STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

December 10, 2007

MEMORANDUM TO: Mr. Wally J. Bowman, PE
Division Five Engineer

FROM: Philip S. Harris, III, P.E., Unit Head
Natural Environment Unit
Project Development and Environmental Analysis Branch

SUBJECT: Wake County, NC Bypass from US 1 to Thompson Mill Road; T.I.P. Number R-2809 A; Federal Aid Project No. STP-98(1); State Project No. 8.1402501

Attached are the modifications to the U. S. Army Corps of Engineers Individual 404, the special conditions for the 401 Water Quality Certification and the 401 Buffer Authorization for the above referenced project. All environmental permits have been received for the construction of this project.

PSH/gyb

Attachment

Cc:

Mr. Majed Alghandour, P. E., Programming and TIP
Mr. Jay Bennett, P.E., Roadway Design
Dr. David Chang, P.E., Hydraulics
Mr. Randy Garris, P.E. State Contract Officer
Mr. Art McMillan, P.E., Highway Design
Mr. Greg Perfetti, P.E., Structure Design
Mr. Mark Staley, Roadside Environmental
Mr. John F. Sullivan, FHWA
Mr. Eric Midkiff, P.E., PDEA Central Region Unit Head
Mr. Chris Murray, Division Environmental Officer

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS
1598 MAIL SERVICE CENTER
RALEIGH NC 27699-1598

TELEPHONE: 919-733-3141
FAX: 919-715-1501
WEBSITE: WWW.DOH.DOT.STATE.NC.US

LOCATION:
TRANSPORTATION BUILDING
1 SOUTH WILMINGTON STREET
RALEIGH NC

PROJECT COMMITMENTS

NC 98 Bypass from US 1 to Thompson Mill Road
Wake Forest, Wake County
Federal Aid No. STP-98(1)
State Project No. 8.1402501
TIP No. R-2809A

In addition to Section 404 Individual Permit General Conditions and Section 401 Water Quality Conditions the following special commitments have been agreed to by NCDOT:

Commitments Developed Through Project Development and Design

All standard procedures and measures, including Best Management Practices for the Protection of Surface Waters and Sedimentation, will be implemented to avoid or minimize environmental impacts.

Roadway Design Unit and Hydraulics Unit

Hazardous spill catch basins which are warranted on this project will be installed in accordance with the criteria set forth in Mr. Dorney's (DEM) 5/22/95 memorandum: Streams classified as Outstanding Resource Waters (ORW) or WS-I: and streams within ½ mile of the critical areas in streams classified as WS-II, WS-III or WS-IV. Final determination will be made during final design.

After reviewing the criteria for installation of hazardous spill catch basins during final design, it was determined that these basins were not warranted and will not be constructed. Retention basins will be installed per the Neuse River Riparian Buffer Rules.

Roadway Design Unit and Right of Way Branch

NCDOT will not acquire any right of from the Purefoy-Dunn plantation as currently listed on the National Register until the Keeper of the National Register has approved the requested boundary revision.

No right of way was acquired from the Perefoy-Dunn plantation during the acquisition of right-of-way for this project.

PDEA

Impacts to Waters of the U.S. will be in the form of wetlands and surface water impacts at stream crossings. These impacts require an Department of the Army Section 404 Individual Permit, as well as an Individual Section 401 Water Quality Certification from the NC Division of Water Quality.

Commitments Developed Through Permitting

Division 5 Construction

Within 270 days from the date of this permit modification, the permitee shall complete the restoration of the temporary stream and wetland impacts at Site 5 in Section C (Station 85+20 –L-Lt), as shown in the revised construction plans for Section C at Buffer Sites 4 and 5, in the September 10, 2007 permit modification application.

PDEA-Natural Environment Unit

Compensatory mitigation for the unavoidable impacts to 0.01 acre of non-riparian wetlands, and 95 linear feet of stream associated with Section A of the proposed project shall be provided by the Ecosystem Enhancement Program (EEP), as outlined in the letter dated August 29, 2007 from William D. Gilmore, EEP Director. Pursuant to the EEP Memorandum of Agreement (MOA) between the State of North Carolina and the US Army Corp of Engineers signed on July 22, 2003, the EEP will provide 0.02 acre of restoration equivalent non-riparian wetlands, and 190 linear feet of restoration equivalent warm water stream channel in the Neuse River basin (Hydrological Cataloging Unit 03020201) by one year in the form of restoration. The NCDOT shall, within 30 days of the issue date of this permit, certify that sufficient funds have been provided to the EEP to complete the required mitigation, pursuant to Paragraph V. of the MOA.

Compensatory mitigation for impacts to 7,556 square feet of protected riparian buffers in Zone 1 and 4,198 square feet of protected riparian buffers in Zone 2 shall be required at the following rates:

Zone of Impact	Impacts (Square Feet)	Replacement Ratio	Total Square Feet of Mitigation Required
Zone 1	7,556	3:1	22,668
Zone 2	4,198	1.5:1	6,297
Total	**11,754**		**28,965**

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1890
WILMINGTON, NORTH CAROLINA 28402-1890

IN REPLY REFER TO

November 29, 2007

Regulatory Division

SUBJECT: Action ID 2007-03114-292; TIP No. R-2809

Gregory J. Thorpe, Ph.D.
Environmental Management Director, PDEA
N.C. Department of Transportation
1598 Mail Service Center
Raleigh, NC 27699-1598

Dear Dr. Thorpe:

Reference the Department of the Army (DA) permit issued on April 4, 2002, and subsequently modified, to authorize the discharge of dredged and fill material into the waters of United States, for construction of Sections A, B, and C of the NC 98 Wake Forest Bypass (T.I.P.No. R-2809), located generally south of Wake Forest, in Wake County, North Carolina. Reference also your September 10, 2007 letter requesting modification of the permit to authorize additional impacts for Section A of R-2809 based on final design, as well as revised plans for the restoration of the temporary stream and wetland impacts at Site 5 of Section C.

We have reviewed your proposal, issued a public notice for the proposal on October 11, 2007, and have determined that the proposed modification is reasonable and justified. Therefore, the permit is hereby modified to include the revised impacts to an additional 264 linear feet of stream, for total impacts to 354 linear feet of stream and 0.01 acre of wetlands for Section A, as shown on the attached drawings, subject to additional Special Conditions 1) and 2) below.

1) Within 270 days from the date of this permit modification, the permittee shall complete the restoration of the temporary stream and wetland impacts at Site 5 in Section C (Station 85+20 –L- LT), as shown in the revised construction plans for Section C at Buffer Sites 4 and 5, in the September 10, 2007 permit modification application.

2) Compensatory mitigation for the unavoidable impacts to 0.01 acre of non- riparian wetlands, and 95 linear feet of stream associated with Section A of the proposed project shall be provided by the Ecosystem Enhancement Program (EEP), as outlined in the letter dated August 29, 2007 from William D. Gilmore, EEP Director. Pursuant to the EEP Memorandum of Agreement (MOA) between the State of North Carolina and the US Army Corps of Engineers signed on July 22, 2003, the EEP will provide

0.02 acre of restoration equivalent non- riparian wetlands, and 190 linear feet of restoration equivalent warm water stream channel in the Neuse River basin (Hydrologic Cataloging Unit 03020201) by one year of the date of this permit. For wetlands, a minimum of 1:1 (impact to mitigation) must be in the form of wetland restoration. The NCDOT shall, within 30 days of the issue date of this permit, certify that sufficient funds have been provided to EEP to complete the required mitigation, pursuant to Paragraph V. of the MOA.

It is understood that all other conditions of the modified permit, including the extended expiration date of December 31, 2010, remain applicable.

If you have questions, please contact Eric Alsmeyer of the Raleigh Regulatory Field Office, at telephone (919) 876-8441, extension 25.

Sincerely,

S. Kenneth Jolley

for John E. Pulliam, Jr.
Colonel, U.S. Army
District Commander

Copies Furnished:

Mr. Clarence Coleman
Federal Highway Administration
310 New Bern Ave., Rm. 410
Raleigh, North Carolina 27601-1442

Mr. Brian Wrenn
Division of Water Quality
North Carolina Department of
Environment and
Natural Resources
1650 Mail Service Center
Raleigh, NC 27699-1650

Michael F. Easley, Governor
William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Coleen Sullins, Director
Division of Water Quality

October 29, 2007

Feulner

Dr. Greg Thorpe, PhD., Manager
Planning and Environmental Branch
North Carolina Department of Transportation
1548 Mail Service Center
Raleigh, North Carolina, 27699-1548

Subject: Modification to the 401 Water Quality Certification Pursuant to Section 401 of the Federal Clean Water Act and NEUSE BUFFER RULES, with ADDITIONAL CONDITIONS for Proposed construction of NC 98 Bypass in Wake County, Federal Aid Project No. HPSTP-55(12), State Project No. 8.1402501, TIP No. R-2809A & R-2809C, US COE Action ID No. 2007-03114.
DWQ Project No. 20010550 version 7.

Dear Dr. Thorpe:

Attached hereto is a modification of Certification No. 3343 issued to The North Carolina Department of Transportation dated February 4, 2002 and subsequent modifications dated September 25, 2002; October 22, 2003; October 13, 2004; September 30, 2005; and February 28, 2006. This modification is applicable only to the additional proposed activities in Section A and proposed modification in Section C. All the authorized activities and conditions of certification associated with the original Water Quality Certification and subsequent modifications still apply except where superceded by this certification.

If we can be of further assistance, do not hesitate to contact us.

Sincerely,

Coleen Sullins,
Director

Attachments

cc: Eric Alsmeyer, US Army Corps of Engineers, Raleigh Field Office
Brett Feulner, NCDOT PDEA
Chris Murray, Division 5 Environmental Officer
Kathy Matthews, Environmental Protection Agency
Travis Wilson, NC Wildlife Resources Commission
Gary Jordan, US Fish and Wildlife Service
Beth Harmon, Ecosystem Enhancement Program
File Copy

Transportation Permitting Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
2321 Crabtree Boulevard, Suite 250, Raleigh, North Carolina 27604
Phone: 919-733-1786 / FAX 919-733-6893 / Internet: http://h2o.enr.state.nc.us/ncwetlands

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Coleen Sullins, Director
Division of Water Quality

Modification to the 401 Water Quality Certification Pursuant to Section 401 of the Federal Clean Water Act and NEUSE BUFFER RULES, with ADDITIONAL CONDITIONS

THIS CERTIFICATION is issued in conformity with the requirements of Section 401 Public Laws 92-500 and 95-217 of the United States and subject to the North Carolina Division of Water Quality (DWQ) Regulations in 15 NCAC 2H .0500 and 15A NCAC 2B.0233. This certification authorized the NCDOT to impact 0.01acres of jurisdictional wetlands, 354 linear feet of jurisdictional streams and 43,382 square feet of protected riparian buffers in Wake County. The project shall be constructed pursuant to the modification dated received September 18, 2007. The revised authorized impacts for Section A of the project are as described below:

Revised Stream Impacts in the Neuse River Basin (R-2809A)

Site	Permanent Fill in Intermittent Stream (linear ft)	Temporary Fill in Intermittent Stream (linear ft)	Permanent Fill in Perennial Stream (linear ft)	Temporary Fill in Perennial Stream (linear ft)	Total Stream Impact (linear ft)
1	0	0	95	23	118
2	62	20	0	0	82
3	118	36	0	0	154
Total	**180**	**56**	**95**	**23**	**354**

Total Stream Impact for Project: 354 linear feet.

Revised Wetland Impacts in the Neuse River Basin (R-2809A)

Site	Fill (ac)	Fill (temporary) (ac)	Total Wetland Impact (ac)
1	0.01	0	0.01
Total	**0.01**	**0**	**0.01**

Total Wetland Impact for Project: 0.01 acres.

Revised Neuse Riparian Buffer Impacts (R-2809A)

Site	Zone 1 Impact (sq ft)	*minus* Wetlands in Zone 1 (sq ft)	= Zone 1 Buffers (not wetlands) (sq ft)	Zone 1 Buffer Mitigation Required (using 3:1 ratio)	Zone 2 Impact (sq ft)	*minus* Wetlands in Zone 2 (sq ft)	= Zone 2 Buffers (not wetlands) (sq ft)	Zone 2 Buffer Mitigation Required (using 1.5:1 ratio)
1	5,651	0	5,651	N/A	3,283	0	3,283	N/A
2	4,338	0	4,338	N/A	2,788	0	2,788	N/A
3	7,556	0	7,556	22,668	4,198	0	4,198	6,297
Totals	**25,814**	**0**	**25,814**	**22,668**	**17,568**	**0**	**17,568**	**6,297**

* n/a = Total for Site is less than 1/3 acre and 150 linear feet of impact, no mitigation required

Total Buffer Impact for Project: 43,382 square feet.

The application provides adequate assurance that the discharge of fill material into the waters, wetlands and buffers of the Neuse River Basin in conjunction with the proposed development will not result in a violation of applicable Water Quality Standards and discharge guidelines. Therefore, the State of North Carolina certifies that this activity will not violate the applicable portions of Sections 301, 302, 303, 306, 307 of PL 92-500 and PL 95-217 if conducted in accordance with the application and conditions hereinafter set forth.

Transportation Permitting Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
2321 Crabtree Boulevard, Suite 250, Raleigh, North Carolina 27604
Phone: 919-733-1786 / FAX 919-733-6893 / Internet: http://h2o.enr.state.nc.us/ncwetlands

This approval is only valid for the purpose and design that you submitted in your modified application dated received September 18, 2007. All the authorized activities and conditions of certification associated with the original Water Quality Certification dated February 4, 2002 and all subsequent modifications still apply except where superceded by this certification. The revised impact tables above apply for project Section A only, and does not change the jurisdictional impacts of Sections B or C. However, the proposed design changes for Section C, sites 4 and 5, are also covered by this modification. Should your project make additional changes, you are required to notify the DWQ and submit a new application. If the property is sold, the new owner must be given a copy of this Certification and approval letter, and is thereby responsible for complying with all the conditions. If any additional wetland impacts, or stream impacts, for this project (now or in the future) exceed one acre or 150 linear feet, respectively, additional compensatory mitigation may be required as described in 15A NCAC 2H .0506 (h) (6) and (7). For this approval to remain valid, you are required to comply with all the conditions listed below. In addition, you should obtain all other federal, state or local permits before proceeding with your project including (but not limited to) Sediment and Erosion control, Coastal Stormwater, Non-discharge and Water Supply watershed regulations. This Certification shall expire on the same day as the expiration date of the corresponding Corps of Engineers Permit.

Conditions of Certification:

1. All other conditions written into previous Water Quality Certifications and modifications for this project still apply except where superceded by this modification.

2. Compensatory mitigation for impacts to 7,556 square feet of protected riparian buffers in Zone 1 and 4,198 square feet of protected riparian buffers in Zone 2 shall be required at the following rates:

Zone of Impact	Impacts (Square Feet)	Replacement Ratio	Total Square Feet of Mitigation Required
Zone 1	7,556	3:1	22,668
Zone 2	4,198	1.5:1	6,297
Total	**11,754**		**28,965**

We understand that you have chosen to perform compensatory mitigation for impacts to protected buffers through use of the North Carolina Ecosystem Enhancement Program (EEP). Mitigation for unavoidable impacts to Neuse Riparian Buffers shall be provided in the Neuse River Basin and done in accordance with 15A NCAC 2B. EEP has indicated in a letter dated August 29, 2007 that they will assume responsibility for satisfying the compensatory mitigation requirements for the above-referenced project, in accordance with the Tri-Party MOA signed on July 22, 2003 and the Dual-Party MOA signed on April 12, 2004.

3. Placement of culverts and other structures in waters, streams, and wetlands shall be placed below the elevation of the streambed by one foot for all culverts with a diameter greater than 48 inches, and 20 percent of the culvert diameter for culverts having a diameter less than 48 inches, to allow low flow passage of water and aquatic life. Design and placement of culverts and other structures including temporary erosion control measures shall not be conducted in a manner that may result in dis-equilibrium of wetlands or streambeds or banks, adjacent to or upstream and down stream of the above structures. The applicant is required to provide evidence that the equilibrium is being maintained if requested in writing by DWQ. If this condition is unable to be met due to bedrock or other limiting features encountered during construction, please contact the NC DWQ for guidance on how to proceed and to determine whether or not a permit modification will be required.

5. Riprap shall not be placed in the active thalweg channel or placed in the streambed in a manner that precludes aquatic life passage. Bioengineering boulders or structures should be properly designed, sized and installed.

6. For any streams being impacted due to site dewatering activties, the site shall be graded to its preconstruction contours and revegetated with appropriate native species.

Transportation Permitting Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
2321 Crabtree Boulevard, Suite 250, Raleigh, North Carolina 27604
Phone: 919-733-1786 / FAX 919-733-6893 / Internet: http://h2o.enr.state.nc.us/ncwetlands

7. All stormwater runoff shall be directed as sheetflow through stream buffers at nonerosive velocities, unless otherwise approved by this certification.

8. All riparian buffers impacted by the placement of temporary fill or clearing activities shall be restored to the preconstruction contours and revegetated. Maintained buffers shall be permanently revegetated with non-woody species by the end of the growing season following completion of construction. For the purpose of this condition, maintained buffer areas are defined as areas within the transportation corridor that will be subject to regular DOT maintenance activities including mowing. The area with non-maintained buffers shall be permanently revegetated, with native woody species before the next growing season following completion of construction.

9. Pursuant to NCAC15A 2B.0233(6), sediment and erosion control devices shall not be placed in Zone 1 of any Neuse Buffer without prior approval by the NCDWQ. At this time, the NCDWQ has approved no sediment and erosion control devices in Zone 1, outside of the approved project impacts, anywhere on this project. Moreover, sediment and erosion control devices shall be allowed in Zone 2 of the buffers provided that Zone 1 is not compromised and that discharge is released as diffuse flow.

10. If concrete is used during construction, a dry work area shall be maintained to prevent direct contact between curing concrete and stream water. Water that inadvertently contacts uncured concrete shall not be discharged to surface waters due to the potential for elevated pH and possible aquatic life and fish kills.

