AREA**

Site: Brown Branch

Plot ID: BBP-1

Caldwell County, North Carolina

Project No: 6470-06-1410.02

Date: July 2007

Photo #: 1

Photographed by: L.B. Saal

**Description:**

Red arrow indicates vine strangulation common in BBP-12.

<b>Table 1: Vegetation Metadata</b>	
<b>Project Number and Name: 53, Brown Branch</b>	
<b>Report Prepared By</b>	Lori Saal
<b>Date Prepared</b>	7/31/2007 16:37
<b>database name</b>	CVS_EEP_EntryTool_v210.mdb
<b>database location</b>	L:\6470 Environmental\Databases\Natural Resources\Ecology\Vegetation\CVS EEP\2007
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----</b>	
<b>Metadata</b>	This worksheet, which is a summary of the project and the project data.
<b>Plots</b>	List of plots surveyed.
<b>Vigor</b>	Frequency distribution of vigor classes.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Stem Count by Plot and Spp</b>	Count of living stems of each species for each plot; dead and missing stems are excluded.
<b>PROJECT SUMMARY-----</b>	
<b>Project Code</b>	8
<b>project Name</b>	Brown Branch
<b>Description</b>	Vegetation monitoring of selected portions along 5,200lf stream restoration of Brown Branch
<b>length(ft)</b>	5,200
<b>stream-to-edge width (ft)</b>	
<b>area (sq m)</b>	
<b>Required Plots (calculated)</b>	
<b>Sampled Plots</b>	24

**Table 2: Vegetation Vigor by Species  
Project Number and Name: 53, Brown Branch**

<b>Species</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>Missing</b>
<i>Alnus serrulata</i>	1	11				
<i>Betula nigra</i>	17	38				5
<i>Cornus amomum</i>	1	2	1			1
<i>Diospyros virginiana</i>	1					
<i>Fraxinus pennsylvanica</i>		6				
<i>Juglans nigra</i>						
<i>Oxydendrum arboreum</i>						
<i>Pinus echinata</i>						
<i>Pinus taeda</i>						
<i>Quercus laevis</i>	1					
<i>Rosa multiflora</i>						
<i>Rosa setigera</i>						
<i>Salix nigra</i>	1	4				
<i>Sambucus canadensis</i>		3				
<i>Tsuga canadensis</i>						
<i>Sambucus</i>						
<i>Alnus</i>		4	1			1
<i>Betula lenta</i>	2	17			1	
<i>Carpinus</i>						
<i>Carpinus caroliniana</i>						
<i>Vaccinium</i>	1	2				
<i>Fagus grandifolia</i>						
<i>Quercus</i>		1				
<i>Quercus rubra</i>		1				
<i>Hypericum</i>	1					
<i>Lindera benzoin</i>	3					
<i>Liriodendron tulipifera</i>						
<i>Platanus occidentalis</i>		1				
<i>Acer rubrum</i>						
Unknown		2				
<b>TOTAL:</b>	<b>30</b>	<b>29</b>	<b>92</b>	<b>2</b>	<b>1</b>	<b>7</b>

**Table 3: Vegetation Damage by Species**  
**Project Number and Name: 53, Brown Branch**

Species	All Damage Categories	No Damage	Deer	Diseased	Insects	Unknown	Vine Strangulation
<i>Acer rubrum</i>	2	2					
<i>Alnus</i>	7	1		1	4	1	
<i>Alnus serrulata</i>	14	3		1	10		
<i>Betula lenta</i>	21	3	1	10	5	2	
<i>Betula nigra</i>	65	22	2	21	15	5	
<i>Carpinus</i>	2	2					
<i>Carpinus caroliniana</i>	1	1					
<i>Cornus amomum</i>	5	1	2	1		1	
<i>Diospyros virginiana</i>	1	1					
<i>Fagus grandifolia</i>	1	1					
<i>Fraxinus pennsylvanica</i>	6		1	2	2	1	
<i>Hypericum</i>	1	1					
<i>Juglans nigra</i>	1	1					
<i>Lindera benzoin</i>	3	3					
<i>Liriodendron tulipifera</i>	4	4					
<i>Oxydendrum arboreum</i>	5	5					
<i>Pinus echinata</i>	4	4					
<i>Pinus taeda</i>	7	7					
<i>Platanus occidentalis</i>	13	12			1		
<i>Quercus</i>	1				1		
<i>Quercus laevis</i>	1						1
<i>Quercus rubra</i>	1						1
<i>Rosa multiflora</i>	1	1					
<i>Rosa setigera</i>	1	1					
<i>Salix nigra</i>	7	3		2	2		
<i>Sambucus</i>	1	1					
<i>Sambucus canadensis</i>	3				2	1	
<i>Tsuga canadensis</i>	1	1					
Unknown	6	4		1	1		
<i>Vaccinium</i>	5	3			2		
<b>TOTAL:</b>	<b>30</b>	<b>191</b>	<b>6</b>	<b>39</b>	<b>45</b>	<b>11</b>	<b>2</b>

**Table 4: Vegetation Damage by Plot  
Project Number and Name: 53, Brown Branch**

	<b>Plot</b>	<b>All Damage Categories</b>	<b>No Damage</b>	<b>Deer</b>	<b>Diseased</b>	<b>Insects</b>	<b>Unknown</b>	<b>Vine Strangulation</b>
	00008-01-BBP10	9	7			1	1	
	00008-01-BBP11	28	10	1	2	12	3	
	00008-01-BBP12	16	14					2
	00008-01-BBP1	5	4			1		
	00008-01-BBP2	11	6	1		4		
	00008-01-BBP3	11	4	3	3	1		
	00008-01-BBP4	33	8		8	13	4	
	00008-01-BBP5	12	9			3		
	00008-01-BBP6	11	5		6			
	00008-01-BBP7	30	10		9	9	2	
	00008-01-BBP8	15	5	1	7	1	1	
	00008-01-BBP9	10	6		4			
<b>TOTAL:</b>	<b>12</b>	<b>191</b>	<b>88</b>	<b>6</b>	<b>39</b>	<b>45</b>	<b>11</b>	<b>2</b>

**Table 5: Vegetation Stem Count by Plot and Species  
Project Number and Name: 53, Brown Branch**

	Species	Total Stems	# plots	Average # stems	plot 00008-01-BBP10	plot 00008-01-BBP11	plot 00008-01-BBP12	plot 00008-01-BBP1	plot 00008-01-BBP2	plot 00008-01-BBP3	plot 00008-01-BBP4	plot 00008-01-BBP5	plot 00008-01-BBP6	plot 00008-01-BBP7	plot 00008-01-BBP8	plot 00008-01-BBP9
	<i>Alnus</i>	5	1	5		5										
	<i>Alnus serrulata</i>	12	3	4					3			1		8		
	<i>Betula lenta</i>	19	4	4.8	1	5									9	4
	<i>Betula nigra</i>	55	6	9.2					1	3	24	6	7	14		
	<i>Cornus amomum</i>	4	3	1.3		2	1			1						
	<i>Diospyros virginiana</i>	1	1	1						1						
	<i>Fraxinus pennsylvanica</i>	6	4	1.5					1		2			1	2	
	<i>Hypericum</i>	1	1	1					1							
	<i>Lindera benzoin</i>	3	1	3			3									
	<i>Platanus occidentalis</i>	1	1	1				1								
	<i>Quercus</i>	1	1	1		1										
	<i>Quercus laevis</i>	1	1	1			1									
	<i>Quercus rubra</i>	1	1	1			1									
	<i>Salix nigra</i>	5	2	2.5						3		2				
	<i>Sambucus canadensis</i>	3	1	3		3										
	Unknown	2	1	2							2					
	<i>Vaccinium</i>	3	2	1.5	2						1					
<b>TOTAL:</b>	<b>17</b>	<b>123</b>	<b>17</b>		<b>3</b>	<b>16</b>	<b>6</b>	<b>1</b>	<b>6</b>	<b>8</b>	<b>29</b>	<b>9</b>	<b>7</b>	<b>23</b>	<b>11</b>	<b>4</b>
Total Stems per acre						648	243	40	243	324	1174	364	283	931	445	162
<b>AVG STEMS PER ACRE</b>	<b>405</b>															





## **APPENDIX B**

1. Stream Problem Areas Table B.1
2. Representative Stream Problem Areas Photos
3. Exhibit Table B.2 - Visual Morphological Stability Assessment
4. Annual Overlays of Cross Section Plots (with Photos)
5. Annual Overlays of Longitudinal Plots
6. Annual Overlays of Pebble Count Frequency Distribution Plots

<b>Exhibit Table B.1 - Stream Problem Areas</b>			
<b>Feature/Issue</b>	<b>Station/Range</b>	<b>Problem Cause</b>	<b>Photo #</b>
Engineered Structures	25+80	Slumping of structure	4
	29+50	possible fish passage barrier	5
	29+75	Slumping of structure	6
Bank Scour	3+30 to 3+50	left bank scour - stressed in past	1
	5+75 to 6+25	Bank Scour failed in the past	2
Aggradation/ Bar	9+50 to 10+00	Mid-channel bar	3
	33+10 to 33+30	Mid-channel bar	7
	40+00 to 40+50	Mid-channel bar	8
	42+25 to 42+40	Mid-channel bar	9
	42+75 to 42+90	Mid-channel bar	10
	43+20 to 43+50	Mid-channel bar	10
	48+50 to 50+00	Aggradation in bed/ Beaver	11 and 12

North Carolina Ecosystem Enhancement Program (NC EEP)  
 Problem Area Photo Log

	<p><b>PHOTOLOG SHEET</b></p>
	<p>Site: Brown Branch Station 3+30</p>
	<p>Caldwell County, North Carolina</p>
	<p>Project No: 6470-06-1410</p>
	<p>Date: December, 2007</p>
	<p>Photo #: 1</p>
<p>Photographed by: R. Sain</p>	
<p>Description: Photo taken facing up stream; right bank is in a stressed condition from prior erosion. Vegetation has established, not likely a long term problem.</p>	
	<p>Site: Brown Branch Station 5+75</p>
	<p>Caldwell County, North Carolina</p>
	<p>Project No: 6470-06-1410</p>
	<p>Date: December, 2007</p>
	<p>Photo #: 2</p>
	<p>Photographed by: R. Sain</p>
<p>Description: Photo taken facing down stream just downstream of log foot bridge; left bank appears to have failed several times.</p>	



North Carolina Ecosystem Enhancement Program (NC EEP)  
 Problem Area Photo Log

	<p><b>PHOTOLOG SHEET</b></p> <p>Site: Brown Branch Station 9+50</p> <p>Caldwell County, North Carolina</p> <p>Project No: 6470-06-1410</p> <p>Date: December, 2007</p> <p>Photo #: 3</p> <p>Photographed by: R. Sain</p> <p>Description:        Photo taken facing up stream; mid-channel bar is well vegetated applying only moderate near bank stress, not likely to cause long term problems.</p>
	<p>Site: Brown Branch Station 25+80</p> <p>Caldwell County, North Carolina</p> <p>Project No: 6470-06-1410</p> <p>Date: December, 2007</p> <p>Photo #: 4</p> <p>Photographed by: R. Sain</p> <p>Description:        Photo taken facing down stream; Rock and log structures have experienced some stress that is causing slumping.</p>



North Carolina Ecosystem Enhancement Program (NC EEP)  
 Problem Area Photo Log

<b>PHOTOLOG SHEET</b>	
	Site: Brown Branch Station 29+50 Caldwell County, North Carolina Project No: 6470-06-1410 Date: December, 2007 Photo #: 5 Photographed by: R. Sain
	Description: Photo taken facing up stream; Rock cross-vane demonstrating a 2 foot drop into a plunge pool. This may act as a fish barrier for migrating fish such as salmonids in the future.
	Site: Brown Branch Station 29+75 Caldwell County, North Carolina Project No: 6470-06-1410 Date: December, 2007 Photo #: 6 Photographed by: R. Sain
	Description: Photo taken facing up stream; Rock structure has experienced some stress that is causing slumping.

North Carolina Ecosystem Enhancement Program (NC EEP)  
 Problem Area Photo Log

	<p><b>PHOTOLOG SHEET</b></p> <p>Site: Brown Branch                  Station 33+10</p> <p>Caldwell County, North                  Carolina</p> <p>Project No: 6470-06-1410</p> <p>Date: December, 2007</p> <p>Photo #: 7</p> <p>Photographed by: R. Sain</p> <p>Description:                  Photo taken facing down                  stream; mid-channel bar and                  adjacent banks are well                  vegetated applying only                  moderate near bank stress, not                  likely to cause long term                  problems.</p>
	<p>Site: Brown Branch                  Station 40+00</p> <p>Caldwell County, North                  Carolina</p> <p>Project No: 6470-06-1410</p> <p>Date: December, 2007</p> <p>Photo #: 8</p> <p>Photographed by: R. Sain</p> <p>Description:                  Photo taken facing down                  stream; mid-channel bar and                  adjacent banks are well                  vegetated applying only                  moderate near bank stress, not                  likely to cause long term                  problems.</p>

North Carolina Ecosystem Enhancement Program (NC EEP)  
 Problem Area Photo Log

	<p><b>PHOTOLOG SHEET</b></p> <p>Site: Brown Branch Station 42+25</p> <p>Caldwell County, North Carolina</p> <p>Project No: 6470-06-1410</p> <p>Date: December, 2007</p> <p>Photo #: 9</p> <p>Photographed by: R. Sain</p> <p>Description:        Photo taken facing down stream; mid-channel bar and adjacent banks are well vegetated applying only moderate near bank stress, not likely to cause long term problems.</p>
	<p>Site: Brown Branch Station 42+75 and 43+20</p> <p>Caldwell County, North Carolina</p> <p>Project No: 6470-06-1410</p> <p>Date: December, 2007</p> <p>Photo #: 10 and representative of # 11</p> <p>Photographed by: R. Sain</p> <p>Description:        Photo taken facing down stream; mid-channel bar and adjacent banks are well vegetated applying only moderate near bank stress, not likely to cause long term problems.</p>

