Bailey Fork Restoration Plan

Full Delivery Project Catawba 01 • Contract No. D04006-2

Burke County, North Carolina
Catawba River Basin: 8-digit CU 03050101

Prepared for:

Ecosystem Enhancement
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1.0 Introduction

Bailey Fork and two unnamed tributaries of Bailey Fork have been selected for restoration by the North Carolina Department of Environment and Natural Resources Ecosystem Enhancement Program to fulfill a portion of the Request for Proposals: Full Delivery Project Catawba 01. The purpose of the RFP is to provide compensatory stream mitigation within the Catawba River Basin Cataloging Unit 03050101. The Request for Proposal has been designated RFP 16-D04006. Closing date for the request was March 25, 2004. Wetlands Resource Center (WRC) entered into a contract with the State of North Carolina on July 22, 2004 to deliver 5,500 stream units within this project site (Contract No. D04006-2).

WRC proposes to restore stream dimension, pattern, and bed profile to approximately 5,500 linear feet of existing highly degraded and poorly functioning perennial stream channels. The proposed design will expand the current channel length by approximately 600 linear feet. Also proposed is the restoration of approximately 7.5 acres of riparian buffer (extending landward 30 feet from bankfull on each side of the stream) which will be protected in perpetuity. As outlined in the request for proposals for this project, the riparian buffer width requirements were obtained from the US Army Corps of Engineers April 2003 Stream Mitigation Guidelines.

The site has been selected because of the highly degraded state of Bailey Fork and the tributaries. Based on site observations the degraded condition of the streams within the project area may be the result of flood plain accretion, historic channelization, periodic dredging, past and present day vegetation maintenance practices, and to a lesser extent storm water runoff onto the site from the incremental increase in impervious surface associated with urbanization.

The stream banks are generally denuded, actively eroding, and have a nearly vertical profile. Vegetative cover is minimal along the embankment. As a result, the banks are eroding, subsequently slumping, promoting lateral channel migration and asymmetrical meander creation. The majority of the stream is classified as an "F" type channel with some sections classifying as E and G-type channel under the Rosgen Stream Classification System. Some sections of channel have limited access to the flood plain during peak flood flows. The channels do not have access to the flood plain during bankfull events that typically occur in stable stream channel during the 1.5 to 2 year return period storm (Leopold et al. 1992). The channels are in a highly incised state; therefore, flood flows are constrained to the channel and the flood plain functions more as a terrace that is not accessible at the bankfull elevation. The streams are in a progressive state of channel evolution referred to as Stage III and Stage IV (Ward and Trimble, 2004). Meanders and a new lower and functional flood plain located at the bankfull elevation are beginning to take form within the existing confined channel as a result of active stream bank erosion, and bed degradation. Only during intense rain storm events does flood water ever reach the historic flood plain.

Bailey Fork and its unnamed tributaries within the project site present a viable and feasible restoration project. The main stem of Bailey Fork and its tributaries are morphologically unstable and are contributing to water quality degradation and possess limited aquatic habitat. Several factors support this proposed restoration project. The current degraded state of the channel, limited flood plain functionality due to channel incision, existing and future erosion potential, limited native vegetation along the banks and riparian area, and amenable landowners make this site a viable and feasible restoration project.

Additional information is located in the Appendicies of this report. Report figures are located in **Appendix A**. A comparison of the North Carolina Stream Restoration Institute's regional curve versus the project specific regional curve is presented in **Appendix B**. The existing conditions data collected for Bailey Fork is presented in **Appendix C** and the Pre-Construction Notification Form is located in **Appendix D**. Documents related to the project such as agency correspondence and legal agreements with the property owners are located in **Appendix E**. Photographs of the project site can be found in **Appendix F**.

2.0 Project Goals and Objectives

The project goal for this restoration plan is to modify the current dimension, pattern and profile of the existing stream channels so it will be stable and self-maintaining by utilizing natural channel design techniques and procedures. The design has been developed utilizing Rosgen-based natural channel design principles. Physical restoration and the return of the overall biological and water quality functionality will be accomplished by fulfilling the following objectives:

1) Design a channel with the appropriate cross-sectional dimension, pattern, and longitudinal profile utilizing the existing channel condition survey, and collected reference reach data as a guide.
2) Improve upon and create bed form and aquatic habitat diversity (riffles, runs, pools, and glides).
3) Integrate, in conjunction with the stream restoration, a nested flood plain (bankfull bench) that will be accessible at the proposed bankfull channel elevation (Priority II restoration) or raise the bed elevation of the current stream so the bankfull elevation matches the current flood plain elevation (Priority I).
4) Ensure channel and stream bank stabilization by integrating in-channel grade control structures, root wads, and native vegetation into the proposed restoration design while also creating a stable and functional aquatic and terrestrial habitat.
5) Establish a native forested riparian plant community within a minimum of 30 feet from the proposed top of the bankfull channel along with the removal of exotic vegetation during construction implementation and the elimination of current embankment maintenance practices.
6) Provide aesthetic and educational opportunities.

3.0 Site Description

3.1 General Description

The project site is located approximately 2 miles southwest of Morganton, Burke County, North Carolina (**Figure 1**). The site is specifically located approximately 1.7 miles southwest of the I-40/US 64 interchange. To get to the site from I-40, take US 64 south to Propst Road (SR 1112), turn right and the project site is located on the north and south sides of Propst Road approximately 1,800 feet from the Propst Road and US 64 Intersection (**Figure 2**). The site includes four parcels of property owned by three separate parties (**Figure 3**). The project site and subject properties are also depicted against an aerial photograph as shown in **Figure 4**.

3.2 Surface Waters

The project site is located within the Catawba River Basin, USGS Hydrologic Unit 03050101 (USGS 1974), subbasin 030831 (NCDENR, 2003), and Local Watershed 14-digit basin 03050101050050 (NCDENR, 2001). Bailey Fork (Stream Index Number 11-34-(2)) flows directly into the Catawba River approximately 1.7 miles downstream of the project terminus. The North Carolina Division of Water Quality (NC DWQ) has not assigned stream index numbers to the unnamed tributaries of Bailey Fork located within the project extents. The current State classification of Bailey Fork and each unnamed tributary is Class C waters (NCDENR, 2004). Class C waters are protected for aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture (NCDENR, 2004). Based on the most recently published USGS quadrangle, Bailey Fork is a 2nd order stream and the drainage area at the terminus of the project is approximately 6.5 square miles (**Figure 5**).

4.0 General Watershed Description

The primary land use within the immediate project site is agricultural. The project site is currently being utilized to produce hay for livestock feed. The site has been degraded by past land management practices including mechanical land clearing, straightening and dredging of stream channels and continual hay production. Utilizing the United States Geological Survey (USGS) 1993 orthophotograph of the watershed area, it has been estimated that the land use within the Bailey Fork watershed consists primarily of forested, agricultural, and urban land uses. Approximately sixty percent (60%) of the watershed is forested, thirty percent (30%) is agricultural, and ten percent (10%) is urbanized (**Figure 6**).

The watershed area is located in the Piedmont physiographic region of North Carolina and is classified geologically as the Chauga Belt. The ecoregion has been classified as the Northern Inner Piedmont ecoregion. The surrounding landscape topography of the watershed is characterized as predominately strongly sloping to very steep uplands and narrow nearly level flood plains. The site topography along the flood plain is relatively flat adjacent to the subject streams. Elevations within the watershed vary from 2800 feet mean sea level (MSL) at the headwaters of Bailey Fork to a low of 1035 feet (MSL) at the project terminus (USGS, 1993a and USGS, 1993b).

Bailey Fork originates in the Burkemont Mountains and flows from south to the north and eventually empties directly into the Catawba River, which flows from west to east. The confluence of Bailey Fork and the Catawba River is west of Morganton, North Carolina. An unnamed tributary, referred to in this restoration plan as Unnamed Tributary 1 (UT 1), intersects Bailey Fork approximately 250 feet south of Propst Road. Unnamed Tributary 2 (UT 2) connects to Lower Bailey Fork downstream of Propst Road at the approximate terminus of the restoration project.

Vertical fall across the project site from the origin to the terminus is approximately 8 feet resulting in a valley slope of 0.004 ft/ft based on the 1-foot topographic map developed by 4D Site Solutions. The wide, gently sloping, well-defined flood plain is a Valley Type VIII as defined in Applied River Morphology (Rosgen, 1996). The drainage area for the entire project site, which correlates with the confluence of Lower Bailey Fork with Unnamed Tributary 2 (UT 2) has been estimated to be approximately 6.5 square miles.

The project site currently exhibits various existing uses. The primary land use within the site is agricultural. The current agricultural use is the production of fescue hay and includes the infrastructure required to access, maintain, and service the project area for this purpose. Structures observed on the project site include fencing, a bridged stream crossing, a stormwater outfall fed by NCDOT roadside drainage ditching, driveway access from Propst Road, a swing gate, and three 7.5-foot wide oval corrugated metal pipe (CMP) culverts that pass flow under Propst Road. NCDOT has determined that a right-of-way encroachment agreement is not needed to perform the construction work associated with this project (see 12-20-04 letter, **Appedix E**). In addition to the agricultural use a high tension electrical utility exists north and parallel to Propst Road. Based on property owner information, this electrical utility has a 50-foot right-of-way from each side of its centerline. The utility right-of-way crosses the bottom end of Upper Bailey Fork and the lower most section of UT 1 immediately upstream and adjacent to Propst Road at an estimated 22 degrees to the orientation of Upper Bailey Fork.

Land use within the watershed and immediately surrounding the site has been slowly yet progressively converted to residential and commercial land uses (urban land uses) although the conversion appears to be limited and consists primarily of single family residences. There were no large scale commercial or residential development projects observed within the vicinity of the project. The expectation is that land use within the watershed area will remain fairly constant because there is little evidence of an increase in urbanization or significant shift of current land uses.

5.0 Existing Stream Conditions

The restoration site consists of a historically modified (re-aligned, channelized, and periodically maintained) stream channel as interpreted from the 1993 orthophotograph (**Figure 4**). Based on photographic interpretation, the site has been historically utilized for agricultural production (row crops, hay production). It is very likely the project site has been farmed since the Civil War era. As a result of the conversion to this land use, the natural plant communities, topography, and hydrologic conditions have been altered or in some cases obliterated.

Although the site has been converted and subsequently stabilized due to the termination of tillage and wide spread land clearing, maintenance adjacent to the channel has continued. Vegetation along the channel is sparse and is apparently periodically maintained. The incised nature of Bailey Fork and the unnamed tributaries has resulted in continuous bank erosion, slump, mass wasting, scour, and head cutting. Previous historic alteration such as straightening, dredging and the deforestation of the embankment has increased stream slope, stream power, shear stress, and confined flood flows to the channel have perpetuated the degradation process.

Existing stream features within the project site consist of three separate perennial stream channels. Stream channels consist of Bailey Fork, and two unnamed tributaries of Bailey Fork referred to as UT 1 and UT 2. Bailey Fork has been separated into Upper and Lower Bailey Fork for the purposes of this restoration plan and the dividing point is Propst Road. Upper Bailey Fork has a watershed drainage area of approximately 5.0 square miles and Lower Bailey Fork prior to the confluence with UT 2 is a watershed drainage area of approximately 5.5 square miles. UT 1, which is located on the south side of Propst Road and oriented east of Upper Bailey Fork has an estimated watershed area of 0.54 square miles. The origin of UT 1 within the project site is immediately below the box culvert located under US 64.. UT 2 is located on the north side of Propst Road and is oriented west of Lower Bailey Fork. Watershed drainage area for UT 2 is estimated to be 0.98 square miles. The source of UT 2 within the project area is a 45-inch reinforced concrete pipe (RCP) located under Propst Road.

5.1 Existing Stream Geometry

5.1.1 Stream Survey Methodology

A field reconnaissance of the channel was performed prior to the commencement of the site survey. The purpose of the field reconnaissance was to identify the bankfull elevation utilizing existing indicators. Typical bankfull indicators were obscured and sporadic due to active bank erosion, slumping, land maintenance activities, and past landscape modifications. Features that were utilized when present included depositional features, vegetation positions, scour lines, and wrack lines. Other features that were identified during the reconnaissance and subsequently surveyed included existing stormwater outfalls, culverts, bridges and utilities.

Natural Systems Engineering subcontracted 4D Site Solutions to survey the existing channel conditions under field supervision and to develop a one-foot topographic map that was utilized in the development of this restoration plan. Survey data was collected and compiled during October 2004. The base map generated was used to evaluate present landscape conditions and constraints, and to determine the final location of the proposed channel alignment.

During the site survey, numerous channel cross-sections were collected encompassing all three of the subject channels. Data was collected utilizing either a total station or survey level. The cross-sectional data is presented in **Figure 8, Appendix A.**

5.1.2 Bankfull Verification

Cross-sectional data that was collected in the field was plotted and subsequently compared to the North Carolina Rural Regional Curve (Harmon et al, 1999 and SRI 2000) for accuracy. All of the cross-sectional areas surveyed and subsequently plotted were within the 95% confidence interval relative to drainage area **(Appendix B).**

5.1.3 Stream Classification

Stream channels were classified utilizing the stream classification system devised by Dave Rosgen (Rosgen, 1996 and Rosgen et al. 1998). This classification system utilizes several parameters based on field collected data and site observations, which collectively determines the stream type. The criteria utilized to determine stream type includes the stream slope, width-to-depth ratio, entrenchment ratio, sinuosity, and substrate class.

5.1.4 Channel Classification

Based on the completed channel survey and observations made during the site reconnaissance, Bailey Fork, UT 1 and UT 2 have been functionally and hydrologically modified to maximize available land for the purpose of accommodating current agricultural uses. Modifications may have included dredging, channelization, and clearing and grubbing of the native vegetation once present along the channel and within the flood plain. Stream channelization in this case was probably completed to maximize productive cropland acreage, promote positive site drainage, and to reduce the historic groundwater table elevation. As a direct result of the channelization procedure, the dredged and lowered channel no longer has full access to the historic flood plain at the bankfull elevation. The channel is considered to be incised resulting in the concentration of flood flows within the confines of the channel that would otherwise be dispersed onto the flood plain. As a result of the incision, stream power within the confined channel increases beyond sustainable levels causing destabilization in the form of bed degradation and bank erosion (Ward and Trimble, 2004; Gordon et al., 1992).

Bank erosion is present throughout the length of the project reaches. Perpetuated by incision, the channels are in the preliminary stages of transition from an "E/F" to a "G" type channel. As the degree of vertical incision increases from downstream to upstream (headcutting) the channels will have limited access to the flood plain. The lower most reaches of each channel classify as G-type channel and are exemplifying Stage VI evolution (Ward and Trimble, 2004). Channel reaches above those sections shared characteristic of both E and F type channels and these sections are in Stage III evolution.

Stage III channel evolution consists primarily of channel degradation or erosion of the bed. Stage IV evolution consists of bed degradation and bank erosion. Bank erosion consists primarily of slumping caused when the toe of the embankment is eroded to the point where the critical bank height is exceeded. At this point, the embankment is no longer supported and the entire bank slumps into the channel. Critical bank height is influenced by soil type, vegetation type, rooting densities and depths.

Computing current bank height ratios, which is the maximum bank height divided by the maximum bankfull depth, can numerically express the extent of channel incision. Utilizing the survey data gathered in the field, bank height ratios for Upper Bailey Fork averaged 1.9 with a range of 1.8 to 2.0. UT 1 bank height ratios averaged 2.0 with a range of 1.8 to 2.3. UT 2 bank height ratios averaged 1.6 with values ranging from 1.5 to 2.2. Typically, bank height ratios on reference reach streams are 1.0 and rarely greater than 1.1; therefore, based on this comparison Bailey Fork, UT 1 and UT 2 are extremely incised. Channel adjustments due to these conditions include lateral channel migration, bed degradation, and bank erosion.

Several representative riffle cross-sections were surveyed along Bailey Fork, UT 1, and UT 2. Existing bankfull cross-sectional area for Bailey Fork (includes Upper and Lower Bailey Fork data) ranges from 67.4 to 95.3 square feet. Bankfull width ranges from 19.9 to 37.4 feet with mean depths between 1.6 to 3.0 feet. The stream type transitions from an E to F to a G-type channel as the channels proceed downstream, with the majority of the reach lengths emulating an F channel type. The lower-most segments of each channel are G channels simulating an active bed degradation process (headcutting) which will continue until stream slope equilibrium is reached. The average dimensions are below and the individual cross-sections are summarized in **Appendix C**.

Bailey Fork

Bankfull Width:	27.9 feet
Cross-sectional Area:	78.1 square feet
Bankfull Mean Depth:	2.9 feet
Maximum Depth:	4.3 feet
Width/Depth Ratio:	10.1
Entrenchment Ratio:	5.9
Bank Height Ratio:	2.1

Riffle cross-sections taken along Unnamed Tributary 1 varied from 14.5 to 17.3 square feet. Bankfull widths varied from 9.4 to 12.0 feet with mean depths from 1.4 to 1.6 feet. Average values are below.

Unnamed Tributary 1

Bankfull Width:	10.8 feet
Cross-sectional Area:	16.3 square feet
Bankfull Mean Depth:	1.5 feet
Maximum Depth:	2.2 feet
Width/Depth Ratio:	7.2
Entrenchment Ratio:	2.1
Bank Height Ratio:	2.0

Riffle cross-sectional taken along Unnamed Tributary 2 ranged from 18.7 to 20.8 square feet. The bankfull width ranged from 7.6 to 8.5 with mean depth from 2.2 to 2.7. Average Values are below.

Unnamed Tributary 2

Bankfull Width:	8.2 feet
Cross-sectional Area:	20.1 square feet
Bankfull Mean Depth:	2.4 feet
Maximum Depth:	3.5 feet
Width/Depth Ratio:	2.7
Entrenchment Ratio:	13.0
Bank Height Ratio:	1.6

Additional existing conditions parameters are available on the morphological tables provided in **Section 7.2.**

Past impacts as explained in the previous paragraphs and continual vegetative maintenance are perpetuating and accelerating the degradation process of Bailey Fork and the two unnamed tributaries. Vertical incision has constrained channel discharges resulting in bed scour and bank erosion. As a result native plants along the riparian zone are sparse and these areas are dominated by fescue grass resulting in shallow rooting depths compared to the existing bank heights, essentially providing limited bank stability and high erodibility potential.

5.2 Stream Substrate

Bed material in Bailey Fork and the unnamed tributaries is dominated with coarse sand and fine gravel. Depending on the specific location where the individual pebble count was collected, some samples were slightly coarser compared to the overall substrate class and were composed of coarse gravel. The D_{50} ranged from 6 millimeters for Upper Bailey to a maximum of 24 millimeters for UT1. Therefore 50% of the bed material sampled consisted of particles that are classified as coarse gravel or finer. After evaluation of the collected stream data, it was observed that coarser pebble counts correlated to channel segments that are undergoing active channel degradation (i.e. scour). This observed channel degradation was supported by the data that showed these sections of stream as having the steepest measured facet slopes. The physical attributes at specific locations has revealed subpavement material which is not indicative of the substrate class observed throughout the length of the channel or that is being actively transported during effective discharge.

5.3 Soils

The project site is located in the Northern Inner Piedmont physiographic province of North Carolina. Soils are mostly mesic in nature versus the thermic soils present in the majority of the Piedmont. Soils present in the riparian areas adjacent to Bailey Fork are characteristic of those found in alluvial landforms within this region and have been mapped by USDA Natural Resources Conservation Service (NRCS) as Colvard sandy loam (**Figure 8, Appendix A**).

Colvard soils are the only mapped unit located within the flood plain and located immediately adjacent the subject stream channels. Formed in loamy alluvial deposits, these soils are nearly level, very deep, well drained or moderately well drained.

Other soils in the project's vicinity include Fairview sandy clay loam and Unison fine sandy loam, which are often mapped on adjacent slopes and terraces. No hydric soils were mapped by NRCS within the project corridor.

5.4 Existing Plant Communities

Throughout most of the property, Bailey Fork and its unnamed tributaries flow through a fescue pasture. Thus, the native riparian plant community is restricted to the stream banks and is rarely wider than ten feet wide. Trees are sporadic and are limited to river birch (*Betula nigra*), red maple (*Acer rubrum*), American sycamore (*Platanus occidentalis*), and black willow (*Salix nigra*). Shrub and herbaceous layer consisted of privet (*Ligustrum sinense*) multiflora rose (*Rosa multiflora*), blackberry (*Rubus* spp.), Japanese honeysuckle (*Lonicera japonica*), deer-tongue (*Panicum clandestinum*), poison ivy (*Toxicodendron radicans*), and goldenrod (*Solidago* spp.) (Radford et al., 1968). Fescue grass (*Festuca* sp.) dominates the plant community throughout the site.

In patchy spots along and within the banks, smaller individuals of black willow (*Salix nigra*), alder (*Alnus serrulata*), green ash (*Fraxinus pennsylvanica*), and sweet gum (*Liquidambar styraciflua*) occur sporadically, often within the active channel and on top of depositional features. To a lesser extent, common wetland herbs observed included *Carex* spp. and *Juncus* spp. within the active channel and banks.

5.5 Threatened and Endangered Species

In order to assess any potential impacts to threatened and/or endangered species that may potentially occur within the project site, a search of the North Carolina Natural Heritage Program (NHP) database was conducted for a one-mile radius around the project area.

No occurrence of either federally or state-listed species were identified. This finding was supported by a letter from Mr. Harry LeGrand Jr. of the North Carolina Natural Heritage Program (NHP) which is located in **Appendix E**. The species that are listed as federally threatened or endangered by the U.S. Fish and Wildlife Service for Burke County are listed below (FWS, 2004):

Common Name	Scientific Name	Status
Bald Eagle	*Haliaeetus leucocephalus*	Threatened
Bog Turtle	*Clemmys muhlenbergii*	Threatened
Dwarf-flowered heartleaf	*Hexastylis naniflora*	Threatened
Heller's blazing star	*Liatris helleri*	Threatened
Mountain golden heather	*Hudsonia montana*	Threatened
Small-whorled pogonia	*Isotria medeoloides*	Threatened
Spreading avens	*Geum radiatum*	Endangered

Due to the fact that the land use in the project's immediate vicinity experiences extensive and periodic maintenance associated with hay production and the degraded state of the stream channel, no suitable habitat for the above listed federal species was observed within the proposed restoration site.

The stream restoration is not expected to have any adverse effect on the habitat of any of these listed species; rather, habitat quality will likely be enhanced as a result of the project.

During the field reconnaissance, characteristic piedmont fauna were observed onsite. Tracks of or physical sighting of the following species were observed: whitetail deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), American crow (*Carduelis tristis*), killdeer (*Charadrius vociferus*), Great blue heron (*Ardea herodias*), and red tail hawk (*Buteo jamaicencis*) (Webster et al. 1985 and Potter et al. 1980).

6.0 Reference Reaches

The reference reaches described below were utilized to provide guidance in the design process of the proposed stream restoration plan. Data collected was not used as an exact template but as a vital part of the design process. These channels were chosen because of the similarities that are evident when compared to the project streams. For instance, all of the reference reaches and the project streams are located in a wide flat alluvial valley (Valley Type VIII), classify as E type channels, possess fine grained channel substrate (sand to fine gravel), and have low gradient channel slopes (<0.8%). All of the data collected relative to each reference reach plotted within the 95% confidence interval (**Appendix B**) when compared to the North Carolina Regional Curve (SRI, 2000).

6.1 Sal's Branch

Sal's Branch is located approximately 1.5 miles south east of the Highway 70/540 interchange in Umstead State Park, Raleigh, Wake County, North Carolina. Based on the Southeast Durham 7.5-minute topographic quadrangle Sal's Branch is a 1st order stream and the reference survey was collected at a point at which the drainage area was calculated to be approximately 0.35 square miles. The headwaters of the stream originate at Highway 70, which is predominately characterized as commercial. As the creek flows onto Park property the watershed becomes forested with the exception of an access road and buildings utilized to service the needs of the park and its patrons.

Stream data was collected in July of 2001. Information gathered included pattern and longitudinal profile, cross-sectional area, slope, and pebble count data. Based on the data collected, Sal's Branch was determined to be an E4 channel type when utilizing the Rosgen Stream Classification System. The channel was determined to have a bankfull cross-sectional area of 13.8 square feet, a width of 10.2 feet, and a mean depth of 1.3 feet. The channel is located in a Valley Type VIII, which is characterized as a wide alluvial valley with a low slope gradient.

6.2 Whites Creek

Whites Creek is located on the north side of Lake James approximately 10 miles east-northeast of Morganton, North Carolina near the intersection of Route 126 and Fish Hatchery Road. Based on the Oak Hill 7.5-minute topographic quadrangle Whites Creek is a 1st order stream and the reference survey was collected at a point at which the drainage area was calculated to be approximately 1.7 square miles. The headwaters of the stream originate from the slopes of Shortoff Mountain in the Linville Gorge Wilderness Area. Approximately two thirds of the watershed area is within the Wilderness Area and the remainder is privately owned. The predominant land cover within the watershed is forest.

Stream data was collected in October of 2004. Information gathered included pattern and longitudinal profile, cross-sectional area, slope, and pebble count data. Based on the data collected, Whites Creek was determined to be an E4 channel type when utilizing the Rosgen Stream Classification System. The channel was determined to have a bankfull cross-sectional area of 35.7 square feet, a width of 17.0 feet, and a mean depth of 2.1 feet. The channel is located in a Valley Type VIII, which is characterized as a wide alluvial valley with a low slope gradient.

6.3 S. Muddy Birchfield

South Muddy "Birchfield" is located approximately 1,000 feet upstream of its intersection with SR 1763 near the town of Patten. Patten is located approximately 3 miles south of exit 94 on Highway 40 near Morganton, North Carolina. This section of stream is an unnamed tributary that lies to the west of South Muddy Creek. One relatively short section of this stream (approximately 240 feet) appeared to be stable and was surveyed. A cross section was measured across a stable riffle location. Pattern measurements were not obtained due the short straight nature of the reach.

Based on the Gen Alpine 7.5-minute topographic quadrangle South Muddy "Birchfield" is a 2nd order stream and the reference survey was collected at a point at which the drainage area was calculated to be approximately 1.3 square miles. The headwaters of the stream originate approximately 1.5 miles northwest of SR 1763, which is characterized predominantly as forest. Land use near the reference reach location transitions from forest to agricultural and residential.

Stream data was collected in October of 2004. Information gathered included longitudinal profile, cross-sectional area, slope, and pebble count data. As stated previously, pattern data was not collected. Based on the data collected, South Muddy Birchfield was determined to be an E4 channel type when utilizing the Rosgen Stream Classification System. The channel was determined to have a bankfull cross-sectional area of 20.7 square feet, a width of 10.8 feet, and a mean depth of 1.9 feet. The channel is located in a Valley Type VIII, which is characterized as a wide alluvial valley with a low slope gradient.

6.4 S. Muddy Tributary 4

South Muddy "Trib 4" is an unnamed tributary of South Muddy Creek. This unnamed tributary lies to the east of South Muddy Creek, and is near the intersection of SR 1133 and Dysartville Road. The reference reach is located approximately 2 miles south of exit 94 on Highway 40 near Morganton, North Carolina. The headwaters of the stream originate from the nearby slopes of the watershed, east of Dysartville Road. The predominant land use in the watershed is forest.

Stream data was collected in October of 2004. Based on the Gen Alpine 7.5-minute topographic quadrangle South Muddy "Trib 4" is a 1st order stream and the reference survey was collected at a point at which the drainage area was calculated to be approximately 0.14 square miles. Information gathered included longitudinal profile, cross-sectional area, slope, and pebble count data. Based on the data collected, South Muddy "Trib 4" was determined to be an E4 channel type when utilizing the Rosgen Stream Classification System. The channel was determined to have a bankfull cross-sectional area of 9.1 square feet, a width of 7.3 feet, and a mean depth of 1.3 feet. The channel is located in a Valley Type VIII, which is characterized as a wide alluvial valley with a low slope gradient.

7.0 Stream Channel Design

7.1 Natural Channel Design

The restoration design for Bailey Fork and the two unnamed tributaries is based on natural channel design principles and techniques utilizing reference reach data sets and the existing conditions survey data collected from the restoration site. Reference data that has been utilized to develop the restoration design for the stream channel included the North Carolina Rural Piedmont Regional Curve (SRI

2000), Sal's Branch reference reach data (collected by Doll and Jelenevsky in 2001), Whites Creek reference reach data (collected by NSE in 2004), S. Muddy Birchfield reference reach data (collected by NSE in 2004) and S. Muddy Tributary 4 reference reach data (collected by NSE in 2004), and to a lesser degree past successful stream restoration designs.

The proposed stream design will restore the existing degraded channel to a naturally meandering, ecologically functional E/C type stream channel. A bankfull bench or nested flood plain will also be constructed adjacent to Bailey Fork and to a lesser degree UT1 and UT2. The resulting restored stream channels will be approximately 5,500 linear feet (centerline distance) with an estimated thalweg length of approximately 5,800 linear feet. The proposed design will increase the overall channel length by approximately 800 linear feet using the approximate thalweg length. This restoration is considered to be a Rosgen Priority I and Priority II type of channel restoration. Sections of the design are designated Priority II type stream restoration since a bankfull bench (nested flood plain) will be constructed adjacent to the proposed channel alignment and will be located at a lower elevation relative to the existing flood plain. Where possible the invert of the UT1 and UT2 was elevated and therefore will be reconnected to the existing flood plain at the proposed bankfull elevation. This reduces disturbance to the native soil profile and creates a more environmentally sensitive construction process because the amount of disturbance is greatly reduced. The existing and proposed morphological characteristics are depicted in Tables 1 through 4 on the following pages.

The restoration design will result in a riffle-pool channel profile that will be reinforced utilizing in-stream structures such as boulder cross-vanes, J-hook vanes, double drop cross vanes, step-pool structures, and root wads. The new channel, flood plain and any disturbed areas within the conservation easement will subsequently be vegetated with transplants, bare-root seedlings, live stakes and seeded with temporary and permanent ground cover. Erosion control matting, temporary/permanent seeding, and live stakes will be applied to the channel embankment immediately following completion of each channel segment providing surface protection of the banks.

