Candiff Creek As-built Baseline Report - Final

Surry County, North Carolina

EEP Project Number 92767

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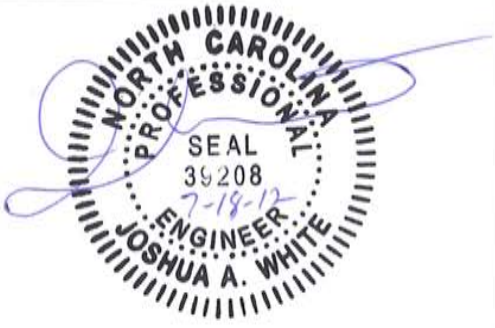

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Date Submitted:	July 2012

EXECUTIVE SUMMARY

The Candiff Creek Restoration Project (Site) was restored through a contract with the North Carolina Ecosystem Enhancement Program (NCEEP). This report documents the completion of the restoration construction and presents base-line as-built monitoring data for the five-year monitoring period. Table 1 summarizes Site conditions before and after restoration, as well as the conditions predicted in the previously completed Site restoration plan. The monitoring plan and as-built baseline data are discussed in detail in Sections 2.1 through 2.5 of this report.

Table 1
Background Information

Preconstruction Site Conditions			
Site			
Location	Surry County, NC (Figure 1), approximately 1.75 miles west of Siloam Township		
USGS Hydro Unit	03040101		
NCDWQ Sub-basin	03-07-02		
Contract Mitigation Units	**4,725 SMU**		
Stream			
Reach	**Length**	**Condition**	**Drainage Area**
M1	690 LF	Thin buffer covered in invasive species	2.35 Mi^2
M2	265 LF	Straightened, Channelized, & Incised F4/1	2.53 Mi^2
M3	3,828 LF	Straightened, Channelized, & Incised C4/1 & F4/1	2.74 Mi^2
UT1	885 LF	Stable channel with preservation in the upper most reach and invasive species and thin buffer in the lower most reach	0.06 Mi^2
UT2	1,117 LF	Stable channel with preservation in the upper most reach and invasive species and thin buffer in the lower most reach	0.14 Mi^2

Mitigation Plan		
Stream		
Reach	**Restoration/Enhancement Type**	**Length**
M1	Enhancement II	690 LF
M2	Enhancement I	265 LF
M3	Restoration – Priority I and II	4,109 LF
UT1	Enhancement II	485 LF
UT1	Preservation	400 LF
UT2	Enhancement II	317 LF
UT2	Preservation	800 LF
	Total	7,066 LF

Post-Construction Site Conditions			
Stream			
Reach	**Restoration/Enhancement Type**	**As-built Length**	**SMU**
M1	Enhancement II	735 LF	276
M2	Enhancement I	265 LF	177
M3	Restoration – Priority I and II	4,123 LF	4,081
UT1 (Lower Reach)	Enhancement II	485 LF	194
UT1 (Upper Reach)	Preservation	400 LF	80
UT2 (Lower Reach)	Enhancement II	362 LF	127
UT2 (Upper Reach)	Preservation	800 LF	160
	Total	7,170 LF	5,095
Riparian Buffer Acreage			
Planted Riparian Buffer Acreage	17.31 Ac		
Permanent Conservation Easement	27.54 Ac		

Ecological Benefits	
Water Quality	Nutrient removal; erosion reduction; increased dissolved oxygen concentrations; and improved stream bank stability.
Water Quantity/Flood Attenuation	Increased water storage/flood control; reduced downstream flooding by reconnecting stream with its floodplain; improved groundwater recharge; improved/restored hydrologic connections.
Aquatic and Terrestrial Habitat	Improved substrate and in-stream cover; addition of large woody debris; reduced water temperature by increasing shading; restoration of terrestrial habitat; improved aesthetics.
Monitoring Plan	
Success Criteria	Success is measured with permanent cross-section, vegetation plots, and longitudinal profile conducted annually for a period of five years.
Methodology	Cross-sections and longitudinal profile are surveyed annually and tied to a common benchmark. Each tree within the 100-square-meter vegetation plots are flagged and identified. Measurements of height and diameter are also taken and annual survival rates are recorded.
Remedial Action	N/A

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Tables and Figures

Appendices

1.0 BACKGROUND INFORMATION

The Candiff Creek Restoration Site (Site) is located in Surry County in western North Carolina approximately 1.75 miles west of Siloam Township and just north of the Surry-Yadkin County line, as shown in Figure 1. The Site lies in the Yadkin Pee-Dee River Basin within the US Geological Survey (USGS) targeted local watershed 03040101 and the North Carolina Division of Water Quality (NCDWQ) sub-basin 03-07-02 and (Figure 1).

Land use on the site consists primarily of pasture and forest. Candiff Creek had been channelized and riparian vegetation had been cleared in the lower half of the site. The upstream area had a narrow, early successional buffer that included several exotic species. Prior to restoration, Candiff Creek was incised and lacked bedform diversity. As a result, channel degradation was widespread throughout the site.

The project involved the proposed restoration of 4,109 linear feet (LF) of stream, 1,757 LF of stream Enhancement (265 LF of Enhancement I and 1,492 LF of Enhancement II) and 1,200 LF of stream preservation. Table 1 and Figure 2 summarize the restoration zones on the project site. Selected site photographs are shown in Appendix A. A total of 27.54 acres of stream and riparian buffer are protected through a permanent conservation easement. Following construction, it was determined that the as-built lengths of M1 and UT2 (Lower) increased due to the as-built survey of the channel. The as-built survey captured the new thalweg alignment which increased the overall channel lengths of M1 and UT2 from 690 to 735 on M1 and 317 to 362 on M2. The new credits for M1 and UT2 are 276 and 127 SMUs respectively.

1.1 Restoration Summary

Directions to the Site are as follows: To reach the Site from Asheville, take I-40 East to I-77 North (exit 152B), just east of Statesville. Take exit 82 East on NC 67 towards Boonville. Travel 12.5 miles, and turn left on Smithtown Road (SR 1541). After 1.2 miles, turn left on Siloam Road (SR 1003). Cross the Yadkin River and turn left on River-Siloam Road (SR 2230). Follow River-Siloam Road for approximately 1.3 miles to the Site. The entrance is on the left and can be accessed via a gravel farm road.

To reach the Site from Raleigh, take I-40 West to Winston-Salem. Take Exit 193B and travel north on US52 from Winston Salem. Take Exit 129 (Pinnacle) and turn left onto Perch Road (SR 2065). Follow Perch Road for 2.4 miles and turn right onto Stony Ridge Road. Follow Stony Ridge Road (SR 2048) for 3.4 miles and turn left onto Quaker Church Road (SR 2080). Follow Quaker Church Road for 3.1 miles and turn left onto Hardy Road (SR 2081). Follow Hardy Road for 1.6 miles and turn right onto Siloam Road. Take the immediate left onto River-Siloam Road. Follow River-Siloam Road for approximately 2.5 miles; the Site entrance is on the left and can be accessed via the gravel farm road.

1.1.1 Mitigation Goals Restoration Approach

The specific goals for the Candiff Creek Site Restoration Project were as follows:

- Create geomorphically stable conditions along Candiff Creek through the project area,
- Prevent cattle from accessing the project reaches, reducing excessive bank erosion,
- Improve habitat quality in a riffle dominated stream by adding pool/riffle sequences and expanding the floodplain while improving overall ecosystem functionality,
- Improve water quality within the Candiff Creek Restoration Project area through reduction of bank erosion, and reductions in nutrient and sediment loads,
- Stabilize streambanks through installation of in-stream structures and establishing a riparian buffer consisting of native plant species,

- Improve aquatic and terrestrial habitat through increased substrate and in-stream cover, additional woody debris, and reduced water temperature by increasing stream shading, and restored terrestrial habitat.

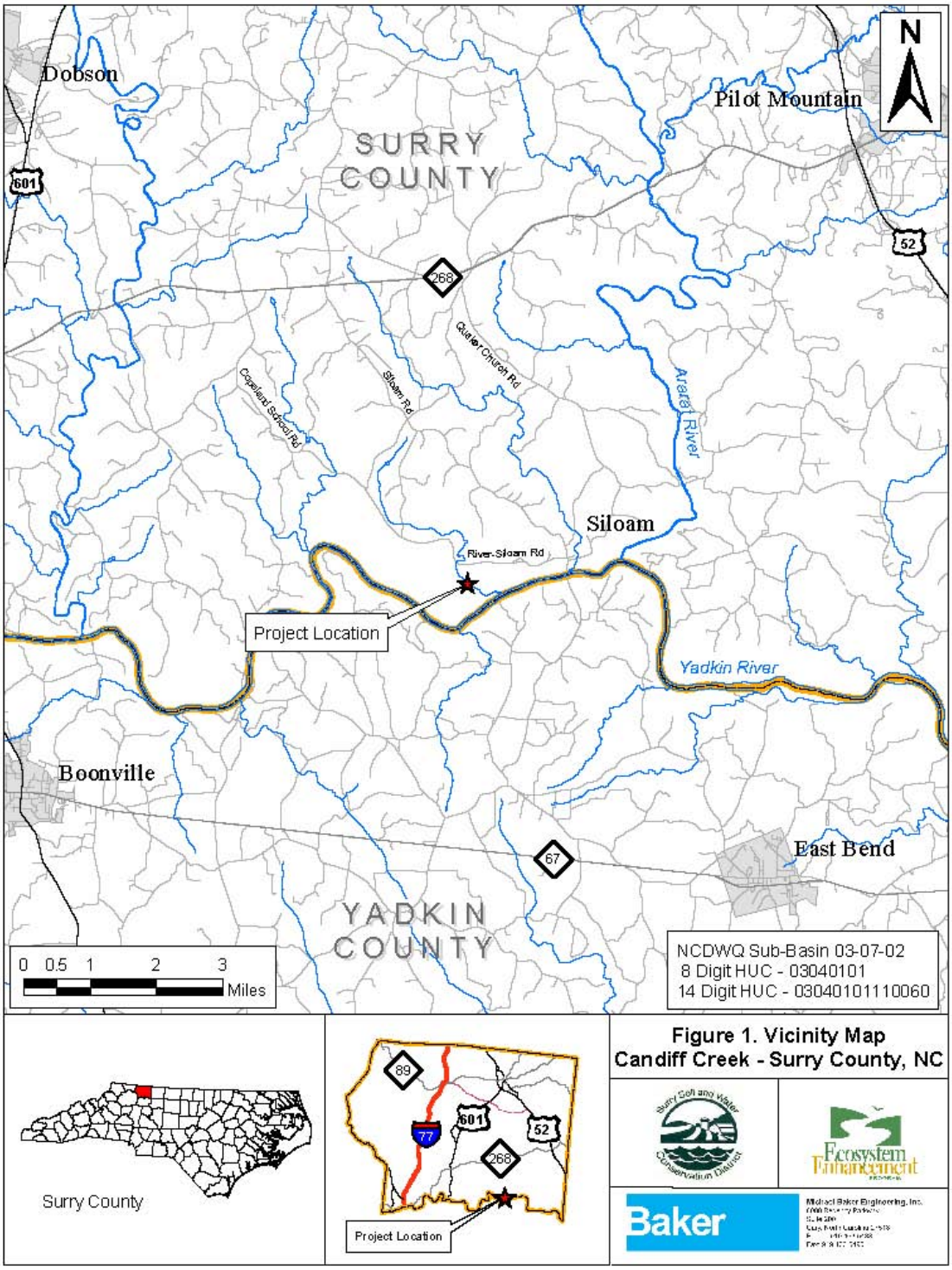
1.1.2 Projection Description and Restoration approach

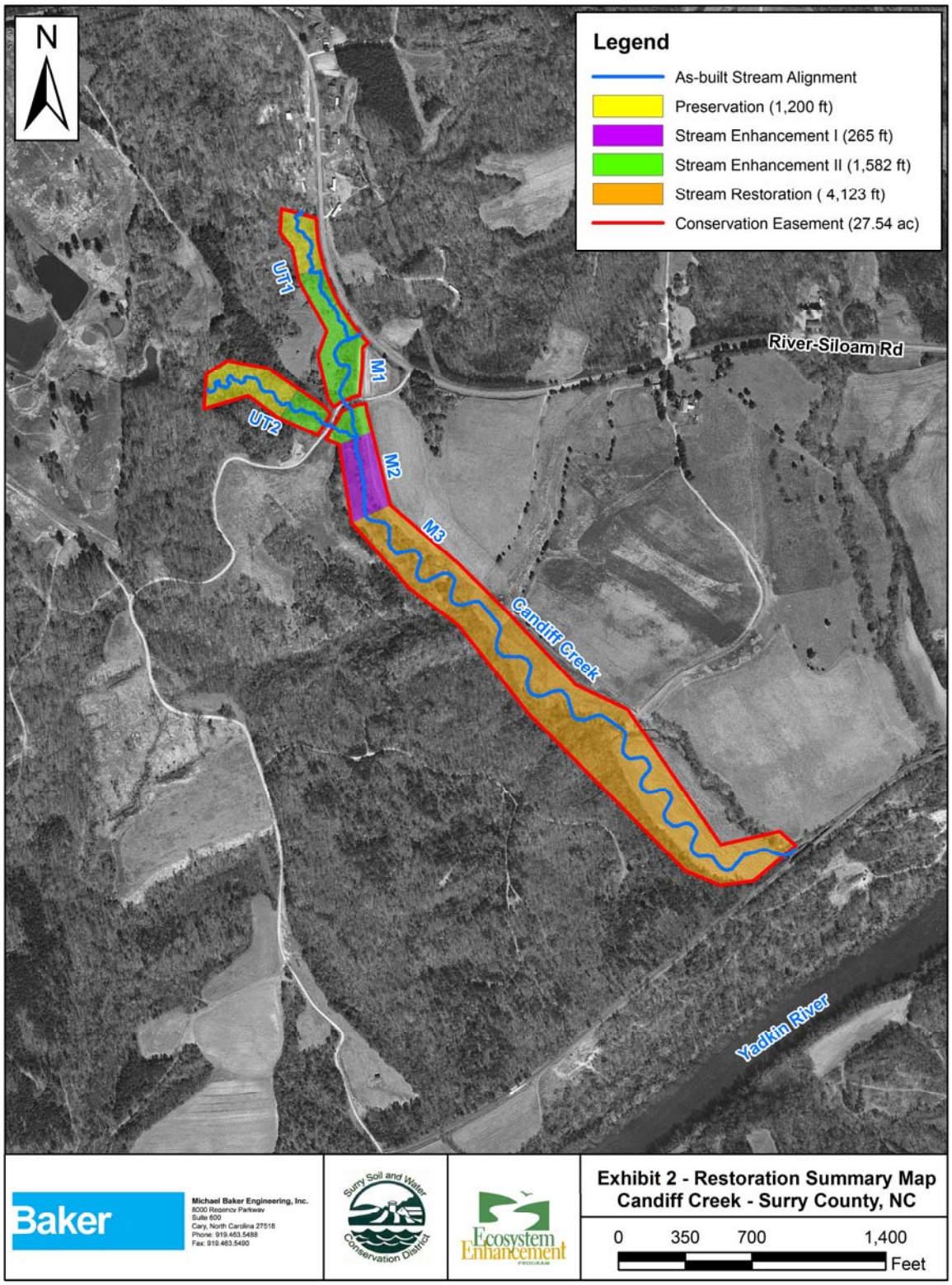
For analysis and design purposes, Michael Baker Engineering, Inc. (Baker) divided on-site streams into reaches. The reaches were numbered sequentially from upstream to downstream, with a "M" designation for the "mainstem" and a "UT" designation for "unnamed tributaries." Two UTs are located on the Site (labeled UT1 and UT2). The on-site streams are described as follows: M1 begins on the upstream section of the Site at the River-Siloam Road culvert, and then flows south to the confluence with UT2. M2 begins at the M1/UT2 confluence and flows south 265 feet to the beginning of the restored portion of the mainstem. M3 begins at the restored channel and then flows southeast for 4,123 feet and terminates at the property line adjacent to the Yakin Valley Railroad right of way located on the downstream section of the Site. UT1 flows onto the Site from the southern Wall property line and flows south for 885 feet to the confluence with M1. UT2 flows onto the Site from the eastern Aztar Group, LLC property line and flows east for 1,162 feet and terminates at the M1/M2 transition. The reaches described above are presented in the plan sheets in Appendix C.

The restoration design allows stream flows larger than bankfull flows to spread onto the floodplain, dissipating flow energies and reducing stress on streambanks. In-stream structures were used to control streambed grade, reduce streambank stress, and promote bedform sequences and habitat diversity. The in-stream structures consisted of constructed riffles, cover logs, log/rock vanes, log/rock j-hook vanes, rock cross vanes, vegetated geolifts, vegetated brush mattresses, and root wads. The structures promote a diversity of habitat features in the restored channel. Where grade control was a consideration, constructed riffles, rock j-hook vanes, and rock cross vanes were installed to provide long-term stability. Streambanks were stabilized using a combination of erosion control matting, temporary and permanent seeding, bare-root planting, transplants, brush mattresses, and geolifts. Transplants provide living root mass to increase streambank stability and create holding areas for fish and aquatic biota.

The purpose of the project is to restore stream functions to the impaired reaches on the Site. Native vegetation was planted across the Site and the entire project area is protected through a permanent conservation easement.

1.2 Project Maps




N
Legend
As-built Stream Alignment
Preservation (1,200 ft)
Stream Enhancement I (265 ft)
Stream Enhancement II (1,582 ft)
Stream Restoration (4,123 ft)
Conservation Easement (27.54 ac)
UT1
UT2
M1
M2
M3
River-Siloam Rd
Candiff Creek
Yadkin River
Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
Surry Soil and Water Conservation District
Ecosystem Enhancement Program
Exhibit 2 - Restoration Summary Map
Candiff Creek - Surry County, NC
0
350
700
1,400
Feet

1.3 Construction Summary and Tables

Construction activities, in accordance with the approved restoration plan for the Site, began in September 2011 with site preparation, harvesting of root wads, and establishment of access sites and stockpile areas. Materials were stockpiled as needed for the initial stages of construction. Construction stakeout was staked in three phases in order for the contractor to effectively and efficiently construct the project. The stakeout phases were completed between September and November, 2011.

The contractor (River Works, Inc.) began channel work at the top of M2 and installed the designed structures while minimizing disturbance to the buffer. Once M2 was completed, the contactor started at the top reach of M3 (Sta 20+00 to 44+00) and worked in a downstream fashion by clearing the area of the new alignment, excavating the new channel and sections of floodplain, installing the in-stream structures, sowing temporary and permanent seed and straw mulch on the banks and floodplain, and installing matting on the stream banks. Once the upper reach of M3 was completed, they moved to the lower reach of M3.

The lower end floodplain of M3 was design entirely as Rosgen Priority Level II in order to tie into the stream as the project flows off the property. The first step was to grade the floodplain areas to reach design grades across the Site. Grade stakes were installed along design contours to direct the grading activities. The excavated material was stockpiled in specified areas near the existing channel that was to be filled. Where necessary, silt fencing was installed between stockpiles and the existing channel to prevent erosion of sediment into the channel.

Once the design floodplain grades were achieved, the new stream channel was sculpted and constructed in the dry. Construction of the stream channel began at the upstream end of the lower reach of M3 (Sta 44+00) and moved in a downstream direction for the entire length of the channel. Upon completion of new channel segments, in-stream structures, temporary and permanent seed, straw mulch, matting, and transplants were installed. The new channel was then tied into the existing streambed and prepared to accept flow. Once fully prepared, temporary sediment traps at the downstream ends of the channels were removed, and water was directed into the newly constructed channel. The abandoned channel was immediately filled and graded to tie into the adjacent landscape. As-built cross-sections and longitudinal profiles are shown in Appendix B.

Modifications made during construction consisted of changes in the order of the construction sequence to increase efficiency during wet or high flow conditions. Other modifications involved changes to the planting list due to availability of the plants. Substitutions were made based on availability of materials and professional judgment. The final as-built stream length for the project, as indicated on Table 2 and in Appendix C, was 7,170 LF.

Table 2
Summary of As-built Lengths, Mitigation Units, and Restoration Approaches

Reach Name	Stations	As-built Length (ft)	Easement Exclusion (ft)	SMU	Restoration Approach
M1	10+00 - 17+35	735	45	276	Enhancement II
M2	17+35 - 20+00	265	0	177	Enhancement I
M3	20+00 - 61+23	4,123	42	4,081	Restoration – Priority I & II
UT1	14+00 - 18+85	485	0	194	Enhancement II
UT1	10+00 - 14+00	400	0	80	Preservation
UT2	18+00 - 21+62	362	45	127	Enhancement II
UT2	10+00 - 18+00	800	0	160	Preservation
Total Length		**7,170**	**132**	**5,095**	

2.0 Monitoring Plan

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

2.1 Stream Monitoring

Geomorphic monitoring of restored stream reaches will be conducted for five years to evaluate the effectiveness of the restoration practices. Monitored stream parameters include bankfull flows, stream dimension (cross-sections), pattern (longitudinal survey), profile (profile survey), and photographic documentation. The methods used and any related success criteria are described below for each parameter. For monitoring stream success criteria, ten permanent cross-sections, and one crest gauge were installed.

2.1.1 Bankfull Events

The occurrence of bankfull events within the monitoring period will be documented by the use of a crest gauge and photographs. A crest gauge was installed on the floodplain within 10 feet of Reach M3. The crest gauge will record the highest watermark between Site visits and will be checked during each Site visit to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring Site visits.

Two bankfull flow events must be documented at the crest gauge within the 5-year monitoring period. The two bankfull events must occur in separate years; otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years.

2.1.2 Cross-sections

For monitoring stream success criteria, ten permanent cross-sections were installed. Approximately two permanent cross-sections were installed per thousand LF of stream restoration work, with one located at a riffle cross-section and one located at a pool cross-section. Each cross-section was marked on both banks with permanent pins to establish the exact transect used. A common benchmark will be used for cross-sections and consistently referenced to facilitate comparison of year-to-year data. The annual cross-sectional survey will include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross-sections will be classified using the Rosgen Stream Classification System.

There should be little change in the as-built cross-sections. If changes do take place they should be evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio).

2.1.3 Longitudinal Profile

A complete longitudinal survey was completed for the restored stream channels to provide a baseline for evaluating changes in bed conditions over time. The longitudinal profile included the elevations of all grade control structures. The permanent cross-section and longitudinal data are provided in Appendix B. A longitudinal profile will be completed annually for the five year monitoring period. The profile will be conducted for 3,000 LF of restored Candiff Creek channel. Measurements will include thalweg, water surface, inner berm, bankfull, and top of low bank. All measurements will be taken at the head of each feature (e.g., riffle, run, pool, and glide) and the maximum pool depth. The survey will be tied to a permanent benchmark.

2.1.4 Benthic Macroinvertebrates

Benthic macro invertebrate data was not a monitoring requirement.

2.1.5 Photo Reference Sites

Photographs will be used to document restoration success visually. Reference stations will be photographed immediately after construction and for at least five years following construction. Reference photos will be taken once a year, from a height of approximately five to six feet. Permanent markers will be established to ensure that the same locations (and view directions) on the Site are monitored during each monitoring period. Selected Site photographs are shown in Appendix A and locations are shown in Appendix C (Sheets 5-6E).