North Carolina Ecosystem Enhancement Program (NC EEP)  
 Problem Area Photo Log

	<p><b>PHOTOLOG SHEET</b></p> <p>Site: Brown Branch                  Station 48+50 to 50+00                  Caldwell County, North Carolina                  Project No: 6470-06-1410                  Date: December, 2007                  Photo #: 11                  Photographed by: R. Sain</p> <p>Description:                  Photo taken from the right bank, looking downstream; show the remaining backwater effect and associated aggradation caused from the beaver dam. Dam is approximately 4.5 feet tall by 40 feet wide.</p>
	<p>Site: Brown Branch                  Station 50+30                  Caldwell County, North Carolina                  Project No: 6470-06-1410                  Date: December, 2007                  Photo #: 12                  Photographed by: R. Sain</p> <p>Description:                  Photo taken looking up stream; shows the remaining backwater effect from the beaver dam, a breach in the dam. Ice and debris have clogged the breach. Recommending some future removal of the entire structure.</p>



**Table B.2. Qualitative Visual Stability Assessment**

**Project Number #53**

**Segment/Reach: Brown Branch (5100 feet)**

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	28	28	NA	100	
	2. Armor stable (e.g. no displacement)?	28	28	NA	100	
	3. Facet grade appears stable?	20	28	NA	71	
	4. Minimal evidence of embedding/ fining?	8	28	NA	29	
	5. Length Appropriate?	28	28	NA	100	<b>80</b>
B. Pools	1. Present? (e.g not subject to severe aggradation or migration?)	32	34	NA	94	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	32	34	NA	94	
	3. Length Appropriate?	34	34	NA	100	<b>96</b>
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	34	34	NA	100	
	2. Downstream of meander (glide/inflection) centering?	34	34	NA	100	<b>100</b>
D. Meanders	1. Outer bend in state of limited/controlled erosion?	37	38	NA	97	
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	NA	NA	
	3. Apparent Rc within spec?	38	38	NA	100	
	4. Sufficient floodplain access and relief?	38	38	NA	100	<b>99</b>
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	7 / 150ft	95	
	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	1 / 10ft	90	<b>93</b>
F. Banks	1. Actively eroding, wasting, or slumping bank	NA	NA	9 / 250ft	99	<b>99</b>
G. Vanes	1. Free of back or arm scour?	31	33	NA	94	
	2. Height appropriate?	32	33	NA	97	
	3. Angle and geometry appear appropriate?	32	33	NA	97	
	4. Free of piping or other structural failures?	32	33	NA	97	<b>96</b>
H. Wads/ Boulders	1. Free of scour?	1	2	NA	50	
	2. Footing stable?	2	2	NA	100	<b>75</b>

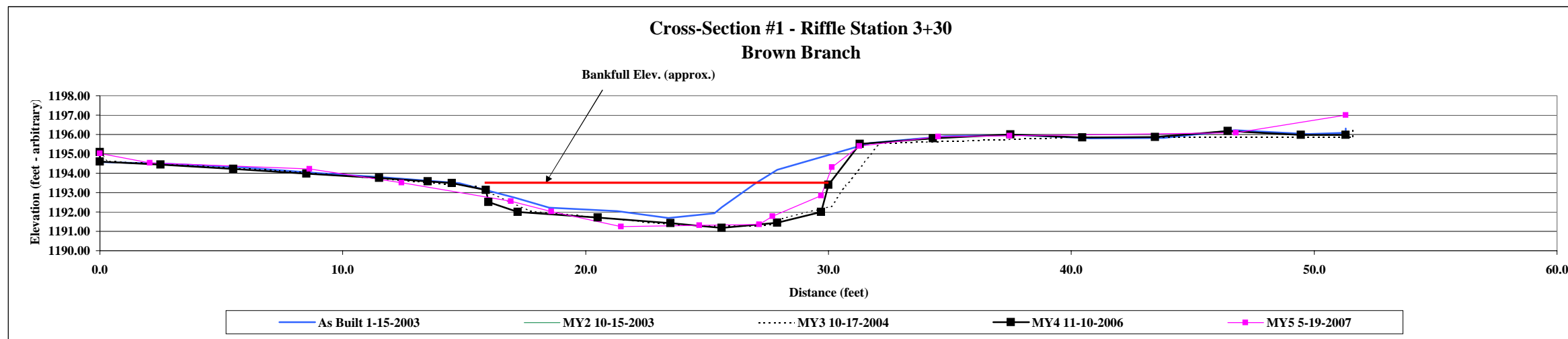
Project Name Brown Branch  
 Cross Section #1  
 Feature Riffle  
 Date Surveyed 5/19/2007  
 Crew Spears, J. Smith(Cav.)

1/15/2003 As-Built Survey			10/15/2003 MY2 Survey			10/17/2004 MY3 Survey			11/10/2006 MY4 Survey			5/19/2007 MY5 Survey		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0.0	1195.09	lp	0.0	1195.09	lp	0	1195.09	lp	0	1195.09	lp	0.00	1195.03	Lpin
0.0	1194.58		0.0	1194.59		0.3	1194.62		0	1194.59		2.05	1194.54	
2.8	1194.49		2.5	1194.44		7.4	1194.14		2.5	1194.44		8.63	1194.22	
5.8	1194.32		5.5	1194.22		15.5	1193.31	bkf	5.5	1194.22		12.43	1193.51	est. bkf
8.8	1194.02		8.5	1193.98		17.7	1192.05		8.5	1193.98		16.92	1192.56	
11.8	1193.77		11.5	1193.76		21.7	1191.58		11.5	1193.76		18.59	1192.02	
14.8	1193.50	bkf	13.5	1193.57		23.5	1191.35		13.5	1193.57		21.47	1191.24	
17.1	1192.73		14.5	1193.49	bkf	25.3	1191.26		14.5	1193.49	bkf	24.68	1191.31	
18.5	1192.23		15.9	1193.14		27	1191.28		15.9	1193.14		27.15	1191.36	
21.3	1192.05		16.0	1192.51		27.7	1191.34		16	1192.51		27.70	1191.78	
23.4	1191.68		17.2	1192		28.1	1191.67		17.2	1192		29.70	1192.84	
25.3	1191.94		20.5	1191.71		30.1	1192.28		20.5	1191.71		30.15	1194.30	
25.6	1192.24		23.5	1191.42		30.7	1193.36		23.5	1191.42		31.27	1195.40	
27.0	1193.50	bkf	25.6	1191.17		32.1	1195.54		25.6	1191.17		34.53	1195.88	
27.9	1194.17		27.9	1191.44		40.6	1195.87		27.9	1191.44		37.46	1195.93	
31.7	1195.55		29.7	1192		51.6	1195.87		29.7	1192		46.77	1196.10	
34.8	1195.90		30.0	1193.4		51.6	1196.26	rp	30	1193.4	bkf	51.30	1197.00	Rpin
37.8	1195.97		31.3	1195.52					31.3	1195.52				
40.8	1195.80		34.3	1195.81					34.3	1195.81				
43.8	1195.83		37.5	1196					37.5	1196				
46.8	1196.23		40.5	1195.85					40.45	1195.85				
49.8	1196.03		43.5	1195.86					43.45	1195.86				
51.3	1196.08		46.5	1196.17					46.45	1196.17				
51.3	1196.31	rp	49.5	1195.98					49.45	1195.98				
			51.3	1195.97	rp				51.3	1195.97	rp			



Photo (12-20-07) of Cross-Section #1 - Looking Upstream

Bankfull Area					
	As Built	MY2	MY3	MY4	MY5
Area	14.1	26.18	21.26	26.18	21.35
Width	12.2	16.5	15.2	16.5	17.7
Mean Depth	1.2	1.6	1.4	1.6	1.2
Max Depth	1.8	2.3	2.2	2.3	2.3
w/d ratio	10.6	10.4	10.9	10.4	14.7
FPW	>100	>100	>100	>100	>100
ER (greater than)	8.2	6.1	6.6	6.1	5.6
Stream Type	C	E	C	C	C



Project Name	Brown Branch
Cross Section	#2 (pins C-D)
Feature	Pool
Date Surveyed	5/19/2007
Crew	R. Spears, J. Smith(Cav.)

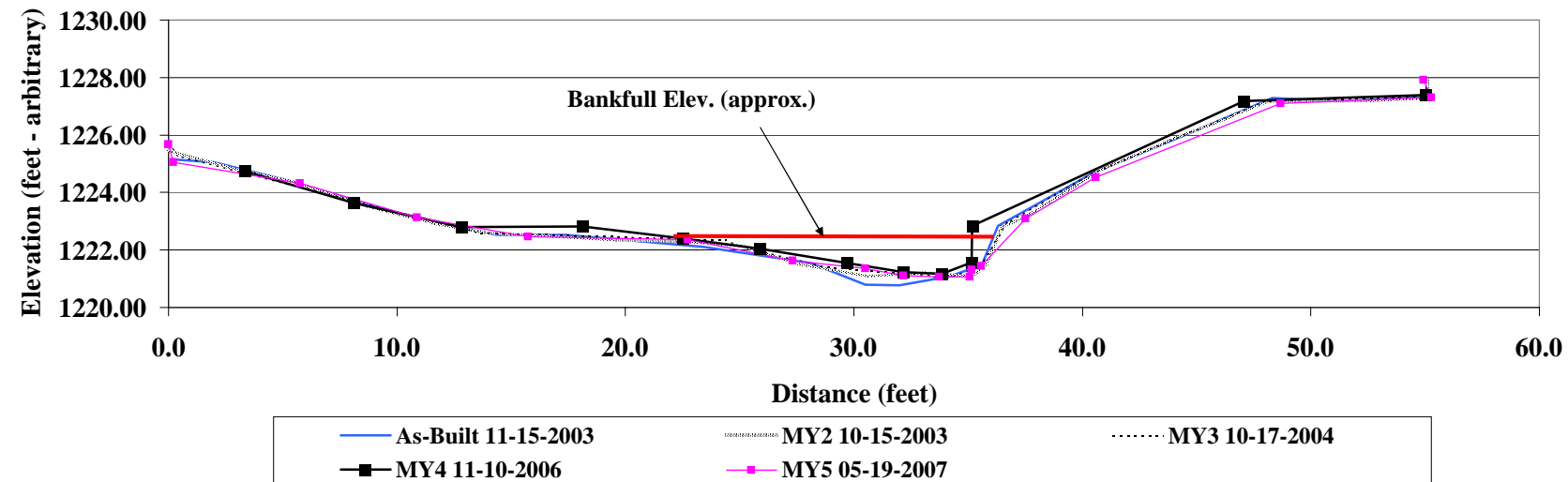
1/15/2003 As-Built Survey			10/15/2003 MY2 Survey			10/17/2004 MY3 Survey			11/10/2006 MY4 Survey			5/19/2007 MY5 Survey		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0.0	1225.63	lp	0	1225.64	lp	0	1225.69	lp	0.0	1225.2103	lp	0.0	1225.67	lp
0.1	1225.16		0	1225.46		0.4	1225.28		3.4	1224.733		0.2	1225.05	
2.0	1225.05		2.6	1224.89		13.6	1222.58	bkf	8.1	1223.64		5.8	1224.33	
5.4	1224.39		5.6	1224.34		24.4	1222.34		12.8	1222.805		10.9	1223.13	
8.4	1223.64		8.6	1223.54		24.9	1222.18		18.1	1222.82	bkf	15.7	1222.47	bkf
11.4	1222.98		11.6	1222.93		28.6	1221.41		22.5	1222.393		22.7	1222.36	
14.4	1222.53	bkf	14	1222.59	bkf	33.4	1221.11		25.9	1222.051		27.3	1221.63	
17.4	1222.52		16.6	1222.48		33.9	1220.95		29.7	1221.553		30.5	1221.35	
20.4	1222.31		19.6	1222.34		35.5	1221.39		32.2	1221.228		32.2	1221.10	
23.4	1222.10		22.6	1222.3		36.7	1222.93	bkf	33.8	1221.161		33.7	1221.07	
28.1	1221.54		25.2	1222.12		40.2	1224.58		35.1	1221.572		35.1	1221.06	
30.5	1220.79		27.5	1221.52		48	1227.18		35.2	1222.846	bkf	35.1	1221.31	
32.0	1220.77		30.6	1221.09		55	1227.33		47.1	1227.185		35.6	1221.44	
34.2	1221.08		33.1	1221.22		55.1	1227.85	rp	55.0	1227.389		37.5	1223.09	
35.6	1221.48		35.2	1221.09								40.6	1224.54	
36.3	1222.84	bkf	35.8	1221.5								48.7	1227.10	
40.5	1224.70		36.5	1222.79								55.3	1227.30	
45.1	1226.19		37.6	1223.17								54.9	1227.91	
48.3	1227.28		40.6	1224.72										
51.4	1227.18		43.6	1225.74										
55.2	1227.33		46.575	1226.67										
55.2	1227.91	rp	48.075	1227.17										
			52.575	1227.18										
			55.155	1227.29										
			55.155	1227.91	rp									



Photo (12-20-07) of Area 1 Cross-Section #2 - Looking downstream

	Bankfull Area				
	As-Built	2003	2004	2006	2007
Area	16.1	24.10	21.36	21.8	19.0
Width	21.9	24.2	36.3	34.3	26.6
Mean Depth	0.7	1.0	0.6	0.6	0.7
Max Depth	1.8	1.7	1.9	1.6	1.7

### Cross-Section #2 - Pool Station 10+70 Brown Branch



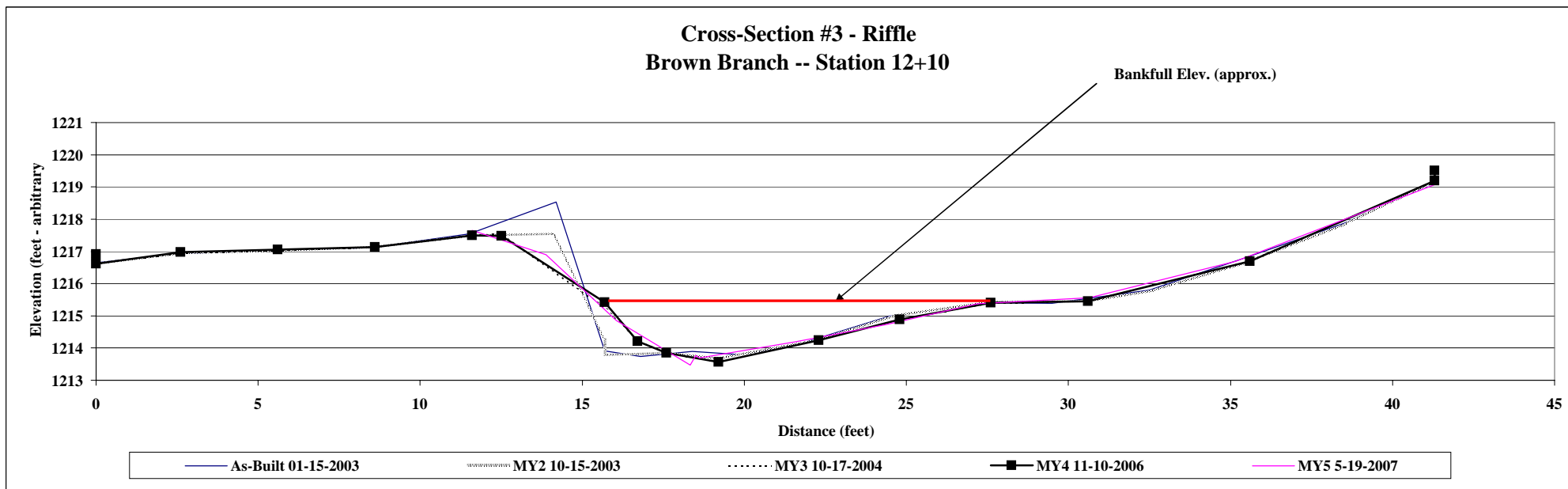
Project Name	Brown Branch
Cross Section	#3
Feature	Riffle
Date Surveyed	5/19/2007
Crew	R. Spears, J. Smith(Cav.)