11. During the construction of the project, no staging of equipment of any kind is permitted in waters of the U.S., or protected riparian buffers.

12. The dimension, pattern and profile of the stream above and below the crossing shall not be modified. Disturbed floodplains and streams shall be restored to natural geomorphic conditions.

13. The use of rip-rap above the Normal High Water Mark shall be minimized. Any rip-rap placed for stream stabilization shall be placed in stream channels in such a manner that it does not impede aquatic life passage.

14. The Permittee shall ensure that the final design drawings adhere to the permit and to the permit drawings submitted for approval.

15. All work in or adjacent to stream waters shall be conducted in a dry work area. Approved BMP measures from the most current version of NCDOT Construction and Maintenance Activities manual such as sandbags, rock berms, cofferdams and other diversion structures shall be used to prevent excavation in flowing water.

16. Heavy equipment shall be operated from the banks rather than in the stream channel in order to minimize sedimentation and reduce the introduction of other pollutants into the stream.

17. All mechanized equipment operated near surface waters must be regularly inspected and maintained to prevent contamination of stream waters from fuels, lubricants, hydraulic fluids, or other toxic materials.

18. No rock, sand or other materials shall be dredged from the stream channel except where authorized by this certification.

19. Discharging hydroseed mixtures and washing out hydroseeders and other equipment in or adjacent to surface waters is prohibited.

20. The permittee and its authorized agents shall conduct its activities in a manner consistent with State water quality standards (including any requirements resulting from compliance with §303(d) of the Clean Water Act) and any other appropriate requirements of State and Federal law. If DWQ determines that such standards or laws are not being met (including the failure to sustain a designated or achieved use) or that State or federal law is being violated, or that further conditions are necessary to assure compliance, DWQ may reevaluate and modify this certification.

Transportation Permitting Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
2321 Crabtree Boulevard, Suite 250, Raleigh, North Carolina 27604
Phone: 919-733-1786 / FAX 919-733-6893 / Internet: http://h2o.enr.state.nc.us/ncwetlands

21. All fill slopes located in jurisdictional wetlands shall be placed at slopes no flatter than 3:1, unless otherwise authorized by this certification..

22. A copy of this Water Quality Certification shall be maintained on site at the construction site at all times. In addition, the Water Quality Certification and all subsequent modifications, if any, shall be maintained with the Division Engineer and the on-site project manager.

23. The outside buffer, wetland or water boundary located within the construction corridor approved by this authorization shall be clearly marked by highly visible fencing prior to any land disturbing activities. Impacts to areas within the fencing are prohibited unless otherwise authorized by this certification.

24. The issuance of this certification does not exempt the Permittee from complying with any and all statutes, rules, regulations, or ordinances that may be imposed by other government agencies (i.e. local, state, and federal) having jurisdiction, including but not limited to applicable buffer rules, stormwater management rules, soil erosion and sedimentation control requirements, etc.

25. The Permittee shall report any violations of this certification to the Division of Water Quality within 24 hours of discovery.

26. Upon completion of the project (including any impacts at associated borrow or waste site), the NCDOT Division Engineer shall complete and return the enclosed "Certification of Completion Form" to notify DWQ when all work included in the 401 Certification has been completed.

27. Native riparian vegetation (trees and shrubs native to the project's geographic region) must be reestablished within the construction limits of the project by the end of the growing season following completion of construction.

28. Erosion and sediment control practices must be in full compliance with all specifications governing the proper design, installation and operation and maintenance of such Best Management Practices in order to protect surface waters standards:

a. The erosion and sediment control measures for the project must be designed, installed, operated, and maintained in accordance with the most recent version of the *North Carolina Sediment and Erosion Control Planning and Design Manual.*
b. The design, installation, operation, and maintenance of the sediment and erosion control measures must be such that they equal, or exceed, the requirements specified in the most recent version of the *North Carolina Sediment and Erosion Control Manual.* The devices shall be maintained on all construction sites, borrow sites, and waste pile (spoil) projects, including contractor-owned or leased borrow pits associated with the project.
c. For borrow pit sites, the erosion and sediment control measures must be designed, installed, operated, and maintained in accordance with the most recent version of the *North Carolina Surface Mining Manual.*
d. The reclamation measures and implementation must comply with the reclamation in accordance with the requirements of the Sedimentation Pollution Control Act.

29. Sediment and erosion control measures shall not be placed in wetlands or waters unless otherwise approved by this Certification.

30. There shall be no excavation from, or waste disposal into, jurisdictional wetlands or waters associated with this permit without appropriate modification. Should waste or borrow sites, or access roads to waste or borrow sites, be located in wetlands or streams, compensatory mitigation will be required since that is a direct impact from road construction activities.

Transportation Permitting Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
2321 Crabtree Boulevard, Suite 250, Raleigh, North Carolina 27604
Phone: 919-733-1786 / FAX 919-733-6893 / Internet: http://h2o.enr.state.nc.us/ncwetlands

Violations of any condition herein set forth may result in revocation of this Certification and may result in criminal and/or civil penalties. This Certification shall become null and void unless the above conditions are made conditions of the Federal 404 and/or Coastal Area Management Act Permit. This Certification shall expire upon the expiration of the 404 or CAMA permit.

If this Certification is unacceptable to you have the right to an adjudicatory hearing upon written request within sixty (60) days following receipt of this Certification. This request must be in the form of a written petition conforming to Chapter 150B of the North Carolina General Statutes and filed with the Office of Administrative Hearings, 6714 Mail Service Center, Raleigh, N.C. 27699-6714. If modifications are made to an original Certification, you have the right to an adjudicatory hearing on the modifications upon written request within sixty (60) days following receipt of the Certification. Unless such demands are made, this Certification shall be final and binding.

This the 29th day of October 2007

DIVISION OF WATER QUALITY

John E. Hennessy

Coleen Sullins
Director

WQC No. 3343

Transportation Permitting Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
2321 Crabtree Boulevard, Suite 250, Raleigh, North Carolina 27604
Phone: 919-733-1786 / FAX 919-733-6893 / Internet: http://h2o.enr.state.nc.us/ncwetlands

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Coleen Sullins, Director
Division of Water Quality

DWQ Project No.: _____ **County:** _____

Applicant: _____

Project Name: _____

Date of Issuance of 401 Water Quality Certification: _____

Certificate of Completion
Upon completion of all work approved within the 401 Water Quality Certification or applicable Buffer Rules, and any subsequent modifications, the applicant is required to return this certificate to the 401 Transportation Permitting Unit, North Carolina Division of Water Quality, 1650 Mail Service Center, Raleigh, NC, 27699-1650. This form may be returned to DWQ by the applicant, the applicant's authorized agent, **or** the project engineer. It is not necessary to send certificates from all of these.

Applicant's Certification
I, _____, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that the construction was observed to be built within substantial compliance and intent of the 401 Water Quality Certification and Buffer Rules, the approved plans and specifications, and other supporting materials.

Signature: _____ Date: _____

Agent's Certification
I, _____, hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that the construction was observed to be built within substantial compliance and intent of the 401 Water Quality Certification and Buffer Rules, the approved plans and specifications, and other supporting materials.

Signature: _____ Date:_____

Engineer's Certification
_____ Partial _____ Final
I, _____, as a duly registered Professional Engineer in the State of North Carolina, having been authorized to observe (periodically, weekly, full time) the construction of the project,for the Permittee hereby state that, to the best of my abilities, due care and diligence was used in the observation of the construction such that the construction was observed to be built within substantial compliance and intent of the 401 Water Quality Certification and Buffer Rules, the approved plans and specifications, and other supporting materials.

Signature _____ Registration No. _____

Date _____

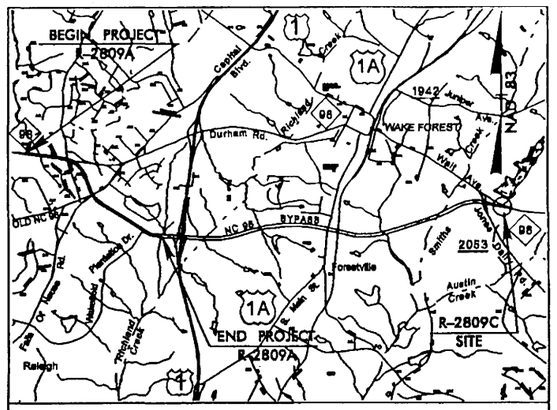
Transportation Permitting Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
2321 Crabtree Boulevard, Suite 250, Raleigh, North Carolina 27604
Phone: 919-733-1786 / FAX 919-733-6893 / Internet: http://h2o.enr.state.nc.us/ncwetlands

9/09/03

TIP PROJECT: R-2809A

CONTRACT: C201737 TIP

See Sheet 1-A For Index of Sheets
See Sheet 1-B For Conventional Symbology
See Sheet 1-C & 1-D For Survey Control Sheets



VICINITY MAP

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

WAKE COUNTY

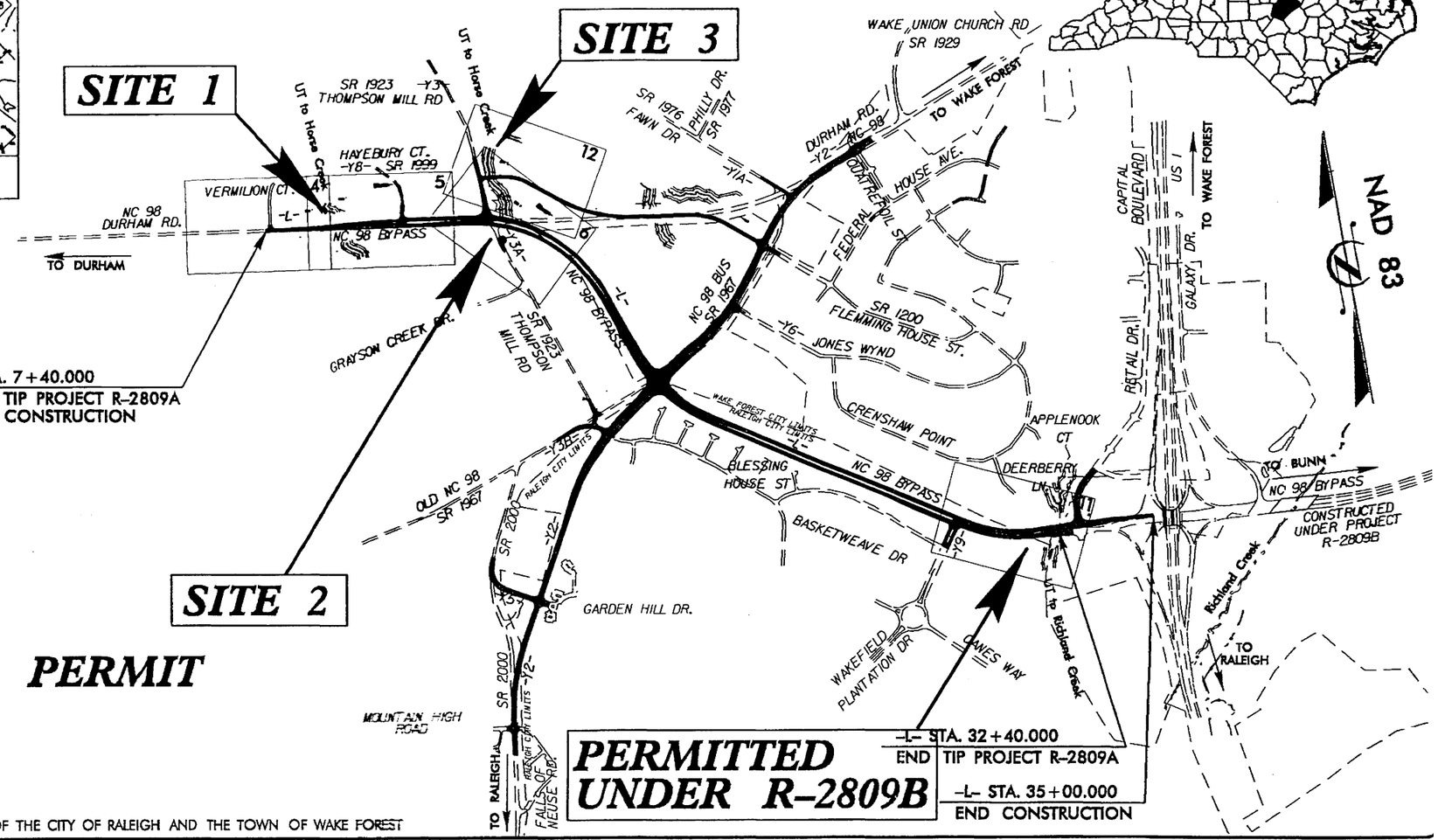
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2809A	1	

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
34503.1.1	STP-98(1)	PE
34503.2.5	STP-98(2)	R/W & UTIL
34503.3.7	STP-98(23)	CONST.

METRIC

ALL DIMENSIONS IN THESE PLANS ARE IN METERS OR MILLIMETERS UNLESS OTHERWISE SHOWN

LOCATION: ***NC 98 (WAKE FOREST BYPASS) FROM WEST OF SR 1923 (THOMPSON MILL ROAD) TO WEST OF US 1 (CAPITAL BLVD.)***



-L- STA. 7+40.000
BEGIN TIP PROJECT R-2809A
BEGIN CONSTRUCTION

PERMITTED UNDER R-2809B

-L- STA. 32+40.000
END TIP PROJECT R-2809A
-L- STA. 35+00.000
END CONSTRUCTION

WETLAND\STREAM PERMIT

PORTIONS OF THIS PROJECT FALLS WITHIN THE BOUNDARIES OF THE CITY OF RALEIGH AND THE TOWN OF WAKE FOREST

GRAPHIC SCALES

PLANS 5 0 10

PROFILE (HORIZONTAL) 5 0 10

PROFILE (VERTICAL) 1 0 2

DESIGN DATA

ADT 2007 = 24,100
ADT 2025 = 36,500
DHV = 10 %
D = 60 %
T = 6 % *
V = 100 km/h

* (TTST 2% & DUAL 4%)

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT R-2809A = 2.500 km
TOTAL LENGTH OF TIP PROJECT R-2809A= 2.500 km

Prepared in the Office of:
DIVISION OF HIGHWAYS
1000 Birch Ridge Dr., Raleigh, NC 27610

2002 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: JUNE 30, 2005

LETTING DATE: DECEMBER 18, 2007

JASON MOORE, PE
PROJECT ENGINEER

KEVIN E. MOORE, PE
PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: P.E.

DIVISION OF HIGHWAYS STATE OF NORTH CAROLINA

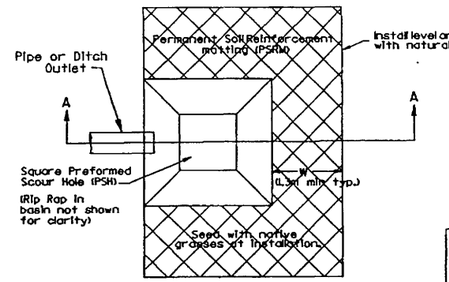
STATE HIGHWAY DESIGN ENGINEER P.E.

Permit Drawing
Sheet 1 of 19

METRIC	PROJECT REFERENCE NO.	SHEET NO.
	R-2809A	2-F
	ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

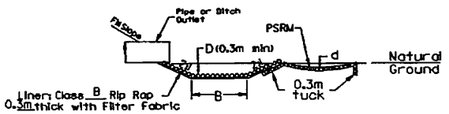
PREFORMED SCOUR HOLE

PLAN VIEW



B	1.2 m
D	0.6 m
W	1.3 m
d	0.15 m

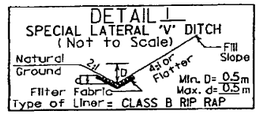
SECTION A-A



4/4/02

STA. 9+50 -L- LT
STA. 9+99 -L- RT
STA. 13+75 -L- LT
STA. 14+30 -L- LT
STA. 18+73 -L- LT
STA. 19+95 -L- LT

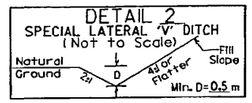
DETAIL 1
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



Type of Liner = CLASS B RIP RAP

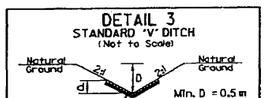
STA. 10+70 TO 11+11 -L- LT
STA. 11+20 TO 11+60 -L- RT
STA. 19+40 TO 19+80 -L- RT
STA. 23+60 TO 23+90 -L- LT
STA. 18+82 TO 19+00 -Y2- RT

DETAIL 2
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



STA. 15+40 TO 15+76 -L- RT
STA. 18+80 TO 19+20 -L- RT
STA. 30+80 TO 31+20 -L- LT
STA. 11+06 TO 11+60 -Y2- LT
STA. 19+20 TO 19+46 -Y2- RT
STA. 26+60 TO 27+00 -Y2- LT
STA. 10+70 TO 10+40 -Y3B- RT
STA. 10+20 TO 10+50 -Y4- LT

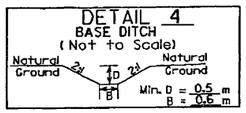
DETAIL 3
STANDARD 'V' DITCH
(Not to Scale)



Type of Liner = CLASS B RIPRAP

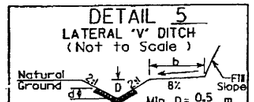
STA. 27+00 TO 27+17 -Y2- LT
STA. 27+17 TO 27+70 -Y2- LT

DETAIL 4
BASE DITCH
(Not to Scale)



STA. 15+73 -L- LT
STA. 15+78 -L- RT
STA. 17+35 TO 17+55 -L- RT
STA. 24+55 -L- LT
STA. 15+30 -Y2- LT
STA. 12+04 -Y5- LT

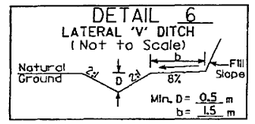
DETAIL 5
LATERAL 'V' DITCH
(Not to Scale)