Table 1 – Upper Bailey Fork Morphology

Variables	Sal's Branch	Whites Creek	S. Muddy Birchfield	S. Muddy Trib 4	Upper Bailey Fork	Upper Bailey Fork
Survey Crew	Doll/ Jelenevsky	NSE	NSE	NSE	4D Site Solutions	NSE
Survey Date	06/01	10/04	10/04	10/04	10/04	12/04
Parameter	Reference	Reference	Reference	Reference	Existing	Design
Stream Type	E	E4	E4	E4	G4/F4	E4/C4
Drainage Area (mi^2)	0.35	1.7	1.3	0.14	5.0	5.0
Bankfull Width (W_{bkf})	10.2	17	10.8	7.35	23.2	28
Bankfull Mean Depth (D_{bkf})	1.3	2.1	1.9	1.3	3.1	2.3
Width/Depth Ratio	7.6	8.1	5.6	6.0	7.8	12.0
Max Riffle Depth (D_{max})	1.9	2.8	2.5	1.8	4.8	4.2
Max Riffle Depth Ratio (D_{max}/D_{bkf})	1.5	1.3	1.3	1.4	1.6	1.8
Bankfull Cross-Section Area (A_{bkf})	13.8	35.7	20.7	9.1	69.5	65.0
Bankfull mean velocity (V_{bkf})	3.8	4.8	4.7	7.1	3.9	3.5
Bankfull Discharge (Q_{bkf})	51.6	194	98	64	268.5	227.5
Width of Flood Prone Area (W_{fpa})	100	150	100	43	180	280.0
Entrenchment Ratio (W_{fpa}/W_{bkf})	9.8	8.8	9.3	5.8	7.9	10.0
Min Meander Length (L_m)	35	49	NA	50	60	70.0
Max Meander Length (L_m)	43	54	NA	160	96	154.0
Min Meander Length Ratio (L_m/W_{bkf})	2	2.1	NA	6.8	2.5	2.5
Max Meander Length Ratio (L_m/W_{bkf})	4.2	2.3	NA	21.8	4.1	2.5
Min Radius of Curvature (R_c)	11	11	NA	10	18	42.0
Max Radius of Curvature (R_c)	21	16	NA	11	30	84.0
Min Radius of Curvature Ratio (R_c/W_{bkf})	1	0.5	NA	1.4	0.78	1.5
Max Radius of Curvature Ratio (R_c/W_{bkf})	2	0.7	NA	1.5	1.3	3.0
Min Belt Width (W_{blt})	20	60	NA	50	75	70.0
Max Belt Width (W_{blt})	62	80	NA	80	105	153.0
Min Meander Width Ratio (W_{blt}/W_{bkf})	2	3.5	NA	6.8	3.2	2.5
Max Meander Width Ratio (W_{blt}/W_{bkf})	6.1	4.7	NA	10.9	3.6	5.5
Sinuosity (stream length/valley length)	2	1.9	NA	1.6	1.1	1.3
Valley Slope (S_{val})	0.006	0.006	NA	0.025	0.0035	0.0033
Avg. Stream Slope (S_{ave})	0.005	0.0044	0.006	0.0219	0.0024	0.0025*
Min Riffle Slope (S_{rif})	0.016	0.0068	0.035	0.0138	0.0086	0.002
Max Riffle Slope (S_{rif})	0.036	0.0607	0.0042	0.07	0.086	0.0035*
Min Riffle Slope/Ave Slope (S_{rif}/S_{ave})	3	1.5	5.8	0.6	3.6	0.8
Max Riffle Slope/Ave Slope (S_{rif}/S_{ave})	6.9	13.8	0.7	3.2	35.8	1.4
Min Riffle Length (L_{rif})	3	3.1	6	3.4	15	23.8
Max Riffle Length (L_{rif})	28	16.1	26	26.4	67.8	68
Min Riffle Length/Bankfull Width (L_{rif}/W_{bkf})	0.3	0.1	0.6	0.5	0.65	0.7
Max Riffle Length/Bankfull Width (L_{rif}/W_{bkf})	2.7	0.7	2.4	3.6	2.92	2.0
Pool Slope (S_{pool})	0	0	0	0	0	0
Pool Slope Ratio (S_{pool}/S_{ave})	0	0	0	0	0	0
Pool Depth (D_{pool})	2.8-3.26	4.92-6.15	3.06-3.89	1.42-3.63	2.6	5.0-6.7
Pool Depth Ratio (D_{pool}/D_{bkf})	2.2-2.5	1.9-2.4	1.8	1.1-2.9	0.8	2.2-2.9
Pool Area (A_{pool})	24	49.5	NA	16.9	91	100
Pool Area Ratio (A_{pool}/A_{bkf})	1.7	1.4	NA	1.9	1.3	1.5
Pool Length (L_{pool})	21-35	32-60.1	6-12	5.5-41.3	90	45-96
Pool Length Ratio (L_{pool}/W_{bkf})	2.1-3.4	1.4-2.6	0.83	0.7-5.6	3.8	1.6-3.4
Pool Width (W_{pool})	10.2	NA	NA	12	36	32
Pool-Pool Spacing (p-p)	51-66	26-73	16-43	17-70	81-211	95-224
Pool Spacing Ratio (p-p/W_{bkf})	5.0-6.5	1.1-3.2	1.5-4.0	2.3-9.5	3.5-9.1	3-7

* excludes step-pool sections

Table 2 - Lower Bailey Fork Morphology

Variables	Sal's Branch	Whites Creek	S. Muddy Birchfield	S. Muddy Trib. 4	Lower Bailey Fork	Lower Bailey Fork
Survey Crew	Doll/ Jelenevsky	NSE	NSE	NSE	4D Site Solutions	NSE
Survey Date	06/01	10/04	10/04	10/04	10/04	12/04
Parameter	Reference	Reference	Reference	Reference	Existing	Design
Stream Type	E	E4	E4	E4	F4	C4/E4
Drainage Area (mi^2)	0.35	1.7	1.3	0.14	5.5	5.5
Bankfull Width (W_{bkf})	10.2	17	10.8	7.35	37.4	30
Bankfull Mean Depth (D_{bkf})	1.3	2.1	1.9	1.3	2.6	2.5
Width/Depth Ratio	7.6	8.1	5.6	6.0	14.7	12.0
Max Riffle Depth (D_{max})	1.9	2.8	2.5	1.8	3.33	4.5
Max Riffle Depth Ratio (D_{max}/D_{bkf})	1.5	1.3	1.3	1.4	1.3	1.8
Bankfull Cross-Section Area (A_{bkf})	13.8	35.7	20.7	9.1	95	75.0
Bankfull mean velocity (V_{bkf})	3.8	4.8	4.7	7.1	4.2	4.0
Bankfull Discharge (Q_{bkf})	51.6	194	98	64	395	302.0
Width of Flood Prone Area (W_{fpa})	100	150	100	43	70	250.0
Entrenchment Ratio (W_{fpa}/W_{bkf})	9.8	8.8	9.3	5.8	1.9	8.3
Min Meander Length (L_m)	35	49	NA	50	90	200
Max Meander Length (L_m)	43	54	NA	160	144	220
Min Meander Length Ratio (L_m/W_{bkf})	2	2.1	NA	6.8	2.4	6
Max Meander Length Ratio (L_m/W_{bkf})	4.2	2.3	NA	21.8	3.8	7.3
Min Radius of Curvature (R_c)	11	11	NA	10	24	45
Max Radius of Curvature (R_c)	21	16	NA	11	30	90
Min Radius of Curvature Ratio (R_c/W_{bkf})	1	0.5	NA	1.4	0.6	1.5
Max Radius of Curvature Ratio (R_c/W_{bkf})	2	0.7	NA	1.5	0.8	3
Min Belt Width (W_{blt})	20	60	NA	50	54	98
Max Belt Width (W_{blt})	62	80	NA	80	66	120
Min Meander Width Ratio (W_{blt}/W_{bkf})	2	3.5	NA	6.8	1.44	3.2
Max Meander Width Ratio (W_{blt}/W_{bkf})	6.1	4.7	NA	10.9	1.76	4
Sinuosity (stream length/valley length)	2	1.9	NA	1.6	1.1	1.3
Valley Slope (S_{val})	0.006	0.006	NA	0.025	0.0040	0.0037
Avg. Stream Slope (S_{ave})	0.005	0.0044	0.006	0.0219	0.0030	0.0029*
Min Riffle Slope (S_{rif})	0.016	0.0068	0.035	0.0138	0.0042	0.0013
Max Riffle Slope (S_{rif})	0.036	0.0607	0.0042	0.07	0.027	0.0029*
Min Riffle Slope/Ave Slope (S_{rif}/S_{ave})	3	1.5	5.8	0.6	1.4	0.4
Max Riffle Slope/Ave Slope (S_{rif}/S_{ave})	6.9	13.8	0.7	3.2	9	1
Min Riffle Length (L_{rif})	3	3.1	6	3.4	15	30
Max Riffle Length (L_{rif})	28	16.1	26	26.4	102	55
Min Riffle Length/Bankfull Width (L_{rif}/W_{bkf})	0.3	0.1	0.6	0.5	0.4	1
Max Riffle Length/Bankfull Width (L_{rif}/W_{bkf})	2.7	0.7	2.4	3.6	2.72	1.8
Pool Slope (S_{pool})	0	0	0	0	0	0
Pool Slope Ratio (S_{pool}/S_{ave})	0	0	0	0	0	0
Pool Depth (D_{pool})	2.8-3.26	4.92-6.15	3.06-3.89	1.42-3.63	N/A	5.5-7.0
Pool Depth Ratio (D_{pool}/D_{bkf})	2.2-2.5	1.9-2.4	1.8	1.1-2.9	N/A	2.2-2.8
Pool Area (A_{pool})	24	49.5	NA	16.9	N/A	112.5
Pool Area Ratio (A_{pool}/A_{bkf})	1.7	1.4	NA	1.9	N/A	1.5
Pool Length (L_{pool})	21-35	32-60.1	6-12	5.5-41.3	30-87	50-100
Pool Length Ratio (L_{pool}/W_{bkf})	2.1-3.4	1.4-2.6	0.83	0.7-5.6	.8-2.3	1.6-3.3
Pool Width (W_{pool})	10.2	NA	NA	12	N/A	30
Pool-Pool Spacing (p-p)	51-66	26-73	16-43	17-70	68-292	110-140
Pool Spacing Ratio (p-p/W_{bkf})	5.0-6.5	1.1-3.2	1.5-4.0	2.3-9.5	1.8-7.8	3.6-4.7

* excludes step-pool sections

Table 3 – UT1 of Bailey Fork Morphology

Variables	Sal's Branch	Whites Creek	S. Muddy Birchfield	S. Muddy Trib 4	UT of Bailey Fork Trib 1	UT of Bailey Fork Trib 1
Survey Crew	Doll/ Jelenevsky	NSE	NSE	NSE	4D Site Solutions	NSE
Survey Date	06/01	10/04	10/04	10/04	10/04	12/04
Parameter	Reference	Reference	Reference	Reference	Existing	Design
Stream Type	E	E4	E4	E4	G4/F4	E4/C4
Drainage Area (mi^2)	0.35	1.7	1.3	0.14	0.54	0.55
Bankfull Width (W_{bkf})	10.2	17	10.8	7.35	10.8	14
Bankfull Mean Depth (D_{bkf})	1.3	2.1	1.9	1.3	1.5	1.3
Width/Depth Ratio	7.6	8.1	5.6	6.0	7.2	11.2 10.77
Max Riffle Depth (D_{max})	1.9	2.8	2.5	1.8	2.1	1.8
Max Riffle Depth Ratio (D_{max}/D_{bkf})	1.5	1.3	1.3	1.4	1.4	1.4
Bankfull Cross-Section Area (A_{bkf})	13.8	35.7	20.7	9.1	16.3	17.5
Bankfull mean velocity (V_{bkf})	3.8	4.8	4.7	7.1	3.5	3.2
Bankfull Discharge (Q_{bkf})	51.6	194	98	64	56.5	56.4
Width of Flood Prone Area (W_{fpa})	100	150	100	43	23.8	65-120
Entrenchment Ratio (W_{fpa}/W_{bkf})	9.8	8.8	9.3	5.8	2.3	4.6-8.5
Min Meander Length (L_m)	35	49	NA	50	48	55
Max Meander Length (L_m)	43	54	NA	160	60	100
Min Meander Length Ratio (L_m/W_{bkf})	2	2.1	NA	6.8	4.5	4
Max Meander Length Ratio (L_m/W_{bkf})	4.2	2.3	NA	21.8	5.6	7
Min Radius of Curvature (R_c)	11	11	NA	10	9	15
Max Radius of Curvature (R_c)	21	16	NA	11	18	35
Min Radius of Curvature Ratio (R_c/W_{bkf})	1	0.5	NA	1.4	0.8	1.1
Max Radius of Curvature Ratio (R_c/W_{bkf})	2	0.7	NA	1.5	1.7	2.5
Min Belt Width (W_{blt})	20	60	NA	50	30	30
Max Belt Width (W_{blt})	62	80	NA	80	40	80
Min Meander Width Ratio (W_{blt}/W_{bkf})	2	3.5	NA	6.8	2.8	2.1
Max Meander Width Ratio (W_{blt}/W_{bkf})	6.1	4.7	NA	10.9	3.7	5.7
Sinuosity (stream length/valley length)	2	1.9	NA	1.6	1.2	1.4
Valley Slope (S_{val})	0.006	0.006	NA	0.025	0.0086	0.0075
Avg. Stream Slope (S_{ave})	0.005	0.0044	0.006	0.0219	0.0090	0.0049*
Min Riffle Slope (S_{rif})	0.016	0.0068	0.0042	0.0138	0.007	0.0025
Max Riffle Slope (S_{rif})	0.036	0.0607	0.035	0.07	0.0235	0.007
Min Riffle Slope/Ave Slope (S_{rif}/S_{ave})	3	1.5	0.7	0.6	0.77	0.51
Max Riffle Slope/Ave Slope (S_{rif}/S_{ave})	6.9	13.8	5.8	3.2	2.6	1.4
Min Riffle Length (L_{rif})	3	3.1	6	3.4	34.8	14
Max Riffle Length (L_{rif})	28	16.1	26	26.4	69.5	40
Min Riffle Length/Bankfull Width (L_{rif}/W_{bkf})	0.3	0.1	0.6	0.5	3.2	1
Max Riffle Length/Bankfull Width (L_{rif}/W_{bkf})	2.7	0.7	2.4	3.6	6.4	2.8
Pool Slope (S_{pool})	0	0	0	0	0	0
Pool Slope Ratio (S_{pool}/S_{ave})	0	0	0	0	0	0
Pool Depth (D_{pool})	2.8-3.26	4.92-6.15	3.06-3.89	1.42-3.63	1.9	2.5
Pool Depth Ratio (D_{pool}/D_{bkf})	2.2-2.5	1.9-2.4	1.8	1.1-2.9	1.3	1.9
Pool Area (A_{pool})	24	49.5	NA	16.9	25.9	26
Pool Area Ratio (A_{pool}/A_{bkf})	1.7	1.4	NA	1.9	1.6	1.6
Pool Length (L_{pool})	21-35	32-60.1	6-12	5.5-41.3	27.2-60.0	20-45
Pool Length Ratio (L_{pool}/W_{bkf})	2.1-3.4	1.4-2.6	0.83	0.7-5.6	2.5-5.6	1.4-3.0
Pool Width (W_{pool})	10.2	NA	NA	12	13.4	16
Pool-Pool Spacing (p-p)	51-66	26-73	16-43	17-70	110	50-85
Pool Spacing Ratio (p-p/W_{bkf})	5.0-6.5	1.1-3.2	1.5-4.0	2.3-9.5	10.2	3.6-6.0

* excludes step-pool sections

Table 4 - UT2 of Bailey Fork Morphology

Variables	Sal's Branch	Whites Creek	S. Muddy Birchfield	S. Muddy Trib 4	UT of Bailey Fork Trib 2	UT of Bailey Fork-Trib 2
Survey Crew	Doll/ Jelenevsky	NSE	NSE	NSE	4D Site Solutions	NSE
Survey Date	06/01	10/04	10/04	10/04	10/04	12/04
Parameter	Reference	Reference	Reference	Reference	Existing	Design
Stream Type	E	E4	E4	E4	G4/F4	E4/C4
Drainage Area (mi^2)	0.35	1.7	1.3	0.14	0.98	0.96
Bankfull Width (W_{bkf})	10.2	17	10.8	7.35	8.2	16
Bankfull Mean Depth (D_{bkf})	1.3	2.1	1.9	1.3	2.4	1.4
Width/Depth Ratio	7.6	8.1	5.6	6.0	2.7	10.6
Max Riffle Depth (D_{max})	1.9	2.8	2.5	1.8	3.5	2
Max Riffle Depth Ratio (D_{max}/D_{bkf})	1.5	1.3	1.3	1.4	1.5	1.3
Bankfull Cross-Section Area (A_{bkf})	13.8	35.7	20.7	9.1	20.1	23
Bankfull mean velocity (V_{bkf})	3.8	4.8	4.7	7.1	6.4	2.78
Bankfull Discharge (Q_{bkf})	51.6	194	98	64	129	64
Width of Flood Prone Area (W_{fpa})	100	150	100	43	12-150	60-180
Entrenchment Ratio (W_{fpa}/W_{bkf})	9.8	8.8	9.3	5.8	1.5-18.3	3.75-11.25
Min Meander Length (L_m)	35	49	NA	50	66	56
Max Meander Length (L_m)	43	54	NA	160	78	104
Min Meander Length Ratio (L_m/W_{bkf})	2	2.1	NA	6.8	8	3.5
Max Meander Length Ratio (L_m/W_{bkf})	4.2	2.3	NA	21.8	9.5	6.5
Min Radius of Curvature (R_c)	11	11	NA	10	15	24
Max Radius of Curvature (R_c)	21	16	NA	11	18	40
Min Radius of Curvature Ratio (R_c/W_{bkf})	1	0.5	NA	1.4	1.8	1.5
Max Radius of Curvature Ratio (R_c/W_{bkf})	2	0.7	NA	1.5	2.2	2.5
Min Belt Width (W_{blt})	20	60	NA	50	30	34
Max Belt Width (W_{blt})	62	80	NA	80	33	91.2
Min Meander Width Ratio (W_{blt}/W_{bkf})	2	3.5	NA	6.8	3.7	2.1
Max Meander Width Ratio (W_{blt}/W_{bkf})	6.1	4.7	NA	10.9	4	5.7
Sinuosity (stream length/valley length)	2	1.9	NA	1.6	1.1	1.4
Valley Slope (S_{val})	0.006	0.006	NA	0.025	0.0048	0.0041
Avg. Stream Slope (S_{ave})	0.005	0.0044	0.006	0.0219	0.0098	0.0030*
Min Riffle Slope (S_{rif})	0.016	0.0068	0.0042	0.0138	0.0072	0.002
Max Riffle Slope (S_{rif})	0.036	0.0607	0.035	0.07	0.065	0.0045
Min Riffle Slope/Ave Slope (S_{rif}/S_{ave})	3	1.5	0.7	0.6	0.7	0.7
Max Riffle Slope/Ave Slope (S_{rif}/S_{ave})	6.9	13.8	5.8	3.2	6.6	1.5
Min Riffle Length (L_{rif})	3	3.1	6	3.4	16	16
Max Riffle Length (L_{rif})	28	16.1	26	26.4	42	44.8
Min Riffle Length/Bankfull Width (L_{rif}/W_{bkf})	0.3	0.1	0.6	0.5	1.95	1
Max Riffle Length/Bankfull Width (L_{rif}/W_{bkf})	2.7	0.7	2.4	3.6	5.1	2.8
Pool Slope (S_{pool})	0	0	0	0	0	0
Pool Slope Ratio (S_{pool}/S_{ave})	0	0	0	0	0	0
Pool Depth (D_{pool})	2.8-3.26	4.92-6.15	3.06-3.89	1.42-3.63	N/A	3.8
Pool Depth Ratio (D_{pool}/D_{bkf})	2.2-2.5	1.9-2.4	1.8	1.1-2.9	N/A	1.9
Pool Area (A_{pool})	24	49.5	NA	16.9	N/A	36.8
Pool Area Ratio (A_{pool}/A_{bkf})	1.7	1.4	NA	1.9	N/A	1.6
Pool Length (L_{pool})	21-35	32-60.1	6-12	5.5-41.3	N/A	22.4-48
Pool Length Ratio (L_{pool}/W_{bkf})	2.1-3.4	1.4-2.6	0.83	0.7-5.6	N/A	1.4-3.0
Pool Width (W_{pool})	10.2	NA	NA	12	N/A	18
Pool-Pool Spacing (p-p)	51-66	26-73	16-43	17-70	N/A	55-85
Pool Spacing Ratio (p-p/W_{bkf})	5.0-6.5	1.1-3.2	1.5-4.0	2.3-9.5	N/A	3.4-5.3

* excludes step-pool sections

7.2 Dimension

Based on the survey data, the existing bankfull cross-sectional areas, measured in square feet averaged 78.1 (Bailey Fork), 16.3 (UT 1), and 20.1 (UT 2). The bankfull widths, measured in feet, averaged 27.9 (Bailey Fork), 10.8 (UT 1), and 8.2 (UT 2). Bankfull mean depths, measured in feet, were 2.88 (Bailey fork), 1.51 (UT 1), and 2.4 (UT 2).

The proposed design width for Upper Bailey Fork is 28 feet with an average depth of 2.3 feet while Lower Bailey Fork has a width of 30 feet and an average depth of 2.5 feet. The proposed dimensions for UT 1 are a bankfull width of 14 feet wide with an average depth of 1.3 feet. The proposed dimensions for UT 2 are a bankfull width of 16 feet wide with an average depth of 1.4 feet. The channel dimensions were determined utilizing the average measured width of the existing stream, the North Carolina regional curve, reference reach data, existing site constraints and the required shear stress to move the D_{84}. The proposed dimensions result in an E/C channel type. As the streams mature and vegetation begins to stabilize the embankments, the channel should slowly convert to an E-type channel. This assumption is based on previous successful project monitoring and is primarily caused by the increase in embankment roughness resulting in deposition on the banks which reduces the originally constructed channel cross-sectional area. The depiction of the typical riffle and pool cross-section profiles are located on **Figure 7, Appendix A**.

7.3 Pattern

The current pattern of the existing project reaches is essentially straight, with a measured sinuosity of approximately 1.1 (stream length divided by valley length). Meanders are beginning to form and are evident by the presence of eroding banks flanked by depositional features located on the opposite bank.

As a result of the proposed channel re-alignment, channel sinuosity will be substantially increased. The proposed sinuosity for the project streams as a result of the proposed alignment will be approximately 1.3 for Upper and Lower Bailey Fork and 1.4 for UT1 and UT2. Meanders have been integrated throughout the length of the project reach to the maximum extent possible based on existing site constraints and the reference reach data. The integration of meanders into the proposed restoration design reduces overall channel slope by increasing channel length and decreasing shear stress, while providing a stable and diversified aquatic habitat. See **Section 8** of this report for detailed plan drawings.

7.4 Bed Form

Bed form along the project reaches is in extremely poor and unstable condition, primarily due to the incised and entrenched nature of the channels. The majority of the longitudinal profile resembles a riffle/run bed with very few observed pools. Bed form is in a degraded condition because of several culminating factors. Flood flows are concentrated within the incised and constrained channel and this water is typically laden with excess sediment as a result of bank erosion and other potentially unknown upstream sediment sources. Excess sediment load, and current site constraints have resulted in a channel that is in constant transition in an attempt to

reach equilibrium and create an active flood plain at its bankfull elevation. Therefore, it is unlikely that the bed form remains consistent. Bed form most likely fluctuates after each storm event depending on storm intensity and duration.

The restoration design incorporates riffles, runs, pools, and glides into the longitudinal profile providing bed form characteristics exemplified by the reference reaches surveyed. Riffles will be located along straight segments of the channel, runs connect the riffles to the pools which are located along the outside meander bends and glides connect the pool to the riffle. Riffles are designed with a maximum depth typically 1.5 times less than the maximum pool depth. The surveyed as-built profile may differ slightly because of unforeseen site constraints, limitations that may be discovered during construction (i.e. bedrock), or slight shifts in the proposed alignment. These bed features may be reinforced with in-stream structures to insure bed stability and to maintain bed form. Structures may be omitted or added during construction due to unknown site conditions or unconsolidated soils. At times, the designer may not install structures that appear on the design sheets. This action is reserved for instances where the damge and potential instability caused by installation is greater than the benefit installing a structure. Structure placement is typically field adjusted to conform to the constructed stream alignment and profile. **Section 8** of this report contains detailed plan drawings of the proposed stream's longitudinal profile.

7.5 Sediment Transport Analysis

A naturally stable channel has the ability to transport its sediment load without aggrading or degrading the channel bed. Sediment load is comprised of suspended load, bed load and wash load. Suspended load is comprised of sediment that is being transported in suspension by upward momentum present in the channel. Bed load is comprised of bed material that is transported by rolling, sliding, or skipping along the channel bed. Wash load is comprised of fine particles that may remain in suspension indefinitely and have very low rates of settling. At high discharge rates, a significant portion of the bed load and potentially the sub pavement may become suspended, especially if the bed material is composed primarily of fine grained material and the substrate is homogenous throughout such as sand-dominated channel.

Commonly used entrainment computations cannot be applied to accurately determine the competency for the individual channels at the site to move a particular particle size. The substrate of Bailey Fork and the unnamed tributaries is a mixture of sand and fine gravel. Entrainment computations are applicable to gravel bed streams where the median diameter of the riffle (D_{50}) particle is two (2) millimeters (mm) or larger. The majority of the bed substrate observed was coarse sand and fine gravel. Based on the collected substrate data and multiple field observations it is conclusive that these channels are sand-dominated. The observed and collected gravel-based riffle samples are believed to actually be representative sub-pavement substrate that has been exposed during the degradation (headcutting) process. This coarser class of material was not found outside of the location where this specific pebble count data was collected and was truly uncharacteristic of the majority of the substrate class observed along the entire length of Bailey Fork and the unnamed tributaries.

To determine if the proposed channel has the competence to transport its current sediment load, shear stress was calculated utilizing the dimensions of the proposed riffle cross-sections of each designed channel utilizing the proposed bankfull slope. The calculated value was then compared to the Shield's Curve (ASCE, 1975) to confirm that the designed channel could move the D_{84} particle of the riffle or bar pebble count, which ranged between 7 and 50 mm. The standard relationships and resulting calculations are presented in this section. The example utilizes Lower Bailey Fork design data. The remaining data is provided in tabular format.

$$\tau = \gamma RS$$ (Wildland Hyrology, 1998)

τ = Shear stress (lbs/ft^2)
γ = Specific gravity of water (62.4 lbs/ft^3)
R = Hydraulic radius (ft)
S = Bankfull channel slope (ft/ft)

The hydraulic radius is calculated by:

$$R = A/W_p$$ (Wildland Hyrology, 1998)

R = Hydraulic radius (ft)
A = Cross-sectional Area (ft^2)
W_p = Wetted perimeter (ft)

Where W_p = (2 * channel depth (mean)) + width = (2 * 2.5) + 30 = 35 ft

$$R = 75 \text{ ft}^2 \text{ (A)}/35 \text{ ft } (W_p) = 2.14 \text{ ft}$$

Therefore, shear stress was calculated to be:

$$\tau = 62.4 \text{lb/ft}^2 (\gamma) * 2.14 \text{ ft (R)} * 0.0029 \text{ ft/ft (S)}$$

$$\tau = 0.39 \text{ lb/ft}^2$$

Shear stress was calculated to be 0.39 lb/ft^2, and Shield's Curve predicts that the proposed stream could move the 22 mm particle. Based on Revised Shields Diagram (Wildland Hydrology 2001), which is the culmination of field collected data in stream channels containing heterogeneous bed substrate, the channel should be able to move a particle up to 80 mm in size. Critical shear stress varied from a minimum of 0.21 lb/ft^2 for Tributary 2 to a maximum of 0.39 lb/ft^2 for Lower Bailey Fork. Therefore, the smallest particle that can be transported by this system of stream is approximately 48 mm using the Revised Shields Diagram. Because the channels are characterized as sand-dominated, the proposed channels should have the capacity to transport current sediment loads based on the completed shear stress calculations and the interpretation of the Revised Shields Curve. Maximum predicted particle size and calculated critical shear stress values are presented in tabular format in this section. Note that bankfull slopes utilized to derive the following results do not encompass the drop-pool sections of the proposed stream; therefore, the values presented are conservative as they are based on minimal proposed slope values.

Stream	Critical Shear Stress	Max. ParticleSize (Revised Shields Curve)
Upper Bailey Fork	0.31 lbs/ft^2	55 mm
Lower Bailey Fork	0.39 lbs/ft^2	80 mm
Tributary 1	0.32 lbs/ft^2	65 mm
Tributary 2	0.21 lbs/ft^2	48 mm

7.6 Riparian Area

A riparian buffer area will be established immediately adjacent to the restored stream channel. The riparian zone will include the entire bankfull bench (nested flood plain) and toe slope, which will tie the surround existing grade with the proposed bankfull bench elevation. Typical width will be no less than 30 feet on either side of the bankfull elevation of each stream bank. These areas will be planted with the appropriate native riparian vegetation and will provide channel stability, flood attenuation and a vegetated buffer that will intercept overland stormwater. Species will consist primarily of native trees and small shrubs of the Piedmont with specific areas dominated by shrubs and small trees where required by current site uses (i.e. power line right-of-way). Refer to **Section 9.0** Riparian Planting Plan for more details.

7.7 Stormwater

The only stormwater that directly affects the project originates from the NCDOT right-of-way along Propst Road. Currently, an 18-inch plastic corrugated pipe discharges directly into UT 1 just above the confluence with Upper Bailey. This section of UT1 is proposed to be abandoned following the construction of the designed channel; therefore, a small impoundment will be created to partially treat, infiltrate and temporarily store stormwater. A small impoundment will be created by blocking the terminus of the existing creek. Discharges that exceed the holding capacity of this impoundment will be directed overland through a grassed swale, which will connect to the riparian buffer and subsequently into Upper Bailey Fork.

The impoundment of this stormwater will provide a level of treatment (total suspended solids and total nitrogen removal) which is not currently provided. The passage of larger storm events though the grassed swale will allow for some level of treatment which is an improvement of the conveyance system currently in place. The benefits of the proposed arrangement include the treatment of stormwater prior to its discharge into Bailey Fork and the creation of open water habitat (vernal pool) that currently does not exist within the project vicinity. This simple solution should not require any type of prolonged maintenance once ground cover is permanently established.

7.8 Stream Structures

To provide grade control following construction of the channel, boulder cross-vane, double step cross-vanes, step-pool structures, J-hook structures, channel sill structures, and root wads have been integrated into the design and will be utilized to reinforce and stabilize the proposed channels. All structures will be constructed out of natural materials typically consisting of locally quarried boulders. Existing natural grade control and stable channel sections will be incorporated into the channel profile. Although, cross-vanes are typically depicted at the riffle/glide interface and J-hooks are located in the run/pool interface, some of the depicted structures may be omitted, or shifted during construction due to naturally occurring site attributes (i.e. bedrock, etc.). Also structures may be added that are not shown on the proposed plan drawings. Typical structure layouts, which are based on Rosgen designs (Rosgen, 2001), are provided in **Section 8**.

7.8.1 Boulder Cross-Vane

The boulder cross-vane structure plan and cross-section views are illustrated in Section 8. The cross-vane is an in-stream grade control structure that concentrates stream energy toward the center of the channel and away from the near-bank areas reducing shear stress along the banks and preventing bank erosion. This structure reduces the potential of headcutting and creates a stable width-to-depth ratio, while also promoting sediment transport capacity. The upstream side of the structure will be lined with a non-woven fabric and backfilled with excavated channel material and in some cases appropriately sized quarried stone aggregate due its placement in a sandy loam substrate material. This modification is required due to the potential for the structures to "pipe" following installation due to the voids created during the installation of the structure in fine-grained substrate. Piping may eventually lead to structure failure and potentially catastrophic stream bed and bank erosion.

7.8.2 J-Hook Vane

The J-Hook vane structure plan and cross-section views are also illustrated in **Section 8**. This structure is typically used along outside meander bends where the near-bank shear stress is the greatest. This structure will be utilized to reduce potential bank erosion by redirecting velocity gradients toward the center of the channel and away from the near-bank area. This structure also promotes sediment transport through the pools, maintains pools depths and provides aquatic habitat. This structure occupies two-thirds of the bankfull channel cross-sectional area and is constructed similarly to the cross-vane with footer boulders, non-woven fabric, and stone aggregate as required.

7.8.3 Root Wads

Root wads will be utilized along the outer-most sections of the meander bends as determined during the construction process. These structures are composed of available native trees with an appropriately sized root fan typically 4 to 5 foot wide and an 8 to 12-foot long trunk section. These structures are installed perpendicular to stream flow into the side of the stream bank with the root fan exposed to the channel while the trunk section anchors the structure in place. If required, logs or boulders can be installed immediately below the channel invert to serve as a

footer on which the root wad is positioned. The root wad structure serves multiple purposes such as providing protection of the outer bank from potential erosion, aquatic habitat, aquatic cover, shade, and a source of detritus.

7.8.4 Channel Sill

The invert sill structure is typically utilized in lieu of the traditional boulder cross-vane due to the compact dimensions of smaller tributaries. The structure functions primarily as a permanent grade control feature that prevents channel degradation or headcutting. This structure can be composed of stone or wood embedded if required in a bed of aggregate and wrapped with non-woven filter cloth. The structure is typically used at the head of riffle or end of riffle.

7.8.5 Boulder Step-Pool Structure

The boulder step-pool structure essentially consists of several cross-vanes located in close proximity of one another or stacked together to form one uniformed structure that creates a series of steps broken up by pools. This structure is used to merge channels together that have large variations in invert elevation. Each step is limited to six (6) inches or less allowing for the migration of aquatic life.

7.8.6 Double Step Cross Vane

The double step cross vane is constructed and functions similarly to a cross vane except the vane drops down approximately six (6) inches from the head rock elevation or the starting point of the structure down to the step. This structure is used when there is a significant vertical change in the valley and the designed channel must compensate without degrading.