1/15/2003 As-Built Survey			10/15/2003 MY2 Survey			10/17/2004 MY3 Survey			11/10/2006 MY4 Survey			5/19/2007 MY5 Survey		
Station	Elevation	Notes	Station	Elev*	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	1216.94		0	1216.95		0	1216.95		0	1216.92		0	1216.92	MY4 data
0	1216.64		0	1216.61		0	1216.61		0	1216.61		0	1216.61	
2.5	1216.93		2.6	1216.94		2.6	1216.94		2.6	1216.98		2.6	1216.98	
5.5	1217.03		5.6	1217.02		5.6	1217.02		5.6	1217.06		5.6	1217.06	
8.5	1217.12		8.6	1217.14		8.6	1217.14		8.6	1217.14		8.6	1217.14	
11.5	1217.54		11.6	1217.5		11.6	1217.5		11.6	1217.5		11.6	1217.65	start. MY5
14.2	1218.53		14.1	1217.54		12.5	1217.54		12.5	1217.48		13.9	1216.90	
15.7	1213.91	bkf	15.7	1214.28	bkf	15.7	1215.25		15.7	1215.42	bkf	16.1	1214.86	
16.8	1213.74		15.7	1213.78		16.7	1214.23		16.7	1214.21		18.3	1213.46	
18.4	1213.89		17.6	1213.85		17.6	1213.85		17.6	1213.85		18.5	1213.77	
19.8	1213.8		19.2	1213.67		19.2	1213.57		19.2	1213.57		18.6	1213.69	
21.4	1214.04		22.3	1214.25		22.3	1214.24		22.3	1214.24		21.6	1214.19	
24.5	1215		24.6	1215	0	24.8	1214.88		24.8	1214.88		24.4	1214.73	
27.5	1215.41	bkf	27.6	1215.44	bkf	27.6	1215.39	bkf	27.6	1215.4	bkf	27.2	1215.38	est. bkf
29.5	1215.39		30.6	1215.45		30.6	1215.45		30.6	1215.45		30.6	1215.56	
32.5	1215.79		32.6	1215.78		35.6	1216.69		35.6	1216.69		35.2	1216.70	
35.5	1216.82		35.6	1216.69		41.3	1219.2		41.3	1219.2		41.3	1219.09	
38.5	1217.87		38.6	1217.88		41.3	1219.5		41.3	1219.5				
41.3	1219.14		41.3	1219.18										
41.3	1219.49		41.3	1219.5										



Photo (12-20-07) of Cross-Section #3 - Looking Upstream

Bankfull Area					
	As-Built	2003	2004	2006	2007
Area	15.8	15.98	14.21	14.96	14.02
Width	13.8	11.9	11.9	14.9	14.6
Mean Depth	1.1	1.3	1.19	1.00	0.96
Max Depth	1.7	1.7	1.8	1.8	1.9
w/d ratio	12.1	8.9	10.0	14.8	14.8
FPW		>100			
ER (greater than)	7.2	8.4	8.4	6.7	6.9
Stream Type	C	C	E	E	E



**Project Name** Brown Branch  
**Cross Section** #4  
**Feature** Pool  
**Date Surveyed** 5/19/2007  
**Crew** R. Spears, J. Smith(Cav.)

1/15/2003 As-Built Survey			10/15/2003 MY2 Survey			10/17/2004 MY3 Survey			11/10/2006 MY4 Survey			5/19/2007 MY5 Survey		
Station	Elevation	Notes	Station	Elev*	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0.0	1213.65		0	1213.65		0	1213.64		0	1213.65		0	1213.65	Lpin
0.0	1213.33		0.0	1213.34		0.1	1213.74		9.97486549	1209.8427		10.07486549	1209.824	
1.8	1213.33		1.8	1213.24		0.2	1212.64		15.0523442	1209.3629 bkf		15.15234423	1209.943	
5.3	1211.57		5.4	1211.37		0.3	1213.59		21.7145223	1207.5592		21.81452229	1209.463	
8.1	1210.36		8.4	1210.25		0.3	1213.59		23.0509778	1206.8164		23.15097776	1207.659	
10.6	1209.66 bkf		11.6	1209.54	bkf	10.7	1209.6	bkf	23.7498776	1206.4014		23.8498776	1206.916	
13.6	1209.36		14.4	1209.27		13.7	1209.2		27.1113721	1206.843		27.21137209	1206.501	
16.6	1208.91		17.4	1208.88		20.3	1208.67		30.1316201	1207.3441		30.23162014	1206.943	
19.6	1208.53		20.4	1208.52		23.6	1207.93		33.370253	1207.9794		33.47025302	1207.444	
22.2	1208.15		23.4	1208.03		25.3	1207.75		35.9157631	1208.2808		36.0157631	1208.079	
23.9	1207.90		24.8	1207.92		28.1	1207.69		44.9547122	1209.1383		45.05471219	1209.564	
26.2	1207.69		26.7	1207.69		31.2	1208.31		51.3073468	1212.3219		51.40734676	1212.1534	
28.1	1207.67		28.1	1207.48		35.4	1210.01		53.7589617	1212.5012		53.85896169	1212.5012	
30.0	1208.18		30.2	1207.92		43.4	1210.68							
31.1	1208.74		30.5	1208.63		47.2	1212.22							
33.6	1209.63		34.5	1209.69		50.6	1213.8							
36.6	1210.17		37.4	1210.26		52.9	1214.8							
39.6	1210.35		40.4	1210.43		52.9	1214.82							
42.6	1210.61		43.1	1210.74		53.1	1214.86							
45.6	1211.60		46.4	1212										
48.6	1213.11		49.4	1213.53										
51.6	1214.29		52.4	1214.43										
52.9	1214.54		52.9	1214.53										
52.9	1214.85		52.9	1214.85										



Bankfull Area					
	As-Built	2003	2004	2006	2007
Area	23.3	23.78	26.72	36.10	31.40
Width	23.0	25.8	32.7	20.9	29.9
Mean Depth	1.0	0.9	0.8	1.7	1.0
Max Depth	1.9	1.9	1.9	3.2	3.1

**Cross-Section #4 - Pool**  
**Brown Branch -- Station 19+40**

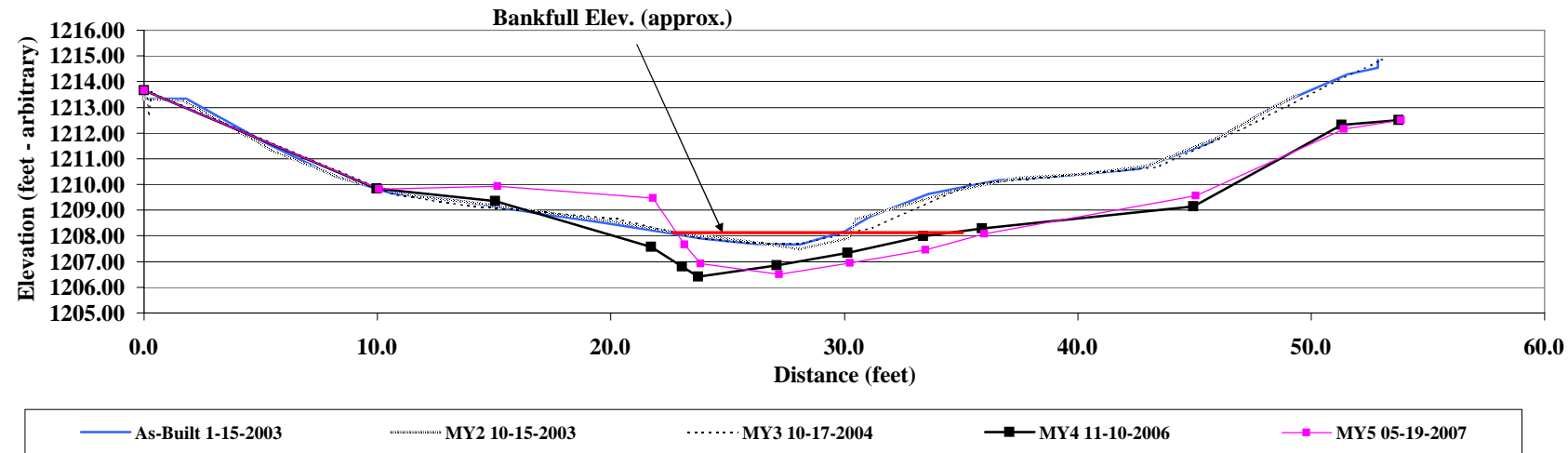


Photo (12-20-07) of Cross-Section #4 -  
 Looking Upstream

Project Name Brown Branch  
 Cross Section #5  
 Feature Riffle  
 Date Surveyed 5/19/2007  
 Crew R. Spears, J. Smith(Cav.)

2006 data adjusted 19.71' horizontal

1/15/2003 As-Built Survey			10/15/2003 MY2 Survey			10/17/2004 MY3 Survey			11/10/2006 MY4 Survey			5/19/2007 MY5 Survey		
Station	Elevation	Notes	Station	Elev*	Notes	Station	Elev**	Notes	Station	Elev**	Notes	Station	Elev**	Notes
0.00	1196.58	lp	0.0	1196.58	p	0.0	1196.58	lp	75.9	1196.28579	lp	0.0	1196.6276	LP
0.00	1196.22		0.0	1196.03		0.0	1196.48		72.4	1196.18238		0.0	1196.0947	
2.20	1196.27		2.5	1196.19		19.2	1195.6		67.9	1195.94811		6.8	1195.7394	
5.20	1196.04		5.5	1195.9		25.2	1195.29	bkf	62.7	1195.88472	bkf	17.6	1196.032	
8.20	1195.80		8.5	1195.67		29.1	1195.07		60.3	1196.18876		27.1	1195.4268	
11.20	1195.82		11.5	1195.63		31.2	1194.27		56.1	1195.99339		29.8	1195.4543	BKF
14.20	1195.72		14.5	1195.57		33.9	1194.41		52.6	1195.83419		32.3	1194.3996	lew
17.20	1195.57		17.5	1195.56		37.5	1194.42		50.2	1195.70203		34.4	1194.3415	
20.20	1195.73		20.5	1195.54		39.4	1194.12		46.8	1195.63492		36.5	1194.2597	
23.20	1195.60		23.5	1195.47		41.6	1193.86		43.5	1194.64225		36.7	1194.3663	rew
26.20	1195.32	bkf	26.5	1195.27		43.7	1193.98		43.5	1194.51261		37.0	1194.6887	
29.20	1194.69		29.5	1195.29	bkf	45.6	1194.59		41.0	1194.32406		39.1	1194.7651	
30.80	1194.53		31.2	1194.21		46.5	1195.72		38.9	1194.57548		40.0	1194.1901	lew
32.90	1194.36		33.5	1194.35		56.0	1196.58		37.7	1194.80935		41.2	1193.9456	TWG
35.10	1194.42		36.5	1194.47		56.2	1196.95	rp	36.5	1194.79887		42.4	1194.061	
38.40	1194.67		39.2	1194.05					36.1	1194.19463		43.6	1193.9895	
41.90	1194.58	bkf	41.9	1193.81					32.3	1194.21518		43.6	1194.1854	rew
45.20	1195.59		43.5	1194.05					31.7	1194.59799		44.1	1194.4688	
48.20	1196.00		45.6	1194.57					28.9	1195.9336		45.8	1194.666	
51.20	1196.34		45.8	1195.62					25.9	1196.31752		47.3	1195.8476	BKF
54.20	1196.47		48.5	1195.97					23.3	1196.46499		53.4	1196.3501	
56.25	1196.67		51.5	1196.25					19.7	1196.72371	rp	56.1	1196.5924	
56.25	1196.94	rp	54.5	1196.48								56.4	1196.9713	RPIN
			56.3	1196.61										
			56.3	1196.94	rp									



	Bankfull Area				
	As-Built	2003	2004	2006	2007
Area	9.7	14.92	15.12	11.54	15.92
Width	15.7	16.1	20.4	17.9	17.5
Mean Depth	0.6	0.9	0.7	0.6	0.9
Max Depth	1.0	1.5	1.5	1.1	1.6
w/d ratio	25.4	17.4	27.5	27.8	19.3
FPW		>100			
ER (greater than)	6.4	6.2	4.9	5.6	5.7
Stream Type	E	E	E	E	E

