

Collins Creek Stream Restoration Site

EEP Project #92205

Contract # D05011

USACE Action ID #SAW-2007-03528-268

DWQ 404 #07-1709

Monitoring Year 05 CLOSEOUT REPORT

Project Type: Stream Restoration



Submitted: December 2012

Table 1a. Project Setting and Classifications Collins Creek Stream Restoration Site	
County	Orange
General Location	Carrboro
Basin	Cape Fear
Physiographic Region	Piedmont
USGS Hydro Unit	03030002050060
NCDWQ Sub-basin	03-06-04
Trout Water	No
Project Performers	
Source Agency	NCEEP
Provider	KCI Technologies
Designer	KCI Technologies
Monitoring Firm	KCI Technologies
Planting	H & J Forest Service
Property Interest Holder	NCEEP

Table 1b. Project Activity and Reporting History Collins Creek Stream Restoration Site		
Activity or Report	Data Collection Complete	Completion or Delivery
Restoration Plan	2005 - 2006	Nov 07
Final Design	2005 - 2006	Nov 07
Construction	N/A	Apr 08
Planting	N/A	Mar 08
Mitigation Plan / As-Built (Year 0 Monitoring - Baseline)	May - July 08	Oct 08
Monitoring Year 01	Oct 08	Dec 08
Gates installed at ford crossings		Dec 08
Monitoring Year 02	Dec 09	Dec 09
Minor stream repairs		Mar 09
Additional easement marking on Britz property		Oct 09
Monitoring Year 03	Dec 10	Jan 11
Beaver Management USDA		2011
Supplemental Planting		April 11
Monitoring Year 04	Jul 11	Jan 12
Monitoring Year 05	Aug 12	Dec 12
Supplemental Planting		Mar 12
Beaver Management USDA		2012
Relocated fence in easement encroachment to easement boundary		Dec 12
Invasive plant treatment		Anticipated March 13
Two isolated bank repairs		Anticipated March 13
Beaver Management USDA		Anticipated March 13
Supplemental planting in easement encroachment area		Anticipated Feb 13

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1.0 PROJECT SETTING AND BACKGROUND SUMMARY

The Collins Creek Stream Restoration Site is a full-delivery project that was developed for the North Carolina Ecosystem Enhancement Program (EEP). The project restored and enhanced 9,453 linear feet on an Unnamed Tributary to Collins Creek (UTCC) and other associated tributaries, and included planting a functional Piedmont Alluvial Forest floodplain community along with Mesic Mixed Hardwood Forest to develop an effective riparian buffer.

Prior to restoration, the project streams had become degraded primarily through poor grazing management and vegetation removal. Historic aerial photographs show that the land surrounding the streams has been in rangeland for at least 65 years and cattle and horses have had access to the stream up until the restoration construction. The streams had experienced bank erosion, which led to excessive sediment throughout the site. Bed degradation and aggradation were also evident throughout the different project reaches. All of the reaches exhibited areas of vertical instability.

Over the course of the project, following construction, supplemental planting has occurred to address poor vigor and survivability throughout the buffer, specifically in areas of the floodplain with poor soil conditions. Early repair work focused on minor bank grading, repairs to in-stream structures, reinstalling coir matting, and repairing fence. In early 2013 the following maintenance actions are planned: invasive plant treatment, planting an area of easement encroachment, two small isolated areas of bank erosion, and beaver removal. Overall the site is stable and well vegetated.

2.0 PROJECT GOALS AND OBJECTIVES

The goals and objectives of the restoration project are as follows:

Restoration Goals:

- Improve water quality by reducing nutrient and sediment inputs.
- Create high-quality aquatic and terrestrial habitat along an interconnected forested riparian corridor.

Restoration Objectives:

- Plant a functional Piedmont Alluvial Forest floodplain community along with Mesic Mixed Hardwood Forest to develop an effective riparian buffer.
- Restore stable stream reaches that can handle the hydrologic input from the surrounding drainages.
- Remove cattle and horses from the riparian areas through livestock exclusion fencing.

3.0 SUCCESS CRITERIA

Feature	Success Criteria
Stream	Minimal changes to the measured stream characteristics, demonstrating system stability. At least two bankfull events occurring in separate years over the course of the monitoring period.
Vegetation	Average of 260 stems/acre, as indicated by permanent vegetation plots after 5 years of monitoring.

Project Segment / Reach ID	Pre-Restoration Linear Footage	Type	Approach	As - Built Footage	Eligible Footage*	Mitigation Ratio	Stream Mitigation Units	Stationing
UTCC-1	500 lf	EI	P2	500 lf	500 lf	1.5	334 SMU	10+00 - 15+00
UTCC-2	909 lf	R	P2	900 lf	851 lf	1.0	851 SMU	15+00 - 24+00
UTCC-3	1,034 lf	R	P2	949 lf	898 lf	1.0	898 SMU	24+00 - 33+49
T1-1	637 lf	R	P2	519 lf	519 lf	1.0	519 SMU	40+00 - 45+19
T1-2	604 lf	R	P2	841 lf	774 lf	1.0	774 SMU	45+19 - 53+60
T1-3	1,932 lf	R	P2	2,010 lf	1,894 lf	1.0	1,894 SMU	53+60 - 73+70
T1A-1	192 lf	R	P2	240 lf	240 lf	1.0	240 SMU	80+00 - 82+40
T1A-2	533 lf	R	P2/P3	560 lf	506 lf	1.0	506 SMU	82+40 - 88+00
T1B	1,102 lf	R	P2	1,100 lf	1,100 lf	1.0	1,100 SMU	100+00 - 111+00
T2	1,879 lf	R	P3	1,833 lf	1,817 lf	1.0	1,817 SMU	120+00 - 138+33
Mitigation Unit Summations								
Stream (lf)	Riparian Wetland (Ac)	Nonriparian Wetland (Ac)	Total Wetland (Ac)			Buffer (Ac)		
8,933	0	0	0			0		

R = Restoration P2 = Priority 2 P2/P3 = Combination of Priorities 2 and 3
 EI = Enhancement I P3 = Priority 3

* These lengths have been calculated by excluding the easement exceptions, including ford and culvert crossings for the landowner and culverted crossings under private driveways.

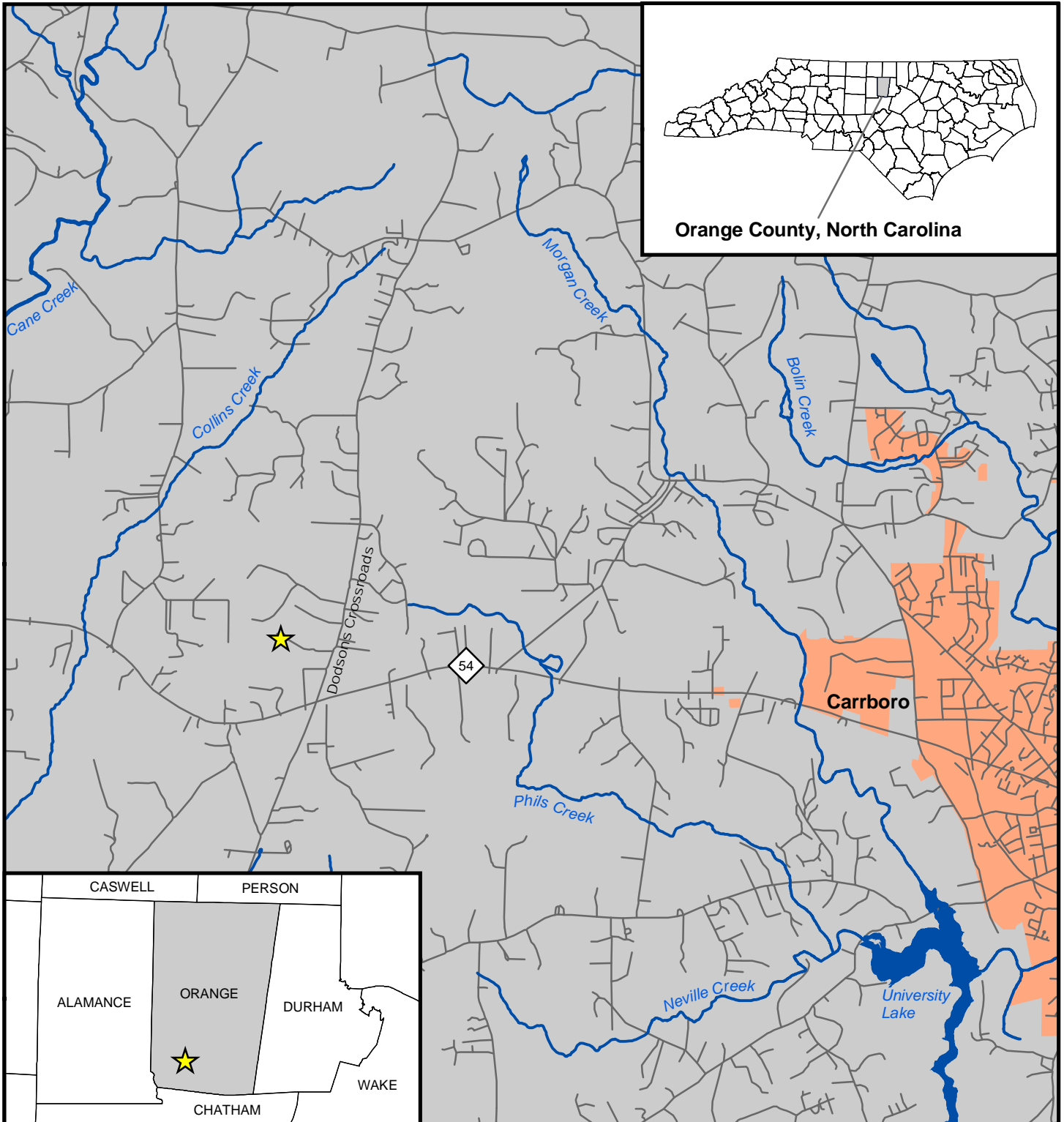
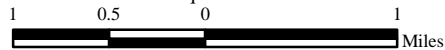


Figure 1. Vicinity Map

-  Project Site Location
-  Streams
-  Lakes and Reservoirs
-  Major Roads
-  Cities and Towns
-  Orange County
-  County Boundaries



1:63,360
1 inch equals 1 miles



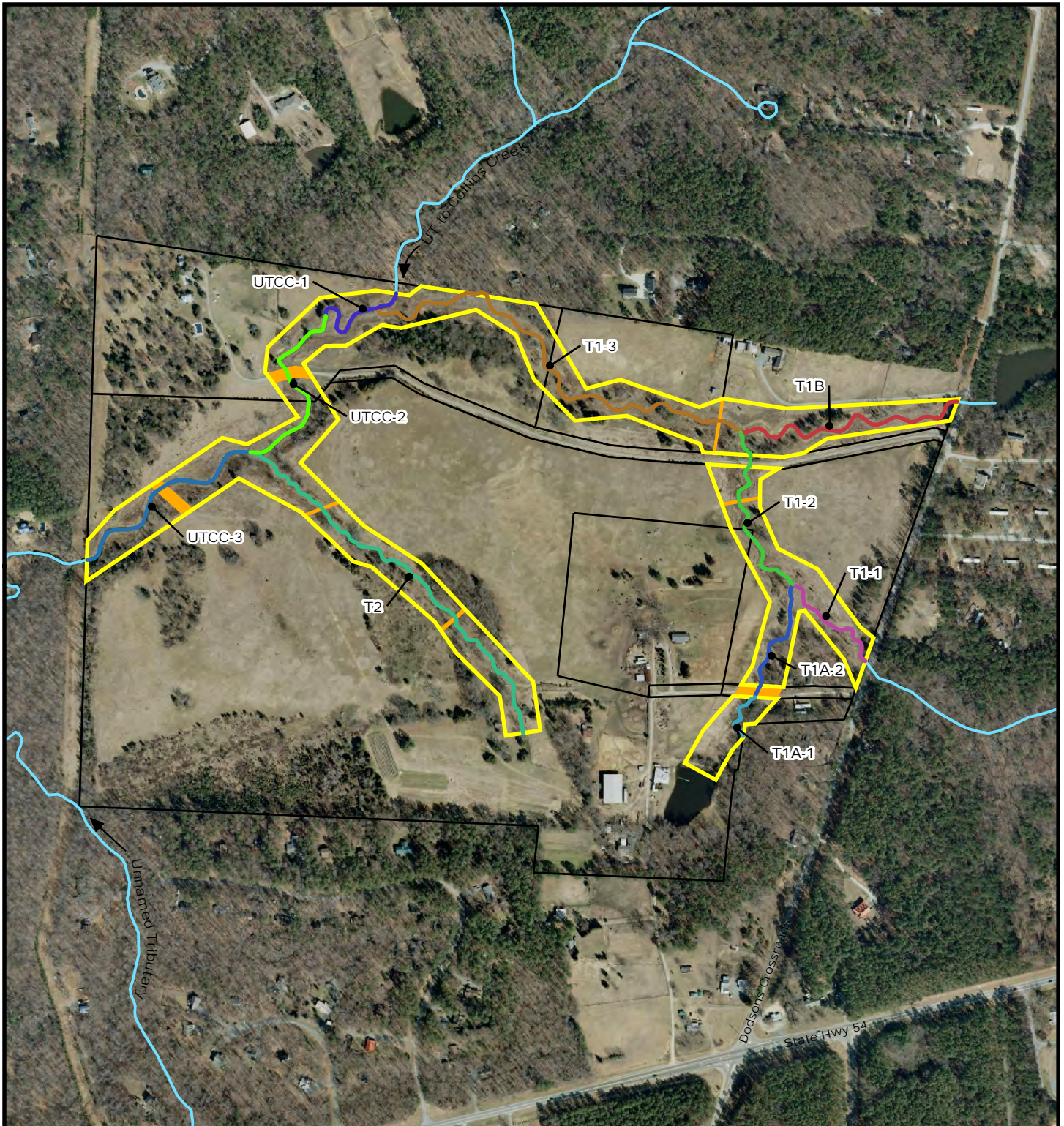




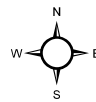


Figure 2. Project Reaches

-  Project Easement
-  Easement Exceptions
-  Other Streams
-  Project Parcel Boundaries



1:7,200
1 inch = 600 feet



Image Source: NC Statewide Orthoimagery, 2010.



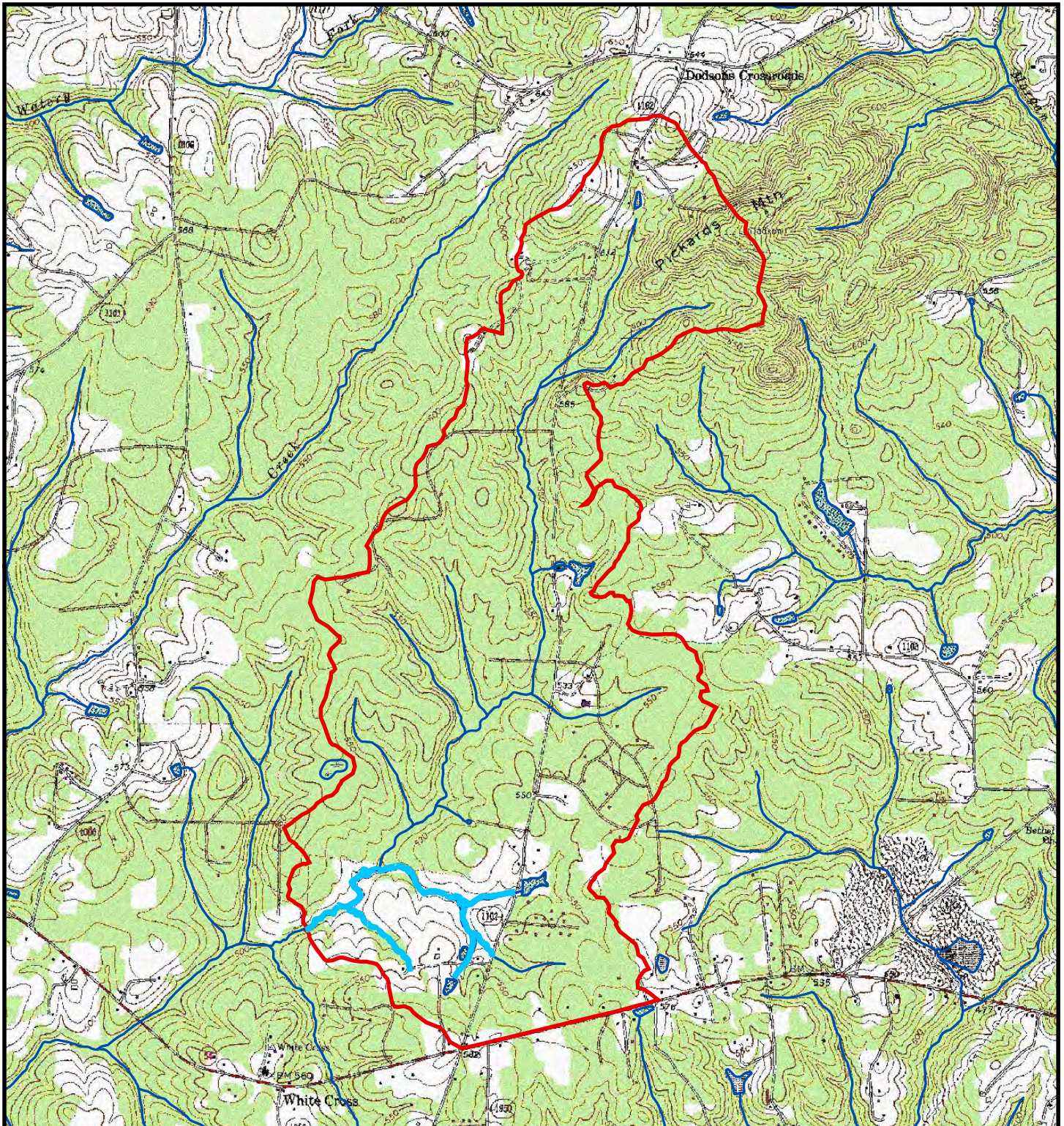



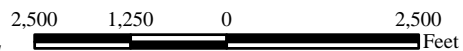


Figure 3. Project Watershed

-  Project Reaches
-  Other Streams
-  Project Watershed (2.6 sq. miles)

