

INDIRECT AND CUMULATIVE IMPACT STUDY

**U-2527, VANCE COUNTY,
NORTH CAROLINA**



Infrastructure, buildings, environment, communications

**Indirect and Cumulative Impact
Study**

U-2527, Vance County, North
Carolina
WBS Number: 34822.1.1

Prepared for:
North Carolina Department of
Transportation

Prepared by:
ARCADIS G&M of North Carolina, Inc.
801 Corporate Center Drive
Suite 300
Raleigh
North Carolina 27607
Tel 919 854 1282
Fax 919 854 5448

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1. Executive Summary

The proposed project, Transportation Improvement Program (TIP) Project No. U-2527 (Western Outer Loop), involves constructing a new two-lane facility within an ultimate four-lane median-divided roadway with limited access control in Vance County, North Carolina. The road begins at SR 1101 (Old Country Home Road) and proceeds north to SR 1128 (Ruin Creek Road) and is within the jurisdictions of Vance County and the city of Henderson. The focus of this study is to determine whether or not indirect and cumulative impacts resulting from the project will cause a violation of downstream water quality standards. The study also makes a finding as to associated water quality impacts.

According to the North Carolina Division of Water Quality's (NCDWQ) *1999 Tar-Pamlico River Basinwide Water Quality Management Plan*, overall water quality conditions in the basin are good. The study area for this project is in water subbasin 03-03-01 of the Tar-Pamlico Water Basin. There are no waters classified as High Quality Waters or as Outstanding Resource Waters in the study area or vicinity and there are no impaired waters within subbasin 03-03-01.

Potential impacts to water quality in the study area:

- A road on new location in an undeveloped area will bring development to an area with pastures and fields as its current land use.
- The facility is being constructed as a limited control access roadway versus a full control access roadway. This limited access control could contribute to additional driveway cuts, which reduce traveling speeds and increase congestion. This could induce the need for an additional bypass, thereby consuming more land around Henderson sooner than it would otherwise be needed.
- Portions of the study area include moderate growth areas in Henderson and Vance County.
- The city of Henderson does not have an effective land use plan. Henderson does have a zoning ordinance and a recently revised zoning map. Except for the highway commercial areas near I-85, the study area is zoned for low-density residential uses.
- Effective growth regulations are absent in Vance County. The county planning director stated that a new land use plan is expected to become effective in 2007.
- The city, but not the county, participates in the state erosion and sedimentation control plan; both have water supply watershed protection regulations.
- Water and sewer capacity is available in the study area and will not be an immediate growth-limiting factor.

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- A moderate amount of residential development is projected in the vicinity. This growth is not expected to be induced by the new facility, but redirected from other areas in the region where roads and other city services currently exist.
- Growth pressures in Vance County are low. Unemployment is high, population projections indicate below average growth, and the local planners forecast slow growth. Further, new development and redevelopment is sparse, and the manufacturing and tobacco sector of the local economy is slowing.
- Vance County's proximity to the employment opportunities, rapid growth, and rising land costs of the Raleigh/Durham metropolitan area could eventually lead to accelerated growth in the county.
- Rapid growth is unlikely to occur in the foreseeable future.
- Current development regulations are inadequate to direct and control growth and protect downstream water quality if unforeseen rapid growth were to occur.

In conclusion, the construction of TIP Project No. U-2527 is not expected to result in any indirect or cumulative impacts that will adversely affect the water quality within the Tar-Pamlico River Basin. No further indirect or cumulative impact analysis is recommended for the proposed project.

2. Purpose of Indirect and Cumulative Impact Study

The focus of this study is to determine whether or not indirect and cumulative impacts resulting from the project will cause a violation of downstream water quality standards. The report analyzes the area's future growth potential, discusses existing plans and programs affecting water quality, and makes a finding as to associated water quality impacts.

The Council on Environmental Quality defines indirect impacts as those, “. . . which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8).” Cumulative impacts are defined as, “. . . impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions (40 CFR 1508.7).”

Indirect impacts of transportation decisions can involve changes in the type, density, design and locations of development. Influences or disturbances caused by urban development such as increased runoff from impervious areas, erosion and sedimentation, disturbance of riparian vegetation, development in the riparian zone, and pollutant loading can have a cumulative effect on future water quality.

3. Project Description

TIP Project No. U-2527 (Western Outer Loop), involves constructing a new two-lane facility approximately 2.5 miles long within an ultimate four-lane median-divided roadway with limited access control in Vance County, North Carolina. The purpose of this facility is to provide a bypass around Henderson connecting Interstate 85 (I-85) and US 1. This phase of the project extends from SR 1128 (Ruin Creek Road) and proceeds south to SR 1101 (Old Country Home Road) and will connect residential areas to I-85. Later phases of the project will complete the proposed connection to US 1 and therefore fulfill the purpose and need of the project. According to the *1995 Henderson Thoroughfare Plan*, there are no other projects planned in the area. The *Environmental Assessment (EA)* for the project was completed in 1995 and the *Finding of No Significant Impact (FONSI)* for the project was completed in 1997. Table 1 lists roadway projects in Vance County from the *2004-2010 NCDOT Transportation Improvement Program*.

Table 1. 2004-2010 NCDOT TIP Roadway Projects in Vance County*

TIP#	Route/City	Description
I-3807	I-85	SR 1128 (Ruin Creek Road), SR 1218 (Graham Avenue) to US 158. Widen to multi-lanes and modify interchange.
I-3812	I-85	US 1 Interchange. Provide additional traffic movements.
R-2503	US 1 Business	SR 1548 (Peter Gill Road) to SR 1267 (Dabney Drive). Widen to five lanes with curb and gutter.
R-4442	NC 39, SR 1574 and SR 1148	NC 39, left-turn lane at SR 1148 (Vanco Mill Road), SR 1574 (Martin Creek Road); strengthen pavement, SR 1148 to SR 1115 (Bearpond Road). SR 1148, add right- and left-turn lanes at Employee Parking Entrance. SR 1148, add right-turn lane at SR 15
U-2527	Henderson	Western Outer Loop, SR 1101 (Old Country Home Road) to SR 1128 (Ruin Creek Road). Multi-lanes on new location.
U-3836	Henderson	New Route, SR 1126 (Poplar Creek Road) to SR 1128 (Ruin Creek Road). Two-lane service road on new location.

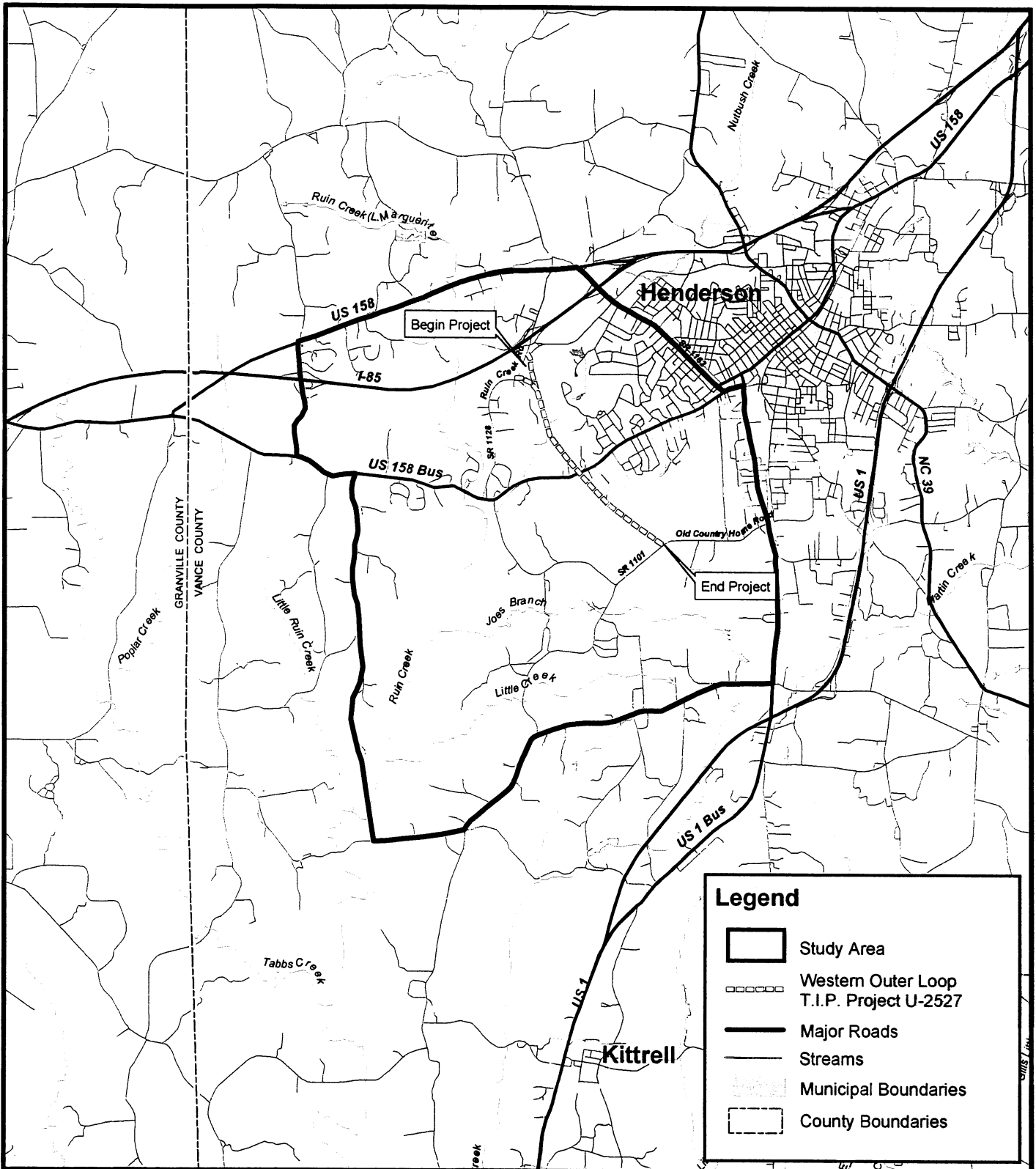
Source: North Carolina Department of Transportation TIP Program Unit.

* Includes only additional roadway area, not resurfacing or bridge replacements.

4. Identification of Study Area

The study area is in central Vance County in the northeast Piedmont section of North Carolina. Vance County borders the state of Virginia and is south of Kerr Lake, the largest lake in the state of North Carolina. The study area is comprised of the western portion of the city of Henderson and parts of unincorporated Vance County. Henderson, the county seat and largest city in the county, is approximately 40 miles from Durham via Interstate 85 (I-85) and approximately 45 miles from Raleigh via US Highway 1 (US 1). The town of Oxford is west of the study area in Granville County (Vance County Economic Development Commission <http://www.vancecountyedc.com/>). The study area is shown in Figure 1.

The study area was devised by examining the project's location in relation to political and planning boundaries; census boundaries; drainage basins and watershed boundaries; the role the facility plays in the local network; regional and local travel patterns; and the development patterns of the region.



Scale 1:89,000



ARCADIS G&M of North Carolina, Inc.

801 Corporate Center Drive, Suite 300
Raleigh, NC 27607-5073 Tel: 919/854-1282 Fax: 919/854-5448

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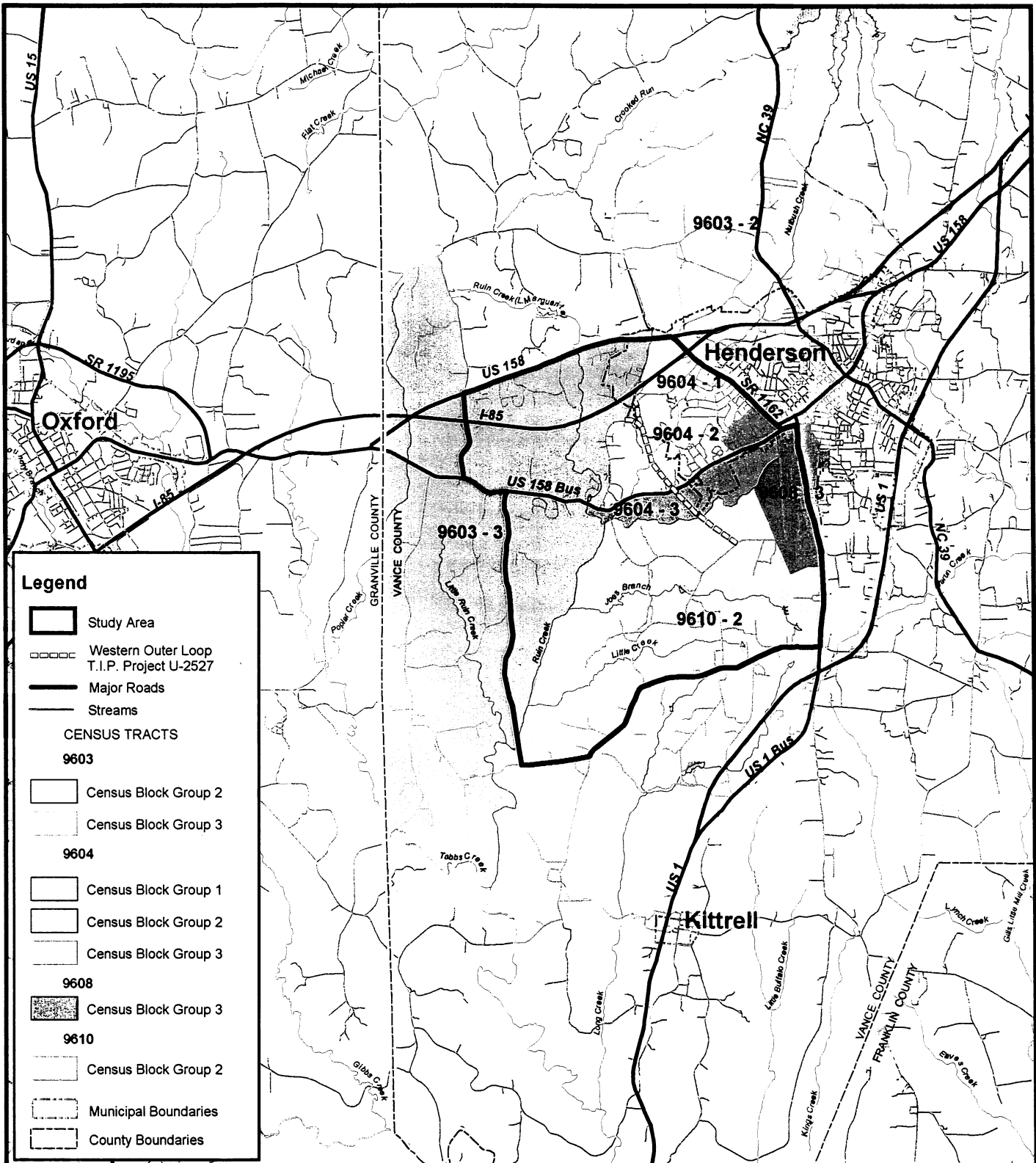


STUDY AREA

T.I.P. Project U-2527
Western Outer Loop
Vance County, NC

Figure

1



Legend

- Study Area
- Western Outer Loop T.I.P. Project U-2527
- Major Roads
- Streams

CENSUS TRACTS

9603

- Census Block Group 2
- Census Block Group 3

9604

- Census Block Group 1
- Census Block Group 2
- Census Block Group 3

9608

- Census Block Group 3

9610

- Census Block Group 2

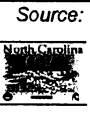
- Municipal Boundaries
- County Boundaries



Scale 1:124,000



ARCADIS G&M of North Carolina, Inc.
 801 Corporate Center Drive, Suite 300
 Raleigh, NC 27607-5073 Tel: 919/854-1282 Fax: 919/854-5448



CENSUS TRACTS
 T.I.P. Project U-2527
 Western Outer Loop
 Vance County, NC

Figure
2

5. Analysis of Study Area

5.1 Demographic Characteristics

Table 2. 1990 – 2000 Population Growth for State, County, City, and Block Groups

	1990 Total Population	2000 Total Population	Percent Change
North Carolina	6,628,637	8,049,313	21.4%
Vance County	38,892	42,954	10.4%
City of Henderson	15,655	16,095	2.8%
CT 9603, BG 2	1,243	1,323	6.4%
CT 9603, BG 3	1,371	1,363	-0.6%
CT 9604, BG 1	1,326	1,500	13.1%
CT 9604, BG 2	919	989	7.6%
CT 9604, BG 3*	586	1,274	-2.9
CT 9604, BG 4*	726	Combined with CT 9604, BG 3 in 2000	
CT 9608, BG 3	579	525	-9.3%
CT 9610, BG 2	1,882	2,083	10.7%

Source: 1990 and 2000 US Census.

*In the 2000 Census, BGs 3 and 4 of CT 9604 were combined into CT 9604, BG 3.

The 1990 and 2000 U.S. Census data were used to gather information on the population of the demographic study area. The boundaries of the block groups and study area are shown in Figure 2.

Overall, the city of Henderson grew at a slow rate in the 1990s, only 2.8 percent. The state grew at twice the rate of the county, 21.4 percent as compared to 10.4 percent for the county. According to Frank Frazier, Engineering Director for the city of Henderson, growth is occurring in the west. Census data is consistent with Mr. Frazier's statement; Block Group 2 of Census Tract 9603, all three block groups in Census Tract 9604, and Block Group 2 of Census Tract 9610 increased in population in the 1990s by at least 6.4 percent.

In contrast, Block Group 3 of Census Tract 9603 in the county's planning jurisdiction had a notable population decrease of 0.6 percent and Block Group 3 of Census Tract 9608 and Block Group 3 of Census Tract 9604 in southern Henderson experienced notable population decreases of 9.3 percent and 2.9 percent. Field observations

revealed many abandoned or neglected buildings. According to Benny Finch of the Vance County Economic Development Commission (VCEDC), neither private nor public funds have been invested in these geographic areas of Henderson and the county. He also stated there has been little interest in renovating the older, vacant industrial buildings in the county. Per the Vance County Planning and Zoning Director, Ron Edmonson, the county as a whole has a large number of structures that have been abandoned or neglected and sufficient funds have not been budgeted to remove such potential hazards. This creates a less desirable place to develop compared to vacant land surrounded by wooded areas and pastures in the western area of Henderson’s Extraterritorial Jurisdiction (ETJ).

Per the North Carolina State Demographics website, Vance County is expected to add approximately 12,600 people (29 percent) in the next 30 years. As a comparison, the state of North Carolina is expected to add approximately 4.4 million people or 55 percent. The growth in the county will encourage additional residential development within Henderson.

Table 3. 2000-2030 Projected Population Growth for North Carolina and Vance County

	April 2000	July 2005	April 2010	July 2015	April 2020	July 2025	April 2030
Vance County	42,954	45,275 5.4%*	47,140 4.1%*	49,123 4.2%*	51,370 4.6%*	53,362 3.9%*	55,575 4.1%*
North Carolina	8,049,313	8,783,752 9.1%*	9,491,372 8.1%*	10,226,897 7.7%*	10,966,139 7.2%*	11,712,440 6.8%*	12,447,597 6.3%*

Source: North Carolina State Demographics.

*Percent change from previous projection.

5.2 Economic Factors Contributing to Growth

According to the North Carolina Department of Commerce, Vance County has a diversified economy that is equally based on its manufacturing, retail trade, service, and government sectors; each sector employs approximately 20 percent of the county workforce. According to Mr. Finch, the manufacturing sector is slowing; several tobacco plants have closed in the past three years. He also stated that the VCEDC is now trying to recruit biotechnology manufacturing companies and other technology-based industries.

Table 4. May 2002-May 2003 Unemployment Rates for Vance County and the State of North Carolina

	May 2003	February 2003	November 2002	May 2002
Vance County	12.8%	12.2%	13.9%	13.2%
North Carolina	6.1%	5.8%	6.6%	6.8%

Source: North Carolina Employment Security Commission

According to the North Carolina Employment Security Commission, as of June 28, 2003, Vance County has the highest unemployment rate in the state of North Carolina and its unemployment rate is twice the state average. This is an indicator that the area is not growing rapidly and economic growth pressures will not be a factor contributing to growth in the region.

5.3 Notable Features

The study area for this project is in water subbasin 03-03-01 of the Tar-Pamlico Water Basin. The Tar-Pamlico River basin is contained entirely within the state and originates in the upper Piedmont region in Person and Granville counties, west of I-85, and flows southeastward toward the Pamlico Sound. Upstream of the city of Washington, the mainstem is called the Tar River. Below this point, it becomes the Pamlico River. The Tar River is primarily a free-flowing freshwater stream while the Pamlico River is entirely estuarine.

The Tar-Pamlico basin contains numerous environmental resources including the dwarf wedge mussel and the bald eagle, which are federally listed as an endangered species in Vance County. According to the *FONSI*, this project will not impact these two species.

According to the *EA*, “no prime farmland or state and locally important farmland will be taken,” by constructing this project. According to the *FONSI* there are no National Register-listed or eligible properties within the study area.

5.4 Existing Land Use

The majority of the study area and all of the Western Outer Loop are in the city of Henderson’s ETJ. The Henderson Country Club and Golf Course are near the northern terminus of the project. The properties around the country club and golf course are predominately residential, dominated by larger homes on larger lots. This

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area, between Ruin Creek Road and south of I-85, is close to using its current land supply. North of I-85 and south of US 158 Business on Ruin Creek Road is the Maria Parham Hospital. According to Mr. Finch of the VCEDC, the hospital and the area around the hospital have experienced considerable growth in recent years and are expected to continue to expand. This is consistent with census data.

The Western Outer Loop intersects with US 158 Business (Oxford Road). The Sunset Memorial Cemetery is approximately 300 feet east of the intersection where the two roads will intersect. According to the *EA*, the cemetery will not be impacted by the proposed project. Also along US 158 Business west of the project is a small water reclamation facility operated by Vance County, a large church, scattered pockets of residential uses, and areas with steep topography that are being used as pasture lands. East of the project on US 158 Business is an established residential community that backs up to the southern border of the Henderson Country Club and Golf Course. East of this development is Henderson's older downtown community. Some older homes have been converted into law offices and other professional uses and an old hospital has been converted into an apartment complex.

The southwestern portion of the study area is in Vance County's planning jurisdiction. This area is undeveloped with few roads and homes. A few pockets of residential development are surrounded by wooded areas and fallow fields and near the Ruin Creek.

US 1 Business serves as the eastern boundary of the study area and SR 1115 (North Lynnbank Road) is the southern boundary of the study area. Development near the intersection of these two roads and along US 1 Business is dominated by industrial uses. There are many abandoned or neglected structures along this corridor. SR 1115 and areas immediately north are dominated by older farmsteads with homes far from the road and are surrounded by fallow fields, wooded areas, and pastures.

Most of the commercial development in the area is focused around the intersection of Dabney Road and I-85. Other commercial development in Henderson is east of the study area along NC 39 (Andrews Avenue). NC 39 is a direct route through the city connecting I-85 and US 1.

5.5 Land Use Plans

5.5.1 Vance County

Vance County recently restructured its planning, zoning, and building inspections functions. Currently, there is a land use plan (adopted 1996), but no land use map. The land use plan is not being enforced and no properties within the county have been given a land use designation. According to Mr. Edmonson, the county plans to have the land use plan implemented by 2007.

5.5.2 City of Henderson

The city of Henderson has a land use plan that has not been updated since 1976 and is no longer used or enforced. Currently, there are no plans to update the land use plan.

5.6 Zoning

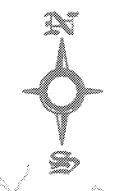
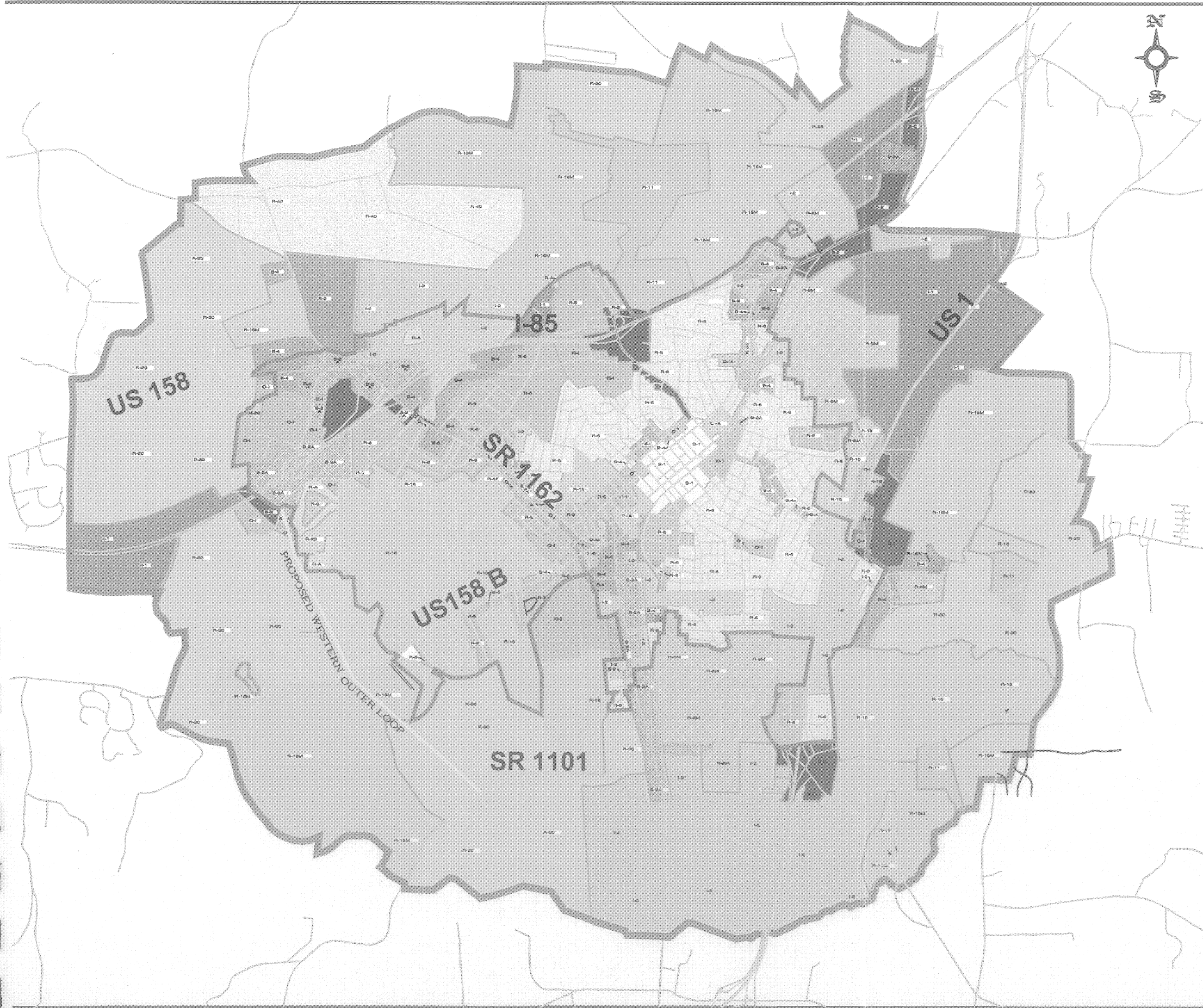
5.6.1 Vance County

Vance County recently restructured its planning, zoning, and building inspections functions. Currently, there is a zoning ordinance, but no zoning map. The zoning ordinance is not being enforced and no properties within the county have been given a zoning designation. According to Mr. Edmonson of the Vance County Planning and Zoning Administration, the county plans to have the zoning ordinance implemented by 2007.

5.6.2 City of Henderson

The city of Henderson has a zoning ordinance that was originally adopted in August 1948. The most recent copy was revised in October 1999. According to the Henderson Zoning Map last revised April 2003, there are 18 zoning districts within the city's corporate limits and planning jurisdiction. Nine of the districts are for residential uses; two districts are for office and institutional uses; five districts are for commercial uses; and two are for manufacturing and industrial uses. See Figure 3 for a map of the city of Henderson Zoning Districts.

