

**UT to Rocky River (Smith Tract) Stream  
and Buffer Restoration, Enhancement,  
and Preservation  
Chatham County, North Carolina  
CU: 03030003  
SCO# 040614001**

**Mitigation Report  
March 20, 2007**



Submitted to:



North Carolina Department of Environment and Natural Resources  
Ecosystem Enhancement Program  
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Parker Lincoln Building  
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Raleigh, NC 27606

# UT to Rocky River (Smith Tract) Stream and Buffer Restoration, Enhancement, and Preservation Chatham County, North Carolina

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## Executive Summary

In 2001, the North Carolina Department of Transportation (NCDOT) identified two unnamed tributaries to Nick Creek in Chatham County, North Carolina, as stream mitigation sites. The tributaries are on a tract that was referred to as the Smith Tract Mitigation Site. The two unnamed tributaries have been designated Reach 1 and Reach 2. These two streams join just south of the Smith property boundary line and then discharge into Nick Creek approximately 6,000 linear feet west of the Smith Property, just above the confluence of Nick Creek and the Rocky River.

The Smith Tract is a combination of four properties owned by Mr. Ernest H. Smith and his wife, Linda S. Smith. The subject property is located at 700 Smith Hudson Road (SR 1328) in the Matthews Township. The property is currently being utilized for cattle pasture for beef production. Reach 1 runs east to west bisecting the property. The drainage area for Reach 1 is approximately 1.28 square miles and is located entirely within a wooded area just north of a cleared field and the landowner's residence. The main factors that contributed to the stream's degradation were the cattle access along the stream banks, causing soil loss and bank instability, limited under-story riparian and stream bank vegetation due to cattle grazing and movement, and pattern instability due to a vehicle crossing access in a stream bend. Reach 2 runs north to south in the western portion of the property and has a drainage area of approximately 0.21 square miles. The area where Reach 2 is located is wooded and fenced off to cattle. The main factors in the degradation of Reach 2 were the riparian buffer removal, the installation of a culvert for farm equipment access, and the incision of the main channel into which Reach 2 flows.

The project involves 1) stream restoration and enhancement, and riparian buffer restoration and preservation. Table 1 displays the approximate areas and lengths of the restoration/enhancement/preservation areas.

Table 1: Project Restoration, Enhancement, and Preservation Specifications

<b>Project Restoration/Enhancement/Preservation</b>		
<b>Type</b>	<b>Acres</b>	<b>Linear Feet</b>
Stream Restoration	N/A	1,113.64
Stream Enhancement	N/A	955
Stream Buffer Enhancement	2.21	N/A
Stream Buffer Restoration	0.3	N/A
Stream Buffer Preservation	6.67	N/A

Stream and buffer restoration were completed in conjunction with vegetation establishment and the removal of an existing culvert along Reach 2 and the installation of a cattle crossing along Reach 1. Stream enhancement consisted of repairing the stream banks along Reach 1 that had been damaged by cattle over the years. The channel dimensions were adjusted by sloping back unstable vertical banks to a stable gradient of 2H:1V or flatter. The sloping back of the banks brought the channel cross section back



into target dimensions for width and cross sectional area. Reach 2 was a priority 1 restoration. The stream was reconnected to its floodplain and the stream pattern, profile, and dimension were adjusted to allow the stream to efficiently transport its water and sediment load through a combination of changes to the channel dimensions, pattern, and bedform. The new channel was constructed with a mean width of 11 feet and an average cross sectional area of 8 square feet in the riffles. The pools were constructed with an average pool width of 10 feet and a larger cross sectional area of 11 square feet. Vegetation in the riparian zone was restored to reflect historic Piedmont/Mountain Bottomland Forest species composition and abundance. Plants were established at 6 x 10 foot spacing (640 plants/acre). Vegetation in the buffer areas was established for bank stability and for control of bed erosion.

Ecological benefits of the restoration include improving the water quality in Nick Creek, the Rocky River, and the Cape Fear River Basin. This was done by planting riparian and wetland vegetation along the stream banks. Riparian vegetation is important for maintaining bank stability and control of bed erosion and can be directly linked to water quality issues. Riparian vegetation also plays a role in increasing biodiversity and serves to provide habitat for native fauna.

The UT to Rocky River (Smith Tract) Project will be monitored once each year for a period of five (5) years, with the first year monitoring to be completed in September of 2007 by the principal design consultant, Ward Consulting Engineers, P.C. The success criteria for the preferred species in the restoration areas will be based on annual and cumulative survival and growth over five (5) years. Survival of preferred species must be at a minimum 320 stems/ac at the end of five (5) years of monitoring. Height growth must average six (6) feet. Species composition will be compared with reference stands and will be subject to review and approval. Average annual growth height increment of preferred species will be 1.25 feet/year over the 5-year monitoring period. Rainfall data will be collected monthly to produce a record of the actual rainfall received at the site. The 1<sup>st</sup>-Year Monitoring Report will be submitted to EEP prior to the end of the first calendar year, documenting plant community conditions within the restoration areas. The report will also include a proposed plan of action for the following year including maintenance activities.

## **1.0 Introduction**

### **1.1 Background**

In 2001, the North Carolina Department of Transportation (NCDOT) identified two unnamed tributaries to Nick Creek in Chatham County, North Carolina, as stream mitigation sites. The tributaries are on a tract that was referred to as the Smith Tract Mitigation Site. The two unnamed tributaries have been designated Reach 1 and Reach 2. Reach 1 is located in the approximate middle of the property and flows from the property's eastern boundary line with Mr. John R. Fox to the western property line with Mr. George Edward Pike. Reach 2 is located in the western most portion of the property and flows from the northern property boundary line with Ms. Julia B. Howard to the southern property boundary line with Mr. George Edward Pike. These two streams join just south of the Smith property boundary line on Mr. Pike's property, and then discharge into Nick Creek approximately 6,000 linear feet west of the Smith Property, just above the confluence of Nick Creek and the Rocky River.

The Smith Tract is a combination of four properties owned by Mr. Ernest H. Smith and his wife, Linda S. Smith. The subject property is located at 700 Smith Hudson Road (SR 1328) in the Matthews Township. The property is currently being utilized for cattle pasture for beef production. Mr. and Mrs. Smith reside on the property. The cattle are kept either in a fenced area where they have access to Reach 1 or on the parcel that is located on the opposite side of Smith Hudson Road. The owner normally maintains approximately 40-50 head of cattle on the property. The cattle are raised for beef production. The stock is primarily sold in February, and to a lesser extent in August or September. The cattle are rotated to various fields on the property. The livestock is grazed approximately 75% of the year on the fields and woods adjacent to the streams on the property.

Reach 1 runs east to west bisecting the property. The reach is located entirely within a wooded area just north of a cleared field and the landowner's residence. There is an access road for vehicles and livestock that crosses through the creek approximately 150 feet upstream of the western property line. A small bridge that is used for pedestrian and 4-wheeler traffic also crosses the stream in the upper portion of the reach. Livestock had complete access to the stream along the entire length of Reach 1.

A pond is located just north of Reach 1. The cattle had access to this pond but the landowner has plans to fence out the livestock. The owner uses the pond for recreational boating and stocks it for fishing.

Reach 2 runs north to south in the western portion of the property. This stream has a drainage area approximately one-sixth the size of that of Reach 1 and is correspondingly smaller in dimension. The area where Reach 2 is located is wooded and fenced off to cattle. A dirt vehicle access road crossed the upstream portion of Reach 2, with a culvert under the roadway to maintain stormwater flows. Just upstream of the culvert is an area

that was dug out to pond water. The owner stated that a natural spring exists just upstream on the adjacent property. At the lower end of Reach 2 the woods have been cleared and an open field, not in agriculture use, borders the stream to the east. The property adjacent to Reach 2 was used for crop production in the past, but was taken out of crop production approximately 30 years ago and planted with pine. The owner is planning on harvesting the pine trees in the future.

## **1.2 Location**

From U.S. Highway 64 just east of Siler City, head north on Silk Hope Road, then turn left onto Rufus Brewer Road, and take the next left onto Smith Hudson Road. The property is in Chatham County (Figure 1). The construction entrance off of Smith Hudson Road, just east of the house, provides access to Reach 1 (Latitude 35°45'56" and Longitude 79°24'57") and Reach 2 (Latitude 35°45'57" and Longitude 79°25'9"). The site is in the Cape Fear River Basin in Cataloging Unit 03030003.

## **1.3 Project Structure, Mitigation Type, Approach, and Objectives**

The project site consists of approximately sixty-seven (67) acres. Reach 1 classified as a C4/E4 stream that was slightly incised along its entire length. The stream has a slate bed and many rock outcrops that have inhibited its further incision. The main factors that contributed to the stream's degradation were the cattle access along the stream banks, causing soil loss and bank instability, limited under-story riparian and stream bank vegetation due to cattle grazing and movement, and pattern instability due to a vehicle crossing access in a stream bend. Reach 2 is a G4 stream with slate outcrops and bedrock nick points. The main factors in the degradation of Reach 2 were the riparian buffer removal, the installation of a culvert for farm equipment access, and the incision of the main channel into which Reach 2 flows. The stream head cut ends at the northern property line with Ms. Howard, and the streams on the Howard property are not incised, providing a natural tie in location to prevent further incision upstream. Reach 2 is located mostly in a wooded buffer with moderate bank vegetation and bank erosion potential.

## **1.4 Watershed Description**

The combined drainage area for Reach 1 and Reach 2 is approximately 1.49 square miles. The entire watershed is located south of Silk Hope Liberty Road (SR 1346), west of Silk Hope Road (SR 1003), north of Smith Hudson Road (SR 1328), and east of Jesse Bridges Road (SR 1332). The drainage area for Reach 1 is approximately 1.28 square miles. The eastern boundary of the watershed for Reach 1 is approximately 5,000 feet east of Rufus Brewer Road and the southern boundary extends almost to Silk Hope Road. The watershed's northwestern boundary parallels Jesse Bridges Road approximately 1,500 feet to the east. The drainage area for Reach 2 is approximately 0.21 square miles. The watershed boundary extends to the north to Jesse Bridges Road and to the east and west approximately 1,000 feet from the stream. The southern boundary of the watershed is at the intersection of the southwest corner of the property and the center of Reach 2.

The watershed contributing to Reach 1 is currently developed with rural agricultural usage. The watershed is approximately 15% wooded, with the remaining 85% cleared

for grazing or crop production. There are scattered residential and farm support buildings within the watershed. Approximately 44% of this watershed is above ponds that have been constructed on line in the streams. A few of the ponds are in the upper portion of the watershed and are not likely to have a significant hydrologic effect on the basin discharges. There are, however, three ponds on the northeast tributary that may impact as much as 30% of the watershed. The watershed contributing storm water runoff to Reach 2 has less agriculturally developed land. Approximately 50% of the land still remains wooded and 50% has been converted to agricultural land usage. No visible ponds were detected from the aerial and topographic maps available at the time of study.

The property falls under the planning and zoning restrictions of Chatham County. The watershed area is not currently zoned and is in an area projected by the county to have the smallest amount of development. The property and watershed fall under the least restrictive Chatham County, Local Watershed Regulations. These regulations state the "agricultural activities conducted after January 1, 1993 shall maintain a minimum ten foot vegetative buffer or equivalent control as determined by the Soil and Water Conservation Commission, along all perennial waters indicated on the most recent versions of U.S.G.S. 1:24,000 (7.5 minute) scale topographic maps or as determined by government studies".

## **2.0 Restoration Summary**

### **2.1 Mitigation Goals and Objectives**

The mitigation goals and objectives of this project are:

1. Reconnect Reach 2 to its floodplain through the restoration of 1,185 linear feet of stream
2. Relocate 150 feet and stabilize 955 feet of stream bank in Reach 1
3. Provide a stable stream channel that neither degrades nor aggrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load.
4. Provide a minimum of 150-foot easement (75 feet from the top of either bank) along Reach 1 and 2.
5. Provide stream buffer enhancement of 2.21 acres, restoration of 0.3 acres, and preservation of 6.67 acres.
6. Fence the buffer in Reach 1 and Reach 2 to exclude livestock. Fencing will allow for cattle/equipment access as well as a future roadway crossing on Reach 1.
7. Improve water quality and reduce erosion by stabilizing the stream banks through restricting cattle and improving riparian vegetation.
8. Improve the aquatic habitat of Reach 1 and 2 with the use of natural material stabilization structures such as root wads, rock cross-vanes, woody debris, and a riparian buffer.
9. Provide aesthetic value, wildlife habitat, and bank stability through the creation or enhancement of a riparian zone.

## 2.2 Restoration Approach

The project involves: 1) stream restoration and enhancement, and 2) riparian buffer enhancement, restoration and preservation. The following sections break down the different restoration efforts on the site.

### 2.2.1 Streams

The stream design was based on Dave Rosgen's natural channel design methodology. Morphologic characteristics were measured on both existing stream reaches and the reference reach. These measurements of pattern, profile and dimension were reduced to a range of values and dimensionless ratios used to determine a proposed stable stream form.

Reach 1 was predominantly a stable C4/E4 stream type that was slightly incised. The restoration and enhancement efforts proposed for this reach was primarily bank stabilization and fencing out the cattle to prevent access to the stream. The bank stabilization work occurred along approximately 955 linear feet of the stream. The channel dimensions were adjusted by sloping back unstable vertical banks to a stable gradient of 2H:1V or flatter. The sloping back of the banks brought the channel cross section back into target dimensions for width and cross sectional area. The pattern was not adjusted in Reach 1 except for approximately 150 feet of relocation near the western property line. The floodplain was also graded down in one area where it was too high and all disturbed areas were seeded with temporary and permanent seed and matted with erosion control matting. Straw was spread out over the floodplain area that was disturbed. Approximately 150 feet of Reach 1 was relocated to reestablish the stream pattern and dimension that had been impaired due to the vehicle crossing around this location. An improved cattle/vehicle crossing was constructed where the vehicle crossing was after the realignment of this portion of the stream had been completed.

Reach 2 was a priority 1 restoration. The stream was reconnected to its floodplain and the stream pattern, profile, and dimension were adjusted to allow the stream to efficiently transport its water and sediment load through a combination of changes to the channel dimensions, pattern, and bedform. The new channel was constructed with a mean width of 11 feet and an average cross sectional area of 8 square feet in the riffles. The pools were constructed with an average pool width of 10 feet and a larger cross sectional area of 11 square feet. Pattern was reintroduced by increasing the overall length and sinuosity, which will decrease the stream slope and channel shear stresses. Constructed riffles were used at many locations along the new channel to provide for vertical grade control and stability. Six (6) single-wing rock vanes and two (2) sills were also installed along the channel to provide for bank and channel dimension stability and to prevent the flow of water from cutting a new channel around the constructed channel. One cross-vane was installed at the bottom of the stream to prevent any stream degradation from moving upstream from the downstream property.

Vegetation was later established along Reaches 1 and 2 after all construction activities had been completed and the time of year was more appropriate for planting.

### **2.2.2 Buffer Restoration**

Vegetation in the riparian zone was restored to reflect historic Piedmont/Mountain Bottomland Forest species composition and abundance. Plants were established at 6 x 10 foot spacing (640 plants/acre). Vegetation in the buffer areas was established for bank stability and for control of bed erosion.

The following planting zones were established for the project:

- Zone 1: Stream buffer within 50 feet of the stream and consisting of 0.96 acres along Reach 1 and 1.38 acres along Reach 2.
- Zone 2: Stream buffer at Reach 2 greater than 50 feet from the stream and consisting of 0.11 acres.
- Zone 3: Stream bank, consisting of approximately 2,400 linear feet along Reaches 1 and 2.

In Zone 1, approximately 615 plants were initially installed at Reach 1 and 885 plants initially installed at Reach 2, for a total of 1,500 plants in Zone 1. In Zone 2, approximately 70 plants were installed. Zone 3 consists of the stream bank area right along each stream and totals approximately 2,400 linear feet for both Reaches 1 and 2. In Zone 3 along Reach 1, approximately 856 plants were installed, and in Zone 3 along Reach 2, approximately 771 plants were installed, for a total of 1,636 plants.

### **3.0 Monitoring Plan**

The UT to Rocky River (Smith Tract) Project will be monitored once each year for a period of five (5) years, with the first year monitoring to be completed in December of 2007 by the principal design consultant, Ward Consulting Engineers, P.C. Monitoring will consist of an overall survey of the condition of the stream restoration and enhancement areas, evaluation of monitoring plots, and evaluation of the stream gauge.

#### **3.1 As-Built Data Collection**

The as-built data for the project site were developed by Niall Gillespie, Surveying. They surveyed the final grades of Reach 1 and Reach 2 including the top of bank, toe, and centerline of the Reach 2, the location of bank repairs on Reach 1, and all structures installed along both reaches. They also surveyed all pool features left or enlarged adjacent to the channel, with the pool depth and water surface elevation indicated, and then prepared a contour map. Ward Consulting Engineers placed additional information on the as-built map including the stream restoration lengths, buffer widths, vegetation plots and cross section locations.

### **3.2 Stream Restoration and Enhancement**

To meet mitigative success, baseline conditions were established in the form of as-built drawings. At the conclusion of construction activities, the channel modifications and planted vegetation based on a 1.4 – 1.7 year bankfull return period will be monitored annually for a minimum of five (5) years. The 1<sup>st</sup> Year Monitoring Report will be prepared at the end of the 1<sup>st</sup> year.

The success criteria for stream restoration is based on the stability of the stream. The geomorphology of the stream will be monitored as follows:

**Dimension:** Permanent cross sections were established in the frequency of one for every 20 bankfull widths along the length of the reach. Cross section sites were selected such that approximately half are placed in riffles and half are placed in pools. Measurements of W/D ratio, entrenchment ratios, and low bank height ratio will be monitored yearly. The location of the cross sections was GPS'd. There is one cross section along Reach 1 and five cross sections along Reach 2.

**Pattern:** Pattern measurements included sinuosity and meander width ratio and will be performed yearly. Measurements of radius of curvature will be monitored on newly constructed meanders for the first year only.

**Profile:** Longitudinal profile was surveyed and measurements collected on slope (average, pool, riffle) and pool-to-pool spacing.

**Materials:** Pebble counts in pools and riffles were performed. The D50 and D84 particle size diameter percentiles will be monitored to assure an increase in coarseness in riffles and an increase in fineness in pools.

**Photo Reference Points:** Photo reference points were established at all cross sections showing banks and channel. Additional photos will be taken at selected structures on the project to monitor their structural stability.

During the annual review the entire stream reach will be evaluated for any potential problem areas and photographs taken to document the degree and severity. Potential problem areas may include bank instability, in-stream structure failure or unsuccessful vegetation establishment. If a failure area is noted, corrective actions will be evaluated to resolve the problem. Remedial actions will be undertaken considering any seasonal limitations. Annual reports will be submitted to EEP prior to the end of each calendar year, documenting plant community conditions within the restoration areas and documenting hydrologic data within these areas and reference plots. The annual reports will also include a proposed plan of action for the following year including maintenance activities.

### **3.3 Vegetation**

The success criteria for the preferred species in the restoration areas will be based on annual and cumulative survival and growth over five (5) years. Survival of preferred species must be at a minimum 320 stems/ac at the end of five (5) years of monitoring. Height growth must average six (6) feet. Species composition will be compared with reference stands and will be subject to review and approval. Average annual height increment of preferred species will be 1.25 ft/yr over the 5-year monitoring period.



Six vegetation plots were installed by The Catena Group for monitoring, with two plots in Zone 1 along Reach 1, three plots in Zone 1 along Reach 2, and one plot in Zone 2 along Reach 2. The plots were set at 32.8 feet x 32.8 feet (10 x 10 meters) square. The corners of each plot were marked with 12" x ½" sections of metal conduit driven in the ground, with 4" exposed. Each metal conduit stake was marked with flagging. The locations of the plots are shown on the as-built plans and described as follows:

- Plot 1: Located along Reach 1 approximately 200 feet downstream of the eastern property line (the upstream limit of Reach 1), on the southern side of the stream.
- Plot 2: Located along Reach 1 approximately 50 feet upstream of the downstream limit of Reach one on the southern side of the stream.
- Plot 3: Located along Reach 2 approximately 120 feet downstream of the northern property line (upstream limit of Reach 2), along the eastern side of Reach 2, east of the pond.
- Plot 4: Located along Reach 2 approximately 320 feet downstream of the northern property line (upstream limit of Reach 2), along the eastern side of the stream.
- Plot 5: Located along Reach 2 approximately 350 feet upstream of the southern property line (downstream limit of Reach 2), along the eastern side of the stream.
- Plot 6: Located along Reach 2 approximately 160 feet upstream of the southern property line (downstream limit of Reach 2), along the eastern side of the stream.

The first vegetation monitoring count was performed on December 20, 2006 and the results are included in Tables 3 and 4. In addition to the woody vegetation plantings, herbaceous seed mixes were applied throughout the site as detailed in the Restoration Plan. The project will be determined to be successful once vegetation success criteria have been met. The vegetation growth data will be matched with rain data to determine if abnormal conditions were present. During vegetation monitoring, planted and volunteer stem densities will be measured in addition to the relative abundance and diversity of herbaceous vegetation within the monitoring plots. Survival, numbers per acre by species, and tree height will be measured at the end of each growing season just prior to leaf fall in the month of September. Planting locations and methods will be completed in the first year Annual Report.

#### **4.0 Maintenance & Contingency Plans**

The North Carolina Ecosystem Enhancement Program (EEP) will be responsible for the maintenance of this project for a period of five (5) years after project completion. During the first year of monitoring by the design consultant, if a problem that requires an immediate corrective action or a flaw in the site is noted at any point, it will be brought immediately to the attention of the EEP. After the first year, repairs will be made as necessary by the EEP.

## 5.0 References

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Radford, A.E., H.E. Ahles and G.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. The University of North Carolina Press. Chapel Hill, North Carolina.

Rosgen, D.L. 1996. Applied River Morphology, Wildland Hydrology, Pagosa Springs Colorado.

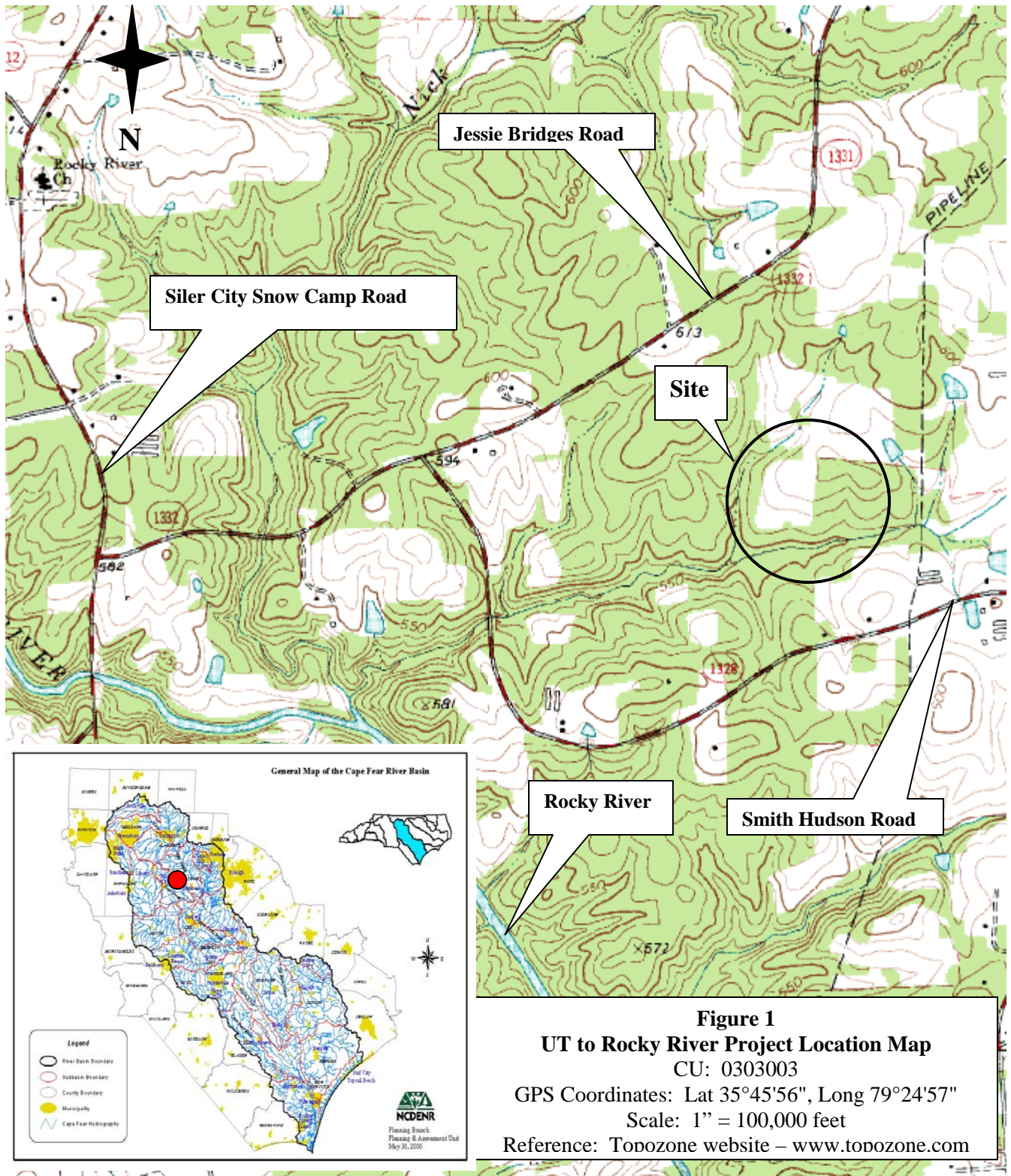
Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina. Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, NCDEM. Raleigh, North Carolina.

Topozone website. 2006. Available URL: [www.topozone.com](http://www.topozone.com).