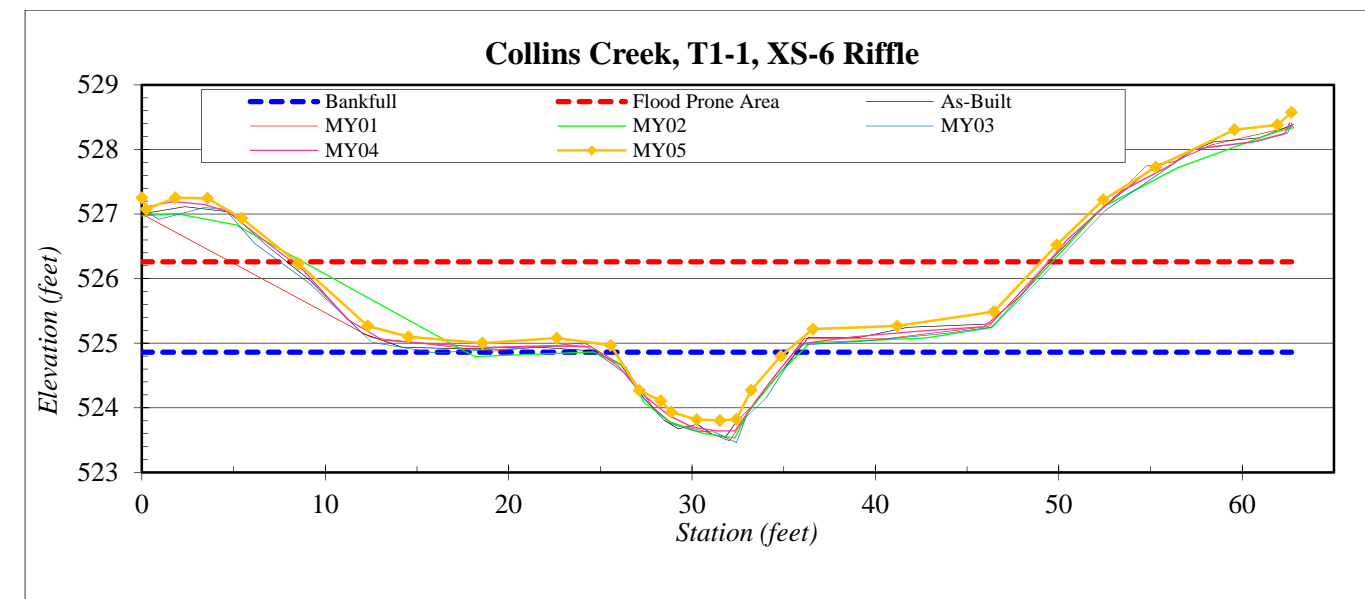
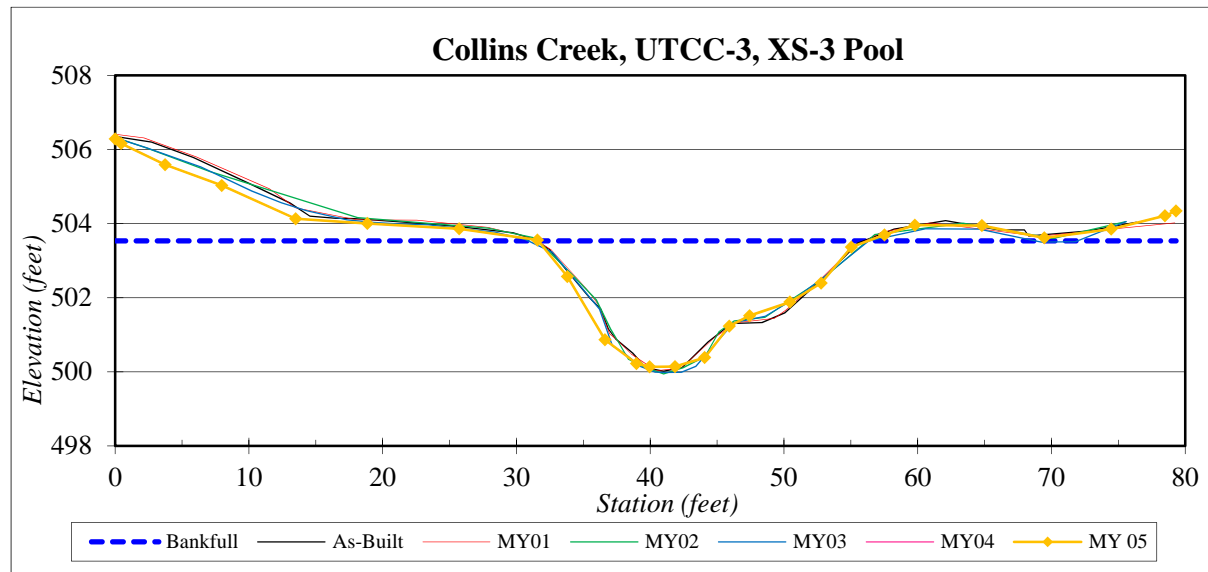
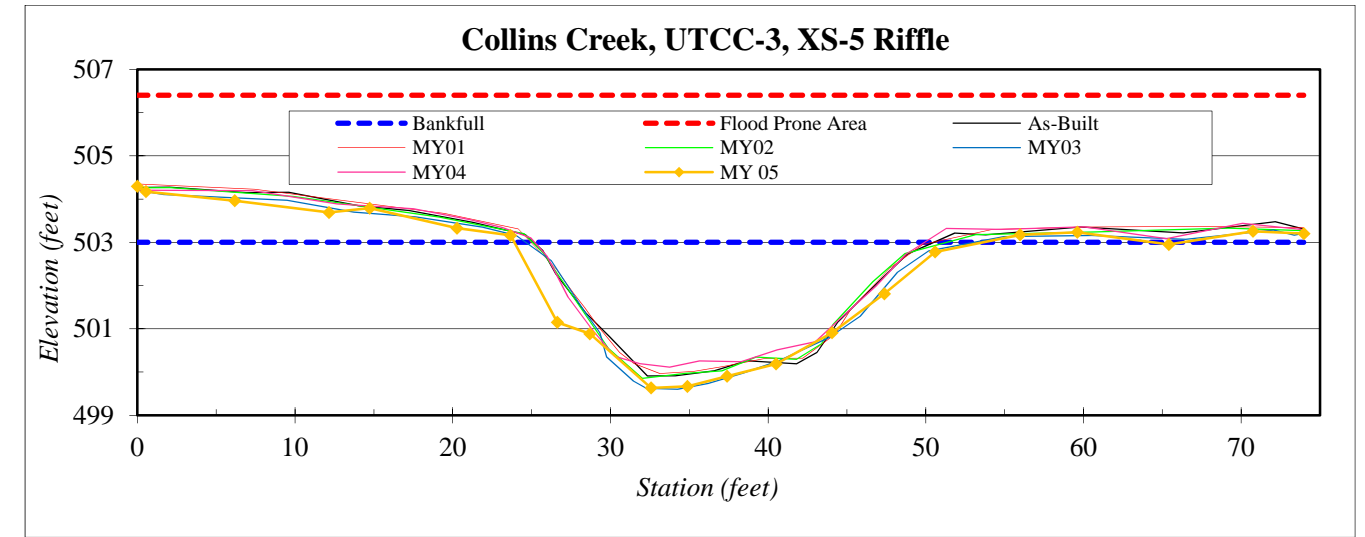
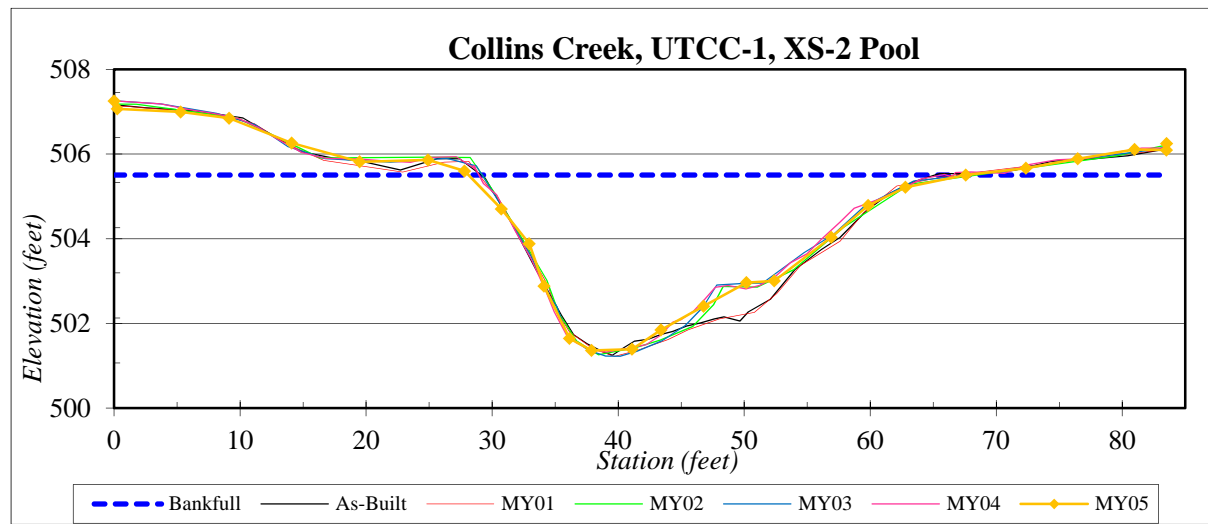
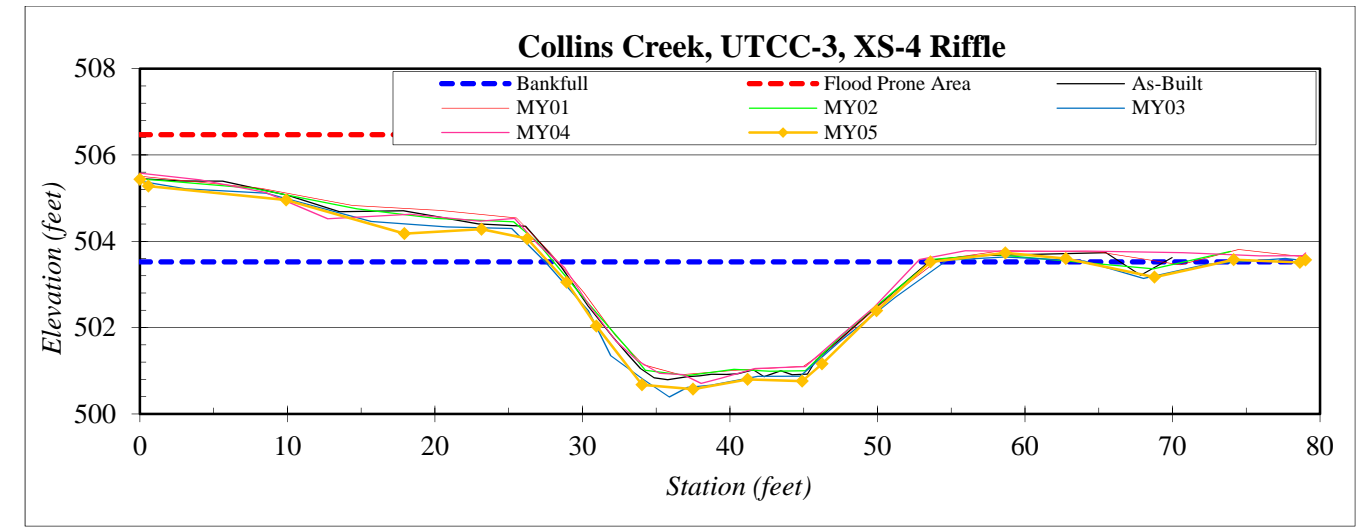
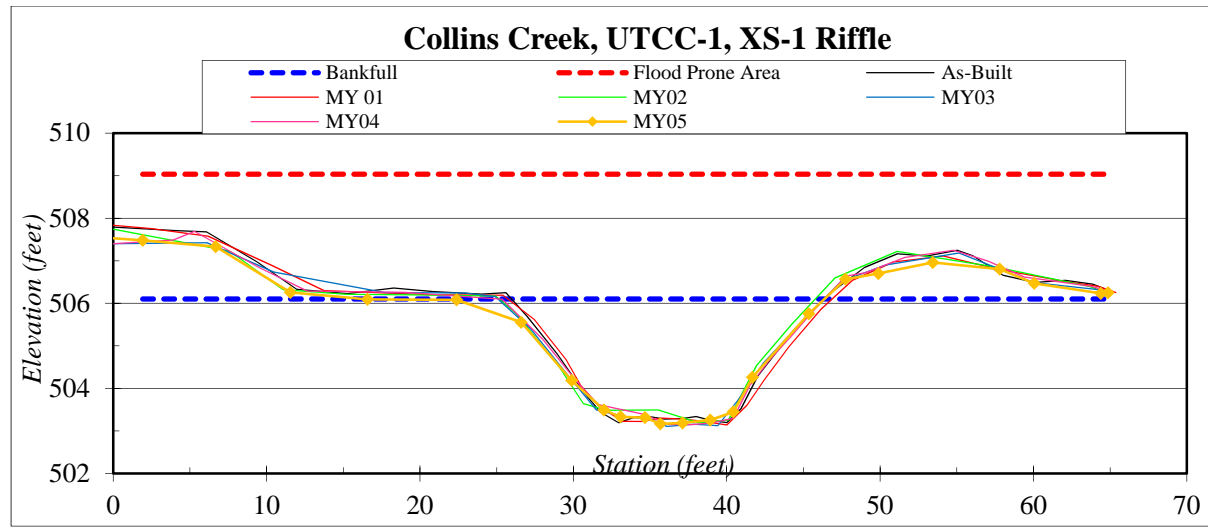