2.1.5.1 Lateral Reference Photos

Reference photo transects will be taken at each of the ten permanent cross-sections. Photographs will be taken of both banks at each the cross-section. The survey tape will be centered in the photographs of the bank. The water line will be located in the lower edge of the frame, and as much of the bank as possible will be included in each photo. Photographers should make an effort to consistently maintain the same area in each photo over time.

2.1.5.2 Structure Photos

Photographs will be taken at each the grade control structures along the restored stream. Photographers should make every effort to consistently maintain the same area in each photo over time. Photographs will be used to evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures subjectively. Lateral photos should not indicate excessive erosion or continuing degradation of the banks. A series of photos over time should indicate successive maturation of riparian vegetation.

2.2 Vegetation Monitoring

Successful restoration of the vegetation on a mitigation site is dependent upon active planting of preferred canopy species and volunteer regeneration of the native plant community. In order to determine if the criteria have been met, vegetation monitoring quadrants were installed across the restoration site, as directed by Stream Mitigation Guidelines (USACE and NCDWQ 2006) and the North Carolina Ecosystem Enhancement Program (CVS/NCEEP guidelines 2007). The number of quadrants required was based on the species/area curve method, as described in NCEEP monitoring guidance documents. A total of thirteen (13) plots were installed, which constitutes greater than 1.8% of the planted area. The size of individual quadrants was 100 square meters for woody tree species, and 1 square meter for herbaceous vegetation. Vegetation monitoring will occur in the fall of each year. Individual quadrant data will be provided and will include diameter, height, density, and coverage quantities. Individual seedlings will be marked such that they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

At the end of the first growing season, species composition, density, and survival will be evaluated. For each subsequent year, until the final success criteria are met, the restored Site will be evaluated between July and November.

The interim measure of vegetative success for the Site will be the survival of at least 320, 3-year old, planted trees per acre at the end of year three of the monitoring period. The final vegetative success criteria will be the survival of 260, 5-year old, planted trees per acre at the end of year five of the monitoring period.

Maintenance and Contingency Plan

Maintenance requirements vary from site to site and are generally driven by the following conditions:

- Projects without established, woody floodplain vegetation are more susceptible to erosion from floods than those with a mature, hardwood forest.
- Projects with sandy, non-cohesive soils are more prone to short-term bank erosion than cohesive soils or soils with high gravel and cobble content.
- Alluvial valley channels with wide floodplains are less vulnerable than confined channels.
- Wet weather during construction can make accurate channel and floodplain excavations difficult.
- Extreme and/or frequent flooding can cause floodplain and channel erosion.
- Extreme hot, cold, wet, or dry weather during and after construction can limit vegetation growth, particularly temporary and permanent seed.
- The presence and aggressiveness of invasive species can affect the extent to which a native buffer can be established.

Maintenance issues and recommended remediation measures will be detailed and documented in the monitoring reports. Factors that may have caused any maintenance needs, including any of the conditions listed above, shall be discussed.

2.3 Monitoring Results – 2012 As-Built Data

The five-year monitoring plan for the Candiff Creek Site includes criteria to evaluate the success of the vegetation and stream components of the project. The specific locations of vegetation plots, permanent cross-sections, and crest gauge are shown on the as-built drawing sheets. The photo points, located at each of the grade control structures along the restored stream channel and are also located on the as-built drawing sheets in Appendix C (Sheets 5-6E).

2.3.1 Morphology

For monitoring stream success criteria, 10 permanent cross-sections, and 1 crest gauge were installed. The permanent cross-sections will be used to monitor channel dimension and bank erosion over time. The crest gauge will be used to document the occurrence of bankfull events. In addition, a complete longitudinal survey was completed for the restored stream channels to provide a base-line for evaluating changes in bed conditions over time. The longitudinal profile included the elevations of all grade control structures. The permanent cross-section and longitudinal data are provided in Appendix B.

2.3.1.1 Results and Discussion

No results are available at the submittal of this report. Vegetation survival will be compared with first year monitoring data in the Year 1 Monitoring Report, scheduled for submittal to NCEEP during December 2012.

2.3.2 Vegetation

Approximately 17.31 acres of bare-root trees were planted within the non-forested areas within the conservation easement. A minimum 50-foot buffer was established along all restored stream reaches. In general, bare-root vegetation was planted at a target density of 680 stems per acre, in an 8-foot by 8-foot grid pattern. Planting of bare-root trees was completed in March 2012. Species planted are summarized in Table 3.

Table 3
Vegetation Species Planted Across the Restoration Site

Scientific Name	Common Name	Percent Planted by Species	Total Number of Stems
Bare Root Trees Species			
Betula nigra	river birch	23.3%	1,800
Diospyros virginiana	persimmon	7.8%	600
Fraxinus pennsylvanica	green ash	15.6%	1,200
Liriodendron tulipfera	tulip poplar	7.8%	600
Platanus occidentalis	sycamore	22.1%	1,700
Quercus michauxii	swamp chestnut oak	15.6%	1,200
Quercus phellos	willow oak	7.8%	600
Bare Root Shrub Species			
Asimina triloba	paw paw	9.5%	400
Carpinus caroliniana	ironwood	12%	500
Cercus canadensis	redbud	14%	600
Cornus amomum	silky dogwood	19%	800
Lindera benzoin	spicebush	9.5%	400
Sambucus canadensis	elderberry	19%	800
Viburnum dentatum	arrowwood	17%	700
Native Herbaceous Species			
Agrostis alba	redtop	10%	NA
Andropogon gerardii	big bluestem	5%	NA
Bidens frondosa	devil's beggartick	5%	NA
Coreopsis lanceolata	lanceleaf tickseed	10%	NA
Dichanthelium clandestinum	deertongue	15%	NA
Elymus virginicus	Virginia wildrye	15%	NA
Juncus effusus	soft rush	5%	NA
Panicum virgatum	switchgrass	15%	NA
Polygonum pennsylvanicum	Pennsylvania smartweed	5%	NA
Schizachyrium scoparium	little bluestem	5%	NA
Sorghastrum nutans	Indiangrass	5%	NA
Tripsacum dactyloides	eastern gamagrass	5%	NA

Table 3
Vegetation Species Planted Across the Restoration Site

Scientific Name	Common Name	Percent Planted by Species	Total Number of Stems
Woody Vegetation for Live Stakes			
Cornus amomum	silky dogwood	30%	2,100
Salix sericia	silky willow	30%	2,100
Salix nigra	black willow	10%	700
Sambucus canadensis	elderberry	30%	2,100

The mitigation plan for the Candiff Creek Site specifies that the number of quadrants required were based on the species/area curve method, as described in NCEEP monitoring guidance documents (2007) and, with a minimum of eleven quadrants. The sizes of individual quadrants are 100 square meters for woody tree species, and 1 square meter for herbaceous vegetation. A total of 13 vegetation plots, each 10 meters by 10 meters in size, were established across the restored Site. The initial planted density within each of the vegetation monitoring plots is given in Table 4. The average density of planted bare root stems, based on the data from the 13 monitoring plots, is 915 stems per acre. The locations of the vegetation plots are shown on the as-built plan sheets.

Table 4
Candiff Creek Initial Stem Counts for Each Species Arranged by Plot

	10m X 10m PLOTS												
Tree Species	1	2	3	4	5	6	7	8	9	10	11	12	13
Betula nigra													
Diospyros virginiana													
Fraxinus pennsylvanica													
Liriodendron tulipfera													
Platanus occidentalis													
Quercus michauxii													
Quercus phellos													
Asimina triloba													
Carpinus caroliniana													
Cercus canadensis													
Cornus amomum													
Lindera benzoin													
Sambucus canadensis													
Viburnum dentatum													
unknown	26	23	25	23	20	18	22	21	19	22	25	25	25

Table 4
Candiff Creek Initial Stem Counts for Each Species Arranged by Plot

	10m X 10m PLOTS												
Tree Species	1	2	3	4	5	6	7	8	9	10	11	12	13
Totals:	26	23	25	23	20	18	22	21	19	22	25	25	25
Stems / Acre	1052	931	1012	931	809	728	890	850	769	890	1012	1012	1012
*Bare root trees were left unidentified until leaf out to ensure proper identification.													

2.3.2.1 Results and Discussion

No results are available at the submittal of this report. As-built data will be compared with first year monitoring data in the Year 1 Monitoring Report, scheduled for submittal to NCEEP during December 2012.

2.4 Areas of Concern

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

Appendix A

Selected Project Photographs

PP1 STA 61+60

PP 2 61+25

PP 3 STA 60+25

PP 4 STA 60+10

PP 5 STA 59+10

PP 6 STA 58+85

PP 7 STA 57+65

PP 8 STA 57+50

PP 9 STA 56+70

PP 10 STA 56+50

PP 11 STA 55+40

PP 12 STA 55+15

PP 13 STA 53+95

PP 14 STA 53+75

PP 15 STA 52+35

PP 16 STA 52+05

PP 17 STA 50+75

PP 18 STA 50+40

PP 19 STA 49+15

PP 20 STA 48+75

PP 21 STA 47+50

PP 22 STA 47+25

PP 23 STA 46+15

PP 24 STA 46+00

PP 25 STA 45+25

PP 26 STA 44+90

PP 27 STA 43+50

PP 28 STA 43+25

PP 29 STA 42+10

PP 30 STA 41+80

PP 31 STA 40+25

PP 32 STA 40+00

PP 33 STA 38+50

PP 34 STA 38+25

PP 35 STA 36+75

PP 36 STA 36+45

PP 37 STA 35+05

PP 38 STA 34+80

PP 39 STA 33+90

PP 40 STA 33+60

PP 41 STA 33+00

PP 42 STA 32+10

PP 43 STA 32+75

PP 44 STA 30+55

PP 45 STA 30+20

PP 46 STA 28+80

PP 47 STA 28+65

PP 48 STA 27+75

PP 49 STA 27+10

PP 50 STA 26+75

PP 51 STA 25+65

PP 52 STA 25+45

PP 53 STA 24+25

PP 54 STA 24+00

PP 55 STA 22+90

PP 56 STA 22+70

PP 57 STA 21+65

PP 58 STA 19+75

PP 59 STA 17+75

PP 60 Crest gage STA 55+50

Appendix B

As-Built Cross-Sections and Longitudinal Profile

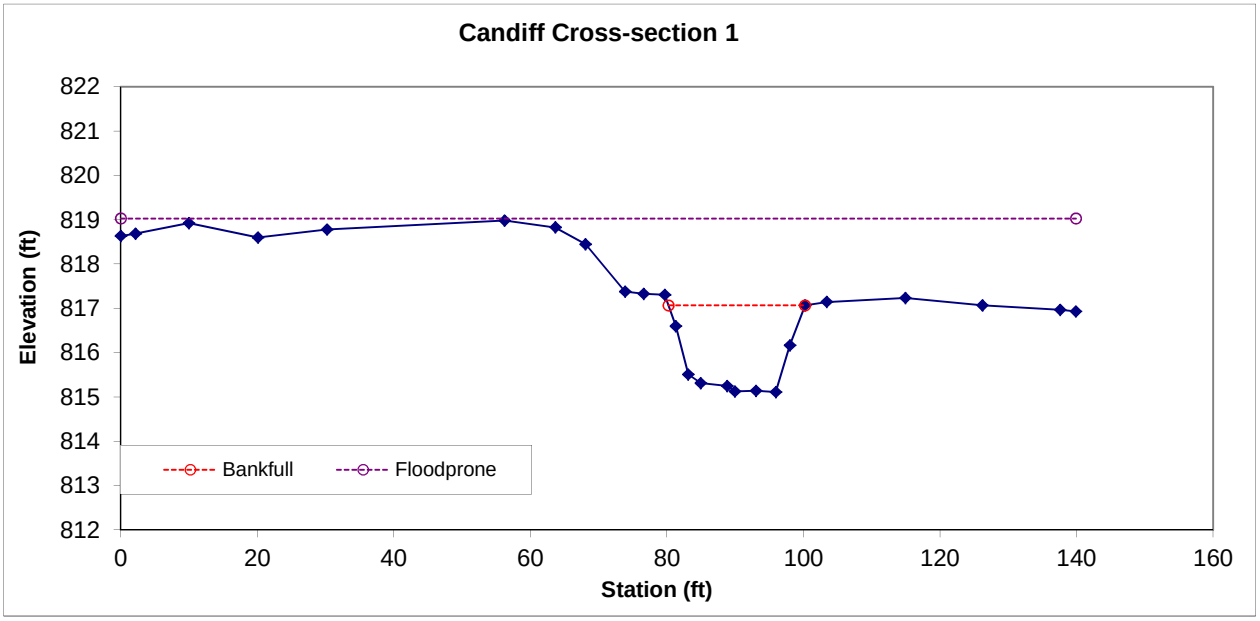
Permanent Cross-section 1

(As-Built Data - collected March 2012)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	29.8	20	1.49	1.96	13.44	1	7	817.07	817.07



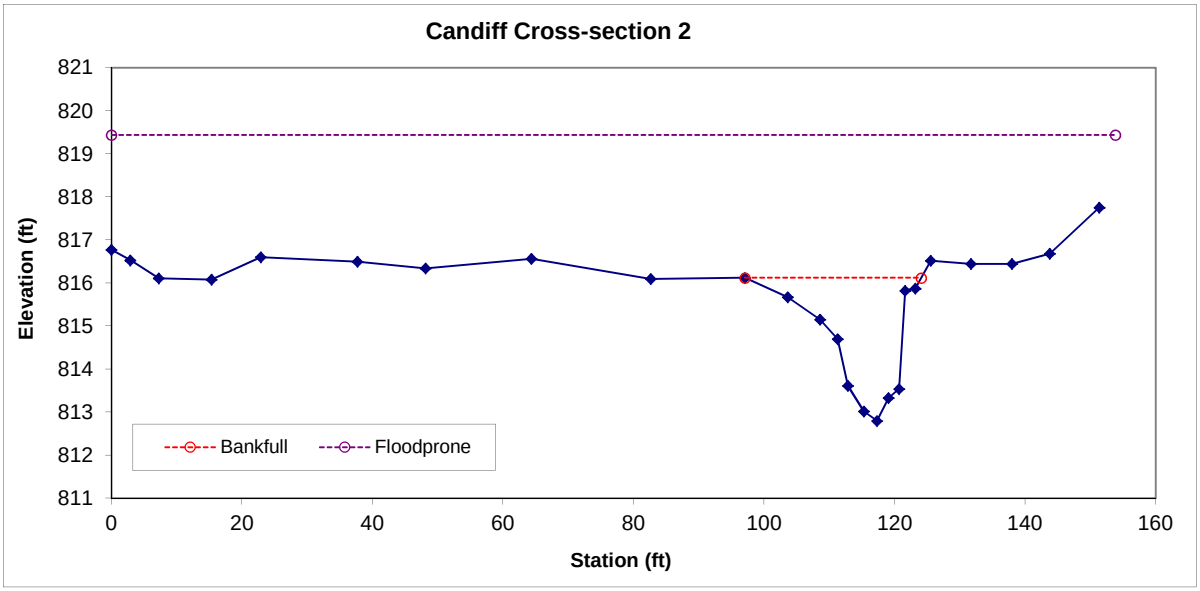
Permanent Cross-section 2

(As-Built Data - collected March 2012)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		36.3	27.02	1.34	3.32	20.13	1	5.7	816.12	816.12



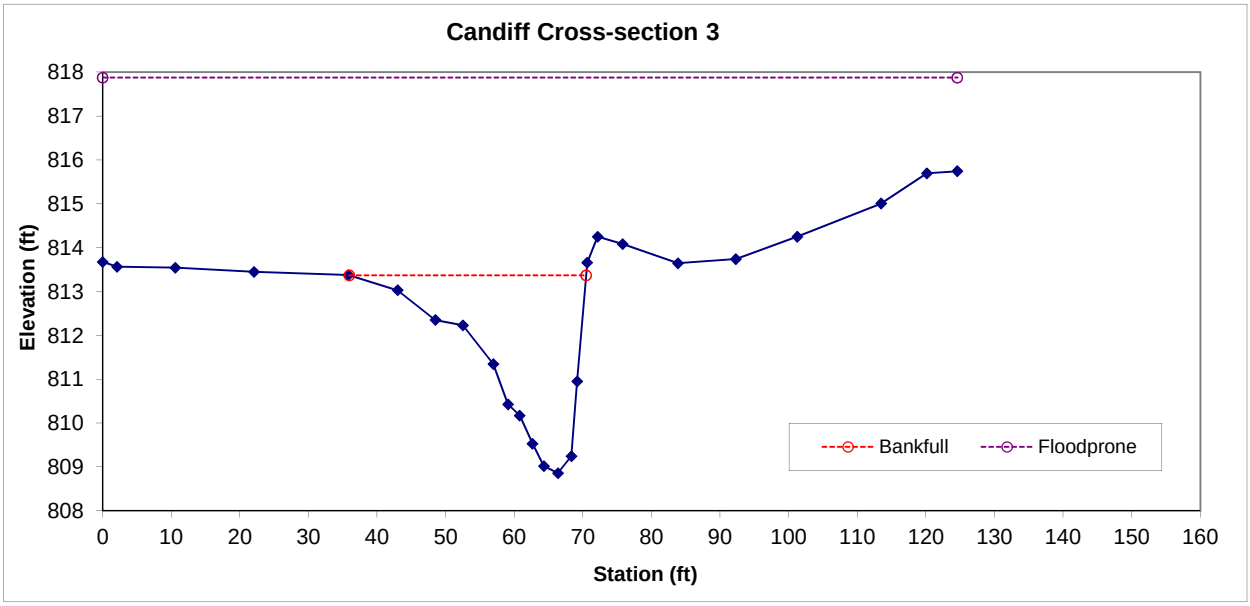
Permanent Cross-section 3

(As-Built Data - collected March 2012)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		61.9	34.5	1.8	4.51	19.22	1	3.6	813.37	813.38



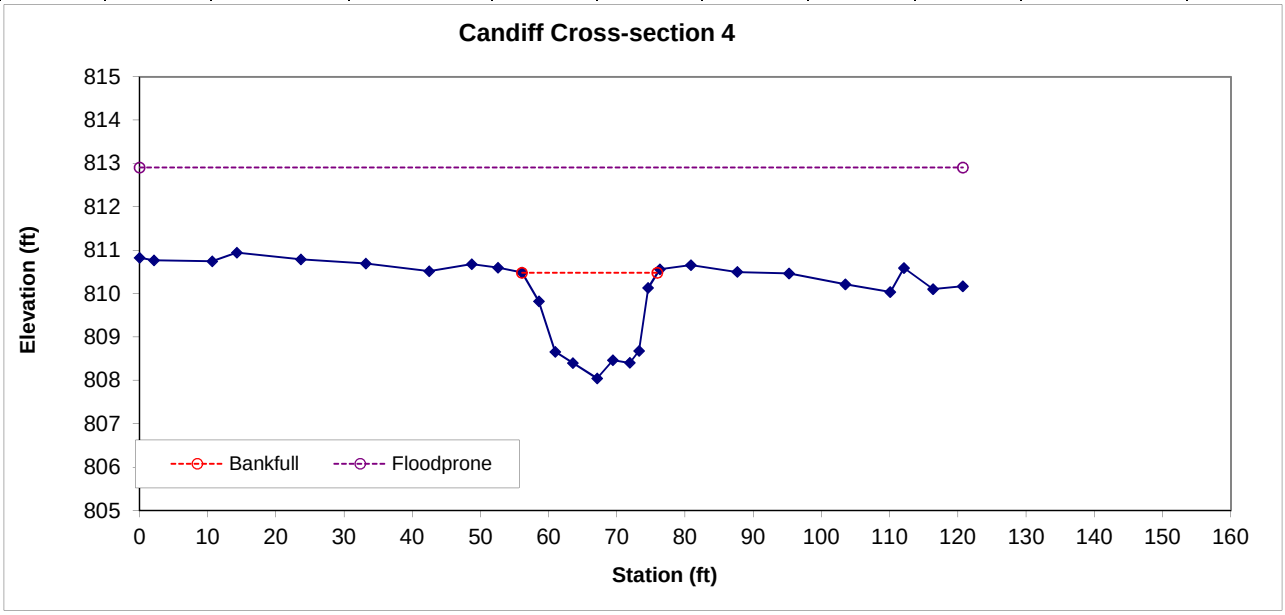
Permanent Cross-section 4

(As-Built Data - collected March 2012)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	31.3	19.84	1.58	2.43	12.56	1	6.1	810.48	810.49



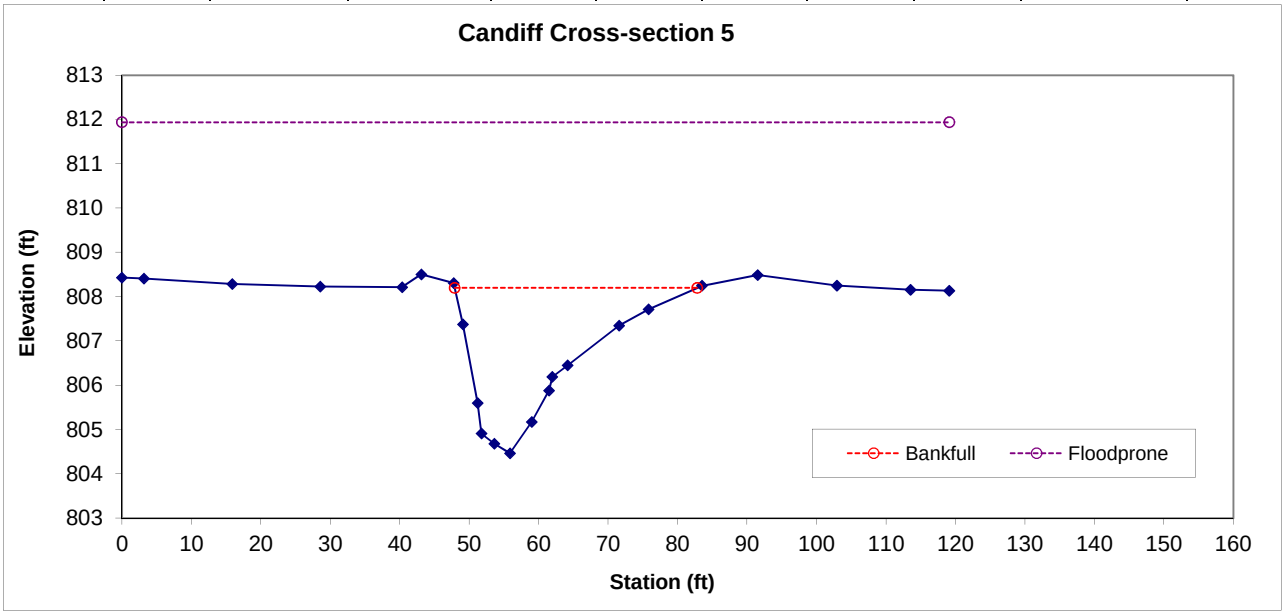
Permanent Cross-section 5

(As-Built Data - collected March 2012)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		56.8	34.91	1.63	3.74	21.46	1	3.4	808.2	808.25



