

UT to Clark Creek at Cato Farms Stream Restoration Annual Monitoring Report

Monitoring Year: 2005

Measurement Year: 1

As-built Date: 2004

NCEEP Project Number: 072



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Submitted: January, 2006



NC STATE UNIVERSITY

UT CLARK CREEK at CATO FARMS STREAM RESTORATION 2005 MONITORING REPORT

CONDUCTED FOR THE NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES



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I. Executive Summary/Project Abstract

The channel has remained fairly stable since construction. Erosional areas exist but remain localized. Most stream bank problems are related to poor establishment of vegetation. The channel bed does not appear to have aggraded or downcut since construction, although bedform has shifted throughout most of the project. Planform remains consistent with design conditions.

Vegetation within the riparian buffer of this stream is mostly successful, with a few small problematic patches. The banks were mostly well-covered with vegetation. Four areas were identified as problem locations but appear to be localized.

Planted trees and shrubs are doing well throughout the buffer. Extrapolation from the eight plots resulted in an overall average of 718 planted woody stems per acre for this restoration site.

II. Project Background

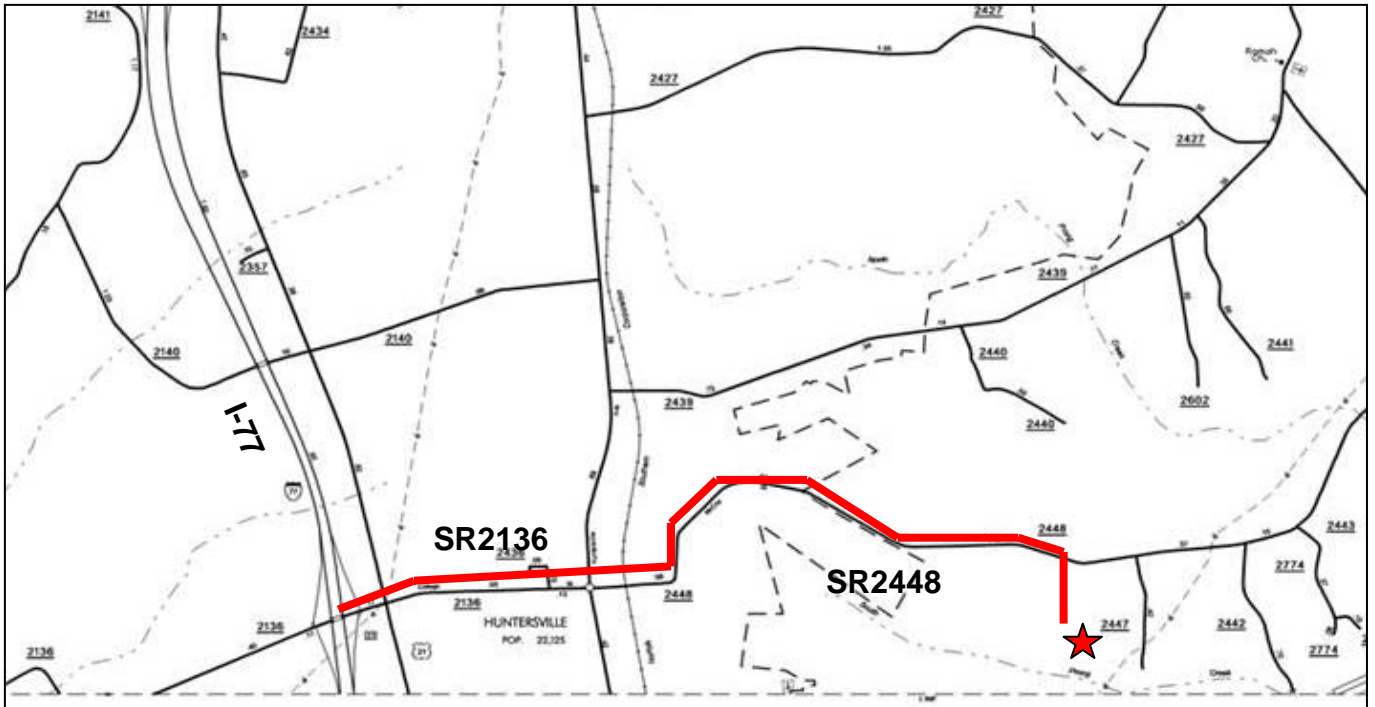
Project background information can be obtained from the as-built monitoring report prepared by CH2M Hill dated 2004.

Table I and II list project structure and objectives. Figure 1 shows a map with detailed directions to the project site. Activities and reporting history for the project are listed in Table III. Table IV lists project contacts and Table V list background information for the project.

Table I. Project Structure	
Project Number and Name: 072 (UT to Clark Creek at Cato Farms)	
Segment/Reach ID	Linear Feet or Acreage
UT to Clark Creek at Cato Farms	2500 linear feet

Table II. Project Objectives Table			
Project Number and Name: 072 (UT to Clark Creek at Cato Farms)			
Segment/Reach ID	Objectives	Linear Feet or Acreage	Comment
Cato Farms	Full Restoration	2,000 linear feet	Priority 1 Approach
Cato Farms	Full Restoration	500 linear feet	Priority 3 Approach
Cato Farms	Buffer Restoration	2.9 Acres	Buffer Replanting

Figure 1. Project Location



Directions from I-85 and I-77 intersection:

Follow I-77 North to Huntersville Exit 23(Gilead Road – SR 2136). Follow Gilead Road East towards Huntersville for 0.85 miles. Go straight and Gilead Road becomes Huntersville-Concord Road (SR 2448). Follow Huntersville-Concord Road for approximately 2.0 miles. At the low point in the road is where UT to Clark Creek Crosses Huntersville-Concord Road. Project begins about 1000 feet downstream of road culvert. Currently (2005) there is a subdivision being built on the west side of the creek. Access is through the construction site.

Contact EEP project manager for access and landowner notification instructions.

Table III. Project Activity and Reporting History		
Project Number and Name: 072 (UT to Clark Creek at Cato Farms)		
Activity or Report	Calendar Year of Completion or Planned Completion	Actual Completion Date
Restoration Plan		
Mitigation Plan		
Construction		
Temporary S&E mix applied to entire project area		
As-Built report		
Permanent seed mix applied to reach		
Structural maintenance (Bank repair and revegetation)		
Initial – Year 1 monitoring	June-05	June-05
Year 2 Monitoring	June-06	
Year 3 Monitoring	June-07	
Year 4 Monitoring	June-08	
Year 5 Monitoring	June-09	

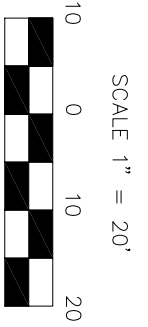
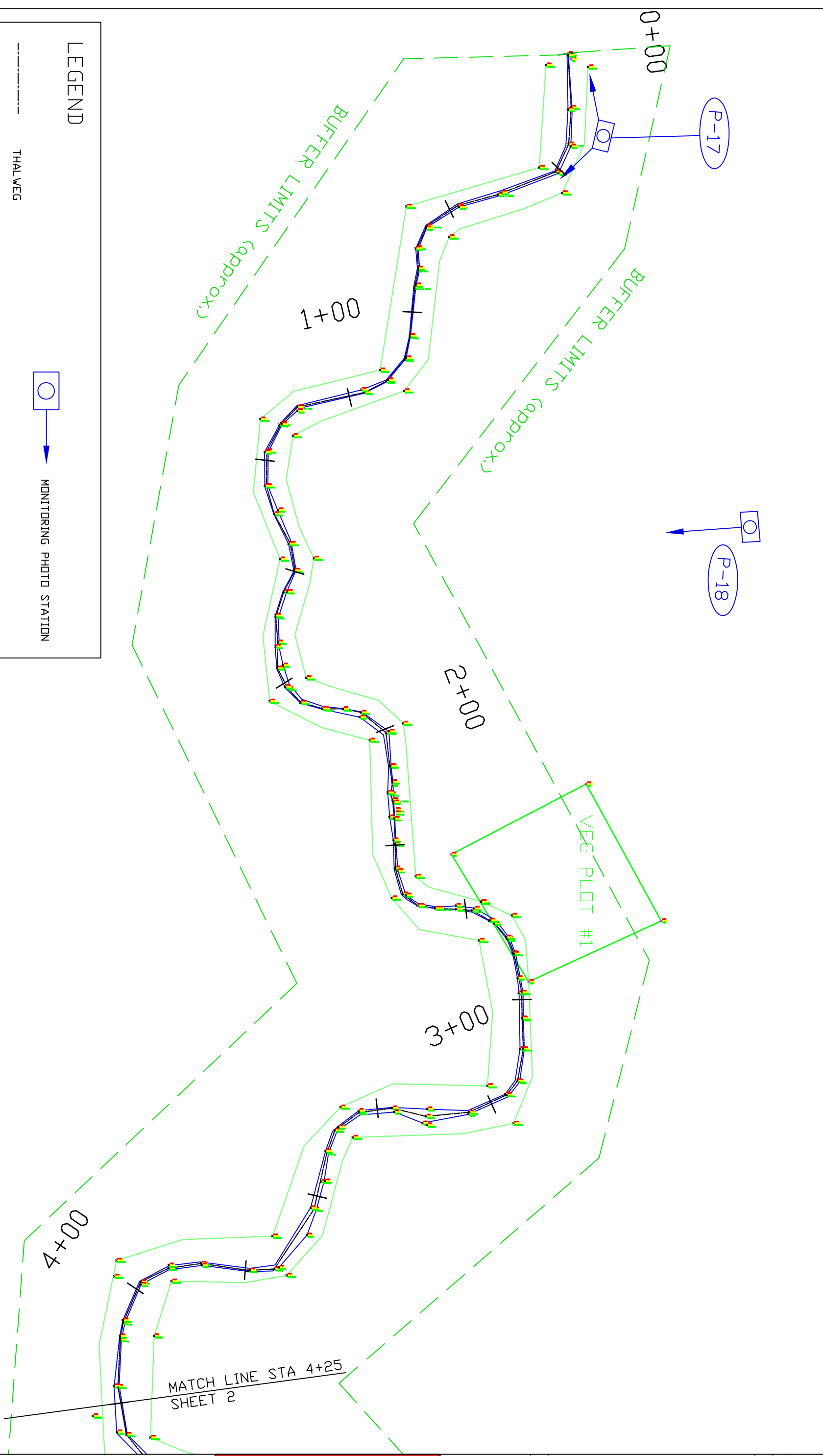
Table IV. Project Contact Table	
Project Number and Name: 072 (UT to Clark Creek at Cato Farms)	
Designer Primary project design POC	CH2M Hill, Inc. 4824 Parkway Plaza Boulevard Suite 200, Charlotte, NC 28217 (704) 329-0072
Construction Contractor Construction contractor POC	
Planting Contractor Planting contractor POC	
Seeding Contractor Planting contractor point of contact	
Seed Mix Sources	N/A
Nursery Stock Suppliers	N/A
Monitoring Performers	Biological & Agricultural Engineering North Carolina State University Campus Box 7625 Raleigh, NC 27695
Stream Monitoring POC	Dan Clinton (919) 515-6771
Vegetation Monitoring POC	Dan Clinton (919) 515-6771

Table V. Project Background Table	
Project Number and Name: 072 (UT to Clark Creek at Cato Farms)	
Project County	Mecklenburg
Drainage Area	?? sq miles
Drainage impervious cover estimate (%)	Estimated at <5%
Stream Order	1st order
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont (45b)
Rosgen Classification of As-built	E-Stream Type Stat 0+00 to 20+00 B-Stream Type 20+00 to End
Cowardin Classification	N/A
Dominant soil types	N/A
Reference site ID	N/A
USGS HUC for Project and Reference	3040105
NCDWQ Sub-basin for Project and Reference	11-129-5-(0.3) - Clark Creek Listed
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%

Figure 2. Watershed Map
See mitigation or as-built plan for watershed map.

LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK
- MONITORING PHOTO STATION



MATCH LINE STA 4+25
SHEET 2

DRAWING NO.	PL - 1
SHEET NO.	CATOLDWG
PROJECT NO.	01/06/2006
DATE	

UT to CLARK CREEK
CATO FARMS
MECKLENBURG COUNTY, N.C.

2005 MONITORING WITH DESIGN
1:20 SCALE PLAN SHEET






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North Carolina State University
Raleigh, NC 27695

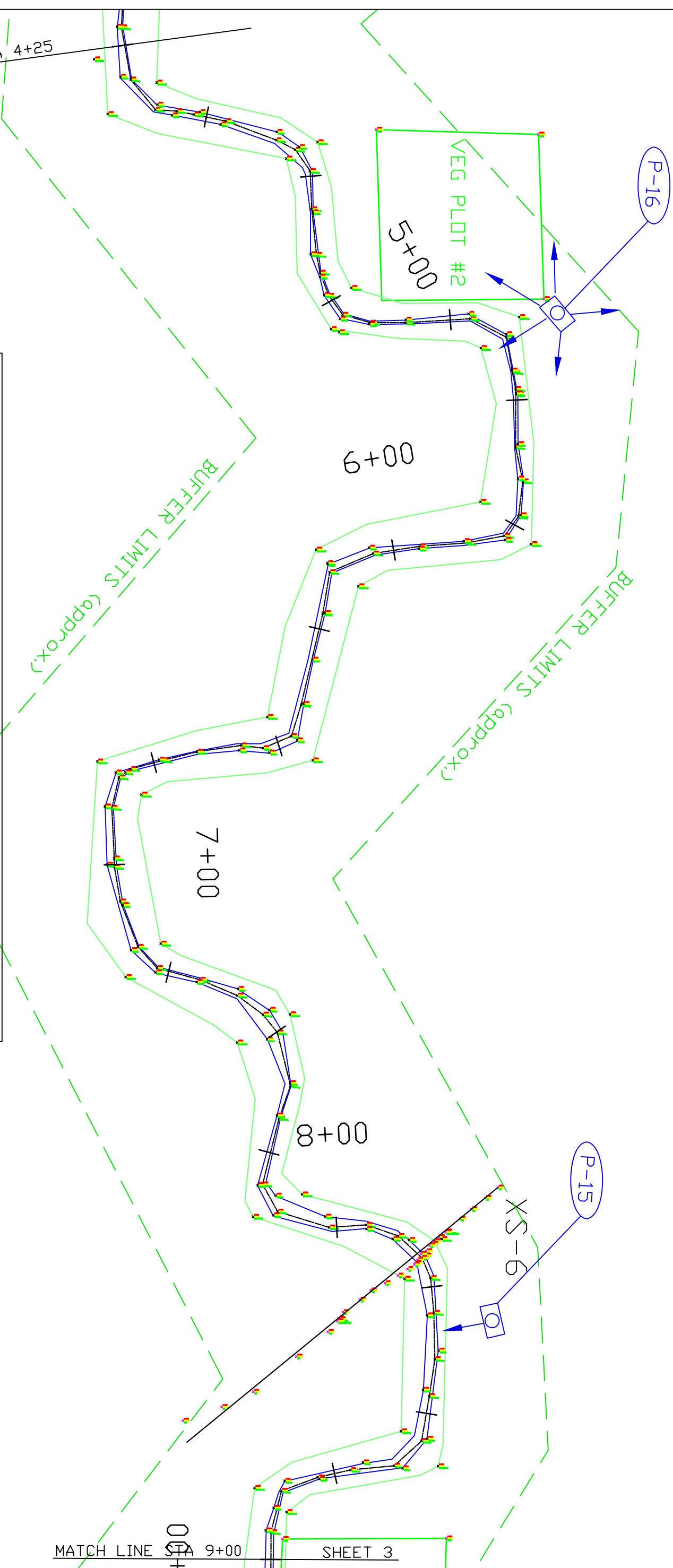
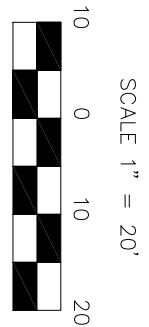
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SHEET 1


LEGEND

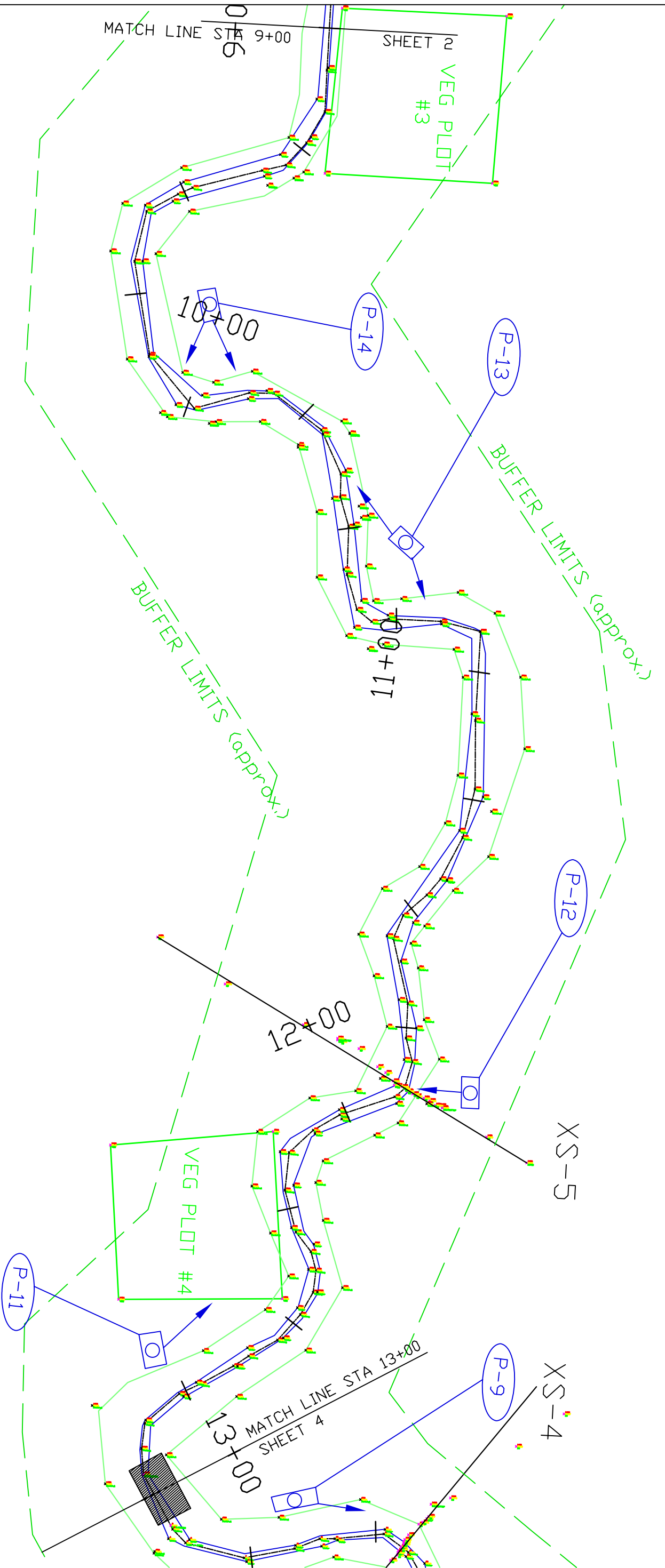
-  THALWEG
-  WATERS EDGE
-  BANKFULL
-  EASEMENT LIMITS (Proposed)
-  TOP OF BANK

 MONITORING PHOTO STATION



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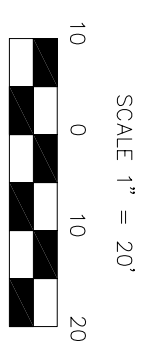
DRAWING NO. SHEET NO. PL - 2	FILENAME CATOLDWG	PROJECT NO. 01/06/2006	DATE 01/06/2006	UT to CLARK CREEK CATO FARMS MECKLENBURG COUNTY, N.C.			BIOLOGICAL & AGRICULTURAL ENGINEERING Weaver Labs Campus Box 7625 North Carolina State University Raleigh, NC 27695	1	2005 Monitoring	DAB	DRC	08/06/08
				NO	REVISIONS			DRN	CHK	DATE		



LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK

□ → MONITORING PHOTO STATION



PROJECT NO.	01/06/2006
DATE	01/06/2006
FILENAME	CAT0.DWG
SHEET NO.	PL - 03
DRAWING NO.	

