South Fork Stream Restoration Project – As-Built Report

Catawba County, North Carolina

Prepared for:

EBX NEUSE -I, LLC
220 CHATHAM BUSINESS DRIVE
PITTSBORO, NC 27312

Design Report Prepared by **Buck Engineering** PC

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July 2005

EXECUTIVE SUMMARY

The South Fork Site was restored through a contract with EBX Neuse - I, LLC (EBX). The goals and objectives of this project were as follows:

- Restore channel dimension, pattern and profile to seven stream reaches (As-built restoration length = 9,590 lf);
- Enhance channel dimension and/or profile to three stream reaches (As-built enhancement length = 4,704 lf);
- Improve floodplain functionality by matching floodplain elevation with bankfull stage;
- Establish native stream bank and floodplain vegetation in the permanent conservation easement;
- Improve the water quality in the South Fork Catawba River watershed by fencing cattle out of the stream and reducing bank erosion; and
- Improve aquatic and riparian habitat by creating deeper pools and areas of re-aeration, planting a riparian buffer, and reducing bank erosion.

This report is being submitted to document completion of the project and to present base-line as-built monitoring data for the 5-year monitoring period.

Table 1
Background Information.

Project Name	South Fork Stream Restoration Site
Designer's Name	Buck Engineering 8000 Regency Parkway, Cary, NC, 27511 (919)463-5488
Contractor's Name	North State Environmental
Project County	Catawba County
Directions to Project Site	From Raleigh, follow Interstate I-40 west to Hickory. In Hickory, take exit 123 (Hwy 321). Merge onto US 321 south and proceed to Startown Rd. Take a left onto Startown Rd. and go North approximately 2 miles to the site. Turn left into site at a driveway with rows of large cedar trees along each side of the driveway.
Drainage Area	1.9 sq. mi. at the downstream end of M1; 0.5 sq. mi. at the downstream end of M2.
USGS Hydro Unit	03050102040010
NCDWQ Subbasin	03-08-35
Project Length	14,294 Linear feet
Restoration Approach	Restore channel dimension, pattern and profile to seven stream reaches (As-built restoration length = 9,590 lf)
	Enhance channel dimension and profile to three stream reaches (As-built enhancement length = 4,704 lf)
Date of Completion	May 2005
Monitoring Dates	Quarterly throughout the 5 year monitoring period.

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1.0 BACKGROUND INFORMATION

The South Fork Restoration Project is located in Catawba County, North Carolina, approximately five miles southwest of Newton (Figure 1). The site has a recent history of pasture and general agricultural usage. The streams on the project site were channelized and riparian vegetation was cleared in most locations. Cattle were allowed to graze on the banks and access the channels. Stream and riparian functions on the site were severely impacted as a result of agricultural conversion.

The project proposed to restore and enhance 14,175 linear feet of channelized stream on several unnamed tributaries to the South Fork Catawba River. The project was proposed to restore 9,591 linear feet of channel dimension, pattern and profile and enhance 4,584 linear feet of channel dimension and/or profile. The final as-built stream length for the project was 14,294 feet, as compared to the 14,175 feet predicted in the restoration plan. The project restored 9,590 linear feet of channel dimension, pattern and profile and enhanced 4,704 linear feet of channel dimension and/or profile.

1.1 Goals and Objectives

The specific goals for the South Fork Restoration Project were as follows:

- Restore channel dimension, pattern and profile to seven stream reaches (As-built restoration length = 9,590 lf);
- Enhance channel dimension and/or profile to three stream reaches (As-built enhancement length = 4,704 lf);
- Improve floodplain functionality by matching floodplain elevation with bankfull stage;
- Establish native stream bank and floodplain vegetation in the permanent conservation easement;
- Improve the water quality in the South Fork Catawba River watershed by fencing cattle out of the stream and reducing bank erosion; and
- Improve aquatic and riparian habitat by creating deeper pools and areas of re-aeration, planting a riparian buffer, and reducing bank erosion.

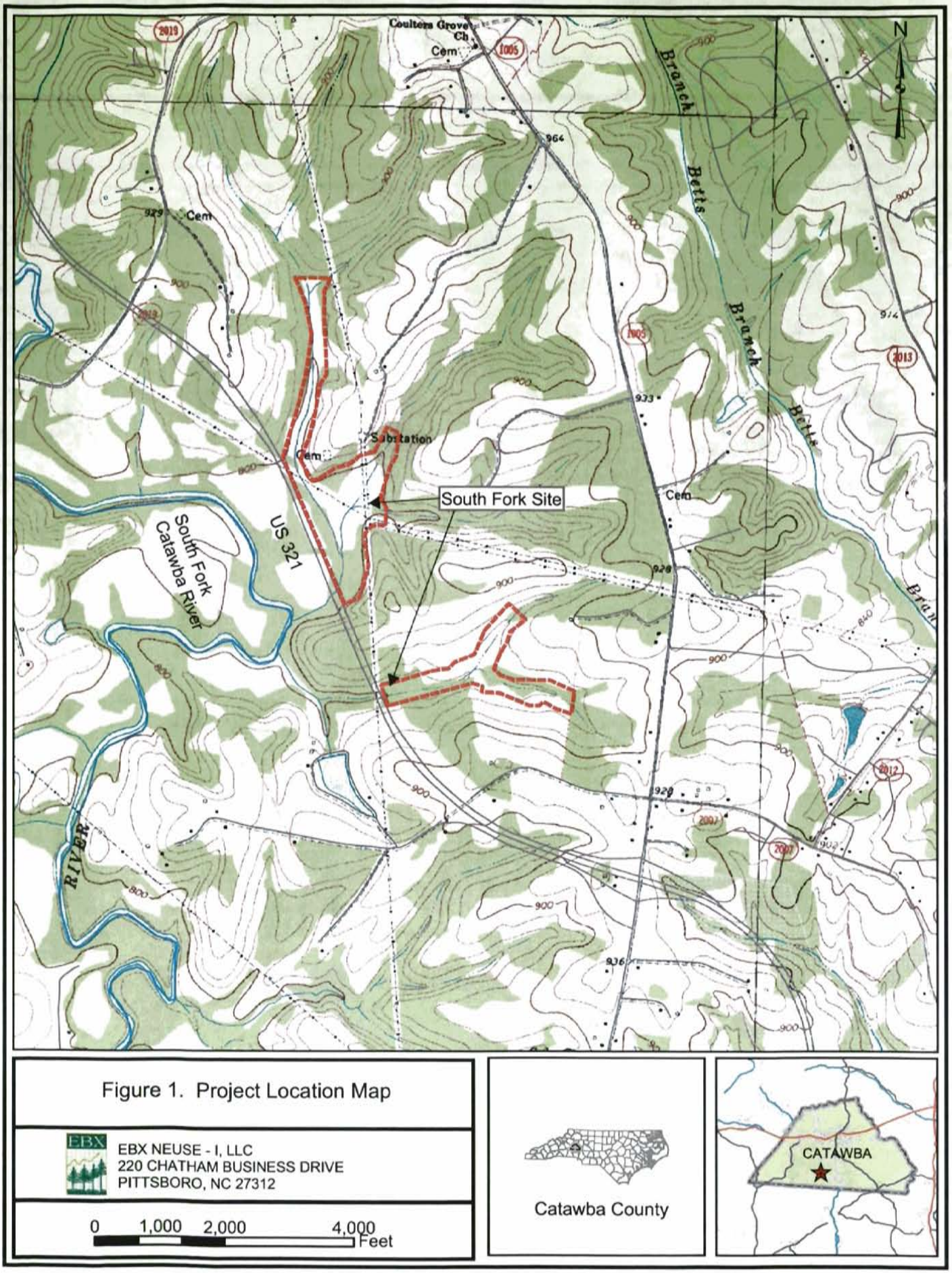
1.2 Project Location

The South Fork Restoration Project is located approximately five miles southwest of Newton in Catawba County, North Carolina. Directions to the site are included in the executive summary section.

1.3 Project Description

Restoration of site hydrology involved the restoration of natural stream systems on the site. The stream systems that historically flowed through the site were channelized and, as a result, were highly incised prior to restoration. The design for the restored stream involved the construction of new meandering channels across the agricultural fields.

The design allows stream flows larger than bankfull flows to spread onto the floodplain, dissipating flow energies and reducing stress on streambanks. In-stream structures were used to control streambed grade, reduce stresses on streambanks, and promote bedform sequences and habitat diversity. The in-stream structures consisted of root-wads, log vanes, and log weirs that promote a diversity of habitat features in the restored channel. Where grade control was a consideration, constructed riffles and cross vanes were installed to provide long-term stability. Streambanks were stabilized using a combination of erosion control matting, bare-root planting, live stakes, and transplants. Transplants provided immediate shading to the restored stream, as well as living root mass to increase streambank stability and create holding areas for fish and aquatic biota.


Coulters Grove Ch
Cem
964
929
Cem
Bells Branch
Bells Branch
914
933
Substation
Cem
South Fork Site
Cem
US 321
South Fork Catawba River
928
RIVER
936
N
Figure 1. Project Location Map
EBX NEUSE - I, LLC
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0 1,000 2,000 4,000 Feet
Catawba County
CATAWBA

The new stream channels were constructed "in the dry" and all stabilization practices were in place prior to routing stream water into the new sections of channel. In order to route stream water into the new channel sections, plugs were installed in the old channel to re-direct the water into the new channel. After the water had been routed from the former channel, the process of filling the old channel with soil began.

1.3.1 Reach Identification

For analysis and design purposes, Buck Engineering divided on-site streams into seven reaches. The reach locations are shown on Figure 2. The reaches were numbered sequentially from north to south with tributaries carrying a UT designation and main reaches an M designation. A ridge separates the project into two subwatersheds. UT1a, UT1b, UT2a, UT2b, and UT3 drain into the M1 subwatershed, while UT4 and UT5 drain into the M2 subwatershed. UT1 begins off-site, flows into the project from the north, and ends at the confluence with UT2. UT1 is split into subreaches UT1a and UT1b at the confluence with a significant tributary. Watershed area doubles below this confluence. UT2 begins off-site, flows into the project from the northeast, and ends at the confluence with UT1. UT2 is split into subreaches UT2a and UT2b at the confluence with UT3. UT3 flows into the project from the east and ends after a short distance at the confluence with UT2. M1 begins at the confluence of UT1 and UT2 and ends at the culvert under US 321. UT4 begins off-site, flows into the project from the east, and ends at the confluence with UT5. UT5 flows into the project site from the southeast and ends at the confluence with UT4. M2 begins at the confluence of UT4 and UT5 and ends at a culvert under US 321.

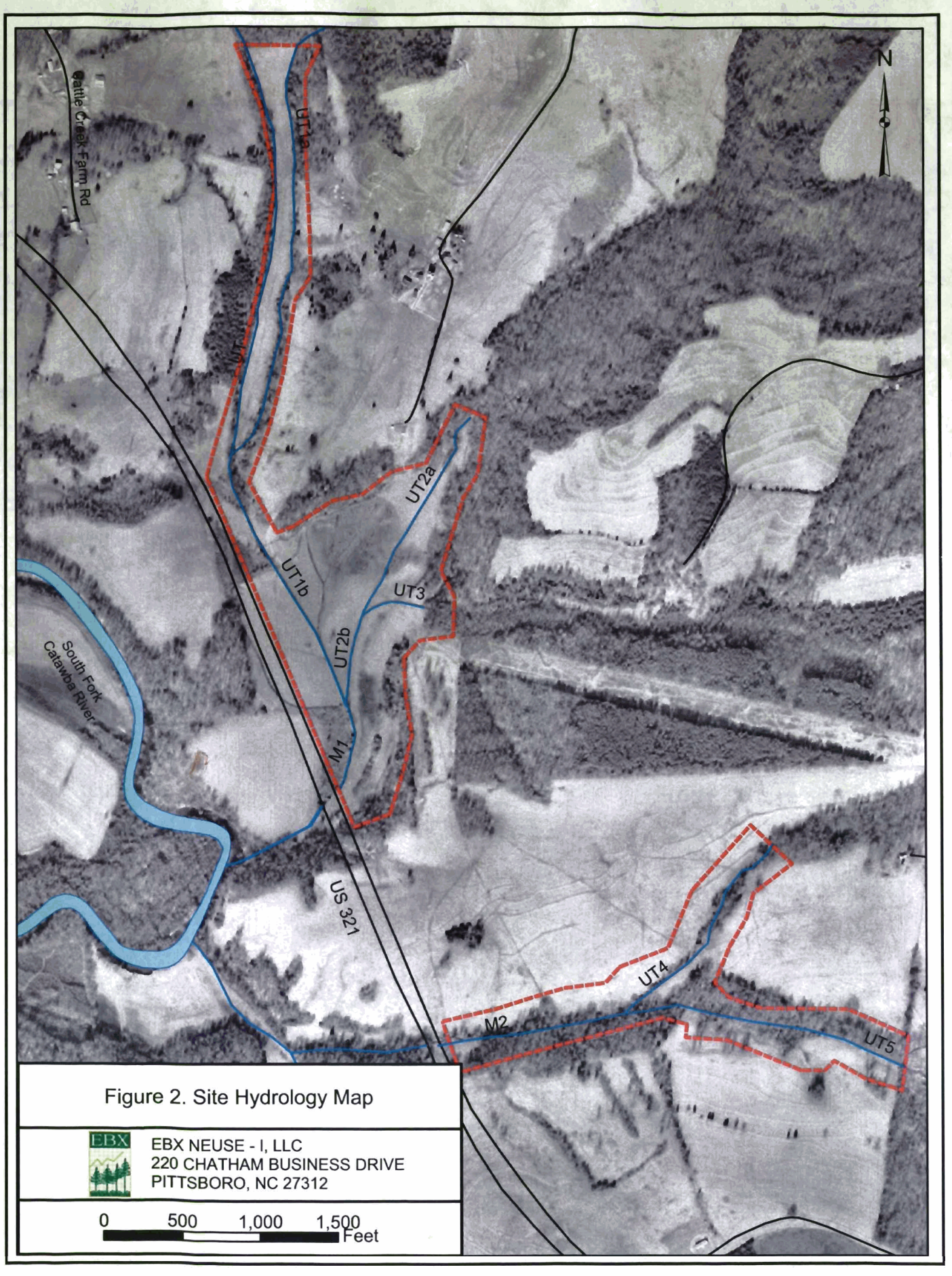
All project reaches are blue-line streams on the USGS topographic map of the area as shown on Figure 2. All project reaches were determined to be perennial streams (based on a minimum score of 30 for perennial streams) using the North Carolina Division of Water Quality (DWQ) *Determination of the Origin of Perennial Streams* guidelines (see forms in Appendix 1). The total pre-restoration length of streams on the project site was 11,996 linear feet.

1.4 Construction

Construction activities, in accordance with the approved restoration plan for the site, began in January 2005 with construction stakeout, followed immediately by the establishment of access sites and stockpile areas. Materials were stockpiled as needed for the initial stages of construction. During this phase the enhancement work was completed on Reach UT1a.

The next step was the grading of the floodplain areas to reach design grades across the site. The excavated material was stockpiled in specified areas near field ditches and existing channels that were to be filled. Where necessary, silt fencing was installed between stockpiles and the active ditches to prevent erosion of sediment into the channel. Farm paths and an access road for Duke Power were constructed according to the construction plans.

Once the design floodplain grades were achieved, the new stream channels were sculpted and constructed. In the M1 subwatershed, construction of the stream channels began at the downstream end of M1 and moved in an upstream direction through the completion of UT1b. After completing UT1b, construction continued on UT2b, UT2a, and UT3. Construction on the M2 subwatershed began at the upstream end of reach UT4 and continued downstream through the end of M2. Construction on UT5 was completed concurrently with M2 construction. Upon completion of each new channel segment, in-stream structures, matting, and transplants were installed, and the channel was prepared to accept flow from the old channel. Once fully prepared, temporary sediment traps at the downstream ends of the channels were removed, and water was turned into the newly constructed channel. Abandoned field ditches and remnant channels were immediately filled and graded.


N
Cattle Creek Farm Rd
UT1a
UT1
UT2a
UT1b
UT3
UT2b
M1
South Fork Catawba River
US 321
UT4
M2
UT5
Figure 2. Site Hydrology Map
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0
500
1,000
1,500
Feet

Despite wet conditions, construction on the site proceeded with very few problems or changes to the proposed Restoration Plan. Modifications made during construction involved the location and selection of in-stream structures and bank stabilization practices. Substitutions were made based on availability of materials and professional judgment. These changes are documented in the attached as-built drawings. Several rainfall events occurred during construction, but the rainfall amounts and intensities were not large enough to cause significant erosion or problems with construction. The final as-built stream length for the project, as indicated on Sheet 1 in Appendix 3, was 14,294 feet, as compared to the 14,175 feet predicted in the restoration plan. Table 2 summarizes the as-built reach lengths and restoration approaches.

Based on early observations, the hydrology of the site has been altered to a much wetter regime than was present prior to construction. Ponding in isolated pockets on the site has been observed for extended periods after rainfall events.

Early observations also indicate that the vegetation treatments were effective at establishing ground cover quickly. Temporary seeding (rye grain and German millet) applied to streambanks beneath the erosion matting sprouted within two weeks of application and have provided good ground coverage. Live stakes and planted bare-root trees were beginning to bud when the growing season began.

Table 2
Summary of As-built Lengths and Restoration Approaches.

Reach Name	As-built Length (ft)	Restoration Approach
UT1	1,681	Restoration
UT1	3,431	Enhancement Level II
UT2	2,975	Restoration
UT2	271	Enhancement Level I
UT3	526	Restoration
M1	726	Restoration
UT4	1,226	Restoration
UT5	896	Restoration
UT5	1,002	Enhancement Level I
M2	1,560	Restoration
Total	**14,294**	

2.0 MONITORING RESULTS – 2005 AS-BUILT DATA

The five-year monitoring plan for the South Fork site includes criteria to evaluate the success of the vegetation and stream components of the project. The specific locations of vegetation plots, permanent cross-sections, and crest gauges are shown on the as-built drawing sheets. Photo points are located at each of the grade control structures along the restored stream channel.

2.1 Vegetation

Bare root trees were planted within all areas of the conservation easement. A minimum 50-foot buffer was established along all restored stream reaches. In general, bare-root vegetation was planted at a target density of 680 stems per acre, in an 8 foot by 8 foot grid pattern. Planting of bare-root trees was completed in April 2005.

Observations were made during construction of the site regarding the relative wetness of areas to be planted. Planting zones were determined based on these assessments, and planted species were matched according to their wetness tolerance and the anticipated wetness of the planting area. Species planted are summarized in Tables 3 and 4.

Table 3
Bare-root Tree Species Planted Across the Restoration Site.

Common Name	Scientific Name	Percent Planted by Species	Total Number of Stems
Sycamore	*Platanus occidentalis*	12.5%	4850
Willow Oak	*Quercus Phellos*	12.5%	4850
River Birch	*Betula Nigra*	12.5%	4850
Bitternut Hickory	*Carya Cordiformis*	12.5%	4850
White Basswood	*Tillia Heterophylla*	12.5%	4850
Persimmon	*Diospyros Virginiana*	12.5%	4850
Pawpaw	*Asimina Triloba*	12.5%	4850
Witch-Hazel	*Hamamelis Virginiana*	12.5%	4850

Table 4
Bare-root Tree Species Planted in Power Line Easement.

Common Name	Scientific Name	Percent Planted by Species	Total Number of Stems
Tag Alder	*Alnus Serrulata*	20 %	1050
Spicebush	*Lindera Benzoin*	20 %	1050
Southern Arrow-wood	*Viburnum Dentatum*	20 %	1050
Rosemallow	*Hibiscus Moscheutos*	20 %	1050
Pawpaw	*Asimina Triloba*	20 %	1050

A total of seven vegetation plots were established across the restored site. Each plot is 50 by 87.5 feet or 0.10 acres. The initial planted density within each of the vegetation monitoring plots is given in Table 5. The average density of planted bare root stems, based on the data from the seven monitoring plots, is 679 stems/ acre. The locations of the vegetation plots are shown on the as-built plan sheets.

Table 5
Initial Planted Density of Trees for the 7 Vegetation Sampling Plots.

Sampling Plot No.	Counted Stems per Plot	Stems per Acre (extrapolated)
CS1	70	700
CS2	55	550
CS3	80	800
CS4	63	630
CS5	69	690
CS6	68	680
CS7	70	700

2.1.1 Results and Discussion

No results are available at the submittal of this report. As-built data will be compared with first year monitoring data in the year 1 monitoring report, scheduled for submittal to EEP during November 2005.

2.2 Morphology

For monitoring stream success criteria, 25 permanent cross-sections and two crest gauges were installed. The permanent cross-sections will be used to monitor channel dimension and bank erosion over time. The crest gauges will be used to document the occurrence of bankfull events. In addition, a complete longitudinal survey was completed for the restored stream channel to provide a base-line for evaluating changes in bed conditions over time. The longitudinal profile included the elevations of all grade control structures. The longitudinal and permanent cross-section data are provided in Appendix 2. The location of the permanent cross-sections and the stream gauges are shown on the as-built plan sheets in Appendix 3.

2.2.1 Results and Discussion

No results are available at the submittal of this report. As-built data will be compared with first year monitoring data in the year 1 monitoring report, scheduled for submittal to EBX during November 2005.

2.3 Areas of Concern

No areas of concern have been identified during the first months following completion of the project.

APPENDIX 1

SELECTED PROJECT PHOTOGRAPHS

South Fork – M1 Subwatershed

Constructed Riffle – M1

Constructed Riffle – M1

Log Weir – UT1A

Constructed Riffle – UT1A

South Fork – M1 Subwatershed

Constructed Riffle – UT1B

Constructed Riffle – UT1B

Constructed Riffle – UT2A

Constructed Riffle – UT2A

South Fork – M1 Subwatershed

Constructed Riffle – UT2B

Log Weir – UT2B

Constructed Riffle – UT3

Constructed Riffle – UT3

South Fork – M2 Subwatershed

Constructed Riffle – UT4

J-Hook – UT4

Log Weir – UT5

Constructed Riffle – UT5

South Fork – M2 Subwatershed

Constructed Riffle – M2

Step Pool – M2

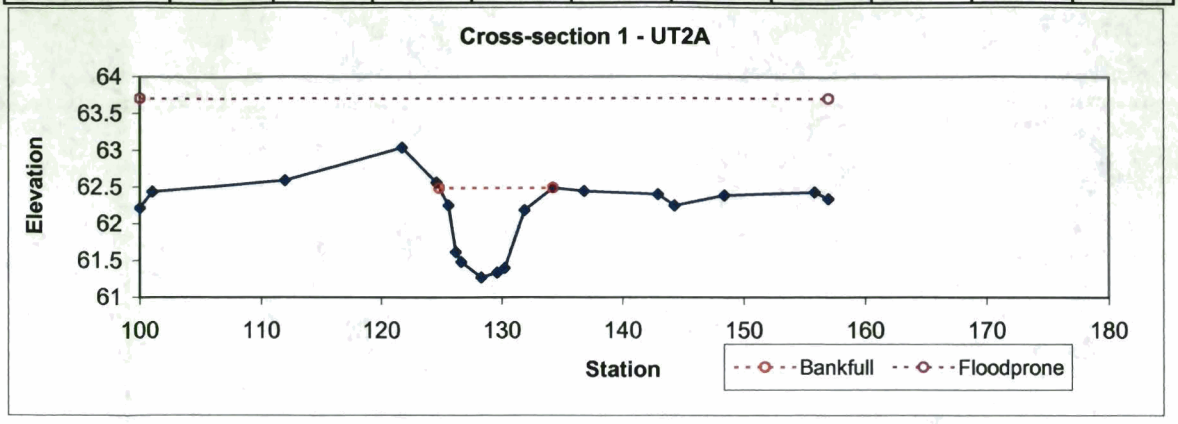
APPENDIX 2

AS-BUILT CROSS-SECTIONS AND LONGITUDINAL PROFILES

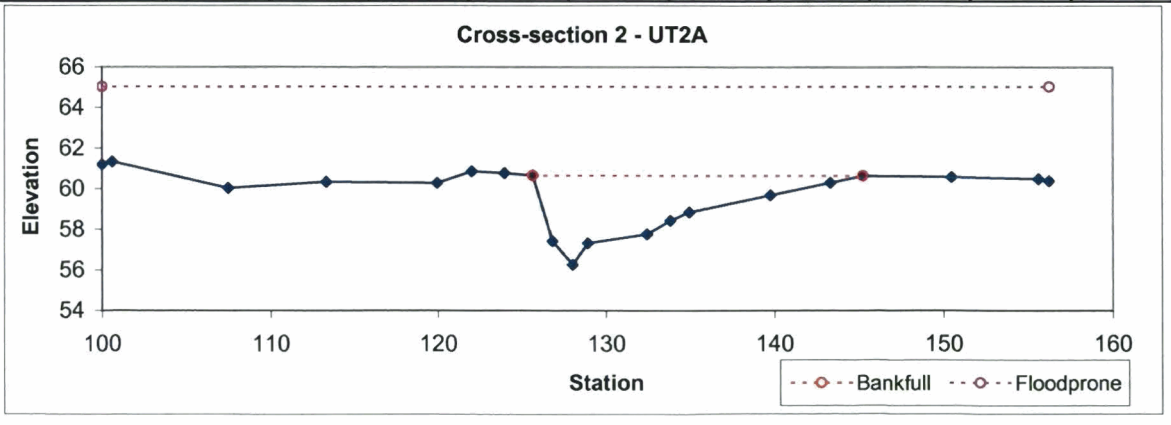
Summary of Cross-section Data: M1 Subwatershed