Cross-Section #5 - Riffle Station 43+00  
Brown Branch

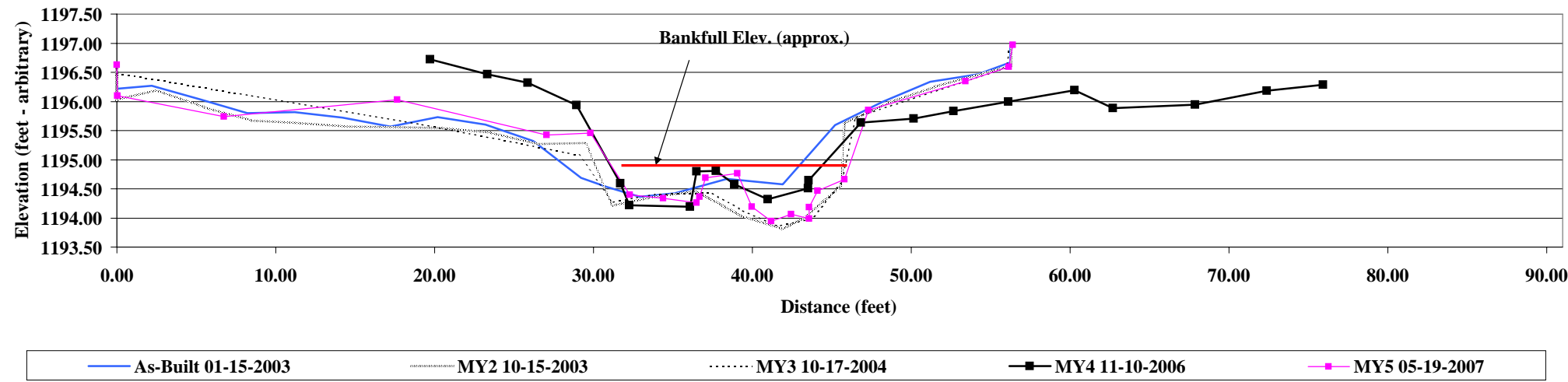


Photo (12-20-07) of Cross-Section #5 - Looking Downstream

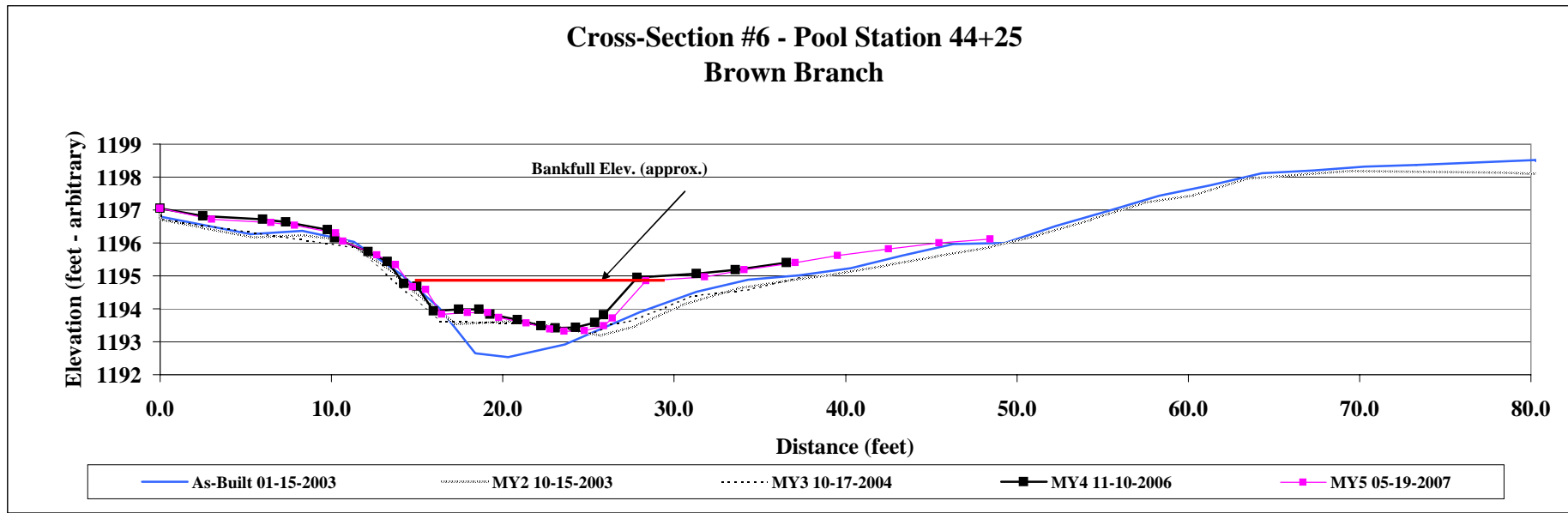
**Project Name** Brown Branch  
**Cross Section** #6  
**Feature** Pool  
**Date Surveyed** 5/19/2007  
**Crew** R. Spears, J. Smith(Cav.)

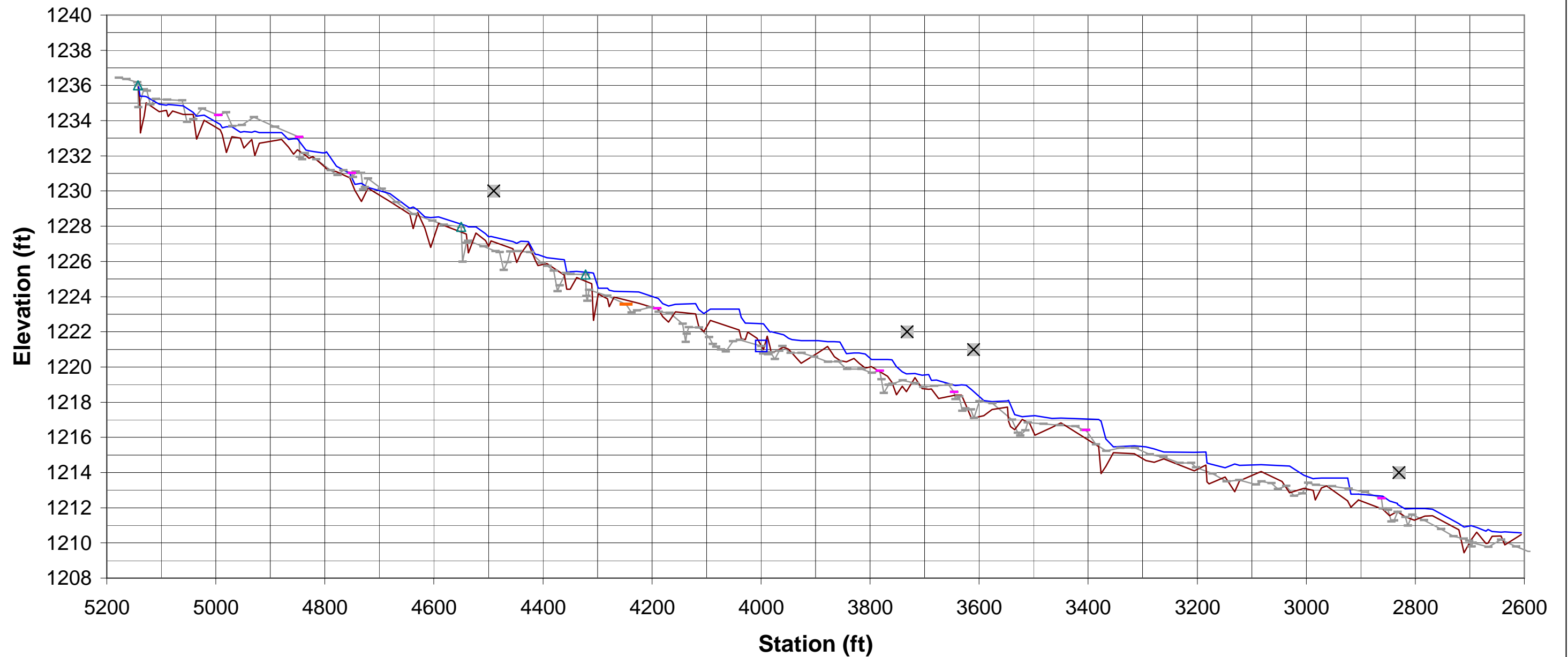
1/15/2003 As-Built Survey			10/15/2003 MY2 Survey			10/17/2004 MY3 Survey			11/10/2006 MY4 Survey			5/19/2007 MY5 Survey		
Station	Elevation	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0.0	1197.06		0	1197.04		0	1197.05		0.00	1197.05		0.00	1197.05	
0.0	1196.8		0.00	1196.71		0.10	1196.72		2.51	1196.82		3.01	1196.72	
2.3	1196.56		2.40	1196.47		11.20	1195.87		5.98	1196.72		6.48	1196.62	
5.3	1196.27		5.40	1196.16		11.40	1195.88		7.34	1196.64		7.84	1196.54	
8.3	1196.37		8.40	1196.24		16.30	1193.61		9.76	1196.40		10.26	1196.30	
11.3	1196.04		10.90	1196.06		21.50	1193.55		10.18	1196.15		10.68	1196.05	
14.1	1195.04 bkf		13.80	1195.03 bkf		25.20	1193.25		12.15	1195.74		12.65	1195.64	
16.3	1194.02		14.80	1194.57		25.80	1193.39		13.25	1195.43 bkf		13.75	1195.33 bkf	
18.4	1192.65		17.20	1193.53		26.10	1193.52		14.24	1194.77		14.74	1194.67	
20.3	1192.54		20.40	1193.62		27.40	1193.62		15.01	1194.68		15.51	1194.58	
23.6	1192.92		22.60	1193.51		29.30	1194.00		15.94	1193.94		16.44	1193.84	
28.0	1193.9		25.70	1193.18		31.00	1194.38		17.43	1193.98		17.93	1193.88	
31.3	1194.52		27.80	1193.49		34.40	1194.58		18.61	1193.99		19.11	1193.89	
34.3	1194.88		30.40	1194.10		37.50	1194.96 bkf		19.26	1193.83		19.76	1193.73	
37.3	1195.02 bkf		33.70	1194.62					20.86	1193.66		21.36	1193.56	
40.3	1195.24		36.40	1194.84					22.24	1193.48		22.74	1193.38	
43.3	1195.62		39.40	1195.05 bkf					23.08	1193.42		23.58	1193.32	
46.3	1195.96		42.40	1195.32					24.27	1193.44		24.77	1193.34	
49.3	1196		45.40	1195.60					25.39	1193.59		25.89	1193.49	
52.3	1196.52		48.40	1195.87					25.89	1193.82		26.39	1193.72	
55.3	1196.96		51.40	1196.25					27.85	1194.95		28.35	1194.85	
58.3	1197.43		54.40	1196.72					31.29	1195.06 bkf		31.79	1194.96 bkf	
61.3	1197.75		57.40	1197.21					33.58	1195.19		34.08	1195.19	
64.3	1198.11		60.40	1197.45					36.55	1195.40		37.05	1195.40	
67.3	1198.2		63.40	1197.95								39.53	1195.61	
70.3	1198.32		66.40	1198.07								42.50	1195.82	
73.3	1198.37		69.40	1198.19								45.47	1196.00	
80.3	1198.51		78.40	1198.14								48.45	1196.11	
80.3	1198.48		80.30	1198.11										

	Bankfull Area				
	As-Built	2003	2004	2006	2007
Area	31.2	26.13	26.63	16.49	17.95
Width	26.2	28.6	26.1	20.6	21.0
Mean Depth	1.2	0.9	1.0	0.8	0.9
Max Depth	2.5	1.8	1.8	1.6	1.7



Photo (12-20-07) of Cross-Section #6 - Looking Upstream





**LEGEND**

- As-Built Thalweg Profile
- × Cross Sections
- MY5 Thalweg Profile
- Log Vanes
- Log J Vanes
- △ Cross Vanes
- Rock Vane
- MY5 Water Surface

**NOTES:**

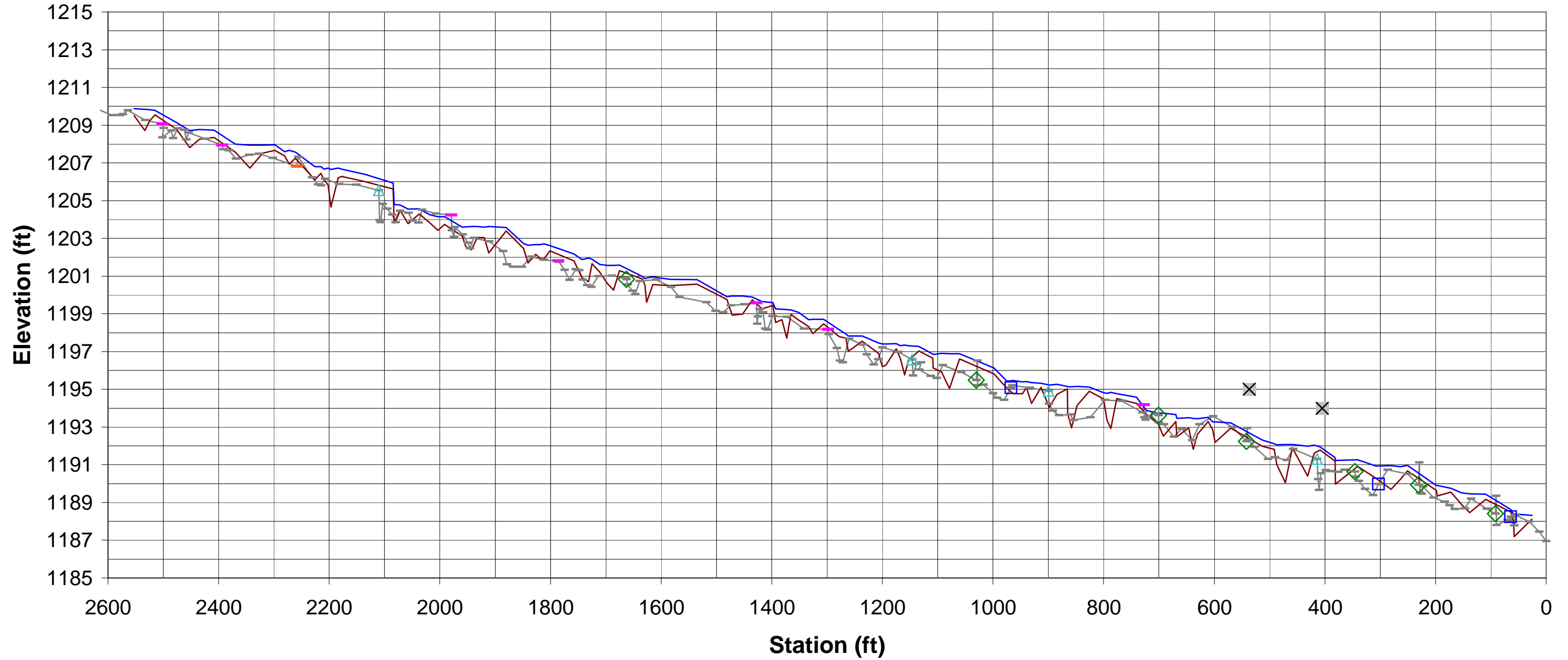
- 1) The As-Built thalweg stationing was done so in reverse order (ie.starting 0+00 from downstream, rather from upstream) from that of MY5; these differences lead to differences in the cumulative length and caused alignment issues.
- 2) Stationing of features shown above also may differ from As Built to MY5 due to differences in the field interpretation of thalweg.