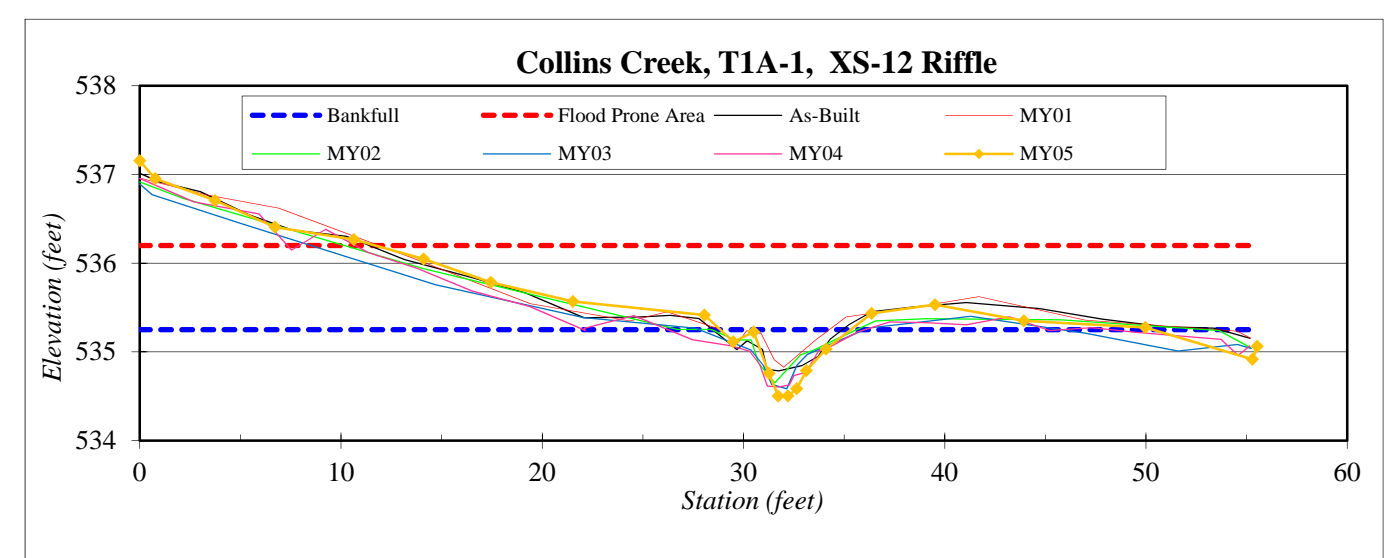
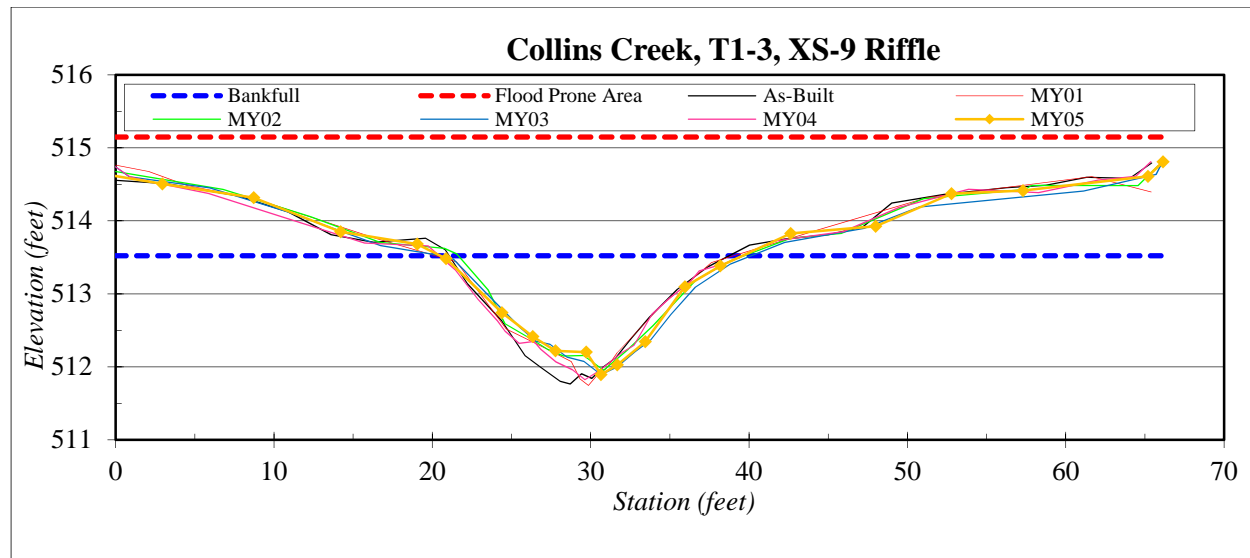
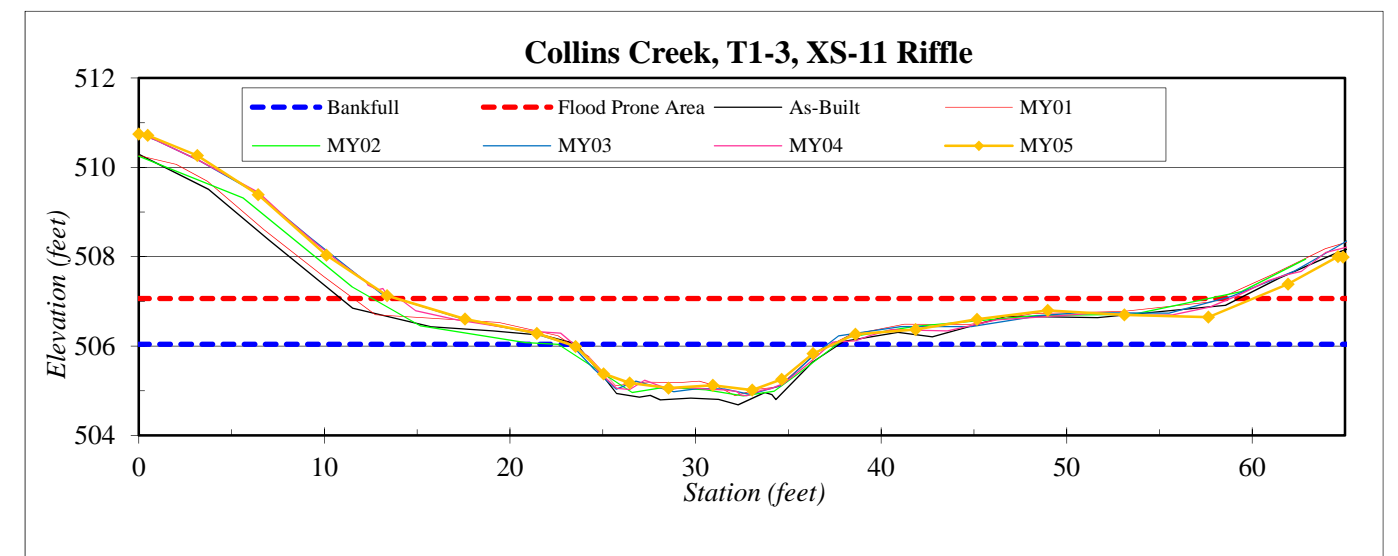
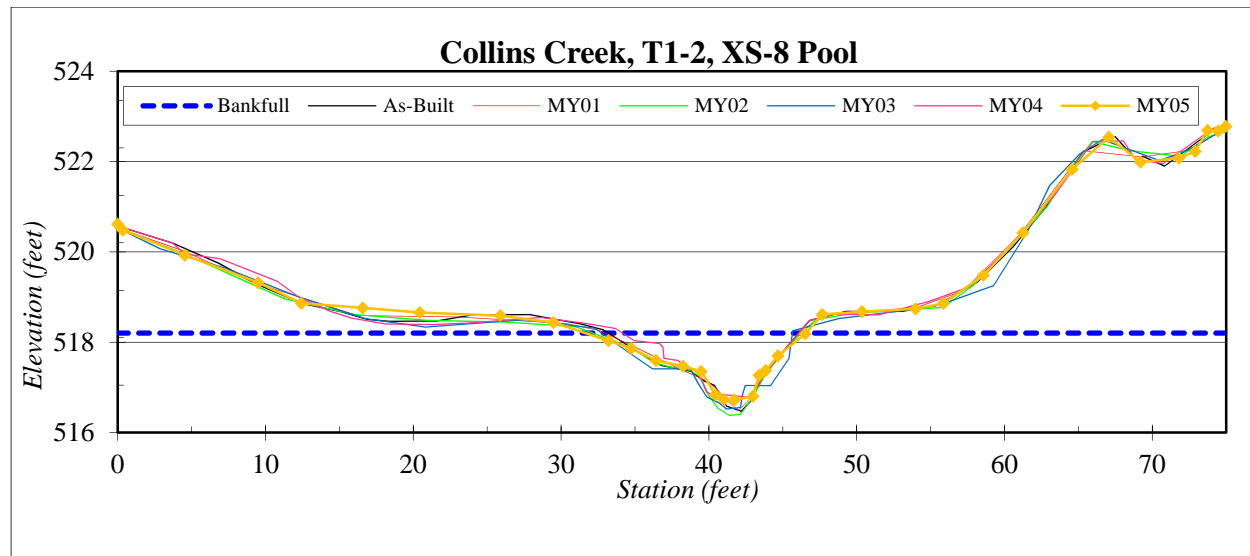
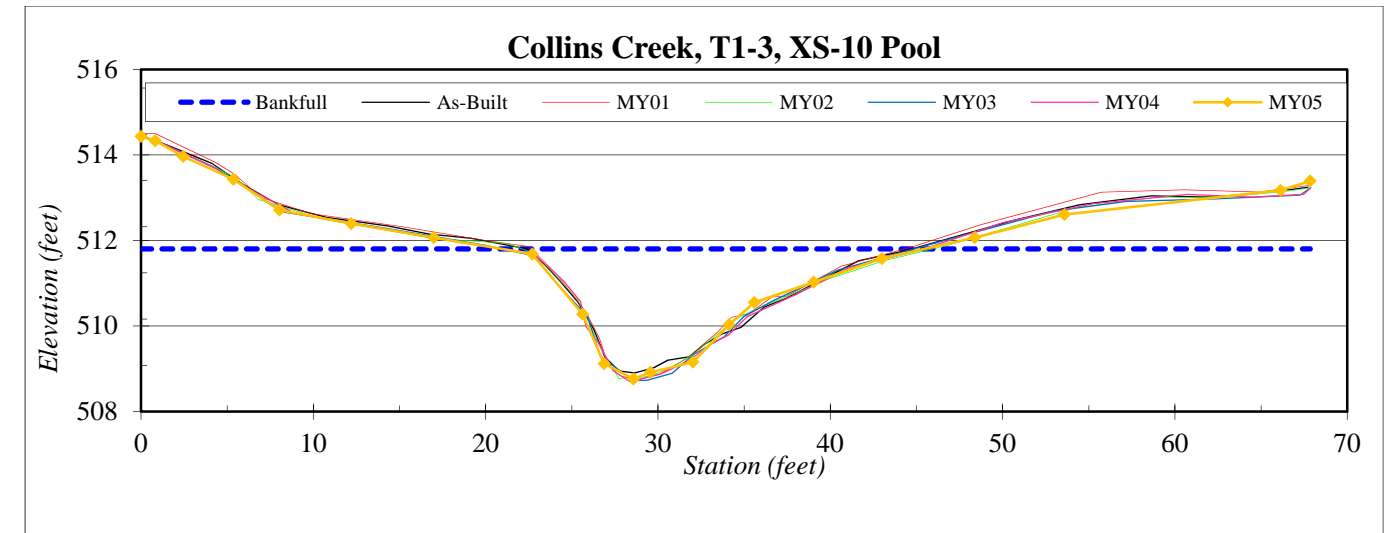
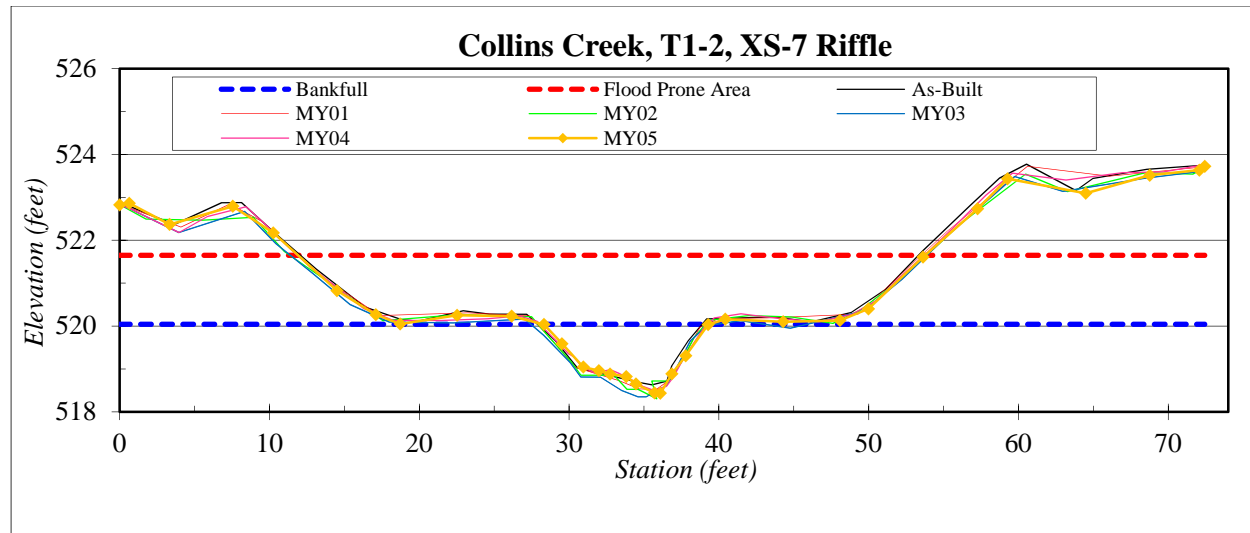
1:30,000
1 inch = 2,500 feet

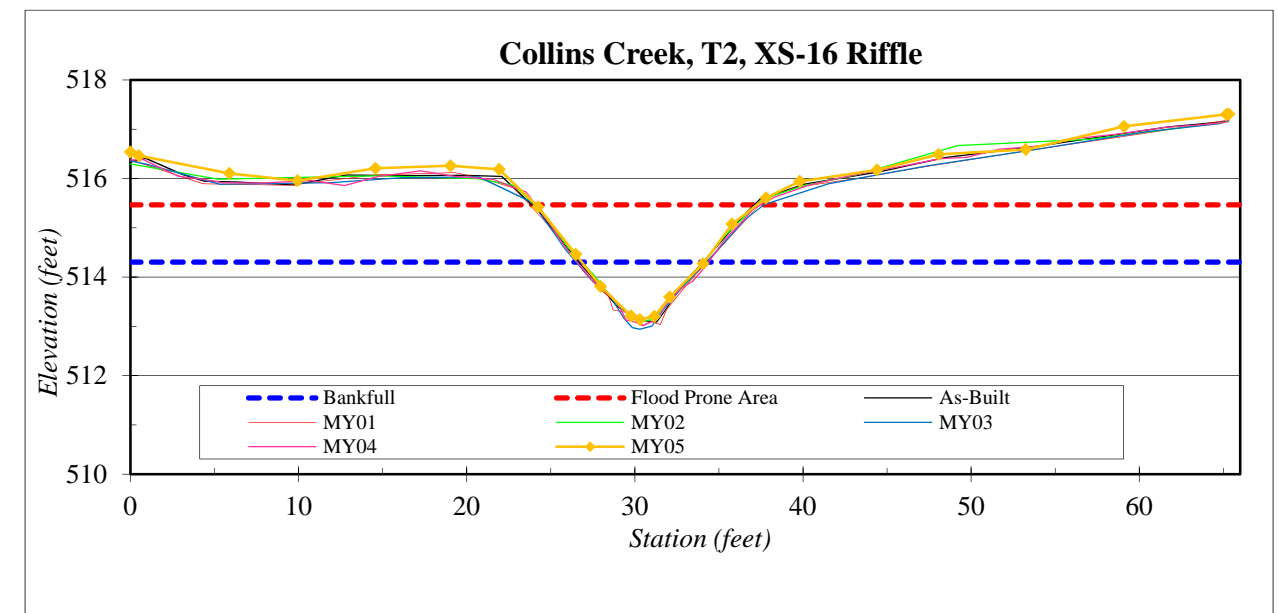
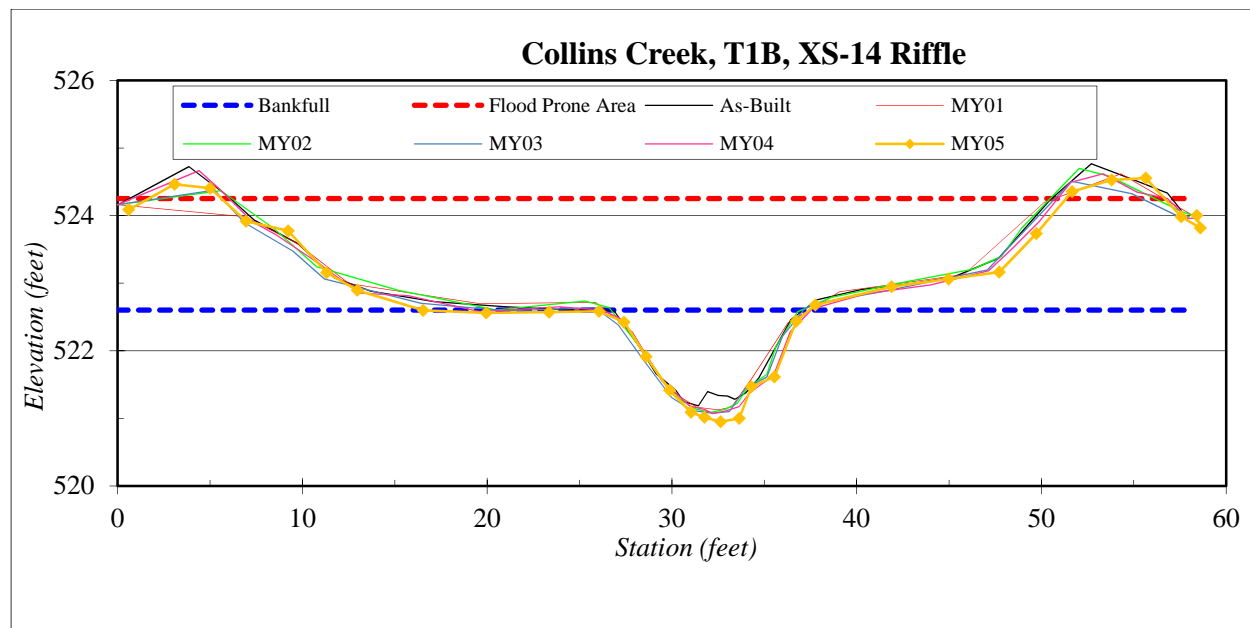
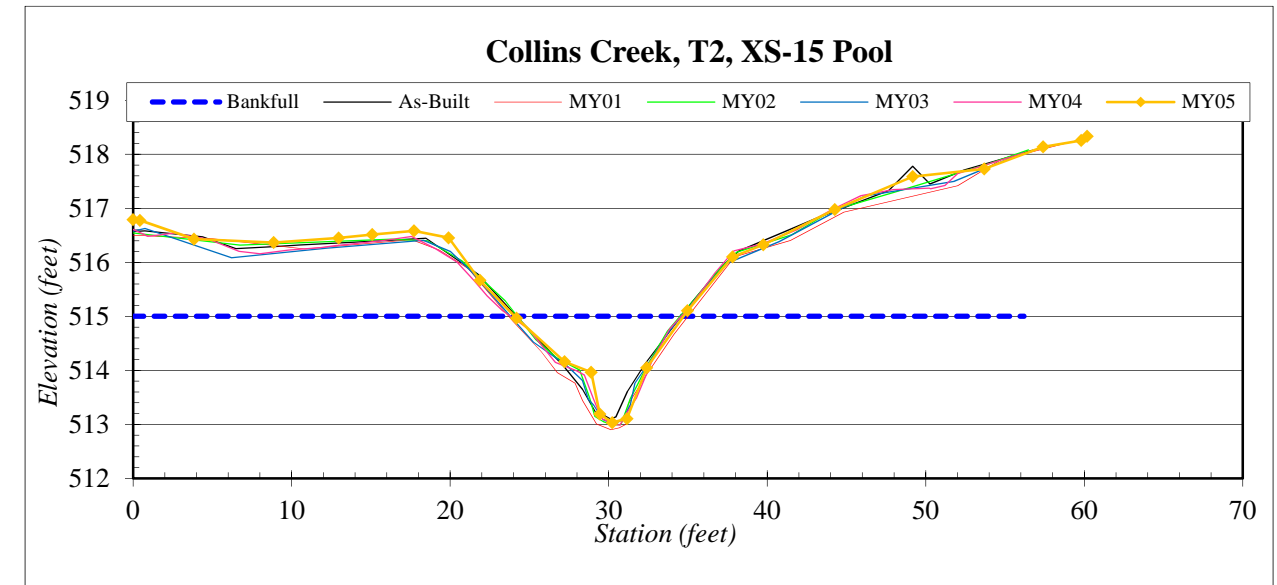
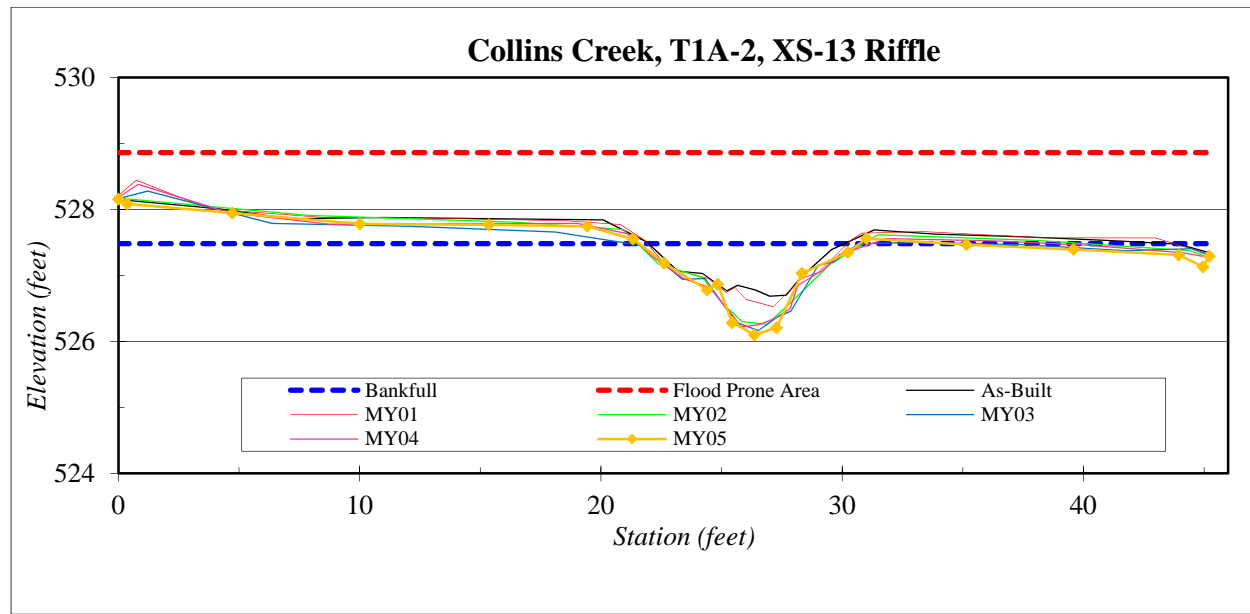