U.S. Geological Survey (USGS). 2005. Water Resources of the United States. Hydrologic Unit Maps. Available URL: <http://water.usgs.gov/GIS/huc.html>. [Accessed: May 1, 2006]

## **6.0 Figures**

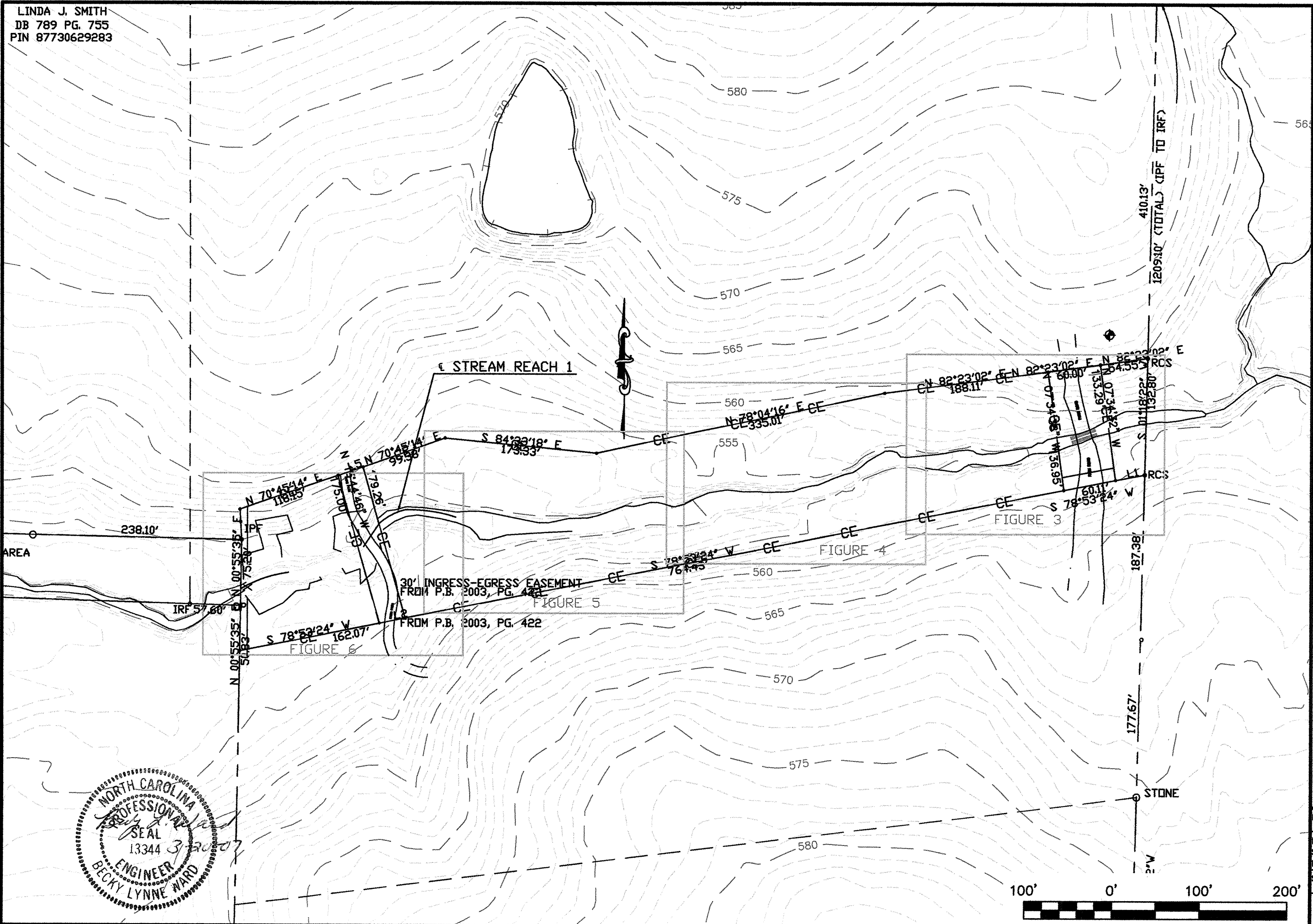
**Figure 1: Location Map**



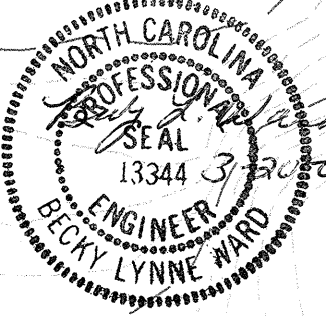
**Figure 1**  
**UT to Rocky River Project Location Map**  
 CU: 0303003  
 GPS Coordinates: Lat 35°45'56", Long 79°24'57"  
 Scale: 1" = 100,000 feet  
 Reference: Topozone website – [www.topozone.com](http://www.topozone.com)


**Figure 2-11: Mitigation Plan**

LINDA J. SMITH  
 DB 789 PG. 755  
 PIN 87730629283



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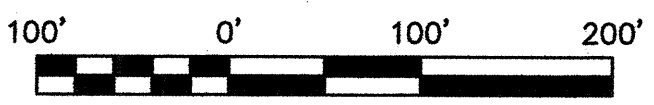


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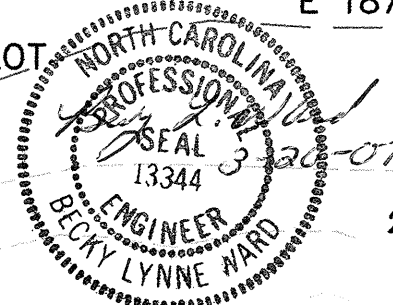
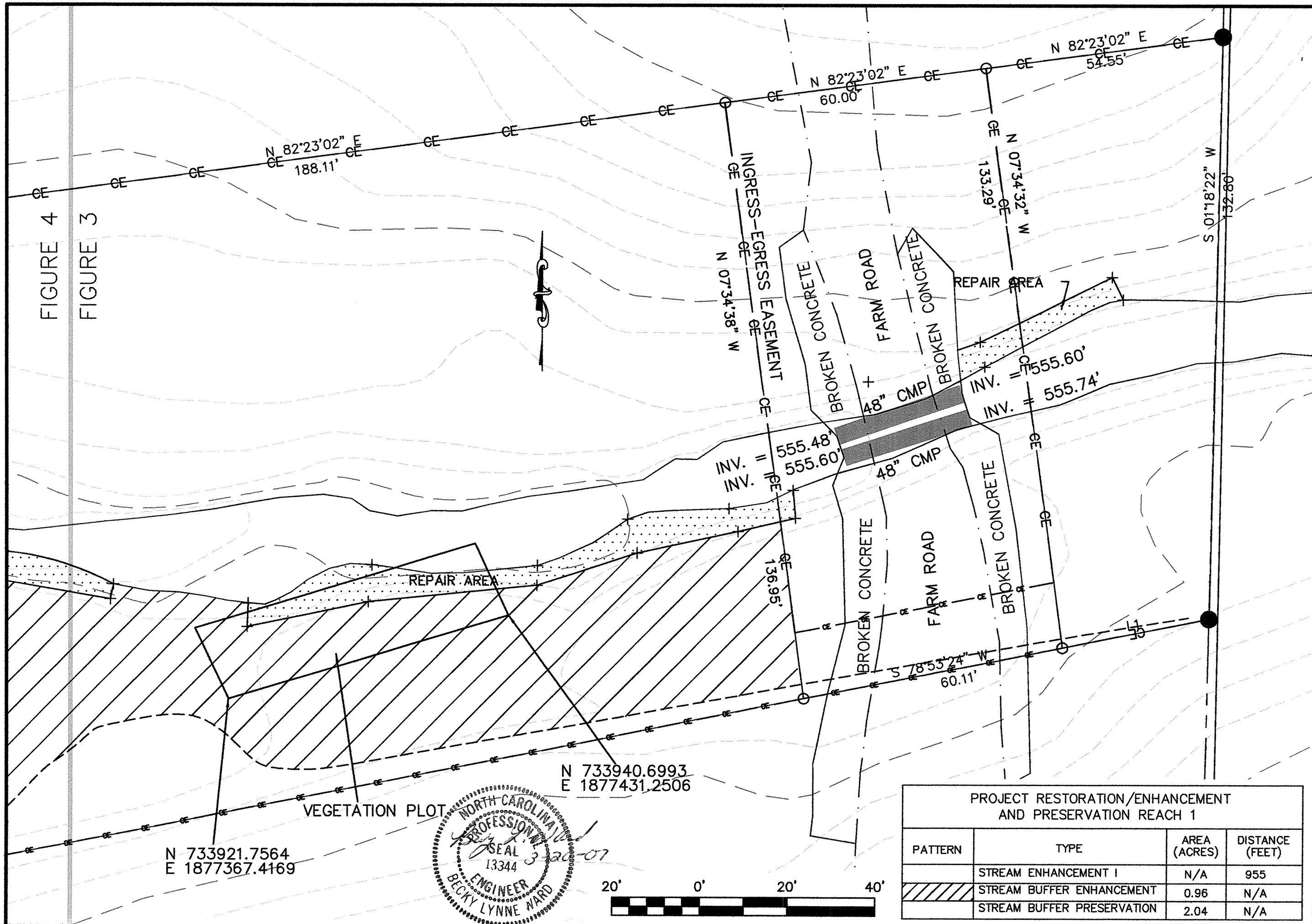
SMITH TRACT REACH 1  
 OVERALL MITIGATION PLAN  
 CHATHAM COUNTY, NORTH CAROLINA

DATE: 3-30-07  
 PROJ./DWG. NAME: Smith Tract MITIGATION  
 SCALE: 1"=100'  
 FIGURE 2



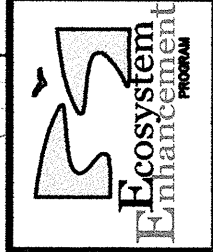


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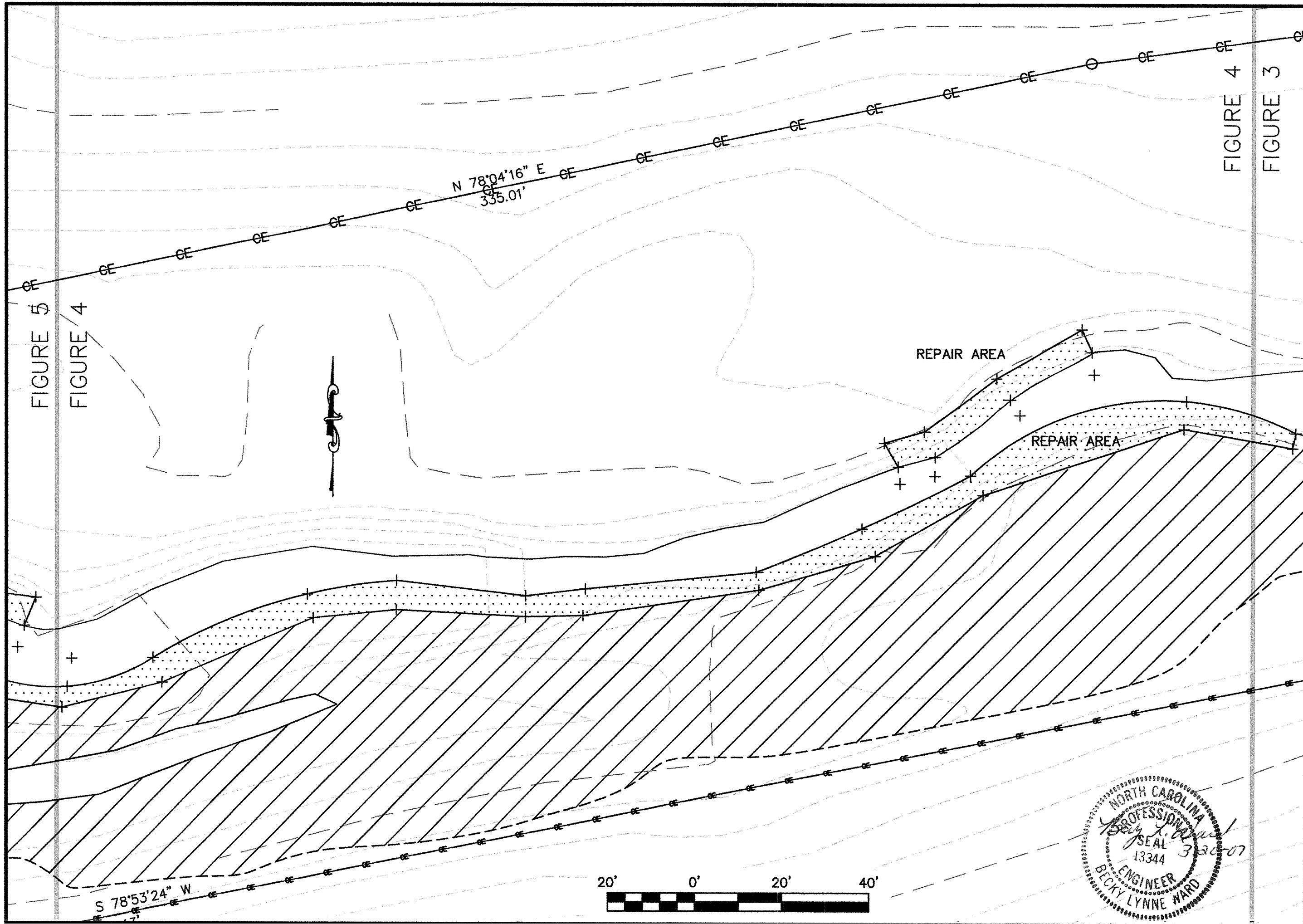
PROJECT RESTORATION/ENHANCEMENT AND PRESERVATION REACH 1			
PATTERN	TYPE	AREA (ACRES)	DISTANCE (FEET)
	STREAM ENHANCEMENT I	N/A	955
	STREAM BUFFER ENHANCEMENT	0.96	N/A
	STREAM BUFFER PRESERVATION	2.04	N/A

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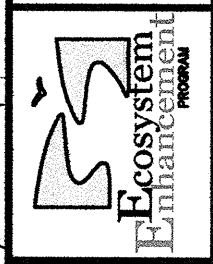


SMITH TRACT REACH 1  
 MITIGATION PLAN  
 CHATHAM COUNTY, NORTH CAROLINA

DATE: 3-20-07  
 PROJ./DWG. NAME: Smith Tract MITIGATION  
 SCALE: 1"=20'  
 FIGURE 3



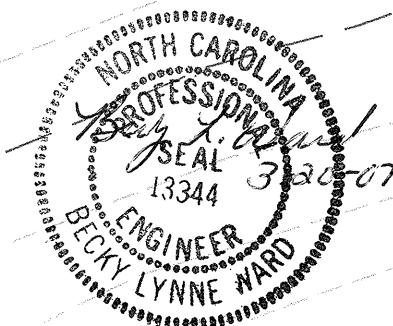
WARD CONSULTING ENGINEERS, PC  
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SMITH TRACT REACH 1  
 MITIGATION PLAN  
 CHATHAM COUNTY, NORTH CAROLINA

DATE: 3-20-07  
 PROJ./DWG. NAME: Smith Tract MITIGATION  
 SCALE: 1"=20'

FIGURE 4



C:\Autocad Drawings\Smith Tract\MITIGATION.dwg, 3/30/2007 5:24:33 PM, 1:1

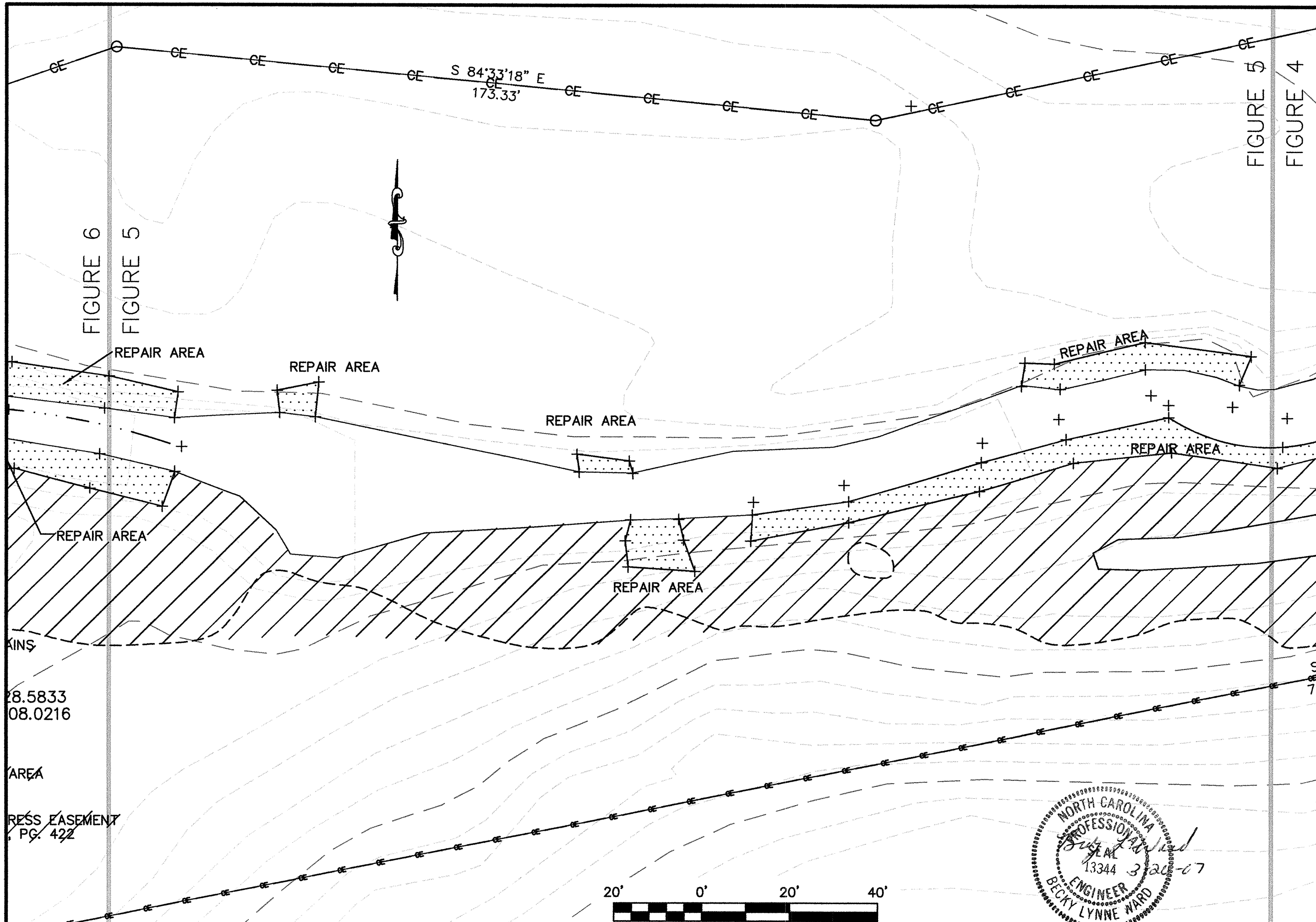


FIGURE 6

FIGURE 5

FIGURE 5

FIGURE 4

REPAIR AREA

REPAIR AREA

REPAIR AREA

REPAIR AREA

REPAIR AREA

REPAIR AREA

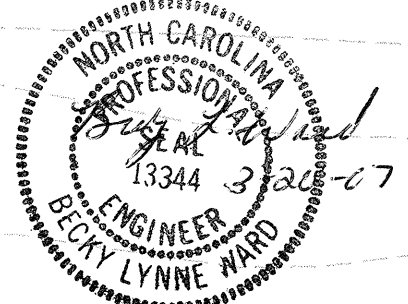
REPAIR AREA

AINS

28.5833  
08.0216

AREA

RESS EASEMENT  
PG. 422



WARD CONSULTING ENGINEERS, PC  
 8986 Six Forks Rd, Suite 101 (919) 870-0588  
 Raleigh, NC 27613 FAX (919) 870-5368

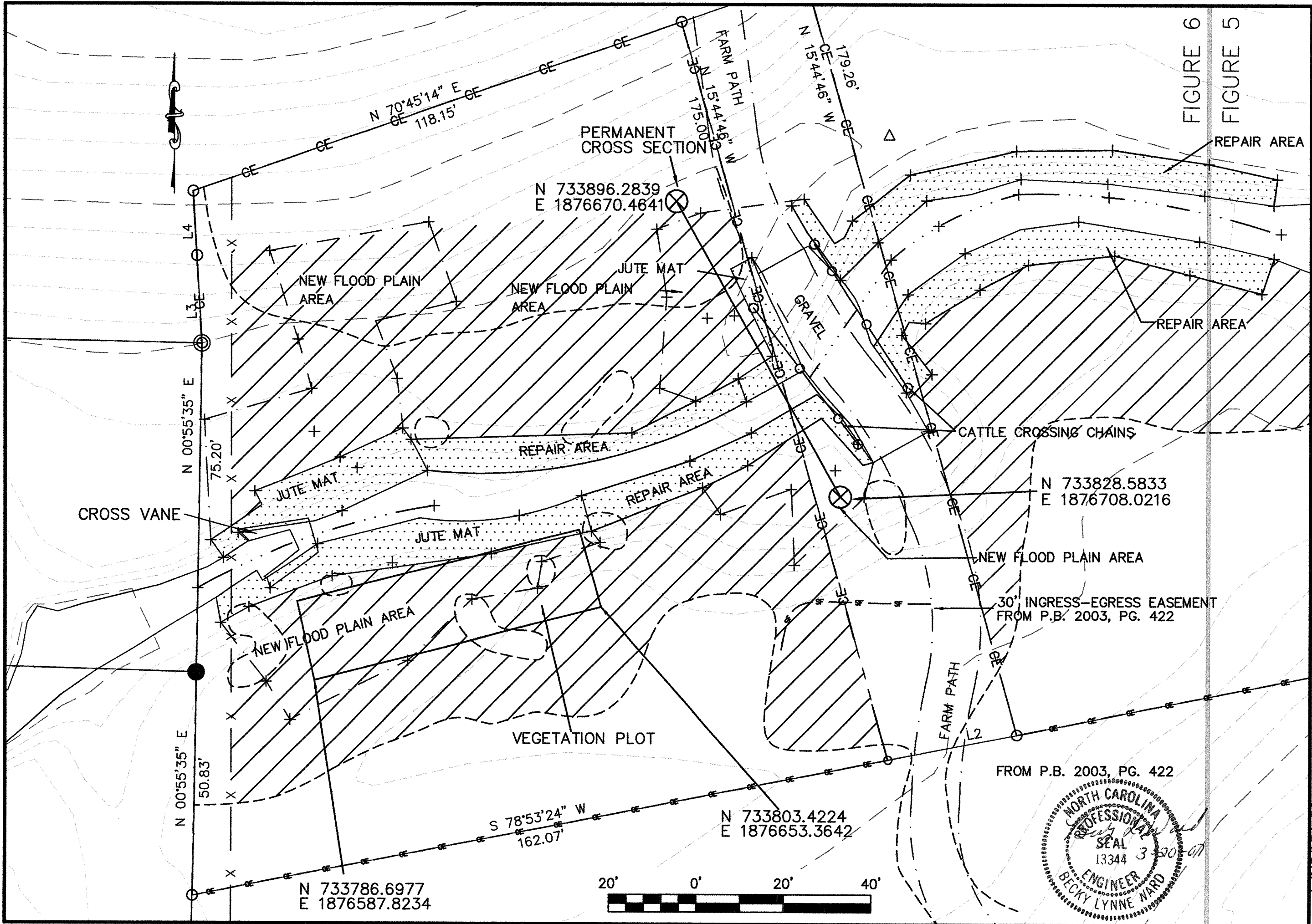


SMITH TRACT REACH 1  
 MITIGATION PLAN  
 CHATHAM COUNTY, NORTH CAROLINA

DATE: 3-20-07  
 PROJ./DWG. NAME:  
 Smith Tract  
 MITIGATION  
 SCALE:  
 1"=20'

FIGURE 5

C:\Autocad Drawings\Smith Tract\MITIGATION.dwg, 3/30/2007 5:45:52 PM, 1:1

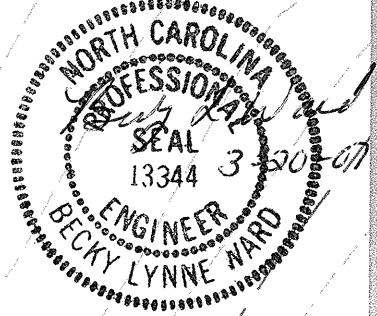


WARD CONSULTING ENGINEERS, PC  
 8986 Six Forks Rd, Suite 101 (919) 870-0526  
 Raleigh, NC 27619 FAX (919) 870-6359

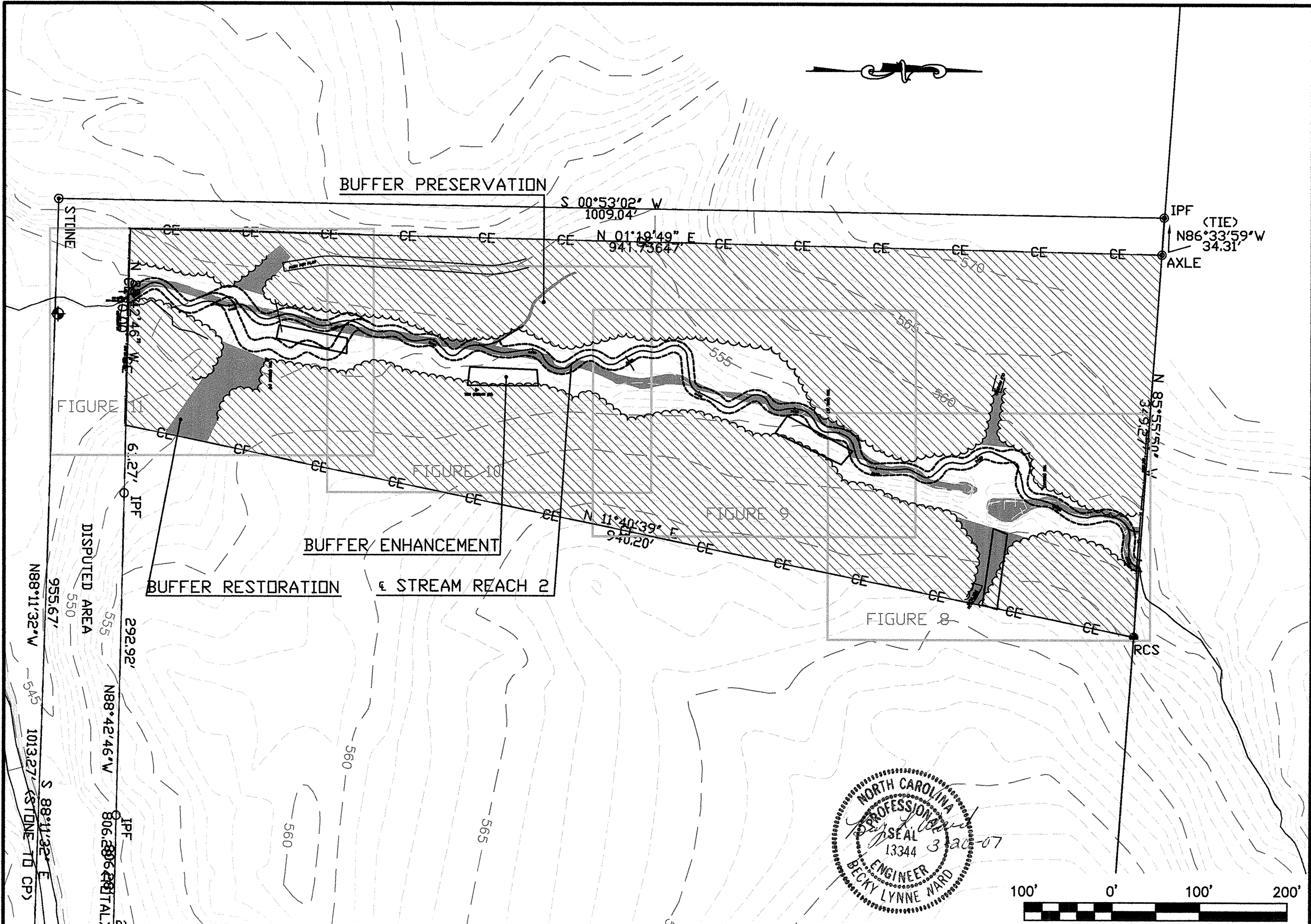


SMITH TRACT REACH 1  
 MITIGATION PLAN  
 CHATHAM COUNTY, NORTH CAROLINA

DATE: 3-20-07  
 PROJ./DWG. NAME: Smith Tract MITIGATION  
 SCALE: 1"=20'  
 FIGURE 6







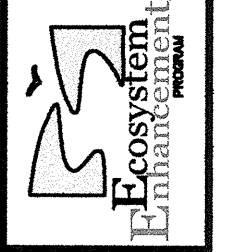
**NORTH CAROLINA**  
**PROFESSIONAL**  
**SEAL**  
**13344**  
**3-20-07**  
**ENGINEER**  
**BECKY LYNNE WARD**



