Unnamed Tributary to Tar River
Stream Restoration
Louisburg, Franklin County, North Carolina
Stream Mitigation Report

NCEEP Project Number 234
SCO Number 01-05600-01A
EEP Project Manger: Jeff Schaffer

May 2006

UNNAMED TRIBUTARY TO TAR RIVER STREAM RESTORATION
STREAM MITIGATION REPORT

CONDUCTED FOR THE NORTH CAROLINA DEPARTMENT
OF
ENVIRONMENT AND NATURAL RESOURCES

Table of Contents

LIST OF FIGURES

TABLES

APPENDICIES

I. EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Unnamed Tributary to Tar River Restoration Site encompasses 1,937 linear feet of stream restoration located within the Town of Louisburg, Franklin County, North Carolina. The site was constructed between January 2005 and June 2005. The following report provides the stream restoration information.

The project site begins at NC Highway 39 and continues towards the northeast between Burnette Road and the Green Hill Country Club. The watershed area for this project is 0.61 square miles. The project is fully contained on publicly owned lands.

The town manager of Louisburg, C. L. Gobble, first identified the UT Tar River as a potential restoration site. His main concern was that streambank erosion would undercut Burnette Road. The lack of vegetation on the banks was one of the main causes of degradation along with past alterations to the stream course. Recent utility work by the town also caused additional channel instability. Typical of many urban streams, the UT Tar River channel was an oversized gully. The town had placed riprap in the channel in some areas to prevent undercutting. Vegetation across the site was minimal due to channel degradation and other disturbances. The combination of extreme streambank erosion, lack of vegetation, and a signed conservation easement made this an excellent potential restoration site.

The Priority 2 restoration involved converting the 1,792 linear foot impaired channel into a sinuous channel that meanders for a total of 1,937 linear feet. Rock grade control vanes and rootwads were incorporated for aquatic habitat enhancement and bed and bank stability. A variable width riparian buffer (16'min/150'max) was planted on either side of the stream with native vegetation.

Table I. Project Mitigation Structure and Objectives Table
UT Tar River Stream Mitigation Site/Project No. 234

Project Segment/Reach ID	Mitigation Type	Approach	Linear Footage	Stationing	Ratio
Ut Tar River, 1,792 ft	Restoration	Priority 2	1,937 (CL)	10+00 to 29+37.13	1:1

Monitoring for the site will consist of evaluating both morphology and vegetation. Morphological stability will be monitored by establishing monumented cross-sections, evaluating the longitudinal profile, and conducting pebble counts. Surveys will follow the methodology contained in the USDA Forest Service Manual *Stream Channel Reference Sites*. Vegetation plots will be established to monitor the vegetation. Monitoring will occur after the first growing season and continue annually for a period of 5 years.

II. PROJECT BACKGROUND

The UT Tar River project site is located in the town of Louisburg in Franklin County, North Carolina (**Figure 1**). Louisburg is located approximately 25 miles north of Raleigh along NC Highway 401. WRP previously obtained a conservation easement on the project from the Town of Louisburg and the Green Hill Country Club, Inc. UT Tar River flows from the southwest to the northeast. The project reach is bound on the west by NC Highway 39, Burnette Road along the left bank, and the country club along the right bank. The project ends at the northeastern extent of the conservation easement where the stream will tie into the old channel located on property owned by Raymond E. Burnette, et al. One small tributary and a small drainage flows off of the country club property and into the conservation easement before entering the UT Tar River from the right bank.

A. General Description of the Watershed

UT Tar River, an intermittent stream, is located within the Piedmont Physiographic Province of the Tar River Basin (USGS Cataloging Unit 03020101). The watershed is located to the southeastern section of the Town of Louisburg in Franklin County, North Carolina. The headwaters of the project originate approximately 1.2 miles to the southwest of the restoration site at the dam of a small pond. From the headwaters, the UT Tar River flows for approximately 2 miles before entering the Tar River. Several small drainages enter UT Tar River along its extent, most via culverts under Hwy. 401.

The watershed for UT Tar River is approximately 0.61 square miles (394 Acres). The watershed is oriented southwest to northeast. The topography of the watershed is gently sloping with relatively flat, narrow floodplains. Land surface elevations range from approximately 210 to 300 feet above mean sea level.

B. Pre-existing Conditions

The town manager of Louisburg, C. L. Gobble, first identified the UT Tar River as a potential restoration site. His main concern was that streambank erosion would undercut Burnette Road. The lack of vegetation on the banks was one of the main causes of degradation along with past alterations to the stream course. Recent utility work by the town also caused additional channel instability. Typical of many urban streams, the UT Tar River channel was an oversized gully. The town had placed riprap in the channel in some areas to prevent undercutting. Vegetation across the site was minimal due to channel degradation and other disturbances. The combination of extreme streambank erosion, lack of vegetation, and a signed conservation easement made this an excellent potential restoration site.

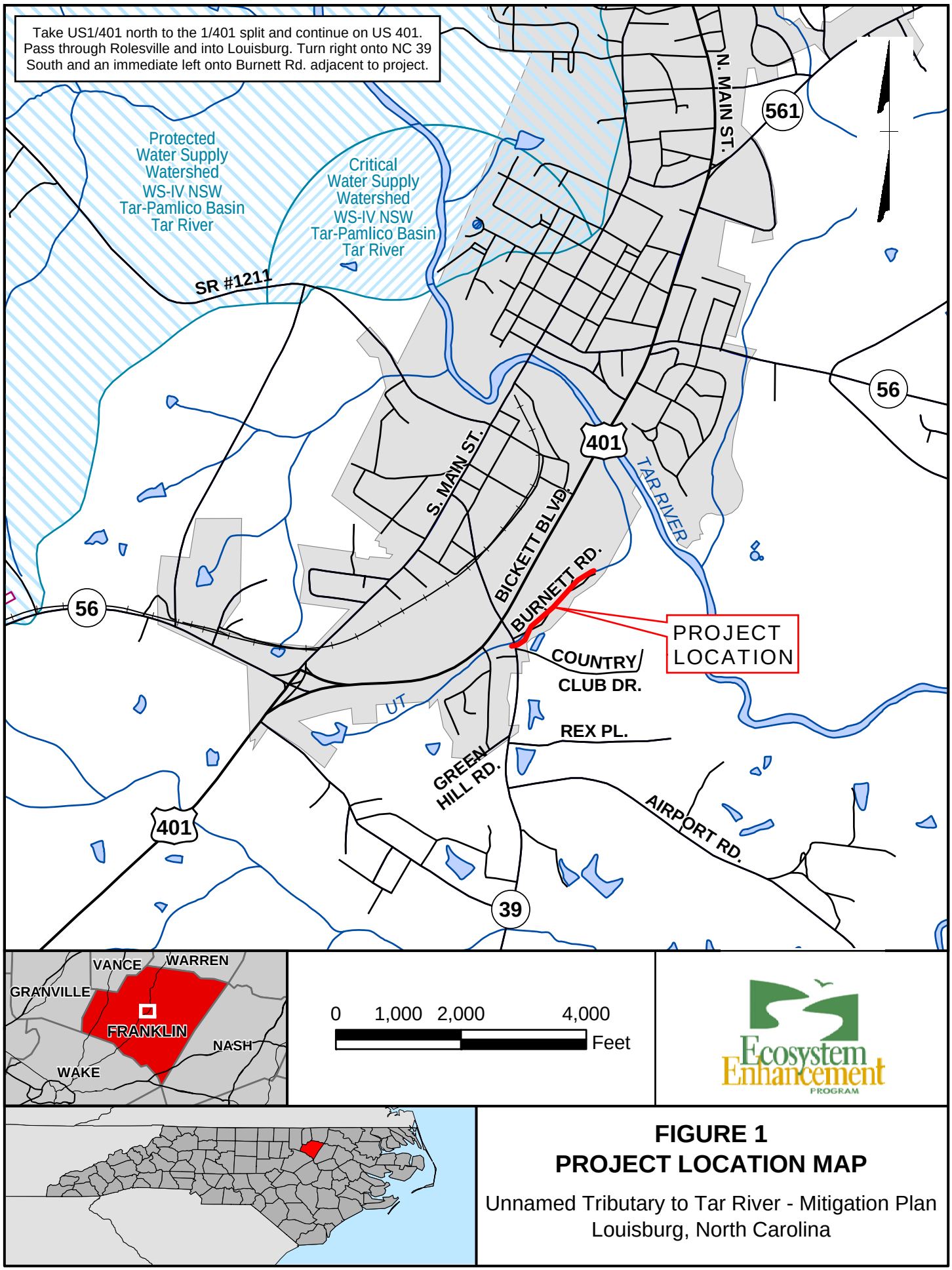


FIGURE 1
PROJECT LOCATION MAP

Unnamed Tributary to Tar River - Mitigation Plan
Louisburg, North Carolina

C. Goals and Objectives

The Priority 2 restoration involved converting the 1,792 linear foot impaired channel into a sinuous channel that meanders for a total of 1,937 linear feet. Rock grade control vanes and rootwads were incorporated for aquatic habitat enhancement and bed and bank stability. A variable width riparian buffer (16'min/150'max) was planted on either side of the stream with native vegetation (**Figure 2**).

This project has the following goals and objectives:

1. Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load.
2. Improve water quality and reduce further property loss by stabilizing eroding streambanks.
3. Reconnect the stream to its floodplain and/or establish a new floodplain at a lower elevation.
4. Improve aquatic habitat with the use of natural material stabilization structures such as root wads, cross-vanes, woody debris, and a riparian buffer.
5. Provide aesthetic value, wildlife habitat, and bank stability through the creation of a riparian zone.
6. Stabilize and enhance the tributary and small drainage that enters the site.

Table II. Project Activity and Reporting History
Unnamed Tributary to Tar River Stream Mitigation Site/Project No. 234

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion Date
Restoration Plan			June 2003
Final Design - 90%			Unknown
Construction			July 26, 2005
Temporary S&E mix applied to entire project area			Throughout Construction
Permanent seed mix applied to entire project area			Throughout Construction
Containerized, B&B, and livestake plantings			December 22, 2005
Mitigation Plan / As-built (Year 0 Monitoring - baseline)	April 2006	April 2006	May 2006
Year 1 Monitoring	Fall 2006		
Year 2 Monitoring	Fall 2007		
Year 3 Monitoring	Fall 2008		
Year 4 Monitoring	Fall 2009		
Year 5 Monitoring	Fall 2010		

K:\65470\GIS\f8_pcond.mxd

Cross Section 1

Cross Section 2

Cross Section 2A

Cross Section 3

VP01

VP02

VP03

VP04

10+00

11+00

12+00

13+00

14+00

15+00

16+00

17+00

18+00

19+00

20+00

21+00

MATCHLINE FIGURE 2B

Legend

- Cross Section
- Roads
- Step Pool
- Culvert
- Rock Sill
- Cross-vane
- Rootwad
- Stream
- Easement Boundary
- Vegetation Plot

Feature	Northing	Easting
X1LPIN	850873.115	2206212.695
X1RPIN	850753.985	2206312.93
X2LPIN	850918.991	2206301.814
X2RPIN	850810.958	2206354.07
X3LPIN	851041.316	2206518.847
X3RPIN	851066.864	2206673.061

N

0 50 100 200 300 Feet

Ecosystem Enhancement PROGRAM

FIGURE 2A
STREAM MITIGATION REPORT
AS-BUILT PLAN VIEW

Unnamed Tributary to Tar River - Mitigation Plan
Louisburg, North Carolina

May 2006

K:\65470\GIS\f8_pcond.mxd

VP01
VP02
VP03
VP04
VP05
VP06
VP07
VP08
VP09

16+00
17+00
18+00
19+00
20+00
21+00
22+00
23+00
24+00
25+00
26+00
27+00
28+00
29+00

Cross Section 4
Cross Section 5

MATCHLINE FIGURE 2A

Legend

- Cross Section
- Roads
- Step Pool
- Culvert
- Rock Sill
- Cross-vane
- Rootwad
- Stream
- Easement Boundary
- Vegetation Plot

Feature	Northing	Easting
X4LPIN	851693.223	2207161.654
X4RPIN	851608.161	2207158.823
X5LPIN	851796.064	2207272.177
X5RPIN	851703.338	2207333.747

N

0 50 100 200 300 Feet

Ecosystem Enhancement PROGRAM

FIGURE 2B
STREAM MITIGATION REPORT
AS-BUILT PLAN VIEW

Unnamed Tributary to Tar River - Mitigation Plan
Louisburg, North Carolina

May 2006

Table III. Project Contact Table **UT Tar River Stream Restoration Site/Project No. 234**	
Designer POC	Earth Tech 701 Corporate Center Drive Suite 475 Raleigh, NC 27607 Bill Jenkins PE (919) 854-6200
Construction Contractor POC	McQueen Construction 619 Patrick Road Bahama, NC 27503 Harvey McQueen (919) 479-4766
Planting Contractor POC	Carolina Environmental Contracting, Inc. P.O. Box 1905 Mount Airy, NC 27030 Joanne Cheatham (336) 320-3849
Seeding Contractor POC	Erosion Solutions 5508 Peakton Dr. Raleigh, NC 27614 Ross Rebne (919) 845-5550
Seed Mix Sources	Not provided by contractor
Nursery Stock Suppliers	Coastal Plain Conservation Nursery (container plants) Ellen Colodney 3067 Conners Drive Edenton, NC 27932 252-482-5707 Cure Nursery (container plants) Jennifer Cure 880 Buteo Road Pittsboro NC 27312 919-542-6186 Gilmore Plant and Bulb Co. Inc. (ball and burlap) Tom Gilmore PO Box 8 Julian, NC 27283 336-685-4451 Foggy Mountain Nursery (live stakes) Glen Sullivan 13213A Hwy 88 W Creston, North Carolina 28615 336-385-2222
Monitoring Performers	Earth Tech 701 Corporation Center Drive, Suite 475 Raleigh, NC 27607 Mr. Ron Johnson (919) 854-6210
Stream Monitoring	Ron Johnson
Vegetation Monitoring	Ron Johnson
Wetland Monitoring	No wetlands monitoring required.