Cross-section Descriptor	X1	X2	X3	X4	X5	X6	X7	X8	X9	X-10	X-11	X-12	X-13	X-14
Feature	Riffle	Pool	Riffle	Riffle	Pool	Riffle	Pool	Riffle	Riffle	Riffle	Riffle	Pool	Riffle	Pool
Rosgen Stream Type	C		C	C		C		C	C	C	C		C	
Bankfull Width (ft)	9.45	19.57	16.22	13.83	20.1	16.07	19.35	15.83	17.72	15.74	22.83	34.76	12.85	21.01
Bankfull Mean Depth (ft)	0.69	1.83	0.68	0.74	1.88	1.05	1.91	0.89	0.99	1.08	1.23	2.04	0.72	1.35
Width/Depth Ratio	13.78	10.68	23.72	18.75	10.67	15.3	10.11	17.84	17.89	14.61	18.54	17.07	17.9	15.53
Bankfull Area (sq ft)	6.48	35.84	11.09	10.2	37.86	16.88	37.04	14.04	17.55	16.96	28.11	70.79	9.22	28.42
Bankfull Max Depth (ft)	1.22	4.38	1.39	1.27	3.07	1.97	3.4	1.53	1.8	1.97	2.21	4.04	1.38	3.07
Width of Floodprone Area (ft)	56.97	56.24	64.68	56.84	81.29	61.49	72.67	56.9	52	53.35	69.73	86.08	61.66	68.45
Entrenchment Ratio	6.03	2.87	3.99	4.11	4.04	3.83	3.76	3.59	2.93	3.39	3.05	2.48	4.8	3.26
Bank Height Ratio	1	0.92	1	1	1.12	0.96	1.12	1	1	1.04	1	1	1	1

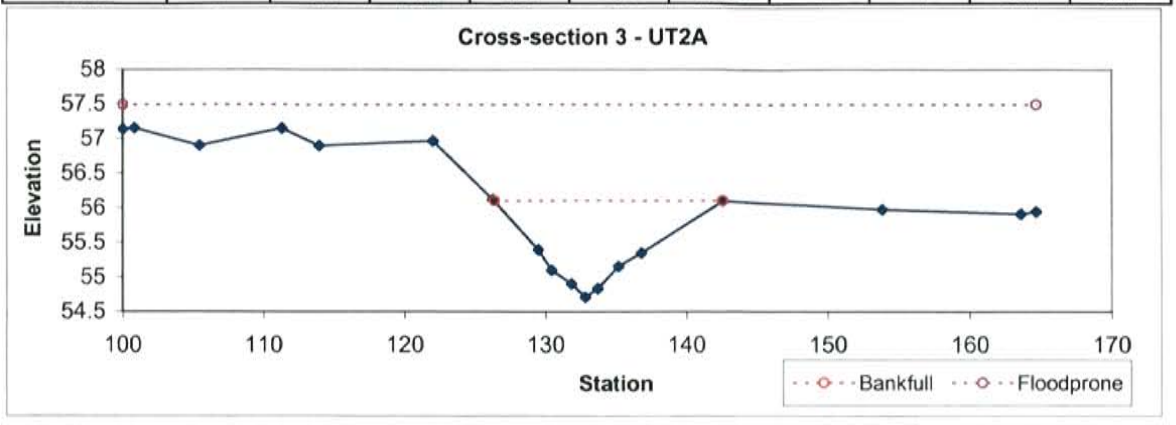
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	6.5	9.45	0.69	1.22	13.78	1	6	62.48	62.48



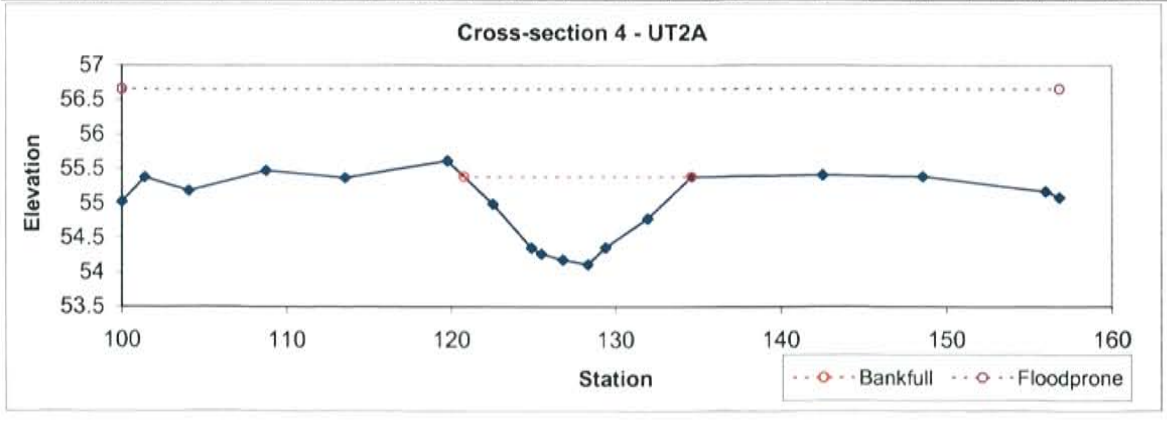
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		35.8	19.57	1.83	4.38	10.68	0.9	2.9	60.64	60.29



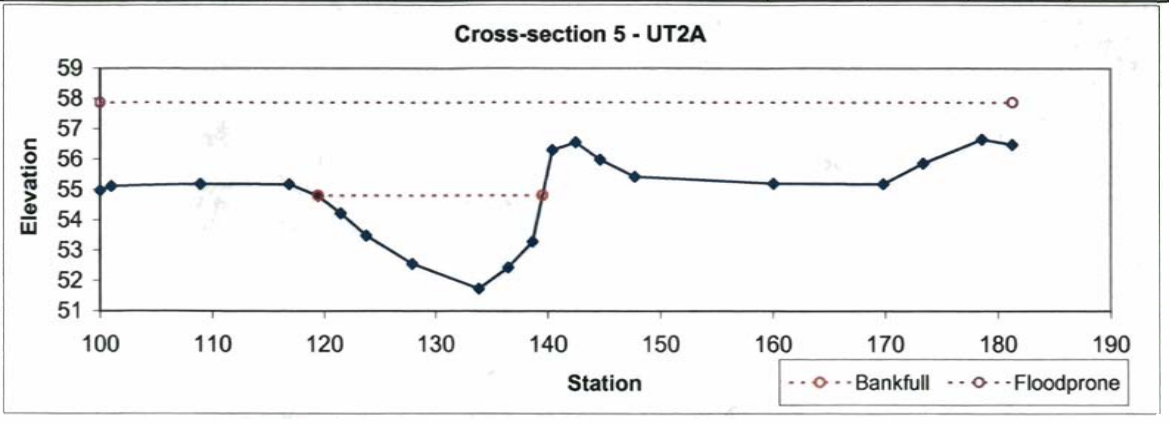
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	11.1	16.22	0.68	1.39	23.72	1	4	56.1	56.1



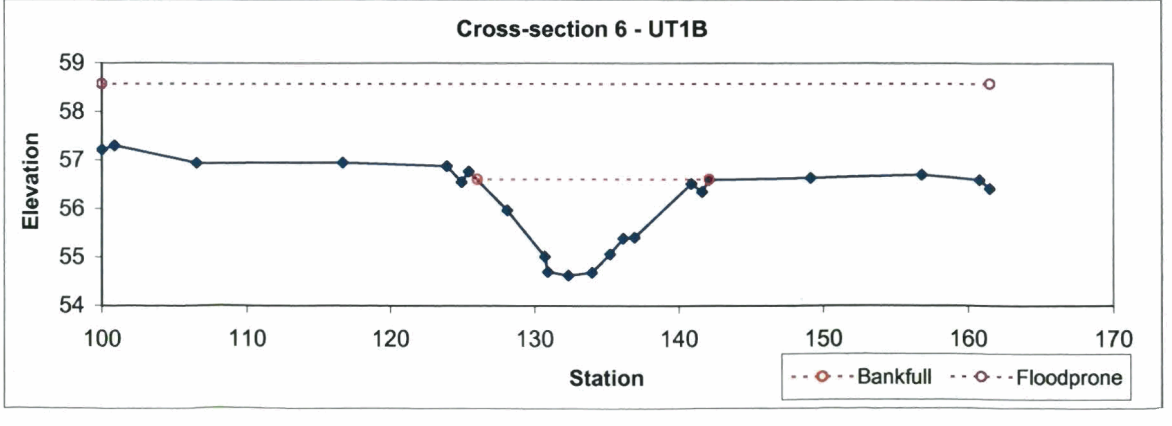
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	10.2	13.83	0.74	1.27	18.75	1	4.1	55.38	55.38



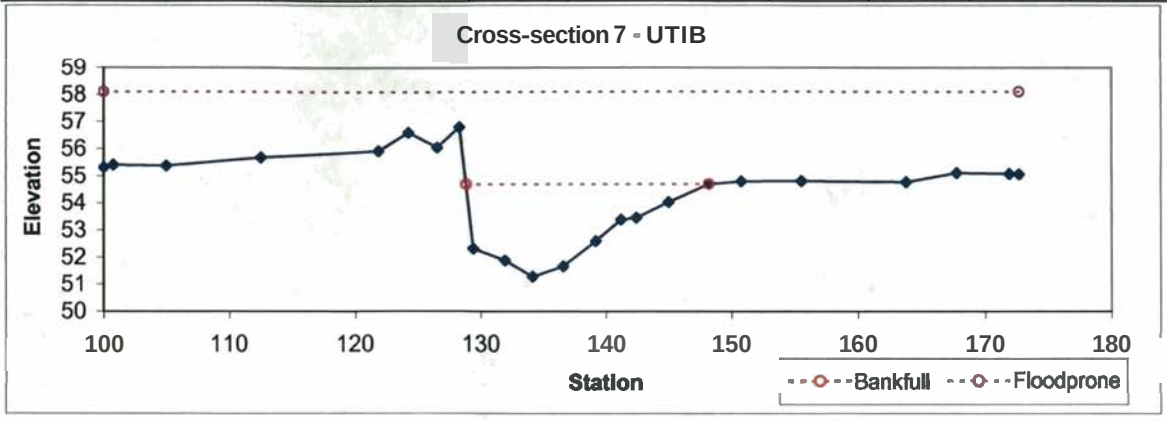
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		37.9	20.1	1.88	3.07	10.67	1.1	4	54.8	55.17



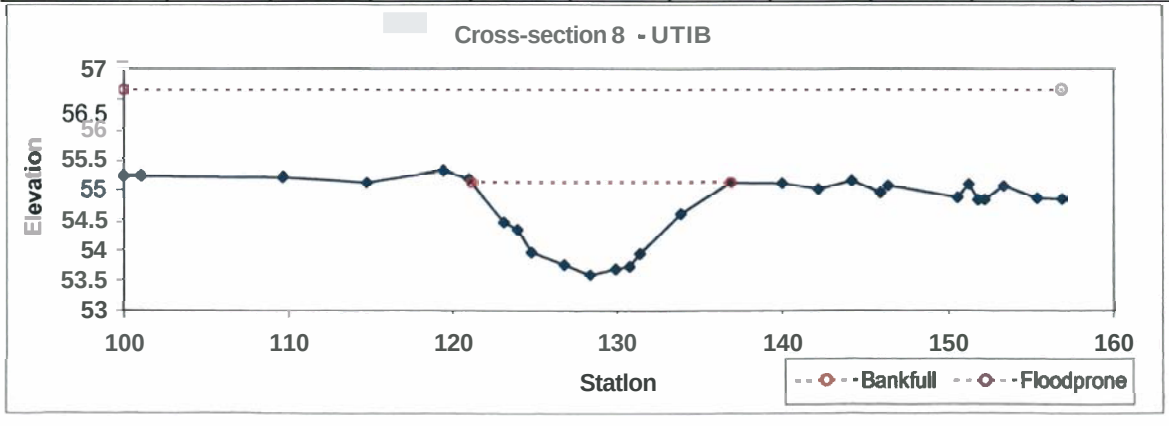
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	16.9	16.07	1.05	1.97	15.3	1	3.8	56.6	56.52



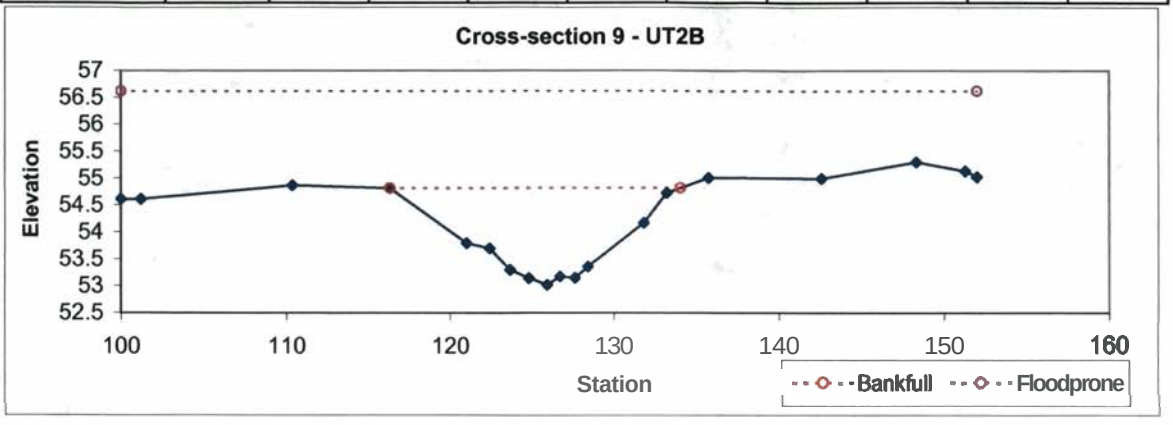
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	WID	BH Ratio	ER	BKF Elev	TOB Elev
Pool		37	19.35	1.91	3.4	10.11	1.1	3.8	54.69	55.11



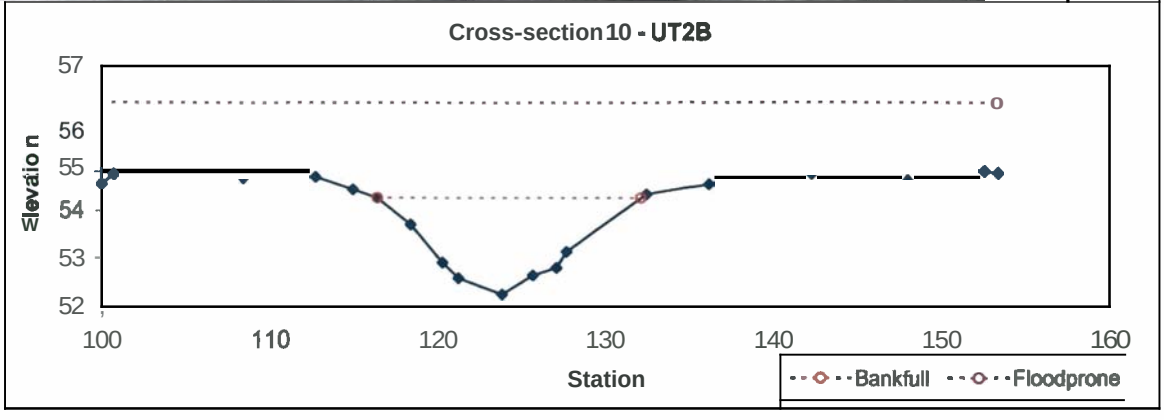
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	WID	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	14	15.83	0.89	1.53	17.84	1	3.6	55.12	55.12



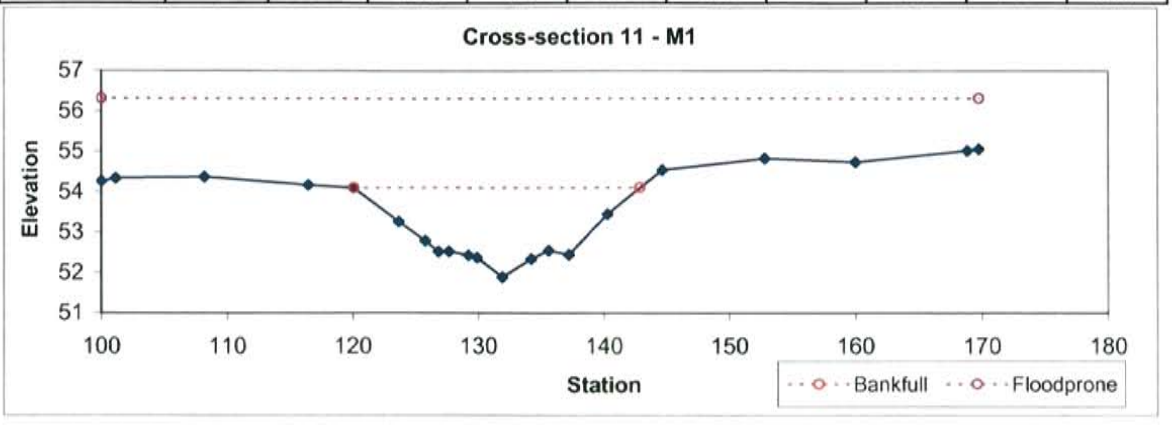
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	17.5	17.72	0.99	1.8	17.89	1	2.9	54.81	54.81



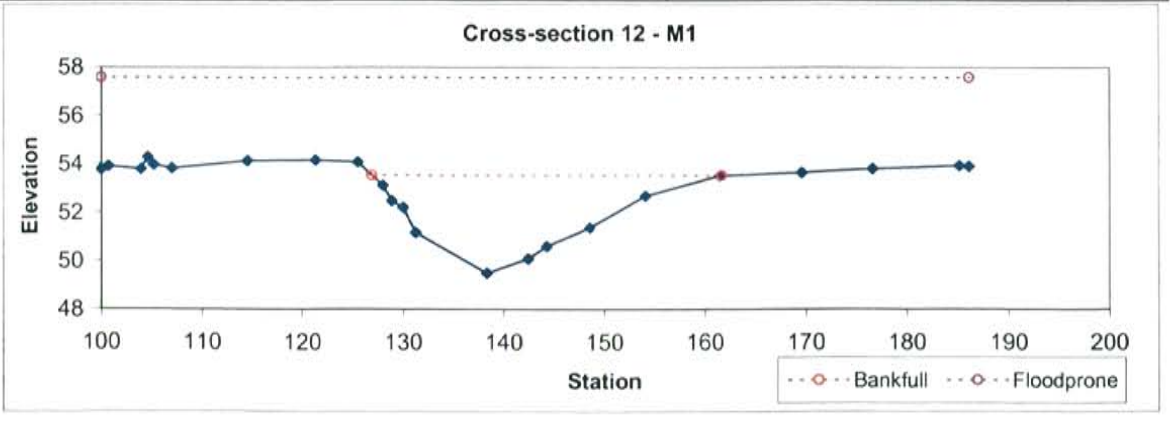
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	WID	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	17	15.74	1.08	1.97	14.61	1	3.4	54.26	54.34



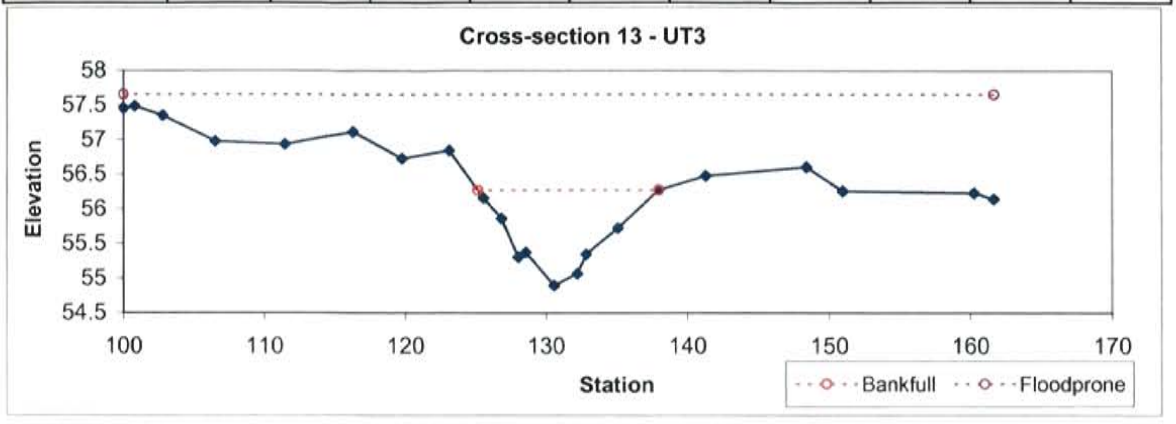
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	28.1	22.83	1.23	2.21	18.54	1	3.1	54.1	54.1



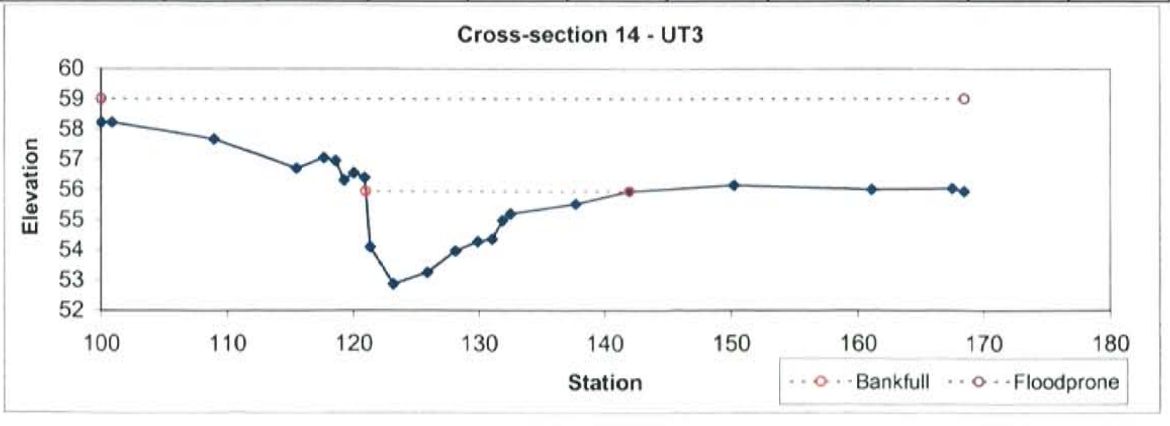
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		70.8	34.76	2.04	4.04	17.07	1	2.5	53.53	53.53



Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	9.2	12.85	0.72	1.38	17.9	1	4.8	56.27	56.27



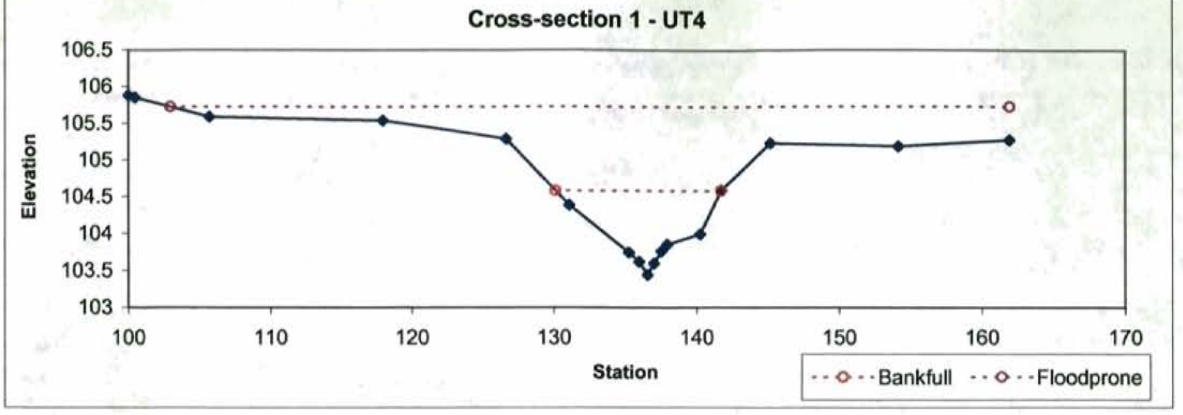
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		28.4	21.01	1.35	3.07	15.53	1	3.3	55.94	55.94



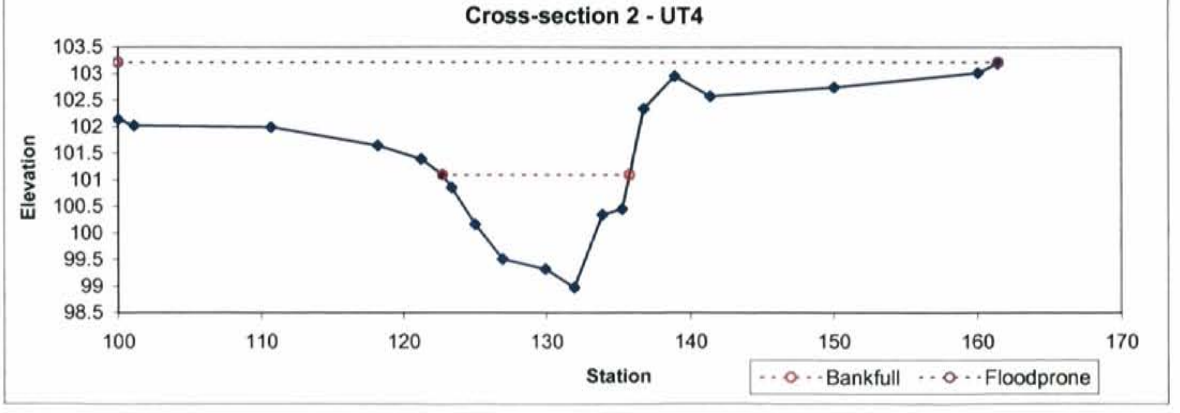
Summary of Cross-section Data: M2 Subwatershed

Cross-section Descriptor	X1	X2	X3	X4	X5	X6	X7	X8	X9	X-10	X-11
Feature	Riffle	Pool	Riffle	Riffle	Riffle	Pool	Riffle	Riffle	Riffle	Riffle	Pool
Rosgen Stream Type											
Bankfull Width (ft)	11.6	13.04	7.71	15.07	14.59	15.99	15.56	15.34	14.91	8.04	11.47
Bankfull Mean Depth (ft)	0.58	1.25	0.67	0.85	1.12	1.63	1.28	0.8	0.75	0.75	0.73
Width/Depth Ratio	20.01	10.45	11.57	17.65	13.07	9.83	12.15	19.21	19.94	10.76	15.66
Bankfull Area (sq ft)	6.72	16.28	5.13	12.87	16.29	26.03	19.93	12.25	11.14	6.01	8.39
Bankfull Max Depth (ft)	1.14	2.12	1.07	1.57	1.84	2.76	2.44	1.76	1.34	1.02	1.78
Width of Floodprone Area (ft)	58.98	61.43	58.2	44.55	63.68	58.78	64.4	46.95	45.71	33.01	34.68
Entrenchment Ratio	5.09	4.71	7.55	2.96	4.36	3.67	4.14	3.06	3.07	4.1	3.02
Bank Height Ratio	1.6	1.26	1.1	1	1.22	1	1	1	1	1	1