8.0 Restoration Design Plan Sheets

(next page)

9.0 Riparian Planting Plan

The proposed riparian planting plan was developed by integrating the native plant species observed on site along with selected species known to inhabit the Piedmont/Mountain bottomland forest community type as described in Classification of the Natural Communities of North Carolina (Schafale and Weakley, 1990) to institute species diversity. According to the Schafale and Weakley publication, "Very few bottomlands of any significant size remain. While many bottomlands exist as successional forest grown up in abandoned fields, intact Bottomland Forests are among the rarest of communities in North Carolina." Most of the bottomlands that have been cleared or logged in the past are dominated by loblolly pine (*Pinus taeda*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), or American sycamore (*Platanus occidentalis*)

The majority of the restored riparian zone will be located within the created bankfull bench and toe slope areas. This area will be planted with bare root seedlings consisting of bottomland hardwood species as outlined in Schafale and Weakley. Native trees and shrubs that are currently located within the channel clearing and excavation limits will be removed with as much of the root ball intact and transplanted adjacent to the restored creek channel or bankfull bench when possible. Trees as large as 4-inches diameter-at-breast-height (DBH) and approximately 20 feet tall will be transplanted and integrated into the buffer restoration when available. The bare root seedlings will be planted during the fall or early spring seasons, as soon as possible after the completion of the earthwork associated with constructing the new stream channel. During the following fall, supplemental shrub and tree species will be planted if survival rates of previously planted seedlings are below target densities as determined in late summer (August-September). Plant species that will be utilized within the restoration site are listed in the table presented in this section.

The restored active channel will be planted with the appropriate channel bank species in the form of live stakes, bare-root seedlings, and transplants consisting primarily of black willow (*Salix nigra*), silky dogwood (*Cornus amomum*), and elderberry (*Sambucus canadensis*). If quantities from on site sources are not plentiful the live stakes will be supplemented by locally identified plant sources (i.e. existing power line right-of-ways (ROWs), adjacent properties, etc.) or purchased from locally reputable nurseries. Black willow will not consist of more than 40 percent of the stream bank plantings.

The planting plan consists of individual hardwood tree species as listed in the table provided in this section. The planting plan is provided on the design sheets in **Section 8**. The goal is to plant 400 to 600 bare-root seedlings per acre, with an approximate 8-foot to 10-foot spacing. Plant composition will consist of at a minimum of at least four (4) of the tree species and two (2) of the shrub species list.

Plant List

Scientific Name	Common Name
Trees	
Fraxinus pennsylvanica	Green ash
Platanus occidentalis	American sycamore
Quercus pagoda	Cherrybark oak
Betula nigra	River birch
Quercus michauxii	Swamp chestnut oak
Quercus phellos	Willow oak
Acer negundo	Box elder
Ulmus americana	American Elm
Liriodendron tulipifera	Tulip tree
Small Trees and Shrubs	
Cornus amomum	Silky dogwood
Cornus florida	Flowering dogwood
Alnus serrulata	Tag alder
Aesculus sylvatica	Painted buckeye
Salix nigra	Black willow
Sambucus canadensis	Elderberry

* Species composition may be adjusted based on local availability.

Temporary and permanent seed will be applied simultaneously to the disturbed areas and channel embankments. Temporary seed will provide cover until the permanent seed applied becomes established. Temporary cover will consist of millet (*Echinochloa crusgalli*), rye grain (*Secale cereale*), and crimson clover (*Trifolium incarnatum*). Permanent ground cover will consist of switchgrass (*Panicum virgatum*), deertongue (*Panicum clandestinman*), black-eyed susan (*Rudbeckia hirta*), riverbank wildrye (*Elymus riparius*), and will also include silky dogwood (*Cornus amomum*). Silky dogwood will only be applied along the channel embankments.

10.0 Monitoring Plan

The restoration site will be monitored for five consecutive years or until the required success criteria has been met as determined by NC DWQ and the USACE. Monitoring activities will begin immediately following the completion of the stream construction in order to alleviate any potential problems as they occur. Planting will likely not occur until Fall of 2005; therefore, the riparian buffer restoration will be monitored the following growing season projected to be summer of 2006. Monitoring activities will follow the guidelines presented in the request for proposals for this project.

Parameters that will be included in the annual stream monitoring to ensure the success of the restoration activities will include stream channel surveys (longitudinal and cross-sectional profiles), pebble counts, photographs, and plant surveys.

Following the submittal of the monitoring reports to the appropriate agency representatives, the recipients of the report will be contacted for the purpose of discussing the monitoring data, required success criteria and whether or not the site is functioning as expected. If the site is not functioning as expected a site visit will be scheduled with the review agencies so that a

remediation plan can be created and implemented. The remediation plans, if required, will directly reflect the requested alterations as discussed with the regulatory agencies.

10.1 Stream Channel

Stream channel stability will be physically monitored by establishing permanent cross-sections located approximately every 500 to 600 feet that will comprise of a nested riffle and pool segment. Each cross-section will be monumented for future identity and survey. All of these cross-sectional surveys will also be utilized as photographic points. Cross-section locations to be monitored will be established immediately following construction during the completion of the "as-built" survey. The "as-built" report will include the constructed stream channel dimension, pattern, and longitudinal profile. This data will be utilized as a baseline to compare future monitoring surveys and subsequently to determine channel stability and transition. Other data collected will include pebble counts, stream pattern data, and stream side plant conditions. Annual inspection of in-stream structures will also occur to verify proper function and channel stability. Stream channel monitoring surveys will be completed annually for five consecutive years, starting one (1) year after the completion of the project.

10.2 Riparian Buffer

Vegetation within the restored riparian buffer will be monitored for five consecutive years. Ten by ten meter square plots will be permanently established following completion of the planting phase and at least two opposing corners will be permanently installed and surveyed for future use. The plant species, density, survival rates, and the cause of mortality if identifiable will be recorded within each plot. Vegetation plots will be sampled annually and reported on every year along with the data collected during the physical monitoring of the channel. The primary focus of the vegetative monitoring will be solely on the tree and shrub stratum, although herbaceous species encountered may also be recorded. The target density for the riparian buffer is to establish a minimum of 360 stems per acre after 3 years with a minimum of 260 stems per acre at the end of the 5-year monitoring period. Vegetation monitoring will occur between August and October.

11.0 Success Criteria

Success criteria will determine if the mitigation project is meeting its prescribed goals as listed in **Section 2.0**. A determination will be made regarding the success of the project following the collection and evaluation of ecological and physical monitoring data, photographs, site observations, and the performance of the streams during storm events. Monitoring components that will be evaluated include vegetation survival, channel bed and bank stability, and in-stream structure performance.

Tree survival should consist of at least 320 trees per acre for the first 3 years after construction with no more than 10% mortality in subsequent years or a minimum of 260 trees per acre after 5 years.

Channel stability will be reflected in the surveyed permanent cross-sections, longitudinal profile, evaluation of bank stability and cover, evaluation of in-stream structure performance and to a lesser degree pebble counts compared to the as-built and any previously collected monitoring data. The general trend should reflect a stable or slightly decreasing riffle cross-sectional area whereas pools may increase and yet be considered relatively stable. The longitudinal profile will typically adjust depending on the frequency of bankfull or greater storm events. Normally the constructed channel profile will adjust (especially in a sand dominated bed) but it will need to function without significant degradation (bed scour), aggradation (mid-channel bars), or bank erosion.

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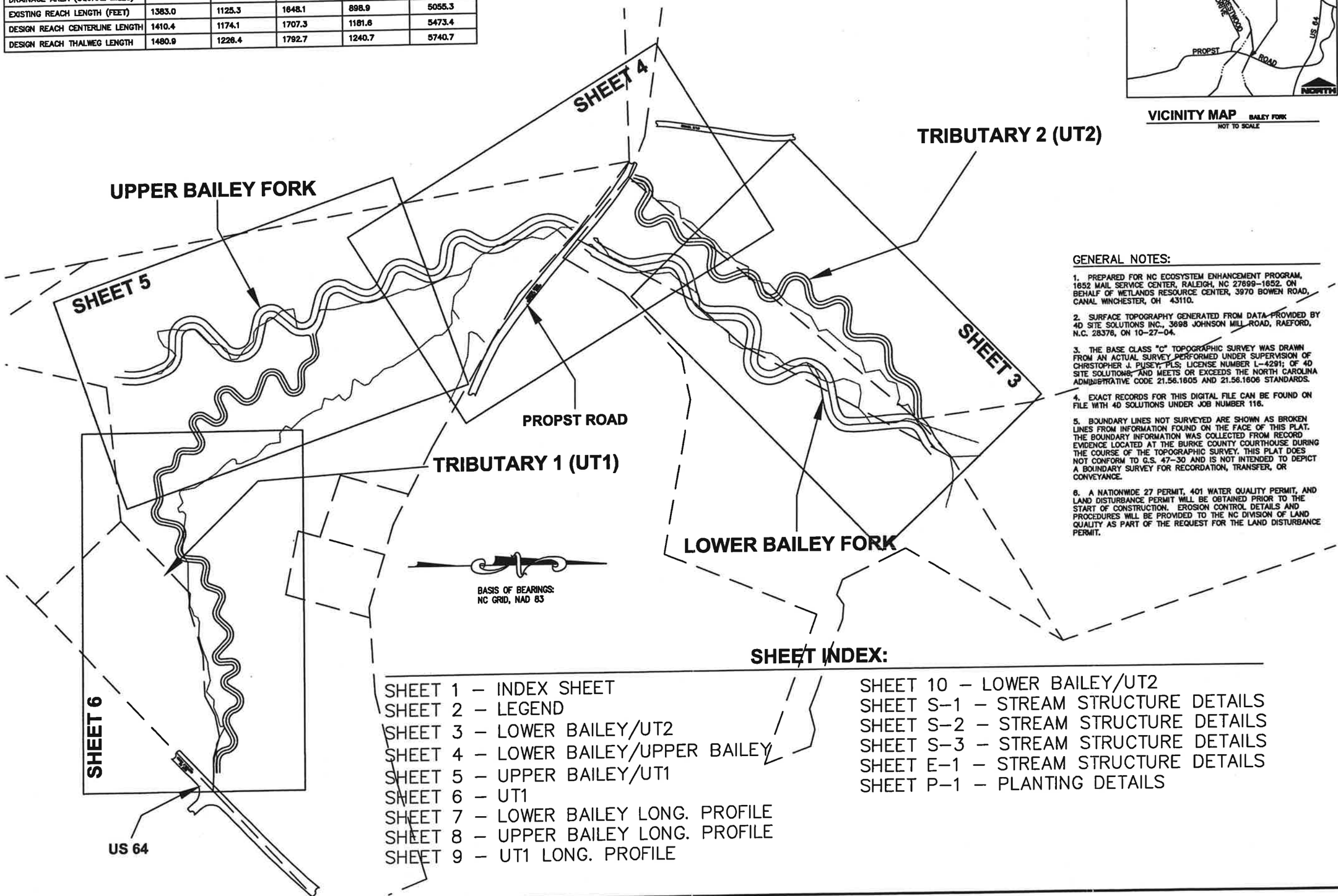
BAILEY FORK STREAM RESTORATION

PROJECT SUMMARY:

	UPPER BAILEY	LOWER BAILEY	TRIBUTARY 1	TRIBUTARY 2	TOTAL
DESIGN STREAM TYPE	C/E	C/E	C/E	C/E	
DRAINAGE AREA (SQUARE MILES)	5.0	5.5	0.54	0.98	
EXISTING REACH LENGTH (FEET)	1383.0	1125.3	1648.1	898.9	5055.3
DESIGN REACH CENTERLINE LENGTH	1410.4	1174.1	1707.3	1181.6	5473.4
DESIGN REACH THALWEG LENGTH	1480.9	1228.4	1792.7	1240.7	5740.7



VICINITY MAP BAILEY FORK
NOT TO SCALE

GENERAL NOTES:

1. PREPARED FOR NC ECOSYSTEM ENHANCEMENT PROGRAM, 1652 MAIL SERVICE CENTER, RALEIGH, NC 27699-1652. ON BEHALF OF WETLANDS RESOURCE CENTER, 3970 BOWEN ROAD, CANAL WINCHESTER, OH 43110.

2. SURFACE TOPOGRAPHY GENERATED FROM DATA PROVIDED BY 4D SITE SOLUTIONS INC., 3698 JOHNSON MILL ROAD, RAEFORD, N.C. 28376, ON 10-27-04.

3. THE BASE CLASS "C" TOPOGRAPHIC SURVEY WAS DRAWN FROM AN ACTUAL SURVEY PERFORMED UNDER SUPERVISION OF CHRISTOPHER J. PUSEY, PLS; LICENSE NUMBER L-4291; OF 4D SITE SOLUTIONS, AND MEETS OR EXCEEDS THE NORTH CAROLINA ADMINISTRATIVE CODE 21.56.1605 AND 21.56.1606 STANDARDS.

4. EXACT RECORDS FOR THIS DIGITAL FILE CAN BE FOUND ON FILE WITH 4D SOLUTIONS UNDER JOB NUMBER 116.

5. BOUNDARY LINES NOT SURVEYED ARE SHOWN AS BROKEN LINES FROM INFORMATION FOUND ON THE FACE OF THIS PLAT. THE BOUNDARY INFORMATION WAS COLLECTED FROM RECORD EVIDENCE LOCATED AT THE BURKE COUNTY COURTHOUSE DURING THE COURSE OF THE TOPOGRAPHIC SURVEY. THIS PLAT DOES NOT CONFORM TO G.S. 47-30 AND IS NOT INTENDED TO DEPICT A BOUNDARY SURVEY FOR RECORDATION, TRANSFER, OR CONVEYANCE.

6. A NATIONWIDE 27 PERMIT, 401 WATER QUALITY PERMIT, AND LAND DISTURBANCE PERMIT WILL BE OBTAINED PRIOR TO THE START OF CONSTRUCTION. EROSION CONTROL DETAILS AND PROCEDURES WILL BE PROVIDED TO THE NC DIVISION OF LAND QUALITY AS PART OF THE REQUEST FOR THE LAND DISTURBANCE PERMIT.

SHEET INDEX:

NATURAL SYSTEMS ENGINEERING
3719 Benson Drive Raleigh, North Carolina 27609 (919) 878-5444 www.nsepc.com

REVISIONS, DATE AND INITIAL:

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 29216 JAMES M. HALLEY

DATE: 01/20/05
DESIGNED BY: PAJ
DRAWN BY: DST/WWR
CHECKED BY: JMH
PROJECT NO.: WRC0402
FILE: bailey_fork_010705
SCALE: NOT TO SCALE

TITLE AND INDEX SHEET

BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET 1

BAILEY FORK
STREAM RESTORATION

DETAIL KEY

LEGEND

TOP OF BANK (PROPOSED)

PROPERTY LINE (NOT SURVEYED)

MINOR CONTOUR (PROPOSED)

MAJOR CONTOUR (PROPOSED)

MINOR CONTOUR (EXISTING)

MAJOR CONTOUR (EXISTING)

LOG CROSS-VANE (SEE DETAIL 1 SHEET S-1)

ROOT WAD (SEE DETAIL 2 SHEET S-1)

BOULDER CROSS-VANE (SEE DETAIL 1 SHEET S-2)

STEP CROSS-VANE (SEE DETAIL 2 SHEET S-2)

DOUBLE STEP CROSS-VANE (SEE DETAIL 3 SHEET S-2)

"J" HOOK CROSS-VANE (SEE DETAIL 1 SHEET S-3)

ROCK CHANNEL SILL (SEE DETAIL 2 SHEET S-3)

LOG CHANNEL SILL (SEE DETAIL 2 SHEET S-3)

TEMP. CONSTRUCTION ENTRANCE (SEE DETAIL 1 SHEET E-1)

STREAM FORD (SEE DETAIL 2 SHEET E-1)

TREE LINE

8" PINE — SINGLE TREE

POWER UTILITY

15" CMP — STORM PIPE

HEADWALL

DEBRIS — EXISTING DEBRIS

STREAM BAR

EXISTING POOL

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REVISIONS, DATE AND INITIAL:

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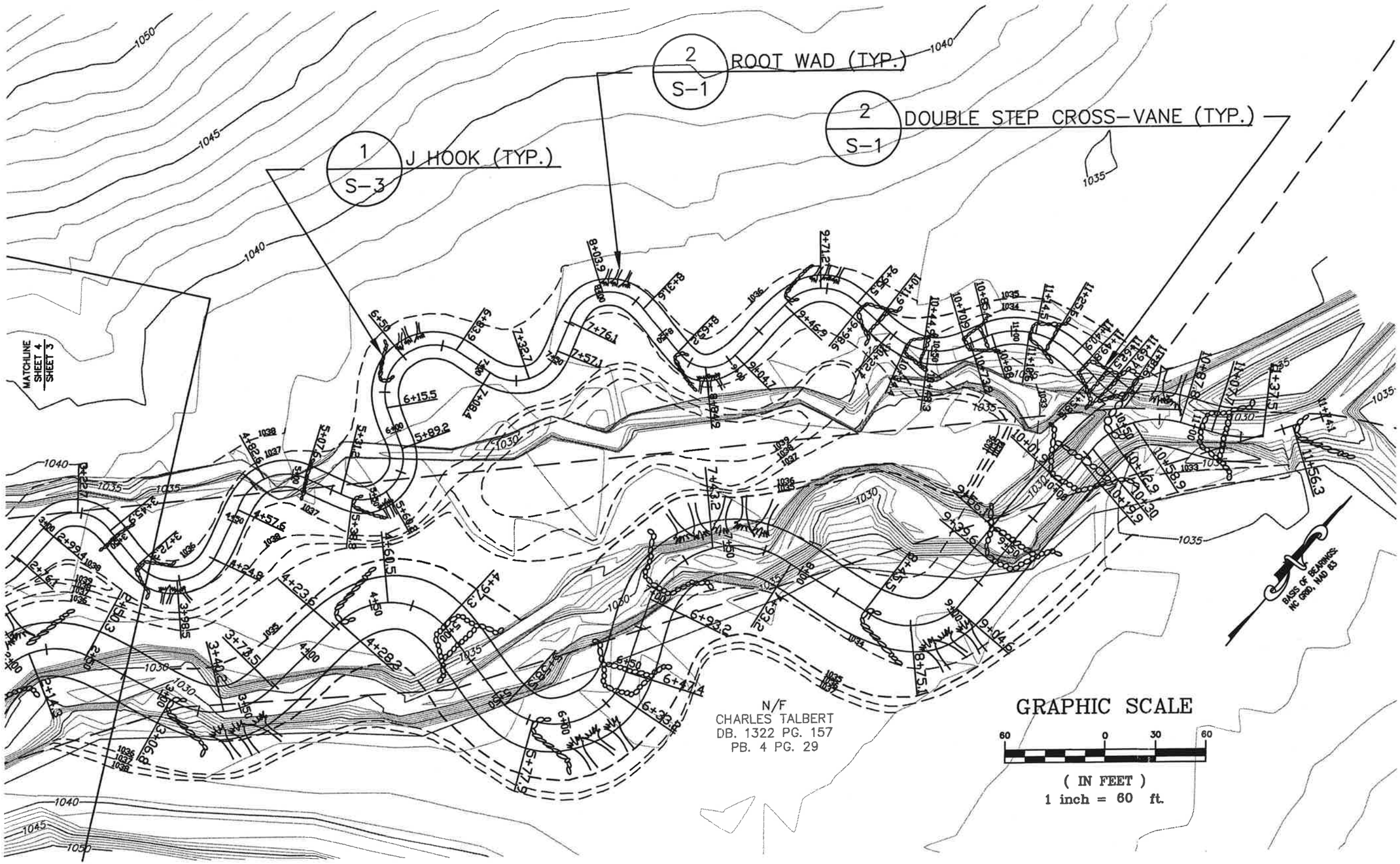
SCALE:	NOT TO SCALE

NSE LEGEND

BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET 2

BAILEY FORK
STREAM RESTORATION



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REVISIONS, DATE AND INITIAL:

NORTH CAROLINA
PROFESSIONAL
1-20-05
SEAL
29216
ENGINEER
JAMES M. HALEY

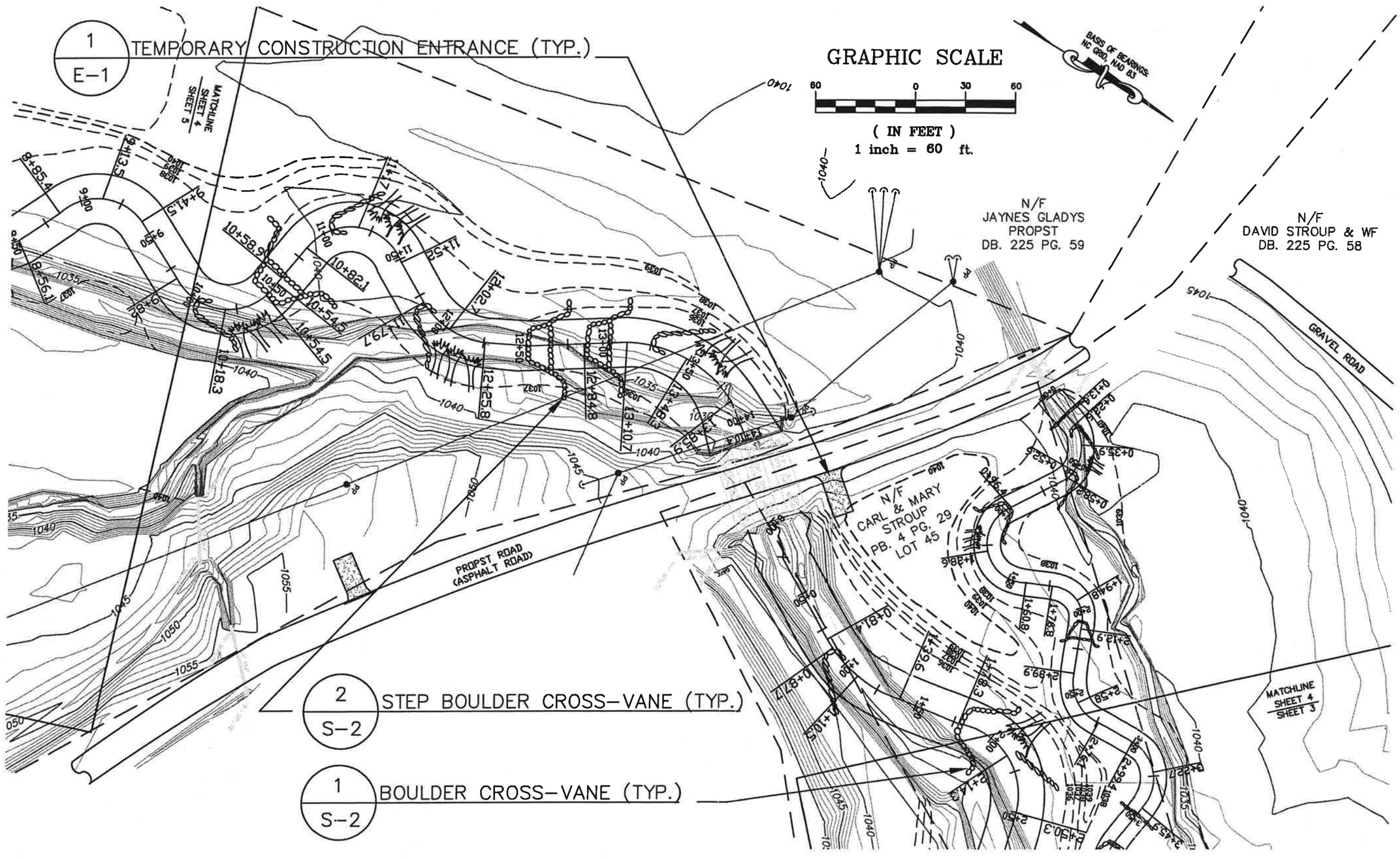
DATE:	01/20/05
DESIGNED BY:	PAJ
DRAWN BY:	DST/WWR
CHECKED BY:	JMH
PROJECT NO.:	WRC0402
FILE:	bailey_fork_010705
SCALE:	NOT TO SCALE

LOWER BAILEY FORK / UT2

BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET 3

BAILEY FORK
STREAM RESTORATION



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REVISIONS, DATE AND INITIAL:

PROFESSIONAL SEAL 29216 ENGINEER JAMES M. HALEY

DATE:	01/20/05
DESIGNED BY:	PAJ
DRAWN BY:	DST/WWR
CHECKED BY:	JMH
PROJECT NO.:	WRC0402
FILE:	bailey_fork_010705
SCALE:	NOT TO SCALE

UPPER AND LOWER BAILEY

BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET 4

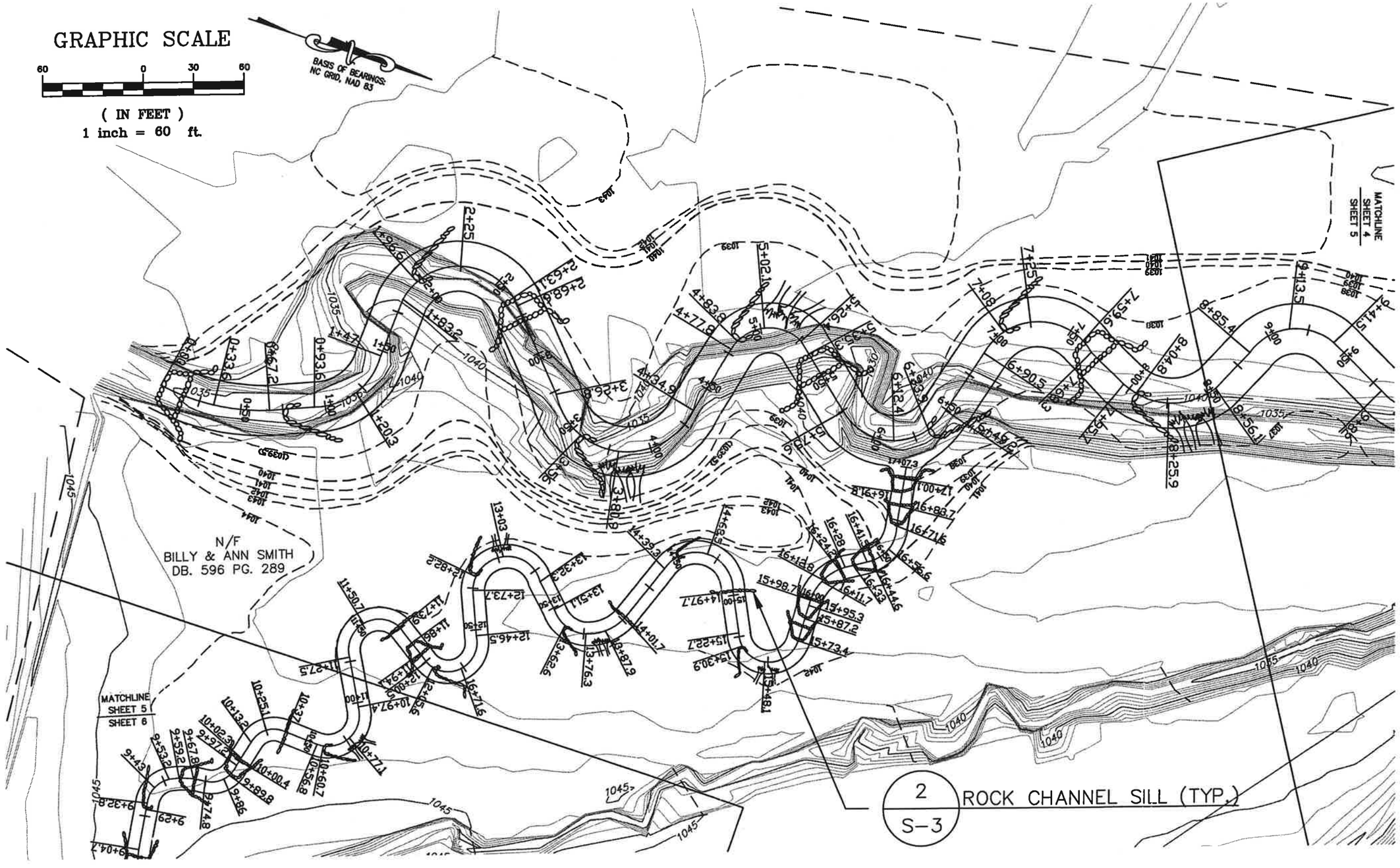
BAILEY FORK
STREAM RESTORATION

GRAPHIC SCALE

60 0 30 60

(IN FEET)
1 inch = 60 ft.

BASIS OF BEARINGS:
NC GRID, NAD 83



REVISIONS, DATE AND INITIAL:

NATURAL SYSTEMS
ENGINEERING
3719 Benson Drive Raleigh, North Carolina 27609 (919) 878-5444 www.nsepc.com

PROFESSIONAL ENGINEER
SEAL
29216
JAMES M. HALEY

DATE: 01/20/05
DESIGNED BY: PAJ
DRAWN BY: DST/WWR
CHECKED BY: JMH
PROJECT NO.: WRC0402
FILE: bailey_fork_010705
SCALE: NOT TO SCALE

UPPER BAILEY / UT1

BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET 5

BAILEY FORK
STREAM RESTORATION

BASIS OF BEARINGS:
NC GRID, NAD 83

GRAPHIC SCALE

60 0 30 60

(IN FEET)
1 inch = 60 ft.