Type of Liner=CLASS B RIP RAP

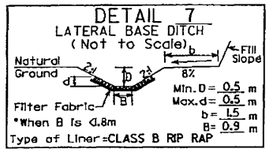
STA. 17+00 TO 17+80 -L- LT
STA. 24+20 TO 24+40 -L- RT
STA. 24+60 TO 25+20 -L- LT
STA. 11+40 TO 11+69 -Y3- LT
STA. 15+20 TO 16+00 -Y2- LT
STA. 16+20 TO 16+80 -Y2- LT

DETAIL 6
LATERAL 'V' DITCH
(Not to Scale)



STA. 16+70 TO 17+33 -L- RT
STA. 25+80 TO 28+20 -L- LT

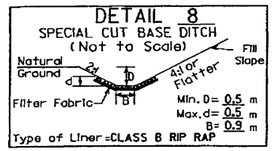
DETAIL 7
LATERAL BASE DITCH
(Not to Scale)



*When B is <1.8m
Type of Liner=CLASS B RIP RAP

STA. 16+42 TO 17+00 -L- LT

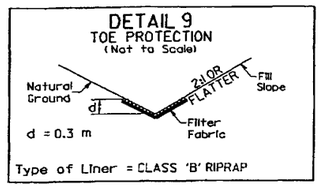
DETAIL 8
SPECIAL CUT BASE DITCH
(Not to Scale)



Type of Liner=CLASS B RIP RAP

STA. 23+00 TO 23+60 -L- LT

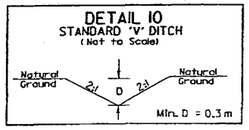
DETAIL 9
TOE PROTECTION
(Not to Scale)



Type of Liner = CLASS 'B' RIPRAP

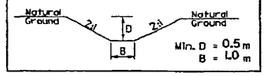
STA 8+35 TO STA 8+50 -L- RT.
STA 9+20 TO STA 9+80 -L- LT.
STA. 23+60 TO 24+10 -L- RT
STA. 12+60 TO 13+00 -Y1- RT
STA. 16+30 TO 17+20-Y1- RT
STA. 26+80 TO 27+20 -Y2- RT

DETAIL 10
STANDARD 'V' DITCH
(Not to Scale)



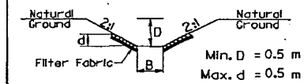
STA. 10+30 -Y1A- RT

DETAIL 11
STANDARD BASE DITCH
(Not to Scale)



STA. 16+42 -Y2- RT

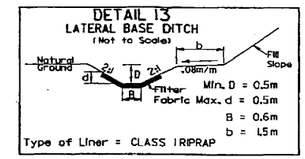
DETAIL 12
OUTLET PROTECTION
(Not to Scale)



Type of Liner = CLASS 1 RIP RAP

STA. 9+15 -L- LT
STA. 11+95 -L- LT
STA. 11+50 -Y3- RT

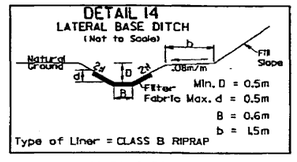
DETAIL 13
LATERAL BASE DITCH
(Not to Scale)



Type of Liner = CLASS 1 RIPRAP

STA. 9+00 TO 9+12 -L- LT

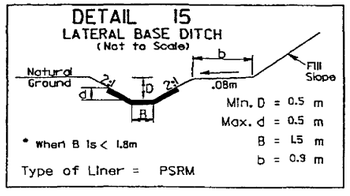
DETAIL 14
LATERAL BASE DITCH
(Not to Scale)



Type of Liner = CLASS B RIPRAP

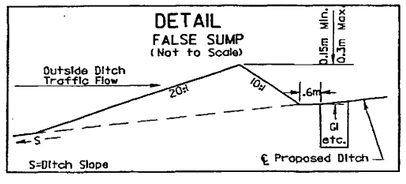
STA. 9+80 TO 10+70 -L- LT

DETAIL 15
LATERAL BASE DITCH
(Not to Scale)

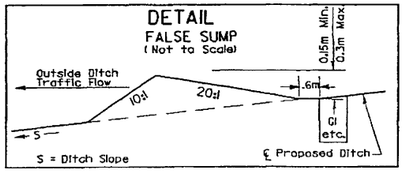


STA. 31+00 TO 31+38 -L- RT

DETAIL
FALSE SUMP
(Not to Scale)



DETAIL
FALSE SUMP
(Not to Scale)

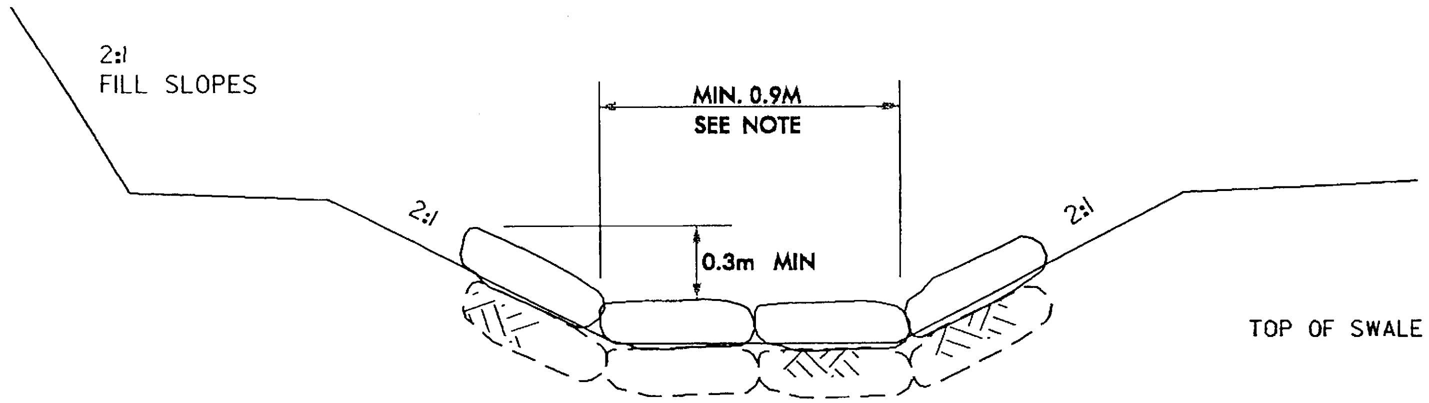


Plans Drawing Sheet 3 of 19

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	2-G
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

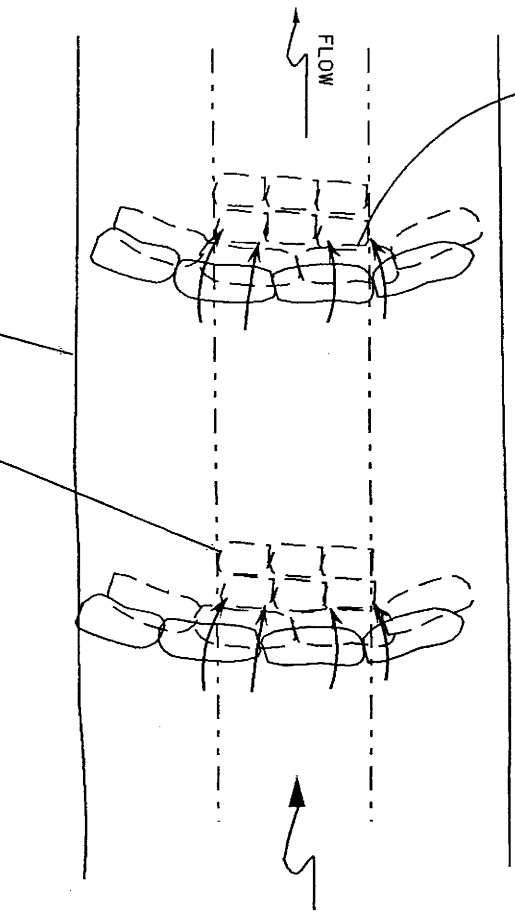
METRIC

LATERAL SWALE/DITCH W/ROCK CHECKS
STA 31+16 TO 31+38 -L- RT



TYPICAL CROSS SECTION

NOT TO SCALE



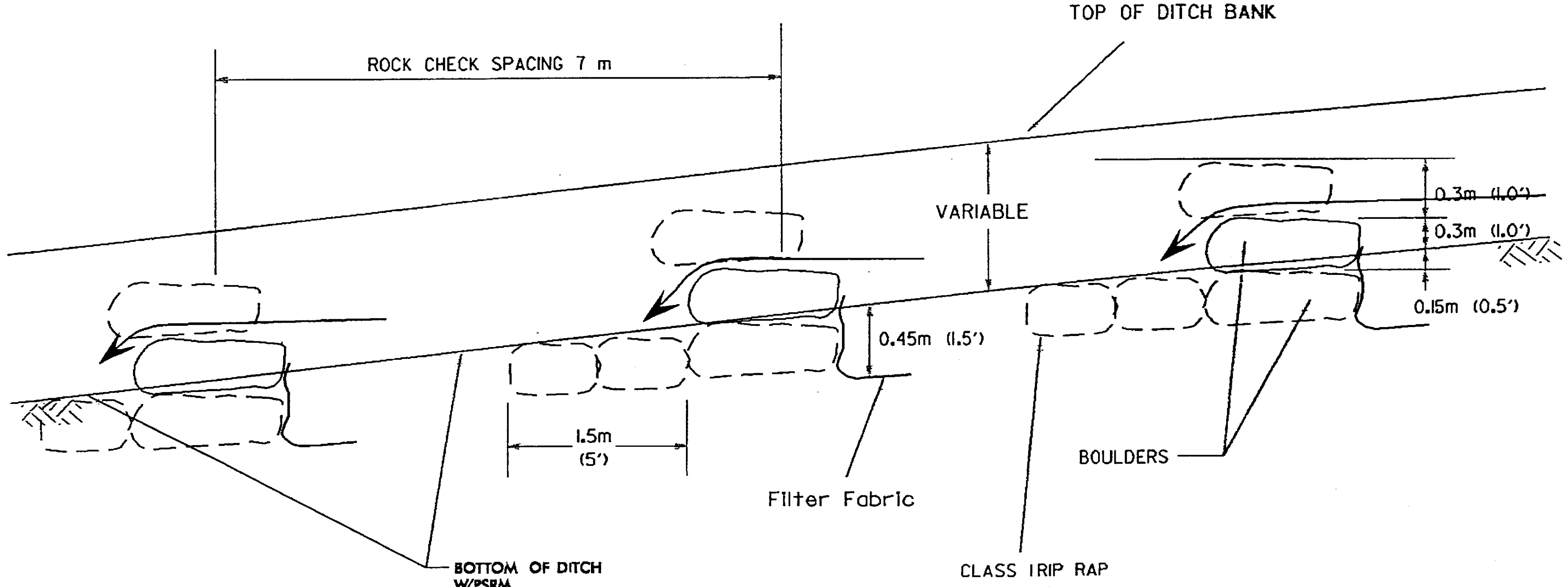
PLAN VIEW

NOT TO SCALE

FILTER FABRIC = $20 m^2$

BOULDERS/FOOTER ROCK = 60 MTN

CLASS I RIP RAP = 5 MTN



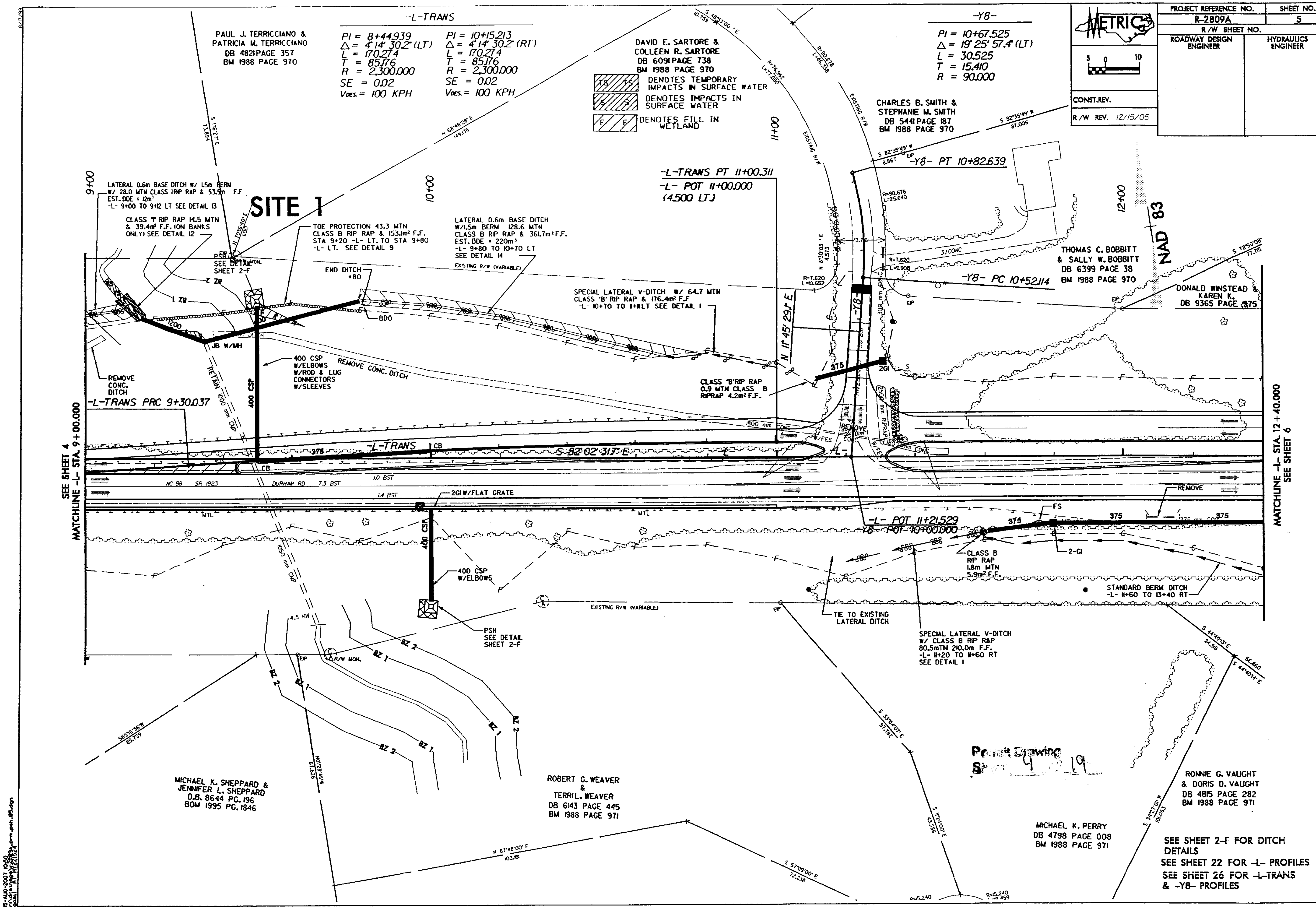
PROFILE

NOT TO SCALE

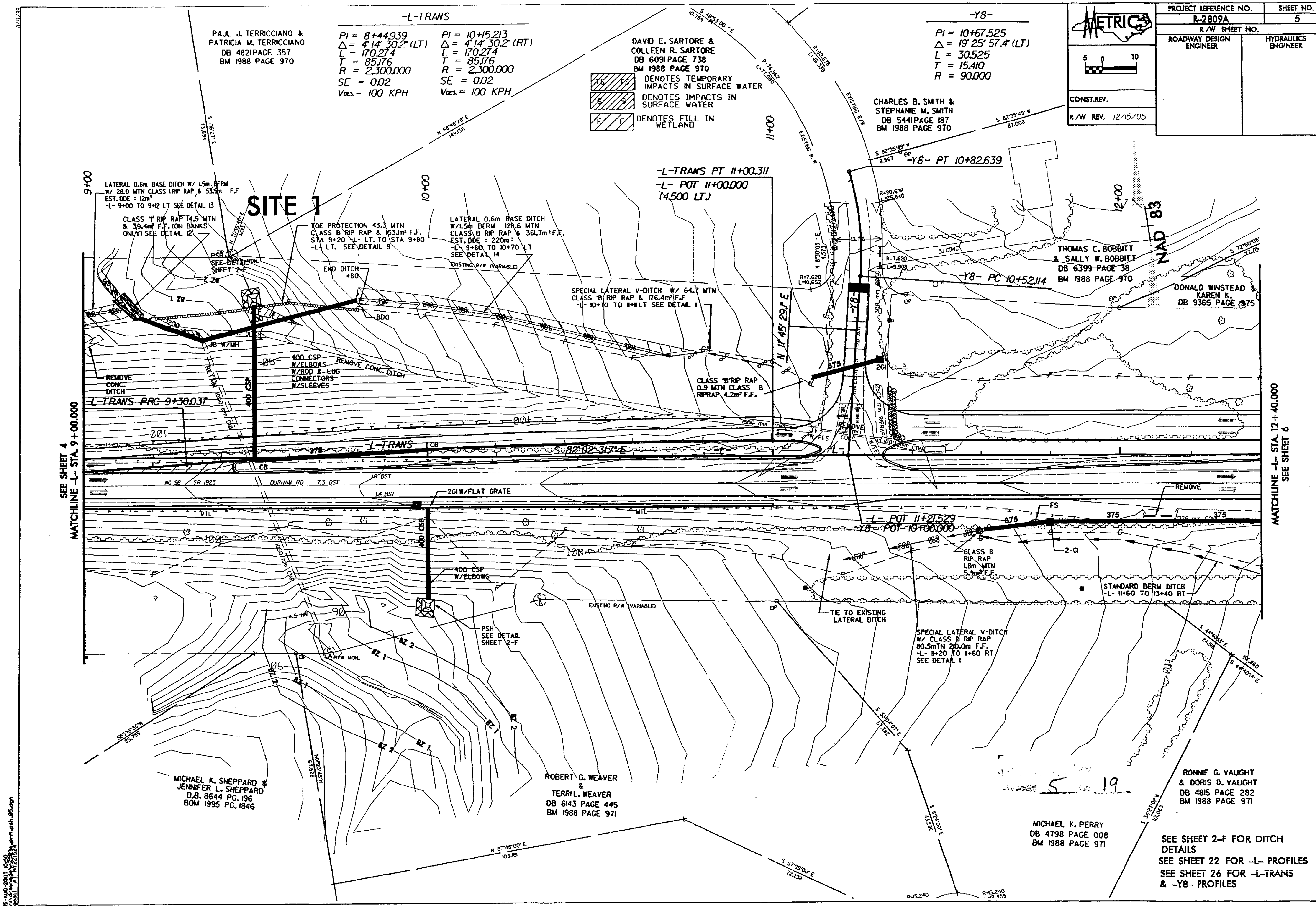
NOTE:

BOULDERS SHOULD BE ANGULAR AND OBLONG WITH APPROXIMATE DIMENSIONS OF 0.6m x 0.45m x 0.45m (2' x 1.5' x 1.5'). ROCK SHOULD FIT TIGHTLY TOGETHER WITH MINIMAL VOIDS. STAGGER BOULDER JOINTS.