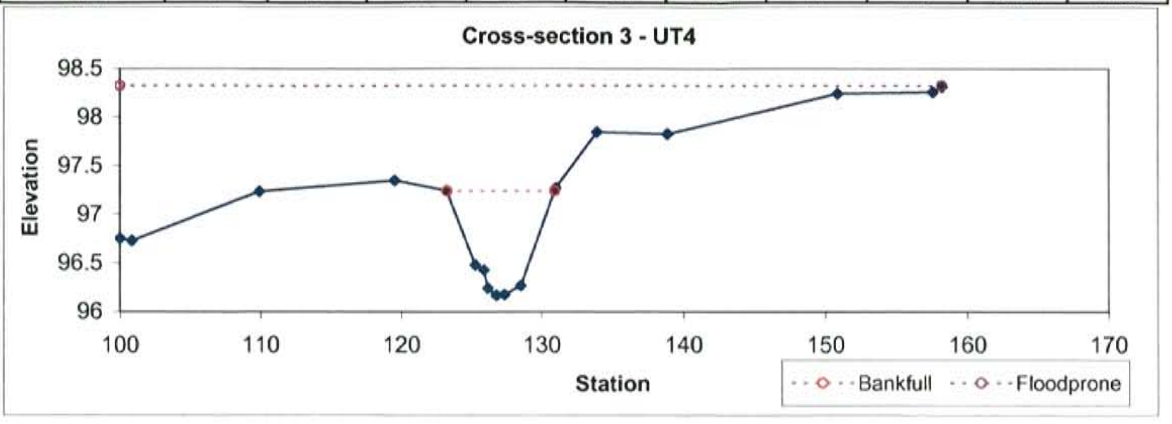
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	6.7	11.6	0.58	1.14	20.01	1.6	5.1	104.58	105.27



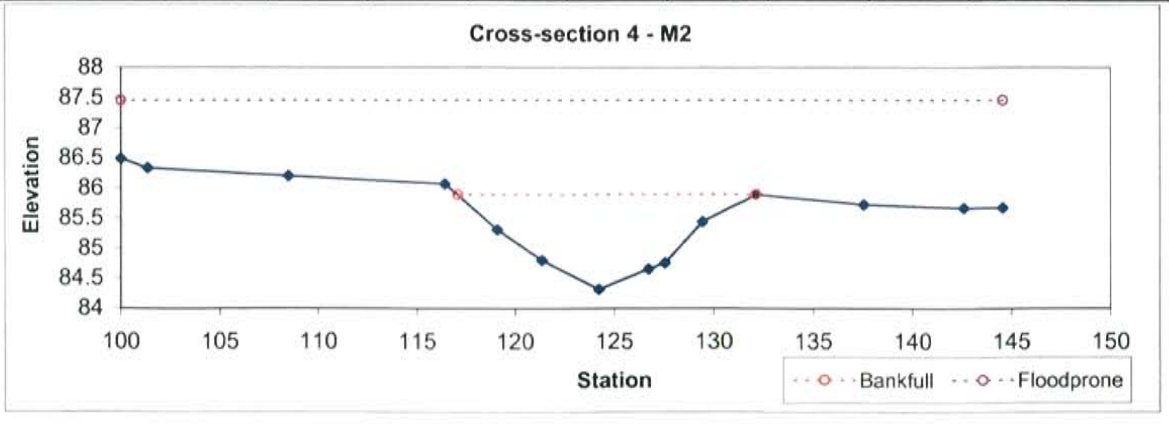
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		16.3	13.04	1.25	2.12	10.45	1.3	4.7	101.09	101.64



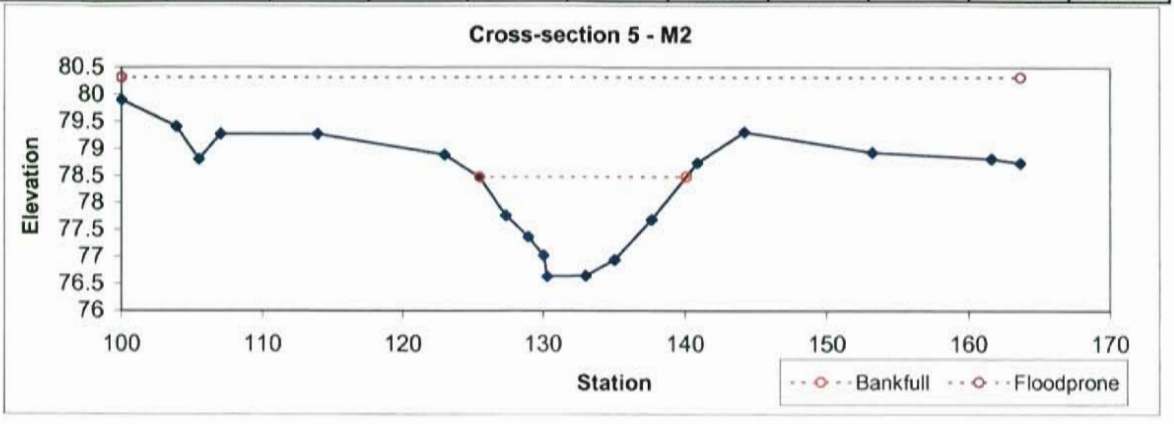
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	5.1	7.71	0.67	1.07	11.57	1.1	7.6	97.24	97.35



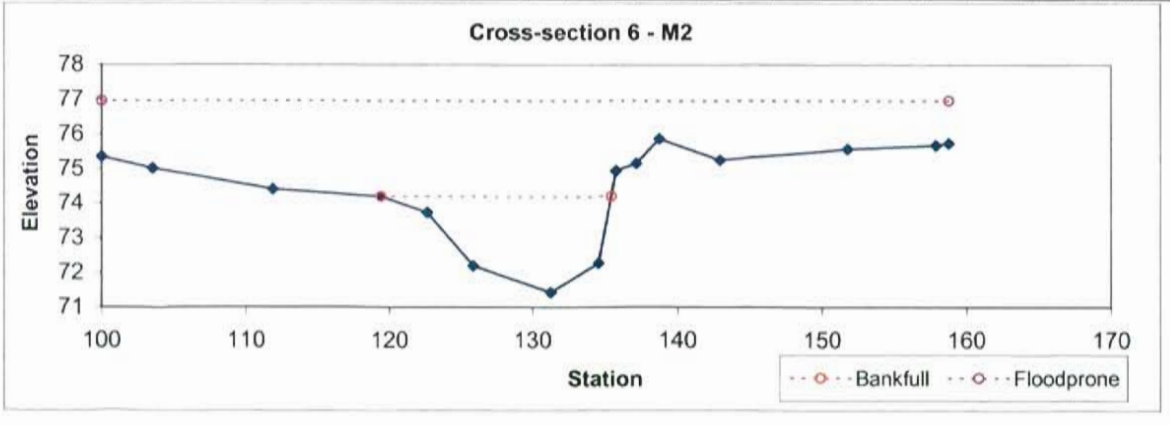
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	12.9	15.07	0.85	1.57	17.65	1	3	85.89	85.89



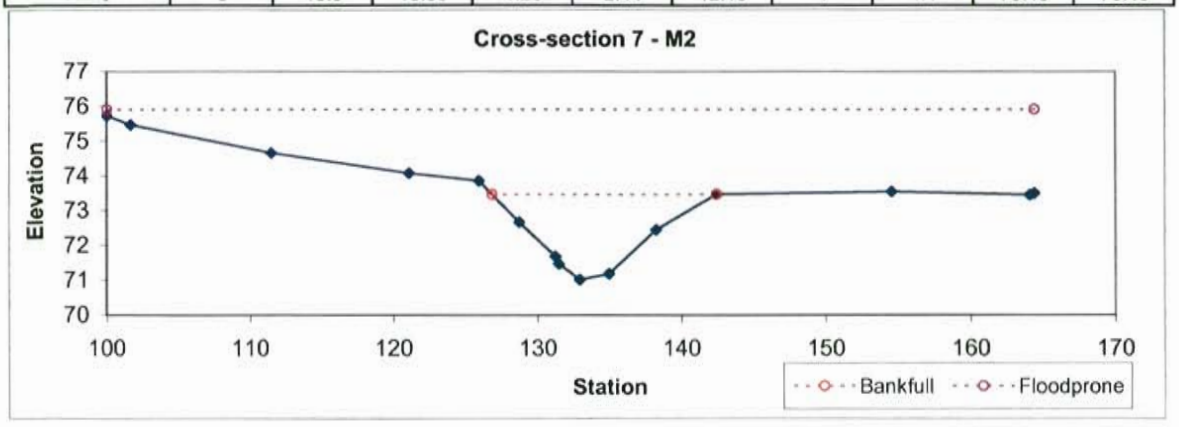
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	16.3	14.59	1.12	1.84	13.07	1.2	4.4	78.47	78.88



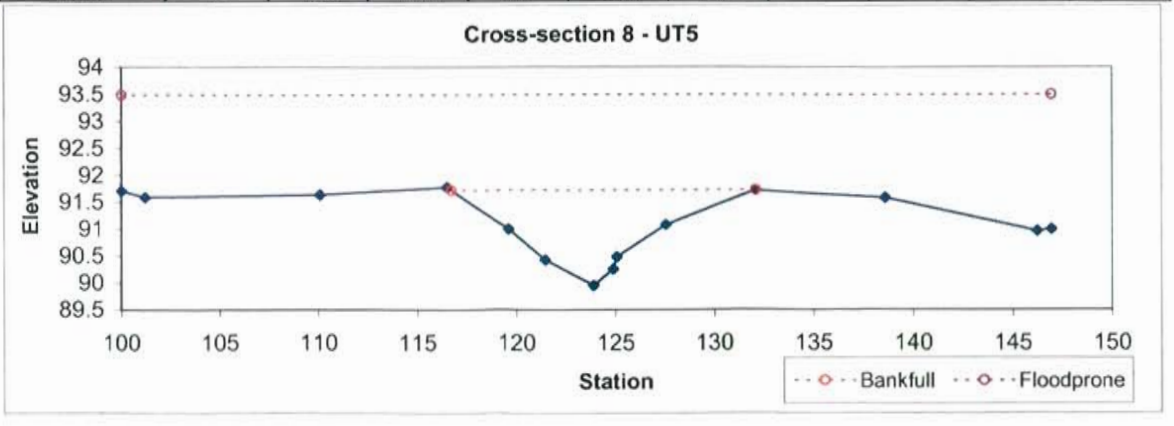
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		26	15.99	1.63	2.76	9.83	1	3.7	74.19	74.19



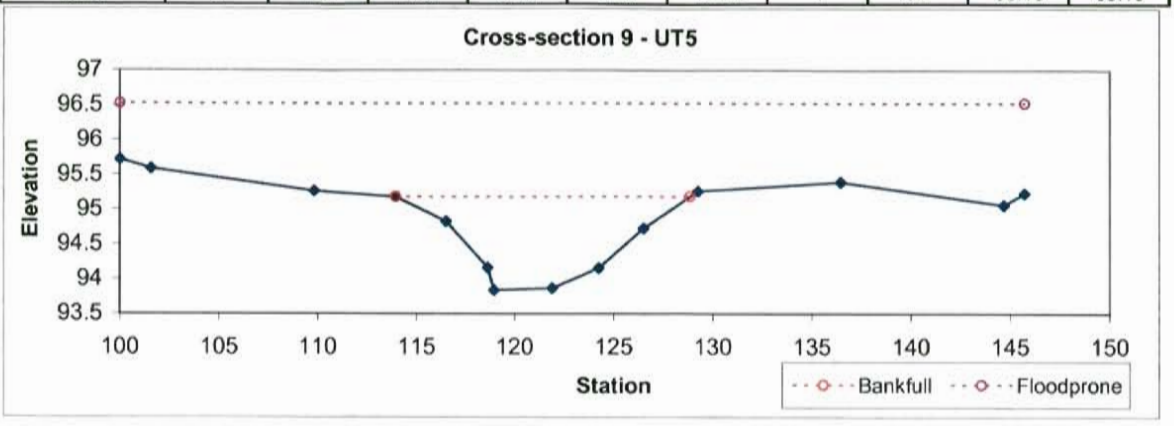
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	19.9	15.56	1.28	2.44	12.15	1	4.1	73.46	73.46



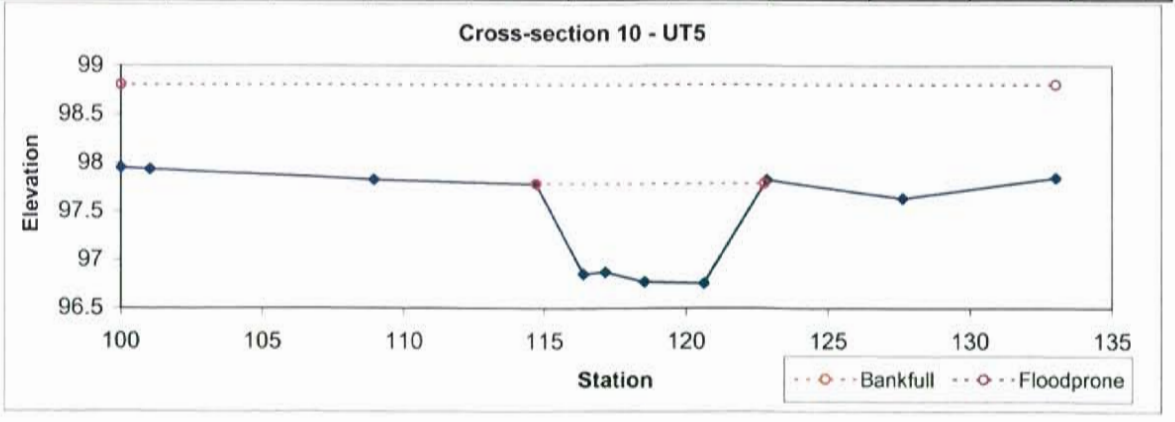
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	12.3	15.34	0.8	1.76	19.21	1	3.1	91.71	91.71



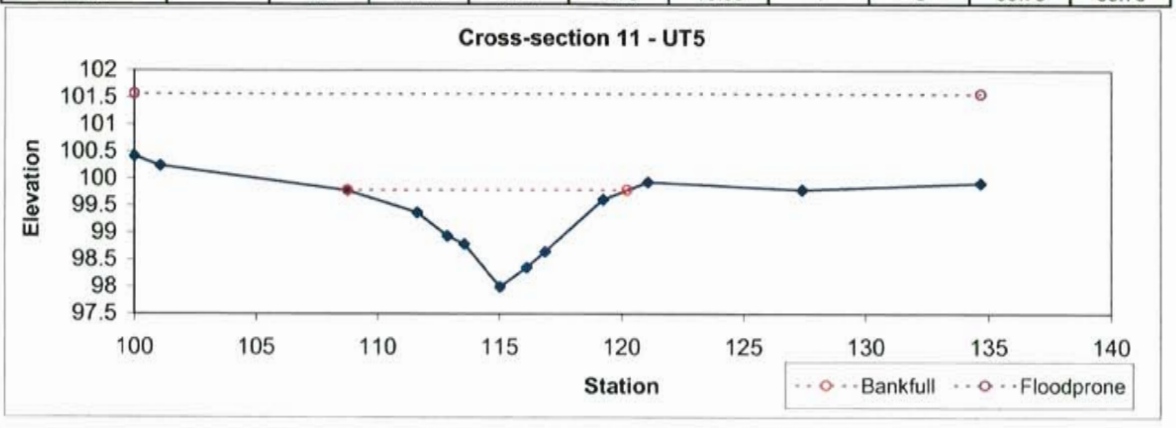
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	11.1	14.91	0.75	1.34	19.94	1	3.1	95.18	95.18



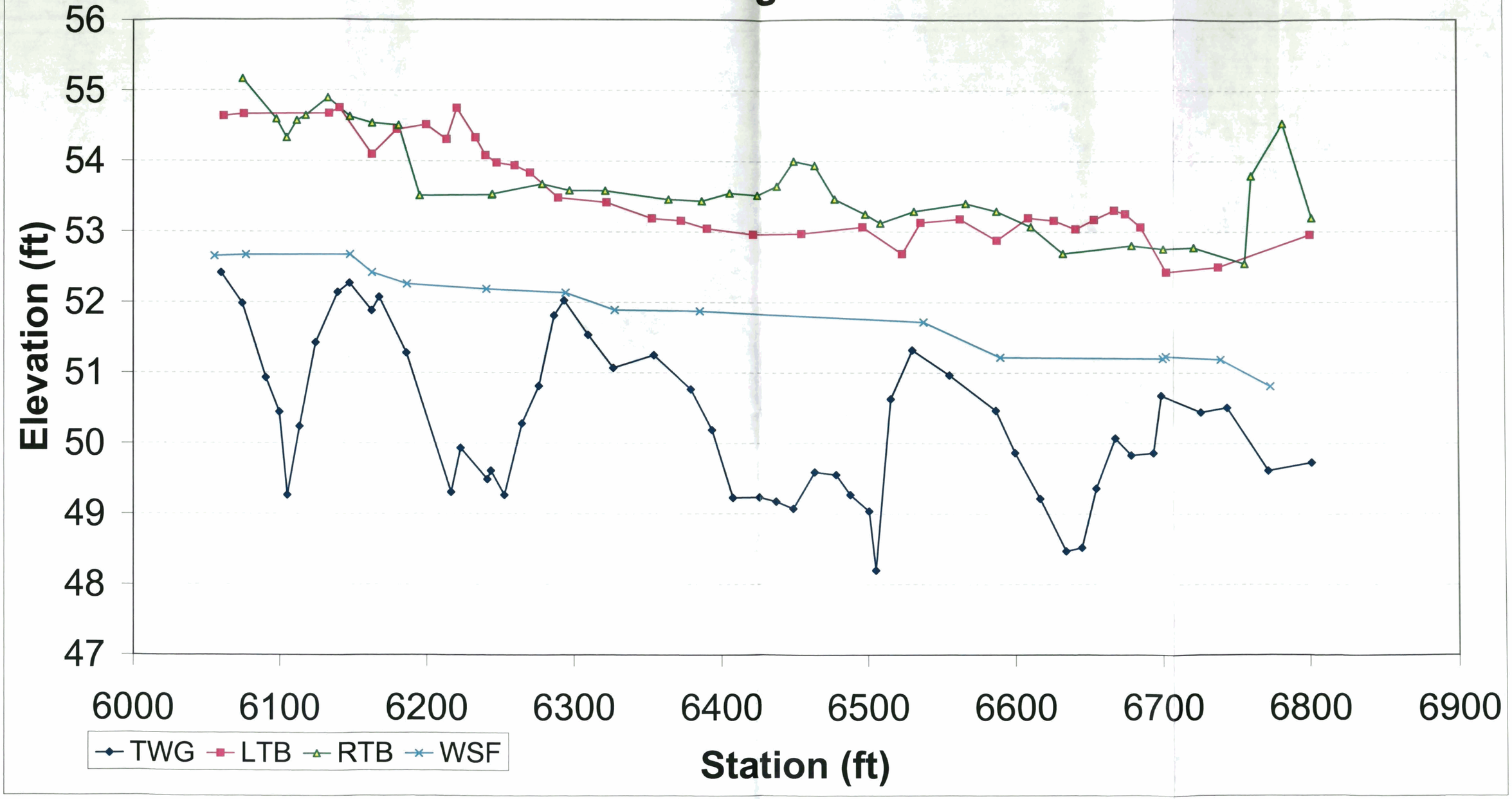
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	6	8.04	0.75	1.02	10.76	1	4.1	97.78	97.78



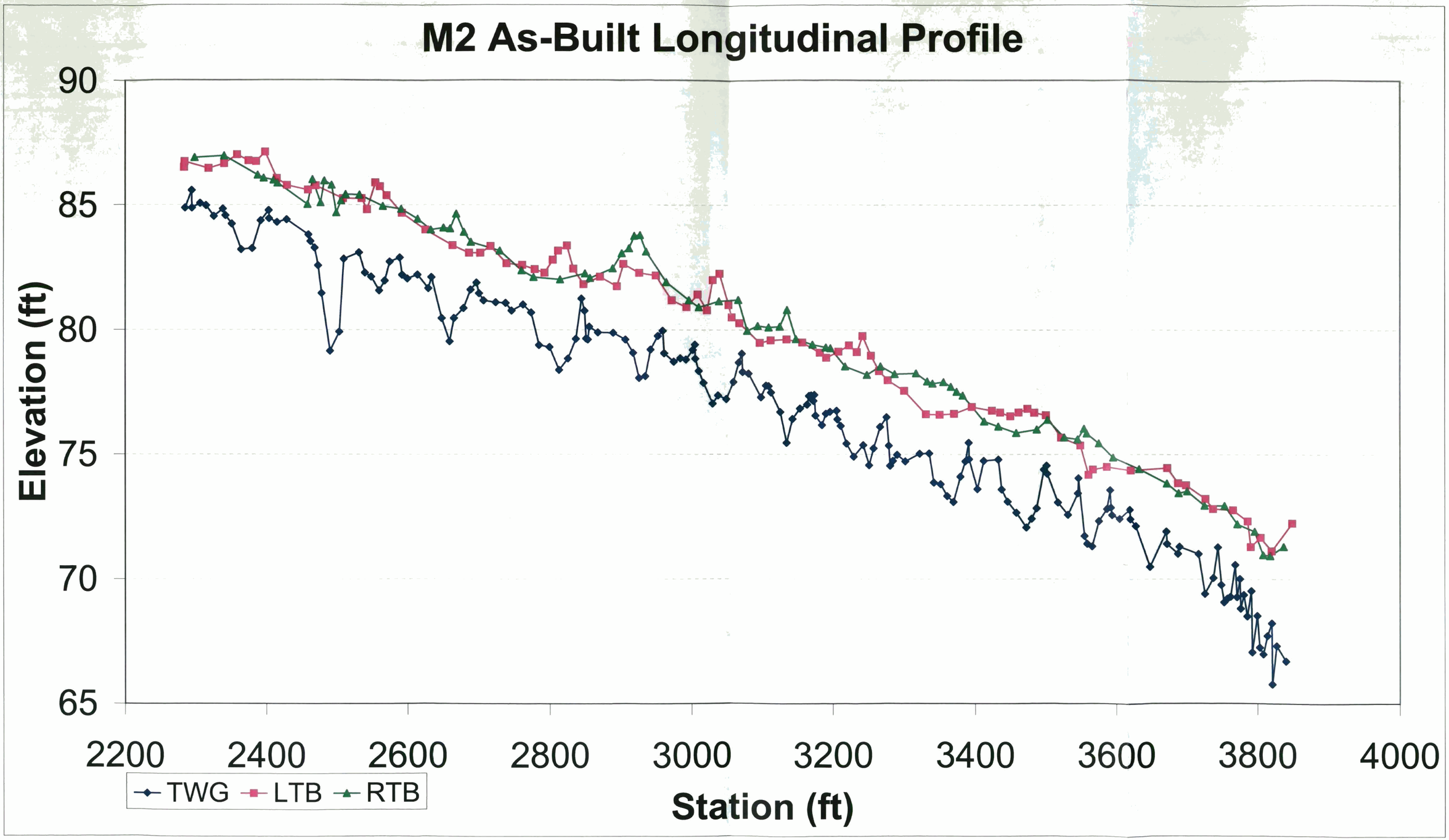
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		8.4	11.47	0.73	1.78	15.66	1	3	99.78	99.78