**WARD CONSULTING ENGINEERS, PC**

8386 Six Forks Rd, Suite 101 (919) 870-0526  
 Raleigh, NC 27613 FAX (919) 870-6369

**WCE**



**SMITH TRACT REACH 2**  
**OVERALL MITIGATION PLAN**  
**CHATHAM COUNTY, NORTH CAROLINA**

DATE: 3-20-07  
 PROJ./DWG. NAME: Smith Tract MITIGATION  
 SCALE: 1"=100'  
**FIGURE 7**

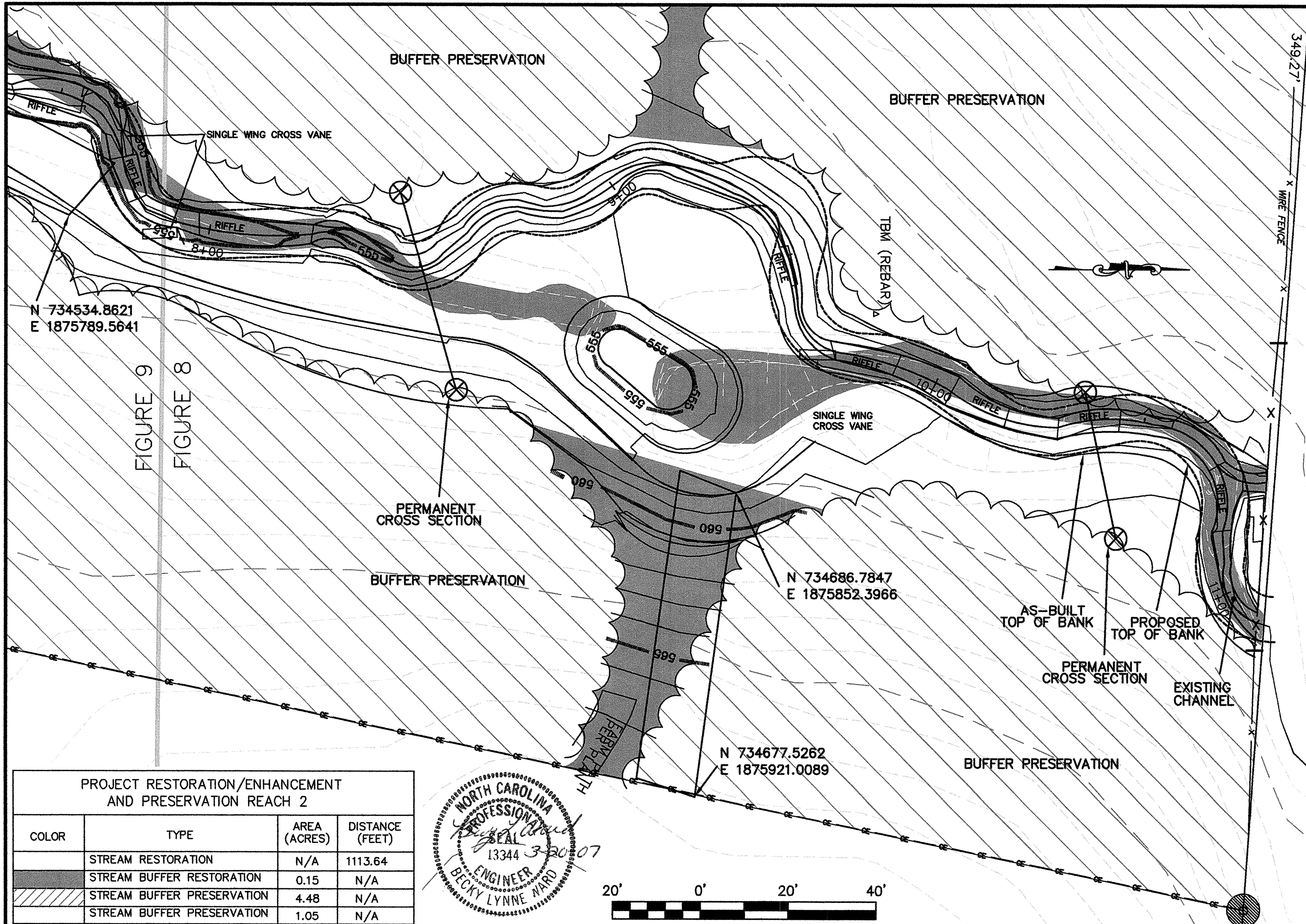


FIGURE 9  
FIGURE 8

PROJECT RESTORATION/ENHANCEMENT AND PRESERVATION REACH 2			
COLOR	TYPE	AREA (ACRES)	DISTANCE (FEET)
	STREAM RESTORATION	N/A	1113.64
	STREAM BUFFER RESTORATION	0.15	N/A
	STREAM BUFFER PRESERVATION	4.48	N/A
	STREAM BUFFER PRESERVATION	1.05	N/A



WARD CONSULTING ENGINEERS, PC  
 6986 Six Forks Rd, Suite 101 (919) 870-0686  
 Raleigh, NC 27613 FAX (919) 870-6369

Ecosystem Enhancement Program

SMITH TRACT REACH 2  
 MITIGATION PLAN  
 CHATHAM COUNTY, NORTH CAROLINA

DATE: 3-20-07  
 PROJ./DWG. NAME: Smith Tract Mitigation  
 SCALE: 1"=20'  
 FIGURE 8

C:\Autocad Drawings\Smith Tract\MITIGATION.dwg, 3/30/2007 5:46:46 PM, 1:1

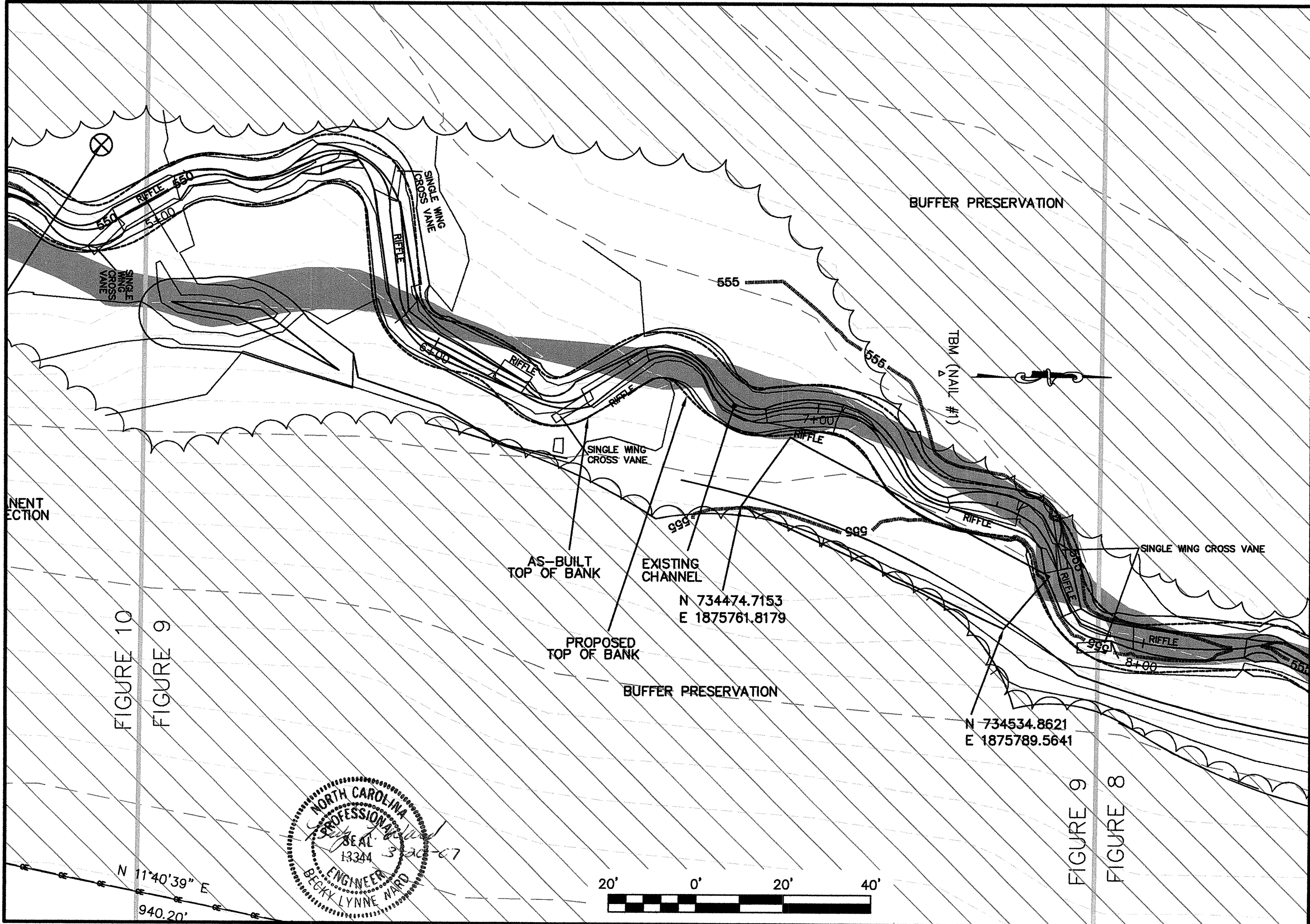
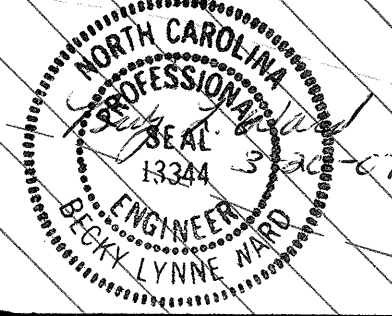


FIGURE 10

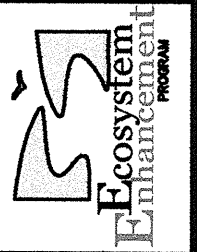
FIGURE 9

FIGURE 9

FIGURE 8



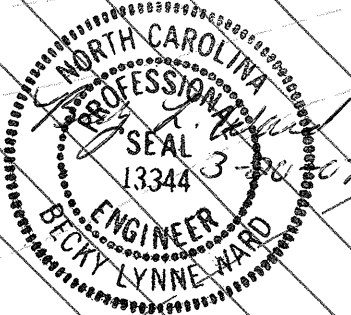
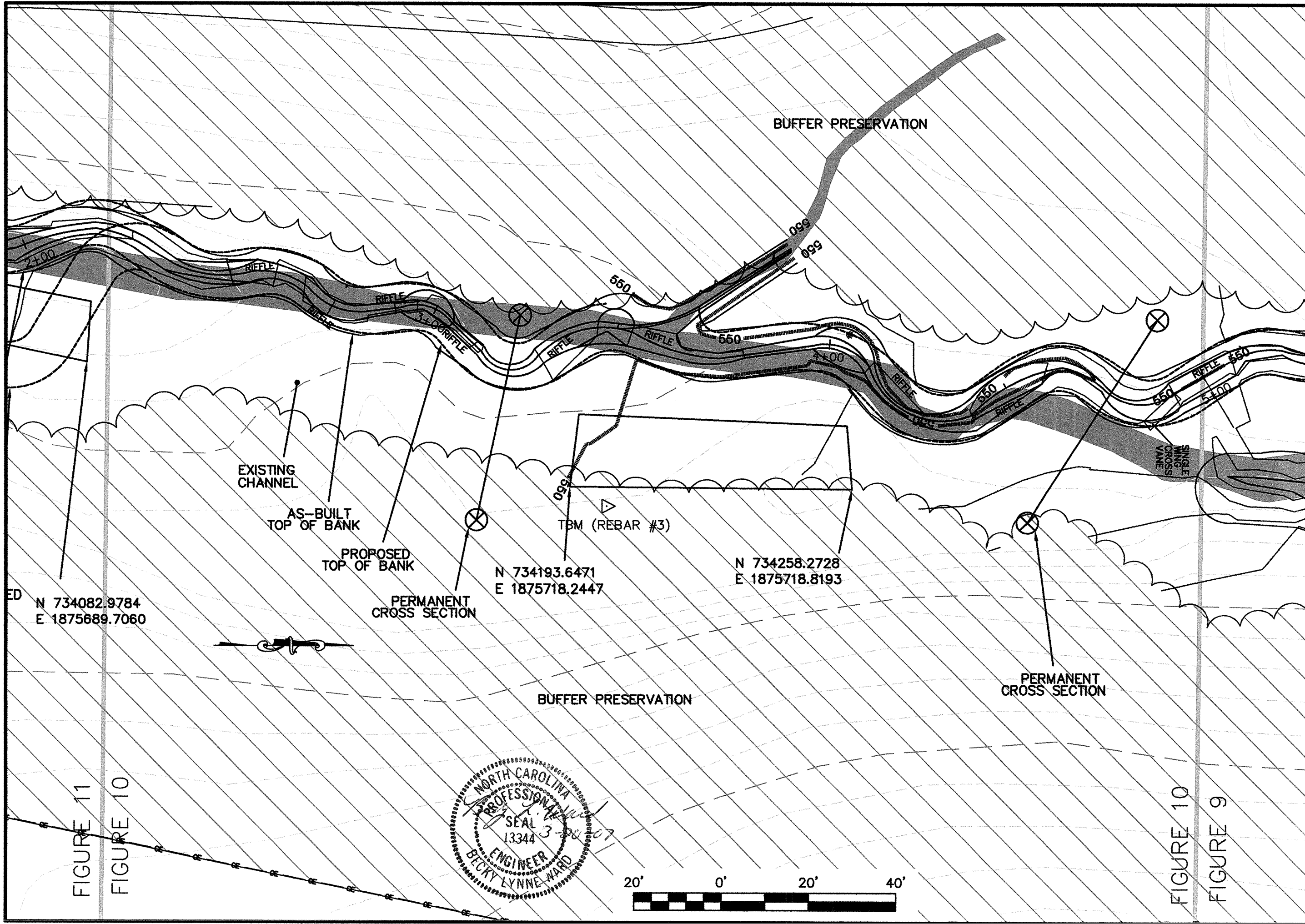
WARD CONSULTING ENGINEERS, PC  
 8986 Six Forks Rd, Suite 101 (919) 870-0888  
 Raleigh, NC 27613 FAX (919) 870-6869



SMITH TRACT REACH 2  
 MITIGATION PLAN  
 CHATHAM COUNTY, NORTH CAROLINA

DATE: 3/30/07  
 PROJ./DWG. NAME: Smith Tract MITIGATION  
 SCALE: 1"=20'  
 FIGURE 9





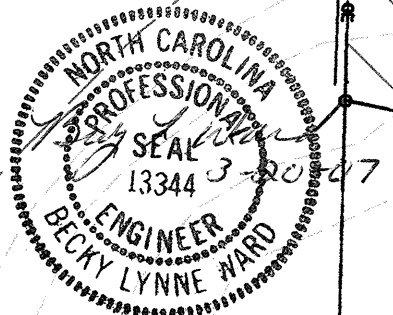
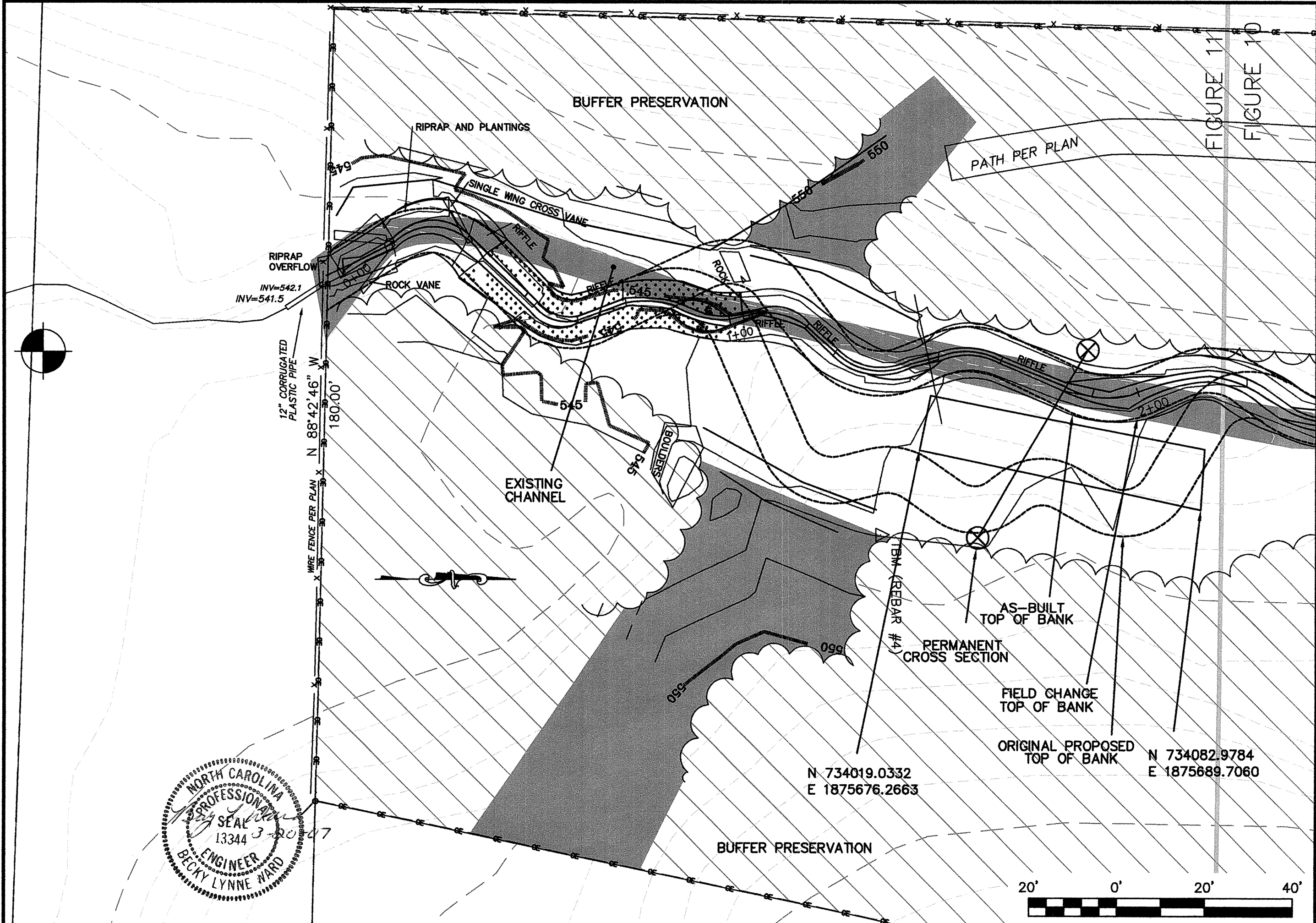
WARD CONSULTING ENGINEERS, PC  
 8986 Six Forks Rd, Suite 101 (919) 870-0698  
 Raleigh, NC 27613 FAX (919) 870-5359



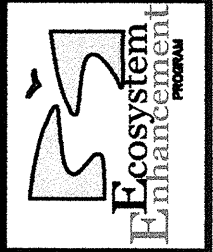
SMITH TRACT REACH 2  
 MITIGATION PLAN  
 CHATHAM COUNTY, NORTH CAROLINA

DATE: 3-20-07  
 PROJ./DWG. NAME:  
 Smith Tract  
 MITIGATION  
 SCALE:  
 1"=20'

FIGURE 10



WARD CONSULTING ENGINEERS, PC  
 8386 Six Forks Rd, Suite 101 (919) 870-0528  
 Raleigh, NC 27613 FAX (919) 870-6569

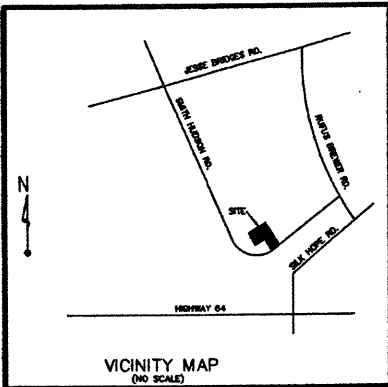


SMITH TRACT REACH 2  
 MITIGATION PLAN  
 CHATHAM COUNTY, NORTH CAROLINA

DATE:  
 PROJ./DWG. NAME:  
 Smith Tract  
 MITIGATION  
 SCALE:  
 1"=20'

FIGURE 11

**As-built**

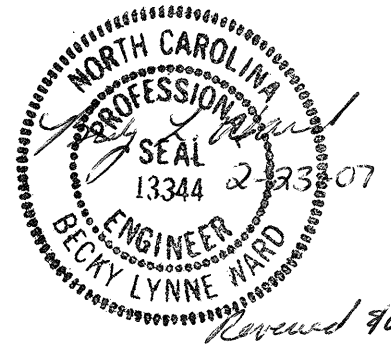
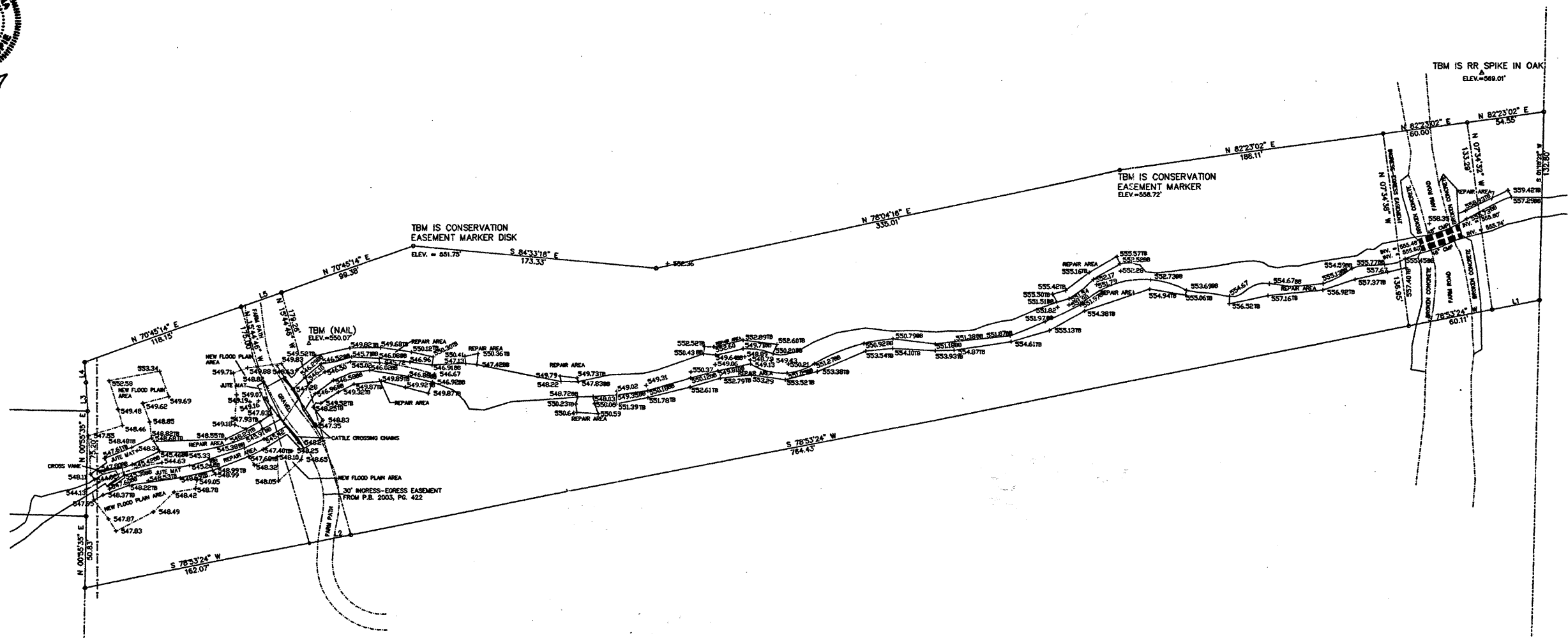


- LEGEND
- COMPUTED POINT
  - IRON PIPE SET
  - DISTING IRON PIPE
  - STREET ADDRESS
  - POWER POLE
  - LIGHT POLE
  - OVERHEAD ELECTRIC LINES
  - OVERHEAD TELEPHONE LINES
  - FENCE
  - CENTER LINE CREEK
  - WATER VALVE
  - FIRE HYDRANT
  - SANITARY SEWER CLEAN OUT
  - SANITARY SEWER MANHOLE
  - WATER METER
  - CATCH BASIN
  - DROP INLET
  - CURB AND GUTTER
  - EDGE OF PAVEMENT
  - BACK OF CURB
  - RES FLARED END SECTION
  - RCP
  - REINFORCED CONCRETE PIPE
- NOTE: ONLY UTILITIES WITH VISIBLE EVIDENCE LOCATED. UNDERGROUND UTILITY LINES SHOWN ARE APPROXIMATE AND EXTENT IS ESTIMATED & MAY BE INCOMPLETE. EXCAVATION MAY BE REQUIRED TO VERIFY LOCATIONS. OTHER UNDERGROUND UTILITIES MAY EXIST. CALL ONE CALL CENTER AT 1-800-832-4949 BEFORE DIGGING.

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.