ROCK CHECK SPACING IS DEPENDENT ON DITCH GRADES AT 1' DROP INTERVALS OR SLOPE CONTROL.



PROJECT REFERENCE NO. R-2809A
SHEET NO. 5
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
METRIC
CONST.REV.
R/W REV. 12/15/05
-L-TRANS
PI = 8+44.939
Δ = 4°14' 30.2" (LT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
Vdes = 100 KPH
PI = 10+15.213
Δ = 4°14' 30.2" (RT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
Vdes = 100 KPH
-Y8-
PI = 10+67.525
Δ = 19°25' 57.4" (LT)
L = 30.525
T = 15.410
R = 90.000
PAUL J. TERRICCIANO & PATRICIA M. TERRICCIANO
DB 4821 PAGE 357
BM 1988 PAGE 970
DAVID E. SARTORE & COLLEEN R. SARTORE
DB 6091 PAGE 738
BM 1988 PAGE 970
DENOTES TEMPORARY IMPACTS IN SURFACE WATER
DENOTES IMPACTS IN SURFACE WATER
DENOTES FILL IN WETLAND
CHARLES B. SMITH & STEPHANIE M. SMITH
DB 5441 PAGE 187
BM 1988 PAGE 970
SITE 1
LATERAL 0.6m BASE DITCH W/ 1.5m BERM W/ 28.0 MTN CLASS II RIP RAP & 53.9m² F.F. EST. DDE = 12m³ -L- 9+00 TO 9+12 LT SEE DETAIL 13
CLASS "I" RIP RAP 14.5 MTN & 39.4m² F.F. (ON BANKS ONLY) SEE DETAIL 12
TOE PROTECTION 43.3 MTN CLASS B RIP RAP & 153.1m² F.F. STA 9+20 -L- LT. TO STA 9+80 -L- LT. SEE DETAIL 9
LATERAL 0.6m BASE DITCH W/1.5m BERM 128.6 MTN CLASS B RIP RAP & 361.7m² F.F. EST. DDE = 220m³ -L- 9+80 TO 10+70 LT SEE DETAIL 14
-L-TRANS PT 11+00.311
-L- POT 11+00.000 (4.500 LT)
-Y8- PT 10+82.639
-Y8- PC 10+52.114
THOMAS C. BOBBITT & SALLY W. BOBBITT
DB 6399 PAGE 38
BM 1988 PAGE 970
DONALD WINSTEAD & KAREN K.
DB 9365 PAGE 375
NAD 83
PSH SEE DETAIL SHEET 2-F
END DITCH +80
BDO
SPECIAL LATERAL V-DITCH W/ 64.7 MTN CLASS 'B' RIP RAP & 176.4m² F.F. -L- 10+70 TO 11+11 LT SEE DETAIL 1
JB W/MH
REMOVE CONC. DITCH
400 CSP W/ELBOWS W/ROD & LUG CONNECTORS W/SLEEVES
REMOVE CONC. DITCH
RETAIN 1000 mm CMP
CLASS 'B' RIP RAP 0.9 MTN CLASS B RIPRAP 4.2m² F.F.
-L-TRANS PRC 9+30.037
-L-TRANS
S 82°02' 31.7" E
MATCHLINE -L- STA. 9+00.000 SEE SHEET 4
MATCHLINE -L- STA. 12+40.000 SEE SHEET 6
NC 98 SR 1923 DURHAM RD
2GI W/FLAT GRATE
-L- POT 11+21.529
-Y8- POT 10+00.000
REMOVE
FS
2-GI
CLASS B RIP RAP 1.8m MTN 5.9m² F.F.
STANDARD BERM DITCH -L- 11+60 TO 13+40 RT
400 CSP W/ELBOWS
PSH SEE DETAIL SHEET 2-F
EXISTING R/W (VARIABLE)
TIE TO EXISTING LATERAL DITCH
SPECIAL LATERAL V-DITCH W/ CLASS B RIP RAP 80.5mTN 210.0m F.F. -L- 11+20 TO 11+60 RT SEE DETAIL 1
R/W MON.
BZ 1
BZ 2
MICHAEL K. SHEPPARD & JENNIFER L. SHEPPARD
D.B. 8644 PG. 196
BOM 1995 PG. 1846
ROBERT C. WEAVER & TERRI L. WEAVER
DB 6143 PAGE 445
BM 1988 PAGE 971
MICHAEL K. PERRY
DB 4798 PAGE 008
BM 1988 PAGE 971
RONNIE G. VAUGHT & DORIS D. VAUGHT
DB 4815 PAGE 282
BM 1988 PAGE 971
Permit Drawing Sheet 4 of 19
SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 22 FOR -L- PROFILES
SEE SHEET 26 FOR -L-TRANS & -Y8- PROFILES



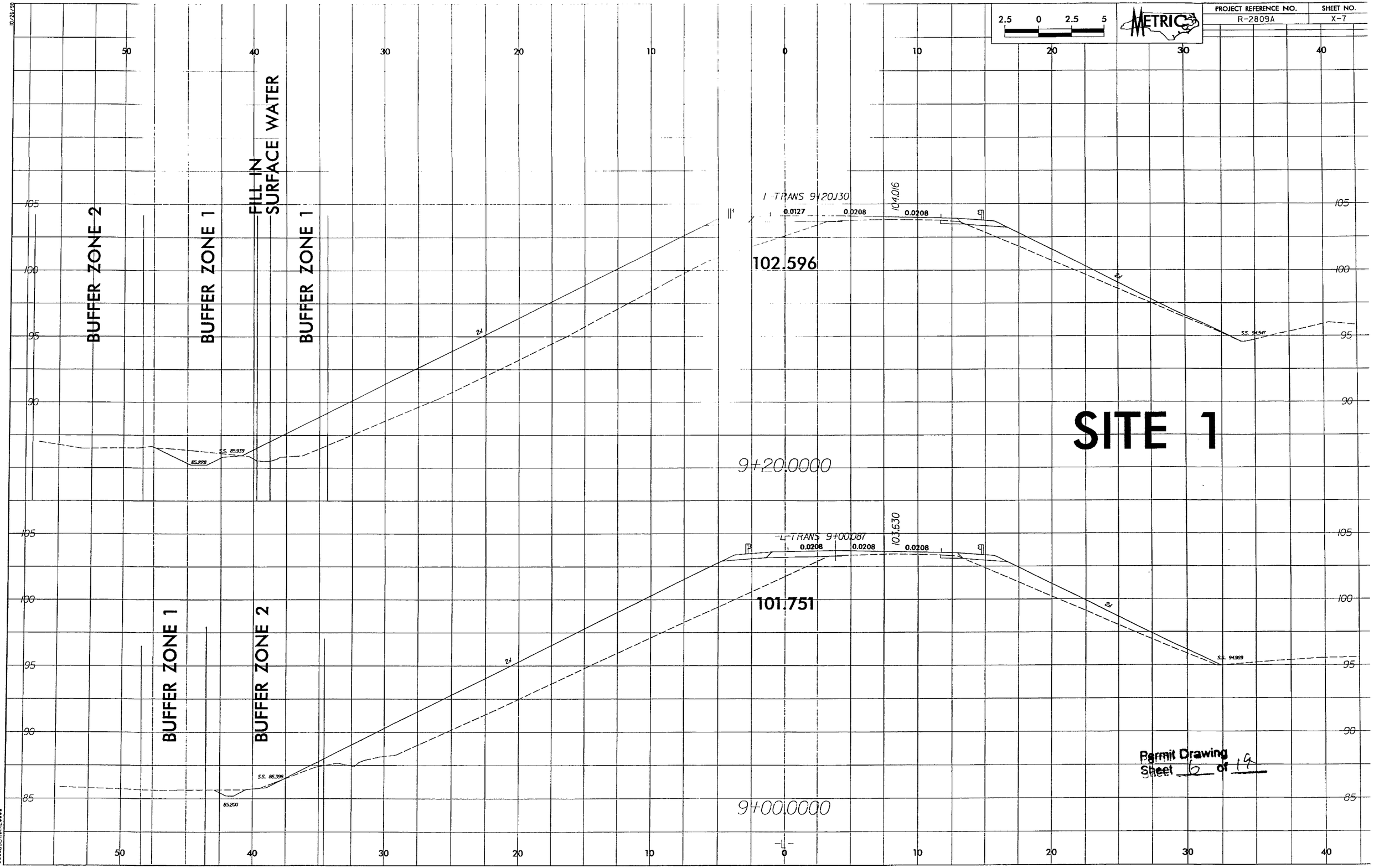
PROJECT REFERENCE NO.
SHEET NO.
R-2809A
5
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
METRIC
CONST.REV.
R/W REV. 12/15/05
-L-TRANS
PI = 8+44.939
Δ = 4°14' 30.2" (LT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
Vdes. = 100 KPH
PI = 10+15.213
Δ = 4°14' 30.2" (RT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
Vdes. = 100 KPH
-Y8-
PI = 10+67.525
Δ = 19° 25' 57.4" (LT)
L = 30.525
T = 15.410
R = 90.000
PAUL J. TERRICCIANO & PATRICIA M. TERRICCIANO
DB 4821 PAGE 357
BM 1988 PAGE 970
DAVID E. SARTORE & COLLEEN R. SARTORE
DB 6091 PAGE 738
BM 1988 PAGE 970
DENOTES TEMPORARY IMPACTS IN SURFACE WATER
DENOTES IMPACTS IN SURFACE WATER
DENOTES FILL IN WETLAND
CHARLES B. SMITH & STEPHANIE M. SMITH
DB 5441 PAGE 187
BM 1988 PAGE 970
SITE 1
-L-TRANS PT 11+00.311
-L- POT 11+00.000 (4.500 LT)
-Y8- PT 10+82.639
-Y8- PC 10+52.114
THOMAS C. BOBBITT & SALLY W. BOBBITT
DB 6399 PAGE 38
BM 1988 PAGE 970
DONALD WINSTEAD KAREN K.
DB 9365 PAGE 375
NAD 83
LATERAL 0.6m BASE DITCH W/ 1.5m BERM W/ 28.0 MTN CLASS I RIP RAP & 53.9m² F.F
EST. DDE = 12m³
-L- 9+00 TO 9+12 LT SEE DETAIL 13
CLASS "I" RIP RAP 14.5 MTN & 39.4m² F.F. (ON BANKS ONLY) SEE DETAIL 12
TOE PROTECTION 43.3 MTN CLASS B RIP RAP & 153.1m² F.F. STA 9+20 -L- LT. TO STA 9+80 -L- LT. SEE DETAIL 9
LATERAL 0.6m BASE DITCH W/1.5m BERM 128.6 MTN CLASS B RIP RAP & 361.7m² F.F.
EST. DDE = 220m³
-L- 9+80 TO 10+70 LT
SEE DETAIL 14
PSH SEE DETAIL SHEET 2-F
END DITCH +80
SPECIAL LATERAL V-DITCH W/ 64.7 MTN CLASS 'B' RIP RAP & 176.4m² F.F. -L- 10+70 TO 11+11 LT SEE DETAIL 1
N 11° 45' 29.7" E
CLASS "B" RIP RAP 0.9 MTN CLASS B RIPRAP 4.2m² F.F.
400 CSP W/ELBOWS W/ROD & LUG CONNECTORS W/SLEEVES
REMOVE CONC. DITCH
REMOVE CONC. DITCH
-L-TRANS PRC 9+30.037
-L-TRANS
S 82°02'31.7" E
NC 98 SR 1923 DURHAM RD 7.3 BST
2GI W/FLAT GRATE
-L- POT 11+21.529
-Y8- POT 10+00.000
REMOVE
CLASS B RIP RAP 1.8m MTN 5.9m² F.F.
STANDARD BERM DITCH -L- 11+60 TO 13+40 RT
400 CSP W/ELBOWS
PSH SEE DETAIL SHEET 2-F
TIE TO EXISTING LATERAL DITCH
SPECIAL LATERAL V-DITCH W/ CLASS B RIP RAP 80.5mTN 210.0m F.F. -L- 11+20 TO 11+60 RT SEE DETAIL 1
EXISTING R/W (VARIABLE)
SEE SHEET 4
MATCHLINE -L- STA. 9+00.000
MATCHLINE -L- STA. 12+40.000
SEE SHEET 6
MICHAEL K. SHEPPARD & JENNIFER L. SHEPPARD
D.B. 8644 PG. 196
BOM 1995 PG. 1846
ROBERT C. WEAVER & TERRI L. WEAVER
DB 6143 PAGE 445
BM 1988 PAGE 971
MICHAEL K. PERRY
DB 4798 PAGE 008
BM 1988 PAGE 971
RONNIE G. VAUGHT & DORIS D. VAUGHT
DB 4815 PAGE 282
BM 1988 PAGE 971
5 19
SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 22 FOR -L- PROFILES
SEE SHEET 26 FOR -L-TRANS & -Y8- PROFILES