**Longitudinal Profile  
Upstream Portion of Brown Branch**

**Baseline Monitoring Conditions**  
**As Built Survey Date: January 15, 2003**  
**MY5 Survey Date: May 19, 2007**

**Final**





**LEGEND**

- As-Built Thalweg Profile
- × Cross Sections
- MY5 Thalweg Profile
- Log Vanes
- Log J Vanes
- △ Cross Vanes
- ◇ Rock J Vanes
- Rock Vanes
- MY5 Water Surface

**NOTES:**

- 1) The As-Built thalweg stationing was done so in reverse order (ie.starting 0+00 from downstream, rather from upstream) from that of MY5; these differences lead to differences in the cumulative length and caused alignment issues.
- 2) Stationing of features shown above also may differ from As Built to MY5 due to differences in the field interpretation of thalweg.

**Longitudinal Profile  
Downstream Portion of Brown Branch**

**Baseline Monitoring Conditions**  
**As Built Survey Date: January 15, 2003**  
**MY5 Survey Date: May 19, 2007**

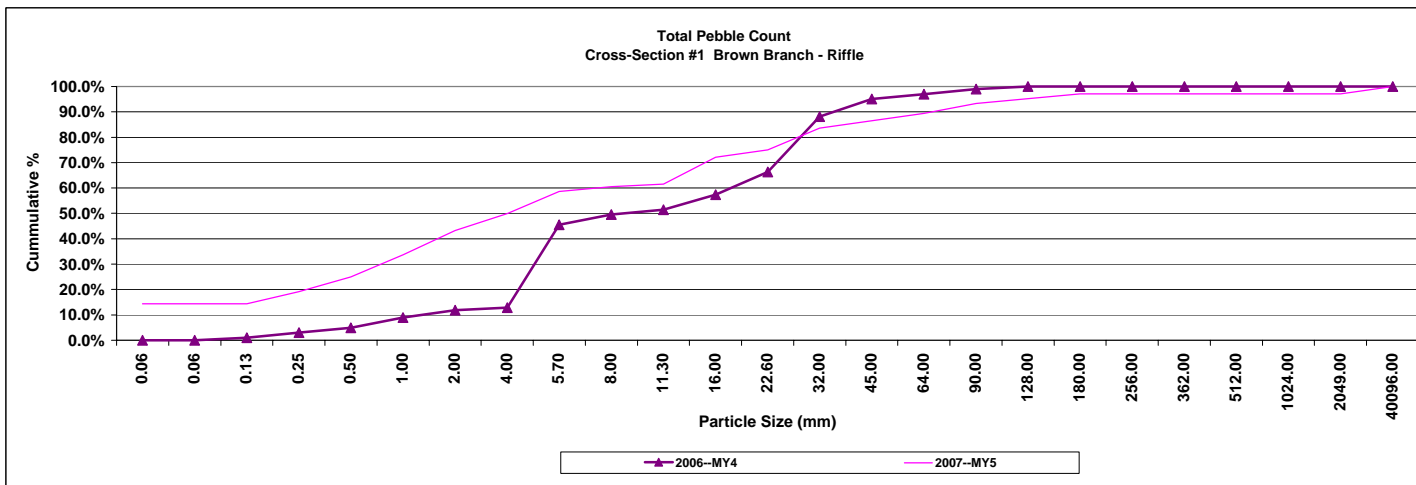
**Final**

<b>Project Name</b>	Brown Branch
<b>Cross Section</b>	#1
<b>Feature</b>	Riffle
<b>Date</b>	12/20/07
<b>Crew</b>	R. Sain
<b>Notes</b>	Pebble count data not available for 2002-2005.

Description	Material	2006--MY4				2007--MY5																					
		Size (mm)	Riffle - Bed	Riffle - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %	Riffle - Bed	Riffle - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %			
Silt/Clay	silt/clay	0.061			0.0%	0.0%						0.0%	0.0%	15		14.4%	14.4%						14.4%	14.4%			
Sand	very fine sand	0.062			0.0%	0.0%					0.0%	0.0%	0		0.0%	14.4%						0.0%	14.4%				
	fine sand	0.125	1		1.0%	1.0%					1.0%	1.0%	0		0.0%	14.4%						0.0%	14.4%				
	medium sand	0.25	2		2.0%	3.0%					2.0%	3.0%	5		4.8%	19.2%		0.249				4.8%	19.2%				
	course sand	0.50	2		2.0%	5.0%					2.0%	5.0%	6		5.8%	25.0%						5.8%	25.0%				
	very course sand	1.0	4		4.0%	8.9%					4.0%	8.9%	9		8.7%	33.7%						8.7%	33.7%				
Gravel	very fine gravel	2.0	3		3.0%	11.9%					3.0%	11.9%	10		9.6%	43.3%		1.71				9.6%	43.3%				
	fine gravel	4.0	1		1.0%	12.9%					1.0%	12.9%	7		6.7%	50.0%			4.85			6.7%	50.0%				
	medium gravel	5.7	33		32.7%	45.5%	5.04	6.20			32.7%	45.5%	9		8.7%	58.7%						8.7%	58.7%				
	medium gravel	8.0	4		4.0%	49.5%					4.0%	49.5%	2		1.9%	60.6%						1.9%	60.6%				
	medium gravel	11.3	2		2.0%	51.5%					2.0%	51.5%	1		1.0%	61.5%						1.0%	61.5%				
	course gravel	16.0	6		5.9%	57.4%					5.9%	57.4%	11		10.6%	72.1%						10.6%	72.1%				
	course gravel	22.6	9		8.9%	66.3%					8.9%	66.3%	3		2.9%	75.0%						2.9%	75.0%				
	very course gravel	32	22		21.8%	88.1%					21.8%	88.1%	9		8.7%	83.7%						8.7%	83.7%				
	very course gravel	45	7		6.9%	95.0%					6.9%	95.0%	3		2.9%	86.5%						2.9%	86.5%				
	Cobble	small cobble	64	2		2.0%	97.0%					2.0%	97.0%	3		2.9%	89.4%						2.9%	89.4%			
	medium cobble	90	2		2.0%	99.0%					2.0%	99.0%	4		3.8%	93.3%						3.8%	93.3%				
	large cobble	128	1		1.0%	100.0%					1.0%	100.0%	2		1.9%	95.2%						1.9%	95.2%				
	very large cobble	180			0.0%	100.0%					0.0%	100.0%	2		1.9%	97.1%						1.9%	97.1%				
Boulder	small boulder	256			0.0%	100.0%					0.0%	100.0%			0.0%	97.1%						0.0%	97.1%				
	small boulder	362			0.0%	100.0%					0.0%	100.0%			0.0%	97.1%						0.0%	97.1%				
	medium boulder	512			0.0%	100.0%					0.0%	100.0%			0.0%	97.1%						0.0%	97.1%				
	large boulder	1024			0.0%	100.0%					0.0%	100.0%			0.0%	97.1%						0.0%	97.1%				
	very large boulder	2049			0.0%	100.0%					0.0%	100.0%			0.0%	97.1%						0.0%	97.1%				
Bedrock	bedrock	40096			0.0%	100.0%					0.0%	100.0%	3		2.9%	100.0%						2.9%	100.0%				
<b>TOTAL / %of whole count</b>			101	0	100.0%						5.04	6.20	10.65	36.38	54.39	100.0%						0.25	1.71	4.85	40.42	149.50	100.0%

	d16	d35	d50	d84	d95
As Built	*	*	*	*	*
2003	*	*	*	*	*
2004	*	*	*	*	*
2005	*	*	*	*	*
2006	5.04	6.20	10.65	36.38	54.39
2007	0.25	1.71	4.85	40.42	149.50

\* Missing Data (Historical data not provided)

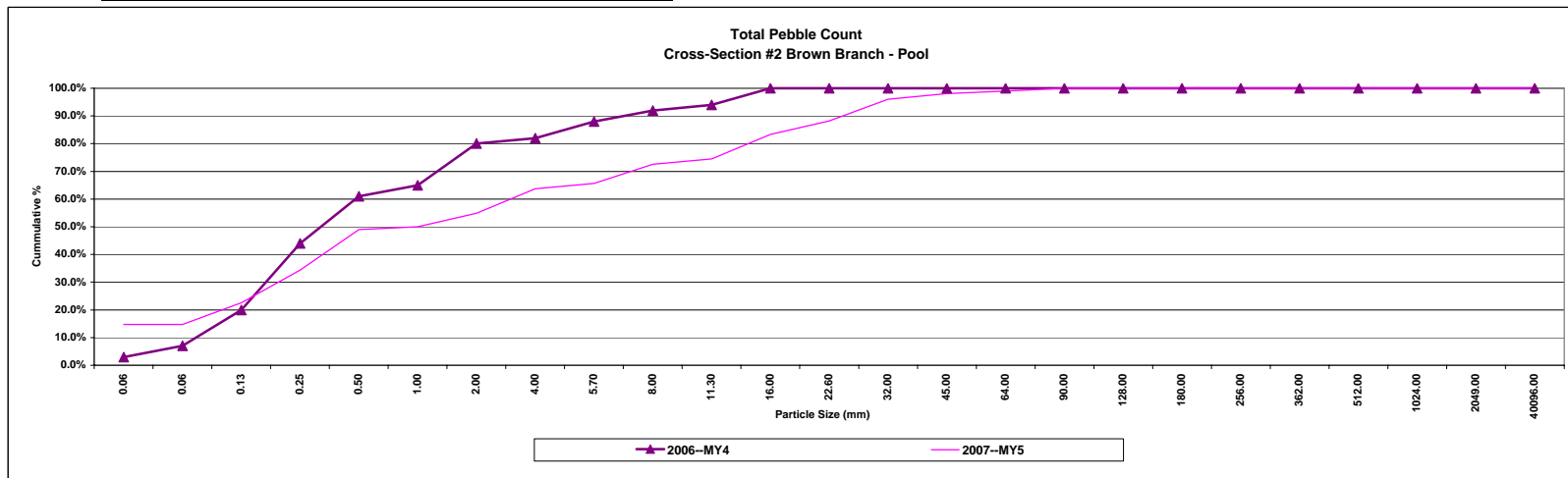


**Project Name** Brown Branch  
**Cross Section** #2  
**Feature** Pool  
**Date** 12/20/07  
**Crew** R. Sain  
**Notes** Pebble count data not available for 2000-2005.

Description	Material	2006--MY4					2007--MY5																		
		Size (mm)	Pool - Bed	Pool - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %	Pool - Bed	Pool - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %	
Silt/Clay	silt/clay	0.061	3		3.0%	3.0%						3.0%	3.0%	15		14.7%	14.7%						14.7%	14.7%	
Sand	very fine sand	0.062	4		4.0%	7.0%	0.16	0.30	0.51			4.0%	7.0%	0		0.0%	14.7%	0.11	0.39	1.50				0.0%	14.7%
	fine sand	0.125	13		13.0%	20.0%						13.0%	20.0%	8		7.8%	22.5%							7.8%	22.5%
	medium sand	0.25	24		24.0%	44.0%						24.0%	44.0%	12		11.8%	34.3%							11.8%	34.3%
	course sand	0.50	17		17.0%	61.0%						17.0%	61.0%	15		14.7%	49.0%							14.7%	49.0%
	very course sand	1.0	4		4.0%	65.0%						4.0%	65.0%	1		1.0%	50.0%							1.0%	50.0%
Gravel	very fine gravel	2.0	15		15.0%	80.0%	5.52	14.59				15.0%	80.0%	5		4.9%	54.9%	20.39	36.96					4.9%	54.9%
	fine gravel	4.0	2		2.0%	82.0%						2.0%	82.0%	9		8.8%	63.7%							8.8%	63.7%
	fine gravel	5.7	6		6.0%	88.0%						6.0%	88.0%	2		2.0%	65.7%							2.0%	65.7%
	medium gravel	8.0	4		4.0%	92.0%						4.0%	92.0%	7		6.9%	72.5%							6.9%	72.5%
	medium gravel	11.3	2		2.0%	94.0%						2.0%	94.0%	2		2.0%	74.5%							2.0%	74.5%
	course gravel	16.0	6		6.0%	100.0%						6.0%	100.0%	9		8.8%	83.3%							8.8%	83.3%
	course gravel	22.6			0.0%	100.0%						0.0%	100.0%	5		4.9%	88.2%							4.9%	88.2%
	very course gravel	32			0.0%	100.0%						0.0%	100.0%	8		7.8%	96.1%							7.8%	96.1%
	very course gravel	45			0.0%	100.0%						0.0%	100.0%	2		2.0%	98.0%							2.0%	98.0%
Cobble	small cobble	64			0.0%	100.0%	0.0%	100.0%	1		1.0%	99.0%	1.0%	99.0%											
	medium cobble	90			0.0%	100.0%	0.0%	100.0%	1		1.0%	100.0%	1.0%	100.0%											
	large cobble	128			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
	very large cobble	180			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
	small boulder	256			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
Boulder	small boulder	362			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
	medium boulder	512			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
	large boulder	1024			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
	very large boulder	2049			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
Bedrock	bedrock	40096			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
<b>TOTAL / %of whole count</b>			100	0	100.0%		0.16	0.30	0.51	5.52	14.59	100.0%		102	0	100.0%		0.11	0.39	1.50	20.39	36.96	100.0%		

	d16	d35	d50	d84	d95
As Built	*	*	*	*	*
2003	*	*	*	*	*
2004	*	*	*	*	*
2005	*	*	*	*	*
2006	0.16	0.30	0.51	5.52	14.59
2007	0.11	0.39	1.50	20.39	36.96

\* Missing Data (Historical data not provided)

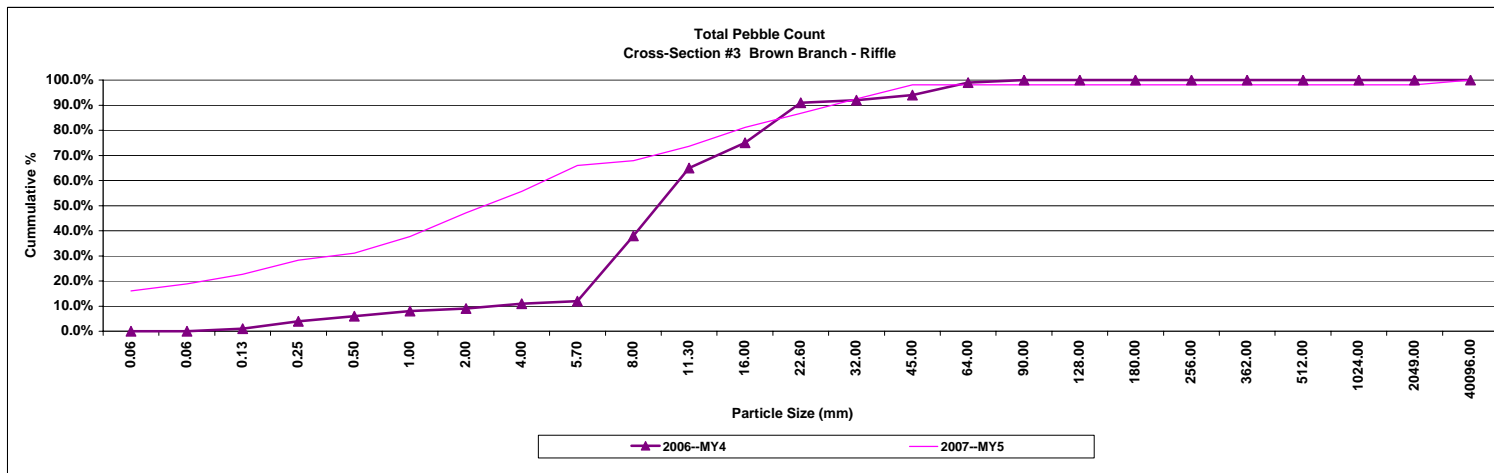


<b>Project Name</b>	Brown Branch
<b>Cross Section</b>	#3
<b>Feature</b>	Riffle
<b>Date</b>	12/20/07
<b>Crew</b>	R. Sain
<b>Notes</b>	Pebble count data not available for 2000-2005.