Table IV. Project Background Table **Unnamed Tributary to Tar River Stream Mitigation Site/Project No. 234**	
Project County	Franklin
Drainage Area	
UT Tar River	0.61 sq mi
Drainage impervious cover estimate (%)	> 30 %
Stream Order	
UT Tar River	1st order
Physiographic Region	Piedmont
Ecoregion	Northern Outer Piedmont
Rosgen Classification of As-Built	C
Cowardin Classification	NA
Dominant Soil Types	Chewacla and Wehadkee loam
	Wedowee-Urbanland_Udorthents complex
Reference site ID	C5 UT Lake Lynn (Wake), C4 UT Hare Snipe Creek (Wake)
USGS HUC for Project	03020101
USGS HUC for Reference	Ut Lake Lynn 03020201, UT Hare Snipe Creek 03020201
NCDWQ Sub-basin for Project	030301
NCDWQ Sub-basin for Reference	Ut Lake Lynn 030402, UT Hare Snipe Creek 030402
NCDWQ Classification for Project	Not Assigned
NCDWQ Classification for Reference	UT Lake Lynn B-NSW, UT Hare Snipe Creek C-NSW
Any portion of any project segment 303D listed?	No
Any portion of any project segment upstream of a 303D listed segment?	No
Reasons for 303D listing or stressor	NA
% of project easement fenced	<5%

III. PROJECT CONDITION AND BASELINE MONITORING RESULTS

A. Vegetation Assessment

1. Vegetative Success Criteria

The final vegetative success measure will be the survival of 260 5-year old planted trees per acre at the end of year 5 of the monitoring period. An interim measure of vegetation planting success will be the survival of at least 320 3-year old planted trees per acre at the end of year three of the monitoring period.

2. Soil Data

Table V. Preliminary Soil Data
UT Tar Stream Mitigation Site/ Project No. 234

Series	Max Depth (in.)	% Clay on Surface	K	T	OM%
Chewacla and Wehadkee Loam	62	6-35	0.28-0.32	5	1-5
Wedowee Sandy Loam	62	5-45	0.24-0.28	4	0.5-3
Wedowee-Urbanland-Udorthents Complex	62	5-20	0.24-0.28	4	0.5-3

3. Stem Counts

Baseline vegetation plots were established on January 31, 2006 after vegetative planting was completed in December 2005. Nine (9) vegetation survival plots were staked out in the floodplain of UT Tar River. Eight (8) of these plots measured 10m X 10m. The final plot measured 5m X 20m to enable placement within the easement area. Stems were flagged and counted. Survival of rooted vegetation will be evaluated using the nine plots and will continue for at least 5 years to determine survival.

Tree species planted include hackberry (*Celtis laevigata*), green ash (*Fraxinus pennsylvanica*), cherrybark oak (*Quercus pagodafolia*), water oak (*Quercus nigra*), willow oak (*Quercus phellos*), river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), and black gum (*Nyssa sylvatica*). Live stakes and shrubs were also planted in this project. Live stake species including silky dogwood (*Cornus amomum*), buttonbush (*Cephalanthus occidentalis*), silky willow (*Salix sericea*), black willow (*Salix nigra*), and elderberry (*Sambucus canadensis*) were planted along the channel and tops of the bank. Shrub species were planted in the floodplain and concentrated along the tops of the bank and include elderberry, spicebush (*Lindera benzoin*), tag alder (*Alnus serrulata*), wax myrtle (*Myrica cerifera*), clematis (*Clematis virginiana*), and possumhaw (*Viburnum nudum*).

Table VII. Stem Counts for Each Species Arranged by Plot UT Tar River/ Project No. 234										
Species	**Plots**									**Initial Totals**
	1	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	
Trees										
Nyssa sylvatica	2	2	2	1	1	1	1	2	1	13
Quercus pagodafolia	2	2	1	1	0	2	0	1	1	10
Fraxinus pennsylvanica	3	0	0	1	1	1	0	0	1	7
Betula nigra	1	6	1	1	1	1	2	1	3	17
Celtis laevigata	2	1	1	1	1	1	2	1	0	10
Platanus occidentalis	2	2	0	0	0	0	2	1	2	9
Quercus nigra	0	0	2	1	2	1	0	0	2	8
Quercus phellos	2	3	0	0	0	1	2	0	0	8
Totals	**14**	**16**	**7**	**6**	**6**	**8**	**9**	**6**	**10**	**82**
Shrubs										
Sambucus canadensis	0	0	0	0	0	0	0	0	2	2
Viburnum nudum	0	0	0	0	0	2	1	0	2	5
Lindera benzoin	0	0	0	0	0	0	0	0	0	0
Alnus serrulata	0	0	0	0	0	1	1	0	1	3
Myrica cerifera	1	0	1	0	1	0	1	0	1	5
Clematis virginiana	0	2	0	0	0	0	0	2	0	4
Totals	**1**	**2**	**1**	**0**	**1**	**3**	**3**	**2**	**6**	**19**

The initial vegetation assessment revealed an average of 369 trees per acre across the restoration easement area. If shrubs are included in the estimate then the average stem density is increased to 454 stems per acre.

4. Vegetation Plot Photos

Photos of the vegetation plots are located in Appendix A.

B. Stream Assessment

1. Chanel Stability Success Criteria

The restored reach should remain stable or if changes occur the movement should be in the direction of increased stability. There should be insignificant changes in channel cross-section and longitudinal profile from the as-built condition. The pool/riffle spacing should remain constant. Pools should not be filling in or riffles starting to change to pools. Pebble counts should show a coarsening of the bed material.

2. Morphometric Criteria

Cross-section and longitudinal surveys were performed on December 8, 2005. Five cross-sections and approximately 1,937 linear feet of stream were surveyed. Photographs were

taken at all permanent photo points and a bed material analysis was performed on April 5, 2006.

The assessment included the survey of five total cross sections, as well as the longitudinal profile. Cross sections were marked with wooden stakes. Cross sections are located at the following locations.

Cross Section #1, Station 1+94, midpoint of pool
Cross Section #2, Station 2+91, midpoint of riffle
Cross Section #3, Station 6+65, midpoint of riffle
Cross Section #4, Station 16+42, midpoint of riffle
Cross Section #5, Station 18+49, midpoint of run

All of the cross sections appeared stable with little or no active bank erosion. Survey data collected during future monitoring periods may vary depending on actual rod placement and alignment; however, from this point forward this information should remain similar in overall appearance.

3. Hydrologic Criteria

Monitoring requirements state that at least two bankfull events must be documented through the five-year monitoring period. No surface water gauges exist on UT Tar River or its tributaries. A review of known U.S. Geological Survey (USGS) surface water gauges identified three surface water gauges within 20 miles of the mitigation site: one on the Tar River at Louisburg (427.0 square miles), one on Swift Creek at Hilliardston (166.0 square miles), and one on Little Fishing Creek west of White Oak (177.0 square miles). None of the three sites have a comparable drainage area to the UT Tar River (0.61 square miles) and do not appear to be suitable for use in determining occurrence of bankfull events. Evidence of one near bankfull event was photographed on 6-8-2005 and is shown in Appendix B. In order to determine future bankfull events for the site it may be necessary to install a stream gauge onsite since comparison to nearby gauges will not be possible given the large difference in watershed area between existing stream gauges and the project stream.

Table VIII. Verification of Bankfull Events
UT Tar River Stream Mitigation Site/Project No. 234

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
2005	Approx. 6-8-2005	Photographic - **Near Bankfull**	Appendix B-3

Table X. Categorical Stream Feature Visual Stability Assessment UT Tar River Stream Mitigation Site/Project No. 234					
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**
A. Riffles	100%				
B. Pools	100%				
C. Thalweg	100%				
D. Meanders	100%				
E. Bed General	100%				
F. Vanes/J Hooks etc.	100%				
G. Wads and Boulders	100%				

Tables XI and XII provide baseline morphology and hydraulic information for the restored stream reach.

C. Wetland Assessment

There is no wetland restoration associated with this site therefore this table is not applicable to this project.

Table XI. Baseline Morphology and Hydraulic Summary
UT Tar River Stream Mitigation Site/Project No. 234

Parameter	USGS Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)				5.5	21.0	11.3	10.2	13.8		10	19.1				18.0	17.6	25.2	20.5
BF Cross Sectional Area (ft^2)				6.2	28	15.3	20.8	28.1		5.5	23.4				24.5	19.8	35.1	23.3
BF Mean Depth (ft)				0.75	2.1	1.4			2.0	0.55	1.22				1.38	1.0	1.4	1.25
BF Max Depth (ft)							2.8	3.3		1.0	2.26				2.2	2.0	2.7	2.35
Width/Depth Ratio							5.0	6.8		10.3	20.6				13.2	13.0	20.2	18.7
Entrenchment Ratio							3.9	4.0		1.9	6.6				2.2	2.4	5.0	3.4
Wetted Perimeter (ft)																20.3	28.0	22.6
Hydraulic radius (ft)																0.90	1.3	1.08
Pattern																		
Channel Beltwidth (ft)							8	30		17	41		23	58		29	66	43
Radius of Curvature (ft)							10	60		12	81		36	72		28	58	34.5
Meander Wavelength							265	470		42	59		59	84		80	165	121
Meander Width ratio							0.7	2.5		1.3	3.2		1.3	3.2		1.64	2.61	2.2
Profile																		
Riffle length (ft)							14	316	83							1.50	51.70	13.10
Riffle slope (ft/ft)							0.0018	0.0171	.0115	0.0085	0.075		0.0085	0.0333		0.00	0.04	0.01
Pool length (ft)							10	102	42							3.30	20.70	9.80
Pool spacing (ft)							33	379	226	32	75		32	75		13.60	158.30	57.93
Substrate																		
d50 (mm)							0.5	1.0		0.25	0.5					0.062	0.25	
d84 (mm)							5.7	8.0		11.3	16.0					0.25	0.5	
Additional Reach Parameters																		
Valley Length (ft)									1662									1662
Channel Length (ft)									1792									1937
Sinuosity									1.07	1.25	1.7				1.25			1.17
Water Surface Slope (ft/ft)									0.0068	0.0050	0.0161				0.0042			0.01
BF slope (ft/ft)									0.0061									0.01
Rosgen Classification									E5	C4	C5				C4			
Habitat Index																		
Macrobenthos																		

Table XII. Morphology and Hydraulic Monitoring Summary
UT Tar River Stream Mitigation Site/Project No. 234

Parameter	Cross Section 1			Cross Section 2			Cross Section 3			Cross Section 4			Cross Section 5		
	1+94 Pool			2+91 Riffle			6+65 Riffle			16+42 Riffle			18+49 Run		
Dimension	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2	MY0	MY1	MY2
BF Width (ft)	22.9			25.2			17.6			21.0			20.0		
Floodprone Width (ft) (approx)				91			100+			90			>100		
BF Cross Sectional Area (ft^2)	21.7			35.1			23.7			22.9			19.8		
BF Mean Depth (ft)	0.9			1.4			1.4			1.1			1.0		
BF Max Depth (ft)	2.6			2.4			2.7			2.3			2.0		
Width/Depth Ratio				18.0			13.0			19.3			20.2		
Entrenchment Ratio				3.6			5.6			4.3			5.0		
Wetted Perimeter (ft)				28.0			20.3			23.2			22.0		
Hydraulic radius (ft)				1.3			1.17			1.0			0.9		
Substrate															
d50 (mm)	.125-.25			.125-.25			.125-.25			.125-.25			.062-.125		
d84 (mm)	.25-.5			.25-.5			.25-.5			.25-.5			.25-.5		

Parameter	MY-01 (2006)			MY-02 (2007)			MY-03 (2008)			MY-04 (2009)			MY-05 (2010)			MY+ (2011)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)																		
Radius of Curvature (ft)																		
Meander Wavelength (ft)																		
Meander Width Ratio																		
Profile																		
Riffle Length (ft)																		
Riffle Slope (ft/ft)																		
Pool length (ft)																		
Pool spacing (ft)																		
Additional Reach Parameters																		
Valley Length (ft)																		
Channel Length (ft)																		
Sinuosity																		
Water Surface Slope (ft/ft)																		
BF Slope (ft/ft)																		
Rosgen Classification																		
Habitat Index*																		
Macrobenthos*																		

Appendix A

Vegetation Raw Data

A-1 Vegetation Raw Data

A-2 Vegetation Survey Data Tables

A-3 Vegetation Monitoring Plot Photos

UT Tar		Date	1-31-06			
AS-BUILT VEGETATION MONITORING		Investigator	G. Lankford IL Lapp			
Species		Plots				
		VP 01	VP 02	VP 03	VP 04	
	Plots Disturbed?	X				
	Type of Disturbance?					
	Spacing Distance (ft)	8-12'				
Trees						
Hackberry	Celtis laev.	•• (2)	• (1)	• (1)	• (1)	
G. Ash	Fraxinus penn	••• (3)			• (1)	
→ Oak - Cherrybark water oak	Quercus pag.	•• (2)	•• (2)	• (1)	• (1)	
Blk Gum	Nyssa Sylv.	•• (2)	•• (2)	•• (2)	• (1)	
Oak - willow	Q phellos	•• (2)	••• (3)			
Sycamore	Platanus occ.	•• (2)	•• (2)			
✓→ R. Birch	Betula nigra	• (1)	•••••• (6)	• (1)	• (1)	
W. Oak	Q. nigra			•• (2)	6 (1)	
Shrubs						
Wax myrtle	Myrica cerf.	• (1)		• (1)		
Viburnum	Viburnum rufidum					
Clematis	Clematis virg		•• (2)			
Exotic Species						
Trees		14	18	7	6	
Shrubs		1	2	1	0	
Total		15	20	8	6	

Photos

Comments (label by plot):

1,2✓ VP 01 - 5x20 m plot — shallow depression near base of Rd embankment

3,4 VP 02 - 10x10 m plot — one corner difficult to drive stakes/corner - old construction entrance

5,6 VP 03 10x10 m plot — shallow depressional area near base of Rd embankment

7,8 VP 04 10x10 M plot — shallow depression centrally located in downhill half. No planted veg in half near Rd

UT Tar		Date 1-31-06			
AS-BUILT VEGETATION MONITORING		Investigator G. Lankford K. LAPP			
Species		Plots			
		VP 05	VP 06	VP 07	VP 08
	Plots Disturbed?				
	Type of Disturbance?				
	Spacing Distance (ft)	10-14'	8-12		
Trees					
Water Oak	Quercus nigra	•• (3)	• (1)		
BK Gum	Nyssa sylvatica	• (1)	• (1)	• (1)	•• (2)
R. Birch	Betula nigra	• (1)	• (1)	•• (2)	• (1)
Hackberry	Celtis laev.	• (1)	• (1)	•• (2)	• (1)
Green Ash	Fraxinus penn	• (1)	• (1)		
Oak - Cherrybark	Q. pag.		•• (2)		• (1)
Oak - willow	Q. phellos		• (1)	•• (2)	
Sycamore	Platanus occ.			•• (2)	• (1)
Shrubs					
Wax Myrtle	Myrica cerifera	• (1)		• (1)	
Viburnum	Viburnum sp.		•• (2)	• (1)	
T. alder	Alnus serr.		• (1)	• (1)	
Clematis	Clematis virg.				•• (2)
Exotic Species					
Trees		~~7~~	8	9	6
Shrubs		1	3	3	2
Total		8	11	12	8

Photos

9,10 11,12 13,14 15,16

Comments (label by plot):

VP05 - 10 x 10 M plot - Limited trees/shrubs planted near Rd vehicle & store in Background (Pic 12)

VP06 - 10 x 10 M plot - Planted trees nearly absent near Rd half of plot. (~ 12-14' of plot