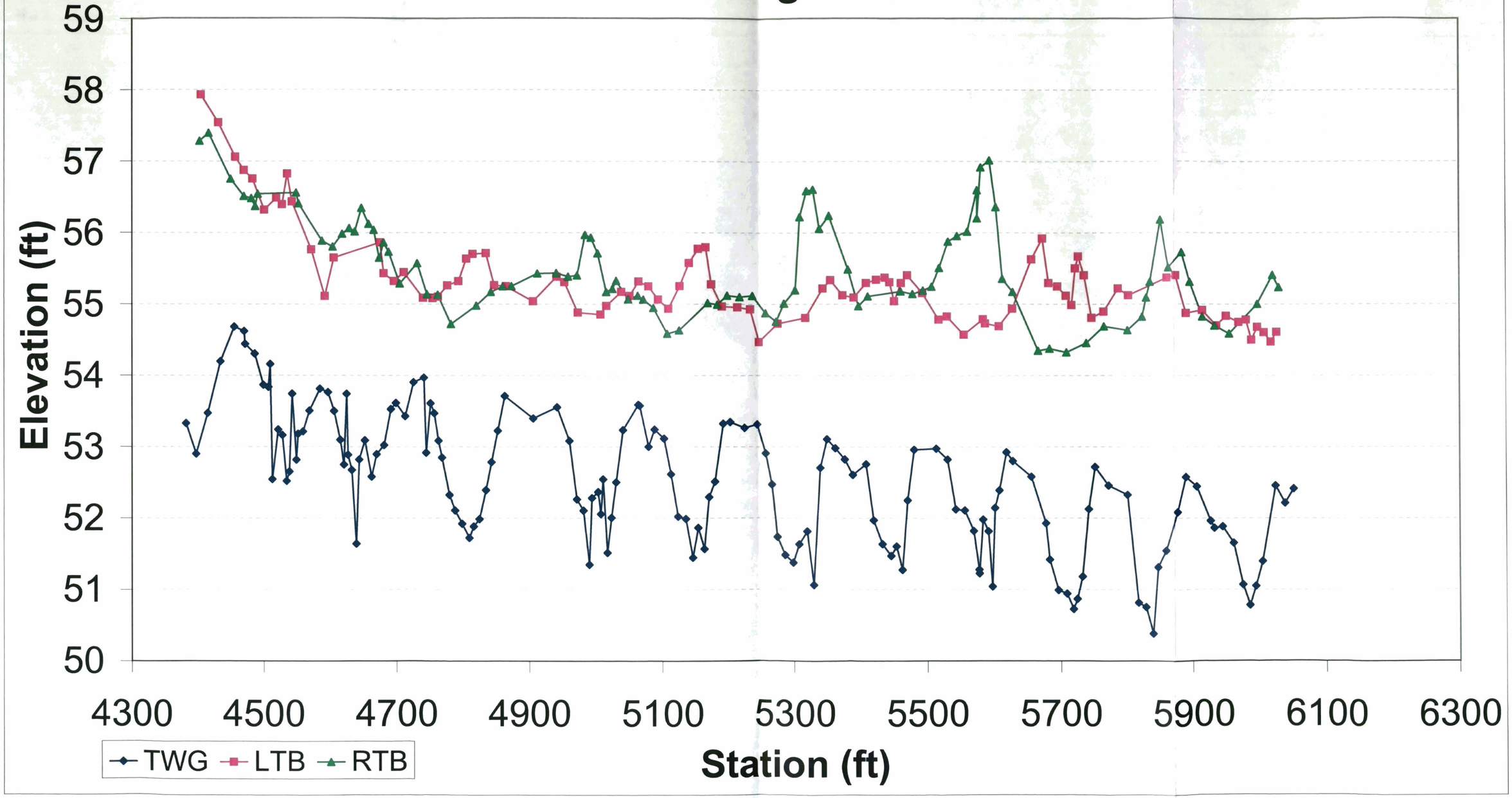
M1 As-Built Longitudinal Profile



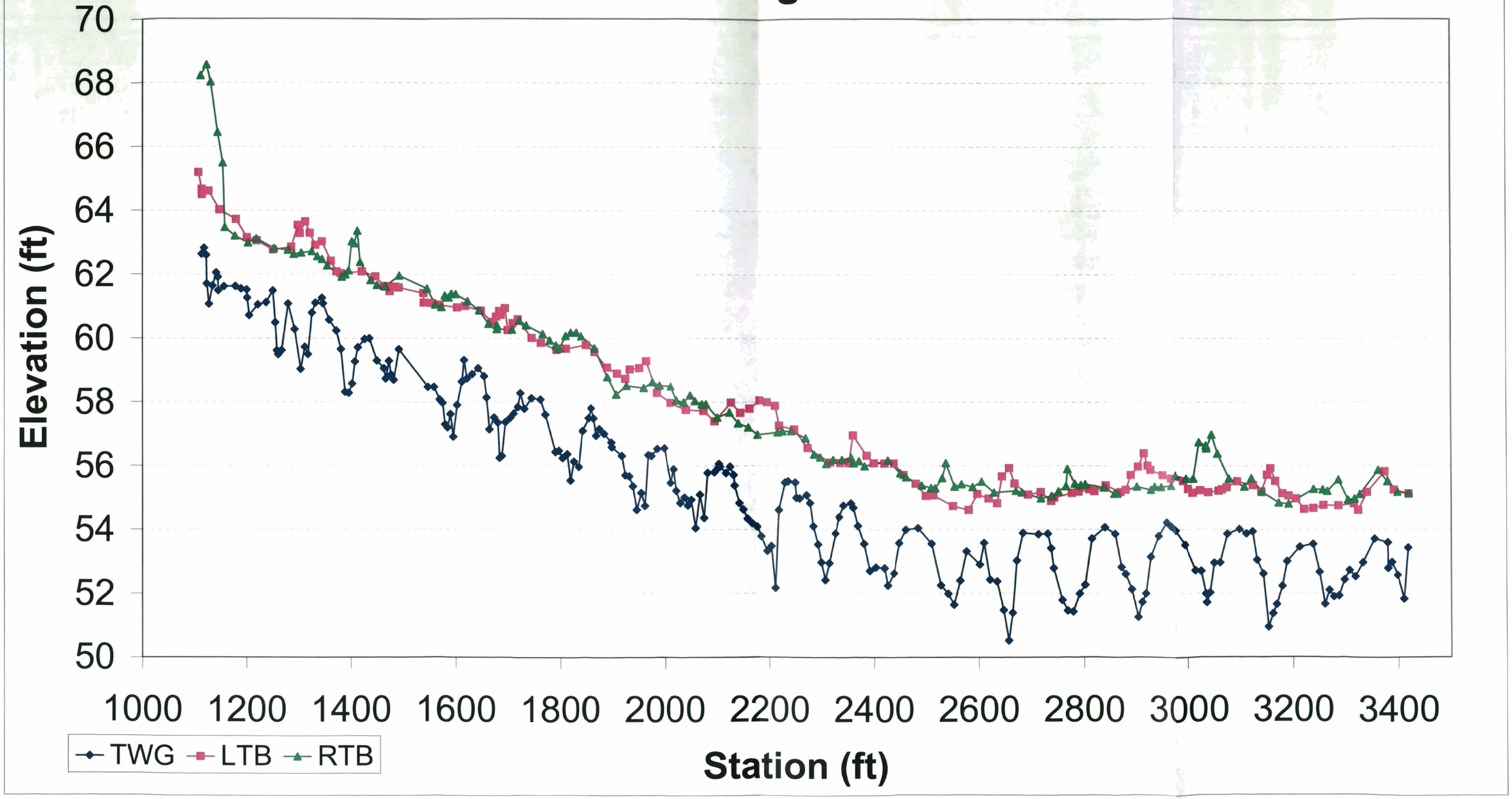
M2 As-Built Longitudinal Profile



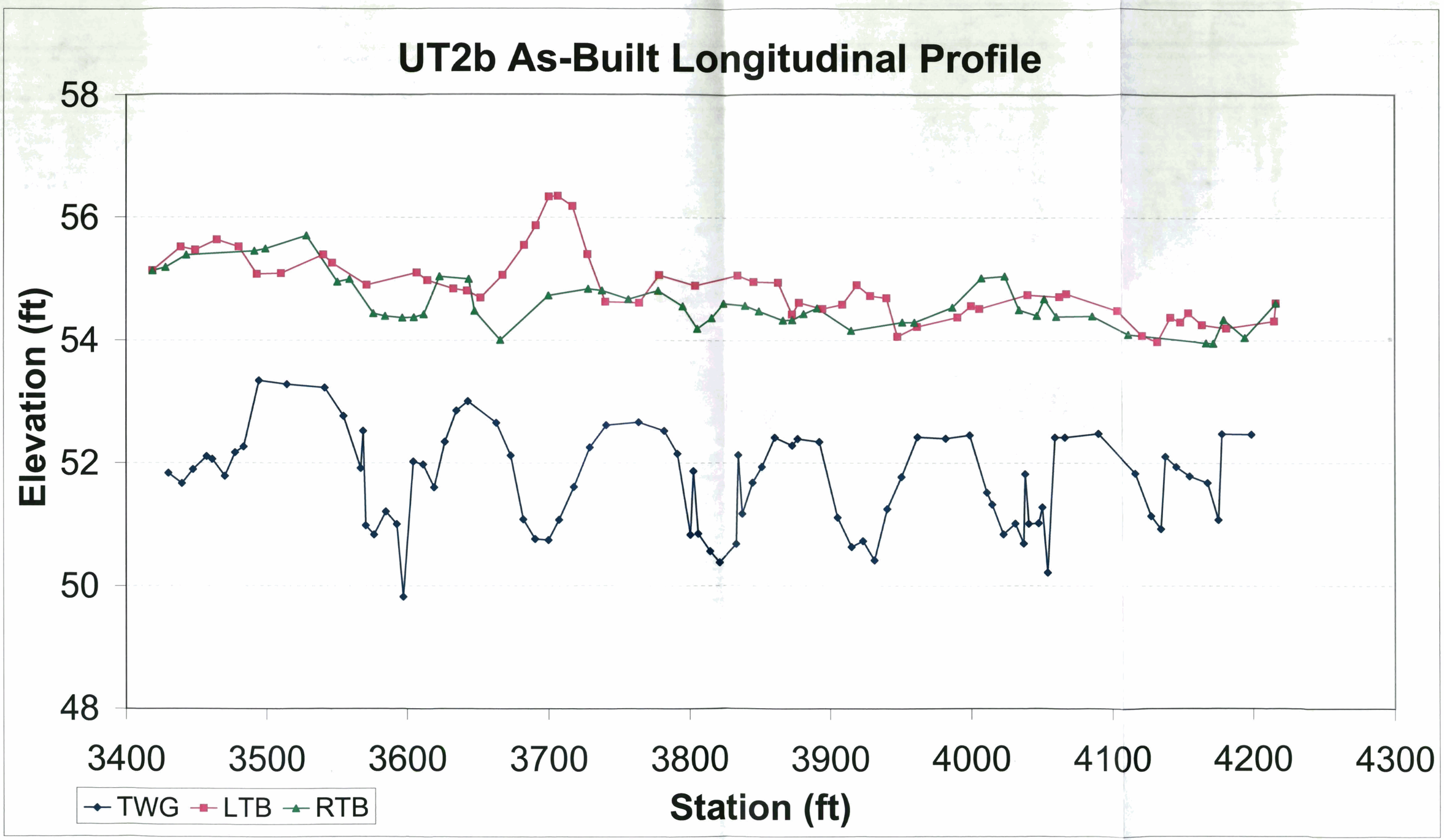
UT1b As-Built Longitudinal Profile



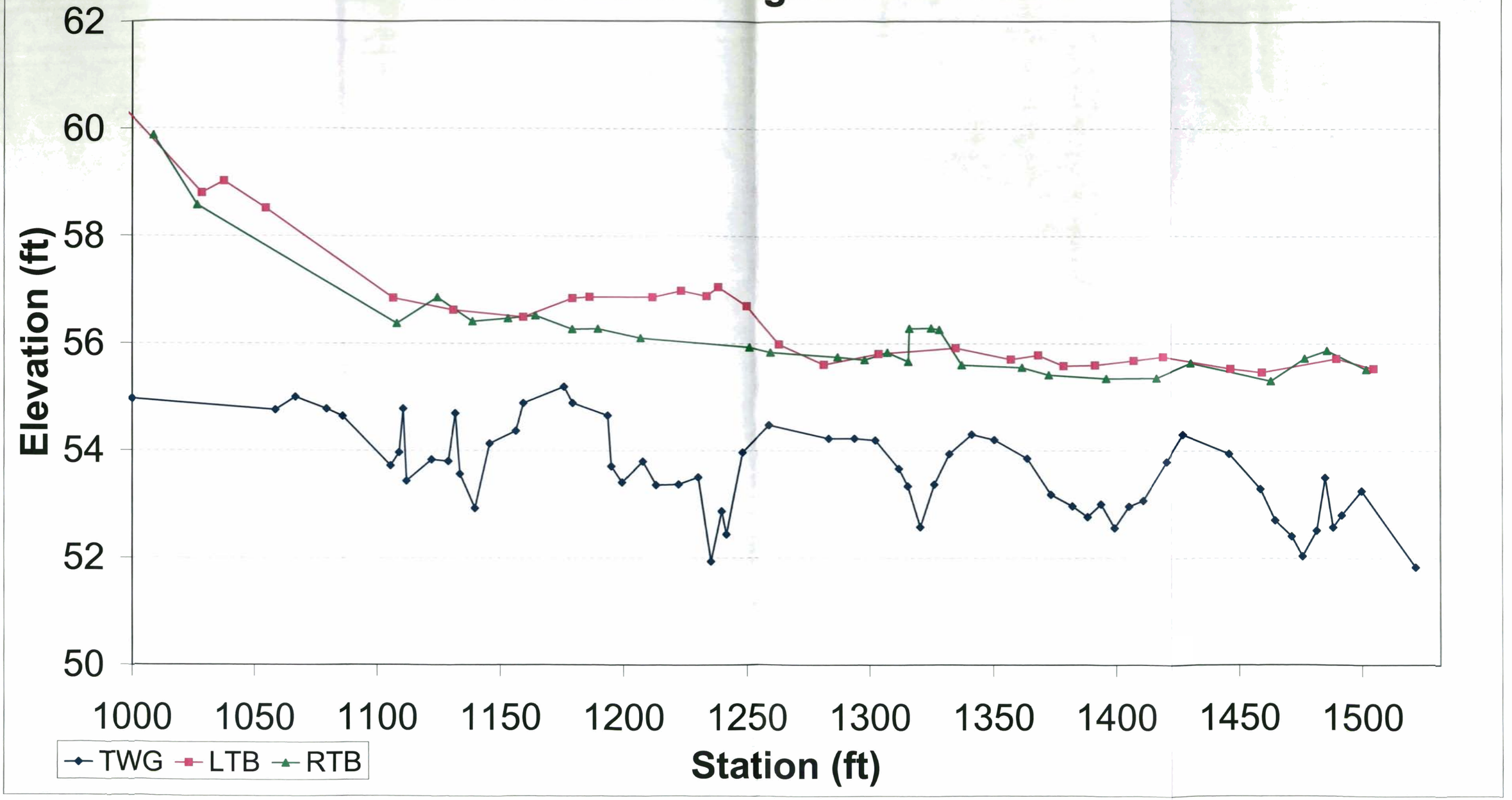
UT2a As-Built Longitudinal Profile

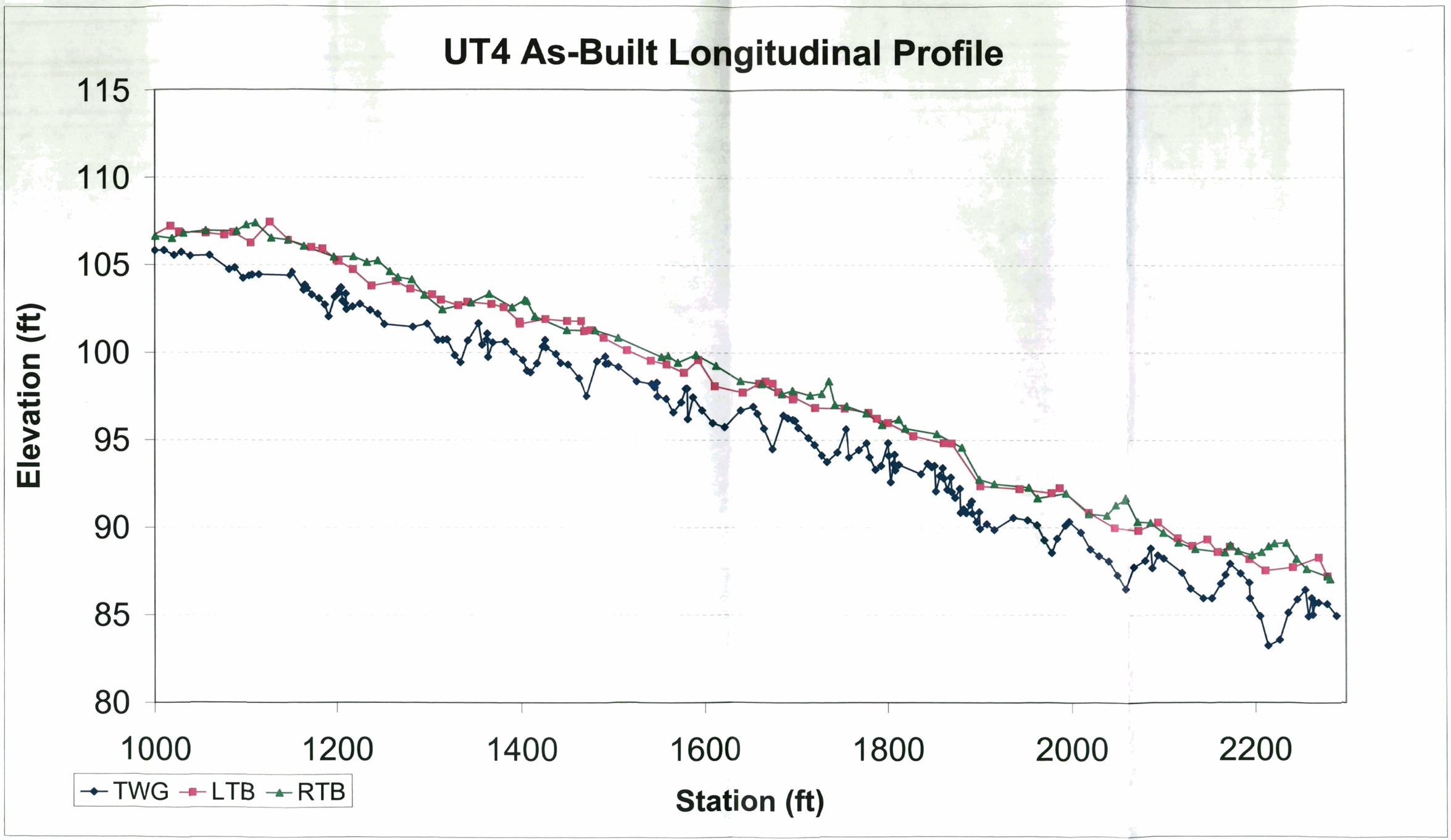


UT2b As-Built Longitudinal Profile

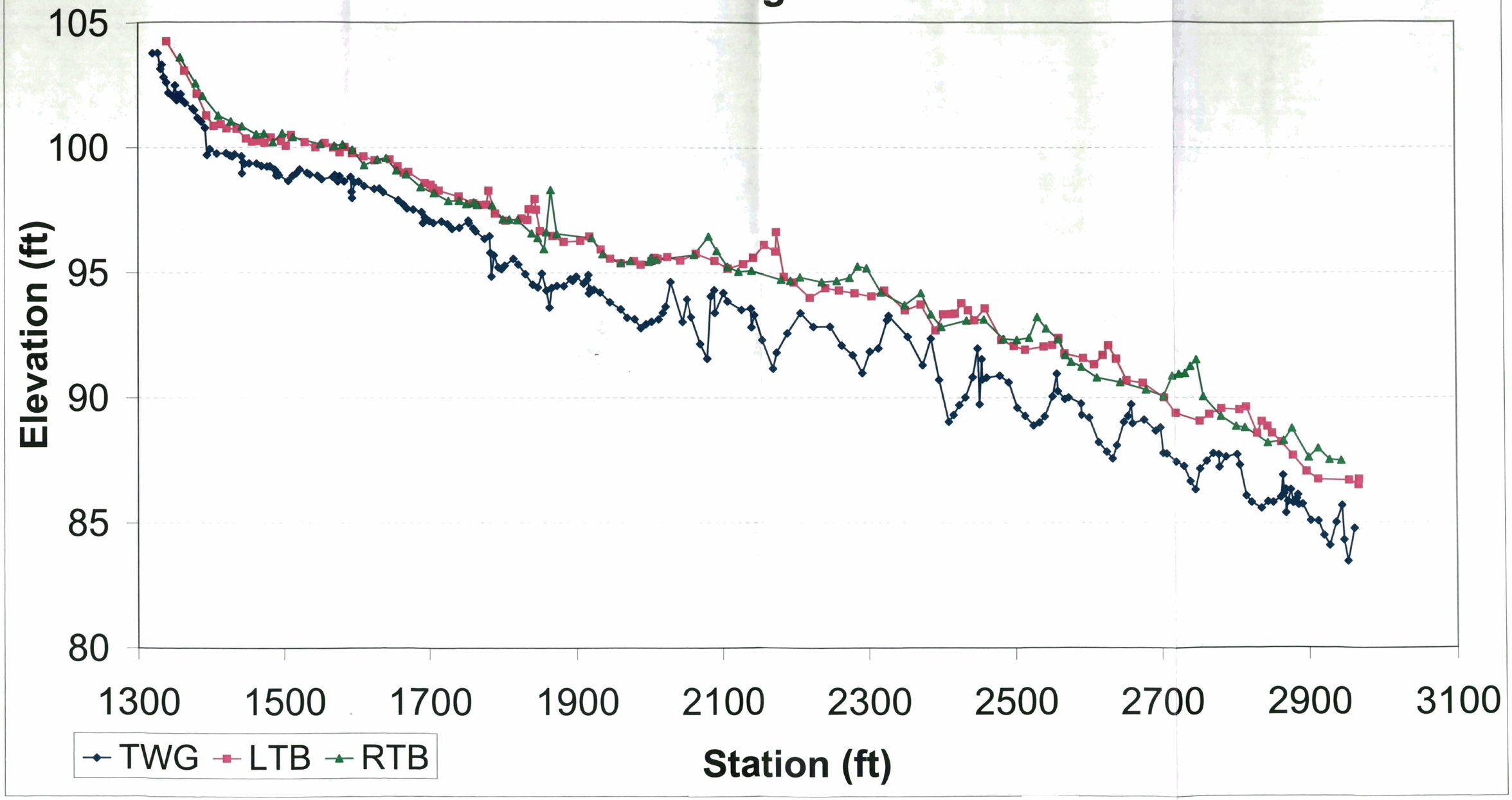


UT3 As-Built Longitudinal Profile




UT4 As-Built Longitudinal Profile
115
110
105
100
95
90
85
80
Elevation (ft)
1000
1200
1400
1600
1800
2000
2200
Station (ft)
TWG
LTB
RTB

UT5 As-Built Longitudinal Profile



APPENDIX 3

AS-BUILT PLAN SHEETS

STATE	PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	0169R	1	24

NO.	DATE	CHECKED BY	APPROVED BY
1	07/11/05	JOHN HUTTON	KEVIN TWEEDY

SOUTH FORK

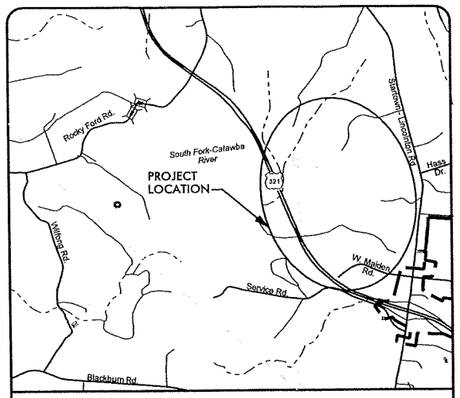
PROJECT: 169

STREAM RESTORATION PROJECT
ENVIRONMENTAL BANC AND EXCHANGE, LLC

CATAWBA COUNTY

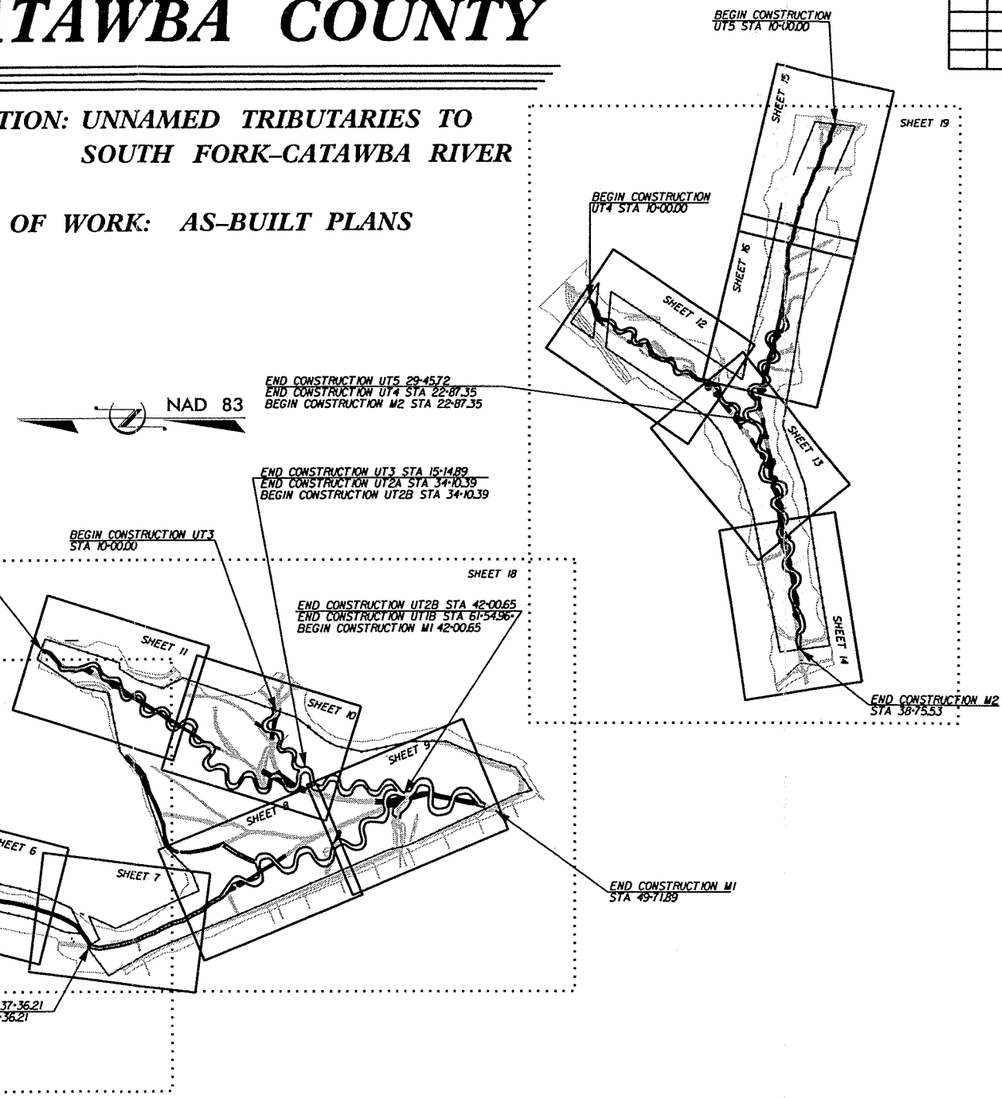
LOCATION: UNNAMED TRIBUTARIES TO SOUTH FORK-CATAWBA RIVER

TYPE OF WORK: AS-BUILT PLANS

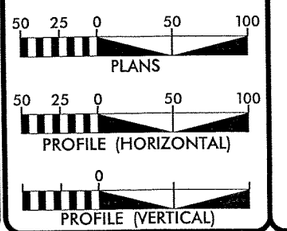


VICINITY MAP

INDEX OF SHEETS



GRAPHIC SCALES



PROJECT SUMMARY

Project Feature	Existing Condition	As-Built Condition
UT1	4,642LF	5,112LF
UT2	2,109LF	3,246LF
UT3	417LF	526LF
M1	547LF	726LF
UT4	1,154LF	1,226LF
UT5	1,795LF	1,898LF
M2	1,254LF	1,560LF
Total	11,918LF	14,294LF

NOTE: LANDOWNER EASEMENTS SUBTRACTED FROM DESIGN STREAM LENGTHS

PREPARED FOR THE OFFICE OF:
ENVIRONMENTAL BANC AND EXCHANGE, LLC

10055 RED RUN BOULEVARD, SUITE 130
OWING MILLS, MD 21117

220 CHATHAM BUSINESS DRIVE
PITTSBORO, NORTH CAROLINA 27312

EBX CONTACT:
TARA DISY ALLDEN
PROJECT MANAGER

PREPARED IN THE OFFICE OF:

BUCK ENGINEERING
8000 Regency Parkway, Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

November 2004
LETTING DATE:

KEVIN L. TWEEDY, PE
PROJECT ENGINEER

JOHN HUTTON
PROJECT MANAGER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

7-21-05

SIGNATURE: P.E.