*Niall Gillespie* P.L.S. L 2829

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  - 2.) Distances are horizontal ground distances.
  - 3.) North arrow is referenced to recorded document shown above unless otherwise noted.
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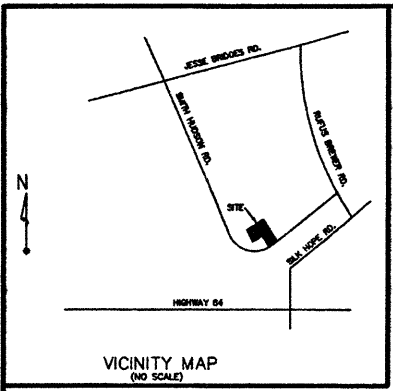
LINE	BEARING	DISTANCE
L1	S 78°53'24" W	34.01'
L2	S 78°53'24" W	30.00'
L3	N 03°22'39" W	20.07'
L4	N 03°22'39" W	14.70'
L5	N 70°45'14" E	30.06'



<b>AS BUILT SURVEY OF REACH 1 SMITH TRACT UN-NAMED TRIBUTARY TO ROCKY RIVER</b>		<b>Niall Gillespie, P.L.S.</b> Land Surveying 4008 Green Level Road West Apex, North Carolina 27523 Telephone & Fax # (919) 387-0208	
<b>REVISIONS</b> <small>REVISED PER ENGINEER'S COMMENTS, ADDED TOP &amp; BOTTOM OF BANKS, STRUCTURES AND GRADES @</small>		<b>PROPERTY OF ERNEST SMITH &amp; LINDA SMITH 700 SMITH HUDSON RD. SILER CITY, NC 27344</b>	
<small>CROSS VANS</small> JWS 9 JAN. 2007	TOWNSHIP: MATTHEWS COUNTY: CHATHAM	<small>SURVEY DATE</small> SEP. 28, 2006	SURVEYED BY: MAR SHEET 1 OF 8
<small>ADDED CONTROL POINTS AND ELEVATIONS</small> JWS 17 JAN. 2007	STATE: NORTH CAROLINA P.I.N.: 8773-54-7542, 8773-73-0994, 8773-73-1084	SCALE: 1"=40' DRAWN BY: JWS	FILENAME
CHECKED & CLOSURE BY: NWG		SMITH CREEK	



CHATHAM COUNTY, NORTH CAROLINA TRACT 11-3-2006-2-AM, 1/16/2007 3:12:12 PM



S 00°53'02" W  
1009.04'

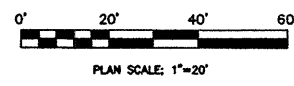
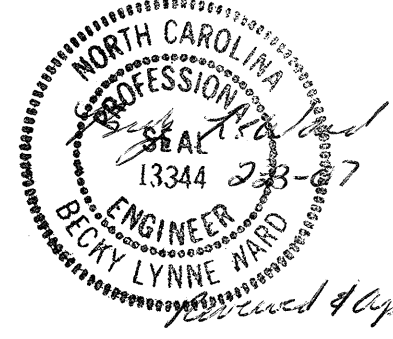
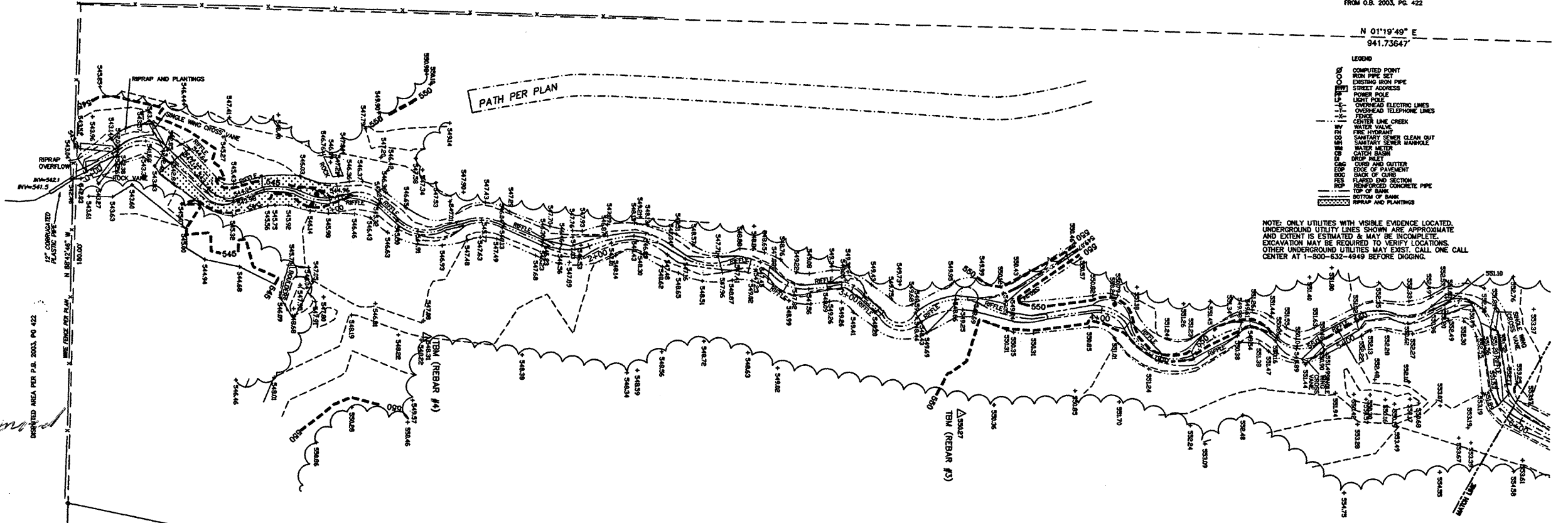
DISPUTED AREA PER P.B. 2003, PG 422

FROM O.B. 2003, PG. 422

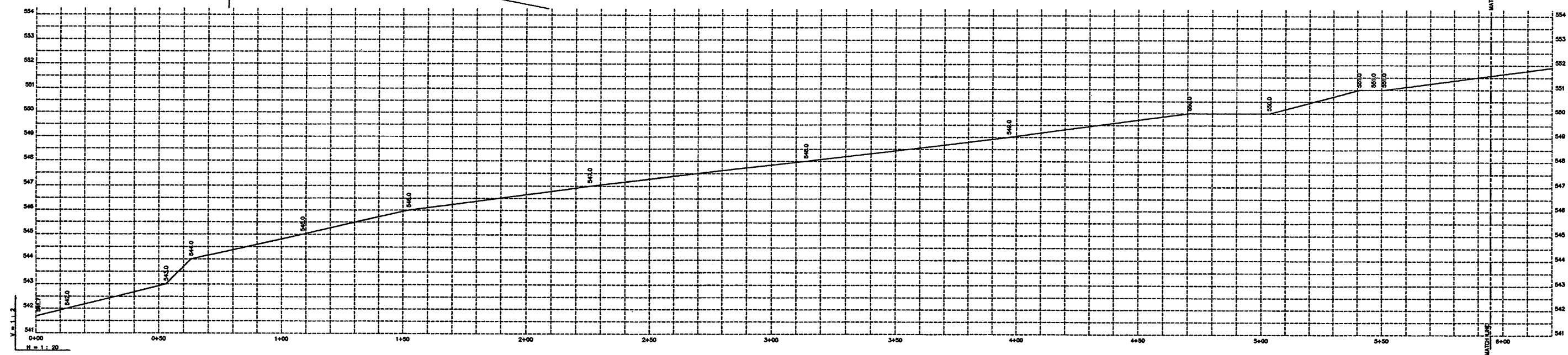
N 01°19'49" E  
941.73647'

- LEGEND
- COMPUTED POINT
  - IRON PIPE SET
  - EXISTING IRON PIPE
  - STREET ADDRESS
  - POWER POLE
  - LIGHT POLE
  - OVERHEAD ELECTRIC LINES
  - OVERHEAD TELEPHONE LINES
  - ROAD
  - RAILROAD
  - CENTER LINE CREEK
  - WATER VALVE
  - PIPE HYDRANT
  - SANITARY SEWER CLEAN OUT
  - SANITARY SEWER MANHOLE
  - WATER METER
  - WATER MAIN
  - SEWER INLET
  - SEWER OUTLET
  - EDGE OF PAVEMENT
  - FLARED END SECTION
  - REINFORCED CONCRETE PIPE
  - TOP OF BANK
  - BOTTOM OF BANK
  - TOPRAIP AND PLANTINGS

NOTE: ONLY UTILITIES WITH VISIBLE EVIDENCE LOCATED. UNDERGROUND UTILITY LINES SHOWN ARE APPROXIMATE AND EXTENT IS ESTIMATED & MAY BE INCOMPLETE. EXCAVATION MAY BE REQUIRED TO VERIFY LOCATIONS. OTHER UNDERGROUND UTILITIES MAY EXIST. CALL ONE CALL CENTER AT 1-800-532-4349 BEFORE DIGGING.



PLAN SCALE: 1"=20'



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*Becky Lynne Ward* P.L.S. L 2629

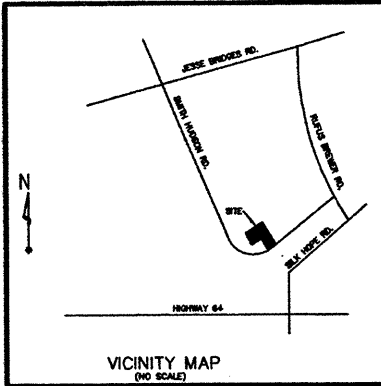


HORIZONTAL SCALE: 1" = 20'  
VERTICAL SCALE: 1" = 2'

- NOTES:
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PLAN AND PROFILE FOR AS BUILT SURVEY FOR: <b>SMITH TRACT</b> UN-NAMED TRIBUTARY TO ROCKY RIVER		PROPERTY OF <b>ERNEST SMITH &amp; LINDA SMITH</b> 700 SMITH HUDSON RD. SILER CITY, NC 27344	
REVISIONS	TOWNSHIP: MATTHEWS COUNTY: CHATHAM		
REVISIONS PER ENGINEER'S COMMENTS, ADDED TOP & BOTTOM OF BANKS, STRUCTURES AND GRADES #	DATE: 9 JAN. 2007	STATE: NORTH CAROLINA	SCALE: 1" = 20'
CROSS VIEWS	DATE: 17 JUN. 2007	ZONE: P.I.N.: 8773-54-7542, 8773-75-0884, & 8773-73-1084	CHECKED & CLOSURE BY: NWG

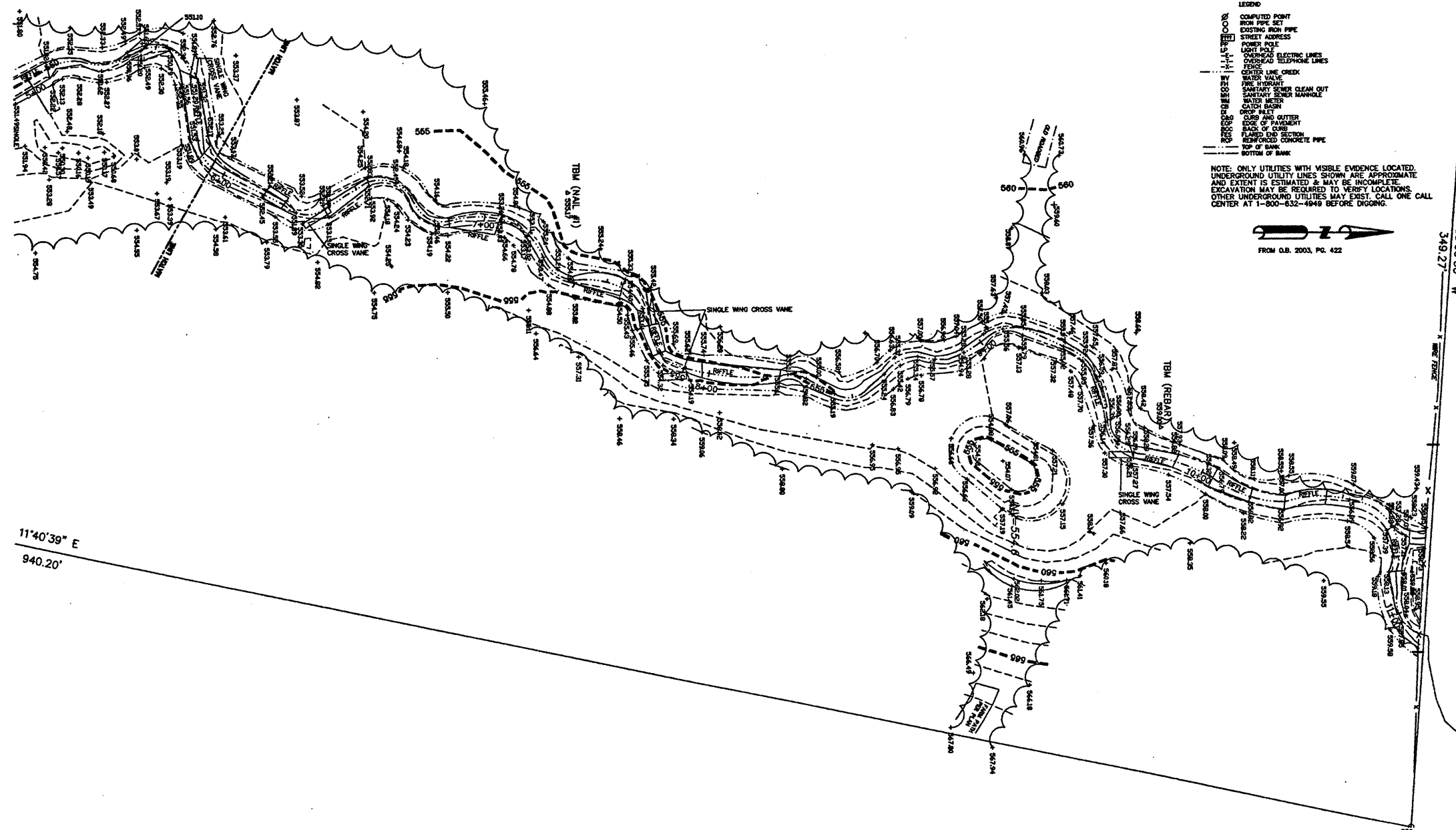
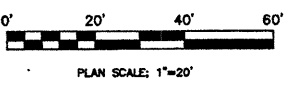
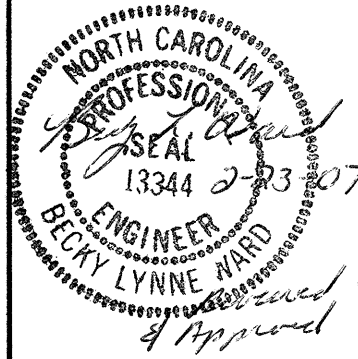
Niall Gillespie, P.L.S. Land Surveying 4008 Green Level Road West Apex, North Carolina 27523 Telephone & Fax # (919) 387-0208			
SURVEY DATE: SEP. 28, 2006	SURVEYED BY: MAR	SHEET 2 OF 8	
SCALE: 1" = 20'	DRAWN BY: JWS	FILE NAME	
CHECKED & CLOSURE BY: NWG		SMITH CREEK	



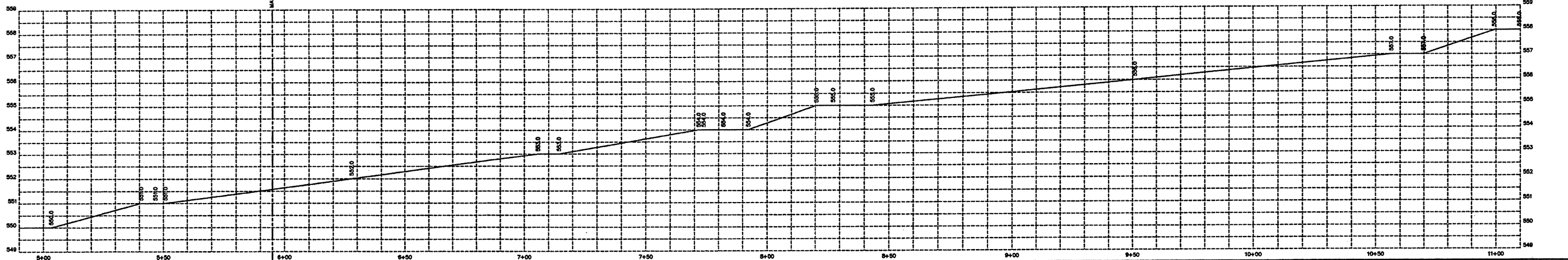
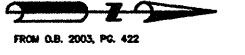
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*[Signature]*  
P.L.S. L 2629

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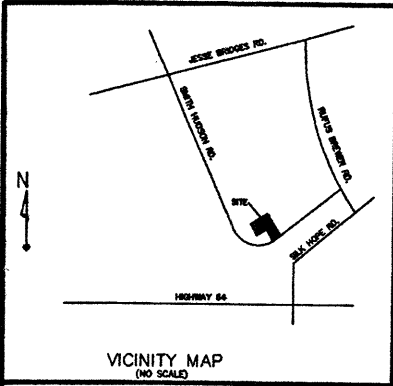
- LEGEND**
- COMPUTED POINT
  - IRON PIPE SET
  - STREET ADDRESS
  - EXISTING IRON PIPE
  - POWER POLE
  - OVERHEAD ELECTRIC LINES
  - TELEPHONE LINES
  - WATER LINE CREEK
  - WATER VALVE
  - SEWER LINE
  - SANITARY SEWER CLEAN OUT
  - SANITARY SEWER MANHOLE
  - WATER MAIN
  - CATCH BASIN
  - CURB AND GUTTER
  - EDGE OF PAVEMENT
  - LAND USE SECTION
  - REINFORCED CONCRETE PIPE
  - TOP OF BANK
  - BOTTOM OF BANK
- NOTE:** ONLY UTILITIES WITH VISIBLE EVIDENCE LOCATED. UNDERGROUND UTILITY LINES SHOWN ARE APPROXIMATE AND EXTENT IS ESTIMATED & MAY BE INCOMPLETE. EXCAVATION MAY BE REQUIRED TO VERIFY LOCATIONS. OTHER UNDERGROUND UTILITIES MAY EXIST. CALL ONE CALL CENTER AT 1-800-632-4949 BEFORE DIGGING.



<b>REVISIONS</b> <small>REVISED PER ENGINEER'S COMMENTS. ADDED TOP &amp; BOTTOM OF BANKS, STRUCTURES AND GRADES &amp; CROSS VANS.</small> JWS 9 JAN. 2007 <small>ADDED CONTROL POINTS AND ELEVATIONS.</small> JWS 17 JAN. 2007	<b>PLAN AND PROFILE FOR AS BUILT OF SMITH TRACT UN-NAMED TRIBUTARY TO ROCKY RIVER</b>		<b>PROPERTY OF ERNEST SMITH &amp; LINDA SMITH</b> 700 SMITH HUDSON RD. SILER CITY, NC 27344		TOWNSHIP: MATTHEWS COUNTY: CHATHAM	
			STATE: NORTH CAROLINA ZONE: P.I.N.: 8773-54-7842, 8773-73-0994, P.I.N.: 8773-73-1084		SURVEY DATE: SEP. 26, 2006 SURVEYED BY: MAR CHECKED & CLOSURE BY: NWG	
			SHEET 3 OF 8 HORIZONTAL SCALE: 1" = 20' VERTICAL SCALE: 1" = 2' FILE NAME: SMITH CREEK		SCALE: 1" = 20' DRAWN BY: JWS	

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

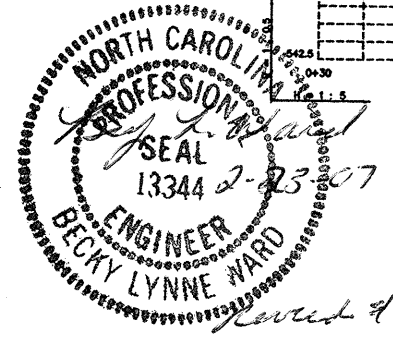
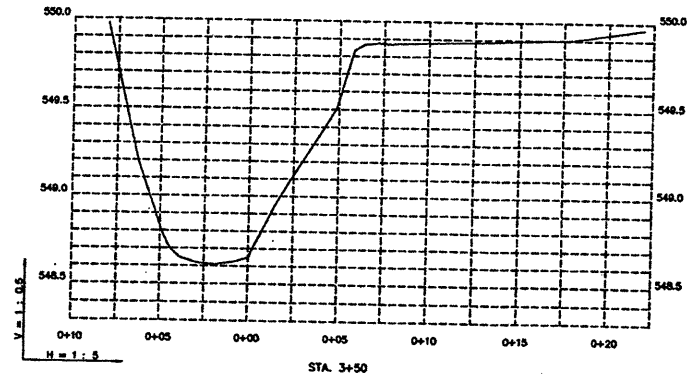
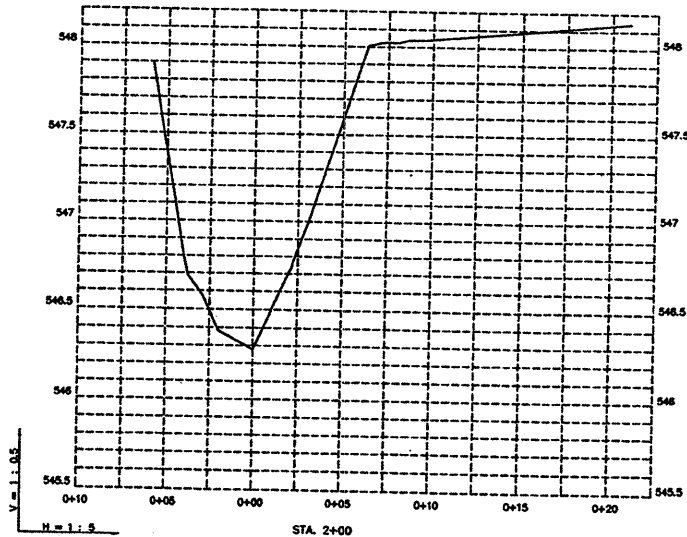
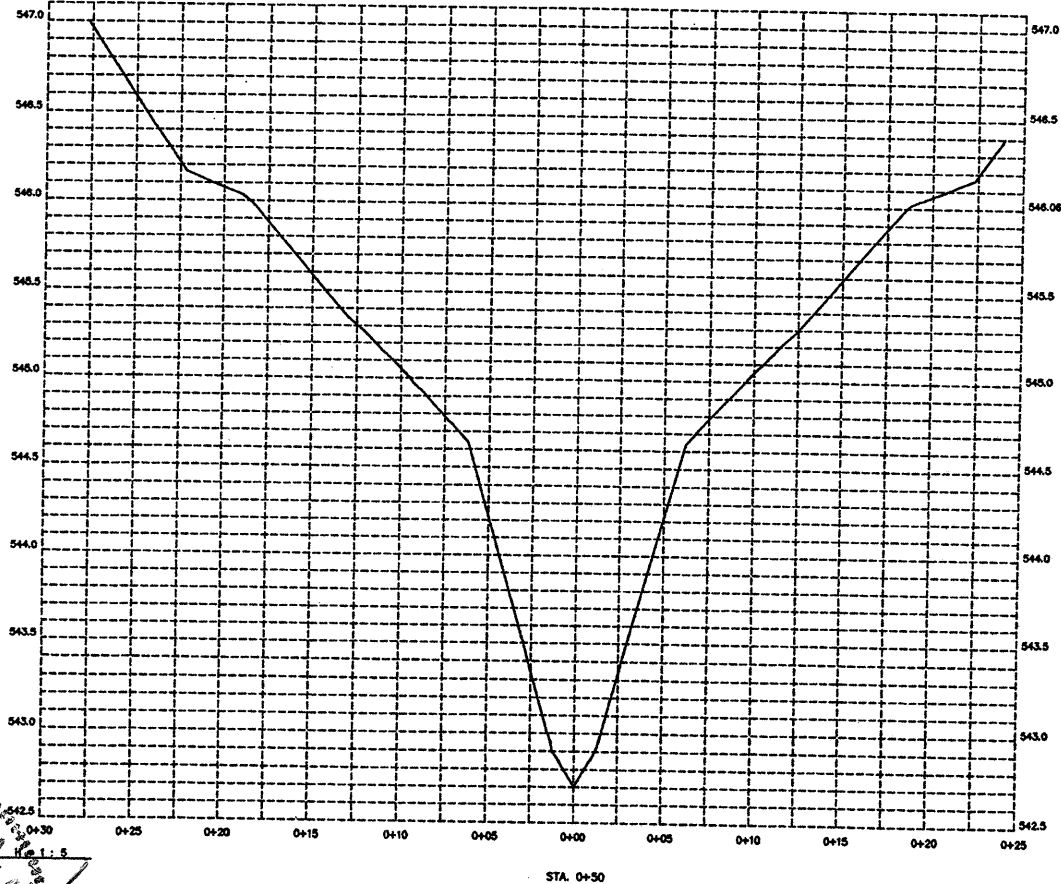
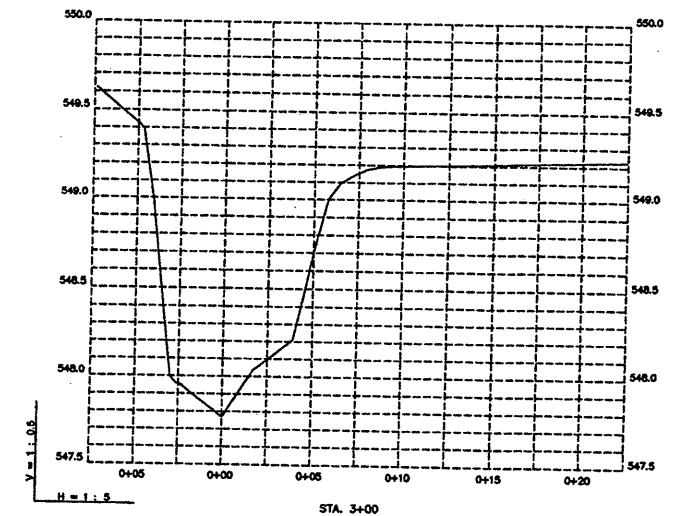
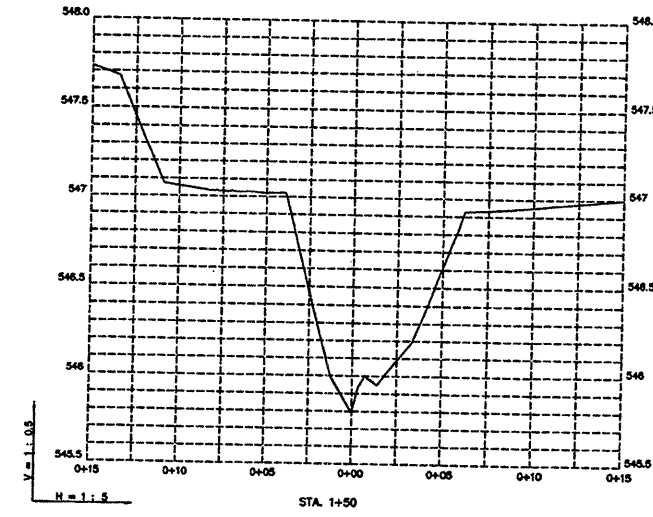
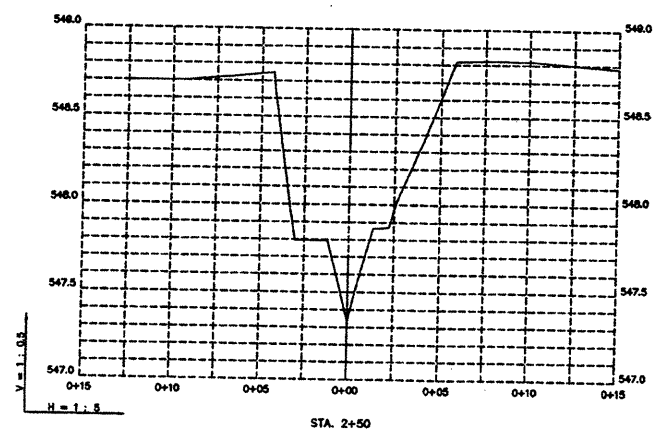
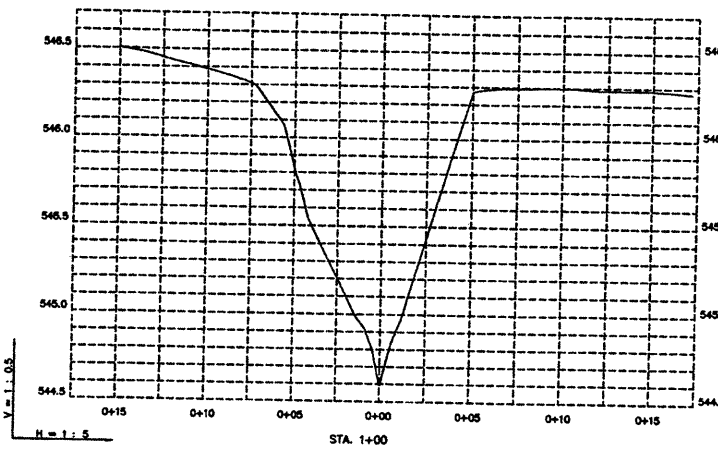
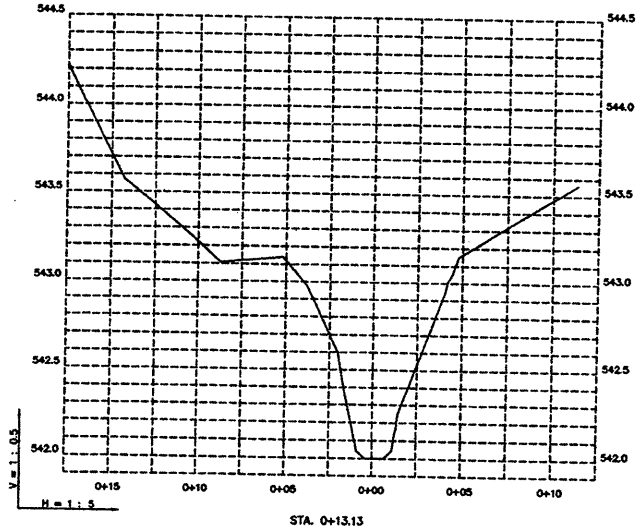
N 85°55'50" W  
349.27'