2
E-1
FORD (TYP.)

N/F
CHARLIE DUVAL
DB. 841 PG. 1650

N/F
CRYSTAL & JIMMA
SMITH
DB. 592 PG. 164

HWY 64
(ASPHALT ROAD)

MATCHLINE
SHEET 5
SHEET 6

1045
1050
1055
1060
1065

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PROFESSIONAL
SEAL
29216
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JAMES M. HALLEY
1-20-05

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SCALE: NOT TO SCALE

UT1

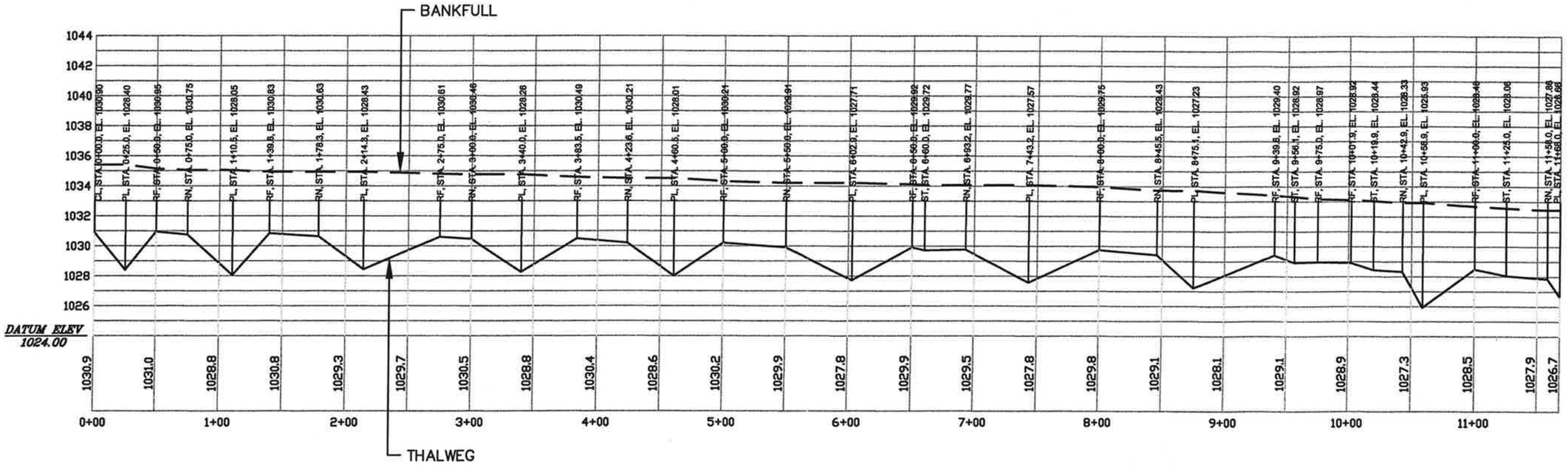
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET
6

SYMBOL KEY:
RF = riffle
ST = step
RN = run
JK = j-hook
PL = pool
CL = culvert
GL = glide

BAILEY FORK
STREAM RESTORATION

LOWER BAILEY FORK



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CHECKED BY:	JMH
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FILE:	bailey_fork_010705
SCALE:	NOT TO SCALE

LOWER BAILEY LONG. PROFILE

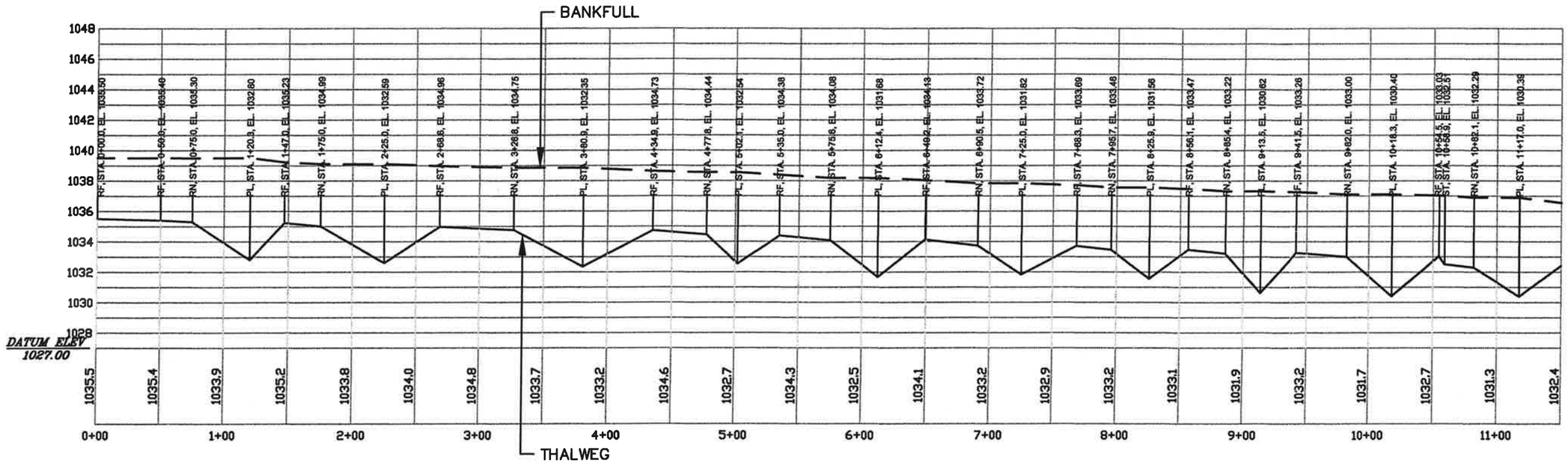
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET 7

SYMBOL KEY:
RF = riffle
ST = step
RN = run
JK = j-hook
PL = pool
CL = culvert
GL = glide

BAILEY FORK
STREAM RESTORATION

UPPER BAILEY FORK



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SCALE: NOT TO SCALE

UPPER BAILEY LONG. PROFILE

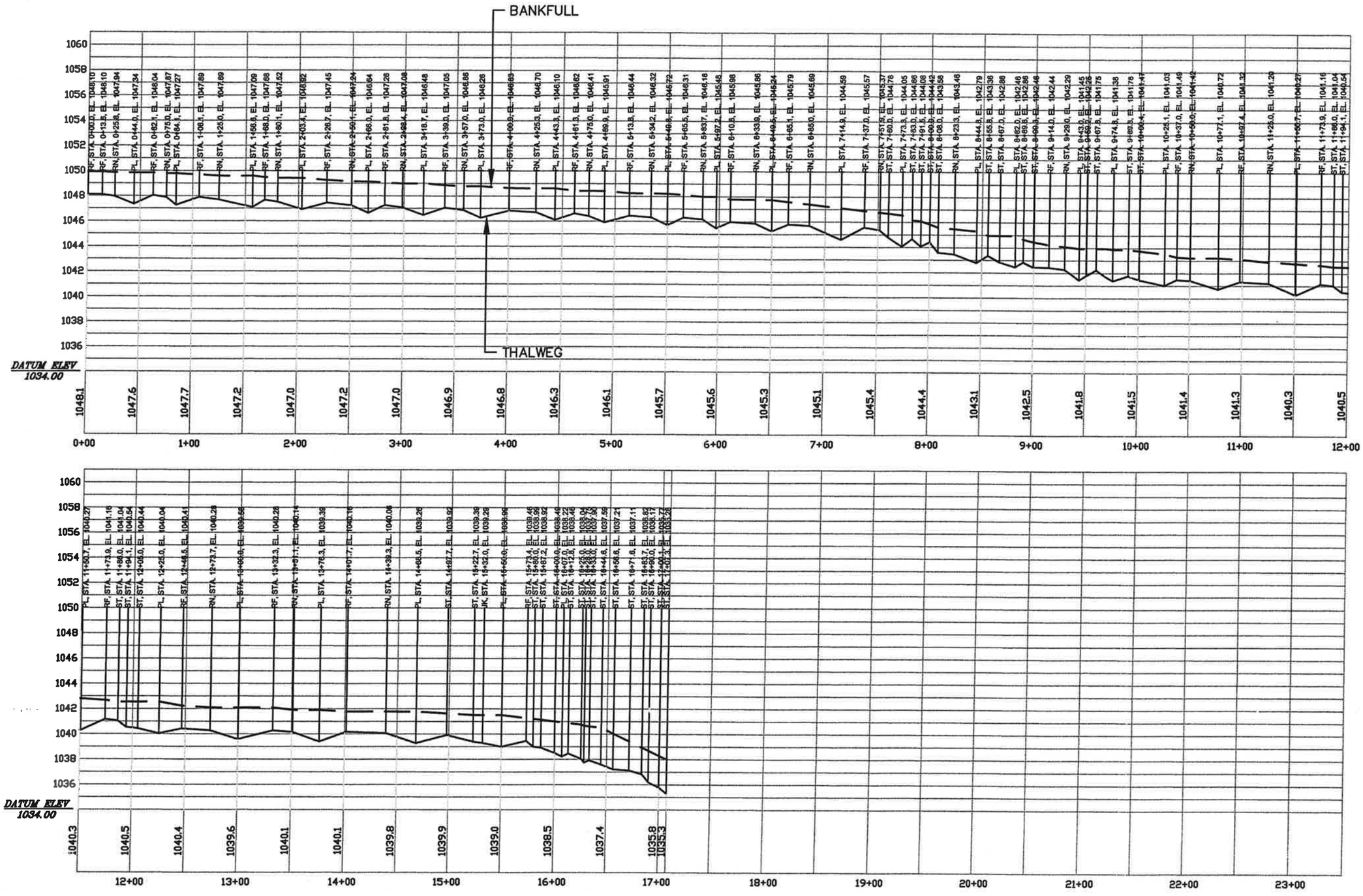
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET 8

SYMBOL KEY:
RF = riffle
ST = step
RN = run
JK = j-hook
PL = pool
CL = culvert
GL = glide

BAILEY FORK
STREAM RESTORATION

UT 1 TO BAILEY FORK



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FILE: bailey_fork_010705
SCALE: NOT TO SCALE

UT1 LONG. PROFILE

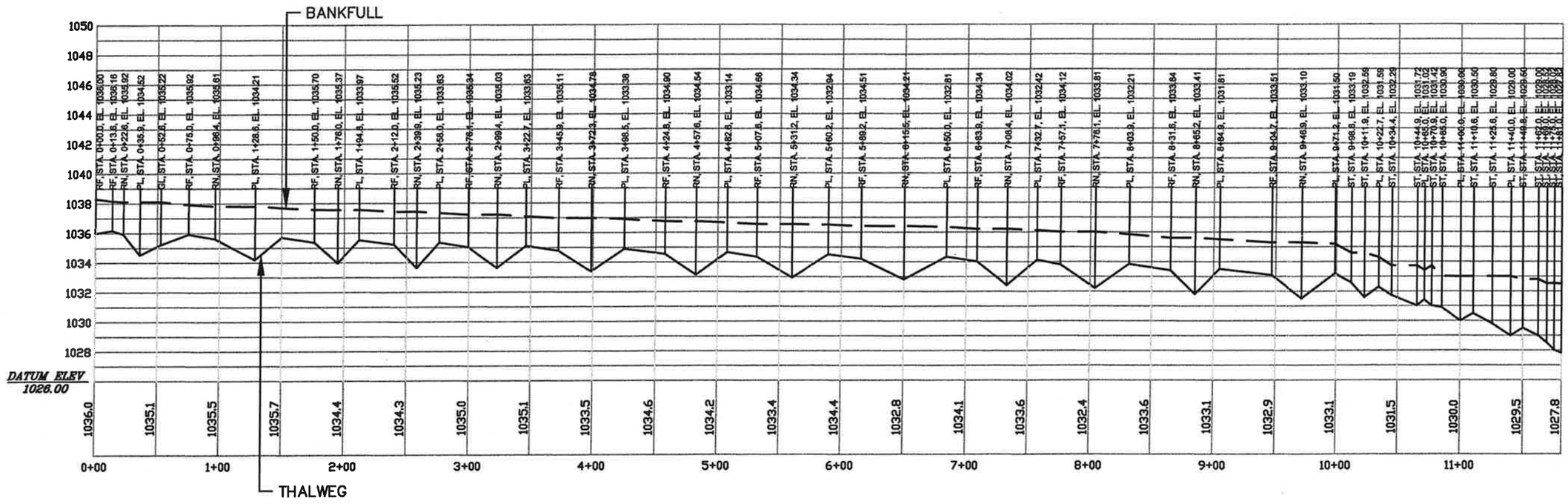
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET 9

SYMBOL KEY:
RF = riffle
ST = step
RN = run
JK = j-hook
PL = pool
CL = culvert
GL = glide

BAILEY FORK
STREAM RESTORATION

UT 2 TO BAILEY FORK



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FILE:	bailey_fork_010705
SCALE:	NOT TO SCALE

UT 2 LONG. PROFILE

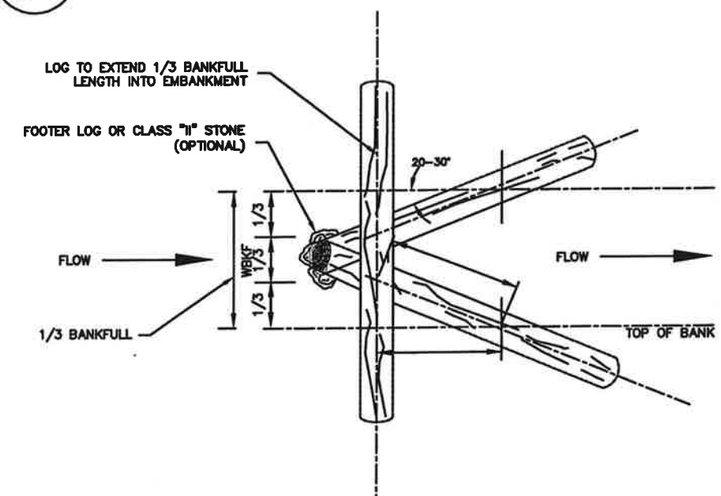
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET 10

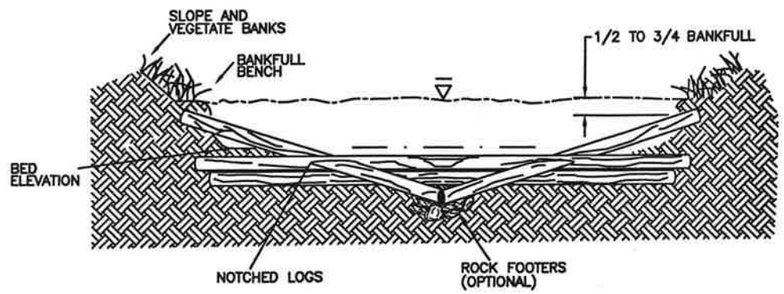
BAILEY FORK
STREAM RESTORATION

1
S-1

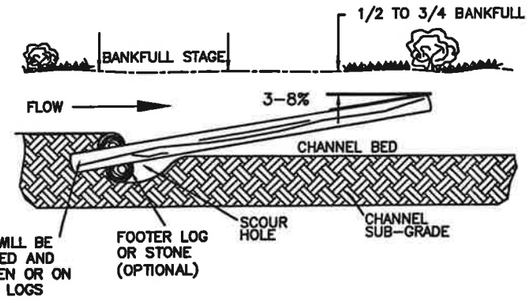
LOG CROSS-VANE
PLAN VIEW
NOT TO SCALE



LOG CROSS-VANE
CROSS-SECTION
NOT TO SCALE

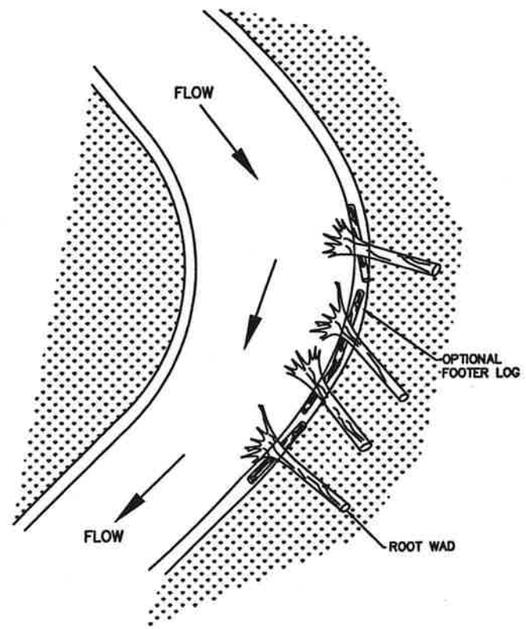


LOG CROSS-VANE
PROFILE VIEW
NOT TO SCALE

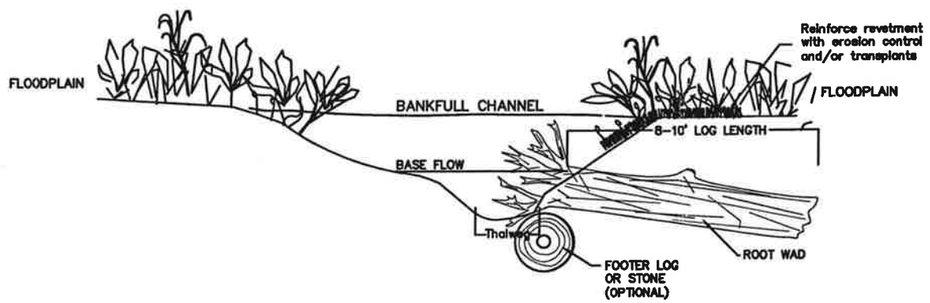


2
S-1

ROOT WADS
PLAN VIEW
NOT TO SCALE



ROOT WAD
CROSS-SECTION VIEW
NOT TO SCALE



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SCALE:	NOT TO SCALE

STREAM STRUCTURE DETAILS

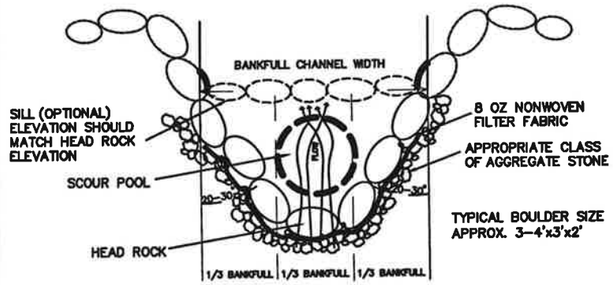
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET S-1

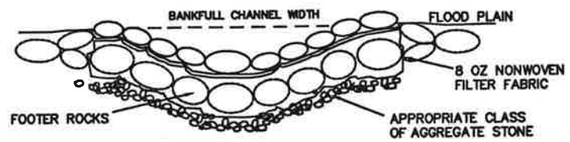
BAILEY FORK
STREAM RESTORATION

1 / S-2

BOULDER CROSS-VANE
PLAN VIEW
NOT TO SCALE

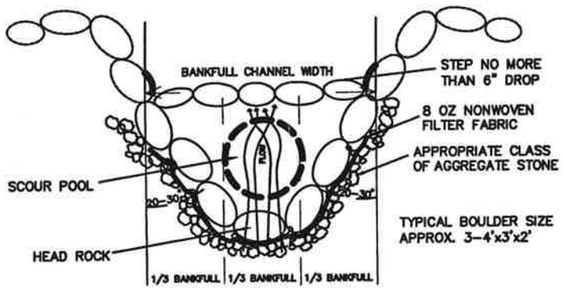


BOULDER CROSS-VANE
CROSS-SECTION VIEW
NOT TO SCALE

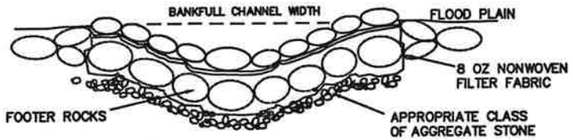


2 / S-2

STEP BOULDER CROSS-VANE
PLAN VIEW
NOT TO SCALE

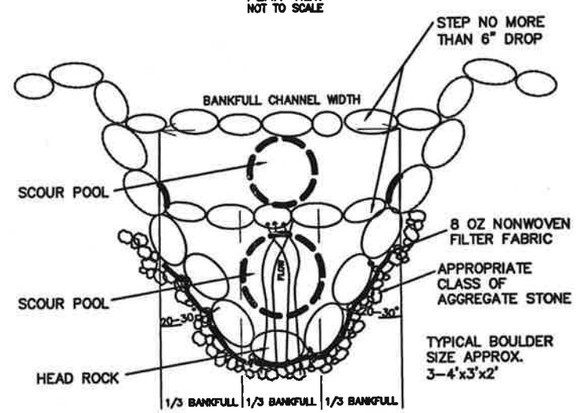


STEP BOULDER CROSS-VANE
CROSS-SECTION VIEW
NOT TO SCALE



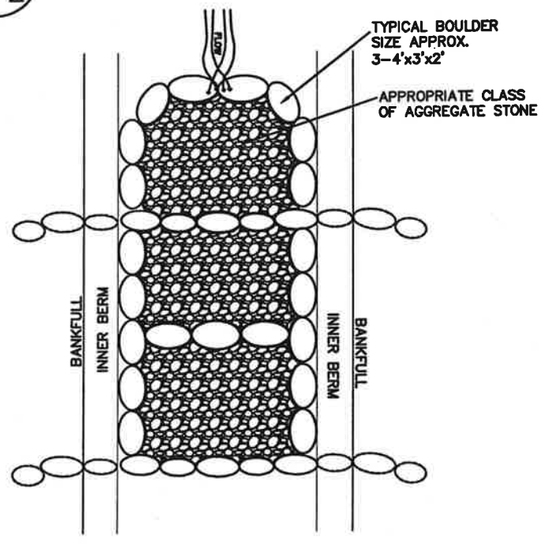
3 / S-2

DOUBLE STEP
BOULDER CROSS-VANE
PLAN VIEW
NOT TO SCALE

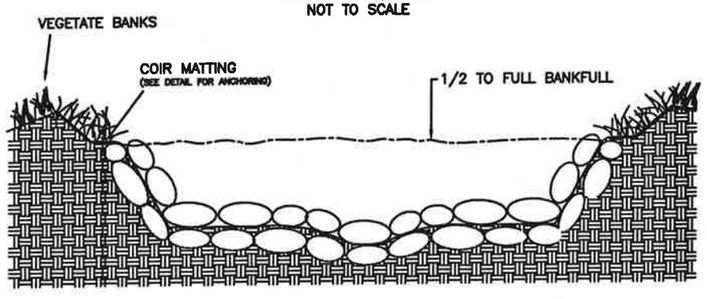


4 / S-2

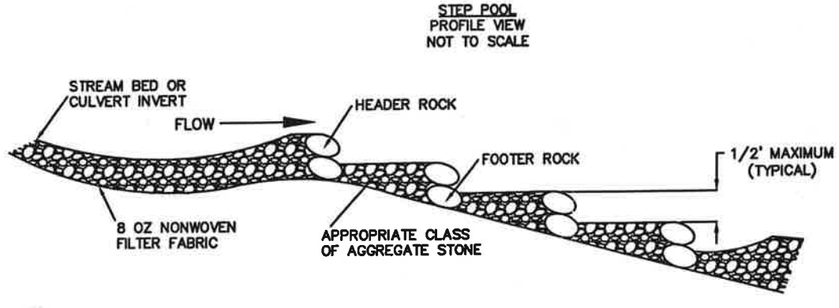
STEP POOL
PLAN VIEW
NOT TO SCALE



STEP POOL
CROSS-SECTION VIEW
NOT TO SCALE



STEP POOL
PROFILE VIEW
NOT TO SCALE



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REVISIONS, DATE AND INITIAL:

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DRAWN BY: DST/WWR
CHECKED BY: JMH
PROJECT NO.: WRC0402
FILE: bailey_fork_122804
SCALE: NOT TO SCALE

STREAM STRUCTURE DETAILS

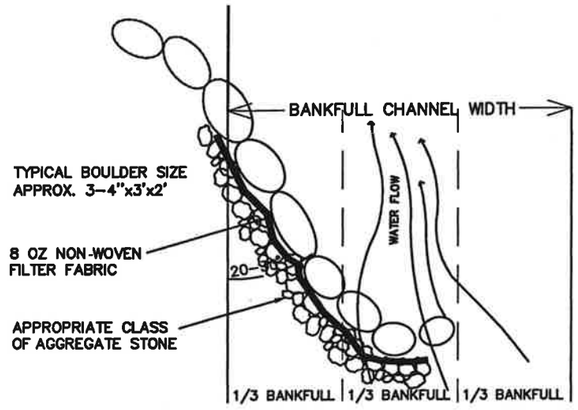
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET S-2

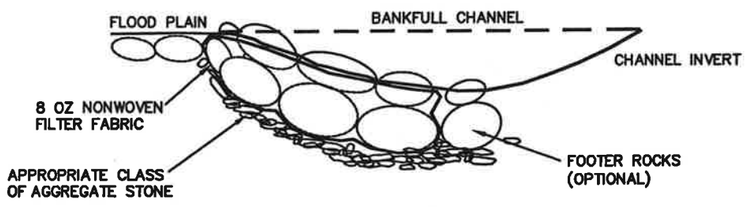
BAILEY FORK
STREAM RESTORATION

1
S-3

"J" HOOK CROSS-VANE
PLAN VIEW
NOT TO SCALE

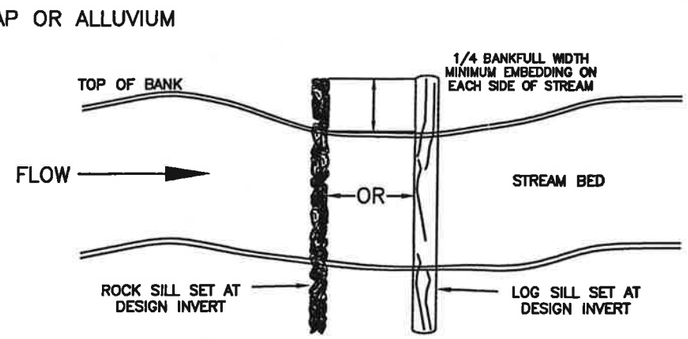


"J" HOOK CROSS-VANE
CROSS-SECTION VIEW
NOT TO SCALE

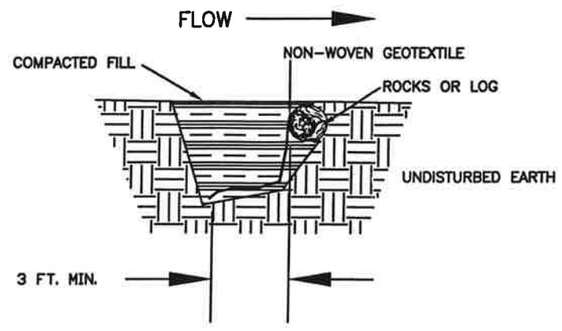


2
S-3

ROCK/LOG CHANNEL SILL
PLAN VIEW
NOT TO SCALE



ROCK/LOG CHANNEL SILL
PROFILE VIEW
NOT TO SCALE



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PROJECT NO.:	WRC0402
FILE:	bailey_fork_122804
SCALE:	NOT TO SCALE

STREAM STRUCTURE DETAILS

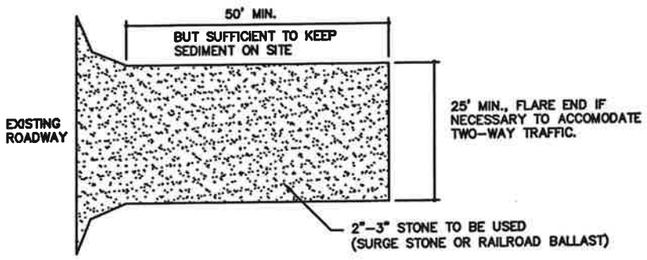
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET S-3

BAILEY FORK
STREAM RESTORATION

1
E–1

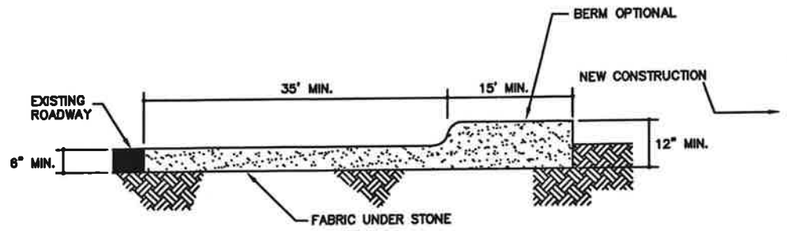
TEMPORARY CONSTRUCTION ENTRANCE
PLAN VIEW
NOT TO SCALE



NOTES:

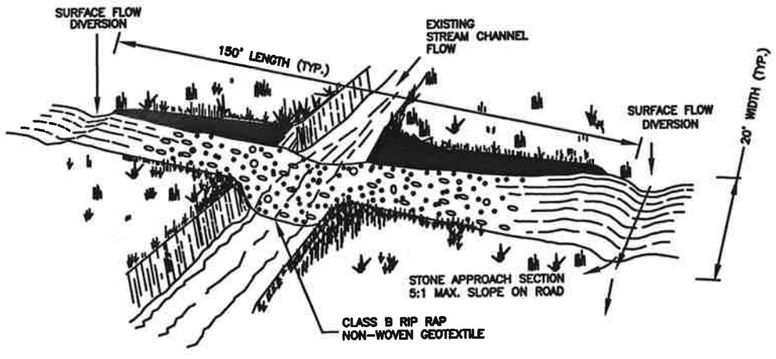
1. PUT SILT FENCE OR TREE PROTECTION FENCE UP TO ENSURE CONSTRUCTION ENTRANCE IS USED.
2. IF CONSTRUCTION ON THE SITE IS SUCH THAT THE MUD IS NOT REMOVED BY THE VEHICLE TRAVELING OVER THE STONE, THEN THE TIRES OF THE VEHICLES MUST BE WASHED BEFORE ENTERING THE PUBLIC ROAD.
3. IF A PROJECT CONTINUES TO PULL MUD AND DEBRIS ON TO THE PUBLIC ROAD, THE GOVERNING AUTHORITY WILL CLEAN THE AREA AND INVOICE THE FINANCIALLY RESPONSIBLE PERSON AS INDICATED ON THE FINANCIAL RESPONSIBILITY FORM.

TEMPORARY CONSTRUCTION ENTRANCE
CROSS SECTION VIEW
NOT TO SCALE



2
E–1

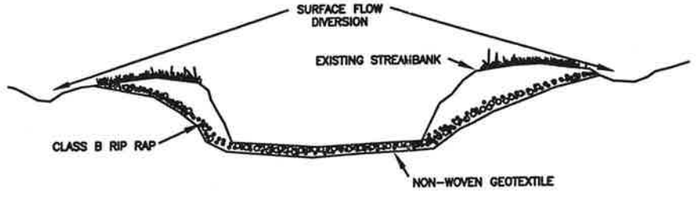
PERMANENT/TEMPORARY FORD
ISOMETRIC VIEW
NOT TO SCALE



NOTES:

1. CLASS B RIP RAP – MINIMUM DEPTH OF 24"
2. UNDERCUT FOR STONE PLACEMENT

PERMANENT/TEMPORARY FORD
CROSS–SECTION VIEW
NOT TO SCALE



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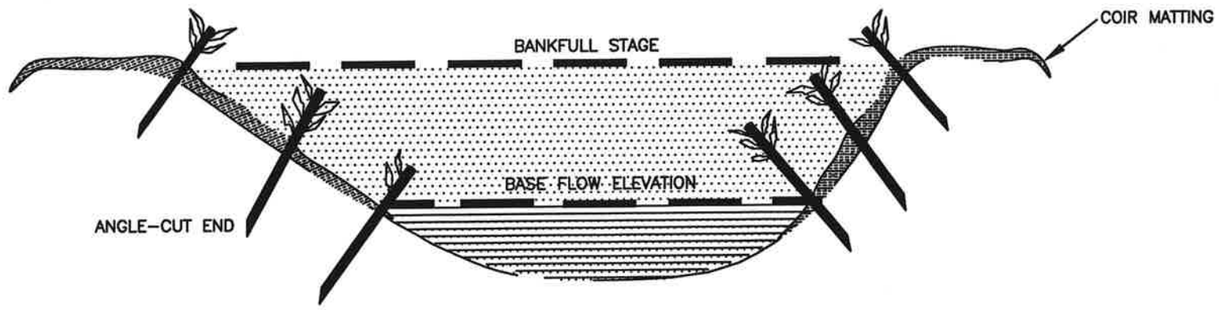
EROSION CONTROL DETAILS

BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET E–1

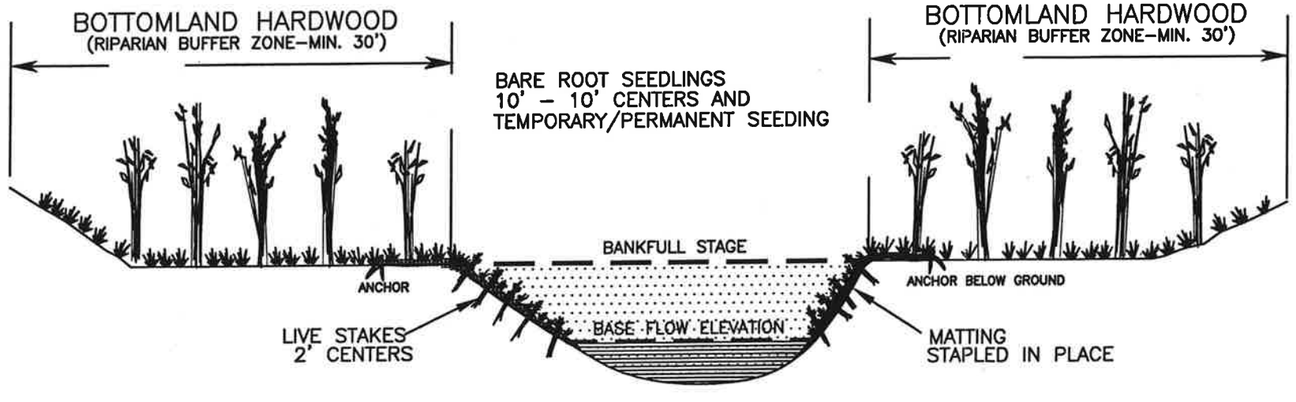
BAILEY FORK
STREAM RESTORATION

LIVE STAKE PLANTING
CROSS–SECTION VIEW
NOT TO SCALE



- LIVE STAKES INSTALLED IN BANK WITH DEAD–BLOW HAMMER
- 3/4 OF STAKE IN GROUND
- AT LEAST 2 BUDS ORIENTED UPWARDS
- 2' CENTERS (APPROX.)

COIR MATTING AND VEGETATION
TYPICAL CROSS–SECTION
NOT TO SCALE



PLANT SPECIES

Live Stakes

Common Name	Scientific Name
Silky dogwood	Cornus amomum
Elderberry	Sambucus canadensis
Black willow	Salix nigra

* 2'x2' centers along outside meanders.
* 3'x3' to 4'x4' centers along riffle sections.
* Black willow shall not exceed 30% of the species composition.

Trees

Common Name	Scientific Name
Green ash	Fraxinus pennsylvanica
River birch	Betula nigra
American sycamore	Platanus occidentalis
Tulip poplar	Liriodendron tulipifera
Swamp chestnut oak	Quercus michaxii
Willow oak	Quercus phellos
Cherrybark oak	Quercus pagoda
Box elder	Acer negundo
Water oak	Ulmus americana

* Min. 10'x10' centers

Small Trees/Shrubs

Common Name	Scientific Name
Painted buckeye	Aesculus sylvatica
Silky dogwood	Cornus amomum
Flowering dogwood	Cornus florida
Elderberry	Sambucus canadensis
Tag alder	Alnus serrulata
Black willow	Salix nigra

* Min. 8'x8' centers

General Notes:

1. Species composition may vary depending on availability.
2. Planted material will consist of a minimum of 4 species of trees and 2 species of shrubs.