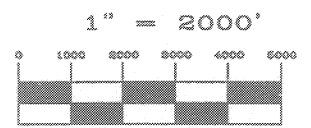
According to the *City of Henderson Zoning Ordinance* and the accompanying *Zoning Map*, excluding the properties around the intersection of Ruin Creek Road and the Western Outer Loop which are zoned for commercial uses (B2 Highway Commercial



ZONING DISTRICTS

- RA RESIDENTIAL AND AGRICULTURAL USE DISTRICT
- R40 VERY LOW DENSITY RESIDENTIAL DISTRICT
- R20 LOW DENSITY RESIDENTIAL
- R15 MODERATE TO LOW DENSITY RESIDENTIAL DISTRICT
- R11 MODERATE DENSITY RESIDENTIAL DISTRICT
- R8 MODERATE TO HIGH DENSITY RESIDENTIAL DISTRICT
- R6 HIGH DENSITY RESIDENTIAL DISTRICT
- R15M MODERATE TO LOW DENSITY RESIDENTIAL-HUD CODE HOME DISTRICT
- R8M MODERATE TO HIGH DENSITY RESIDENTIAL-HUD CODE HOME DISTRICT
- O1 OFFICE-INSTITUTIONAL
- O1A OFFICE INSTITUTIONAL "A" DISTRICT
- B1 RETAIL BUSINESS DISTRICT CENTRAL BUSINESS DISTRICT
- B2 HIGHWAY COMMERCIAL DISTRICT
- B2A HIGHWAY COMMERCIAL "A" DISTRICT
- B3 SHOPPING CENTER COMMERCIAL DISTRICT
- B4 NEIGHBORHOOD COMMERCIAL DISTRICT
- I1 WHOLESALE, STORAGE, AND MANUFACTURING DISTRICTS INDUSTRIAL PARK DISTRICT
- I2 INDUSTRIAL NON-PARK DISTRICT
- HENDERSON CITY LIMITS
- ETJ BOUNDARY

SCALE



EXTRATERRITORIAL ZONING JURISDICTION MAP
PREPARED BY THE CITY OF HENDERSON

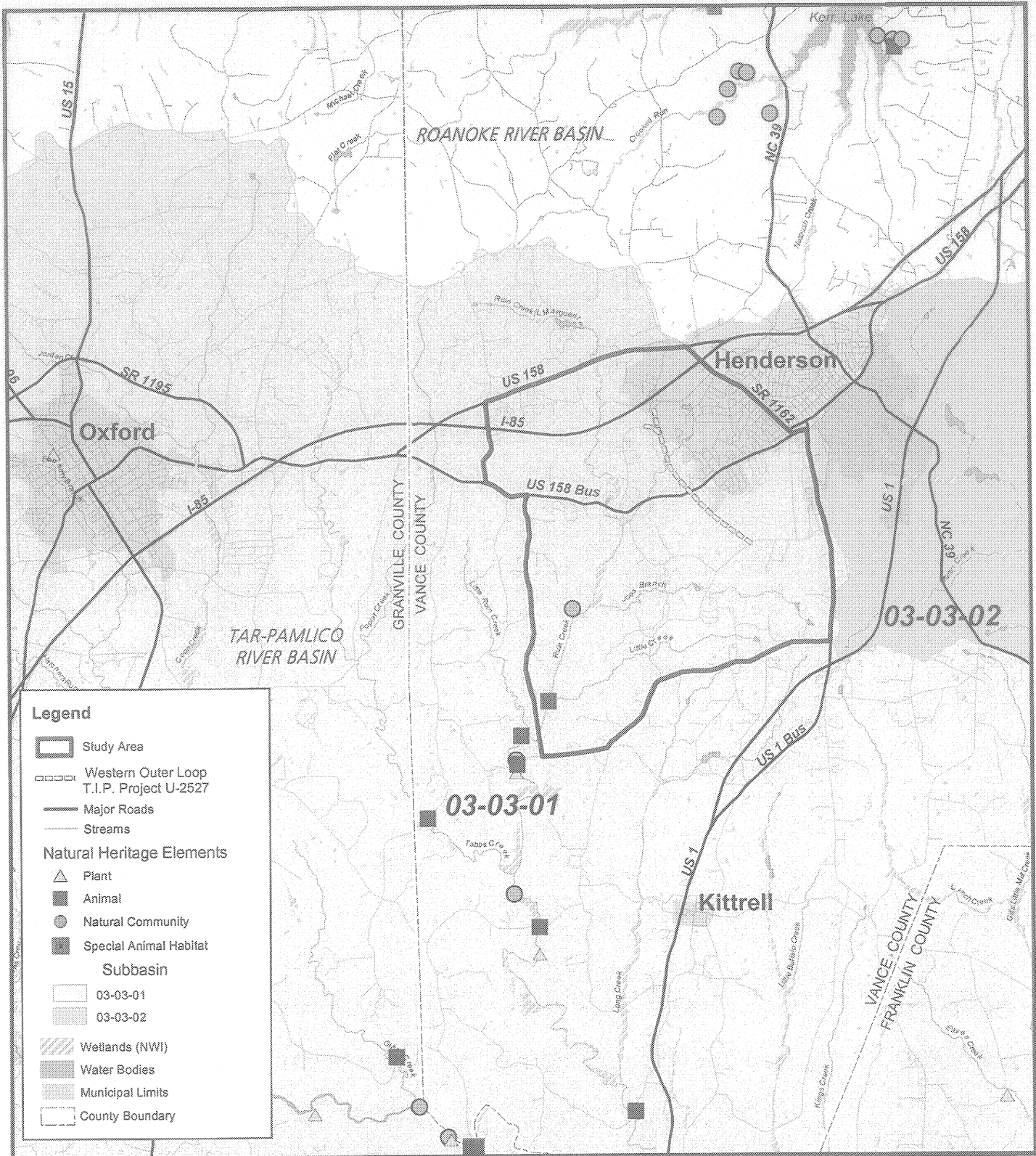
DEPARTMENT OF PLANNING
AND COMMUNITY DEVELOPMENT
&
ENGINEERING DEPARTMENT

OFFICIAL ZONING DISTRICTS AND BOUNDARIES TO BE SIGNED BY CITY CLERK
DIANNE E. WHITE _____

LAST REVISION APRIL 2003

THIS MAP WAS PREPARED FROM PLANIMETRIC MAPS, EASEMENTS, DEEDS, ZONING RECORDS, AND ANNEXATION MAPS BELONGING TO THE CITY OF HENDERSON. VANCE COUNTY TAX MAPS WERE ALSO USED TO PREPARE THIS MAP. THE CITY OF HENDERSON SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION CONTAINED HEREON, EXCEPT FOR ZONING PURPOSE ONLY.

FIGURE 3



Legend

- Study Area
- Western Outer Loop T.I.P. Project U-2527
- Major Roads
- Streams
- Natural Heritage Elements**
- Plant
- Animal
- Natural Community
- Special Animal Habitat
- Subbasin**
- 03-03-01
- 03-03-02
- Wetlands (NWI)
- Water Bodies
- Municipal Limits
- County Boundary



Scale 1:124,000



ARCADIS G&M of North Carolina, Inc.

801 Corporate Center Drive, Suite 300
Raleigh, NC 27607-5073 Tel: 919/854-1282 Fax: 919/854-5448

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Source:



WATER SUBBASINS

T.I.P. Project U-2527
Western Outer Loop
Vance County, NC

Figure

4

A District [B2A]) and are outside the city limits but within the ETJ, the project is surrounded by the Low Density Residential District (R20) and the Moderate to Low Density Residential District-HUD Code Home District (R-15M).

The B2A District was designed to accommodate retail needs near the major interstate highways and “to address areas that have developed in strip commercial uses.” The minimum lot size is 25,000 square feet. The R20 District is designed to preserve areas for residential and related uses. The minimum lot size is 20,000 square feet and the maximum density allowed is 2.18 units per acre. The R-15M District was designed to allow HUD Code Homes, manufactured homes not including recreational vehicles, which are subject to a special use permit. The minimum lot size is 15,000 square feet and the maximum density is 2.90 units per acre.

5.7 Water and Sewer

The city of Henderson currently operates the Kerr Lake Regional Water Plant, which is north of the study area, and the Tar-Pamlico River Basin. It supplies water to the cities of Henderson and Oxford and the counties of Warren, Vance, and Franklin. Its current capacity is 10 million gallons a day (mgd) and water usage is currently around 6 mgd. Per Frank Frazier, Engineering Director of the city of Henderson, in order to meet the future demands of the regional water plant, the city plans to expand the capacity of the plant to 20 mgd in two years.

The city of Henderson also operates the Nutbush Creek Wastewater Treatment Plant serving Henderson and Vance County only. It currently has a capacity of 4.41 mgd and is treating less than 3 mgd. The plant is north of the study area and the Tar-Pamlico River Basin.

5.8 Water Quality Plans and Programs

5.8.1 1999 Tar-Pamlico River Basinwide Water Quality Management Plan

The study area for this project is in water subbasin 03-03-01 of the Tar-Pamlico Water Basin (see Figure 4). According to the *1999 Tar-Pamlico River Basinwide Water Quality Management Plan*, overall water quality conditions in the basin are “generally good” and the benthic macroinvertebrate and fish community samples ratings at five of the six mainstem locations were “Good or Excellent.” Fishing Creek, which is outside the study area, had a rating of “Poor” and a rating of “Fair.”

Streams in the study area include Ruin Creek, Red Bud Creek, Joes Branch, and Little Creek. The proposed Western Outer Loop crosses Red Bud Creek. According to the North Carolina Department of Environment and Natural Resources Basin-wide Information Management System, all of these waterways are listed as “C; NSW.” Class C best usage is secondary recreation and aquatic life propagation and protection. This classification applies to all waters unless preempted by more protective standards. The supplemental classification of Nutrient Sensitive Waters (NSW) requires “no increase of nutrients over background levels.” The NSW waters need additional nutrient management due to “excessive growth of microscopic or macroscopic vegetation” according to the *1999 Tar-Pamlico River Basinwide Water Quality Management Plan*.

There are no waters classified as High Quality Waters or as Outstanding Resource Waters in the study area or vicinity and there are no impaired waters within subbasin 03-03-01. The plan indicates that it is important to maintain existing programs to protect water quality. No other recommendations in the plan apply to the study area.

5.8.2 *Vance County Water Supply Watershed Management and Protection Plan*

The water supply watersheds in the county are managed by the *Vance County Water Supply Watershed Management and Protection Plan*, effective January 1, 1994. There are no water supply watersheds within the study area but there are two watersheds in the county. The Anderson Creek Watershed is northeast of the study area and the water supply begins just outside the corporate limits of Henderson and drains north to the John H. Kerr Reservoir. The Tar River Watershed is southeast of the study along the boundary with Franklin County.

5.8.3 *Environmental Assessment (EA) and Finding of No Significant Impact (FONSI)*

The *FONSI* for the project was signed in September of 1997. One of the “Special Project Commitments” stated that the North Carolina Department of Transportation’s (NCDOT’s) High Water Quality (HWQ) Best Management Practices (BMPs) for the *Protection of Surface Waters and Sedimentation Control Guidelines* be “strictly enforced during the construction of the project.”

In the *FONSI*, the North Carolina Wildlife Resources Commission (NCWRC) provided comments on the *EA*. This agency states that the “*EA* does not adequately address impacts to wildlife and fisheries resources in the project area” and that the NCWRC does “not concur with this *EA*.” The basis for the NCWRC’s concern is

that the purpose of the project is a bypass around the city of Henderson connecting US 1 and I-85 and at the time the *EA* was published, the project was to be designed with five lanes and no control of access; thus, “any traffic benefits that the new roadway provides are quickly negated by unrestricted driveway connections and strip development.” The NCWRC strongly suggested that the NCDOT design for long-range transportation needs by constructing bypasses with full control of access, “thus eliminating the need for a subsequent bypass of this roadway.”

According to the *FONSI*, the project now involves constructing a new two-lane facility within an ultimate four-lane median-divided roadway with limited access control, not full control of access. A limited access control roadway could contribute to additional driveway cuts that reduce traveling speeds and increase congestion. This would induce the need for an additional bypass, thereby consuming more land around Henderson sooner than would otherwise be needed. Although a full access control roadway would be best from a land use issue, limited access control is better than no access control, which would result in sprawl sooner.

5.8.4 Other Regulations and Programs

The city of Henderson relies on the state’s “Rules and Regulations for Erosion and Sedimentation Control.” The county does not participate in such programs.

A National Pollutant Discharge Elimination System (NPDES)-owned right-of-way was issued on June 8, 1998. Requirements contained in the permit address a broad range of NCDOT activities. Included is a requirement for development of a procedure to document newly constructed stormwater outfalls and add them to a stormwater system inventory of existing facilities. This documentation process will include the development of project stormwater management plans, thus protecting water quality during construction.

6. Potential Impacts on Water Quality

Indirect and cumulative impacts of transportation projects can involve changes in the type, density, design and locations of development. Influences or disturbances caused by urban development such as increased runoff from impervious areas, erosion and sedimentation, disturbance of riparian vegetation, development in the riparian zone, and pollutant loading can have a cumulative effect on future water quality. The following factors are potential impacts on water quality as a result of TIP Project No. U-2527 (Western Outer Loop).

Indirect and Cumulative Impact Study

U-2527
Vance County

- A road on new location in an undeveloped area will bring development to an area with pastures and fields as its current land use.
- The facility is being constructed as a limited control access roadway versus a full control access roadway. This limited access control could contribute to additional driveway cuts, which reduce traveling speeds and increase congestion. This could induce the need for an additional bypass thereby consuming more land around Henderson sooner than it would otherwise be needed.
- Portions of the study area include moderate growth areas in Henderson and Vance County.
- The city of Henderson does not have an effective land use plan. Henderson does have a zoning ordinance and a recently revised zoning map. Except for the highway commercial areas near I-85, the study area is zoned for low-density residential uses.
- Effective growth regulations are absent in Vance County. The county planning director stated that a new land use plan is expected to become effective in 2007.
- The city, but not the county, participates in the state erosion and sedimentation control plan; both have water supply watershed protection regulations.
- Water and sewer capacity is available in the study area and will not be an immediate growth-limiting factor.
- A moderate amount of residential development is projected in the vicinity. This growth is not expected to be induced by the new facility, but redirected from other areas in the region where roads and other city services currently exist.
- Growth pressures in Vance County are low. Unemployment is high, population projections indicate below average growth, and the local planners forecast slow growth. Further, new development and redevelopment is sparse and the manufacturing and tobacco sector of the local economy is slowing.
- Vance County's proximity to the employment opportunities, rapid growth, and rising land costs of the Raleigh/Durham metropolitan area could eventually lead to accelerated growth in the county.
- Rapid growth is unlikely to occur in the foreseeable future.
- Current development regulations are inadequate to direct and control growth and protect downstream water quality if unforeseen rapid growth were to occur.

In conclusion, the construction of TIP Project No. U-2527 is not expected to result in any indirect or cumulative impacts that will adversely affect the water quality within the Tar-Pamlico River Basin. No further indirect or cumulative impact analysis is recommended for the proposed project.

References

City of Henderson Planning Department. *City of Henderson Zoning Ordinance*
August 1948.

City of Henderson Planning Department. *City of Henderson Zoning Map*. April 2003.

Council on Environmental Quality. Regulations for Implementing the Procedural
Provisions of the National Environmental Policy Act (40 CFR 1508.7 and
1508.8).

Edmonson, Ron. Director, Vance County Planning and Zoning. Personal
communication to M. Hane, ARCADIS. June 9, 2003.

Finch, Benny. Director of Vance County Economic Development Commission. (252)
492-2094. Personal communication with M. Hane ARCADIS. June 9, 2003.

Frazier, Frank. Director of Engineering, city of Henderson. (252) 431-6026. Personal
communication with M. Hane ARCADIS. June 9, 2003.

The Louis Berger Group. *North Carolina Department of Transportation, Guidance for
Assessing Indirect and Cumulative Impacts of Transportation Projects in North
Carolina. Volume I: Guidance Policy Report*. November 2001.

North Carolina Employment Security Commission.
<http://eslmi12.esc.state.nc.us/pio/Default.aspx>. Accessed June 2003.

North Carolina Department of Commerce. <http://cmedis.commerce.state.nc.us>.
Accessed April 2003.

North Carolina Department of Natural Resources, Division of Water Quality Section.
Tar-Pamlico River Basinwide Water Quality Plan. October 1999.

North Carolina Department of Natural Resources, Division of Water Quality Section.
<http://h2o.enr.state.nc.us/wqs/>. Accessed April 2003.

North Carolina Department of Transportation, 1997. *Best Management Practices for
the Protection of Surface Waters*.

**Indirect and
Cumulative Impact
Study**

U-2527
Vance County

North Carolina Department of Transportation, 1995. *Environmental Assessment, State TIP Project No.U-2527.*

North Carolina Department of Transportation, 1997. *Finding of No Significant Impact, State TIP Project No.U-2727.*

North Carolina Department of Transportation TIP Program Unit Search.
<http://apps.dot.state.nc.us/quickfind/Tipsearch/>. Accessed June 2003.

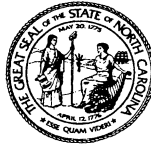
North Carolina Water Quality Assessment and Impaired Waters List (2002 Integrated 305(b) and 303(d) Report). February 2003.
<http://h2o.enr.state.nc.us/tmdl/2002%20Integrated%20Rept.pdf>. Accessed April 14, 2003.

North Carolina State Demographics. <http://demog.state.nc.us/>. Accessed June 28, 2003.

United States Census Data. 1990 and 2000. <http://factfinder.census.gov>. Accessed April and May 2003.

Vance County Economic Development Commission.
<http://www.vancecountyedc.com/index.html>. Accessed May and June 2003.

Vance County, North Carolina. Vance County Water Supply Watershed Management and Protection Plan. Adopted December 1993, effective January 1, 1994.



4M4

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

November 26, 2003

U.S. Army Corps of Engineers
Regulatory Field Office
6508 Falls of the Neuse Road
Suite 120
Raleigh, NC 27615

ATTN: Mr. Eric Alsmeyer
NCDOT Coordinator

SUBJECT: Individual Permit Application for Western Outer Loop from SR 1128 (Ruin Creek Road) to SR 1101 (Old County Home Road) near Henderson, Vance County, TIP No. U-2527; State Project No. 8.2390201. Division 5. \$475 to Work Order 8.2390201 (WBS Element 34822.1.1).

Dear Sir:

The NCDOT proposes to construct a four-lane divided facility (Western Outer Loop of Henderson) on new location in Vance County. A 16-foot grassed median will be used. The proposed right-of-way (ROW) width for the project is 200 feet. The project begins at SR 1128 (Ruin Creek Road) and terminates at SR 1101 (Old County Home Road). The proposed project is approximately 2.5 miles long. Enclosed please find the cover letter, ENG 4345 Form, 8 ½ x 11 drawings, and half-sized plan sheets for the subject project.

Summary of Impacts: Impacts on jurisdictional areas consists of a total of 0.06 acres of permanent wetland impacts which are riverine. There will also be approximately 2,368 linear feet of jurisdictional stream impacts (1,529 linear feet require mitigation). There will also be approximately 214,072 square feet of riparian buffer impacts.

Summary of Mitigation: The project has been designed to avoid and minimize impacts to jurisdictional areas throughout the NEPA and design processes. Detailed descriptions of these actions are presented elsewhere in this application. We propose to relocate 2,592 linear feet using natural stream design. We propose to use this natural stream design to mitigate for 1,529 linear feet of stream impacts at a 1:1 ratio. We propose to use the Ecosystem Enhancement Program (EEP) to mitigate for 0.29 acres of riparian buffer impacts.

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS
1548 MAIL SERVICE CENTER
RALEIGH NC 27699-1548

TELEPHONE: 919-733-3141
FAX: 919-733-9794

WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
TRANSPORTATION BUILDING
1 SOUTH WILMINGTON STREET
RALEIGH NC

Purpose and Need

The purpose of the proposed project is to provide a western bypass of the City of Henderson. It is anticipated this project will increase traffic mobility and enhance safety, as well as alleviate traffic congestion on some of the routes in the City of Henderson, which are heavily used by truck traffic. The proposed improvements are warranted to accommodate projected traffic growth and to insure safety. This project is included in the NCDOT's 2004-2010 Transportation Improvement Program. This project is scheduled to be let February 2004.

Alternatives: NCDOT investigated several alternatives for this project, which were discussed in detail on page 17 in the EA.

NEPA Document Status

A Finding Of No Significant Impact (FONSI) for this project was approved by the Project Development and Environmental Analysis Branch (PDEA) on September 29, 1997. An Environmental Assessment (EA) for this project was approved by PDEA on September 29, 1995. The EA explains the purpose and need for the project, provides a description of the project and characterizes the social, economic, and environmental effects of the project. Copies of the EA have been provided to the regulatory agencies involved in the approval process. Additional copies will be provided upon request.

Independent Utility

According to 23 CFR 771.111(f), "...in order to ensure meaningful evaluation of alternatives and to avoid commitments to transportation improvements before they are fully evaluated, the action evaluated...shall:

- (1) Connect logical termini and be of sufficient length to address environmental matters on a broad scope;
- (2) Have an independent utility or independent significance, i.e., be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made; and,
- (3) Not restrict consideration of alternatives for other reasonably foreseeable transportation improvements."

The proposed project will connect a new route from SR 1126 (Poplar Creek Road) to SR 1128 (Ruin Creek Road)(U-3836) to SR 1101 (Old County Home Road). The locations of the proposed project's termini have been coordinated with other programmed TIP projects in the area. The locations of this project's termini do not preclude the development and assessment of multiple alternates for other programmed TIP projects in the area. In this regard, the proposed project demonstrates logical termini and independent utility.

This project can stand alone as a functioning project and is designed to be compatible with other TIP projects in the area. The environmental impacts of the other projects will

be fully evaluated in separate environmental documents. NCDOT has determined this project meets the criteria set forth in 23 CFR 771.111(f).

Resource Status

Delineations: Wetland and stream delineations were conducted on February 20 and 21, 1995 by NCDOT biologists using the criteria specified in the 1987 Corps of Engineers Wetland Delineation Manual. Mr. Eric Alsmeyer of the USACE Raleigh Regulatory Field Office verified the delineations in the field on February 12, 2002. Mr. Steve Mitchell of the NCDWQ verified riparian buffers in the field on March 12, 2002. In addition to the delineations, the streams were characterized and data recorded on both the NCDWQ Stream Classification Form and the USACE Intermittent Channel Evaluation Form. The following characterization of the jurisdictional sites summarizes the March 1995 Natural Systems Report including the data form, aforementioned forms, and field notes. This project has 0.06 acres of jurisdictional wetland impacts, 2,368 feet of jurisdictional stream impacts, and 4.9 ac riparian buffer impacts. The jurisdictional impacts are summarized in Tables 1, 2, and 3.

Wetlands: There are no temporary wetland impacts or any impacts to ponds. The small wetland at Site 7 is classified as Palustrine Emergent Persistent Seasonally Flooded as defined by Cowardin et al. (1979). This wetland is dominated by black needle rush (*Juncus effusus*), broom sedge (*Andropogon* sp.), sweetgum (*Liquidambar styraciflua*), blackberry (*Rubus* sp.), and Japanese grass (*Microstegium vimineum*).

Streams: The project corridor is located within the Tar-Pamlico River Drainage Basin (DWQ sub-basin 03-03-01)(Hydrologic Unit 03020101). Drainage from the project flows into Red Bud Creek (28-17-2-3) which is a tributary to Ruin Creek. Red Bud Creek and its tributaries are in the Tar River Headwaters sub-basin (03-03-01) and are classified as C NSW. Red Bud Creek is a perennial stream and its tributaries are either perennial streams or intermittent important streams (as classified by the USACE Intermittent Channel Evaluation protocol). Mitigation will be provided for all such stream impacts. There are no 303d streams located on the project.

Table 1. Jurisdictional Wetland Impacts

SITE	STATION	Wetlands (ac)
7	46+20 -L-	0.06
Total		0.06

Table 2. Jurisdictional Stream Impacts

SITE	STATION	Streams (ft)	Natural Stream Design (ft)	Stream Name	DWQ ID No.	Streams Requiring Mitigation /Ratio	Stream Class.
1	18+40 -L-	174		Ut Red Bud Creek	28-17-2-3	No	Intermittent
2	21+30 -L-	272		Ut Red Bud Creek	28-17-2-3	No	Intermittent
3	23+40 -L-	266		Red Bud Creek	28-17-2-3	Yes/2:1	Perennial
4	26+00 to 26+30 -L-	262		Ut Red Bud Creek	28-17-2-3	Yes/2:1	Perennial
5	36+72 -L-	394		Ut Red Bud Creek	28-17-2-3	No	Intermittent
6	40+81 -L-	223	2592	Ut Red Bud Creek	28-17-2-3	Yes/2:1	Perennial
7	46+20 -L-	777		Ut Red Bud Creek	28-17-2-3	Yes/2:1	Perennial
Total		2368	2592				

Note- The USACE agreed to these mitigation requirements during the field verification on February 12, 2002. The DWQ concurred with these calls during a phone conversation in January 2002. Documentation can be provided if needed.

Table 3. Riparian Buffer Impacts

SITE	STATION	ALLOWABLE IMPACT		MITIGABLE IMPACT	
		Zone 1 (ft ²)	Zone 2 (ft ²)	Zone 1 (ft ²)	Zone 2 (ft ²)
1	18+40 -L-	10,340	6,714		
2	21+30 -L-	14,806	8,231		
3	23+40 -L-	12,944	8,576		
4	23+90 to 24+60 -L-			1,356	6,165
5	26+00 to 26+30 -L-	16,065	8,597		
6	35+40 to 35+80 -L-	6,994	7,607		
7	36+40 to 37+00 -L-	22,359	12,697		
8	40+81 -L-	11,793	8,221		
9	46+20 -L-	31,053	19,476		
Total		126,354	80,119	1,356	6,165

All of these sites were deemed subject to the Tar-Pamlico Buffer Rules.

Protected Species

Plants and animals with federal classifications of Endangered, Threatened, Proposed Endangered, and Proposed Threatened are protected under provisions of Section 7 and Section 9 of the Endangered Species Act. As of January 29, 2003, a total of two federally-protected species are listed for Vance County (Table 4).

Table 4. Federally-protected species for Vance County

SCIENTIFIC NAME	COMMON NAME	STATUS
<i>Haliaeetus leucocephalus</i>	Bald eagle	Threatened (proposed for delisting)
<i>Alasmidonta heterodon</i>	Dwarf wedgemussel	Endangered

Endangered: a species that is in danger of extinction throughout all or a significant portion of its range.

Threatened: a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

A Biological Conclusion of “No Effect” for the bald eagle was resolved in several documents including the Environmental Assessment. This conclusion was based on the fact that there is no suitable habitat present for bald eagle in the project area. The last survey for Dwarf wedgemussel was done in March 2002. No mussel species were observed during this survey. Tim Savidge recommended that no additional surveys be done.

Cultural Resources

Archaeology: On July 7, 1995 the SHPO concurred that no additional archaeological investigation is warranted in connection with the project. A copy of the July 7, 1995 letter is located in the EA on page A-7.

Historic: On May 1, 1995 the SHPO concurred that there are no properties considered eligible for the National Register and that no further evaluations are required. A copy of the concurrence form is located on page A-6 of the EA.

FEMA Compliance

Vance County does not currently participate in the National Flood Insurance Regular Program. The resulting backwater from the proposed culverts will not have any substantial adverse impact on the existing floodplains nor increase the existing flood hazards.

Wild and Scenic River System

The project will not impact any Designated Wild and Scenic Rivers or any rivers included in the list of study rivers (Public Law 90-542, as amended).

Indirect and Cumulative Impacts

An Indirect and Cumulative Effects report was completed by Arcadis in September 2003. This report concludes that the construction of TIP Project No. U-2527 is not expected to result in any indirect or cumulative impacts that will adversely affect the water quality within the Tar-Pamlico River Basin. A copy of this report was sent to the Division of Water Quality on September 8, 2003. A copy of this report is enclosed for the USACE to review.

Mitigation Options

The Corps of Engineers has adopted, through the Council on Environmental Quality (CEQ), a wetland mitigation policy that embraces the concept of “no net loss of wetlands” and sequencing. The purpose of this policy is to restore and maintain the chemical, biological, and physical integrity of the Waters of the United States. Mitigation of wetland and surface water impacts has been defined by the CEQ to include: avoiding impacts, minimizing impacts, rectifying impacts, reducing impacts over time, and compensating for impacts (40 CFR 1508.20). Executive Order 11990 (Protection of Wetlands) and Department of Transportation Order 5660.1A (Preservation of the Nations Wetlands), emphasize protection of the functions and values provided by wetlands. These directives require that new construction in wetlands be avoided as much as possible and that all practicable measures are taken to minimize or mitigate impacts to wetlands.

AVOIDANCE AND MINIMIZATION: The NCDOT is committed to incorporating all reasonable and practicable design features to avoid and minimize jurisdictional impacts, and to provide full compensatory mitigation of all remaining, unavoidable jurisdictional impacts. Avoidance measures were taken during the planning and NEPA compliance stages; minimization measures were incorporated as part of the project design.

Avoidance: All wetland areas not affected by the project will be protected from unnecessary encroachment. No staging of construction equipment or storage of construction supplies will be allowed in wetlands or near surface waters.

Minimization: Minimization includes the examination of appropriate and practicable steps to reduce the adverse impacts. Minimization techniques were implemented as follows:

- Slopes: Fill slopes in wetlands are at a 2:1 ratio.
- Ditching: It is the policy of the NCDOT to eliminate lateral ditching in wetlands as much as possible, thus preserving the hydrology of adjacent wetlands. There are no ditches in wetlands on this project.
- Median Width: The project was designed using a 16-foot median width
- Pipe Culvert Design: Pipe culvert and box culvert inverts are to be buried one foot below the stream bed where feasible, depending on the relative elevations of the stream bed. All pipe culverts and box culverts will maintain the normal stream flow and channel characteristics. This design will allow unimpeded passage by fish and other aquatic organisms.
- BMP's: In order to minimize potential adverse impacts to the dwarf wedgemussel, wetlands, and stream resources in the project area, the NCDOT's High Quality Water

(HQW) Best Management Practices for the Protection of Surface Waters and Sedimentation Control Guidelines will be strictly enforced during construction of the project. This will include:

1. all cleared and grubbed areas along the roadways will be re-vegetated soon after project completion to reduce loss of wildlife habitat
 2. the NCDOT will minimize activities, including clearing and grubbing, in and adjacent to bodies of water
- Stations 18+70, 24+95, 25+40, 25+95, 37+20, 37+55, 40+20, 40+40, and 47+40
Preformed Scour Holes
To minimize impacts to the water quality and aquatic life, and to comply with the Tar-Pamlico Buffer Rules, the design has incorporated preformed scour holes.
 - Station 23+60 Level Spreader: To minimize impacts to the water quality and aquatic life, and to comply with the Tar-Pamlico Buffer Rules, the design has incorporated a level spreader.
 - Station 40+80 to 47+20: We will be doing natural stream design at these stations. A Natural Channel Design Report is provided in this application. Approximately 2,592 linear feet of channel will be relocated at these stations.

COMPENSATION: No compensatory mitigation is required for impacts to wetlands and streams.

Compensatory Mitigation for U-2527:

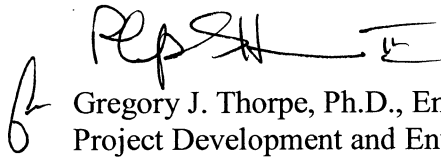
The unavoidable impacts to 7,521 square feet of riparian buffers will be offset by compensatory mitigation provided by the EEP program. A total of 13,316 square feet of riparian buffer mitigation is required (1,356 ft² Zone 1 impact @ 3:1 ratio, 6,165 ft² Zone 2 impact @ 1.5:1 ratio).

Regulatory Approvals

Application is hereby made for a Section 404 Individual Permit as required for the above-mentioned activities. By copy of this letter, we are also requesting a 401 Individual Water Quality Certification and Riparian Buffer Certification. In compliance with Section 143-215.3D(e) of the NCAC we will provide \$475 to act as payment for processing the Section 401 permit application as previously noted in this application (see Subject line). Seven copies of the application are being provided to the North Carolina Department of Environment and Natural Resources, Division of Water Quality, for their review.

Thank you for your assistance with this project. If you have any questions or need any additional information about this project, please contact Mr. Matt Haney at (919) 715-1428.