2/25/03

GENERAL NOTES

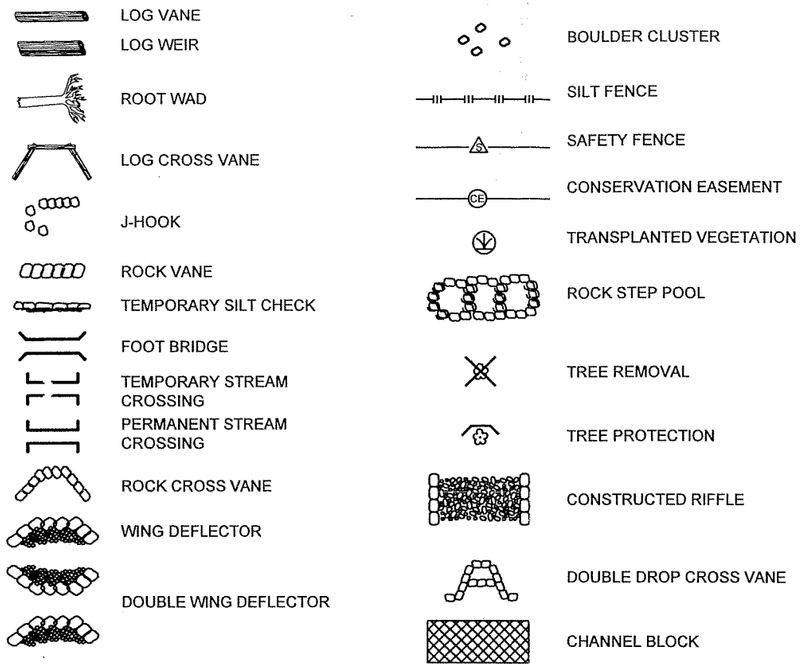
1. The Contractor is required to install instream structures using a track hoe with a hydraulic thumb of sufficient size to move boulders 4ft X 3ft X 2ft (approximately 2 tons).

2. The Contractor shall be required to provide, at a minimum, two operators at all times during construction of the new stream channel. In general, one operator will cut the new channel with a track hoe, while the other operator follows and installs instream structures, bank stabilization practices, and transplants. During construction of the new stream channel, the contractor will be required to have two track hoes and one loader on-site.

3. Construction is scheduled to begin November 2004.

STREAM CONVENTIONAL SYMBOLS

SUPERCEDES SHEET 1B



**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

PROJECT REFERENCE NO.	SHEET NO.
169	1-B

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

7-21-05

DATE:

BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

VEGETATION SELECTION

BARE ROOT/CONTAINERIZED VEGETATION			
NOTE: CONTAINERIZED AND BARE ROOT VEGETATION SHALL BE INSTALLED RANDOMLY 6 TO 8 FEET APART FROM THE TOP OF THE STREAMBANK OUT TO THE EDGE OF REVEGETATION LIMITS			
COMMON NAME	*SCIENTIFIC NAME*	Quantity	
SYCAMORE	*PLATANUS OCCIDENTALIS*	4850	
WILLOW OAK	*QUERCUS PHELLOS*	4850	
RIVER BIRCH	*BETULA NIGRA*	4850	
BITTERNUT HICKORY	*CARYA CORDIFORMIS*	4850	
WHITE BASSWOOD	*TILIA HETEROPHYLLA*	4850	
PERSIMMON	*DIOSPYROS VIRGINIANA*	4850	
PAWPAW	*ASIMINA TRILOBA*	4850	
WITCH-HAZEL	*HAMAMELIS VIRGINIANA*	4850	
LIVE STAKING			
NOTE: LIVE STAKES SHALL BE INSTALLED RANDOMLY 2 TO 3 FEET APART ALONG THE STREAMBANKS FROM THE TOE OF THE BANK TO THE TOP OF BANK.			
COMMON NAME	*SCIENTIFIC NAME*	Quantity	
BUTTONBUSH	*CEPHALANTHUS OCCIDENTALIS*	5,244	
SILKY DOGWOOD	*COMUS AMOMUM*	5,244	
SILKY WILLOW	*SALIX SERICEA*	5,244	
BARE ROOT/CONTAINERIZED VEGETATION FOR POWERLINE EASEMENT			
NOTE: CONTAINERIZED AND BARE ROOT VEGETATION SHALL BE INSTALLED RANDOMLY 6 TO 8 FEET APART FROM THE TOP OF THE STREAMBANK OUT TO THE EDGE OF REVEGETATION LIMITS			
COMMON NAME	*SCIENTIFIC NAME*	Quantity	
TAG ALDER	*ALNUS SERRULATA*	1050	
SPICEBUSH	*LINDERA BENZOIN*	1050	
SOUTHERN ARROW-WOOD	*VIBURNUM DENTATUM*	1050	
ROSEMALLOW	*HIBISCUS MOSCHEUTOS*	1050	
PAWPAW	*ASIMINA TRILOBA*	1050	
NOTE: IF THE SPECIFIED QUANTITIES OF THE ABOVE SPECIES ARE NOT AVAILABLE THE FOLLOWING SPECIES MAY BE SUBSTITUTED FOR PLANTING WITHIN THE POWERLINE EASEMENT			
COMMON NAME	*SCIENTIFIC NAME*		
RED CHOKEBERRY	*ARONIA ARBUTIFOLIA*		
WITCH-HAZEL	*HAMAMELIS VIRGINIANA*		
DOGHOBBLE	*LEUCOTHOE AXILLARIS*		
TEMPORARY SEED MIX			
NOTE: ALL DISTURBED AREAS WILL BE STABILIZED USING MULCH AND TEMPORARY SEED MIX			
COMMON NAME	RATE	DATES	lbs
ANNUAL RYE (COOL SEASON)	130 LBS/ACRE	SEPTEMBER TO MARCH	687
MILLET (WARM SEASON)	45 LBS/ACRE	APRIL TO AUGUST	

RIPARIAN SEED MIX (PERMANENT)			
NOTE: RIPARIAN SEED MIX SHALL BE SEEDED AT A RATE OF ½ LB PER 1000 FT² ALONG THE STREAMBANKS FROM THE TOE OF THE BANK TO THE TOP OF BANK.			
COMMON NAME	*SCIENTIFIC NAME*	PERCENTAGE	lbs
Switchgrass	*Panicum virgatum*	25	111
Big Bluestem	*Andropoon Gerardii*	25	111
Ironweed	*Vernonia noveboracensis*	15	67
Joe Pye Weed	*Eupatorium fistulosum*	10	44
Deertongue	*Panicum clandestinum*	25	111
AMENDMENTS			
NOTE: APPLY AMENDMENTS TO ALL DISTURBED AREAS NEAR STREAM OR WITH HIGH SLOPE			
COMMON NAME	RATE	TOTAL	
MULCHING	10 BALES PER 1000 FT²	500 BALES	

STANDARD SPECIFICATIONS
NC. EROSION AND SEDIMENT CONTROL
PLANNING AND DESIGN MANUAL - DECEMBER 1993

EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
DECEMBER 1993

6.60 TEMPORARY SEDIMENT TRAP

6.06 CONSTRUCTION ACCESS

6.62 SILT FENCE

6.70 TEMPORARY STREAM CROSSING (CULVERTED)

7/26/2005
r:\0169R\Design\Plans\0169-_southfork_sym_01a.dgn

PROJECT REFERENCE NO.	SHEET NO.
0169	1-B

*S.U.E = SUBSURFACE UTILITY ENGINEER

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL SYMBOLS

ROADS & RELATED ITEMS

Edge of Pavement
Curb
Prop. Slope Stakes Cut
Prop. Slope Stakes Fill
Prop. Woven Wire Fence
Prop. Chain Link Fence
Prop. Barbed Wire Fence
Prop. Wheelchair Ramp
Curb Cut for Future Wheelchair Ramp
Exist. Guardrail
Prop. Guardrail
Equality Symbol
Pavement Removal

RIGHT OF WAY

Baseline Control Point
Existing Right of Way Marker
Exist. Right of Way Line w/Marker
Prop. Right of Way Line with Proposed R/W Marker (Iron Pin & Cap)
Prop. Right of Way Line with Proposed (Concrete or Granite) R/W Marker
Exist. Control of Access Line
Prop. Control of Access Line
Exist. Easement Line
Prop. Temp. Construction Easement Line
Prop. Temp. Drainage Easement Line
Prop. Perm. Drainage Easement Line

HYDROLOGY

Stream or Body of Water
River Basin Buffer
Flow Arrow
Disappearing Stream
Spring
Swamp Marsh
Shoreline
Falls, Rapids
Prop Lateral, Tail, Head Ditches

STRUCTURES

MAJOR
Bridge, Tunnel, or Box Culvert
Bridge Wing Wall, Head Wall and End Wall

MINOR
Head & End Wall
Pipe Culvert
Footbridge
Drainage Boxes
Paved Ditch Gutter

UTILITIES

Exist. Pole
Exist. Power Pole
Prop. Power Pole
Exist. Telephone Pole
Prop. Telephone Pole
Exist. Joint Use Pole
Prop. Joint Use Pole
Telephone Pedestal
U/G Telephone Cable Hand Hold
Cable TV Pedestal
U/G TV Cable Hand Hold
U/G Power Cable Hand Hold
Hydrant
Satellite Dish
Exist. Water Valve
Sewer Clean Out
Power Manhole
Telephone Booth
Cellular Telephone Tower
Water Manhole
Light Pole
H-Frame Pole
Power Line Tower
Pole with Base
Gas Valve
Gas Meter
Telephone Manhole
Power Transformer
Sanitary Sewer Manhole
Storm Sewer Manhole
Tank; Water, Gas, Oil
Water Tank With Legs
Traffic Signal Junction Box
Fiber Optic Splice Box
Television or Radio Tower
Utility Power Line Connects to Traffic Signal Lines Cut Into the Pavement

Recorded Water Line
Designated Water Line (S.U.E.*)
Sanitary Sewer
Recorded Sanitary Sewer Force Main
Designated Sanitary Sewer Force Main(S.U.E.*)
Recorded Gas Line
Designated Gas Line (S.U.E.*)
Storm Sewer
Recorded Power Line
Designated Power Line (S.U.E.*)
Recorded Telephone Cable
Designated Telephone Cable (S.U.E.*)
Recorded U/G Telephone Conduit
Designated U/G Telephone Conduit (S.U.E.*)
Unknown Utility (S.U.E.*)
Recorded Television Cable
Designated Television Cable (S.U.E.*)
Recorded Fiber Optics Cable
Designated Fiber Optics Cable (S.U.E.*)
Exist. Water Meter
U/G Test Hole (S.U.E.*)
Abandoned According to U/G Record
End of Information

BOUNDARIES & PROPERTIES

State Line
County Line
Township Line
City Line
Reservation Line
Property Line
Property Line Symbol
Exist. Iron Pin
Property Corner
Property Monument
Property Number
Parcel Number
Fence Line
Existing Wetland Boundaries
High Quality Wetland Boundary
Medium Quality Wetland Boundaries
Low Quality Wetland Boundaries
Proposed Wetland Boundaries
Existing Endangered Animal Boundaries
Existing Endangered Plant Boundaries

BUILDINGS & OTHER CULTURE

Buildings
Foundations
Area Outline
Gate
Gas Pump Vent or U/G Tank Cap
Church
School
Park
Cemetery
Dam
Sign
Well
Small Mine
Swimming Pool

TOPOGRAPHY

Loose Surface
Hard Surface
Change in Road Surface
Curb
Right of Way Symbol
Guard Post
Paved Walk
Bridge
Box Culvert or Tunnel
Ferry
Culvert
Footbridge
Trail, Footpath
Light House

VEGETATION

Single Tree
Single Shrub
Hedge
Woods Line
Orchard
Vineyard

RAILROADS

Standard Gauge
RR Signal Milepost
Switch

revised 02/02/00

PROJECT REFERENCE NO.	SHEET NO.
169	2

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

8-21-05

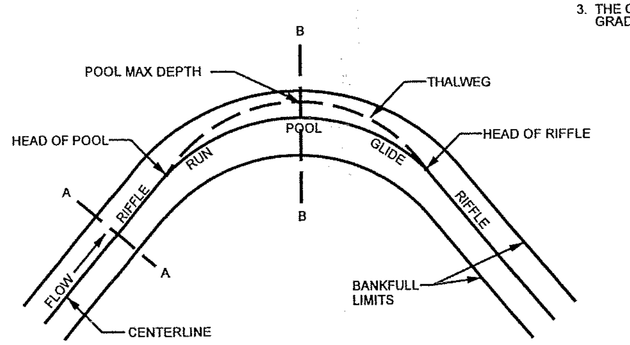
DATE:

BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

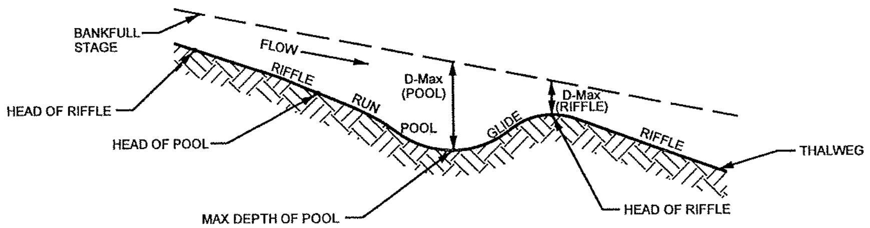
TYPICAL PLAN VIEW AND PROFILE

NOTES:
1. THE POINTS SHOWN, e.g. HEAD OF RIFFLE, HEAD OF POOL AND MAX DEPTH OF POOL ARE THE CONTROL POINTS USED TO CUT THE PROFILE; HOWEVER, THE CONTRACTOR SHOULD CREATE SMOOTH TRANSITIONS BETWEEN CONTROL POINTS AS SHOWN.
2. THE HEAD OF RIFFLE ELEVATION SHOULD NOT EXCEED THE HEAD OF POOL ELEVATION.
3. THE CHANGE IN WIDTH BETWEEN THE RIFFLES AND POOLS SHOULD OCCUR GRADUALLY OVER THE ENTIRE LENGTH OF THE BEND.

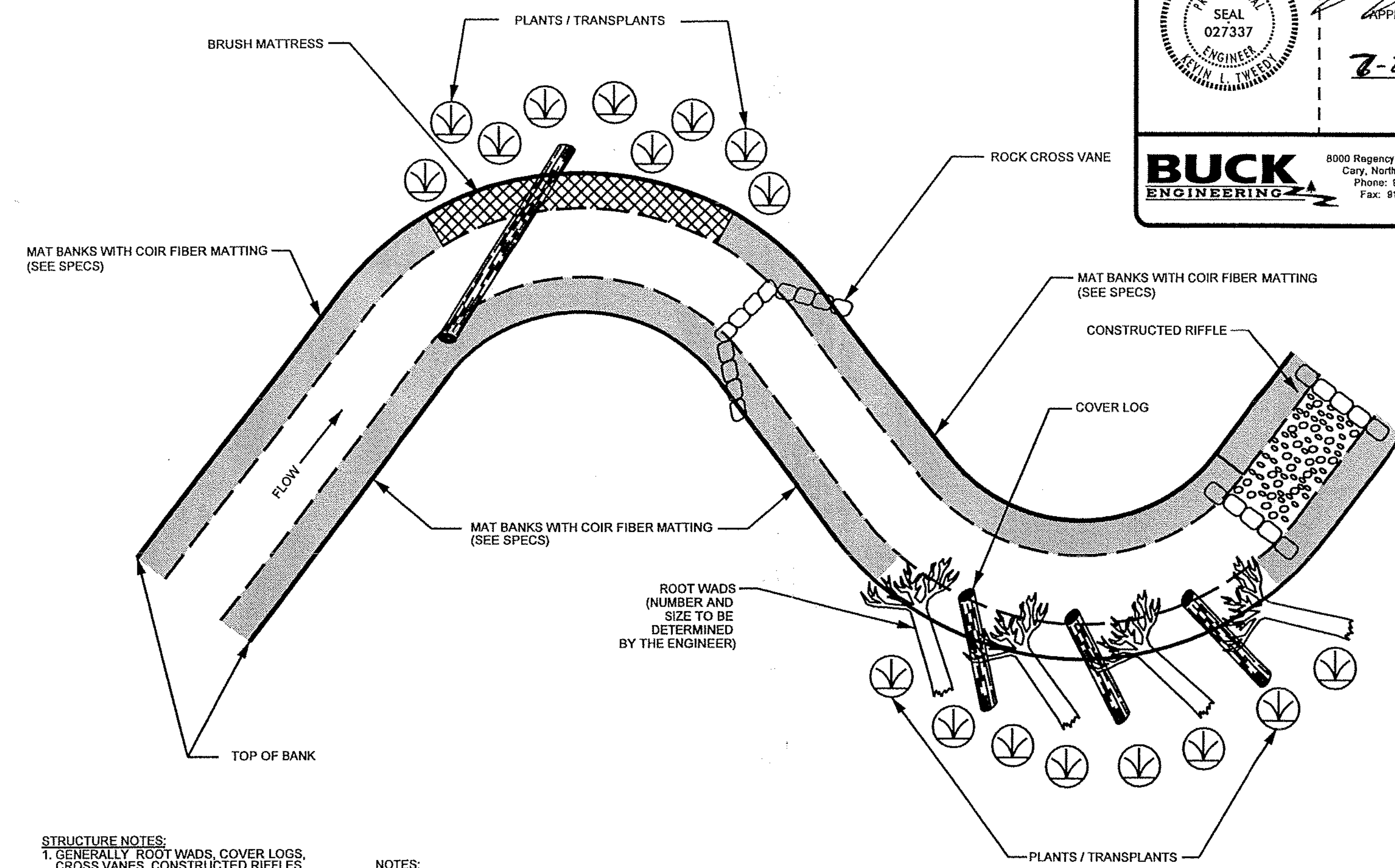
PLAN VIEW



PROFILE VIEW



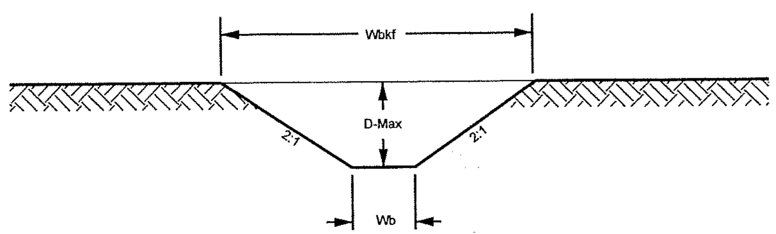
TYPICAL STRUCTURE PLACEMENT



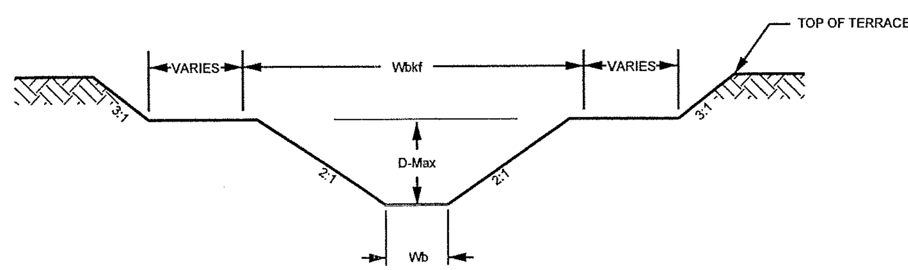
STRUCTURE NOTES:
1. GENERALLY ROOT WADS, COVER LOGS, CROSS VANES, CONSTRUCTED RIFFLES, AND COIR FIBER MATTING WILL BE INSTALLED IN THE LOCATION AND SEQUENCE AS SHOWN.
2. ADDITIONAL STRUCTURES OR CHANGES TO STRUCTURE LOCATIONS MAY BE MADE BY THE ENGINEER DURING CONSTRUCTION.

NOTES:
1. COIR FIBER MATTING TO BE INSTALLED ON RIFFLE/RUN SECTIONS BETWEEN BENDS AND ON THE INSIDE OF MEANDER BENDS.
2. IF ROOT WADS DO NOT COVER ENTIRE SLOPE ON OUTSIDE OF MEANDER BENDS, COIR FIBER MATTING IS NEEDED.

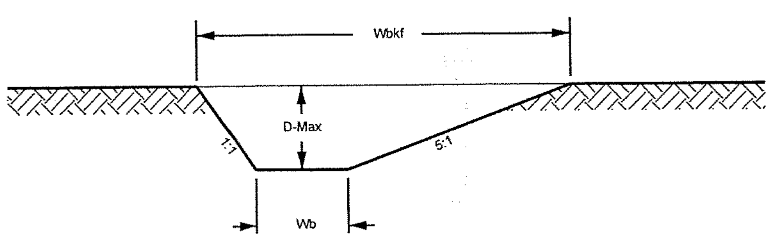
TYPICAL RIFFLE, POOL AND BANKFULL BENCH



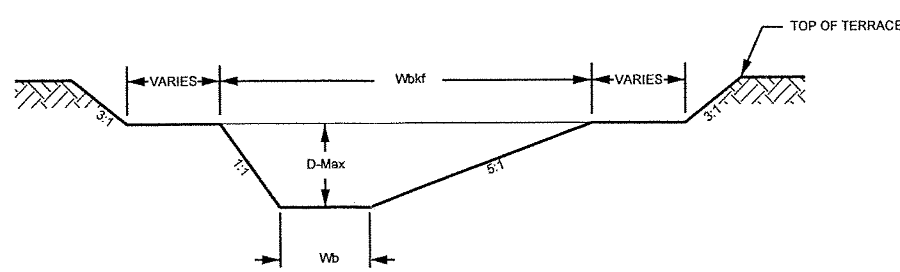
RIFFLE A-A



RIFFLE WITH BANKFULL BENCH



POOL B-B



POOL WITH BANKFULL BENCH

REACH UT 1B		REACH UT 2A		REACH UT 2B		REACH UT 3		
RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	
16	26	12	18	14.9	24	11.5	18	WIDTH OF BANKFULL (Wbkf)
1.3	2.1	1	1.5	1.2	2	1	1.5	AVERAGE DEPTH (D)
1.9	3.5	1.3	2.8	1.8	3.5	1.4	2.8	MAXIMUM DEPTH (D-Max)
12	12.5	12	12.1	12	12.2	12	12.1	WIDTH TO DEPTH RATIO (Wbkf / D)
21.4	54.3	12	26.9	18.5	47.3	11	26.9	BANKFULL AREA (Abkf)
6.5	5.0	6.9	1.2	6.1	3.0	4.7	1.2	BOTTOM WIDTH (Wb)

REACH UT 4		REACH UT 5		REACH M1		REACH M2		
RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	
7.9	12	10.6	16	19	29	12.3	18	WIDTH OF BANKFULL (Wbkf)
0.6	1.2	0.8	1.5	1.6	2.4	1	1.9	AVERAGE DEPTH (D)
0.7	1.6	1	2	2	4.2	1.3	3	MAXIMUM DEPTH (D-Max)
14	10.2	14	10.7	12	12.2	12	9.6	WIDTH TO DEPTH RATIO (Wbkf / D)
4.5	14.1	8	24	30	68.9	12.6	33.8	BANKFULL AREA (Abkf)
4.2	5.6	5.7	8	11	3.8	7.1	4.5	BOTTOM WIDTH (Wb)

NOTES:
1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.
2. POOLS SHOWN ABOVE ARE LEFT POOLS ONLY.