VP07 10 x 10 M plot } side by side Plots, Ruts in plot 8 - corner

VP08 10 x 10 M plot } near 7 at Rd doesn't appear significant Planted tree absent near Rd (outside 12 feet of plot)

ET#65470

UT Tar		Date 1-31-06			
AS-BUILT VEGETATION MONITORING		Investigator G. Lankford K. Lapp			
Species		Plots			
		VP 09			
	Plots Disturbed?				
	Type of Disturbance?				
	Spacing Distance (ft)				
Trees					
Oak - Water	Quercus nigra	•• (2)			
R. Birch	Betula nigra	••• (3)			
Sycamore	Platanus occ.	•• (2)			
G. Ash	Fraxinus penn	• (1)			
Blk Gum	Nyssa sylv.	• (1)			
Oak - Cherrybark	Q. pag.	• (1)			
Shrubs					
Viburnum	Viburnum nudum	•• (2)			
Elderberry	Sambucus cana.	•• (2)			
Wax Myrtle	Myrica cerifi	• (1)			
Tag Alder	Alnus serr.	• (1)			
Clematis	Clematis virg.				
Exotic Species					
Trees		10			
Shrubs		6			
Total		16			

Comments (label by plot):

Photo 17, 18 VP09 10x10m plot Only Plot on Rt Bank of stream mature tree shelter eastern edge Plots 7 and 8 in background of Pic 18

Appendix A-2
UT Tar River Stream Restoration
EEP Site Number 234
January 2006 As-Built

	Stem Counts for each species arranged by plot												
	Species	**Plots***									**Initial Totals**	**Year 1 Totals**	**Survival %**
		Main Channel							**Trib**				
Scientific Name	**Common Name**	**VP-01**	**VP-02**	**VP-03**	**VP-04**	**VP-05**	**VP-06**	**VP-07**	**VP-08**	**VP-09**	**total shrubs**	**total shrubs**	**% total shrubs**
Shrubs													
Alnus serrulata	Tag alder						1	1		1	***3***		***3.0***
Clematis virginiana	Clematis		2						2		***4***		***4.0***
Lindera benzoin	Spice bush										***0***		***0.0***
Myrica cerifera	Wax myrtle	1		1		1		1		1	***5***		***5.0***
Sambucus canadensis	Elderberry									2	***2***		***2.0***
Viburnum nudum	Possumhaw						2	1		2	***5***		***5.0***
	Total Shrubs	***1***	***2***	***1***	***0***	***1***	***3***	***3***	***2***	***6***	***19***		
Trees													
Scientific Name	**Common Name**	**VP-01**	**VP-02**	**VP-03**	**VP-04**	**VP-05**	**VP-06**	**VP-07**	**VP-08**	**VP-09**	**total trees**	**total trees**	**% total trees**
Betula nigra	River birch	1	6	1	1	1	1	2	1	3	***17***		***16.8***
Celtis laevigata	Southern hackberry	2	1	1	1	1	1	2	1		***10***		***9.9***
Fraxinus pennsylvanica	Green ash	3			1	1	1			1	***7***		***6.9***
Nyssa sylvatica	Black gum	2	2	2	1	1	1	1	2	1	***13***		***12.9***
Platanus occidentalis	Sycamore	2	2					2	1	2	***9***		***8.9***
Quercus nigra	Water oak			2	1	2	1			2	***8***		***7.9***
Quercus pagodaefolia	Cherrybark oak	2	2	1	1		2		1	1	***10***		***9.9***
Quercus phellos	Willow oak	2	3				1	2			***8***		***7.9***
	Total Trees	***14***	***16***	***7***	***6***	***6***	***8***	***9***	***6***	***10***	***82***		
TABLE SUMMARY	Total Stems of planted Woody vegetaion.	15	18	8	6	7	11	12	8	16	***101***		
	% Shrubs	7%	11%	13%	0%	14%	27%	25%	25%	38%	***19%***		
	% Trees	93%	89%	88%	100%	86%	73%	75%	75%	63%	***81%***		
	Current Density												
	Shrubs per acre	40	81	40	0	40	121	121	81	243	85		
	Shrubs per hectare	100	200	100	0	100	300	300	200	600	211		
	Trees per acre	567	647	283	243	243	324	364	243	405	369		
	Trees per hectare	1400	1600	700	600	600	800	900	600	1000	911		
	Total stems per acre	607	728	324	243	283	445	486	324	647	454		
	Total stems per hectare	1500	1800	800	600	700	1100	1200	800	1600	1122		

UT Tar River Stream Restoration Site
Stream Mitigation Report
Appendix A-3
Vegetation Monitoring Plot Photos

Vegetation Plot #01 from Western Stake (~Bearing 70˚)

Vegetation Plot #02 from Western Stake (~Bearing 110˚)

Vegetation Plot #03 from Western Stake (~Bearing 95˚)

Vegetation Plot #04 from Western Stake (~Bearing 95˚)

Vegetation Plot #05 from Western Stake (~Bearing 110˚)

Vegetation Plot #06 from Western Stake (~Bearing 100˚)

UT Tar River Stream Restoration Site
Stream Mitigation Report
Appendix A-3
Vegetation Monitoring Plot Photos

Vegetation Plot #07 from Western Stake (~Bearing 100˚)

Vegetation Plot #08 from Western Stake (~Bearing 100˚)

Vegetation Plot #09 from Western Stake (~Bearing 100˚)

Appendix B

Geomorphologic Raw Data

B-1 Stream Photo Station Points

B-2 Cross Section Plots and Raw Data Tables

B-3 Longitudinal Plots and Raw Data Tables

B-4 Pebble Counts

UT Tar River Stream Restoration Site
Stream Mitigation Report
Appendix B-1
Stream Photo Station Photos

Photo Point 1. Downstream From Culvert at NC39 (from SREV 10+00)

Photo Point 2. Upstream Cross Section #1 (SREV 1+94)

Photo Point 2. Left to Right Bank Cross Section #1 (SREV 1+94)

Photo Point 2. Downstream Cross Section #1 (SREV 1+94)

UT Tar River Stream Restoration Site
Stream Mitigation Report
Appendix B-1
Stream Photo Station Photos

Photo Point 3. Upstream Cross Section #2 (SREV 2+91)

Photo Point 3. Downstream Cross Section #2 (SREV 2+91)

Photo Point 3. Left to Right Bank Cross Section #2 (SREV 2+91)

Photo Point 4. Downstream to Corner C-8 from C-7

Photo Point 4. Upstream to Corner C-6 from C-7

Photo Point 5. Upstream of Veg Plot #01 to Corner C-8

UT Tar River Stream Restoration Site
Stream Mitigation Report
Appendix B-1
Stream Photo Station Photos

Photo Point 5. Downstream of Veg Plot #01 to Corner C-9

Photo Point 6. Upstream Cross Section #3 (SREV 6+65)

Photo Point 6. Downstream Cross Section #3 (SREV 6+65)

Photo Point 6. Left to Right Bank Cross Section #3 (SREV 6+65)

Photo Point 7. Upstream of Veg Plot #02 to Curve C-12

UT Tar River Stream Restoration Site
Stream Mitigation Report
Appendix B-1
Stream Photo Station Photos

Photo Point 7. Downstream of Veg Plot #02 to Curve C-14

Photo Point 8. Downstream of Veg Plot #03 to Curve C-16

Photo Point 8. Upstream of Veg Plot #03 to Curve C-14

Photo Point 9. Downstream of Veg Plot #04 to Curve C-18

Photo Point 9. Upstream of Veg Plot #04 to Curve C-16

Photo Point 10. Upstream of Veg Plot #05 to Curve C-18

UT Tar River Stream Restoration Site
Stream Mitigation Report
Appendix B-1
Stream Photo Station Photos

Photo Point 10. Downstream of Veg Plot #05 to Curve C-19 and C-20

Photo Point 11. Downstream from ~SREV 24+00 to Curve C-22

Photo Point 11. Upstream from ~SREV 24+00 to Curve C-20

Photo Point 12. Upstream Grade Control Vane (SREV 25+00)

Photo Point 12. Downstream Grade Control Vane (SREV 25+00)

Photo Point 13. Upstream Cross Section #4 (SREV 16+42)

UT Tar River Stream Restoration Site
Stream Mitigation Report
Appendix B-1
Stream Photo Station Photos

Photo Point 13. Downstream Cross Section #4 (SREV 16+42)

Photo Point 13. Right to Left Bank Cross Section #4 (SREV 16+42)

Photo Point 13. Left to Right Bank Cross Section #4 (SREV 16+42)

Photo Point 14. Downstream Cross Section #5 (SREV 18+49)

Photo Point 14. Upstream Cross Section #5 (SREV 18+49)

UT Tar River Stream Restoration Site
Stream Mitigation Report
Appendix B-1
Stream Photo Station Photos

Photo Point 14. Left to Right Bank
Cross Section #5 (SREV 18+49)

Photo Point 14. Right to Left Bank
Cross Section #5 (SREV 18+49)

2. Representative Stream Problem Area Photos

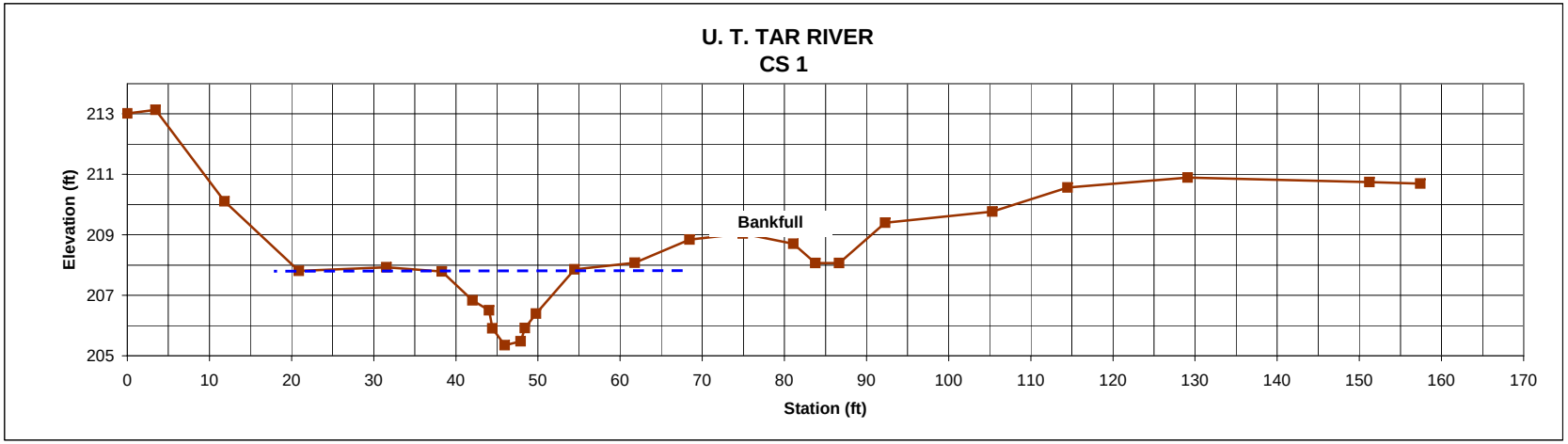
Erosion Area, Cross Section #3
(SREV 6+65)

Field Crew:	Chad Holland,Wade Patton, and Wendell Ball
Watershed:	Unamed Tributary to the Tar River
Stream Reach:	Main Channel
Date:	week of December 8,2005
Station:	1+94
Feature:	Pool

STATION (FEET)	ELEVATION (FEET)	NOTES
0.00	213.01	LPIN
3.46	213.13	
11.82	210.11	
20.90	207.81	
31.55	207.93	
38.29	207.79	
42.02	206.83	
44.06	206.50	
44.46	205.91	LEW WS
45.96	205.35	TW
47.89	205.48	
48.40	205.92	REW WS
49.76	206.39	
54.47	207.86	
61.77	208.08	
68.45	208.84	
74.94	209.04	
81.10	208.70	
83.76	208.07	EW/WS TR R
86.68	208.07	EW/WS TR R
92.28	209.40	
105.33	209.77	
114.49	210.57	
129.10	210.89	
151.22	210.74	
157.43	210.69	RPIN
44.46	205.91	WS

BANKFULL Hydraulic Geometry		
Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
0.0	0.0	0.0
1.9	-0.1	-0.1
0.5	-0.6	-0.2
1.4	-1.0	-1.1
4.7	-2.5	-8.4
7.3	-2.7	-19.1
6.7	-3.5	-20.8
6.5	-3.7	-23.3
6.2	-3.3	-21.7
2.7	-2.7	-8.1
2.9	-2.7	-7.9
5.6	-4.1	-19.0
13.1	-4.4	-55.3
9.2	-5.2	-44.2
14.6	-5.5	-78.6
22.1	-5.4	-120.9
6.2	-5.3	-33.3
TOTALS 111.5		-461.8

SUMMARY DATA	
A(BKF)	-461.8
W(BKF)	111.5
Max d	0.0
Mean d	-4.1



Field Crew:	Chad Holland,Wade Patton, and Wendell Ball
Watershed:	Unamed Tributary to the Tar River
Stream Reach:	Main Channel
Date:	week of December 8,2005
Station:	2+91
Feature:	Riffle

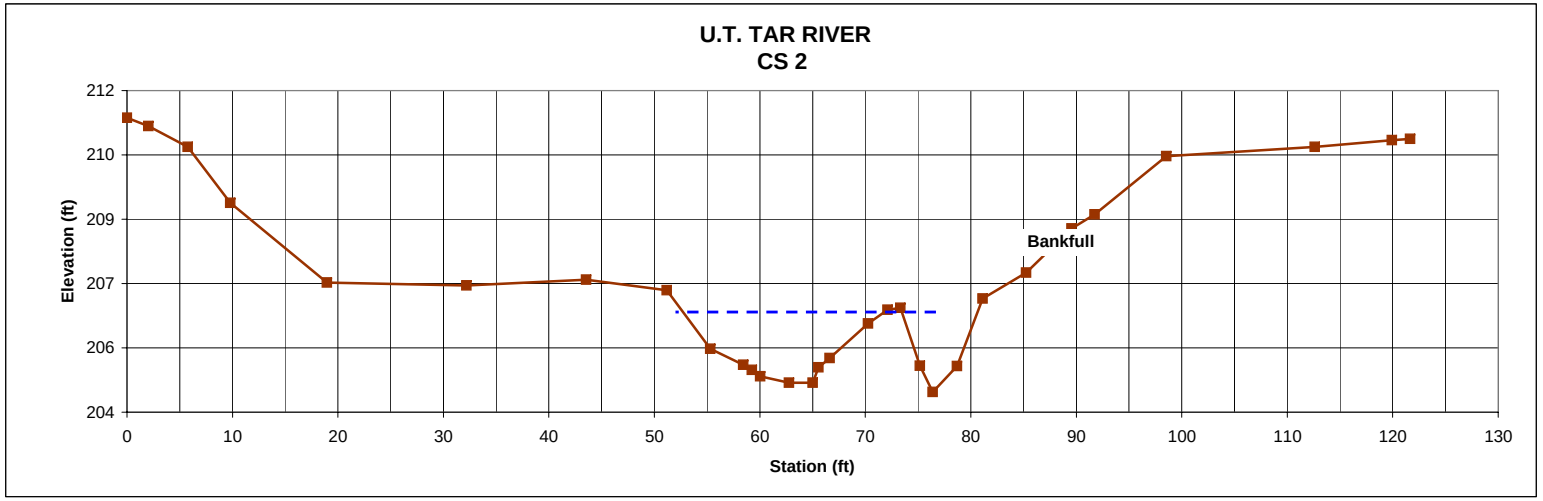
STATION (FEET)	ELEVATION (FEET)	NOTES
0.00	211.34	LPIN
2.02	211.14	
5.75	210.65	
9.80	209.32	
18.95	207.43	
32.20	207.36	
43.54	207.50	
51.18	207.25	
55.31	205.86	
58.42	205.48	
59.24	205.36	LEW WS
60.04	205.21	
62.78	205.06	
65.02	205.06	TW
65.56	205.42	REW WS
66.61	205.64	
70.25	206.46	
72.12	206.79	
73.33	206.83	
75.18	205.46	EW/WS TR R
76.38	204.84	
78.69	205.45	EW/WS TR R
81.14	207.05	
85.25	207.67	
89.56	208.71	
91.73	209.05	
98.54	210.43	
112.61	210.65	
119.94	210.81	
121.67	210.84	RPIN
65.56	205.42	WS