10/26/98

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	X-7

2.5 0 2.5 5 METRIC

SITE 1



Permit Drawing
Sheet 12 of 19

2.5 0 2.5 5

METRIC

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	X-8

50 40 30 20 10 0 10 20 30 40

WETLAND

BUFFER ZONE 2

BUFFER ZONE 1

105 100 95 90

2:1

88.202

S.S. 87.857

S.S. 87.857

-L-TRANS 9+60.224

103.898

0.0211

104.940

104.864

0.0208

0.0208

2:1

S.S. 88.874

9+60.0000

SITE 1

-L-TRANS 9+40.182

104.403

0.0129

0.0208

0.0208

103.617

2:1

S.S. 93.391

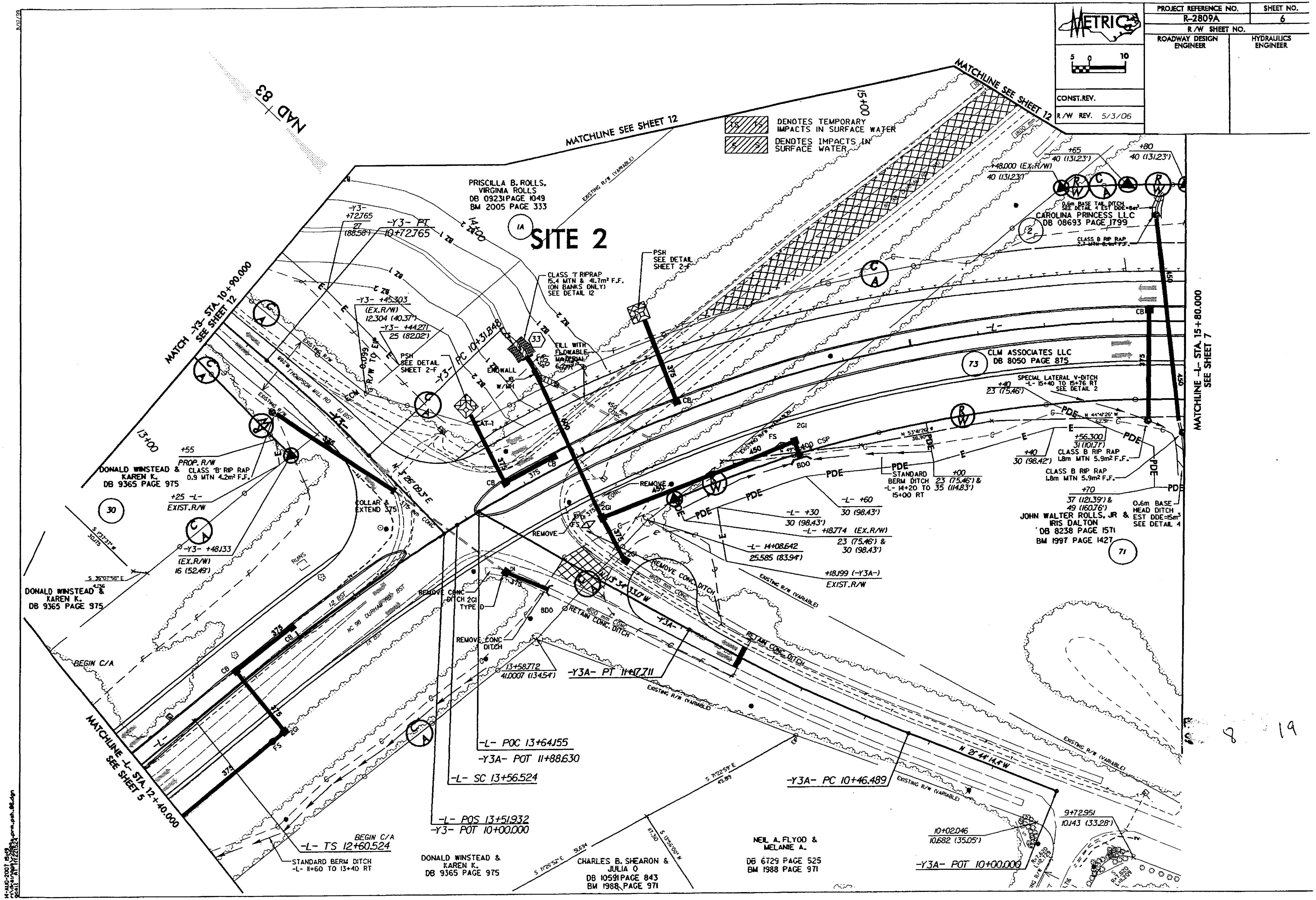
93.211

S.S. 88.324

9+40.0000

-L-

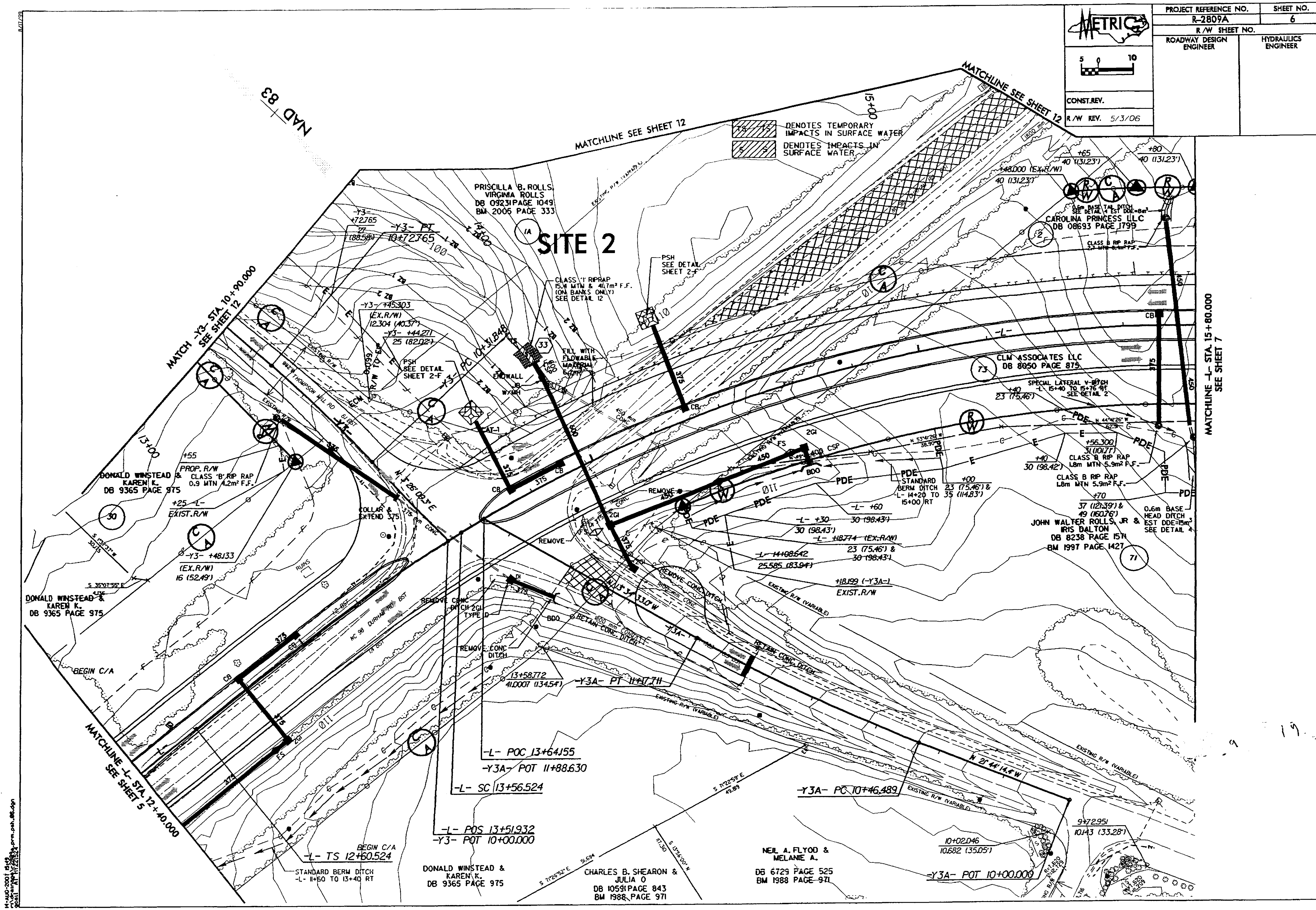
Parts Drawing
Sheet 7 of 19


PROJECT REFERENCE NO.
R-2809A
SHEET NO.
6
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
METRIC
5 0 10
CONST.REV.
R/W REV. 5/3/06
NAD 83
SITE 2
MATCHLINE SEE SHEET 12
MATCHLINE SEE SHEET 12
MATCH -Y3- STA. 10+90.000 SEE SHEET 12
MATCHLINE -L- STA. 15+80.000 SEE SHEET 7
MATCHLINE -L- STA. 12+40.000 SEE SHEET 5
DENOTES TEMPORARY IMPACTS IN SURFACE WATER
DENOTES IMPACTS IN SURFACE WATER
PRISCILLA B. ROLLS, VIRGINIA ROLLS
DB 09231 PAGE 1049
BM 2005 PAGE 333
CAROLINA PRINCESS LLC
DB 08693 PAGE 1799
CLM ASSOCIATES LLC
DB 8050 PAGE 875
JOHN WALTER ROLLS, JR & IRIS DALTON
DB 8238 PAGE 1571
BM 1997 PAGE 1427
DONALD WINSTEAD & KAREN K.
DB 9365 PAGE 975
CHARLES B. SHEARON & JULIA O
DB 10591 PAGE 843
BM 1988 PAGE 971
NEIL A. FLYOD & MELANIE A.
DB 6729 PAGE 525
BM 1988 PAGE 971
-Y3- +72.765
27 (88.58')
-Y3- PT 10+72.765
-Y3- +45.303
(EX.R/W)
12.304 (40.37')
-Y3- +44.271
25 (82.02')
-Y3- PC 10+31.848
PSH SEE DETAIL SHEET 2-F
CLASS 'I' RIPRAP 15.4 MTN & 41.7m² F.F. (ON BANKS ONLY) SEE DETAIL 12
FILL WITH FLOWABLE MATERIAL 6.2m³
ENDWALL
JB W/MH
CAT-1
+65
40 (131.23')
+80
40 (131.23')
+48.000 (EX.R/W)
40 (131.23')
0.6m BASE TAIL DITCH SEE DETAIL 4 EST DDE=8m³
CLASS B RIP RAP 2.7 MTN 8.4m² F.F.
SPECIAL LATERAL V-DITCH -L- 15+40 TO 15+76 RT SEE DETAIL 2
+40
23 (75.46')
+56.300
31 (101.71')
CLASS B RIP RAP 1.8m MTN 5.9m² F.F.
+40
30 (98.42')
CLASS B RIP RAP 1.8m MTN 5.9m² F.F.
+70
37 (121.39') & 49 (160.76')
0.6m BASE HEAD DITCH EST DDE=15m³ SEE DETAIL 4
STANDARD BERM DITCH -L- 14+20 TO 15+00 RT
+00
23 (75.46') & 35 (114.83')
-L- +60
30 (98.43')
-L- +30
30 (98.43')
-L- +18.774 (EX.R/W)
23 (75.46') & 30 (98.43')
-L- 14+08.642
25.585 (83.94')
+18.199 (-Y3A-)
EXIST.R/W
+55
PROP. R/W
CLASS 'B' RIP RAP 0.9 MTN 4.2m² F.F.
+25 -L-
EXIST.R/W
-Y3- +48.133
(EX.R/W)
16 (52.49')
COLLAR & EXTEND 375
REMOVE CONC DITCH 2GI TYPE D
REMOVE CONC DITCH
RETAIN CONC. DITCH
REMOVE CONC. DITCH
13+58.772
41.0007 (134.54')
-Y3A- PT 11+17.711
-L- POC 13+64.155
-Y3A- POT 11+88.630
-L- SC 13+56.524
-L- POS 13+51.932
-Y3- POT 10+00.000
BEGIN C/A
-L- TS 12+60.524
STANDARD BERM DITCH -L- 11+60 TO 13+40 RT
-Y3A- PC 10+46.489
9+72.951
10.143 (33.28')
10+02.046
10.682 (35.05')
-Y3A- POT 10+00.000
N 21°44'14.4" W
N 13°34'33.0" W
N 44°41'26" W
N 53°41'26" W
S 71°22'59" E
S 71°26'52" E
S 13°56'00" W
S 1°37'37" W
S 35°07'55" E
THOMPSON MILL RD
NC 98 DURHAM RD
EXISTING R/W (VARIABLE)
400 CSP
1800 mm CONC
450 mm CONC
RUINS
13+00
14+00
15+00
8 19

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

CONST.REV.

R/W REV. 5/3/06



2.5 0 2.5 5

METRIC

50 40 30 20 10 0 10 20 30 40

113.546
14+80.0000

111.691
14+60.0000

108.794
14+40.0000

108.398
14+20.0000

108.751
14+00.0000

0.0800 0.0800 0.0800 4:1 6:1 2:1

0.0744 0.0800 0.0800 4:1 6:1 2:1

S.S. 108.229 S.S. 111.838 108.808

S.S. 108.359 S.S. 109.295 108.592

S.S. 108.183 S.S. 108.376

S.S. 108.425 S.S. 109.982 108.338

S.S. 103.838 S.S. 110.241 108.271

110.374 110.147 109.877 109.904 109.904

110.158 110.131 109.910 109.837 109.837

110.001 109.974 109.880

110 115 110 105

BUFFER ZONE 1

FILL IN SURFACE WATER

BUFFER ZONE 1

Permit Drawing
Sheet 10 of 19

SITE 2

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	11
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

METRIC 5 0 10

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

CONST.REV.

R/W REV. 12/15/05

NAD 83

MATCHLINE -L- STA. 29+40.00
SHEET 10

MATCHLINE -L- STA. 32+40.00
SHEET 21

-L- POS Sta. 29+51.580
-Y9- POT Sta. 10+00.000

-L- SC 30+01.468

-L- ST 32+05.700

-L- CS 31+41.700

THOMAS R. AYRES
& BROOK AYRES
DB 5849 PAGE 162
BM 1990 PAGE 1192

DAVID G. STUERWALD
& CAROL A. STUERWALD
DB 5068 PAGE 442
BM 1990 PAGE 1192

STEPHEN C. GOULD & JUDITH M. GOULD
DB 4552 PAGE 514
BM 1990 PAGE 1192

MICHAEL PUSZCZYNSKI
& ANN V. PUSZCZYNSKI
BM 1990 PAGE 1192

RONALD ZOPPO &
VALERIE ZOPPO
DB 4552 PAGE 514
BM 1990 PAGE 1192

PADDY B. SHETLEY
& PAMELA S. MICHAEL
DB 6021 PAGE 835
BM 1990 PAGE 1192

NC DOT
DB 6392 PAGE 113
BM 1990 PAGE 1192

NORTH HILLS PROPERTIES
DB 3021 PAGE 304
BM 1994 PAGE 1621

TOURNAMENT PLAYERS CLUB OF RALEIGH, LLC
DB 9349 PG 10
BM 2000 PG 2220

WAKEFIELD PLANTATION DR.

PL CORNER

TIE TO GUARDRAIL PLACED UNDER R-2809B (LT.& RT.)

EXISTING GUARDRAIL

REMOVE EXISTING GUARDRAIL BARRICADE

SPECIAL DITCH
-L- 30+80 TO 31+20 LT
SEE PROFILE FOR GRADE
SEE DETAIL 2

CONVERT TO CB

PROPOSED G/R

3 CHECK DAMS SEE DETAIL SHT.#2-G

CLASS B RIP RAP L8 MTN 5.9m² F.F.

CLASS I RIP RAP 10.0m MTN 18.4m² F.F.