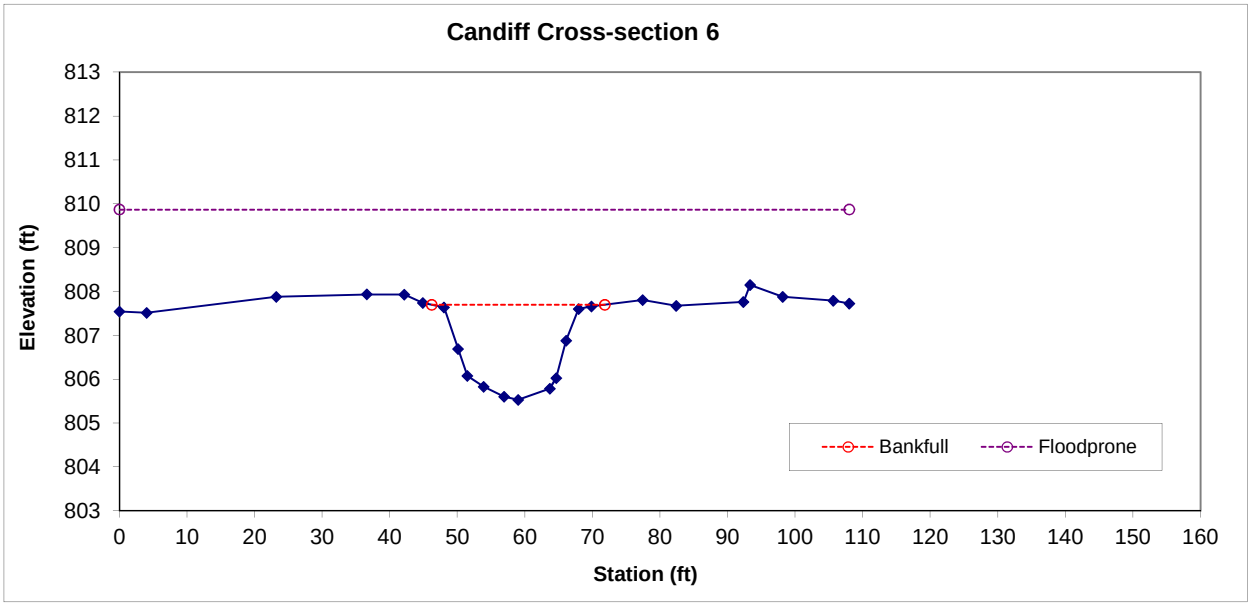
Permanent Cross-section 6

(As-Built Data - collected March 2012)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	31.7	25.61	1.24	2.17	20.7	1	4.2	807.7	807.64



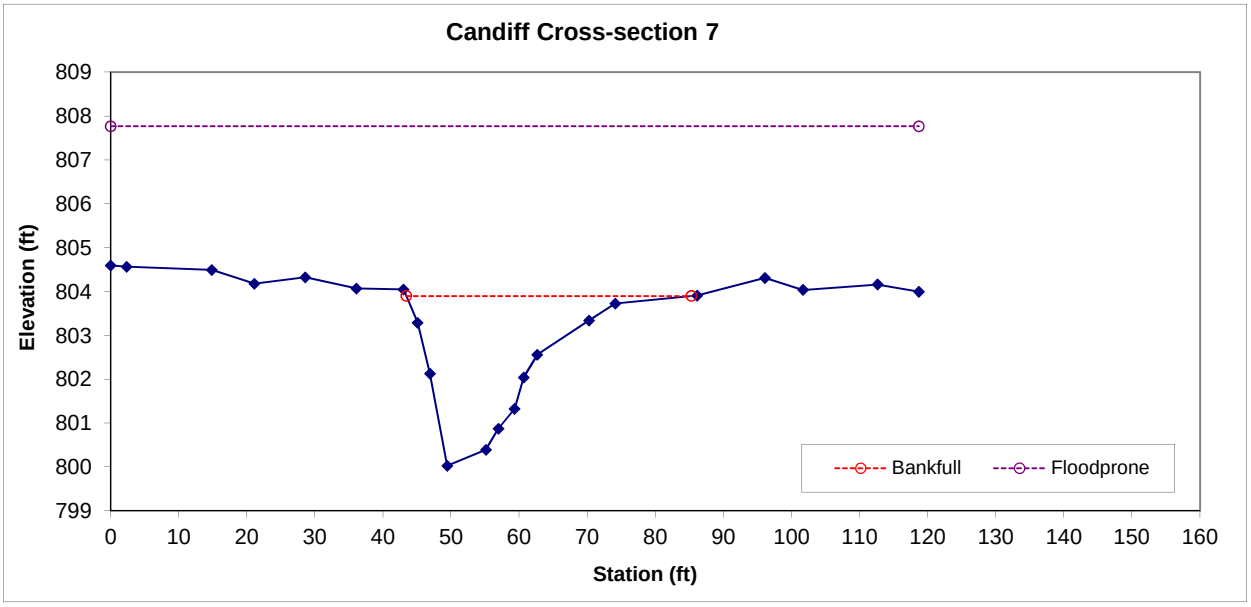
Permanent Cross-section 7

(As-Built Data - collected March 2012)

Looking at the Left Bank

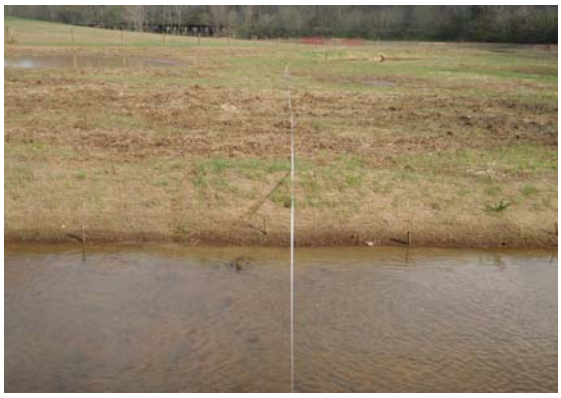
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		59.1	41.86	1.41	3.87	29.63	1	2.8	803.9	803.91

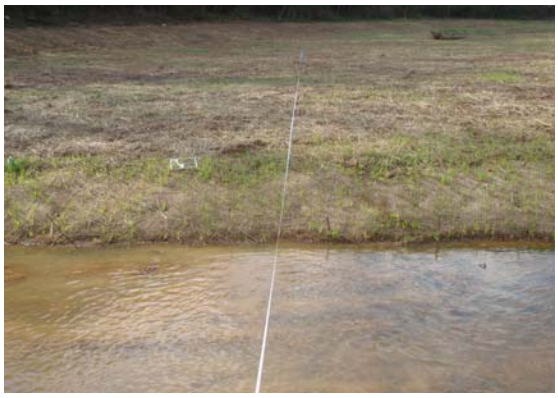


Permanent Cross-section 8

(As-Built Data - collected March 2012)

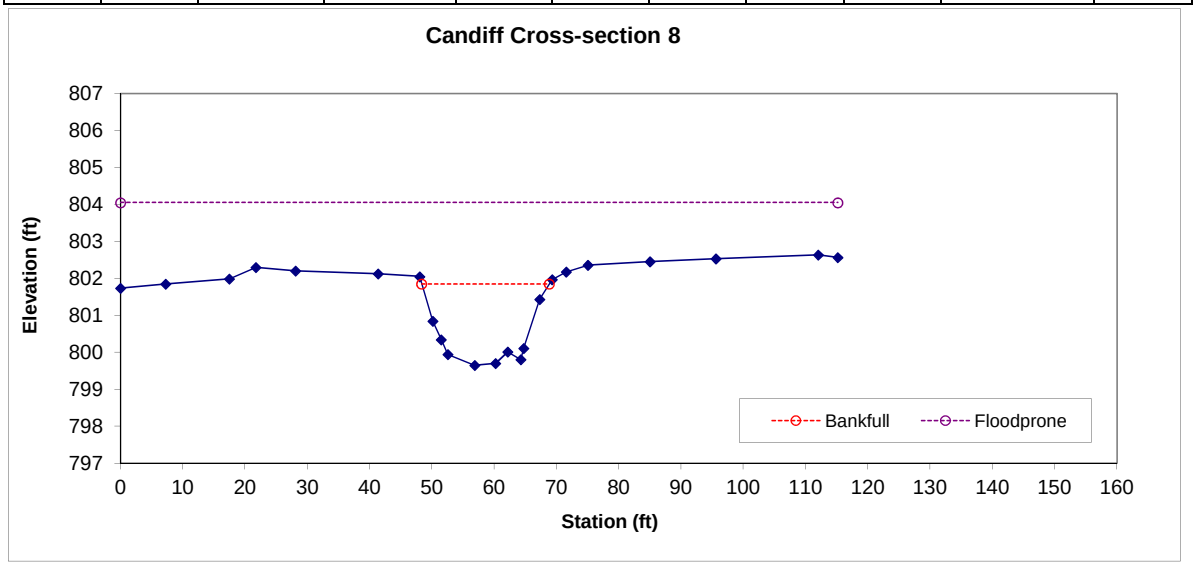


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	32.4	20.48	1.58	2.2	12.93	1.1	5.6	801.85	801.97



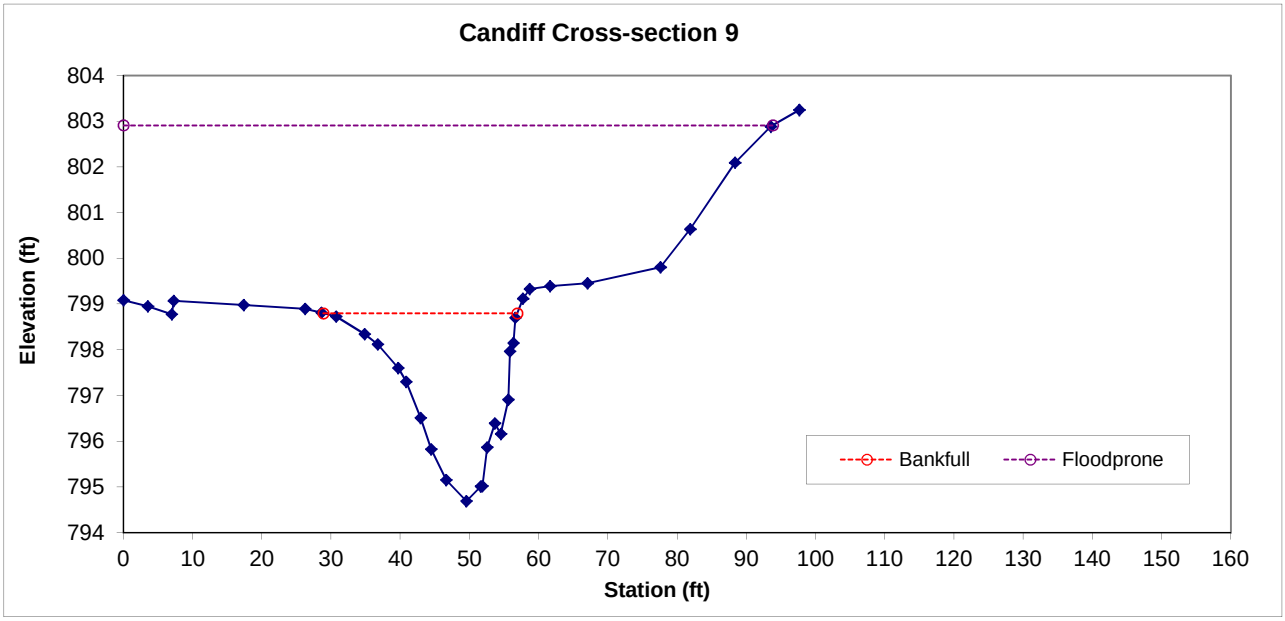
Permanent Cross-section 9

(As-Built Data - collected March 2012)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		52.8	28	1.88	4.11	14.86	1	3.3	798.8	798.81



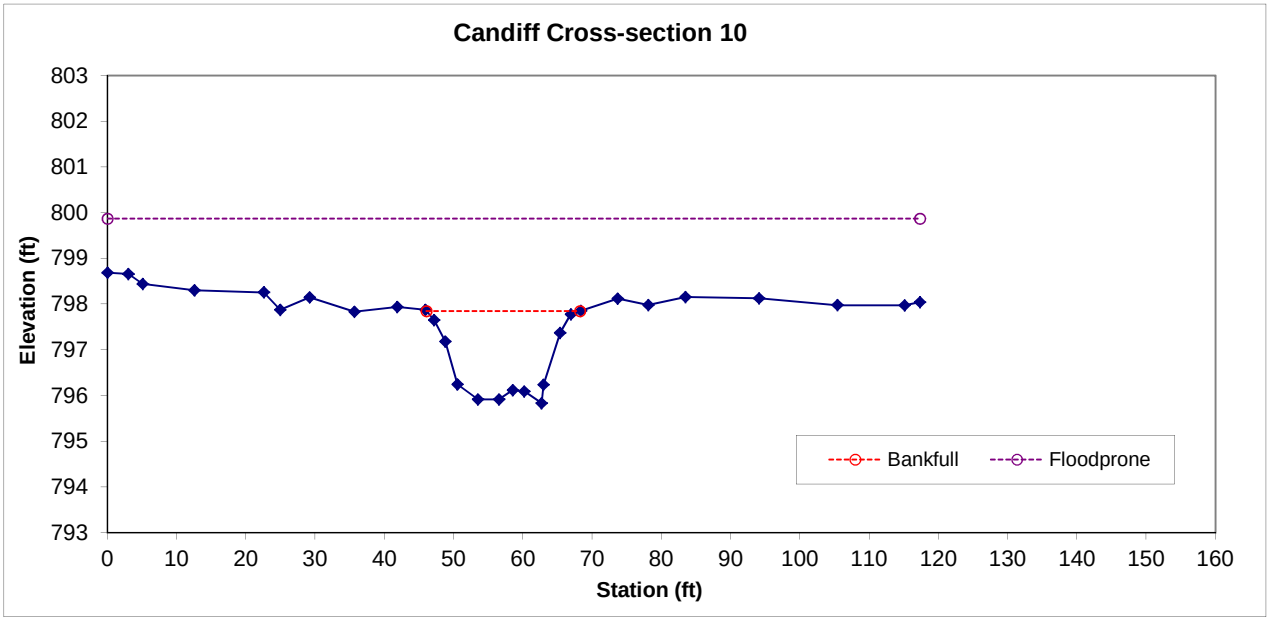
Permanent Cross-section 10

(As-Built Data - collected March 2012)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	28.6	22.18	1.29	2.02	17.18	1	5.3	797.85	797.86



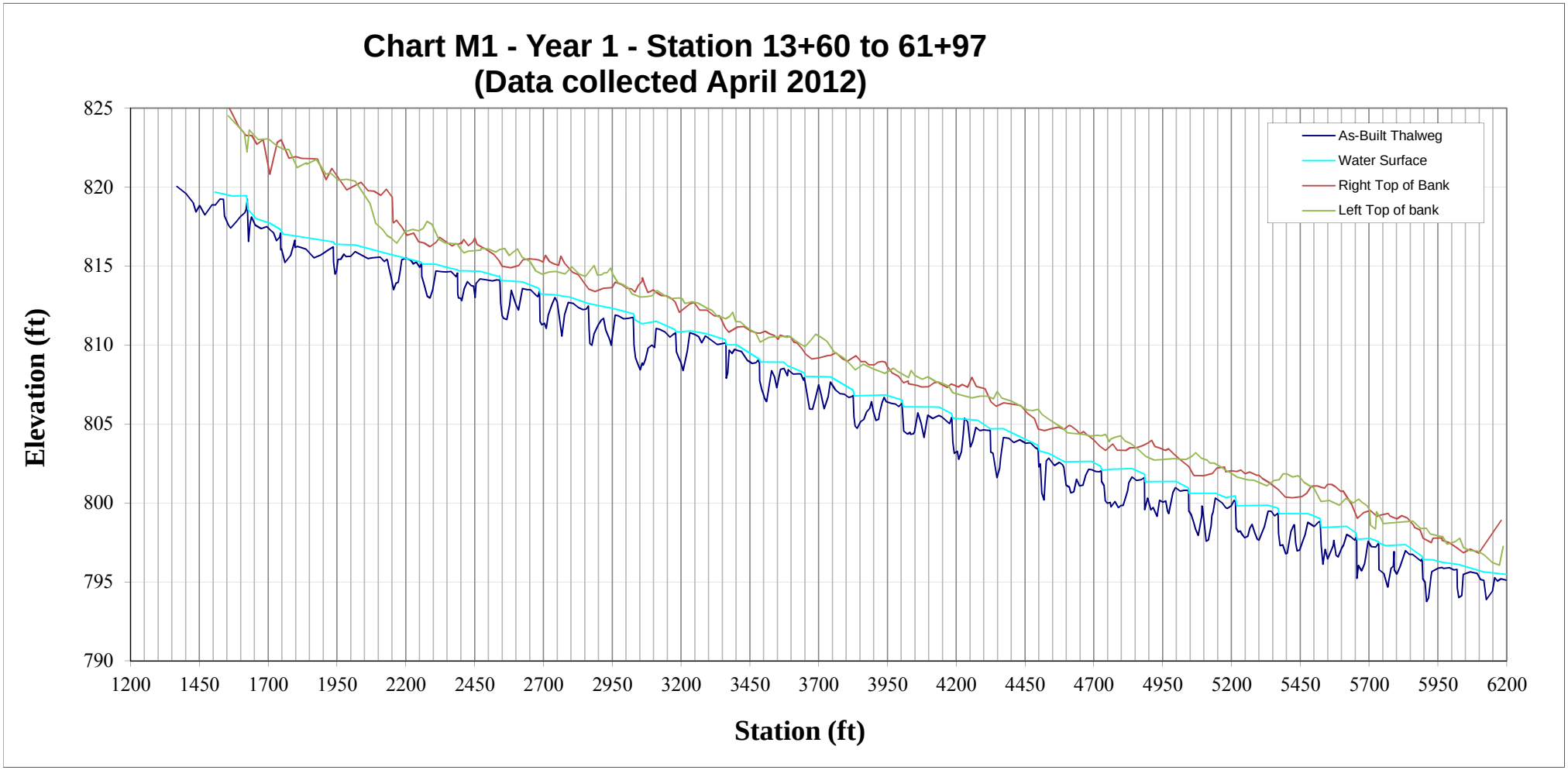


Chart M1 - Year 1 - Station 13+60 to 61+97
(Data collected April 2012)
Elevation (ft)
825
820
815
810
805
800
795
790
1200
1450
1700
1950
2200
2450
2700
2950
3200
3450
3700
3950
4200
4450
4700
4950
5200
5450
5700
5950
6200
Station (ft)
As-Built Thalweg
Water Surface
Right Top of Bank
Left Top of bank

Appendix C

As-Built Plan Sheets

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	118335	1	31

NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

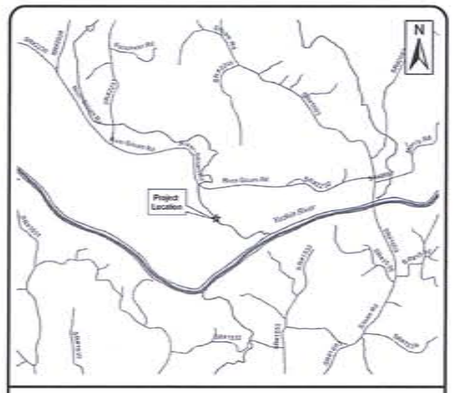
SURRY COUNTY

LOCATION: ON THE JOHNSON PROPERTY NEAR SILOAM, NC OFF RIVER–SILOAM ROAD

TYPE OF WORK: AS–BUILT PLANS FOR STREAM RESTORATION, ENHANCEMENT, AND PRESERVATION

CANDIFF CREEK

PROJECT: 118335



VICINITY MAP

INDEX OF SHEETS

DATUM DESCRIPTION:

NORTH CAROLINA GRID COORDINATES (NAD83) FOR PRIMARY GPS DERIVED CONTROL POINTS WERE ESTABLISHED FOR MICHAEL BAKER ENGINEERING INC. CARY, NC.

SUPPLEMENT CONTROL POINTS (NAD83) UTILIZED FOR THIS SURVEY WERE ESTABLISHED BY MICHAEL BAKER ENGINEERING USING CONVENTIONAL METHODS.

NORTH CAROLINA PROFESSIONAL SEAL 5708 LAND SURVEYOR WILLIAM KENT 6.5.12

GRAPHIC SCALES

40 20 0 40 80
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

5 0 5 10
PROFILE (VERTICAL)

PROJECT LENGTH

	CANDIFF	UT1	UT2
EXISTING REACH LENGTH =	4,783	885	1,117
DESIGN REACH LENGTH =	5,064	885	1,117
AS–BUILT REACH LENGTH =	5,078	885	1,117

PREPARED FOR THE OFFICE OF:

Ecosystem Enhancement Program

JULIE CAHILL
PROJECT MANAGER

SUBMITTED BY THE OFFICE OF:

Surry Soil and Water Conservation District

TONY DAVIS
PROJECT MANAGER

PREPARED IN THE OFFICE OF:

Baker

Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: P-1084

APRIL 2012
COMPLETION DATE:

WILLIAM SCOTT HUNT III, PE
PROJECT ENGINEER

JOSHUA WHITE, PG, PE
PROJECT MANAGER /GEOMORPHOLOGIST

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT III 06.06.2012

SIGNATURE: *P.E.*

PROJECT REFERENCE NO.	SHEET NO.
118335	I-A

PROJECT ENGINEER

Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

STREAM CONVENTIONAL SYMBOLS

SUPERCEDES SHEET 1B

- ROCK J-HOOK
- ROCK VANE
- OUTLET PROTECTION
- ROCK CROSS VANE
- DOUBLE DROP ROCK CROSS VANE
- SINGLE WING DEFLECTOR
- DOUBLE WING DEFLECTOR
- TEMPORARY SILT CHECK
- ROOT WAD
- LOG J-HOOK
- LOG VANE
- LOG WEIR
- LOG CROSS VANE
- CONSTRUCTED RIFFLE
- BOULDER CLUSTER
- CREST GAUGE / PHOTO POINT
- SAFETY FENCE
- TF — TAPE FENCE
- FP — 100 YEAR FLOOD PLAIN
- CE — CONSERVATION EASEMENT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- LIMITS OF DISTURBANCE
- PERMANENT STREAM CROSSING
- TRANSPLANTED VEGETATION
- DITCH PLUG
- CHANNEL FILL
- BRUSH MATTRESS
- GEOLIFT
- VEGETATION PLOT
- CROSS-SECTION FROM EXISTING CONDITIONS
- AS-BUILT CROSS-SECTION

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

GENERAL NOTES

1. CONSTRUCTION BEGAN IN SEPT. 2011 AND WAS COMPLETED MARCH 2012.
2. PLANTING BEGAN IN MARCH 2012 AND WAS COMPLETED IN APRIL 2012.

STANDARD SPECIFICATIONS

EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
MARCH 2009

- 6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
- 6.62 SILT FENCE
- 6.63 TEMPORARY ROCK DAM
- 6.70 TEMPORARY STREAM CROSSING

NORTH CAROLINA PROFESSIONAL SEAL 39208 ENGINEER JOSHUA A. WHITE
07/18/12

VEGETATION SELECTION

The following table lists bare-root vegetation selection for the project site. Species were planted at a density of 702 stems per acre. Total planting area is approximately 18 acres. Exact placement of species was determined prior to site planting.