VICINITY MAP  
(NO SCALE)

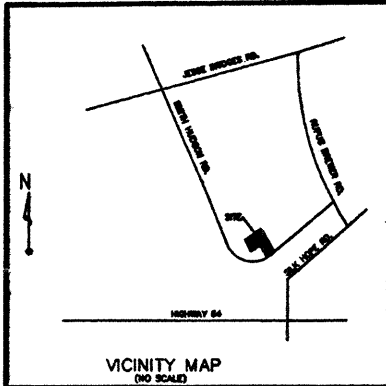
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*[Signature]* P.L.S. L. 2629



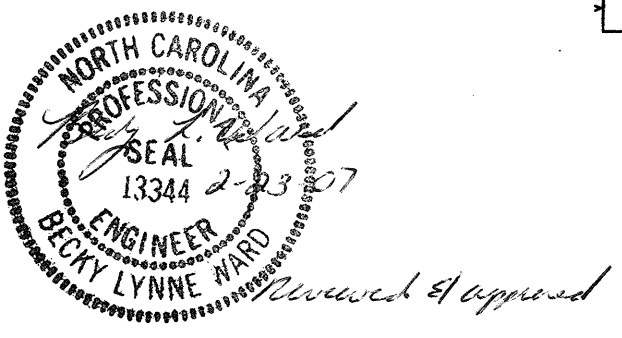
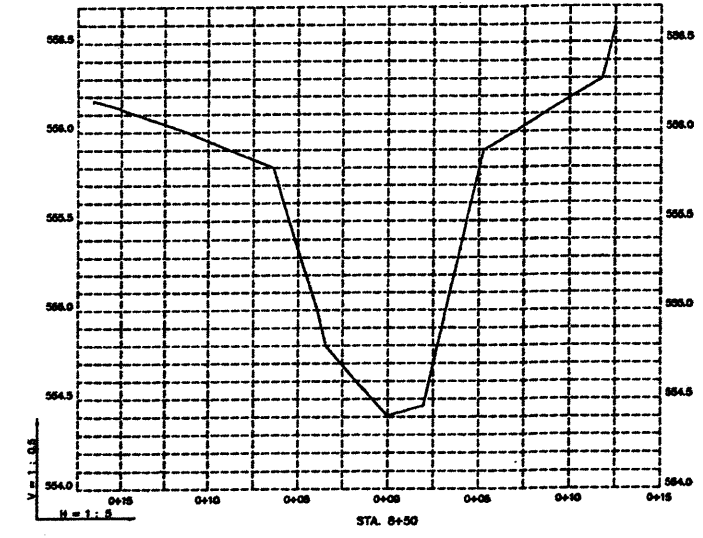
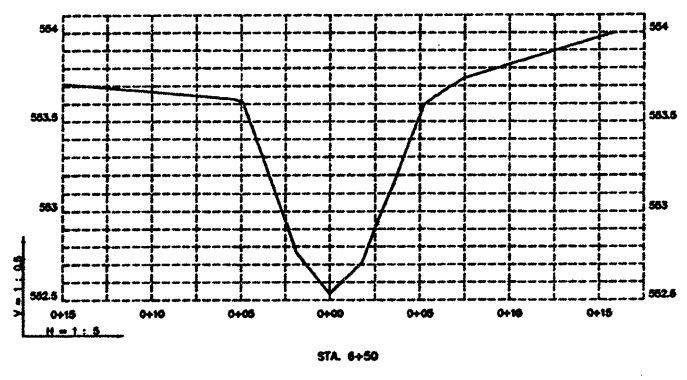
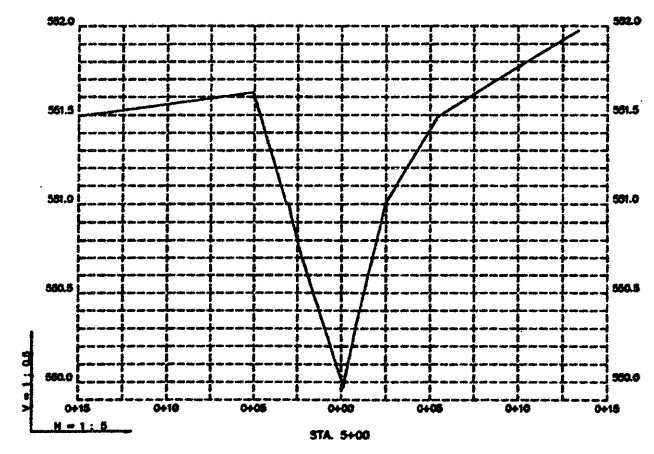
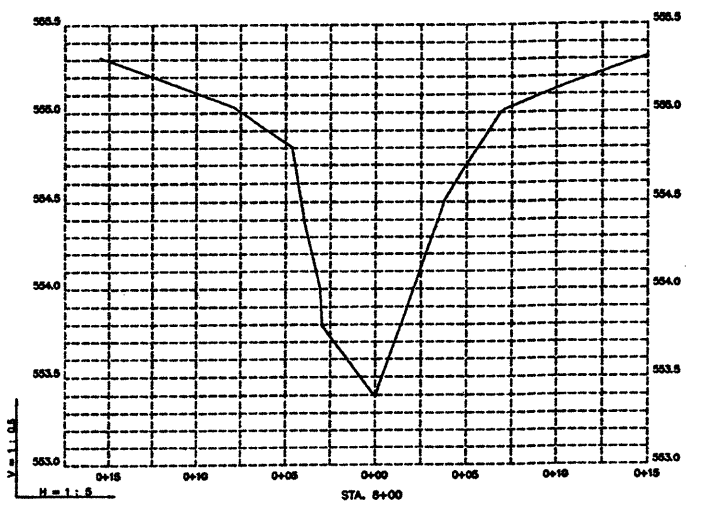
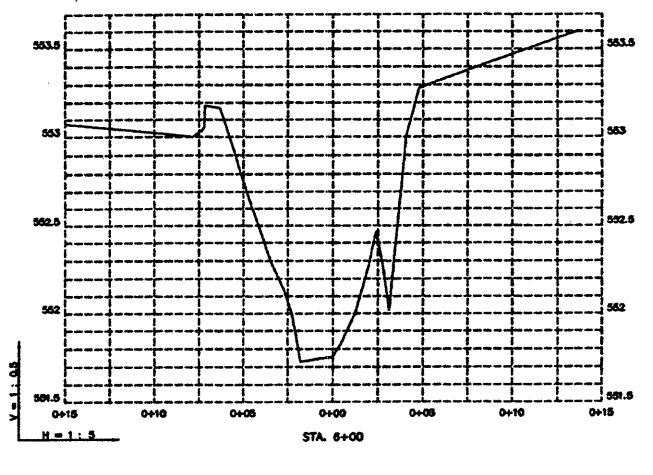
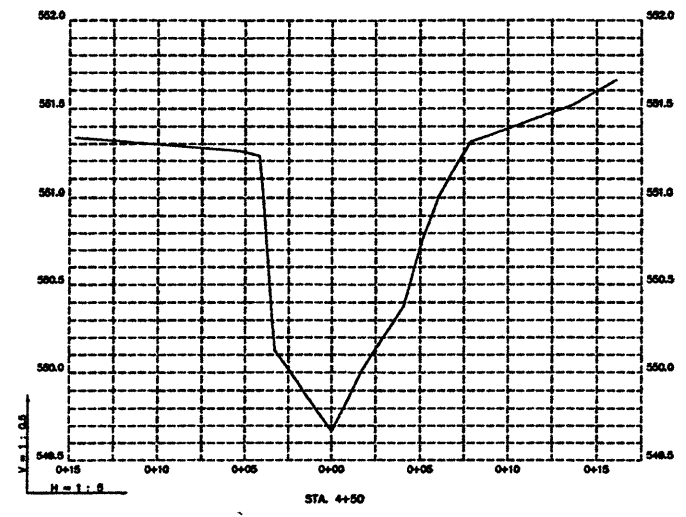
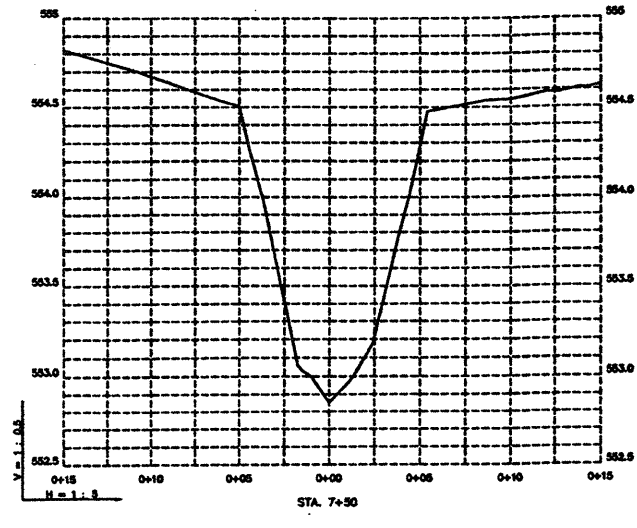
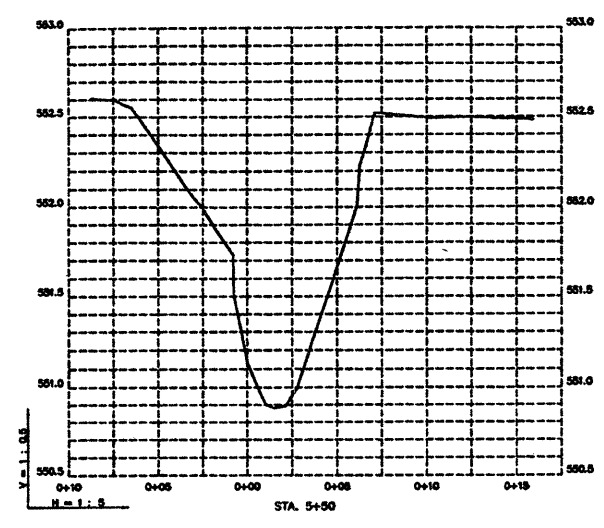
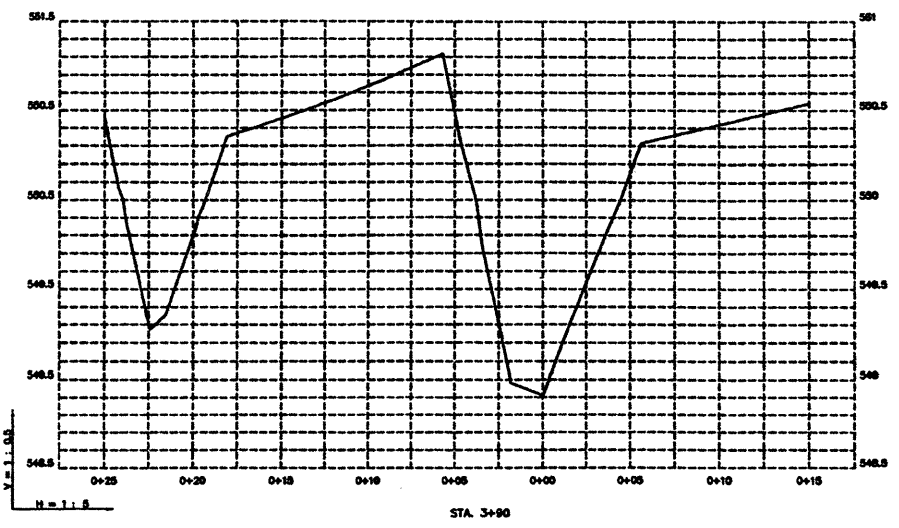
REVISIONS		PROPERTY OF ERNEST SMITH & LINDA SMITH 700 SMITH HUDSON RD. SILER CITY, NC 27344		Niall Gillespie, P.L.S. Land Surveying 4008 Green Level Road West Apex, North Carolina 27523 Telephone & Fax # (919) 387-0208	
		TOWNSHIP: MATTHEWS	COUNTY: CHATHAM	SURVEY DATE SEPT. 26, 2006	SURVEYED BY: MAR
		STATE: NORTH CAROLINA		SCALE: 1" = 5'	DRAWN BY: JWS
		ZONE: P.I.N.: & 8773-73-1084		CHECKED & CLOSURE BY: NWG	SMITH CREEK
				SHEET 4 OF 8	FILE NAME



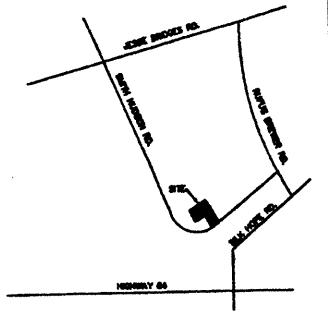


This map is drawn from an actual survey made under my supervision based on information found in the above referenced document(s), and is correct to the best of my knowledge. The unadjusted ratio of precision is 1/10,000+. This map does not meet the standards for record plot as per GS47-30 and is not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

*Niall Gillespie* P.L.S. 1 2829



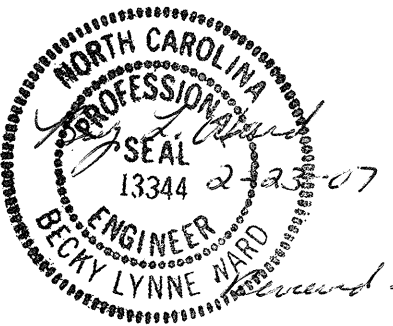
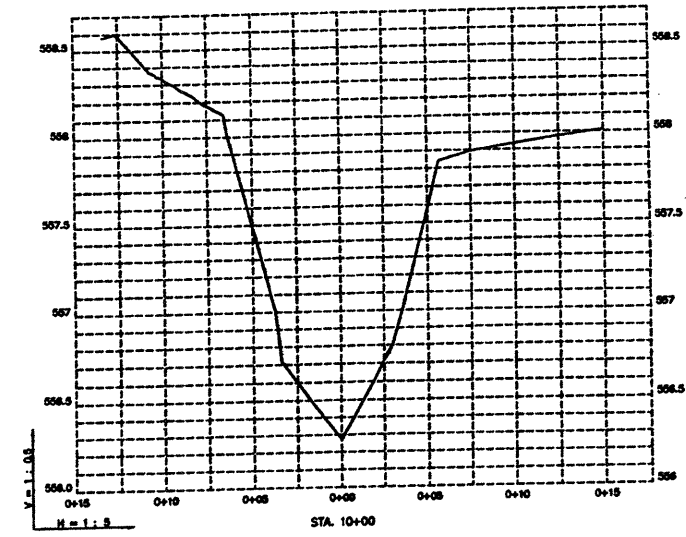
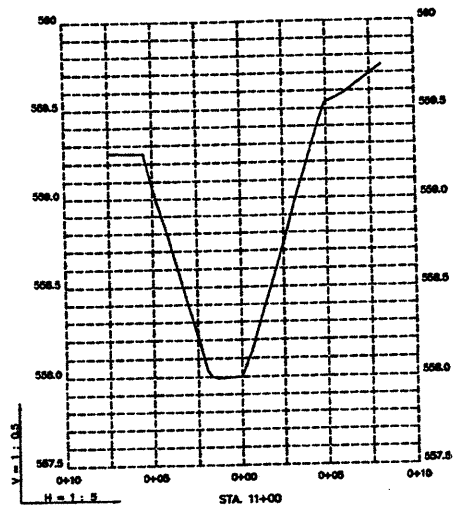
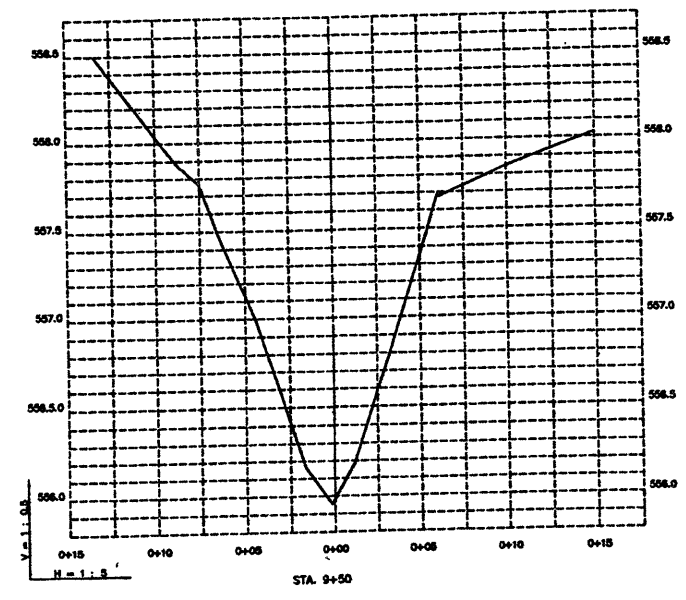
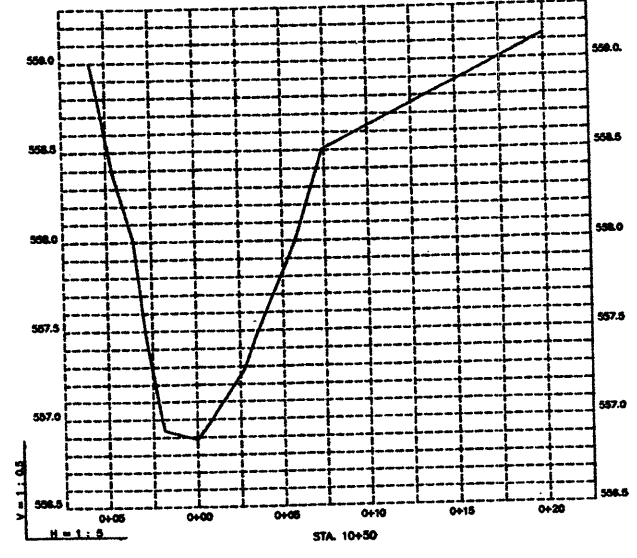
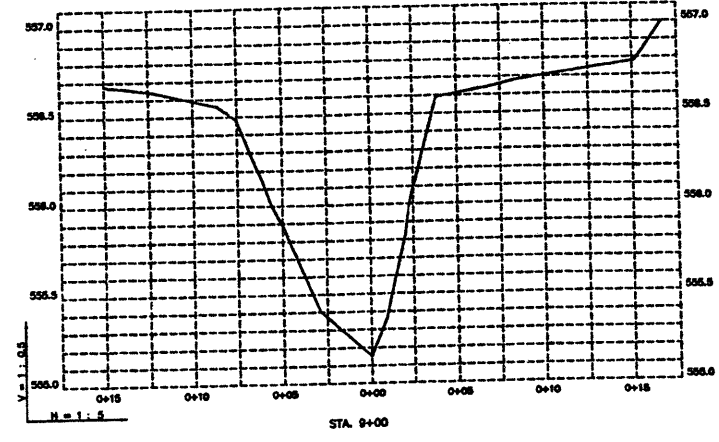
STREAM CENTERLINE CROSS SECTIONS FOR REACH TWO OF <b>SMITH TRACT</b> UN-NAMED TRIBUTARY TO ROCKY RIVER		<b>Niall Gillespie, P.L.S.</b> Land Surveying 4008 Green Level Road West Apex, North Carolina 27523 Telephone & Fax # (919) 387-0208			
REVISIONS    	PROPERTY OF <b>ERNEST SMITH &amp; LINDA SMITH</b> 700 SMITH HUDSON RD. SILVER CITY, NC 27344		SURVEY DATE <b>SEPT. 28, 2006</b>	SURVEYED BY: <b>MAR</b>	SHEET 5 OF 8
	TOWNSHIP: <b>MATTHEWS</b>	COUNTY: <b>CHATHAM</b>	SCALE: <b>1" = 5'</b>	DRAWN BY: <b>JWS</b>	FILE NAME
	STATE: <b>NORTH CAROLINA</b>	ZONE: <b>P.L.N.: 8773-54-7542, 8773-73-0984, &amp; 8773-73-1084</b>	CHECKED & CLOSURE BY: <b>NWG</b>	<b>SMITH CREEK</b>	



VICINITY MAP  
(NO SCALE)

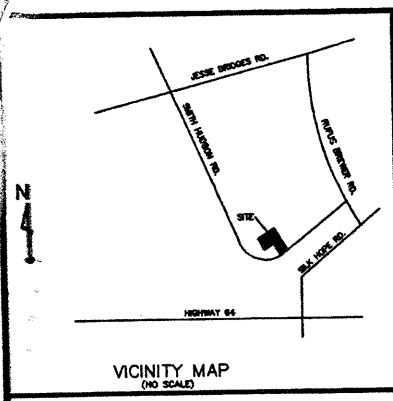
This map is drawn from an actual survey made under my supervision based on information found in the above referenced document(s), and is correct to the best of my knowledge. The unadjusted ratio of precision is 1/10,000+. This map does not meet the standards for record plot as per GS47-30 and is not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

*[Signature]* P.L.S. L. 2529



*Becky Lynne Nard* approved & approved

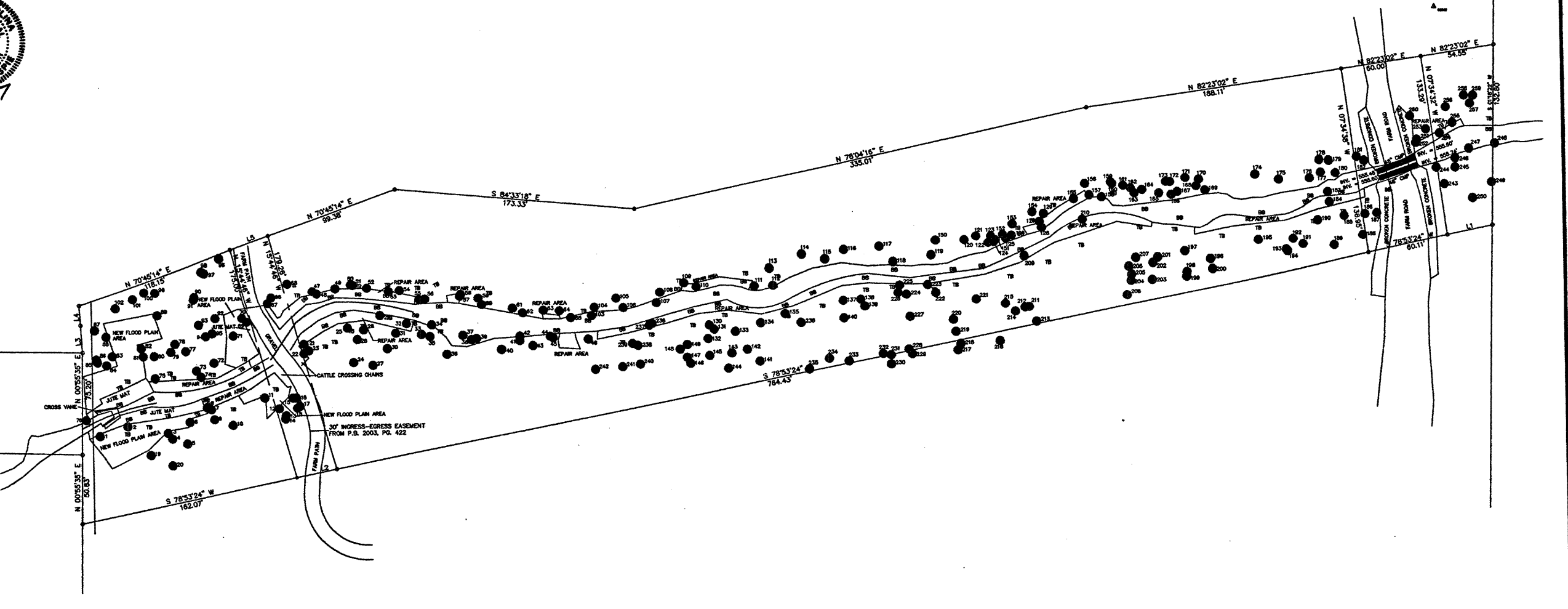
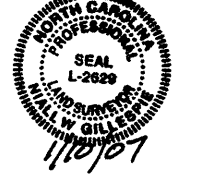
STREAM CENTERLINE CROSS SECTIONS FOR REACH TWO OF SMITH TRACT UN-NAMED TRIBUTARY TO ROCKY RIVER		Niall Gillespie, P.L.S. Land Surveying 4008 Green Level Road West Apex, North Carolina 27523 Telephone & Fax # (919) 387-0208	
REVISIONS	PROPERTY OF ERNEST SMITH & LINDA SMITH 700 SMITH HUDSON RD. SILER CITY, NC 27344		SHEET 6 OF 8
	TOWNSHIP: MATTHEWS	COUNTY: CHATHAM	SURVEYED BY: MAR
	STATE: NORTH CAROLINA		DRAWN BY: JWS
	ZONE: P.L.N.: 8773-84-7842, 8773-73-0884, & 8773-73-1094	CHECKED & CLOSURE BY: NWG	FILE NAME SMITH CREEK
		DATE: SEPT. 26, 2006	SCALE: 1" = 5'



TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART													
NUMBER	SIZE	DESIGNATION	SPECIES	NUMBER	SIZE	DESIGNATION	SPECIES	NUMBER	SIZE	DESIGNATION	SPECIES	NUMBER	SIZE	DESIGNATION	SPECIES	NUMBER	SIZE	DESIGNATION	SPECIES
1	12' 10" / 14"	TRIPLE	SYCAMORE	41	11"	SINGLE	ELM	81	6"	SINGLE	ELM	121	9"	SINGLE	GUM				
2	8"	SINGLE	SYCAMORE	42	9"	SINGLE	GUM	82	6"	SINGLE	ELM	122	10"	SINGLE	GUM				
3	8"	SINGLE	SYCAMORE	43	8' 8" / 20"	TRIPLE	SYCAMORE	83	7"	SINGLE	OAK	123	10"	SINGLE	GUM				
4	12"	SINGLE	POPLAR	44	7"	SINGLE	GUM	84	10"	TWIN	GUM	124	9"	SINGLE	GUM				
5	7"	SINGLE	POPLAR	45	7"	SINGLE	GUM	85	6"	SINGLE	GUM	125	16"	SINGLE	OAK				
6	15"	SINGLE	ASH	46	6"	SINGLE	GUM	86	6"	SINGLE	OAK	126	12"	SINGLE	OAK				
7	13' 7" / 10"	TWIN	SYCAMORE	47	9"	SINGLE	POPLAR	87	6"	SINGLE	OAK	127	12"	SINGLE	OAK				
8	5"	SINGLE	REDBUD	48	3"	SINGLE	DOGWOOD	88	6"	SINGLE	HICKORY	128	9"	SINGLE	GUM				
9	5"	SINGLE	ELM	49	8"	SINGLE	CEDAR	89	7"	SINGLE	HICKORY	129	6"	SINGLE	HICKORY				
10	6"	SINGLE	GUM	50	5"	SINGLE	ASH	90	9"	SINGLE	IRONWOOD	130	6"	SINGLE	GUM				
11	6"	SINGLE	GUM	51	8"	SINGLE	ELM	91	6"	SINGLE	OAK	131	9"	SINGLE	GUM				
12	6"	SINGLE	GUM	52	4"	SINGLE	ELM	92	7"	SINGLE	HICKORY	132	12"	SINGLE	ASH				
13	10"	SINGLE	GUM	53	5"	SINGLE	DOGWOOD	93	6"	SINGLE	CEDAR	133	12"	SINGLE	ASH				
14	11' 13"	TWIN	SYCAMORE	54	11"	SINGLE	GUM	94	6"	SINGLE	ASH	134	10"	SINGLE	GUM				
15	6"	SINGLE	GUM	55	6"	SINGLE	DOGWOOD	95	5"	SINGLE	ELM	135	10' 7" / 11"	TWIN	GUM				
16	6"	SINGLE	GUM	56	12"	SINGLE	ASH	96	7"	SINGLE	ELM	136	9"	SINGLE	GUM				
17	5"	SINGLE	ELM	57	6"	SINGLE	IRONWOOD	97	6"	SINGLE	IRONWOOD	137	12"	SINGLE	GUM				
18	10"	SINGLE	ELM	58	5"	SINGLE	IRONWOOD	98	12"	SINGLE	MAPLE	138	14"	SINGLE	GUM				
19	9"	SINGLE	REDBUD	59	11"	SINGLE	ASH	99	9"	SINGLE	HICKORY	139	11"	SINGLE	GUM				
20	6"	SINGLE	REDBUD	60	6"	SINGLE	ASH	100	9"	SINGLE	MAPLE	140	14"	SINGLE	GUM				
21	10"	SINGLE	ASH	61	9"	SINGLE	ASH	101	7"	SINGLE	GUM	141	15"	SINGLE	POPLAR				
22	6"	SINGLE	ASH	62	8"	SINGLE	GUM	102	7"	SINGLE	OAK	142	8"	SINGLE	GUM				
23	17"	SINGLE	MAPLE	63	6"	SINGLE	GUM	103	10"	SINGLE	OAK	143	14"	SINGLE	GUM				
24	12"	SINGLE	GUM	64	10"	SINGLE	GUM	104	10"	SINGLE	ASH	144	10"	SINGLE	HICKORY				
25	17"	SINGLE	MAPLE	65	10"	SINGLE	ASH	105	8' 7" / 4"	TWIN	HORNBEAM	145	9"	SINGLE	GUM				
26	11"	SINGLE	GUM	66	6"	SINGLE	CEDAR	106	13"	SINGLE	GUM	146	12"	SINGLE	GUM				
27	5"	SINGLE	HORNBEAM	67	6"	SINGLE	ASH	107	6"	SINGLE	ASH	147	8"	SINGLE	GUM				
28	13"	SINGLE	GUM	68	9"	SINGLE	ELM	108	6"	SINGLE	ASH	148	5"	SINGLE	GUM				
29	11"	SINGLE	MAPLE	69	8"	SINGLE	ASH	109	8"	SINGLE	ASH	149	8"	SINGLE	GUM				
30	17"	SINGLE	SYCAMORE	70	8"	SINGLE	DEAD	110	6"	SINGLE	DEAD	150	5"	SINGLE	TRIPLE IRONWOOD				
31	11"	SINGLE	BIRCH	71	8"	SINGLE	ASH	111	16"	SINGLE	SYCAMORE	151	4"	SINGLE	GUM				
32	16"	SINGLE	POPLAR	72	14"	SINGLE	MAPLE	112	13"	SINGLE	ASH	152	12"	SINGLE	HICKORY				
33	8"	SINGLE	HORNBEAM	73	8"	SINGLE	GUM	113	14"	SINGLE	HICKORY	153	3"	SINGLE	GUM				
34	12"	SINGLE	GUM	74	6"	SINGLE	MALBERRY	114	11' 7" / 2" / 12"	TRIPLE	SYCAMORE	154	14"	SINGLE	HICKORY				
35	6"	SINGLE	GUM	75	18"	SINGLE	GUM	115	6"	SINGLE	MAPLE	155	16"	SINGLE	HICKORY				
36	10"	SINGLE	GUM	76	8"	SINGLE	GUM	116	11"	SINGLE	GUM	156	5"	SINGLE	HICKORY				
37	10"	SINGLE	OAK	77	14"	SINGLE	SWEET GUM	117	14"	SINGLE	POPLAR	157	13"	SINGLE	HICKORY				
38	14"	SINGLE	POPLAR	78	9"	SINGLE	ASH	118	11"	SINGLE	SYCAMORE	158	5"	SINGLE	SYCAMORE				
39	8"	SINGLE	GUM	79	6"	SINGLE	REDBUD	119	10"	SINGLE	GUM	159	6"	SINGLE	GUM				
40	12"	SINGLE	GUM	80	9"	SINGLE	ASH	120	12"	SINGLE	GUM	160	8"	SINGLE	GUM				

TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART												
NUMBER	SIZE	DESIGNATION	SPECIES	NUMBER	SIZE	DESIGNATION	SPECIES	NUMBER	SIZE	DESIGNATION	SPECIES	NUMBER	SIZE	DESIGNATION	SPECIES
201	7"	SINGLE	HICKORY	217	6"	SINGLE	POPLAR								
202	6"	SINGLE	ELM	218	16"	SINGLE	SYCAMORE								
203	6"	SINGLE	MAPLE	219	16"	SINGLE	POPLAR								
204	6"	SINGLE	CHERRY	220	8"	SINGLE	ASH								
205	6"	SINGLE	HICKORY	221	7"	SINGLE	SYCAMORE								
206	6"	SINGLE	HICKORY	222	12"	SINGLE	GUM								
207	6"	SINGLE	HICKORY	223	7"	SINGLE	GUM								
208	6"	SINGLE	HICKORY	224	6"	SINGLE	GUM								
209	6"	SINGLE	HICKORY	225	14"	SINGLE	GUM								
210	6"	SINGLE	HICKORY	226	6"	SINGLE	GUM								
211	6"	SINGLE	HICKORY	227	10"	SINGLE	MAPLE								
212	6"	SINGLE	HICKORY	228	15"	SINGLE	HICKORY								
213	6"	SINGLE	HICKORY	229	8"	SINGLE	HICKORY								
214	6"	SINGLE	HICKORY	230	8"	SINGLE	HICKORY								
215	6"	SINGLE	HICKORY	231	6"	SINGLE	SYCAMORE								
216	6"	SINGLE	HICKORY	232	8"	SINGLE	SYCAMORE								
217	6"	SINGLE	HICKORY	233	6"	SINGLE	SYCAMORE								
218	6"	SINGLE	HICKORY	234	14"	SINGLE	POPLAR								
219	6"	SINGLE	HICKORY	235	6"	SINGLE	BEECH								
220	6"	SINGLE	HICKORY	236	10"	SINGLE	ASH								
221	6"	SINGLE	HICKORY	237	10"	SINGLE	ASH								
222	6"	SINGLE	HICKORY	238	10"	SINGLE	ASH								
223	6"	SINGLE	HICKORY	239	12"	SINGLE	OAK								
224	6"	SINGLE	HICKORY	240	8' 7" / 12"	TWIN	GUM								

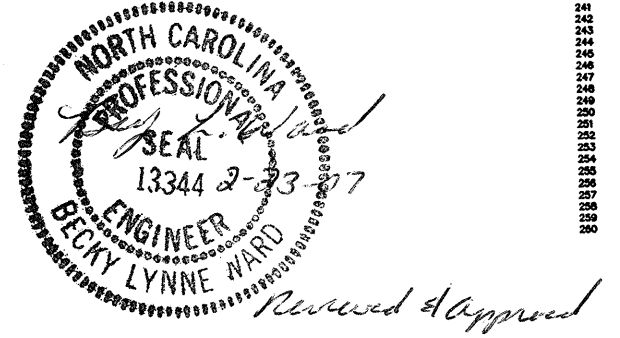
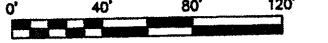
NOTES:  
 1) Areas are by coordinate computation.  
 2) Distances are horizontal ground distances.  
 3) North arrow is referenced to recorded document shown unless otherwise noted.  
 4) Building / house line(s) are perpendicular to property lines unless otherwise noted.  
 5) Bearings and distances of title lines shown are from record plat(s) and/or deeds(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.  
 8) Property Boundary and Survey Control are from plans by Ward Consulting Engineers, P.C. titled "SMITH TRACT, UT TO ROCKY RIVER, STREAM, AND BUFFER RESTORATION, ENHANCEMENT, AND PRESERVATION CHATHAM COUNTY, NORTH CAROLINA."



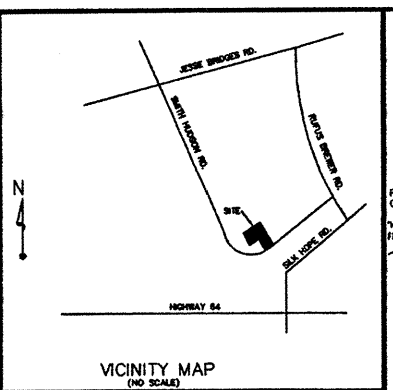
TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART	TREE IDENTIFICATION CHART
NUMBER	SIZE	DESIGNATION	SPECIES
241	8"	SINGLE	GUM
242	8"	TWIN	HICKORY
243	8"	SINGLE	HICKORY
244	8"	SINGLE	ELM
245	8"	SINGLE	ELM
246	8"	SINGLE	ASH
247	8"	TWIN	HICKORY
248	8"	SINGLE	MAPLE
249	8"	SINGLE	DEAD TREE
250	8"	SINGLE	DEAD
251	8"	SINGLE	HICKORY
252	8"	SINGLE	HICKORY
253	8"	SINGLE	HICKORY
254	8"	SINGLE	HICKORY
255	8"	SINGLE	HICKORY
256	8"	SINGLE	HICKORY
257	8"	SINGLE	HICKORY
258	8"	SINGLE	HICKORY
259	8"	SINGLE	HICKORY
260	8"	SINGLE	OAK

LEGEND:  
 COMPUTED POINT  
 IRON PIPE SET  
 EXISTING IRON PIPE  
 STREET ADDRESS  
 POWER POLE  
 LIGHT POLE  
 OVERHEAD ELECTRIC LINES  
 OVERHEAD TELEPHONE LINES  
 FENCE  
 CENTER LINE CREEK  
 WATER VALVE  
 FIRE HYDRANT  
 SANITARY SEWER CLEAN OUT  
 SANITARY SEWER MANHOLE  
 WATER METER  
 CATCH BASIN  
 DRAIN INLET  
 CURB AND GUTTER  
 EDGE OF PAVEMENT  
 BACK OF CURB  
 FLAGGED END SECTION  
 REINFORCED CONCRETE PIPE

LINE	BEARING	DISTANCE
L1	S 78°53'24" W	34.01'
L2	S 78°53'24" W	30.00'
L3	N 03°22'39" W	20.07'
L4	N 03°22'39" W	14.70'
L5	N 70°45'14" E	30.06'



TREE LOCATIONS FOR AS BUILT SURVEY OF REACH 1 SMITH TRACT UN-NAMED TRIBUTARY TO ROCKY RIVER		PROPERTY OF ERNEST SMITH & LINDA SMITH 700 SMITH HUDSON RD. SILER CITY, NC 27344		Niall Gillespie, P.L.S. Land Surveying 4008 Green Level Road West Apex, North Carolina 27523 Telephone & Fax # (919) 387-0208	
REVISIONS	TOWNSHIP: MATTHEWS	COUNTY: CHATHAM	SURVEY DATE JAN. 10, 2008	SURVEYED BY: MAR	SHEET 7 OF 8
	STATE: NORTH CAROLINA		SCALE: 1"=40'	DRAWN BY: JWS	FILENAME
	ZONE: 6773-64-7642, 6773-73-0994, P.I.N.- & 6773-73-1084		CHECKED & CLOSURE BY: NWG	SMITH CREEK	



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- 1.) Areas are by coordinate computation.
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- 3.) North arrow is referenced to recorded document shown above unless otherwise noted.
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**TREE IDENTIFICATION CHART**

NUMBER	SIZE	DESIGNATION	SPECIES
281	16"	SINGLE	BIRCH
282	12"	SINGLE	BEECH
283	12"	SINGLE	POPLAR
284	8"	SINGLE	POPLAR
285	8"	SINGLE	POPLAR
286	8"	SINGLE	GUM
287	11"	SINGLE	BIRCH
288	11"	SINGLE	POPLAR
289	4"	SINGLE	HOLLY
270	11"	SINGLE	POPLAR
271	15"	SINGLE	POPLAR
272	18"	SINGLE	GUM
273	15"	SINGLE	GUM
274	4"	SINGLE	POPLAR
275	20"	SINGLE	MAPLE
276	14"	SINGLE	ELM
277	14"	SINGLE	GUM
278	5"	SINGLE	BEECH
279	5 3/5"	TRIPLE	BEECH
280	5"	SINGLE	DEAD
281	4"	SINGLE	BEECH
282	5"	SINGLE	IRONWOOD
283	14"	SINGLE	POPLAR
284	8"	SINGLE	GUM
285	8"	SINGLE	POPLAR
286	12"	SINGLE	POPLAR
287	5"	SINGLE	GUM
288	12"	SINGLE	POPLAR
289	5 7/8"	TWIN	POPLAR
290	11"	SINGLE	POPLAR
291	5"	SINGLE	GUM
292	5"	SINGLE	POPLAR
293	5"	SINGLE	BEECH
294	5"	SINGLE	POPLAR
295	5"	SINGLE	POPLAR
296	14"	SINGLE	POPLAR
297	14"	SINGLE	POPLAR
298	10"	SINGLE	OAK
299	10"	SINGLE	ELM
300	10"	SINGLE	ELM
301	10"	SINGLE	ELM
302	10"	SINGLE	POPLAR
303	5"	SINGLE	ASH
304	5"	SINGLE	POPLAR

**NORTH CAROLINA PROFESSIONAL SEAL**  
 13344 2-23-07  
**ENGINEER**  
 BECKY LYNNE NARD  
*Reviewed & Approved*

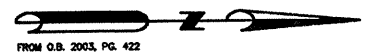
This map is drawn from an actual survey made under my supervision based on information found in the above referenced record document(s), and is correct to the best of my knowledge. The unadjusted ratio of precision is 1/10,000+. This map does not meet the standards for record plat as per GS47-30 and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

*Niall Gillespie* P.L.S. L 2629

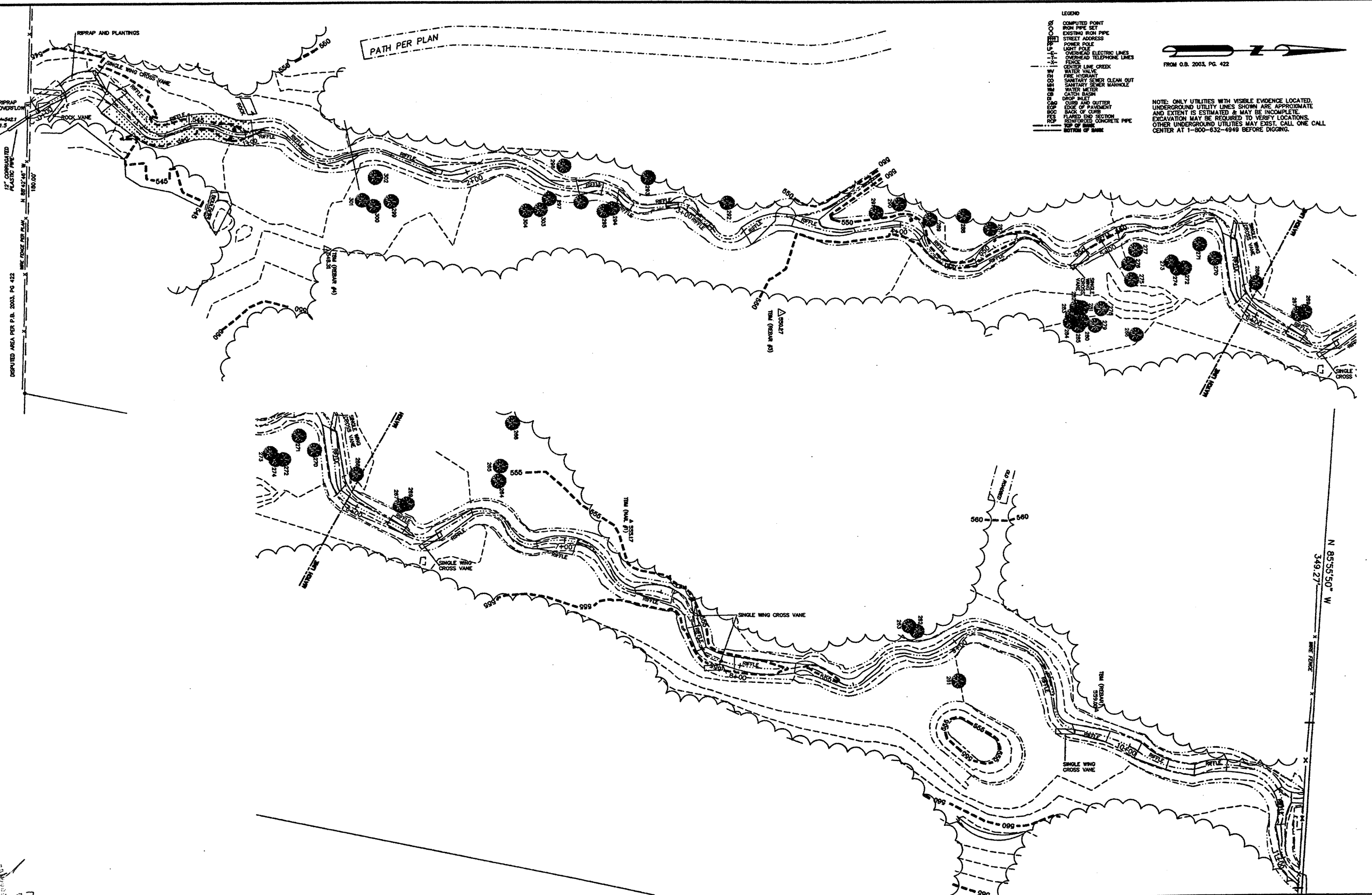


**NORTH CAROLINA PROFESSIONAL SEAL**  
 1-2629  
 NIALL W. GILLESPIE  
 1/10/07

- LEGEND**
- COMPUTED POINT
  - IRON PIPE SET
  - EXISTING IRON PIPE
  - STREET ADDRESS
  - POWER POLE
  - OVERHEAD ELECTRIC LINES
  - OVERHEAD TELEPHONE LINES
  - LIGHT POLE
  - FENCE
  - CENTER LINE CREEK
  - WATER VALVE
  - FIRE HYDRANT
  - SANITARY SEWER CLEAN OUT
  - SANITARY SEWER MANHOLE
  - WATER METER
  - CATCH BASIN
  - ORCP INLET
  - CURB AND OUTER
  - EDGE OF PAVEMENT
  - FLARED END SECTION
  - REINFORCED CONCRETE PIPE
  - TOP OF BANK
  - BOTTOM OF BANK

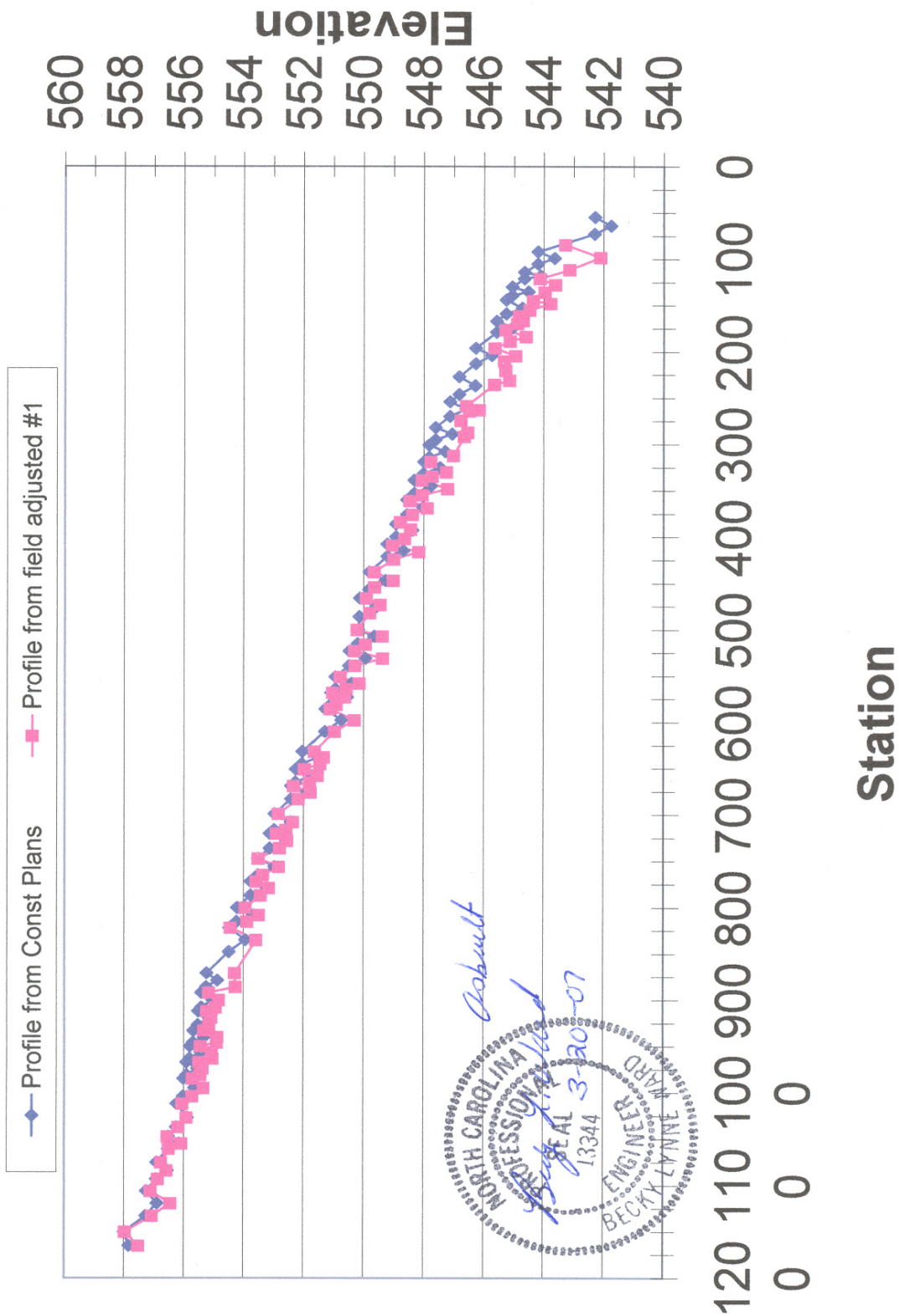


NOTE: ONLY UTILITIES WITH VISIBLE EVIDENCE LOCATED. UNDERGROUND UTILITY LINES SHOWN ARE APPROXIMATE AND EXTENT IS ESTIMATED & MAY BE INCOMPLETE. EXCAVATION MAY BE REQUIRED TO VERIFY LOCATIONS. OTHER UNDERGROUND UTILITIES MAY EXIST; CALL ONE CALL CENTER AT 1-800-632-4949 BEFORE DIGGING.



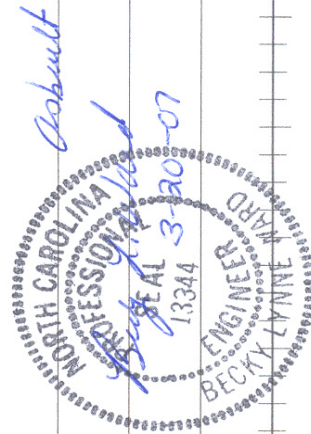
TREE LOCATIONS FOR AS BUILT SURVEY OF REACH 2 FOR: SMITH TRACT UN-NAMED TRIBUTARY TO ROCKY RIVER		Niall Gillespie, P.L.S. Land Surveying 4008 Green Level Road West Apex, North Carolina 27523 Telephone & Fax # (919) 387-0208	
REVISIONS	PROPERTY OF ERNEST SMITH & LINDA SMITH 700 SMITH HUDSON RD. SILER CITY, NC 27344	SURVEY DATE JAN. 10, 2006	SHEET 8 OF 8
TOWNSHIP: MATTHEWS	COUNTY: CHATHAM	SURVEYED BY: MAR	DRAWN BY: JWS
STATE: NORTH CAROLINA	ZONE: 8773-54-7542, 8773-73-0984, P.L.N.: & 8773-73-1084	SCALE: 1" = 20'	FILE NAME
		CHECKED & CLOSURE BY: NWG	SMITH CREEK

Comparison of Construction Plans and Final Field adjusted profile #1 Use for Monitoring

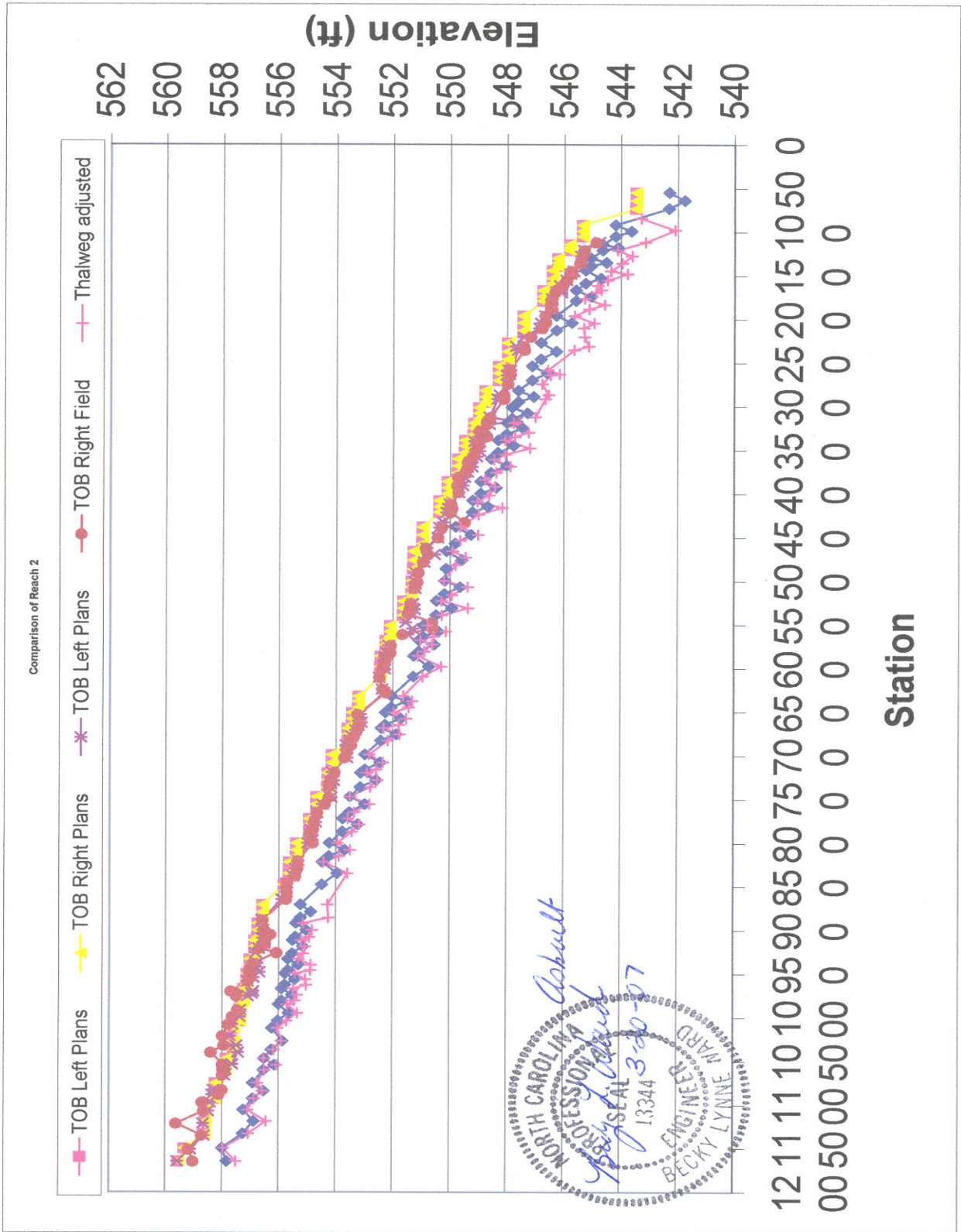


Ward Consulting Engineers, P.C.