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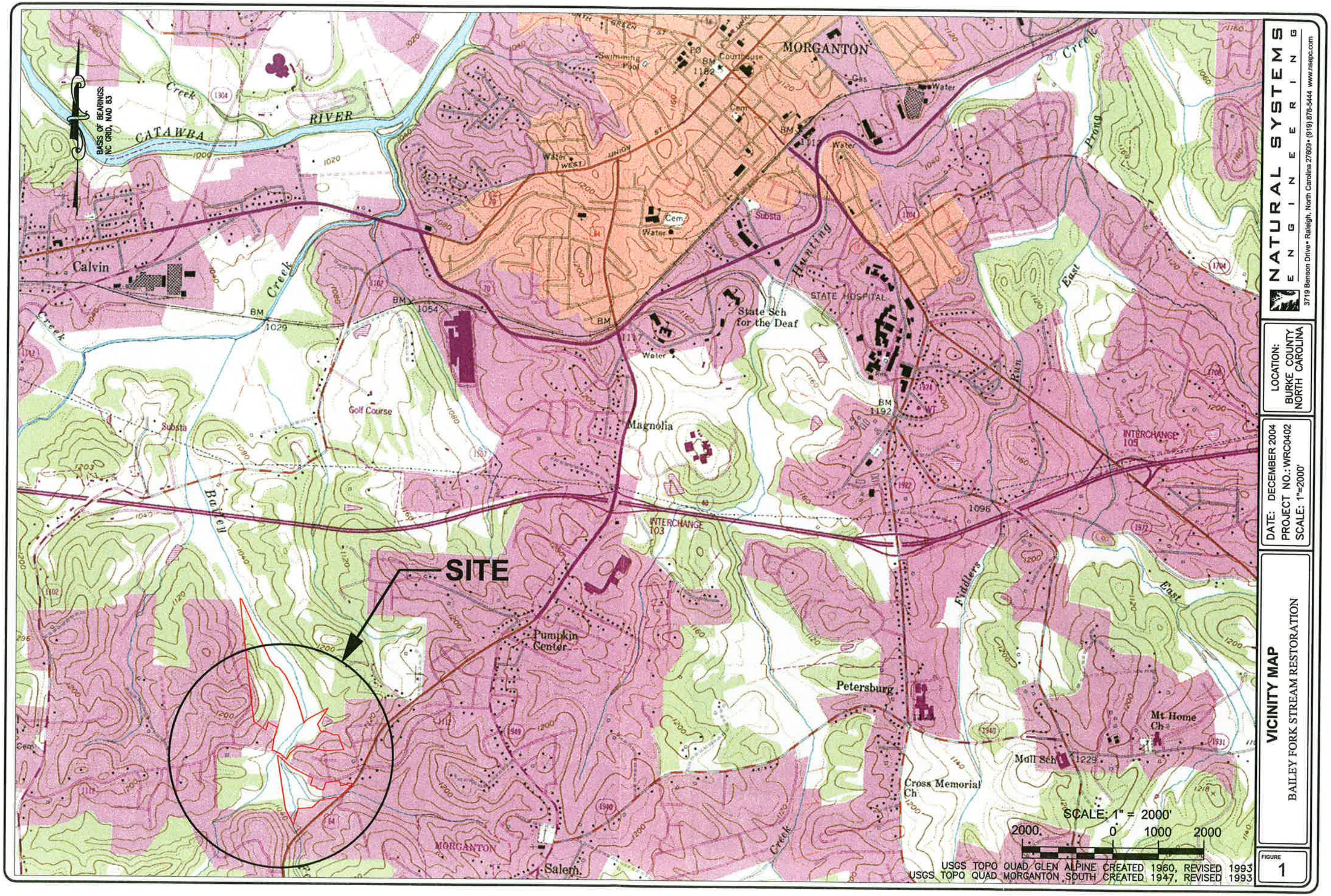
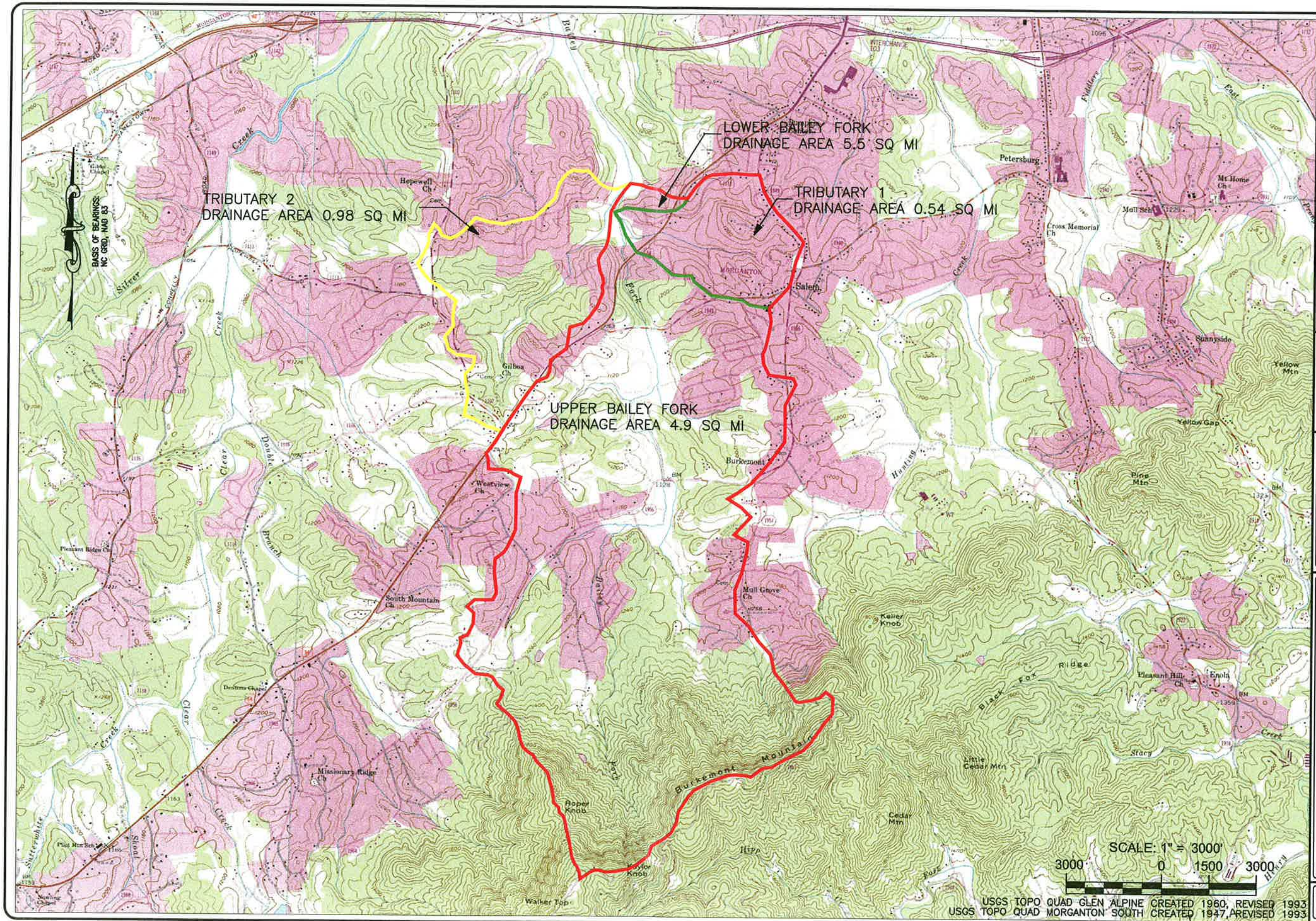
SCALE: NOT TO SCALE

PLANTING DETAILS

BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA

SHEET P–1


SITE
MORGANTON
Calvin
CATAWBA RIVER
Bailey Creek
Magnolia
State Sch for the Deaf
STATE HOSPITAL
Golf Course
INTERCHANGE 103
INTERCHANGE 105
Pumpkin Center
Petersburg
Cross Memorial Ch
Mull Sch
Mt Home Ch
Salem
Hunting Creek
Fiddlers Run
East Prong
BASIS OF BEARINGS: NC GRID, NAD 83
SCALE: 1" = 2000'
2000 0 1000 2000
USGS TOPO QUAD GLEN ALPINE CREATED 1960, REVISED 1993
USGS TOPO QUAD MORGANTON SOUTH CREATED 1947, REVISED 1993
NATURAL SYSTEMS ENGINEERING
3719 Benson Drive • Raleigh, North Carolina 27609 • (919) 878-5444 www.nsepc.com
LOCATION: BURKE COUNTY NORTH CAROLINA
DATE: DECEMBER 2004
PROJECT NO.: WRC0402
SCALE: 1"=2000'
VICINITY MAP
BAILEY FORK STREAM RESTORATION
FIGURE 1



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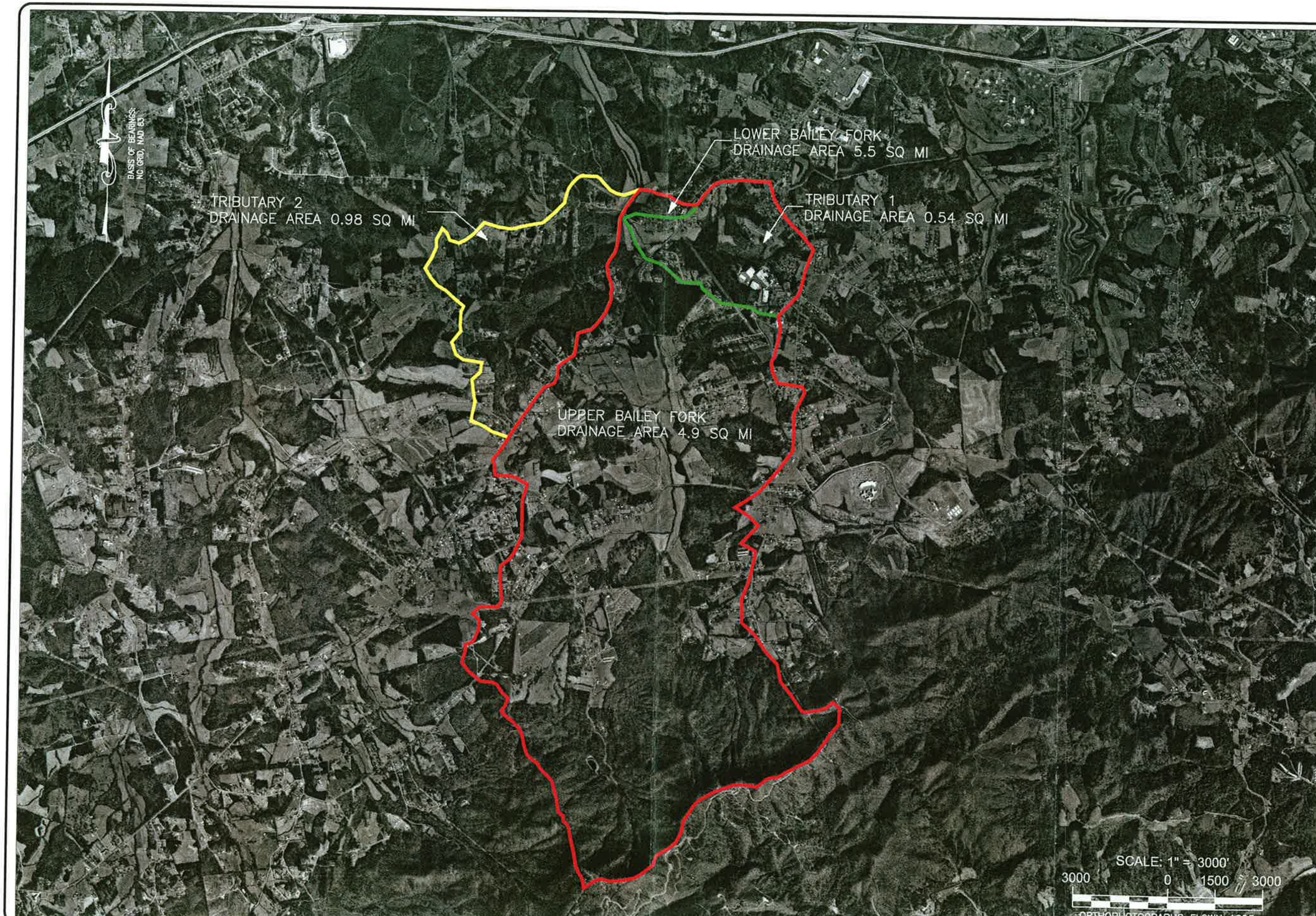
LOCATION:
BURKE COUNTY
NORTH CAROLINA

DATE: DECEMBER 2004
PROJECT NO.: WRC0402
SCALE: 1"=3000'

WATERSHED MAP
BAILEY FORK STREAM RESTORATION

FIGURE
5



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LOCATION:
BURKE COUNTY
NORTH CAROLINA

DATE: DECEMBER 2004
PROJECT NO.: WRC0402
SCALE: 1"=3000'

WATERSHED MAP WITH ORTHOGRAPHICS
BAILEY FORK STREAM RESTORATION

FIGURE
6

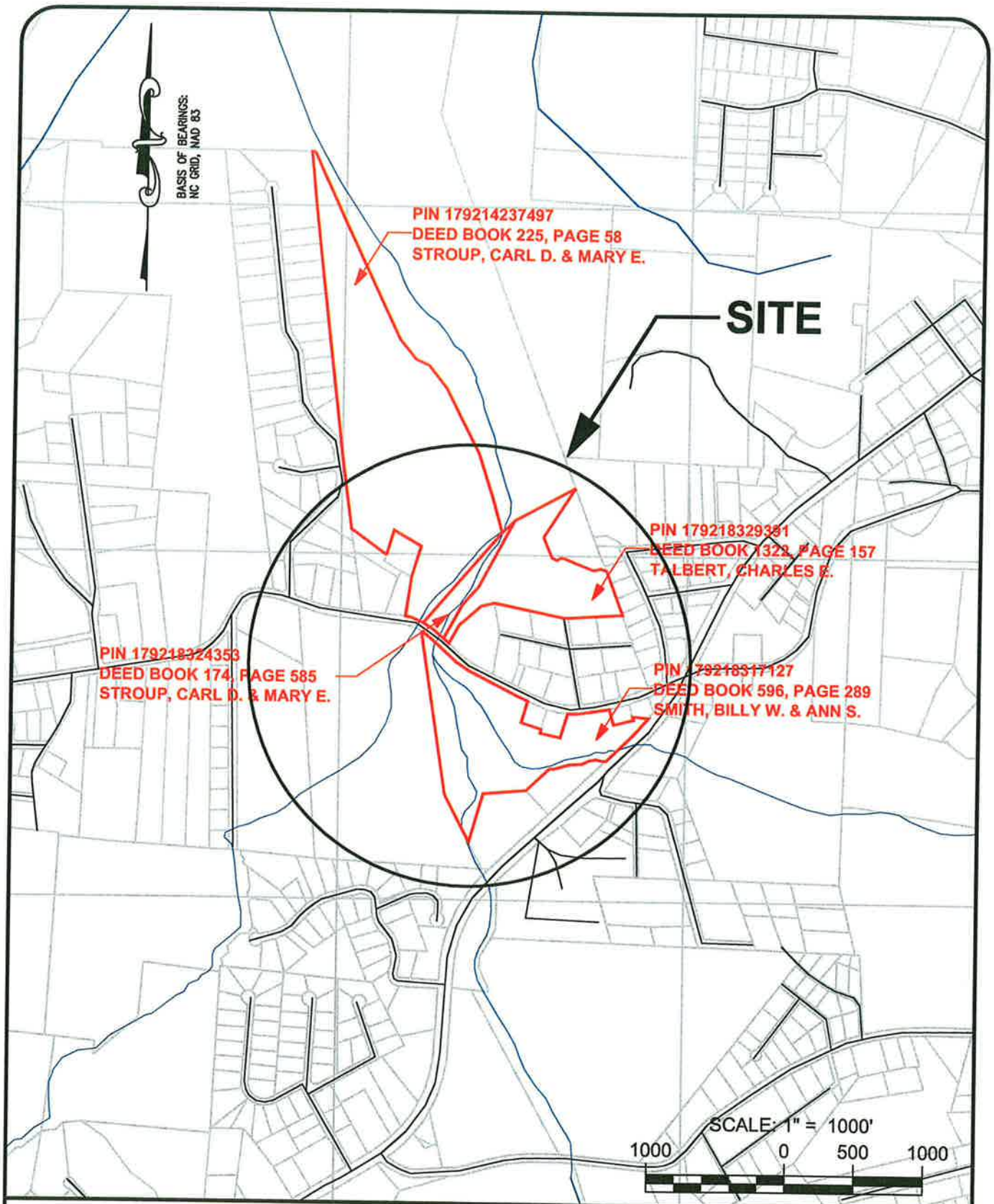

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FIGURE 3
SITE MAP WITH TAX PARCELS
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA
DATE: DECEMBER 2004

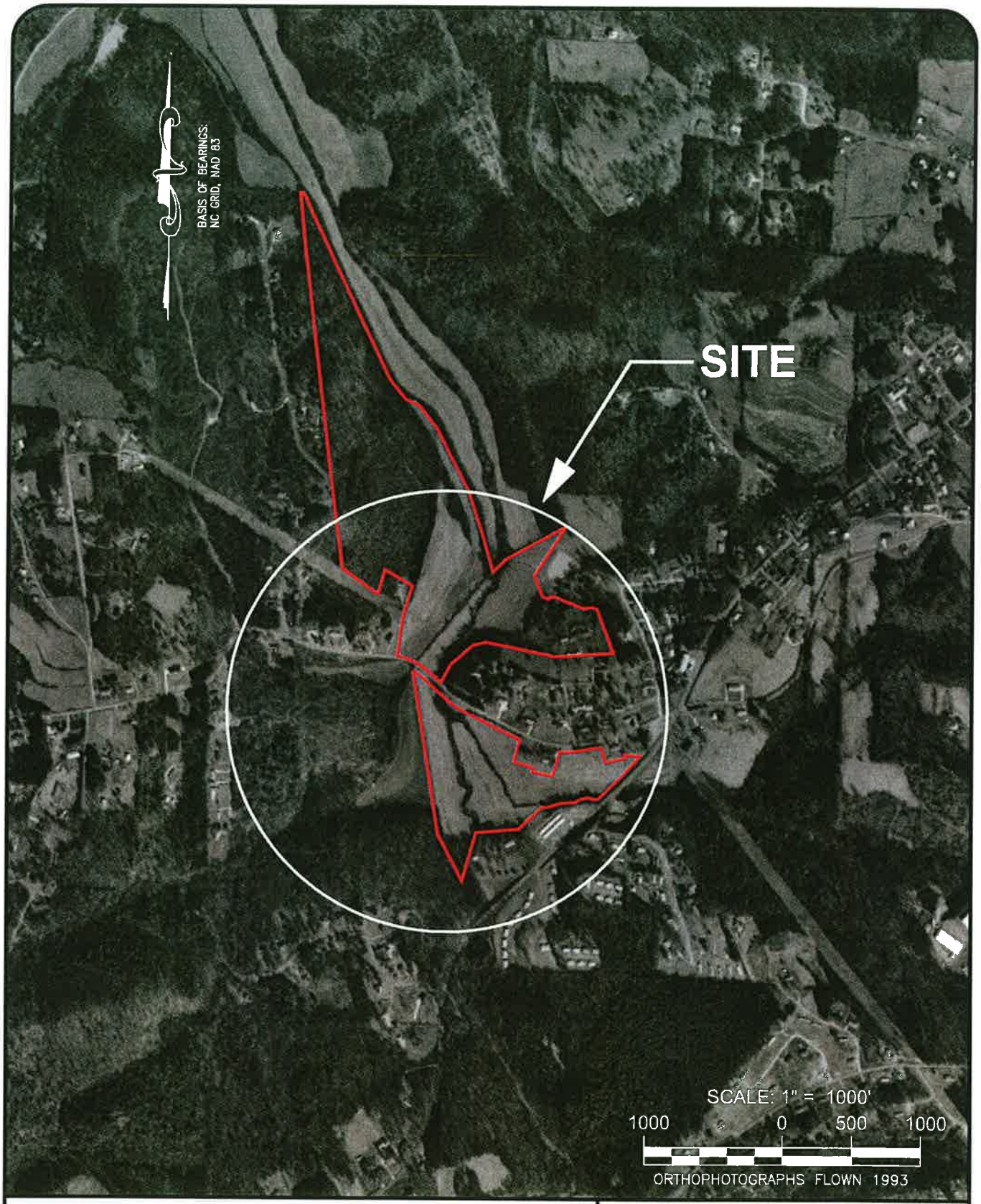

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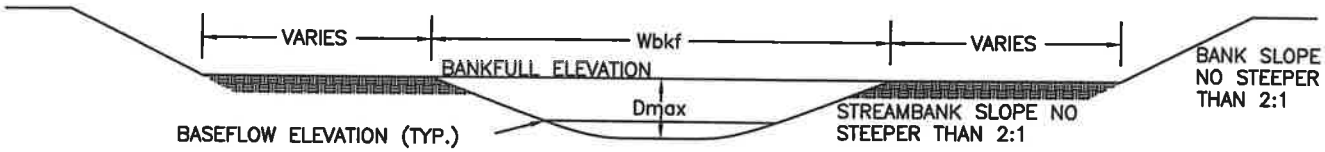
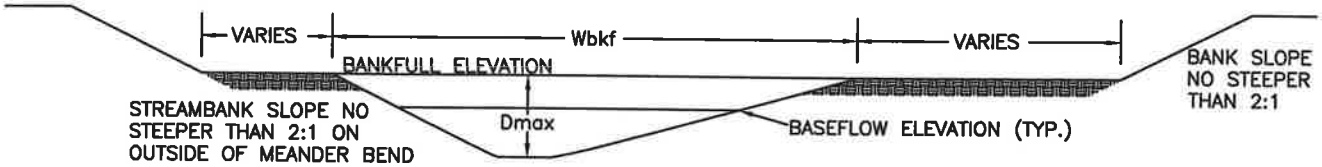
FIGURE 4
SITE MAP WITH ORTHOGRAPHICS
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA
DATE: DECEMBER 2004



TYPICAL RIFFLE CROSS SECTION



TYPICAL POOL CROSS SECTION
(LEFT POOL SHOWN)

TYPICAL CROSS SECTION DATA TABLE	TRIB 1		TRIB 2		UPPER BAILEY		LOWER BAILEY	
	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL
BANKFULL WIDTH (Wbkf, ft)	14	16	16	18	28	32	30	34
MAXIMUM DEPTH (Dmax, ft)	1.8	2.5	2	3.8	4.0	6.7	4.2	7.0
BANKFULL AREA (Abkf, sq ft)	17.5	26	23	36.8	65	100	75	112.5
MEAN DEPTH (Dmean, ft)	1.3	1.6	1.4	2.0	2.3	3.1	2.5	3.3
WIDTH TO DEPTH RATIO (Wbkf/Dmean)	10.8	10.0	11.4	9.0	12.2	10.3	12.0	10.3

NOTE: CORNERS OF DESIGN CHANNEL SHALL BE ROUNDED AND A THALWEG SHALL BE SHAPED DURING CONSTRUCTION, PER THE DIRECTION OF THE ENGINEER.

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FIGURE 7
TYPICAL CROSS SECTIONS
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA
DATE: DECEMBER 2004

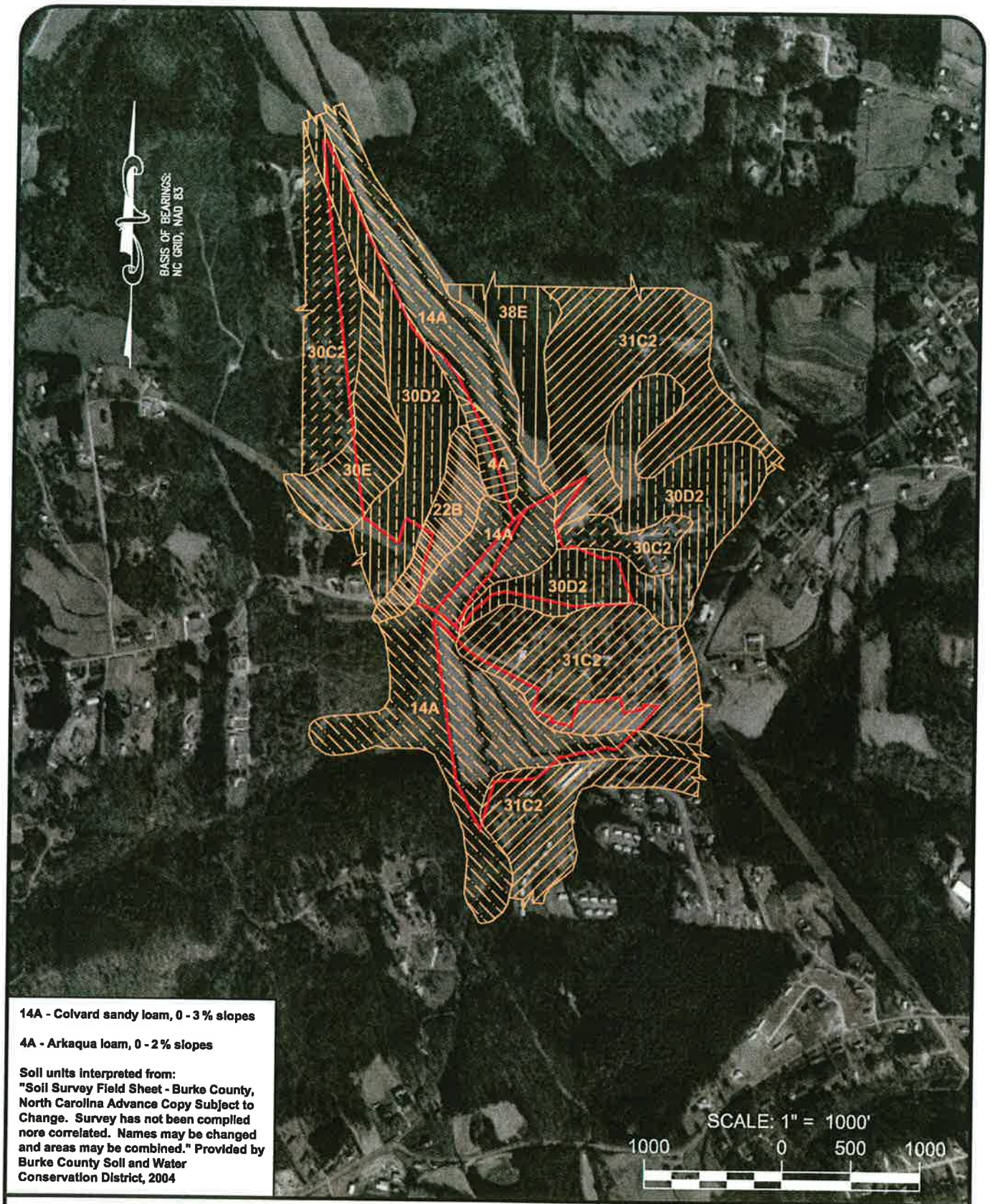

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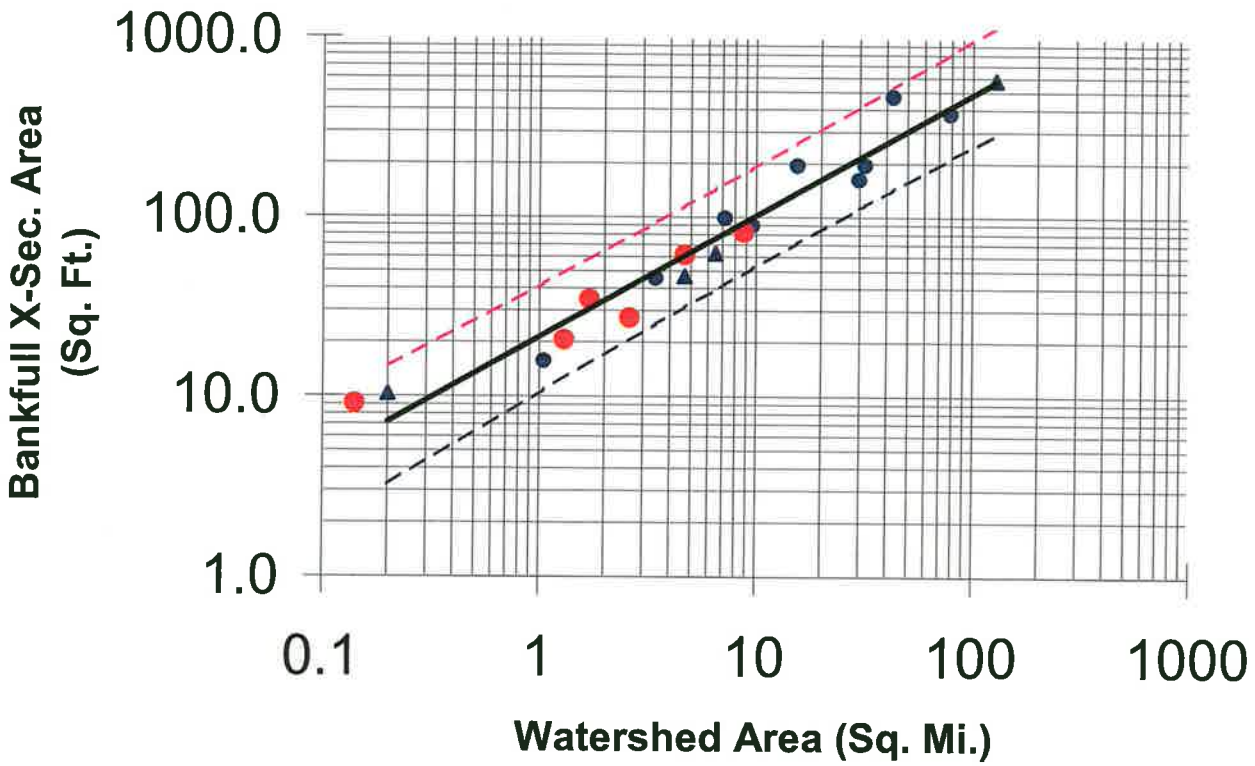
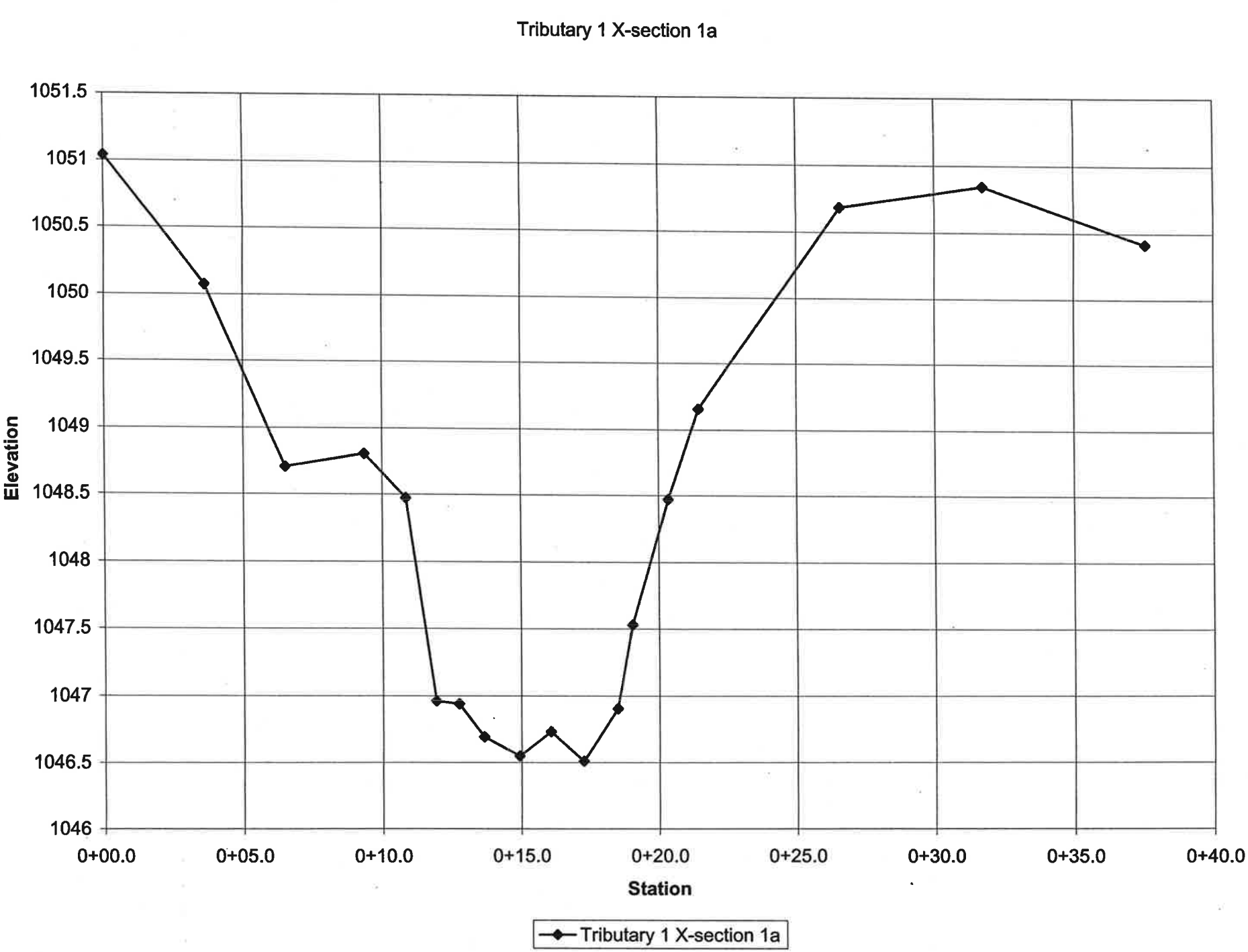
FIGURE 8
SITE MAP WITH SOIL SERIES
BAILEY FORK STREAM RESTORATION
BURKE COUNTY, NORTH CAROLINA
DATE: DECEMBER 2004