Common Name	Scientific Name	Percent Planted by Species	Total Number of Stems	Wetness Tolerance
Trees (75%) Planted 9' X 9' Spacing – 445 Trees/ Acre				
River Birch	*Betula nigra*	23.3%	1,800	FACW
Sycamore	*Platanus occidentalis*	22.1%	1,700	FACW-
Green Ash	*Fraxinus pennsylvanica*	15.6%	1,200	FACW
Swamp Chestnut Oak	*Quercus michauxii*	15.6%	1,200	FACW-
Tulip Poplar	*Liriodendron tulipifera*	7.8%	600	FAC
Willow Oak	*Quercus phellos*	7.8%	600	FACW-
Persimmon	*Diospyros virginiana*	7.8%	600	FAC
	Tree total	**100%**	**7,700**	
Shrubs (25%) Planted 16' X 16' Spacing – 243 Shrubs/ Acre				
Spicebush	*Lindera benzoin*	9.5%	400	FACW
Arrowwood	*Viburnum dentatum*	17%	700	FAC
Paw Paw	*Asimina triloba*	9.5%	400	FAC
Ironwood	*Carpinus caroliniana*	12%	500	FAC
Redbud	*Cercis canadensis*	14%	600	FACU
Elderberry	*Sambucus canadensis*	19%	800	FACW-
Silky Dogwood	*Cornus amomum*	19%	800	FACW+
	Shrub Total	**100%**	**4,200**	
	Total Plants		**11,900**	

Live staking were applied to all restored streambanks following the details in this plan set and according to the construction specifications.

Common Name	Scientific Name	Percentage of Total	Wetness Tolerance
Elderberry	*Sambucus canadensis*	30%	FACW-
Silky Dogwood	*Cornus amonum*	30%	FACW+
Silky Willow	*Salix sericia*	30%	OBL
Black Willow	*Salix nigra*	10%	OBL

The following table lists temporary seed mix for the project site. All disturbed areas were stabilized using mulch and temporary seed.

Common Name	Rate	Dates
ANNUAL RYE (COOL SEASON)	130 LBS/ACRE	SEPTEMBER TO MARCH
MILLET (WARM SEASON)	40 LBS/ACRE	APRIL TO AUGUST

Permanent seed mixtures for the project site were planted throughout the floodplain and riparian buffer areas. Permanent seed mixtures shall be applied with temporary seed, as defined in the construction specifications.

Common Name	Scientific Name	Percent of Mixture	Seeding Density (lbs/acre)	Wetness Tolerance
Redtop	*Agrostis alba*	10%	1.5	FACW
Virginia Wildrye	*Elymus virginicus*	15%	2.25	FAC
Switchgrass	*Panicum virgatum*	15%	2.25	FAC+
Eastern Gamagrass	*Tripsacum dactyloides*	5%	0.75	FAC+
Pennsylvania Smartweed	*Polygonum pennsylvanicum*	5%	0.75	FACW
Little Bluestem	*Schizachyrium scoparium*	5%	0.75	FACU
Soft Rush	*Juncus effusus*	5%	0.75	FACW+
Devil's Beggartick	*Bidens frondosa*	5%	0.75	FACW
Lanceleaf Tickseed	*Coreopsis lanceolata*	10%	1.5	UPL
Deertongue	*Dichanthelium clandestinum*	15%	2.25	FACW
Big Bluestem	*Andropogon gerardii*	5%	0.75	FAC
Indiangrass	*Sorgastrum nutans*	5%	0.75	FACU

2/28/03

7/18/2012
M:\118335_Cardiff\Design\as-built\plans\118335_Cardiff_92767_Baseline_2012_AB_1a.dgn

*S.U.E = SUBSURFACE UTILITY ENGINEER

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL SYMBOLS

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III 06.06.2012

ROADS & RELATED ITEMS

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

RIGHT OF WAY

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

HYDROLOGY

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

STRUCTURES

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

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

UTILITIES

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

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

BOUNDARIES & PROPERTIES

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

BUILDINGS & OTHER CULTURE

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

TOPOGRAPHY

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

VEGETATION

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard

RAILROADS

- Standard Gauge
- RR Signal Milepost
- Switch

PROJECT REFERENCE NO.	SHEET NO.
118335	2

PROJECT ENGINEER

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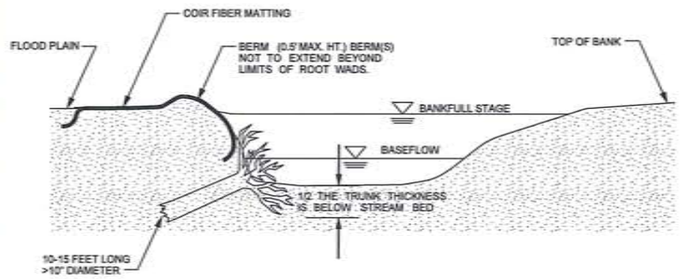
Fax: 919.463.5490
License #: F-1084

ROOT WADS

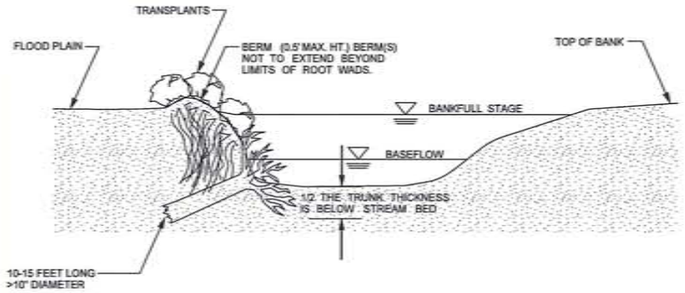
ROOT WADS WITHOUT TRANSPLANTS

CROSS SECTION VIEW
NTS

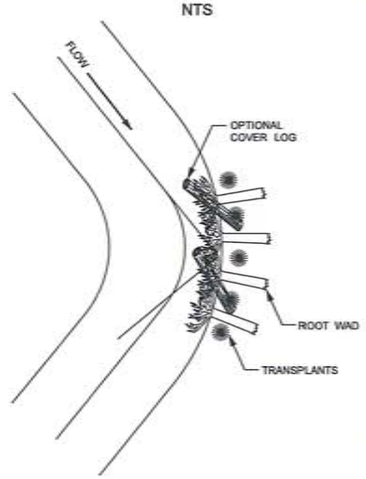


ROOT WADS WITH TRANSPLANTS

CROSS SECTION VIEW
NTS



PLAN VIEW
NTS



NOTES:

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

NOTES:

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

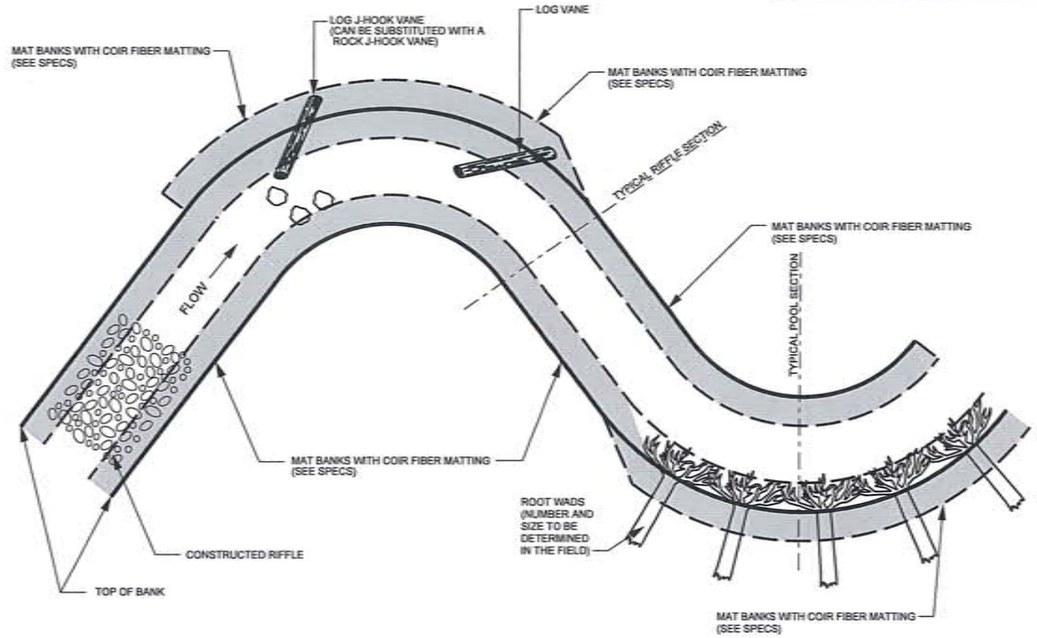
TYPICAL STRUCTURE PLACEMENT

STRUCTURE NOTES:

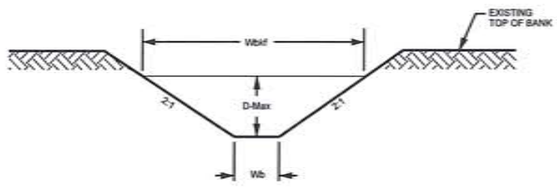
1. GENERALLY LOG AND ROCK J-HOOK VANES, ROOT WADS, LOG VANES AND COIR FIBER MATTING WILL BE INSTALLED IN THE LOCATION AND SEQUENCE AS SHOWN.
2. ADDITIONAL STRUCTURES OR CHANGES TO STRUCTURE LOCATIONS MAY BE MADE BY THE DESIGN ENGINEER DURING CONSTRUCTION.

NOTES:

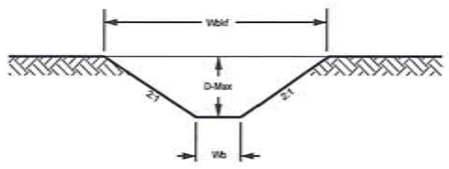
1. COIR FIBER MATTING TO BE INSTALLED ON ALL RESTORED STREAMBANKS.
2. IF ROOT WADS DO NOT COVER ENTIRE SLOPE ON OUTSIDE OF MEANDER BENDS, COIR FIBER MATTING IS NEEDED.



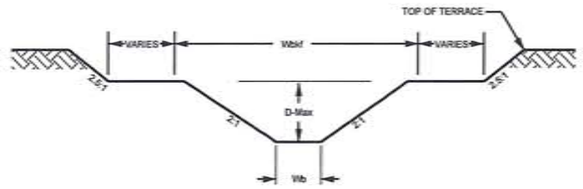
TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS SECTIONS



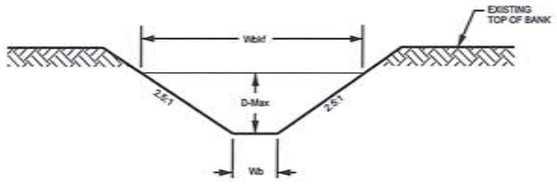
RIFFLE - M2



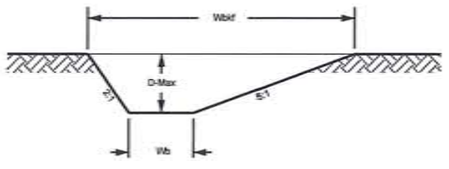
RIFFLE - M3



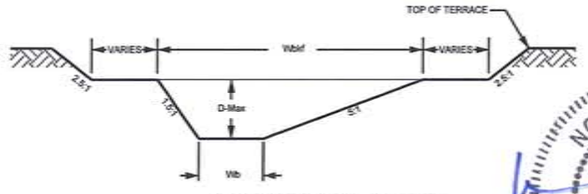
RIFFLE WITH BANKFULL BENCH - M3



POOL - M2



POOL - M3



POOL WITH BANKFULL BENCH - M3

NOTES:

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

CANDIFF M2		CANDIFF M3		
RIFFLE	POOL	RIFFLE	POOL	
20.0	29.0	20.4	30.0	WIDTH OF BANKFULL (Wbkf)
1.7	3.4	1.9	4.4	MAXIMUM DEPTH (D-Max)
13.9	12.1	13.0	13.0	WIDTH TO DEPTH RATIO (Wbkf / Dbkf)
28.8	69.7	32.0	69.1	BANKFULL AREA (Abkf)
13.0	12.0	12.6	1.4	BOTTOM WIDTH (Wb)

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2013

** M1, UT1, AND UT2 CONSTRUCTION ONLY INCLUDES INVASIVE SPECIES REMOVAL AND FENCE INSTALLATION SO NO CROSS SECTION DATA IS PROVIDED

6/4/2013
R:\118335_Candiff\Design\as-built\plans\118335_Candiff_92767_Baseline_2012_AB_2.dgn

PROJECT REFERENCE NO.	SHEET NO.
118335	2-A

PROJECT ENGINEER

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Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
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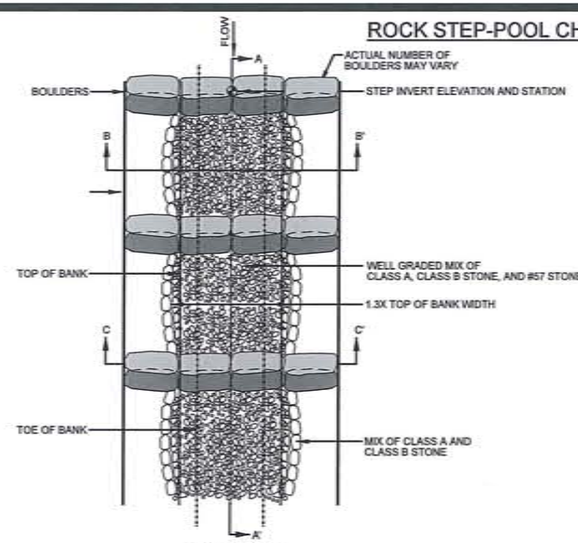
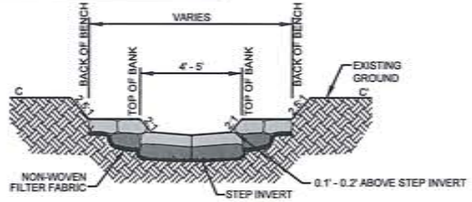
License #: F-1084

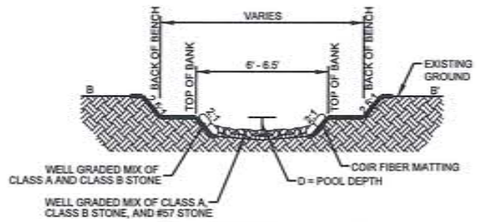
ROCK STEP-POOL CHANNEL / OUTLET PROTECTION



PLAN VIEW



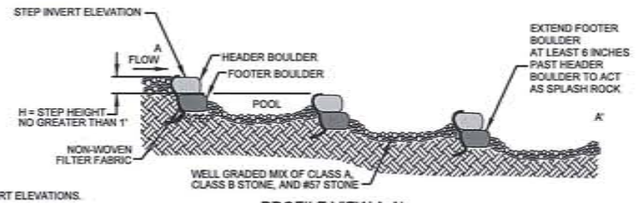
POOL CROSS SECTION C-C'



POOL CROSS SECTION B-B'

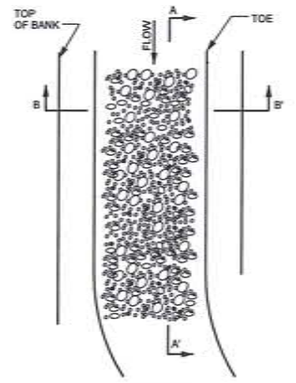
NOTES:

1. HEADER BOULDERS MUST BE 2' X 2' X 1' AND FOOTERS SHALL NOT EXCEED 3' X 2' X 1'.
2. FOOTERS SHALL BE INSTALLED SUCH THAT 1/4 TO 1/3 OF THE LENGTH IS DOWNSTREAM OF THE HEADER.
3. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTERS WITH THE BUCKET OF EXCAVATOR.
4. INSTALL NON-WOVEN FILTER FABRIC UNDERNEATH FOOTER BOULDERS.
5. UNDERCUT POOL BED ELEVATION 8 INCHES TO ALLOW FOR LAYER OF STONE.
6. INSTALL EROSION CONTROL MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
7. INSTALL WELL GRADED MIX OF CLASS A AND CLASS B STONE ALONG SIDE SLOPES.
8. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, COMPACTED, AND CONCAVE, WITH THE ELEVATION OF THE BED APPROXIMATELY 0.5 FT DEEPER IN THE CENTER THAN AT THE EDGES.
9. STEP HEIGHT (H) SHALL NOT EXCEED 1.0 FT.
10. MINIMUM POOL DEPTH (D) SHALL BE NO LESS THAN 1.3 FT.
11. AT LEAST 6" OF THE UPSTREAM FOOTER MUST BE BURIED BELOW THE DOWNSTREAM HEADER INVERT ELEVATIONS.
12. ALL STRUCTURES MUST BE FOOTERED.



PROFILE VIEW A-A'

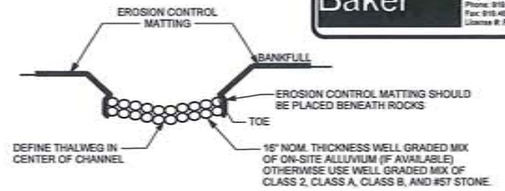
CONSTRUCTED RIFFLE



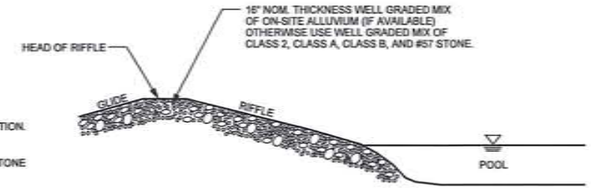
PLAN VIEW

NOTES:

1. DIG A TRENCH BELOW THE BED FOR THE BED MATERIAL INSTALLATION.
2. FILL TRENCH WITH ON-SITE ALLUVIUM (IF AVAILABLE) OTHERWISE USE WELL GRADED MIX OF CLASS 2, CLASS A, CLASS B, AND #57 STONE TO THE BED ELEVATION OF THE CHANNEL.
3. DEFINE THALWEG IN CENTER OF CHANNEL.

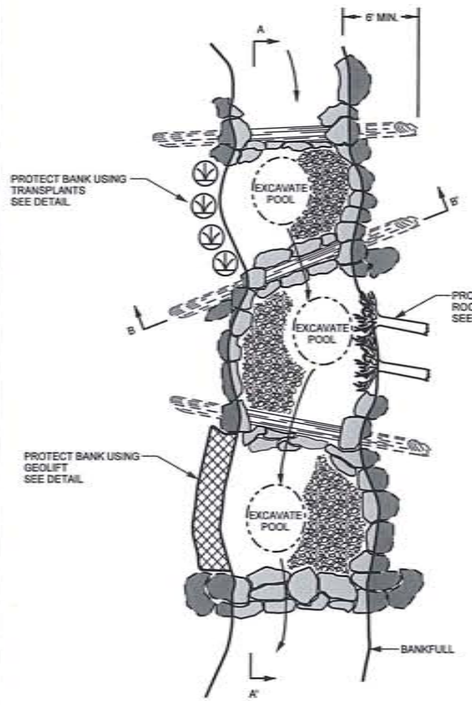


SECTION B - B'

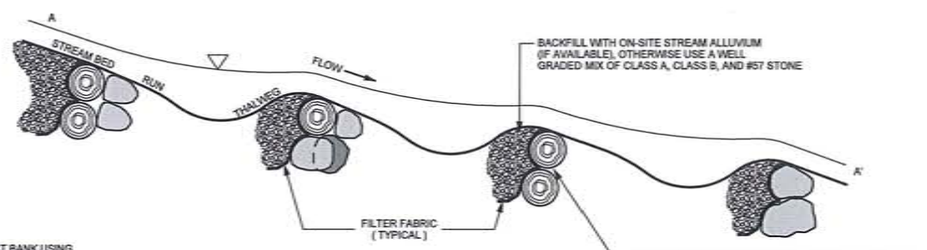


PROFILE A - A'

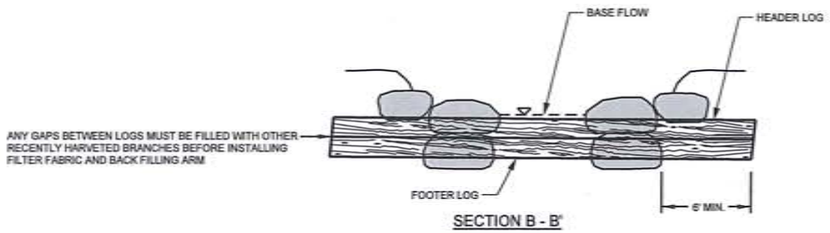
LOG AND ROCK STEP / POOL



PLAN VIEW



SECTION A - A'

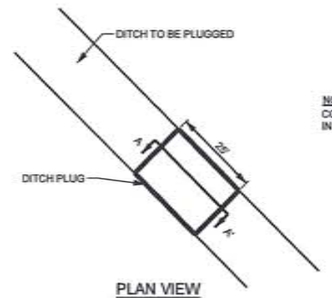


SECTION B - B'

NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED AND EXTENDING INTO THE BANK 5' ON EACH SIDE.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
3. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
4. BOULDERS SHOULD BE 2' x 2' x 1' AND PLACED ON TOP OF HEADER LOG FOR ANCHORING.
5. TRANSPLANTS CAN BE USED INSTEAD OF BOUDERS, PER DIRECTION OF ENGINEER.
6. AT LEAST 6" OF THE UPSTREAM FOOTER MUST BE BURIED BELOW THE DOWNSTREAM HEADER INVERT ELEVATIONS.
7. ALL STRUCTURES MUST BE FOOTERED.

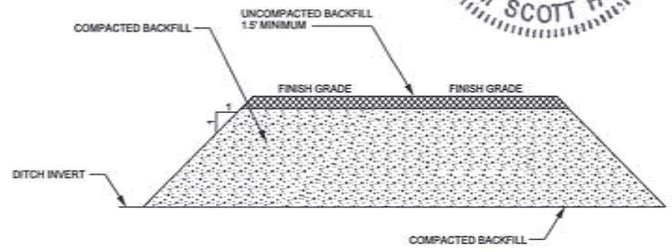
DITCH PLUG



PLAN VIEW

NOTE:
COMPACT BACKFILL USING ON-SITE HEAVY EQUIPMENT IN 10 INCH LIFTS.

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
04.06.2012



SECTION A - A'

PROJECT REFERENCE NO.	SHEET NO.
118335	2-B

PROJECT ENGINEER

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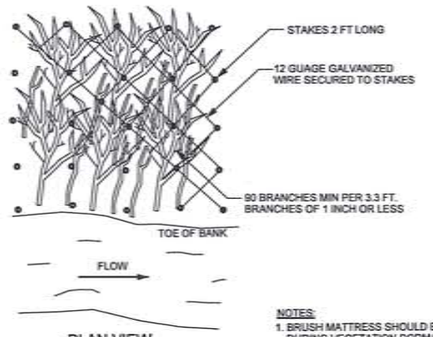
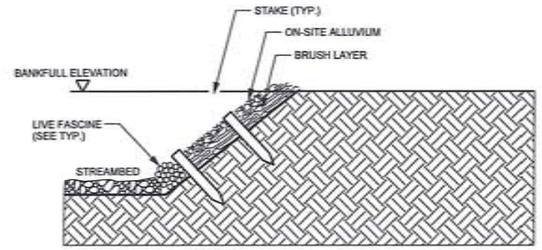
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

BRUSH MATTRESS



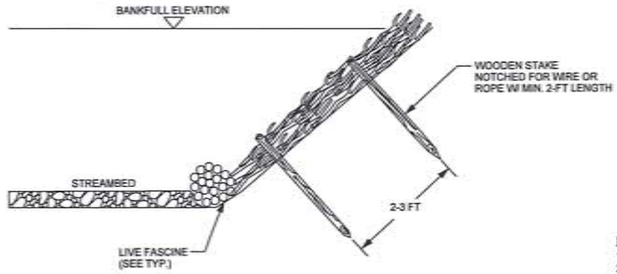
PLAN VIEW

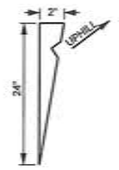
NOTES:
1. BRUSH MATTRESS SHOULD BE INSTALLED DURING VEGETATION DORMANCY.
2. ONLY USE SPECIES SPECIFIED UNDER LIVE STAKES SECTION OF VEGETATION SELECTION.