UT to CLARK CREEK
CATO FARMS
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2005 MONITORING WITH DESIGN
1:20 SCALE PLAN SHEET

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NO.	1	2005 Monitoring	DAB	DRC	08/06/08
REVISIONS					
NO.			DRN	CHK	DATE

MATCH LINE STA 13+00
SHEET 3

14+00

15+00






XS-3
16+00

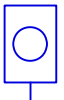
17+00

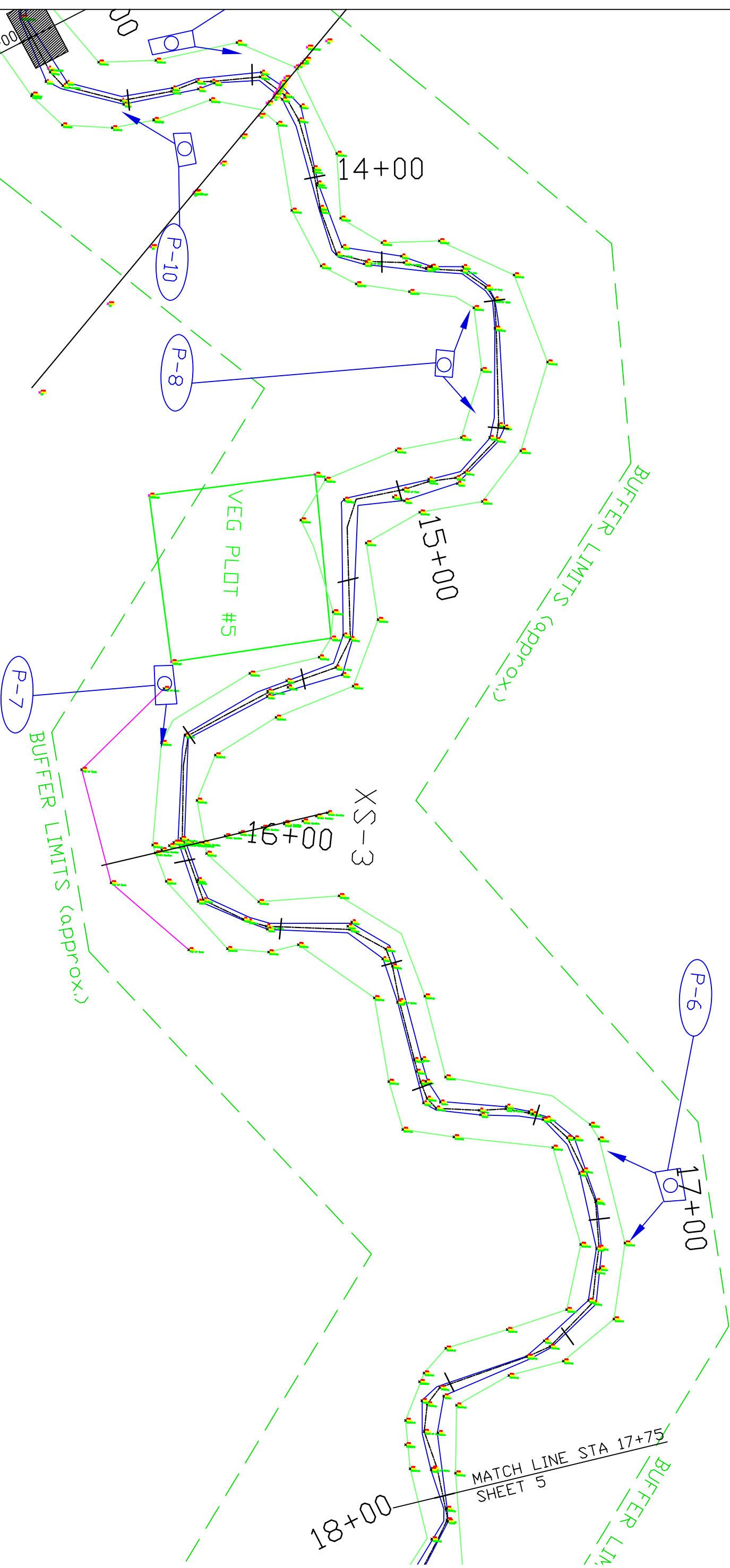
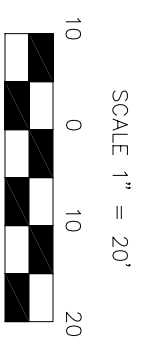
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SHEET 5

18+00

LEGEND

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-  WATERS EDGE
-  BANKFULL
-  EASEMENT LIMITS (Proposed)
-  TOP OF BANK

 MONITORING PHOTO STATION



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SHEET NO. PL - 04

DATE: 01/06/2006
PROJECT NO.: CATOLDWG
FILENAME: CATOLDWG

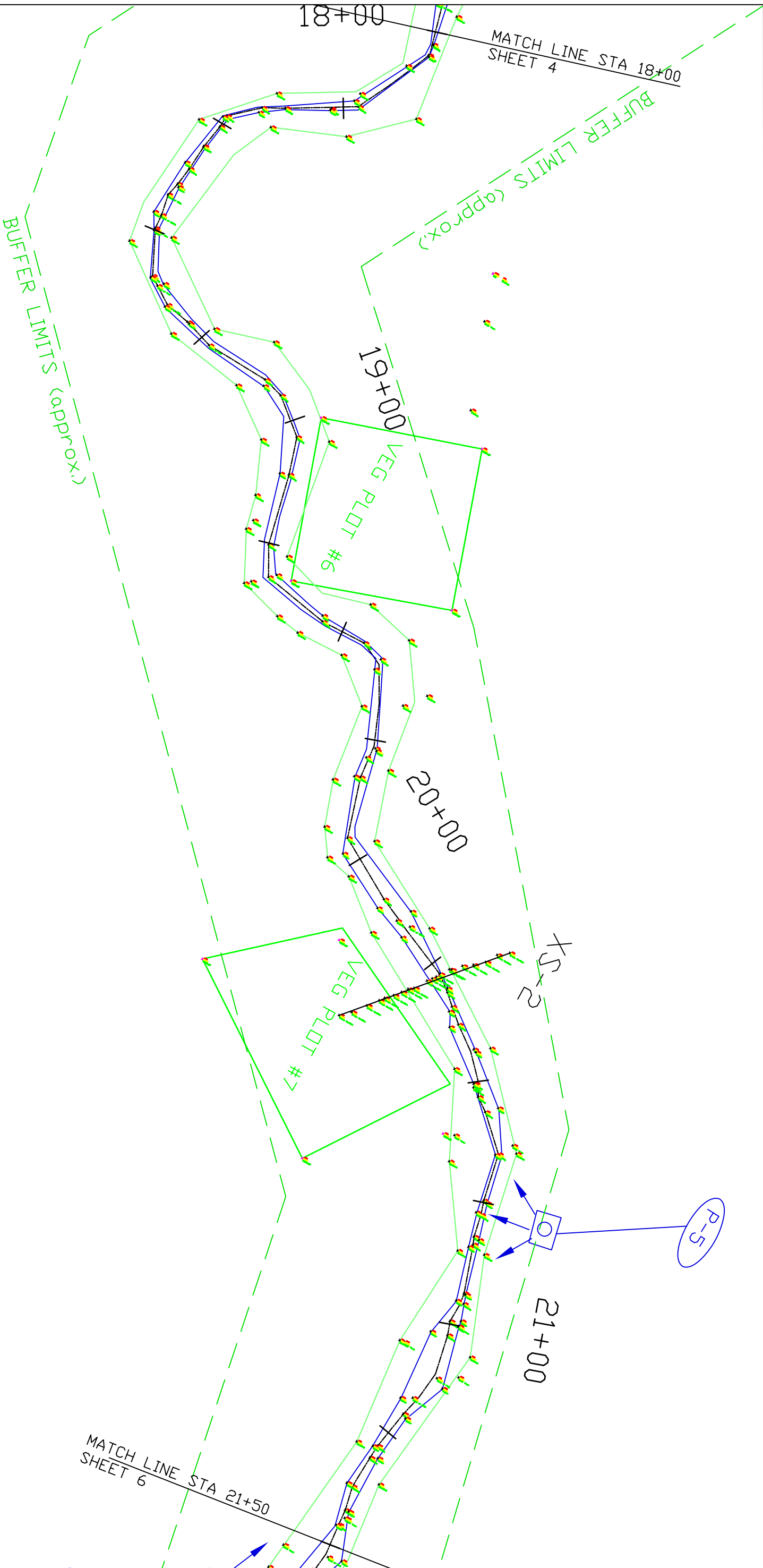
UT to CLARK CREEK
CATO FARMS
MECKLENBURG COUNTY, N.C.

2005 MONITORING WITH DESIGN
1:20 SCALE PLAN SHEET

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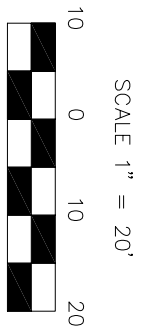
1	2005 Monitoring	DAB	DRC	01/06/08
NO	REVISIONS	DRN	CHK	DATE



LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK

MONITORING PHOTO STATION



DATE	01/06/2006
PROJECT NO.	CAT01DWG
FILENAME	PL - 05
SHEET NO.	PL - 05
DRAWING NO.	

UT to CLARK CREEK
CATO FARMS
MECKLENBURG COUNTY, N.C.

2005 MONITORING WITH DESIGN
1:20 SCALE PLAN SHEET

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NO	REVISIONS	DRN	CHK	DATE
1	2005 Monitoring	DAB	DRC	01/06/06

III. Project Condition and Monitoring Results

Results of the 2005 monitoring are shown below. 2005 Monitoring was conducted in June, 2005.

A. Vegetation Assessment

Using the protocols specified in the Content, Format and Data Requirements for EEP Monitoring Reports, eight vegetation monitoring plots were established and surveyed within the riparian buffer of the UT to Clark Creek at Cato Farms project.

Vegetation within the riparian buffer of this stream is mostly successful, with a few small problematic patches. The banks were mostly well-covered with vegetation. Wetter herbaceous species such as *Juncus* (rushes) and *Carex* (sedges) are growing profusely in many low areas along the banks and floodplain.

Planted trees and shrubs are doing well throughout the buffer. Extrapolation from the eight plots resulted in an overall average of 718 planted woody stems per acre for this restoration site. Dogwood and willow dominate the woody stem count with shrub extrapolated density at 460 stems/acre and tree extrapolated density at 258 stems per acre.

In some areas, compacted or nutrient-poor soil resulted in bare ground. Live stakes planted in this compacted soil did not survive. Other livestakes were planted too high on the banks and have high mortality in limited patches. In most areas, live stakes, particularly silky dogwood, have thrived.

Problem areas along this project include:

- Bare Banks at Stations 18+50 to 18+80 and 21+90 to 22+30
 - Compacted soil
 - Erosion
- Bare Floodplain 16+40 to 16+60 and 21+90 to 22+30
 - Compacted soil
 - Nutrient-poor soil
- Dead Live Stakes
 - Compacted soil
 - Planted too high on banks

In the areas of compacted soil, live stake mortality and poor herbaceous cover may result in future erosion problems. Coir matting was still protecting most of the banks, but as it decomposes, a more consistent stand of vegetation along the channel banks will be required.

Invasive species were not a significant problem on the site when monitored in 2005. However, new construction adjacent and uphill of the buffer may encourage invasion and this should be monitored in upcoming monitoring periods.

In four areas where vegetation is a concern, steps can be taken to revegetate and stabilize the ground. Where herbaceous vegetation has not become established, soil rehabilitation and the addition of temporary and permanent seeding are recommended. On the banks, replacement of missing and dead live stakes will help to provide long-term stability.

The following table summarizes vegetation and soils results for 2005 monitoring. Soil samples were collected and analyzed during the 2005 monitoring period. Vegetation problem areas are summarized below in table VII. Raw vegetation data can be found in Appendix A. Data is summarized in Table VIII below. Photos of each vegetation plot can be found in the photo log.

Table VI. Preliminary Soil Data					
Project Number and Name: 072 (UT to Clark Creek at Cato Farms)					
Series	Max Depth (in.)	% Clay on Surface	K	T	OM %
Enon (EnB)	60		0.34	4	
Helena (HeB)	64		0.37	3	
Monacan (MO)	65		0.28	4	
Wilkes (WkD)	45		0.28	2	

Table VII. Vegetative Problem Areas			
Project Number and Name: 072 (UT to Clark Creek at Cato Farms)			
Feature/Issue	Station # / Range	Probable Cause	Photo #
Bare Bank	18+50 to 18+80 - VPA 2	Compacted soils	VPA 2a and b, VPA 3a and b
	21+90 to 22+30 - VPA 3	Poor soil preparation	
Bare Floodplain	16+40 to 16+60 - VPA 1	Compacted soils	VPA 1 and VPA 3c
	21+90 to 22+30 - VPA 3	Poor soil preparation	
Invasive/Exotic Populations	Minimal locations not field identified	Existing or upland seed source	No photo taken

Table VIII: Stem counts for each species arranged by plot.

Species	Plots								Initial Totals	Year 1 Totals	Survival %
	1	2	3	4	5	6	7	8			
Shrubs											
<i>Aronia arbutifolia</i>	0	3	1	1	2	4	1	1	Unknown	13	
<i>Cephalanthus occidentalis</i>	3	0	1	3	1	0	0	0	Unknown	8	
<i>Cornus amomum</i>	0	0	2	2	10	1	12	17	Unknown	44	
<i>Cornus sericea</i>	0	1	0	4	0	0	0	0	Unknown	5	
<i>Salix nigra</i>	4	0	2	0	1	5	4	0	Unknown	16	
<i>Sambucus nigra</i>	1	1	2	1	0	0	0	0	Unknown	5	
Trees											
<i>Acer negundo</i>	1	2	2	2	2	1	4	4	Unknown	18	
<i>Carpinus caroliniana</i>	1	0	0	0	0	0	0	0	Unknown	1	
<i>Carya aquatica</i>	0	2	0	0	1	0	0	0	Unknown	3	
<i>Fraxinus pennsylvanica</i>	0	1	0	0	0	1	3	0	Unknown	5	
<i>Juglans nigra</i>	0	0	0	0	0	0	1	0	Unknown	1	
<i>Nyssa sylvatica</i>	1	0	0	0	0	0	0	0	Unknown	1	
<i>Populus deltoides</i>	0	0	0	0	1	1	0	0	Unknown	2	
<i>Quercus alba</i>	1	1	0	0	0	1	1	2	Unknown	6	
<i>Quercus michauxii</i>	1	3	0	2	0	4	2	2	Unknown	14	
									Average		
Woody stem plot totals	13	14	10	15	18	18	28	26	17.75		
Extrapolated woody stems/acre	526	567	405	607	728	728	1133	1052	718		

B. Stream Assessment

Channel banks have remained fairly stable since construction. There are 15 locations, totaling 325 feet, of the banks that currently have some degradation. Problem locations and descriptions are listed in Table IX. The majority of bank problems are related to poor establishment of vegetation.

The channel bed does not appear to have aggraded or downcut since construction. Bedform has shifted throughout most of the project. Many riffle-pool complexes are missing throughout the project. Stations 75-140, 340-355, 370-425, 510-535, 685-742, 912-930, 960-1005, 1105-1135, 1250-1265, 1460-1512, and 1880-2000 are the areas where riffle pool complexes have developed into a single complex, typically a run or pool. Several areas have a reversal in bedform as well. Stations 243-265, 314-328, 604-673, 750-890, 1012-1083, 1189-1214, 1390-1449, and 1640-1682 are the areas where complexes have reversed compared to the design bedform. Several new complexes have formed, particularly at the lower end of the project from station 2130 to the end the project. A bedform comparison table can be found in Appendix B.

Channel dimension has not changed substantially since construction. Table XI summarizes cross-section data. The raw data with graphs are included in Appendix B. There are no indications of significant downcutting or rapid aggrading at the cross-section locations.

Channel substrate was measured at riffle cross-sections or at the riffle directly downstream of the pool cross-sections in the case of cross-sections 3 through 6. A random zigzag bed pebble count was taken throughout the entire riffle. The banks were not sampled. A classification pebble count should be conducted at Year 0 and Year 5, at a minimum, for permit requirements. Interim year pebble counts should be conducted at riffle bed following methodology described above. The coarsest riffle was located at section number 5 resulting of a d50 of 0.38mm, medium sand, and a d84 of 0.86mm, very coarse sand. The finest riffle was located at section 3 resulting in a d50 of silt and a d84 of 0.31mm, medium sand. Overall, the pebble counts were fairly similar throughout the project.

Channel pattern is similar to design conditions and is summarized in Appendix B.

Overall the channel has remained stable since construction. With the exception of several localized areas of bank erosion, banks are stable. The channel bed has adjusted longitudinally but has not significantly aggraded or degraded.

Some minor bank repair work was completed shortly after construction. No specific information was supplied related to this work. Sites with observed repairs have not been successful.

Baseline morphology and Summary morphology data are located in tables X and XI, respectively.