Rural Piedmont Regional Curves



--- Lower 95 %
--- Upper 95%
• SRI Reference Data
• NSE Reference Data
— Power (SRI Reference Data)


Tributary 1 X-section 1a
1051.5
1051
1050.5
1050
1049.5
1049
1048.5
1048
1047.5
1047
1046.5
1046
Elevation
0+00.0
0+05.0
0+10.0
0+15.0
0+20.0
0+25.0
0+30.0
0+35.0
0+40.0
Station
Tributary 1 X-section 1a

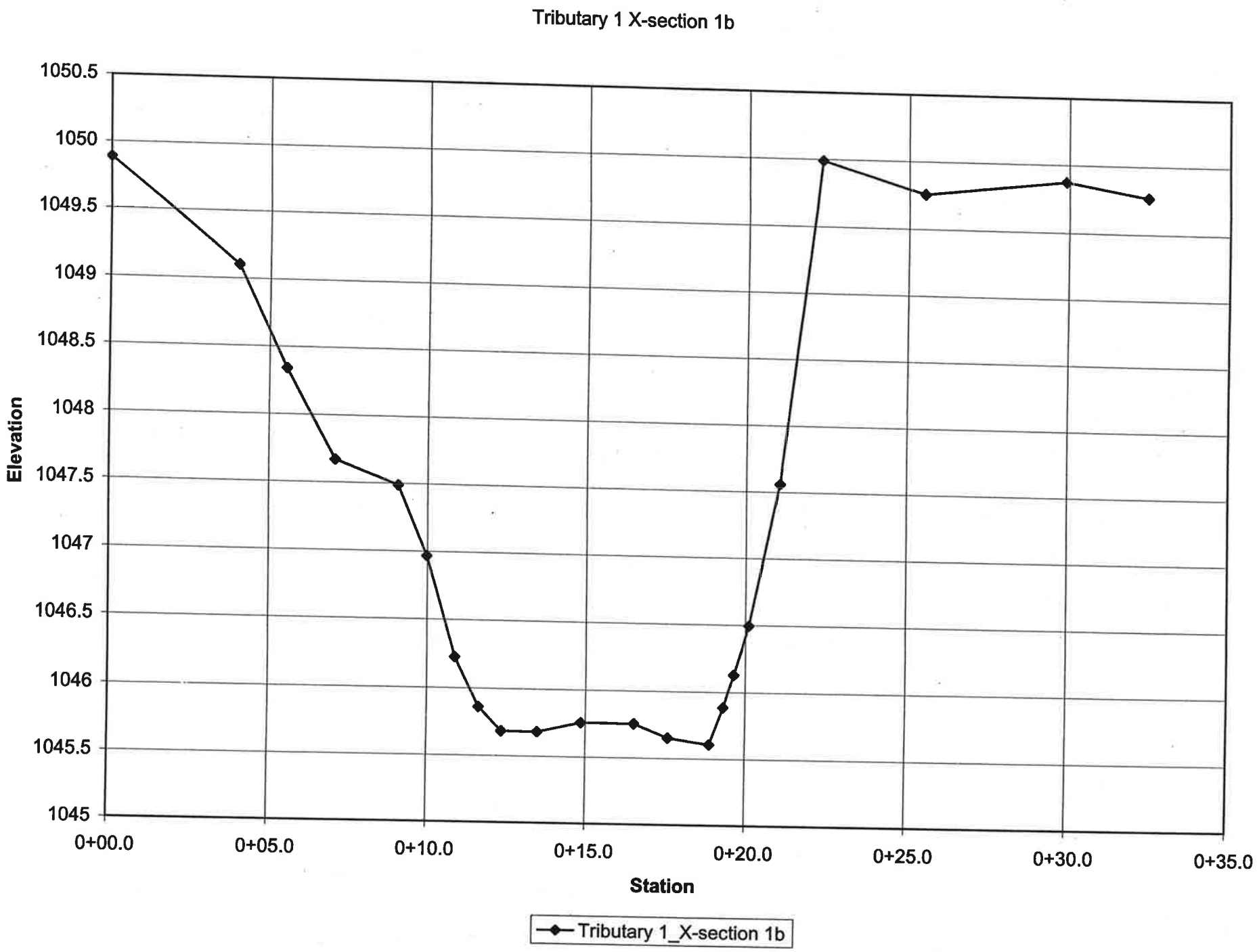
X-section 1a (Riffle) Tributary 1

Point No.	Northing	Easting	Elevation	Description	Distance	Station
5001	721022.5527	1194333.83	1051.04	gn	0	0+00.0
5002	721025.9271	1194332.521	1050.0728	gn	3.62	0+03.6
5003	721028.4262	1194331.083	1048.7064	gn	2.88	0+06.5
5004	721031.2709	1194330.916	1048.8056	bf	2.85	0+09.4
5005	721032.5723	1194330.178	1048.4733	ch	1.50	0+10.8
5006	721033.503	1194329.643	1046.9617	ch	1.07	0+11.9
5007	721034.1515	1194329.127	1046.9398	ew lt	0.83	0+12.8
5008	721034.7426	1194328.447	1046.6921	ck	0.90	0+13.7
5009	721035.5709	1194327.475	1046.5474	tw	1.28	0+14.9
5010	721036.4228	1194326.728	1046.7315	ck	1.13	0+16.1
5011	721037.2956	1194325.924	1046.5078	ck	1.19	0+17.2
5012	721038.2527	1194325.135	1046.9033	ew rt	1.24	0+18.5
5013	721038.7083	1194324.844	1047.5295	ch	0.54	0+19.0
5014	721039.8525	1194324.199	1048.4712	bf	1.31	0+20.3
5015	721040.6602	1194323.447	1049.1563	gn	1.10	0+21.4
5016	721044.8423	1194320.495	1050.6843	gn	5.12	0+26.6
5017	721049.4713	1194318.241	1050.8435	gn	5.15	0+31.7
5018	721054.7747	1194315.801	1050.4148	gn	5.84	0+37.6

Width	Depth	Area		
1.50	0.17	0.25	**max depth**	2.26
1.07	1.09	1.17	**Bkfl.width**	10.99
0.83	1.85	1.54	**Ave depth**	1.56
			w/d	7.06
0.90	1.99	1.79	**Floodprone Elevation**	1051.06
1.28	2.19	2.79	**Floodprone Width**	25
1.13	2.17	2.45	**Entrenchment Ratio**	2.27
1.19	2.19	2.59	**Wetted perimeter**	14.10
1.24	2.10	2.61	**Hydraulic radius**	1.21
0.54	1.59	0.86	**Velocity**	4.79
1.31	0.81	1.06	**Discharge**	81.96

Cross-sectional area **17.11**

Bailey Fork Stream Restoration-Existing Conditions Data Summary												
Channel	X-section	Bankfull Width	Mean Depth	Bankfull X-sectional Area	Width/Depth Ratio	Maximum Depth	Flood-prone Width	Entrenchment Ratio	Water Surface Slope	Channel Sinuosity	Velocity	Discharge
Upper Bailey Fork	2b	26.47	2.71	71.69	9.77	4.96	180.00	6.80	0.0024	1.10	3.72	266.49
	2c	19.90	3.38	67.37	5.88	4.55	180.00	9.04	0.0024	1.10	4.01	270.41
	Average	23.19	3.05	69.53	7.83	4.76	180.00	7.92	0.0024	1.10	3.87	268.45
Lower Bailey Fork	3a	37.42	2.55	95.26	14.70	3.33	70.00	1.87	0.0030	1.10	4.15	395.00
Includes Upper and Lower Bailey	Average	27.93	2.88	78.11	10.12	4.28	143.33	5.90	0.0029	1.10	3.96	310.63
Tributary 1	1a	10.99	1.56	17.11	7.06	2.26	25	2.27	0.0086	1.14	4.79	81.96
	1b	11.98	1.44	17.26	8.31	1.88	17	1.42	0.0086	1.14	4.66	80.37
	1d	9.39	1.54	14.46	6.09	2.53	23	2.45	0.0086	1.14	4.65	67.26
Average		10.79	1.51	16.28	7.15	2.22	21.67	2.05	0.0086	1.14	4.70	76.53
Tributary 2	1	8.4	2.2	18.7	3.8	3.6	150.0	17.9	0.0098	1.10	6.2	116.1
	2	7.6	2.7	20.8	2.8	3.6	150	19.7	0.0098	1.10	6.4	133.5
	3	8.5	2.4	20.8	1.4	3.2	12	1.4	0.0098	1.10	6.6	137.9
	Average	8.2	2.4	20.1	2.7	3.5	104.0	13.0	0.0098	1.10	6.40	129.17

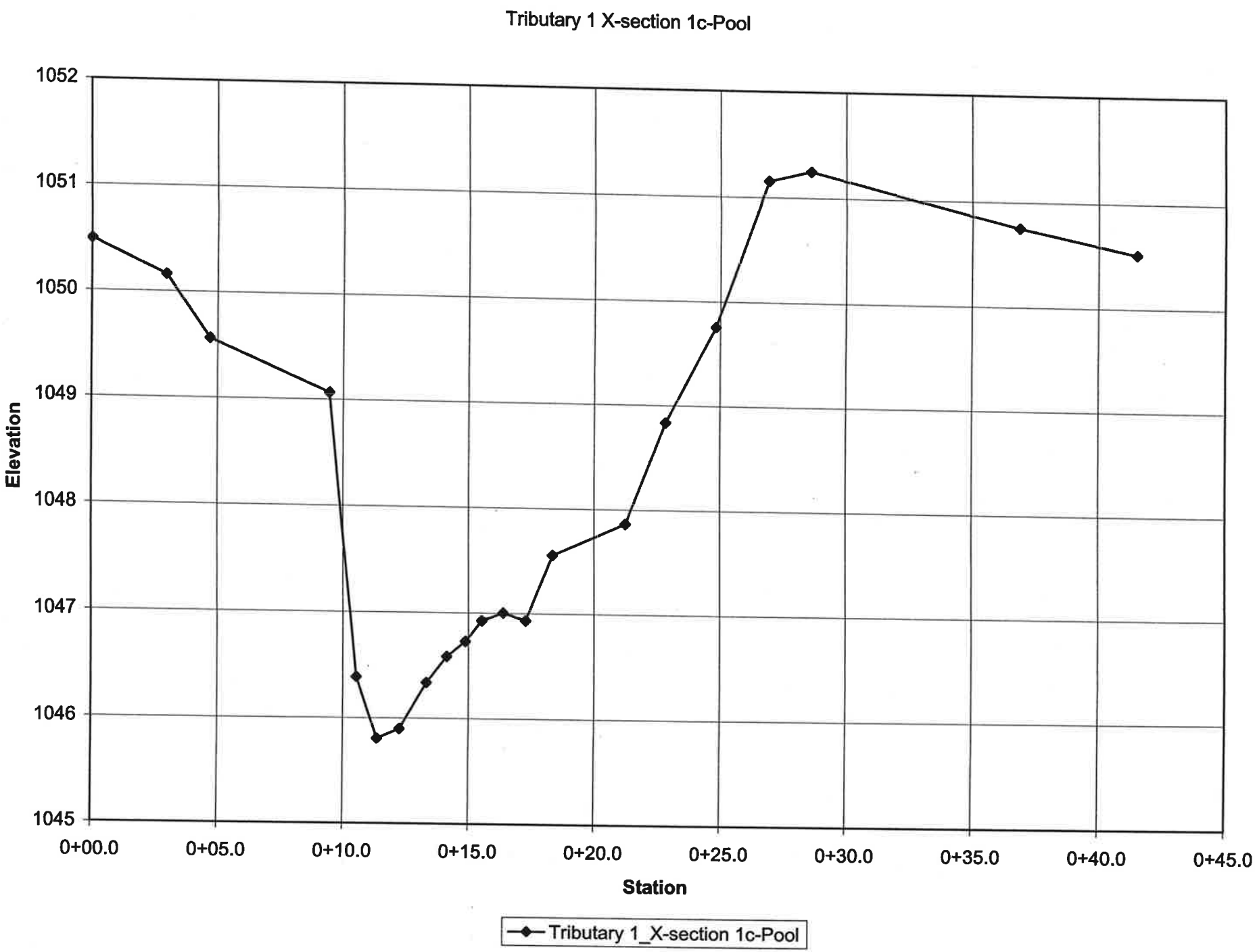

Tributary 1 X-section 1b
1050.5
1050
1049.5
1049
1048.5
1048
1047.5
1047
1046.5
1046
1045.5
1045
Elevation
0+00.0
0+05.0
0+10.0
0+15.0
0+20.0
0+25.0
0+30.0
0+35.0
Station
Tributary 1_X-section 1b

X-section 1b (Riffle) Tributary 1

Point No.	Northing	Easting	Elevation	Description	Distance	Station
5019	720995.8402	1194208.209	1049.8853	gn	0	0+00.0
5020	720999.8633	1194208.165	1049.1029	gn	4.02	0+04.0
5021	721001.3659	1194207.981	1048.3411	gn	1.51	0+05.5
5022	721002.9057	1194208.047	1047.6663	gn	1.54	0+07.1
5023	721004.8827	1194207.919	1047.4874	bf	1.98	0+09.1
5024	721005.7938	1194207.893	1046.9652	ch	0.91	0+10.0
5025	721006.5553	1194208.364	1046.227	ch	0.90	0+10.9
5026	721006.9189	1194207.701	1045.8575	ew	0.76	0+11.6
5027	721007.6348	1194207.592	1045.6815	ck	0.72	0+12.3
5028	721008.7582	1194207.474	1045.6796	ck	1.13	0+13.5
5029	721010.1312	1194207.398	1045.7517	ck	1.38	0+14.9
5030	721011.7503	1194207.05	1045.7516	ck	1.66	0+16.5
5031	721012.8059	1194207.152	1045.6503	ck	1.06	0+17.6
5032	721014.1091	1194207.092	1045.6041	tw	1.30	0+18.9
5033	721014.507	1194206.929	1045.8832	ew rt	0.43	0+19.3
5034	721014.8324	1194206.906	1046.1294	ch	0.33	0+19.6
5035	721015.2588	1194206.719	1046.4939	ch	0.47	0+20.1
5036	721016.1961	1194206.61	1047.5571	bf	0.94	0+21.0
5037	721017.4391	1194206.736	1049.9892	gn	1.25	0+22.3
5038	721020.6274	1194206.908	1049.7535	gn	3.19	0+25.5
5039	721024.942	1194207.776	1049.8694	gn	4.40	0+29.9
5040	721027.4897	1194207.734	1049.7636	gn	2.55	0+32.4

Width	Depth	Area		
0.91	0.26	0.24	**max depth**	1.88
0.90	0.89	0.80	**Bkfl.width**	11.98
0.76	1.45	1.09	**Ave depth**	1.44
			w/d	8.31
0.72	1.72	1.24	**Floodprone Elevation**	1049.37
1.13	1.81	2.04	**Floodprone Width**	17
			Entrenchment	
1.38	1.77	2.44	**Ratio**	1.42
1.66	1.74	2.87	**Wetted perimeter**	14.86
			Hydraulic	
1.06	1.79	1.89	**radius**	1.16
1.30	1.86	2.43	**Velocity**	4.66
0.43	1.74	0.75	**Discharge**	80.37
0.33	1.48	0.48		
0.47	1.18	0.55		
0.94	0.46	0.44		

Cross-sectional area **17.26**


Tributary 1 X-section 1c-Pool
1052
1051
1050
1049
1048
1047
1046
1045
Elevation
0+00.0
0+05.0
0+10.0
0+15.0
0+20.0
0+25.0
0+30.0
0+35.0
0+40.0
0+45.0
Station
Tributary 1_X-section 1c-Pool

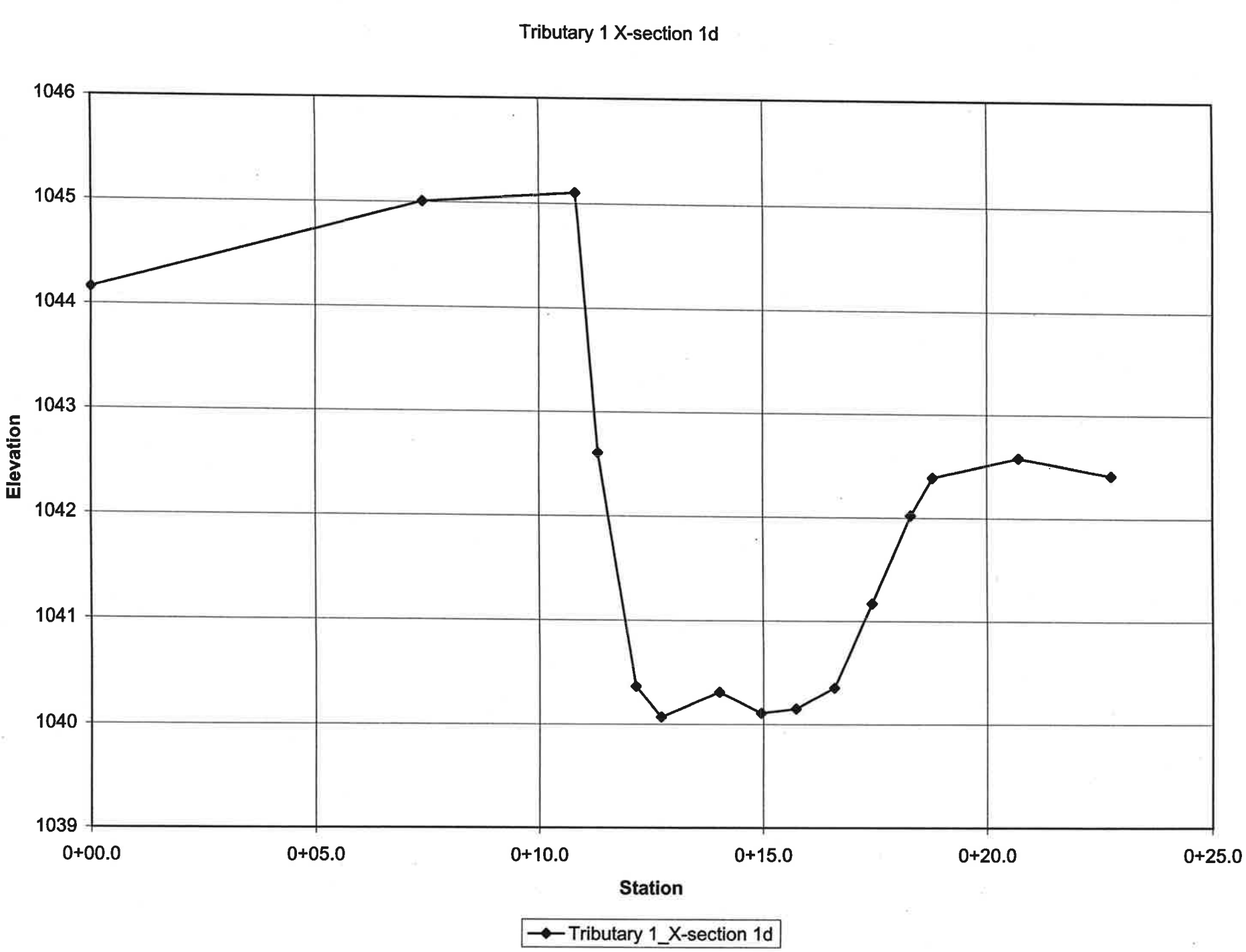
X-section 1c (Pool) Tributary 1 X-section 20 feet upstream of X-section 1a

Point No.	Northing	Easting	Elevation	Description	Distance	Station
5041	721024.3319	1194345.659	1050.486	gn	0	0+00.0
5042	721027.1612	1194344.836	1050.1573	gn	2.95	0+02.9
5043	721028.857	1194344.452	1049.5558	gn	1.74	0+04.7
5044	721033.4098	1194343.092	1049.0612	bf	4.75	0+09.4
5045	721034.4261	1194342.713	1046.3886	ch	1.08	0+10.5
5046	721035.173	1194342.357	1045.8015	tw	0.83	0+11.3
5047	721036.0316	1194342.116	1045.8949	ck	0.89	0+12.2
5048	721037.0285	1194341.696	1046.3394	ck	1.08	0+13.3
5049	721037.7874	1194341.42	1046.5883	ck	0.81	0+14.1
5050	721038.499	1194341.213	1046.7301	ew rt	0.74	0+14.9
5051	721039.1228	1194341.021	1046.9252	ch	0.65	0+15.5
5052	721039.9255	1194340.745	1047.002	ch	0.85	0+16.4
5053	721040.7868	1194340.536	1046.9302	ch	0.89	0+17.3
5054	721041.7076	1194339.978	1047.556	ch	1.08	0+18.3
5055	721044.0784	1194338.319	1047.8609	ch	2.89	0+21.2
5056	721045.4765	1194337.562	1048.8296	bf	1.59	0+22.8
5057	721047.1061	1194336.41	1049.7491	gn	2.00	0+24.8
5058	721049.0526	1194335.666	1051.1553	gn	2.08	0+26.9
5059	721050.6579	1194335.196	1051.2502	gn	1.67	0+28.6
5060	721057.9476	1194331.298	1050.7531	gn	8.27	0+36.8
5061	721062.024	1194329.07	1050.515	gn	4.65	0+41.5

Width	Depth	Area
1.08	1.34	1.45
0.83	2.97	2.45
0.89	3.21	2.87
1.08	2.94	3.18
0.81	2.60	2.10
0.74	2.40	1.78
0.65	2.23	1.46
0.85	2.10	1.78
0.89	2.10	1.86
1.08	1.82	1.96
2.89	1.35	3.91
1.59	0.72	1.14

max depth	3.26
Bkfl.width	13.38
Ave depth	1.94
w/d	6.90

Cross-sectional area **25.94**

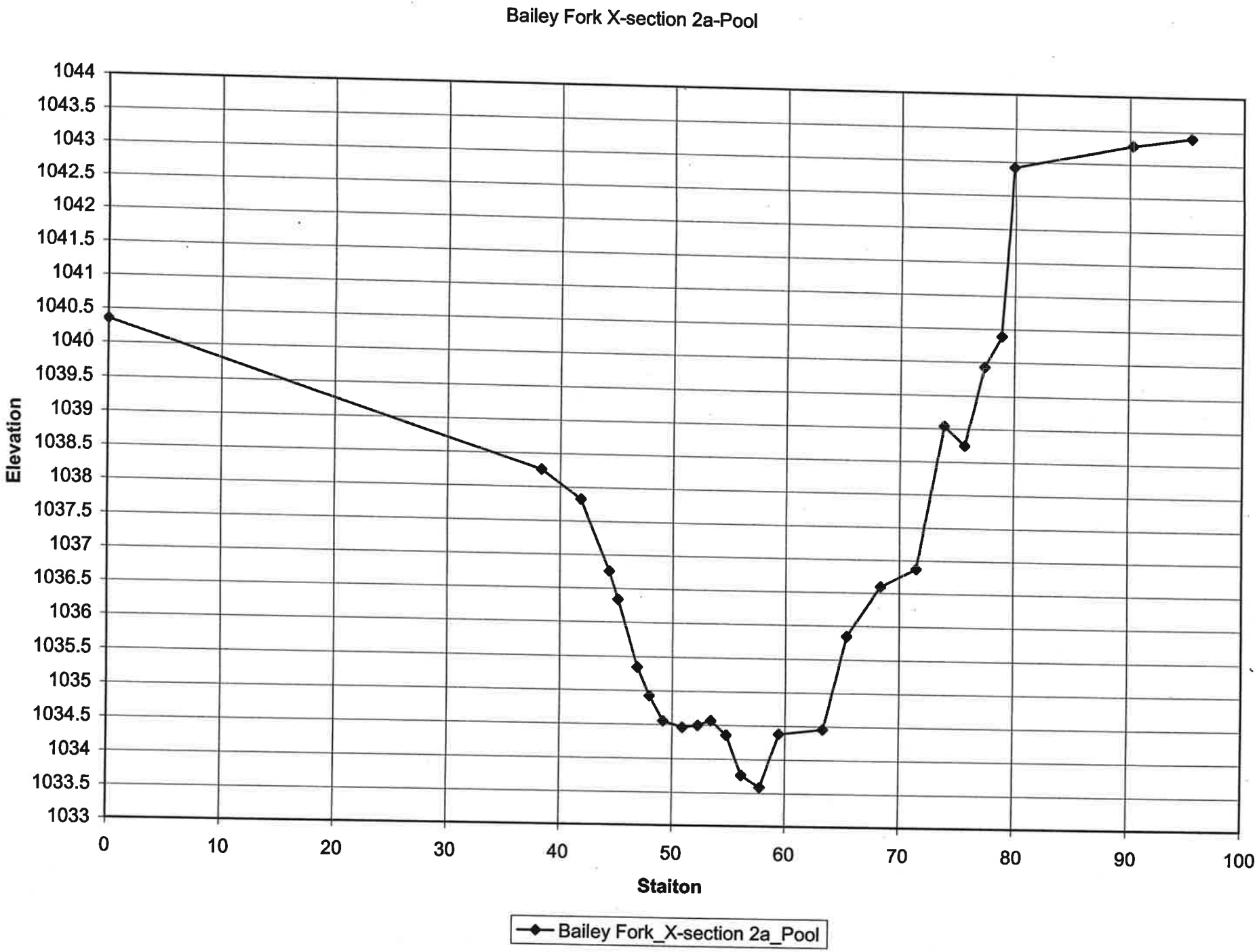

Tributary 1 X-section 1d
1046
1045
1044
1043
1042
1041
1040
1039
Elevation
0+00.0
0+05.0
0+10.0
0+15.0
0+20.0
0+25.0
Station
Tributary 1_X-section 1d

X-section 1d (Riffle) Tributary 1 Downstream-most X-section

Point No.	Northing	Easting	Elevation	Description	Distance	Station
5109	721066.4992	1193716.407	1044.1597	gn	0	0+00.0
5110	721069.4192	1193723.194	1045.0045	gn	7.39	0+07.4
5111	721070.2696	1193726.508	1045.0976	gn	3.42	0+10.8
			1042.6	bf	0.50	0+11.3
5112	721070.9656	1193726.966	1040.3634	ew lt	0.83	0+12.1
5113	721070.5667	1193727.373	1040.0664	tw	0.57	0+12.7
5114	721070.9721	1193728.606	1040.3085	ck	1.30	0+14.0
5115	721071.2387	1193729.499	1040.1053	ck	0.93	0+14.9
5116	721071.2844	1193730.275	1040.1454	ck	0.78	0+15.7
5117	721071.6366	1193731.056	1040.3515	ew rt	0.86	0+16.6
5118	721071.5837	1193731.905	1041.1652	ch	0.85	0+17.4
5119	721071.8862	1193732.72	1042.0174	ch	0.87	0+18.3
5120	721071.4091	1193732.817	1042.3835	bf	0.49	0+18.8
5121	721071.6383	1193734.715	1042.5737	gn	1.91	0+20.7
5122	721071.6719	1193736.768	1042.4082	gn	2.05	0+22.7

Width	Depth	Area		
0.83	1.12	0.93	max depth	2.53
0.57	2.39	1.36	Bkfl.width	9.39
1.30	2.41	3.13	Ave depth	1.54
0.93	2.39	2.23	w/d	6.09
0.78	2.47	1.92	Floodprone Elevation	1045.13
0.86	2.35	2.02	Floodprone Width	23
0.85	1.84	1.57	Entrenchment Ratio	2.45
0.87	1.01	0.88	Wetted perimeter	12.47
0.49	0.40	0.19	Hydraulic radius	1.16
1.91	0.12	0.23	Velocity	4.65
			Discharge	67.26

Cross-sectional area **14.46** Highly eroding and migrating channel reach


Bailey Fork X-section 2a-Pool
Elevation
1044
1043.5
1043
1042.5
1042
1041.5
1041
1040.5
1040
1039.5
1039
1038.5
1038
1037.5
1037
1036.5
1036
1035.5
1035
1034.5
1034
1033.5
1033
0
10
20
30
40
50
60
70
80
90
100
Staiton
Bailey Fork_X-section 2a_Pool