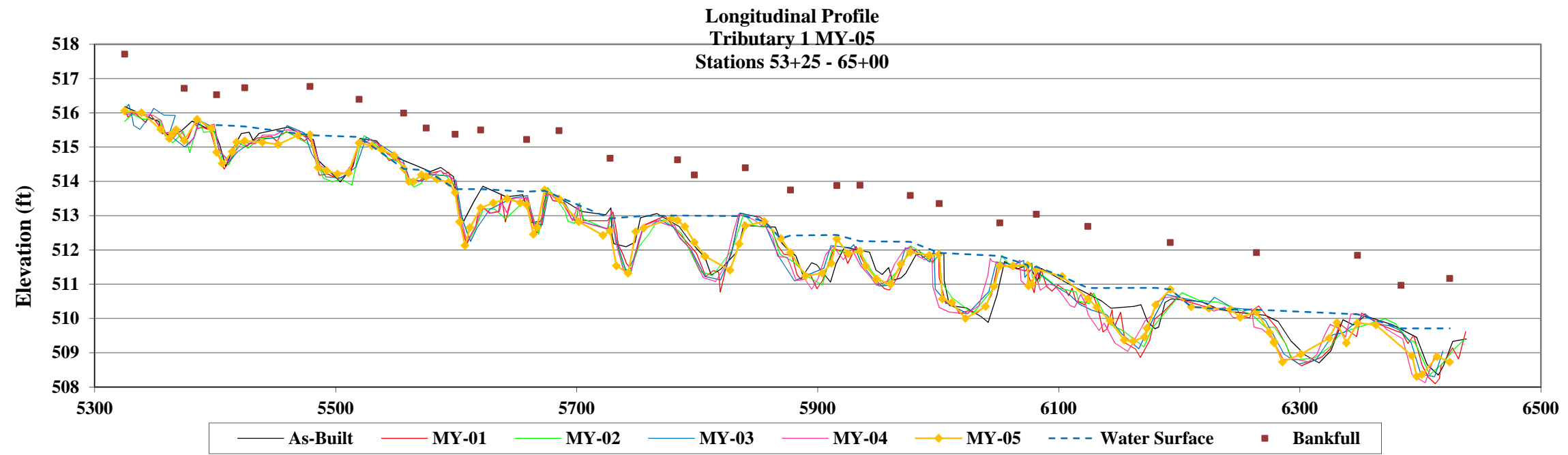
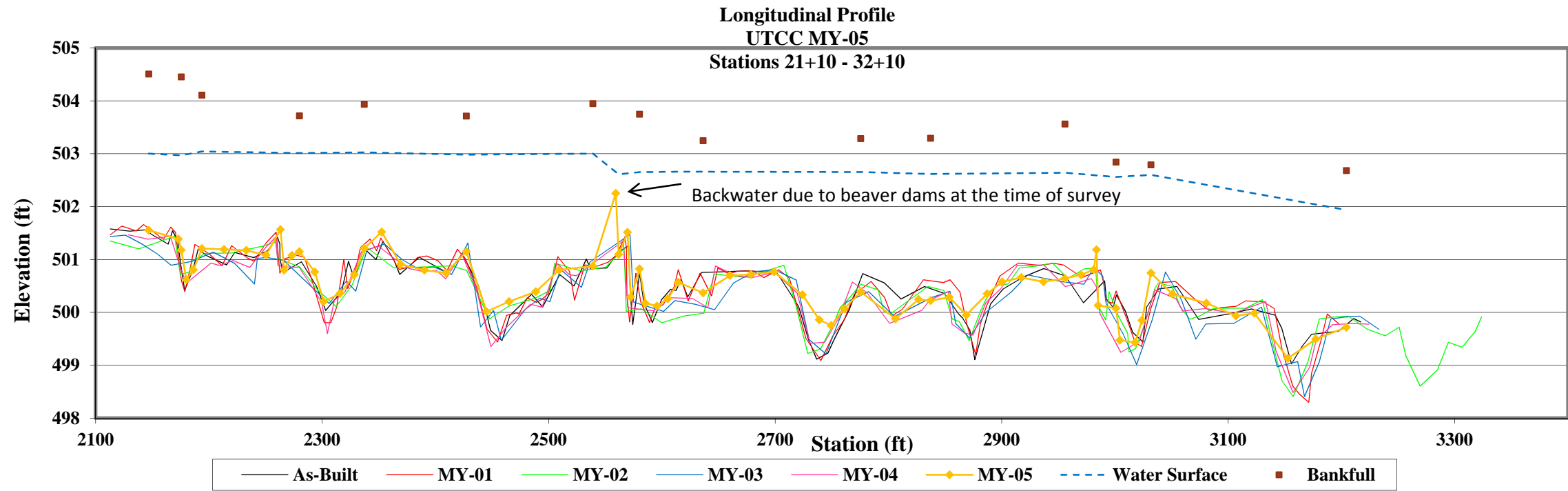
Source: USGS Topographic Quadrangle, White Cross 1981

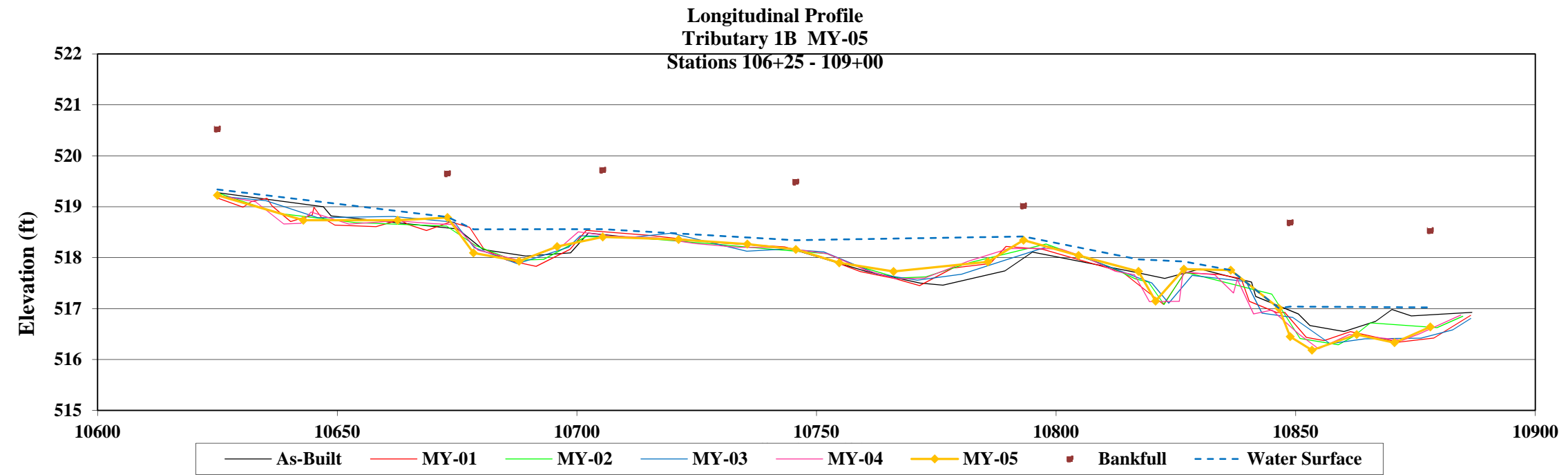
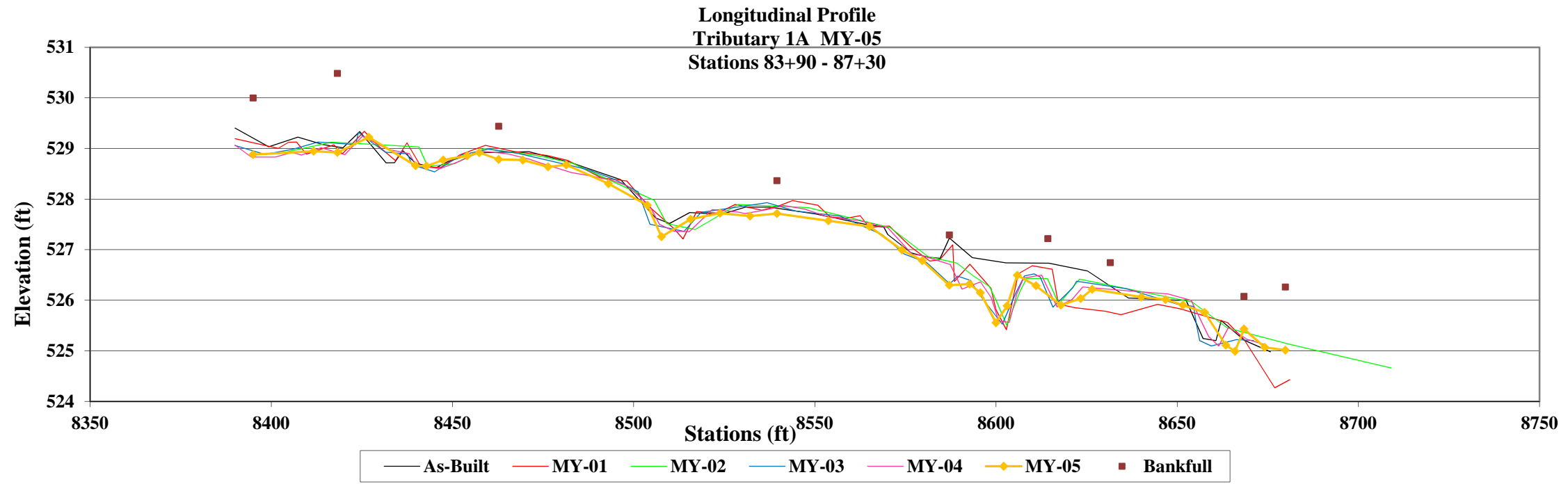












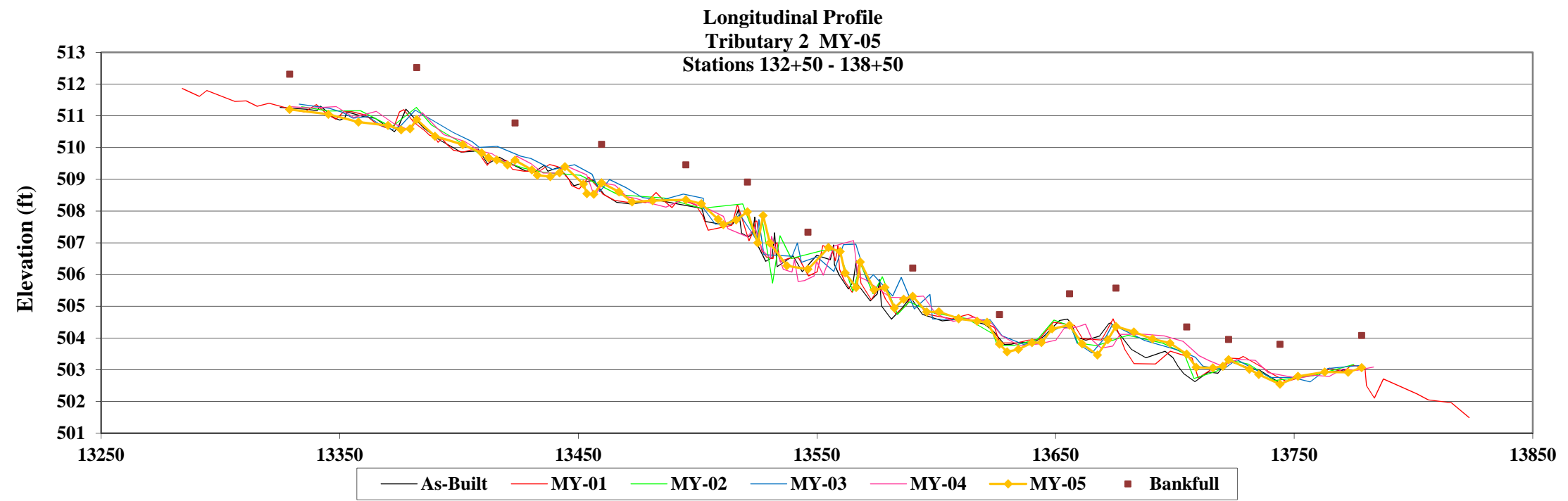


Table 4a. Morphology and Hydraulic Monitoring Summary																		
Collins Creek Stream Restoration Site																		
Parameter	Cross-Section 1 Riffle						Cross-Section 2 Pool						Cross-Section 3 Pool					
Reach	UTCC-1						UTCC-1						UTCC-3					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	21.2	21.9	21.2	21.6	23.3	24.0	35.9	37.5	39.1	38.3	37.0	39.4	25.3	25.4	25.0	26.9	24.4	24.6
Floodprone Width (ft)	>65	>65	>65	>65	>65	>65	-	-	-	-	-	-	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	42.5	43.6	41.7	41.3	40.6	40.8	86.7	88.0	83.7	82.7	81.3	82.7	49.1	48.6	49.1	50.3	47.7	48.8
Bankfull Mean Depth (ft)	2.0	2.0	2.0	1.9	1.7	1.7	2.4	2.3	2.1	2.2	2.2	2.1	1.9	1.9	2.0	1.9	2.0	2.0
Bankfull Max Depth (ft)	3.1	3.1	3.1	3.0	3.0	2.9	4.3	4.3	4.2	4.3	4.2	4.1	3.6	3.6	3.7	3.6	3.5	3.4
Width/Depth Ratio	10.6	11.0	10.8	11.3	13.4	14.1	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	>3.1	>3.0	>3.0	>3.0	>3.0	>2.8	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-
Substrate																		
d50 (mm)	0.4	0.2	0.1	0.1	0.1	0.1	0.4	7.7	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	3.6	0.1
d84 (mm)	17.0	17.0	0.2	0.2	45.0	0.1	4.9	15.0	20.0	0.1	27.0	0.1	16.0	11.0	16.0	0.2	21.0	0.1