Table IX. Stream Problem Areas

Project Number and Name: 072 (UT to Clark Creek at Cato Farms)

Problem Number	Feature Issue	Station numbers	Suspected Cause	Photo number
PA 1	Erosion and scour behind matting	2+50 to 2+60	Lack of deep rooting vegetation	PA 1
PA 2	Minor bank slump	3+10 to 3+20	Lack of deep rooting vegetation Overland flow being directed by upstream point bar	PA 2
PA 3	Rills forming along channel bank/slope Note: repair efforts failed in this area	4+00 to 4+60	Lack of deep rooting vegetation Poor soil preparation Compacted soil Sub-soil conditions (lack of nutrients)	PA 3
PA 4	Erosion and scour behind matting	5+00 to 5+10	Lack of deep rooting vegetation	PA 4
PA 5	Scour and slump along outside bank	9+25 to 9+30	Lack of deep rooting vegetation	PA 5
PA 6	Scour and slump along outside bank Note: repair efforts failed in this area due to soil washing out around facines and facines out of water	9+95 to 10+05	Lack of deep rooting vegetation Matting on repair area not adequately secured	PA 6
PA 7	Scour and slump along outside bank Note: repair efforts failed in this area due to soil washing out around facines and facines out of water	10+20 to 10+65	Lack of deep rooting vegetation Matting on repair area not adequately secured	PA 7
PA 8	Scour and slump along outside bank Note: repair efforts failed in this area due to soil washing out around facines and facines out of water	10+95 to 11+00	Lack of deep rooting vegetation Matting on repair area not adequately secured	PA 8
PA 9	Minor Bank Slump	15+40 to 15+50	High bank along outside bend Lack of deep rooting vegetation	PA 9
PA 10	Rills forming along channel bank/slope	15+75 to 16+25	Lack of deep rooting vegetation Poor soil preparation Compacted soil Sub-soil conditions (lack of nutrients)	PA 10
PA 11	Scour and slump along outside bank Note: repair efforts failed in this area due to soil washing out around facines and facines out of water	16+75 to 16+90	Lack of deep rooting vegetation Matting on repair area not adequately secured	PA 11
PA 12	Scour and slump along outside bank Note: repair efforts failed in this area due to soil washing out around facines and facines out of water	17+50 to 17+65	Lack of deep rooting vegetation Matting on repair area not adequately secured	PA 12
PA 13	Rills forming along channel bank/slope	18+35 to 18+85	Lack of deep rooting vegetation Poor soil preparation Compacted soil Sub-soil conditions (lack of nutrients)	PA 13
PA 14	Scour and slump along outside bank	19+20 to 19+30	Lack of deep rooting vegetation	PA 14
PA 15	Bank scour upstream of xvane Note: repaired but vegetation has not recovered	21+75 to 21+95	Lack of deep rooting vegetation	PA 15

Table XI. Morphology and Hydraulic Monitoring Summary

Project Number and Name:

Segment/Reach: Project Number and Name: 072 (UT to Clark Creek at Cato Farms)

Parameter	Cross Section 1			Cross Section 2			Cross Section 3			Cross Section 4			Cross Section 5			Cross Section 6		
	Station 21+67 Riffle			Station 20+27 Riffle			Station 15+71 Pool			Station 13+55 Pool			Station 11+86 Pool			Station 8+18 Pool		
Dimension	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2
BF Width (ft)		6.2			10.7			6.7			16.2			7			6.2	
Floodprone Width (ft) (approx)		28.1			24.8													
BF Cross Sectional Area (ft ²)		5.4			4.4			6.4			8.4			6			7.7	
BF Mean Depth (ft)		0.9			0.4													
BF Max Depth (ft)		1.7			0.7			1.9			1.6			2.1			1.9	
Width/Depth Ratio		7.2			26.2													
Entrenchment Ratio		4.5			2.3													
Wetted Perimeter(ft)																		
Hydraulic radius (ft)																		
Substrate																		
d50 (mm)		0.27			0.06			Silt			0.1			0.38			0.15	
d84 (mm)		0.5			0.31			0.19			0.23			0.86			0.55	
Parameter	MY-00 (2004)			MY-01 (2005 - Upper)			MY-01 (2005 - Lower)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)				10	55	15	46	61	51									
Radius of Curvature (ft)				10	18	34	42	56	51									
Meander Wavelength (ft)				40	99	57	141	249	217									
Meander Width ratio																		
Profile																		
Riffle length (ft)				8	80	13												
Riffle slope (ft/ft)				0.23%	8.00%	1.89%												
Pool length (ft)				8	118	20												
Pool spacing (ft)				15.5	215	33.5												
Additional Reach Parameters	MY-00 (2004)			MY-01 (2005)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)			MY-05 (2009)		
Valley Length (ft)	1746																	
Channel Length (ft)				2512														
Sinuosity				1.4														
Water Surface Slope (ft/ft)				0.71%														
BF slope (ft/ft)				0.69%														
Rosgen Classification				E5/B5														
Number of Bankfull Events				n/a														
Extent of BF floodplain (area)				n/a														
BEHI*																		

IV. Methodology Section

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

References:

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

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

APPENDIX A

Vegetation Raw Data

1. Vegetation Photo Log
2. Vegetation Survey Data Tables

Note: Vegetation problem areas are shown in problem area plan view in Appendix B

APPENDIX B

Morphology Raw Data

1. Problem Area Plan View
2. Plan View of Monitoring Overlain Design Plans
3. Project Photo Log
4. Stream Problem Area Photos
5. Cross section and Pebble Count Plots and Raw Data Tables
6. Longitudinal Plots and Raw Data Tables

APPENDIX A

Vegetation Raw Data

1. Vegetation Photo Log
2. Vegetation Survey Data Tables

Note: Vegetation problem areas are shown in problem area plan view in Appendix B

UT to Clark Creek at Cato Farms

Vegetation Plot Photos



Plot 1



Plot 2



Plot 3



Plot 4



Plot 5



Plot 6



Plot 7



•Plot 8

Cato Farm 2005 Vegetation Problem Areas



VPA 1. Bare Flood Plain



VPA 2a. Bare Bank



VPA 2b, Bare Bank, photo 2



VPA 3, Bare Bank



VPA 3b. Bare Bank, photo



VPA 3c, Bare Flood Plain

VEGETATION DATA - RAW									
UT to Clark's Creek on Cato Farm									
11-Jul-05									
Plot No.	Species	Count	Plot No.	Species	Count	Plot No.	Species	Count	
1	QUMI	1	4	QUMI	2	7	QUMI	2	
	SANI	4		SANI			SANI		
	CEOC3	3		CEOC3	3		CEOC3		
	CBUNK1	1		CBUNK1			CBUNK1		
	SACA	1		SACA	1		SACA		
	NYSL	1		NYSL			NYSL		
	ACNE	1		ACNE	2		ACNE	4	
	CBUNK2	1		CBUNK2			CBUNK2		
	QUAL	1		QUAL			QUAL	2	
				COST	4		COST		
2	QUMI	3		ARAR	1		ARAR	1	
	SANI			CBUNK3			CBUNK3		
	CEOC3			FRPE			FRPE		
	CBUNK1			COAM	2		COAM	17	
	SACA	1					PODE		
	NYSL		5	QUMI			CBUNK4		
	ACNE	2		SANI					
	CBUNK2	1		CEOC3	1	8	QUMI	2	
	QUAL	1		CBUNK1			SANI	4	
	COST	1		SACA			CEOC3		
	ARAR	3		NYSL			CBUNK1		
	CBUNK3	2		ACNE	2		SACA		
	FRPE	1		CBUNK2			NYSL		
				QUAL			ACNE	4	
3	QUMI			COST			CBUNK2		
	SANI	2		ARAR	2		QUAL	1	
	CEOC3	1		CBUNK3	1		COST		
	CBUNK1			FRPE			ARAR	1	
	SACA	2		COAM	10		CBUNK3		
	NYSL			PODE	1		FRPE	3	
	ACNE	2		CBUNK4	1		COAM	12	
	CBUNK2						PODE		
	QUAL		6	QUMI	4		CBUNK4		
	COST			SANI	5		JUNI	1	
	ARAR	1		CEOC3					
	CBUNK3			CBUNK1					
	FRPE			SACA					
	COAM	2		NYSL					
				ACNE	1				
				CBUNK2					
				QUAL	1				
				COST					
				ARAR	4				
				CBUNK3					
				FRPE	1				
				COAM	1				
				PODE	1				
				CBUNK4					

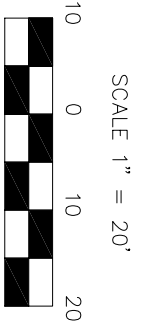
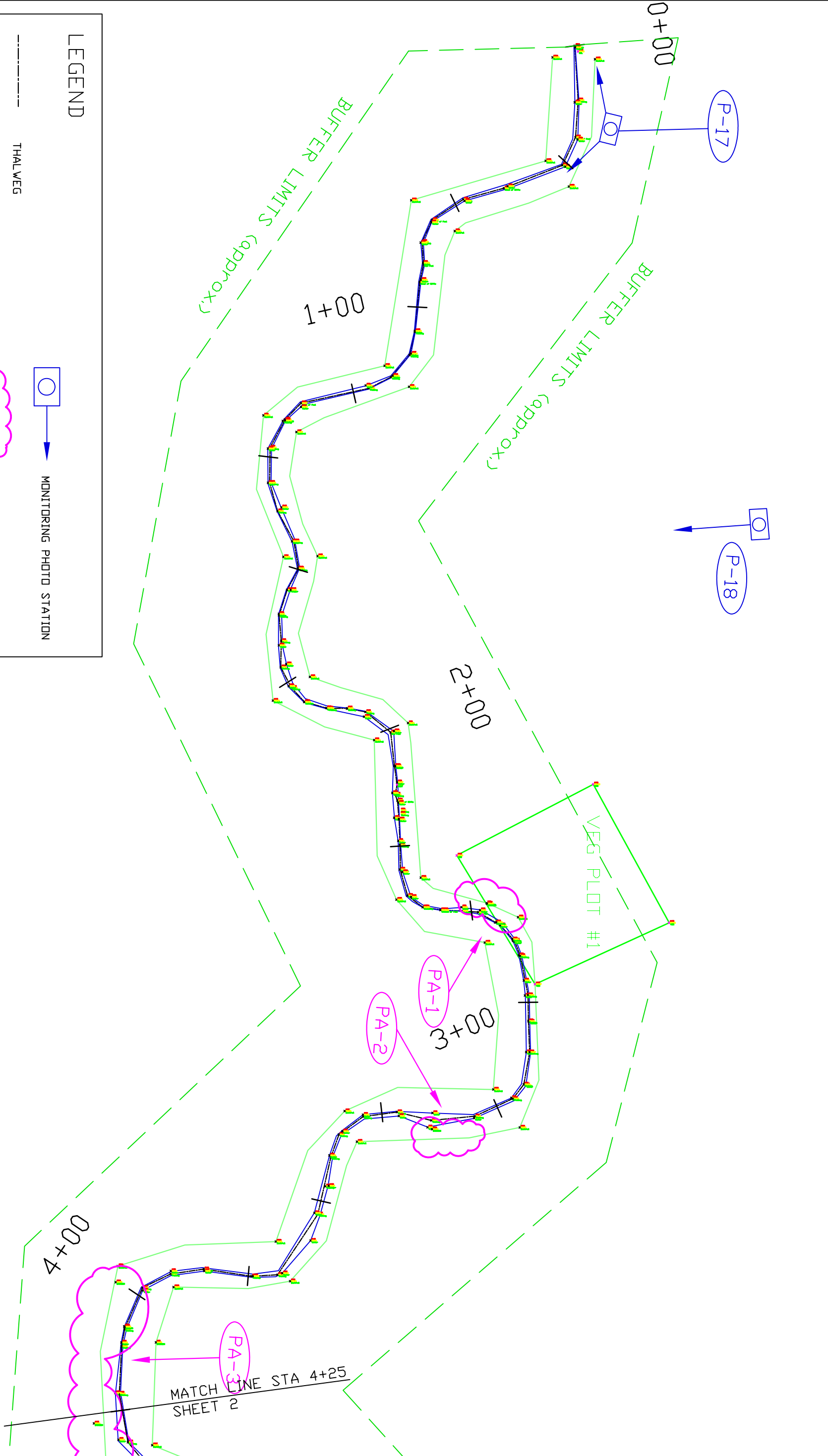
APPENDIX B

Morphology Raw Data

1. Problem Area Plan View
2. Plan View of Monitoring Overlain Design Plans
3. Project Photo Log
4. Stream Problem Area Photos
5. Cross section and Pebble Count Plots and Raw Data Tables
6. Longitudinal Plots and Raw Data Tables

LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK
- ☐ → MONITORING PHOTO STATION
- ☁ AREA OF CONCERN
- → AREA OF CONCERN PHOTO



DATE	01/06/2006
PROJECT NO.	
FILENAME	CATOLDWG
SHEET NO.	PL - 1
DRAWING NO.	

UT to CLARK CREEK
CATO FARMS
MECKLENBURG COUNTY, N.C.

2005 MONITORING WITH DESIGN
1:20 SCALE PLAN SHEET









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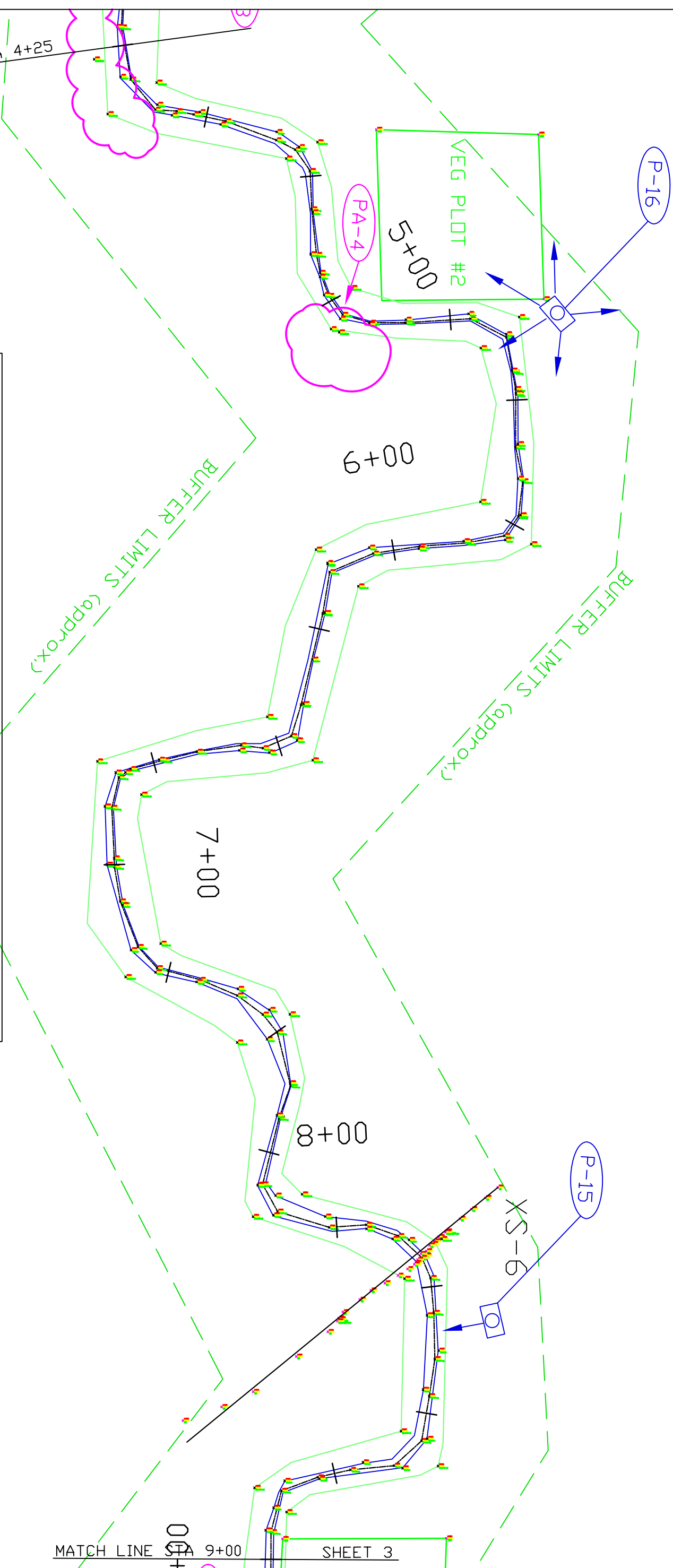
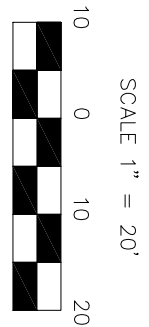
BIOLOGICAL & AGRICULTURAL ENGINEERING
Weaver Labs Campus Box 7625
North Carolina State University
Raleigh, NC 27695

1	2005 Monitoring	DAB	DRC	01/06/06
NO	REVISIONS	DRN	CHK	DATE

MATCH LINE STA 4+25
SHEET 1

LEGEND

-  THALWEG
-  WATERS EDGE
-  BANKFULL
-  EASEMENT LIMITS (Proposed)
-  TOP OF BANK
-  MONITORING PHOTO STATION
-  AREA OF CONCERN
-  AREA OF CONCERN PHOTO



MATCH LINE STA 9+00 SHEET 3

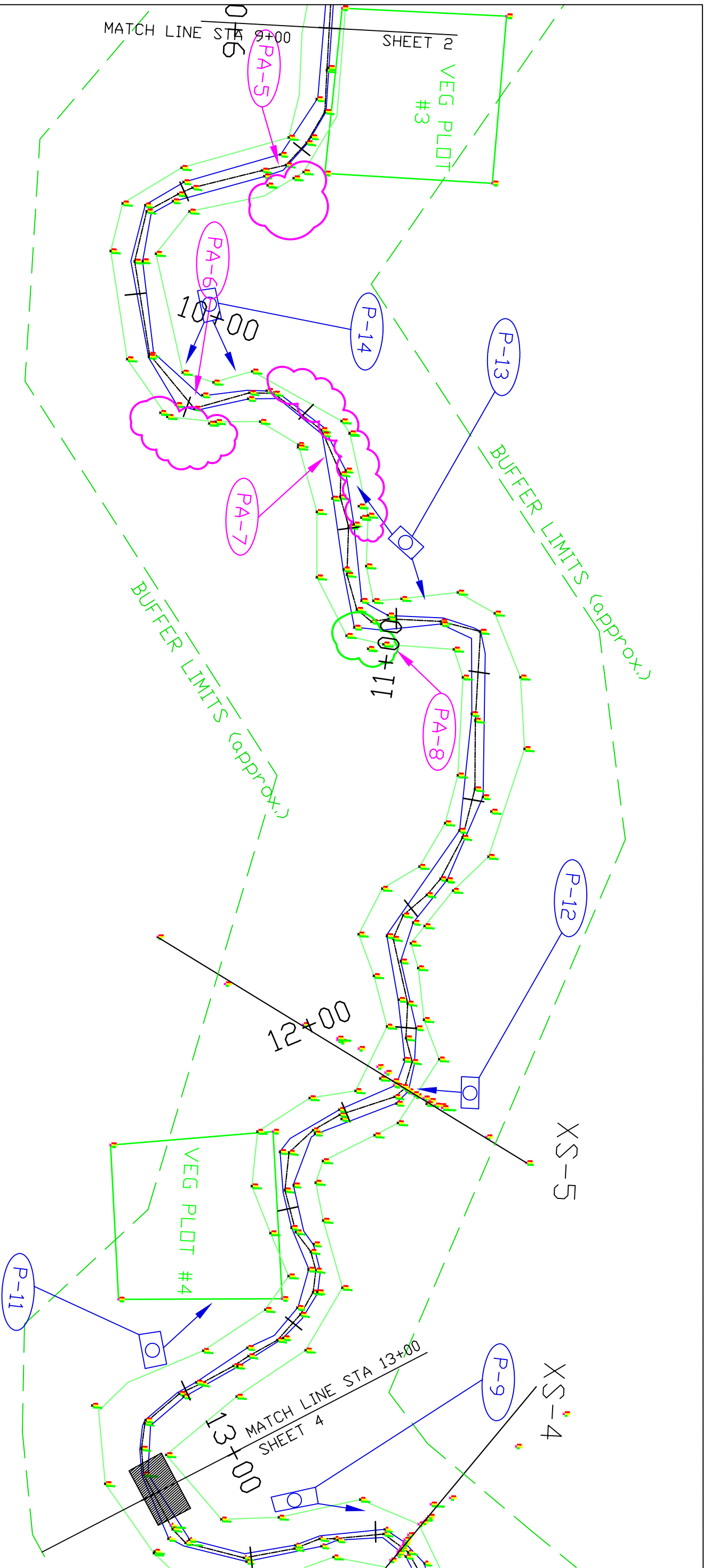
DRAWING NO. PL - 2

PROJECT NO. 01/06/2006
 FILENAME CATOLDWG
 DATE 01/06/2006
 UT to CLARK CREEK
 CATO FARMS
 MECKLENBURG COUNTY, N.C.
 2005 MONITORING WITH DESIGN
 1:20 SCALE PLAN SHEET

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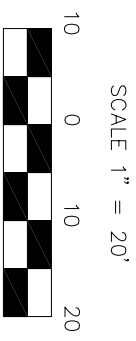
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LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK
- → MONITORING PHOTO STATION
- ☁ AREA OF CONCERN
- → AREA OF CONCERN PHOTO



PROJECT NO. 01/06/2006
 FILENAME CATOLDWG
 SHEET NO. PL - 03
 DRAWING NO.

UT to CLARK CREEK
 CATO FARMS
 MECKLENBURG COUNTY, N.C.