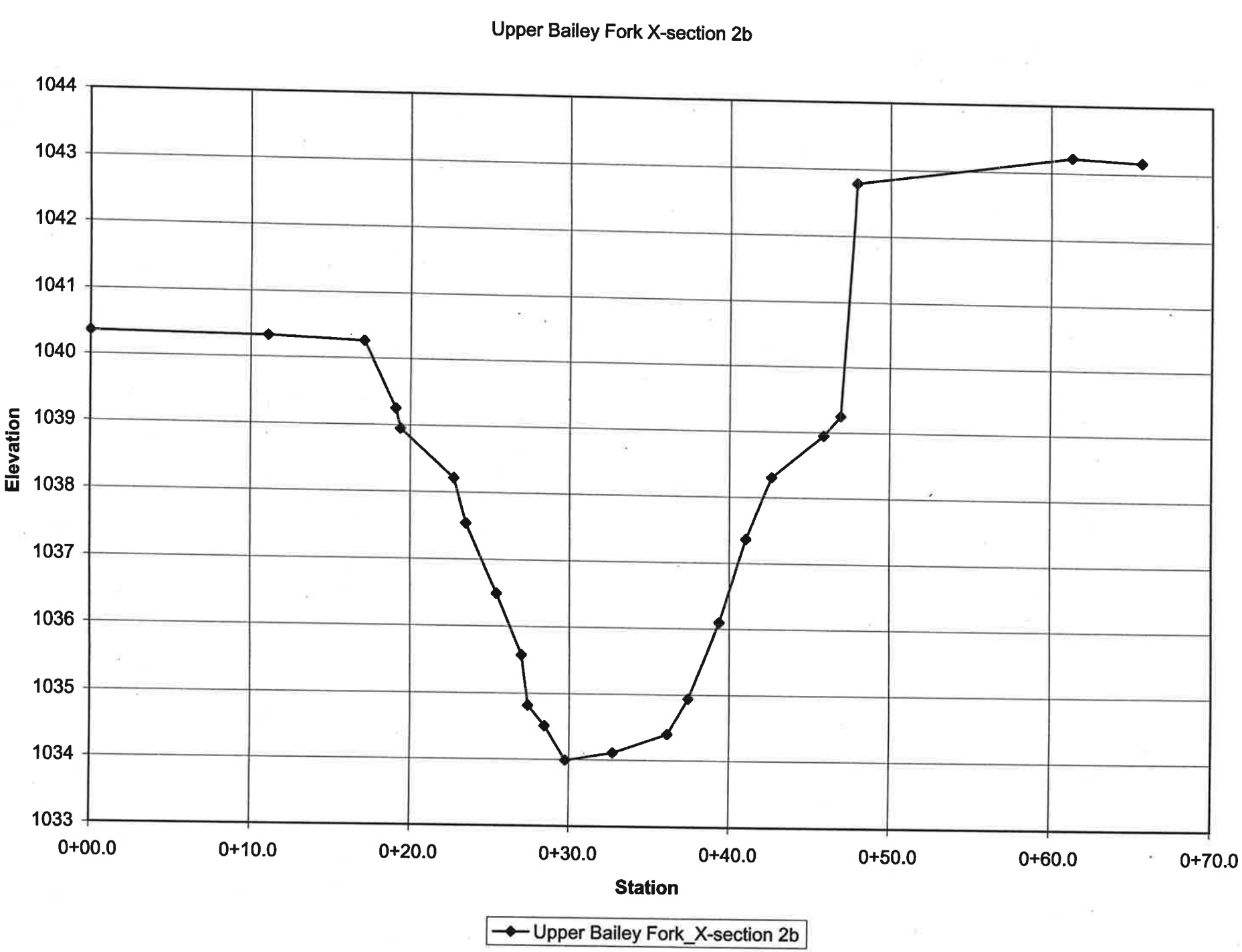
X-section 2a (Pool) Upper Bailey Fork

Point No.	Northing	Easting	Elevation	Description	Distance	Station
5087	720888.3828	1193501.028	1040.3522	gn	0	0
5062	720922.583	1193483.764	1038.2553	bf	38.31	0+38.3
5063	720925.8838	1193482.547	1037.8221	ch	3.52	0+41.8
5064	720928.216	1193481.54	1036.7539	ch	2.54	0+44.4
5065	720928.8216	1193481.064	1036.331	ch	0.77	0+45.1
5066	720930.4482	1193480.458	1035.3421	ch	1.74	0+46.9
5067	720931.4999	1193480.207	1034.9231	ch	1.08	0+48.0
5068	720932.5956	1193479.636	1034.5517	ew lt	1.24	0+49.2
5069	720934.3065	1193479.634	1034.4582	ck	1.71	0+50.9
5070	720935.5931	1193479.213	1034.493	ck	1.35	0+52.3
5071	720936.7251	1193478.99	1034.5622	ck	1.15	0+53.4
5072	720938.0159	1193478.551	1034.3562	ck	1.36	0+54.8
5073	720939.3328	1193478.248	1033.7627	ck	1.35	0+56.1
5074	720940.8902	1193477.81	1033.5839	tw	1.62	0+57.7
5075	720942.5174	1193477.358	1034.379	ck	1.69	0+59.4
5076	720945.9556	1193475.611	1034.4522	ew rt	3.86	0+63.3
5077	720947.9014	1193474.982	1035.841	ch	2.05	0+65.3
5078	720950.8671	1193474.675	1036.5906	ch	2.98	0+68.3
5079	720953.9775	1193474.925	1036.864	ch	3.12	0+71.4
5080	720956.3473	1193475.26	1039.0317	bf	2.39	0+73.8
5081	720958.1319	1193475.157	1038.7383	gn	1.79	0+75.6
5082	720959.8611	1193475.021	1039.9248	gn	1.73	0+77.4
5083	720961.155	1193474.363	1040.3878	gn	1.45	0+78.8
5084	720962.1961	1193474.114	1042.9188	gn	1.07	0+79.9
5085	720972.5362	1193473.899	1043.2709	gn	10.34	0+90.2
5086	720977.6835	1193474.129	1043.3932	gn	5.15	0+95.4

Width	Depth	Area
3.52	0.22	0.76
2.54	0.97	2.46
0.77	1.71	1.32
1.74	2.42	4.20
1.08	3.12	3.38
1.24	3.52	4.35
1.71	3.75	6.42
1.35	3.78	5.12
1.15	3.73	4.30
1.36	3.80	5.18
1.35	4.20	5.67
1.62	4.58	7.41
1.69	4.27	7.22
3.86	3.84	14.81
2.05	3.11	6.36
2.98	2.04	6.08
3.12	1.53	4.77
2.39	0.31	0.74

Cross-sectional area **90.52**

max depth	4.67
Bkfl.width	35.52
Ave depth	2.55
w/d	13.94
Wetted perimeter	40.61
Hydraulic radius	2.23
Velocity	3.70
Discharge	334.57


Upper Bailey Fork X-section 2b
1044
1043
1042
1041
1040
1039
1038
1037
1036
1035
1034
1033
Elevation
0+00.0
0+10.0
0+20.0
0+30.0
0+40.0
0+50.0
0+60.0
0+70.0
Station
Upper Bailey Fork_X-section 2b

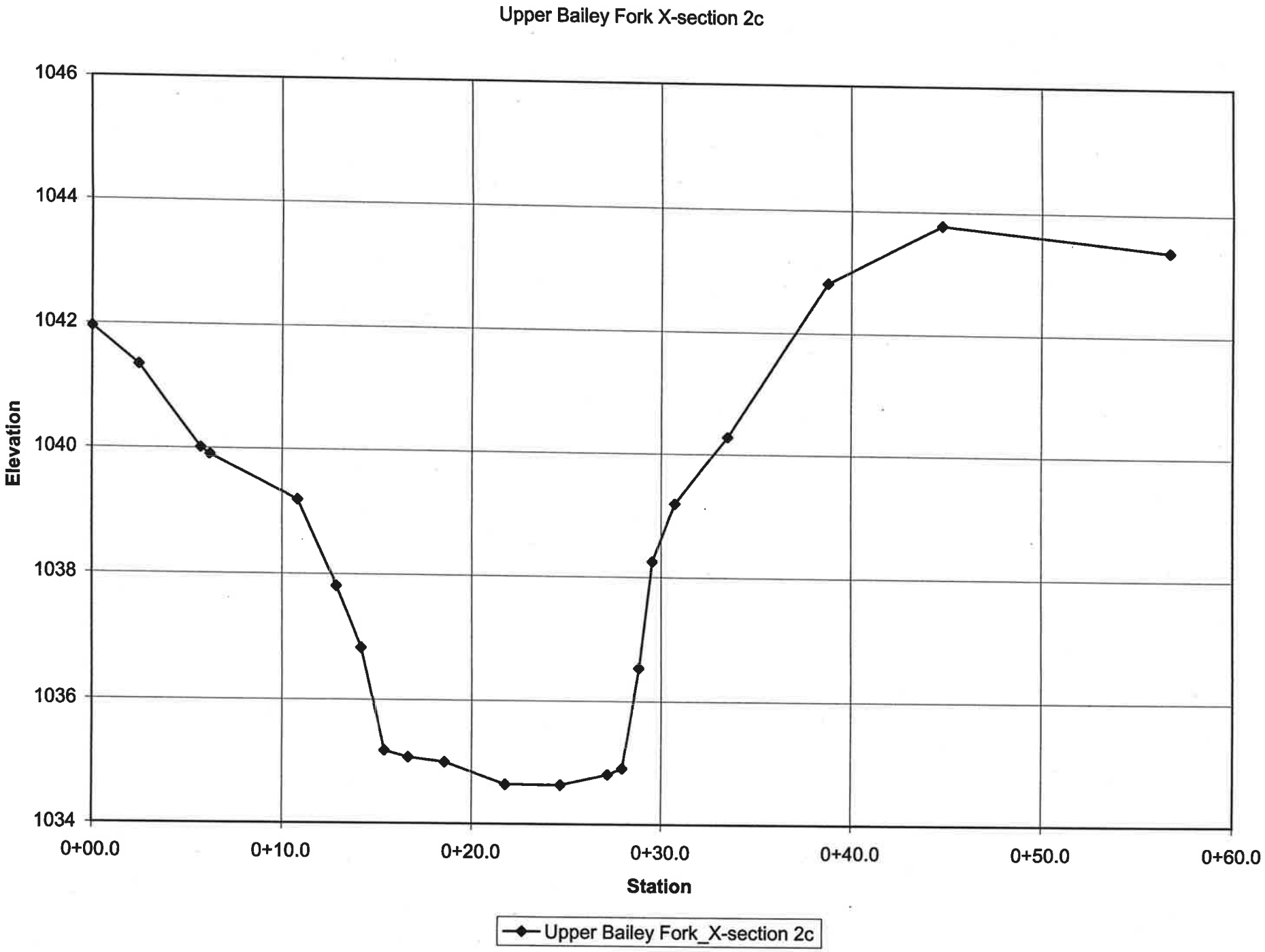
X-section 2b (Riffle) Upper Bailey Fork

Point No.	Northing	Easting	Elevation	Description	Distance	Station
5087	720888.3828	1193501.028	1040.3522	gn	0	0+00.0
5088	720890.4835	1193511.912	1040.3181	gn	11.08	0+11.1
5089	720892.62	1193517.519	1040.2577	gn	6.00	0+17.1
			1039.2436	gn	2.00	0+19.1
		bankfull	1038.9406	bf	0.30	0+19.4
5090	720893.5658	1193520.727	1038.2074	ch	3.34	0+22.7
5091	720894.3125	1193520.936	1037.5389	bf	0.78	0+23.5
5092	720894.4781	1193522.84	1036.4858	ch	1.91	0+25.4
5093	720895.3051	1193524.183	1035.5708	ch	1.58	0+27.0
5094	720895.6783	1193524.306	1034.8146	ew lt	0.39	0+27.4
5095	720895.0303	1193525.132	1034.5052	ck	1.05	0+28.4
5096	720895.2749	1193526.429	1033.9849	tw	1.32	0+29.8
5097	720894.6447	1193529.32	1034.1001	ck	2.96	0+32.7
5098	720894.6875	1193532.726	1034.3911	ck	3.41	0+36.1
5099	720894.7197	1193534.037	1034.9343	ew rt	1.31	0+37.4
5100	720895.1753	1193535.908	1036.0928	ch	1.93	0+39.4
5101	720895.3882	1193537.556	1037.3624	ch	1.66	0+41.0
5102	720895.2257	1193539.145	1038.2962	ch	1.60	0+42.6
5103	720896.117	1193542.256	1038.9406	bf	3.24	0+45.9
5104	720896.3702	1193543.287	1039.2436	gn	1.06	0+46.9
5106	720896.1791	1193544.249	1042.7812	gn	0.98	0+47.9
5107	720898.0941	1193557.461	1043.2174	gn	13.35	0+61.2
5108	720898.896	1193561.706	1043.1607	gn	4.32	0+65.6

Width	Depth	Area
3.34	0.37	1.23
0.78	1.07	0.83
1.91	1.93	3.68
1.58	2.91	4.60
0.39	3.75	1.47
1.05	4.28	4.50
1.32	4.70	6.20
2.96	4.90	14.49
3.41	4.69	15.99
1.31	4.28	5.61
1.93	3.43	6.60
1.66	2.21	3.68
1.60	1.11	1.77
3.24	0.32	1.04

Cross-sectional area **71.69**

max depth	4.96
Bkfl.width	26.47
Ave depth	2.71
w/d	9.77
Floodprone Elevation	1043.90
Floodprone Width	180
Entrenchment Ratio	6.80
Wetted perimeter	31.89
Hydraulic radius	2.25
Velocity	3.72
Discharge	266.49

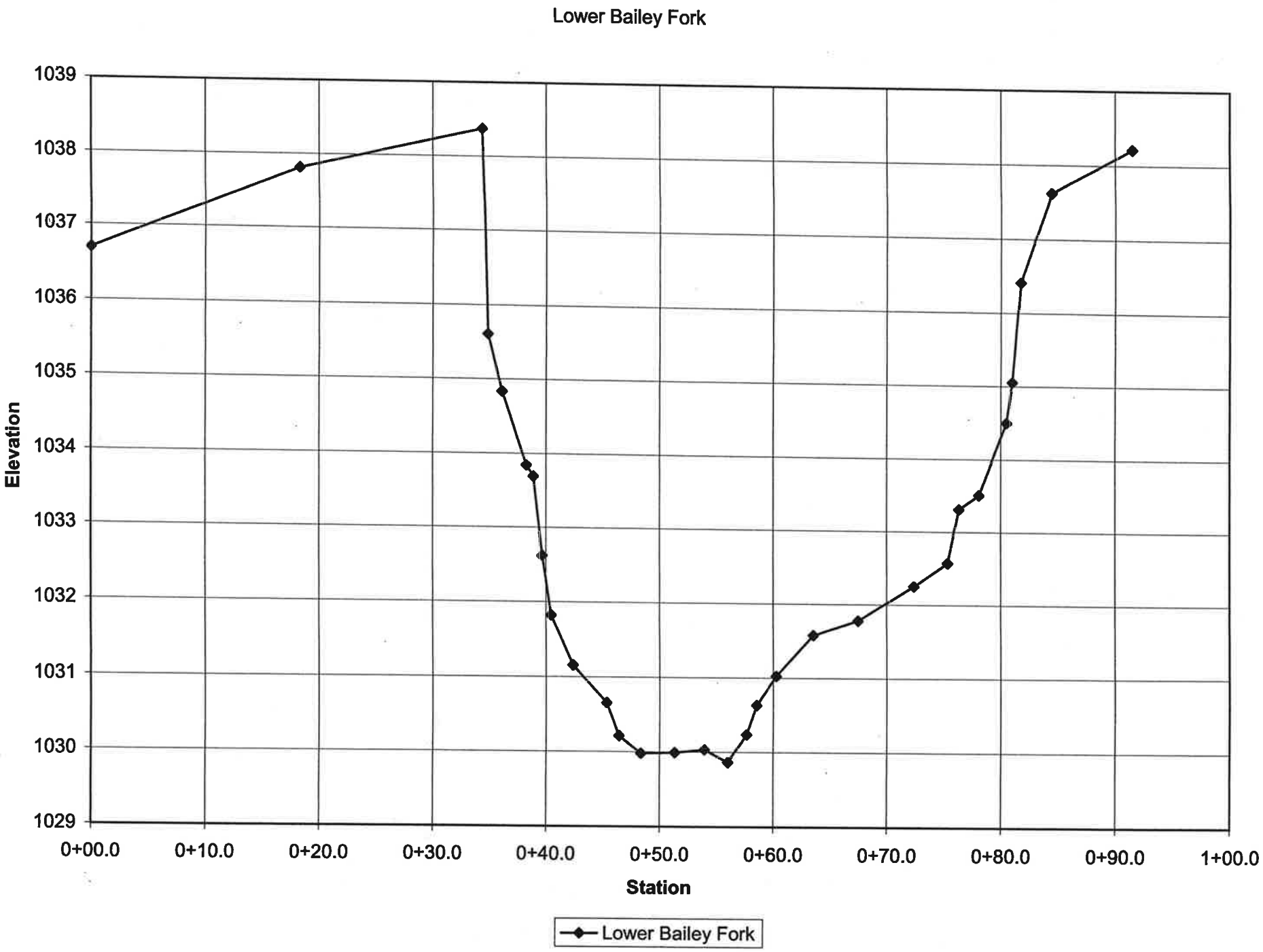

Upper Bailey Fork X-section 2c
1046
1044
1042
1040
1038
1036
1034
Elevation
0+00.0
0+10.0
0+20.0
0+30.0
0+40.0
0+50.0
0+60.0
Station
Upper Bailey Fork_X-section 2c

X-section 2c (Riffle) Upper Bailey Fork Upper-most X-section

Point No.	Northing	Easting	Elevation	Description	Distance	Station
5123	720849.2408	1193517.124	1041.954	gn	0	0+00.0
5124	720849.4436	1193519.564	1041.3407	gn	2.45	0+02.4
5125	720848.6144	1193522.708	1040.0077	gn	3.25	0+05.7
5126	720848.6142	1193524.796	1039.9006	gn	0.50	0+06.2
5127	720848.3652	1193527.323	1039.1834	bf	4.62	0+10.8
5128	720848.3465	1193529.371	1037.8077	ch	2.05	0+12.9
5129	720848.4078	1193530.67	1036.8265	ch	1.30	0+14.2
5130	720848.1101	1193531.866	1035.1744	ew lt	1.23	0+15.4
5131	720848.6809	1193532.995	1035.0651	ck	1.27	0+16.7
5132	720848.1842	1193534.854	1034.9917	ck	1.92	0+18.6
5133	720848.2834	1193538.045	1034.635	ck	3.19	0+21.8
5134	720849.2341	1193540.795	1034.6323	tw	2.91	0+24.7
5135	720849.2786	1193543.285	1034.8042	ck	2.49	0+27.2
5136	720849.6192	1193543.967	1034.9016	ew rt	0.76	0+27.9
5137	720849.755	1193544.835	1036.5309	ch	0.88	0+28.8
5138	720849.8981	1193545.52	1038.2513	ch	0.70	0+29.5
		extrapolated	1039.1834	bf	1.20	0+30.7
5139	720849.7686	1193548.278	1040.2816	gn	2.76	0+33.5
5140	720849.5671	1193553.543	1042.8191	gn	5.27	0+38.8
5141	720850.3412	1193559.485	1043.7735	gn	5.99	0+44.7
5142	720853.2352	1193571.06	1043.3836	gn	11.93	0+56.7

Width	Depth	Area		
2.05	0.69	1.41	**max depth**	4.55
1.30	1.87	2.43	**Bkfl.width**	19.90
1.23	3.18	3.92	**Ave depth**	3.38
			w/d	5.88
1.27	4.06	5.14	**Floodprone Elevation**	1043.73
1.92	4.15	7.99	**Floodprone Width**	180
3.19	4.37	13.95	**Entrenchment Ratio**	9.04
2.91	4.55	13.24	**Wetted perimeter**	26.67
2.49	4.47	11.12	**Hydraulic radius**	2.53
0.76	4.33	3.30	**Velocity**	4.01
0.88	3.47	3.05	**Discharge**	270.41
0.70	1.79	1.26		
1.20	0.47	0.56		

Cross-sectional area **67.37**


Lower Bailey Fork
1039
1038
1037
1036
1035
1034
1033
1032
1031
1030
1029
Elevation
0+00.0
0+10.0
0+20.0
0+30.0
0+40.0
0+50.0
0+60.0
0+70.0
0+80.0
0+90.0
1+00.0
Station
Lower Bailey Fork

X-section 3a (Riffle) Lower Bailey Fork

Point No.	Northing	Easting	Elevation	Description	Distance	Station
5143	722167.2098	1193314.279	1036.6993	gn	0	0+00.0
5144	722154.9965	1193327.933	1037.8146	gn	18.32	0+18.3
5145	722143.7441	1193339.386	1038.3726	gn	16.06	0+34.4
5146	722143.0659	1193340.284	1035.606	bf	0.50	0+34.9
5147	722142.7849	1193340.189	1034.8358	ch	1.25	0+36.1
5148	722141.2764	1193341.709	1033.8518	ch	2.14	0+38.3
5149	722140.8776	1193342.172	1033.699	bf	0.61	0+38.9
5150	722140.1395	1193342.496	1032.6302	ch	0.81	0+39.7
5151	722139.6607	1193343.102	1031.8241	ch	0.77	0+40.5
5152	722138.2642	1193344.402	1031.1606	ch	1.91	0+42.4
5153	722136.3168	1193346.631	1030.6642	ew lt	2.96	0+45.3
5154	722135.3189	1193347.064	1030.2194	ck	1.09	0+46.4
5155	722134.01	1193348.499	1029.982	tw	1.94	0+48.4
5156	722131.8291	1193350.543	1029.9964	ck	2.99	0+51.3
5157	722129.7297	1193352.088	1030.0372	ck	2.61	0+54.0
5158	722128.425	1193353.672	1029.867	ck	2.05	0+56.0
5159	722127.461	1193355.011	1030.2441	ck	1.65	0+57.7
5160	722126.8713	1193355.658	1030.6418	ew rt	0.88	0+58.5
5161	722125.6971	1193356.959	1031.0275	ch	1.75	0+60.3
5162	722123.2439	1193359.112	1031.5833	ch	3.26	0+63.5
5163	722120.4336	1193361.873	1031.7843	ch	3.94	0+67.5
5164	722117.1869	1193365.515	1032.2617	ch	4.88	0+72.4
5165	722114.8825	1193367.34	1032.579	ch	2.94	0+75.3
5172	722114.1279	1193368.65	1033.3151	bf	1.00	0+76.3
5166	722113.6746	1193368.6	1033.513	bf	1.74	0+78.0
5167	722111.7005	1193370.006	1034.5005	gn	2.42	0+80.5
5168	722111.3325	1193370.367	1035.0549	gn	0.52	0+81.0
5169	722110.999	1193370.979	1036.4147	gn	0.70	0+81.7
5170	722108.5792	1193372.215	1037.627	gn	2.72	0+84.4
5171	722102.9424	1193376.435	1038.2131	gn	7.04	0+91.4

Width	Depth	Area
0.81	0.53	0.43
0.77	1.47	1.14
1.91	2.21	4.21
2.96	2.79	8.25
1.09	3.26	3.54
1.94	3.60	6.99
2.99	3.71	11.09
2.61	3.68	9.60
2.05	3.75	7.69
1.65	3.64	6.01
0.88	3.26	2.85
1.75	2.86	5.02
3.26	2.39	7.81
3.94	2.02	7.94
4.88	1.68	8.18
2.94	1.28	3.76
1.00	0.75	0.75

Cross-sectional area **95.26**

max depth	3.45
Bkfl.width	37.42
Ave depth	2.55
w/d	14.70
Floodprone Elevation	1036.88
Floodprone Width	70
Entrenchment Ratio	1.87
Wetted perimeter	42.52
Hydraulic radius	2.24
Velocity	4.15
Discharge	395.00

Pre-Construction Notification (PCN) Application Form

For Section 404 and/or Section 10 Nationwide, Regional and General Permits, Section 401 General Water Quality Certifications, and Riparian Buffer and Watershed Buffer Rules

This form is to be used for projects qualifying for any of the U.S. Army Corps of Engineers' (USACE) Nationwide, Regional or General Permits as required by Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act, and for the North Carolina Division of Water Quality's (DWQ) associated General 401 Water Quality Certifications. This form is also to be used for any project requiring approval under any Riparian Buffer Rules implemented by the N.C. Division of Water Quality. This form should **not** be used if you are requesting an Individual 404 Permit or Individual 401 Water Quality Certification. The USACE Individual Permit application form is available online at http://www.saw.usace.army.mil/wetlands/Perm_app.htm.

The USACE is the lead regulatory agency. To review the requirements for the use of Nationwide, Regional or General permits, and to determine which permit applies to your project, please go to the USACE website at http://www.saw.usace.army.mil/wetlands/regtour.htm, or contact one of the field offices listed on page 3 of this application. The website also lists the responsible project manager for each county in North Carolina and provides additional information regarding the identification and regulation of wetlands and waters of the U.S.

The DWQ issues a corresponding Certification (General or Individual), and cannot tell the applicant which 401 Certification will apply until the 404 Permit type has been determined by the USACE. Applicants are encouraged to visit DWQ's 401/Wetlands Unit website at http://h2o.enr.state.nc.us/ncwetlands to read about current requirements for the 401 Water Quality Certification Program and to determine whether or not Riparian Buffer Rules are applicable. The applicant is also advised to read the full text of the General Certification (GC) matching the specific 404 Permit requested. In some cases, written approval for General Certifications is not required, provided that the applicant adheres to all conditions of the GC. Applicants lacking access to the internet should contact DWQ's Central Office in Raleigh at (919) 733-1786.

Trout Waters Coordination - Special coordination with the North Carolina Wildlife Resources Commission (NCWRC) is required for projects occurring in any of North Carolina's twenty-five counties that contain trout waters. In such cases, the applicant should contact the appropriate NCWRC regional coordinator (listed by county on page 4 of this application) prior to submittal of the application.

Coastal Area Management Act (CAMA) Coordination - If the project occurs in any of North Carolina's twenty coastal counties (listed on page 4) the applicant should contact the North Carolina Division of Coastal Management (DCM). DCM will determine whether or not the project is within a designated Area of Environmental Concern, in which case DCM will act as the lead permitting agency. In such cases, DCM will require a CAMA Permit and will coordinate the 404/401 Permits.

The applicant may also choose to coordinate with the United States Fish and Wildlife Service to ensure that the proposed project will have no impact upon any endangered or threatened species or critical habitat as regulated by the Endangered Species Act, and the State Historic Preservation Office, North Carolina Department of Cultural Resources to ensure that the proposed project will have no impact upon any properties listed or eligible for listing on the National Register of Historic Places. Compliance with these regulations is required to be eligible for any Department of the Army permit. The addresses for both agencies are listed on page 3 of this application.

USACE Permits - Submit one copy of this form, along with supporting narratives, maps, data forms, photos, etc. to the applicable USACE Regulatory Field Office. Upon receipt of an application, the USACE will determine if the application is complete as soon as possible, not to exceed 30 days. This PCN form is designed for the convenience of the applicant to address information needs for all USACE Nationwide, Regional or General permits, as well as information required for State authorizations, certifications, and coordination. Fully providing the information requested on this form will result in a complete application for any of the USACE Nationwide, Regional or General permits. To review the minimum amount of information that must be provided for a complete PCN for each USACE Nationwide permit, see Condition 13, 65 Fed. Reg. 12893 (March 9, 2000), available at http://www.saw.usace.army.mil/wetlands/nwpfinalFedReg.pdf. Processing times vary by permit and begin once the application has been determined to be complete. Please contact the appropriate regulatory field office for specific answers to permit processing periods.

401 Water Quality Certification or Buffer Rules - All information is required unless otherwise stated as optional. Incomplete applications will be returned. Submit **seven** collated copies of **all** USACE Permit materials to the Division of Water Quality, 401/Wetlands Unit, 1650 Mail Service Center, Raleigh, NC, 27699-1650. If written approval is required or specifically requested for a 401 Certification, then a non-refundable application fee is required. In brief, if project impacts include less than one acre of cumulative wetland/water impacts **and** less than 150 feet cumulative impacts to streams, then a fee of $200 is required. If either of these thresholds is exceeded, then a fee of $475 is required. A check made out to the North Carolina Division of Water Quality, with the specific name of the project or applicant identified, should be stapled to the front of the application package. For more information, see the DWQ website at http://h2o.ehnr.state.nc.us/ncwetlands/fees.html. The fee must be attached with the application unless the applicant is a federal agency in which case the check may be issued from a separate office. In such cases, the project must be identifiable on the U.S. Treasury check so that it can be credited to the appropriate project. If written approval is sought solely for Buffer Rules, the application fee does not apply, and the applicant should clearly state (in a cover letter) that only Buffer Rule approval is sought in writing. Wetlands or waters of the U.S. may not be impacted prior to issuance or waiver of a Section 401 Water Quality Certification. Upon receipt of a complete application for a 401 Certification, the Division of Water Quality has 60 days to prepare a written response to the applicant. This may include a 401 Certification, an on-hold letter pending receipt of additional requested information, or denial.

US Army Corps Of Engineers Field Offices and County Coverage

Asheville Regulatory Field Office
US Army Corps of Engineers
151 Patton Avenue
Room 208
Asheville, NC 28801-5006
Telephone: (828) 271-7980
Fax: (828) 281-8120

Alexander	Caldwell	Haywood	McDowell	Swain
Alleghany	Catawba	Henderson	Mecklenburg	Transylvania
Ashe	Cherokee	Iredell	Mitchell	Union
Avery	Clay	Jackson	Polk	Watauga
Buncombe	Cleveland	Lincoln	Rowan	Yancey
Burke	Gaston	Macon	Rutherford	
Cabarrus	Graham	Madison	Stanley	

Raleigh Regulatory Field Office
US Army Corps Of Engineers
6508 Falls of the Neuse Road
Suite 120
Raleigh, NC 27615
Telephone: (919) 876-8441
Fax: (919) 876-5823

Alamance	Franklin	Nash	Surry
Caswell	Forsyth	Northampton	Vance
Chatham	Granville	Orange	Wake
Davidson	Guilford	Person	Warren
Davie	Halifax	Randolph	Wilkes
Durham	Johnston	Rockingham	Wilson
Edgecombe	Lee	Stokes	Yadkin

Washington Regulatory Field Office
US Army Corps Of Engineers
Post Office Box 1000
Washington, NC 27889-1000
Telephone: (252) 975-1616
Fax: (252) 975-1399

Beaufort	Currituck	Jones	Pitt
Bertie	Dare	Lenoir	Tyrrell
Camden	Gates	Martin	Washington
Carteret*	Green	Pamlico	Wayne
Chowan	Hertford	Pasquotank	
Craven	Hyde	Perquimans	

*Croatan National Forest Only

Wilmington Regulatory Field Office
US Army Corps Of Engineers
Post Office Box 1890
Wilmington, NC 28402-1890
Telephone: (910) 251-4511
Fax: (910) 251-4025

Anson	Duplin	Onslow
Bladen	Harnett	Pender
Brunswick	Hoke	Richmond
Carteret	Montgomery	Robeson
Columbus	Moore	Sampson
Cumberland	New Hanover	Scotland

North Carolina State Agencies

Division of Water Quality
401 Wetlands Unit
1650 Mail Service Center
Raleigh, NC 27699-1650
Telephone: (919) 733-1786
Fax: (919) 733-6893

Division of Water Quality
Wetlands Restoration Program
1619 Mail Service Center
Raleigh, NC 27699-1619
Telephone: (919) 733-5208
Fax: (919) 733-5321

State Historic Preservation Office
Department Of Cultural Resources
4617 Mail Service Center
Raleigh, NC 27699-4617
Telephone: (919) 733-4763
Fax: (919) 715-2671

US Fish and Wildlife Service / National Marine Fisheries Service

US Fish and Wildlife Service
Raleigh Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Telephone: (919) 856-4520

US Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801
Telephone: (828) 258-3939

National Marine Fisheries Service
Habitat Conservation Division
Pivers Island
Beaufort, NC 28516
Telephone: (252) 728-5090

CAMA and NC Coastal Counties

Division of Coastal Management
1638 Mail Service Center
Raleigh, NC 27699-1638
Telephone: (919) 733-2293
Fax: (919) 733-1495

Beaufort	Chowan	Hertford	Pasquotank
Bertie	Craven	Hyde	Pender
Brunswick	Currituck	New Hanover	Perquimans
Camden	Dare	Onslow	Tyrrell
Carteret	Gates	Pamlico	Washington

NCWRC and NC Trout Counties

Western Piedmont Region Coordinator
3855 Idlewild Road
Kernersville, NC 27284-9180
Telephone: (336) 769-9453

Alleghany	Caldwell	Watauga
Ashe	Mitchell	Wilkes
Avery	Stokes	
Burke	Surry	

Mountain Region Coordinator
20830 Great Smoky Mtn. Expressway
Waynesville, NC 28786
Telephone: (828) 452-2546
Fax: (828) 452-7772

Buncombe	Henderson	Polk
Cherokee	Jackson	Rutherford
Clay	Macon	Swain
Graham	Madison	Transylvania
Haywood	McDowell	Yancey

APPLICATION FORM BEGINS ON PAGE 5. PLEASE DO NOT SUBMIT PAGES 1 - 4.

Office Use Only: Form Version May 2002

USACE Action ID No. _____ **DWQ No.** _____

(If any particular item is not applicable to this project, please enter "Not Applicable" or "N/A".)

I. Processing

1. Check all of the approval(s) requested for this project:
   - ☒ Section 404 Permit
   - ☐ Section 10 Permit
   - ☒ 401 Water Quality Certification
   - ☐ Riparian or Watershed Buffer Rules
   - ☐ Isolated Wetland Permit from DWQ

2. Nationwide, Regional or General Permit Number(s) Requested: 27

3. If this notification is solely a courtesy copy because written approval for the 401 Certification is not required, check here: ☐

4. If payment into the North Carolina Wetlands Restoration Program (NCWRP) is proposed for mitigation of impacts (verify availability with NCWRP prior to submittal of PCN), complete section VIII and check here: ☐

5. If your project is located in any of North Carolina's twenty coastal counties (listed on page 4), and the project is within a North Carolina Division of Coastal Management Area of Environmental Concern (see the top of page 2 for further details), check here: ☐

II. Applicant Information

1. Owner/Applicant Information
   Name: Wetlands Resource Center, Mr. Cal Miller
   Mailing Address: 3970 Bowen Road
   Canal Winchester, OH 43110
   Telephone Number: 614-327-7034 Fax Number: 614-759-7988
   E-mail Address: cltt1218@aol.com

2. Agent/Consultant Information (A signed and dated copy of the Agent Authorization letter must be attached if the Agent has signatory authority for the owner/applicant.)
   Name: Mr. Peter Jelenevsky
   Company Affiliation: Natural Systems Engineering
   Mailing Address: 3917 Benson Drive
   Raleigh, North Carolina 27609
   Telephone Number: 919-878-5444 Fax Number: 919-872-8444
   E-mail Address: pjelenevsky@nsepc.com

III. Project Information

Attach a **vicinity map** clearly showing the location of the property with respect to local landmarks such as towns, rivers, and roads. Also provide a detailed **site plan** showing property boundaries and development plans in relation to surrounding properties. Both the vicinity map and site plan must include a scale and north arrow. The specific footprints of all buildings, impervious surfaces, or other facilities must be included. If possible, the maps and plans should include the appropriate USGS Topographic Quad Map and NRCS Soil Survey with the property boundaries outlined. Plan drawings, or other maps may be included at the applicant's discretion, so long as the property is clearly defined. For administrative and distribution purposes, the USACE requires information to be submitted on sheets no larger than 11 by 17-inch format; however, DWQ may accept paperwork of any size. DWQ prefers full-size construction drawings rather than a sequential sheet version of the full-size plans. If full-size plans are reduced to a small scale such that the final version is illegible, the applicant will be informed that the project has been placed on hold until decipherable maps are provided.