Sincerely,


Gregory J. Thorpe, Ph.D., Environmental Management Director,
Project Development and Environmental Analysis Branch

GJT/mmh
Enclosure

cc: Mr. John Dorney, NCDWQ (7 copies)
Mr. Travis Wilson, NCWRC
Ms. Becky Fox, USEPA
Mr. Gary Jordan, USFWS
Mr. John F. Sullivan, III, FHWA
Mr. Jay Bennett, P.E., Roadway Design
Mr. Omar Sultan, Programming and TIP
Ms. Debbie Barbour, P.E., Highway Design
Mr. David Chang, P.E., Hydraulics
Mr. Greg Perfetti, P.E., Structure Design
Mr. Mark Staley, Roadside Environmental
Mr. Jon Nance, P.E., Division 5 Engineer
Mr. Chris Murray, Division 5 DEO
Mr. David Franklin, USACE, Wilmington
Mr. William D. Gilmore, P.E., EEP, Raleigh

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT
(33 CFR 325)

OMB APPROVAL NO. 0710-003
Expires December 31, 2004

Public reporting burden for this collection of information is estimated to average 10 hours per response, although the majority of applications should require 5 hours or less. This includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authority: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research and Sanctuaries Act, 33 USC 1413, Section 103. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED
--------------------	----------------------	------------------	-------------------------------

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME North Carolina Department of Transportation Project Development & Environmental Analysis	8. AUTHORIZED AGENT'S NAME AND TITLE (an agent is not required)
6. APPLICANT'S ADDRESS 1548 Mail Service Center Raleigh, NC 27699-1548	9. AGENT'S ADDRESS
7. APPLICANT'S PHONE NOS. W/AREA CODE a. Residence b. Business 919-733-3141	10. AGENT'S PHONE NOS. W/AREA CODE a. Residence b. Business

11. STATEMENT OF AUTHORIZATION

I hereby authorize, _____ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT'S SIGNATURE

DATE

NAME, LOCATION, AND DESCRIPTION OR PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

Western Outer Loop from SR 1128 to SR 1101 near Henderson, Vance County, NC

13. NAME OF WATERBODY, IF KNOWN (if applicable)
Red Bud Creek

14. PROJECT STREET ADDRESS (if applicable)

15. LOCATION OF PROJECT

Vance COUNTY NC STATE

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions) Section, Township, Range, Lat/Lon, and/or Accessors's Parcel Number, for example.

See cover letter

17. DIRECTIONS TO THE SITE

See vicinity map associated with permit drawings

18. Nature of Activity (Description of project, include all features)
Construct a four-lane divided facility (Western Outer Loop of Henderson) on new location. The project is 2.5 miles long and will provide a median divided, curb and gutter roadway.

This project will involve one wetland crossing, impacting 0.06 acre of riverine wetland. This project will also involve 7 stream crossings, impacting 2368 linear feet of stream channel. Natural channel design will be used to relocate 2592 linear feet of stream below the road crossing.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

Public transportation. To increase traffic mobility and enhance safety, as well as alleviate traffic congestion on some of the routes in the City of Henderson, which are heavily used by truck traffic.

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Roadway fill, pipe/culvert construction

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

Roadway fill

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Wetland impact: 0.06 ac riverine
Stream impact: 2368 ft
Stream impact needing mitigation: 1529 ft

23. Is Any Portion of the Work Already Complete? Yes ___ No x IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

See listing of property owners associated with permit drawings

25. List of Other Certifications or Approvals/Denials Received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
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* Would include but is not restricted to zoning, building, and flood plain permits

26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.


SIGNATURE OF APPLICANT

11/20/03
DATE

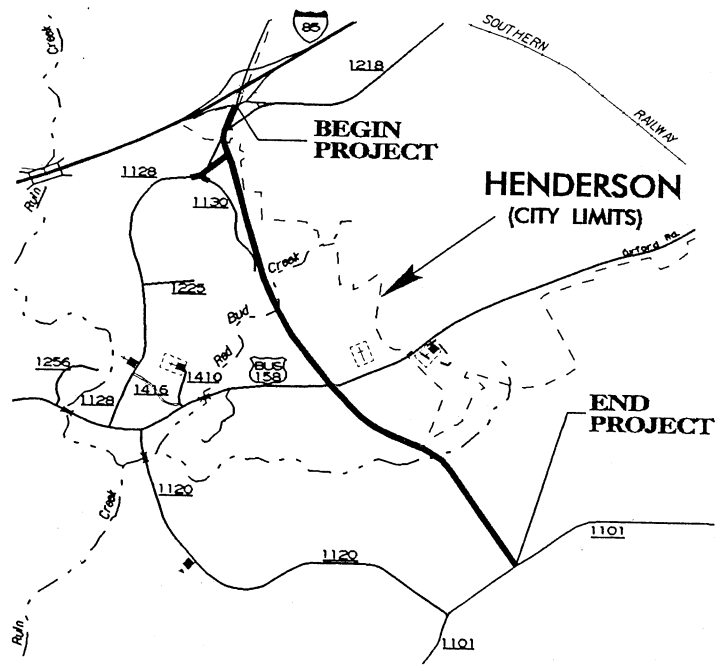
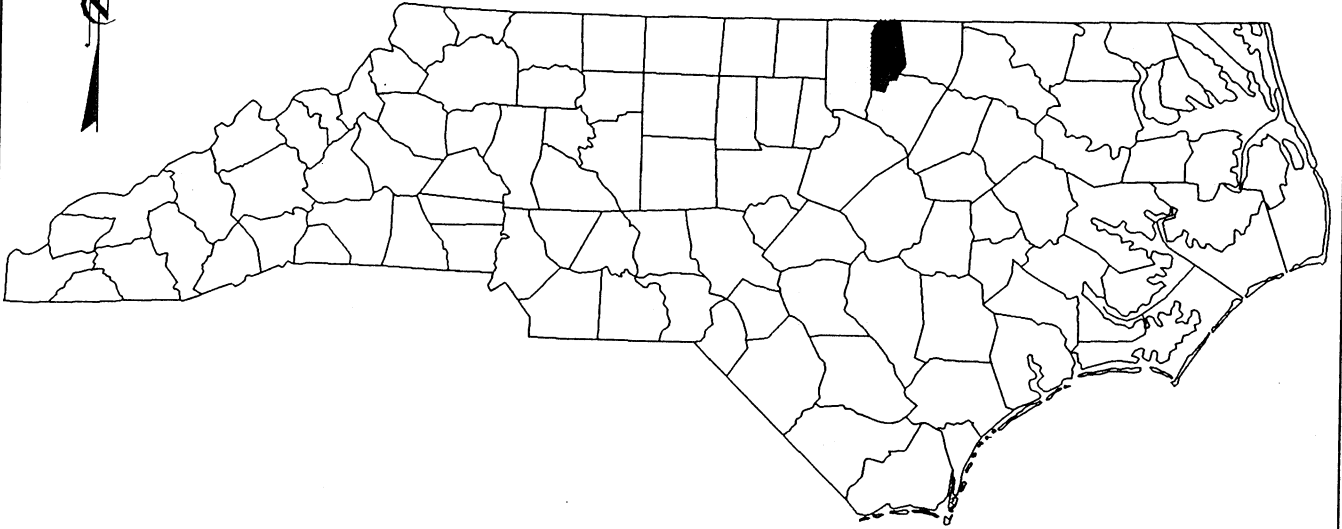
SIGNATURE OF AGENT

DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

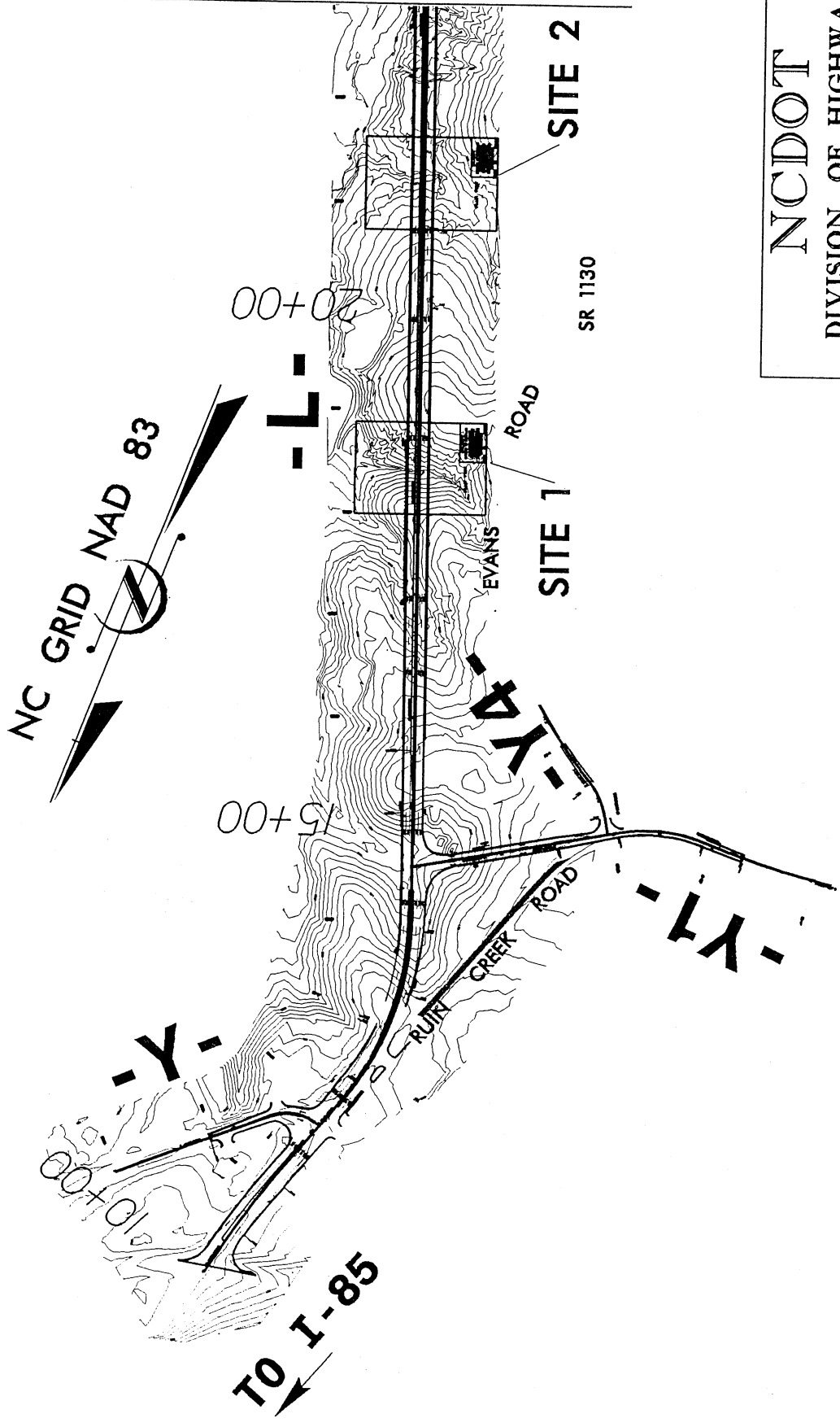
18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than \$10,000 or imprisoned not more than five years or both.

NORTH CAROLINA



STREAM AND WETLANDS IMPACTS VICINITY MAPS

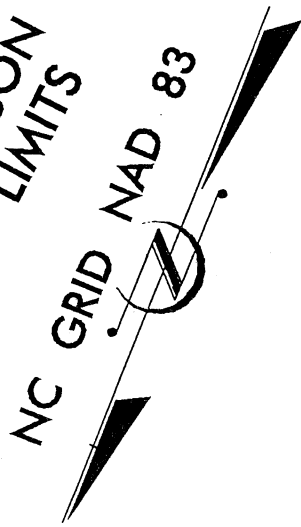
NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2390201 (U-2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101



SITE VIEW
STREAM AND WETLAND IMPACTS

NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2390201 (U-2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 SHEET 2 OF 4 | 3/16/02

HENDERSON
CITY LIMITS



-Y2- US 158 BUS

SITE 5

25+00

SITE 3

SITE 4

0+00

00+01

05+00

-L-

RED BUD
CREEK

SITE VIEW
STREAM AND WETLAND IMPACTS

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2390201 (U-2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 3 OF 4

3/16/02

TO HENDERSON

TO KITTRELL

10+00

50+00

-Y3-

4+00

NC GRID NAD 83

45+00

-L-

SITE 7

SITE 7

SITE 6

40+00

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2390201 (U-2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 4 OF 41

3/16/02

SITE VIEW
STREAM AND WETLAND IMPACTS

JOHN D. ELLIS
&
MILDRED A. ELLIS

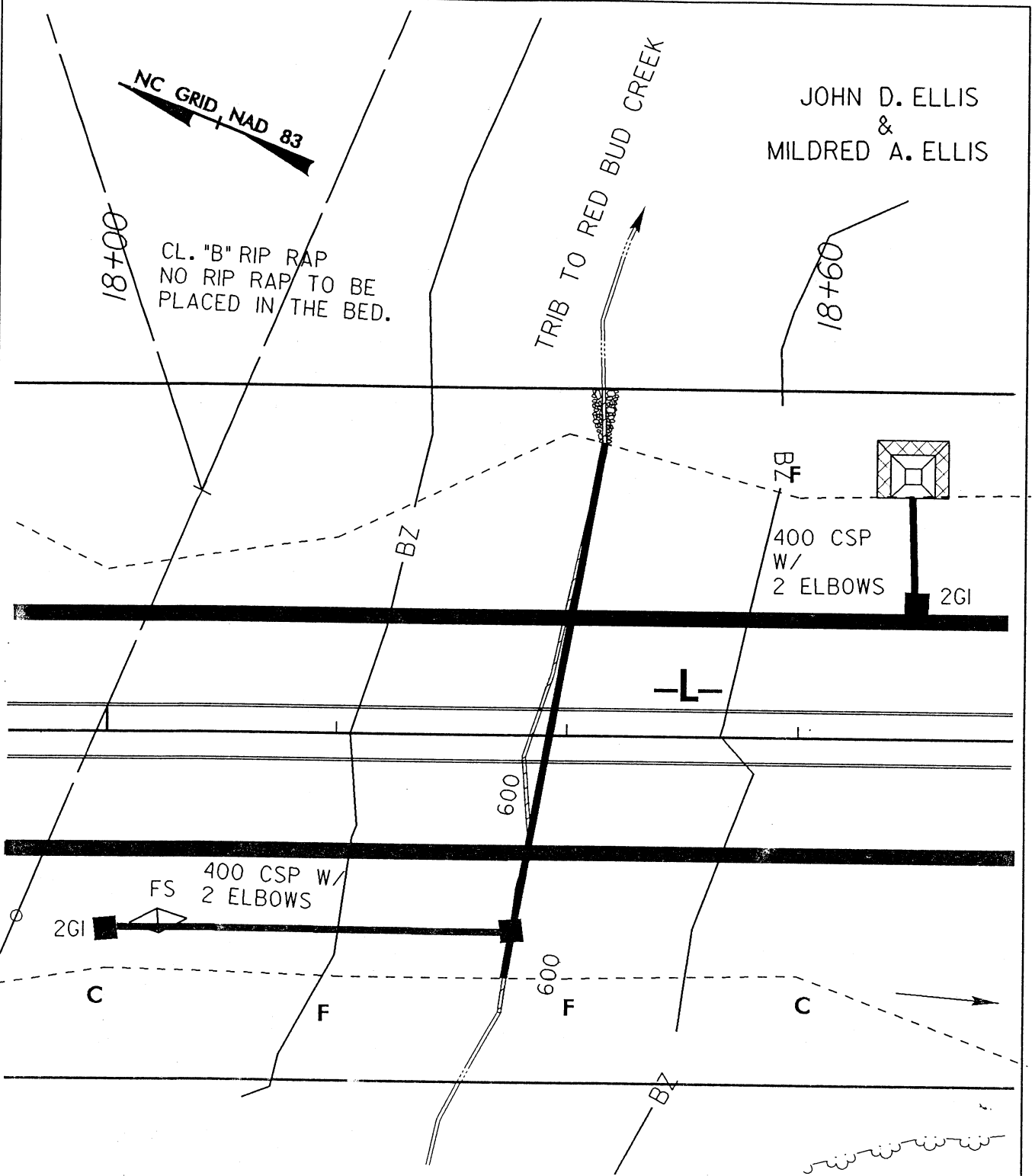
NC GRID, NAD 83

18+00

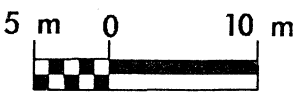
CL. "B" RIP RAP
NO RIP RAP TO BE
PLACED IN THE BED.

TRIB TO RED BUD CREEK

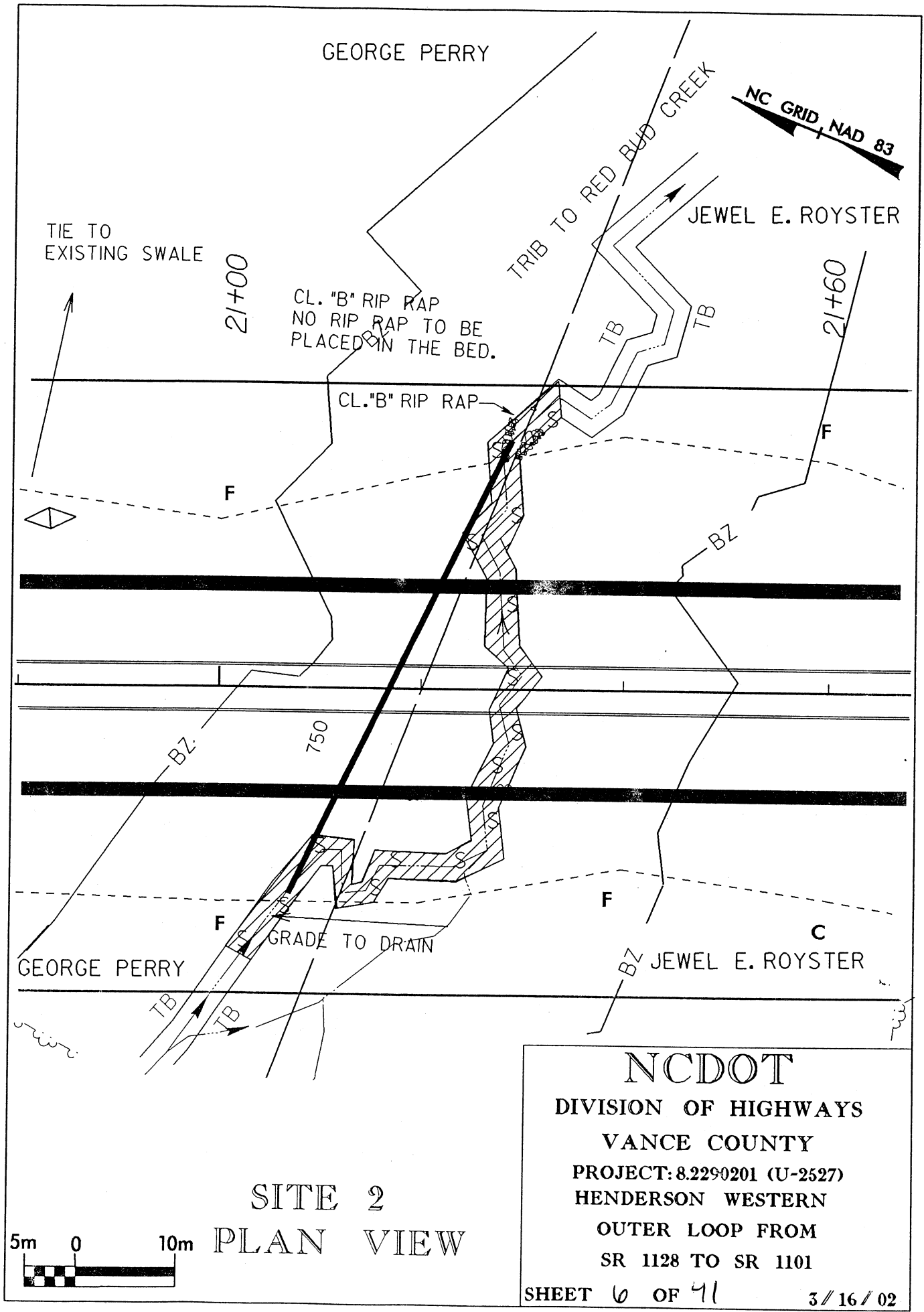
18+60



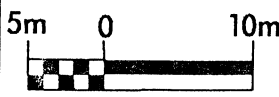
SITE 1
PLAN VIEW



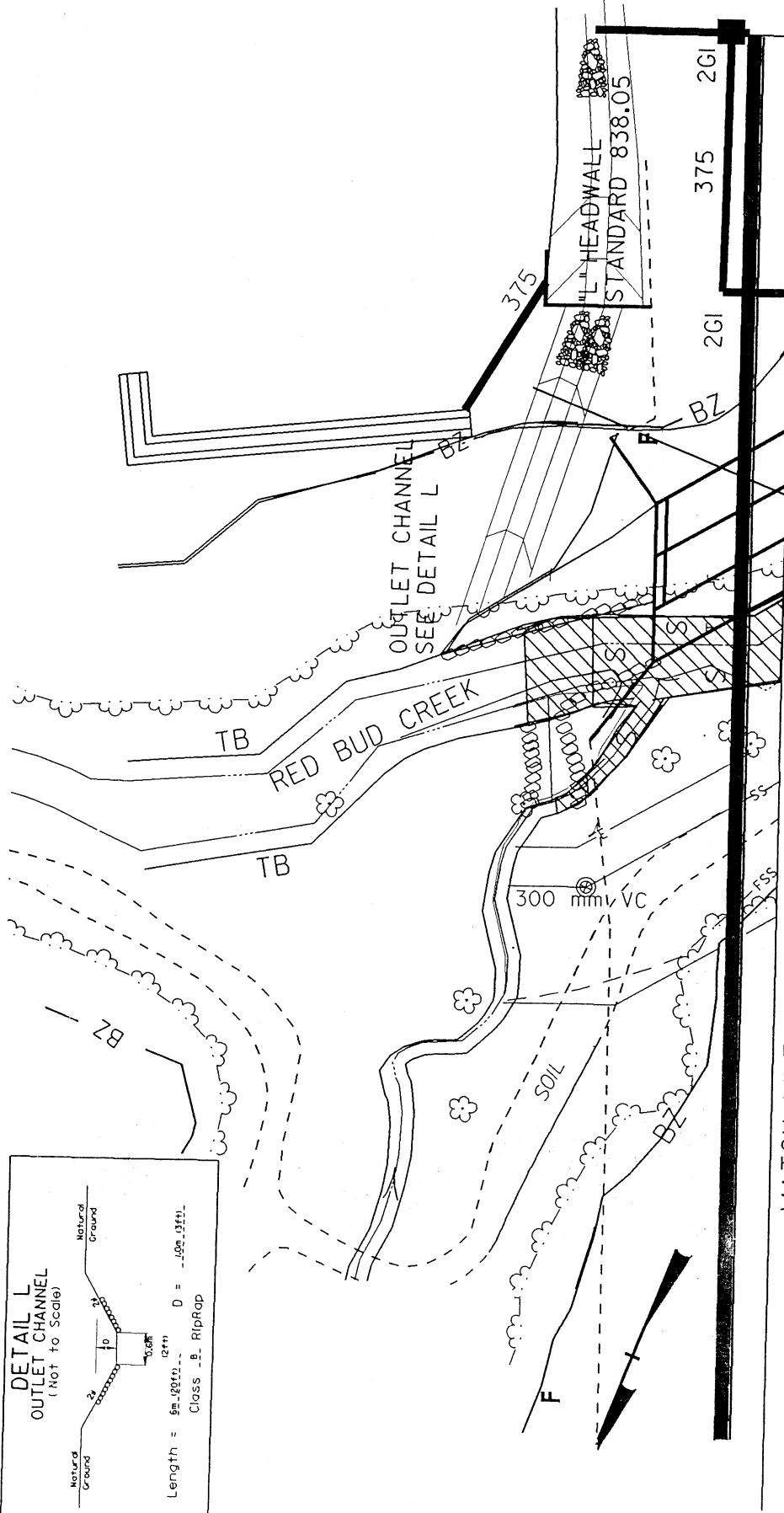
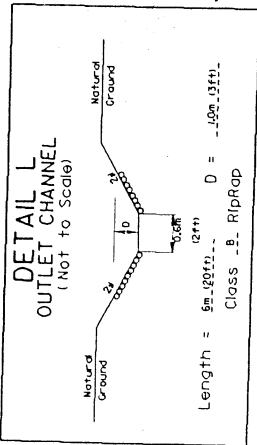
NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2290201 (U-2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101
SHEET 5 OF 41
3/16/02



SITE 2
PLAN VIEW



NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U-2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 SHEET 6 OF 41 3/16/02



MATCH LINE A



3 @ 3.6m x 2.7m RCBC
Depth bkf = 0.5m (1.6ft)
Width bkf = 5.4m (17.7ft)
Area bkf = 2.3 m² (24.8sq.ft.)

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2290201 (U-2527)

HENDERSON WESTERN

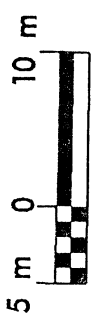
OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 7 OF 41

3/16/02

SITE 3
PLAN VIEW



23+00

23+60



23+00

23+60

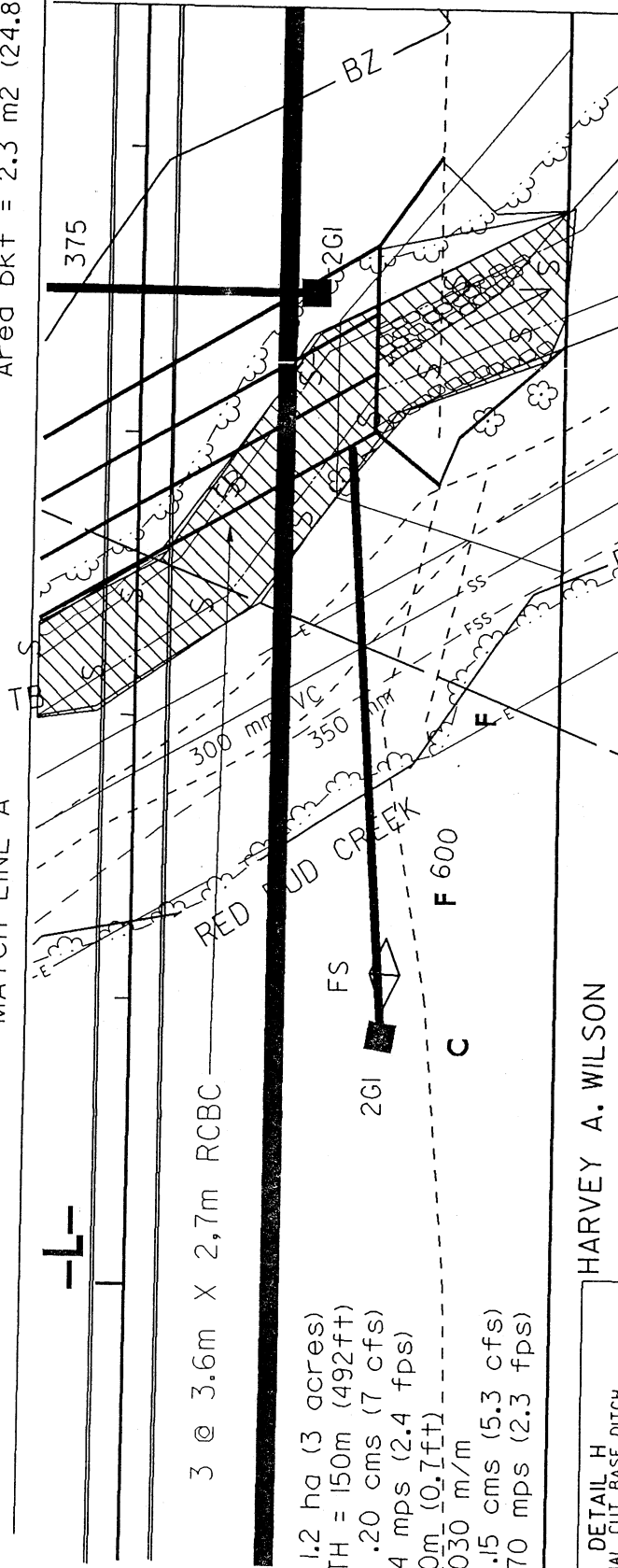
MATCH LINE A

-L-

3 @ 3.6m X 2,7m RCBC

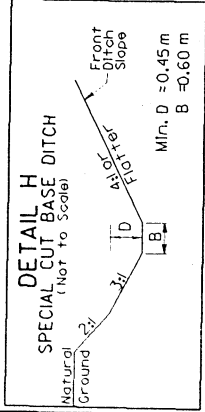
3 @ 3.6m X 2.7m RCBC
 Depth bkf = 0.5m (1.6ft)
 Width bkf = 5.4m (17.7ft)
 Area bkf = 2.3 m2 (24.8sq.ft.)