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

CROSS SECTION

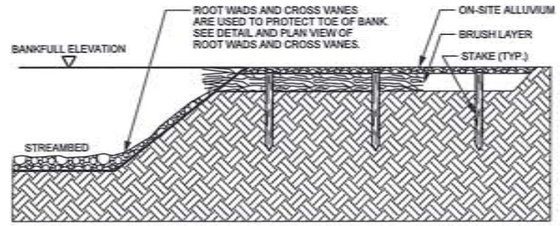




TYPICAL STAKE

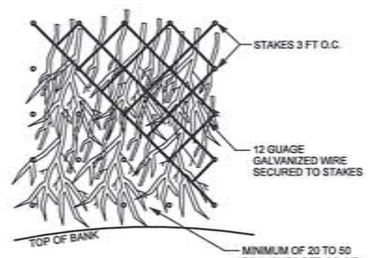
NOTES:
1. BOARD FOR STAKE SHOULD BE 2" x 4" x 24".
2. SAW 2" x 4" TIMBER DIAGONALLY TO PRODUCE 2 DEAD STOUT STAKES.

BRUSH LAYER



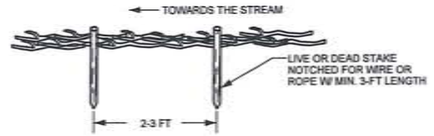
NOTES:
1. CREATE 12" DEEP TRENCH
2. STAKE AND WIRE BRUSH LAYER INTO TRENCH.
3. BACK FILL 3" OF ON-SITE ALLUVIUM OVER BRUSH LAYER.

CROSS SECTION

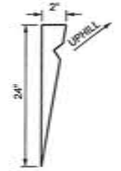


NOTES:
1. BRUSH MATTRESS SHOULD BE INSTALLED DURING VEGETATION DORMANCY.
2. ONLY USE SPECIES SPECIFIED UNDER LIVE STAKES SECTION OF VEGETATION SELECTION.
3. BACKFILL 3" OF ON-SITE ALLUVIUM OVER BRUSH LAYER.

PLAN VIEW



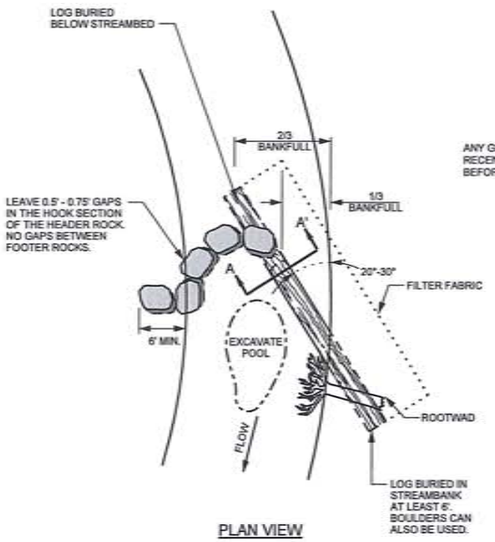
DETAIL



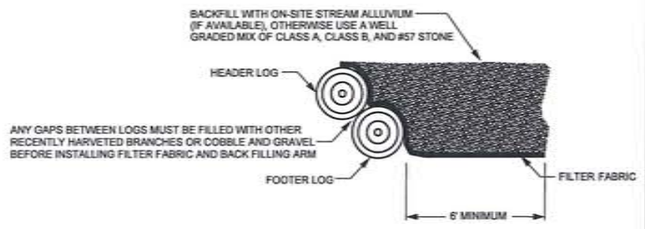
TYPICAL STAKE

NOTES:
1. BOARD FOR STAKE SHOULD BE 2" X 4" X 24".
2. SAW 2" x 4" TIMBER DIAGONALLY TO PRODUCE 2 DEAD STOUT STAKES.

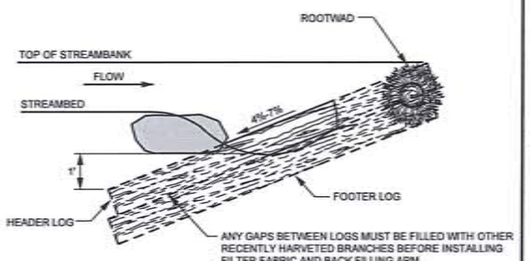
GRADE CONTROL LOG J-HOOK VANE



PLAN VIEW



SECTION A - A'

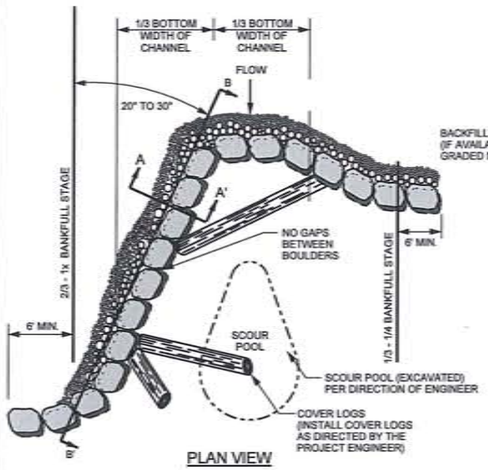


PROFILE VIEW

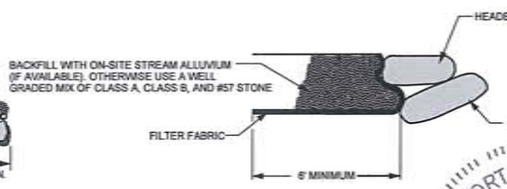
NOTES:
1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, RECENTLY HARVESTED, AND FOOTERED.
2. BOULDERS MUST BE AT LEAST 2' x 2' x 1'.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK. SEE ROOTWAD DETAIL.
5. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ACHORING.
6. HEADER BOULDERS TO BE PLACED 0.5 TO 0.75 FEET APART.
7. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
8. TRANSPLANTS CAN BE USED INSTEAD OF ROOWADS, PER DIRECTION OF ENGINEER.
9. BOULDER SILL MUST BE A MINIMUM OF 6'.

GRADE CONTROL J-HOOK VANE

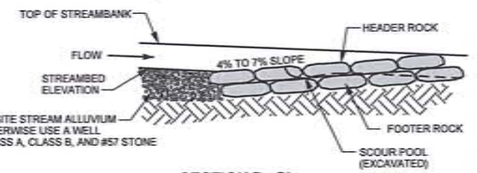
FOR SAND/GRAVEL BED SYSTEMS



PLAN VIEW



SECTION A - A'



SECTION B - B'

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

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.04.2012

2/26/03

6/4/2012
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PROJECT REFERENCE NO.	SHEET NO.
118335	2-C

PROJECT ENGINEER

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Cary, NORTH CAROLINA 27518
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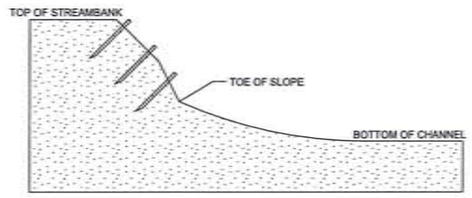
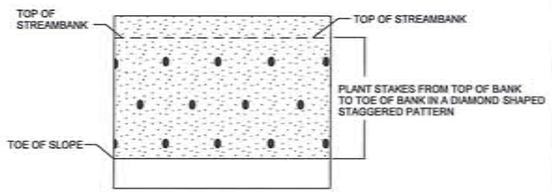
License #: F-1084

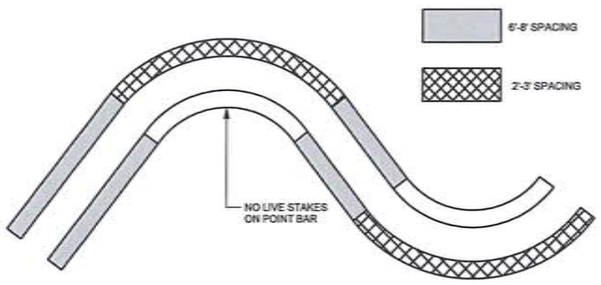
LIVE STAKING



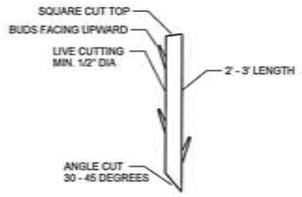
CROSS SECTION VIEW



PLAN VIEW



PLAN VIEW

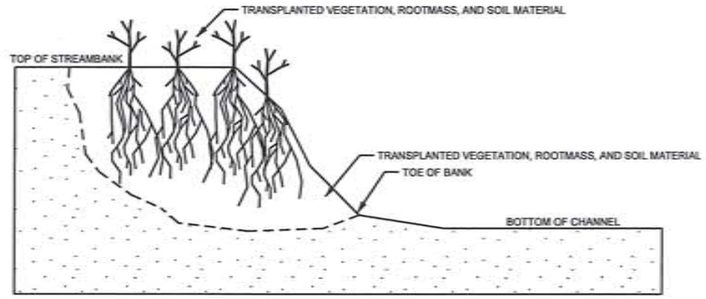


LIVE STAKE DETAIL

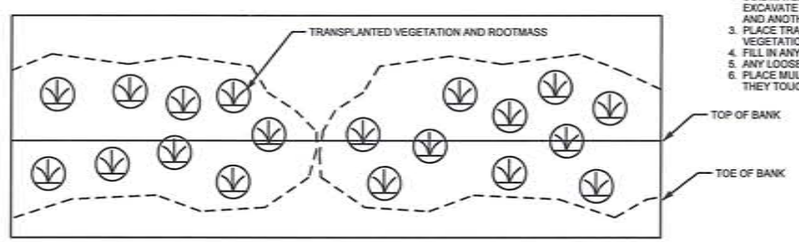
NOTES:

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

TRANSPLANTED VEGETATION



CROSS SECTION VIEW

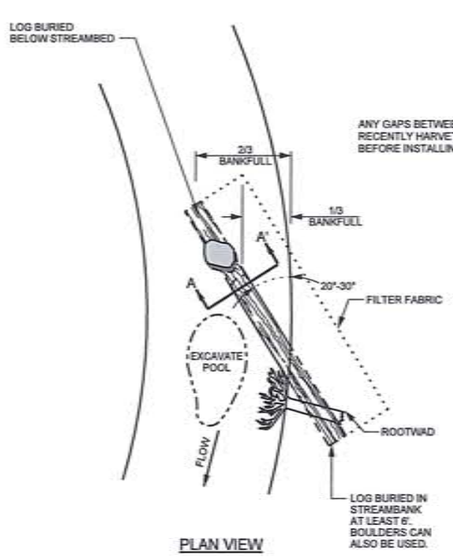


PLAN VIEW

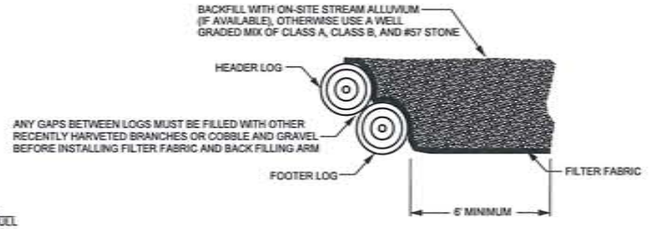
NOTES:

1. EXCAVATE A HOLE IN THE BANK TO BE STABILIZED THAT WILL ACCOMMODATE THE SIZE OF TRANSPLANT TO BE PLACED. BEGIN EXCAVATION AT THE TOE OF THE BANK.
2. EXCAVATE TRANSPLANT USING A FRONT END LOADER. EXCAVATE THE ENTIRE ROOT MASS AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE. IF ENTIRE ROOT MASS CAN NOT BE EXCAVATE IN ONE BUCKET LOAD, THE TRANSPLANT IS TOO LARGE AND ANOTHER SHOULD BE SELECTED.
3. PLACE TRANSPLANT IN THE BANK TO BE STABILIZED SO THAT VEGETATION IS ORIENTATED VERTICALLY.
4. FILL IN ANY HOLES AROUND THE TRANSPLANT AND COMPACT.
5. ANY LOOSE SOIL LEFT IN THE STREAM SHOULD BE REMOVED.
6. PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.

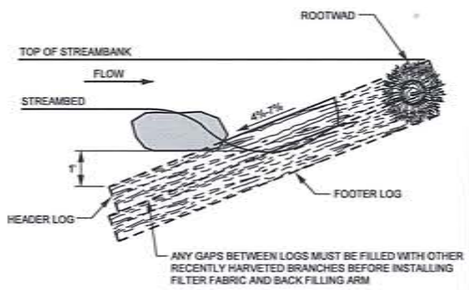
LOG VANE



PLAN VIEW



SECTION A - A'

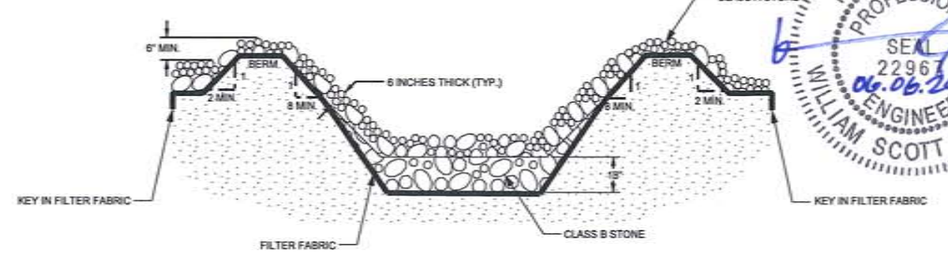


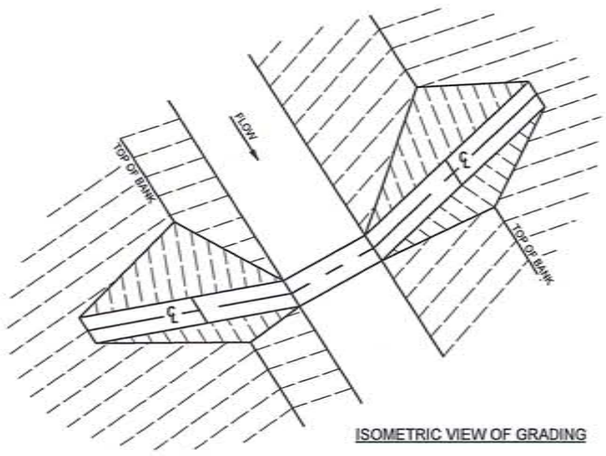
PROFILE VIEW

NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, RECENTLY HARVESTED, AND FOOTERED.
2. BOULDERS MUST BE AT LEAST 2' x 2' x 1'.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK. SEE ROOTWAD DETAIL.
5. BOULDER SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
6. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
7. TRANSPLANTS CAN BE USED INSTEAD OF ROOWADS, PER DIRECTION OF ENGINEER.
8. BOULDER SILL MUST BE A MINIMUM OF 6'.

PERMANENT FORD STREAM CROSSING





ISOMETRIC VIEW OF GRADING

NOTES:

1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.
3. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. COMPLETE ONE SIDE BEFORE STARTING ON THE OTHER SIDE.
4. INSTALL STREAM CROSSING AT RIGHT ANGLE TO THE FLOW.
5. BED ELEVATION OF FORD CROSSING SHALL MATCH THE BED ELEVATION OF THE STREAM THALWEG.
6. GRADE SLOPES TO A 8:1 SLOPE. TRANSPLANT SOD FROM ORIGINAL STREAMBANK ONTO SIDE SLOPES, IF AVAILABLE.
7. MAINTAIN CROSSING SO THAT RUNOFF IN THE ROAD DOES NOT ENTER EXISTING CHANNEL.
8. A STABILIZED PAD OF CLASS A STONE, 6 INCHES THICK, LINED WITH FILTER FABRIC FOR DRAINAGE SHALL BE USED OVER THE BERM AND ACCESS SLOPES.
9. WIDTH OF THE CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE THE LARGEST VEHICLE CROSSING THE CHANNEL (~16).
10. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.
11. FORD CROSSING WILL NOT BE GRAVELED FROM ONE EASEMENT BOUNDARY TO THE OTHER EASEMENT BOUNDARY. GRAVEL FORD CROSSING WILL EXTEND 10' PASSED THE POINT WHERE THE CROSSING MEETS BANKFULL ON BOTH SIDES.

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

2/26/03

6/4/2012
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PROJECT REFERENCE NO.	SHEET NO.
118335	2-D

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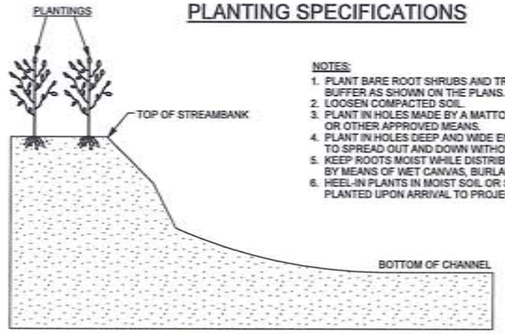
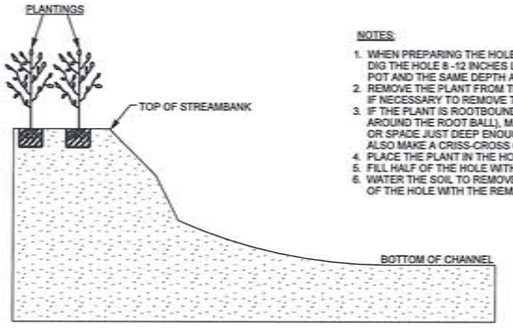
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

PLANTING SPECIFICATIONS



CROSS SECTION VIEW OF BARE ROOT PLANTING

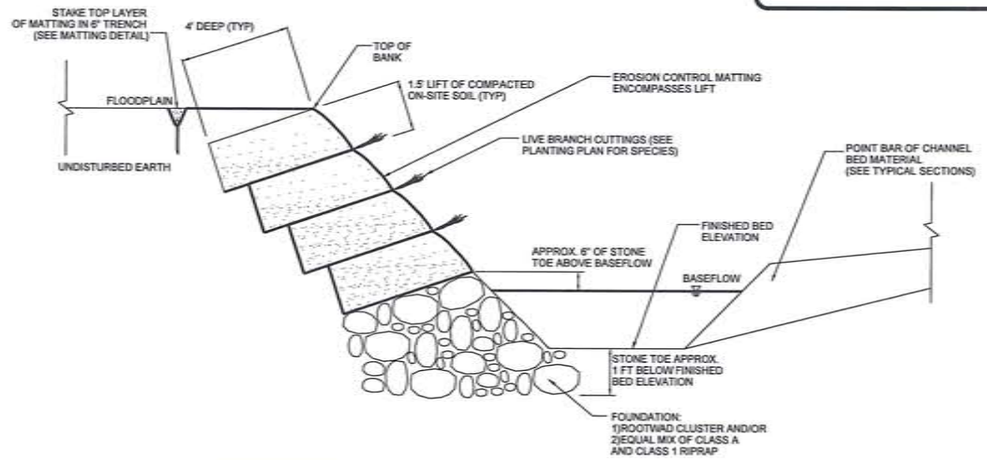
NOTES:
1. PLANT BARE ROOT SHRUBS AND TREES TO THE WIDTH OF THE BUFFER AS SHOWN ON THE PLANS.
2. LOOSEN COMPACTED SOIL.
3. PLANT IN HOLES MADE BY A MATTOCK, DIBBLE, PLANTING BAR, OR OTHER APPROVED MEANS.
4. PLANT IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.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



CROSS SECTION VIEW OF CONTAINER PLANTING

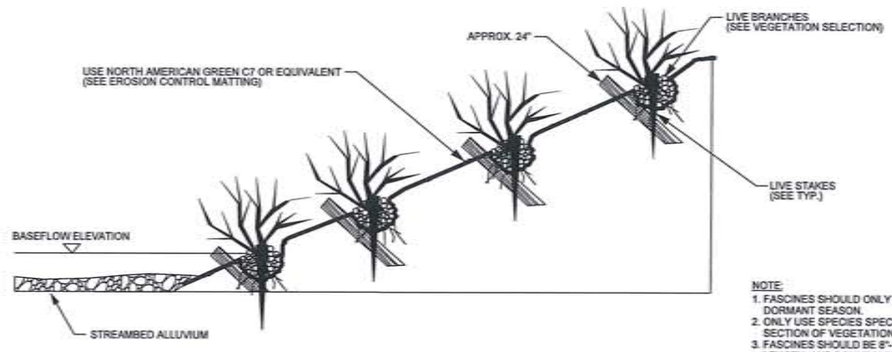
NOTES:
1. WHEN PREPARING THE HOLE FOR A POTTED PLANT OR SHRUB DIG THE HOLE 8 -12 INCHES LARGER THAN THE DIAMETER OF THE POT AND THE SAME DEPTH AS THE POT.
2. REMOVE THE PLANT FROM THE POT. LAY THE PLANT ON ITS SIDE IF NECESSARY TO REMOVE THE POT.
3. IF THE PLANT IS ROOTBOUND (ROOTS GROWING IN A SPIRAL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

GEOLIFT

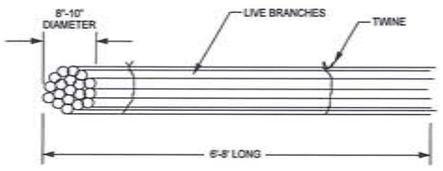


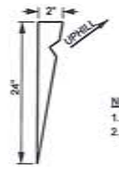
LIVE FASCINE

RECOMMENDED SPACING FOR LIVE FASCINES IS 5' to 7'



NOTE:
1. FASCINES SHOULD ONLY BE INSTALLED DURING DORMANT SEASON.
2. ONLY USE SPECIES SPECIFIED UNDER LIVE STAKE SECTION OF VEGETATION SELECTION.
3. FASCINES SHOULD BE 8"-12" DIAMETER, 6'-8' IN LENGTH, AND BOUND WITH BIODEGRADABLE TWINE

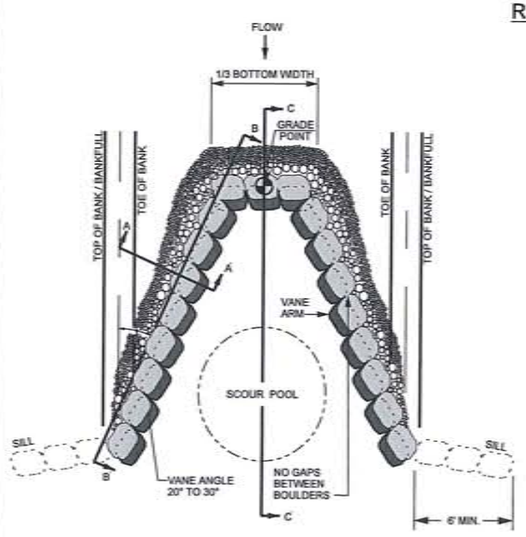




NOTES:
1. BOARD FOR STAKE SHOULD BE 2" X 4" X 24".
2. SAW 2" x 4" TIMBER DIAGONALLY TO PRODUCE 2 DEAD STOUT STAKES.