1. Name of project: Bailey Fork Stream Restoration Project

2. T.I.P. Project Number or State Project Number (NCDOT Only): N/A

3. Property Identification Number (Tax PIN): 179214237497, 179218324353, 179218317127, 179218329391

4. Location
   County: Burke Nearest Town: Morganton
   Subdivision name (include phase/lot number): N/A
   Directions to site (include road numbers, landmarks, etc.): Take I-40 to Morganton, take US64 South to Propst Road (SR 1112) turn right onto Propst Road and the project site is north and south of the road approximately 1,800 feet from the US64/Propst Road Intersection

5. Site coordinates, if available (UTM or Lat/Long): 35°42'10.82"N 81°43'4.89"W
   (Note – If project is linear, such as a road or utility line, attach a sheet that separately lists the coordinates for each crossing of a distinct waterbody.)

6. Property size (acres): approximately 75

7. Nearest body of water (stream/river/sound/ocean/lake): Bailey Fork

8. River Basin: Catawba
   (Note – this must be one of North Carolina's seventeen designated major river basins. The River Basin map is available at http://h2o.enr.state.nc.us/admin/maps/.)

9. Describe the existing conditions on the site and general land use in the vicinity of the project at the time of this application: Site is currently used for agricultural purposes- hayfield.

10. Describe the overall project in detail, including the type of equipment to be used: Project will restore over 5,500 linear feet of highly degraded and eroding streams, consisting of three separate perennial streams. Project will utilize natural channel design techniques and principles to restore the streams to a stable state along with the establishment of a permanent riparian area of at least 30-foot in width. Equipment that will be used on site during construction includes hydraulic excavators, track trucks, front-end loaders, etc.

11. Explain the purpose of the proposed work: Restore stream channel function and form while also eliminating existing bed scour and bank erosion. Mitigation credits generated will be utilized by Ecosystem Enhancement Program to offset compensatory mitigation requirements within Catawba 01 drainage basin, Contract No. D04006-2.

IV. Prior Project History

If jurisdictional determinations and/or permits have been requested and/or obtained for this project (including all prior phases of the same subdivision) in the past, please explain. Include the USACE Action ID Number, DWQ Project Number, application date, and date permits and certifications were issued or withdrawn. Provide photocopies of previously issued permits, certifications or other useful information. Describe previously approved wetland, stream and buffer impacts, along with associated mitigation (where applicable). If this is a NCDOT project, list and describe permits issued for prior segments of the same T.I.P. project, along with construction schedules.

N/A

V. Future Project Plans

Are any future permit requests anticipated for this project? If so, describe the anticipated work, and provide justification for the exclusion of this work from the current application.

No. Project site is protected in perpetuity by a legally binding protective agreement.

VI. Proposed Impacts to Waters of the United States/Waters of the State

It is the applicant's (or agent's) responsibility to determine, delineate and map all impacts to wetlands, open water, and stream channels associated with the project. The applicant must also

provide justification for these impacts in Section VII below. All proposed impacts, permanent and temporary, must be listed herein, and must be clearly identifiable on an accompanying site plan. All wetlands and waters, and all streams (intermittent and perennial) must be shown on a delineation map, whether or not impacts are proposed to these systems. Wetland and stream evaluation and delineation forms should be included as appropriate. Photographs may be included at the applicant's discretion. If this proposed impact is strictly for wetland or stream mitigation, list and describe the impact in Section VIII below. If additional space is needed for listing or description, please attach a separate sheet.

1. Provide a written description of the proposed impacts: No impacts are proposed. Implementation of the restoration plan will actually increase overall channel length by approximately 600 linear feet

2. Individually list wetland impacts below:

Wetland Impact Site Number (indicate on map)	Type of Impact*	Area of Impact (acres)	Located within 100-year Floodplain** (yes/no)	Distance to Nearest Stream (linear feet)	Type of Wetland***
N/A					

* List each impact separately and identify temporary impacts. Impacts include, but are not limited to: mechanized clearing, grading, fill, excavation, flooding, ditching/drainage, etc. For dams, separately list impacts due to both structure and flooding.

** 100-Year floodplains are identified through the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM), or FEMA-approved local floodplain maps. Maps are available through the FEMA Map Service Center at 1-800-358-9616, or online at http://www.fema.gov.

*** List a wetland type that best describes wetland to be impacted (e.g., freshwater/saltwater marsh, forested wetland, beaver pond, Carolina Bay, bog, etc.) Indicate if wetland is isolated (determination of isolation to be made by USACE only).

List the total acreage (estimated) of all existing wetlands on the property: None observed
Total area of wetland impact proposed: 0.0

3. Individually list all intermittent and perennial stream impacts below:

Stream Impact Site Number (indicate on map)	Type of Impact*	Length of Impact (linear feet)	Stream Name**	Average Width of Stream Before Impact	Perennial or Intermittent? (please specify)
N/A					

* List each impact separately and identify temporary impacts. Impacts include, but are not limited to: culverts and associated rip-rap, dams (separately list impacts due to both structure and flooding), relocation (include linear feet before and after, and net loss/gain),

stabilization activities (cement wall, rip-rap, crib wall, gabions, etc.), excavation, ditching/straightening, etc. If stream relocation is proposed, plans and profiles showing the linear footprint for both the original and relocated streams must be included.

** Stream names can be found on USGS topographic maps. If a stream has no name, list as UT (unnamed tributary) to the nearest downstream named stream into which it flows. USGS maps are available through the USGS at 1-800-358-9616, or online at www.usgs.gov. Several internet sites also allow direct download and printing of USGS maps (e.g., www.topozone.com, www.mapquest.com, etc.).

Cumulative impacts (linear distance in feet) to all streams on site: 0.0

4. Individually list all open water impacts (including lakes, ponds, estuaries, sounds, Atlantic Ocean and any other water of the U.S.) below:

Open Water Impact Site Number (indicate on map)	Type of Impact*	Area of Impact (acres)	Name of Waterbody (if applicable)	Type of Waterbody (lake, pond, estuary, sound, bay, ocean, etc.)
N/A				

* List each impact separately and identify temporary impacts. Impacts include, but are not limited to: fill, excavation, dredging, flooding, drainage, bulkheads, etc.

5. Pond Creation

If construction of a pond is proposed, associated wetland and stream impacts should be included above in the wetland and stream impact sections. Also, the proposed pond should be described here and illustrated on any maps included with this application.

Pond to be created in (check all that apply): ☐ uplands ☐ stream ☐ wetlands

Describe the method of construction (e.g., dam/embankment, excavation, installation of draw-down valve or spillway, etc.): N/A

Proposed use or purpose of pond (e.g., livestock watering, irrigation, aesthetic, trout pond, local stormwater requirement, etc.):

Size of watershed draining to pond:_____ Expected pond surface area:_____

VII. Impact Justification (Avoidance and Minimization)

Specifically describe measures taken to avoid the proposed impacts. It may be useful to provide information related to site constraints such as topography, building ordinances, accessibility, and financial viability of the project. The applicant may attach drawings of alternative, lower-impact site layouts, and explain why these design options were not feasible. Also discuss how impacts were minimized once the desired site plan was developed. If applicable, discuss construction techniques to be followed during construction to reduce impacts.

No permanent impacts to waters of the U.S. are being proposed. Temporary impacts may occur due to the placement of temporary erosion control measures (i.e. check dams, temporary crossings, etc.) but once the project is completed there will be a net gain of approximately 600 linear feet of restored stream .

VIII. Mitigation

DWQ - In accordance with 15A NCAC 2H .0500, mitigation may be required by the NC Division of Water Quality for projects involving greater than or equal to one acre of impacts to freshwater wetlands or greater than or equal to 150 linear feet of total impacts to perennial streams.

USACE – In accordance with the Final Notice of Issuance and Modification of Nationwide Permits, published in the Federal Register on March 9, 2000, mitigation will be required when necessary to ensure that adverse effects to the aquatic environment are minimal. Factors including size and type of proposed impact and function and relative value of the impacted aquatic resource will be considered in determining acceptability of appropriate and practicable mitigation as proposed. Examples of mitigation that may be appropriate and practicable include, but are not limited to: reducing the size of the project; establishing and maintaining wetland and/or upland vegetated buffers to protect open waters such as streams; and replacing losses of aquatic resource functions and values by creating, restoring, enhancing, or preserving similar functions and values, preferable in the same watershed.

If mitigation is required for this project, a copy of the mitigation plan must be attached in order for USACE or DWQ to consider the application complete for processing. Any application lacking a required mitigation plan or NCWRP concurrence shall be placed on hold as incomplete. An applicant may also choose to review the current guidelines for stream restoration in DWQ's Draft Technical Guide for Stream Work in North Carolina, available at http://h2o.enr.state.nc.us/ncwetlands/strmgide.html.

1. Provide a brief description of the proposed mitigation plan. The description should provide as much information as possible, including, but not limited to: site location (attach directions and/or map, if offsite), affected stream and river basin, type and amount (acreage/linear feet) of mitigation proposed (restoration, enhancement, creation, or preservation), a plan view, preservation mechanism (e.g., deed restrictions, conservation easement, etc.), and a description of the current site conditions and proposed method of construction. Please attach a separate sheet if more space is needed.

   Proposed stream restoration project will restore 5500 linear feet of stream channel (centerline distance) within the Catawba River Basin. A conservation easement will preserve the site in perpetuity. See Bailey Fork Stream Restoration Plan for specific details and information.

2. Mitigation may also be made by payment into the North Carolina Wetlands Restoration Program (NCWRP). Please note it is the applicant's responsibility to contact the NCWRP at (919) 733-5208 to determine availability and to request written approval of mitigation prior to submittal of a PCN. For additional information regarding the application process for the NCWRP, check the NCWRP website at http://h2o.enr.state.nc.us/wrp/index.htm. If use of the NCWRP is proposed, please check the appropriate box on page three and provide the following information:

Amount of stream mitigation requested (linear feet):_____
Amount of buffer mitigation requested (square feet):_____
Amount of Riparian wetland mitigation requested (acres):_____
Amount of Non-riparian wetland mitigation requested (acres):_____
Amount of Coastal wetland mitigation requested (acres):_____

IX. Environmental Documentation (required by DWQ)

Does the project involve an expenditure of public (federal/state) funds or the use of public (federal/state) land?

Yes ☐ No ☒

If yes, does the project require preparation of an environmental document pursuant to the requirements of the National or North Carolina Environmental Policy Act (NEPA/SEPA)? Note: If you are not sure whether a NEPA/SEPA document is required, call the SEPA coordinator at (919) 733-5083 to review current thresholds for environmental documentation.

Yes ☐ No ☒

If yes, has the document review been finalized by the State Clearinghouse? If so, please attach a copy of the NEPA or SEPA final approval letter.

Yes ☐ No ☐

X. Proposed Impacts on Riparian and Watershed Buffers (required by DWQ)

It is the applicant's (or agent's) responsibility to determine, delineate and map all impacts to required state and local buffers associated with the project. The applicant must also provide justification for these impacts in Section VII above. All proposed impacts must be listed herein, and must be clearly identifiable on the accompanying site plan. All buffers must be shown on a map, whether or not impacts are proposed to the buffers. Correspondence from the DWQ Regional Office may be included as appropriate. Photographs may also be included at the applicant's discretion.

Will the project impact protected riparian buffers identified within 15A NCAC 2B .0233 (Neuse), 15A NCAC 2B .0259 (Tar-Pamlico), 15A NCAC 2B .0250 (Randleman Rules and Water Supply Buffer Requirements), or other (please identify_____)?

Yes ☐ No ☒ If you answered "yes", provide the following information:

Identify the square feet and acreage of impact to each zone of the riparian buffers. If buffer mitigation is required calculate the required amount of mitigation by applying the buffer multipliers.

Zone*	Impact (square feet)	Multiplier	Required Mitigation
1		3	
2		1.5	
Total			

* Zone 1 extends out 30 feet perpendicular from near bank of channel; Zone 2 extends an additional 20 feet from the edge of Zone 1.

If buffer mitigation is required, please discuss what type of mitigation is proposed (i.e., Donation of Property, Conservation Easement, Riparian Buffer Restoration / Enhancement, Preservation or Payment into the Riparian Buffer Restoration Fund). Please attach all appropriate information as identified within 15A NCAC 2B .0242 or .0260.

N/A

XI. Stormwater (required by DWQ)

Describe impervious acreage (both existing and proposed) versus total acreage on the site. Discuss stormwater controls proposed in order to protect surface waters and wetlands downstream from the property.

N/A No proposed impervious surfaces

XII. Sewage Disposal (required by DWQ)

Clearly detail the ultimate treatment methods and disposition (non-discharge or discharge) of wastewater generated from the proposed project, or available capacity of the subject facility.

N/A

XIII. Violations (required by DWQ)

Is this site in violation of DWQ Wetland Rules (15A NCAC 2H .0500) or any Buffer Rules?

Yes ☐ No ☒

Is this an after-the-fact permit application?

Yes ☐ No ☒

XIV. Other Circumstances (Optional):

It is the applicant's responsibility to submit the application sufficiently in advance of desired construction dates to allow processing time for these permits. However, an applicant may choose to list constraints associated with construction or sequencing that may impose limits on work schedules (e.g., draw-down schedules for lakes, dates associated with Endangered and Threatened Species, accessibility problems, or other issues outside of the applicant's control).

N/A

Jan. 20, 2005

Applicant/Agent's Signature **Date**

(Agent's signature is valid only if an authorization letter from the applicant is provided.)

Wetlands Resource Center

3970 Bowen Road
Canal Winchester, OH 43110

January 10, 2005

US Army Corps of Engineers
151 Patton Avenue
Room 208
Asheville, NC 28801-5006

RE: Agent Authorization

Dear Sir or Madam:

The purpose of this letter is to inform the US Army Corps Of Engineers that the responsible party:

Wetlands Resource Center
3970 Bowen Road
Canal Winchester, OH 43110

Telephone Number: 614-327-7034
Fax Number: 614-759-7988
Email: clttl218@aol.com

Designates:

Natural Systems Engineering
3719 Benson Drive
Raleigh, NC 27609

Telephone Number: 919-878-5444
Fax Number: 919-872-8444
Email: pjelenevsky@nsepc com

As the responsible party's authorized agent for the Bailey Fork Stream Restoration Project located in Burke County, North Carolina.

Please contact me with any questions (614) 327-7034.

Cal Miller
Wetlands Resource Center

TEMPORARY CONSTRUCTION EASEMENT

This Agreement, made this 19 day of August, 2004, between Ernest Stroup hereinafter designated as **Grantor**, and the **Wetlands Resource Center, LLC for the State of North Carolina**, acting by and through the **Ecosystem Enhancement Program**, hereinafter designated **Grantee**, does hereby grant unto the **Grantee**, its successors, assigns, agents, contractors, subcontractors and employees the exclusive right to perform those certain construction activities necessary to perform a stream restoration, enhancement and/or wetlands restoration, enhancement or creation project, herein after designated **Project**, along with the right of reasonable ingress and egress to the Project along Bailey Fork and its Unnamed Tributaries in Burke County for the benefit of the **Grantor**.

Ernest Stroup, **Grantor**, for the true and actual consideration of One Dollar ($1.00) and other considerations does convey to **Grantee**, by and through **Wetlands Resource Center for the Department of Environment and Natural Resources, Ecosystem Enhancement Program**, its successors and assigns, a Temporary Construction Easement, hereinafter **Easement**, for a specified work area on the property identified as PIN # 179218324353, Burke County Tax Office and recorded in Deed Book 174 at Page 585 recorded in the Burke County Registry. Said project will extend approximately One Thousand Two Hundred (1,200) linear feet along the stream and the temporary construction easement will have a width of 150 feet from the top of bank on both sides of the stream and contain approximately 4.5 acres for the purpose of said **Project**.

Grantor agrees the consideration recited herein is just compensation for the **Easement**, including any and all damages to Grantor's remaining property, if any, which may result from the acquisition or use of said property and said **Project**.

The **Grantor** also grants to the **Grantee**, its successors, assigns, agents, contractors and employees the right to erect and use construction equipment at the site of the **Easement** herein described.

IT IS UNDERSTOOD that the **Easement** rights herein granted shall automatically terminate 2 years from the date rendered hereof or upon completion of the above referenced **Project**, whichever is sooner.

FOR REGISTRATION REGISTER OF DEEDS
ELIZABETH T COOPER
BURKE COUNTY, NC
2004 SEP 09 02:54:02 PM
BK:1395 PG:451-454 FEE:$20.00

INSTRUMENT # 2004013288

1395 -451

IT IS ALSO UNDERSTOOD AND AGREED that the **Easement** herein granted further allows, binds by mutual agreement, that the **Grantor** shall convey and the **Grantee** shall receive a **Conservation Easement** in the for attached hereto to perpetually protect the intent of said **Project**. The conveyance of the conservation easement shall occur at completion of the **Project** and will be based upon a metes and bounds description rendered by a Professional Land Surveyor. Said conservation easement will run as the stream meanders, extending landward from the bankfull elevation on each side of the stream a distance of 30 feet where physically possible, as per the U.S. Army Corps of Engineers April 2003 Stream Mitigation Guidelines for North Carolina Mountain Counties.

The **Grantee**, its successors, assigns, agents, contractors, and employees agree to the following conditions of this **Easement**:

1. **DAMAGE TO PROPERTY**: Shall exercise care to avoid damaging the property in any manner not consistent with the purpose for which this agreement is issued.
2. **COOPERATION WITH GRANTOR**: Shall at all times cooperate with **Grantor** and comply with reasonable requests not inconsistent with the purpose for which this agreement is issued
3. **CLEARING**: If necessary, shall perform felling, bucking, and decking of merchantable timber according to acceptable logging practices with a minimum of breakage, damage and waste. Utilization of heavy equipment to grade, fill and prepare the soil, including modification of hydrology of the site.
4. **CLEANUP**: At a minimum, Grantee shall spread material uniformly over the construction site for uniform topography and seed with grass. Includes possible planting of trees, shrubs and herbaceous vegetation, and fertilize all areas. Upon completion of the **Project**, shall clean all the ground occupied of all rubbish, excess material, temporary structures, and equipment.
5. **ACCEPTANCE**: All parts of the **Project** site shall be left in acceptable condition.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal the day and year first above written,

Ernest Carl Stamps (SEAL)

BUNCOMBE COUNTY, NC
NOTARY PUBLIC
GAYLA P. HAWLEY

452

NORTH CAROLINA

COUNTY OF Burke

I, Gayla P. Hamby, a Notary Public in and for the County and State aforesaid, do hereby certify that Ernest Carl Strong Grantor personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 19 day of August, 2004.

Gayla P. Hamby
Notary Public

My commission expires:

3-21-08

TEMPORARY CONSTRUCTION EASEMENT

This Agreement, made this 19 day of August, 2004, between Bill and Ann Smith hereinafter designated as **Grantor**, and the **Wetlands Resource Center, LLC for the State of North Carolina**, acting by and through the **Ecosystem Enhancement Program**, hereinafter designated **Grantee**, does hereby grant unto the **Grantee**, its successors, assigns, agents, contractors, subcontractors and employees the exclusive right to perform those certain construction activities necessary to perform a stream restoration, enhancement and/or wetlands restoration, enhancement or creation project, herein after designated **Project**, along with the right of reasonable ingress and egress to the Project along Bailey Fork and its Unnamed Tributaries in Burke County for the benefit of the **Grantor**.

Bill and Ann Smith, **Grantor**, for the true and actual consideration of One Dollar ($1.00) and other considerations does convey to **Grantee**, by and through **Wetlands Resource Center for the Department of Environment and Natural Resources, Ecosystem Enhancement Program**, its successors and assigns, a Temporary Construction Easement, hereinafter **Easement**, for a specified work area on the property identified as PIN # 179218317127, Burke County Tax Office and recorded in Deed Book 596 at Page 289 recorded in the Burke County Registry. Said project will extend approximately Three Thousand One Hundred (3,100) linear feet along the stream and the temporary construction easement will have a width of 150 feet from the top of bank on both sides of the stream and contain approximately 5.5 acres for the purpose of said **Project**.

Grantor agrees the consideration recited herein is just compensation for the **Easement**, including any and all damages to Grantor's remaining property, if any, which may result from the acquisition or use of said property and said **Project**.

The **Grantor** also grants to the **Grantee**, its successors, assigns, agents, contractors and employees the right to erect and use construction equipment at the site of the **Easement** herein described.

IT IS UNDERSTOOD that the **Easement** rights herein granted shall automatically terminate 2 years from the date rendered hereof or upon completion of the above referenced **Project**, whichever is sooner.

FOR REGISTRATION REGISTER OF DEEDS
ELIZABETH T COOPER
BURKE COUNTY, NC
2004 SEP 09 02:55:02 PM
BK:1395 PG:455-458 FEE:$20.00

INSTRUMENT # 20040013289

IT IS ALSO UNDERSTOOD AND AGREED that the **Easement** herein granted further allows, binds by mutual agreement, that the **Grantor** shall convey and the **Grantee** shall receive a **Conservation Easement** in the for attached hereto to perpetually protect the intent of said **Project**. The conveyance of the conservation easement shall occur at completion of the **Project** and will be based upon a metes and bounds description rendered by a Professional Land Surveyor. Said conservation easement will run as the stream meanders, extending landward from the bankfull elevation on each side of the stream a distance of 30 feet where physically possible, as per the U.S. Army Corps of Engineers April 2003 Stream Mitigation Guidelines for North Carolina Mountain Counties.

The **Grantee**, its successors, assigns, agents, contractors, and employees agree to the following conditions of this **Easement**:

1. **DAMAGE TO PROPERTY**: Shall exercise care to avoid damaging the property in any manner not consistent with the purpose for which this agreement is issued.
2. **COOPERATION WITH GRANTOR**: Shall at all times cooperate with **Grantor** and comply with reasonable requests not inconsistent with the purpose for which this agreement is issued
3. **CLEARING**: If necessary, shall perform felling, bucking, and decking of merchantable timber according to acceptable logging practices with a minimum of breakage, damage and waste. Utilization of heavy equipment to grade, fill and prepare the soil, including modification of hydrology of the site.
4. **CLEANUP**: At a minimum, Grantee shall spread material uniformly over the construction site for uniform topography and seed with grass. Includes possible planting of trees, shrubs and herbaceous vegetation, and fertilize all areas. Upon completion of the **Project**, shall clean all the ground occupied of all rubbish, excess material, temporary structures, and equipment.
5. **ACCEPTANCE**: All parts of the **Project** site shall be left in acceptable condition.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal the day and year first above written,

Bill Smith (SEAL)

4560

NORTH CAROLINA

COUNTY OF Burke

I, Carol M. Decker, a Notary Public in and for the County and States aforesaid, do hereby certify that Bill Smith, Grantor personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 19th day of August, 2004.

Carol M. Decker
Notary Public

CAROL M DECKER NOTARY PUBLIC BURKE COUNTY, N.C.

My commission expires:

July 8, 2006

457

TEMPORARY CONSTRUCTION EASEMENT

This Agreement, made this 9th day of September, 2004, between Charles Edwin Talbert hereinafter designated as **Grantor**, and the **Wetlands Resource Center, LLC for the State of North Carolina**, acting by and through the **Ecosystem Enhancement Program**, hereinafter designated **Grantee**, does hereby grant unto the **Grantee**, its successors, assigns, agents, contractors, subcontractors and employees the exclusive right to perform those certain construction activities necessary to perform a stream restoration, enhancement and/or wetlands restoration, enhancement or creation project, herein after designated **Project**, along with the right of reasonable ingress and egress to the Project along Bailey Fork and its Unnamed Tributaries in Burke County for the benefit of the **Grantor**.

Charles Edwin Talbert, **Grantor**, for the true and actual consideration of One Dollar ($1.00) and other considerations does convey to **Grantee**, by and through **Wetlands Resource Center for the Department of Environment and Natural Resources, Ecosystem Enhancement Program**, its successors and assigns, a Temporary Construction Easement, hereinafter **Easement**, for a specified work area on the property identified as PIN # 179218329391, Burke County Tax Office and recorded in Deed Book 1322 at Page 157, and PIN # 179218329391, Burke County Tax Office and recorded in Deed Book 1828 at Page 990 recorded in the Burke County Registry. Said project will extend approximately One Thousand Two Hundred (1,200) linear feet along the stream and the temporary construction easement will have a width of 150 feet from the top of bank on both sides of the stream and contain approximately 4.5 acres for the purpose of said **Project**.

Grantor agrees the consideration recited herein is just compensation for the **Easement**, including any and all damages to Grantor's remaining property, if any, which may result from the acquisition or use of said property and said **Project**.

The **Grantor** also grants to the **Grantee**, its successors, assigns, agents, contractors and employees the right to erect and use construction equipment at the site of the **Easement** herein described.

IT IS UNDERSTOOD that the **Easement** rights herein granted shall automatically terminate 2 years from the date rendered hereof or upon completion of the above referenced **Project**, whichever is sooner.

IT IS ALSO UNDERSTOOD AND AGREED that the **Easement** herein granted further allows, binds by mutual agreement, that the **Grantor** shall convey and the **Grantee** shall receive a **Conservation Easement** in the for attached hereto to perpetually protect the intent of said **Project**. The conveyance of the conservation easement shall occur at completion of the **Project** and will be based upon a metes and bounds description rendered by a Professional Land Surveyor. Said conservation easement will run as the stream meanders, extending landward from the bankfull elevation on each side of the stream a distance of 30 feet where physically possible, as per the U.S. Army Corps of Engineers April 2003 Stream Mitigation Guidelines for North Carolina Mountain Counties.

The **Grantee**, its successors, assigns, agents, contractors, and employees agree to the following conditions of this **Easement**:

1. **DAMAGE TO PROPERTY**: Shall exercise care to avoid damaging the property in any manner not consistent with the purpose for which this agreement is issued.
2. **COOPERATION WITH GRANTOR**: Shall at all times cooperate with **Grantor** and comply with reasonable requests not inconsistent with the purpose for which this agreement is issued
3. **CLEARING**: If necessary, shall perform felling, bucking, and decking of merchantable timber according to acceptable logging practices with a minimum of

FOR REGISTRATION REGISTER OF DEEDS
ELIZABETH Y COOPER
BURKE COUNTY, NC
2004 SEP 09 02:53:02 PM
BK:1395 PG:448-450 FEE:$17.00
INSTRUMENT # 200409120027

1395 448

breakage, damage and waste. Utilization of heavy equipment to grade, fill and prepare the soil, including modification of hydrology of the site.

4. **CLEANUP**: At a minimum, Grantee shall spread material uniformly over the construction site for uniform topography and seed with grass. Includes possible planting of trees, shrubs and herbaceous vegetation, and fertilize all areas. Upon completion of the **Project**, shall clean all the ground occupied of all rubbish, excess material, temporary structures, and equipment.
5. **ACCEPTANCE**: All parts of the **Project** site shall be left in acceptable condition.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal the day and year first above written,

GAYLA P. HAMBY NOTARY PUBLIC BURKE COUNTY, N.C.

_____ **(SEAL)**

NORTH CAROLINA

COUNTY OF Burke

I, GAYLA P. HAMBY, a Notary Public in and for the County and States aforesaid, do hereby certify that Eddie Talbert, ~~Grantor personally appeared before me this day and acknowledged the execution~~ of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 9 day of ~~September~~, 2004.

Gayla P. Hamby
Notary Public

My commission expires:

3-21-08

4/4

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

December 20, 2004

Mr. James M. Halley, PE
Natural Systems Engineering
3719 Benson Drive
Raleigh, NC 27609

Reference: Propst Road (SR 1112) Right of Way Encroachment Agreement

Dear Mr. Halley:

This office has reviewed the above-mentioned right of way encroachment package at your request. Per that review and our conversation on December 20, 2004 it has been determined that due to the nature and location of the work and the parties involved in the mitigation that an executed agreement between you and the North Carolina Department of Transportation would not be necessary.

If you have any questions or need further information, I may be contacted at (828) 652-3344.

Sincerely,

D. R. McNeal, PE
District Engineer

DRM:shk

cc: Mr. J. J. Swain, Jr., PE

3931 NC 226 S, Marion, North Carolina 28752
Phone 828-652-3344 Fax 828-652-8391

NCDENR

North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor William G. Ross Jr., Secretary

November 16, 2004

Ms. Melissa A. Queen
EMH&T, Inc.
170 Mill Street
Gahanna, OH 43230-3036

Subject: Bailey Fork and South Muddy Creek Tributaries Project; Burke County, NC

Dear Ms. Queen:

The Natural Heritage Program has no record of rare species, significant natural communities, or priority natural areas at the two sites nor within a mile of the project areas. Although our maps do not show records of such natural heritage elements in the project area, it does not necessarily mean that they are not present. It may simply mean that the area has not been surveyed. The use of Natural Heritage Program data should not be substituted for actual field surveys, particularly if the project area contains suitable habitat for rare species, significant natural communities, or priority natural areas.

You may wish to check the Natural Heritage Program database website at <www.ncsparks.net/nhp/search.html> for a listing of rare plants and animals and significant natural communities in the county and on the topographic quad map. Please do not hesitate to contact me at 919-715-8697 if you have questions or need further information.

Sincerely,

Harry E. LeGrand, Jr.

Harry E. LeGrand, Jr., Zoologist
Natural Heritage Program

HEL/hel

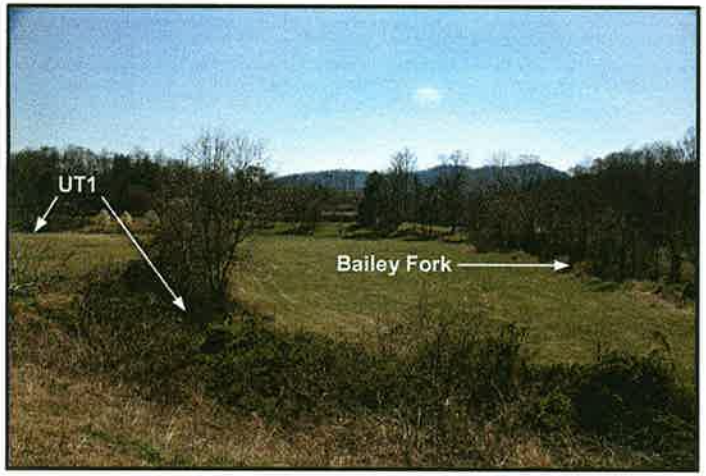


Photo 1 – Feb 04, UT1 (left foreground), Bailey Fork (right background)

Photo 2 – Feb 04, UT1 at base of hillside

Photo 3 – Feb 04, UT1 (foreground), Bailey Fork (background), Note invasive vegetation

Photo 4 – Feb 04, Bank erosion at approximate proposed station 1+50, Upper Bailey

Photo 5 – Oct 04, Bank erosion at approximate proposed station 2+00, Upper Bailey

Photo 6 – Oct 04, Bank erosion at approximate proposed station 5+50, Upper Bailey

Photo 7 – Feb 04, Three pipe culvert under Propst Road

Photo 8 – Oct 04, Severe bank erosion, approximate station 1+50, Lower Bailey

Photo 9 – Oct 04, Severe bank erosion, approximate proposed station 2+14, Lower Bailey

Photo 10 – Oct 04, Severe bank erosion, approximate proposed station 2+14, Lower Bailey

Photo 11 – Oct 04, Fence fallen into stream from bank erosion, approximate proposed station 7+00, Lower Bailey

Photo 12 – Feb 04, Bank erosion along UT2, at confluence of Lower Bailey and UT2