2006--MY4						2007--MY5																							
Description	Material	Size (mm)	Riffle - Bed	Riffle - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %	Riffle - Bed	Riffle - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %					
Silt/Clay	silt/clay	0.061	0		0.0%	0.0%						0.0%	0.0%	17		16.0%	16.0%						16.0%	16.0%					
Sand	very fine sand	0.062	0		0.0%	0.0%						0.0%	0.0%	3		2.8%	18.9%						2.8%	18.9%					
	fine sand	0.125	1		1.0%	1.0%						1.0%	1.0%	4		3.8%	22.6%						3.8%	22.6%					
	medium sand	0.25	3		3.0%	4.0%						3.0%	4.0%	6		5.7%	28.3%						5.7%	28.3%					
	course sand	0.50	2		2.0%	6.0%						2.0%	6.0%	3		2.8%	31.1%						2.8%	31.1%					
	very course sand	1.0	2		2.0%	8.0%						2.0%	8.0%	7		6.6%	37.7%						6.6%	37.7%					
Gravel	very fine gravel	2.0	1		1.0%	9.0%						1.0%	9.0%	10		9.4%	47.2%						9.4%	47.2%					
	fine gravel	4.0	2		2.0%	11.0%						2.0%	11.0%	9		8.5%	55.7%						8.5%	55.7%					
	fine gravel	5.7	1		1.0%	12.0%						1.0%	12.0%	11		10.4%	66.0%						10.4%	66.0%					
	medium gravel	8.0	26		26.0%	38.0%	7.28	9.33				26.0%	38.0%	2		1.9%	67.9%						1.9%	67.9%					
	medium gravel	11.3	27		27.0%	65.0%			11.43			27.0%	65.0%	6		5.7%	73.6%						5.7%	73.6%					
	course gravel	16.0	10		10.0%	75.0%						10.0%	75.0%	8		7.5%	81.1%						7.5%	81.1%					
	course gravel	22.6	16		16.0%	91.0%						16.0%	91.0%	6		5.7%	86.8%						5.7%	86.8%					
	very course gravel	32	1		1.0%	92.0%				23.80		1.0%	92.0%	6		5.7%	92.5%					23.35		5.7%	92.5%				
	very course gravel	45	2		2.0%	94.0%						2.0%	94.0%	6		5.7%	98.1%						45.70		5.7%	98.1%			
Cobble	small cobble	64	5		5.0%	99.0%				59.00		5.0%	99.0%			0.0%	98.1%							0.0%	98.1%				
	medium cobble	90	1		1.0%	100.0%						1.0%	100.0%			0.0%	98.1%							0.0%	98.1%				
	large cobble	128			0.0%	100.0%						0.0%	100.0%			0.0%	98.1%							0.0%	98.1%				
	very large cobble	180			0.0%	100.0%						0.0%	100.0%			0.0%	98.1%							0.0%	98.1%				
Boulder	small boulder	256			0.0%	100.0%						0.0%	100.0%			0.0%	98.1%							0.0%	98.1%				
	small boulder	362			0.0%	100.0%						0.0%	100.0%			0.0%	98.1%							0.0%	98.1%				
	medium boulder	512			0.0%	100.0%						0.0%	100.0%			0.0%	98.1%							0.0%	98.1%				
	large boulder	1024			0.0%	100.0%						0.0%	100.0%			0.0%	98.1%							0.0%	98.1%				
	very large boulder	2049			0.0%	100.0%						0.0%	100.0%			0.0%	98.1%							0.0%	98.1%				
Bedrock	bedrock	40096			0.0%	100.0%						0.0%	100.0%	2		1.9%	100.0%							1.9%	100.0%				
<b>TOTAL / %of whole count</b>				100	0	100.0%						7.3	9.3	11.4	23.8	59.0	100.0%						0.0	1.2	3.6	23.4	45.7	100.0%	

	d16	d35	d50	d84	d95
As-Built	*	*	*	*	*
2003	*	*	*	*	*
2004	*	*	*	*	*
2005	*	*	*	*	*
2006	7.28	9.33	11.43	23.80	59.00
2007	0.00	1.19	3.62	23.35	45.70

\* Missing Data (Historical data not provided)

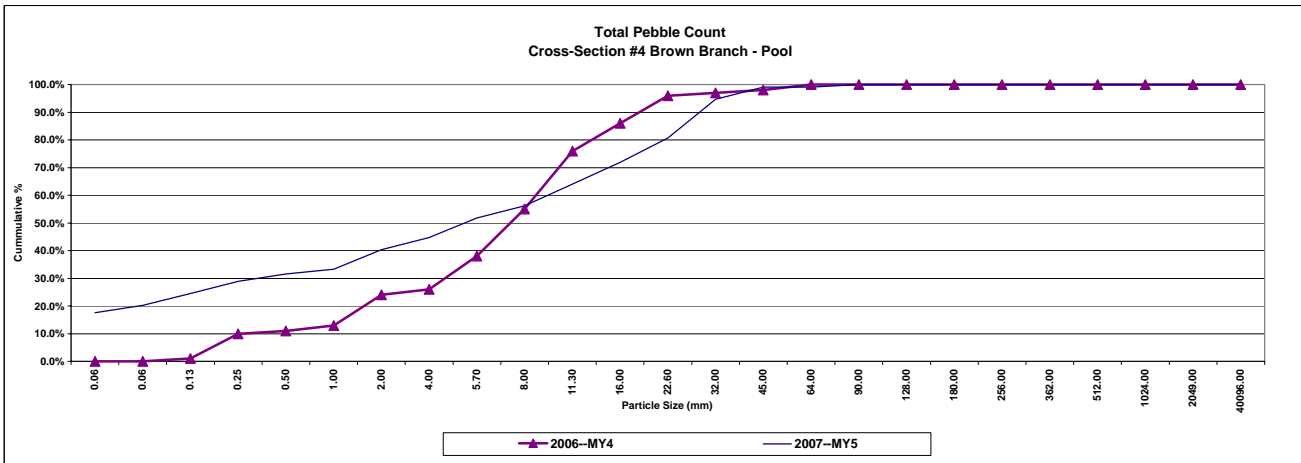


<b>Project Name</b>	Brown Branch
<b>Cross Section</b>	#4
<b>Feature</b>	Pool
<b>Date</b>	12/20/07
<b>Crew</b>	R. Sain
<b>Notes</b>	Pebble count data not available for 2000-2005.

Description	Material	2006--MY4				2007--MY5				2006--MY4				2007--MY5												
		Size (mm)	Pool - Bed	Pool - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %	Pool - Bed	Pool - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %		
Silt/Clay	silt/clay	0.061	0		0.0%	0.0%					0.0%	0.0%	20		17.5%	17.5%								17.5%	17.5%	
Sand	very fine sand	0.062	0		0.0%	0.0%					0.0%	0.0%	3		2.6%	20.2%								2.6%	20.2%	
	fine sand	0.125	1		1.0%	1.0%					1.0%	1.0%	5		4.4%	24.6%								4.4%	24.6%	
	medium sand	0.25	9		9.0%	10.0%					9.0%	10.0%	5		4.4%	28.9%								4.4%	28.9%	
	course sand	0.50	1		1.0%	11.0%					1.0%	11.0%	3		2.6%	31.6%								2.6%	31.6%	
	very course sand	1.0	2		2.0%	13.0%					2.0%	13.0%	2		1.8%	33.3%								1.8%	33.3%	
Gravel	very fine gravel	2.0	11		11.0%	24.0%	1.91				11.0%	24.0%	8		7.0%	40.4%			1.86					7.0%	40.4%	
	fine gravel	4.0	2		2.0%	26.0%					2.0%	26.0%	5		4.4%	44.7%								4.4%	44.7%	
	fine gravel	5.7	12		12.0%	38.0%	6.35				12.0%	38.0%	8		7.0%	51.8%			6.35					7.0%	51.8%	
	medium gravel	8.0	17		17.0%	55.0%		8.83			17.0%	55.0%	5		4.4%	56.1%								4.4%	56.1%	
	medium gravel	11.3	21		21.0%	76.0%					21.0%	76.0%	9		7.9%	64.0%								7.9%	64.0%	
	course gravel	16.0	10		10.0%	86.0%			18.17		10.0%	86.0%	9		7.9%	71.9%								7.9%	71.9%	
	course gravel	22.6	10		10.0%	96.0%				26.50	10.0%	96.0%	10		8.8%	80.7%								8.8%	80.7%	
	very course gravel	32	1		1.0%	97.0%					1.0%	97.0%	16		14.0%	94.7%			29.93						14.0%	94.7%
	very course gravel	45	1		1.0%	98.0%					1.0%	98.0%	5		4.4%	99.1%								4.4%	99.1%	
Cobble	small cobble	64	2		2.0%	100.0%					2.0%	100.0%			0.0%	99.1%								0.0%	99.1%	
	medium cobble	90			0.0%	100.0%					0.0%	100.0%	1		0.9%	100.0%								0.9%	100.0%	
	large cobble	128			0.0%	100.0%					0.0%	100.0%			0.0%	100.0%								0.0%	100.0%	
	very large cobble	180			0.0%	100.0%					0.0%	100.0%			0.0%	100.0%								0.0%	100.0%	
Boulder	small boulder	256			0.0%	100.0%					0.0%	100.0%			0.0%	100.0%								0.0%	100.0%	
	small boulder	362			0.0%	100.0%					0.0%	100.0%			0.0%	100.0%								0.0%	100.0%	
	medium boulder	512			0.0%	100.0%					0.0%	100.0%			0.0%	100.0%								0.0%	100.0%	
	large boulder	1024			0.0%	100.0%					0.0%	100.0%			0.0%	100.0%								0.0%	100.0%	
Bedrock	bedrock	40096			0.0%	100.0%					0.0%	100.0%			0.0%	100.0%								0.0%	100.0%	
	<b>TOTAL / %of whole count</b>		100	0	100.0%		1.91	6.35	8.83	18.17	26.50	100.0%		114	0	100.0%		0.00	1.86	6.35	29.93	39.46	100.0%			

	d16	d35	d50	d84	d95
As Built	*	*	*	*	*
2003	*	*	*	*	*
2004	*	*	*	*	*
2005	*	*	*	*	*
2006	1.91	6.35	8.83	18.17	26.50
2007	0.00	1.86	6.35	29.93	39.46

\* Missing Data (Historical data not provided)

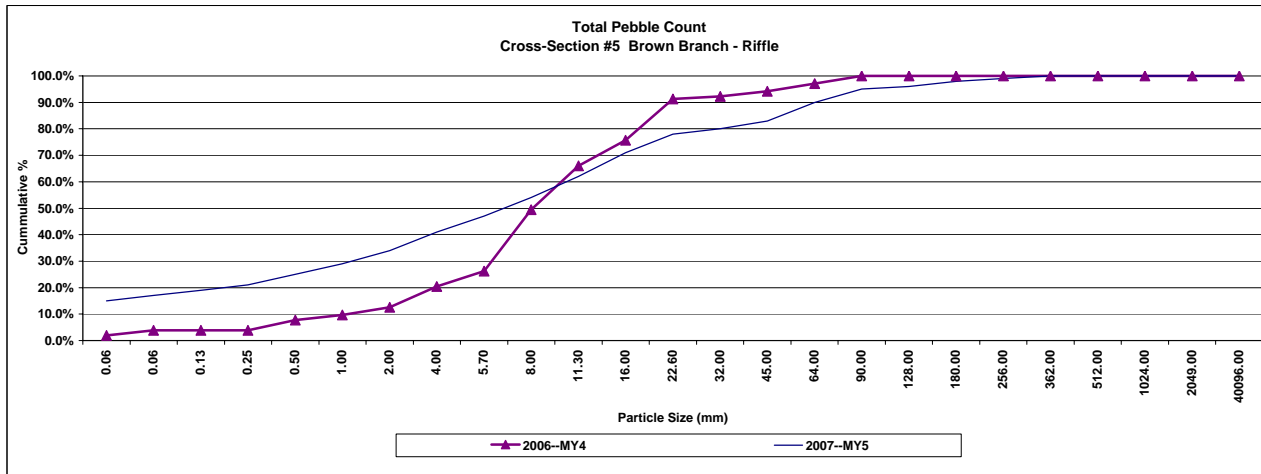


<b>Project Name</b>	Brown Branch
<b>Cross Section</b>	#5
<b>Feature</b>	Riffle
<b>Date</b>	12/20/07
<b>Crew</b>	R. Sain
<b>Notes</b>	Pebble count data not available for 2000-2005.