2005 MONITORING WITH DESIGN
 1:20 SCALE PLAN SHEET

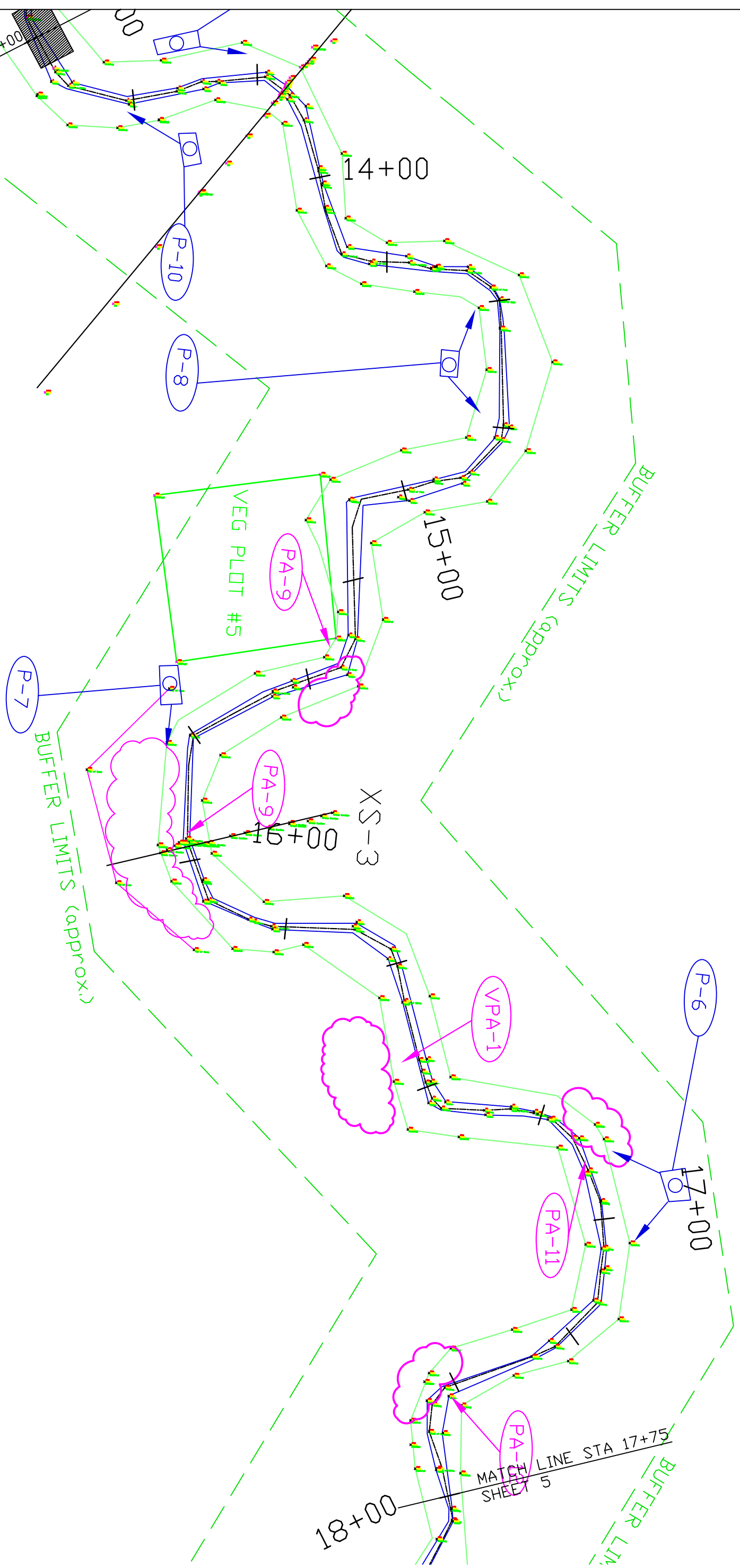
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1	2005 Monitoring	DAB	DRC	08/06/08
NO	REVISIONS	DRN	CHK	DATE

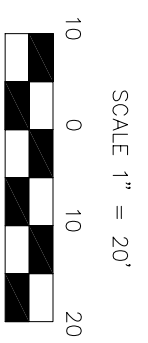
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SHEET 3

MATCH LINE STA 17+75
SHEET 5

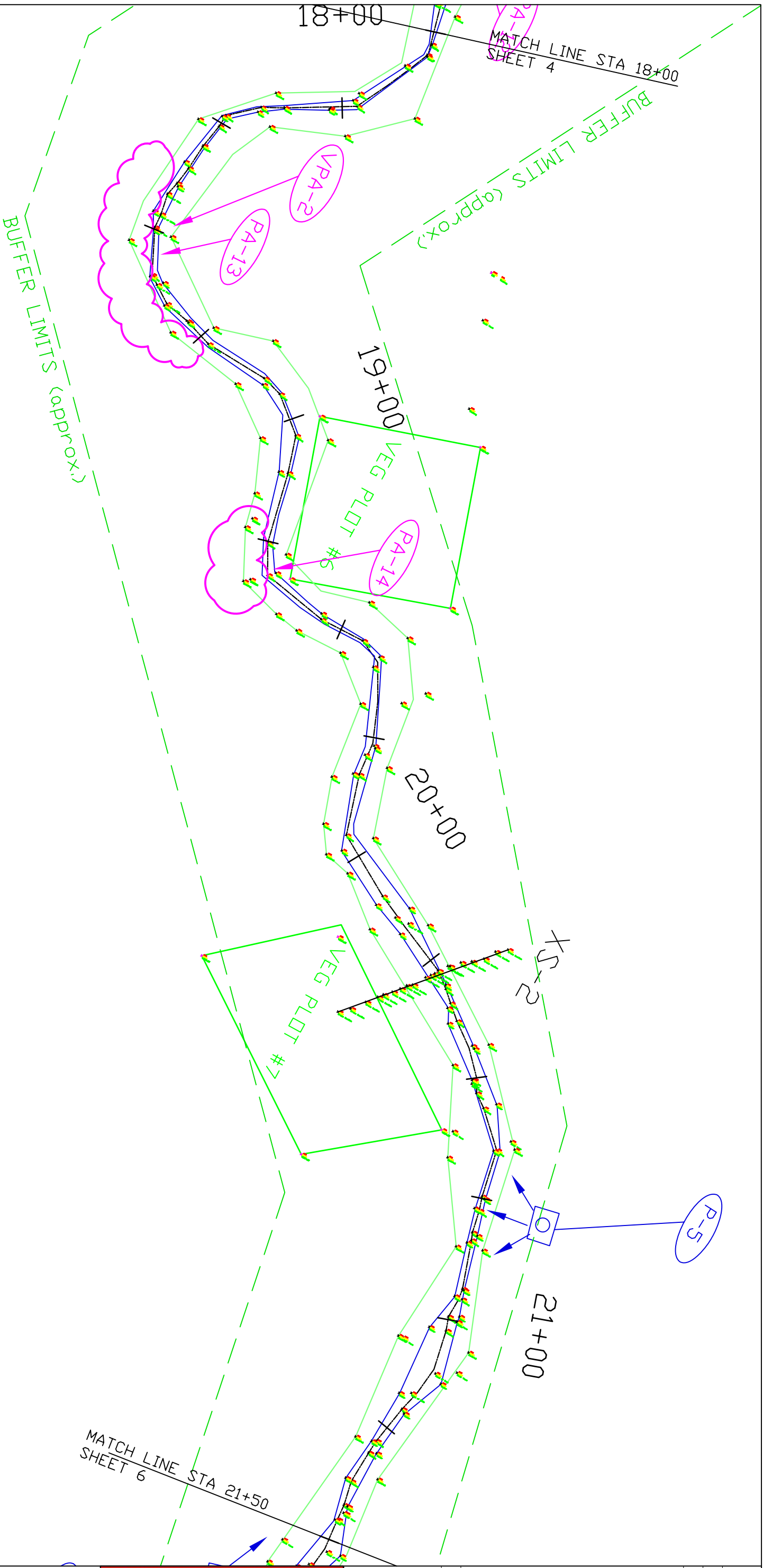


LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK
- ☐ → MONITORING PHOTO STATION
- ☁ → AREA OF CONCERN
- → AREA OF CONCERN PHOTO

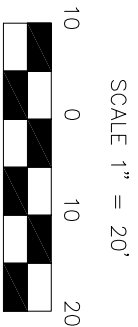


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	DATE 01/06/2006		NO		DRN	CHK	DATE



LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK
- → MONITORING PHOTO STATION
- ☁ AREA OF CONCERN
- → AREA OF CONCERN PHOTO



DATE	01/06/2006
PROJECT NO.	
FILENAME	CAT0.DWG
SHEET NO.	PL - 05
DRAWING NO.	

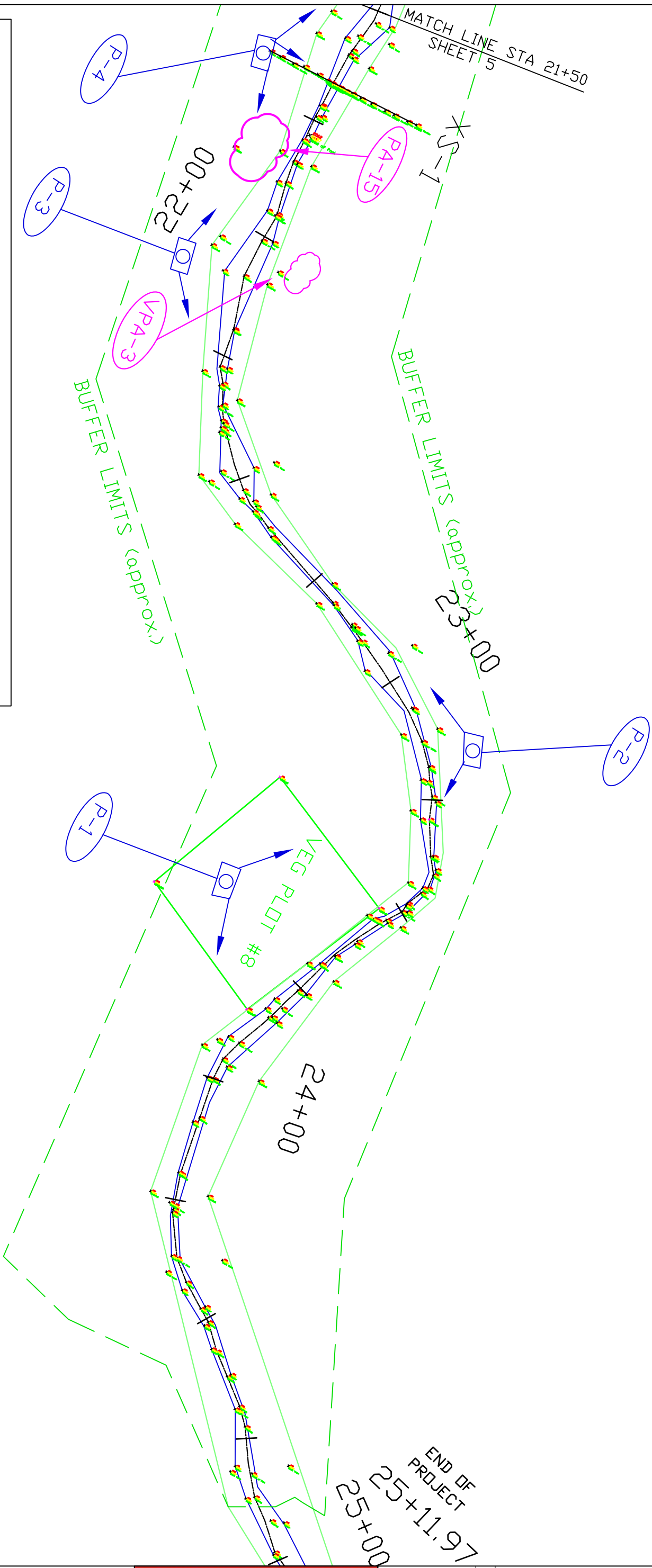
UT to CLARK CREEK
CATO FARMS
MECKLENBURG COUNTY, N.C.

2005 MONITORING WITH DESIGN
1:20 SCALE PLAN SHEET

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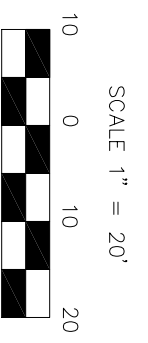
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Raleigh, NC 27695

1	2005 Monitoring	DAB	DRC	01/06/06
REVISIONS				
NO		DRN	CHK	DATE



LEGEND

-----	THALWEG		MONITORING PHOTO STATION
-----	WATERS EDGE		AREA OF CONCERN
-----	BANKFULL		AREA OF CONCERN PHOTO
-----	EASEMENT LIMITS (Proposed)		
-----	TOP OF BANK		



DATE	01/06/2006
PROJECT NO.	CATOLDWG
FILENAME	PL - 08
SHEET NO.	
DRAWING NO.	

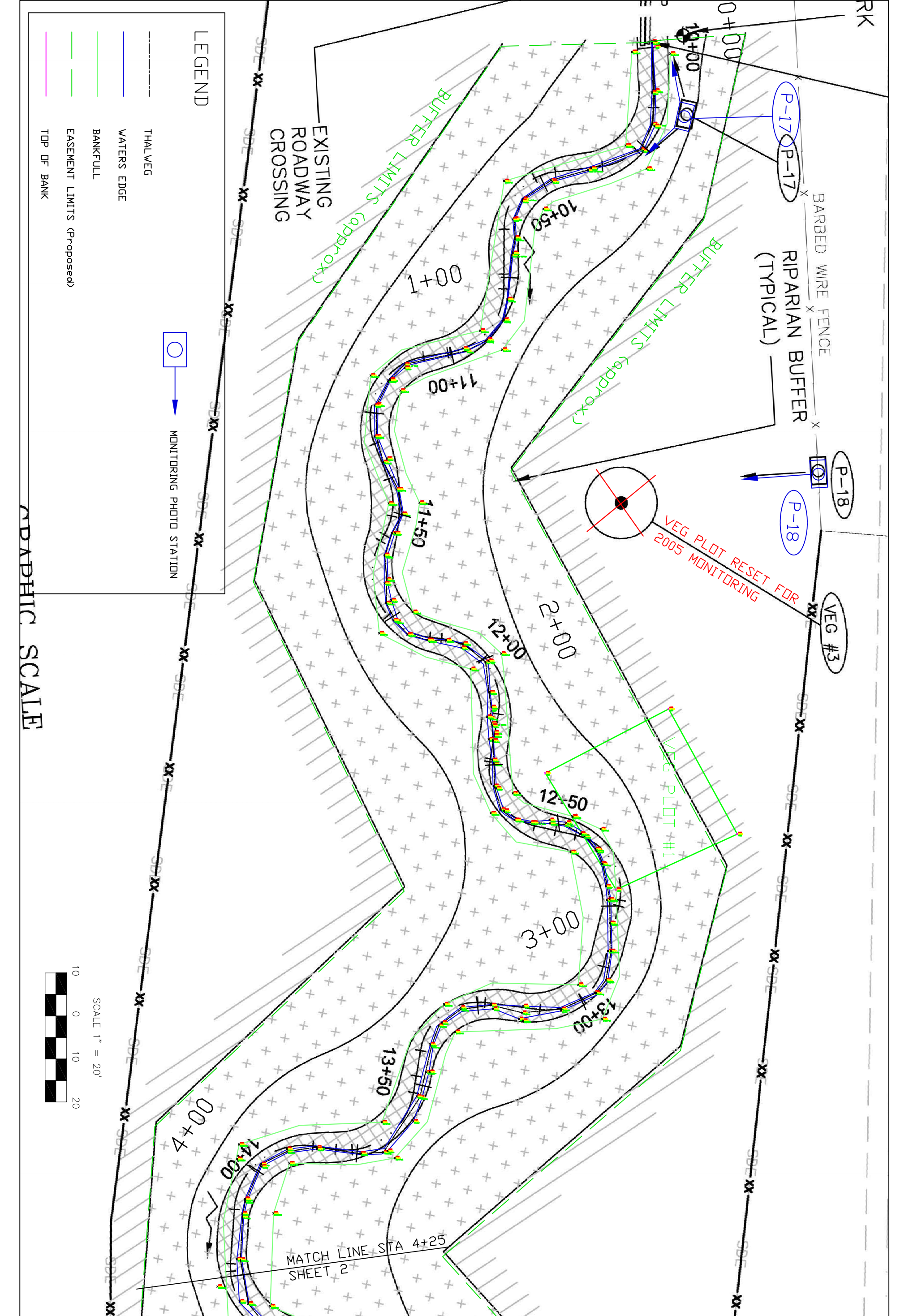
UT to CLARK CREEK
CATO FARMS
MECKLENBURG COUNTY, N.C.

2005 MONITORING WITH DESIGN
1:20 SCALE PLAN SHEET

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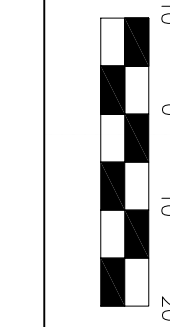
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1	2005 Monitoring	DAB	DRC	01/06/08
NO	REVISIONS	DRN	CHK	DATE



LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK
- → MONITORING PHOTO STATION



GRAPHIC SCALE

UT to CLARK CREEK
CATO FARMS
MECKLENBURG COUNTY, N.C.

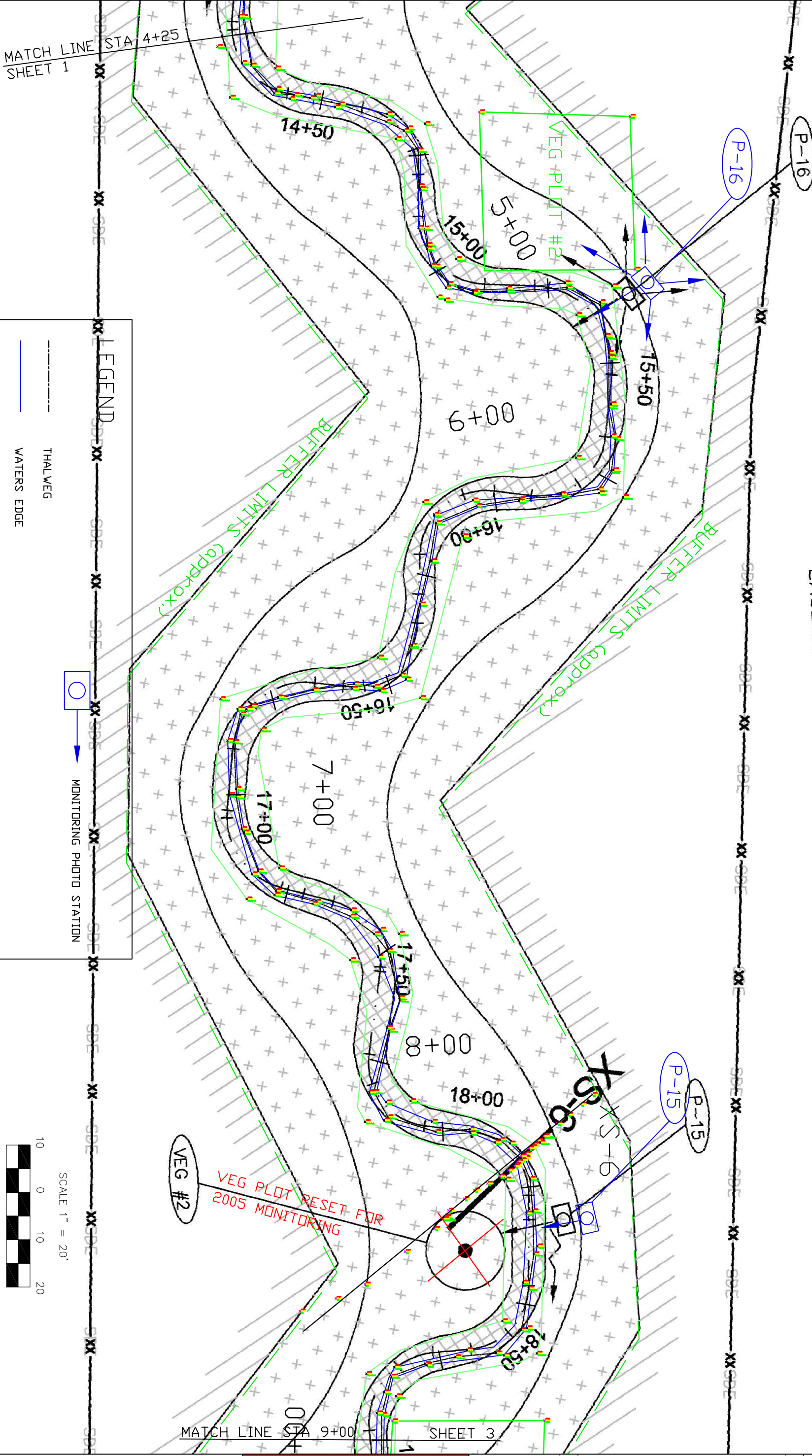
2005 MONITORING WITH DESIGN
1:20 SCALE PLAN SHEET

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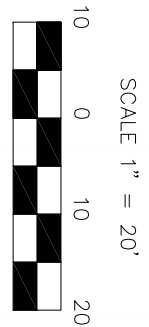
CONSTRUCTION
EASEMENT



MATCH LINE STA 4+25
SHEET 1

MATCH LINE STA 9+00
SHEET 3

- LEGEND**
- THALWEG
 - WATERS EDGE
 - BANKFULL
 - EASEMENT LIMITS (Proposed)
 - TOP OF BANK
 - → MONITORING PHOTO STATION



PROJECT NO. 01/06/2006
DATE
FILENAME CATOLDWG
SHEET NO. PL - 2
DRAWING NO.