MATCH STATION 23+90



DA = 1.2 ha (3 acres)
 LENGTH = 150m (492ft)
 Q10 = .20 cms (7 cfs)
 V = .74 mps (2.4 fps)
 D = .20m (0.7ft)
 S = 0.030 m/m
 Q2 = .15 cms (5.3 cfs)
 V = .70 mps (2.3 fps)

HARVEY A. WILSON
 &
 GLORIA D. CARVER



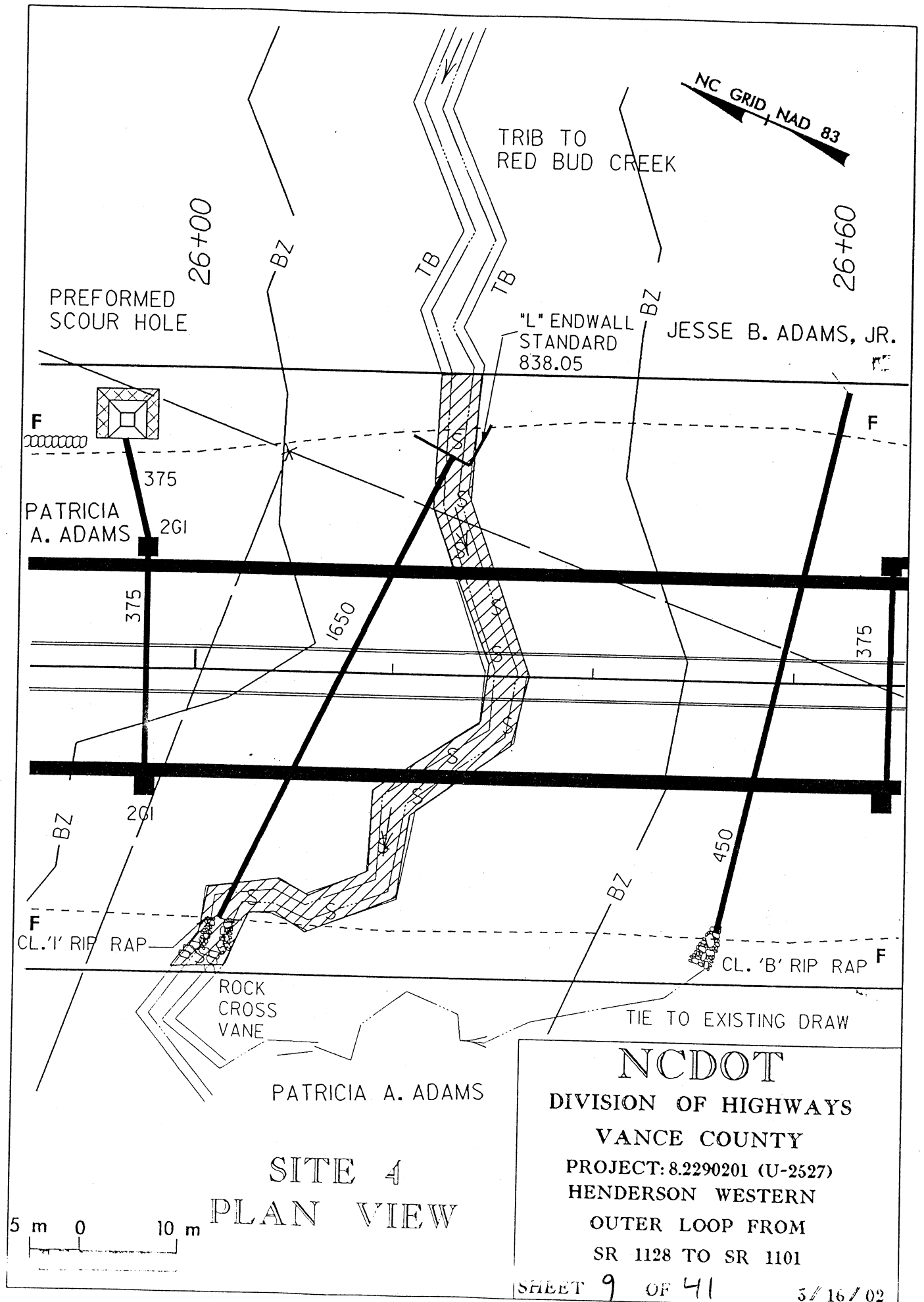
SITE 3
 PLAN VIEW

NC DOT

DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8-2290201 (U-2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101

SHEET 8 OF 41 3/16/02

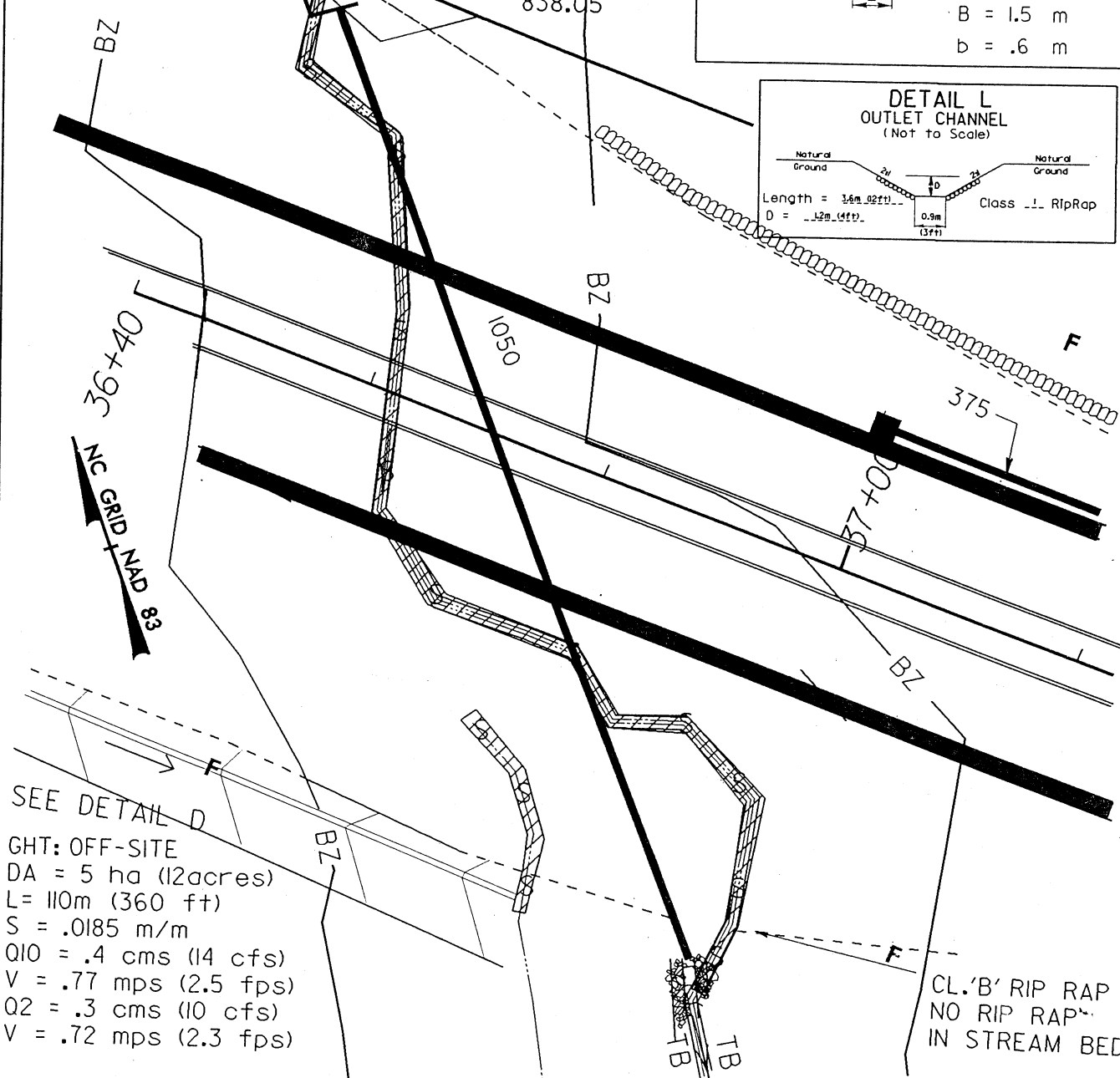
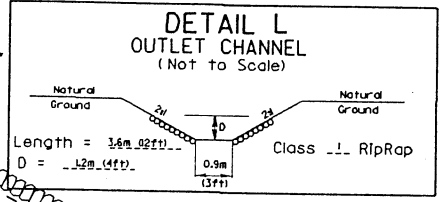
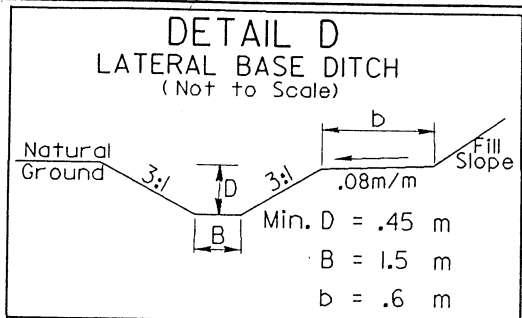
MARJORIE P. LEWIS



SITE 4
PLAN VIEW

NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U-2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 SHEET 9 OF 41
 3/16/02

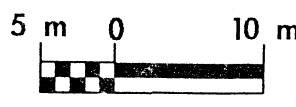
SEE DETAIL D
 TB B PROPERTIES
 TRIB TO RED BUD & CREEK
 "L" ENDWALL STANDARD 838.05



SEE DETAIL D
 GHT: OFF-SITE
 DA = 5 ha (12 acres)
 L = 110m (360 ft)
 S = .0185 m/m
 Q10 = .4 cms (14 cfs)
 V = .77 mps (2.5 fps)
 Q2 = .3 cms (10 cfs)
 V = .72 mps (2.3 fps)

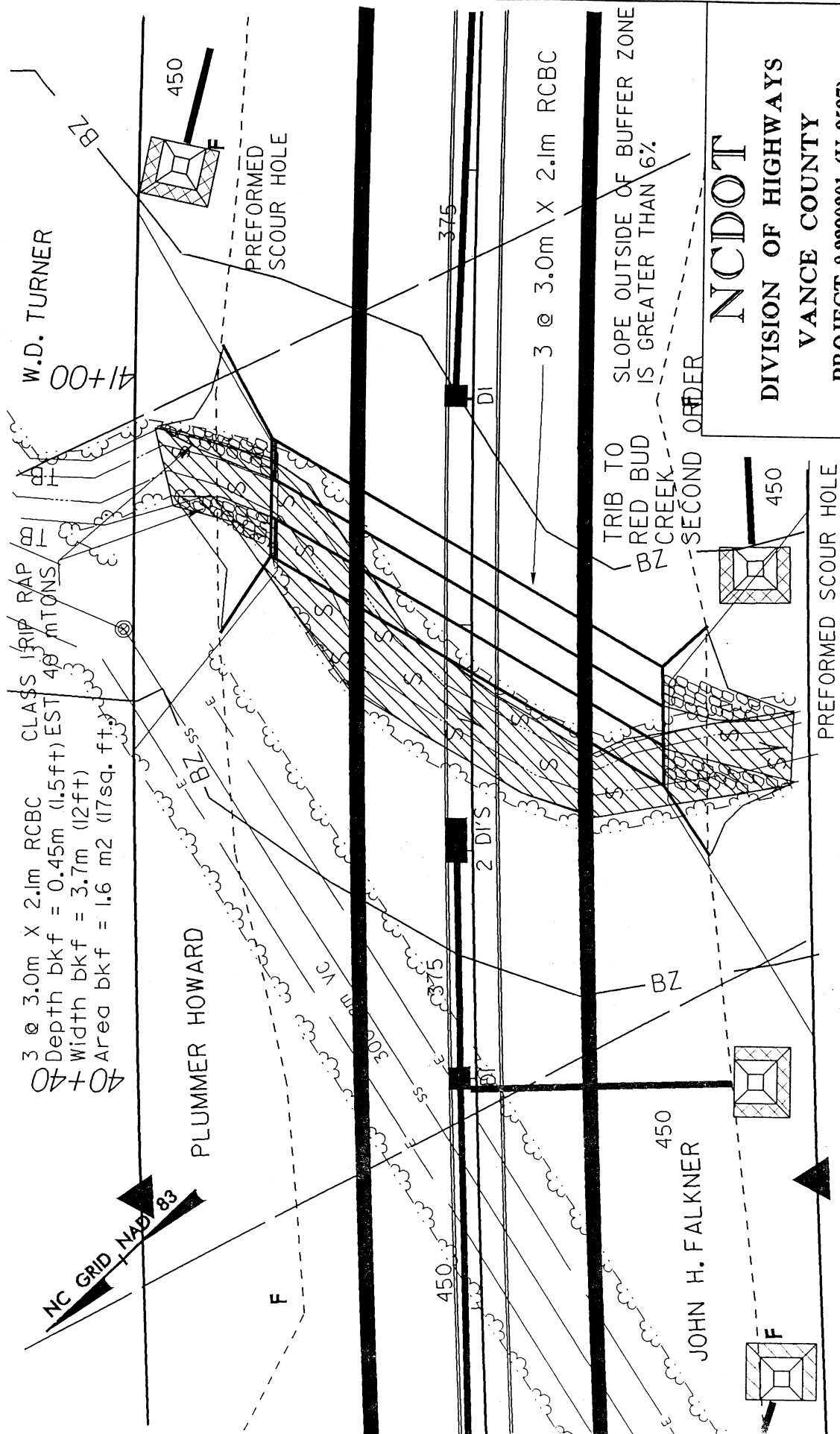
LEFT: DA = 1.9 ha (4.7 acres)
 L = 125m (410 ft)
 S = .0400 m/m
 Q10 = .14cms (5 cfs)
 V = .78 mps (2.6 fps)
 Q2 = .11cms (3.8 cfs)
 V = .72 mps (2.3 fps)

SITE 5
 PLAN VIEW

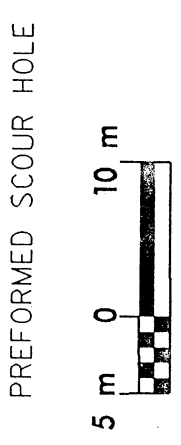


NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 SHEET 10 OF 41
 3/16/02

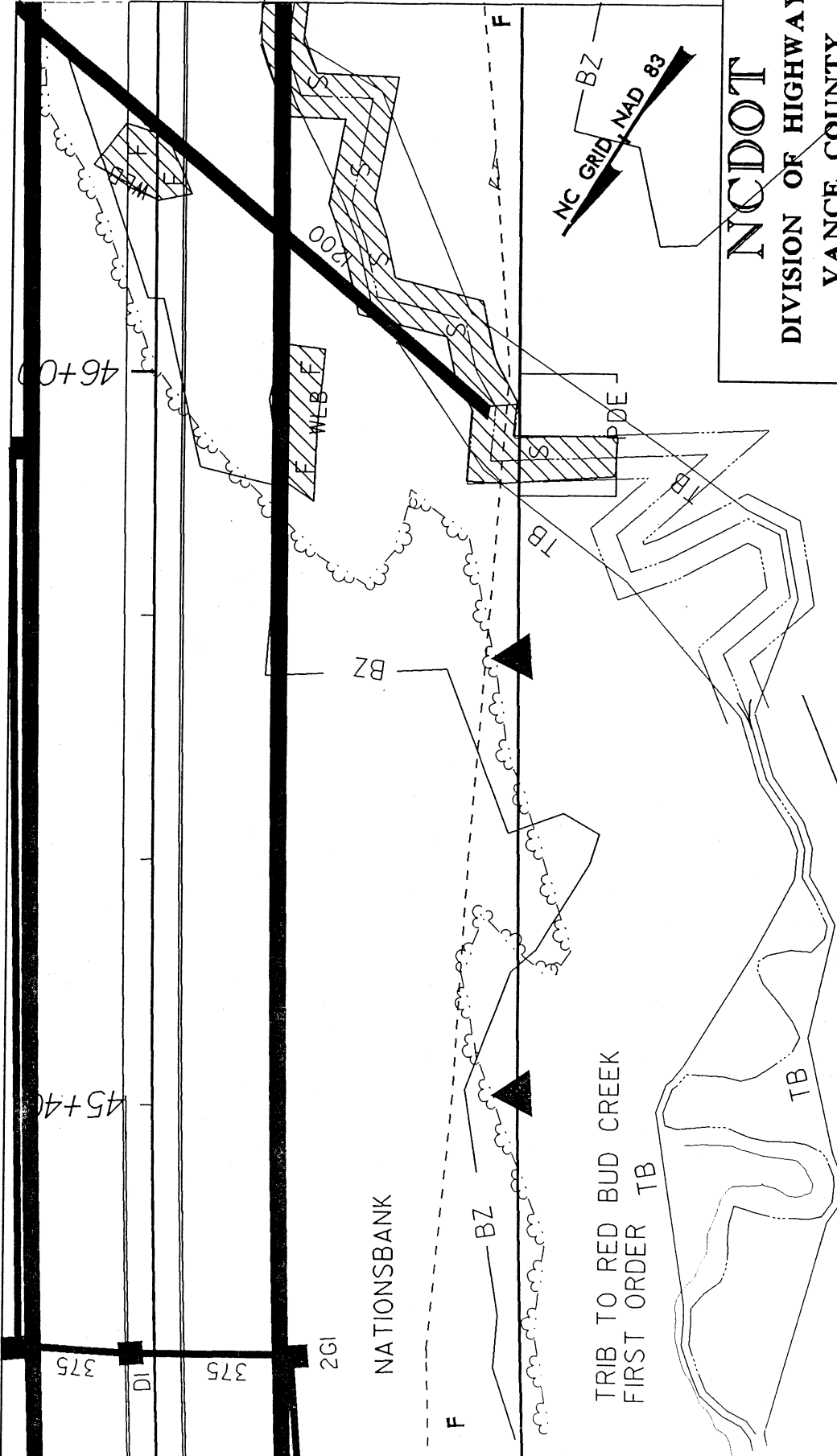
40+40 CLASS 1 RIP RAP 40 m TONS
 3 @ 3.0m X 2.1m RCBC
 Depth bkf = 0.45m (1.5ft) EST
 Width bkf = 3.7m (12ft)
 Area bkf = 1.6 m² (17sq. ft.)



NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U-2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 SHEET 11 OF 41



MATCH STATION 46+30



NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101

SHEET 12 OF 41 3/16/02

SITE 7
 PLAN VIEW



46+00

45+40

375

DI

375

261

NATIONS BANK

TRIB TO RED BUD CREEK
FIRST ORDER TB

NATIONS BANK

NC GRID, NAD 83

BZ

F

WEB F

BZ

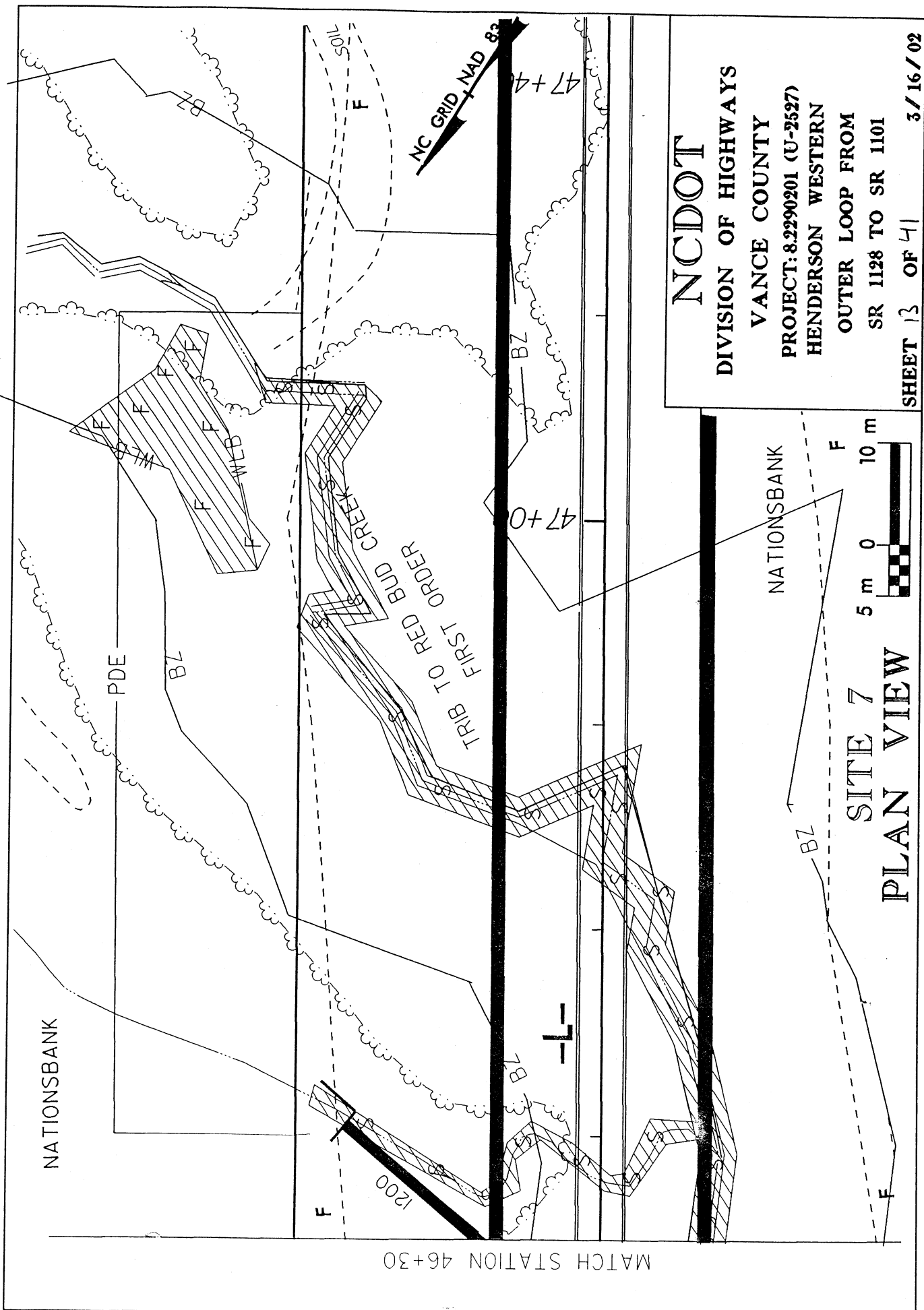
TB

PDE

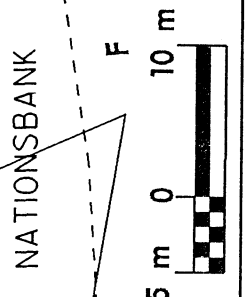
F

TB

TB



NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U-2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 SHEET 13 OF 41



SITE 7
PLAN VIEW

WETLAND PERMIT IMPACT SUMMARY

Site No.	Station (From/To)	Structure Size / Type	WETLAND IMPACTS				SURFACE WATER IMPACTS							
			Fill In Wetlands (ac)	Temp. Fill In Wetlands (ac)	Excavation In Wetlands (ac)	Mechanized Clearing (Method III) (ac)	Fill In SW (Natural) (ac)	Fill In SW (Pond) (ac)	Temp. Fill In SW (ac)	Existing Channel Impacted (ft)	Natural Stream Design (ft)			
1	18+40 -L-	450 RCP					0.00						173.8	
2	21+30 -L-	600 RCP					0.06						272.2	
3	23+40 -L-	CULVERT					0.11						265.7	
4	26+00 to 26+30 -L-	1500 RCP					0.07						262.4	
5	36+72 -L-	900 RCP					0.03						393.6	
6	40+81 -L-	CULVERT					0.11						223.0	
7	46+20 -L-	1500 RCP	0.06				0.18						777.4	
TOTALS:			0.06	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	2368.2	0.0

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

VANCE COUNTY
PROJECT 8.2290201 U-2527

SHEET **14** of **41** 3/2002 Rev.1C

PROPERTY OWNER

NAME AND ADDRESS

OWNER'S NAME	ADDRESS
J.P. Howard Heirs	630 Farrar Ave. Henderson, NC 27536
David & Marjorie Lewis	Rt. 4 Box 290 Henderson, NC 27536
Nationsbank c/o Nannie Crowder	Nationsbank Trust HSZ-5 P.O. Box 27287 Raleigh, NC 27611
George Washington Perry	Rt. 5 Box 26 Henderson, NC 27536
Shannon P. & John Rock	P.O. Box 676 Louisburg, NC 27549
Jewel Royster	Rt. 4 Box 352-A Henderson, NC 27536
Geneva Turner	243 North 8th Street Kenilworth, NJ 07033
W.D. Turner, et al.	938 Hargrove St. Henderson, NC 27536

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2290201 (U-2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 15 OF 47

5/16/02

PROPERTY OWNER

NAME AND ADDRESS

OWNER'S NAME

ADDRESS

Jesse B. Adams, Jr.

3758 Evans Trailway
Beltsville, MD 20705

Patricia Ann Adams

9039 Sligo Parkway, #509
Silver Springs, MD 20901

B & B Properties c/o W. L. Stanley

P. O. Box 1092
Henderson, NC 27536

Gloria Carver &
Harvey A. Wilson

Rt. 4 Box 352-C
Henderson, NC 27536

John D. Ellis & Mildred Ellis

435 Oak Hill Street
Henderson, NC 27536

Virgil Evans
c/o Lillian B. Evans

PO BOX 684
Henderson, NC 27536

John H. Faulkner

215 Crestwood Road
Henderson, NC 27536

Plummer Howard

630 Farrar Ave.
Henderson, NC 27536

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2290201 (U-2527)

HENDERSON WESTERN

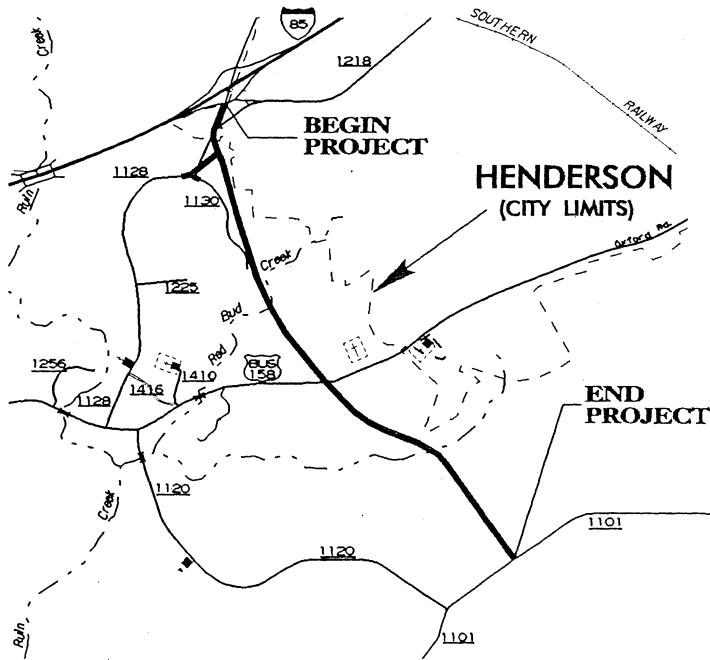
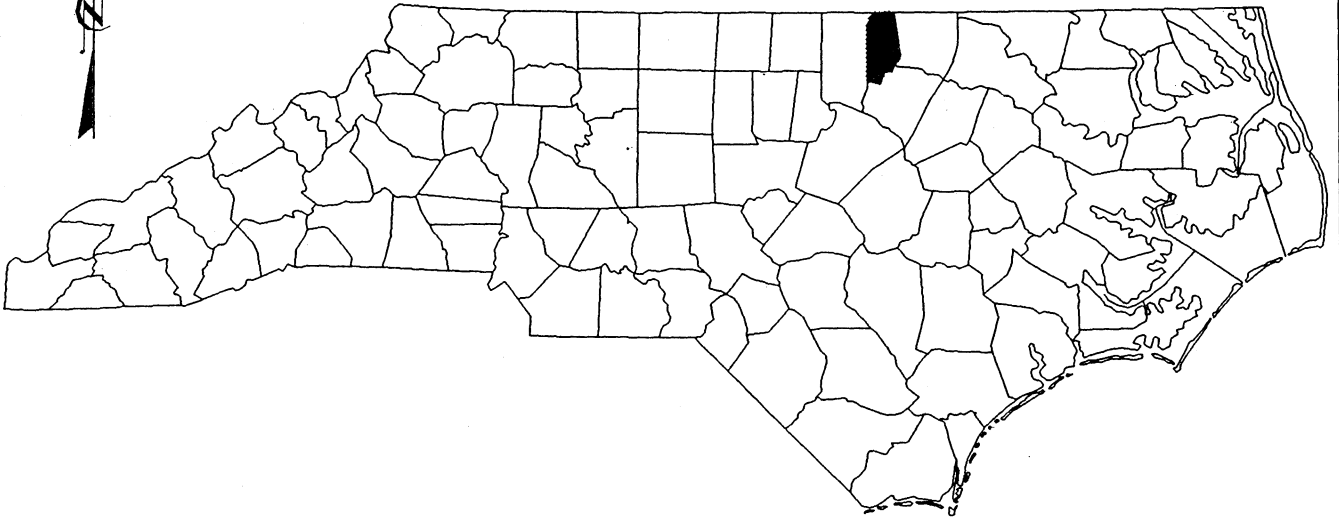
OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 16 OF 41

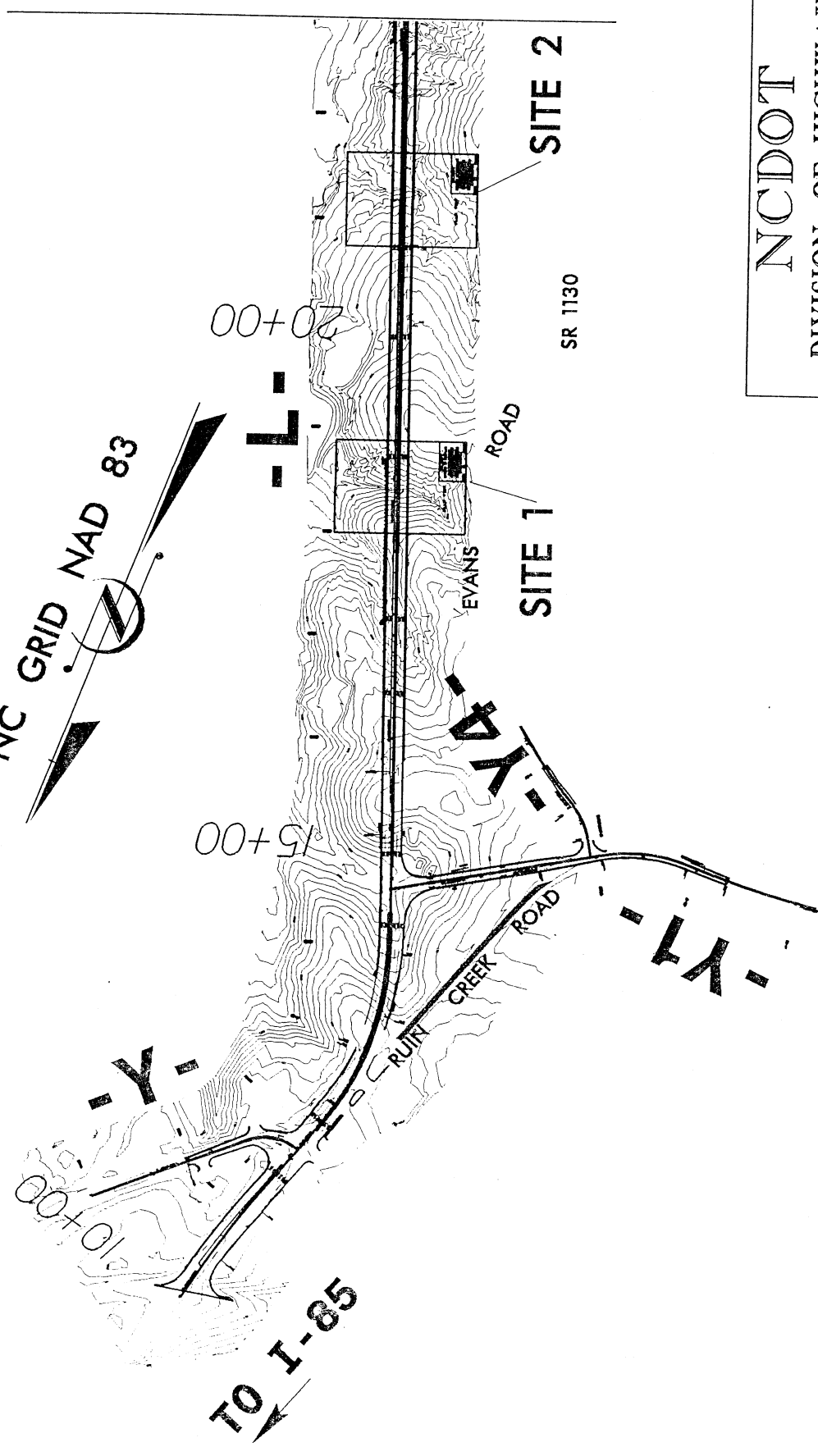
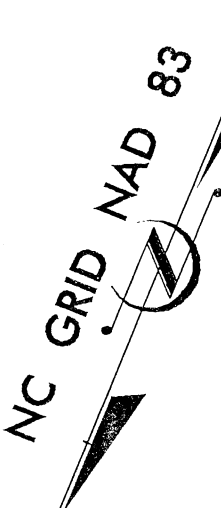
3/16/02