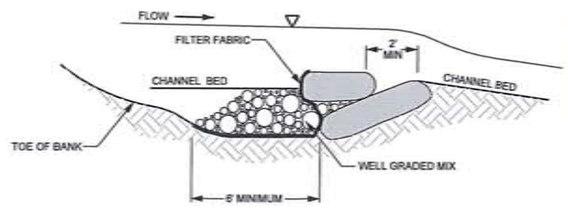
TYPICAL STAKE

ROCK CROSS VANE

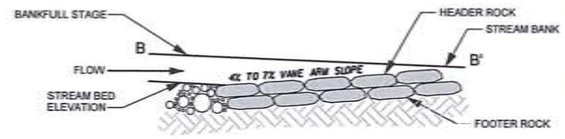


PLAN VIEW

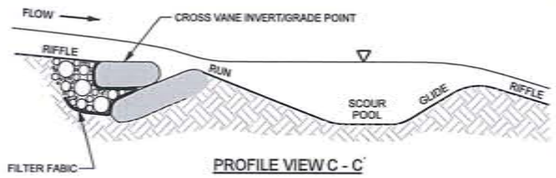
NOTES FOR ALL VANE STRUCTURES:
1. BOULDERS MUST BE AT LEAST 3' x 2' x 1'.
2. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF SIX FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
4. CONSTRUCT FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
5. USE CLASS 1 STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS, AND CLASS A STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS 1 STONE.
6. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF ONE HALF THE HEADER ROCK.
7. BOULDER SILL MUST BE A MINIMUM OF 6'.



SECTION A - A'



PROFILE VIEW B - B'
VANE ARM



PROFILE VIEW C - C'

6/4/2012
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PROJECT REFERENCE NO.	SHEET NO.
118335	2-E

PROJECT ENGINEER

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06.06.2014

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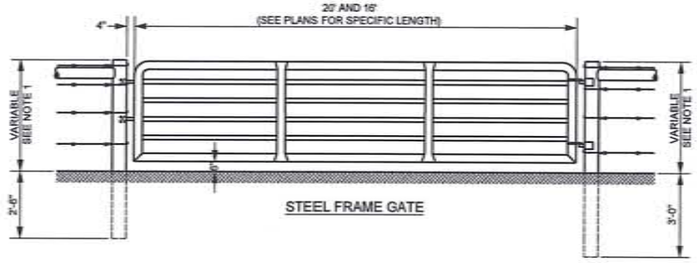
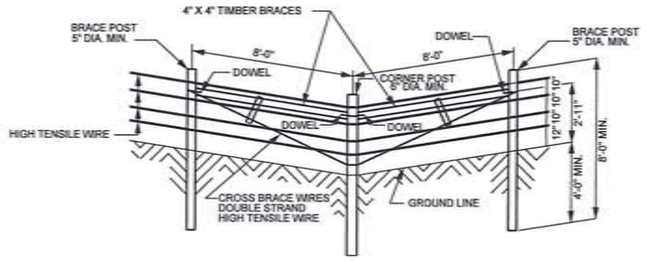
STEEL GATES



NOTES:

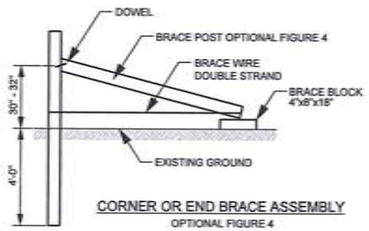
1. POST HEIGHT DIMENSION SHALL BE THE SAME AS REQUIRED FOR THE ADJACENT FENCE.
2. CONSTRUCT AN END OR STRESS PANEL, AS REQUIRED IN THE SPECIFICATION, ON EACH SIDE OF GATE.
3. HINGES AND LOCKS SHALL BE INSTALLED AS SPECIFIED BY GATE MANUFACTURER.

4 STRAND - HIGH TENSILE FENCING



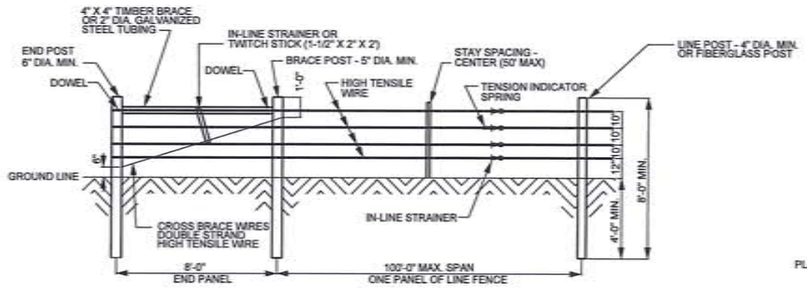
CORNER AND VERICAL CHANGE BRACING

INSTALL AT ALL POINTS WHERE FENCE ALIGNMENT CHANGES 15 DEGREES OR MORE

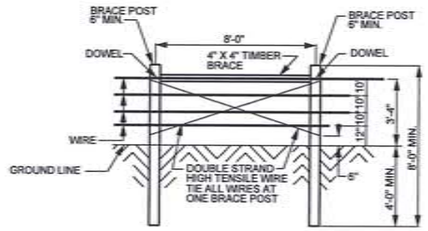


CORNER OR END BRACE ASSEMBLY

OPTIONAL FIGURE 4



END ASSEMBLY AND LINE FENCE SECTION



PULL POST ASSEMBLY

PLACE IN FENCE LINE SO THAT MAXIMUM DISTANCE BETWEEN BRACED POSTS DOES NOT EXCEED 1320 FEET

NOTES:

1. NOTCH POSTS 3/4" FOR 4" X 4" TIMBER BRACES.
2. DOWELS TO BE 1/2" DIA. X 5" PLAIN STEEL RODS. DRIVE DOWELS IN 7/16" DIA. HOLES, 2-1/2" INTO EACH POST AND TIMBER BRACE.
3. STAPLE CROSS-BRACE WIRES TO BRACE AND CORNER POSTS AT QUARTER POINTS OF THE POSTS.
4. HIGH TENSILE WIRE WILL BE NEW AND SMOOTH AND WILL MEET THE FOLLOWING 1) TENSILE STRENGTH - 110,000 PSI 2) GALVANIZING - TYPE III 3) GAGE - 12-1/2.
5. ALL CORNER POSTS, BRACE POSTS, BRACES, AND STAY SPACERS, SHALL BE PRESSURE TREATED. PRESSURE TREATMENT SHALL CONFORM TO FEDERAL SPECIFICATION TT-W-571. (1-1/4" LONG FOR HARD WOODS).
6. AT CORNER POSTS, STAPLE EACH WIRE AT QUARTER POINTS OF POSTS. AT BRACE POSTS, DOUBLE STAPLE EACH WIRE. AT LINE POSTS, SECURE EACH WIRE WITH STANDARD CLAMPS.
7. FIBERGLASS MAY BE USED FOR LINE POSTS. THESE WILL CONSIST OF MARBLE, FIBERGLASS, AND POLYMER RESINS WHICH HAVE BEEN TREATED BY THERMOSETTINGS (HEAT TREATMENT). POSTS MUST BE DRIVEN IN THE SOIL AT LEAST 18 INCHES.
8. 2" DIAMETER PIPE DIAGONAL BRACE MAY BE USED IN PLACE OF HORIZONTAL TIMBER BRACE AND DIAGONAL WIRES.
9. SEE NORTHEAST REGIONAL AGRICULTURAL ENGINEERING SERVICE PUBLICATION NO. 11, HIGH-TENSILE WIRE FENCING, FOR SPECIFIC DETAILS ON BEST METHODS OF HIGH-TENSILE FENCE INSTALLATION.
10. MINIMUM NET RETENTION OF CHROMATED COPPER ARSENATE (CCA) FOR WOOD FENCE POSTS SHALL BE 0.40 POUNDS PER CUBIC FOOT.
11. A SINGLE 12 FOOT LONG, 6 INCH MINIMUM DIAMETER POST MAY BE SUBSTITUTED FOR END PANEL, CORNER AND VERTICAL CHANGE BRACING, AND PULL POST ASSEMBLY. THE 12 FOOT LONG POSTS SHALL EXTEND A MINIMUM OF 7.5 FEET INTO THE GROUND AND BE BACKFILLED WITH GRAVEL.

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	3

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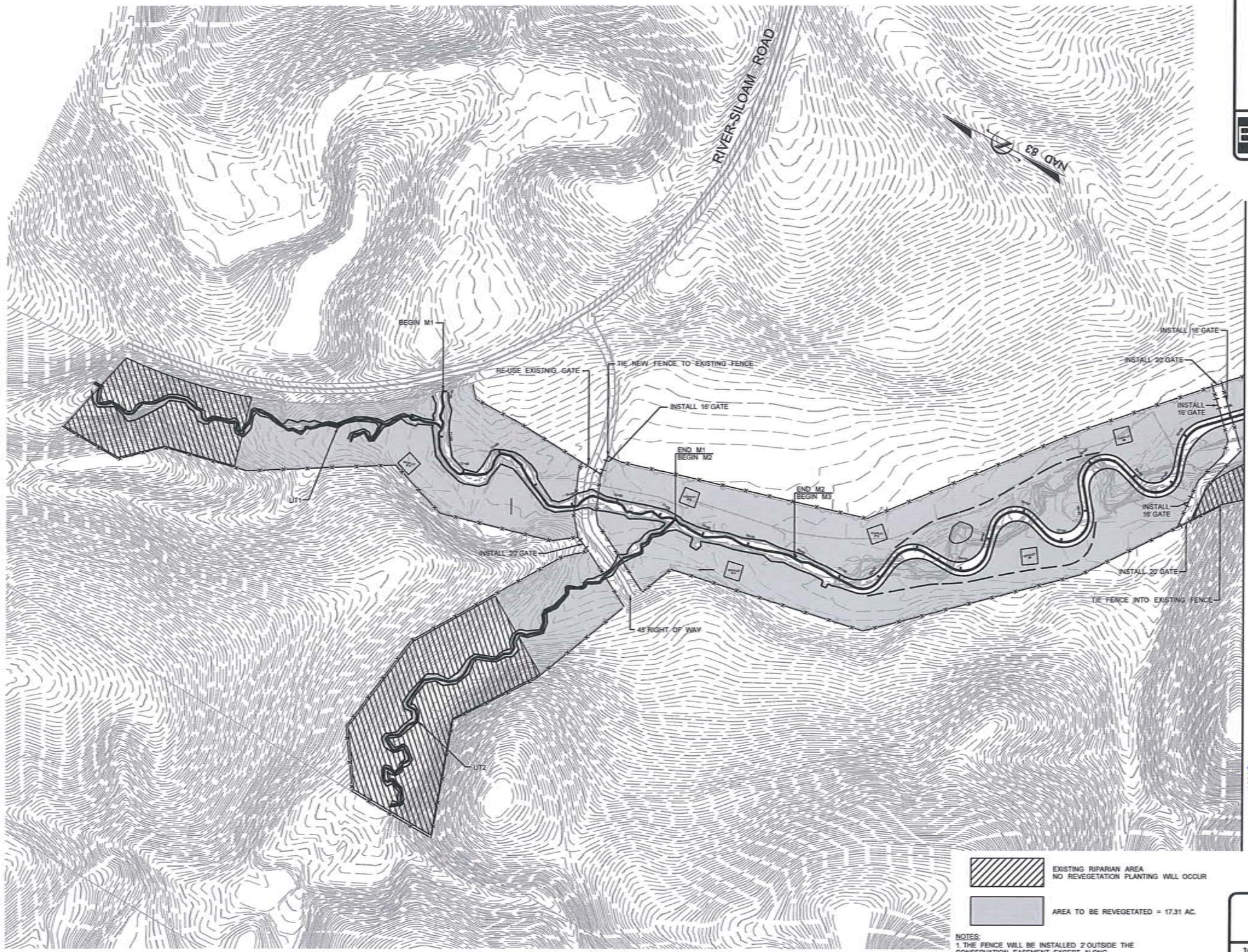

EXISTING RIPARIAN AREA
NO REVEGETATION PLANTING WILL OCCUR

AREA TO BE REVEGETATED = 17.31 AC.

NOTES:
1. THE FENCE WILL BE INSTALLED 2' OUTSIDE THE CONSERVATION EASEMENT EXCEPT ALONG RIGHT OF WAYS AND PROPERTY BOUNDARIES WHICH WILL BE FENCED AT THEIR BOUNDARIES.
2. CONTRACTOR WILL CONTROL ANY INVASIVE SPECIES WITHIN EASEMENT.

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

REVEGETATION/ FENCING

100 50 0 100 200
SCALE (FT)

2/26/03

6/5/2012
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William

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	3A

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NAD 83

INSTALL 16' GATE

END M3

INSTALL 20' GATE

INSTALL 16' GATE

INSTALL 16' GATE

INSTALL 16' GATE

INSTALL 20' GATE

MATCHLINE SHEET 12

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
02.06.2012

NOTES:
1. THE FENCE WILL BE INSTALLED 2' OUTSIDE THE CONSERVATION EASEMENT EXCEPT ALONG RIGHT OF WAYS AND PROPERTY BOUNDARIES WHICH WILL BE FENCED AT THEIR BOUNDARIES.
2. CONTRACTOR WILL CONTROL ANY INVASIVE SPECIES WITHIN EASEMENT.

EXISTING RIPARIAN AREA NO REVEGETATION PLANTING WILL OCCUR

AREA TO BE REVEGETATED = 17.31 AC.

REVEGETATION/ FENCING

100 50 0 100 200
SCALE (FT)

2/28/03

6/5/2012
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BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	4

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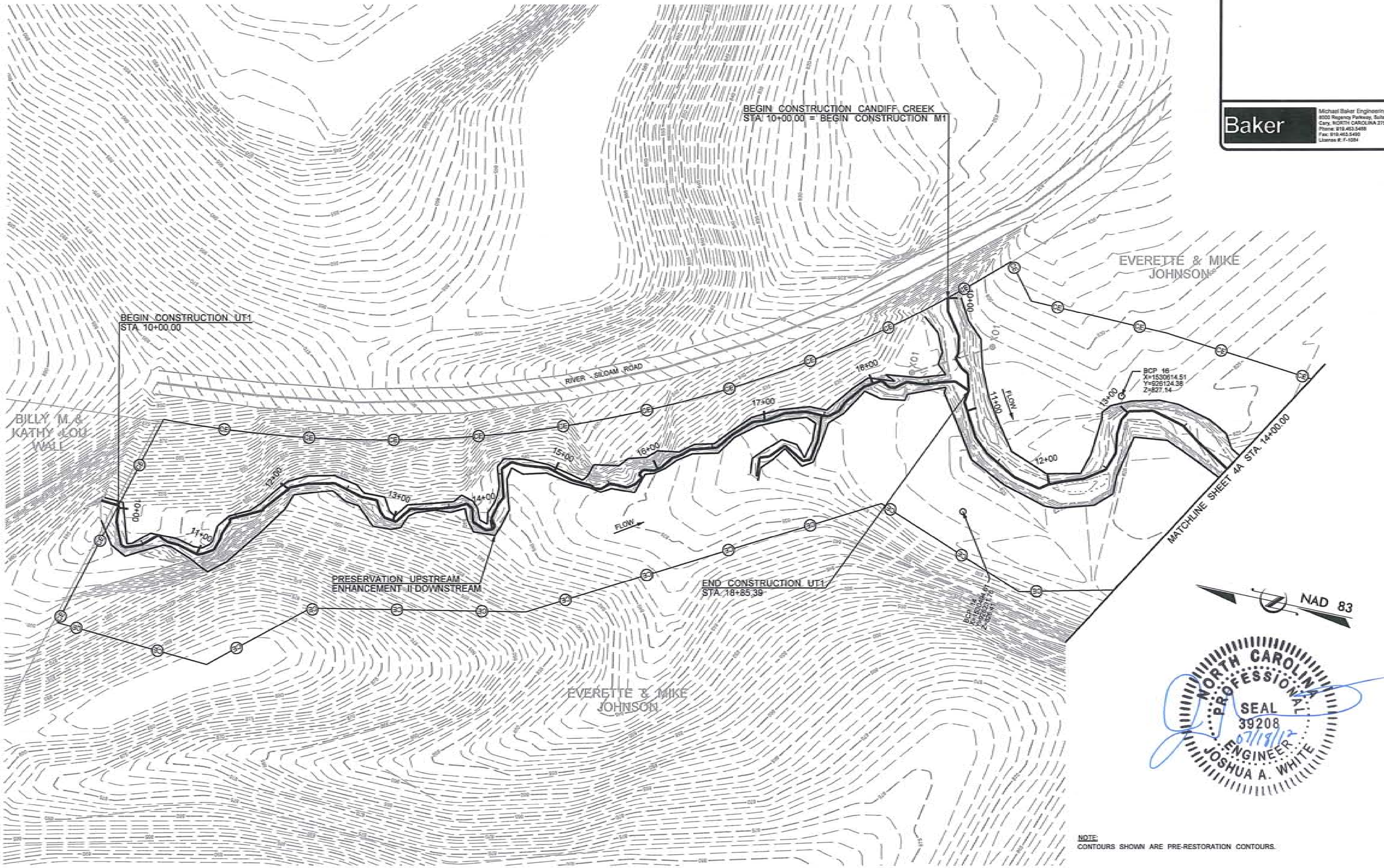

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

PLAN VIEW OF DESIGN

40 20 0 40 80

SCALE (FT)

7/18/2012
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2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	4A

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NAD 83

RIVER SLOAM RD

FARM ROAD

EVERETTE & MIKE JOHNSON

END CONSTRUCTION M1 =
BEGIN CONSTRUCTION M2
STA. 17+34.94

END CONSTRUCTION M2 =
BEGIN CONSTRUCTION M3
STA. 20+00.00

GPS 1
X=1530718.46
Y=925858.86
Z=821.24

MATCHLINE SHEET 4 STA. 14+00.00

EXISTING GATE

BEDROCK

EXISTING FENCE

BCP 11
X=1530564.12
Y=925913.00
Z=827.14

GPS 2
X=1530791.18
Y=925420.81
Z=818.88

BENCHING LIMITS

FLOW

UT2

END CONSTRUCTION UT2
STA. 21+61.79

MATCHLINE SHEET 4E STA. 16+50.00

MATCHLINE SHEET 4B STA. 23+00.00

45' RIGHT OF WAY

BRUSH MATTRESS

BENCHING LIMITS

EVERETTE & MIKE JOHNSON

NORTH CAROLINA PROFESSIONAL SEAL 22960 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

DITCH PLUG

FILL EXISTING DITCH

NOTES:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

PLAN VIEW OF DESIGN

40 20 0 40 80
SCALE (FT)

2/26/09

6/5/2012
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BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	4B

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Fax: 919.463.5490
License #: F-1084

Michael Baker Engineering Inc.

NAD 83

EVERETTE & MIKE JOHNSON

EXISTING FENCE

GPS 3
X=1531442.21
Y=924779.03
Z=812.64

BRUSH MATTRESS

BENCHING LIMITS

BCP 29
X=1531025.15
Y=925066.70
Z=815.95

BCP 8
X=1531054.57
Y=924957.01
Z=812.37

BCP 30
X=1531052.94
Y=924978.39
Z=812.49

PERMANENT FORD CROSSING

FLOW

GEOLIFT

MATCHLINE SHEET 4A STA. 23+00.00

MATCHLINE SHEET 4C STA. 37+00.00

EVERETTE & MIKE JOHNSON

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

DITCH PLUG

FILL EXISTING DITCH

PLAN VIEW OF DESIGN

40 20 0 40 80
SCALE (FT)

2/26/03

6/4/2012
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BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	4C

PROJECT ENGINEER

Baker
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

EVERETTE & MIKE JOHNSON

EXISTING FENCE

FILL EXISTING DITCH WITH MATERIAL FROM NEWLY EXCAVATED CHANNEL. CONTRACTOR WILL EXCAVATE STREAMBED MATERIAL FROM EXISTING CHANNEL PRIOR TO ADDING FILL MATERIAL. STREAMBED MATERIAL WILL BE INCORPORATED INTO THE NEWLY EXCAVATED CHANNEL PER DIRECTION OF ENGINEER. THE CONTRACTOR WILL BLEND THE NORTHERN SLOPE INTO THE LANDSCAPE PER DIRECTION OF ENGINEER.

GPS 4
X=1531925.69
Y=924354.65
Z=807.84

GPS 5
X=1532174.03
Y=924262.34
Z=808.56

MATCHLINE SHEET 4B STA. 37+00.00

MATCHLINE SHEET 4D STA 47+50.00

PERMANENT FORD CROSSING

GEOLIFT

BENCHING LIMITS

BRUSH MATTRESS

FLOW

TIE SWALE INTO CHANNEL PER DIRECTION OF ENGINEER

CREATE SHALLOW FLOODPLAIN POOL PER DIRECTION OF ENGINEER

CREATE SHALLOW FLOODPLAIN POOL PER DIRECTION OF ENGINEER

DITCH PLUG

FILL EXISTING DITCH

NAD 83

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

PLAN VIEW OF DESIGN

40 20 0 40 80
SCALE (FT)

2/28/03

6/4/2012
R:\118335_Cardiff\Design\as-built\plans\118335_Cardiff_92767_Baseline_2012_AB_04c.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	4D

PROJECT ENGINEER

Baker
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License #: F-1084

NAD 83

EVERETTE & MIKE JOHNSON

FILL EXISTING DITCH WITH MATERIAL FROM NEWLY EXCAVATED CHANNEL. CONTRACTOR WILL EXCAVATE STREAMBED MATERIAL FROM EXISTING CHANNEL PRIOR TO ADDING FILL MATERIAL STREAMBED MATERIAL WILL BE INCORPORATED INTO THE NEWLY EXCAVATED CHANNEL PER DIRECTION OF ENGINEER. THE CONTRACTOR WILL BLEND THE NORTHERN SLOPE INTO THE LANDSCAPE PER DIRECTION OF ENGINEER.