BANKFULL Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	4.1	1.4	2.9
	3.1	1.8	4.9
	0.8	1.9	1.5
	0.8	2.0	1.6
	2.7	2.2	5.8
	2.2	2.2	4.9
	0.5	1.8	1.1
	1.1	1.6	1.8
	3.6	0.8	4.4
	1.9	0.5	1.2
	1.2	0.4	0.5
	1.9	1.8	2.0
	1.2	2.4	2.5
TOTALS	25.2		35.1

SUMMARY DATA

A(BKF)	35.1	W(FPA)	>60
W(BKF)	25.2		
Max d	2.4		
Mean d	1.4	Area=	A
W/D	18.1	Width=	W
Entrenchment	>2.5	Depth=	D
Stream Type	C	Bankfull=	BKF



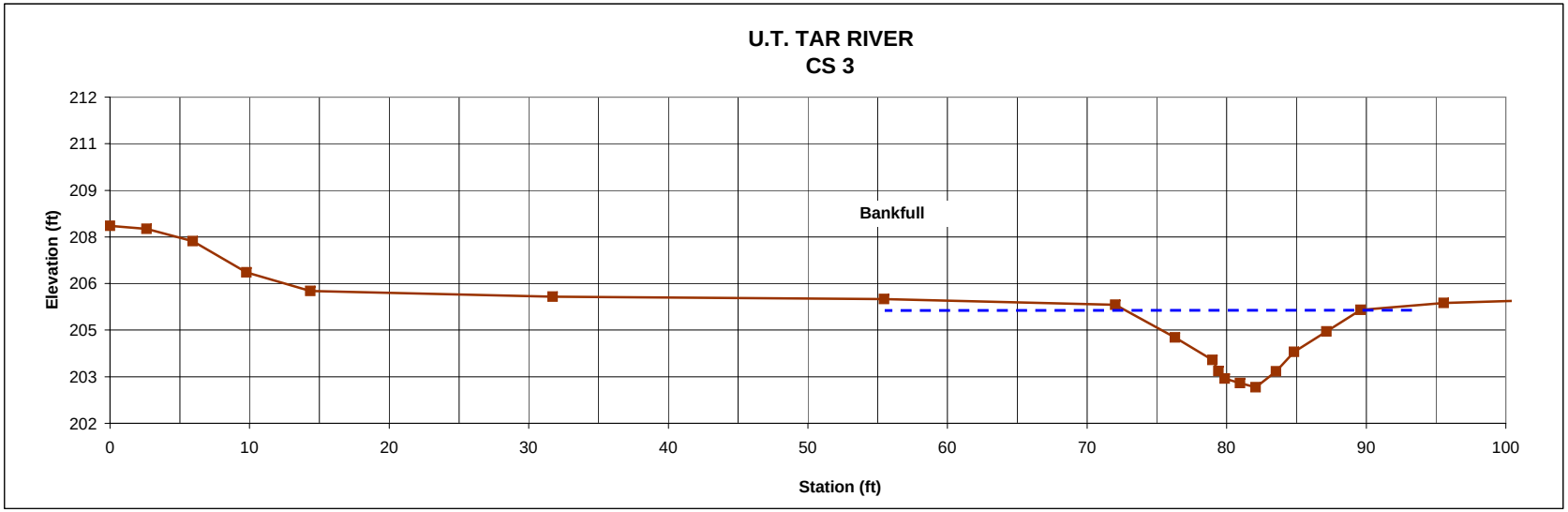
Field Crew:	Chad Holland,Wade Patton, and Wendell Ball
Watershed:	Unamed Tributary to the Tar River
Stream Reach:	Main Channel
Date:	week of December 8,2005
Station:	6+65
Feature:	Riffle

STATION (FEET)	ELEVATION (FEET)	NOTES
0.00	207.98	LPIN
2.62	207.88	
5.94	207.48	
9.77	206.46	
14.35	205.85	
31.71	205.66	
55.45	205.58	
72.03	205.39	
76.30	204.32	
78.98	203.58	
79.41	203.22	LEW WS
79.86	202.98	
80.97	202.83	
82.07	202.69	TW
83.54	203.21	REW WS
84.83	203.85	
87.15	204.52	
89.60	205.23	
95.55	205.45	
102.66	205.55	
106.95	208.16	
113.16	210.75	
122.76	211.48	
133.74	210.83	
150.14	210.03	
156.98	210.22	RPIN
79.41	203.22	WS

	BANKFULL Hydraulic Geometry		
	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	23.7	0.1	0.9
	16.6	0.3	2.9
	4.3	1.3	3.4
208.63	2.7	2.1	4.6
	0.4	2.4	1.0
	0.5	2.7	1.2
	1.1	2.8	3.1
	1.1	3.0	3.2
	1.5	2.4	4.0
	1.3	1.8	2.7
	2.3	1.1	3.4
TOTALS	55.4		30.4

SUMMARY DATA

A(BKF)	30.4	W(FPA)	>90
W(BKF)	55.4		
Max d	3.0		
Mean d	0.5	Area=	A
W/D	101.1	Width=	W
Entrenchment	>2.4	Depth=	D
Stream Type	C	Bankfull=	BKF

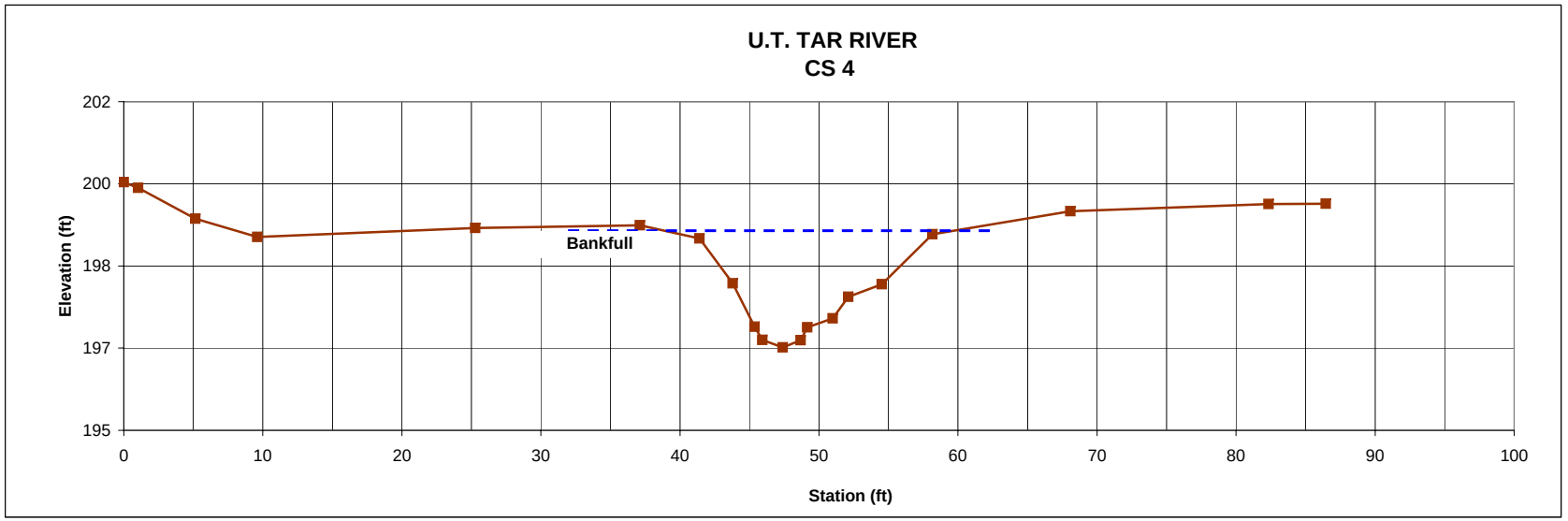


Field Crew:	Chad Holland,Wade Patton, and Wendell Ball
Watershed:	Unamed Tributary to the Tar River
Stream Reach:	Main Channel
Date:	week of December 8,2005
Station:	16+42
Feature:	RIFFLE

STATION (FEET)	ELEVATION (FEET)	NOTES
0.00	200.03	LPIN
1.04	199.92	
5.15	199.35	
9.61	199.01	
25.29	199.18	
37.13	199.23	
41.41	198.98	
43.80	198.15	
45.36	197.34	LEW WS
45.92	197.10	
47.40	196.96	TW
48.69	197.09	
49.16	197.33	REW WS
50.99	197.50	
52.12	197.90	
54.52	198.13	
58.16	199.06	
68.08	199.49	
82.34	199.62	
86.45	199.63	RPIN
49.16	197.33	WS

	BANKFULL Hydraulic Geometry		
	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	4.3	0.3	0.5
	2.4	1.1	1.6
	1.6	1.9	2.3
	0.6	2.1	1.1
	1.5	2.3	3.3
	1.3	2.1	2.8
	0.5	1.9	0.9
	1.8	1.7	3.3
	1.1	1.3	1.7
TOTALS	15.0		17.7

SUMMARY DATA	
A(BKF)	17.7
W(BKF)	15.0
Max d	2.3
Mean d	1.2

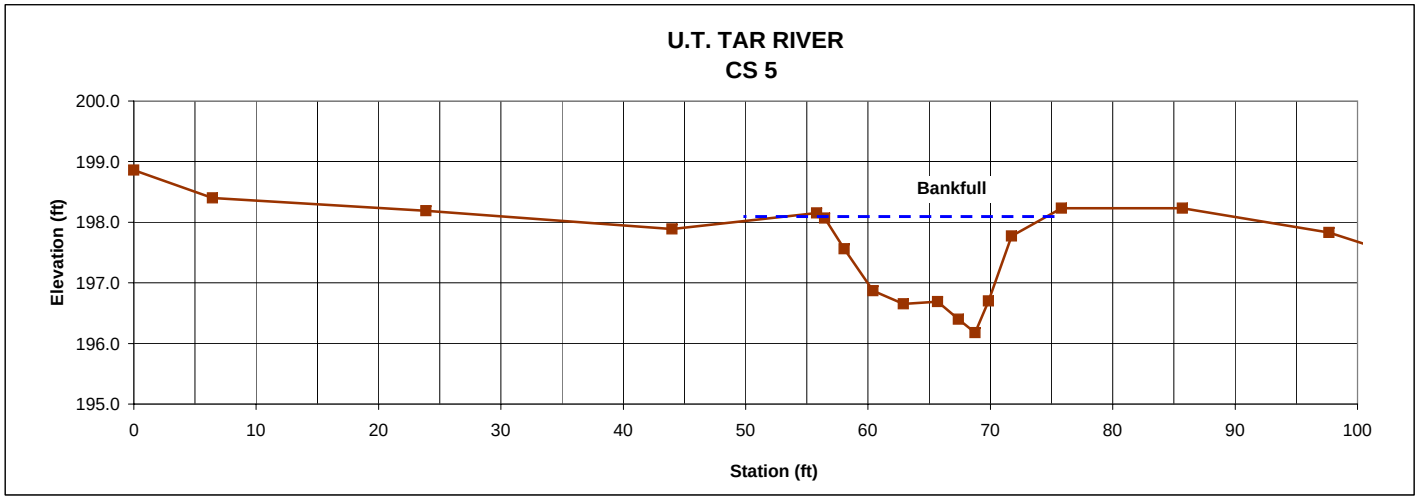


Field Crew:	Chad Holland,Wade Patton, and Wendell Ball
Watershed:	Unamed Tributary to the Tar River
Stream Reach:	Main Channel
Date:	week of December 8,2005
Station:	18+49
Feature:	Run

STATION (FEET)	ELEVATION (FEET)	NOTES
0.00	198.86	LPIN
6.44	198.40	
23.88	198.19	
43.99	197.89	
55.80	198.15	
56.47	198.07	
58.06	197.56	
60.41	196.87	
62.88	196.65	
65.69	196.69	LEW/WS
67.40	196.40	
68.76	196.18	
69.84	196.70	REW/WS
71.74	197.77	
75.80	198.23	
85.70	198.23	
97.68	197.83	
109.53	197.06	
111.57	197.42	RPIN
65.69	196.69	WS

	BANKFULL Hydraulic Geometry		
	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	0.7	0.1	0.0
	1.6	0.6	0.5
	2.3	1.3	2.2
	2.5	1.5	3.4
	2.8	1.5	4.2
	1.7	1.8	2.7
	1.4	2.0	2.5
	1.1	1.5	1.8
	1.9	0.4	1.7
	4.1	-0.1	0.6
TOTALS	20.0		19.8

	SUMMARY DATA			
	A(BKF)	19.8	W(FPA)	>185
200.20	W(BKF)	20.0		
	Max d	2.0		
	Mean d	1.0	Area=	A
	W/D	20.2	Width=	W
	Entrenchment	>7.4	Depth=	D
	Stream Type	E/C	Bankfull=	BKF