NORTH CAROLINA



BUFFER IMPACTS VICINITY MAPS

NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2390201 (U-2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101



SR 1130

SITE 1

SITE 2

SITE VIEW
BUFFER IMPACTS

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2390201 (U-2527)

HENDERSON WESTERN

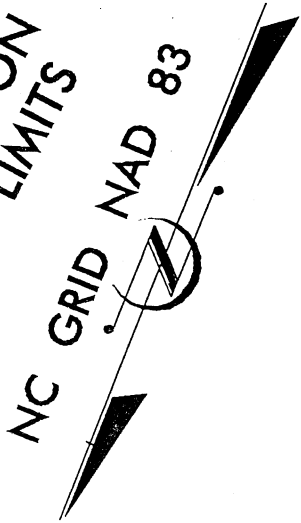
OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 17 OF 41

3/16/02

HENDERSON
CITY LIMITS



-Y2- US 158 BUS

SITE 7

SITE 6

00+00
00+01

00+00
00+01

SITE 5

-L-

00+00
00+01

SITE 3

SITE 4

RED BUD
CREEK

SITE VIEW
BUFFER IMPACTS

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2390201 (U-2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 19 OF 41

3/16/02

TO HENDERSON

10+00



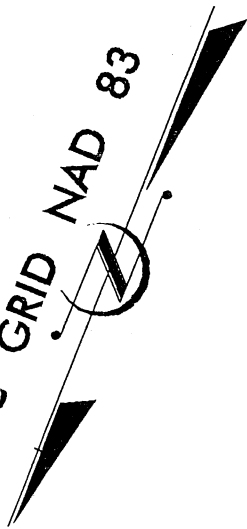
-Y3-

14+00

TO KITTRELL

50+00

NC GRID NAD 83



45+00

-L-

SITE 9

SITE 9

40+00

SITE 8

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2390201 (U-2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

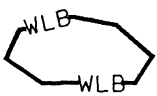




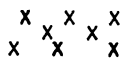

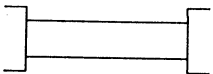
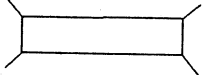


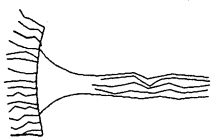
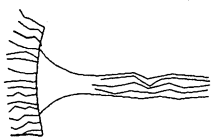



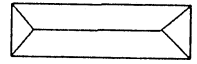
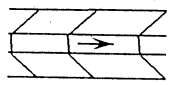
SHEET 20 OF 41

3/16/02

SITE VIEW

BUFFER IMPACTS

BUFFER LEGEND

- | | |
|---|---|
| <p>— WLB — WETLAND BOUNDARY</p> <p> WETLAND</p> <p> ALLOWABLE IMPACTS ZONE 1</p> <p> ALLOWABLE IMPACTS ZONE 2</p> <p> MITIGABLE IMPACTS ZONE 1</p> <p> MITIGABLE IMPACTS ZONE 2</p> <p>— BZ — RIPARIAN BUFFER ZONE</p> <p>— BZ1 — RIPARIAN BUFFER ZONE 1
30 ft (9.2m)</p> <p>— BZ2 — RIPARIAN BUFFER ZONE 2
20 ft (6.1m)</p> <p>← — FLOW DIRECTION</p> <p>— TB — TOP OF BANK</p> <p>— WE — EDGE OF WATER</p> <p>— C — PROP. LIMIT OF CUT</p> <p>— F — PROP. LIMIT OF FILL</p> <p>▲ — PROP. RIGHT OF WAY</p> <p>— NG — NATURAL GROUND</p> <p>— PL — PROPERTY LINE</p> <p>— TDE — TEMP. DRAINAGE EASEMENT</p> <p>— PDE — PERMANENT DRAINAGE EASEMENT</p> <p>— EAB — EXIST. ENDANGERED ANIMAL BOUNDARY</p> <p>— EPB — EXIST. ENDANGERED PLANT BOUNDARY</p> <p>▽ — WATER SURFACE</p> <p> LIVE STAKES</p> <p> BOULDER</p> <p>— — — CORE FIBER ROLLS</p> | <p> PROPOSED BRIDGE</p> <p> PROPOSED BOX CULVERT</p> <p> PROPOSED PIPE CULVERT
12"-48"
PIPES
54" PIPES & ABOVE</p> <p>(DASHED LINES DENOTE EXISTING STRUCTURES)</p> <p> SINGLE TREE</p> <p>— — — WOODS LINE</p> <p> DRAINAGE INLET</p> <p> ROOTWAD</p> <p> RIP RAP</p> <p> 5
ADJACENT PROPERTY OWNER
OR PARCEL NUMBER
IF AVAILABLE</p> <p> PREFORMED SCOUR HOLE (PSH)</p> <p> LEVEL SPREADER (LS)</p> <p> GRASS SWALE</p> |
|---|---|

NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2290201 (U-2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101
 SHEET 21 OF 41 3/16/02

NC GRID, NAD 83

JOHN D. ELLIS
&
MILDRED A. ELLIS

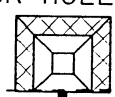
18+00

CL. "B" RIP RAP
NO RIP RAP TO BE
PLACED IN THE BED.

TRIB TO RED BUD CREEK

18+60

PREFORMED
SCOUR HOLE



400 CSP
W/
2 ELBOWS

2GI

BZ2

BZ1

BZ1

BZ2

400 CSP W/
2 ELBOWS
FS

2GI

C

F

4B

600

600

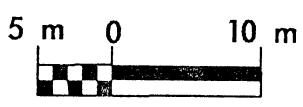
BZ2

C

BZ2

BUFFER IMPACTS SITE 1 PLAN VIEW

NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2290201 (U-2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101



GEORGE PERRY

NC GRID, NAD 83

TIE TO EXISTING SWALE

21+00

CL. "B" RIP RAP
NO RIP RAP TO BE
PLACED IN THE BED.

TRIB TO RED BUD CREEK

JEWEL E. ROYSTER

21+60

CL. "B" RIP RAP

F

BZ1

BZ2

F

BZ2

150

BZ1

F

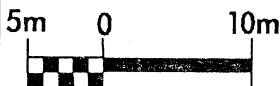
C

GEORGE PERRY

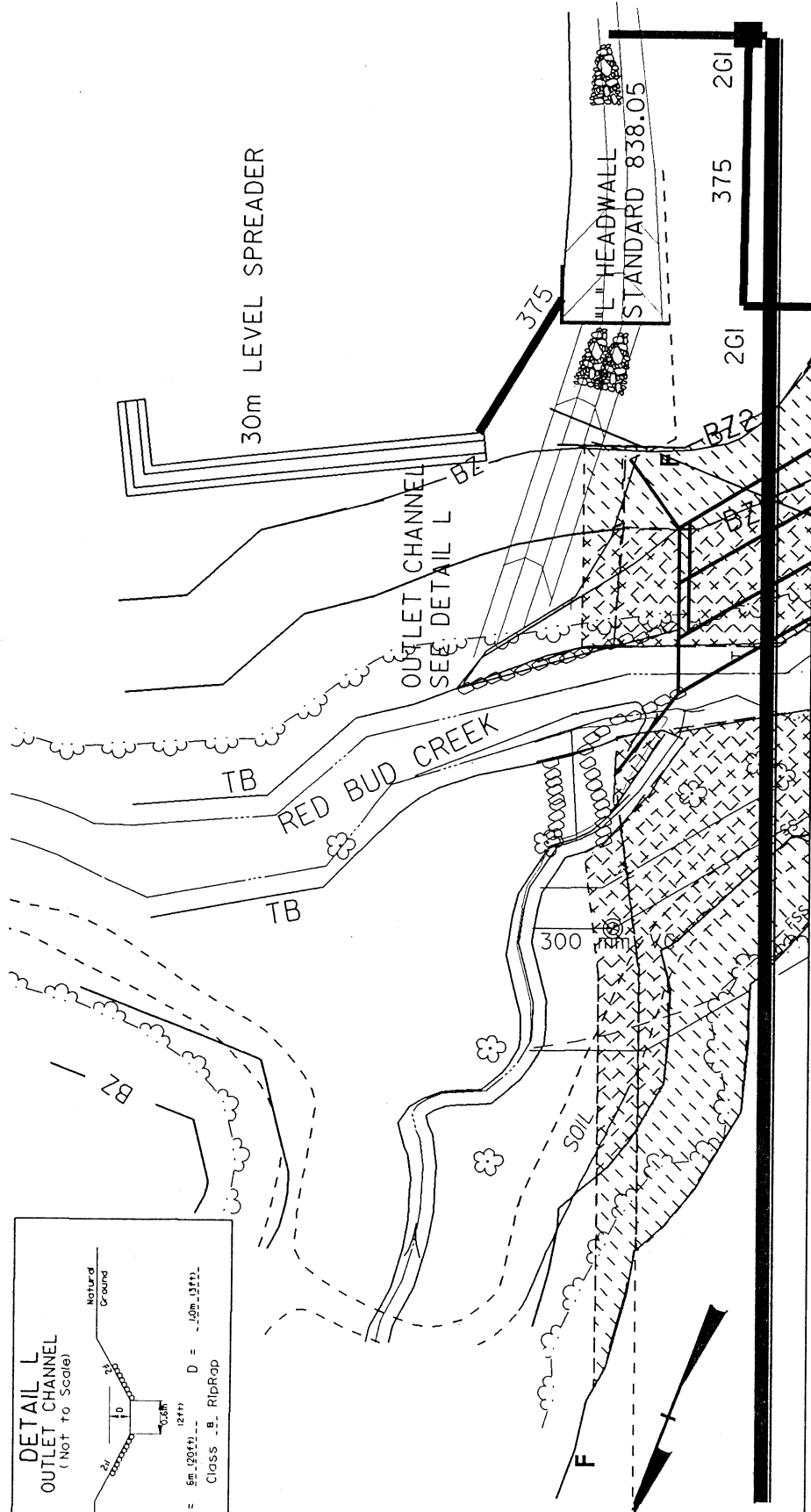
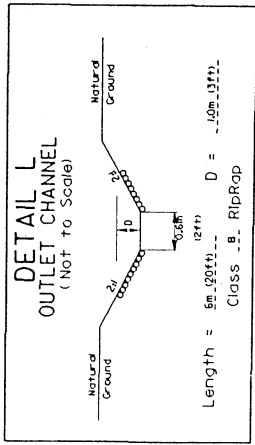
GRADE TO DRAIN

JEWEL E. ROYSTER

BUFFER IMPACTS
SITE 2
PLAN VIEW



NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2290201 (U-2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101
SHEET 23 OF 41 3/16/02



MATCH LINE A

3 @ 3.6m X 2.7m RCBC

Depth bkf = 0.5m (1.6ft)

Width bkf = 5.4m (17.7ft)

Area bkf = 2.3 m² (24.8sq.ft.)



23+00

23+60



BUFFER IMPACTS
SITE 3
PLAN VIEW

NC DOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2290201 (U-2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 24 OF 41

3/16/02

23+00

23+60

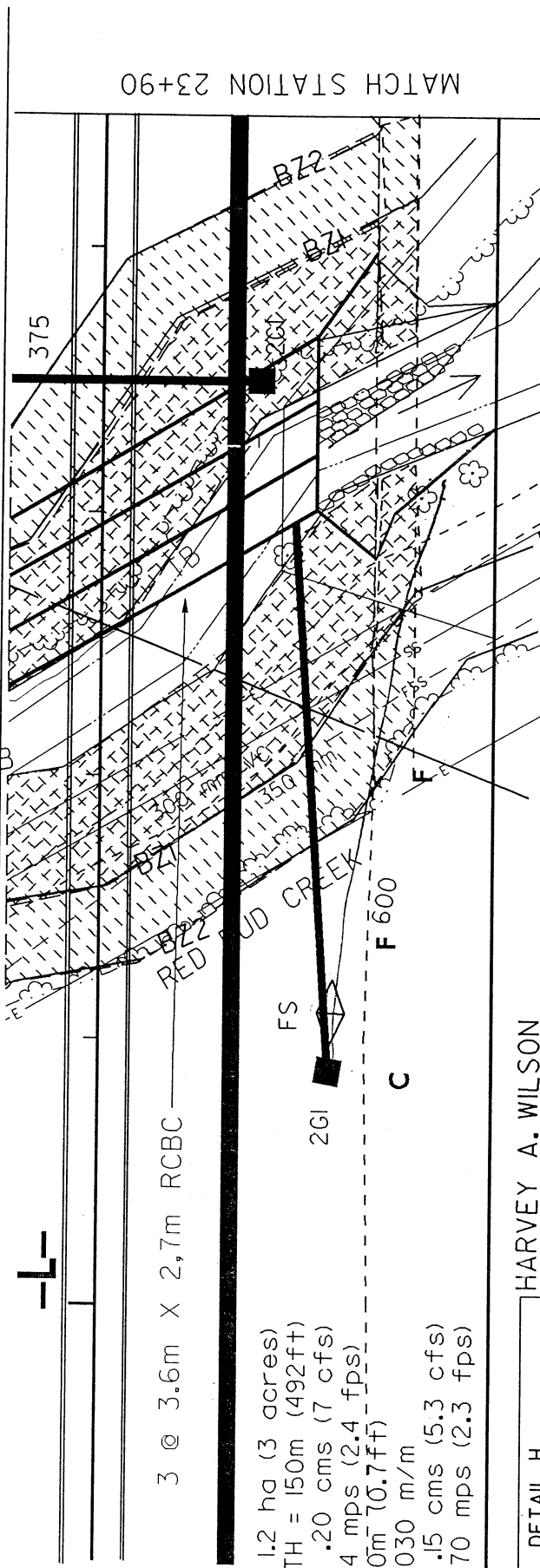


MATCH LINE A



3 @ 3.6m X 2.7m RCBC

3 @ 3.6m X 2.7m RCBC
Depth bkf = 0.5m (1.6ft)
Width bkf = 5.4m (17.7ft)
Area bkf = 2.3 m2 (24.8sq.ft.)

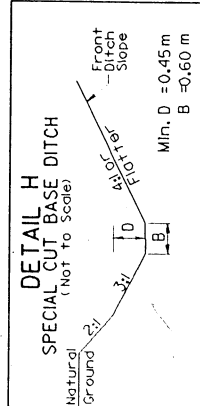


MATCH STATION 23+90

DA = 1.2 ha (3 acres)
LENGTH = 150m (492ft)
Q10 = .20 cms (7 cfs)
V = .74 mps (2.4 fps)
D = .20m (0.7ft)
S = 0.030 m/m
O2 = .15 cms (5.3 cfs)
V = .70 mps (2.3 fps)

HARVEY A. WILSON
&
GLORIA D. CARVER

BUFFER IMPACTS SITE 3 PLAN VIEW



NCDOT

DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2290201 (U-2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101

SHEET 25 OF 41 3/16/02

24+60

24+00

MARJORIE P. LEWIS

MATCH STATION 23+90

GENEVA F. TURNER

VIRGIL EVANS

BZ2

F

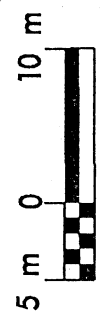
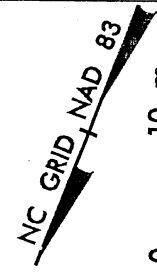
RED BUD CREEK

ELSON FLOYD

BUFFER IMPACTS

SITE 4

PLAN VIEW



NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

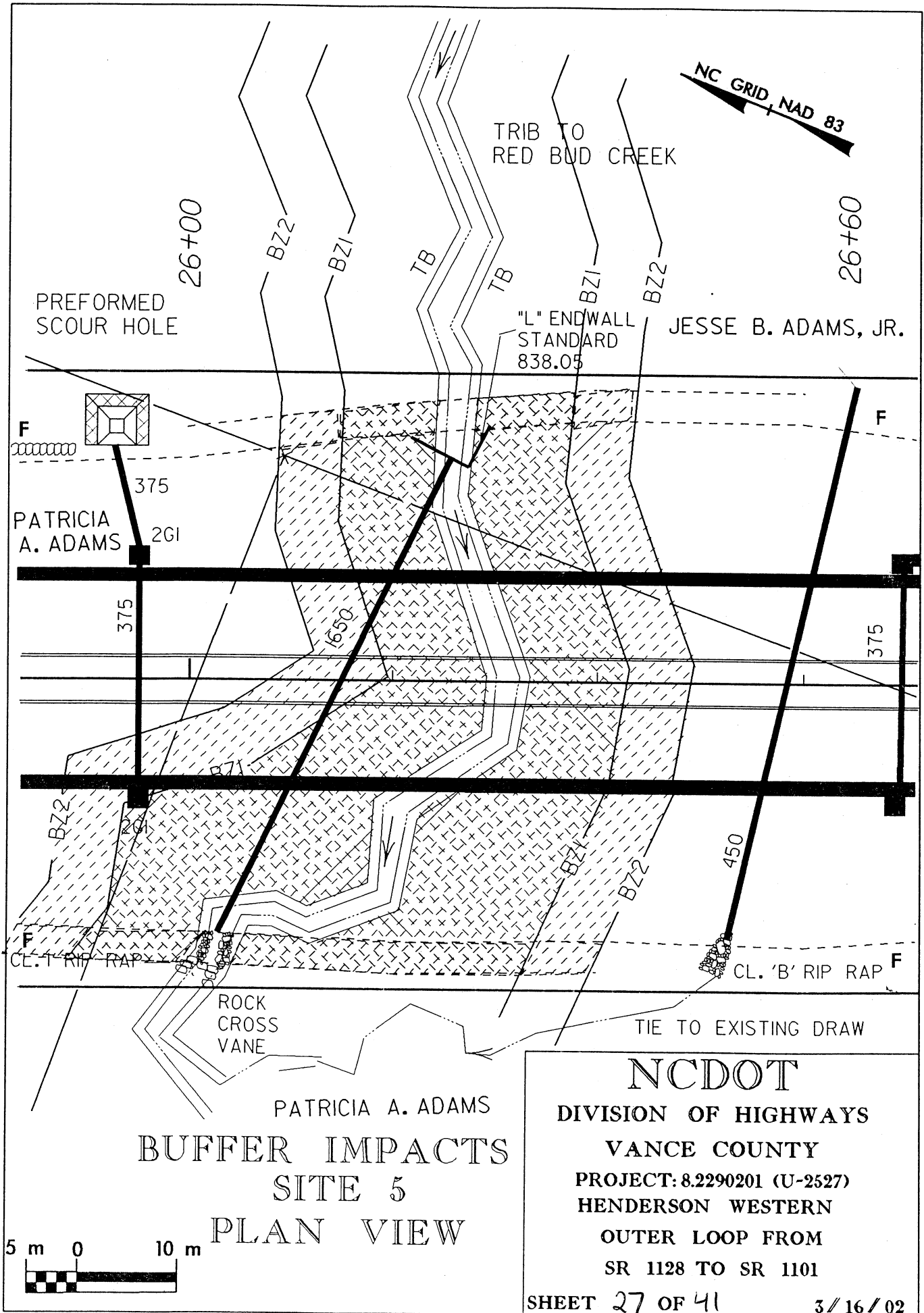
PROJECT: 8.2290201 (U-2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 26 OF 41 3/16/02



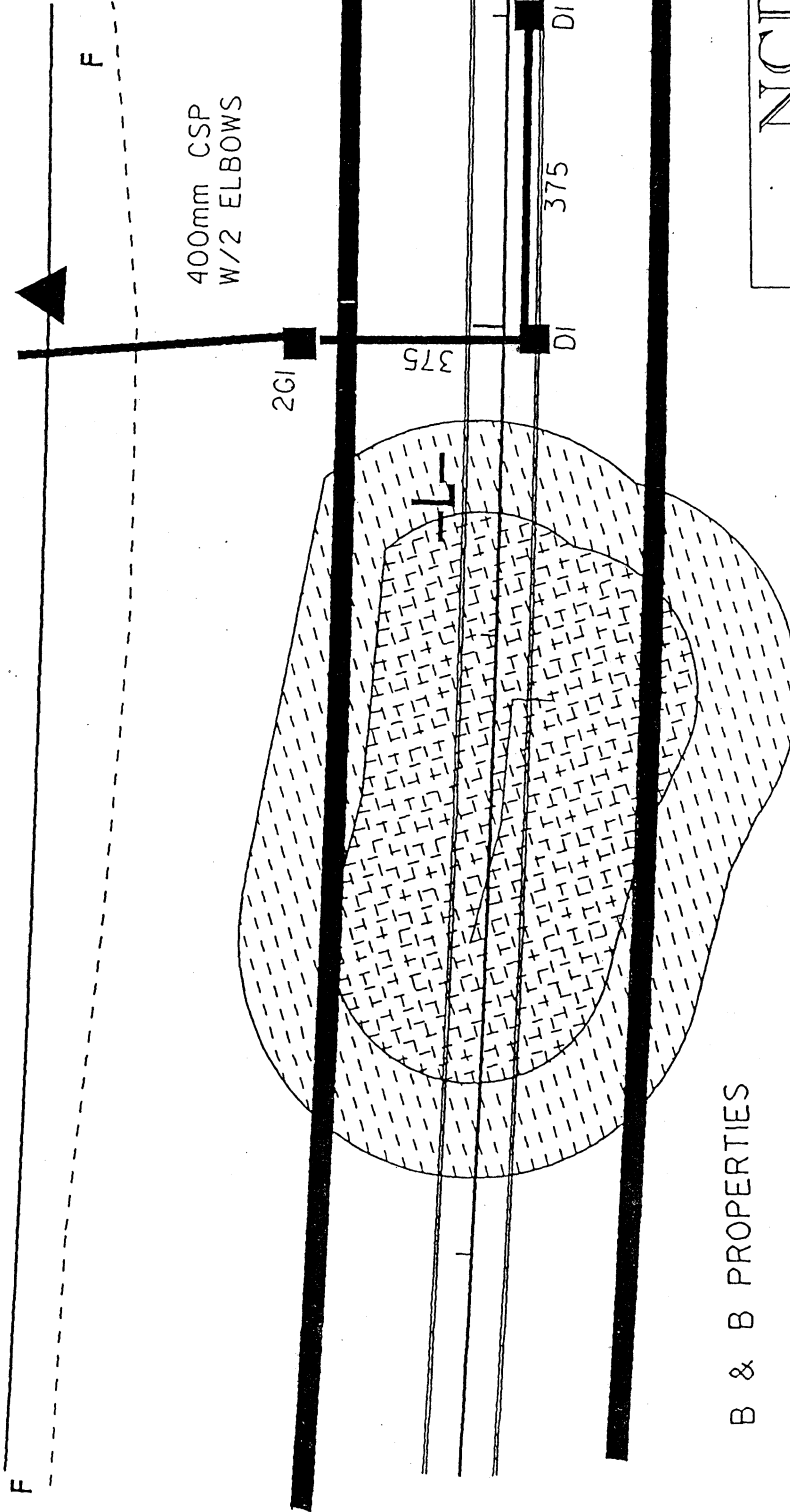
PATRICIA A. ADAMS
 BUFFER IMPACTS
 SITE 5
 PLAN VIEW

NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U-2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 SHEET 27 OF 41 3/16/02

NC GRID NAD 83

36+00

35+40



B & B PROPERTIES

BUFFER IMPACTS SITE 6

PLAN VIEW



NC DOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2290201 (U2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

SHEET 28 OF 41

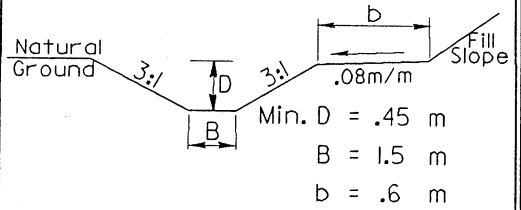
3/16 12

SEE DETAIL D

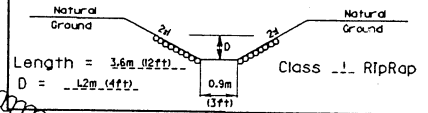
TB B B PROPERTIES
TRIB TO RED BUD & CREEK

"L" ENDWALL
STANDARD
838.05

DETAIL D LATERAL BASE DITCH (Not to Scale)



DETAIL L OUTLET CHANNEL (Not to Scale)



36+40
NC GRID NAD 83

375

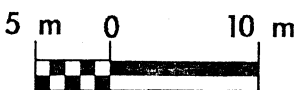
37+00

SEE DETAIL D

GHT: OFF-SITE
 DA = 5 ha (12 acres)
 L = 110m (360 ft)
 S = .0185 m/m
 Q10 = .4 cms (14 cfs)
 V = .77 mps (2.5 fps)
 Q2 = .3 cms (10 cfs)
 V = .72 mps (2.3 fps)

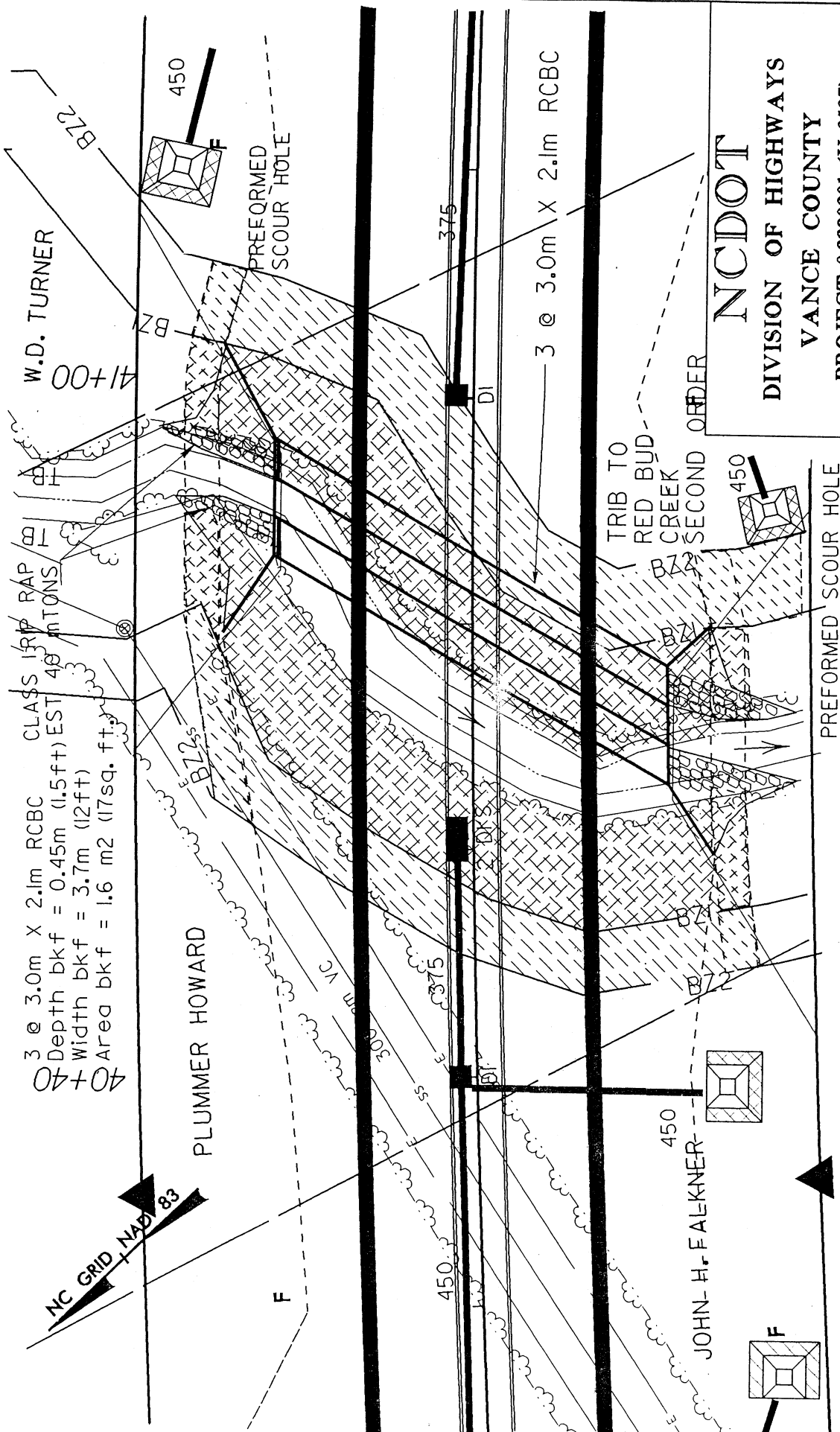
LEFT: DA = 1.9 ha (4.7 acres)
 L = 125m (410 ft)
 S = .0400 m/m
 Q10 = .14 cms (5 cfs)
 V = .78 mps (2.6 fps)
 Q2 = .11 cms (3.8 cfs)
 V = .72 mps (2.3 fps)

BUFFER IMPACTS SITE 7 PLAN VIEW



CL. 'B' RIP RAP
NO RIP RAP
IN STREAM BED

NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101



3 @ 3.0m X 2.1m RCBC
 CLASS 1.5 RAP / 40 TONS / 1.5
 Depth bkf = 0.45m (1.5ft) EST
 Width bkf = 3.7m (12ft)
 Area bkf = 1.6 m² (17sq. ft.)