Table 4b. Morphology and Hydraulic Monitoring Summary continued																		
Collins Creek Stream Restoration Site																		
Parameter	Cross-Section 4 Riffle						Cross-Section 5 Riffle						Cross-Section 6 Riffle					
Reach	UTCC-3						UTCC-3						T1-1					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	25.5	25.9	25.8	27.3	24.3	25.9	27.0	28.2	28.6	30.8	24.7	26.7	11.1	11.8	11.3	11.0	10.7	11.3
Floodprone Width (ft)	>76	>76	>76	>76	>76	>79	>74	>74	>74	>74	>74	>74	41	45	40	40	40	43
Bankfull Cross-Sectional Area (ft ²)	48.0	46.2	46.7	52.9	45.3	51.6	55.5	54.9	55.6	59.2	48.9	58.7	8.4	8.5	8.4	8.7	7.9	8.0
Bankfull Mean Depth (ft)	1.9	1.8	1.8	1.9	1.9	2.0	2.1	1.9	1.9	1.9	2.0	2.2	0.8	0.7	0.7	0.8	0.7	0.7
Bankfull Max Depth (ft)	2.8	2.7	2.7	3.2	2.8	2.9	3.3	3.2	3.3	3.5	2.9	3.4	1.3	1.4	1.3	1.4	1.2	1.2
Width/Depth Ratio	13.5	14.5	14.3	14.1	13.0	13.0	13.1	14.5	14.7	16.0	12.5	12.1	14.7	16.4	15.2	13.91	14.5	16.0
Entrenchment Ratio	>3.0	>3.0	>3.0	>3.0	>3.0	>3.0	>2.7	>3.0	>3.0	>3.0	>3.0	>2.8	3.7	3.8	3.6	3.6	3.7	3.8
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Substrate																		
d50 (mm)	1.3	0.1	0.1	0.1	3.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	7.4	0.2	19.0	18.0	21.0	24.0
d84 (mm)	24.0	11.0	0.1	0.1	45.0	0.1	1.0	9.2	0.1	0.1	18.0	0.1	20.0	0.4	27.0	26.0	32.0	33.0

Table 4c. Morphology and Hydraulic Monitoring Summary continued																		
Collins Creek Stream Restoration Site																		
Parameter	Cross-Section 7 Riffle						Cross-Section 8 Pool						Cross-Section 9 Riffle					
Reach	T1-2						T1-2						T1-3					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	11.7	12.4	11.7	12.3	11.2	11.0	13.1	13.4	14.4	13.0	12.1	14.6	20.8	24.3	20.1	19.4	19.1	19.0
Floodprone Width (ft)	42	42	45	45	41	42	-	-	-	-	-	-	>65	>65	>65	>65	>65	>68
Bankfull Cross-Sectional Area (ft ²)	11.5	12.4	12.6	11.9	10.4	10.3	10.9	10.5	11.7	12.2	9.3	9.8	20.0	19.3	17.1	16.2	16.3	15.6
Bankfull Mean Depth (ft)	1.0	1.0	1.1	1.0	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.7	1.0	0.8	0.9	0.8	0.9	0.8
Bankfull Max Depth (ft)	1.5	1.7	1.9	1.7	1.5	1.6	1.8	1.7	1.9	1.7	1.5	1.5	1.9	2.0	1.7	1.6	1.7	1.6
Width/Depth Ratio	11.9	12.4	10.9	12.7	12.1	11.7	-	-	-	-	-	-	21.6	30.6	23.6	23.2	22.4	23.2
Entrenchment Ratio	3.6	3.4	3.8	3.6	3.7	3.8	-	-	-	-	-	-	>3.1	>3.0	>3.0	>3.0	>3.0	>3.6
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	1.0	1.0	1.0	1.0	1.0	1.0
Substrate																		
d50 (mm)	0.8	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.3	8.6	0.1	0.1	2.0	0.1
d84 (mm)	13.0	15.0	6.0	16.0	4.0	0.1	0.3	0.3	0.1	0.1	0.1	0.1	24.0	21.0	0.1	7.3	28.0	0.1

Table 4d. Morphology and Hydraulic Monitoring Summary continued																		
Collins Creek Stream Restoration Site																		
Parameter	Cross-Section 10 Pool						Cross-Section 11 Riffle						Cross-Section 12 Riffle					
Reach	T1-3						T1-3						T1A-1					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	22.3	21.6	23.8	23.9	24.3	24.5	14.8	14.6	16.3	14.5	13.8	14.2	7.9	7.7	7.2	8.2	8.2	9.1
Floodprone Width (ft)	-	-	-	-	-	-	49	46	48	48	46	46	>40	>40	>40	>40	>40	>48.6
Bankfull Cross-Sectional Area (ft ²)	31.4	30.8	32.3	32.7	32.9	32.3	14.3	11.3	12.9	12.1	11.2	10.3	2.5	1.7	1.6	2.0	2.5	3.5
Bankfull Mean Depth (ft)	1.4	1.4	1.4	1.4	1.4	1.3	1.0	0.8	0.8	0.8	0.8	0.7	0.3	0.2	0.2	0.2	0.3	0.4
Bankfull Max Depth (ft)	2.9	3.1	3.0	3.1	3.1	3.0	1.4	1.2	1.2	1.1	1.2	1.0	0.6	0.5	0.6	0.7	0.6	0.9
Width/Depth Ratio	-	-	-	-	-	-	15.3	19.0	20.6	17.4	17.0	19.7	25.0	34.9	32.1	33.6	26.9	23.4
Entrenchment Ratio	-	-	-	-	-	-	3.3	3.2	3.0	3.3	3.3	3.3	>5.1	>5.2	>5.6	>5.6	>4.9	>5.4
Bank Height Ratio	-	-	-	-	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Substrate																		
d50 (mm)	0.2	0.6	0.1	0.2	2.3	0.3	0.7	12.0	0.1	0.1	22.0	17.0	0.1	0.1	0.2	0.1	0.1	0.1
d84 (mm)	0.5	7.5	0.1	8.4	11.0	2.3	9.5	23.0	27.0	19.0	41.0	37.0	0.2	0.1	0.2	0.1	0.2	0.2

Table 4e. Morphology and Hydraulic Monitoring Summary continued																		
Collins Creek Stream Restoration Site																		
Parameter	Cross-Section 13						Cross-Section 14						Cross-Section 15					
	Riffle						Riffle						Pool					
Reach	T1A-2						T1A-2						T2					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	9.7	9.7	10.3	9.4	9.7	9.1	11.1	11.0	10.3	11.1	11.4	11.4	10.4	11.3	10.3	10.8	10.8	10.6
Floodprone Width (ft)	>40	>40	>40	>40	>40	>45	43	53	44	45	45.1	48.5	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	5.2	6.3	7.1	5.9	5.9	5.8	8.4	9.1	9.5	10.1	10.0	10.5	9.8	12.0	10.1	10.4	10.4	9.8
Bankfull Mean Depth (ft)	0.5	0.6	0.7	0.6	0.6	0.6	0.8	0.8	0.9	0.9	0.9	0.9	0.9	1.1	1.0	1.0	1.0	0.9
Bankfull Max Depth (ft)	0.9	1.2	1.4	1.3	1.3	1.4	1.4	1.5	1.5	1.5	1.5	1.7	1.9	2.1	2.0	2.0	2.0	2.0
Width/Depth Ratio	18.1	14.9	14.9	15.1	15.9	14.3	14.7	13.3	11.2	12.2	13.0	12.4	-	-	-	-	-	-
Entrenchment Ratio	>4.1	>4.1	>3.9	>4.0	>4.0	>4.9	3.8	4.8	4.3	4.0	4.0	4.3	-	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-
Substrate																		
d50 (mm)	0.1	0.1	0.1	34.0	31.0	47.0	0.2	0.3	0.1	0.1	2.8	4.1	2.2	1.3	0.1	9.7	2.0	4.2
d84 (mm)	0.5	0.1	11.0	46.0	45.0	68.0	5.5	6.3	6.2	0.8	12.0	17.0	19.0	22.0	4.0	20.0	18.0	17.0

Table 4f. Morphology and Hydraulic Monitoring Summary continued						
Collins Creek Stream Restoration Site						
Parameter	Cross-Section 16					
	Riffle					
Reach	T2					
Dimension	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	7.4	7.7	7.2	7.7	7.8	7.3
Floodprone Width (ft)	14	14	13	13	14	13
Bankfull Cross-Sectional Area (ft ²)	5.2	5.7	4.9	5.6	5.4	4.8
Bankfull Mean Depth (ft)	0.7	0.7	0.7	0.7	0.7	0.7
Bankfull Max Depth (ft)	1.2	1.3	1.2	1.4	1.3	1.2
Width/Depth Ratio	10.5	10.4	10.6	10.6	11.3	11.1
Entrenchment Ratio	1.8	1.9	1.9	1.7	1.8	1.8
Bank Height Ratio	2.5	2.5	2.6	2.4	2.5	2.6
Substrate						
d50 (mm)	0.9	9.3	0.1	0.1	0.8	2.8
d84 (mm)	11.0	18.0	27.0	12.0	32.0	45.0

Table 5. Verification of Bankfull Events Collins Creek Stream Restoration Site		
Date of Data Collection	Date of Occurrence	Method
10/1/08	7/5/2008	Stream Gauge
10/1/08	8/27/2008	Stream Gauge
10/1/08	9/6/2008	Stream Gauge
10/1/08	9/10/2008	Stream Gauge
10/1/08	9/16/2008	Stream Gauge
1/12/10	3/1/2009	Stream Gauge
1/12/10	3/15/2009	Stream Gauge
1/12/10	6/5/2009	Stream Gauge
1/12/10	6/10/2009	Stream Gauge
1/12/10	11/11/2009	Stream Gauge
1/12/10	12/2/2009	Stream Gauge
9/30/10	1/14/2010	Stream Gauge
9/30/10	1/25/2010	Stream Gauge
9/30/10	2/5/2010	Stream Gauge
9/30/10	5/18/2010	Stream Gauge
9/30/10	9/29/2010	Stream Gauge
5/25/11	5/4/2011	Stream Gauge
7/27/11	5/9/2011-5/22/2011	Stream Gauge
12/13/12		See Photo



**Table 6. Stem counts arranged by plot.
Collins Creek Stream Restoration Site**

Species	Plots															Initial Totals	Year 5 Totals	Survival %
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
Shrubs																		
<i>Aronia arbutifolia</i>	1	2	3	1	3	6	2					2				31	20	65%
<i>Callicarpa americana</i>				4			1									5	5	100%
<i>Ilex decidua</i> *						2	1	2	1	2	1					9	9	100%
<i>Ilex verticillata</i>		1	1				1					1				6	4	67%
<i>Lindera benzoin</i>																3	0	0%
<i>Symphoricarpos orbiculatas</i>			1			1		1	1	1	1	1				8	7	88%
Trees																		
<i>Betula nigra</i>	1	6	1		3	1	1				2	1				18	16	89%
<i>Carya ovata</i> *									1	1	3	1	2			8	8	100%
<i>Cornus amomum</i>	4			3	4				1	3				3		32	18	56%
<i>Diospyros virginiana</i> *	2	3	6		3			2	1	3	6	8	2	3	2	39	41	105%
<i>Fraxinus pennsylvanica</i>				1			1									2	2	100%
<i>Juglans nigra</i>								3	8	2	3	3	2	2	3	42	26	62%
<i>Platanus occidentalis</i>	2	4		1	2	3	4				1	4				22	21	95%
<i>Quercus falcata</i>									1	3	2	1	2	4	2	15	15	100%
<i>Quercus michauxii</i>			1		1		4									15	6	40%
<i>Quercus pagoda</i>													1			1	1	100%
<i>Quercus phellos</i> *	1		1	2			2									6	6	100%
<i>Quercus sp.</i>																8	0	0%
<i>Salix nigra</i>	1													1		6	2	33%
<i>Salix sericea</i>																8	0	0%
<i>Sambucus canadensis</i>																26	0	0%
Total	12	16	14	12	16	13	17	8	14	15	19	22	9	13	7	310	207	-
Density	486	648	567	486	648	526	688	324	567	607	769	891	364	526	283		559	

**Table 7. Vegetation History: Stems/Acre Planted and Total with Volunteers
Collins Creek Stream Restoration Site**

Plot Number	MY-00	MY-01	MY-02	MY-03	MY-04		MY-05	
	Planted	Planted	Planted	Planted	Planted	Total	Planted	Total
1	1,080	680	560	520	486	728	486	972
2	760	720	720	720	728	2,833	648	2,267
3	800	680	640	640	607	3,966	567	5,182
4	640	600	560	520	567	3,035	486	2,874
5	1,160	1,000	720	680	647	1,942	648	1,498
6	760	680	600	600	567	2,509	526	3,563
7	680	680	680	680	688	1,335	688	1,579
8	1,080	840	640	560	405	688	324	1,215
9	680	680	640	560	567	890	567	1,579
10	1,360	840	640	640	647	1,214	607	1,296
11	960	800	800	800	809	1,416	769	1,417
12	1,120	880	880	880	890	4,654	891	3,401
13	720	520	520	400	364	2,995	364	3,117
14	840	560	520	480	526	3,764	526	3,360
15	680	360	280	280	283	1,578	283	1,984

4.0 EEP RECOMMENDATIONS AND CONCLUSIONS

The stream assessment found the stream to be generally stable, with no significant changes from the previous monitoring year. The surveyed profiles and cross-sections reveal few significant changes between fourth and fifth-year monitoring. The fifth year of monitoring found the majority of the project to be functioning as designed. Small isolated areas of bank erosion have been noted on the Current Condition Plan View (CCPV), but there are no systematic problems that indicate that the project streams are becoming unstable. Two beaver dams were built on UTCC in 2011. Both of these beaver dams have been breached and were fully removed in 2012. Another large beaver dam has been constructed since the removal of these two and will be removed in early 2013. With multiple bankfull events since construction, the stream has met the success criterion of at least two bankfull events occurring in separate years over the course of the monitoring period.

The floodplain, stream banks, and riparian buffer have isolated areas with sparse vegetation, but overall they are well vegetated. Some scattered populations of invasive species have been identified in the floodplain and surrounding areas. These include Chinese privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*) which are targeted for removal in early 2013.

The monitored vegetation plots within the stream buffer revealed that the planted vegetation is growing well with an average of 559 stems/acre. None of the monitoring plots had calculated planted stem densities less than 260 stems/acre. The overall vegetation assessment found the site has met the vegetative success criteria for monitoring year 5.

Overall the wetland, stream, and the site's vegetation condition indicate that it is on a path to success. The EEP recommends that this site be closed out.

Pre-Construction Photos (2005)





Post-Construction Photos MY-05



PP#3A – MY05 – 12/14/12



PP#3B – MY05 – 12/14/12



PP#6B – MY05 – 12/14/12



PP#9B – MY05 – 12/14/12



PP#10C – MY05 – 12/14/12



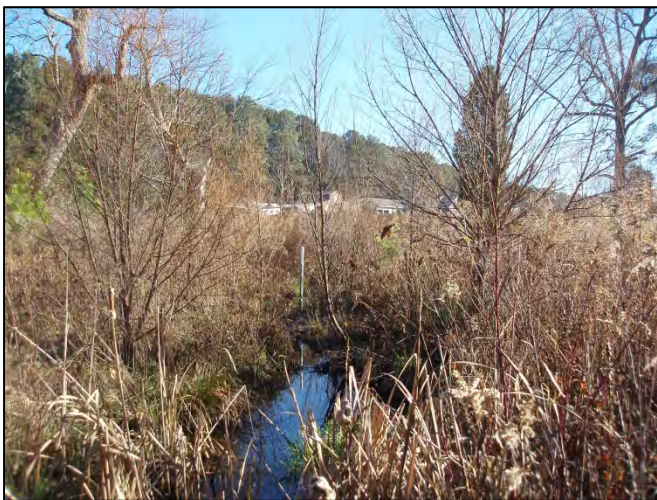
PP#12A – MY05 – 12/14/12



PP#12B – MY05 – 12/14/12



PP#13C – MY05 – 12/14/12



PP#15A – MY05 – 12/14/12



PP#17A – MY05 – 12/14/12



PP#22A – MY05 – 12/14/12



PP#28B – MY05 – 12/14/12

Appendix A
Watershed Planning Summary
To be completed by the EEP Watershed Planner.

Appendix B
Land Ownership and Protection
To be completed by the EEP Property Section.