2/26/03

7/20/2005
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2/26/03

PROJECT REFERENCE NO.	SHEET NO.
169	2-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

7-21-05

DATE:

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8000 Regency Parkway Suite 200
Cary, North Carolina 27511
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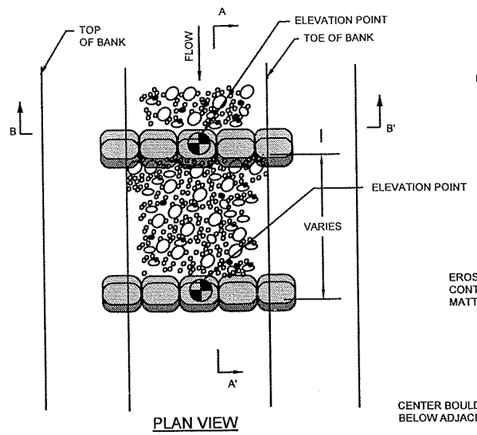
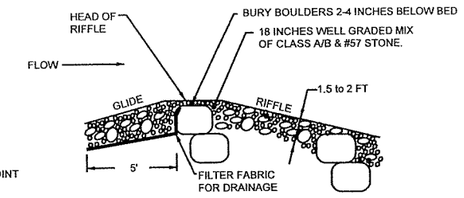
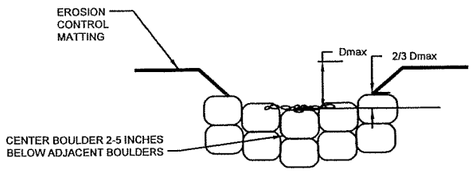
CONSTRUCTED RIFFLE



PLAN VIEW



PROFILE A-A'



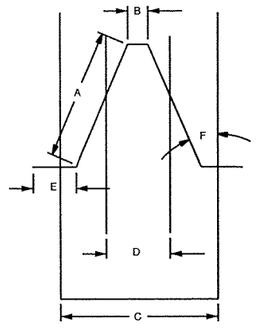
SECTION B-B'

NOTES:

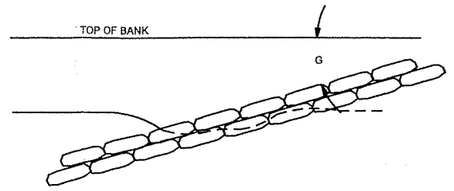
1. BOULDERS MUST BE AT LEAST 4' x 3' x 2'.
2. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF FIVE FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBED.
4. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
5. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. USE CLASS B STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS,THEN CLASS A STONE IN FRONT OF CLASS B STONE AND #57 STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS A STONE.
7. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

REACHES	UT 1A	UT 1B	UT 2A	UT 2B	UT 3	UT 4	UT 5	M1	M2
Wbkf (ft)	11.7	16	12	14.9	11.5	7.9	10.6	19	12.3
Dmax (ft)	1.4	1.9	1.3	1.8	1.4	0.7	1	2	1.3

CROSS VANE TYPICAL



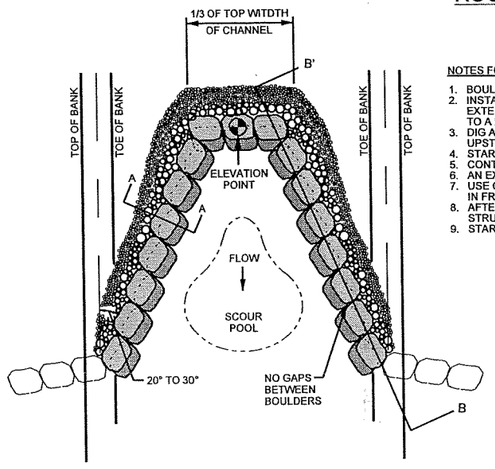
PLAN VIEW



PROFILE VIEW

		UT 1B	UT 2A	UT 2B	UT 4	UT 5	M2
A	VANE ARM LENGTH	20.3 FT	14.2 FT	18.8 FT	8.6 FT	12.6 FT	14.6 FT
B	INVERT LENGTH	2.1 FT	2.3 FT	2.0 FT	2.0 FT	2.0 FT	2.3 FT
C	BANKFULL WIDTH	16.0 FT	12.0 FT	14.9 FT	7.9 FT	10.6 FT	12.3 FT
D	BOTTOM WIDTH	6.5 FT	6.9 FT	6.1 FT	4.2 FT	5.7 FT	7.1 FT
E	SILL LENGTH	5.0 FT	5.0 FT	5.0 FT	5.0 FT	5.0 FT	5.0 FT
F	ARM ANGLE	20°	20°	20°	20°	20°	20°
G	ARM SLOPE	7.0%	6.9%	7.2%	8.1%	8.0%	6.7%
H	STRUCTURE LENGTH	19.0 FT	13.4 FT	17.7 FT	8.1 FT	11.8 FT	13.7 FT

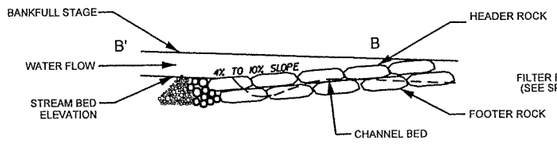
ROCK CROSS VANE



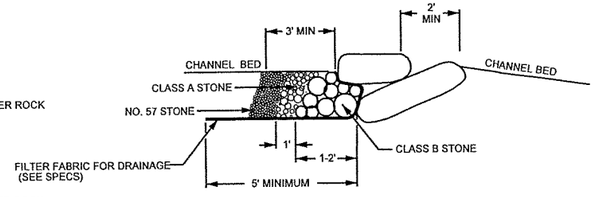
PLAN VIEW

NOTES FOR ALL VANE STRUCTURES:

1. BOULDERS MUST BE AT LEAST 4' x 3' x 2'.
2. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF FIVE FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBED.
4. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
5. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. AN EXTRA BOULDER CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
7. USE CLASS B STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS,THEN CLASS A STONE IN FRONT OF CLASS B STONE, AND #57 STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS A STONE.
8. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.
9. START SLOPE AT BANKFULL STAGE.

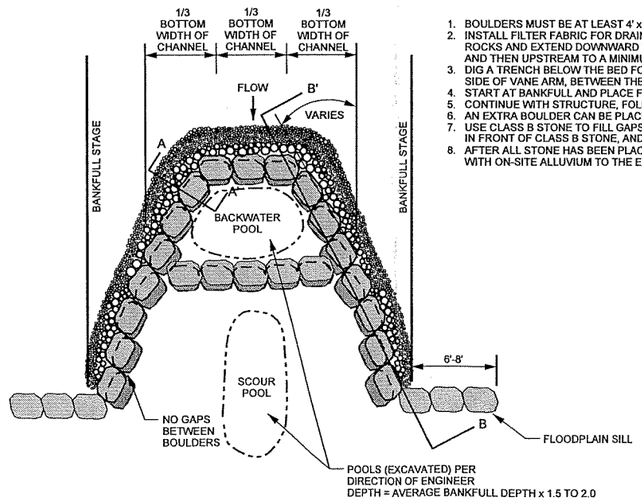


PROFILE VIEW B-B



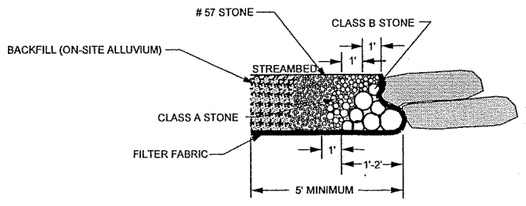
SECTION A - A

DOUBLE DROP CROSS VANE

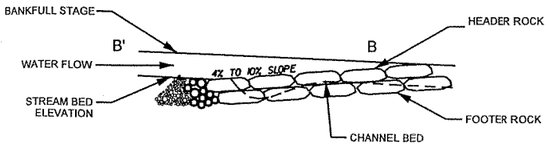


PLAN VIEW

1. BOULDERS MUST BE AT LEAST 4' x 3' x 2'.
2. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF 5 FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAM BANK.
4. START AT BANKFULL AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
5. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. AN EXTRA BOULDER CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
7. USE CLASS B STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS,THEN CLASS A STONE IN FRONT OF CLASS B STONE, AND #57 STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS A STONE.
8. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.



SECTION A-A'



PROFILE VIEW

7/20/2005
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2/26/03

PROJECT REFERENCE NO.	SHEET NO.
169	2-B

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

2-21-05

DATE:

BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
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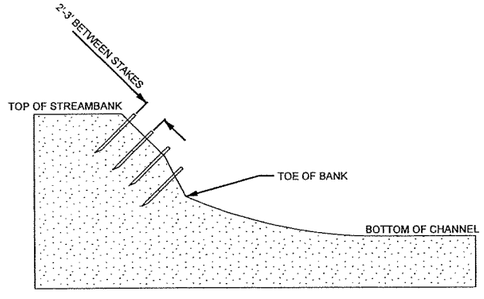
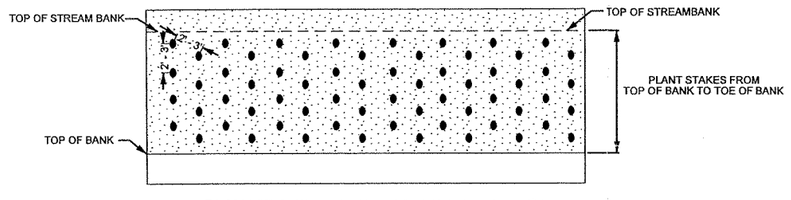
LIVE STAKING



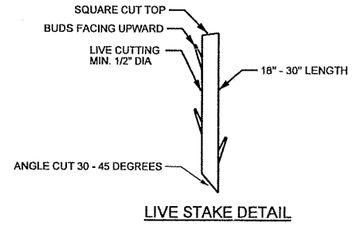
CROSS-SECTION VIEW OF LIVE STAKING SPECIFICATION

NOTES:

1. STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
2. DO NOT INSTALL STAKES THAT HAVE BEEN SPLIT.
3. STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
4. STAKES SHOULD BE INSTALLED PERPENDICULAR TO BANK.
5. STAKES SHOULD BE 1/2 TO 2 INCHES IN DIAMETER AND 18" TO 30" LONG.
6. STAKES SHOULD BE INSTALLED LEAVING 1/5 OF STAKE ABOVE GROUND.



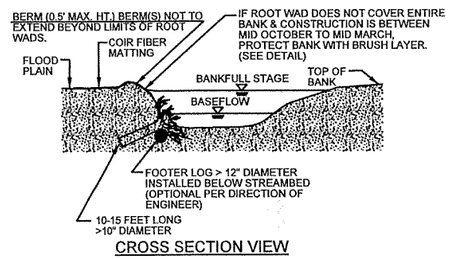
PLAN VIEW OF LIVE STAKING SPECIFICATION



LIVE STAKE DETAIL

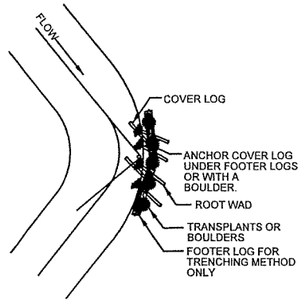
ROOT WADS WITHOUT TRANSPLANTS

NTS



CROSS SECTION VIEW

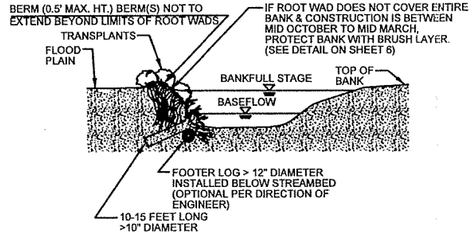
TRENCHING METHOD:
IF THE ROOT WAD CANNOT BE DRIVEN INTO THE BANK OR THE BANK NEEDS TO BE RECONSTRUCTED, THE TRENCHING METHOD SHOULD BE USED. THIS METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. IN THIS CASE, A FOOTER LOG SHOULD BE INSTALLED UNDERNEATH THE ROOT WAD IN A TRENCH EXCAVATED PARALLEL TO THE BANK AND WELL BELOW THE STREAMBED. ONE-THIRD OF THE ROOT WAD SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS.



PLAN VIEW

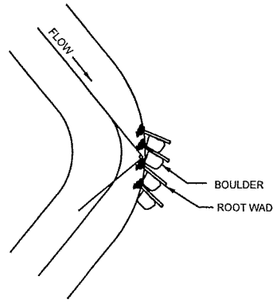
ROOT WADS WITH TRANSPLANTS

NTS



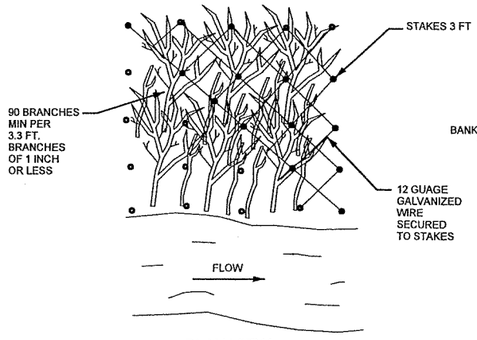
CROSS SECTION VIEW

DRIVE POINT METHOD:
SHARPEN THE END OF THE LOG WITH A CHAINSAW BEFORE "DRIVING" IT INTO THE BANK. ORIENT ROOT WADS UPSTREAM SO THAT THE STREAM FLOW MEETS THE ROOT WAD AT A 90-DEGREE ANGLE, DEFLECTING THE WATER AWAY FROM THE BANK. A TRANSPLANT OR BOULDER SHOULD BE PLACED ON THE DOWNSTREAM SIDE OF THE ROOT WAD IF A BACK EDDY IS FORMED BY THE ROOT WAD. THE BOULDER SHALL BE APPROXIMATELY 2' X 3' X 3'.

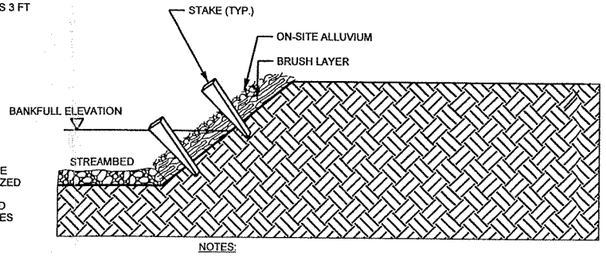


PLAN VIEW DRIVE POINT METHOD

BRUSH MATTRESS

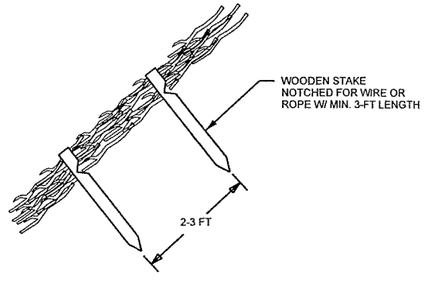


PLAN VIEW

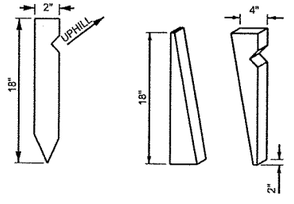


NOTES:
1. CREATE 12" DEEP TRENCH
2. STAKE AND WIRE BRUSH LAYER INTO TRENCH
3. BACK FILL 3" OF ON-SITE ALLUVIUM OVER BRUSH LAYER

CROSS SECTION



DETAIL



TYPICAL STAKE

NOTES:
1. BOARD FOR STAKE SHOULD BE 2" x 4" x 18"
2. SAW 2 x 4 TIMBER DIAGONALLY TO PRODUCE 2 DEAD STOUT STAKES

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2/26/03

PROJECT REFERENCE NO.	SHEET NO.
169	2-C

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN I. TWEEDY

APPROVED BY:

DATE: 2-21-05

BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
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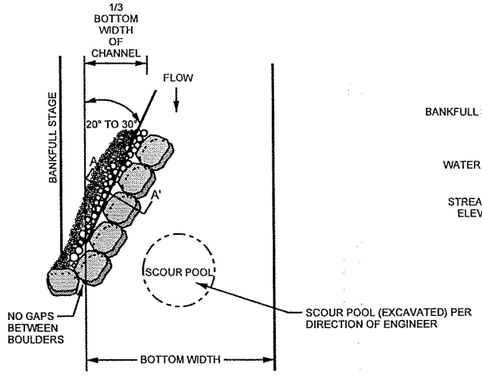
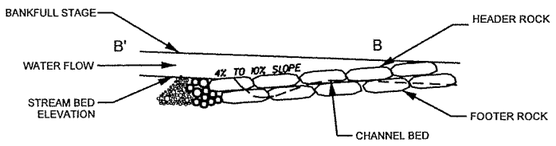
Fax: 919-463-5490

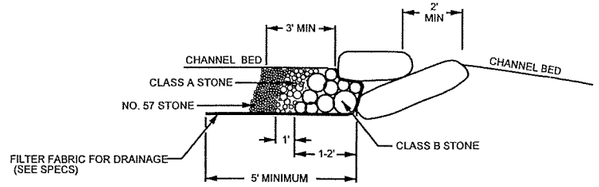
ROCK VANE



PLAN VIEW



PROFILE VIEW B-B

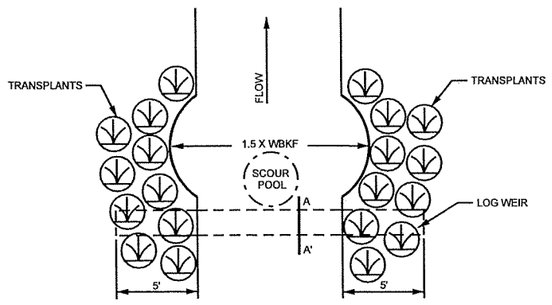


SECTION A - A

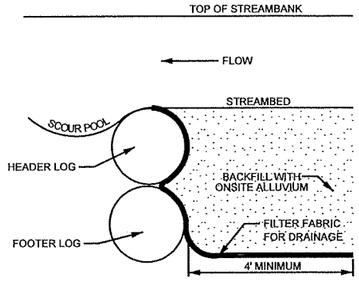
NOTES FOR ALL VANE STRUCTURES:

1. BOULDERS MUST BE AT LEAST 4' x 3' x 2'.
2. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
3. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF FIVE FEET.
4. START AT 1/2 - 2/3 BANKFULL AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
5. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
7. USE CLASS B STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS,THEN CLASS A STONE IN FRONT OF CLASS B STONE, AND #57 STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS A STONE.
7. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

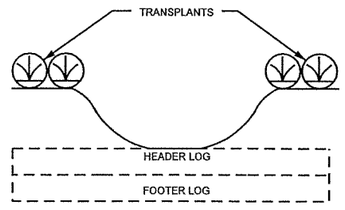
LOG WEIR



PLAN VIEW



SECTION A-A'

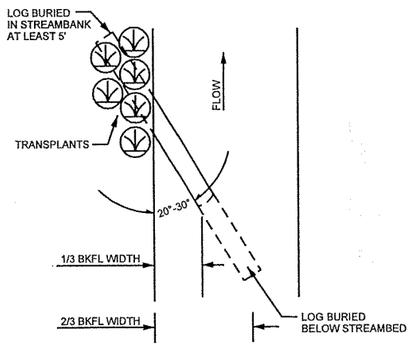


CROSS SECTION VIEW

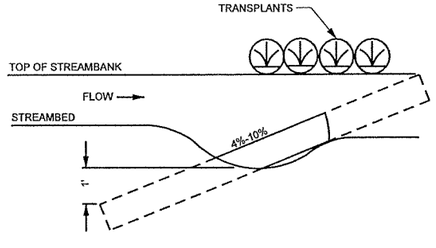
NOTES:

1. LOGS SHOULD BE AT LEAST 10 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. TOP OF HEADER LOG SHOULD BE SET AT SAME ELEVATION AS THE STREAMBED.
3. USE FILTER FABRIC TO SEAL GAPS BETWEEN LOGS.
4. PLACE TRANSPLANTS ALONG BANKS TO PROTECT AGAINST BANK EROSION.

LOG VANE



PLAN VIEW

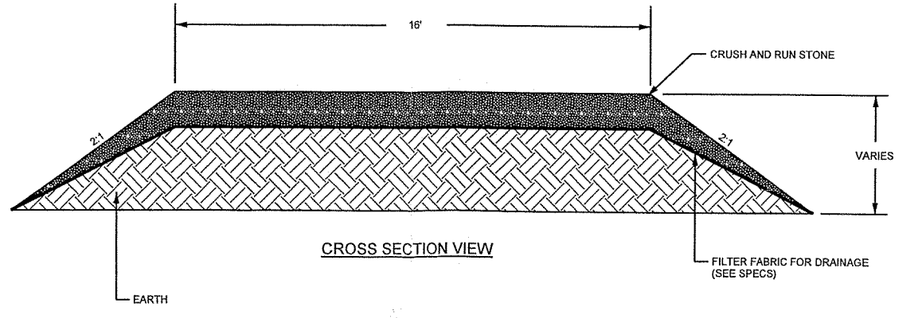


PROFILE VIEW

NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARWOOD, AND RECENTLY HARVESTED.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG
3. TRANSPLANTS ARE PLACED ALONG THE TOP OF THE BANK OVER THE BURIED LOG VANE TO PROTECT AGAINST EROSION DURING HIGH FLOWS.

CATTLE PATH



CROSS SECTION VIEW

NOTES:
PLACE 6 INCHES OF CRUSH & RUN
THEN SLOPE BANKS AT A 2:1 SLOPE.

7/30/2005
I:\2169\Design\Plans\0169r_southfork_dta_02c.dgn
dkeen

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
169	2-D

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

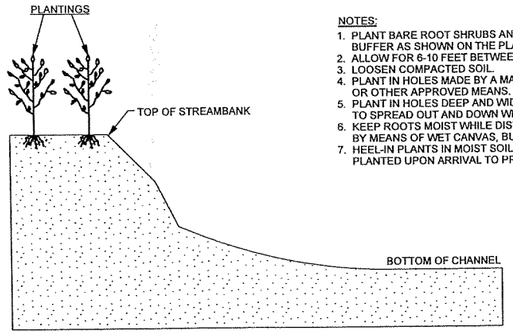
APPROVED BY:

2-21-05

DATE:

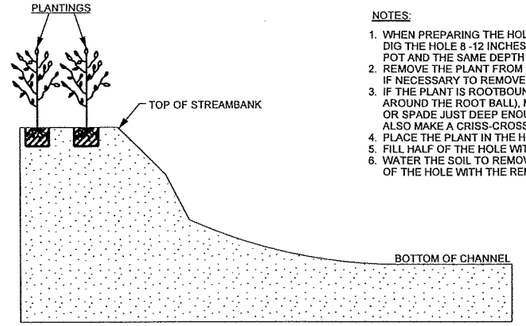
BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

BARE ROOT PLANTING SPECIFICATIONS



CROSS SECTION VIEW OF BARE ROOT PLANTING

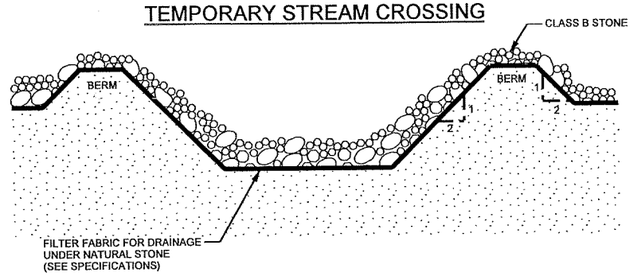
NOTES:
1. PLANT BARE ROOT SHRUBS AND TREES TO THE WIDTH OF THE BUFFER AS SHOWN ON THE PLANS.
2. ALLOW FOR 6-10 FEET BETWEEN PLANTINGS, DEPENDING ON SIZE.
3. LOOSEN COMPACTED SOIL.
4. PLANT IN HOLES MADE BY A MATTOCK, DIBBLE, PLANTING BAR, OR OTHER APPROVED MEANS.
5. PLANT IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.
6. KEEP ROOTS MOIST WHILE DISTRIBUTING OR WAITING TO PLANT BY MEANS OF WET CANVAS, BURLAP, OR STRAW.
7. HEEL-IN PLANTS IN MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL TO PROJECT SITE.



CROSS SECTION VIEW OF CONTAINER PLANTING

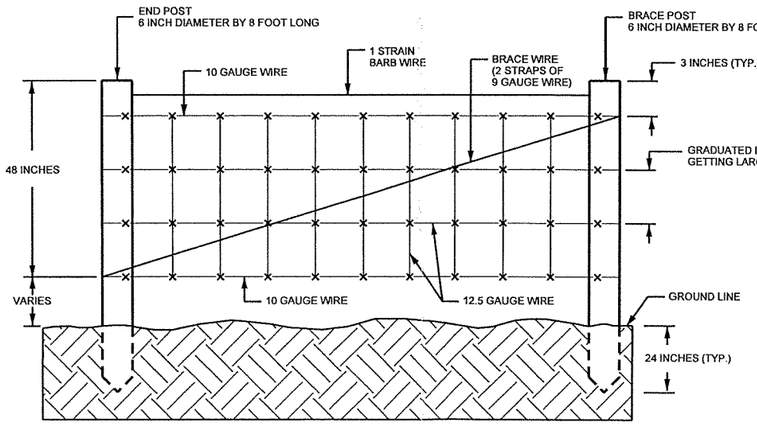
NOTES:
1. WHEN PREPARING THE HOLE FOR A POTTED PLANT OR SHRUB DIG THE HOLE 8 -12 INCHES LARGER THAN THE DIAMETER OF THE POT AND THE SAME DEPTH AS THE POT.
2. REMOVE THE PLANT FROM THE POT. LAY THE PLANT ON ITS SIDE IF NECESSARY TO REMOVE THE POT.
3. IF THE PLANT IS ROOTBOUND (ROOTS GROWING IN A SPIRAL AROUND THE ROOT BALL), MAKE VERTICAL CUTS WITH A KNIFE OR SPADE JUST DEEP ENOUGH TO CUT THE NET OF ROOTS. ALSO MAKE A CRISS-CROSS CUT ACROSS THE BOTTOM OF THE BALL.
4. PLACE THE PLANT IN THE HOLE.
5. FILL HALF OF THE HOLE WITH SOIL (SAME SOIL REMOVED FOR BACKFILL).
6. WATER THE SOIL TO REMOVE AIR POCKETS AND FILL THE REST OF THE HOLE WITH THE REMAINING SOIL.

TEMPORARY STREAM CROSSING



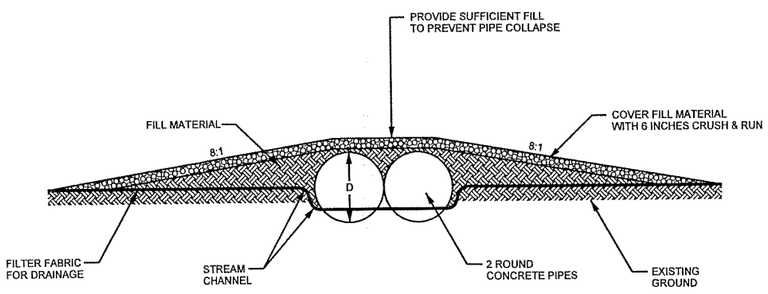
NOTES:
1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.
3. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM. COMPLETE ONE SIDE BEFORE STARTING ON THE OTHER SIDE.
4. INSTALL STREAM CROSSING AT RIGHT ANGLE TO THE FLOW.
5. GRADE SLOPES TO A 2:1 SLOPE. TRANSPLANT SOD FROM ORIGINAL STREAMBANK ONTO SIDE SLOPES.
6. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
7. A STABILIZED PAD OF CLASS A STONE, 6 INCHES THICK, LINED WITH FILTER FABRIC FOR DRAINAGE SHALL BE USED OVER THE BERM AND ACCESS SLOPES.
8. WIDTH OF THE CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE THE LARGEST VEHICLE CROSSING THE CHANNEL.
9. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT USED.