PLUMMER HOWARD

W.D. TURNER

JOHN-H. FALKNER

TRIB TO
RED BUD
CREEK
SECOND ORDER

3 @ 3.0m X 2.1m RCBC

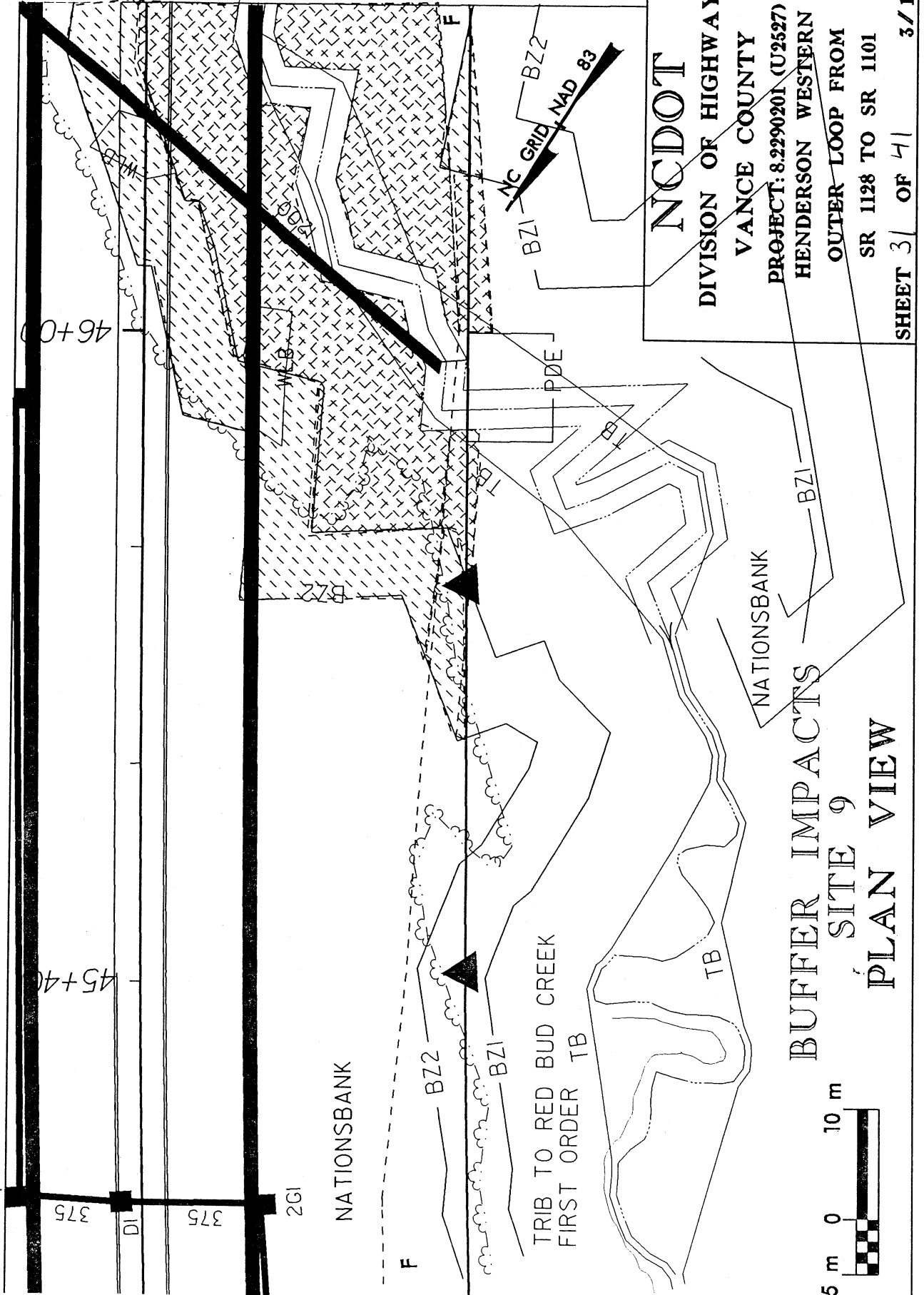
PREFORMED SCOUR HOLE



BUFFER IMPACTS
SITE 8
PLAN VIEW

NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U-2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 SHEET 30 OF 41
 Rev. 10/03
 3/16/02

MATCH STATION 46+30



NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2290201 (U2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

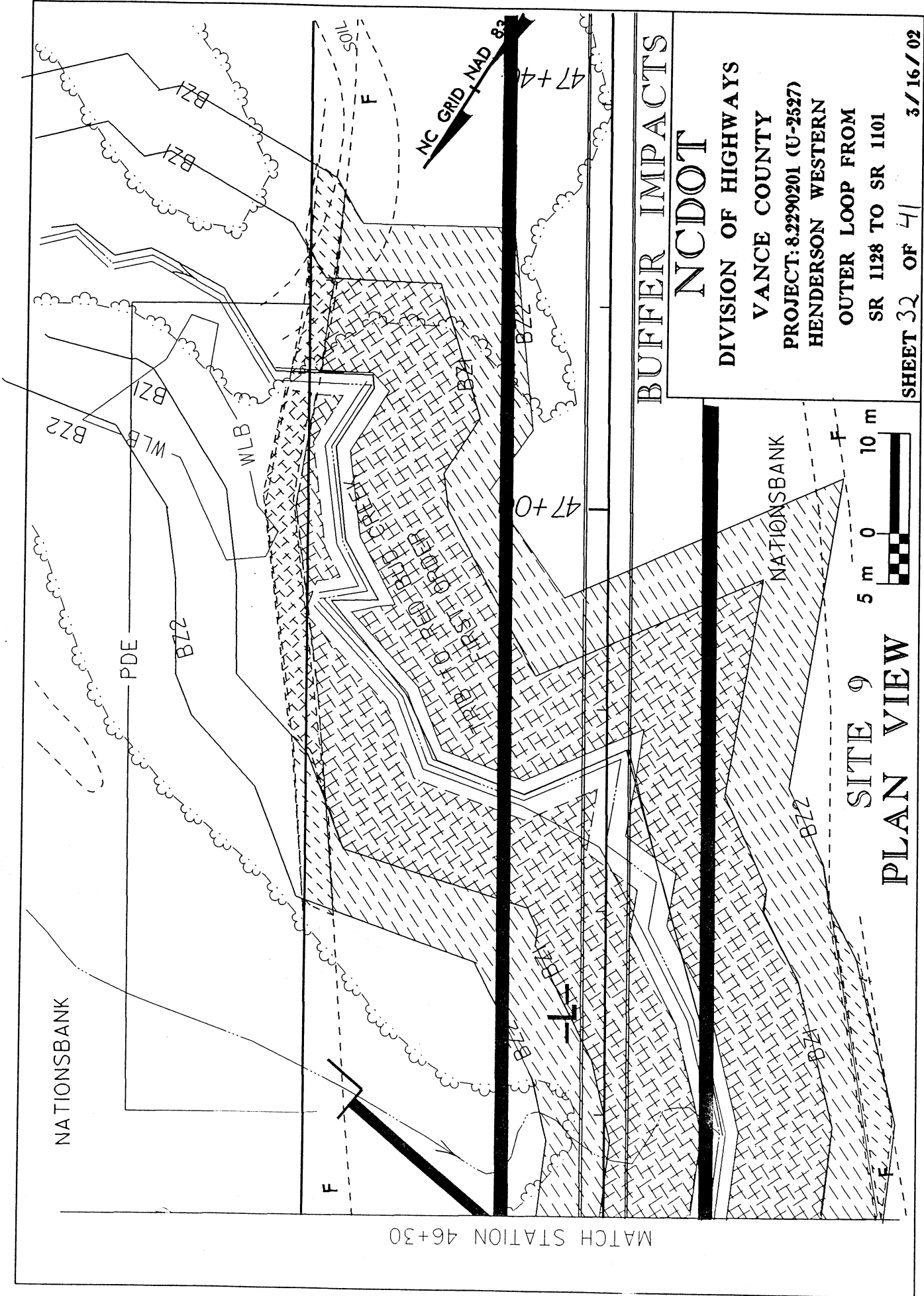
SHEET 3 OF 41

3/16/02

BUFFER IMPACTS
SITE 9
PLAN VIEW



MATCH STATION 46+30



BUFFER IMPACTS

NCDOT

DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U-2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101

SHEET 32 OF 41 3/16/02

SITE 9
PLAN VIEW

MATCH LINE B

NC DOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2290201 (U2527)

HENDERSON WESTERN

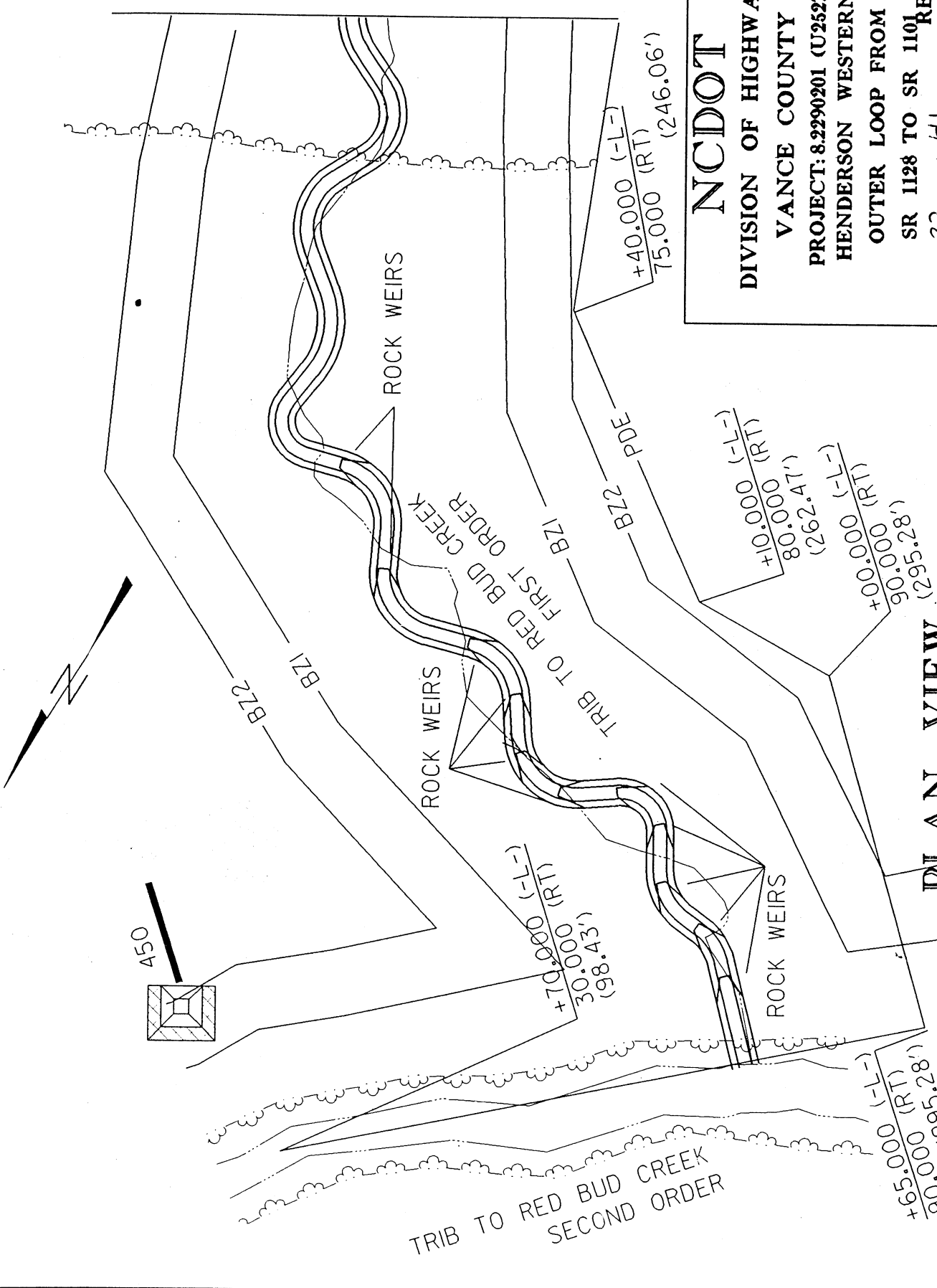
OUTER LOOP FROM

SR 1128 TO SR 1101

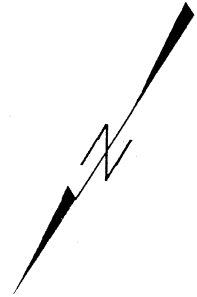
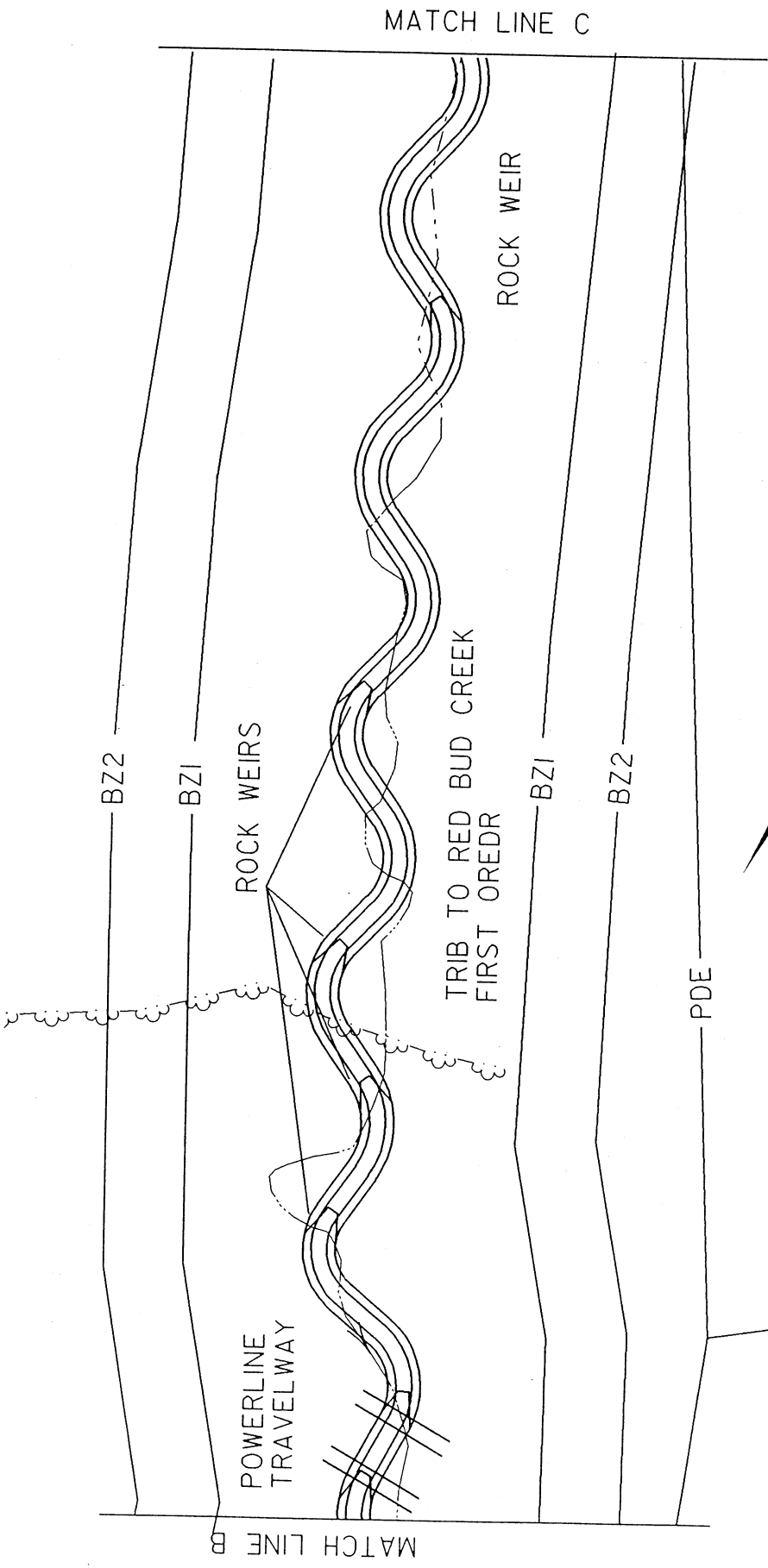
REV 5/03

SHEET 33 OF 41

3/16/02



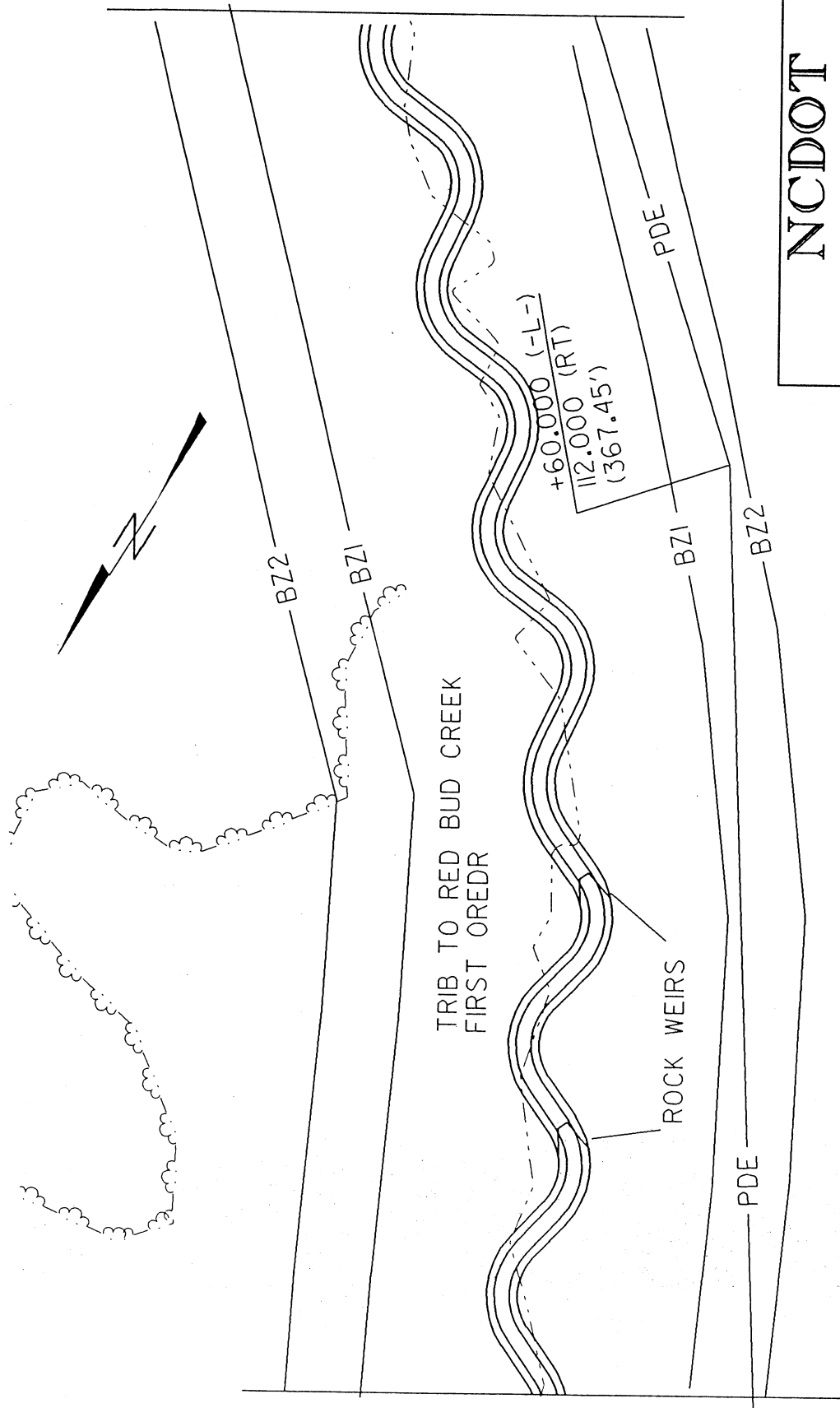
PLAN VIEW



PLAN VIEW

NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 REV 5/03
 3/16/02
 SHEET 34 OF 41

MATCH LINE D



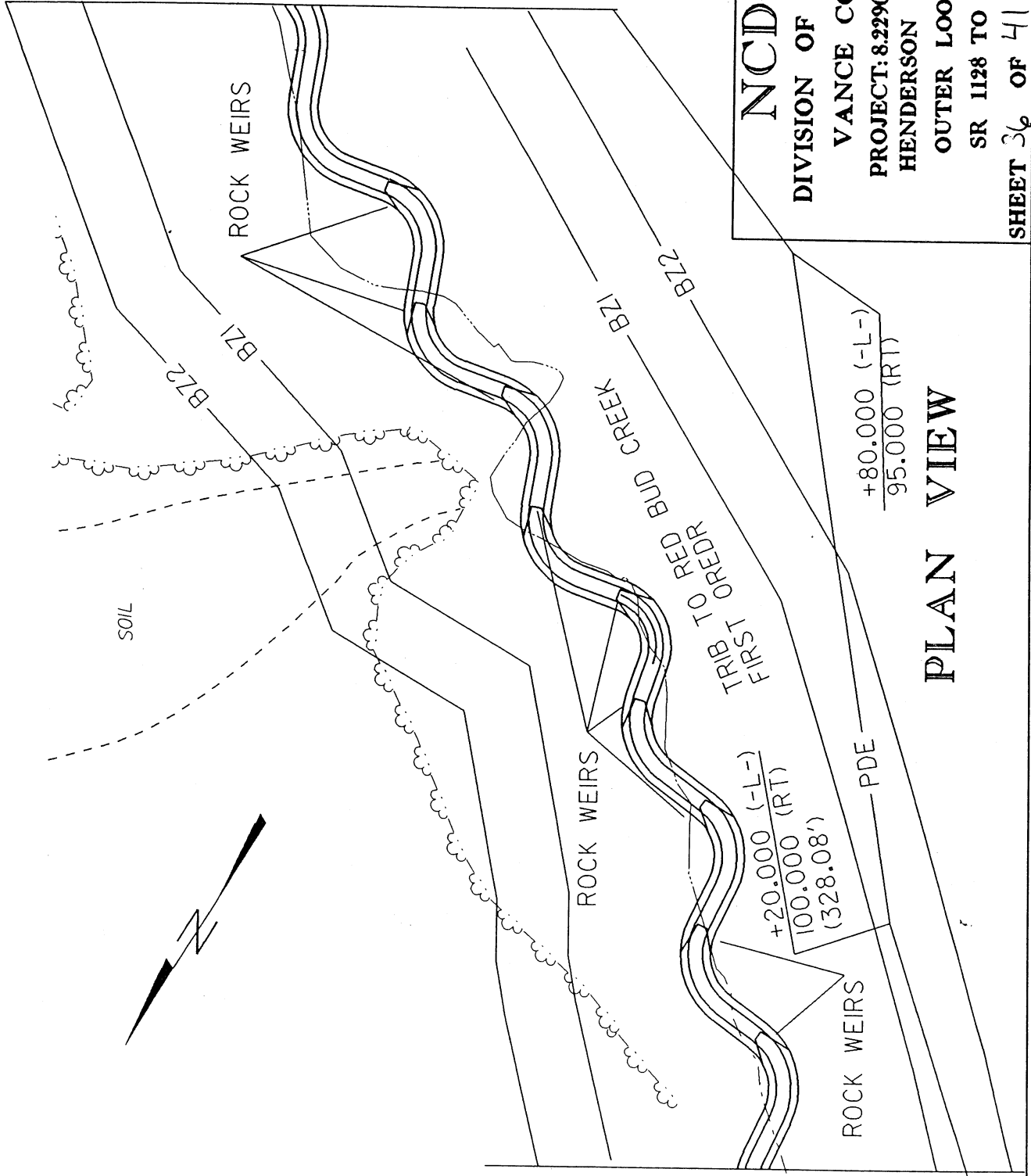
MATCH LINE C

NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2290201 (U2527)
 HENDERSON WESTERN
 OUTER LOOP FROM
 SR 1128 TO SR 1101
 REV 5/03
 3/16/02

PLAN VIEW

SHEET 35 OF 41

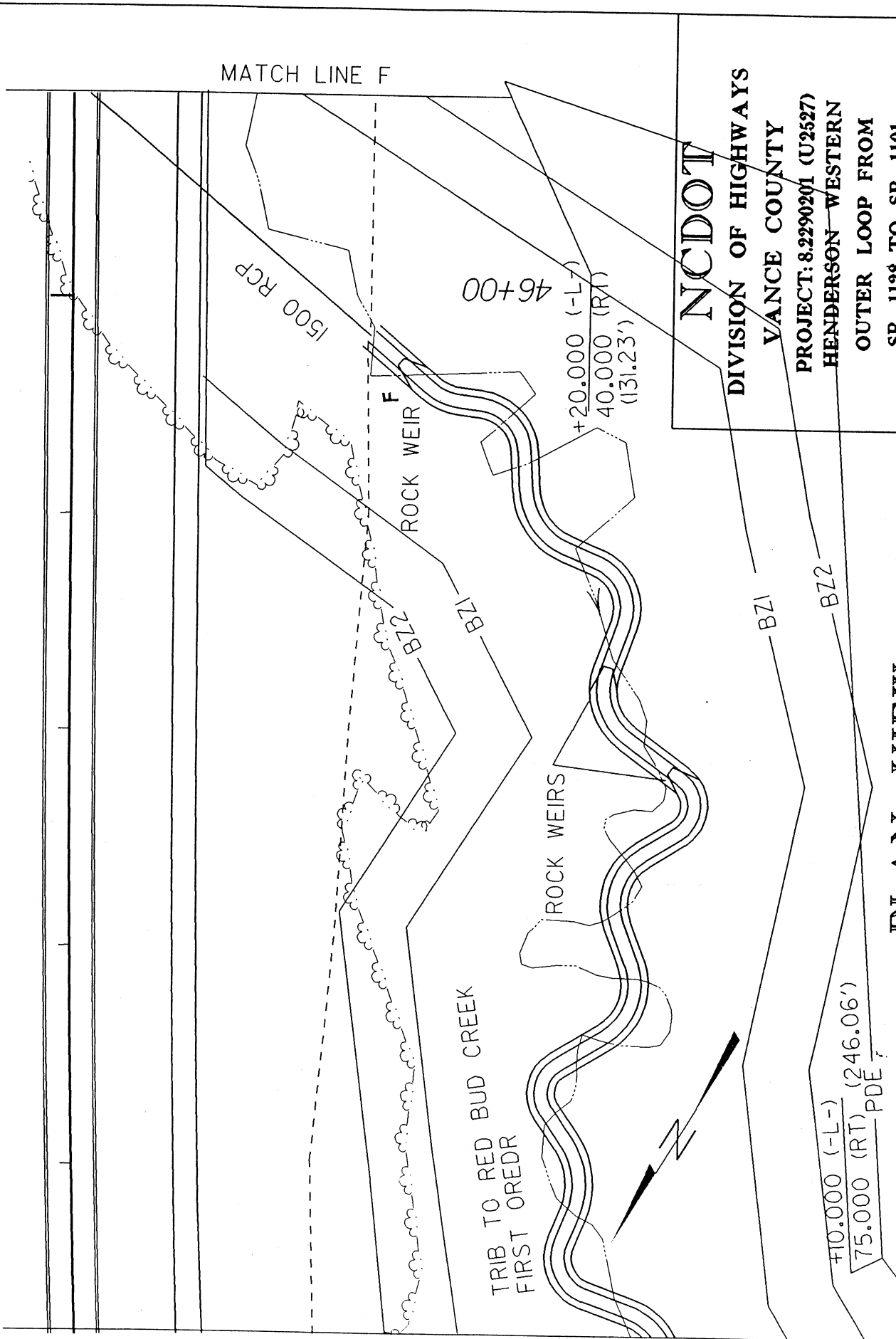
MATCH LINE E



MATCH LINE D

NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2290201 (U2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101
REV 5/03
SHEET 36 OF 41
5/16/02

PLAN VIEW



MATCH LINE F

MATCH LINE E

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2290201 (U2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

REV 5/03

3/16/02

SHEET 37 OF 41

PLAN VIEW

TRIB TO RED BUD CREEK
FIRST OREDR

1500 RCP

ROCK WEIR

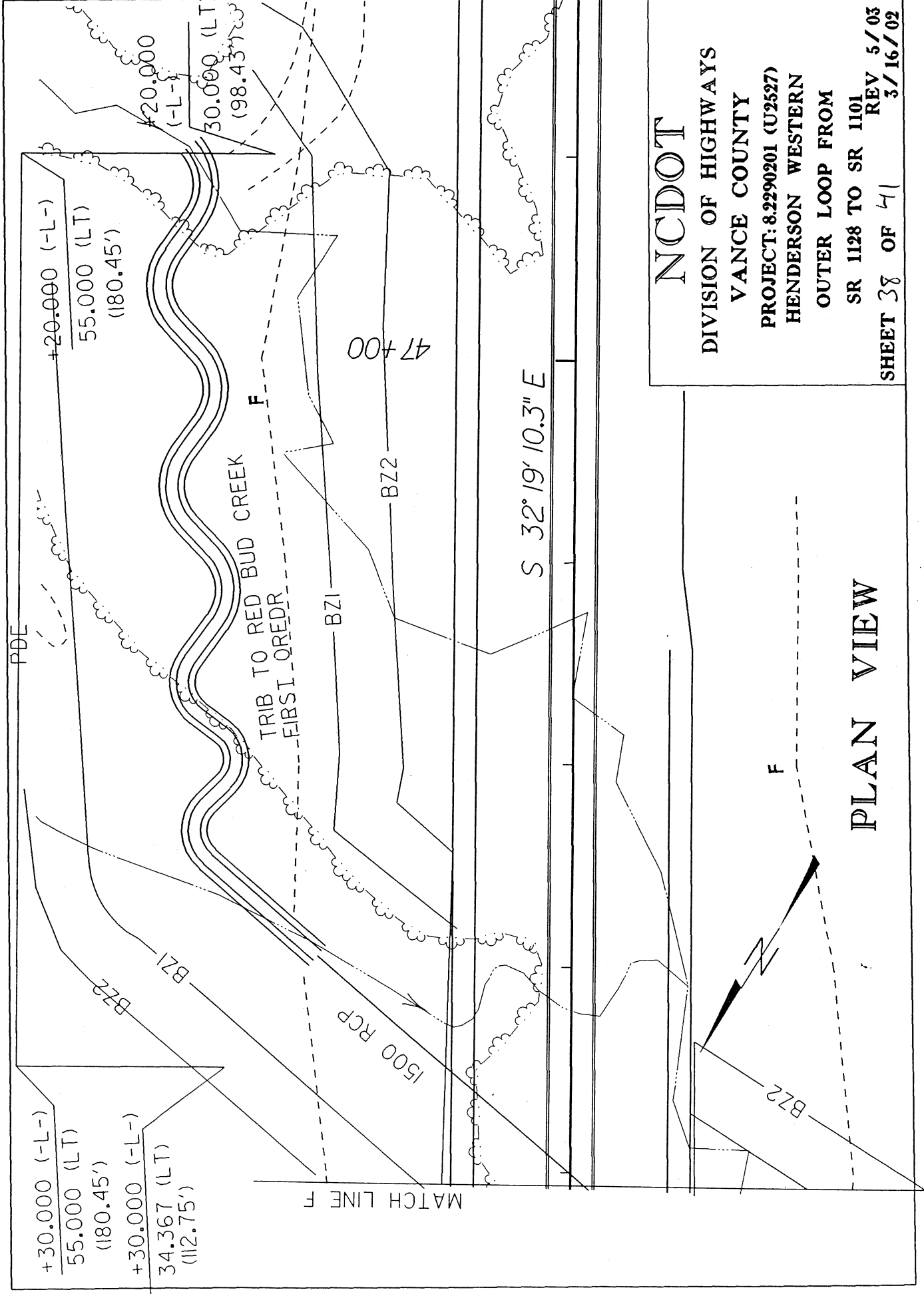
ROCK WEIRS

46+00

+20.000 (-L-)
40.000 (RT)
(131.23')

+10.000 (-L-)
75.000 (RT) (246.06')
PDE ?