Appendix C
NCDWQ 401/USACE Section 404



Michael F. Easley, Governor

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Coleen H. Sullins, Director
Division of Water Quality

November 13, 2007

DWQ Project # 07-1709
Orange County

Ms. Kristin Knight
KCI Technologies, Inc.
4601 Six Forks Road, Suite 220
Raleigh, NC 27609

Subject Property: **Collins Creek Stream Restoration**
Ut to Collins Creek [030604, 16-30-(0.5), C, NSW]

Approval of 401 Water Quality Certification with Additional Conditions

Dear Ms. Knight:

You have our approval, in accordance with the attached conditions and those listed below, to place fill within or otherwise impact 9,189 linear feet of perennial stream, as described in your application dated October 8, 2007, and received by the Division of Water Quality (DWQ) on October 10, 2007, to perform the proposed stream restoration project at the site. After reviewing your application, we have decided that the impacts are covered by General Water Quality Certification Number(s) 3626 (GC3626). The Certification(s) allows you to use Nationwide Permit(s) 27 (NW27), when issued by the US Army Corps of Engineers (USACE). In addition, you should obtain or otherwise comply with any other required federal, state or local permits before you go ahead with your project including (but not limited to) Erosion and Sediment Control, and Non-discharge regulations. **Also, this approval to proceed with your proposed impacts or to conduct impacts to waters as depicted in your application shall expire upon expiration of the 404 or CAMA Permit.**

This approval is for the purpose and design that you described in your application. If you change your project, you must notify us and you may be required to send us a new application. If the property is sold, the new owner must be given a copy of this Certification and approval letter and is thereby responsible for complying with all conditions. If total fills for this project (now or in the future) exceed one acre of wetland or 150 linear feet of stream, compensatory mitigation may be required as described in 15A NCAC 2H .0506 (h). **This approval requires you to follow the conditions listed in the attached certification and any additional conditions listed below.**

The Additional Conditions of the Certification are:

1. Impacts Approved

The following impacts are hereby approved as long as all of the other specific and general conditions of this Certification (or Isolated Wetland Permit) are met. No other impacts are approved including incidental impacts:

Type of Impact	Amount Approved (Units)	Plan Location or Reference
Stream - perennial	9,189 (linear feet)	PCN page 8 of 12



2. No Waste, Spoil, Solids, or Fill of Any Kind

No waste, spoil, solids, or fill of any kind shall occur in wetlands, waters, or riparian areas beyond the footprint of the impacts depicted in the Pre-Construction Notification. All construction activities, including the design, installation, operation, and maintenance of sediment and erosion control Best Management Practices, shall be performed so that no violations of state water quality standards, statutes, or rules occur.

3. Erosion and sediment control practices must be in full compliance with all specifications governing the proper design, installation and operation and maintenance of such Best Management Practices in order to protect surface waters standards:

- a. The erosion and sediment control measures for the project must be designed, installed, operated, and maintained in accordance with the most recent version of the *North Carolina Sediment and Erosion Control Planning and Design Manual*.
- b. The design, installation, operation, and maintenance of the sediment and erosion control measures must be such that they equal, or exceed, the requirements specified in the most recent version of the *North Carolina Sediment and Erosion Control Manual*. The devices shall be maintained on all construction sites, borrow sites, and waste pile (spoil) projects, including contractor-owned or leased borrow pits associated with the project.
- c. Sufficient materials required for stabilization and/or repair of erosion control measures and stormwater routing and treatment shall be on site at all times.

4. Sediment and Erosion Control Measures

Sediment and erosion control measures shall not be placed in wetlands or waters to the maximum extent practicable. If placement of sediment and erosion control devices in wetlands and waters is unavoidable, they shall be removed and the natural grade restored within six months of the date that the Division of Land Resources has released the project;

5. Protective Fencing

The outside buffer, wetland or water boundary and along the construction corridor within these boundaries approved under this authorization shall be clearly marked with orange warning fencing (or similar high visibility material) for the areas that have been approved to infringe within the buffer, wetland or water prior to any land disturbing;

6. Stream Restoration Plans

You have our approval for your proposed final wetland enhancement and stream restoration plans. The enhancement and stream restoration must be constructed, maintained, and monitored according to the plans approved by this Office. Any repairs or adjustments to the site must be made according to the approved plans or must receive written approval from this Office to make the repairs or adjustments.

7. Certificate of Completion

Upon completion of all work approved within the 401 Water Quality Certification or applicable Buffer Rules, and any subsequent modifications, the applicant is required to return the attached certificate of completion to the 401 Oversight/Express Review Permitting Unit, North Carolina Division of Water Quality, 1650 Mail Service Center, Raleigh, NC, 27699-1650.

November 13, 2007

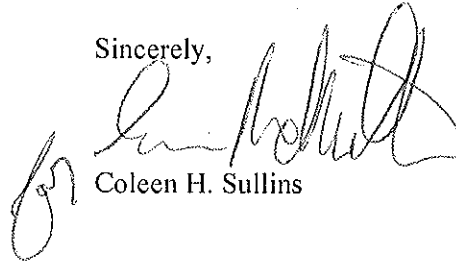
Violations of any condition herein set forth may result in revocation of this Certification and may result in criminal and/or civil penalties. The authorization to proceed with your proposed impacts or to conduct impacts to waters as depicted in your application and as authorized by this Certification, shall expire upon expiration of the 404 or CAMA Permit.

If you do not accept any of the conditions of this Certification (associated with the approved wetland or stream impacts), you may ask for an adjudicatory hearing. You must act within 60 days of the date that you receive this letter. To ask for a hearing, send a written petition, which conforms to Chapter 150B of the North Carolina General Statutes to the Office of Administrative Hearings, 6714 Mail Service Center, Raleigh, N.C. 27699-6714. This certification and its conditions are final and binding unless you ask for a hearing.

Any disputes over determinations regarding this Authorization Certificate (associated with the approved buffer impacts) shall be referred in writing to the Director for a decision. The Director's decision is subject to review as provided in Articles 3 and 4 of G.S. 150B.

This letter completes the review of the Division of Water Quality under Section 401 of the Clean Water Act. If you have any questions, please telephone Cyndi Karoly or Ian McMillan at 919-733-1786.

Sincerely,



Coleen H. Sullins

CHS/ijm

Enclosures: GC 3627
Certificate of Completion

cc: USACE Raleigh Regulatory Field Office
Lauren Witherspoon, DWQ Raleigh Regional Office
DLR Raleigh Regional Office
File Copy
Central Files

Filename: 071709CollinsCreekStreamRestoration(Orange)401

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action ID. SAW-2007-03528-268 County: Orange USGS Quad: White Cross

GENERAL PERMIT (REGIONAL AND NATIONWIDE) VERIFICATION

Property Owner / Authorized Agent: KCI Technologies, Inc.

Address: Attention: Kristin Knight
4601 Six Forks Road, Suite 220
Raleigh, North Carolina 27609

Telephone No.: 919-783-9214

Size and location of property (water body, road name/number, town, etc.): 33 Acres; Located approximately 1500 feet North of the State Highway 54, Dodson Crossroads intersection, near White Cross, in Orange County, North Carolina.

Description of projects area and activity: This authorization is for the discharge of fill material associated with the proposed restoration/enhancement project involving 5 unnamed tributaries to Collins Creek, as described in your application and plans received on 02 November 2007. Specifically, this verification is for the restoration/enhancement of 2,310 linear feet of an unnamed tributary to Collins Creek; restoration of 3,173 linear feet of tributary 1; restoration of 725 linear feet of tributary 1A; restoration of 1,102 linear feet of tributary 1B; restoration of 1, 879 linear feet of tributary 2. The total impact authorized for the five unnamed tributaries is 9,189 linear feet. The project must be conducted in accordance with the application and drawings submitted on 02 November 2007.

This verification is for the authorization of the proposed work in jurisdictional waters of the United States; it does not confirm or deny the credit of the successful work for the purpose of future mitigation credits.

We were unable to provide a timely verification for impacts proposed in your complete preconstruction notification application (PCN) received in our office on 02 November 2007. General Condition number 13, which lists the notification requirements for nationwide permits, states that "the prospective permittee shall not begin the activity unless 45 days have passed from the District Engineer's receipt of the complete notification and the prospective permittee has not received written notice from the District or Division Engineer." Accordingly, on 16 December 2007, the KCI Technologies, Inc. was authorized to conduct the work associated with construction of the restoration project.

Applicable Law: Section 404 (Clean Water Act, 33 USC 1344)
 Section 10 (Rivers and Harbors Act, 33 USC 403)

Authorization: Regional General Permit Number: _____
Nationwide Permit Number: 27

Your work is authorized by the above referenced permit provided it is accomplished in strict accordance with the attached conditions and your submitted plans. Any violation of the attached conditions or deviation from your submitted plans may subject the permittee to a stop work order, a restoration order and/or appropriate legal action.

This verification will remain valid until the expiration date identified below unless the nationwide authorization is modified, suspended or revoked. If, prior to the expiration date identified below, the nationwide permit authorization is reissued and/or modified, this verification will remain valid until the expiration date identified below, provided it complies with all requirements of the modified nationwide permit. If the nationwide permit authorization expires or is suspended, revoked, or is modified, such that the activity would no longer comply with the terms and conditions of the nationwide permit, activities which have commenced (i.e., are under construction) or are under contract to commence in reliance upon the nationwide permit, will remain authorized provided the activity is completed within twelve months of the date of the nationwide permit's expiration, modification or revocation, unless discretionary authority has been exercised on a case-by-case basis to modify, suspend or revoke the authorization.

Activities subject to Section 404 (as indicated above) may also require an individual Section 401 Water Quality Certification. You should contact the NC Division of Water Quality (telephone (919) 733-1786) to determine Section 401 requirements.

For activities occurring within the twenty coastal counties subject to regulation under the Coastal Area Management Act (CAMA), prior to beginning work you must contact the N.C. Division of Coastal Management .

This Department of the Army verification does not relieve the permittee of the responsibility to obtain any other required Federal, State or local approvals/permits.

If there are any questions regarding this verification, any of the conditions of the Permit, or the Corps of Engineers regulatory program, please contact Andrew Williams at telephone number 919-876-8441 extension 26.

Corps Regulatory Official Andrew Williams

Date: **January 8, 2008**

Expiration Date of Verification: **January 8, 2010**

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete the Customer Satisfaction Survey located at <http://regulatory.usacesurvey.com/> to complete the survey online.

Determination of Jurisdiction:

- Based on preliminary information, there appear to be waters of the US including wetlands within the above described project area. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331).
- There are Navigable Waters of the United States within the above described project area subject to the permit requirements of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.
- There are waters of the US and/or wetlands within the above described project area subject to the permit requirements of Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.
- The jurisdictional areas within the above described project area have been identified under a previous action. Please reference jurisdictional determination issued _____. Action ID _____

Basis of Jurisdictional Determination: **The 5 streams are relatively permanent waters (RPW) and are all unnamed tributaries to the Haw River, a traditionally navigable water (TNW), which is a tributary to the Cape Fear River, a navigable water of the United States. The Ordinary High Water Mark (OHWM) of the unnamed tributaries were indicated by the following physical characteristics: clear natural line impressed on the bank, shelving, and the destruction of terrestrial vegetation.**

This jurisdictional determination is only for the waters proposed for impacts associated with this Nationwide Permit and does not include any other waters/wetlands that may be located on the property.

Appeals Information (This information applies only to approved jurisdictional determinations.)

Attached to this verification is an approved jurisdictional determination. If you are not in agreement with that approved jurisdictional determination, you can make an administrative appeal under 33 CFR 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

District Engineer, Wilmington Regulatory Division
Attn: Andrew Williams, Project Manager,
Raleigh Regulatory Field Office
U.S. Army Corps of Engineers
6508 Falls of the Neuse Road, Suite 120
Raleigh, North Carolina 27615

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the District Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **March 7, 2008**.

****It is not necessary to submit an RFA form to the District Office if you do not object to the determination in this correspondence.****

Corps Regulatory Official: Andrew Williams

Date **January 8, 2008**

Expiration Date **January 8, 2013**

Summary of Authorized Impacts and Required Mitigation

Action ID #	NWP / GP #	Open Water (ac)		Wetland (ac)		Unimportant Stream (lf)		Important Stream (lf)	
		Temporary	Permanent	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
SAW-2007-03528	NWP 27								9,189
Impact Totals									
Total Loss of Waters of the U.S. (ac)				Total Loss of Waters of the U.S. (lf)					
Required Wetland Mitigation (ac)				Required Stream Mitigation (lf)					

Additional Remarks and/or Special Permit Conditions:

This verification is for the authorization of the proposed work in jurisdictional waters of the United States; it does not confirm or deny the credit of the successful work for the purpose of future mitigation credits.

SURVEY PLATS, FIELD SKETCH, WETLAND DELINEATION FORMS, PROJECT PLANS, ETC., MUST BE ATTACHED TO THE FILE COPY OF THIS FORM, IF REQUIRED OR AVAILABLE.

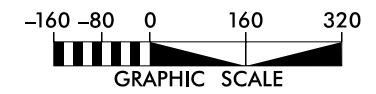
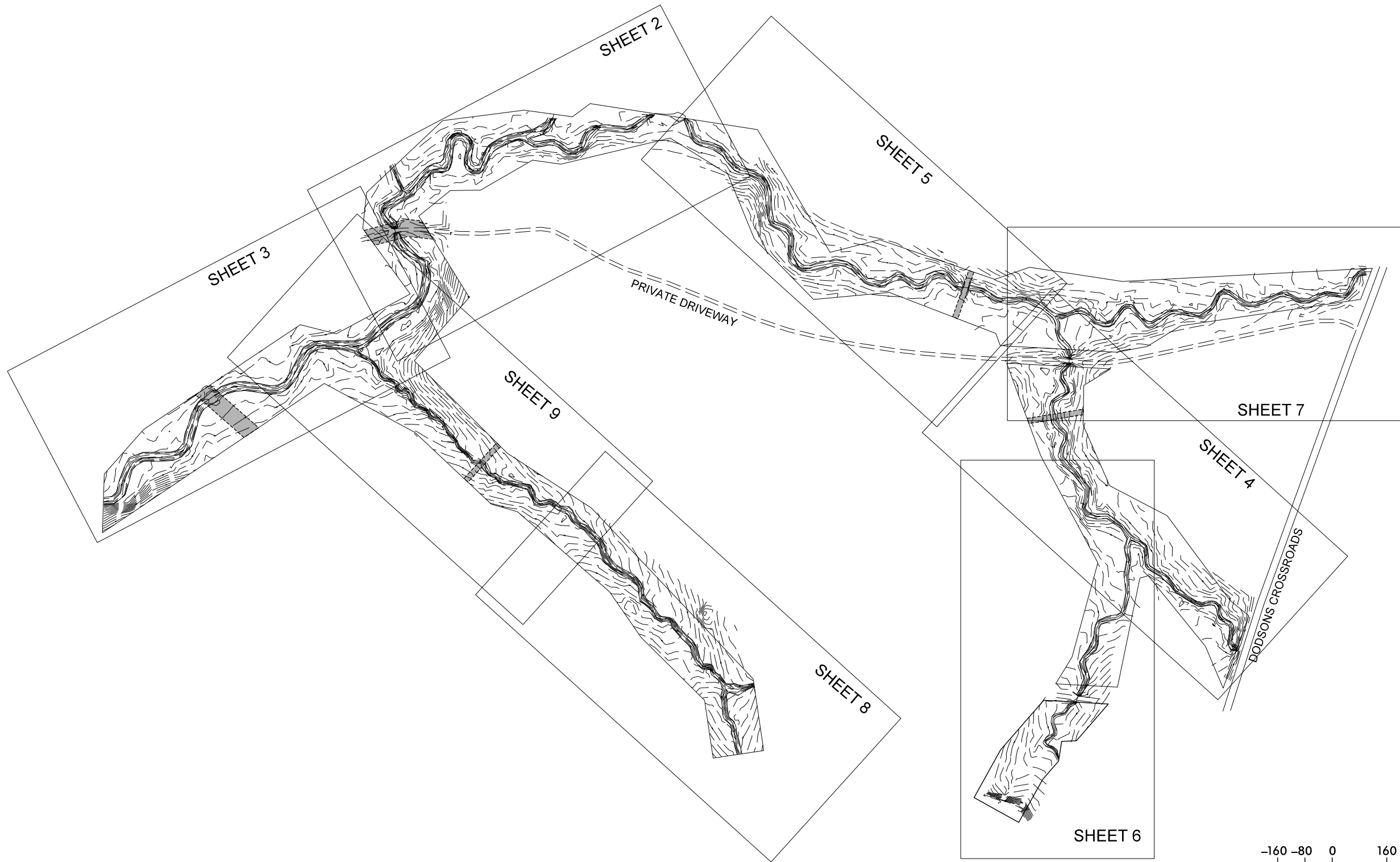
Copy Furnished:
 Sue Homewood
 North Carolina Department of Natural Resources
 Division of Water Quality
 585 Waughtown Street
 Winston-Salem, NC 27107

Appendix D
Debit Ledger
Closeout Coordinator to obtain.