BCP 32
X=1532773.38
Y=923717.56
Z=811.01

END CONSTRUCTION CANDIFF CREEK M3
STA. 61+09.61

MATCHLINE SHEET 4C STA. 47+50.00

FLOW

BRUSH MATTRESS

GPS 6
X=1533508.71
Y=923713.58
Z=802.48

BENCHING LIMITS

GEOLIFT

EXISTING FENCE

TOWN VALLEY RAILROAD RIGHT-OF-WAY

DITCH PLUG

FILL EXISTING DITCH

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

PLAN VIEW OF DESIGN

40 20 0 40 80
SCALE (FT)

2/26/03

6/5/2012
R:\118335_Candiff\Design\as-built\plans\118335_Candiff_92767_Baseline_2012_06_04d.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	4E

PROJECT ENGINEER

Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
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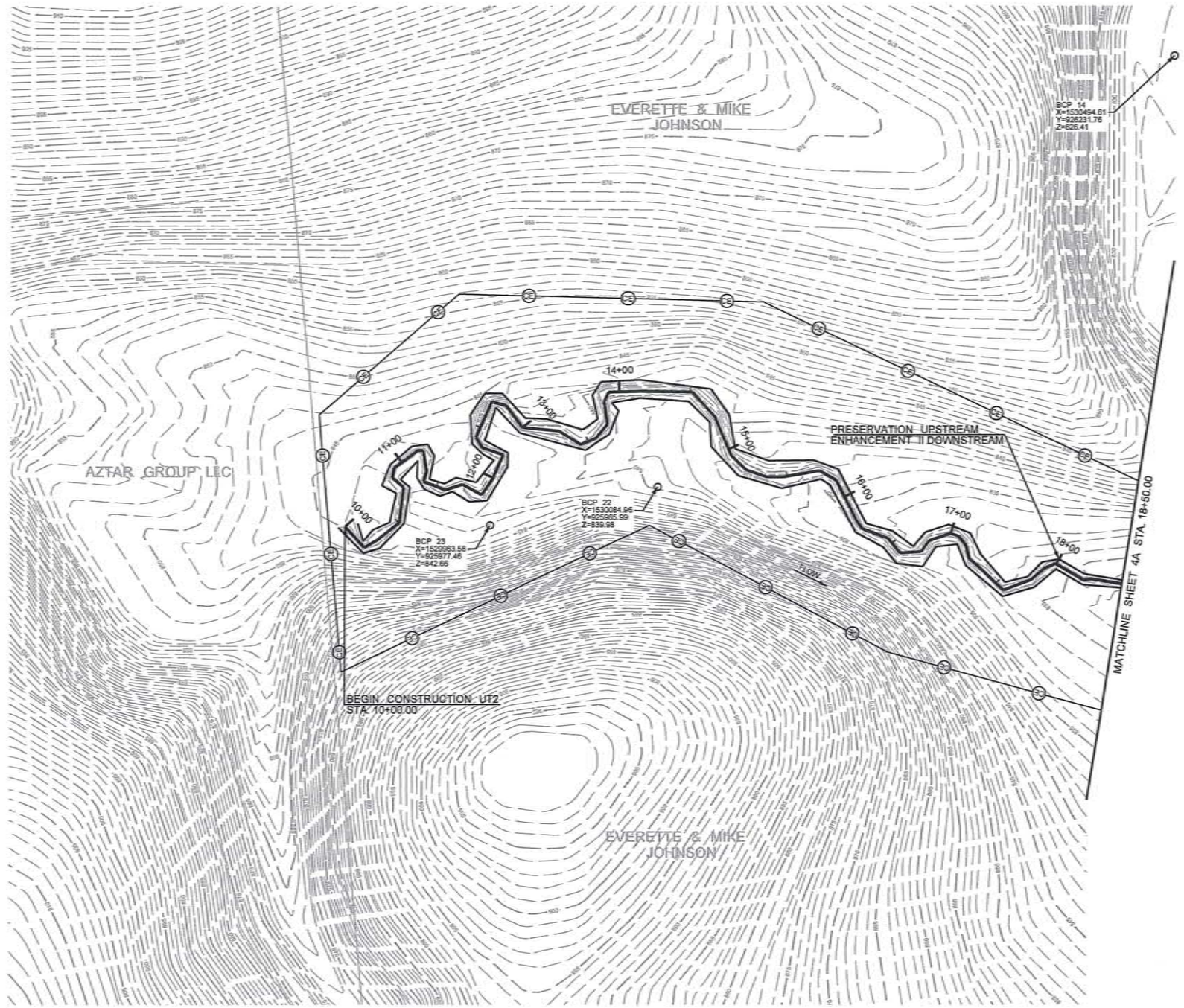

NAD 83

NORTH CAROLINA PROFESSIONAL SEAL 39208 ENGINEER JOSHUA A. WHITE
7/18/12

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

PLAN VIEW OF DESIGN

40 20 0 40 80
SCALE (FT)

2/26/01

7/18/2012
H:\118335_Cardiff\Design\as-built\plans\118335_Cardiff_92767_Baseline_2012_AB_04e.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	5

PROJECT ENGINEER

Baker
Michael Baker Engineering Inc.
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Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

BEGIN CONSTRUCTION CANDIFF CREEK
STA. 10+00.00 = BEGIN CONSTRUCTION M1

BEGIN CONSTRUCTION UT1
STA. 10+00.00

END CONSTRUCTION UT1
STA. 18+85.39

RIVER SLOAN ROAD

BILLY M. & KATHY LOU WALL

EVERETTE & MIKE JOHNSON

EVERETTE & MIKE JOHNSON

VEGPLOT #13

BCP 16
X=1530514.51
Y=926124.38
Z=827.14

BCP 14
X=1530494.61
Y=926031.76
Z=826.41

MATCHLINE SHEET 5A STA. 14+00.00

NAD 83

NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT

6.5.12

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT PLAN VIEW

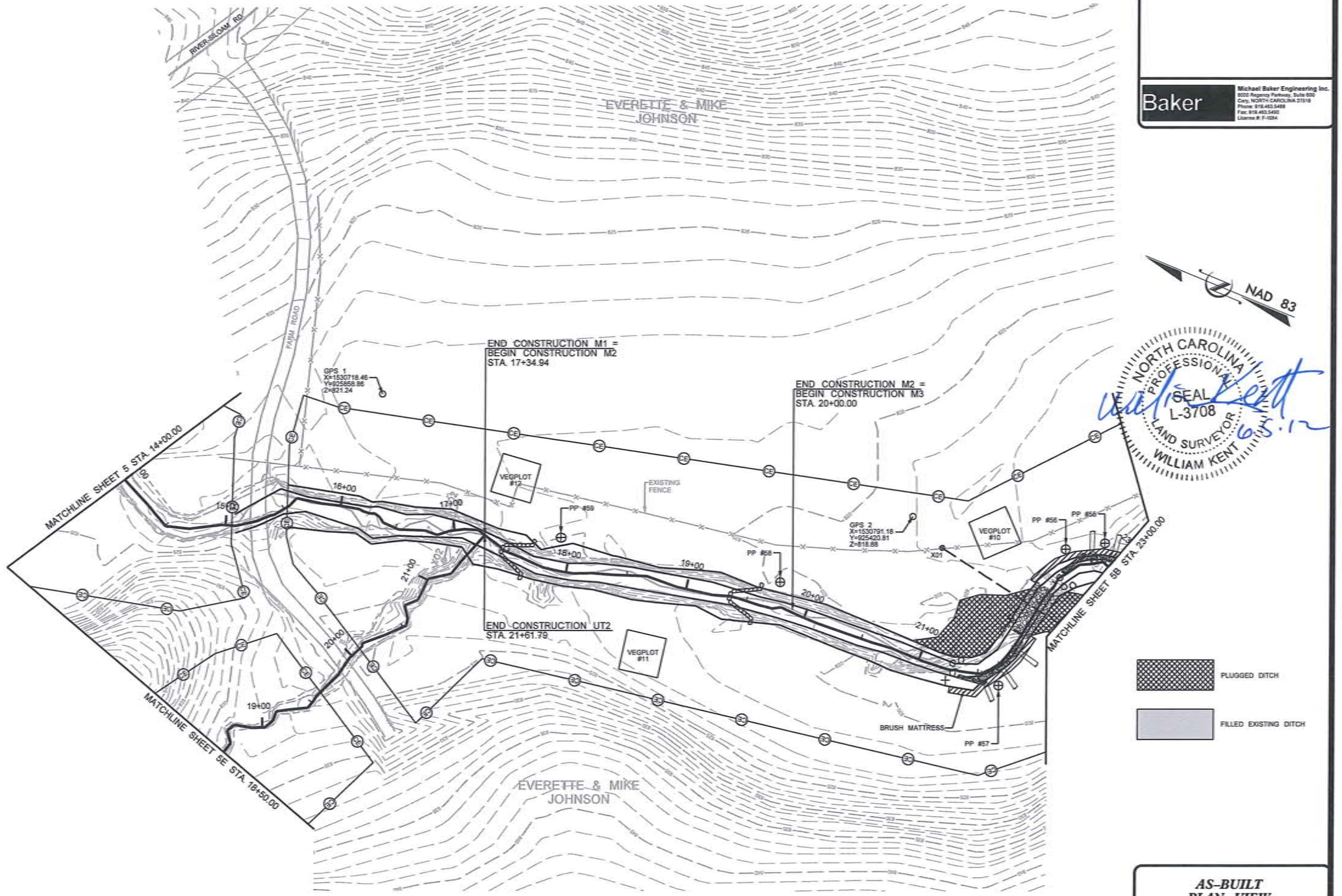
40 20 0 40 80
SCALE (FT)

6/5/2012
R:\118335_Candiff\Design\as-built\plans\118335_Candiff_92767_Baseline_2012_AB_05.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	5A

PROJECT ENGINEER

Baker
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084



NAD 83

NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT

6.5.12

NOTES:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT PLAN VIEW

40 20 0 40 80
SCALE (FT)

2/26/03

6/5/2012
R:\118335_Cardiff\Design\as-built\plans\118335_Cardiff_92767_Baseline_2012_AB_05a.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	5B

PROJECT ENGINEER

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Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NAD 83

EVERETTE & MIKE JOHNSON

EMERGENCY LIVESTOCK ACCESS

EXISTING FENCE

VEGPLOT #6

VEGPLOT #7

VEGPLOT #9

BRUSH MATTRESS

PP #35 PP #36 PP #37 PP #38 PP #39 PP #40 PP #41 PP #42 PP #43 PP #44 PP #45 PP #46 PP #47 PP #48 PP #49 PP #50 PP #51 PP #52 PP #53 PP #54

GEOLIFT

X01 X02 X03 X04 X05

MATCHLINE SHEET 5A STA. 23+00.00

MATCHLINE SHEET 5C STA. 37+00.00

EVERETTE & MIKE JOHNSON

NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT

6.5.12

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

PLUGGED DITCH

FILLED EXISTING DITCH

AS-BUILT PLAN VIEW

40 20 0 40 80
SCALE (FT)

2/26/01

6/5/2012
R:\118335-Cardiff\Design\as-built\plans\118335-_Cardiff_92767_Baseline_2012_AB_05b.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	5C

PROJECT ENGINEER

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Michael Baker Engineering Inc.
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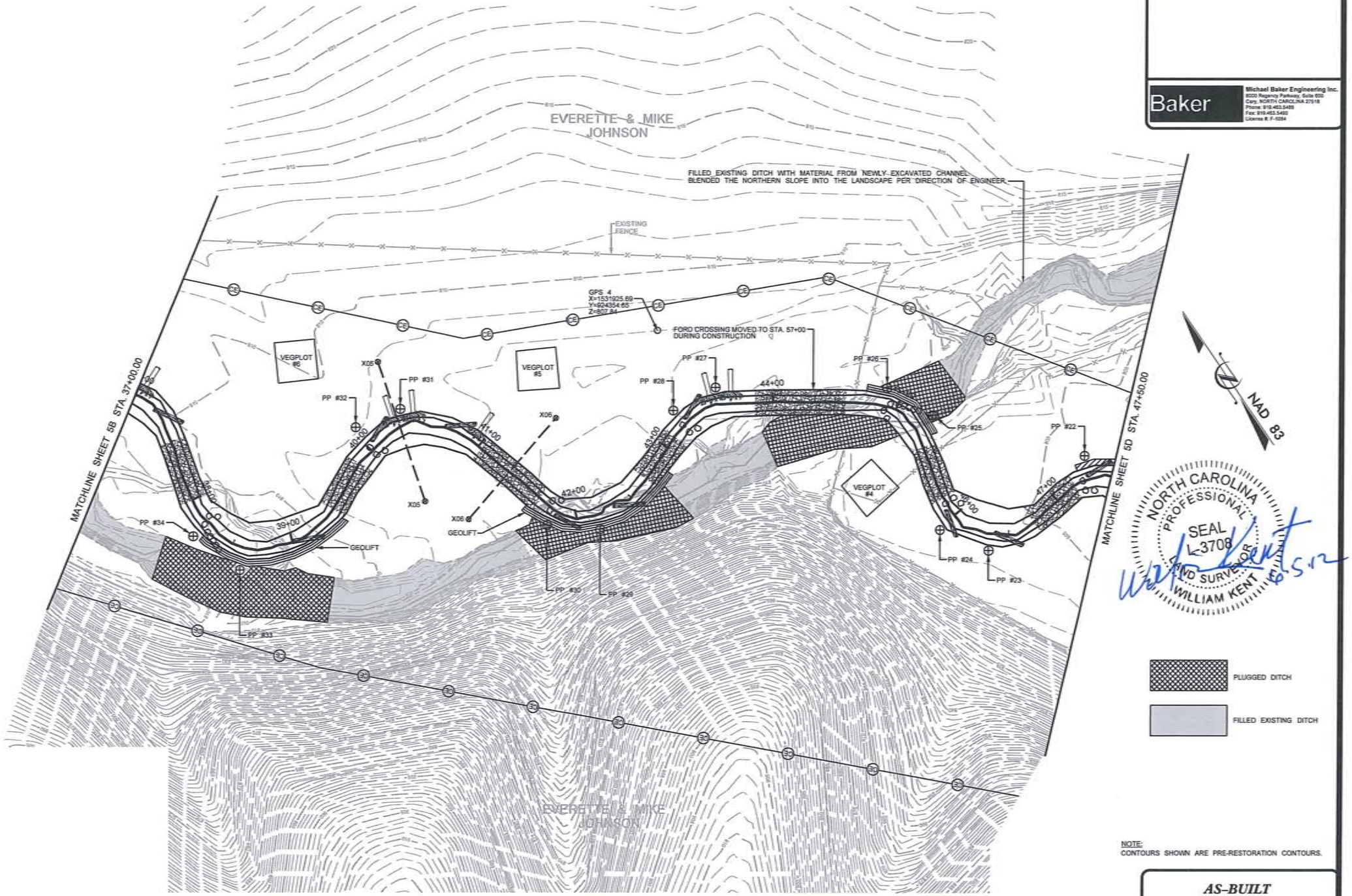
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084



NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT

PLUGGED DITCH

FILLED EXISTING DITCH

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT PLAN VIEW

40 20 0 40 80
SCALE (FT)

2/26/01

5/5/2012
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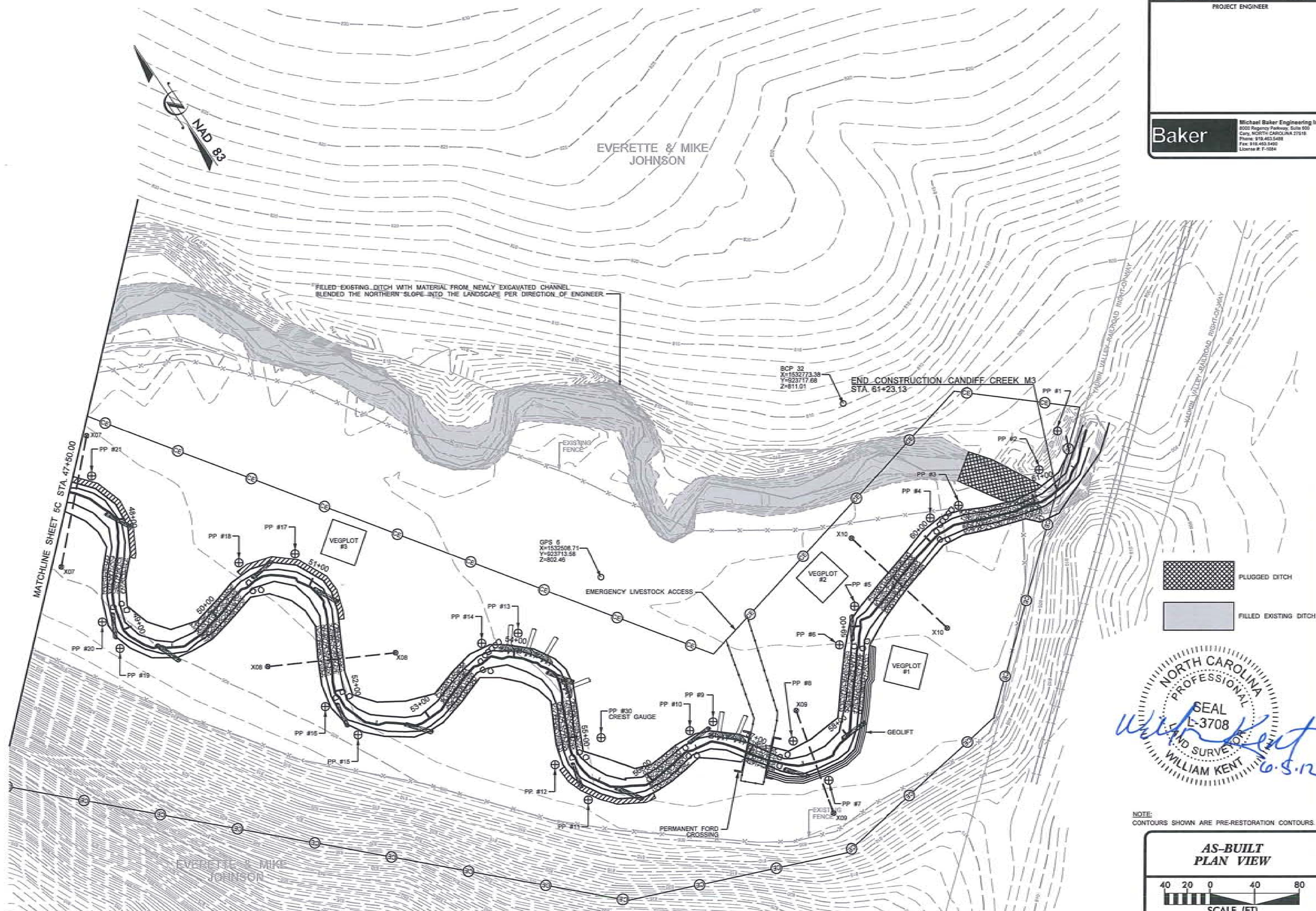

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	50

PROJECT ENGINEER

Baker

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8000 Regency Parkway, Suite 600
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Fax: 919.463.5490
License #: F-1084

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT PLAN VIEW

2/26/03

6/5/2012
R:\118335_Candiff\Design\as-built\plans\118335_Candiff_92767_Baseline_2012_AB_05d.dgn

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	5E

PROJECT ENGINEER

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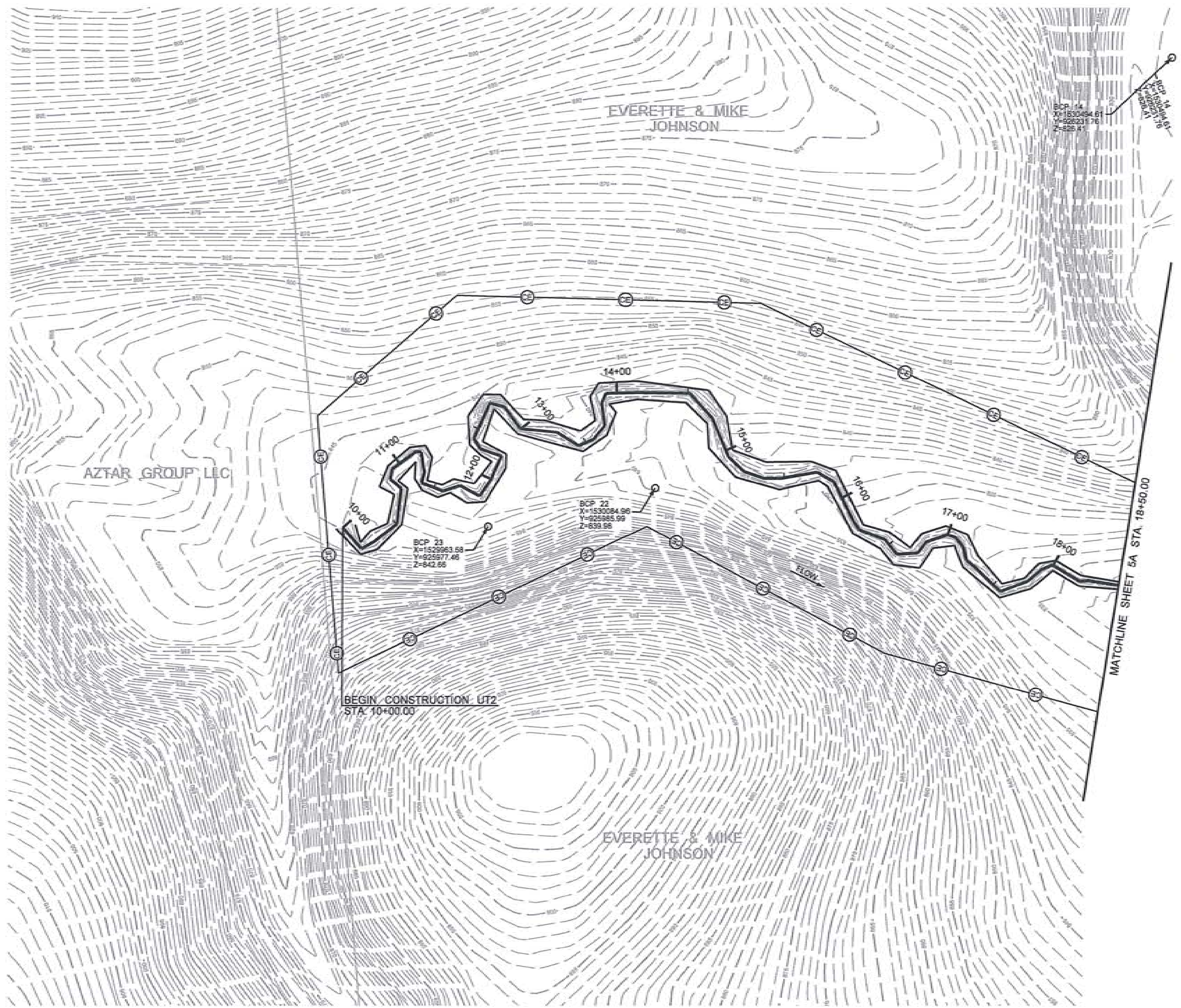
License #: F-1084



NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT

6.5.12

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT PLAN VIEW

40 20 0 40 80
SCALE (FT)

6/5/2012
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BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	6

PROJECT ENGINEER

Baker
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Fax: 919.463.5490
License #: F-1084

BEGIN CONSTRUCTION CANDIFF CREEK
STA. 10+00.00 = BEGIN CONSTRUCTION M1

BEGIN CONSTRUCTION UT1
STA. 10+00.00

END CONSTRUCTION UT1
STA. 18+85.39

RIVER \ SLOAM ROAD

BILLY M. & KATHY LOU WALL

EVERETTE & MIKE JOHNSON

EVERETTE & MIKE JOHNSON

VEGPLOT #13

BCP 15
X=1530614.51
Y=926124.38
Z=827.14

BCP 14
X=1530494.61
Y=926231.76
Z=826.41

MATCHLINE SHEET 6A STA. 14+00.00

FLOW

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

NAD 83

NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT
6.5.12

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT OVER DESIGN PLAN VIEW

40 20 0 40 80
SCALE (FT)

6/5/2012
R:\118335_Candiff\Design\as-built\plans\118335_Candiff_92767_Baseline_2012_AB_06.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	6A