Description	Material	2006--MY4					2007--MY5																		
		Size (mm)	Riffle - Bed	Riffle - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %	Riffle - Bed	Riffle - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %	
Silt/Clay	silt/clay	0.061	0	2	1.9%	1.9%						0.0%	0.0%	15		15.0%	15.0%								
Sand	very fine sand	0.062	1	1	1.9%	3.9%						1.0%	1.0%	2		2.0%	17.0%	0.08						15.0%	15.0%
	fine sand	0.125	0		0.0%	3.9%						0.0%	1.0%	2		2.0%	19.0%							2.0%	17.0%
	medium sand	0.25	0		0.0%	3.9%						0.0%	1.0%	2		2.0%	21.0%							2.0%	19.0%
	course sand	0.50	4		3.9%	7.8%						4.0%	5.0%	4		4.0%	25.0%							4.0%	21.0%
	very course sand	1.0	2		1.9%	9.7%						2.0%	7.0%	4		4.0%	29.0%							4.0%	25.0%
												3.0%	10.0%	5		5.0%	34.0%							4.0%	29.0%
Gravel	very fine gravel	2.0	3		2.9%	12.6%						3.0%	10.0%	5		5.0%	34.0%							5.0%	34.0%
	fine gravel	4.0	8		7.8%	20.4%	3.80					8.0%	18.0%	7		7.0%	41.0%							5.0%	34.0%
	fine gravel	5.7	6		5.8%	26.2%						6.0%	24.0%	6		6.0%	47.0%	3.26						7.0%	41.0%
	medium gravel	8.0	24		23.3%	49.5%	7.91					24.0%	48.0%	7		7.0%	54.0%							7.0%	47.0%
	medium gravel	11.3	17		16.5%	66.0%						17.0%	65.0%	8		8.0%	62.0%							8.0%	54.0%
	course gravel	16.0	10		9.7%	75.7%						10.0%	75.0%	9		9.0%	71.0%							8.0%	62.0%
	course gravel	22.6	16		15.5%	91.3%						16.0%	91.0%	7		7.0%	78.0%							9.0%	71.0%
	very course gravel	32	1		1.0%	92.2%						1.0%	92.0%	2		2.0%	80.0%							7.0%	78.0%
	very course gravel	45	2		1.9%	94.2%						2.0%	94.0%	3		3.0%	83.0%							2.0%	80.0%
												3.0%	97.0%	7		7.0%	90.0%							3.0%	83.0%
												3.0%	100.0%	5		5.0%	95.0%							3.0%	80.0%
Cobble	small cobble	64	3		2.9%	97.1%						0.0%	100.0%	1		1.0%	96.0%							5.0%	95.0%
	medium cobble	90	3		2.9%	100.0%						0.0%	100.0%	1		1.0%	99.0%							1.0%	99.0%
	large cobble	128			0.0%	100.0%						0.0%	100.0%	1		1.0%	100.0%							1.0%	100.0%
	very large cobble	180			0.0%	100.0%						0.0%	100.0%	2		2.0%	98.0%							2.0%	98.0%
												0.0%	100.0%	1		1.0%	99.0%							1.0%	99.0%
Boulder	small boulder	256			0.0%	100.0%						0.0%	100.0%	1		1.0%	100.0%							1.0%	100.0%
	small boulder	362			0.0%	100.0%						0.0%	100.0%	1		1.0%	100.0%							1.0%	100.0%
	medium boulder	512			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%							0.0%	100.0%
	large boulder	1024			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%							0.0%	100.0%
	very large boulder	2049			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%							0.0%	100.0%
												0.0%	100.0%			0.0%	100.0%							0.0%	100.0%
Bedrock	bedrock	40096			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%							0.0%	100.0%
<b>TOTAL / %of whole count</b>			100	3	100.0%		3.80	7.91	9.77	23.56	60.87	100.0%		100	0	100.0%		0.08	3.26	8.05	57.71	109.00	100.0%		

	d16	d35	d50	d84	d95
<b>As Built</b>	*	*	*	*	*
<b>2003</b>	*	*	*	*	*
<b>2004</b>	*	*	*	*	*
<b>2005</b>	*	*	*	*	*
<b>2006</b>	3.80	7.91	9.77	23.56	60.87
<b>2007</b>	0.08	3.26	8.05	57.71	109.00

\* Missing Data (Historical data not provided)

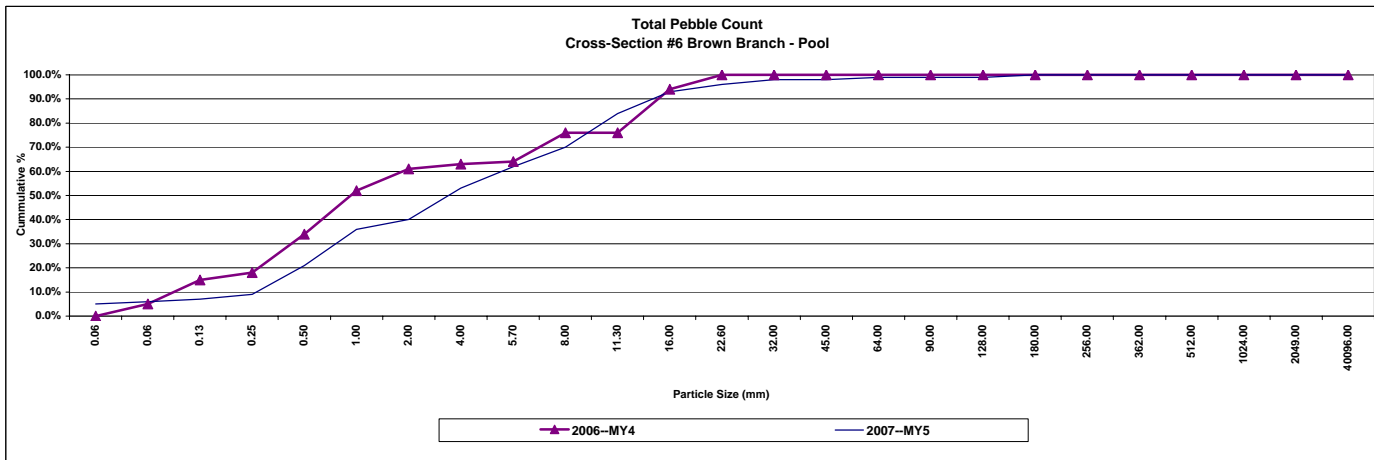


<b>Project Name</b>	Brown Branch
<b>Cross Section</b>	#6
<b>Feature</b>	Pool
<b>Date</b>	12/20/07
<b>Crew</b>	R. Sain
<b>Notes</b>	Pebble count data not available for 2000-2005.

Description	Material	2006--MY4				2007--MY5																			
		Size (mm)	Pool - Bed	Pool - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %	Pool - Bed	Pool - Bank	%	Cum %	d16	d35	d50	d84	d95	%	Cum %	
Silt/Clay	silt/clay	0.061	0		0.0%	0.0%						0.0%	0.0%			5.0%	5.0%							5.0%	5.0%
Sand	very fine sand	0.062	1	4	5.0%	5.0%	0.25	0.79	1.42		0.0%	0.0%	1		1.0%	6.0%	0.59	1.45					1.0%	6.0%	
	fine sand	0.125	7	3	10.0%	15.0%					1.1%	1.1%	1		1.0%	6.0%							1.0%	7.0%	
	medium sand	0.25	3		3.0%	18.0%					7.6%	8.7%	1		1.0%	7.0%							2.0%	9.0%	
	course sand	0.50	15	1	16.0%	34.0%					3.3%	12.0%	2		2.0%	9.0%							12.0%	21.0%	
	very course sand	1.0	18		18.0%	52.0%					16.3%	28.3%	12		12.0%	21.0%							15.0%	36.0%	
Gravel	very fine gravel	2.0	9		9.0%	61.0%	19.6%	47.8%	15		15.0%	36.0%	15.0%	36.0%											
	fine gravel	4.0	2		2.0%	63.0%	9.8%	57.6%	4		4.0%	40.0%	4.0%	40.0%											
	fine gravel	5.7	1		1.0%	64.0%	2.2%	59.8%	13		13.0%	53.0%	13.0%	53.0%											
	medium gravel	8.0	12		12.0%	76.0%	1.1%	60.9%	9		9.0%	62.0%	9.0%	62.0%											
	medium gravel	11.3			0.0%	76.0%	13.0%	73.9%	8		8.0%	70.0%	8.0%	70.0%											
	course gravel	16.0	18		18.0%	94.0%	0.0%	73.9%	14		14.0%	84.0%	14.0%	84.0%											
	course gravel	22.6	6		6.0%	100.0%	19.6%	93.5%	9		9.0%	93.0%	9.0%	93.0%											
	very course gravel	32			0.0%	100.0%	6.5%	100.0%	3		3.0%	96.0%	3.0%	96.0%											
	very course gravel	45			0.0%	100.0%	0.0%	100.0%	2		2.0%	98.0%	2.0%	98.0%											
Cobble	small cobble	64			0.0%	100.0%	0.0%	100.0%	1		1.0%	99.0%	1.0%	99.0%											
	medium cobble	90			0.0%	100.0%	0.0%	100.0%			0.0%	99.0%	0.0%	99.0%											
	large cobble	128			0.0%	100.0%	0.0%	100.0%			0.0%	99.0%	0.0%	99.0%											
	very large cobble	180			0.0%	100.0%	0.0%	100.0%	1		1.0%	100.0%	1.0%	100.0%											
Boulder	small boulder	256			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
	small boulder	362			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
	medium boulder	512			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
	large boulder	1024			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
	very large boulder	2049			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
Bedrock	bedrock	40096			0.0%	100.0%	0.0%	100.0%			0.0%	100.0%	0.0%	100.0%											
<b>TOTAL / %of whole count</b>			92	8	100.0%		0.25	0.79	1.42	16.16	20.63	100.0%		100	0	100.0%		0.59	1.45	4.42	13.65	24.63	100.0%		

	d16	d35	d50	d84	d95
As Built	*	*	*	*	*
2003	*	*	*	*	*
2004	*	*	*	*	*
2005	*	*	*	*	*
2006	0.25	0.79	1.42	16.16	20.63
2007	0.59	1.45	4.42	13.65	24.63

\* Missing Data (Historical data not provided)



## **APPENDIX C**

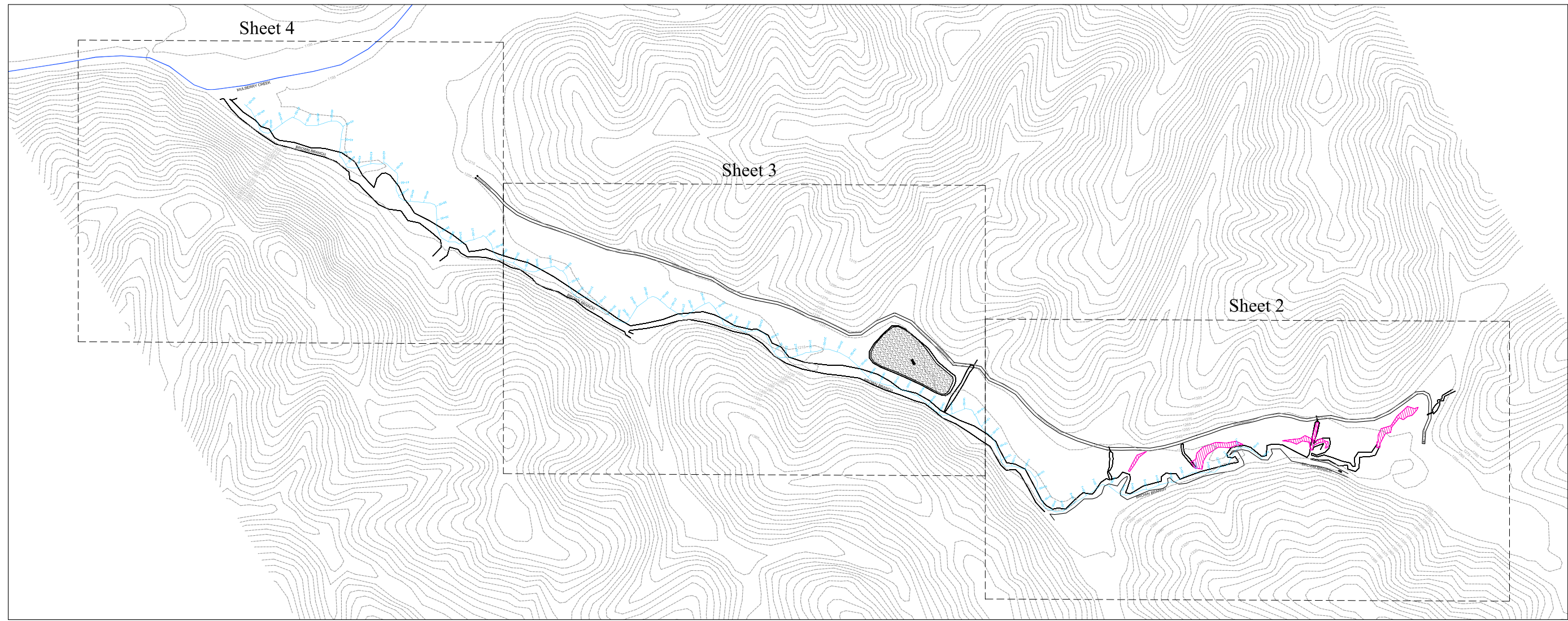
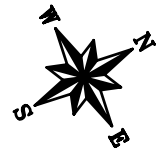
Vegetation Data

Not Applicable For This Project

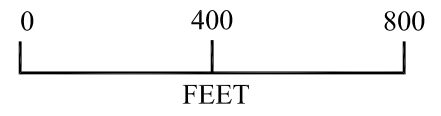


## **APPENDIX D**

Integrated Problem Area Plan View



Scale: 1" = 400'  
Source: NCDOT (10' Contour Elevations)