UT to Rocky River Stream Restoration,  
 Enhancement, and Preservation Project,  
 SCO# 040614001  
 Mitigation Report  
 March 20, 2007







Ward Consulting Engineers, P.C.

UT to Rocky River Stream Restoration,  
 Enhancement, and Preservation Project,  
 SCO# 040614001  
 Mitigation Report  
 March 20, 2007

Ward Consulting Engineers, P.C.  
 UT Rocky River Smith Tract  
 Chatham County, North Carolina  
 SCO ID # 040614001  
 20-Mar-07

Elevations from Construction Plans

Station	Elevation	Elevation	Elevation	
1165	557.84	559.54	559.54	CP
1150	558	559.33	559.33	HR
1133	557.27	558.6	558.6	ER
1119	556.89	558.59	558.59	CP
1106	557.25	558.58	558.58	HR
1093	556.92	558.25	558.25	ER
1084	556.54	558.24	558.24	CP
1075	556.91	558.24	558.24	HR
1060.5	556.53	557.86	557.86	ER
1054.5	556.15	557.85	557.85	CP
1047	556.52	557.85	557.85	HR
1037	556.26	557.59	557.59	ER
1027	555.88	557.58	557.58	CP
1012	556.24	557.57	557.57	HR
1004	556.03	557.36	557.36	ER
995	555.65	557.35	557.35	CP
985	556.01	557.34	557.34	HR
981	555.91	557.24	557.24	ER
974	555.54	557.24	557.24	CP
967	555.9	557.23	557.23	HR
963	555.8	557.13	557.13	ER
956.5	555.43	557.13	557.13	CP
950	555.79	557.12	557.12	HR
946	555.69	557.02	557.02	ER
940	555.32	557.02	557.02	CP
933	555.68	557.01	557.01	HR
927	555.53	556.86	556.86	ER
919	555.15	556.85	556.85	CP
912	555.52	556.85	556.85	HR
908	555.42	556.75	556.75	ER
900	555.04	556.74	556.74	CP
892	555.41	556.74	556.74	HR
886	555.25	556.58	556.58	ER
879	554.87	556.57	556.57	CP
871	555.24	556.57	556.57	HR
848	554.5	555.83	555.83	ER
835	553.95	555.65	555.65	CP
822	554.48	555.64	555.64	HR
815	554.24	555.4	555.4	ER
808	553.69	555.39	555.39	CP
800	554.23	555.39	555.39	HR

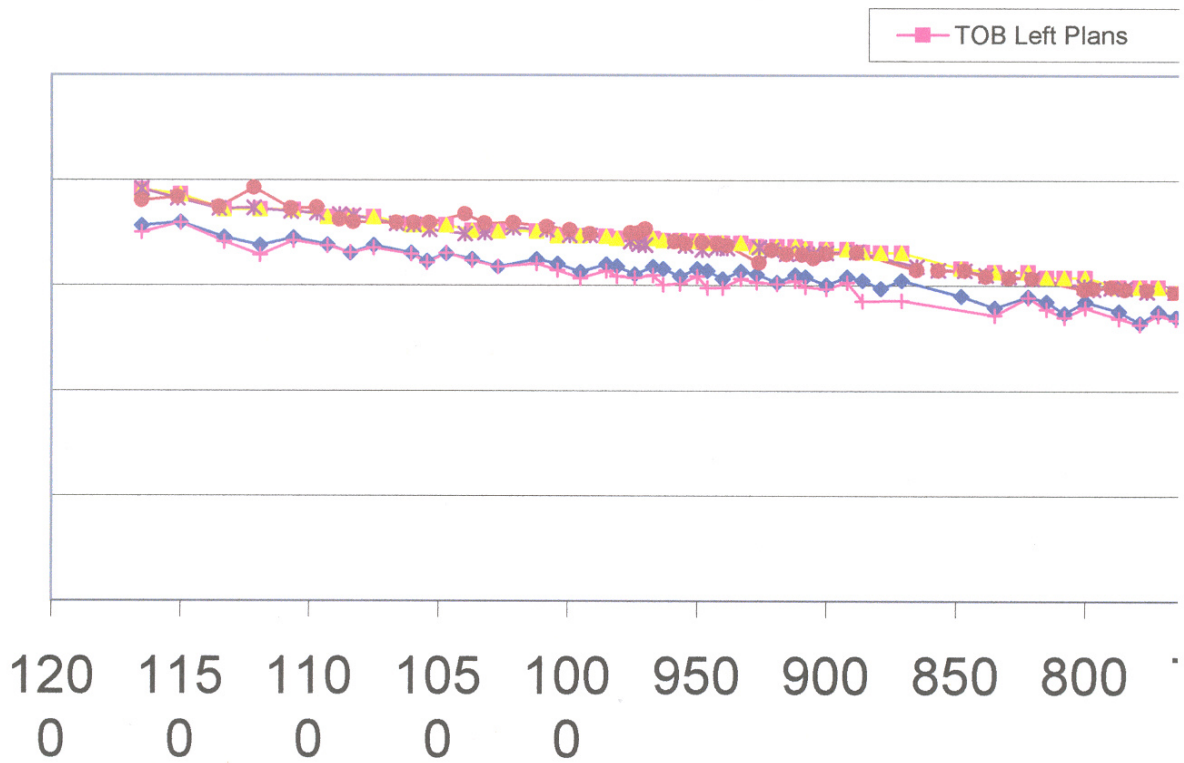
Elevations from field work 11/27/06

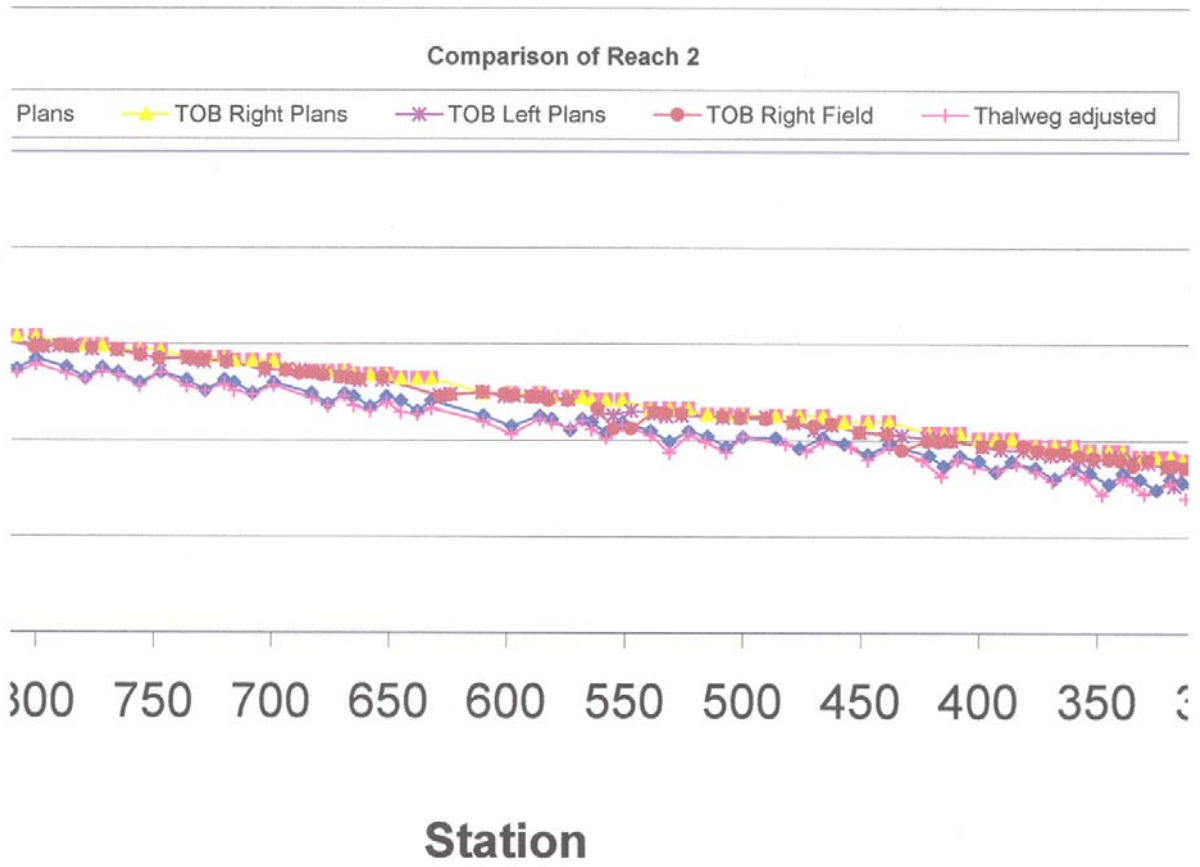
Station	Elevation	Elevation	Elevation
1165	557.52	559.58	559.02
1151	557.97	559.12	559.19
1135	557.07	558.64	558.72
1121.5	556.44	558.67	559.63
1107	557.11	558.5	558.64
1097	556.87	558.44	558.7
1088.3	556.57	558.35	558.11
1083	556.77	558.31	558.005
1066.3	556.5	557.93	557.98
1059.6	556.08	557.88	557.97
1053.4	556.54	557.65	557.98
1039.7	556.18	557.445	558.39
1032	555.9	557.505	557.945
1021	556.045	557.73	557.98
1008	555.72	557.65	557.78
999.2	555.345	557.38	557.64
991.3	555.71	557.37	557.45
975.6	555.445	557.1	557.5
972.4	555.365	556.96	557.5
970	555.49	556.92	557.685
958.6	555.035	557.105	557.085
954.5	555.065	556.9	556.99
948	555.44	556.7	557.04
942.2	554.885	556.81	556.99
938.3	554.88	556.77	556.91
926	555.32	556.83	556.08
921	555.15	556.71	556.685
915.4	555.08	556.52	556.49
909.3	555.22	556.57	556.47
905	554.93	556.505	556.3
900	554.84	556.56	556.52
888.2	555.16	556.61	556.57
865	554.26	555.91	555.75
865	554.29		
856.8	553.59	555.74	555.72
846.6	554.44	555.73	555.72
838.3	553.89	555.51	555.43
829.5	553.5	555.44	555.36
820.5	553.95	555.33	555.35
800.3	553.44	554.99	554.82
796.8	553.17	554.84	554.86

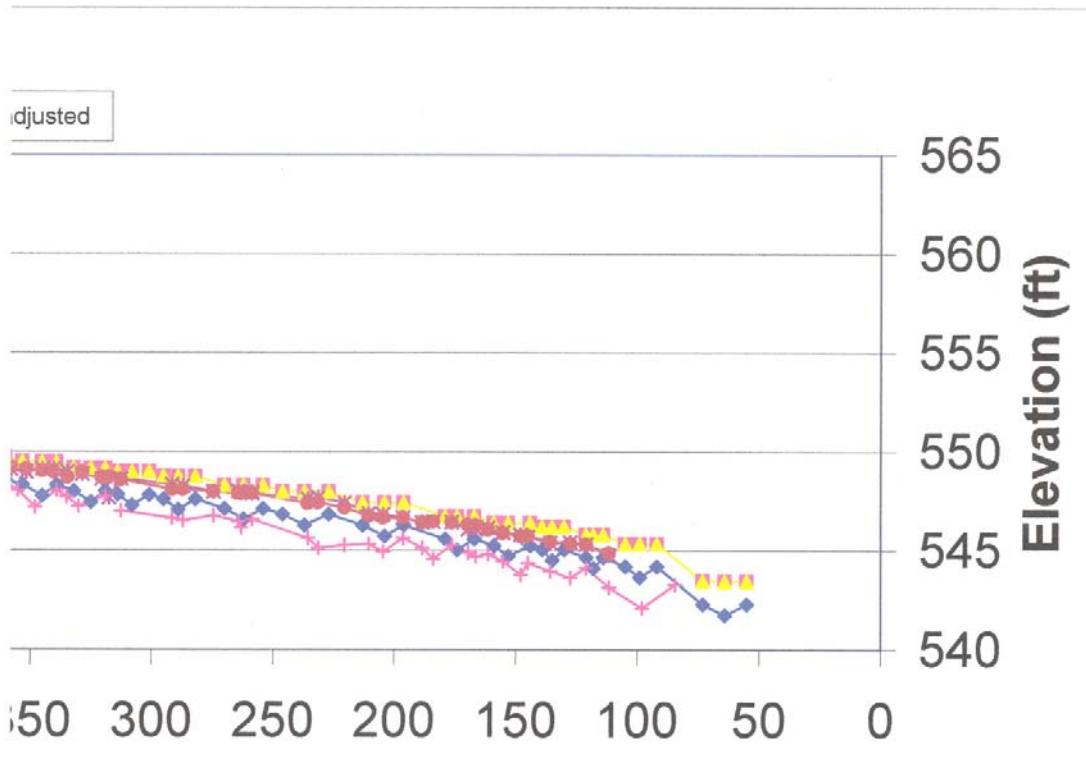
Final Profile Use for Monitoring  
Adjusting profile to correct stationing

Station	Elevation
1165	557.52 CP
1150	557.97 HR
1133	557.07 ER
1119	556.44 CP
1106	557.11 HR
1093	556.87 ER
1084	556.57 CP
1075	556.77 HR
1060.5	556.5 ER
1054.5	556.08 CP
1047	556.54 HR
1037	556.18 ER
1027	555.9 CP
1012	556.045
1004	555.72
995	555.345
985	555.71
981	555.445
974	555.365
967	555.49
963	555.035
956.5	555.065
950	555.44
946	554.885
940	554.88
933	555.32
927	555.15
919	555.08
912	555.22
908	554.93
900	554.84
892	555.16
886	554.26
871	554.29
835	553.59
822	554.44
815	553.89
808	553.5
800	553.95
787	553.44
779	553.17



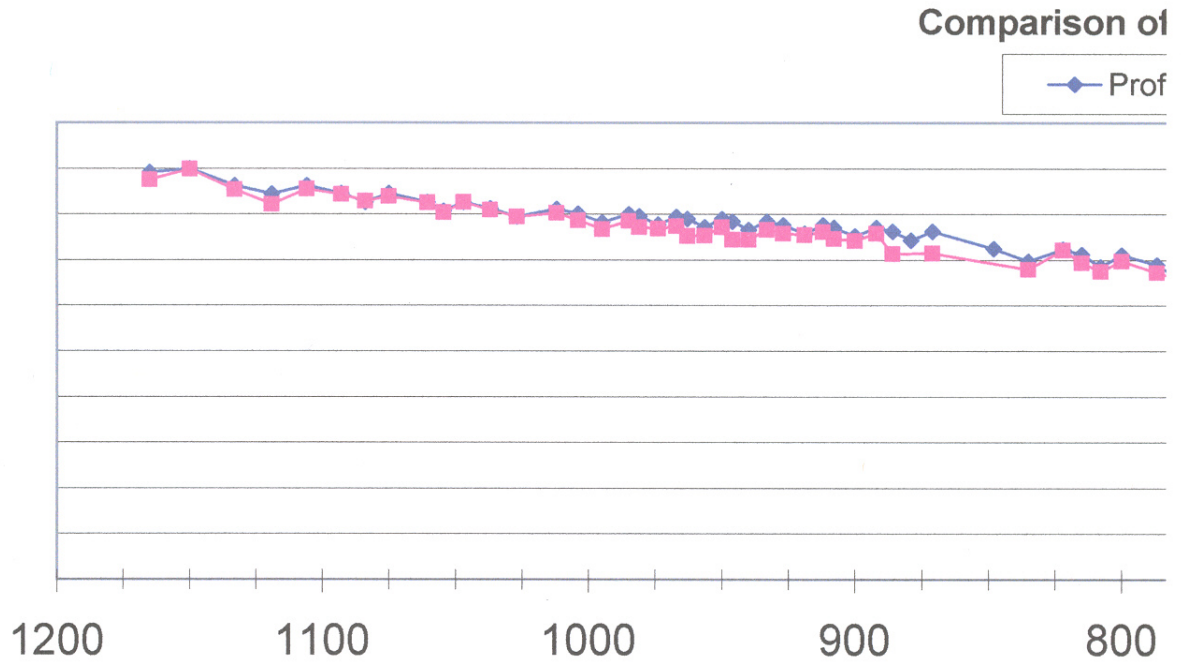






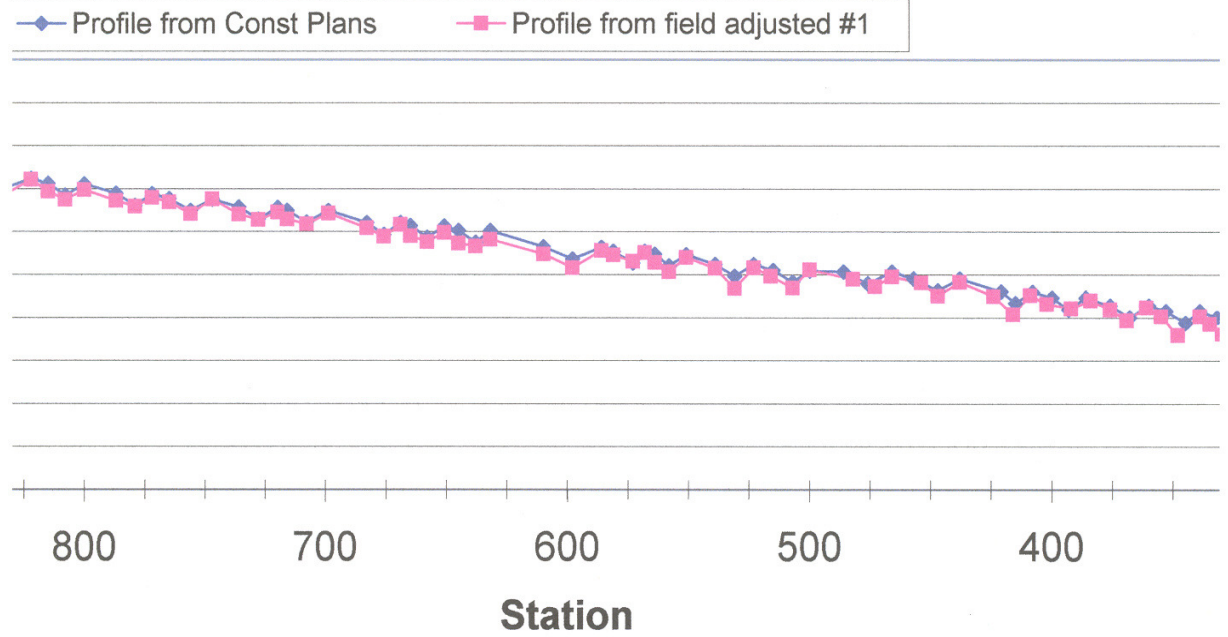
787	553.78	554.94	554.94	ER	790	553.58	554.92	554.94
779	553.23	554.93	554.93	CP	784.6	553.37	554.89	554.81
772	553.77	554.93	554.93	HR	776.3	552.83	554.71	554.78
765	553.53	554.69	554.69	ER	765.6	553.51	554.67	554.67
756	552.98	554.68	554.68	CP	755.6	552.8	554.48	554.4
747	553.52	554.68	554.68	HR	747.8	552.55	554.17	554.25
736	553.14	554.3	554.3	ER	735.4	552.91	554.25	554.25
728	552.59	554.29	554.29	CP	732	552.585	554.19	554.2
720	553.13	554.29	554.29	HR	728.6	552.36	554.09	554.17
716	552.99	554.15	554.15	ER	719	552.845	554.14	554.05
708	552.44	554.14	554.14	CP	702.8	552.18	553.61	553.705
699	552.98	554.14	554.14	HR	694	551.77	553.66	553.62
683	552.43	553.59	553.59	ER	688	552.33	553.64	553.47
676	551.88	553.58	553.58	CP	682.6	551.8	553.525	553.52
669	552.42	553.58	553.58	HR	678	551.54	553.46	553.37
665	552.28	553.44	553.44	ER	670.8	551.97	553.33	553.27
658	551.73	553.43	553.43	CP	665.8	551.45	553.22	553.21
651	552.27	553.43	553.43	HR	662.3	551.33	553.12	553.16
645	552.06	553.22	553.22	ER	652.9	551.64	553.14	553.25
638	551.51	553.21	553.21	CP	628.4	550.97	552.33	552.24
632	552.05	553.21	553.21	HR	624	550.31	552.385	552.35
610	551.29	552.45	552.45	ER	610.5	551.12	552.49	552.48
598	550.74	552.44	552.44	CP	601	550.91	552.29	552.39
586	551.27	552.43	552.43	HR	597	550.62	552.31	552.33
581	551.1	552.26	552.26	ER	589.7	551.03	552.29	552.26
573	550.55	552.25	552.25	CP	587	550.58	552.29	552.25
568	551.09	552.25	552.25	HR	582.4	550.14	552.24	552.09
564	550.95	552.11	552.11	ER	574	550.79	552.16	552.08
558	550.4	552.1	552.1	CP	561.5	550.29		
551	550.94	552.1	552.1	HR				
539	550.49	551.65	551.65	ER	561.5	549.84	551.49	551.66
531	549.94	551.64	551.64	CP	554.8	549.36	551.32	550.6
523	550.48	551.64	551.64	HR	547.4	550.31	551.56	550.62
515	550.2	551.36	551.36	ER	537.5	549.935	551.41	551.47
507	549.65	551.35	551.35	CP	532.5	549.38	551.26	551.42
500	550.19	551.35	551.35	HR	526	550.22	551.32	551.39
486	550.14	551.3	551.3	ER	508.5	549.8	551.22	551.25
476	549.59	551.29	551.29	CP	501	549.45	551.24	551.16
466	550.13	551.29	551.29	HR	490.2	549.915	551.23	551.11
457	549.82	550.98	550.98	ER	478.5	549.64	550.92	550.955
447	549.27	550.97	550.97	CP	469.7	549.01	550.55	550.77
438	549.81	550.97	550.97	HR	462.3	549.65	550.81	550.85
421	549.22	550.38	550.38	ER	450.5	549	550.44	550.42
415	548.68	550.38	550.38	CP	438.7	548.16	550.37	550.295
408	549.21	550.37	550.37	HR	432.7	549.04	550.25	549.48
400	548.93	550.09	550.09	ER	421.8	548.64	550.13	549.98
393	548.38	550.08	550.08	CP	416.9	548.43	550.07	549.93
386	548.92	550.08	550.08	HR	411.8	548.78	550.01	549.96
376	548.57	549.73	549.73	ER	398.5	548.38	549.71	549.71
368	548.02	549.72	549.72	CP	390.7	547.88	549.55	549.75

772	553.58	
765	553.37	
756	552.83	
747	553.51	
736	552.8	
728	552.55	
720	552.91	
716	552.585	
708	552.36	
699	552.845	
683	552.18	
676	551.77	
669	552.33	
665	551.8	
658	551.54	
651	551.97	
645	551.45	
638	551.33	
632	551.64	
610	550.97	
598	550.31	
586	551.12	
581	550.91	
573	550.62	
568	551.03	
564	550.58	
558	550.14	
551	550.79	
539	550.29	
531	549.36	
523	550.31	
516	549.935	523
507	549.38	516
500	550.22	502
482	549.8	492
473	549.45	482
466	549.915	473
454	549.64	463
447	549.01	454
438	549.65	437
424	549	431
416	548.16	424
409	549.04	416
402	548.64	409
392	548.43	402
384	548.78	392
376	548.38	384
369	547.88	376
361	548.46	369
355	548.06	361

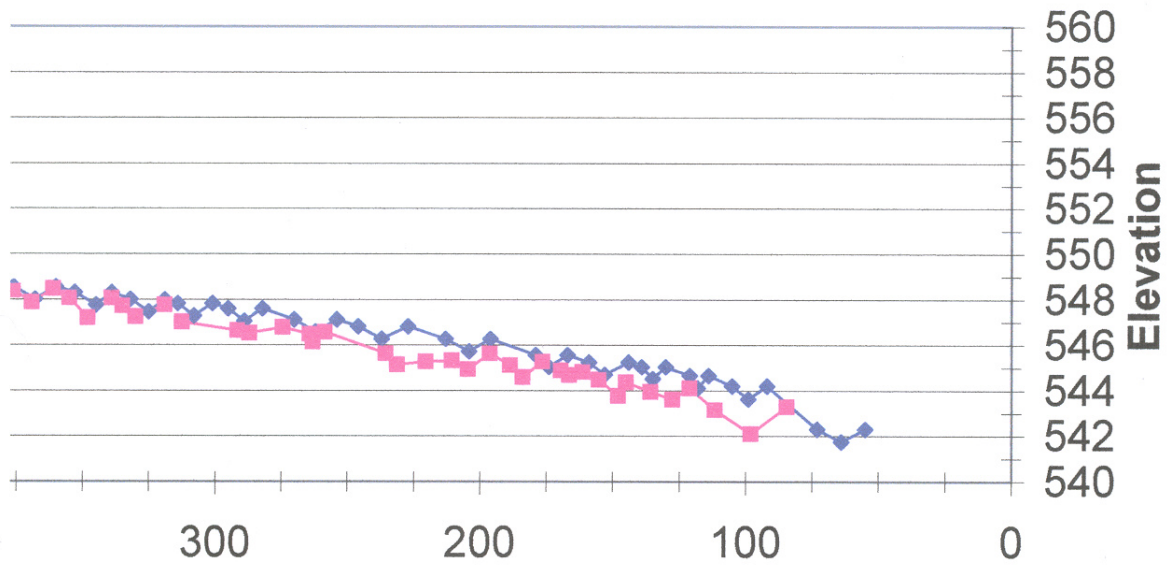




**Comparison of Construction Plans and Final Field adjusted profile #1 Use for Monitor**



## Monitoring





360	548.56	549.72	549.72	HR	381.1	548.46	549.5	549.72
353	548.32	549.48	549.48	ER	375.2	548.06	549.4	549.46
345	547.77	549.47	549.47	CP	369.5	547.2	549.24	549.35
339	548.31	549.47	549.47	HR	364	548.06	549.29	549.375
332	548.01	549.17	549.17	ER	357.5	547.72	549.07	549.2
325	547.46	549.16	549.16	CP	351.5	547.24	548.97	549.12
319	548	549.16	549.16	HR	344.8	547.77	549.13	549.03
314	547.83	548.99	548.99	ER	340	547.53	549.15	548.97
308	547.28	548.98	548.98		334.5	547.175	549	548.7
301	547.82	548.98	548.98		328.5	547.58	548.86	548.97
295	547.61	548.77	548.77		320.5	546.87	548.64	548.71
289	547.06	548.76	548.76		317.5	546.61	547.66	548.71
282	547.6	548.76	548.76		312.5	547.01	548.62	548.59
270	547.13	548.29	548.29		291.5	546.65	548.34	548.1
262	546.59	548.29	548.29		287	546.53	548.27	548.1
254	547.13	548.29	548.29		274.5	546.77	547.98	547.98
246	546.82	547.98	547.98		264.2	546.48	548.01	547.91
237	546.28	547.98	547.98		263	546.15	547.93	547.89
227	546.82	547.98	547.98		258.5	546.51	547.955	547.92
213	546.27	547.43	547.43					
204	545.73	547.43	547.43		258.5	546.57	547.89	547.92
196	546.27	547.43	547.43		235.5	545.64	547.62	547.38
179	545.58	546.74	546.74		231.2	545.135	547.69	547.42
174	545.04	546.74	546.74		220.4	545.27	547.43	547.16
167	545.58	546.74	546.74		210.5	545.31	546.88	546.77
159	545.25	546.41	546.41		204.5	544.94	546.82	546.655
153	544.71	546.41	546.41		196.2	545.635	546.665	546.66
144	545.25	546.41	546.41		188.5	545.12	546.43	546.415
139	545.05	546.21	546.21		183.8	544.58	546.47	546.475
135	544.51	546.21	546.21		176.3	545.275	546.44	546.42
130	545.05	546.21	546.21		169.5	544.88	546.09	546.31
121	544.65	545.81	545.81		166.4	544.69	546.09	546.27
118	544.11	545.81	545.81		161.3	544.82	546.16	546.06
114	544.65	545.81	545.81		155.2	544.47	545.92	545.9
105	544.19	545.35	545.35		148	543.77	545.79	545.72
99	543.64	545.35	545.35		144.9	544.36	545.67	545.75
92	544.19	545.35	545.35		135.8	543.96	545.4	545.44
73	542.31	543.47	543.47		127.5	543.61	545.41	545.35
64	541.76	543.46	543.46		121	544.12	545.31	545.29
55	542.3	543.46	543.46		111.5	543.14	544.77	544.87
					98	542.1		
					84.5	543.28		