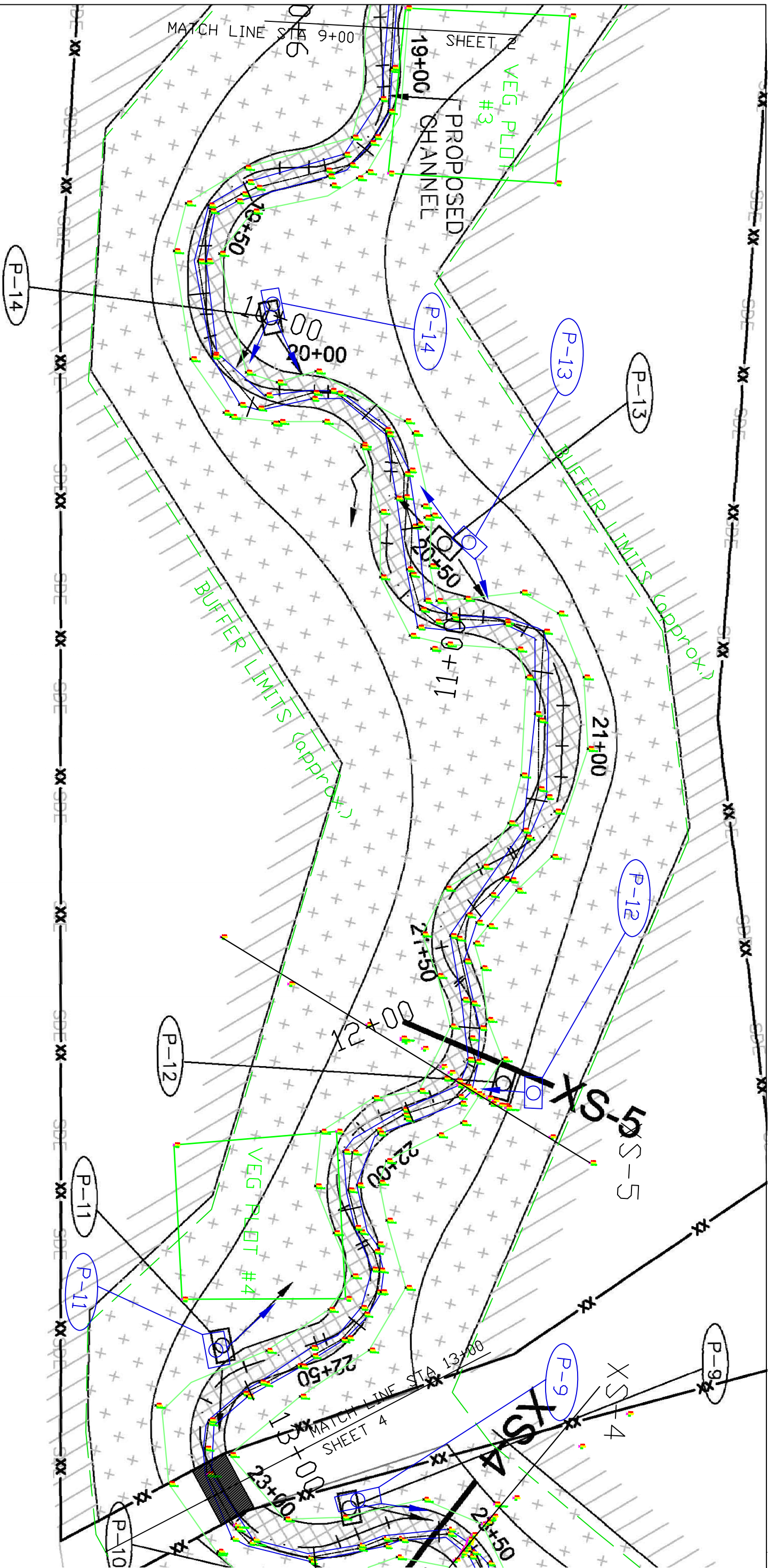
UT to CLARK CREEK
CATO FARMS
MECKLENBURG COUNTY, N.C.

2005 MONITORING WITH DESIGN
1:20 SCALE PLAN SHEET

NC STATE UNIVERSITY

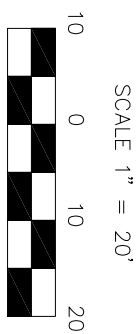
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1	2005 Monitoring	DAB	DRC	08/06/08
NO	REVISIONS	DRN	CHK	DATE



LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK



DATE: 01/06/2006
 PROJECT NO.: CATOLDWG
 SHEET NO.: PL-03
 DRAWING NO.:

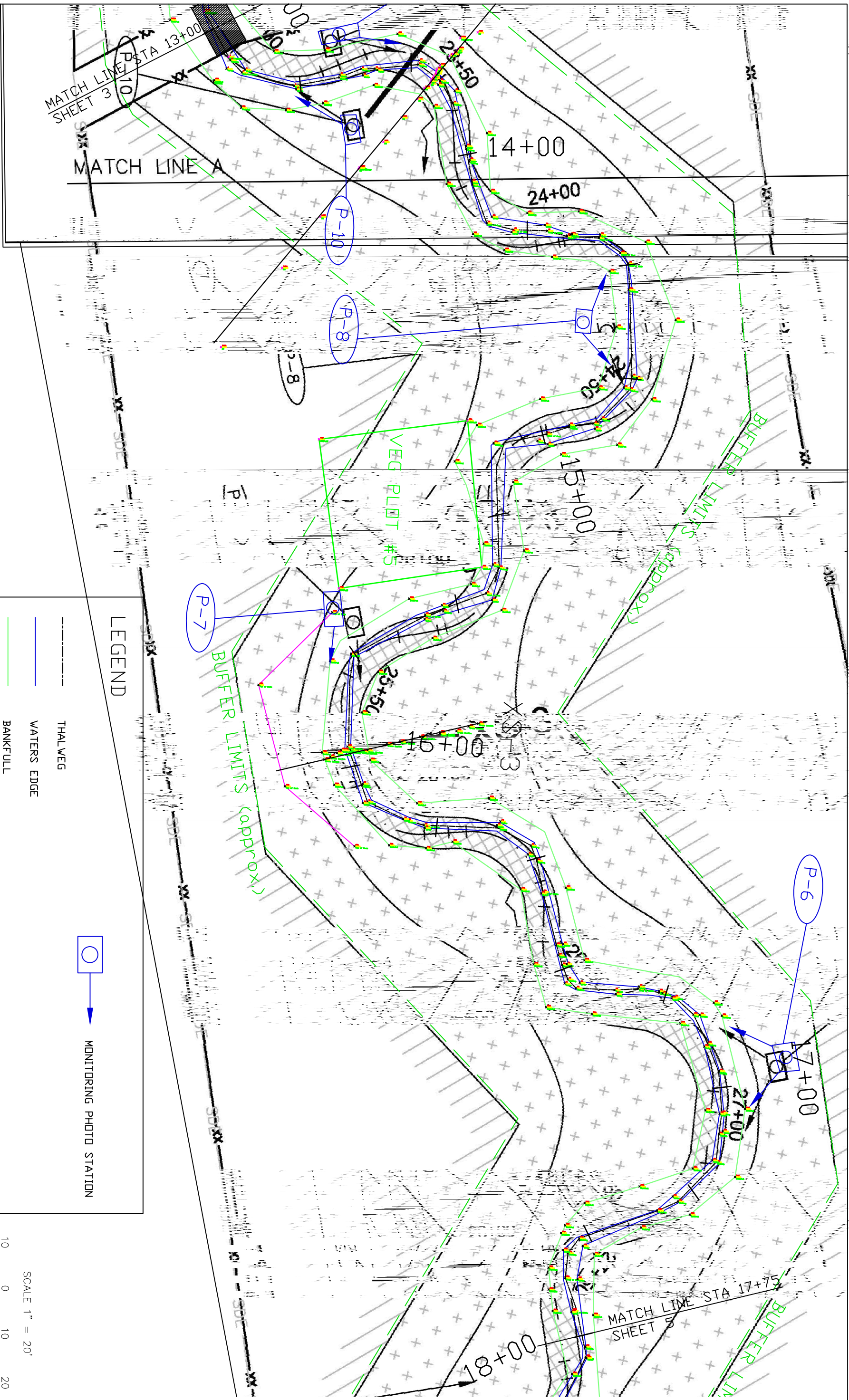
2005 MONITORING WITH DESIGN
 1:20 SCALE PLAN SHEET

UT to CLARK CREEK
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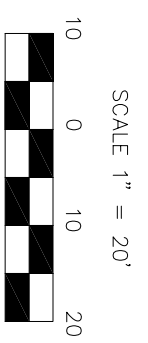
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NO	REVISIONS	DRN	CHK	DATE



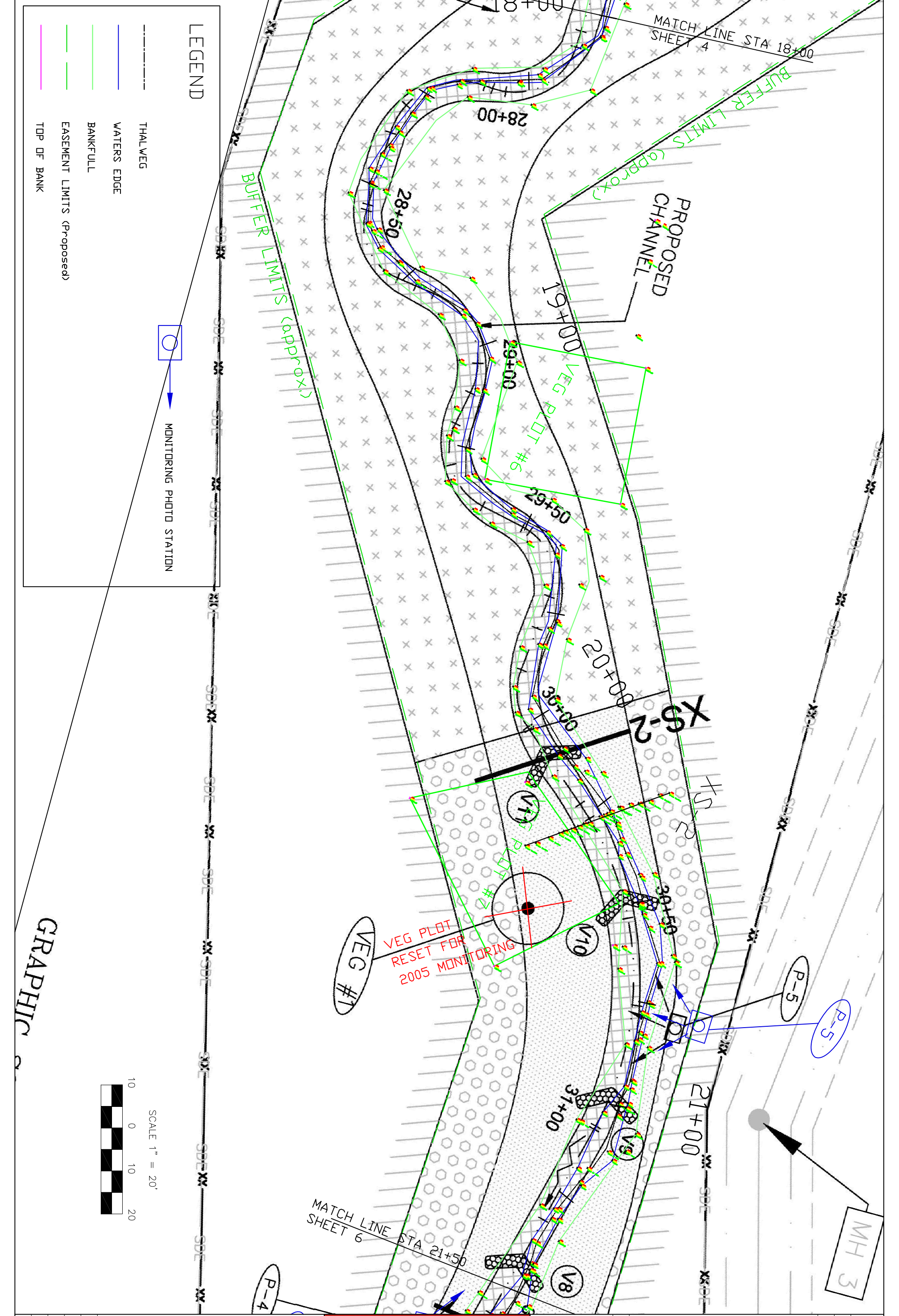
LEGEND

- THALWEG
- WATERS EDGE
- BANKFULL
- EASEMENT LIMITS (Proposed)
- TOP OF BANK

○ → MONITORING PHOTO STATION



DRAWING NO. PL - 04	SHEET NO. CATOLDWG	FILENAME CATOLDWG	PROJECT NO. 01/06/2006	DATE 01/06/2006	UT to CLARK CREEK CATO FARMS MECKLENBURG COUNTY, N.C.		BIOLOGICAL & AGRICULTURAL ENGINEERING Weaver Labs Campus Box 7625 North Carolina State University Raleigh, NC 27695	1 2005 Monitoring		DAB	DRC	01/06/08
					2005 MONITORING WITH DESIGN 1:20 SCALE PLAN SHEET			NO	REVISIONS	DRN	CHK	DATE



PROJECT NO. 01/06/2006
 FILENAME CATOLDWG
 SHEET NO. PL - 05
 DRAWING NO.

UT to CLARK CREEK
 CATO FARMS
 MECKLENBURG COUNTY, N.C.

2005 MONITORING WITH DESIGN
 1:20 SCALE PLAN SHEET

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NO	REVISIONS	DRN	CHK	DATE
1	2005 Monitoring	DAB	DRC	01/06/08

UT to Clark Creek at Cato Farms

2005 Photo Log



End Downstream



End Upstream



P1a



P1b



P2a



P2b



P3a



P3b



P4a



P4b



P4c



P5a



P5b



P5c



P6a



P6b



P7c



P8a



P9c



P10c



P11a



P11b



P12



P13a



P13b



P14a



P14b



P15



P16a1



P16a



P16b1



P16b



P16c1



P16c



P16d1



P16d



P16e1



P16e



P17a



P17b



P18



START down



START up

Cato Farm 2005 Problem Areas



PA1



PA2



PA3



PA3b



PA3c



PA4



PA5



PA6



PA7



PA8



PA9



PA10



PA10b



PA11



PA12



PA13a



PA13b



PA13c



PA14



PA15



PA16a



PA16b

Cato Farm 2005 Cross Section Photos



X1u



x1d



X2u



X2d



X3u



X3d



X4u



X4d



X5u



X5d



X6u



X6d

Project Name Cato Farms
Cross Section X1 - Station 21+67
Feature Riffle
Right Pin GPS coordinate 35.40819 80.82066
Date 6/10/2005
Crew Dan Clinton, David Bidelspach



2004 As-Built Survey			2005		
Station	Elev	Notes	Station	Elev	Notes
			0+00	90.36	(XSPIN)
			0+02	90.17	(XS)
			0+05	89.90	(XS)
			0+07	89.74	(XS)
			0+10	88.80	(XS)
			0+12	88.66	(XS)
			0+14	88.54	(XS)
			0+16	88.42	B
			0+17	87.79	(XS)
			0+17	87.24	(XS)
			0+18	86.79	(XS)
			0+19	86.72	(XS)
			0+19	86.82	(XS)
			0+19	87.04	(XS)
			0+20	87.57	(XS)
			0+22	88.51	(XS)
			0+25	88.85	(XS)
			0+27	89.17	(XS)
			0+30	90.48	(XS)
			0+32	90.84	(XSPIN)

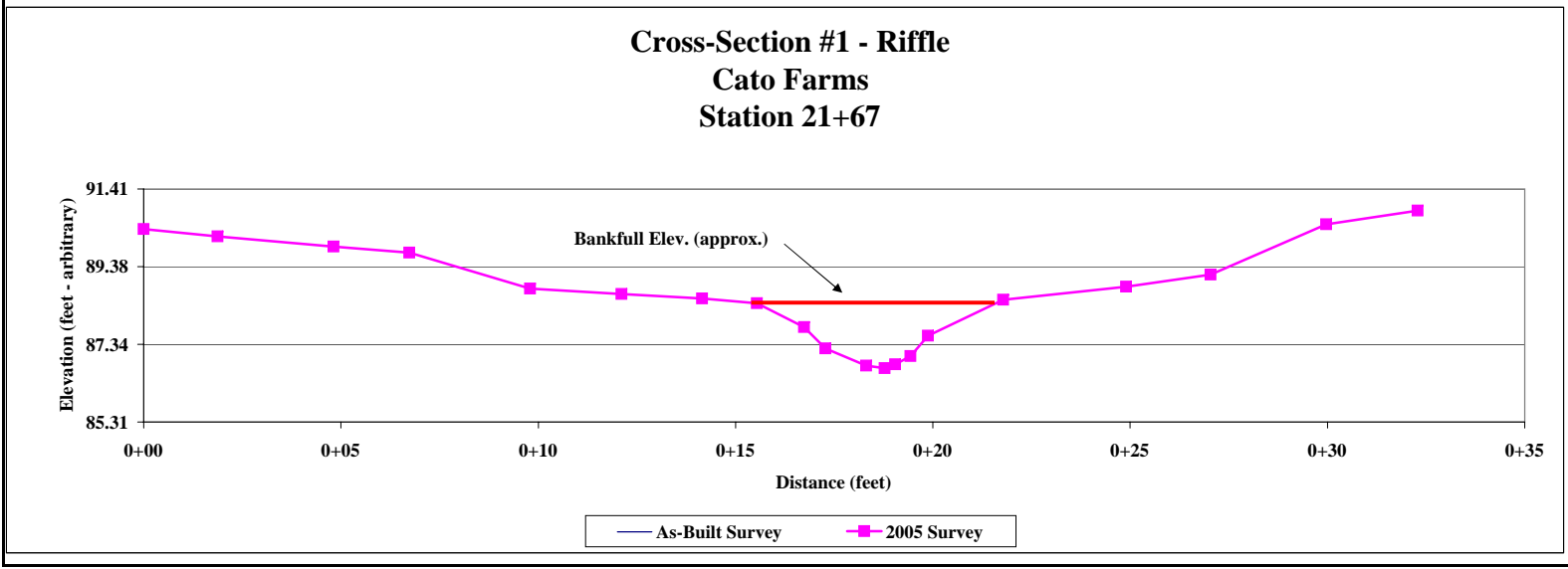
FP

FP

Cross-Section #1 - Looking Downstream

Bankfull Area		
	As-Built	2004
Area	0.0	5.4
Width	0.0	6.2
Mean Depth		0.9
Max Depth	0.0	1.7
w/d ratio		7.2
FP Width		28.10
ER		4.5
Stream Type		E