LATERAL 0.9m BASE DITCH w/ PSRM
170 m² PSRM
EST DDE = 385m³
-L- 31+00 TO 31+38 RT
SEE DETAIL 15

Pls = 29+80.149
Θs = 4° 38' 30"
Ls = 64.0
LT = 42.6813
ST = 21.3467

PI = 30+72.330
Δ = 20° 20' 27.8" (LT)
L = 140.2322
T = 70.8619
R = 395.000
SE = 0.08
Vdes = 100 KPH

Pls = 31+63.047
Θs = 4° 38' 30"
Ls = 64.0
LT = 42.6813
ST = 21.3467

IMPACTS PERMITTED UNDER R-2809B

20' TOWN OF WAKE FOREST SEWER EASEMENT
BM 1990 PAGE 1103
BM 1994 PAGE 1621

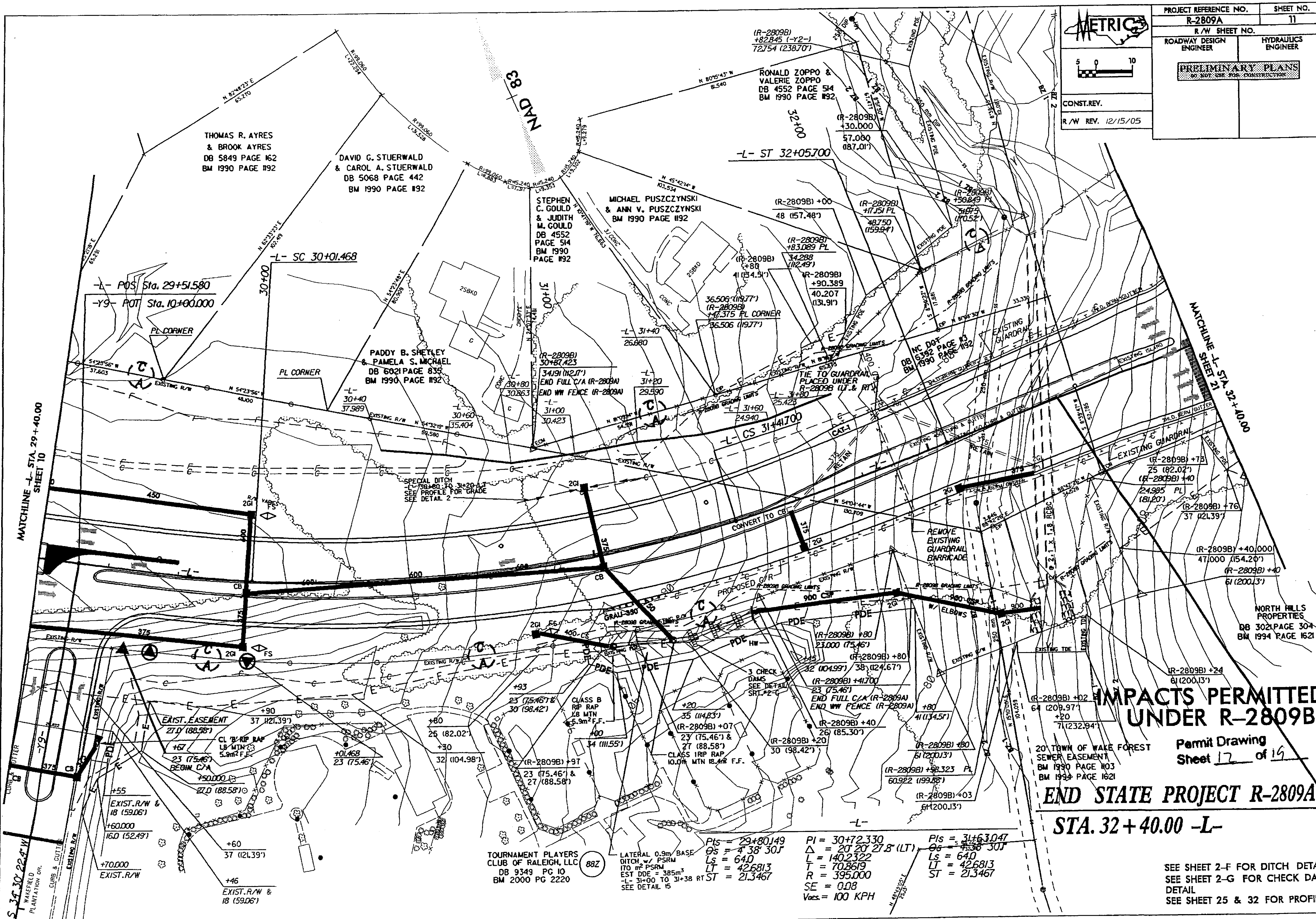
Permit Drawing
Sheet 11 of 19

END STATE PROJECT R-2809A

STA. 32+40.00 -L-

SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 2-G FOR CHECK DAM DETAIL
SEE SHEET 25 & 32 FOR PROFILE

15-AUG-2007 09:41
c:\projects\r2809a\prm\r2809a_prm_ash_11.dgn



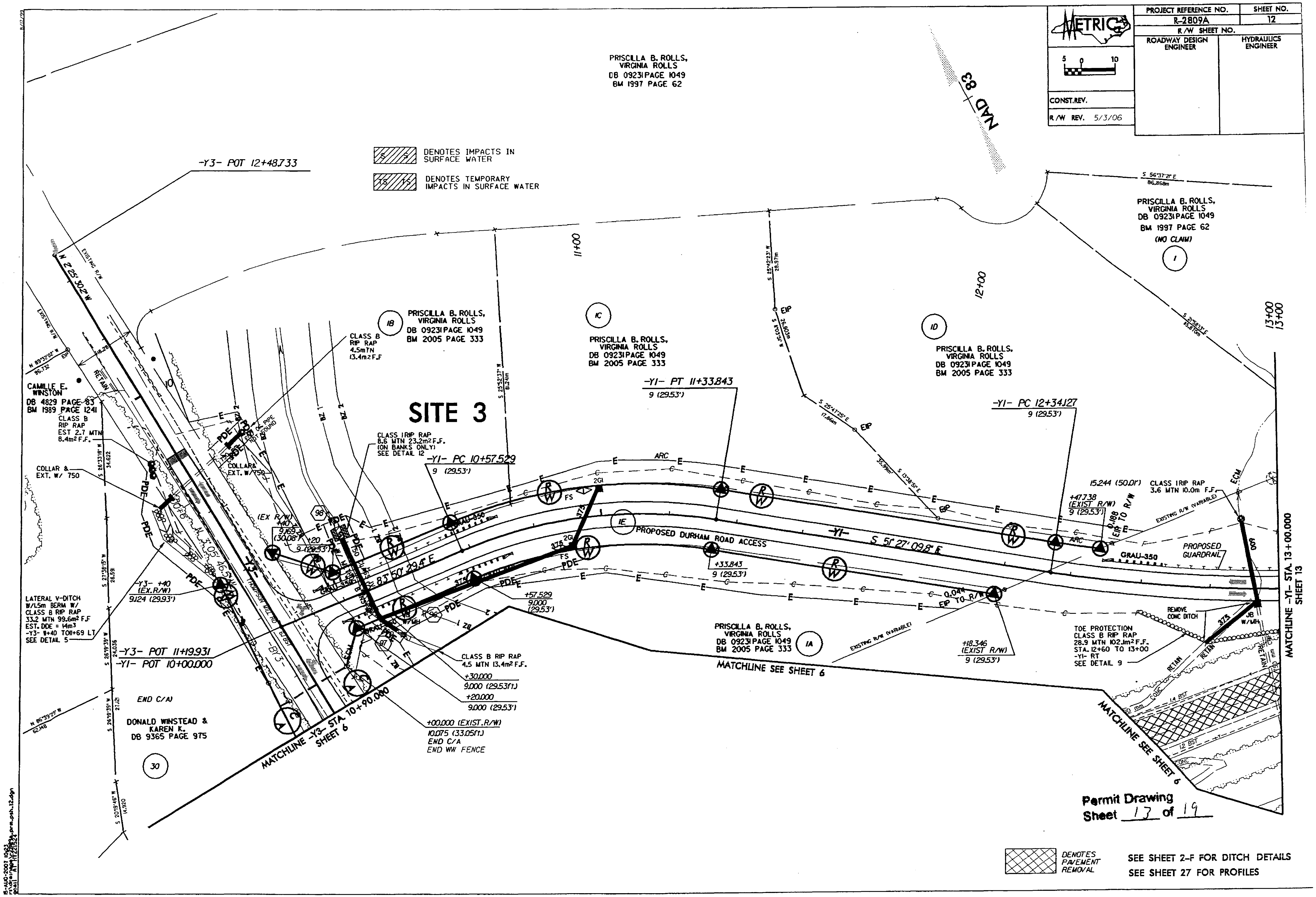
IMPACTS PERMITTED UNDER R-2809B

Permit Drawing Sheet 17 of 19

END STATE PROJECT R-2809A

STA. 32+40.00 -L-

SEE SHEET 2-F FOR DITCH DETAIL
SEE SHEET 2-G FOR CHECK DAM DETAIL
SEE SHEET 25 & 32 FOR PROFILE



PROJECT REFERENCE NO.
SHEET NO.
R-2809A
12
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
METRIC
CONST. REV.
R/W REV. 5/3/06
NAD 83
PRISCILLA B. ROLLS, VIRGINIA ROLLS
DB 09231 PAGE 1049
BM 1997 PAGE 62
DENOTES IMPACTS IN SURFACE WATER
DENOTES TEMPORARY IMPACTS IN SURFACE WATER
-Y3- POT 12+48.733
SITE 3
PRISCILLA B. ROLLS, VIRGINIA ROLLS
DB 09231 PAGE 1049
BM 2005 PAGE 333
CAMILLE E. WINSTON
DB 4829 PAGE 83
BM 1989 PAGE 1241
CLASS B RIP RAP EST 2.7 MTN 8.4m2 F.F.
COLLAR & EXT. W/ 750
CLASS B RIP RAP 4.5 MTN 13.4m2 F.F
CLASS I RIP RAP 8.6 MTN 23.2m2 F.F. (ON BANKS ONLY) SEE DETAIL 12
-Y1- PC 10+57.529
9 (29.53')
-Y1- PT 11+33.843
9 (29.53')
-Y1- PC 12+34.127
9 (29.53')
PROPOSED DURHAM ROAD ACCESS
-Y1- S 51° 27' 09.8" E
15.244 (50.01')
CLASS I RIP RAP 3.6 MTN 10.0m F.F.
+47.738 (EXIST R/W) 9 (29.53')
PROPOSED GUARDRAIL
GRAU-350
LATERAL V-DITCH W/1.5m BERM W/ CLASS B RIP RAP 33.2 MTN 99.6m2 F.F EST. DDE = 14m3 -Y3- 11+40 TO 11+69 LT SEE DETAIL 5
-Y3- +40 (EX.R/W) 9.124 (29.93')
-Y3- POT 11+19.931
-Y1- POT 10+00.000
END C/A
DONALD WINSTEAD & KAREN K.
DB 9365 PAGE 975
MATCHLINE -Y3- STA. 10+90.000 SHEET 6
+00.000 (EXIST. R/W) 10.075 (33.05ft) END C/A END WW FENCE
CLASS B RIP RAP 4.5 MTN 13.4m2 F.F.
+30.000 9.000 (29.53ft)
+20.000 9.000 (29.53')
+57.529 9.000 (29.53')
+33.843 9 (29.53')
MATCHLINE SEE SHEET 6
+18.346 (EXIST R/W) 9 (29.53')
TOE PROTECTION CLASS B RIP RAP 28.9 MTN 102.1m2 F.F. STA. 12+60 TO 13+00 -Y1- RT SEE DETAIL 9
REMOVE CONC DITCH
MATCHLINE -Y1- STA. 13+00.000 SHEET 13
MATCHLINE SEE SHEET 6
Permit Drawing Sheet 13 of 19
DENOTES PAVEMENT REMOVAL
SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 27 FOR PROFILES

METRIC	PROJECT REFERENCE NO.	SHEET NO.
5 0 10	R-2809A	12
CONST.REV.	R/W SHEET NO.	
R/W REV. 5/3/06	ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DENOTES IMPACTS IN SURFACE WATER

DENOTES TEMPORARY IMPACTS IN SURFACE WATER

NAD 83

-Y3- POT 12+48.733

PRISCILLA B. ROLLS, VIRGINIA ROLLS
DB 09231 PAGE 1049
BM 1997 PAGE 62

PRISCILLA B. ROLLS, VIRGINIA ROLLS
DB 09231 PAGE 1049
BM 1997 PAGE 62
(NO CLAIM)

PRISCILLA B. ROLLS, VIRGINIA ROLLS
DB 09231 PAGE 1049
BM 2005 PAGE 333

CAMILLE E. WINSTON
DB 4829 PAGE 83
BM 1989 PAGE 1241

CLASS B RIP RAP
EST 2.7 MTN
8.4m² F.F.

COLLAR & EXT. W/ 750

LATERAL V-DITCH W/1.5m BERM W/ CLASS B RIP RAP
33.2 MTN 99.6m² F.F
EST:- QDE = 1Mm³
-Y3- M+40 TO M+69 LT
SEE DETAIL 5

-Y3- POT 11+19.931
-Y1- POT 10+00.000

END C/A

DONALD WINSTEAD & KAREN K.
DB 9365 PAGE 975

MATCHLINE -Y3- STA. 10+90.000
SHEET 6

CLASS B RIP RAP
4.5m TN
13.4m² F.F

CLASS I RIP RAP
8.6 MTN 23.2m² F.F.
(ON BANKS ONLY)
SEE DETAIL 12

SITE 3

-Y1- PC 10+57.529
9 (29.53')

-Y1- PT 11+33.843
9 (29.53')

-Y1- S 51° 27' 09.5" E

PROPOSED DURHAM ROAD ACCESS

-Y1- PC 12+34.127
9 (29.53')

CLASS I RIP RAP
3.6 MTN 10.0m F.F.

PROPOSED GUARDRAIL

GRAU-350

TOE PROTECTION
CLASS B RIP RAP
28.9 MTN 102.4m² F.F.
STA. 12+60 TO 13+00
-Y1- RT
SEE DETAIL 9

REMOVE CONE DITCH

PRISCILLA B. ROLLS, VIRGINIA ROLLS
DB 09231 PAGE 1049
BM 2005 PAGE 333

MATCHLINE SEE SHEET 6

MATCHLINE -Y1- STA. 13+00.000
SHEET 13

Permit Drawing
Sheet 14 of 19

DENOTES PAVEMENT REMOVAL

SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 27 FOR PROFILES

10/28/38

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	X-38

2.5 0 2.5 5

METRIC

50 40 30 20 10 0 10 20 30 40 50

BUFFER ZONE 1

BUFFER ZONE 2

BUFFER ZONE 2

0.0317 0.0317

S.S. 96.776

96.543

10+40.0000

S.S. 96.940

96.182

SITE 3

100

95

0.0650 0.0650

99.867

4:1

3:1

4:1

91.841

S.S. 94.320

SP -Y3- 11+40.000

23.256m Rt.

SP -Y3- 11+80.000

17.218m Rt.

95.164

10+20.0000

105

99.619

10+00.0000

Permit Drawing
Sheet 15 of 19

-Y1-

50 40 30 20 10 0 10 20 30 40 50

SYSTIME
USERNAME
DGN

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	26
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

METRIC

5 0 10

CONST.REV.

R/W REV.

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

-Y3- THOMPSON MILL RD. SR 1923

PI = 10+30.000
EL = 110.493 m
VC = 36 m
K = 3
$V_{DES.}$ = 30 KPH

+1.5089%

-12.7812%

BEGIN GRADE
-Y3- STA. 10+11.907
EL. 110.220

PIPE HYDRAULIC DATA
DRAINAGE STRUCTURE NO. -Y3- 11+19.931 -Y1- 10+00.000

DRAINAGE AREA	= 1.8	ha
DESIGN FREQUENCY	= 25	yrs
DESIGN DISCHARGE	= 0.347	cms
DESIGN HW ELEVATION	= 93.81	m
100 YEAR DISCHARGE	= 0.40	cms
100 YEAR HW ELEVATION	= 93.86	m
OVERTOPPING FREQUENCY	= +500	yrs
OVERTOPPING DISCHARGE	= +0.66	cms
OVERTOPPING ELEVATION	= +94.2	m

PI = 11+15.000
EL = 99.697 m
VC = 90 m
K = 13
$V_{DES.}$ = 50 KPH

-5.8422%

(-)11.000%

END GRADE
-Y3- STA. 11+60.000
EL. 97.068

MINIMUM RESURFACING

END CONST
-Y3- STA. 11+80.000

BEG. DITCH GRADE
-Y3- LT. PI = 11+40.000
EL. = 96.500

END DITCH GRADE
-Y3- LT. PI = 11+69.000
EL. = 93.300

750

SEE SHEETS 6 & 12 FOR PLANS

-Y1- THOMPSON MILL RD./NC 98 BUS. CONNECTOR

PI = 11+20.000
EL = 102.954 m
VC = 100 m
K = 43
$V_{DES.}$ = 80 KPH

PI = 13+20.000
EL = 106.652 m
VC = 230 m
K = 70
$V_{DES.}$ = 80 KPH
GRADE AHEAD = -1.4400%

105.637

+1.8490%

PIPE HYDRAULIC DATA
DRAINAGE STRUCTURE NO. -Y1-

DRAINAGE AREA	= 3.7	ha
DESIGN FREQUENCY	= 25	yrs
DESIGN DISCHARGE	= 0.65	cms
DESIGN HW ELEVATION	= 97.14	m
100 YEAR DISCHARGE	= 0.79	cms
100 YEAR HW ELEVATION	= 97.23	m
OVERTOPPING FREQUENCY	= +500	yrs
OVERTOPPING DISCHARGE	= +1.3	cms
OVERTOPPING ELEVATION	= +99.8	m

BEGIN GRADE
-Y1- STA. 10+03.641
EL. 99.997

PI = 10+40.000
EL = 99.610 m
VC = 60 m
K = 11

+4.1800%

600

750

PIPE HYDRAULIC DATA
DRAINAGE STRUCTURE NO. -Y1-

DRAINAGE AREA	= 2.0	ha
DESIGN FREQUENCY	= 25	yrs
DESIGN DISCHARGE	= 0.43	cms
DESIGN HW ELEVATION	= 103.18	m
100 YEAR DISCHARGE	= 0.50	cms
100 YEAR HW ELEVATION	= 103.37	m
OVERTOPPING FREQUENCY	= +500	yrs
OVERTOPPING DISCHARGE	= +0.83	cms
OVERTOPPING ELEVATION	= +104.4	m

SEE SHEET 12 FOR PLANS

SITE 3

Permit Drawing Sheet 16 of 19

$$$$SYSTIME$$$$ $$$$DGN$$$$ $$$$USERNAME$$$$

WETLAND PERMIT IMPACT SUMMARY

Site No.	Station (From/To)	Structure Size / Type	WETLAND IMPACTS					SURFACE WATER IMPACTS				
			Permanent Fill In Wetlands (ac)	Temp. Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in Wetlands (ac)	Permanent SW impacts (ac)	Temp. SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
1	9+25 -L- LT	48" RCP	0.01					0.01	<0.01	95	23	
2	14+00 -L- LT	24" CSP						0.01	<0.01	62	20	
3	10+30 -Y1-	30" RCP						0.01	<0.01	118	36	
TOTALS:			0.01		0.00		0.00	0.03	0.00	275	79	

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY
PROJECT: 34503.1.1 (R-2809A)

SHEET 17 of 19 Jul-07

ATN Revised 3/31/05

WETLAND PERMIT IMPACT SUMMARY

Site No.	Station (From/To)	Structure Size / Type	WETLAND IMPACTS: Permanent Fill In Wetlands (ha)	WETLAND IMPACTS: Temp. Fill In Wetlands (ha)	WETLAND IMPACTS: Excavation in Wetlands (ha)	WETLAND IMPACTS: Mechanized Clearing In Wetlands (ha)	WETLAND IMPACTS: Hand Clearing in Wetlands (ha)	SURFACE WATER IMPACTS: Permanent SW Impacts (ha)	SURFACE WATER IMPACTS: Temp. SW Impacts (ha)	SURFACE WATER IMPACTS: Existing Channel Impacts Permanent (m)	SURFACE WATER IMPACTS: Temp. SW Impacts (m)
1	9+26 -L- LT	1200 RCP	0.003					0.003	0.001	29	7
2	14+00 -L- LT	600 CSP						0.002	0.001	19	6
3	10+30 -Y8-	750 RCP						0.004	0.001	36	11
TOTALS:								0.009	0.003	84	24

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY
WBS - 34503.1.1 (R-2809A)

SHEET 18 OF 19 July-07

JMD Revised 2/03/05

List of Property Owners:

SITE #	PROPERTY OWNER	ADDRESSES
1	NCDOT	
2	NCDOT	
3	PRISCILLA ROLLS	7104 THOMPSON MILL ROAD WAKE FOREST, NC 27587

NC DEPARTMENT OF TRANSPORTION
DIVISION OF HIGHWAYS
WAKE COUNTY
34503.1.1 (R-2809A)
WAKE FOREST BYPASS

 August-07

CONTRACT: C201737 TIP PROJECT: R-2809A

See Sheet 1-A For Index of Sheets
See Sheet 1-B For Conventional Symbology
See Sheet 1-C & 1-D For Survey Control Sheets

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

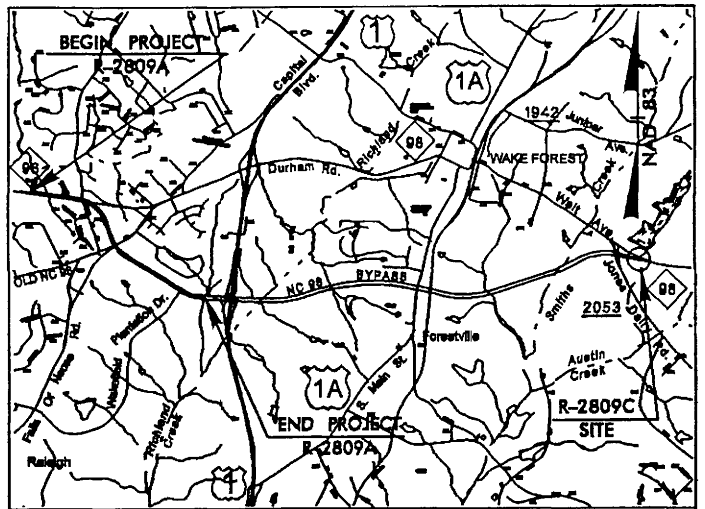
WAKE COUNTY

METRIC

ALL DIMENSIONS IN THESE PLANS ARE IN METERS OR MILLIMETERS UNLESS OTHERWISE SHOWN

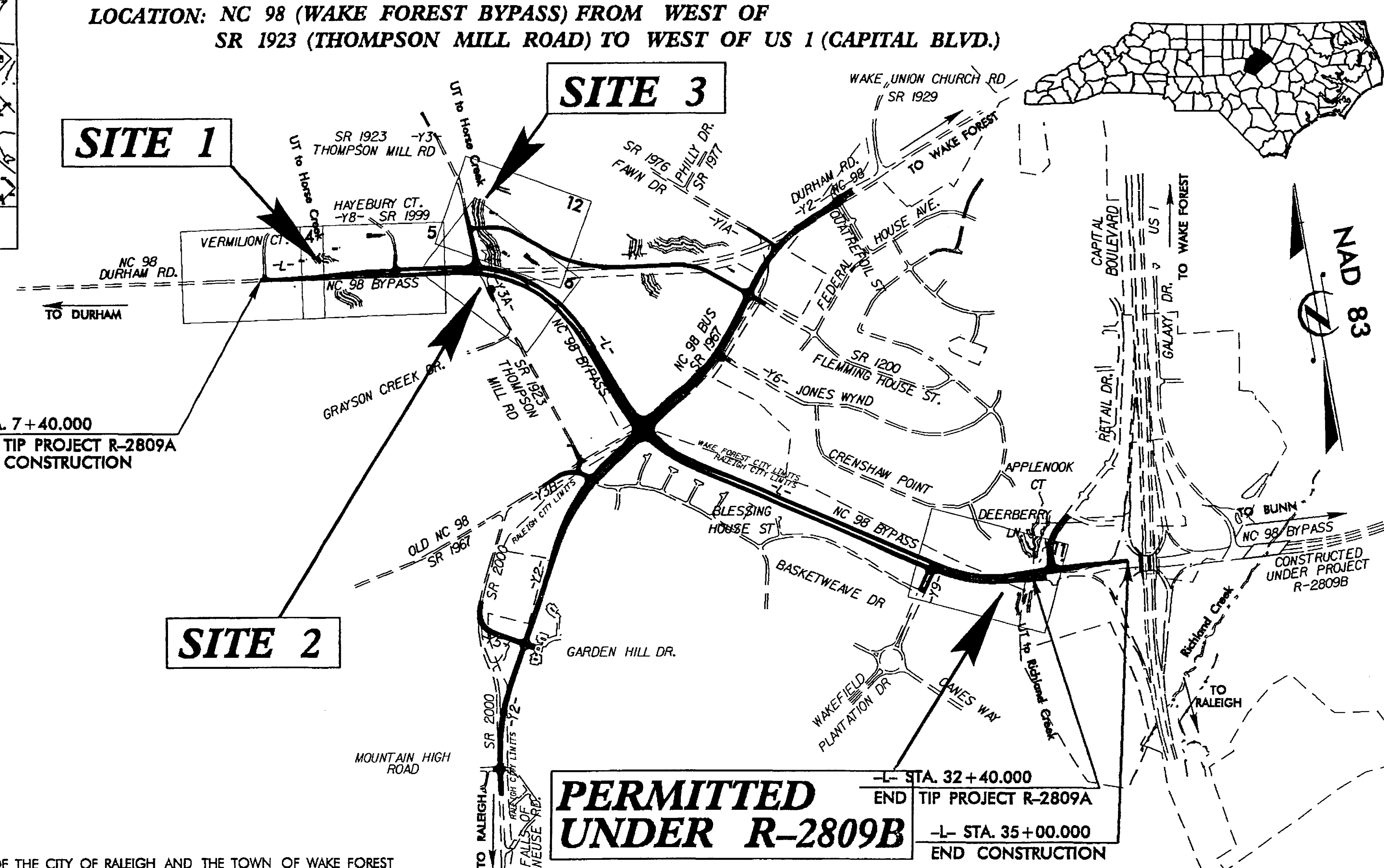
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2809A	1	

STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION
34503.1.1	STP-98(1)	PE
34503.2.5	STP-98(2)	R/W & UTIL
34503.3.7	STP-98(23)	CONST.