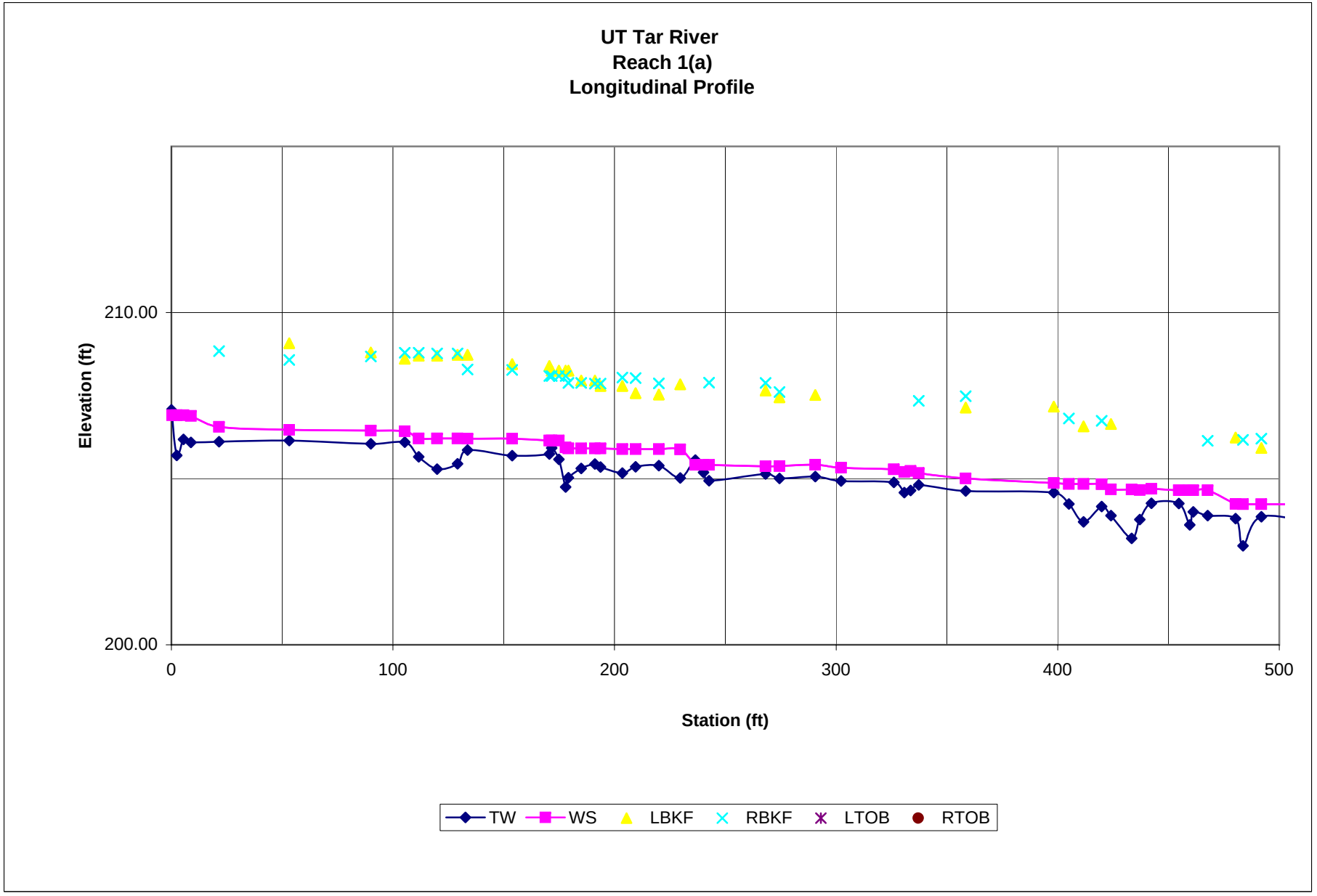
Field Crew:	Chad Holland, Wade Patton, and Jan Patterson
Watershed	Unnamed Tributary to the Tar River
Stream Reach:	Main Channel
Date:	week of December 8,2005
Description:	LONGITUDINAL PROFILE

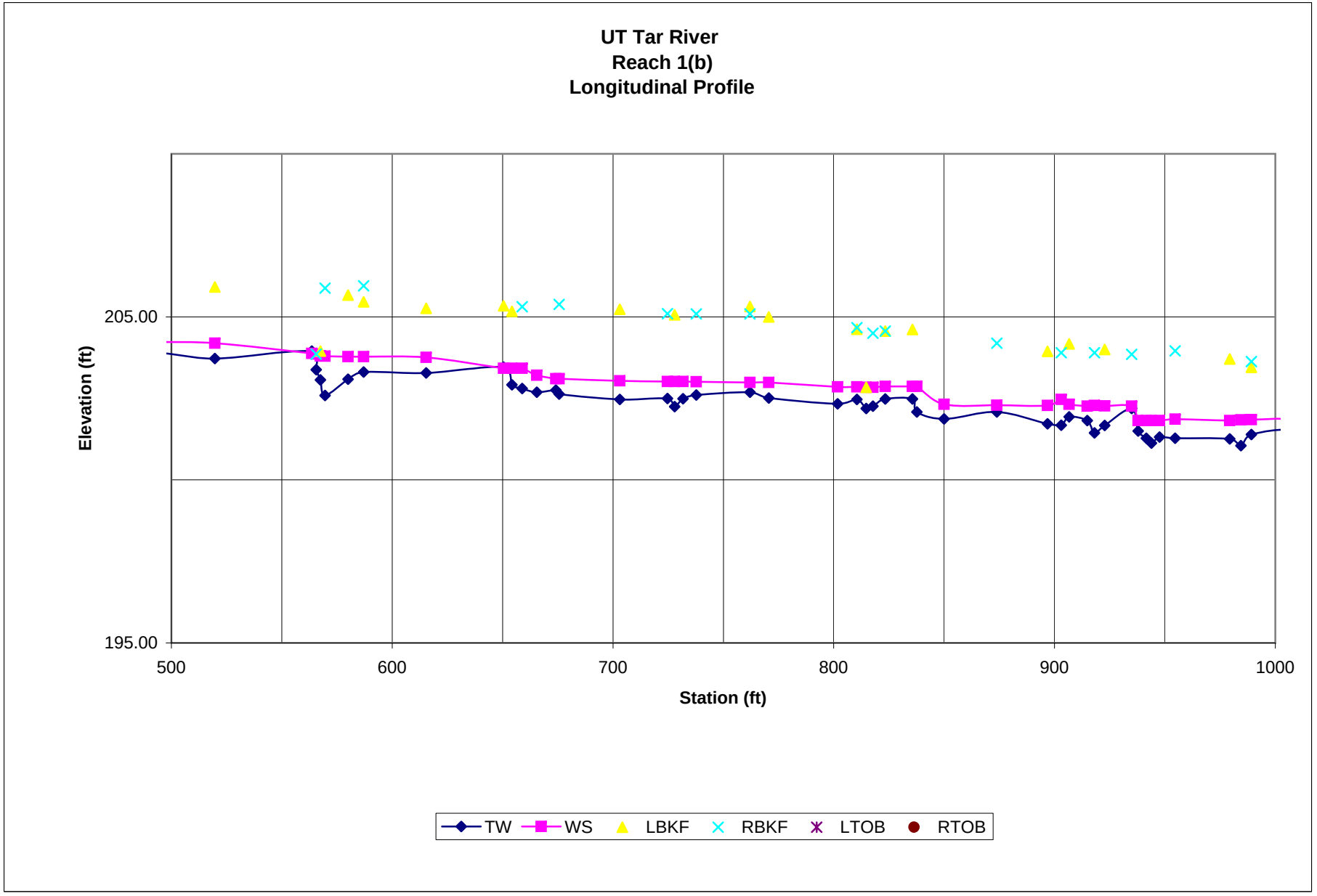
STATION	TW	WS	LBKF	RBKF	LTOB	RTOB	NOTE
00+00.0	207.07	206.91					invert fes 72" cmp
00+02.4	205.70	206.91					MP
00+05.5	206.18	206.91					HG
00+08.8	206.09	206.89					HR
00+21.5	206.11	206.56	209.08	208.84			HRU
00+53.2	206.15	206.47	208.80	208.57			IM
00+90.0	206.05	206.45	208.61	208.68			IM
01+05.3	206.10	206.43	208.70	208.79			HR
01+11.6	205.66	206.21	208.70	208.79			HP
01+20.0	205.29	206.21	208.73	208.77			MP
01+29.1	205.45	206.21	208.73	208.77			HG
01+33.7	205.86	206.20	208.45	208.29			HRU
01+53.8	205.69	206.20	208.39	208.27			IM
01+70.6	205.74	206.15	208.25	208.09			HP
01+71.6	205.92	206.15	208.25	208.09			ROCK
01+74.9	205.58	206.15	208.25	208.09			DO
01+77.9	204.75	205.94	208.25	208.09			MP
01+79.2	205.03	205.91	207.95	207.88			HG
01+85.0	205.31	205.91	207.95	207.88			HRU
01+91.1	205.44	205.91	207.79	207.86			HP
01+93.7	205.35	205.91	207.79	207.86			IM XSECTION1
02+03.5	205.17	205.89	207.57	208.04			MP
02+09.6	205.36	205.89	207.53	208.03			HG
02+20.0	205.39	205.89	207.84	207.87			HP
02+29.6	205.02	205.88					MP
02+36.5	205.56	205.41					HR ROCK
02+40.1	205.19	205.41					DO
02+42.7	204.94	205.41	207.65	207.89			HRU
02+68.1	205.14	205.37	207.45	207.88			IM
02+74.4	205.01	205.38	207.52	207.61			HR
02+90.6	205.06	205.42					IM XSECTION2
03+02.2	204.93	205.33					IM TRIB RT
03+26.1	204.89	205.28					HP
03+30.8	204.58	205.20					MP
03+33.6	204.64	205.23					HG
03+37.3	204.81	205.17	207.14	207.34			HR
03+58.5	204.63	205.01	207.17	207.48			HRU
03+98.2	204.58	204.87					IM
04+05.1	204.24	204.84	206.57	206.81			
04+11.7	203.70	204.84					MP
04+19.8	204.16	204.83	206.64	206.74			HG ROCK
04+24.1	203.89	204.68					DO
04+33.4	203.20	204.67					MP
04+37.1	203.77	204.66					HG

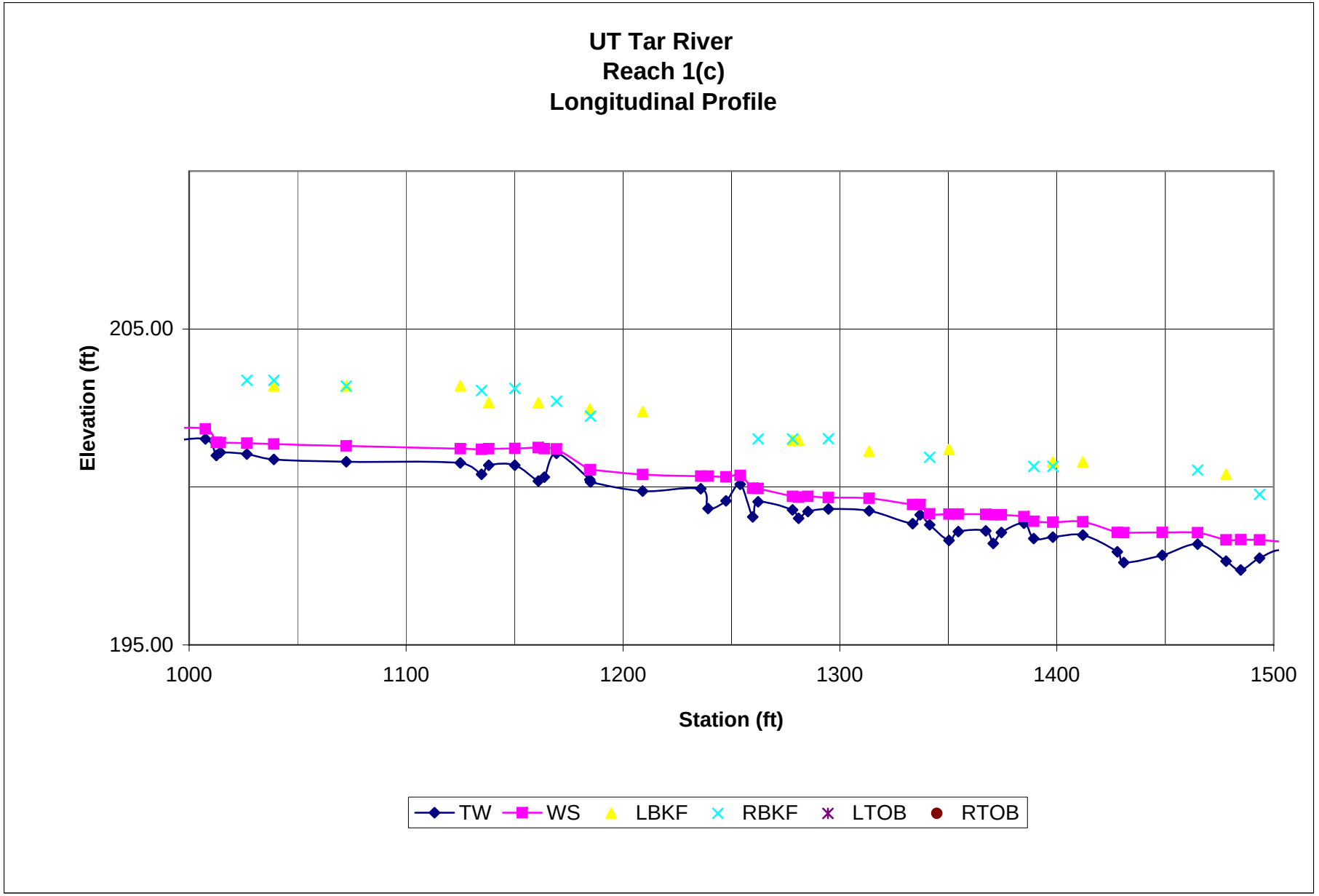
04+42.3	204.26	204.69			HRU
04+54.7	204.25	204.65			HP
04+59.6	203.61	204.65			MP
04+61.2	204.00	204.65			HG
04+67.7	203.89	204.65	206.24	206.14	DO
04+80.3	203.80	204.24			HP
04+83.6	202.98	204.23	205.92	206.17	HG
04+91.9	203.85	204.23	205.92	206.20	HRU
05+19.7	203.72	204.19			IM
05+63.6	203.95	203.88			ROCK
05+65.6	203.38	203.86	203.95	203.86	DO
05+67.5	203.07	203.80			HP
05+69.6	202.59	203.79	205.67	205.88	MP
05+80.0	203.09	203.78	205.46	2005.86	HG
05+87.1	203.31	203.78	205.26	205.95	HRU
06+15.4	203.28	203.76	205.34		IM
06+50.5	203.46	203.42	205.17		HR ROCK
06+54.2	202.92	203.42			DO
06+58.9	202.80	203.42		205.31	HR
06+65.5	202.69	203.21			IM XSECTION 3
06+74.1	202.75	203.10			HR
06+75.6	202.63	203.10	205.23	205.38	IM
07+03.1	202.47	203.04			IM
07+24.7	202.50	203.02	205.06	205.10	HP
07+27.9	202.25	203.02			MP
07+31.7	202.49	203.02			HG
07+37.7	202.60	203.01	205.32	205.09	HRU
07+62.1	202.69	202.99	205.00	205.09	HR
07+70.6	202.51	202.99			HRU
08+01.8	202.33	202.85	204.62		IM
08+10.5	202.47	202.85	202.84	204.67	HP
08+14.7	202.19	202.84			MP
08+17.7	202.26	202.84	204.56	204.50	HG
08+23.3	202.48	202.87	204.61	204.56	HR
08+35.6	202.48	202.87			ROCK
08+37.6	202.08	202.87			DO HR
08+50.0	201.87	202.32			HRU
08+73.9	202.08	202.29	203.94	204.19	IM
08+96.8	201.72	202.28			HP
09+03.0	201.68	202.47	204.17	203.90	MP
09+06.6	201.93	202.32			HG
09+14.8	201.82	202.26			HP
09+18.1	201.44	202.28	204.00	203.90	MP
09+22.7	201.67	202.27			HG
09+34.9	202.19	202.26		203.85	ROCK
09+37.9	201.50	201.82			DO
09+41.6	201.28	201.82			HP
09+43.9	201.13	201.82			MP
09+47.6	201.31	201.82			HG
09+54.6	201.28	201.86	203.71	203.96	HRU
09+79.4	201.26	201.82			HP
09+84.4	201.05	201.84	203.45		MP
09+89.2	201.39	201.85		203.63	HG
10+07.5	201.52	201.84			ROCK