Appendix E

Additional Data

CCPV



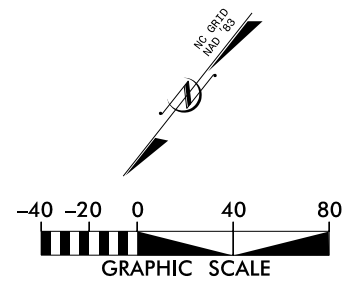
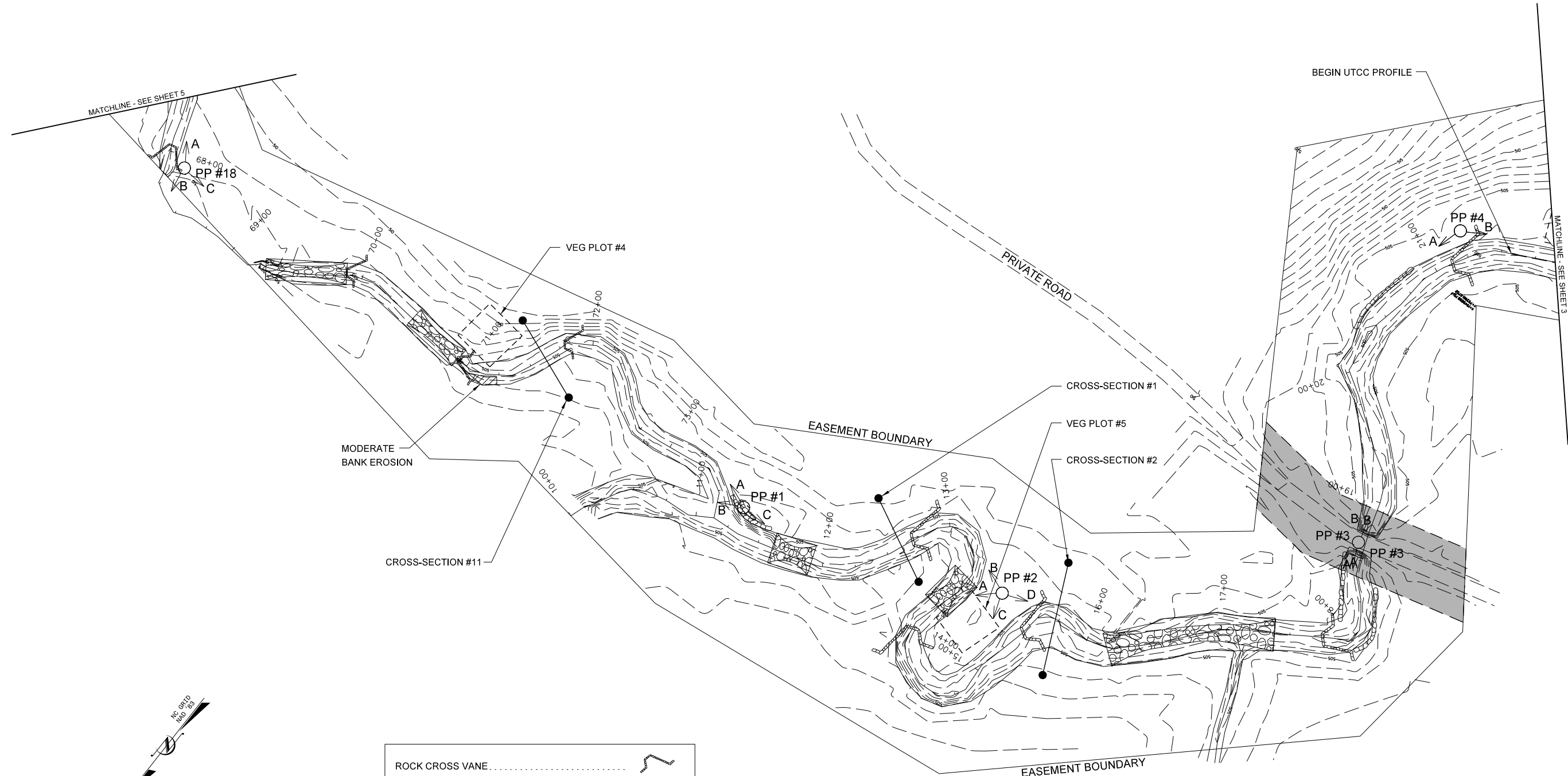
SYMBOL	DESCRIPTION	DATE	APPROVED



KCI
 TECHNOLOGIES
 ENGINEERS • PLANNERS • SCIENTISTS
 4601 SIX FORKS ROAD
 RALEIGH, NORTH CAROLINA 27609

**COLLINS CREEK
 STREAM RESTORATION PROJECT**
 CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

DATE: DEC 2012
 SCALE: 1"=320'
**CURRENT
 CONDITION
 PLAN VIEW**
 SHEET 1 OF 9



ROCK CROSS VANE	
CONSTRUCTED RIFFLE	
STONE TOE PROTECTION	
STEP POOL STRUCTURE	
ROCK OUTLET	

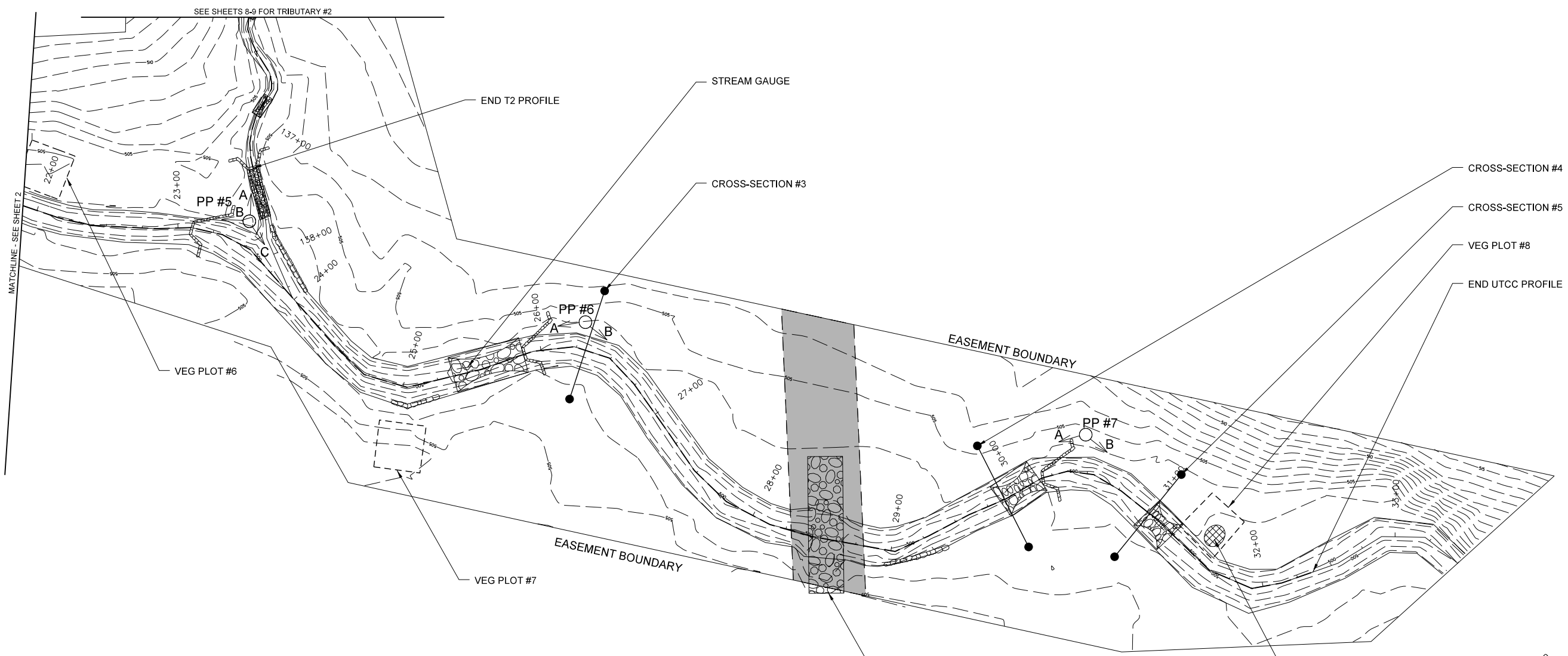
SYL	DESCRIPTION	DATE	APPROVED



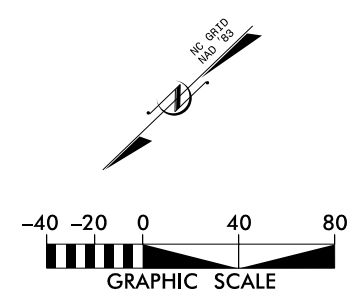
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 RALEIGH, NORTH CAROLINA 27609

**COLLINS CREEK
 STREAM RESTORATION PROJECT**
 CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
 UTCC-1 & 2: STA. 10+00 - 21+90, T1-3: STA. 67+60 - 73+70

DATE: DEC 2012
 SCALE: 1"=80'
**CURRENT
 CONDITION
 PLAN VIEW**
 SHEET 2 OF 9



ROCK CROSS VANE	
CONSTRUCTED RIFFLE	
STONE TOE PROTECTION	
STEP POOL STRUCTURE	
ROCK OUTLET	



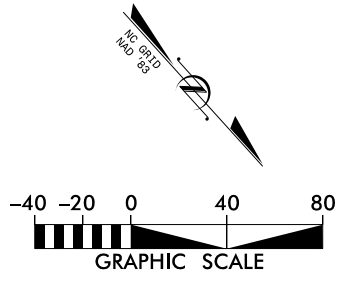
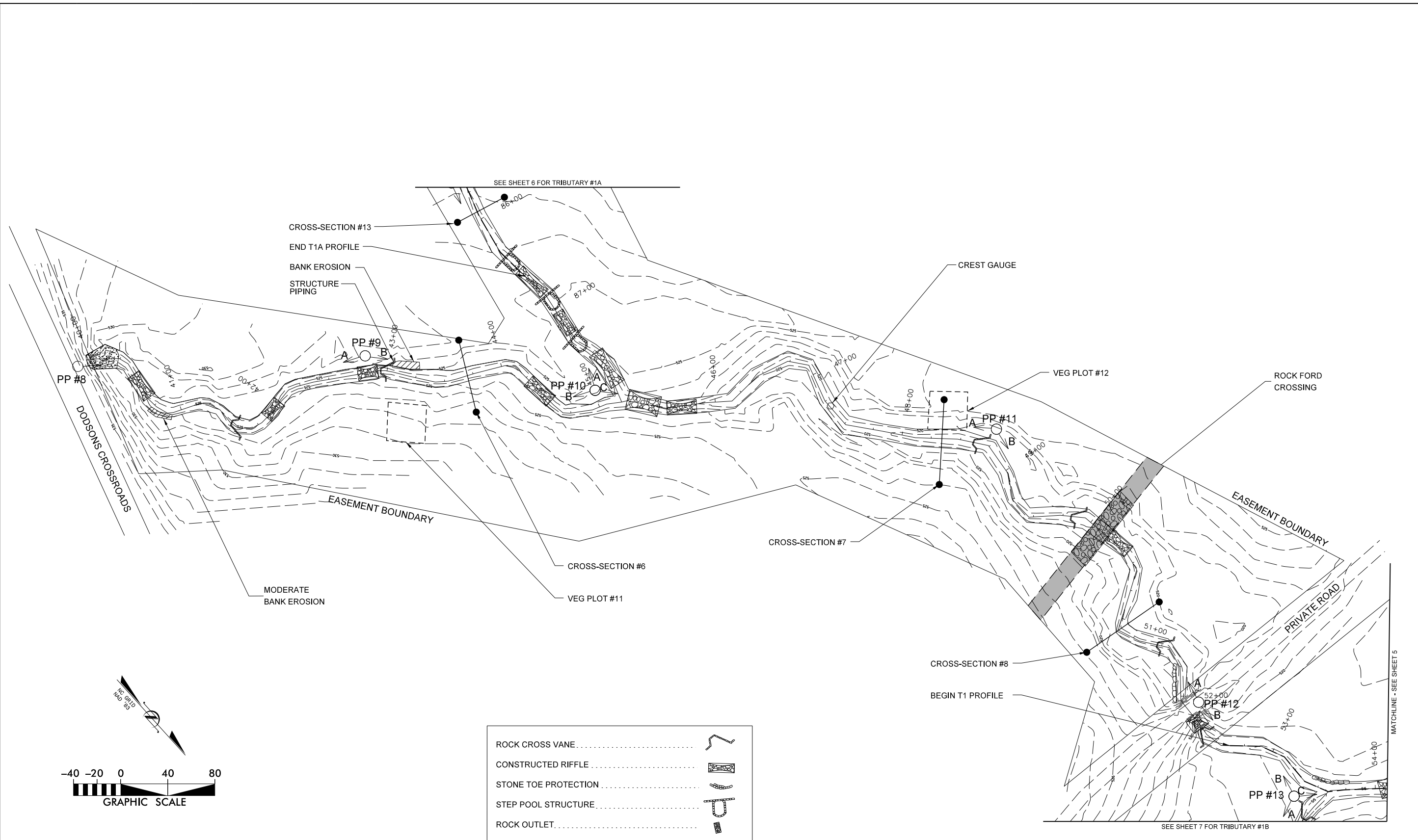
SYL	DESCRIPTION	DATE	APPROVED



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**COLLINS CREEK
 STREAM RESTORATION PROJECT**
 CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
 UTCC-2 AND UTCC-3: STATION 21+90 TO STATION 33+50

DATE: DEC 2012
 SCALE: 1"=80'
**CURRENT
 CONDITION
 PLAN VIEW**
 SHEET 3 OF 9



ROCK CROSS VANE	
CONSTRUCTED RIFFLE	
STONE TOE PROTECTION	
STEP POOL STRUCTURE	
ROCK OUTLET	

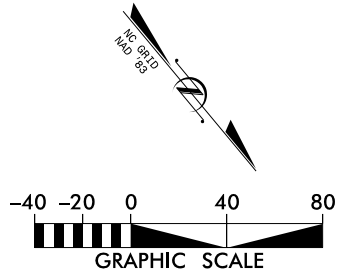
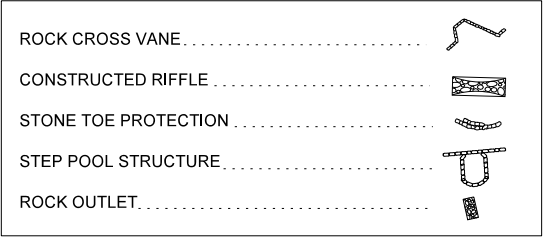
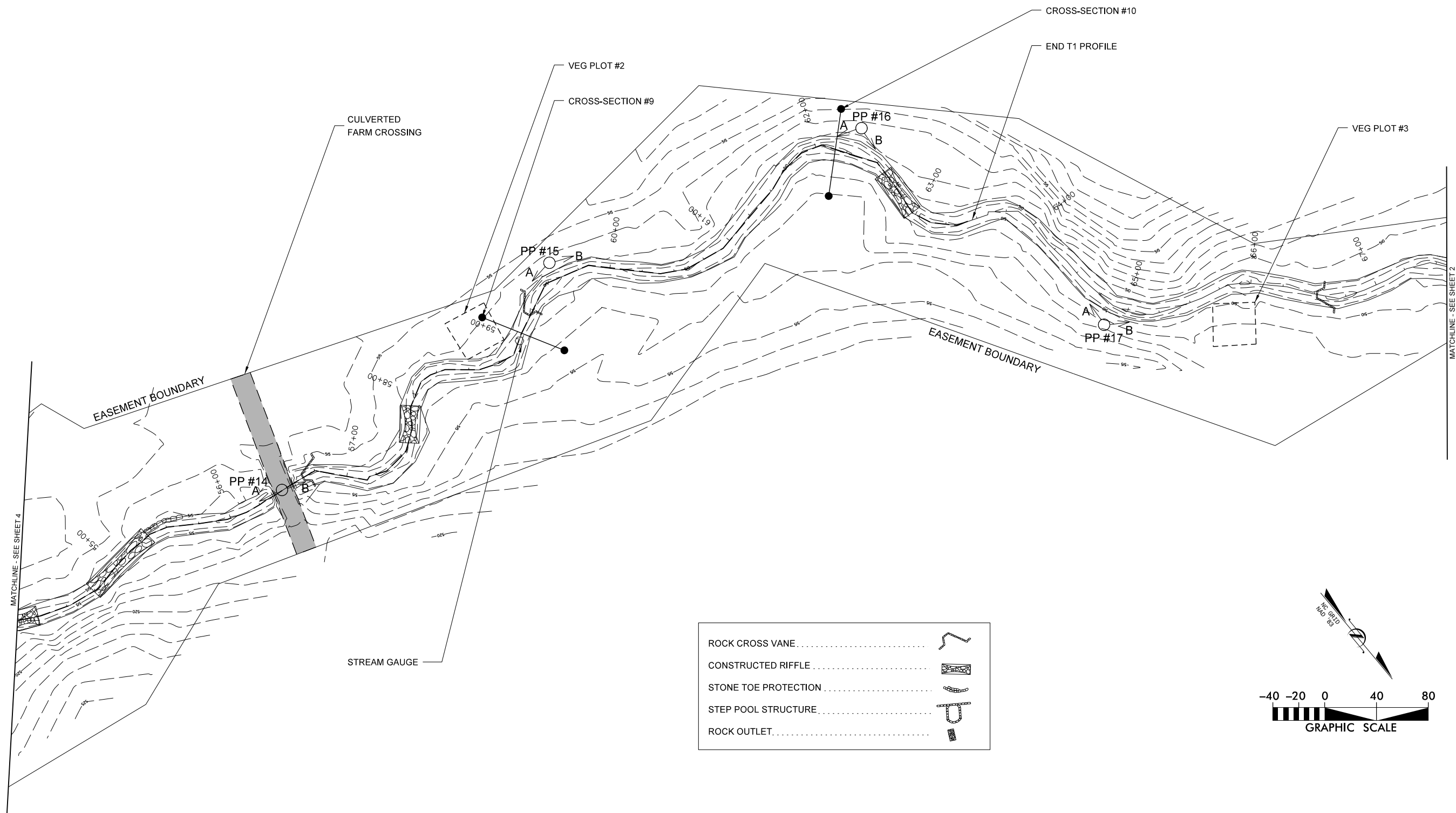
SYMBOL	DESCRIPTION	DATE	APPROVED



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**COLLINS CREEK
 STREAM RESTORATION PROJECT**
 CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
 T1-1 AND T1-2: STATION 40+00 TO STATION 54+10