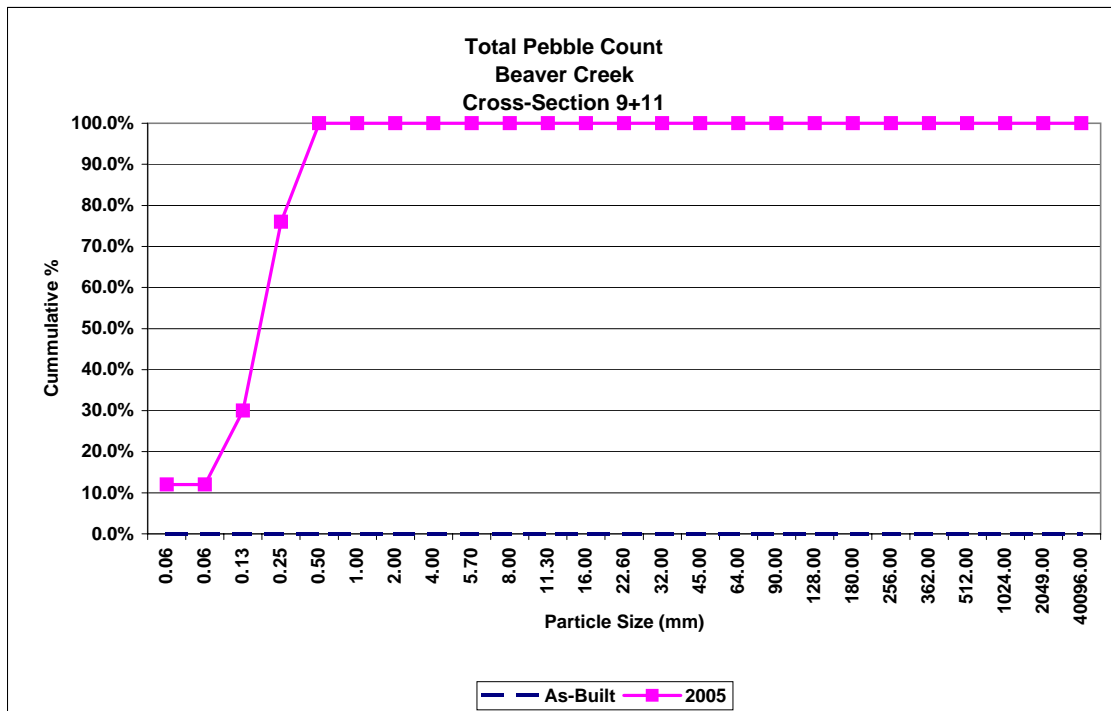
Cross-Section #1 - Riffle
Cato Farms
Station 21+67



Project Name	Cato Branch
Cross Section	X1 - Station 21+67
Feature	Riffle
Date	6/10/05
Crew	Shaffer, Clinton

Description	Material	Size (mm)	As-Built			2005		
			Pool	%	Cum %	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061		0.0%	0.0%	6	12.0%	12.0%
Sand	very fine sand	0.062		0.0%	0.0%	0	0.0%	12.0%
	fine sand	0.125		0.0%	0.0%	9	18.0%	30.0%
	medium sand	0.25		0.0%	0.0%	23	46.0%	76.0%
	course sand	0.50		0.0%	0.0%	12	24.0%	100.0%
	very course sand	1.0		0.0%	0.0%	0	0.0%	100.0%
G r a v e l	very fine gravel	2.0		0.0%	0.0%	0	0.0%	100.0%
	fine gravel	4.0		0.0%	0.0%	0	0.0%	100.0%
	fine gravel	5.7		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	8.0		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	11.3		0.0%	0.0%	0	0.0%	100.0%
	course gravel	16.0		0.0%	0.0%	0	0.0%	100.0%
	course gravel	22.6		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	32		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	45		0.0%	0.0%	0	0.0%	100.0%
	Cobble	small cobble	64		0.0%	0.0%	0	0.0%
medium cobble		90		0.0%	0.0%	0	0.0%	100.0%
large cobble		128		0.0%	0.0%	0	0.0%	100.0%
very large cobble		180		0.0%	0.0%	0	0.0%	100.0%
Boulder	small boulder	256		0.0%	0.0%	0	0.0%	100.0%
	small boulder	362		0.0%	0.0%	0	0.0%	100.0%
	medium boulder	512		0.0%	0.0%	0	0.0%	100.0%
	large boulder	1024		0.0%	0.0%	0	0.0%	100.0%
	very large boulder	2049		0.0%	0.0%	0	0.0%	100.0%
Bedrock	bedrock	40096		0.0%	0.0%	0	0.0%	100.0%
TOTAL / % of whole count				0	0.0%		50	100.0%

	d16	d35	d50	d84	d95
As-Built	0.00	0.00	0.00	0.00	0.00
2005	0.11	0.21	0.27	0.50	0.67



Project Name	Cato Farms		
Cross Section	X2 - Station 20+27		
Feature	Riffle		
Right Pin GPS coordinate	35.40846	80.82085	
Date	6/10/2005		
Crew	Dan Clinton, David Bidelspach		



Cross-Section #2 - Looking Upstream

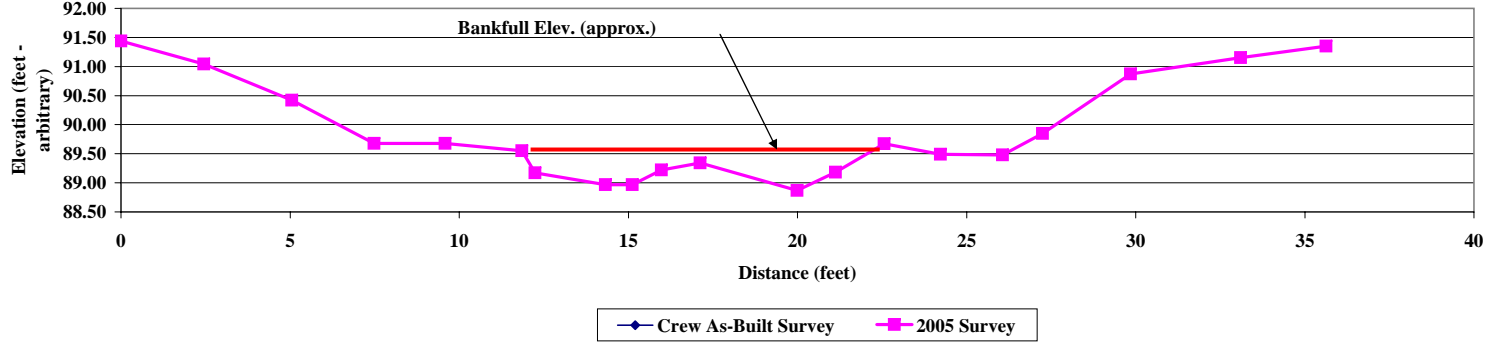
2004 As-Built Survey			2005 2005 Survey		
Station	Elev	Notes	Station	Elev	Notes
			0+00.0	91.44	(XSPIN)
			0+02.5	91.04	(XS)
			0+05.1	90.42	(XS)
			0+07.5	89.68	(XS)
			0+09.6	89.68	(XS)
			0+11.9	89.55	(XS)
			0+12.2	89.17	(XS)
			0+14.3	88.97	(XS)
			0+15.1	88.97	(XS)
			0+16.0	89.22	(XS)
			0+17.1	89.34	(XS)
			0+20.0	88.87	(XS)
			0+21.1	89.18	(XS)
			0+22.6	89.67	(XS)
			0+24.2	89.49	(XS)
			0+26.1	89.48	(XS)
			0+27.3	89.85	(XS)
			0+29.9	90.87	(XS)
			0+33.1	91.15	(XS)
			0+35.6	91.35	(XSPIN)

FP

FP

Bankfull Area		
	As-Built	2004
Area	N/A	4.4
Width	N/A	10.7
Mean Depth	N/A	0.4
Max Depth	N/A	0.7
w/d ratio		26.2
FP Width		24.8
ER		2.32
Stream Type		B

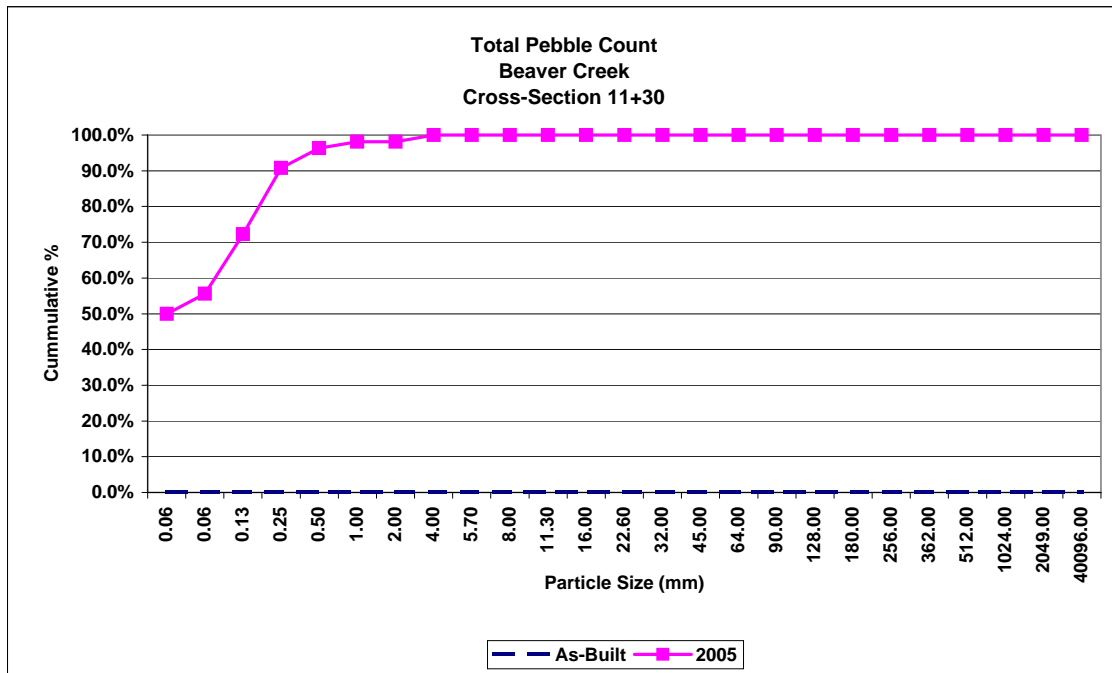
Cross-Section #2 - Riffle Cato Farms Station 20+27



Project Name	Cato Branch
Cross Section	X2 - Station 20+27
Feature	Riffle
Date	6/10/05
Crew	Shaffer, Clinton

Description	Material	As-Built			2005			
		Size (mm)	Riffle	%	Cum %	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061		0.0%	0.0%	27	50.0%	50.0%
Sand	very fine sand	0.062		0.0%	0.0%	3	5.6%	55.6%
	fine sand	0.125		0.0%	0.0%	9	16.7%	72.2%
	medium sand	0.25		0.0%	0.0%	10	18.5%	90.7%
	course sand	0.50		0.0%	0.0%	3	5.6%	96.3%
	very course sand	1.0		0.0%	0.0%	1	1.9%	98.1%
G r a v e l	very fine gravel	2.0		0.0%	0.0%	0	0.0%	98.1%
	fine gravel	4.0		0.0%	0.0%	1	1.9%	100.0%
	fine gravel	5.7		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	8.0		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	11.3		0.0%	0.0%	0	0.0%	100.0%
	course gravel	16.0		0.0%	0.0%	0	0.0%	100.0%
	course gravel	22.6		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	32		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	45		0.0%	0.0%	0	0.0%	100.0%
	Cobble	small cobble	64		0.0%	0.0%	0	0.0%
medium cobble		90		0.0%	0.0%	0	0.0%	100.0%
large cobble		128		0.0%	0.0%	0	0.0%	100.0%
very large cobble		180		0.0%	0.0%	0	0.0%	100.0%
Boulder	small boulder	256		0.0%	0.0%	0	0.0%	100.0%
	small boulder	362		0.0%	0.0%	0	0.0%	100.0%
	medium boulder	512		0.0%	0.0%	0	0.0%	100.0%
	large boulder	1024		0.0%	0.0%	0	0.0%	100.0%
	very large boulder	2049		0.0%	0.0%	0	0.0%	100.0%
Bedrock	bedrock	40096		0.0%	0.0%	0	0.0%	100.0%
TOTAL / % of whole count			0	0.0%		54	100.0%	

	d16	d35	d50	d84	d95
As-Built	0.00	0.00	0.00	0.00	0.00
2005	0.00	0.00	0.06	0.31	0.66



Project Name Cato Farms
 Cross Section X3 - Station 15+71
 Feature Pool
 Right Pin GPS coordinate 35.40918 80.82152
 Date 6/10/2005
 Crew Dan Clinton, David Bidelspach

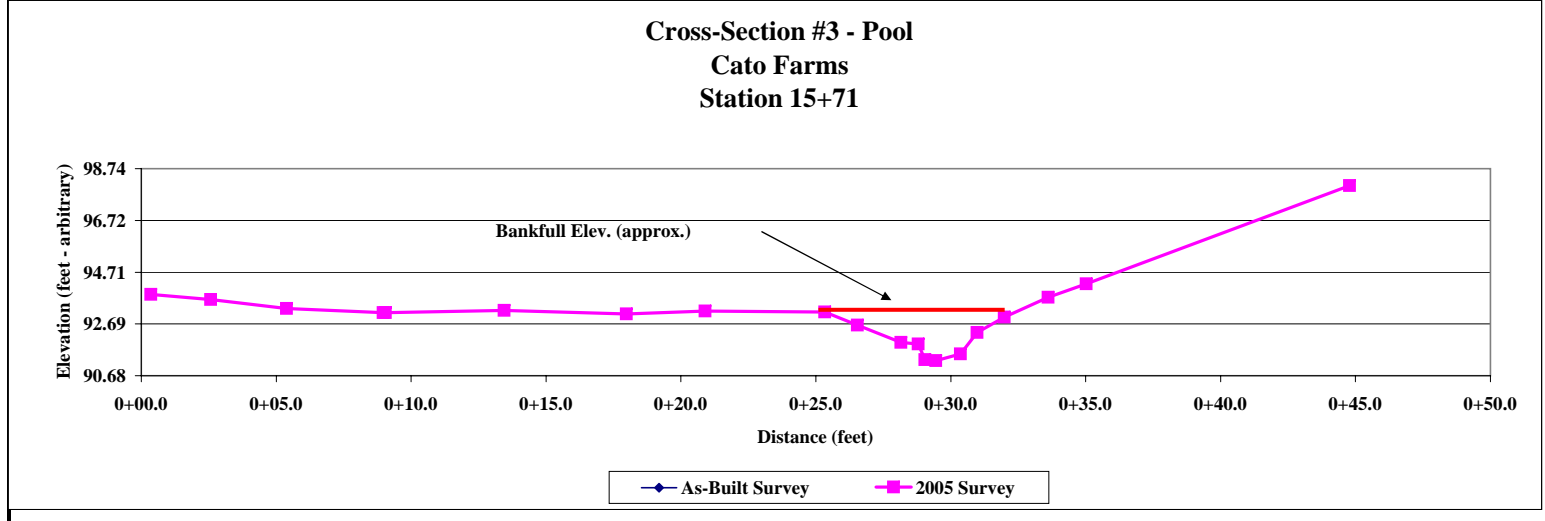
2004 As-Built Survey			2005 2005 Survey		
Station	Elev	Notes	Station	Elev	Notes
			0+00.4	93.84	(XSPIN)
			0+02.6	93.64	(XSPIN)
			0+05.4	93.29	(XS)
			0+09.0	93.13	(XS)
			0+09.1	93.13	(XS)
			0+13.5	93.22	(XS)
			0+18.0	93.08	(XS)
			0+20.9	93.19	(XS)
			0+25.3	93.16	(XS)
			0+26.5	92.64	(XS)
			0+28.2	91.97	(XS)
			0+28.8	91.91	(XS)
			0+29.0	91.3	(XS)
			0+29.5	91.26	(XS)
			0+30.4	91.52	(XS)
			0+31.0	92.36	(XS)
			0+32.0	92.96	(XS)
			0+33.6	93.73	(XS)
			0+35.0	94.25	(XSPIN)
			0+44.8	98.08	(TOB)



Cross-Section #3 - Looking Downstream

Bankfull Area		
	As-Built	2004
Area	0.0	6.4
Width	0.0	6.7
Max Depth	0.0	1.9

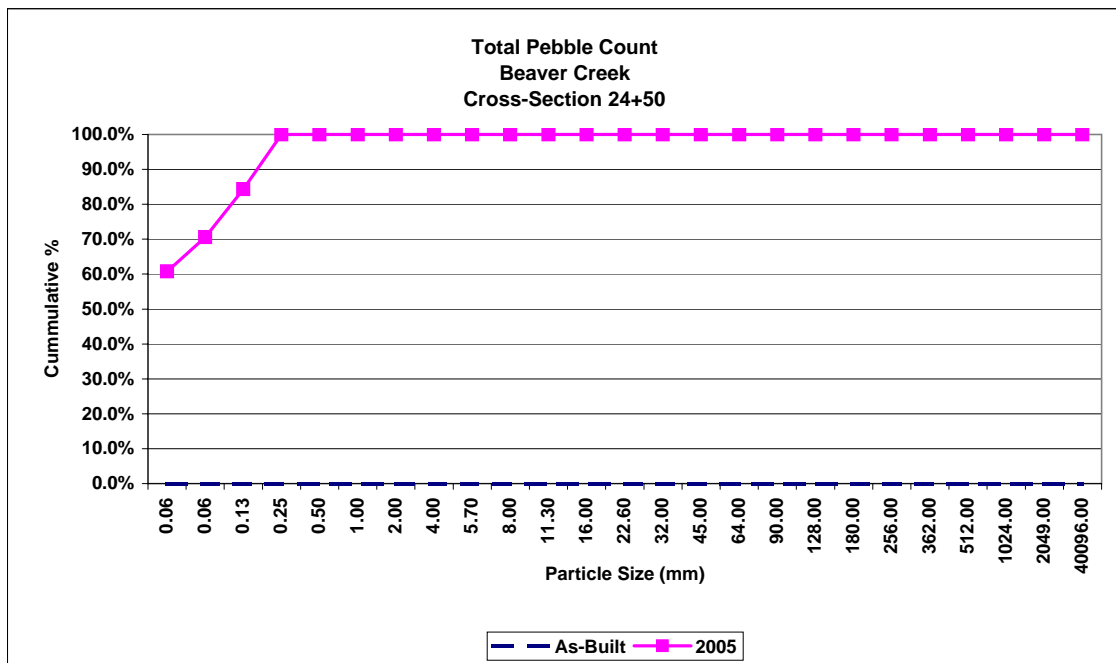
Cross-Section #3 - Pool
 Cato Farms
 Station 15+71



Project Name	Cato Branch		
Cross Section	X3 - Station 15+71		
Feature	Pool	Riffle directly downstream of xsc	
Date	6/10/05		
Crew	Shaffer, Clinton		

Description	Material	Size (mm)	As-Built			2005		
			Pool	%	Cum %	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061		0.0%	0.0%	31	60.8%	60.8%
Sand	very fine sand	0.062		0.0%	0.0%	5	9.8%	70.6%
	fine sand	0.125		0.0%	0.0%	7	13.7%	84.3%
	medium sand	0.25		0.0%	0.0%	8	15.7%	100.0%
	course sand	0.50		0.0%	0.0%	0	0.0%	100.0%
	very course sand	1.0		0.0%	0.0%	0	0.0%	100.0%
Gravel	very fine gravel	2.0		0.0%	0.0%	0	0.0%	100.0%
	fine gravel	4.0		0.0%	0.0%	0	0.0%	100.0%
	fine gravel	5.7		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	8.0		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	11.3		0.0%	0.0%	0	0.0%	100.0%
	course gravel	16.0		0.0%	0.0%	0	0.0%	100.0%
	course gravel	22.6		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	32		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	45		0.0%	0.0%	0	0.0%	100.0%
Cobble	small cobble	64		0.0%	0.0%	0	0.0%	100.0%
	medium cobble	90		0.0%	0.0%	0	0.0%	100.0%
	large cobble	128		0.0%	0.0%	0	0.0%	100.0%
	very large cobble	180		0.0%	0.0%	0	0.0%	100.0%
Boulder	small boulder	256		0.0%	0.0%	0	0.0%	100.0%
	small boulder	362		0.0%	0.0%	0	0.0%	100.0%
	medium boulder	512		0.0%	0.0%	0	0.0%	100.0%
	large boulder	1024		0.0%	0.0%	0	0.0%	100.0%
	very large boulder	2049		0.0%	0.0%	0	0.0%	100.0%
Bedrock	bedrock	40096		0.0%	0.0%	0	0.0%	100.0%
TOTAL / % of whole count				0	0.0%		51	100.0%

	d16	d35	d50	d84	d95
As-Built	0.00	0.00	0.00	0.00	0.00
2005	0.00	0.00	0.00	0.19	0.32