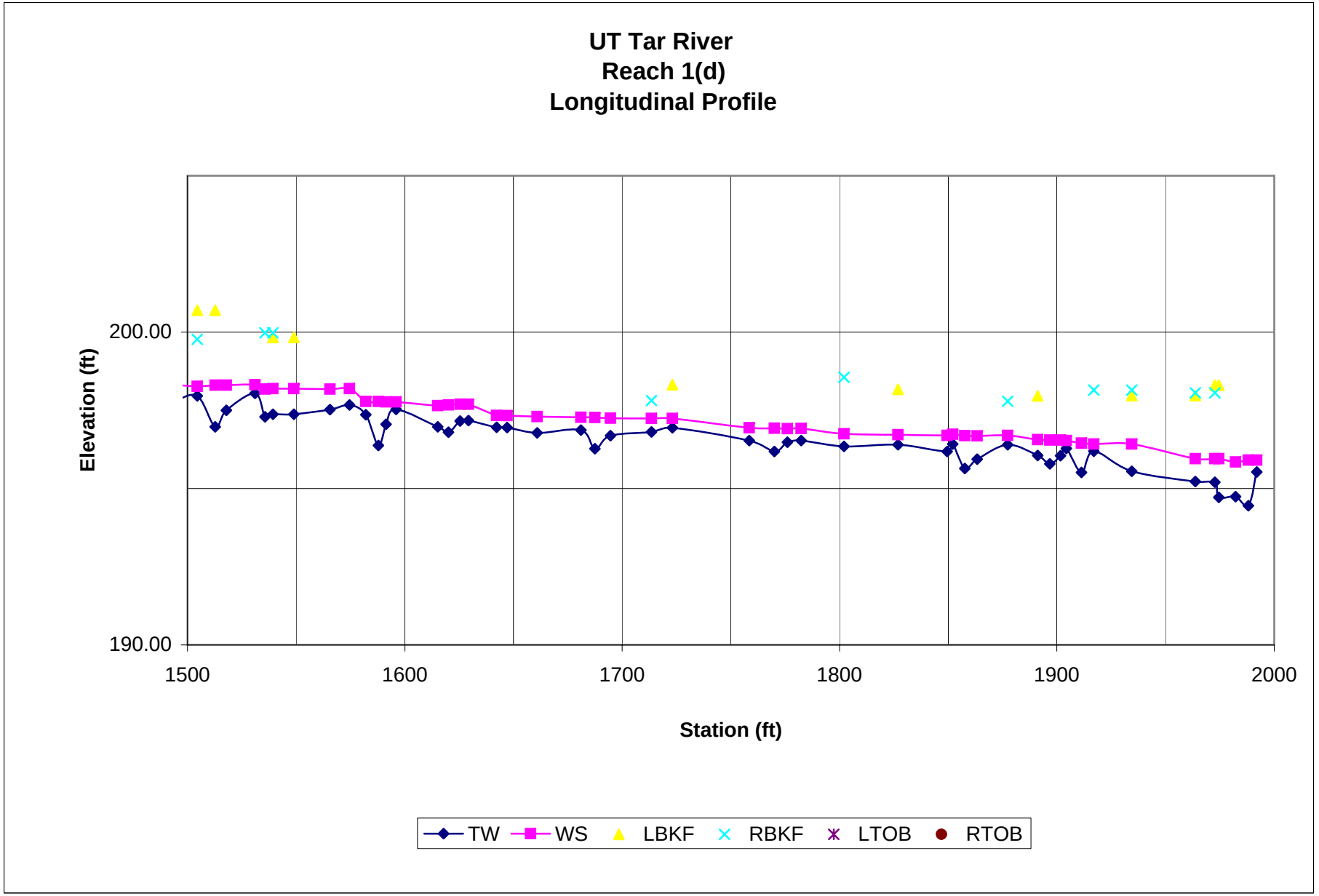
10+12.6	201.00	201.41			DO
10+14.4	201.09	201.40			HR
10+26.6	201.04	201.39	203.20	203.38	HRU
10+39.0	200.87	201.36	203.20	203.38	IM
10+72.4	200.80	201.30	203.20	203.19	IM
11+25.0	200.76	201.21			HP
11+34.8	200.40	201.19	202.67	203.05	MP
11+38.1	200.69	201.21			HG
11+50.1	200.69	201.22	202.66	203.12	HP
11+60.9	200.19	201.25			MP
11+63.8	200.31	201.21			HG
11+69.3	201.06	201.20	202.47	202.71	HR
11+84.7	200.23	200.53			HP
11+85.0	200.16	200.55	202.38	202.24	IM JH
12+09.1	199.87	200.39			IM
12+35.9	199.94	200.34			HP
12+39.2	199.32	200.34			MP
12+47.5	199.56	200.32			HG
12+54.0	200.08	200.36			ROCK
12+59.8	199.05	199.96			MP
12+62.3	199.53	199.95	201.48	201.52	HG HR
12+78.2	199.27	199.70	201.48	201.52	HP
12+81.0	199.01	199.68			MP
12+85.3	199.22	199.70			HG
12+94.8	199.30	199.66	201.13	201.53	HRU
13+13.5	199.24	199.64			HR
13+33.5	198.84	199.44			IM
13+37.0	199.12	199.44			ROCK
13+41.4	198.80	199.15	201.19	200.94	DO
13+50.3	198.31	199.14			MP
13+54.6	198.59	199.14			HG
13+67.2	198.61	199.13			HP CULVERT LT
13+70.7	198.21	199.12			MP
13+74.4	198.56	199.12			HG
13+84.8	198.85	199.06			ROCK
13+89.4	198.37	198.91	200.79	200.65	DO
13+98.2	198.41	198.88	200.79	200.65	HR
14+12.0	198.48	198.90			HRU
14+27.9	197.95	198.56			HP
14+30.9	197.61	198.55			MP
14+48.6	197.84	198.56			HGIM
14+64.9	198.19	198.55	200.4	200.53	HR
14+78.0	197.65	198.32			HP
14+84.8	197.37	198.33			MP
14+93.5	197.75	198.32	200.7	199.77	HG
15+04.5	197.96	198.27	200.7	199.77	HP
15+12.7	196.97	198.30			MP
15+17.9	197.50	198.30			HG
15+31.1	198.04	198.32			IM JH
15+35.7	197.29	198.18	199.83	199.98	HP
15+39.3	197.37	198.19	199.83	199.98	HG
15+48.9	197.37	198.19			HG
15+65.6	197.52	198.18			IM
15+74.5	197.67	198.19			CV

15+82.0	197.36	197.78			HP
15+87.8	196.38	197.78			MP
15+91.4	197.05	197.77			HG
15+96.0	197.53	197.77			JH
16+15.1	196.97	197.65			HP
16+20.1	196.80	197.67			MP
16+25.4	197.16	197.69			HG
16+29.3	197.17	197.69			HR
16+42.2	196.96	197.34			IM
16+47.1	196.95	197.33			HRU
16+60.9	196.78	197.30			V
16+81.0	196.87	197.28			HP
16+87.4	196.27	197.27			MP
16+94.6	196.69	197.25			HG
17+13.4	196.81	197.24	198.32	197.81	HR
17+23.1	196.94	197.24			IM TRIB RT
17+58.5	196.53	196.94			HP
17+70.0	196.18	196.93			MP
17+76.0	196.48	196.91			HG
17+82.3	196.53	196.92			HR
18+02.1	196.35	196.75	198.17	198.56	HRU
18+26.9	196.40	196.72			IM
18+49.5	196.18	196.70			IM XSECTION 5
18+52.1	196.42	196.73			HP
18+57.7	195.64	196.69			MP
18+63.3	195.94	196.68			HG
18+77.4	196.40	196.70	197.96	197.79	HR
18+91.2	196.06	196.56			HRU
18+96.7	195.79	196.55			HP
19+01.7	196.05	196.55			HG
19+04.4	196.28	196.53			HR
19+11.3	195.51	196.45			MP
19+17.0	196.19	196.42	197.97	198.15	HG HR
19+34.4	195.55	196.42	197.97	198.15	INV 42" RCP
19+63.7	195.22	195.95	198.30	198.06	INV 42" RCP HR
19+72.7	195.20	195.95	198.30	198.06	HP
19+74.5	194.72	195.95			MP
19+82.2	194.74	195.85			HP
19+88.1	194.45	195.91			MP
19+92.0	195.53	195.91			HG

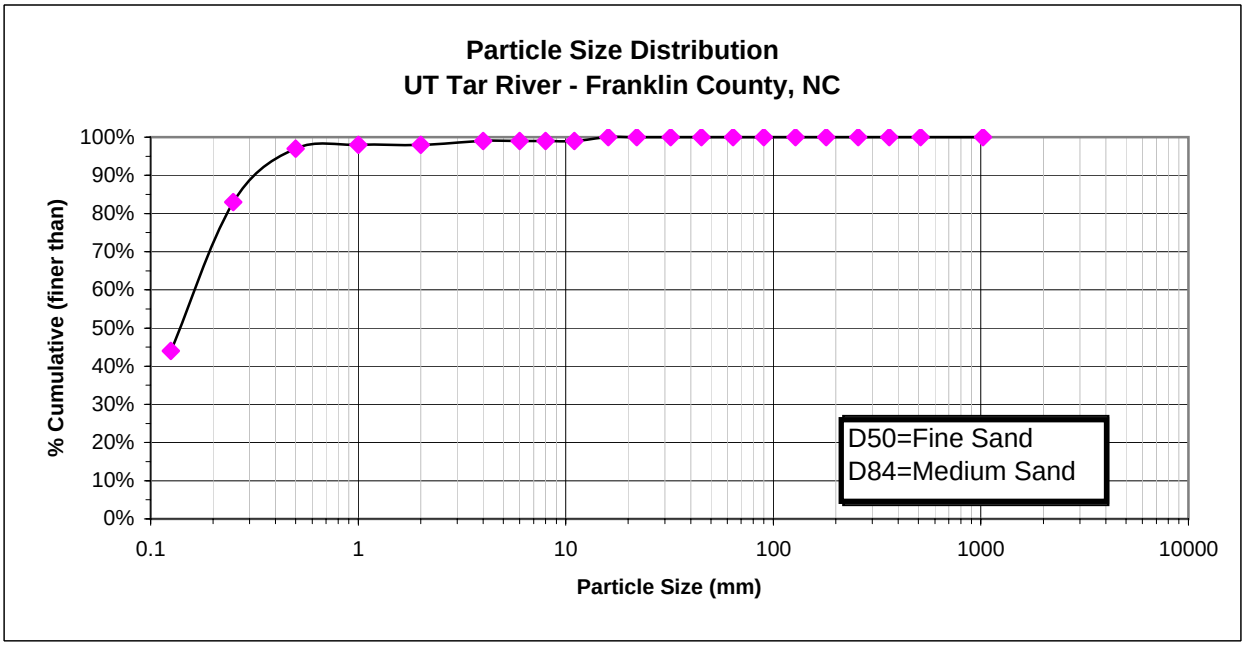

UT Tar River
Reach 1(a)
Longitudinal Profile
Elevation (ft)
210.00
200.00
0
100
200
300
400
500
Station (ft)
TW
WS
LBKF
RBKF
LTOB
RTOB


UT Tar River
Reach 1(b)
Longitudinal Profile
Elevation (ft)
205.00
195.00
500
600
700
800
900
1000
Station (ft)
TW
WS
LBKF
RBKF
LTOB
RTOB

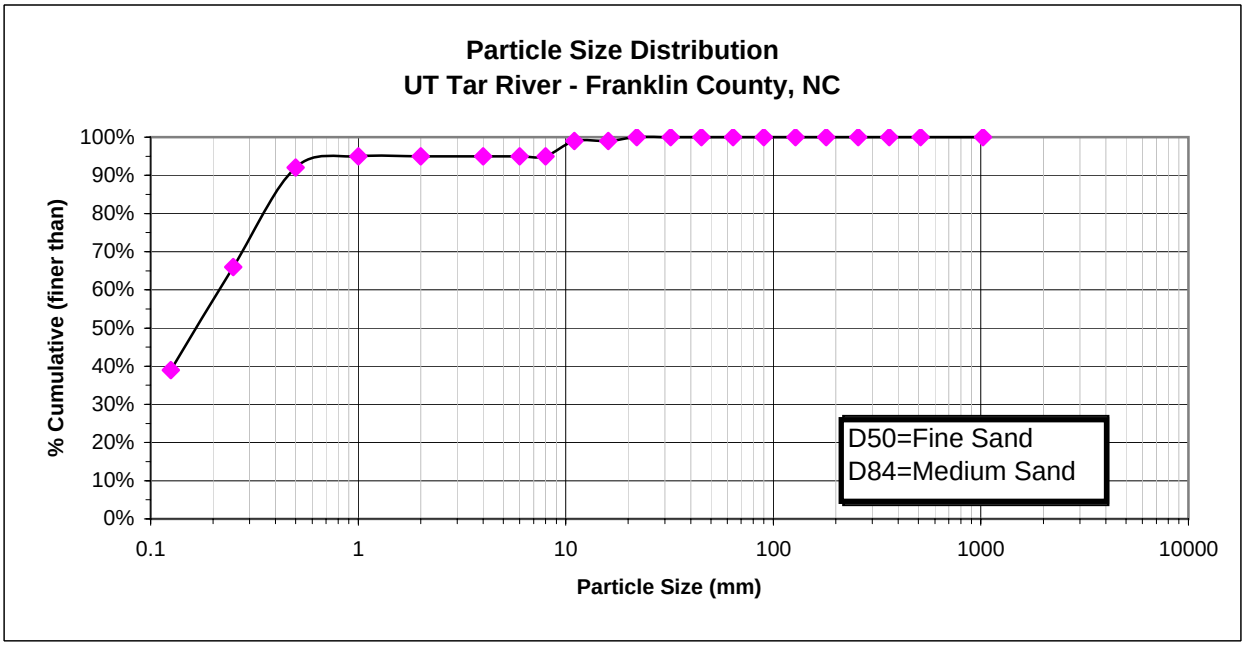

UT Tar River
Reach 1(c)
Longitudinal Profile
Elevation (ft)
205.00
195.00
1000
1100
1200
1300
1400
1500
Station (ft)
TW
WS
LBKF
RBKF
LTOB
RTOB