348	547.2	355
339	548.06	348
335	547.72	341
330	547.24	335
319	547.77	330
	547.53	324
312.5	547.01	
291.5	546.65	
287	546.53	
274.5	546.77	
264.2	546.48	
263	546.15	
258.5	546.57	
235.5	545.64	
231.2	545.135	
220.4	545.27	
210.5	545.31	
204.5	544.94	
196.2	545.635	
188.5	545.12	
183.8	544.58	
176.3	545.275	
169.5	544.88	
166.4	544.69	
161.3	544.82	
155.2	544.47	
148	543.77	
144.9	544.36	
135.8	543.96	
127.5	543.61	
121	544.12	
111.5	543.14	
98	542.1	
84.5	543.28	

## **7.0 Cross Sections**

**Project:** UT to Rocky River (Smith Tract)

**Location:** Reach 1 Permanent Cross Section #1 Riffle

**Date:** 1/15/2007

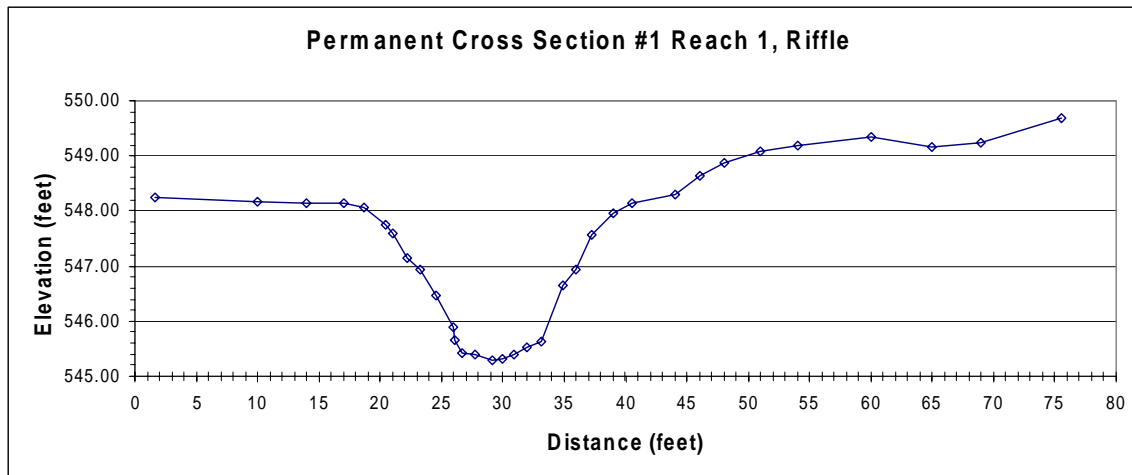
Left Permanent Benchmark Elevation:	550.07
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Benchmark description: Iron pin by old shed

Note: Cross Section taken from left to right looking downstream

Photo Reference Location: Looking upstream

	Back-Sight	Height of Instrument	Fore-Sight	Height	Notes Comments Remarks
Station	BS	HI	FS	Elevation	
Feet	Feet	Feet	Feet	Feet	
	4.18	554.25			Iron pin
1.70			6.00	548.25	
10.00			6.07	548.18	
14.00			6.10	548.15	
17.00			6.12	548.13	
18.70			6.19	548.06	TOB Left
20.40			6.51	547.74	Bankfull
21.00			6.65	547.60	
22.20			7.11	547.14	
23.30			7.31	546.94	
24.60			7.79	546.46	
26.00			8.36	545.89	
26.10			8.60	545.65	Edge of water/water surface
26.70			8.84	545.41	
27.70			8.86	545.39	
29.10			8.97	545.28	TW
30.00			8.94	545.31	
30.90			8.85	545.40	
32.00			8.73	545.53	
33.10			8.63	545.63	Edge of water/water surface
34.90			7.60	546.65	
35.90			7.31	546.94	
37.2			6.68	547.58	
39			6.28	547.97	TOB/Bankfull Right
40.50			6.12	548.14	
44.00			5.96	548.30	
46.00			5.62	548.63	
48.00			5.37	548.89	
51.00			5.17	549.08	
54.00			5.06	549.19	
60.00			4.91	549.35	
65.00			5.09	549.16	
69.00			5.00	549.25	
75.50			4.56	549.69	



**Project:** UT to Rocky River

**Location:** Reach 2 Permanent Cross Section #1 Riffle

**Date:** 11/27/2006

Left Permanent Benchmark Elevation:	559
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Right Permanent Benchmark Elevation:	
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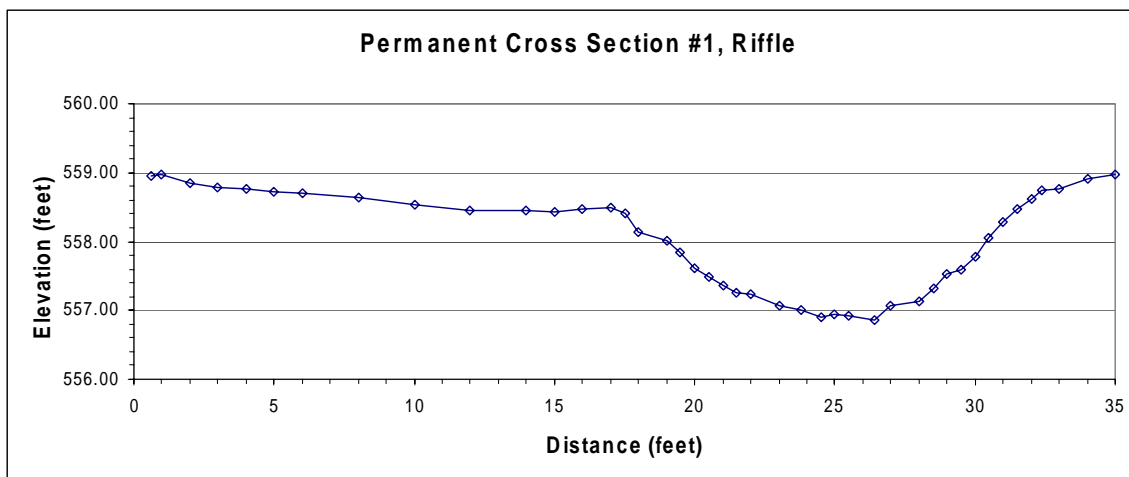
Benchmark description: Rebar approx. 110 stream ft downstream from upper project limit on right side of stream

Note: Cross Section taken from left to right looking downstream

Photo Reference Location: Looking upstream

	Back-Sight	Height of Instrument	Fore-Sight	Height	Notes
Station	BS	HI	FS	Elevation	Comments
Feet	Feet	Feet	Feet	Feet	Remarks
	2.93	561.93			
0.60			2.97	558.96	
1.00			2.96	558.97	
2.00			3.08	558.85	
3.00			3.14	558.79	
4.00			3.16	558.77	
5.00			3.20	558.73	
6.00			3.22	558.71	
8.00			3.29	558.64	
10.00			3.39	558.54	
12.00			3.47	558.46	
14.00			3.49	558.44	
15.00			3.50	558.43	
16.00			3.45	558.48	
17.00			3.44	558.49	TOB Left
17.50			3.53	558.40	
18.00			3.79	558.14	
19.00			3.92	558.01	
19.50			4.09	557.84	
20.00			4.31	557.62	
20.50			4.44	557.49	
21.00			4.57	557.36	
21.5			4.67	557.26	BF Bench Left
22			4.69	557.24	
23.00			4.87	557.06	
23.80			4.93	557.00	Toe Left
24.50			5.02	556.91	
25.00			4.99	556.94	
25.50			5.01	556.92	4.96 is WS reading = 556.97 feet
26.40			5.08	556.85	Toe Right
27.00			4.87	557.06	
28.00			4.80	557.13	BF Bench Right
28.50			4.62	557.31	
29.00			4.41	557.52	
29.50			4.34	557.59	
30.00			4.15	557.78	
30.50			3.87	558.06	
31.00			3.64	558.29	
31.50			3.46	558.47	
32.00			3.32	558.61	
32.40			3.18	558.75	TOB Right
33.00			3.17	558.77	
34.00			3.02	558.91	
35.00			2.95	558.98	



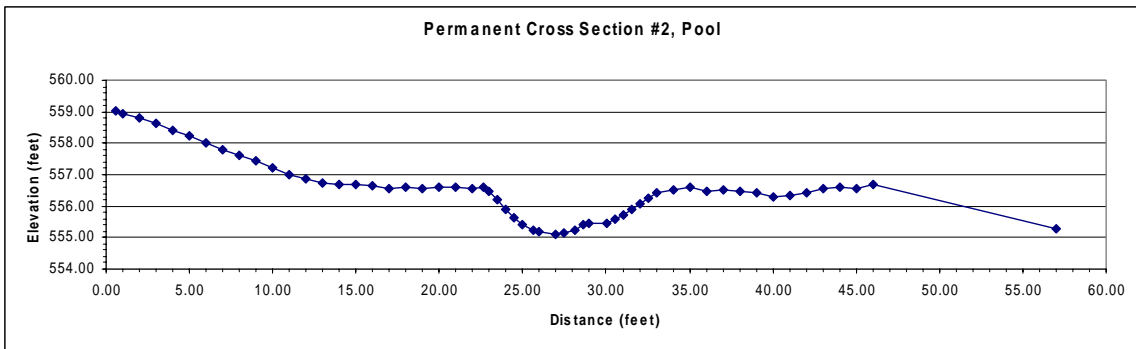


**Project:** UT to Rocky River  
**Location:** Reach 2 Permanent Cross Section #2 Pool  
**Date:** 11/27/2006

Left Permanent Benchmark Elevation: 559

Note: Cross Section taken from left to right looking downstream  
 Photo Reference Location: Looking upstream

	Back-Sight	Height of Instrument	Fore-Sight	Height	Notes Comments Remarks
Station	BS	HI	FS	Elevation	
Feet	Feet	Feet	Feet	Feet	
	2.93	561.93			
0.60			2.91	559.02	
1.00			3.00	558.93	
2.00			3.14	558.79	
3.00			3.31	558.62	
4.00			3.53	558.40	
5.00			3.70	558.23	
6.00			3.93	558.00	
7.00			4.14	557.79	
8.00			4.31	557.62	
9.00			4.51	557.42	
10.00			4.72	557.21	
11.00			4.94	556.99	
12.00			5.08	556.85	
13.00			5.18	556.75	
14.00			5.23	556.70	
15.00			5.26	556.67	
16.00			5.27	556.66	
17.00			5.39	556.55	
18.00			5.35	556.59	
19.00			5.36	556.57	
20.00			5.31	556.62	
21.00			5.32	556.62	
22.00			5.35	556.58	
22.60			5.33	556.60	TOB Left
23.00			5.44	556.49	
23.50			5.73	556.21	
24			6.02	555.91	
24.5			6.31	555.63	
25.00			6.54	555.39	
25.60			6.71	555.23	Toe Left
26.00			6.76	555.17	
27.00			6.84	555.10	Water surface reading 6.65 = 555.28 feet
27.50			6.80	555.13	
28.10			6.71	555.22	Toe Right
28.60			6.50	555.43	
29.00			6.47	555.46	
30.00			6.47	555.47	BF Bench Right
30.50			6.33	555.60	
31.00			6.22	555.71	
31.50			6.03	555.91	
32.00			5.85	556.08	
32.50			5.67	556.26	
33.00			5.50	556.43	TOB Right
34.00			5.43	556.50	
35.00			5.34	556.59	
36.00			5.45	556.48	
37.00			5.40	556.54	
38.00			5.44	556.49	
39.00			5.51	556.42	
40.00			5.62	556.31	
41.00			5.60	556.33	
42.00			5.51	556.42	
43.00			5.38	556.55	
44.00			5.34	556.59	
45.00			5.35	556.58	
46.00			5.26	556.67	
			6.65	555.28	



**Project:** UT to Rocky River

**Location:** Reach 2 Permanent Cross Section #3 Riffle

**Date:** 11/27/2006

**Left Permanent Benchmark Elevation:** 554.65

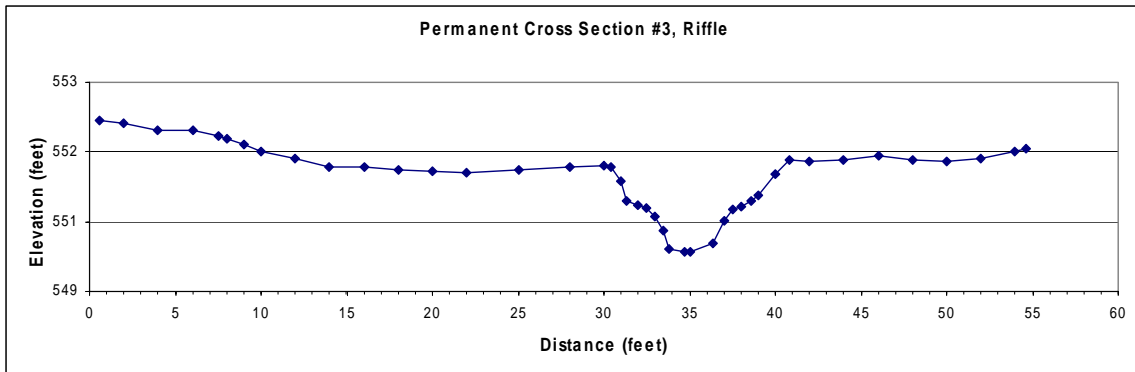
**Benchmark description:** Rebar, TBM located on right side of stream approx. 446 feet downstream of upper project limit

**Note:** Cross Section taken from left to right looking downstream

**Photo Reference Location:** Looking upstream

	Back-Sight	Height of Instrument	Fore-Sight	Height	Notes Comments Remarks
Station	BS	HI	FS	Elevation	
Feet	Feet	Feet	Feet	Feet	
	0.77	555.42			
0.6			3.19	552.24	
2.0			3.24	552.18	
4.0			3.35	552.07	
6.0			3.35	552.07	
7.5			3.46	551.96	
8.0			3.51	551.91	
9.0			3.60	551.83	
10.0			3.72	551.70	
12.0			3.84	551.58	
14.0			3.98	551.44	
16.0			3.98	551.44	
18.0			4.01	551.41	
20.0			4.05	551.37	
22.0			4.06	551.36	
25.0			4.02	551.40	
28.0			3.98	551.45	
30.0			3.94	551.48	
30.4			3.97	551.45	TOB Left
31.0			4.20	551.22	
31.3			4.55	550.87	BF Bench Left
32.0			4.61	550.81	
32.5			4.66	550.76	
33.0			4.81	550.61	
33.5			5.04	550.38	
33.8			5.35	550.07	Toe Left
34.7			5.39	550.03	Center channel
35.0			5.40	550.03	
36.4			5.24	550.18	Toe Right
37.0			4.87	550.56	
37.5			4.68	550.74	
38.0			4.63	550.80	
38.6			4.53	550.89	BF Bench Right
39.0			4.44	550.98	
40.0			4.10	551.32	
40.8			3.85	551.57	TOB Right
42.0			3.89	551.53	
44.0			3.85	551.57	
46.0			3.79	551.63	
48.0			3.86	551.56	
50.0			3.87	551.55	
52.0			3.83	551.60	
54.0			3.72	551.70	
54.6			3.67	551.75	





**Project:** UT to Rocky River

**Location:** Reach 2 Permanent Cross Section #4 Pool

**Date:** 11/27/2006

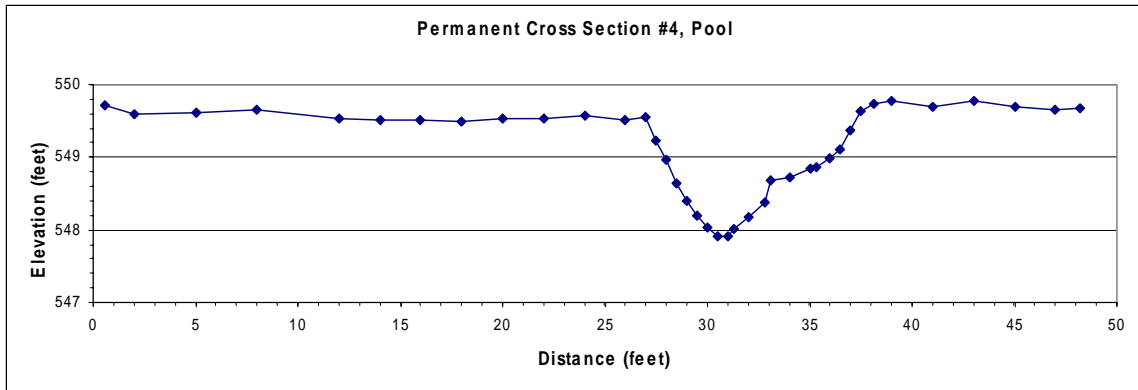
Left Permanent Benchmark Elevation:	554.65
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Note: Cross Section taken from left to right looking downstream

Photo Reference Location: Looking upstream

	Back-Sight	Height of Instrument	Fore-Sight	Height	Notes
Station	BS	HI	FS	Elevation	Comments
Feet	Feet	Feet	Feet	Feet	Remarks
	0.77	555.42			
0.6			5.71	549.71	
2.0			5.83	549.59	
5.0			5.81	549.62	
8.0			5.77	549.65	
12.0			5.89	549.53	
14.0			5.91	549.52	
16.0			5.91	549.52	
18.0			5.94	549.49	
20.0			5.89	549.53	
22.0			5.89	549.53	
24.0			5.86	549.57	
26.0			5.90	549.52	
27.0			5.87	549.55	TOB Left
27.5			6.20	549.22	
28.0			6.45	548.97	
28.5			6.77	548.65	
29.0			7.03	548.39	
29.5			7.22	548.20	water surface reading 6.98 = 548.44 ft
30.0			7.39	548.03	Toe Left
30.5			7.50	547.92	
31.0			7.51	547.92	
31.3			7.41	548.01	
32.0			7.24	548.18	
32.8			7.05	548.37	Toe Right
33.1			6.74	548.68	
34.0			6.70	548.72	
35.0			6.58	548.84	
35.3			6.56	548.87	BF bench Right
36.0			6.44	548.98	
36.5			6.32	549.10	
37.0			6.05	549.37	
37.5			5.79	549.63	
38.1			5.68	549.74	TOB Right
39.0			5.65	549.78	
41.0			5.73	549.70	
43.0			5.65	549.77	
45.0			5.72	549.70	
47.0			5.77	549.65	
48.2			5.75	549.68	





**Project:** UT to Rocky River

**Location:** Reach 2 Permanent Cross Section #5 Riffle

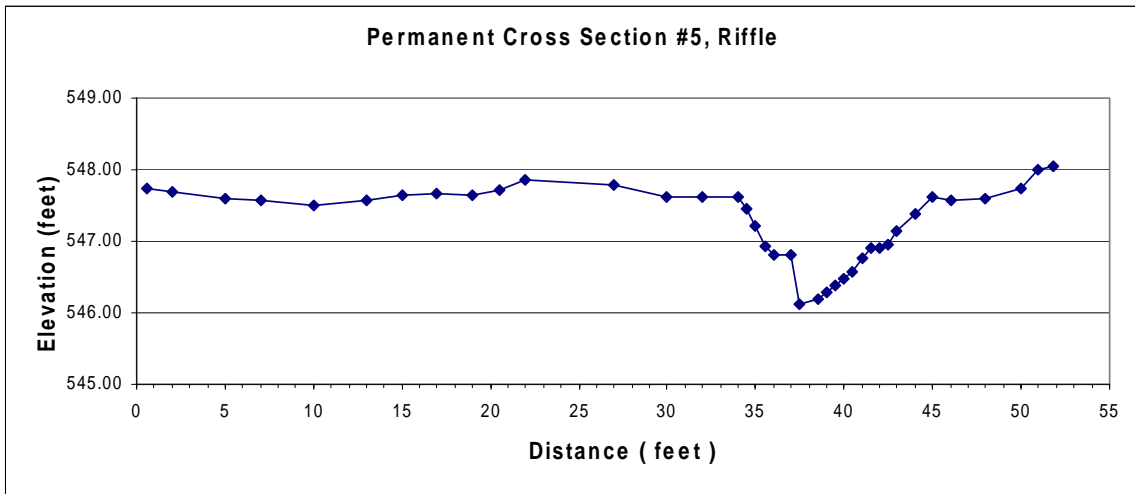
**Date:** 11/27/2006

Left Permanent Benchmark Elevation:	549.17
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Note: Cross Section taken from left to right looking downstream

Photo Reference Location: Looking upstream

	Back-Sight	Height of Instrument	Fore-Sight	Height	Notes
Station	BS	HI	FS	Elevation	Comments
Feet	Feet	Feet	Feet	Feet	Remarks
	2.71	551.88			
0.6			4.13	547.75	
2			4.19	547.69	
5			4.28	547.60	
7			4.31	547.57	
10			4.39	547.49	
13			4.31	547.57	
15			4.24	547.64	
17			4.22	547.66	
19			4.23	547.65	
20.5			4.155	547.73	
22			4.015	547.87	
27			4.095	547.79	
30			4.26	547.62	
32			4.26	547.62	
34			4.25	547.63	TOB Left
34.5			4.43	547.45	
35			4.66	547.22	
35.5			4.96	546.92	
36			5.06	546.82	BF Bench Left
37			5.07	546.81	
37.5			5.77	546.11	Toe Left
38.5			5.695	546.19	
39			5.59	546.29	
39.5			5.49	546.39	
40			5.4	546.48	Toe Right
40.5			5.31	546.57	
41			5.11	546.77	
41.5			4.98	546.90	
42			4.985	546.90	
42.5			4.93	546.95	BF Bench Right
43			4.735	547.15	
44			4.51	547.37	
45			4.26	547.62	TOB Right
46			4.31	547.57	
48			4.285	547.60	
50			4.13	547.75	
51			3.87	548.01	
51.8			3.83	548.05	



## **8.0 Tables**

**Table 1: Project Restoration, Enhancement, and Preservation Specifications**

Table 1: Project Restoration, Enhancement, and Preservation Specifications

<b>Project Restoration/Enhancement/Preservation</b>		
<b>Type</b>	<b>Acres</b>	<b>Linear Feet</b>
Stream Restoration	N/A	1,010
Stream Enhancement	N/A	955
Stream Buffer Enhancement	2.21	N/A
Stream Buffer Restoration	0.3	N/A
Stream Buffer Preservation	6.67	N/A



**Table 2: Project Restoration, Enhancement, and Preservation Post Construction Credits**

<b>Table 2: UT to Rocky River Restoration/Enhancement/Preservation Project Post Construction Credits</b>			
<b>Type</b>	<b>Level of Restoration</b>	<b>Proposed Credit Ratio</b>	<b>SMU</b>
Stream	Enhancement	2:1	477.5
	Restoration	1:1	1,010
	Preservation	5:1	-
<b>Stream Total</b>			<b>1487.5</b>

**Table 3: Vegetation Results**

December 2006  
Total # planted

		Exhibit Table VII: Stem counts for each species arranged by plot						
Species		Plots						Initial Totals
		1	2	3	4	5	6	
<b>Reach 1, Zone 1</b>								
90	<i>Carya cordiformis</i>	8	3					11
60	<i>Quercus pagodaefolia</i>	2	2					4
60	<i>Quercus phellos</i>		3					3
60	<i>Liriodendron tulipifera</i>	3	2					5
60	<i>Ulmus americana</i>							0
60	<i>Celtis laevigata</i>							0
60	<i>Fraxinus pennsylvanica</i>	2	4					6
65	<i>Betula nigra</i>		3					3
60	<i>Carpinus caroliniana</i>	2	4					6
40	<i>Platanus occidentalis</i>	3						3
<b>Reach 1, Zone 3</b>								
172	<i>Alnus serrulata</i>	1						1
172	<i>Viburnum nudum</i>							0
172	<i>Sambucus canadensis</i>							0
175	<i>Ilex verticillata</i>							0
175	<i>Liriodendron tulipifera</i>	1						1
<b>Reach 2, Zone 1</b>								
130	<i>Carya cordiformis</i>				5	4	6	15
87	<i>Quercus pagodaefolia</i>				2	2		4
87	<i>Quercus phellos</i>				1	5	1	7
87	<i>Liriodendron tulipifera</i>				3	3		6
87	<i>Ulmus americana</i>				5	1	2	8
87	<i>Celtis laevigata</i>				5			5
87	<i>Fraxinus pennsylvanica</i>				5	4	1	10
90	<i>Betula nigra</i>				4	5		9
88	<i>Carpinus caroliniana</i>							0
55	<i>Platanus occidentalis</i>				1	2	1	4
<b>Reach 2, Zone 2</b>								
14	<i>Carya cordiformis</i>			2				2
14	<i>Quercus alba</i>			6				6
14	<i>Quercus rubra</i>			5				5
14	<i>Liriodendron tulipifera</i>			4				4
14	<i>Nyssa sylvatica</i>			6				6
<b>Reach 2, Zone 3</b>								
157	<i>Alnus serrulata</i>				3		6	9
157	<i>Viburnum nudum</i>						2	2
157	<i>Sambucus canadensis</i>				2		6	8
160	<i>Ilex verticillata</i>				2		4	6
160	<i>Liriodendron tulipifera</i>				2		5	7
<b>Reach 2, Zone 3 Live Stakes in Rock Joint Planting area only</b>								
30	<i>Cornus amomum</i>							0
10	<i>Salix nigra</i>							0
<b>Total plants per plot</b>		<b>22</b>	<b>21</b>	<b>23</b>	<b>40</b>	<b>26</b>	<b>34</b>	<b>166</b>