VICINITY MAP

LOCATION: NC 98 (WAKE FOREST BYPASS) FROM WEST OF SR 1923 (THOMPSON MILL ROAD) TO WEST OF US 1 (CAPITAL BLVD.)



BUFFER PERMIT

PORTIONS OF THIS PROJECT FALLS WITHIN THE BOUNDARIES OF THE CITY OF RALEIGH AND THE TOWN OF WAKE FOREST

GRAPHIC SCALES

PLANS (5 0 10)

PROFILE (HORIZONTAL) (5 0 10)

PROFILE (VERTICAL) (1 0 2)

DESIGN DATA

ADT 2007	=	24,100
ADT 2025	=	36,500
DHV	=	10 %
D	=	60 %
T	=	6 % *
V	=	100 km/h

* (TTST 2% & DUAL 4%)

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT R-2809A = 2.500 km

TOTAL LENGTH OF TIP PROJECT R-2809A = 2.500 km

Prepared in the Office of:

DIVISION OF HIGHWAYS

1000 Birch Ridge Dr., Raleigh, NC 27610

2002 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: JUNE 30, 2005

LETTING DATE: DECEMBER 18, 2007

JASON MOORE, PE — PROJECT ENGINEER

KEVIN E. MOORE, PE — PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: P.E.

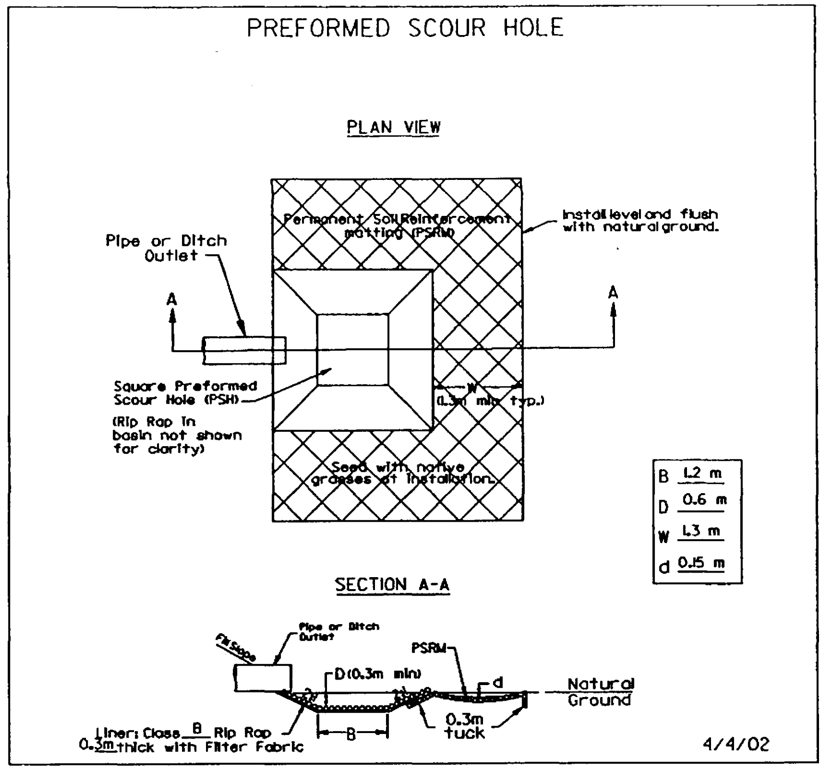
DIVISION OF HIGHWAYS STATE OF NORTH CAROLINA

STATE HIGHWAY DESIGN ENGINEER P.E.

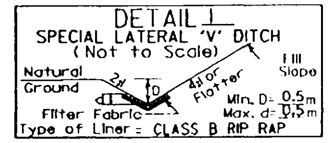
15-AUG-2007 12:47

Buffer Drawing Sheet 1 of 23

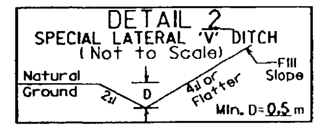
PROJECT REFERENCE NO.	SHEET NO.
R-2809A	2-F
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER



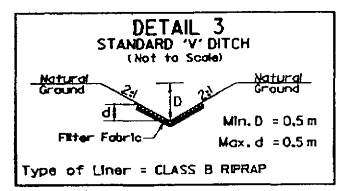
STA. 9+50 -L- LT
STA. 9+99 -L- RT
STA. 13+75 -L- LT
STA. 14+30 -L- LT
STA. 18+73 -L- LT
STA. 19+95 -L- LT



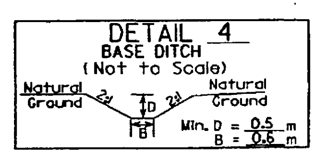
STA. 10+70 TO 11+11 -L- LT
STA. 11+20 TO 11+60 -L- RT
STA. 19+40 TO 19+80 -L- RT
STA. 23+60 TO 23+90 -L- LT
STA. 18+82 TO 19+00 -Y2- RT



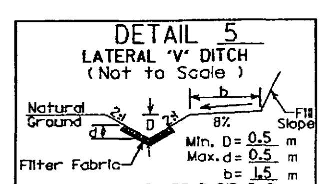
STA. 15+40 TO 15+76 -L- RT
STA. 18+80 TO 19+20 -L- RT
STA. 30+80 TO 31+20 -L- LT
STA. 11+06 TO 11+60 -Y2- LT
STA. 19+20 TO 19+46 -Y2- RT
STA. 26+60 TO 27+00 -Y2- LT
STA. 10+70 TO 10+40 -Y3B- RT
STA. 10+20 TO 10+50 -Y4- LT



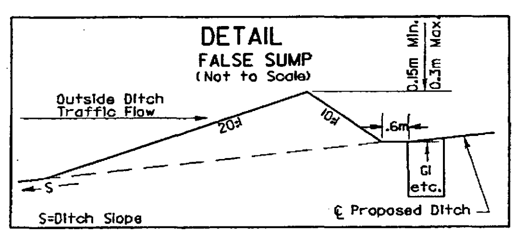
STA. 27+00 TO 27+17 -Y2- LT
STA. 27+17 TO 27+70 -Y2- LT

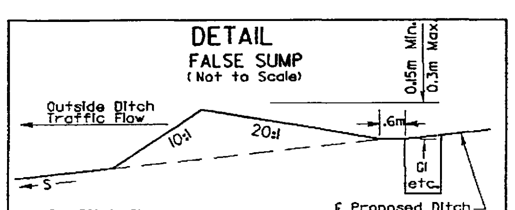


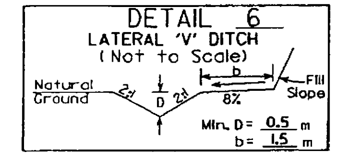
STA. 15+73 -L- LT
STA. 15+78 -L- RT
STA. 17+35 TO 17+55 -L- RT
STA. 24+55 -L- LT
STA. 15+30 -Y2- LT
STA. 12+04 -Y5- LT



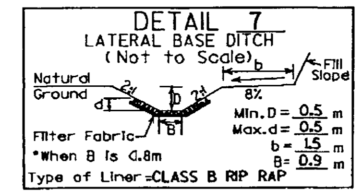
STA. 17+00 TO 17+80 -L- LT
STA. 24+20 TO 24+40 -L- RT
STA. 24+60 TO 25+20 -L- LT
STA. 11+40 TO 11+69 -Y3- LT
STA. 15+20 TO 16+00 -Y2- LT
STA. 16+20 TO 16+80 -Y2- LT



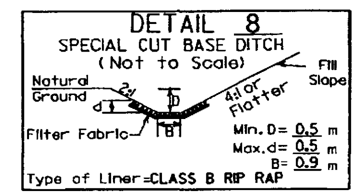




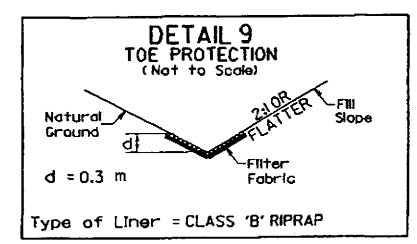
STA. 16+70 TO 17+33 -L- RT
STA. 25+80 TO 28+20 -L- LT



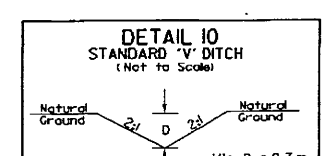
STA. 16+42 TO 17+00 -L- LT



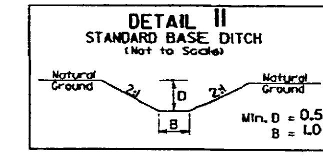
STA. 23+00 TO 23+60 -L- LT



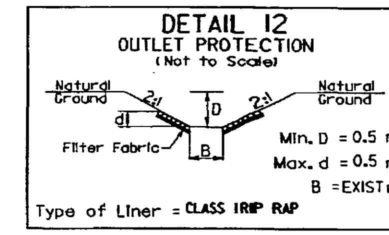
STA 8+35 TO STA 8+50 -L- RT.
STA 9+20 TO STA 9+80 -L- LT.
STA. 23+60 TO 24+10 -L- RT
STA. 12+60 TO 13+00 -Y1- RT
STA. 16+30 TO 17+20-Y1- RT
STA. 26+80 TO 27+20 -Y2- RT



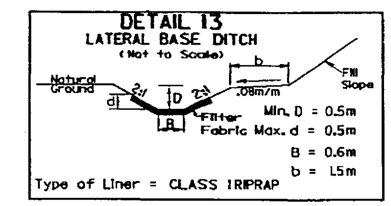
STA. 10+30 -Y1A- RT



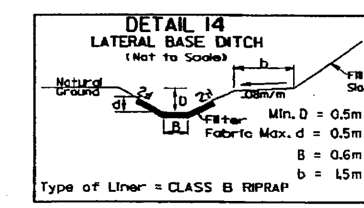
STA. 16+42 -Y2- RT



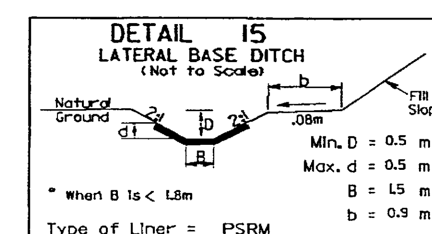
STA. 9+15 -L- LT
STA. 13+95 -L- LT
STA. 11+50 -Y3- RT



STA. 9+00 TO 9+12 -L- LT



STA. 9+80 TO 10+70 -L- LT

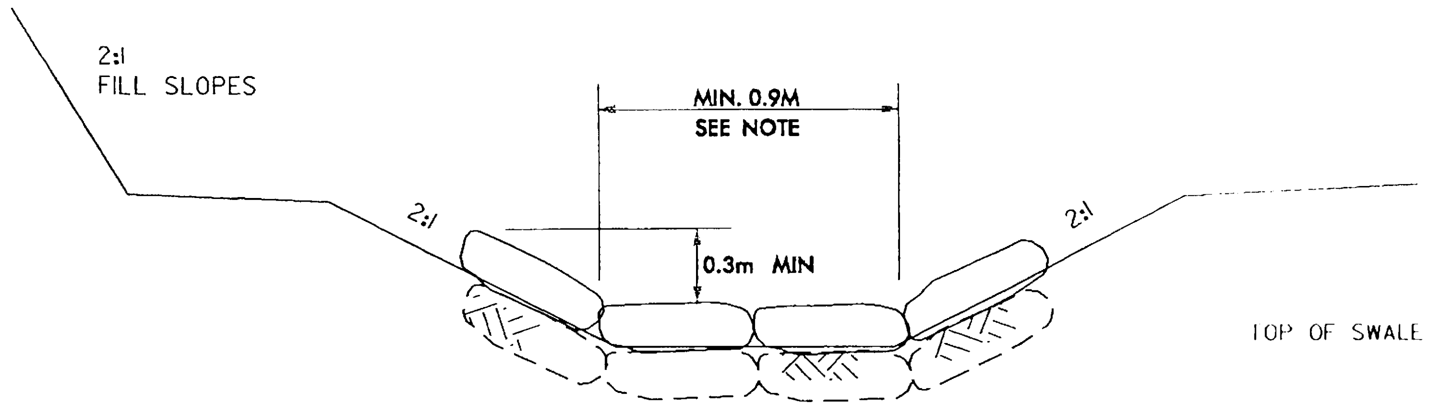


STA. 31+00 TO 31+38 -L- RT

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	2-G
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