UT Tar River
Reach 1(d)
Longitudinal Profile
Elevation (ft)
200.00
190.00
1500
1600
1700
1800
1900
2000
Station (ft)
TW
WS
LBKF
RBKF
LTOB
RTOB

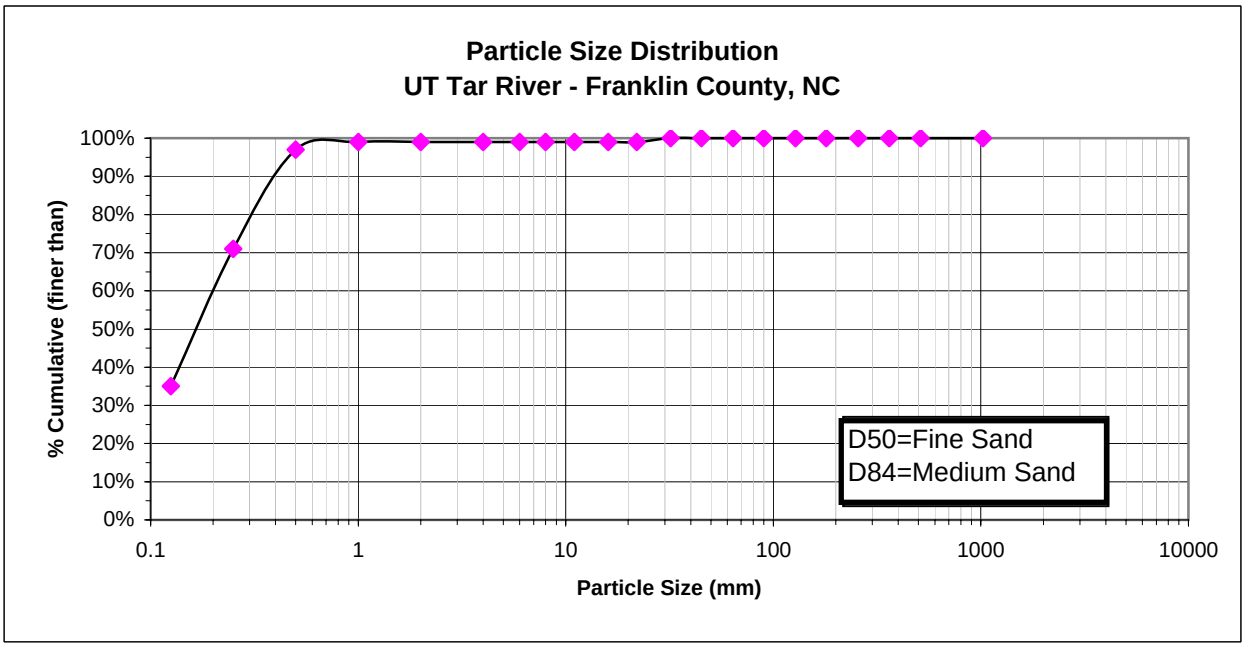
PEBBLE COUNT								
Site: Unnamed Tributary to Tar River						4/5/2006		
Party: E.L. Renninger, Kevin Lapp						Reach: Cross Section #1		
Particle Counts								
Inches	Particle	Millimeter		Pool	Riffle	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C		11	11	11%	11%
	Very Fine	.062 - .125	S		33	33	33%	44%
	Fine	.125 - .25	A		39	39	39%	83%
	Medium	.25 - .50	N		14	14	14%	97%
	Coarse	.50 - 1.0	D		1	1	1%	98%
.04 -.08	Very Coarse	1.0 - 2.0	S			0	0%	98%
.08 - .16	Very Fine	2.0 - 4.0			1	1	1%	99%
.16 - .22	Fine	4.0 - 5.7	G			0	0%	99%
.22 - .31	Fine	5.7 - 8.0	R			0	0%	99%
.31 - .44	Medium	8.0 - 11.3	A			0	0%	99%
.44 - .63	Medium	11.3 - 16.0	V		1	1	1%	100%
.63 - .89	Coarse	16.0 - 22.6	E			0	0%	100%
.89 - 1.26	Coarse	22.6 - 32.0	L			0	0%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S			0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0				0	0%	100%
2.5 - 3.5	Small	64 - 90	C			0	0%	100%
3.5 - 5.0	Small	90 - 128	O			0	0%	100%
5.0 - 7.1	Large	128 - 180	B			0	0%	100%
7.1 - 10.1	Large	180 - 256	L			0	0%	100%
10.1 - 14.3	Small	256 - 362	B			0	0%	100%
14.3 - 20	Small	362 - 512	L			0	0%	100%
20 - 40	Medium	512 - 1024	D			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R			0	0%	100%
	Bedrock		BDRK			0	0%	100%
			Totals	**0**	**100**	**100**	**100%**	**100%**



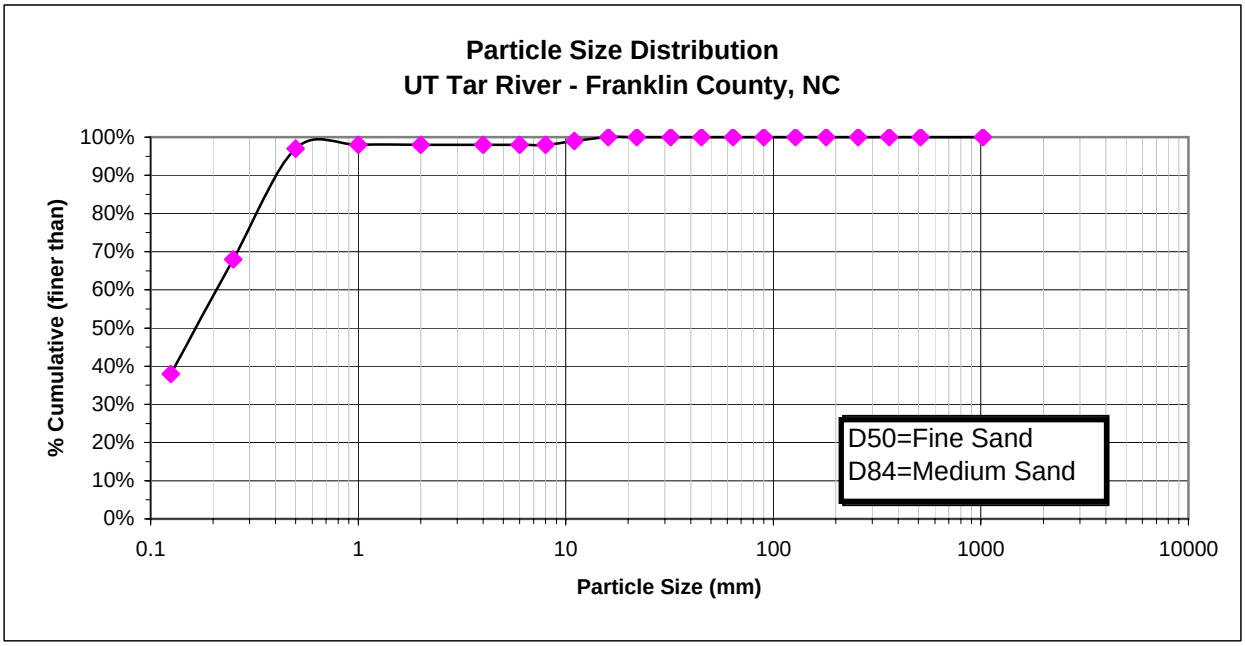
PEBBLE COUNT								
Site: Unnamed Tributary to Tar River						4/5/2006		
Party: E.L. Renninger, Kevin Lapp						Reach: Cross Section #2		
Particle Counts								
Inches	Particle	Millimeter		Pool	Riffle	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C		14	14	14%	14%
	Very Fine	.062 - .125	S		25	25	25%	39%
	Fine	.125 - .25	A		27	27	27%	66%
	Medium	.25 - .50	N		26	26	26%	92%
	Coarse	.50 - 1.0	D		3	3	3%	95%
.04 -.08	Very Coarse	1.0 - 2.0	S			0	0%	95%
.08 - .16	Very Fine	2.0 - 4.0				0	0%	95%
.16 - .22	Fine	4.0 - 5.7	G			0	0%	95%
.22 - .31	Fine	5.7 - 8.0	R			0	0%	95%
.31 - .44	Medium	8.0 - 11.3	A		4	4	4%	99%
.44 - .63	Medium	11.3 - 16.0	V			0	0%	99%
.63 - .89	Coarse	16.0 - 22.6	E		1	1	1%	100%
.89 - 1.26	Coarse	22.6 - 32.0	L			0	0%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S			0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0				0	0%	100%
2.5 - 3.5	Small	64 - 90	C			0	0%	100%
3.5 - 5.0	Small	90 - 128	O			0	0%	100%
5.0 - 7.1	Large	128 - 180	B			0	0%	100%
7.1 - 10.1	Large	180 - 256	L			0	0%	100%
10.1 - 14.3	Small	256 - 362	B			0	0%	100%
14.3 - 20	Small	362 - 512	L			0	0%	100%
20 - 40	Medium	512 - 1024	D			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R			0	0%	100%
	Bedrock		BDRK			0	0%	100%
			Totals	**0**	**100**	**100**	**100%**	**100%**



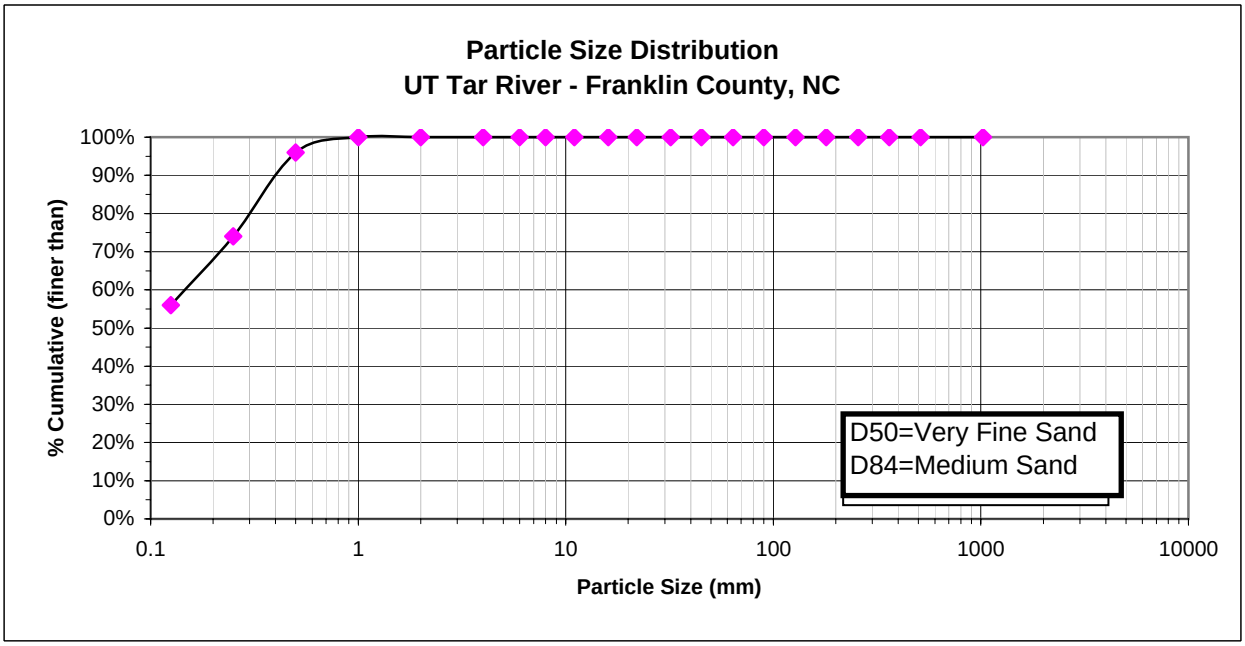
PEBBLE COUNT								
Site: Unnamed Tributary to Tar River						4/5/2006		
Party: E.L. Renninger, Kevin Lapp						Reach: Cross Section #3		
Particle Counts								
Inches	Particle	Millimeter		Pool	Riffle	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C		14	14	14%	14%
	Very Fine	.062 - .125	S		21	21	21%	35%
	Fine	.125 - .25	A		36	36	36%	71%
	Medium	.25 - .50	N		26	26	26%	97%
	Coarse	.50 - 1.0	D		2	2	2%	99%
.04 -.08	Very Coarse	1.0 - 2.0	S			0	0%	99%
.08 - .16	Very Fine	2.0 - 4.0				0	0%	99%
.16 - .22	Fine	4.0 - 5.7	G			0	0%	99%
.22 - .31	Fine	5.7 - 8.0	R			0	0%	99%
.31 - .44	Medium	8.0 - 11.3	A			0	0%	99%
.44 - .63	Medium	11.3 - 16.0	V			0	0%	99%
.63 - .89	Coarse	16.0 - 22.6	E			0	0%	99%
.89 - 1.26	Coarse	22.6 - 32.0	L		1	1	1%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S			0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0				0	0%	100%
2.5 - 3.5	Small	64 - 90	C			0	0%	100%
3.5 - 5.0	Small	90 - 128	O			0	0%	100%
5.0 - 7.1	Large	128 - 180	B			0	0%	100%
7.1 - 10.1	Large	180 - 256	L			0	0%	100%
10.1 - 14.3	Small	256 - 362	B			0	0%	100%
14.3 - 20	Small	362 - 512	L			0	0%	100%
20 - 40	Medium	512 - 1024	D			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R			0	0%	100%
	Bedrock		BDRK			0	0%	100%
			Totals	**0**	**100**	**100**	**100%**	**100%**