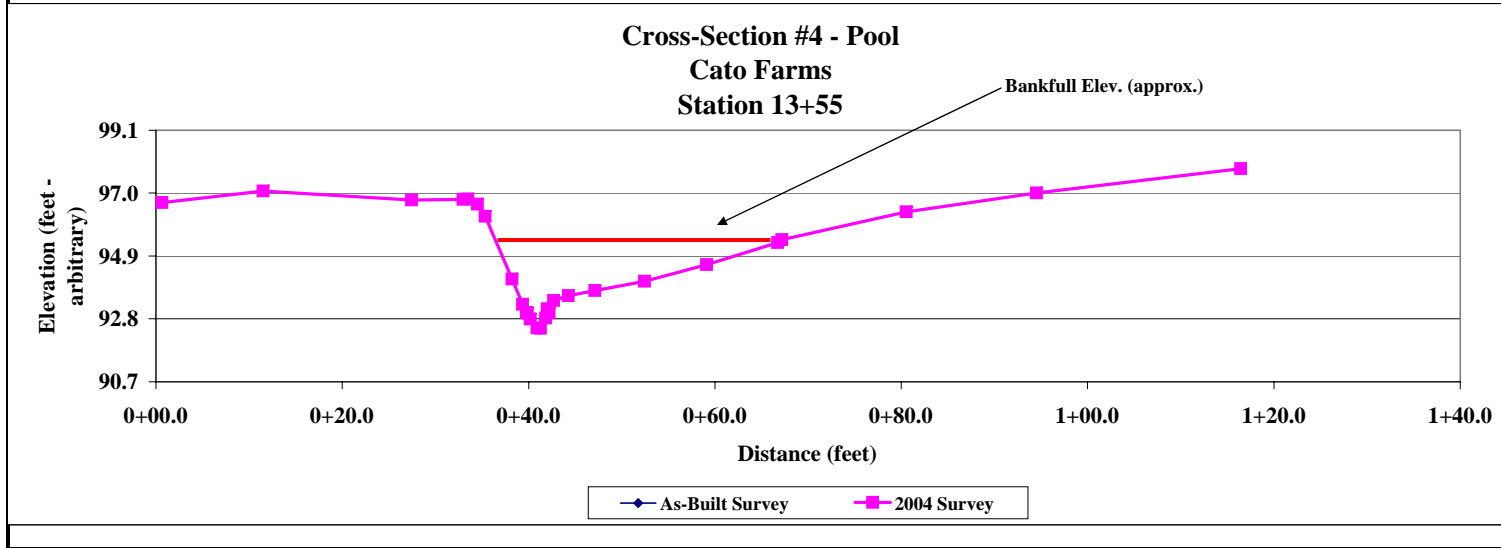
Project Name	Cato Farms		
Cross Section	X4 - Station 13+55		
Feature	Pool		
Right Pin GPS coordinate	35.40957	80.82164	
Date	6/10/2005		
Crew	Dan Clinton, David Bidelspach		



Cross-Section #4- Looking Downstream

2002 As-Built Survey			2004 Survey		
Station	Elev	Notes	Station	Elev	Notes
			0+00.7	96.67	(X4)
			0+11.5	97.05	(X4)
			0+27.5	96.75	(X4)
			0+33.0	96.77	(X4)
			0+33.5	96.78	(X4LP)
			0+34.5	96.61	(X4)
			0+35.3	96.21	(X4)
			0+38.2	94.1	B
			0+39.4	93.25	(X4)
			0+39.8	92.98	(X4)
			0+39.9	92.95	(X4)
			0+40.2	92.76	(X4)
			0+40.9	92.46	(X4)
			0+41.3	92.45	(X4)
			0+41.9	92.79	(X4)
			0+42.0	93.1	(X4)
			0+42.2	92.97	(X4)
			0+42.7	93.38	(X4)
			0+44.3	93.54	(X4)
			0+47.1	93.72	(X4)
			0+52.5	94.03	(X4)
			0+59.1	94.58	(X4)
			0+66.7	95.32	(X4RPIN)
			0+67.2	95.42	(X4)
			0+80.5	96.36	(X4)
			0+94.5	96.99	(X4)
			1+16.5	97.8	(X4)
			0+30.8	99.22	(X4LPOSTTOP)
			0+66.9	97.67	(X4RPOSTTOP)

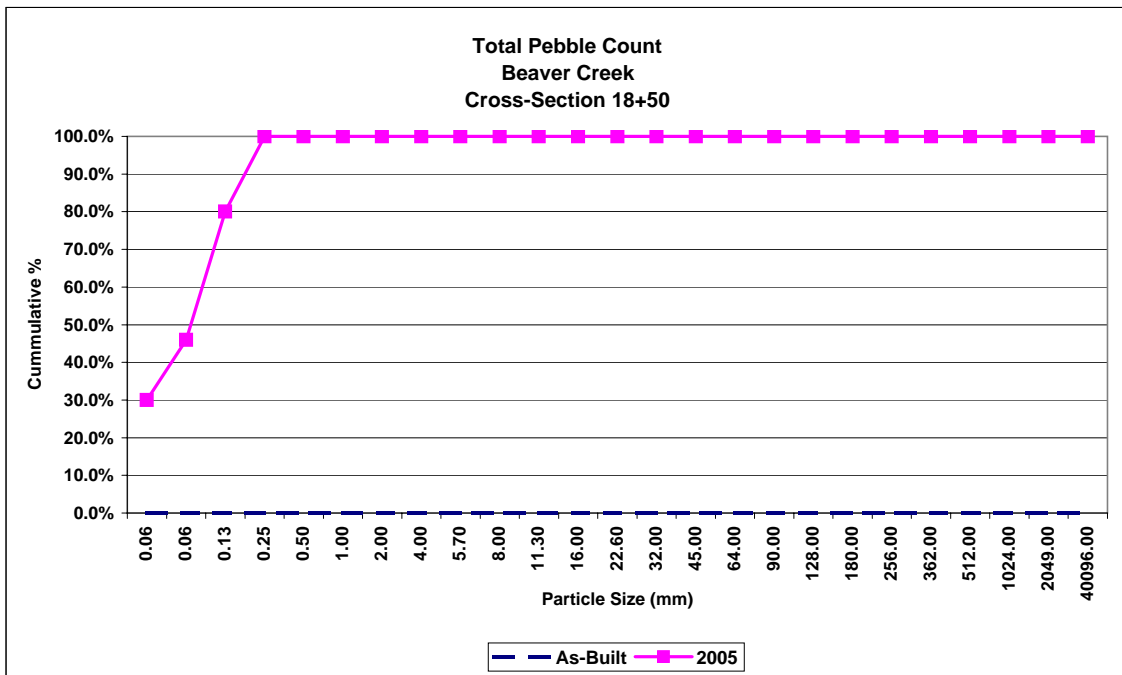
Bankfull Area		
	As-Built	2004
Area	0.0	8.4
Width	0.0	16.2
Max Depth	0.0	1.6



Project Name	Cato Branch	
Cross Section	X4 - Station 13+55	
Feature	Pool	Riffle directly downstream of xsc
Date	6/10/05	
Crew	Shaffer, Clinton	

As-Built								
Description	Material	Size (mm)	Riffle	%	Cum %	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061		0.0%	0.0%	15	30.0%	30.0%
Sand	very fine sand	0.062		0.0%	0.0%	8	16.0%	46.0%
	fine sand	0.125		0.0%	0.0%	17	34.0%	80.0%
	medium sand	0.25		0.0%	0.0%	10	20.0%	100.0%
	course sand	0.50		0.0%	0.0%	0	0.0%	100.0%
	very course sand	1.0		0.0%	0.0%	0	0.0%	100.0%
Gravel	very fine gravel	2.0		0.0%	0.0%	0	0.0%	100.0%
	fine gravel	4.0		0.0%	0.0%	0	0.0%	100.0%
	fine gravel	5.7		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	8.0		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	11.3		0.0%	0.0%	0	0.0%	100.0%
	course gravel	16.0		0.0%	0.0%	0	0.0%	100.0%
	course gravel	22.6		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	32		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	45		0.0%	0.0%	0	0.0%	100.0%
	Cobble	small cobble	64		0.0%	0.0%	0	0.0%
medium cobble		90		0.0%	0.0%	0	0.0%	100.0%
large cobble		128		0.0%	0.0%	0	0.0%	100.0%
very large cobble		180		0.0%	0.0%	0	0.0%	100.0%
Boulder	small boulder	256		0.0%	0.0%	0	0.0%	100.0%
	small boulder	362		0.0%	0.0%	0	0.0%	100.0%
	medium boulder	512		0.0%	0.0%	0	0.0%	100.0%
	large boulder	1024		0.0%	0.0%	0	0.0%	100.0%
	very large boulder	2049		0.0%	0.0%	0	0.0%	100.0%
Bedrock	bedrock	40096		0.0%	0.0%	0	0.0%	100.0%
TOTAL / % of whole count				0	0.0%		50	100.0%

	d16	d35	d50	d84	d95
As-Built	0.00	0.00	0.00	0.00	0.00
#REF!	0.00	0.07	0.10	0.23	0.33



Project Name Cato Farms
Cross Section X5 - Station 11+86
Feature Pool
Date 6/10/2005
Crew Dan Clinton, David Bidelspach

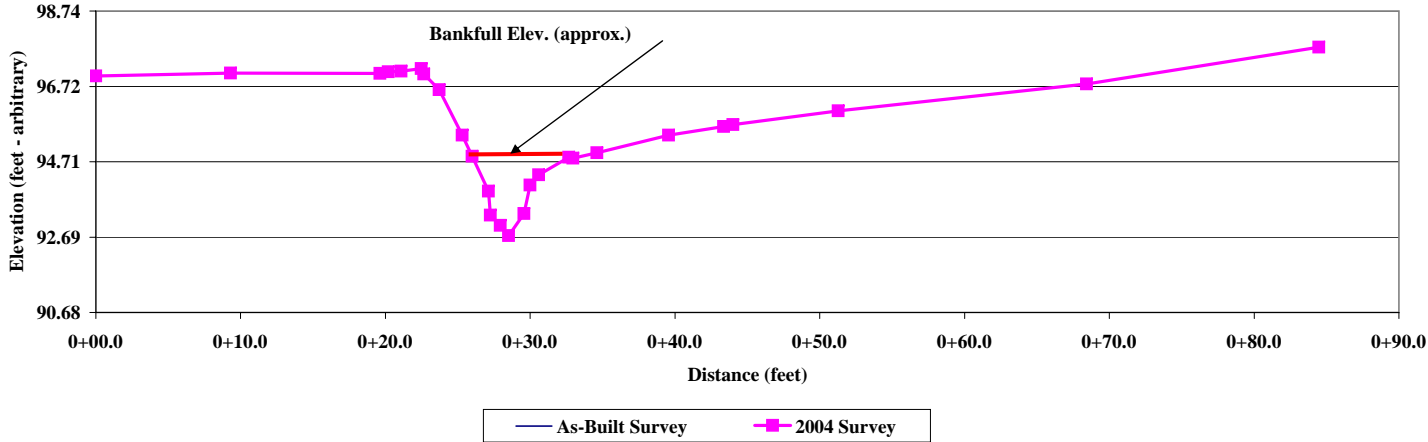


Cross-Section #5 - Looking Upstream

2002 As-Built Survey			2004 Survey		
Station	Elev	Notes	Station	Elev	Notes
			0+00.0	97	(X5PIN)
			0+09.3	97.08	(X5)
			0+19.6	97.07	(X5)
			0+20.2	97.11	(X5LP)
			0+21.1	97.13	(X5)
			0+22.5	97.2	(X5)
			0+22.7	97.05	(B)
			0+23.7	96.63	(X5)
			0+25.3	95.42	(X5)
			0+26.0	94.85	(X5)
			0+27.1	93.92	(X5)
			0+27.3	93.28	(X5)
			0+27.9	93	(X5)
			0+28.5	92.73	(X5)
			0+29.6	93.32	(X5)
			0+30.0	94.08	(X5)
			0+30.6	94.36	(X5)
			0+32.7	94.83	(X5)
			0+33.0	94.8	(B)
			0+34.6	94.95	(X5)
			0+39.6	95.42	(X5)
			0+43.4	95.65	(X5)
			0+44.0	95.7	(X5RP)
			0+51.3	96.07	(X5)
			0+68.4	96.79	(X5)
			0+84.5	97.77	(X5)
			0+19.6	99.37	(X5LPOSTTOP)
			44.18	97.78	(X5RPOSTTOP)

Bankfull Area		
	As-Built	2004
Area	0.0	6.0
Width	0.0	7.0
Max Depth	0.0	2.1

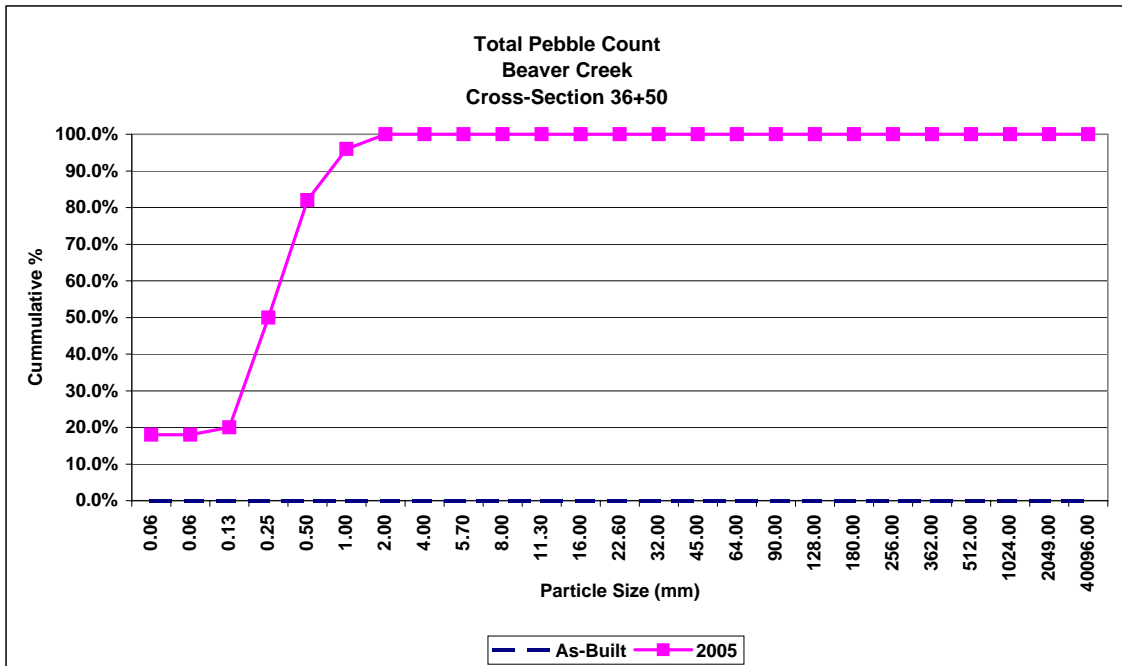
Cross-Section #5 - Pool
Cato Farms
Station 11+86



Project Name	Cato Branch		
Cross Section	X5 - Station 11+86		
Feature	Pool	Riffle directly downstream of xsc	
Date	6/10/05		
Crew	Shaffer, Clinton		

Description	Material	Size (mm)	As-Built			2005		
			Pool	%	Cum %	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061		0.0%	0.0%	9	18.0%	18.0%
Sand	very fine sand	0.062		0.0%	0.0%	0	0.0%	18.0%
	fine sand	0.125		0.0%	0.0%	1	2.0%	20.0%
	medium sand	0.25		0.0%	0.0%	15	30.0%	50.0%
	course sand	0.50		0.0%	0.0%	16	32.0%	82.0%
	very course sand	1.0		0.0%	0.0%	7	14.0%	96.0%
Gravel	very fine gravel	2.0		0.0%	0.0%	2	4.0%	100.0%
	fine gravel	4.0		0.0%	0.0%	0	0.0%	100.0%
	fine gravel	5.7		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	8.0		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	11.3		0.0%	0.0%	0	0.0%	100.0%
	course gravel	16.0		0.0%	0.0%	0	0.0%	100.0%
	course gravel	22.6		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	32		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	45		0.0%	0.0%	0	0.0%	100.0%
	Cobble	small cobble	64		0.0%	0.0%	0	0.0%
medium cobble		90		0.0%	0.0%	0	0.0%	100.0%
large cobble		128		0.0%	0.0%	0	0.0%	100.0%
very large cobble		180		0.0%	0.0%	0	0.0%	100.0%
Boulder	small boulder	256		0.0%	0.0%	0	0.0%	100.0%
	small boulder	362		0.0%	0.0%	0	0.0%	100.0%
	medium boulder	512		0.0%	0.0%	0	0.0%	100.0%
	large boulder	1024		0.0%	0.0%	0	0.0%	100.0%
	very large boulder	2049		0.0%	0.0%	0	0.0%	100.0%
Bedrock	bedrock	40096		0.0%	0.0%	0	0.0%	100.0%
TOTAL / % of whole count			0	0.0%		50	100.0%	

	d16	d35	d50	d84	d95
As-Built	0.00	0.00	0.00	0.00	0.00
2005	0.00	0.28	0.38	0.86	1.45



Project Name Cato Farms
Cross Section X6 - Station 8+18
Feature Pool
Date 6/10/2005
Crew Dan Clinton, David Bidelspach

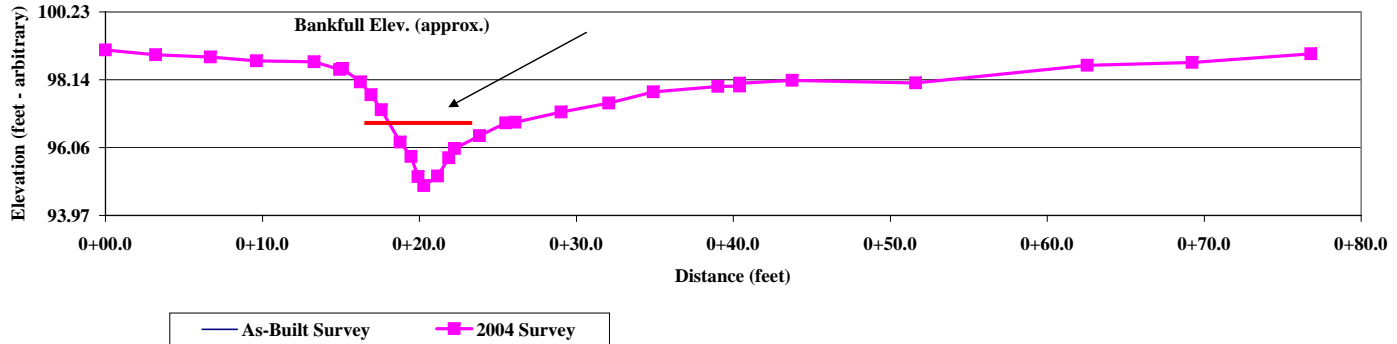


Cross-Section #6 - Looking Upstream

2002 As-Built Survey			2004 Survey		
Station	Elev	Notes	Station	Elev	Notes
			0+00.0	99.06	(X6)
			0+03.2	98.91	(X6)
			0+06.7	98.84	(X6)
			0+09.6	98.73	(X6)
			0+13.3	98.7	(X6RPING)
			0+14.9	98.46	(B)
			0+15.1	98.49	(X6)
			0+16.3	98.08	(X6)
			0+16.9	97.68	(X6)
			0+17.6	97.22	(X6)
			0+18.8	96.22	(X6)
			0+19.5	95.78	(X6)
			0+19.9	95.16	(X6)
			0+20.3	94.88	(X6)
			0+21.2	95.18	(X6)
			0+21.9	95.74	(X6)
			0+22.3	96.03	(X6)
			0+23.8	96.42	(X6)
			0+25.5	96.81	(B)
			0+26.1	96.83	(X6)
			0+29.0	97.15	(X6)
			0+32.1	97.43	(X6)
			0+34.9	97.77	(X6)
			0+39.0	97.94	(X6)
			0+40.4	97.95	(X6RPIN)
			0+40.4	98.04	(X6)
			0+43.8	98.12	(X6)
			0+51.6	98.05	(X6)
			0+62.5	98.59	(X6)
			0+69.2	98.68	(X6)
			0+76.8	98.94	(X6)
			0+13.5	100.87	(X6LPOSTTOP)
			0+41.0	100.57	(X6RPOSTTOP)