PROJECT ENGINEER

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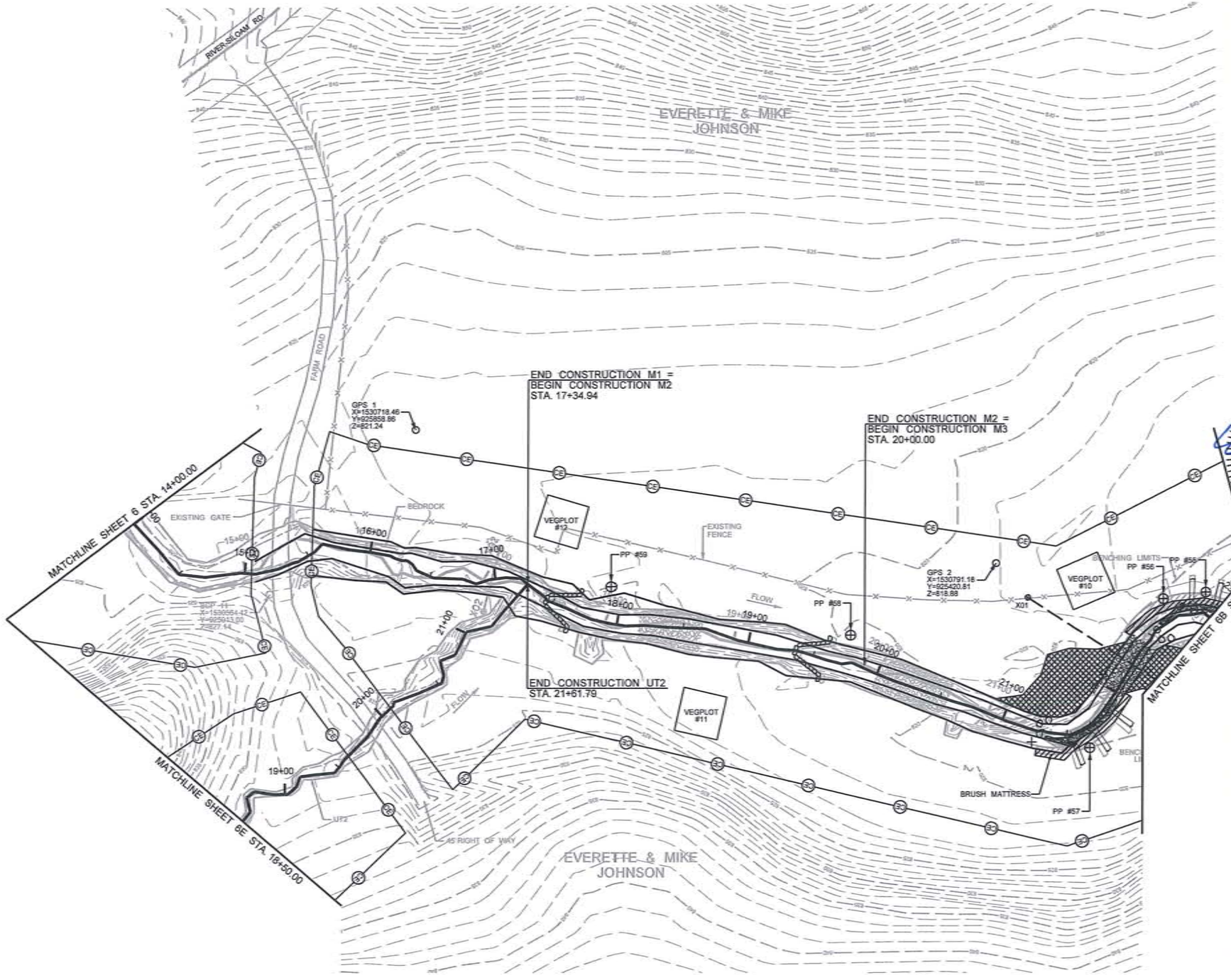
Fax: 919.463.5490
License #: F-1084



NAD 83

NORTH CAROLINA PROFESSIONAL SEAL 3708 LAND SURVEYOR WILLIAM KENT
6.5.12

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

PLUGGED DITCH

FILLED EXISTING DITCH

NOTES:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT OVER DESIGN PLAN VIEW

40 20 0 40 80
SCALE (FT)

2/26/13

6/5/2012
R:\118335_Cendiff\Design\as-built\plans\118335_Cendiff_92767_Baseline_2012_06_06a.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	6B

PROJECT ENGINEER

Baker
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Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

NAD 83

EVERETTE & MIKE JOHNSON

EMERGENCY LIVESTOCK ACCESS

EXISTING FENCE

GPS 3
X=1531442.21
Y=924779.03
Z=812.64

PP #41 PP #42 PP #43 PP #40 PP #39 PP #38 PP #35 PP #46 PP #47 PP #51 PP #52 PP #54 PP #53 PP #48 PP #50 PP #49 PP #45 PP #44 PP #37

VEGPLOT #8

VEGPLOT #7

VEGPLOT #9

GEOLIFT

BRUSH MATTRESS

BRUSH MATTRESS

BENCHING LIMITS

BCP 29
X=1531...
Y=924...
Z=815...

BCP 8
X=1531054.57
Y=924957.01
Z=812.37

BCP 30
X=1531852.64
Y=924978.39
Z=812.49

X01 X02 X03 X04 X05

MATCHLINE SHEET 6A STA. 23+00.00

MATCHLINE SHEET 6C STA. 37+00.00

EVERETTE & MIKE JOHNSON

NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT
6.5.12

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

PLUGGED DITCH

FILLED EXISTING DITCH

AS-BUILT OVER DESIGN PLAN VIEW

40 20 0 40 80
SCALE (FT)

6/5/2012
K:\118335_Cardiff\Design\as-built\plans\118335_Cardiff_92767_Baseline_2012_AB_06b.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	6C

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22967 WILLIAM SCOTT HUNT, III 06-06-2012

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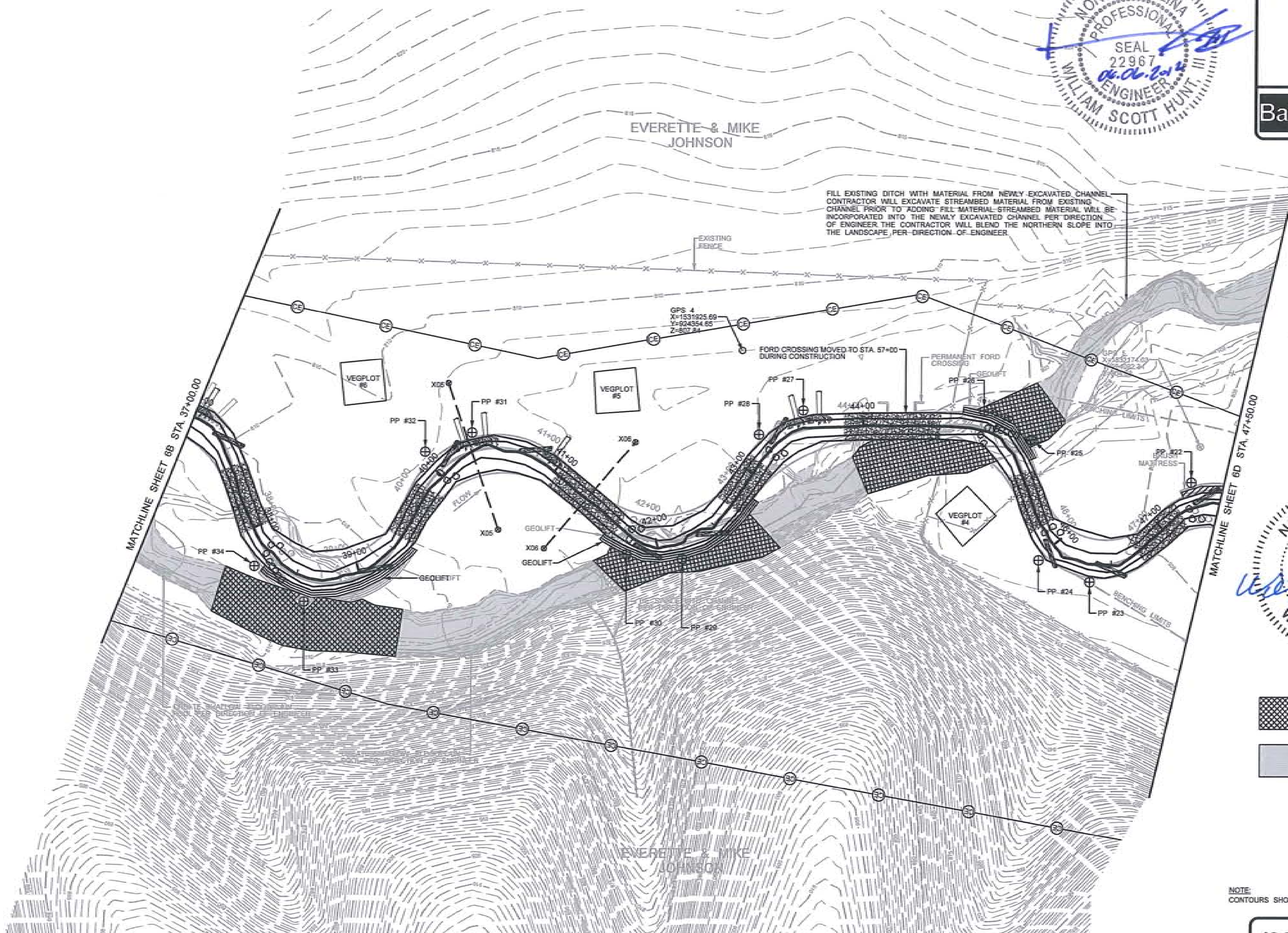
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084



NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-3708 WILLIAM KENT 6.5.12

PLUGGED DITCH

FILLED EXISTING DITCH

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT OVER DESIGN PLAN VIEW

40 20 0 40 80
SCALE (FT)

2/26/03

6/5/2012 ...\118335_Candiff\Design\as-built\plans\118335_Candiff_92767_Baseline_2012_AB_06c.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	6D

PROJECT ENGINEER

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Fax: 919.463.5490
License #: F-1084

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
6.6.2012

NAD 83

EVERETTE & MIKE JOHNSON

FILL EXISTING DITCH WITH MATERIAL FROM NEWLY EXCAVATED CHANNEL. CONTRACTOR WILL EXCAVATE STREAMBED MATERIAL FROM EXISTING CHANNEL PRIOR TO ADDING FILL MATERIAL. STREAMBED MATERIAL WILL BE INCORPORATED INTO THE NEWLY EXCAVATED CHANNEL PER DIRECTION OF ENGINEER. THE CONTRACTOR WILL BLEND THE NORTHERN SLOPE INTO THE LANDSCAPE PER DIRECTION OF ENGINEER.

MATCHLINE SHEET 6C STA. 47+50.00

BCP 32
X=1532773.38
Y=923717.68
Z=811.01

END CONSTRUCTION CANDIFF CREEK IM3
STA 61+23.13

GPS 6
X=1532508.71
Y=923713.58
Z=802.46

EMERGENCY LIVESTOCK ACCESS

PERMANENT FORD CROSSING

PP #1 PP #2 PP #3 PP #4 PP #5 PP #6 PP #7 PP #8 PP #9 PP #10 PP #11 PP #12 PP #13 PP #14 PP #15 PP #16 PP #17 PP #18 PP #19 PP #20 PP #21

PP #30 CREST GAUGE

VEGPLOT #1 (GEOLIFT)
VEGPLOT #2
VEGPLOT #3

GEOLIFT

EXISTING FENCE

BENCHING LIMITS

X06 X07 X08 X09 X10

MADISON VALLEY RAILROAD RIGHT-OF-WAY

PLUGGED DITCH

FILLED EXISTING DITCH

NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT
6.5.12

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT OVER DESIGN PLAN VIEW

40 20 0 40 80
SCALE (FT)

2/26/03

6/5/2012
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BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	6E

PROJECT ENGINEER

Baker
Michael Baker Engineering Inc.
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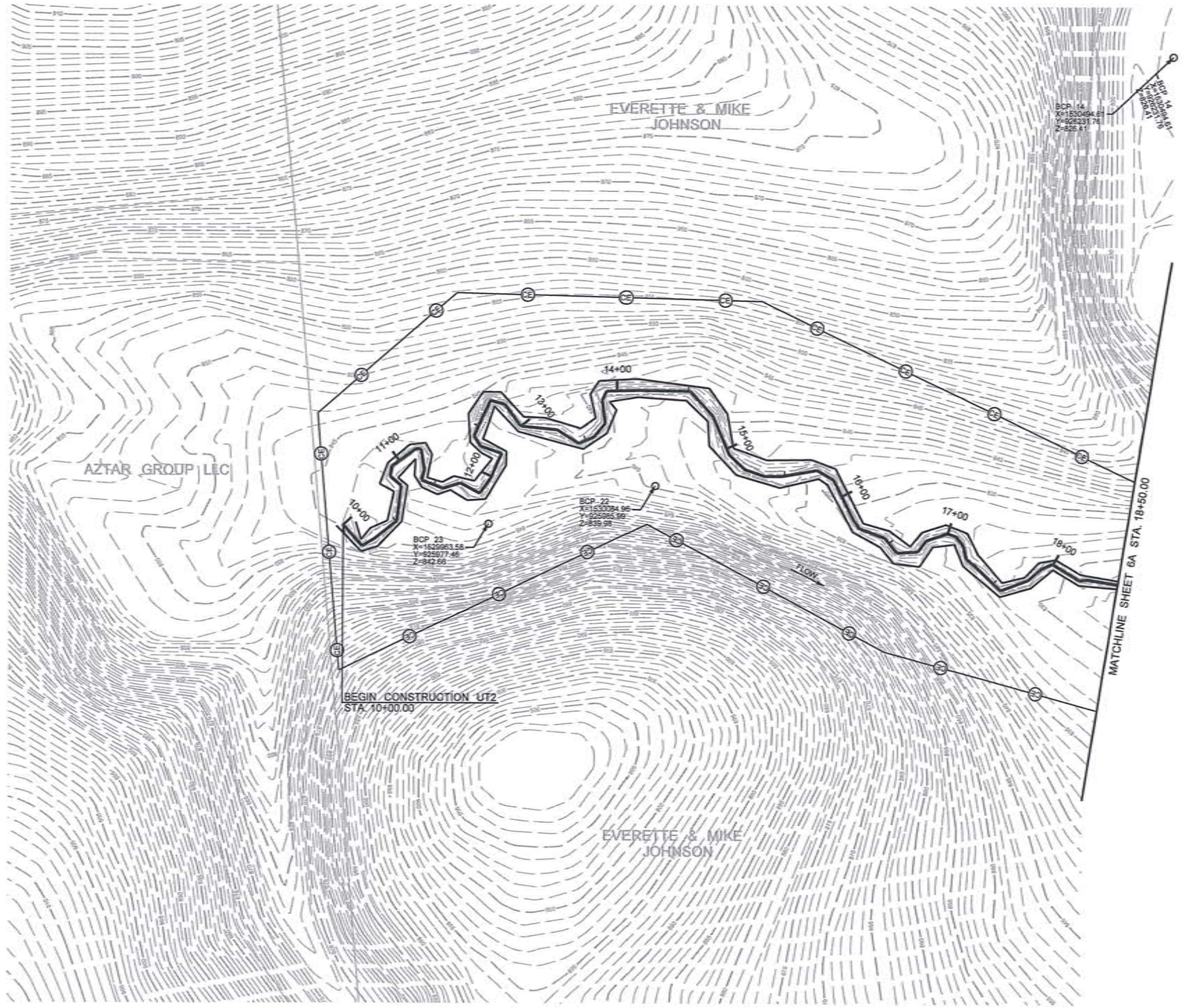
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084



NAD 83

NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT
6.5.12

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.06.2012

NOTE:
CONTOURS SHOWN ARE PRE-RESTORATION CONTOURS.

AS-BUILT OVER DESIGN PLAN VIEW

40 20 0 40 80
SCALE (FT)

6/5/2012
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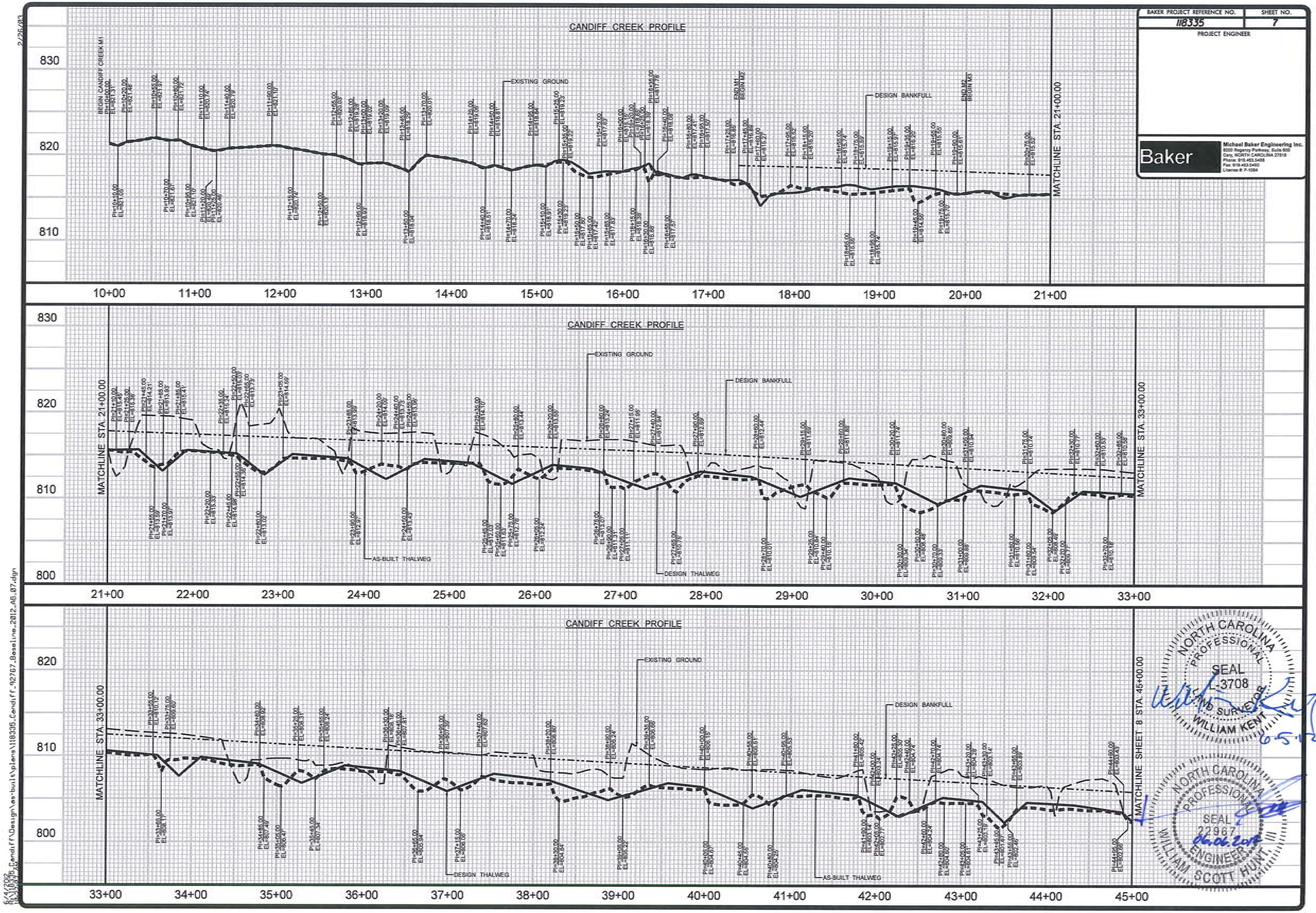
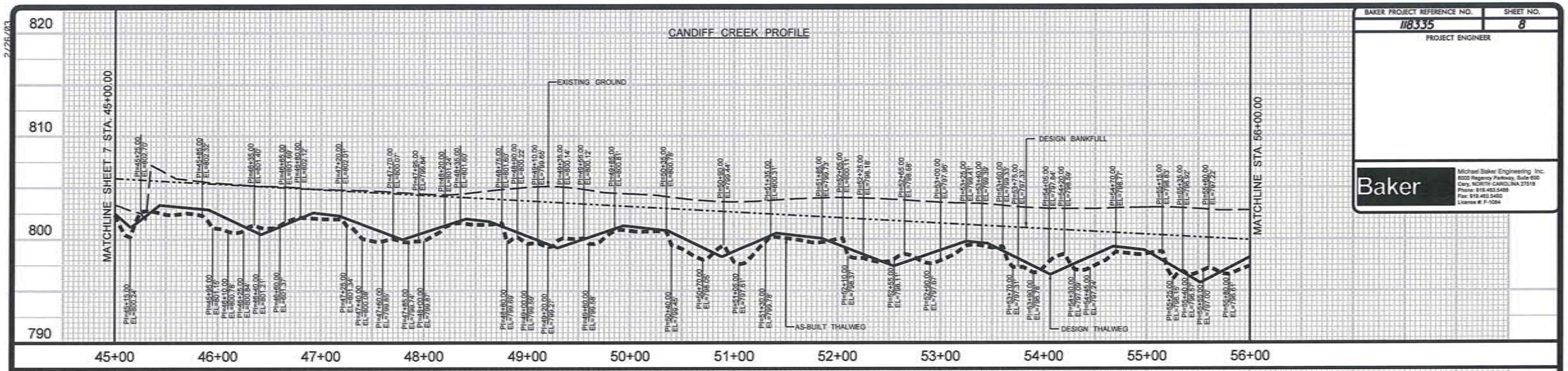
2/26/08



BAKER PROJECT REFERENCE NO.
118335
SHEET NO.
7
PROJECT ENGINEER
Baker
Michael Baker Engineering Inc.
CANDIFF CREEK PROFILE
EXISTING GROUND
DESIGN BANKFULL
BEGIN CANDIFF CREEK M1
END M1 BEGIN M2
END M2 BEGIN M3
MATCHLINE STA. 21+00.00
10+00
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
19+00
20+00
21+00
830
820
810
CANDIFF CREEK PROFILE
EXISTING GROUND
DESIGN BANKFULL
AS-BUILT THALWEG
DESIGN THALWEG
MATCHLINE STA. 21+00.00
MATCHLINE STA. 33+00.00
21+00
22+00
23+00
24+00
25+00
26+00
27+00
28+00
29+00
30+00
31+00
32+00
33+00
830
820
810
800
CANDIFF CREEK PROFILE
EXISTING GROUND
DESIGN BANKFULL
DESIGN THALWEG
AS-BUILT THALWEG
MATCHLINE STA. 33+00.00
MATCHLINE SHEET 8 STA. 45+00.00
33+00
34+00
35+00
36+00
37+00
38+00
39+00
40+00
41+00
42+00
43+00
44+00
45+00
820
810
800
NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT III

2/26/03

CANDIFF CREEK PROFILE



BAKER PROJECT REFERENCE NO.	SHEET NO.
118335	8

PROJECT ENGINEER

Baker

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8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
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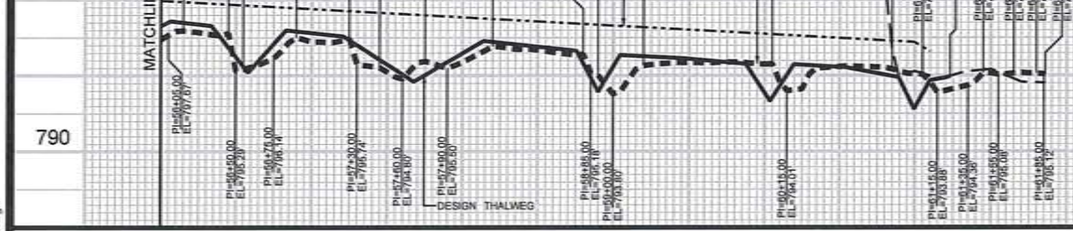
Fax: 919.463.5490
License #: F-1084

CANDIFF CREEK PROFILE



NORTH CAROLINA PROFESSIONAL SEAL 39208 ENGINEER JOSHUA A. WHITE 07/18/12

NORTH CAROLINA PROFESSIONAL SEAL L-3708 LAND SURVEYOR WILLIAM KENT

7/18/2012
R:\118335_Candiff\Design\as-built\plans\118335_Candiff_92767_Baseline_2012_08_08.dgn