Prepared by / Date: R.R./12-28-07  
Checked by/ Date: R.S./12-28-07

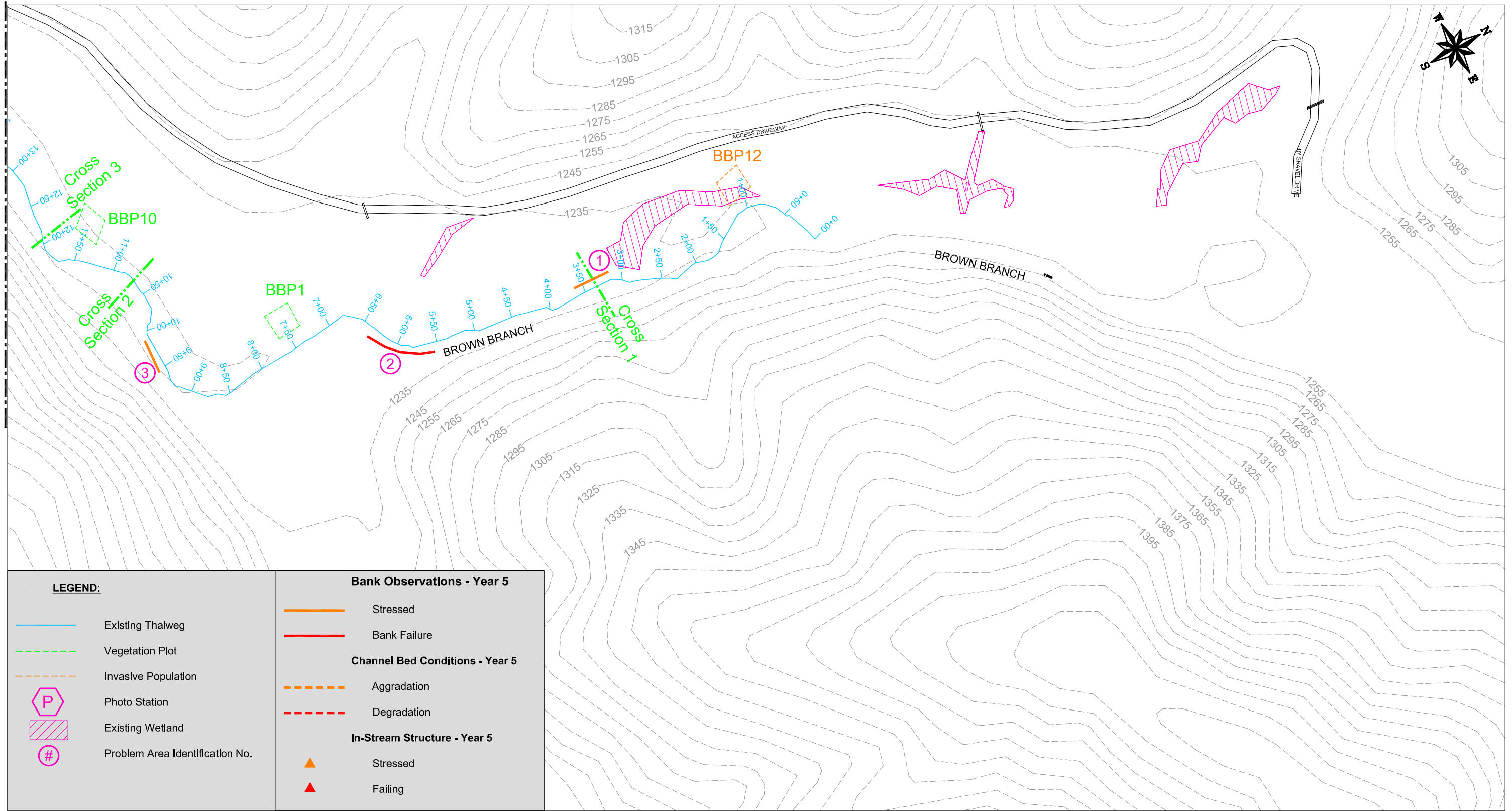


BROWN BRANCH RESTORATION  
YEAR 5 MONITORING  
CALDWELL COUNTY, NORTH CAROLINA

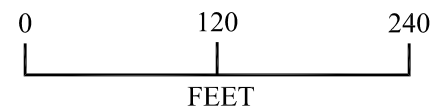


PROBLEM AREA PLAN VIEW-  
DECEMBER 2007  
NC EEP Project : 53  
Project: 6470-06-1410/02

MATCH LINE TO FIGURE 4



Scale: 1" = 120'  
 Source: NCDOT (10' Contour Elevations)



Prepared by / Date: R.R./12-28-07  
 Checked by/ Date: R.S./12-28-07



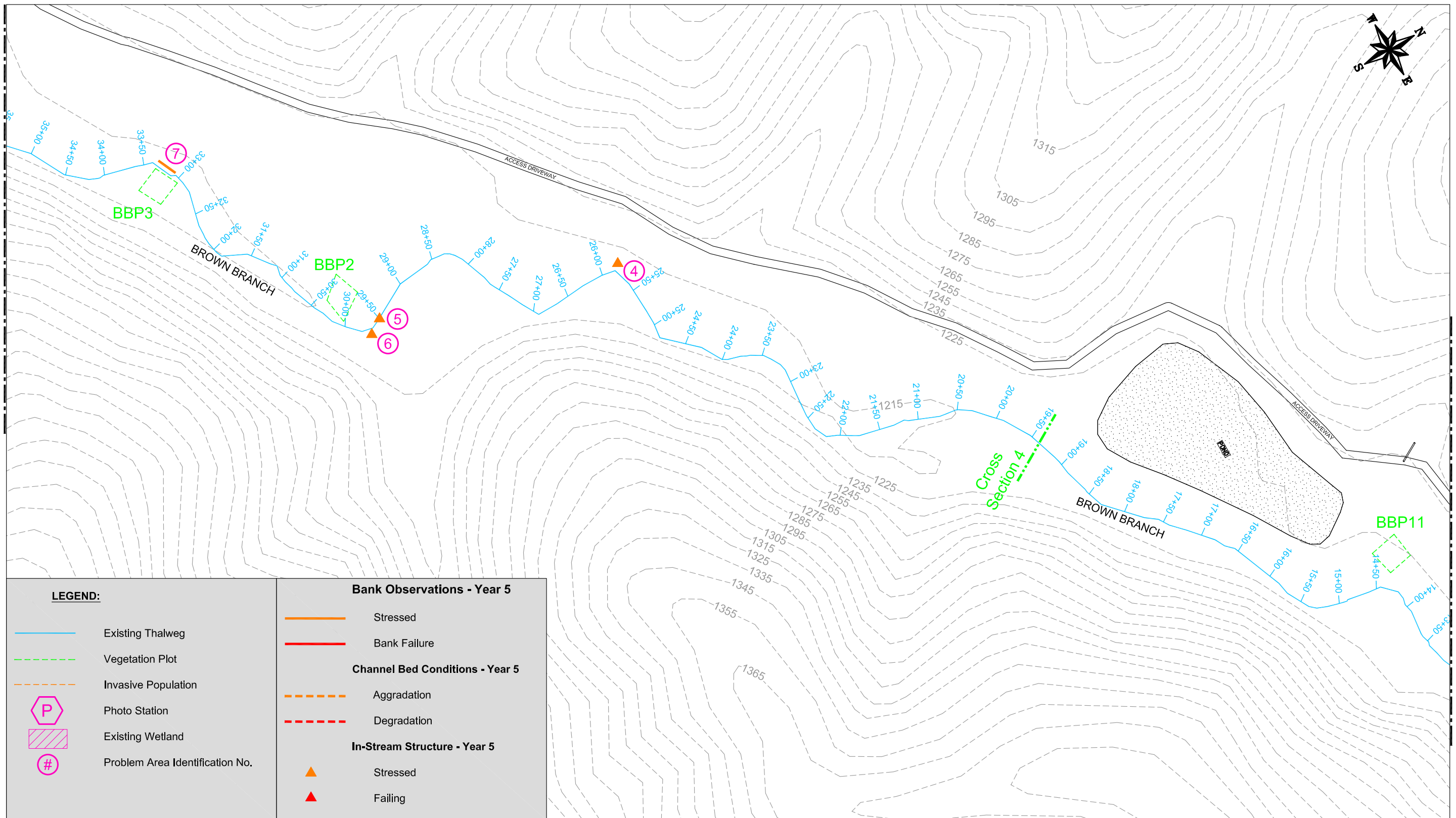
BROWN BRANCH RESTORATION  
 YEAR 5 MONITORING  
 CALDWELL COUNTY, NORTH CAROLINA



PROBLEM AREA PLAN VIEW-  
 DECEMBER 2007

NC EEP Project : 53  
 Project: 6470-06-1410/02

MATCH LINE TO FIGURE 5



MATCH LINE TO FIGURE 3

**LEGEND:**

- Existing Thalweg
- Vegetation Plot
- Invasive Population
- Photo Station
- Existing Wetland
- Problem Area Identification No.

**Bank Observations - Year 5**

- Stressed
- Bank Failure

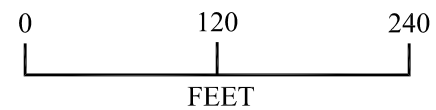
**Channel Bed Conditions - Year 5**

- Aggradation
- Degradation

**In-Stream Structure - Year 5**

- Stressed
- Failing

Scale: 1" = 120'  
Source: NCDOT (10' Contour Elevations)



Prepared by / Date: R.R./12-28-07  
Checked by/ Date: R.S./12-28-07



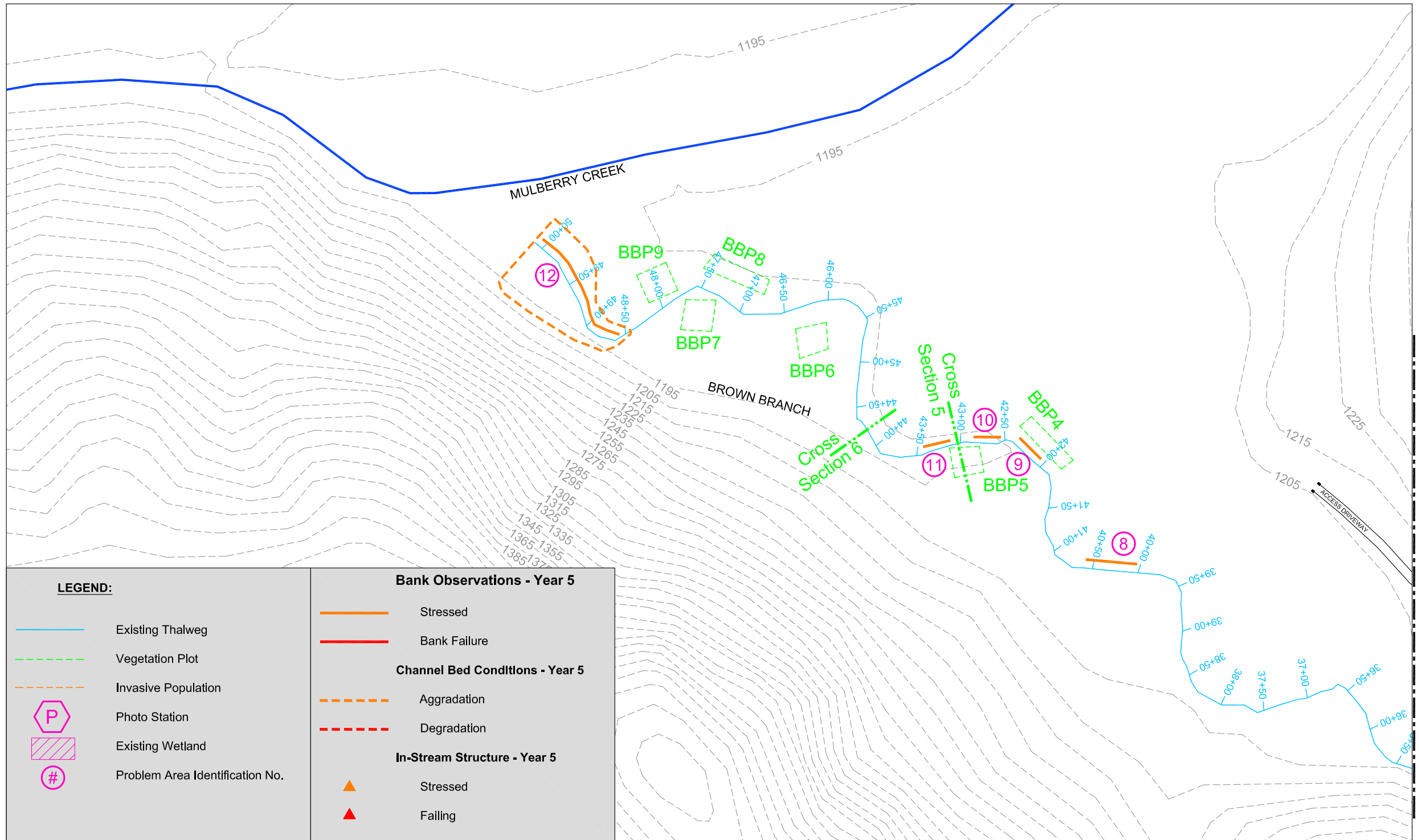
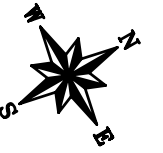
BROWN BRANCH RESTORATION  
YEAR 5 MONITORING  
CALDWELL COUNTY, NORTH CAROLINA



PROBLEM AREA PLAN VIEW-  
DECEMBER 2007

NC EEP Project : 53  
Project: 6470-06-1410/02

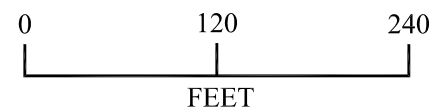
Sheet 3 of 4



LEGEND:		Bank Observations - Year 5	
	Existing Thalweg		Stressed
	Vegetation Plot		Bank Failure
	Invasive Population	<b>Channel Bed Conditions - Year 5</b>	
	Photo Station		Aggradation
	Existing Wetland		Degradation
	Problem Area Identification No.	<b>In-Stream Structure - Year 5</b>	
			Stressed
			Falling

Scale: 1" = 120'

Source: NCDOT (10' Contour Elevations)



Prepared by / Date: R.R./12-28-07

Checked by/ Date: R.S./12-28-07



BROWN BRANCH RESTORATION  
YEAR 5 MONITORING  
CALDWELL COUNTY, NORTH CAROLINA



PROBLEM AREA PLAN VIEW-  
DECEMBER 2007

NC EEP Project : 53  
Project: 6470-06-1410/02

Sheet 4 of 4