+30.000 (-L-)
 55.000 (LT)
 (180.45')

+30.000 (-L-)
 34.367 (LT)
 (112.75')

+20.000 (-L-)
 55.000 (LT)
 (180.45')

#20.000 (-L-)
 30.000 (LT)
 (98.43')

MATCH LINE F

1500 RCP

TRIB TO RED BUD CREEK

F

BZ1

BZ2

47+00

S 32° 19' 10.3" E

F

BZ2

NCDOT

DIVISION OF HIGHWAYS

VANCE COUNTY

PROJECT: 8.2290201 (U2527)

HENDERSON WESTERN

OUTER LOOP FROM

SR 1128 TO SR 1101

REV 5/03

SHEET 38 OF 41

3/16/02

PLAN VIEW

BUFFER IMPACTS SUMMARY

SITE NO.	STRUCTURE SIZE / TYPE	STATION (FROM/TO)	IMPACT							BUFFER REPLACEMENT			
			TYPE		ALLOWABLE			MITIGABLE		ZONE 1 (ft ²)	ZONE 2 (ft ²)		
			ROAD CROSSING	PARALLEL IMPACT	ZONE 1 (ft ²)	ZONE 2 (ft ²)	TOTAL (ft ²)	ZONE 1 (ft ²)	ZONE 2 (ft ²)				
1	450 RCP	-L- Sta 18+40	X		10344.1	6716.7	17060.8						
2	600 RCP	-L- Sta 21+30	X		14811.1	8234.4	23045.5						
3	culvert	-L- Sta 23+40	X		12949.0	8578.8	21527.8						
4		- Sta 23+90 to 24+6		X									
5	1500 RCP	- Sta 26+00 to 26+3	X		16070.5	8600.4	24670.9	1356.3	6167.7	7524.0			
6		- Sta 35+40 to 35+8		X	6996.5	7610.1	14606.6						
7	900 RCP	- Sta 36+40 to 37+0	X		22367.4	12701.4	35068.8						
8	culvert	-L- Sta 40+81	X		11797.2	8223.6	20020.9						
9	1500 RCP	-L- Sta 46+20	X		31064.6	19482.7	50547.3						
TOTAL:					126400.6	80148.1	206548.7	1356.3	6167.7	7524.0			

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

Vance county
PROJECT: 8.2290201 (U-2527)
Henderson Western Outer Loop

11/7/2001 Rev. 10/03
SHEET 39 OF 41

PROPERTY OWNER

NAME AND ADDRESS

OWNER'S NAME	ADDRESS
J.P. Howard Heirs	630 Farrar Ave. Henderson, NC 27536
David & Marjorie Lewis	Rt. 4 Box 290 Henderson, NC 27536
Nationsbank c/o Nannie Crowder	Nationsbank Trust HSZ-5 P.O. Box 27287 Raleigh, NC 27611
George Washington Perry	Rt. 5 Box 26 Henderson, NC 27536
Shannon P. & John Rock	P.O. Box 676 Louisburg, NC 27549
Jewel Royster	Rt. 4 Box 352-A Henderson, NC 27536
Geneva Turner	243 North 8th Street Kenilworth, NJ 07033
W.D. Turner, et al.	938 Hargrove St. Henderson, NC 27536

NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2290201 (U-2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101
SHEET 40 OF 41 3/16/02

PROPERTY OWNER

NAME AND ADDRESS

OWNER'S NAME	ADDRESS
Jesse B. Adams, Jr.	3758 Evans Trailway Beltville, MD 20705
Patricia Ann Adams	9039 Sligo Parkway, #509 Silver Springs, MD 20901
B & B Properties c// o W. L. Stanley	P. O. Box 1092 Henderson, NC 27536
Gloria Carver & Harvey A. Wilson	Rt. 4 Box 352-C Henderson, NC 27536
John D. Ellis & Mildred Ellis	435 Oak Hill Street Henderson, NC 27536
Virgil Evans c// o Lillian B. Evans	PO BOX 684 Henderson, NC 27536
John H. Faulkner	215 Crestwood Road Henderson, NC 27536
Plummer Howard	630 Farrar Ave. Henderson, NC 27536

NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2290201 (U-2527)
HENDERSON WESTERN
OUTER LOOP FROM
SR 1128 TO SR 1101
SHEET 41 OF 41 3/16/02

Stream Mitigation Plan
U-2527 Vance County
June 2, 2003

This project involves restoration of approximately 790 m. (2592ft.) of an unnamed tributary to Red Bud Creek. The proposed Western Outer Loop near Henderson is unavoidably impacting Red Bud Creek as well as its tributaries along the proposed alignment. The proposed restoration will be used to mitigate these impacts. The existing stream flows through cut over woods with uncut trees along the stream. The stream has low riffle/ pool sequence and sinuosity. The side slopes are 1:1 in some areas and eroded in pool areas. The existing stream reach is entrenched and most nearly fits the geomorphic characteristics of a G4 stream type (see Morphological Measurement Table). At the confluence of the tributary to Red Bud Creek and the proposed stream, bedrock exist and will prevent any further down cutting at the confluence. With this in mind it is proposed to restore the unnamed tributary to its original dimension, pattern, and profile to the extent practicable by installing grade control structures in a riffle pool sequence at the confluence thus exposing the tributary to its original floodplain.

The drainage area contributing to the project site is 0.16 sq.mi. The drainage area for the proposed restoration for the most part lies between the main tributary to the north, NCSR 1101 to the south, and approximately 2000 feet east of the proposed outer loop. This drainage basin is totally wooded and cut over for the most part. Currently there is no development in the basin. Development in the future would encompass approximately 10 to 15 percent of the drainage basin. The stream extends approximately 1200 feet upstream of the site.

As stated above the existing stream is entrenched. Morphological data was difficult to collect on the existing stream but was attempted and is shown on the Morphological Measurement Table. Pebble counts were conducted at two locations and the D50 size material was approximately 0.031 inches (.79 mm). The bankfull depth and width were determined for the existing stream so that a bankfull discharge could be developed for design purposes.

The reference stream for the proposed project is Sandy Creek near Malancton in Randolph County (see attached location map). The drainage area for Sandy Creek is 0.97 sq.mi. Morphological ratios from the reference stream in conjunction with natural stream design techniques from the Applied River Morphology book by Dave Rosgen and bankfull depth from the existing stream were used to extrapolate pertinent data to the proposed stream. Sandy Creek best fits the geomorphic characteristics of an E4 stream type (see Morphological Measurement Table).

The proposed stream reach has a drainage area of 0.16 sq.mi. and will be 791m (2595ft.) long. The width/depth ratio was adjusted to 10.42 so that the stream could be constructed as a E4 stream type. Bed material from the existing stream will be removed, stockpiled and placed on the riffles of the proposed stream (see plan for location.). Shear

calculations indicate that the bed material will need to be supplemented with rock to increase the d50 size material such that the calculated shear is slightly higher than the permissible shear for the bed. This will insure motion of the bed load and reduce the possibility of degrading the riffles (see shear calculations).

Sediment Transport:

The following is a summary of the shear stress and stream power for the proposed stream restoration.

The shear calculations come from the HYCHL program in the FHWA Integrated Drainage Design Computer System, Version 6.0 (HYDRAIN). HYCHL can analyze channels for stability through application of tractive force theory. The program compares shear exerted on the lining with the permissible shear stress of the lining. HYCHL can analyze composite linings (i.e. a bed lining and a side slope lining). Attached are the results calculated by HYCHL for the proposed stream having a natural cobble bed liner (d50=1.0in.) and vegetative side slope lining. The results were determined for the proposed bankfull elevation. The results indicate a stable side slope lining and an unstable bed lining for the stockpiled bed material (d50=0.031in.). It would take a d50 = 4.0in to increase the permissible shear to slightly less than the bed shear.

Stream power in lb/ft-s is given by the equation $\omega = \tau V$, where: τ is the average channel shear stress in lb/ft² given by HYCHL.

	<u>STREAM POWER</u>	<u>BED SHEAR</u>	<u>SIDE SHEAR</u>	<u>PERMISSIBLE SHEAR</u>	
				Bed	Side
D50 = 0.031in	1.1	1.34	1.07	0.33	2.10
D50 = 4.0in	1.1	1.47	1.15	1.34	2.10

```

JOB U-2527 FIRST ORDER TRIBUTARY
UNI 0
** UNITS PARAMETER = 0 (ENGLISH)
   CHL 0.0162 27
   TRP 4 2
** LEFT SIDE SLOPE      2.0 AND RIGHT SIDE SLOPE      2.0
** THE BASE WIDTH OF THE TRAPEZOID (ft)      4.00
   N .055 .08
** LOW FLOW N VALUE= .055
** SIDE SLOPE N VALUE= .080
   LRR .333
** D50' (ft)      .33
   CPS .25
   LVG B
   PSS 1.34 2.10
** USER SUPPLIED - LOW PERMIS. SHEAR = (lb/ft^2)      1.34
** USER SUPPLIED - HIGH PERMIS. SHEAR = (lb/ft^2)      2.10
   END
*****END OF COMMAND FILE*****

```

U-2527 FIRST ORDER TRIBUTARY

INPUT REVIEW

```

DEFAULT ANGLE OF REPOSE (degrees):      40.96
DESIGN PARAMETERS:
  DESIGN DISCHARGE (ft^3/s):      27.00
  CHANNEL SHAPE:      TRAPEZOIDAL
  CHANNEL SLOPE (ft/ft):      .016
  LINING TRANSITION HEIGHT (ft):      .25

```

HYDRAULIC CALCULATIONS USING NORMAL DEPTH

	DESIGN	MAXIMUM
FLOW (cfs)	27.00	22.76
DEPTH (ft)	1.46	1.33
AREA (ft^2)	10.06	8.82
WETTED PERIMETER (ft)	10.51	9.93
HYDRAULIC RADIUS (ft)	.96	.89
VELOCITY (ft/s)	2.68	2.58
MANNINGS N (LOW FLOW)	.055	.055
MANNINGS N (SIDE SLOPE)	.080	.080
EFFECTIVE MANNINGS N	.068	.068
REYNOLDS NUMBER (10^5)	.22	

STABILITY ANALYSIS

CONDITION	LINING TYPE	PERMIS SHR (lb/ft^2)	CALC. SHR (lb/ft^2)	STAB. FACTOR	REMARKS
LOW FLOW LINING					
BOTTOM; STRAIGHT	RIPRAP	1.34	1.47	.91	UNSTABLE
SIDE SLOPE LINING					
SIDE; STRAIGHT	VEGETATIVE B	2.10	1.13	1.85	STABLE

RATIO OF SIDE SHEAR TO BOTTOM SHEAR = .77

*** NORMAL END OF HCHL ***

```

JOB U-2527 FIRST ORDER TRIBUTARY
UNI 0
** UNITS PARAMETER = 0 (ENGLISH)
   CHL 0.0162 27
   TRP 4 2
** LEFT SIDE SLOPE 2.0 AND RIGHT SIDE SLOPE 2.0
** THE BASE WIDTH OF THE TRAPEZOID (ft) 4.00
   N .03 .08
** LOW FLOW N VALUE= .030
** SIDE SLOPE N VALUE= .080
   LRR .003
** D50 (ft) .00
   CPS .25
   LVG B
   PSS .33 2.10
** USER SUPPLIED - LOW PERMIS. SHEAR = (lb/ft^2) .33
** USER SUPPLIED - HIGH PERMIS. SHEAR = (lb/ft^2) 2.10
END
*****END OF COMMAND FILE*****
  
```

U-2527 FIRST ORDER TRIBUTARY

 INPUT REVIEW

```

DEFAULT ANGLE OF REPOSE (degrees): 33.98
DESIGN PARAMETERS:
  DESIGN DISCHARGE (ft^3/s): 27.00
  CHANNEL SHAPE: TRAPEZOIDAL
  CHANNEL SLOPE (ft/ft): .016
  LINING TRANSITION HEIGHT (ft): .25
  
```

 HYDRAULIC CALCULATIONS USING NORMAL DEPTH

	DESIGN	MAXIMUM
FLOW (cfs)	27.00	3.59
DEPTH (ft)	1.33	.33
AREA (ft^2)	8.82	1.52
WETTED PERIMETER (ft)	9.93	5.46
HYDRAULIC RADIUS (ft)	.89	.28
VELOCITY (ft/s)	3.06	2.37
MANNINGS N (LOW FLOW)	.030	.030
MANNINGS N (SIDE SLOPE)	.080	.080
EFFECTIVE MANNINGS N	.057	.034
REYNOLDS NUMBER (10^5)	.00	

 STABILITY ANALYSIS

CONDITION	LINING TYPE	PERMIS SHR (lb/ft^2)	CALC. SHR (lb/ft^2)	STAB. FACTOR	REMARKS
LOW FLOW LINING					
BOTTOM; STRAIGHT	RIPRAP	.33	1.34	.25	UNSTABLE
SIDE SLOPE LINING					
SIDE; STRAIGHT	VEGETATIVE B	2.10	1.03	2.03	STABLE

RATIO OF SIDE SHEAR TO BOTTOM SHEAR = .77

*** NORMAL END OF HYCHL ***

<i>Variables</i>	<i>Existing Channel</i>	<i>Proposed Reach</i>	<i>USGS Station</i>	<i>Reference Reach</i>
1. Stream type	G4	E4	NONE	E4
2. Drainage area (D.A.) (ac.)	102.5 ac.	102.5 ac.		620.4 ac.
3. Bankfull width (W_{bkt}) (ft.)	5.26 ft.	8.23 ft.		12.1 ft.
4. Bankfull mean depth (d_{bkt}) (ft.)	1.04 ft.	0.79 ft.		1.4 ft.
5. Width/depth ratio (W_{bkt}/d_{bkt})	5.06	10.42		8.5
6. Bankfull cross-sectional area (A_{bkt}) (ft ²)	5.47 ft ²	6.47		17.3 ft ²
7. Bankfull mean velocity (V_{bkt}) (ft/s)	4.84 ft/s	4.18		4.1 ft/s
8. Bankfull discharge (Q_{bkt}) (ft ³ /s)	26.50 ft ³ /s	27		70.0 ft ³ /s
9. Bankfull max depth (d_{mbkt}) (ft)	1.47 ft.	1.06		2.1 ft
10. Width of floodprone area (W_{fpa}) (ft)	2.95 ft.	20.58 ft.		80.0 ft
11. Entrenchment ratio (W_{fpa}/W_{bkt})	0.56	2.5		6.6
12. Meander length (L_m) (ft)	62.57 ft.	65.10 ft.		75.5 ft
13. Ratio of meander length to bankfull width (L_m/W_{bkt})	11.90	7.91		6.3
14. Radius of curvature (R_c) (ft)	8.04 ft.	18 ft.		26.0 ft
15. Ratio of radius of curvature to bankfull width (R_c/W_{bkt})	1.53	2.2		2.2
16. Belt width (W_{bit}) (ft)	26.02 ft.	24.48 ft.		40.0 ft
17. Meander width ratio (W_{bit}/W_{bkt})	4.95	2.97		3.3
18. Sinuosity (stream length/valley length) (K)	1.35	1.18		1.35
19. Valley Slope (VS)	.0196	.0191		0.0043
20. Average slope (CS)	.0145	.0162		0.0058
21. Pool slope	.0142	.005		0.0026
22. Ratio of pool slope to average slope	.01	.31		0.45
23. Maximum pool depth (dp_{max}) (ft)	1.80 ft.	1.80		3.0 ft
24. Ratio of pool depth to average bankfull depth (dp/d_{bkt})	1.73	2.28		2.1
25. Pool width (W_p) (ft)	3.29 ft.	10.80 ft.		9.5 ft
26. Ratio of pool width to bankfull width	.63	1.31		0.79
27. Pool to pool spacing (ft)	23.83 ft.	36.30		75.1 ft
28. Ratio of pool to pool spacing to bankfull width	4.53	4.41		6.3
29. Ratio of lowest bank height to bankfull height (or max bankfull depth) (BH_{low}/d_{mbkt})	1.00	1.00		1.0

NATURAL CHANNEL DESIGN DATA
MORPHOLOGICAL MEASUREMENT
TABLE (ENGLISH UNITS)

SITE 1

* Reference reach is a tributary to Sandy Creek near Malancton in Randolph County, NC.

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2390201 (U-2527)

June 2, 2003
SHEET __ OF __

Pebble Count

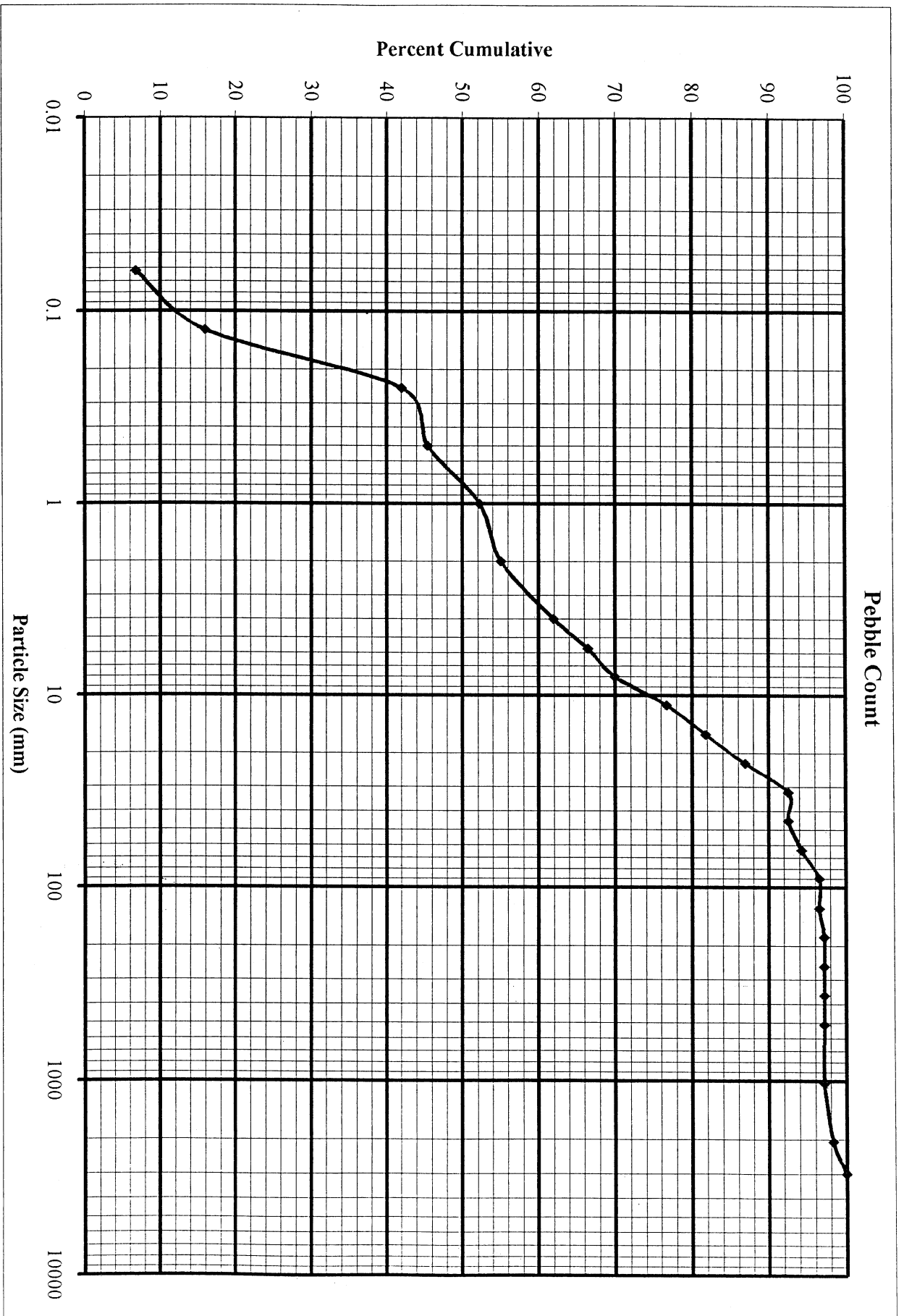
Project: 8.2390201
 TIP No.: U-2527
 Comm. No.: _____

Sheet # 5 of 6

Pebble Count

	Particle	mm	PARTICLE COUNT			Total #	Item %	% Cum.
			1	2	3			
	Silt/Clay	<.062	11	1		12	6.8	6.8
(Sand)	Very Fine	.062-.125	15	1		16	9.1	15.9
	Fine	.125-.25	14	32		46	26.1	42.0
	Medium	.25-.50	6			6	3.4	45.5
	Coarse	.50-1.0	2	10		12	6.8	52.3
	Very Coarse	1.0-2	4	1		5	2.8	55.1
(Gravel)	Very Fine	2.0-4.0	4	8		12	6.8	61.9
	Fine	4.0-5.7	3	5		8	4.5	66.5
	Fine	5.7-8.0	3	3		6	3.4	69.9
	Medium	8.0-11.3	3	9		12	6.8	76.7
	Medium	11.3-16.0	5	4		9	5.1	81.8
	Coarse	16.0-22.6	9			9	5.1	86.9
	Coarse	22.6-32.0	10			10	5.7	92.6
	Very Coarse	32-45				0	0.0	92.6
	Very Coarse	45-64	3			3	1.7	94.3
(Cobble)	Small	64-90	4			4	2.3	96.6
	Small	90-128				0	0.0	96.6
	Large	128-180	1			1	0.6	97.2
	Large	180-256				0	0.0	97.2
(Boulder)	Small	256-362				0	0.0	97.2
	Small	362-512				0	0.0	97.2
	Medium	512-1024				0	0.0	97.2
	Lg-Very Lg	1024-2048	2			2	1.1	98.3
(Bedrock)			3			3	1.7	100.0
TOTALS						176		100.0

D ₁₆ :	<u>0.13</u>	mm	Sand & <	<u>55</u>	%
D ₃₅ :	<u>0.21</u>	mm	Gravel	<u>39</u>	%
D ₅₀ :	<u>0.79</u>	mm	Cobble	<u>3</u>	%
D ₈₄ :	<u>18.57</u>	mm	Boulder	<u>1</u>	%
D ₉₅ :	<u>71.0</u>	mm	Bedrock	<u>2</u>	%



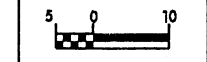
REVISIONS



PROJECT REFERENCE NO. U-2527 SHEET NO. 12

R/W SHEET NO.

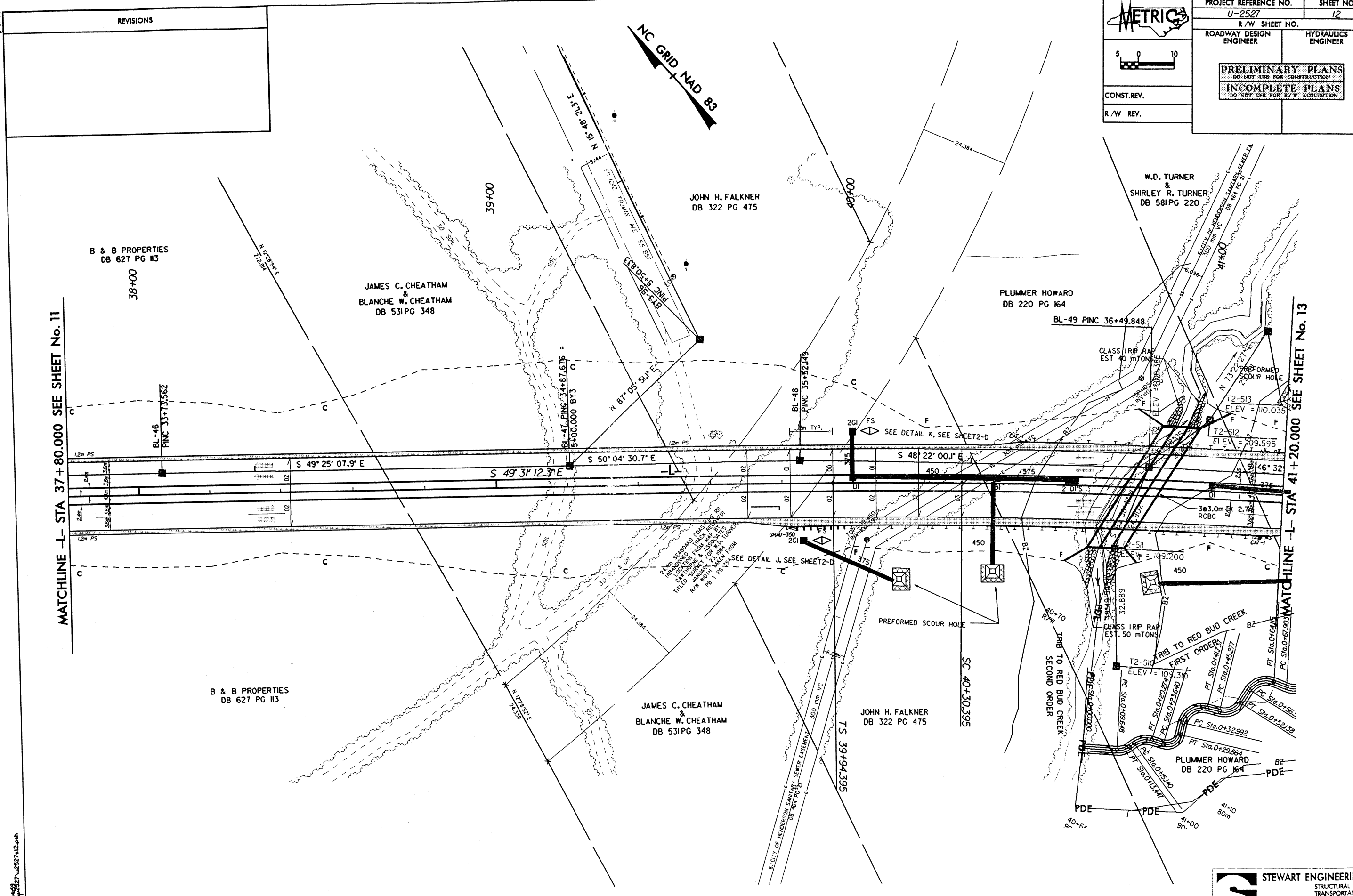
ROADWAY DESIGN ENGINEER HYDRAULICS ENGINEER



CONST. REV.

R/W REV.

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION



SEE SHEETS 22 & 23 FOR -L- PROFILE

4-18K-0003 1459
11/20/27 U-2527-12.dwg

STEWART ENGINEERING
STRUCTURAL
TRANSPORTATION
CIVIL

P.O. BOX 12264 RESEARCH TRIANGLE PARK, NC 27709
TEL 919.380.8750 FAX 919.380.8752

REVISIONS

-L-		
PIs Sta 40+18.395	PI Sta 42+87.268	PIs Sta 45+52.770
$\theta_s = 0^\circ 33' 60.0''$	$\Delta = 16^\circ 04' 02.0''$ (LT)	$\theta_s = 0^\circ 33' 60.0''$
$L_s = 36.000$	$L = 510.376$	$L_s = 36.000$
$LT = 24.000$	$T = 256.873$	$LT = 24.000$
$ST = 12.000$	$R = 1820.000$	$ST = 12.000$
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	$DS = 100 \text{ km/h}$	

METRIC

PROJECT REFERENCE NO. U-2527 SHEET NO. 13

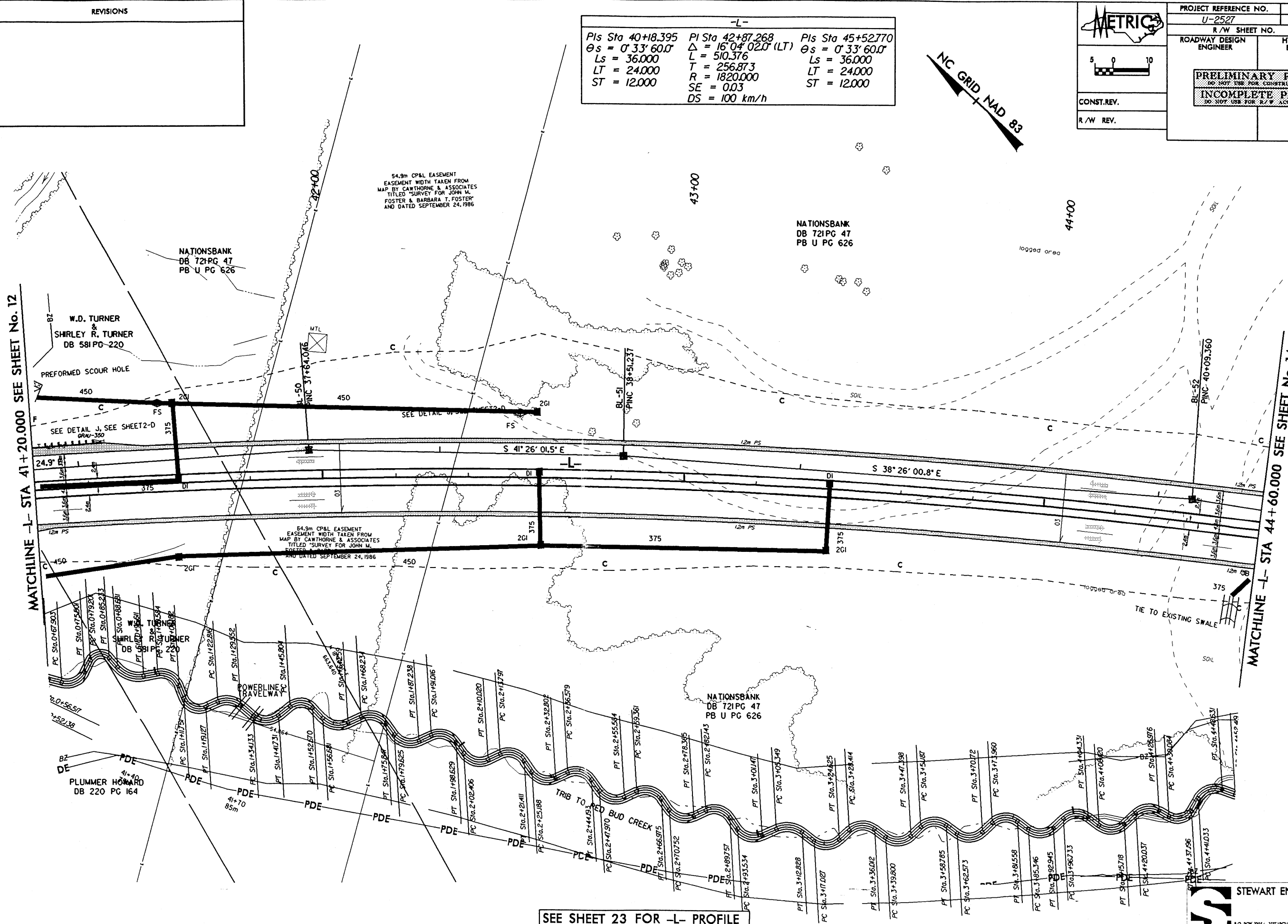
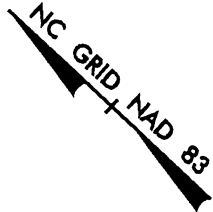
R/W SHEET NO.