PEBBLE COUNT								
Site: Unnamed Tributary to Tar River						4/5/2003		
Party: E.L.Renninger, Kevin Lapp						Reach: Cross section #4		
Particle Counts								
Inches	Particle	Millimeter		Pool	Riffle	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	10		10	10%	10%
	Very Fine	.062 - .125	S	28		28	28%	38%
	Fine	.125 - .25	A	30		30	30%	68%
	Medium	.25 - .50	N	29		29	29%	97%
	Coarse	.50 - 1.0	D	1		1	1%	98%
.04 -.08	Very Coarse	1.0 - 2.0	S			0	0%	98%
.08 - .16	Very Fine	2.0 - 4.0				0	0%	98%
.16 - .22	Fine	4.0 - 5.7	G			0	0%	98%
.22 - .31	Fine	5.7 - 8.0	R			0	0%	98%
.31 - .44	Medium	8.0 - 11.3	A	1		1	1%	99%
.44 - .63	Medium	11.3 - 16.0	V	1		1	1%	100%
.63 - .89	Coarse	16.0 - 22.6	E			0	0%	100%
.89 - 1.26	Coarse	22.6 - 32.0	L			0	0%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S			0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0				0	0%	100%
2.5 - 3.5	Small	64 - 90	C			0	0%	100%
3.5 - 5.0	Small	90 - 128	O			0	0%	100%
5.0 - 7.1	Large	128 - 180	B			0	0%	100%
7.1 - 10.1	Large	180 - 256	L			0	0%	100%
10.1 - 14.3	Small	256 - 362	B			0	0%	100%
14.3 - 20	Small	362 - 512	L			0	0%	100%
20 - 40	Medium	512 - 1024	D			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R			0	0%	100%
	Bedrock		BDRK			0	0%	100%
			Totals	**100**	**0**	**100**	**100%**	**100%**

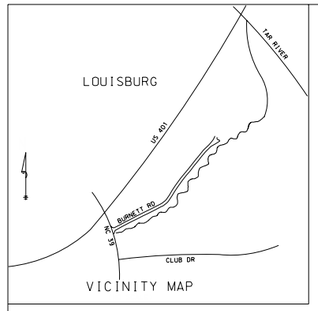


PEBBLE COUNT								
Site: Unnamed Tributary to Tar River						4/5/2006		
Party: E.L. Renninger, Kevin Lapp						Reach: Cross Section #5		
Particle Counts								
Inches	Particle	Millimeter		Pool	Riffle	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	18		18	18%	18%
	Very Fine	.062 - .125	S	38		38	38%	56%
	Fine	.125 - .25	A	18		18	18%	74%
	Medium	.25 - .50	N	22		22	22%	96%
	Coarse	.50 - 1.0	D	4		4	4%	100%
.04 -.08	Very Coarse	1.0 - 2.0	S			0	0%	100%
.08 - .16	Very Fine	2.0 - 4.0				0	0%	100%
.16 - .22	Fine	4.0 - 5.7	G			0	0%	100%
.22 - .31	Fine	5.7 - 8.0	R			0	0%	100%
.31 - .44	Medium	8.0 - 11.3	A			0	0%	100%
.44 - .63	Medium	11.3 - 16.0	V			0	0%	100%
.63 - .89	Coarse	16.0 - 22.6	E			0	0%	100%
.89 - 1.26	Coarse	22.6 - 32.0	L			0	0%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S			0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0				0	0%	100%
2.5 - 3.5	Small	64 - 90	C			0	0%	100%
3.5 - 5.0	Small	90 - 128	O			0	0%	100%
5.0 - 7.1	Large	128 - 180	B			0	0%	100%
7.1 - 10.1	Large	180 - 256	L			0	0%	100%
10.1 - 14.3	Small	256 - 362	B			0	0%	100%
14.3 - 20	Small	362 - 512	L			0	0%	100%
20 - 40	Medium	512 - 1024	D			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R			0	0%	100%
	Bedrock		BDRK			0	0%	100%
			Totals	**100**	**0**	**100**	**100%**	**100%**



Appendix C

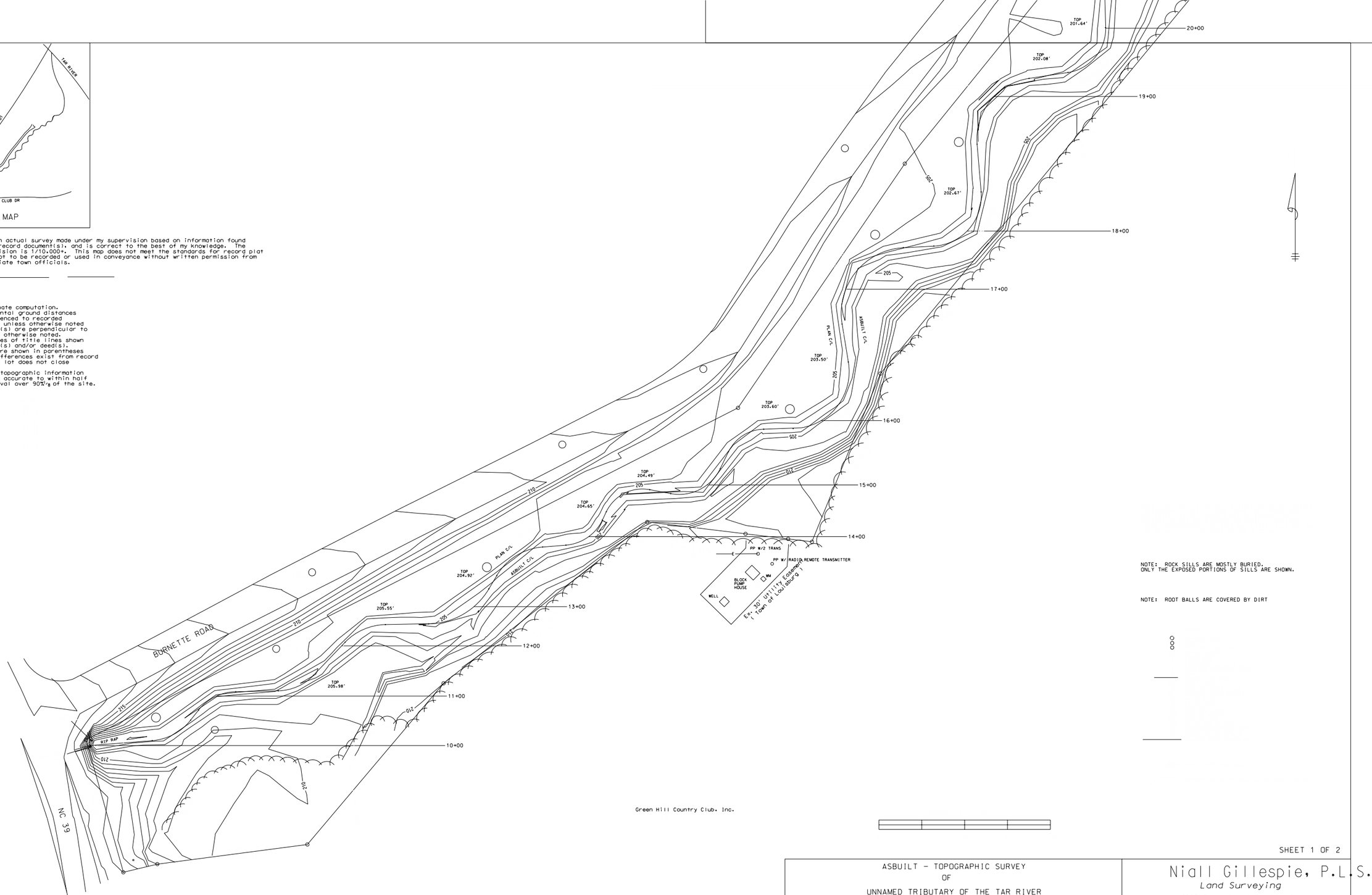
As-Built Survey



This map is drawn from an actual survey made under my supervision based on information found in the above referenced record document(s). and is correct to the best of my knowledge. The unadjusted ratio of precision is 1/10,000+. This map does not meet the standards for record plat as per GS47-30 and is not to be recorded or used in conveyance without written permission from the surveyor and appropriate town officials.

NOTES:

1.) Areas are by coordinate computation.
2.) Distances are horizontal ground distances
3.) North arrow is referenced to recorded document shown above unless otherwise noted
4.) Building / house tie(s) are perpendicular to property lines unless otherwise noted.
5.) Bearings and distances of title lines shown are from record plat(s) and/or deed(s).
6.) Field measurements are shown in parentheses where significant differences exist from record lot, or where record lot does not close mathematically.
7.) The accuracy of the topographic information shown on this map is accurate to within half of one contour interval over 90% of the site.



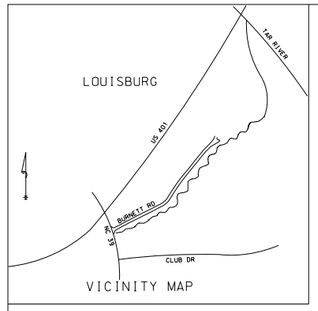
Green Hill Country Club, Inc.

NOTE: ROCK SILLS ARE MOSTLY BURIED. ONLY THE EXPOSED PORTIONS OF SILLS ARE SHOWN.

NOTE: ROOT BALLS ARE COVERED BY DIRT

SHEET 1 OF 2

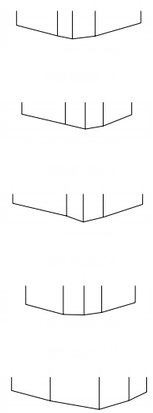
ASBUILT - TOPOGRAPHIC SURVEY OF UNNAMED TRIBUTARY OF THE TAR RIVER		Niall Gillespie, P.L.S. *Land Surveying* *4008 Green Level Road West Apex, North Carolina 27523 Telephone & Fax # (919) 387-0208*	
REVISIONS	PROPERTY OF		
	TOWNSHIP / COUNTY : FRANKLIN	SURVEYED BY MAR	
	STATE: NORTH CAROLINA	SCALE 1" = 30' / DRAWN BY AM	FILE NAME
	ZONE: P.I.N.	CHECKED & CLOSURE BY NWG	UTTAR

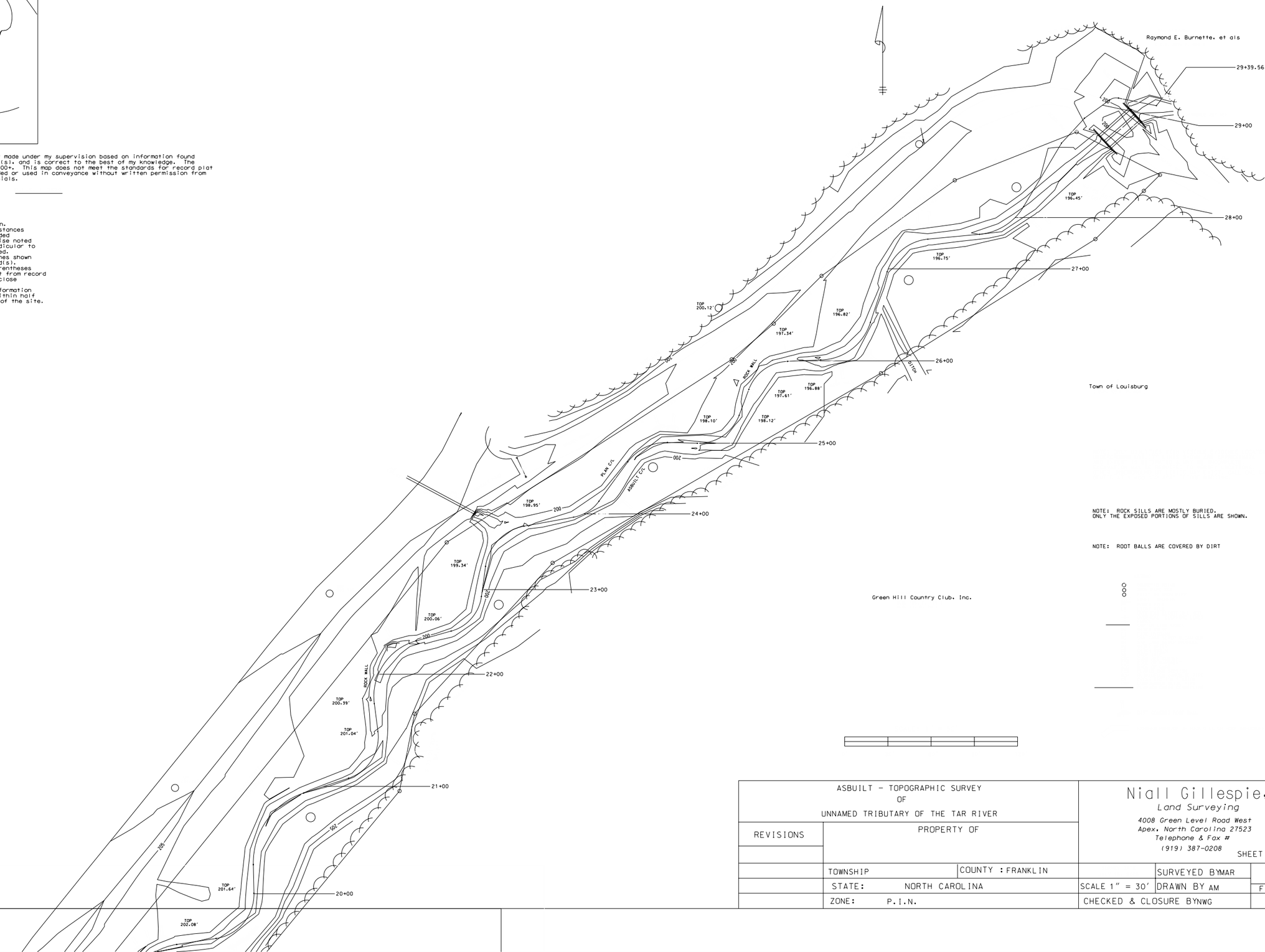


This map is drawn from an actual survey made under my supervision based on information found in the above referenced record document(s), and is correct to the best of my knowledge. The unadjusted ratio of precision is 1/10,000+. This map does not meet the standards for record plat as per GS47-30 and is not to be recorded or used in conveyance without written permission from the surveyor and appropriate town officials.

NOTES:

1.) Areas are by coordinate computation.
2.) Distances are horizontal ground distances
3.) North arrow is referenced to recorded document shown above unless otherwise noted
4.) Building / house tie(s) are perpendicular to property lines unless otherwise noted.
5.) Bearings and distances of title lines shown are from record plat(s) and/or deed(s).
6.) Field measurements are shown in parentheses where significant differences exist from record lot, or where record lot does not close mathematically.
7.) The accuracy of the topographic information shown on this map is accurate to within half of one contour interval over 90% of the site.





NOTE: ROCK SILLS ARE MOSTLY BURIED.
ONLY THE EXPOSED PORTIONS OF SILLS ARE SHOWN.

NOTE: ROOT BALLS ARE COVERED BY DIRT

ASBUILT - TOPOGRAPHIC SURVEY
OF
UNNAMED TRIBUTARY OF THE TAR RIVER

REVISIONS

PROPERTY OF

TOWNSHIP | COUNTY : FRANKLIN

STATE: NORTH CAROLINA

ZONE: P.I.N.

SCALE 1" = 30'

SURVEYED BY MAR

DRAWN BY AM

CHECKED & CLOSURE BY NWG

FILE NAME
UTTAR

Niall Gillespie, P.L.S.
Land Surveying
4008 Green Level Road West
Apex, North Carolina 27523
Telephone & Fax #
(919) 387-0208

SHEET 2 OF 2