DATE: DEC 2012
 SCALE: 1"=80'
**CURRENT
 CONDITION
 PLAN VIEW**
 SHEET 4 OF 9



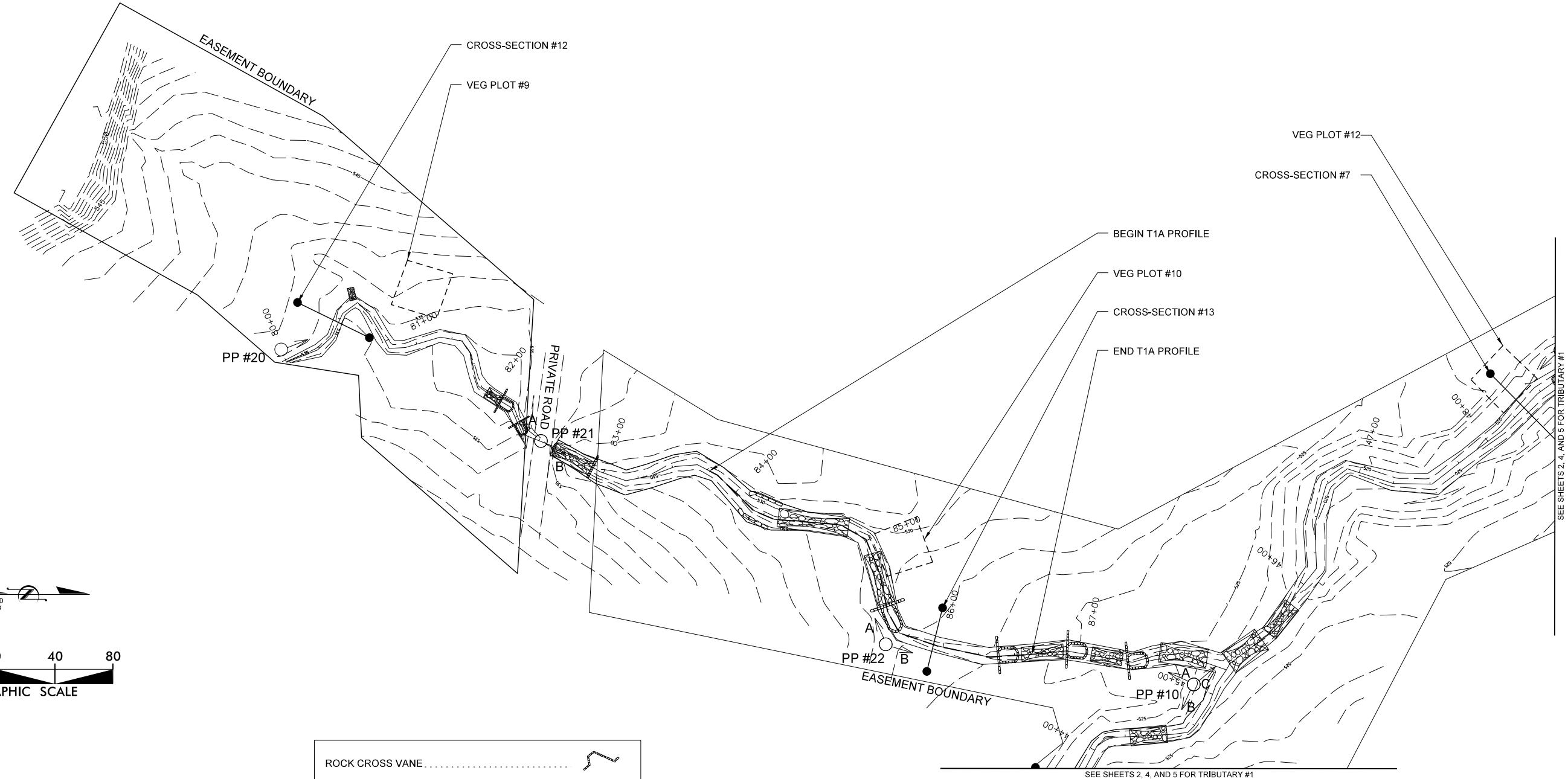
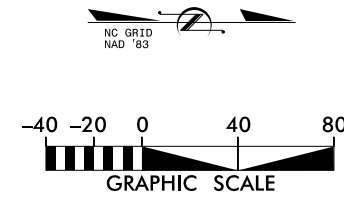
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**COLLINS CREEK
 STREAM RESTORATION PROJECT**
 CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
 T1-3: STATION 54+10 TO STATION 67+60

DATE: DEC 2012
 SCALE: 1"=80'
**CURRENT
 CONDITION
 PLAN VIEW**
 SHEET 5 OF 9



ROCK CROSS VANE	
CONSTRUCTED RIFFLE	
STONE TOE PROTECTION	
STEP POOL STRUCTURE	
ROCK OUTLET	

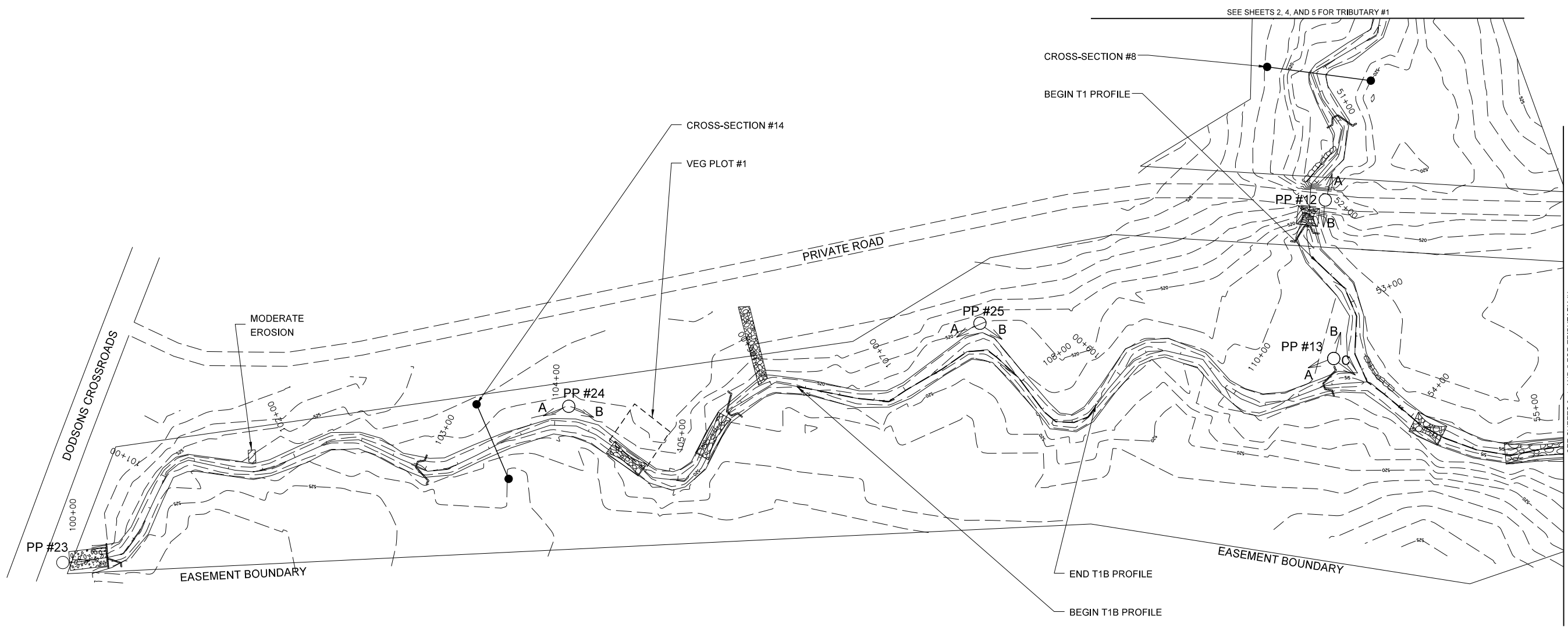
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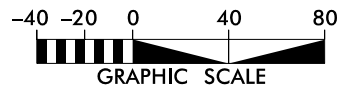
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**COLLINS CREEK
 STREAM RESTORATION PROJECT**
 CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
 T1A-1 AND T1A-2: STATION 80+00 TO STATION 87+75

DATE: DEC 2012
 SCALE: 1"=80'
**CURRENT
 CONDITION
 PLAN VIEW**
 SHEET 6 OF 9



ROCK CROSS VANE	
CONSTRUCTED RIFFLE	
STONE TOE PROTECTION	
STEP POOL STRUCTURE	
ROCK OUTLET	



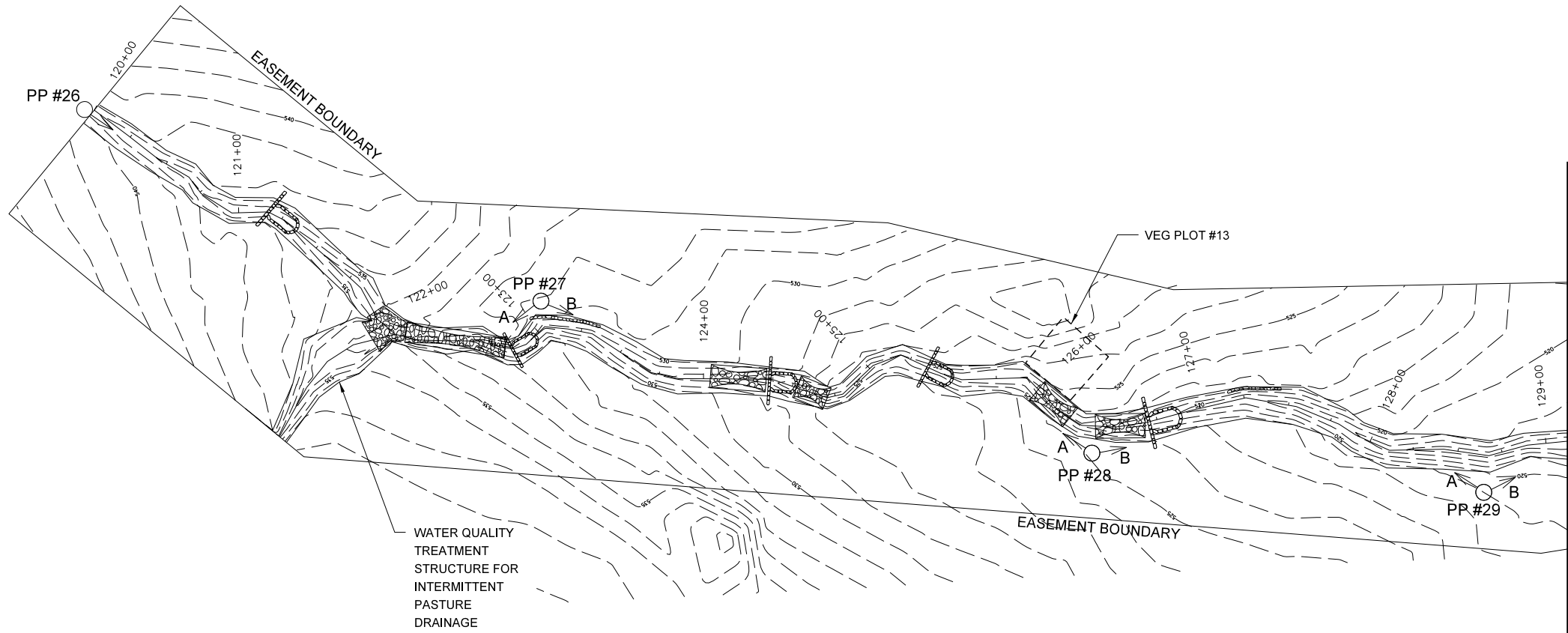
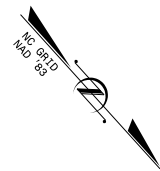
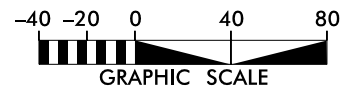
SYMBOL	DESCRIPTION	DATE	APPROVED



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**COLLINS CREEK
 STREAM RESTORATION PROJECT**
 CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
 T1B: STATION 100+00 TO STATION 111+00

DATE: DEC 2012
 SCALE: 1"=80'
 CURRENT CONDITION
 PLAN VIEW
 SHEET 7 OF 9



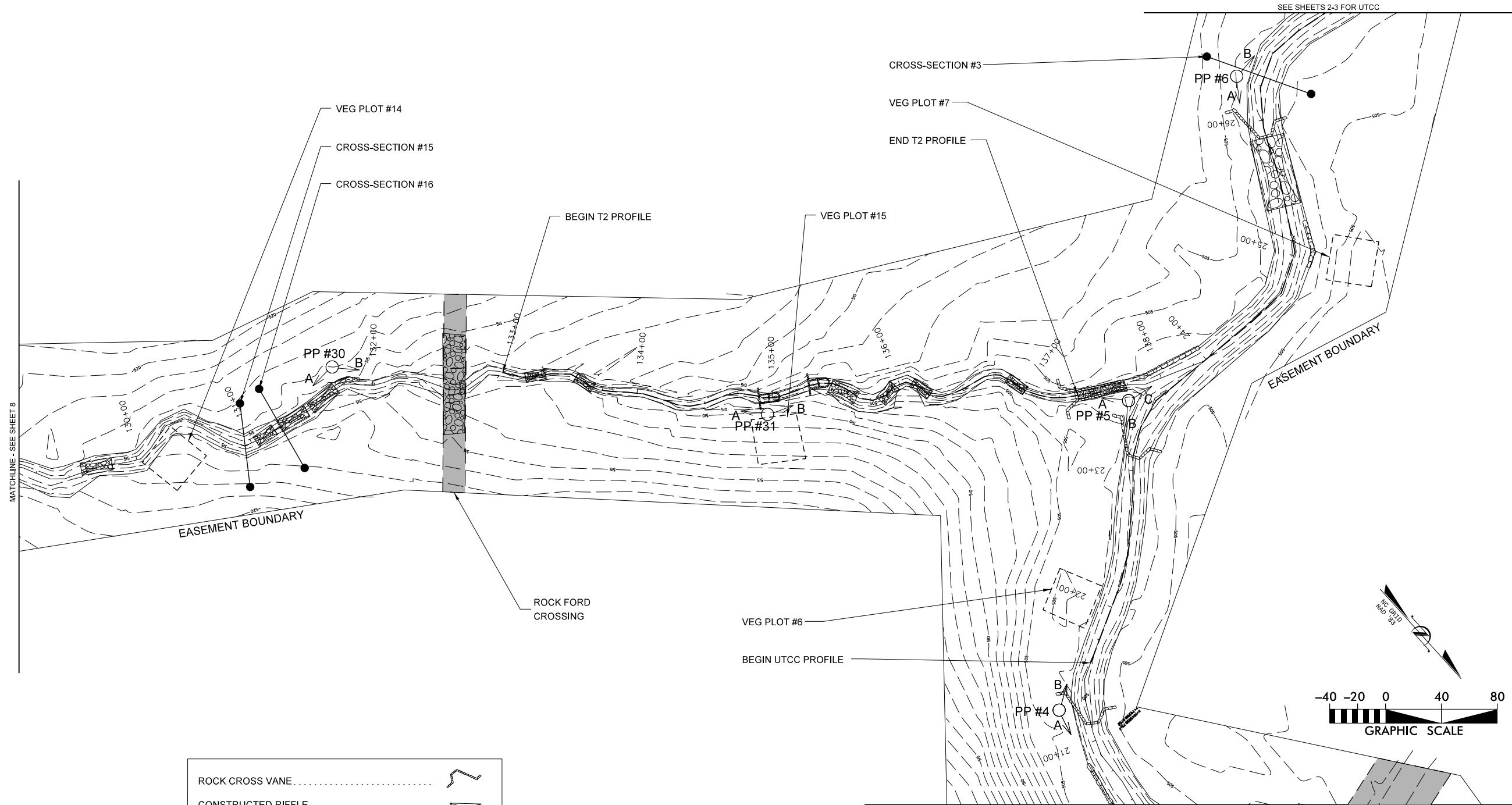
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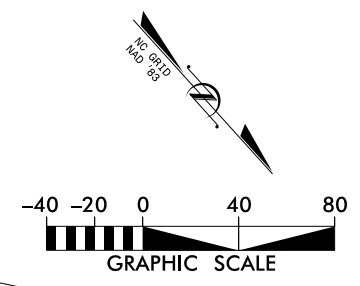
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**COLLINS CREEK
 STREAM RESTORATION PROJECT**
 CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
 T2: STATION 120+00 TO STATION 129+12

DATE: DEC 2012
 SCALE: 1"=80'
**CURRENT
 CONDITION
 PLAN VIEW**
 SHEET 8 OF 9



ROCK CROSS VANE	
CONSTRUCTED RIFFLE	
STONE TOE PROTECTION	
STEP POOL STRUCTURE	
ROCK OUTLET	



MATCHLINE - SEE SHEET 8

SEE SHEETS 2-3 FOR UTCC

SEE SHEETS 2-3 FOR UTCC

SYMBOL	DESCRIPTION	DATE	APPROVED



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**COLLINS CREEK
 STREAM RESTORATION PROJECT**
 CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
 T2: STATION 129+12 TO STATION 138+33

DATE: DEC 2012
 SCALE: 1"=80'
 CURRENT
 CONDITION
 PLAN VIEW
 SHEET 9 OF 9