ROADWAY DESIGN ENGINEER HYDRAULICS ENGINEER

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

CONST. REV.

R/W REV.



04-JUN-2003 10:50 AM
U-2527-2327-13204

SEE SHEET 23 FOR -L- PROFILE

STEWART ENGINEERING
STRUCTURAL
TRANSPORTATION
CIVIL

P.O. BOX 12054 RESEARCH TRIANGLE PARK, NC 27709
TEL 919.380.8750 FAX 919.380.8752

06/01/97

REVISIONS

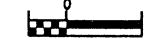


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14 R/W SHEET NO.

ROADWAY DESIGN ENGINEER

HYDRAULICS ENGINEER

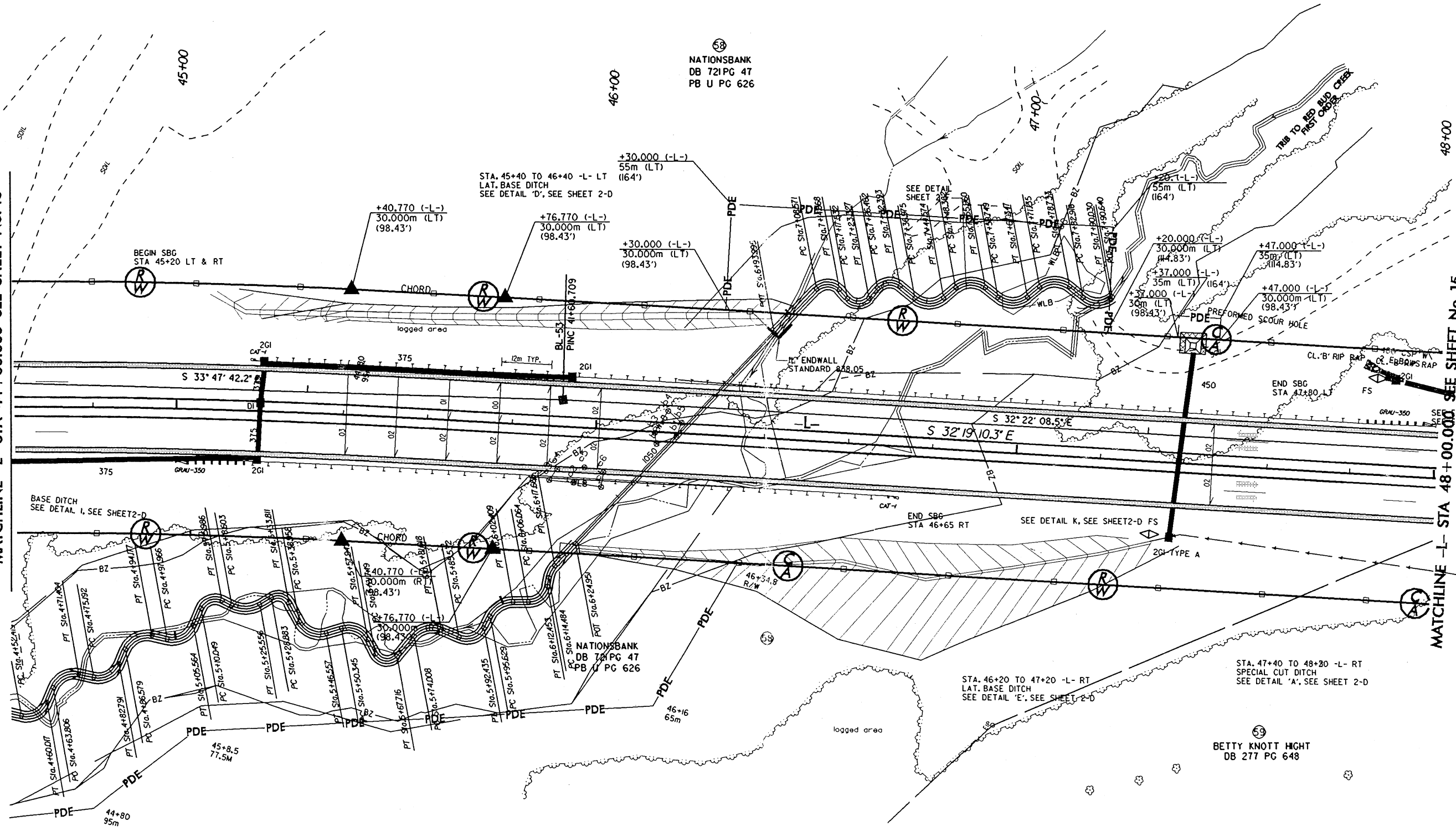


CONST. REV.

R/W REV.

MATCHLINE -L- STA 44 + 60.000 SEE SHEET No. 13

MATCHLINE -L- STA 48 + 00.000 SEE SHEET No. 15



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04-APR-2003 5:49 PM
04-APR-2003 5:49 PM

SEE SHEETS 23 & 24 FOR -L- PROFILE

STEWART ENGINEERING
 STRUCTURAL
 TRANSPORTATION
 CIVIL
 P.O. BOX 2054 RESEARCH TRIANGLE PARK, NC 27709
 TEL 919.380.8750 FAX 919.380.8752

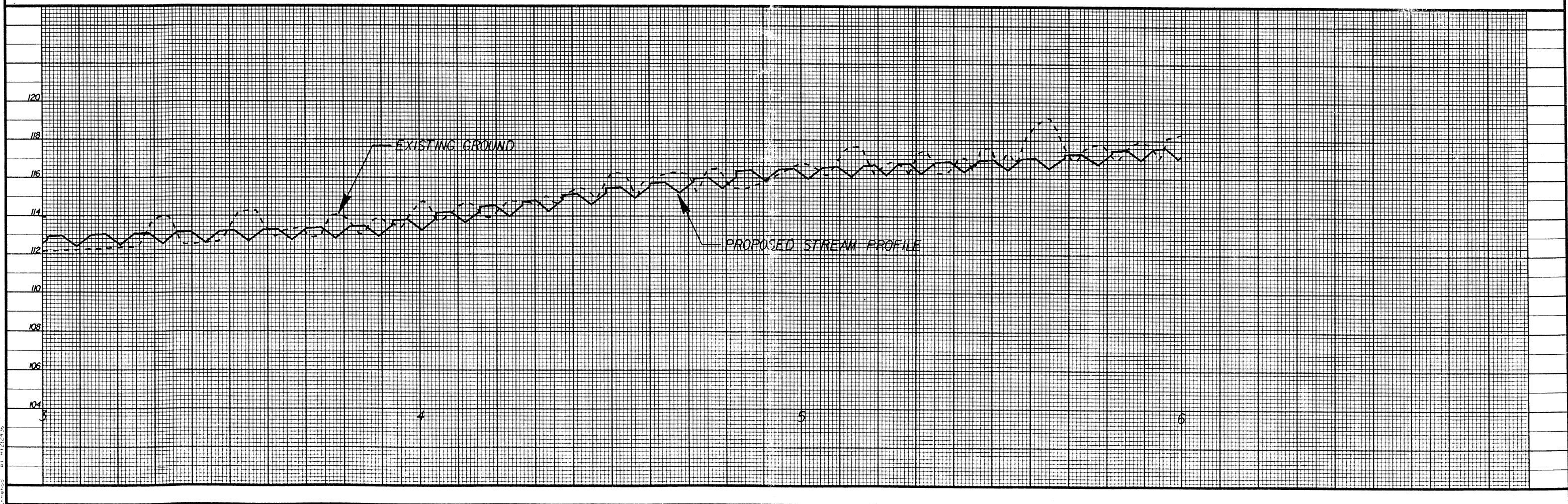
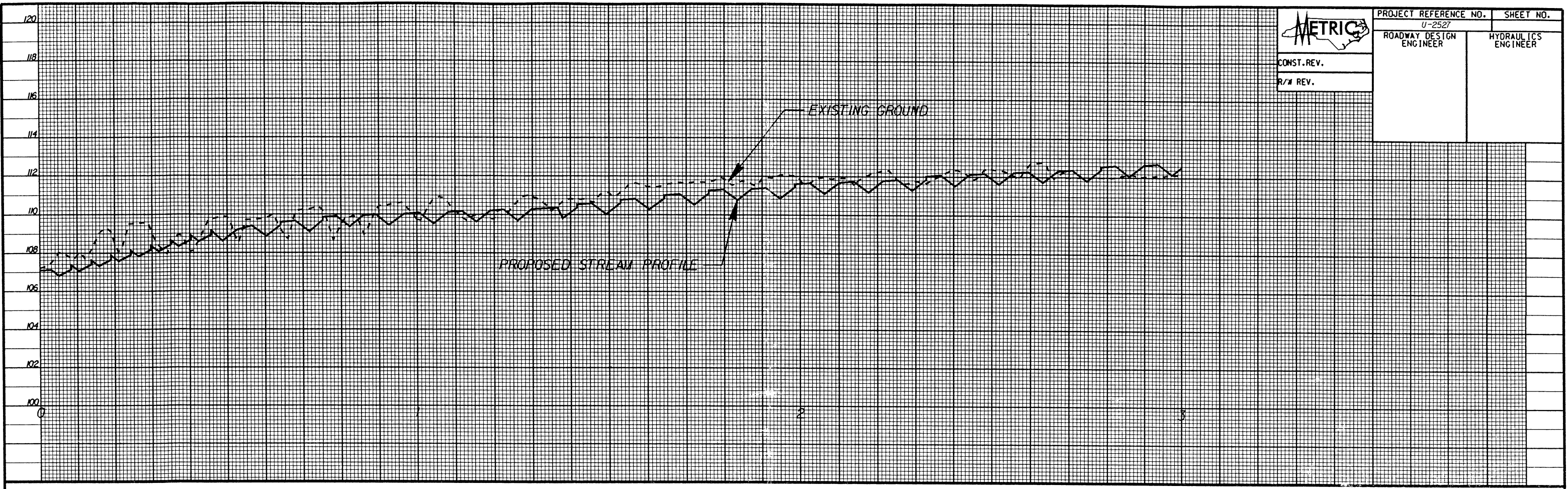
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PROJECT REFERENCE NO. U-2527	SHEET NO.
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

CONST. REV.

R/W REV.



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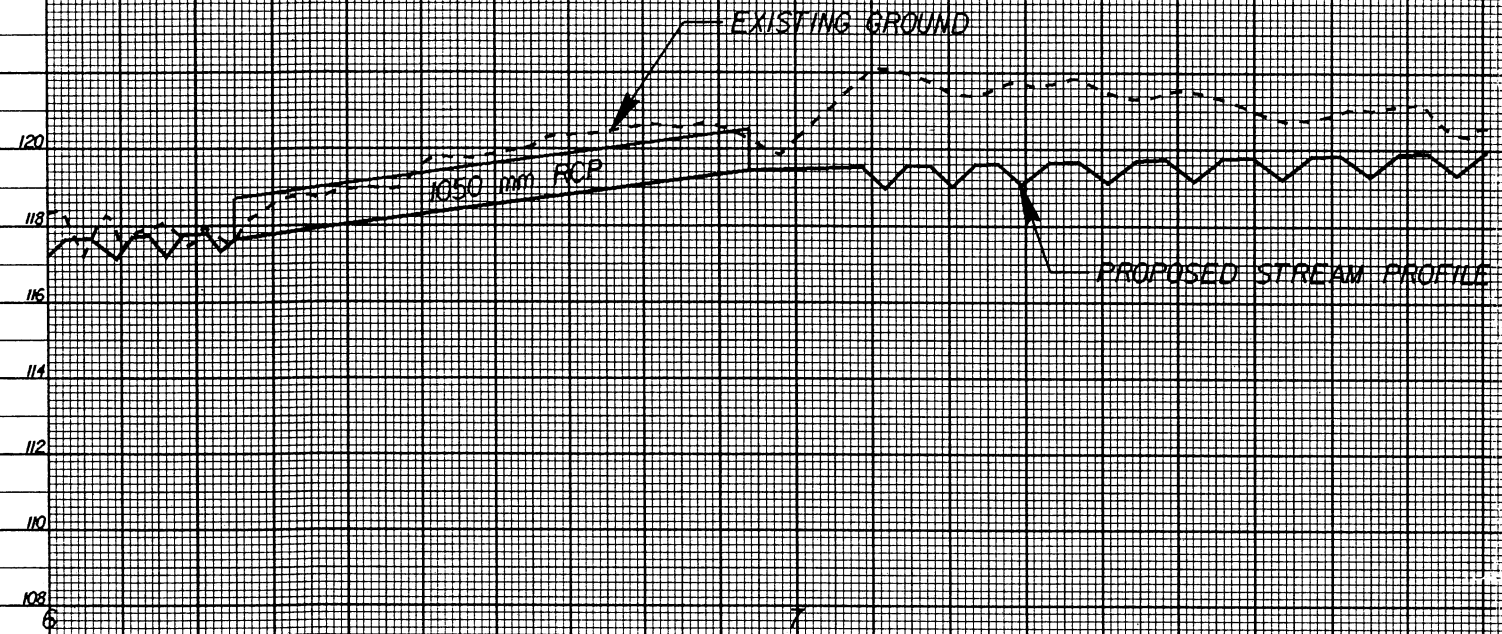


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U-2527
ROADWAY DESIGN ENGINEER HYDRAULICS ENGINEER

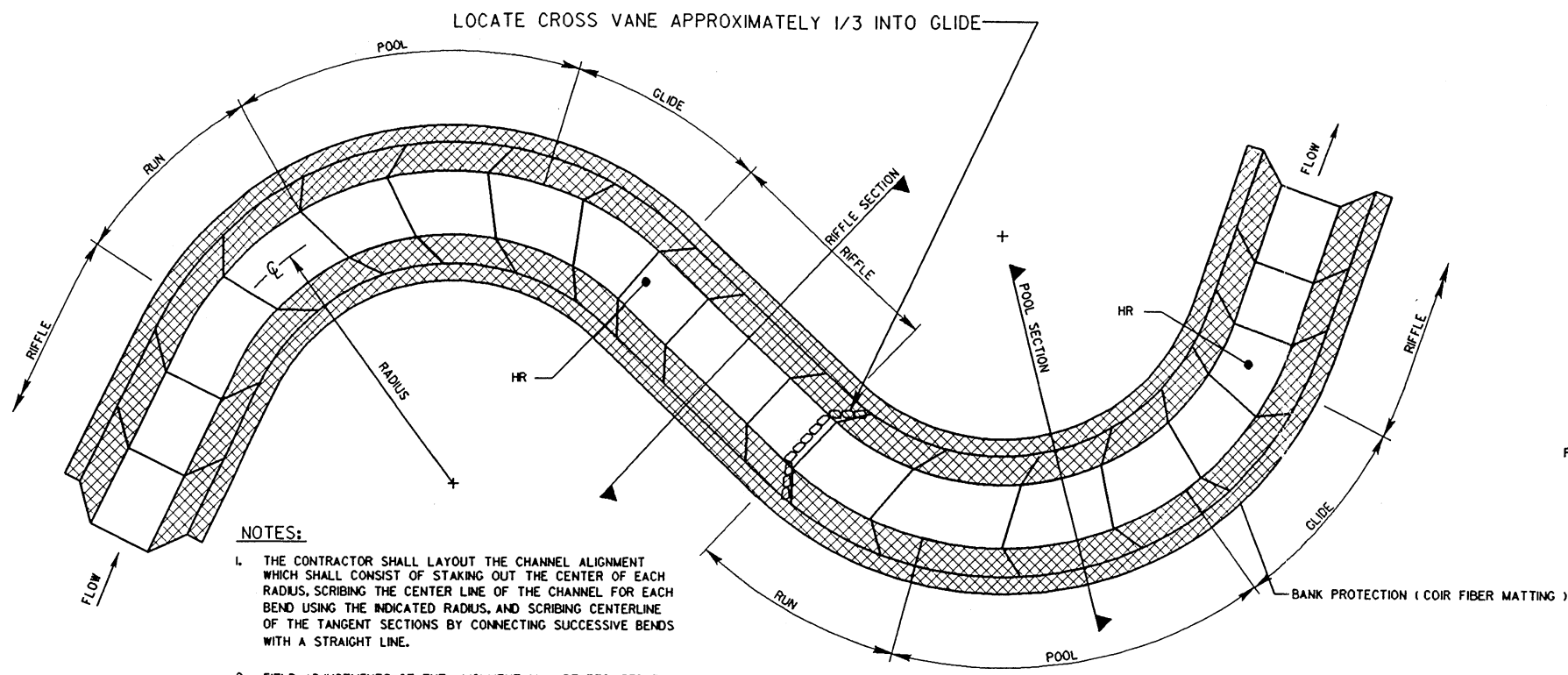
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R/W REV.



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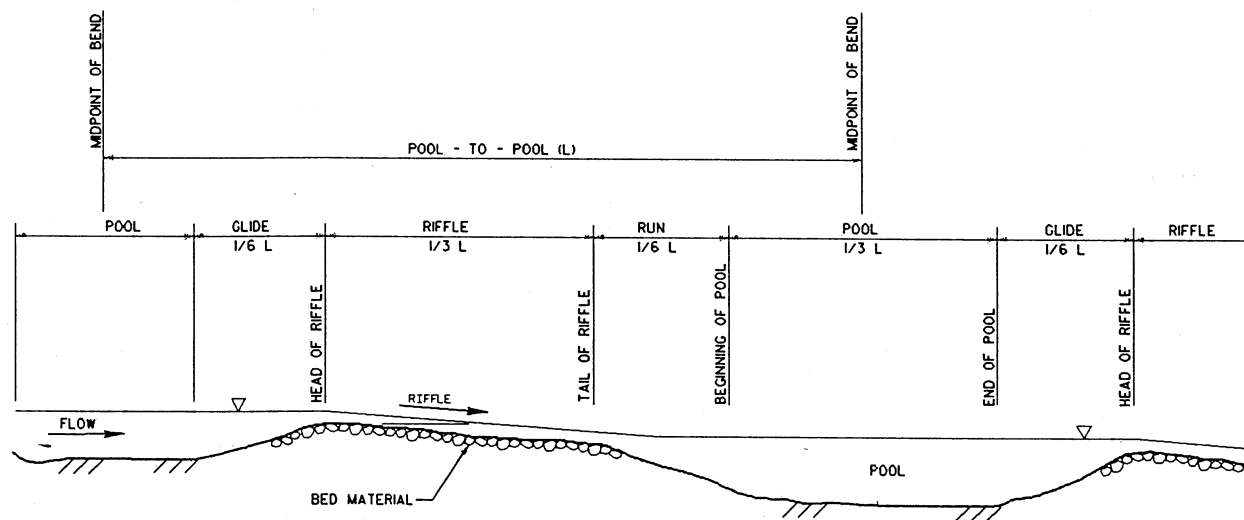


NOTES:

1. THE CONTRACTOR SHALL LAYOUT THE CHANNEL ALIGNMENT WHICH SHALL CONSIST OF STAKING OUT THE CENTER OF EACH RADIUS, SCRIBING THE CENTER LINE OF THE CHANNEL FOR EACH BEND USING THE INDICATED RADIUS, AND SCRIBING CENTERLINE OF THE TANGENT SECTIONS BY CONNECTING SUCCESSIVE BENDS WITH A STRAIGHT LINE.
2. FIELD ADJUSTMENTS OF THE ALIGNMENT MAY BE REQUIRED TO AVOID CERTAIN OBSTACLES. APPROVAL BY THE ENGINEER OF THE STAKE-OUT ALIGNMENT SHALL BE REQUIRED PRIOR TO INITIATION OF THE CONSTRUCTION OF THE CHANNEL.
3. LOCATE ROCK VANES ACCORDING TO PLAN SHEET.

TYPICAL PLAN

NOT TO SCALE

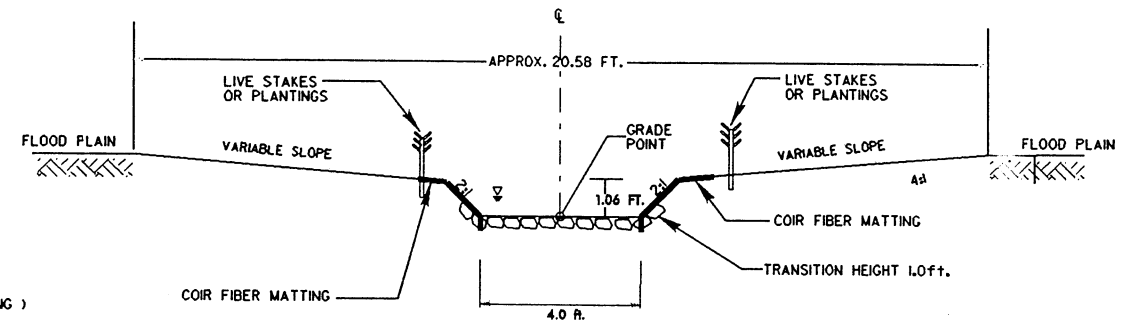


NOTES:

1. THE POOL TO POOL SPACING (L) SHALL BE MEASURED AS THE DISTANCE FROM THE MIDPOINT OF THE UPSTREAM BEND TO THE MIDPOINT OF THE DOWNSTREAM BEND.
2. REFER TO MORPHOLOGICAL MEASUREMENT TABLE AND PLAN SHEET FOR DIMENSIONS. NOTE THAT POOL TO POOL SPACING VARIES.

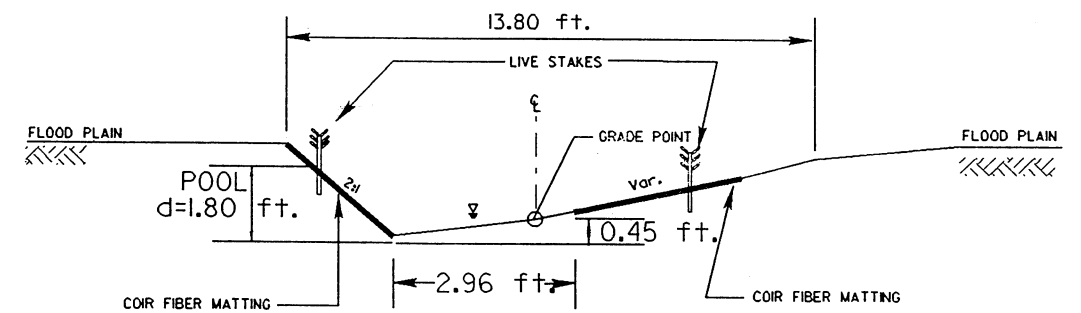
TYPICAL PROFILE

NOT TO SCALE



TYPICAL RIFFLE SECTION

NOT TO SCALE



TYPICAL POOL SECTION

NOT TO SCALE

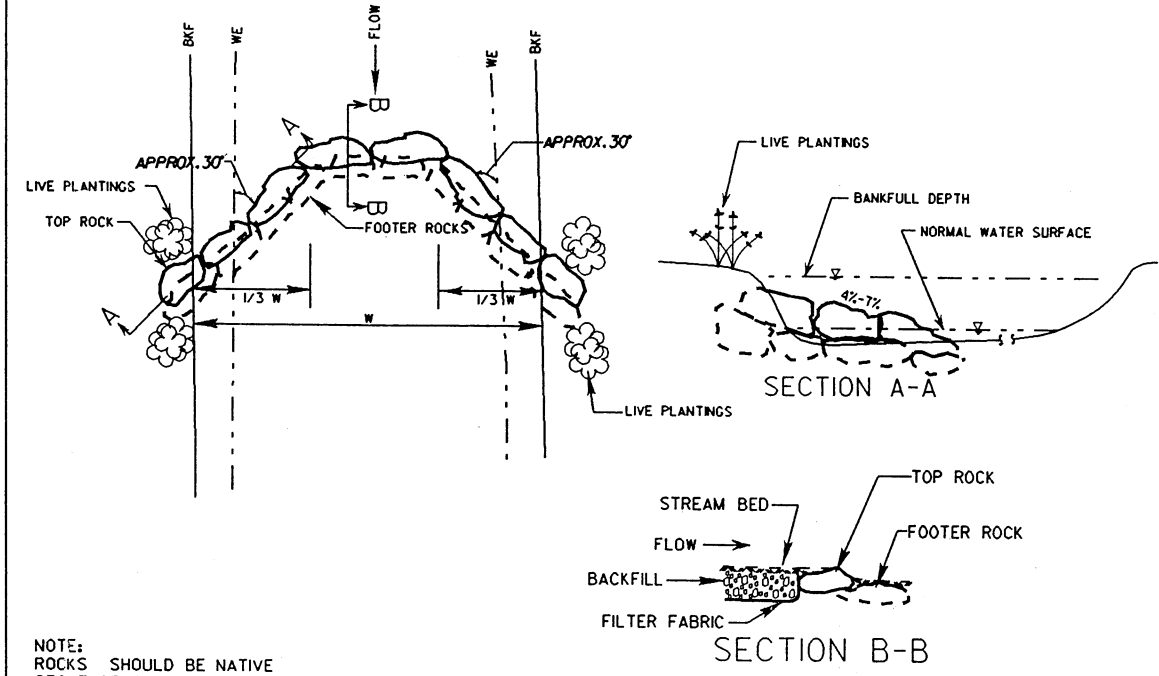
MORPHOLOGICAL MEASUREMENT TABLE

VARIABLES	EXISTING CHANNEL	PROPOSED REACH 1	PROPOSED REACH 2	REFERENCE REACH 3
1 STREAM TYPE	G4	E4	NONE	E4
2 DRAINAGE AREA	0.16sq.m	0.16sq.m		0.97sq.m
3 BANKFULL WIDTH	5.25ft	8.23ft		12.1ft
4 BANKFULL MEAN DEPTH	1.04ft	0.79ft		1.4ft
5 WIDTH/DEPTH RATIO	5.06	10.42		8.50
6 BANKFULL CROSS-SECTIONAL AREA	5.47sq.ft	6.47sq.ft		17.3sq.ft
7 BANKFULL MEAN VELOCITY	4.84fps	4.18fps		4.1fps
8 BANKFULL DISCHARGE	26.50cfs	27cfs		70cfs
9 BANKFULL MAX DEPTH	1.47ft	1.06ft		2.1ft
10 WIDTH OF FLOODPRONE AREA	2.95ft	20.58ft		80ft
11 ENTRENCHMENT RATIO	0.56	2.5		6.6
12 MEANDER LENGTH	62.57ft	65.10ft		75.5ft
13 RATIO OF MEANDER LENGTH TO BANKFULL WIDTH	11.90	7.91		6.30
14 RADIUS OF CURVATURE	8.04ft	18ft		26ft
15 RATIO OF RADIUS OF CURVATURE TO BANKFULL WIDTH	1.53	2.2		2.2
16 BELT WIDTH	26.02ft	24.48ft		40ft
17 MEANDER WIDTH RATIO	4.95	2.97		3.3
18 MEANDER WIDTH RATIO TO VALLEY LENGTH	1.35	1.18		1.35
19 VALLEY SLOPE	0.0196	0.0191		0.0043
20 AVERAGE SLOPE	0.0145	0.0162		0.0058
21 POOL SLOPE	0.042	0.005		0.0026
22 RATIO OF POOL SLOPE TO AVERAGE SLOPE	.01	0.31		0.45
23 MAXIMUM POOL DEPTH	1.80ft	1.80ft		3.0ft
24 FEET OF POOL DEPTH TO AVERAGE BANKFULL DEPTH	1.73	2.28		2.1
25 POOL WIDTH	3.29ft	10.80ft		9.5ft
26 RATIO OF POOL WIDTH TO BANKFULL WIDTH	.63	1.31		0.79
27 POOL TO POOL SPACING	23.83ft	36.30ft		75.10ft
28 RATIO OF POOL TO POOL SPACING TO BANKFULL WIDTH	4.53	4.41		6.3
29 RATIO OF LOWEST BANK HEIGHT TO BANKFULL HEIGHT	1.8	1.0		1.0

NCDOT
DIVISION OF HIGHWAYS
VANCE COUNTY
PROJECT: 8.2390201 (U-2527)
WESTERN OUTER LOOP OF HENDERSON
FROM SR 1128 (RUIN CREEK ROAD) TO
SR 1101 (OLD COUNTY HOME ROAD)

ROCK CROSS VANE

(NOT TO SCALE)



NOTE:
 ROCKS SHOULD BE NATIVE
 STONE OR SHOT ROCK, ANGULAR AND OBLONG WITH
 AXIS APPROXIMATELY 3'Lx2'Wx1'D.

NCDOT
 DIVISION OF HIGHWAYS
 VANCE COUNTY
 PROJECT: 8.2390201 (U-2527)
 WESTERN OUTER LOOP OF HENDERSON
 FROM SR 1128 (RUIN CREEK ROAD) TO
 SR 1101 (OLD COUNTY HOME ROAD)

SHEET OF

06 / 05 / 03