Bankfull Area		
	As-Built	2004
Area	0.0	6.2
Width	0.0	7.7
Max Depth	0.0	1.9

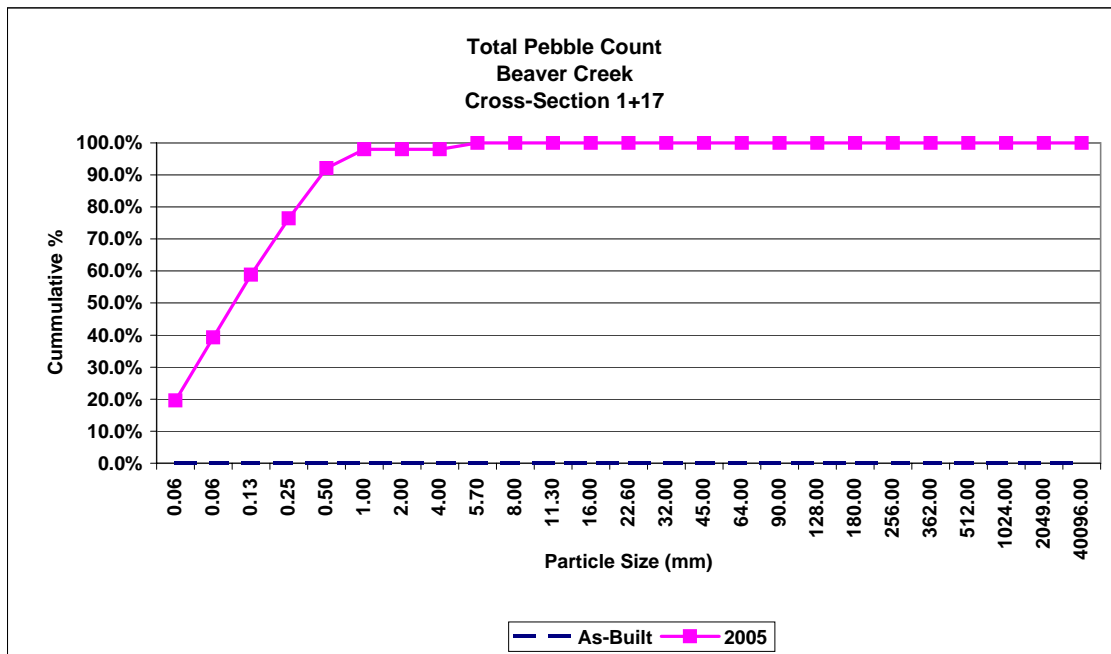
Cross-Section #6 - Pool
Cato Farms
Station 8+18



Project Name	Cato Branch		
Cross Section	X6 - Station 8+18		
Feature	Pool	Riffle directly downstream of xsc	
Date	6/10/05		
Crew	Shaffer, Clinton		

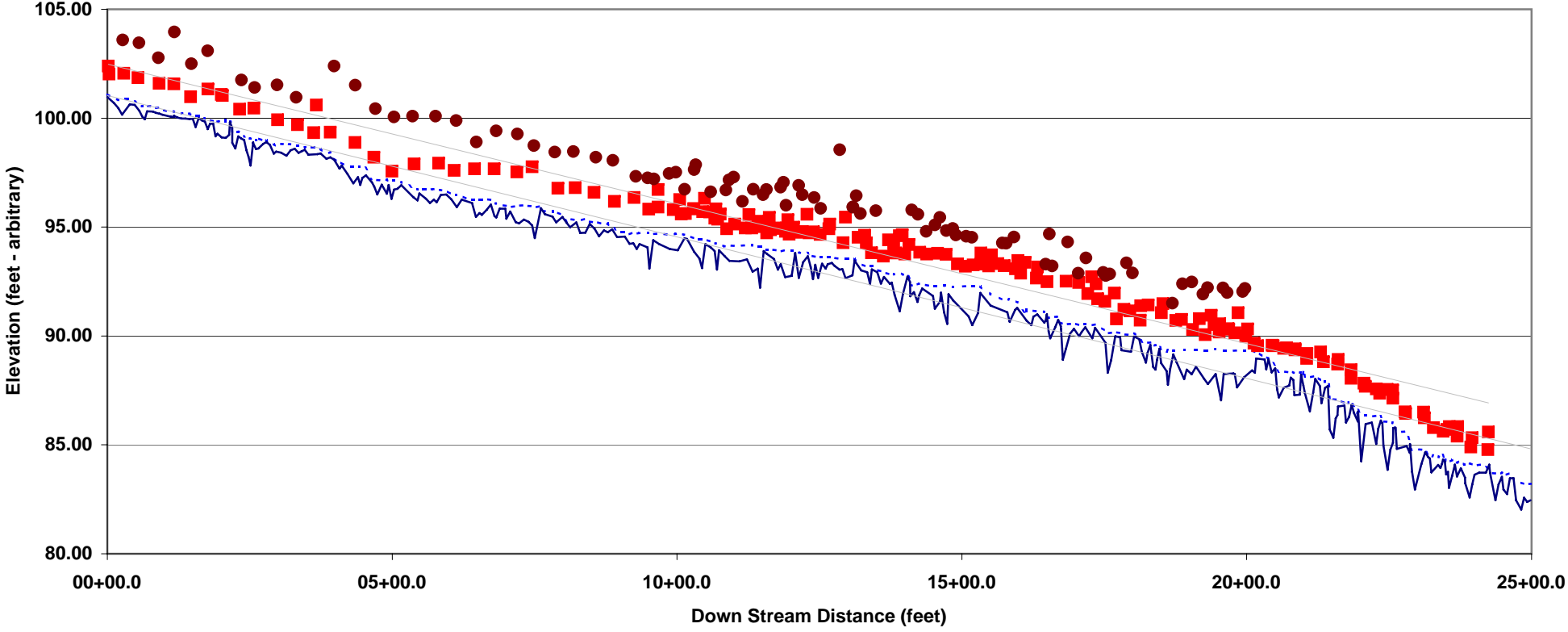
Description	Material	As-Built			2005			
		Size (mm)	Riffle	%	Cum %	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061		0.0%	0.0%	10	19.6%	19.6%
Sand	very fine sand	0.062		0.0%	0.0%	10	19.6%	39.2%
	fine sand	0.125		0.0%	0.0%	10	19.6%	58.8%
	medium sand	0.25		0.0%	0.0%	9	17.6%	76.5%
	course sand	0.50		0.0%	0.0%	8	15.7%	92.2%
	very course sand	1.0		0.0%	0.0%	3	5.9%	98.0%
Gravel	very fine gravel	2.0		0.0%	0.0%	0	0.0%	98.0%
	fine gravel	4.0		0.0%	0.0%	0	0.0%	98.0%
	fine gravel	5.7		0.0%	0.0%	1	2.0%	100.0%
	medium gravel	8.0		0.0%	0.0%	0	0.0%	100.0%
	medium gravel	11.3		0.0%	0.0%	0	0.0%	100.0%
	course gravel	16.0		0.0%	0.0%	0	0.0%	100.0%
	course gravel	22.6		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	32		0.0%	0.0%	0	0.0%	100.0%
	very course gravel	45		0.0%	0.0%	0	0.0%	100.0%
Cobble	small cobble	64		0.0%	0.0%	0	0.0%	100.0%
	medium cobble	90		0.0%	0.0%	0	0.0%	100.0%
	large cobble	128		0.0%	0.0%	0	0.0%	100.0%
	very large cobble	180		0.0%	0.0%	0	0.0%	100.0%
Boulder	small boulder	256		0.0%	0.0%	0	0.0%	100.0%
	small boulder	362		0.0%	0.0%	0	0.0%	100.0%
	medium boulder	512		0.0%	0.0%	0	0.0%	100.0%
	large boulder	1024		0.0%	0.0%	0	0.0%	100.0%
	very large boulder	2049		0.0%	0.0%	0	0.0%	100.0%
Bedrock	bedrock	40096		0.0%	0.0%	0	0.0%	100.0%
TOTAL / % of whole count			0	0.0%		51	100.0%	

	d16	d35	d50	d84	d95
As-Built	0.00	0.00	0.00	0.00	0.00
2005	0.00	0.09	0.15	0.55	1.11



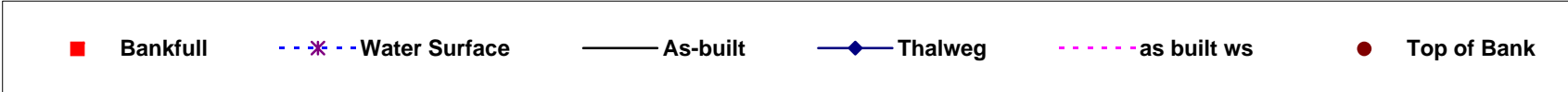
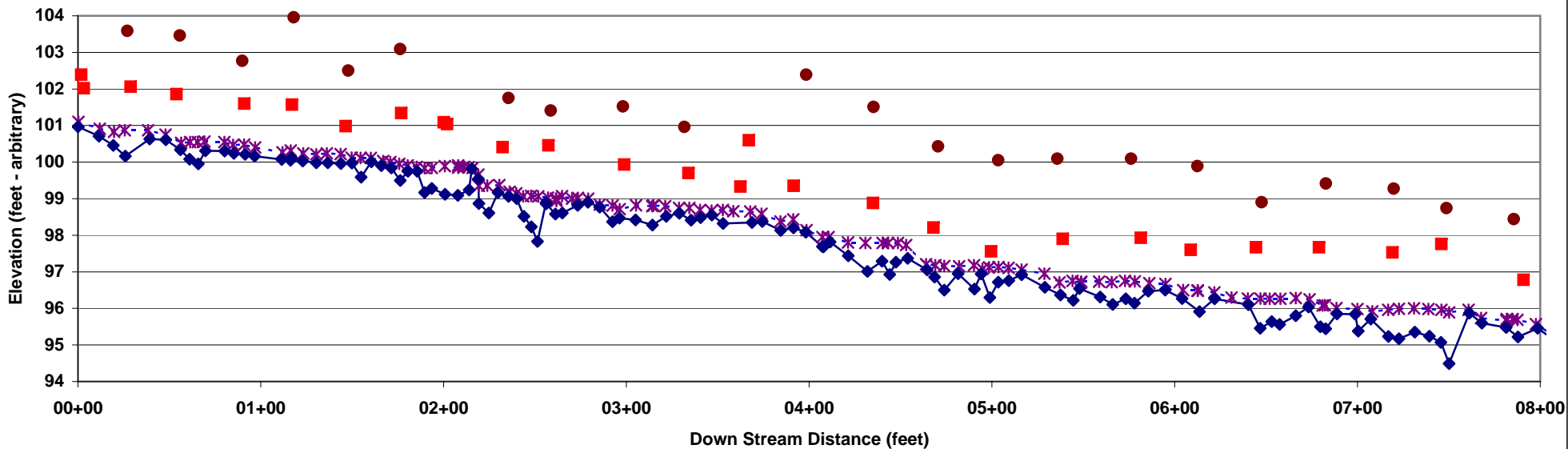
CATO FARMS
 UT Clark Creek
 Longitudinal Profile 2005

BKF Regression	$y = -0.0064x + 102.48$
WS Regression	$y = -0.0065x + 101.04$

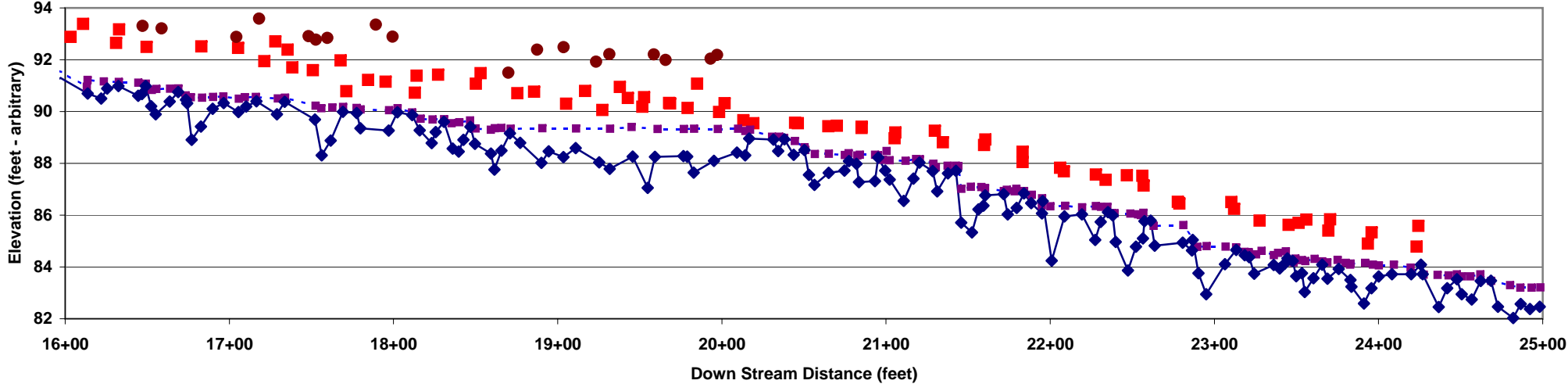


- Bankfull
- - - Water Surface
- As-built
- Thalweg
- - - as built ws
- Top of Bank
- Linear (Water Surface)
- Linear (Bankfull)

CATO FARMS Longitudinal Profile 2005 Stations 0+00 to 8+00

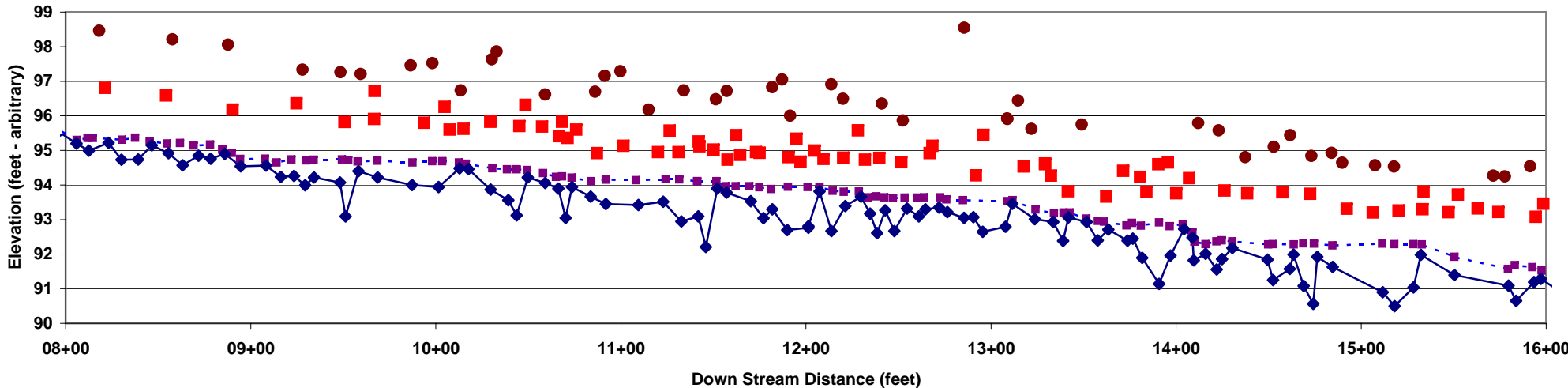


CATO FARMS
Longitudinal Profile 2005
Stations 16+00 to 25+00 (end of project)



- Bankfull
- - ■ - - Water Surface
- As-built
- ◆ — Thalweg
- . . . as built ws
- Top of Bank

CATO FARMS Longitudinal Profile 2005 Stations 8+00 to 16+00



**Pattern Measurement
CATO FARMS 2005**

	Design	2005	Design	2005	Design	2005
	Wavelength	Wavelength	Beltwidth	Beltwidth	Rad. Of Curv	Rad. Of Curv.
		54		22.7		13
		53		21.4		10
		45		24		13
		40		10.3		14
		51		20.8		13
		57		20		15
		53		20.2		12
		57		33		19
		58		23.2		13
		54		21.8		12
		61		42.2		26
		62		23.2		19
		57		25.4		21
		56		43		16
		53		26.1		17
		65		26.3		17
		58		43.7		10
		55		24.6		12
		57		27.4		24
		58		39.4		12
		43		23.6		14
		61		22.1		23
		63		43.5		18
		42		24.4		11
		46		32.7		16
		57		19.4		10
		63		23.5		14
		57		25.3		22
		51		22.3		18
		50		55.4		20
		53		31.2		22
		57		23		13
		91		45.1		12
		66		27.8		34
		58		25.6		17
		51		45		18
		74		24.2		16
		99		23.7		19
		54		40.7		19
	B Section	217		26.2		23
		249		23.5		22
		141		45.5		19
				23.2		21
	Major WL	201		23.7		17
		196		26.5		20
		156		23.8		16
		171	B Section	46.3		25
		170		61.2		23
		191		51		21
		168				17
		230	Major BW			18
		211		83.2		22
		166		91.3		18
		182		89		19
		188		83.1		27
		244		76		22
		347		82.5		18

GPS Coordinates

**Project Number and Name: Project Number and Name: ??????
(UT to Clark Creek at Cato Farms)**

Description	GPS Coordinate	
	Northing	Easting
P-18	35.41170	80.82196
P-17	35.41192	80.82210
P-16	35.41105	80.82194
P-15	35.41052	80.82181
P-14	35.41021	80.82193
P-13	35.41010	80.82176
P-12	35.40982	80.82170
P-11	35.40968	80.82179
P-10	35.40953	80.82164
P-9	n/a	
P-8	35.40948	80.82143
P-7	35.40929	80.82156
P-6	35.40906	80.82119
P-5	35.40850	80.82070
P-4	35.40823	80.82065
P-3	35.40804	80.82060
P-2	35.40793	80.82023
P-1	35.40785	80.82030
VP-1	35.41144	-80.82201
VP-2	35.41105	80.82194
VP-3	35.41030	-80.82192
VP-4	35.40973	80.82171
VP-5	35.40932	80.82141
VP-6	35.40865	80.82103
VP-7	35.40849	80.82077
VP-8	35.40781	80.82025
X-1	35.40819	80.82066
X-2	35.40846	80.82085
X-3	35.40918	80.82152
X-4	35.40957	80.82164
X-5	35.40986	80.82171
X-6	35.40050	80.82191
		Notes
PA-1	35.41146	80.82207 Big scour behind matting, no vegetation
PA-2	35.41135	80.82207 4'x2' minor slump, no veg from overland flow on upstream pointbar
PA-3	35.41150	80.82230 Repaired lower section still has no veg, scour and rills along slope
PA-4	35.41100	80.82205 6'x3' scour behind matting, no veg, not repaired
PA-5	35.41029	80.82191 2'x4' scour and slump on outside bank
PA-6	35.41026	80.82181 Scour and slump along outside bank
PA-7	35.41014	80.82183 Scour and slump along outside bank
PA-8	35.41004	80.82181 Scour and slump along outside bank
PA-9	35.40934	80.82147 Minor Bank Slump
PA-10	35.40918	80.82152 Rills forming along channel bank/slope
PA-11	35.40910	80.82120 Scour and slump along outside bank
PA-12	35.40891	80.82122 Scour and slump along outside bank
PA-13	35.40812	80.82061 Rills forming along channel bank/slope
PA-14	35.40859	80.82107 Scour and slump along outside bank
PA-15	35.40812	80.82061 Bank scour upstream of xvane