WOVEN FIELD FENCE

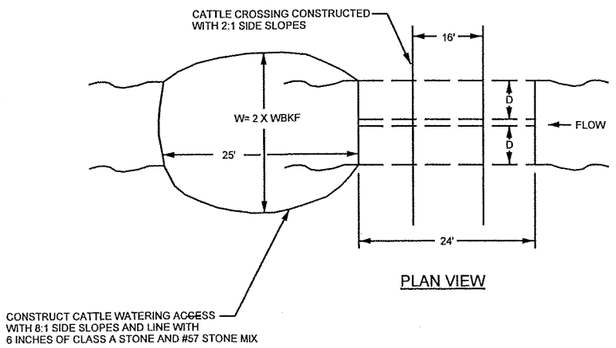


NOTE:
1. END POSTS SHALL BE INSTALLED AT A SPACING OF 10-15 FEET.

PERMANENT STREAM CROSSING

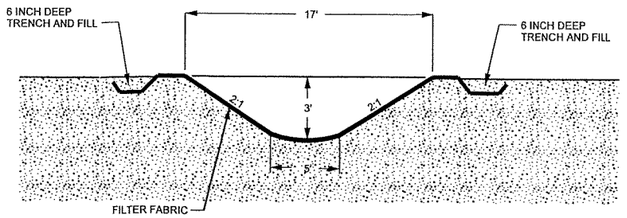


CROSS SECTION VIEW



PLAN VIEW

TEMPORARY DIVERSION CHANNEL



NOTE: RUN FILTER FABRIC LENGTHWISE ALONG DIVERSION DITCH.

7/20/2005
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2/26/03

PROJECT REFERENCE NO.	SHEET NO.
0169	4

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

2-21-05

DATE:

BUCK ENGINEERING
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Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

DUKE POWER EASEMENT

SHERRILL FURNITURE COMPANY
SHERRILL-UPHOLSTERING COMPANY
DB 1475, PG 784
DB 751, PG 211

GATE

WOODS

BEGIN CONSTRUCTION UTIA
STA 10+00.00

10+00 11+00 12+00 13+00 14+00 15+00 16+00

UTIA

MATCHLINE SHEET 5 STA 16+73.05

APPROXIMATE BOUNDARY LINE

TRANSPLANTS

SOUTH FORK

30 15 0 30 60
SCALE (FT)

7/20/2005
I:\0169R\Design\Plans\0169r_southfork_asb_psh_04.dgn

PROJECT REFERENCE NO.	SHEET NO.
0169	5

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 027337 KEVIN L. TWEEDY

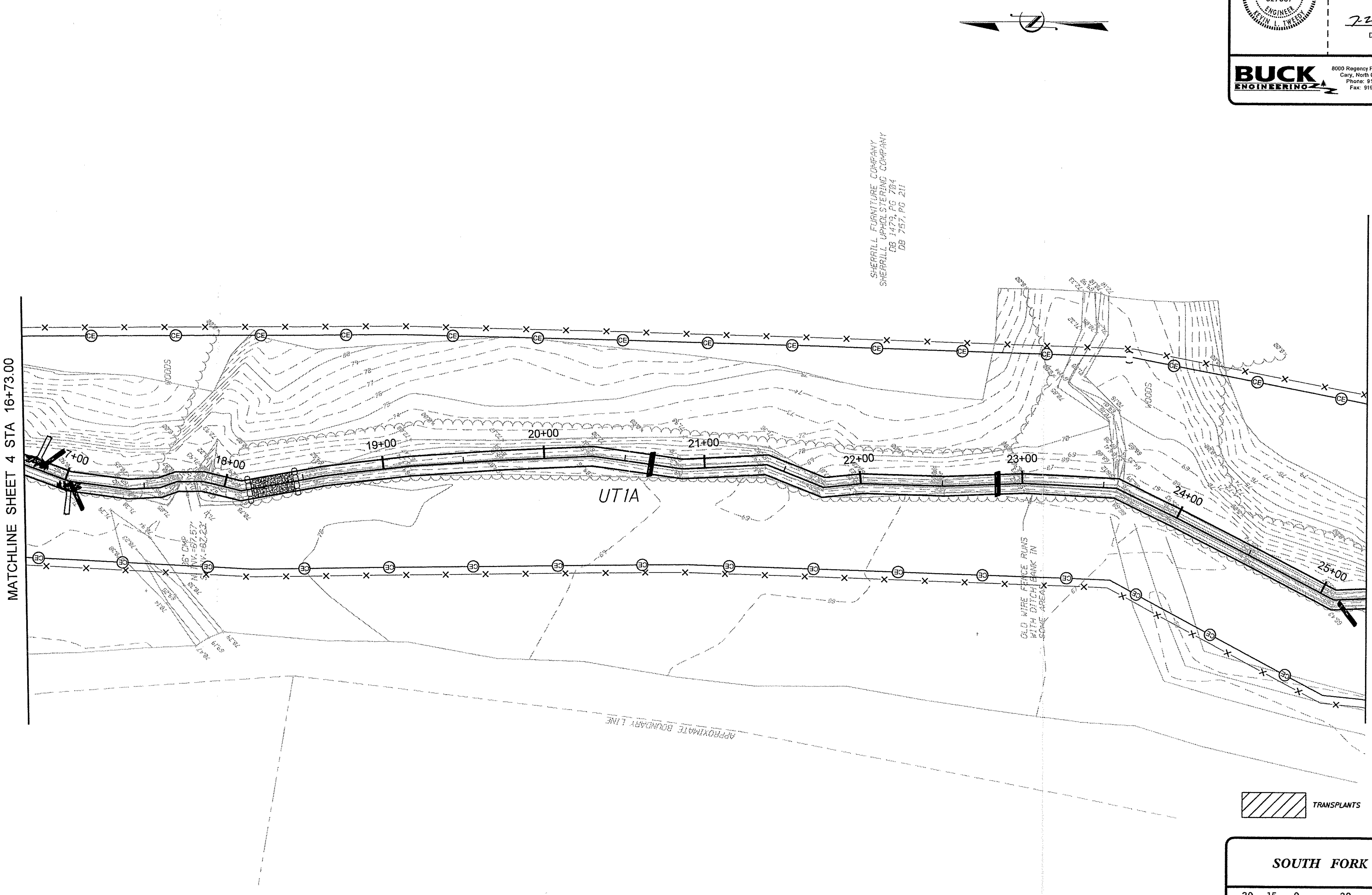
APPROVED BY:

2-21-05

DATE:

BUCK ENGINEERING

8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490



SOUTH FORK

30 15 0 30 60

SCALE (FT)

2/26/03

7/20/2005
r:\0169R\Design\Plans\0169r_southfork_esb_psh_05.dgn

2/25/03

PROJECT REFERENCE NO.	SHEET NO.
0169	6

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

2-21-05

DATE:

BUCK ENGINEERING
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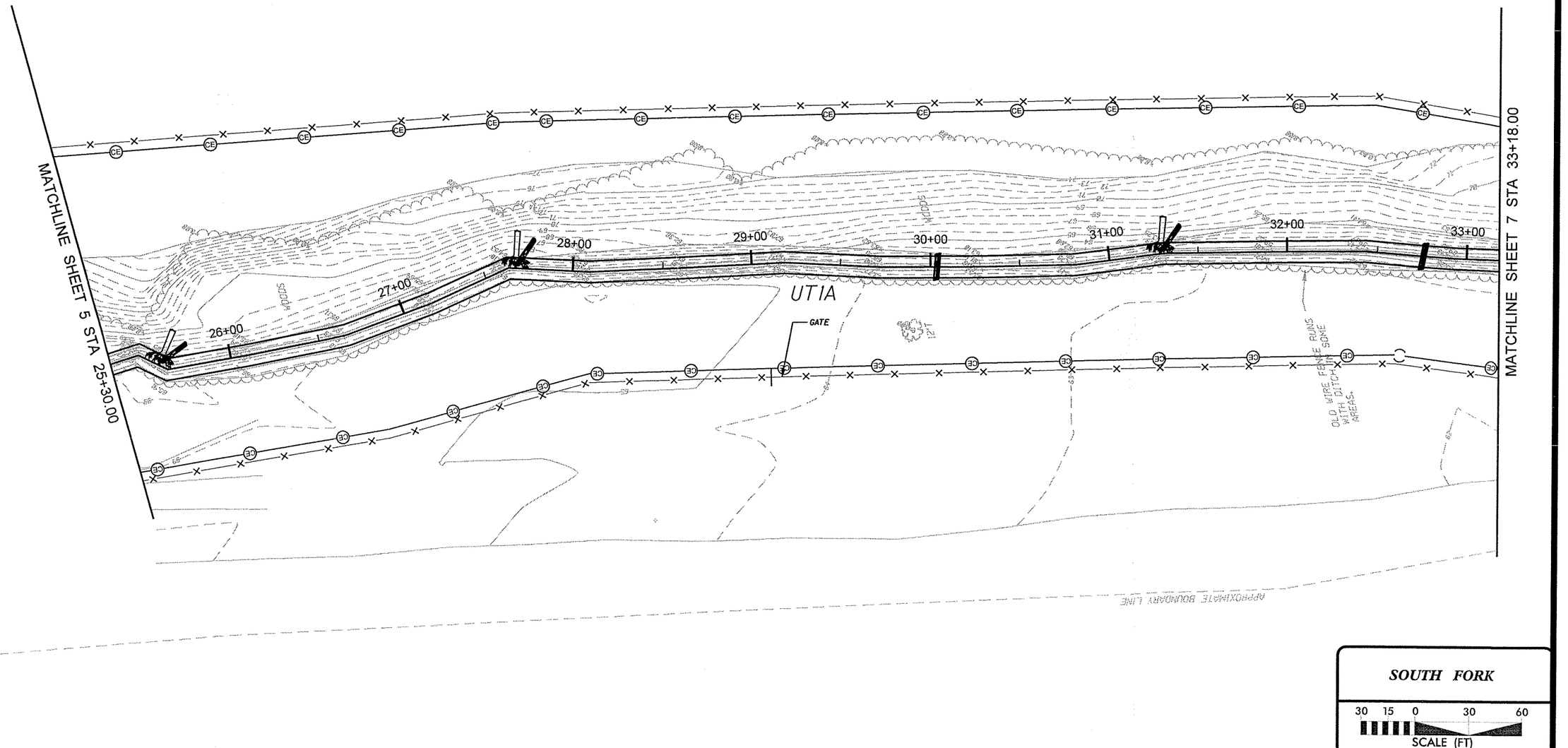
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490



SOUTH FORK

30 15 0 30 60
SCALE (FT)

7/30/2005
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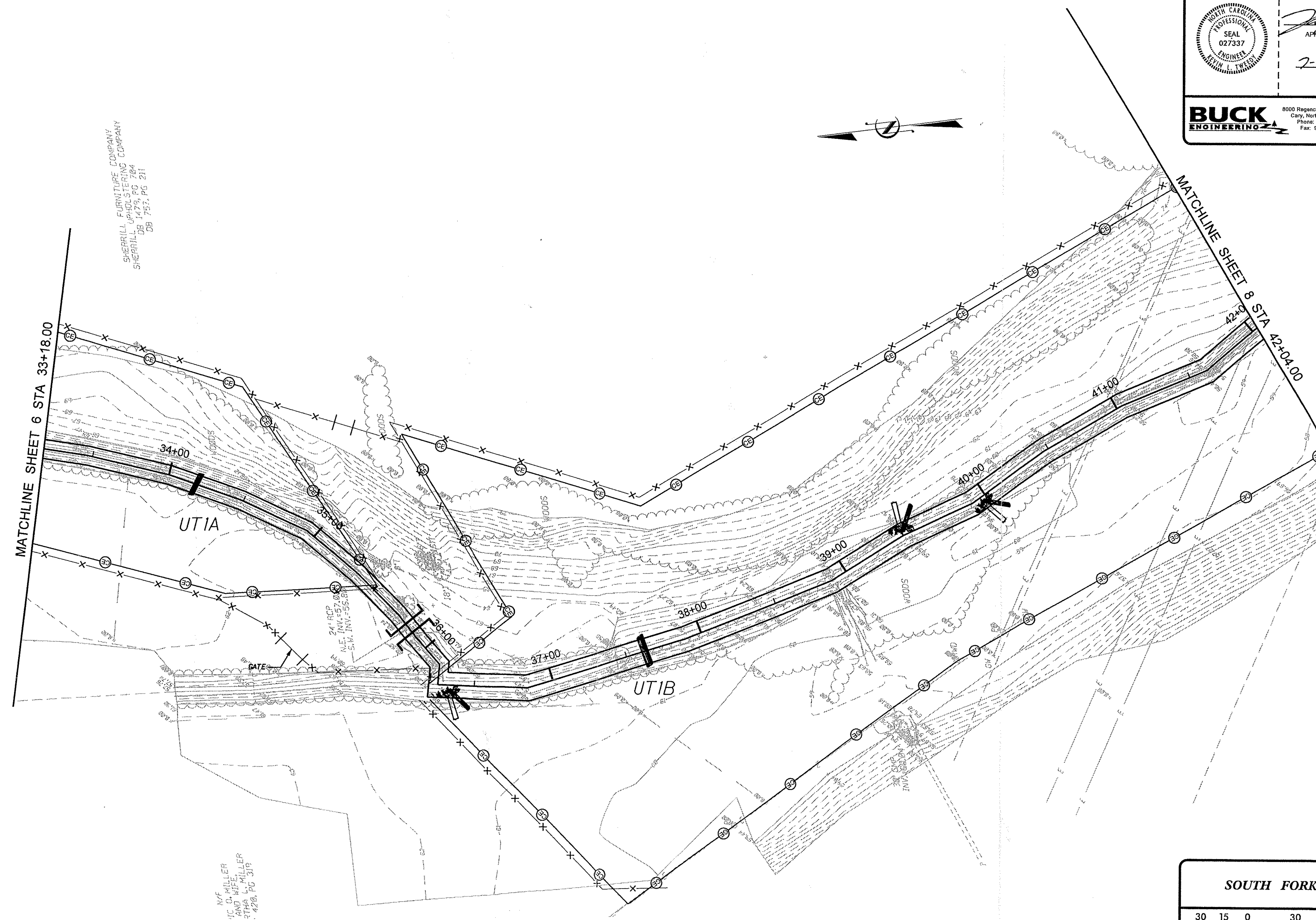


PROJECT REFERENCE NO. 0169

SHEET NO. 7

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

2-21-05

DATE:

BUCK ENGINEERING

8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

SOUTH FORK

30 15 0 30 60

SCALE (FT)

2/26/03

7/20/2005

PROJECT REFERENCE NO. 0169 | SHEET NO. 8

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

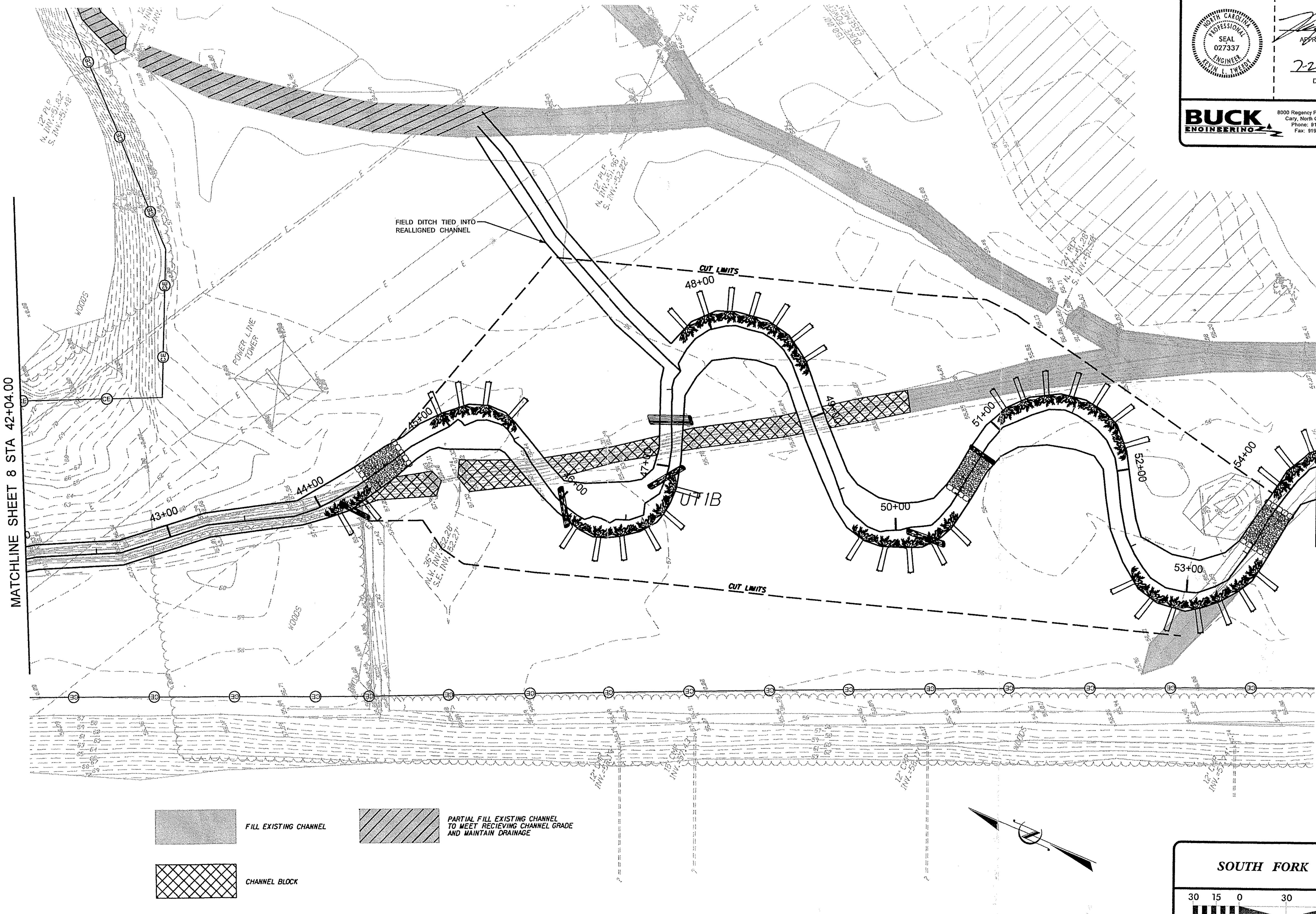
APPROVED BY:

2-21-05

DATE:

BUCK ENGINEERING

8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490



SOUTH FORK

30 15 0 30 60

SCALE (FT)

2/26/03

7/30/2005
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PROJECT REFERENCE NO.	SHEET NO.
0169	9

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

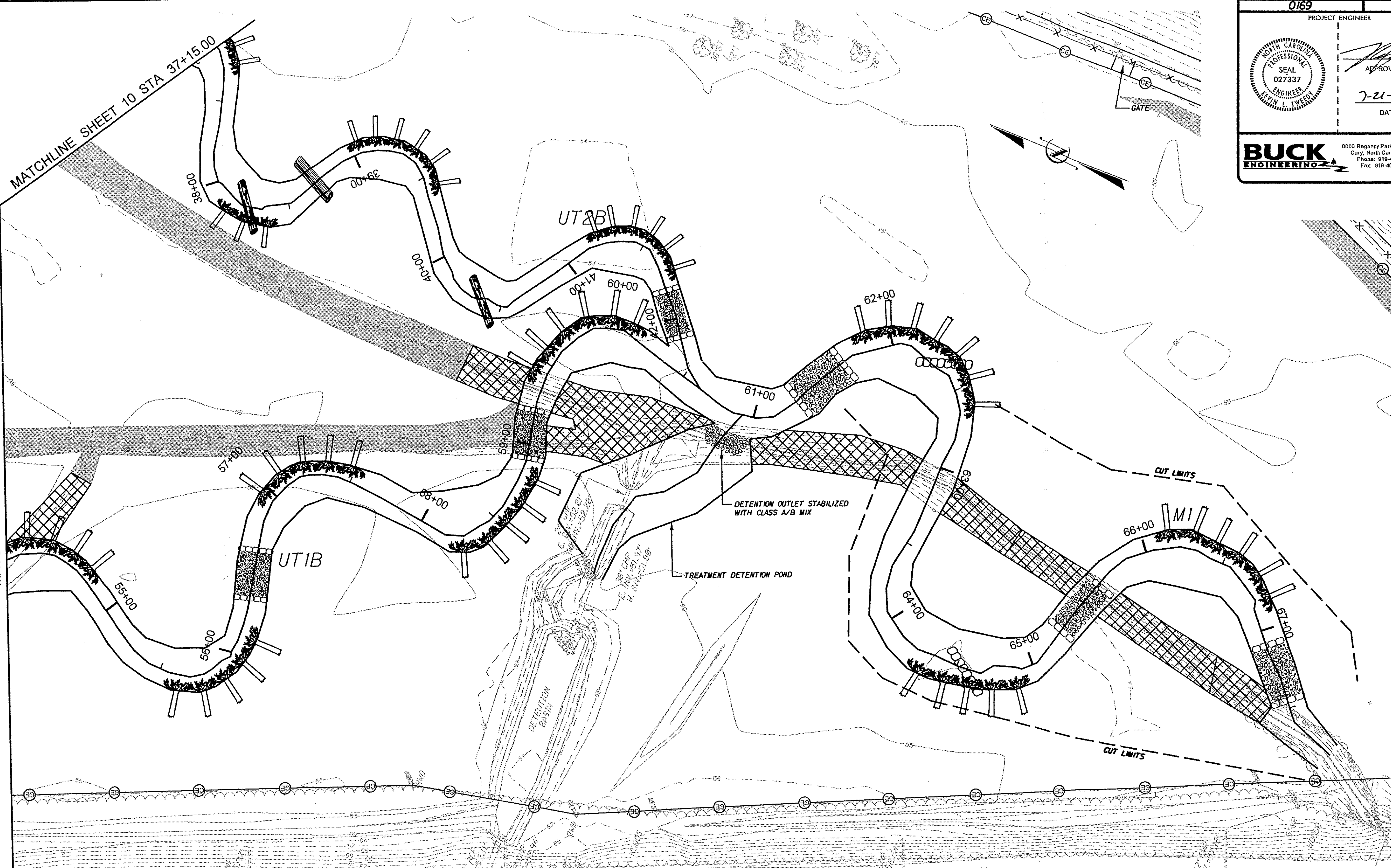
APPROVED BY:

7-21-05

DATE:

BUCK ENGINEERING

8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490



FILL EXISTING CHANNEL

PARTIAL FILL EXISTING CHANNEL TO MEET RECIEVING CHANNEL GRADE AND MAINTAIN DRAINAGE

CHANNEL BLOCK

SOUTH FORK

30 15 0 30 60

SCALE (FT)

2/26/03

7/20/2005
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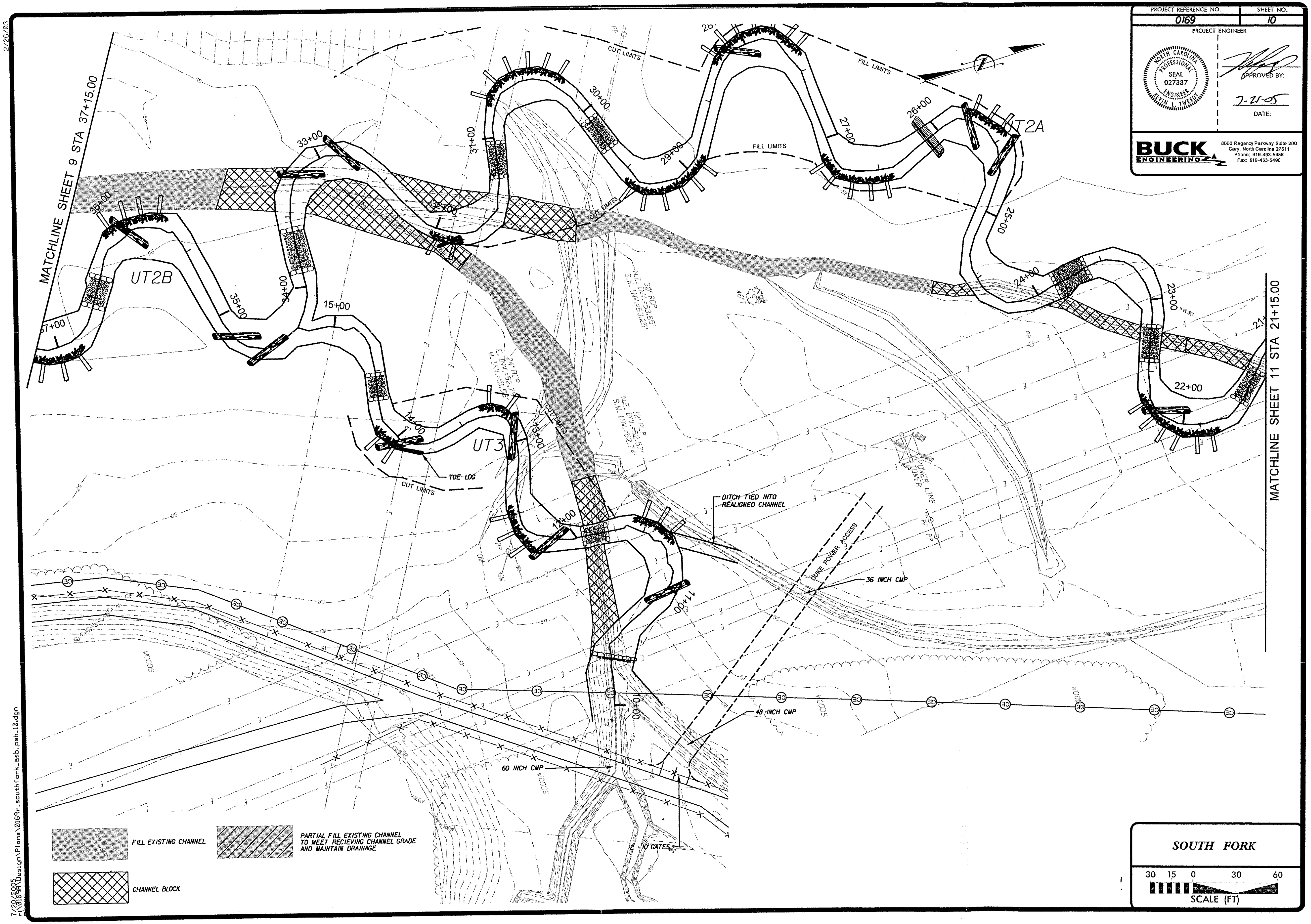

PROJECT REFERENCE NO.
0169
SHEET NO.
10
PROJECT ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY
APPROVED BY:
2-21-05
DATE:
BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490
MATCHLINE SHEET 9 STA 37+15.00
MATCHLINE SHEET 11 STA 21+15.00
UT2A
UT2B
UT3
CUT LIMITS
FILL LIMITS
TOE-LOG
DITCH TIED INTO REALIGNED CHANNEL
DUKE POWER ACCESS
36 INCH CMP
48 INCH CMP
60 INCH CMP
2 - 10' GATES
POWER LINE
WOODS
30" RCP N.E. INV.=53.65' S.W. INV.=53.25'
24" RCP E. INV.=52.7 W. INV.=51.5
12" PIP N.E. INV.=52.57' S.W. INV.=52.74'
FILL EXISTING CHANNEL
PARTIAL FILL EXISTING CHANNEL TO MEET RECIEVING CHANNEL GRADE AND MAINTAIN DRAINAGE
CHANNEL BLOCK
SOUTH FORK
30 15 0 30 60
SCALE (FT)
7/20/2005
r:\0169R\Design\Plans\0169r_southfork_asb_psh_10.dgn
2/26/03

PROJECT REFERENCE NO.	SHEET NO.
169	11

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

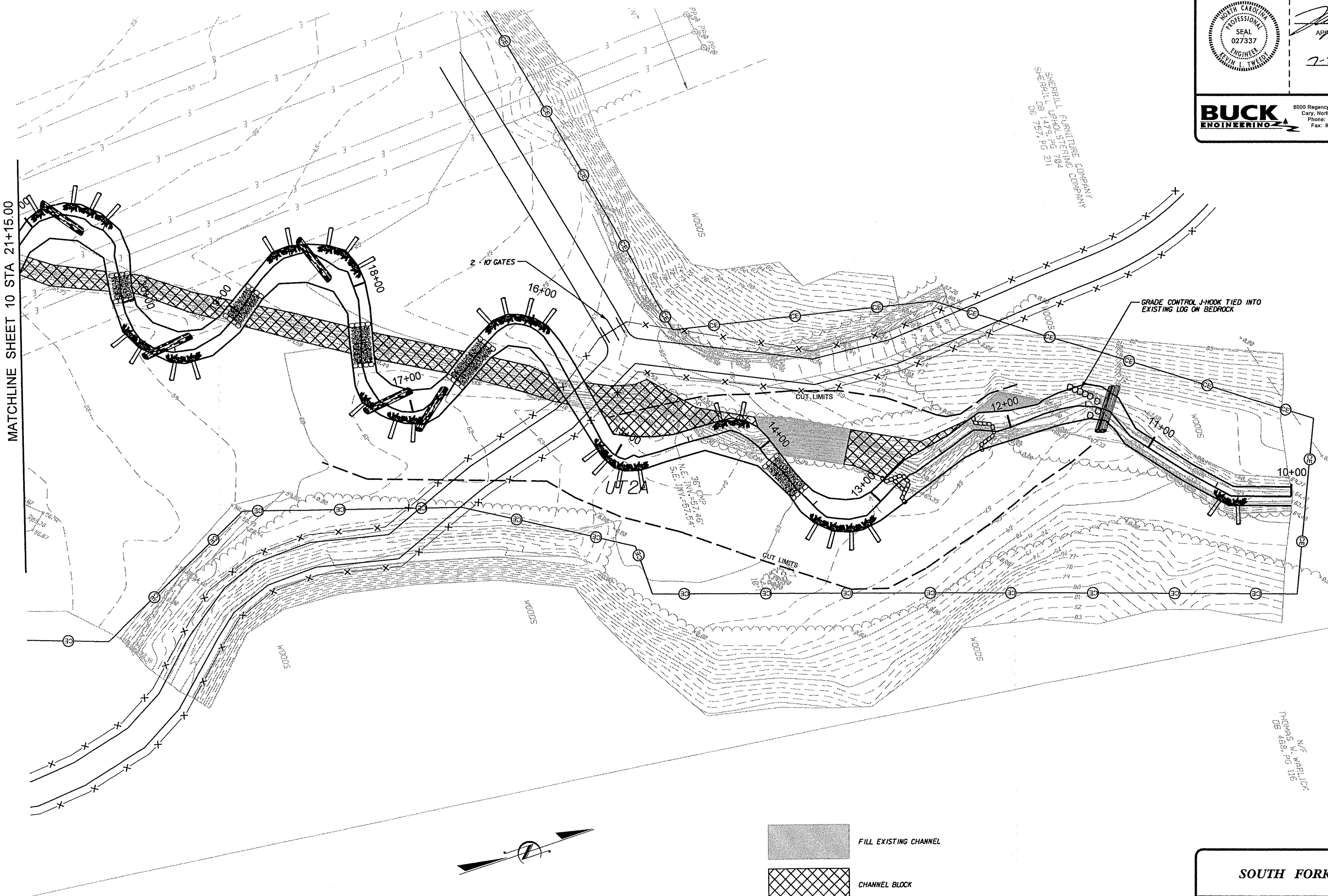
APPROVED BY:

7-21-05

DATE:

BUCK ENGINEERING

8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490



FILL EXISTING CHANNEL

CHANNEL BLOCK

SOUTH FORK

30 15 0 30 60

SCALE (FT)

2/26/03

7/20/2005
r:\0169R\Design\Plans\0169r_southfork_esb_psh_11.dgn

PROJECT REFERENCE NO.	SHEET NO.
169	12

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

7-21-05

DATE:

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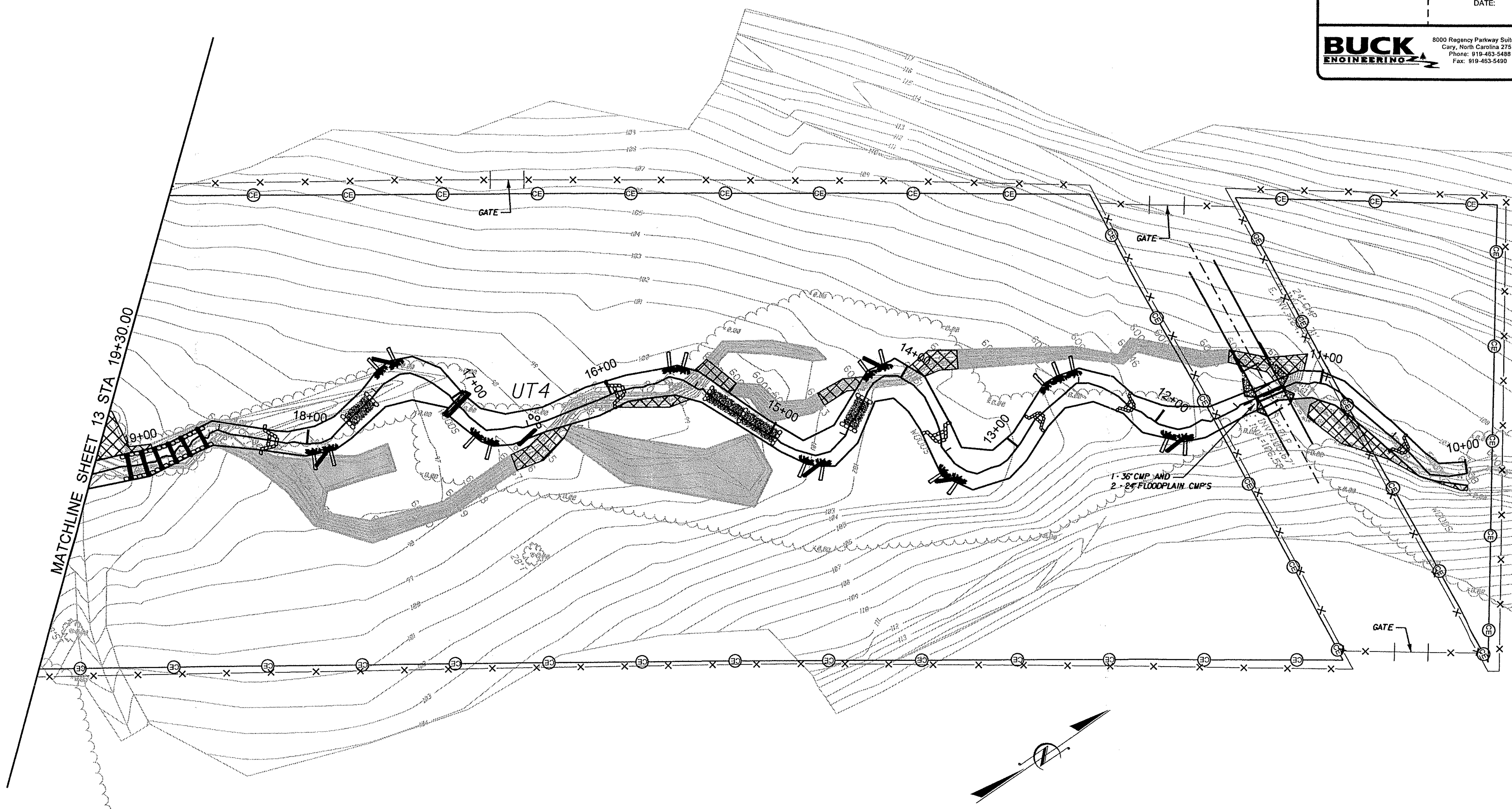
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490



FILL EXISTING CHANNEL

CHANNEL BLOCK

SOUTH FORK

30 15 0 30 60

SCALE (FT)

2/26/03

7/20/2005
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2/26/03

PROJECT REFERENCE NO.	SHEET NO.
169	13

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

2-21-05

DATE:

BUCK ENGINEERING

8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

SHERRILL FURNITURE COMPANY
SHERRILL UPHOLSTERING COMPANY
DB 1479, PG 764
DB 757, PG 211

MATCHLINE SHEET 14 STA 30+17.00

MATCHLINE SHEET 12 STA 19+30.00

MATCHLINE SHEET 16 STA 26+20.00

M2

UT4

UT5

CONSTRUCTED RIFFLE TIED INTO LOG VANE

WOODS

FILL EXISTING CHANNEL

CHANNEL BLOCK

SOUTH FORK

30 15 0 30 60
SCALE (FT)

7/28/2005
I:\2169\Design\Plans\2169r_southfork_asb_psh_13.dgn

PROJECT REFERENCE NO.	SHEET NO.
169	14

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

7-21-05

DATE:

BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

SHERRILL FURNITURE COMPANY
SHERRILL UPHOLSTERING COMPANY
DB 1479, PG 704
DB 757, PG 211

WOODS

39+00 38+00 37+00 36+00 35+00 34+00 33+00

2 - 16' GATES

M1 M2

RWD

GATE

MATCHLINE SHEET 13 STA 30+17.00

FILL EXISTING CHANNEL

CHANNEL BLOCK

SOUTH FORK

30 15 0 30 60
SCALE (FT)

2/26/03

7/20/2005
r:\169RR\Design\Plans\169r_southfork_asb_psh_14.dgn
alsoop

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
169	15

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

7-21-05

DATE:

BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

MATCHLINE SHEET 16 STA 16+20.00

CUT LIMITS

CUT LIMITS

16+00

15+00

14+00

13+00

12+00

11+00

10+00

WOODS

WOODS

WOODS

60' CMP
INV.=104.19'
INV.=104.08'

GATE

UT5

TROY P. CANSLER, JR.
DB 1914, PG 148

SHERRILL FURNITURE COMPANY
SHERRILL UPHOLSTERING COMPANY
DB 704

FILL EXISTING CHANNEL

CHANNEL BLOCK

SOUTH FORK

30 15 0 30 60
SCALE (FT)

7/21/2005
I:\0169R\Design\Plans\0169r_southfork_asb_psh_15.dgn

PROJECT REFERENCE NO.	SHEET NO.
169	16

PROJECT ENGINEER

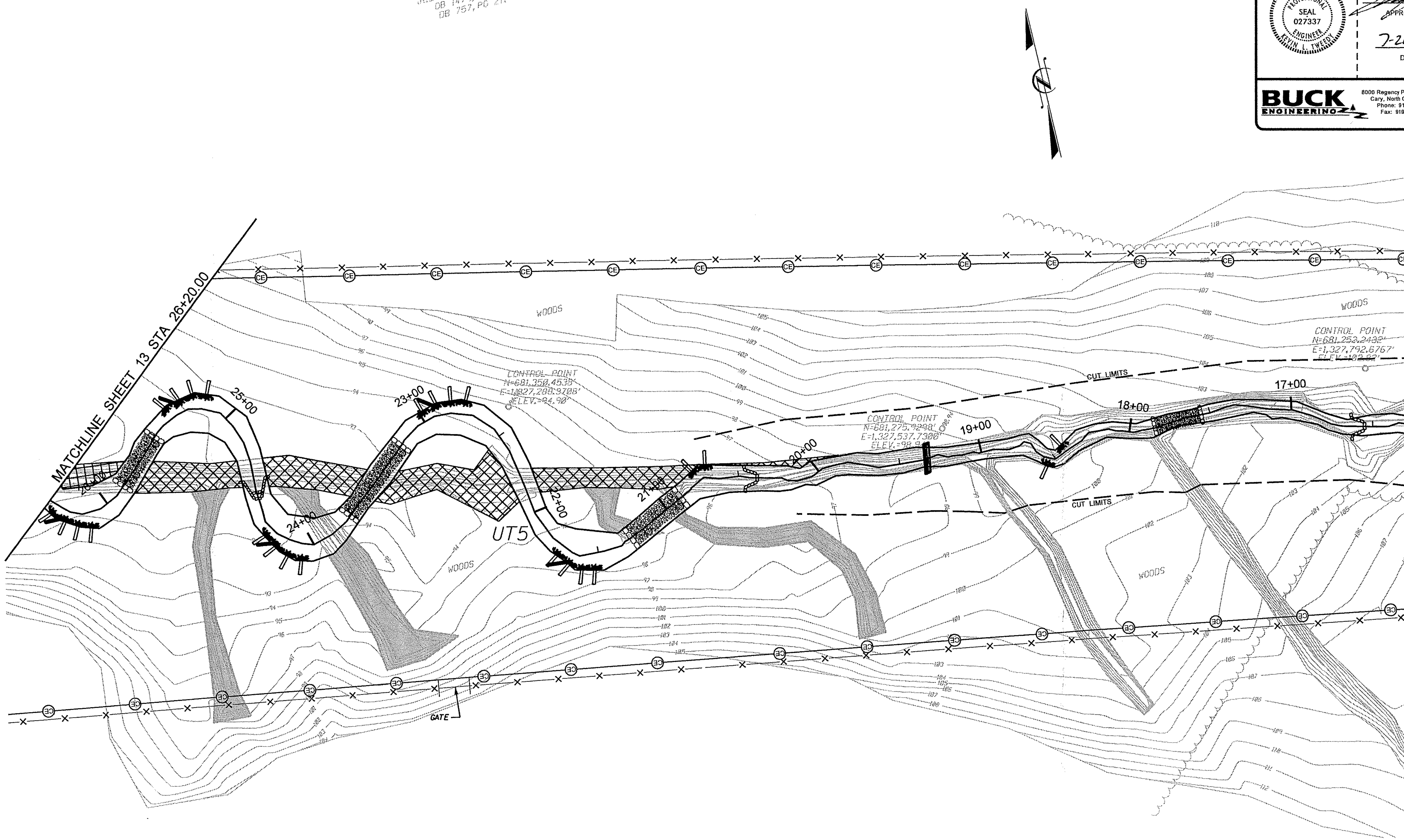
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 027337 KEVIN L. TWEEDY

APPROVED BY:

7-21-05

DATE:

BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490



FILL EXISTING CHANNEL

CHANNEL BLOCK

SOUTH FORK

30 15 0 30 60

SCALE (FT)

7/20/2005
F:\0169R\Design\Plans\0169r_southfork_asb_psh_16.dgn

2/26/03

2/25/03

PROJECT REFERENCE NO.	SHEET NO.
169	17

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN I. TWEEDY

APPROVED BY:

7-21-05

DATE:

BUCK ENGINEERING
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Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490

NAD 83

CONSERVATION EASEMENT BOUNDARY

CONSERVATION EASEMENT BOUNDARY

UT 1A

VEG PLOT #2

MATCHLINE SHEET 18

SITE OVERVIEW

100 50 0 100 200

SCALE (FT)

7/30/2005
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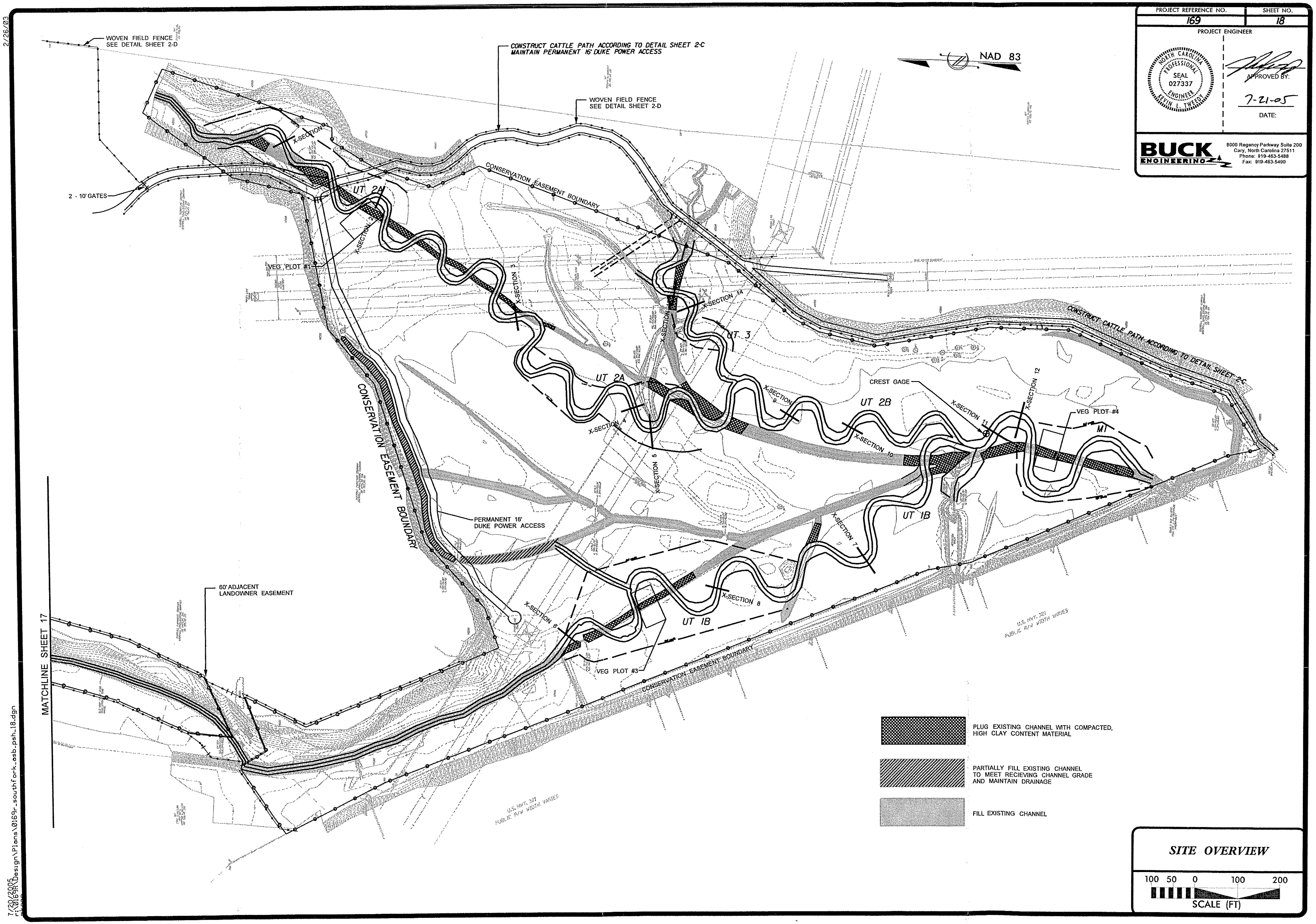
PROJECT REFERENCE NO.
169
SHEET NO.
18
PROJECT ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY
APPROVED BY:
7-21-05
DATE:
BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
Phone: 919-463-5488
Fax: 919-463-5490
NAD 83
WOVEN FIELD FENCE SEE DETAIL SHEET 2-D
CONSTRUCT CATTLE PATH ACCORDING TO DETAIL SHEET 2-C
MAINTAIN PERMANENT 16' DUKE POWER ACCESS
2 - 10' GATES
CONSERVATION EASEMENT BOUNDARY
VEG PLOT #1
VEG PLOT #3
VEG PLOT #4
CREST GAGE
UT 2A
UT 2B
UT 3
UT 1B
M1
X-SECTION 3
X-SECTION 4
X-SECTION 5
X-SECTION 6
X-SECTION 7
X-SECTION 8
X-SECTION 9
X-SECTION 10
X-SECTION 11
X-SECTION 12
X-SECTION 14
PERMANENT 16' DUKE POWER ACCESS
60' ADJACENT LANDOWNER EASEMENT
MATCHLINE SHEET 17
U.S. HWY. 321 PUBLIC R/W WIDTH VARIES
PLUG EXISTING CHANNEL WITH COMPACTED, HIGH CLAY CONTENT MATERIAL
PARTIALLY FILL EXISTING CHANNEL TO MEET RECIEVING CHANNEL GRADE AND MAINTAIN DRAINAGE
FILL EXISTING CHANNEL
SITE OVERVIEW
100 50 0 100 200
SCALE (FT)
2/26/03
7/29/2005
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PROJECT REFERENCE NO.	SHEET NO.
169	19

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 027337 ENGINEER KEVIN L. TWEEDY

APPROVED BY:

7-21-05

DATE:

BUCK ENGINEERING
8000 Regency Parkway Suite 200
Cary, North Carolina 27511
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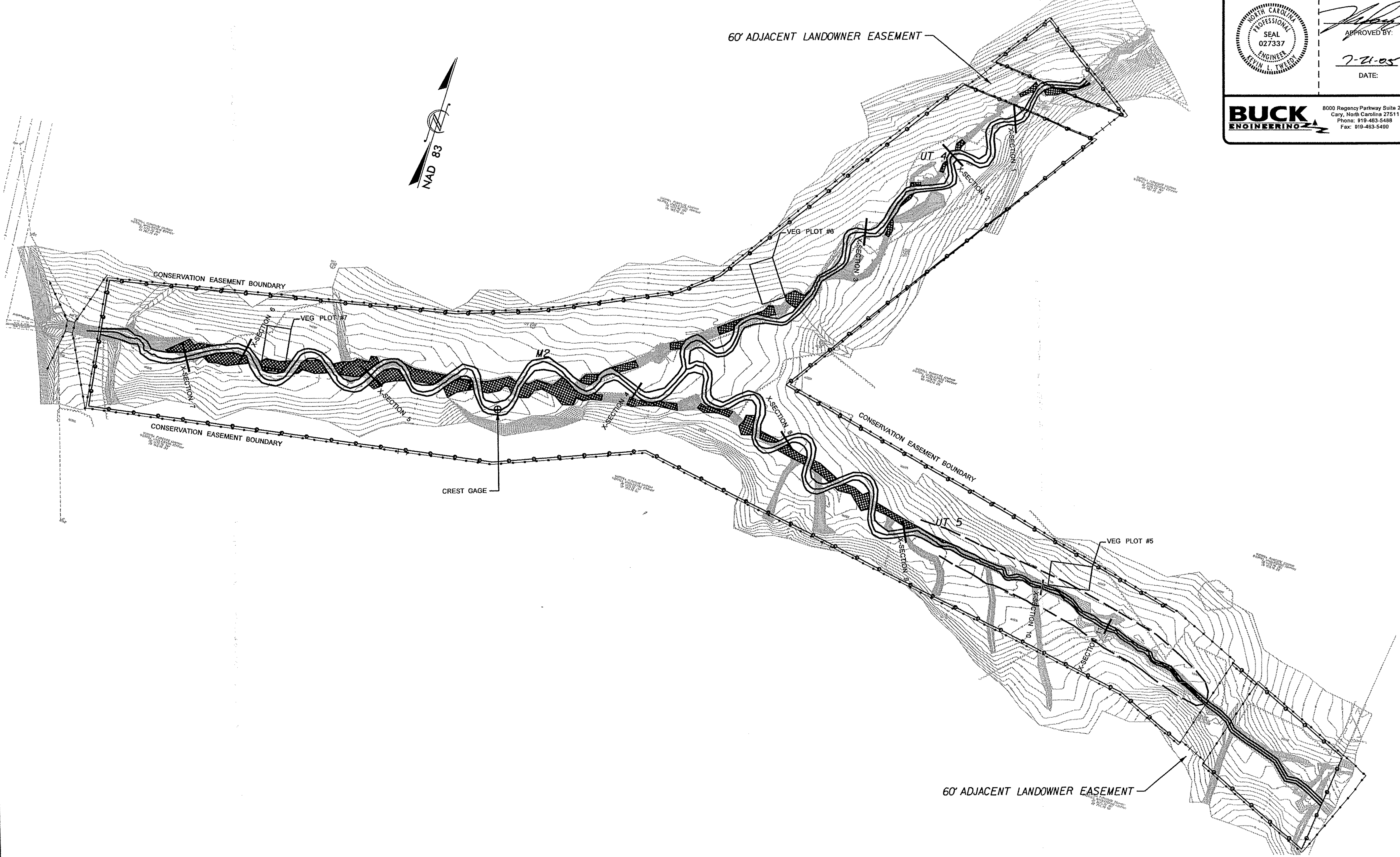

SITE OVERVIEW

100 50 0 100 200

SCALE (FT)

2/26/03

7/20/2005
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