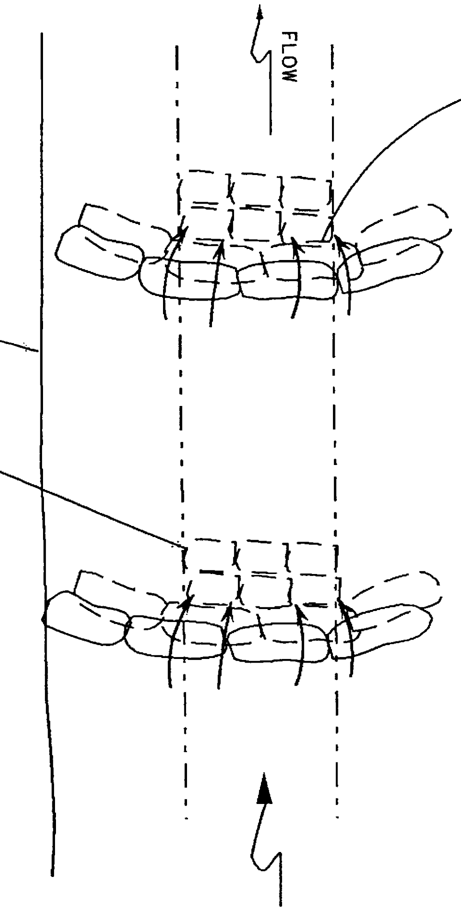
METRIC

LATERAL SWALE/DITCH W/ROCK CHECKS
STA 31+16 TO 31+38 -L- RT



TYPICAL CROSS SECTION

NOT TO SCALE



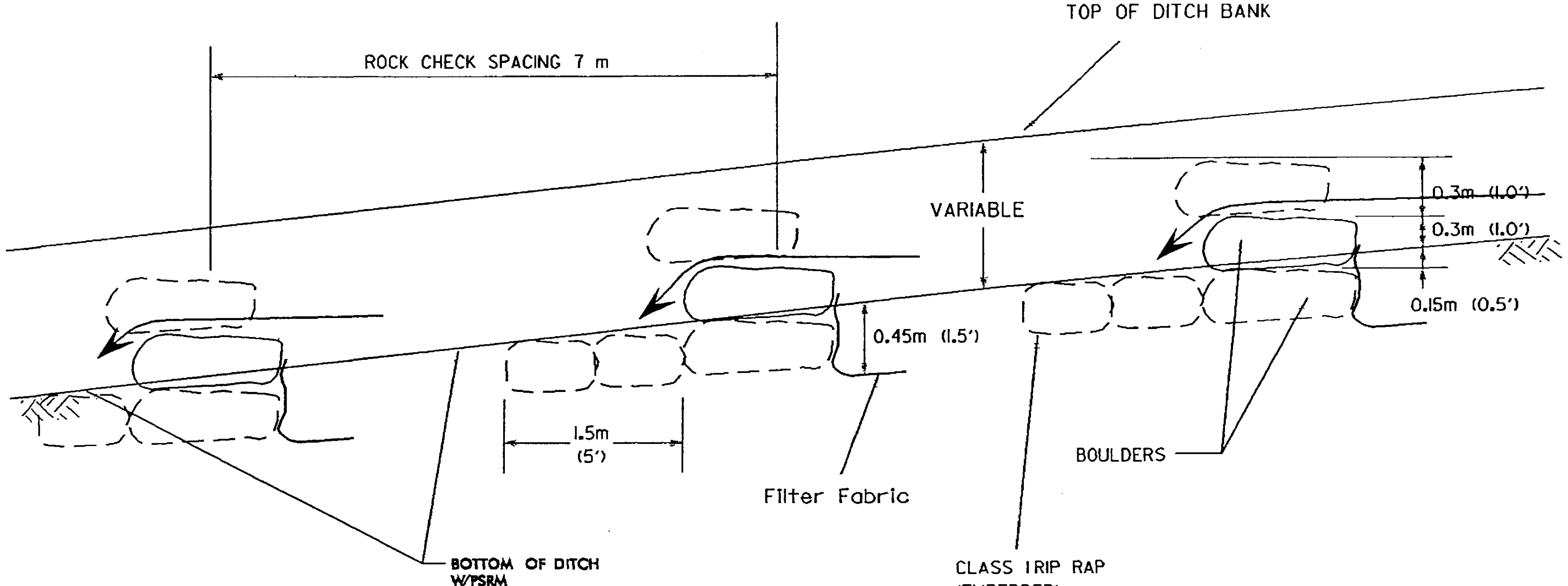
PLAN VIEW

NOT TO SCALE

FILTER FABRIC = 20m²

BOULDERS/FOOTER ROCK = 60 MTN

CLASS I RIP RAP = 5 MTN



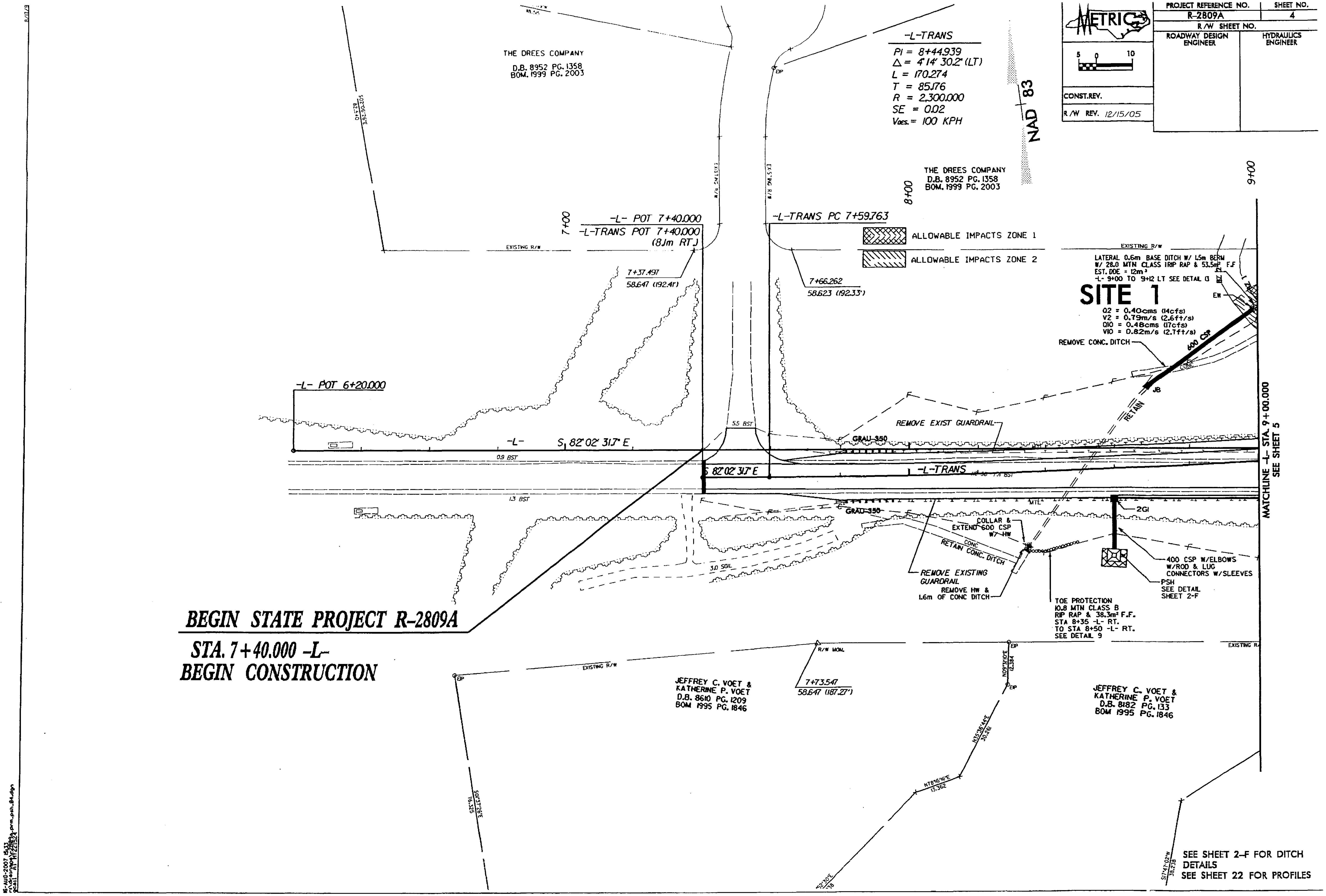
PROFILE

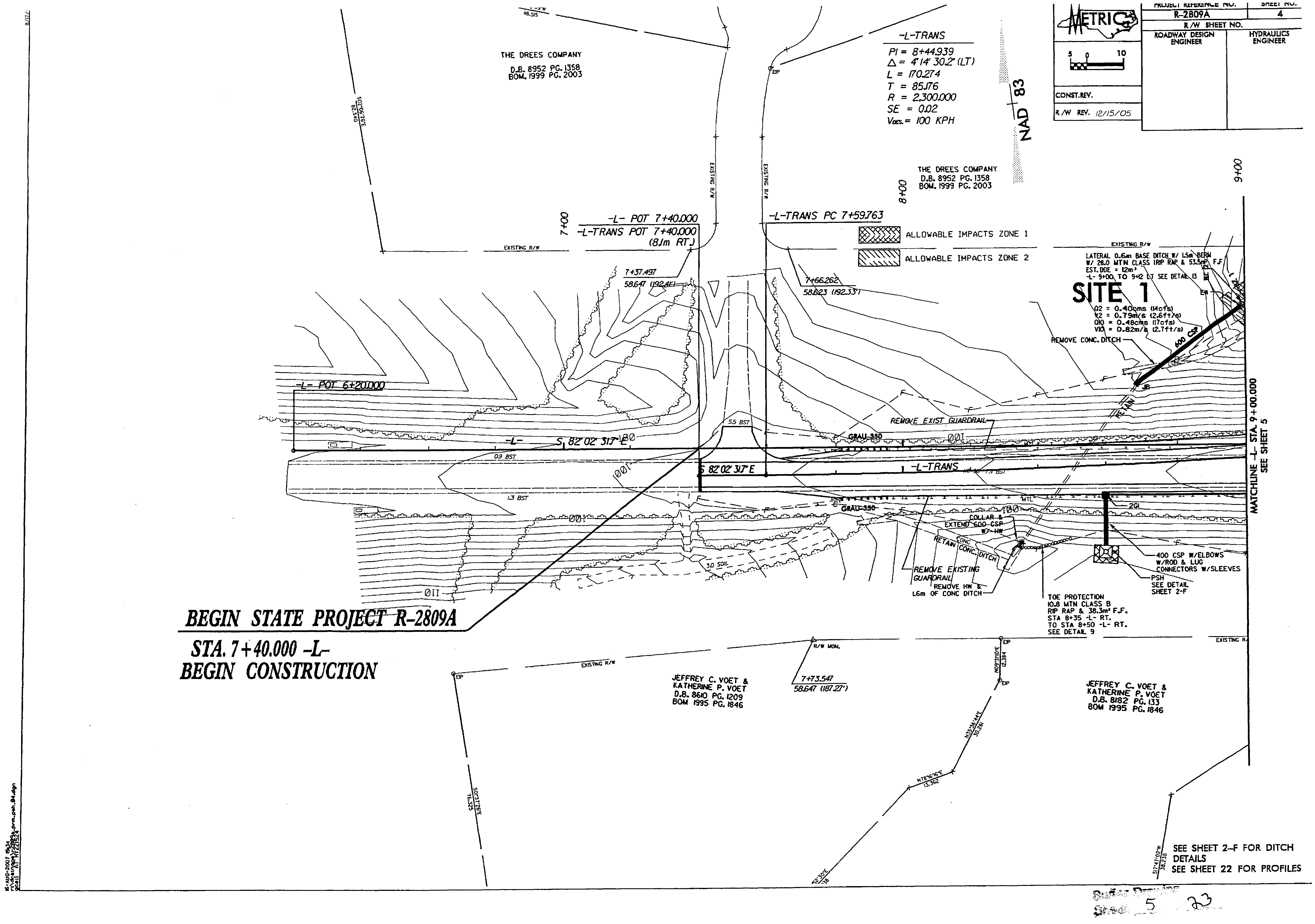
NOT TO SCALE

NOTE:

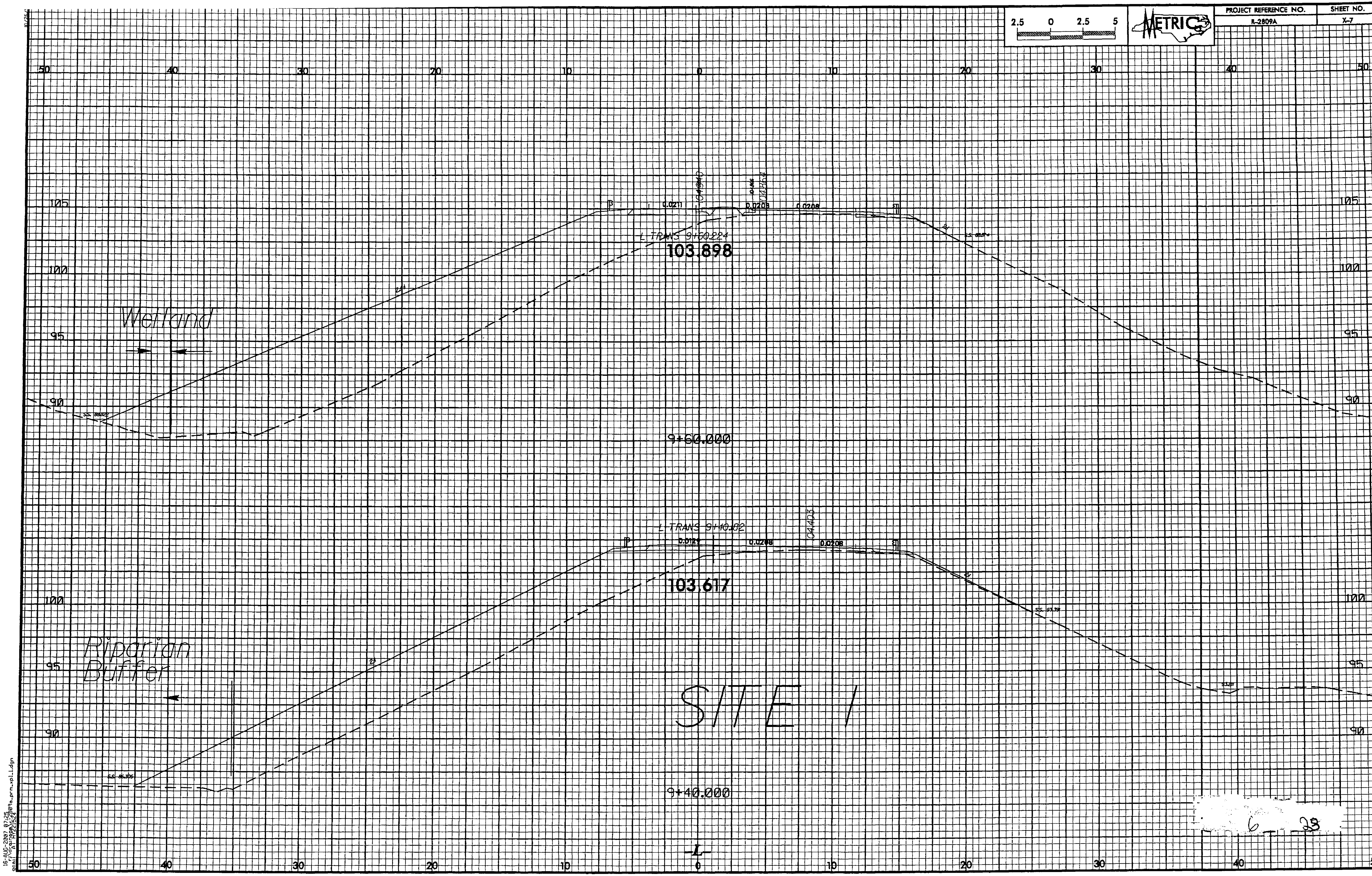
BOULDERS SHOULD BE ANGULAR AND OBLONG WITH APPROXIMATE DIMENSIONS OF 0.6m x 0.45m x 0.45m (2' x 1.5' x 1.5'). ROCK SHOULD FIT TIGHTLY TOGETHER WITH MINIMAL VOIDS. STAGGER BOULDER JOINTS.

ROCK CHECK SPACING IS DEPENDENT ON DITCH GRADES AT 1' DROP INTERVALS OR SLOPE CONTROL.

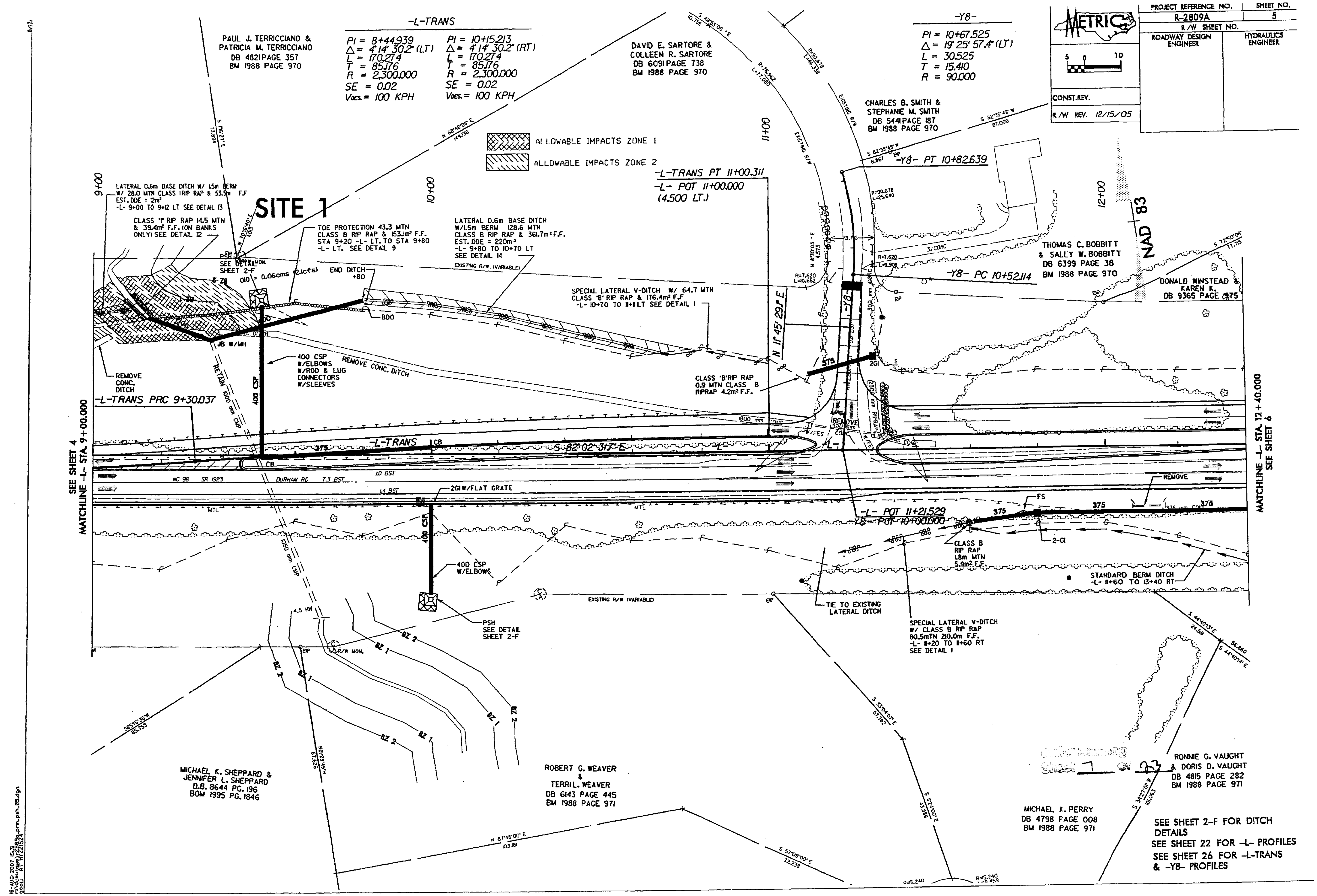

METRIC
PROJECT REFERENCE NO. R-2809A
SHEET NO. 4
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
CONST. REV.
R/W REV. 12/15/05
NAD 83
-L-TRANS
PI = 8+44.939
Δ = 4°14' 30.2" (LT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
Vdes. = 100 KPH
THE DREES COMPANY
D.B. 8952 PG. 1358
BOM. 1999 PG. 2003
-L- POT 7+40.000
-L-TRANS POT 7+40.000 (8.1m RT.)
-L-TRANS PC 7+59.763
ALLOWABLE IMPACTS ZONE 1
ALLOWABLE IMPACTS ZONE 2
7+37.497
58.647 (192.41')
7+66.262
58.623 (192.33')
LATERAL 0.6m BASE DITCH W/ 1.5m BERM W/ 28.0 MTN CLASS I RIP RAP & 53.5m² F.F
EST. DDE = 12m³
-L- 9+00 TO 9+12 LT SEE DETAIL 13
SITE 1
Q2 = 0.40cms (14cfs)
V2 = 0.79m/s (2.6ft/s)
Q10 = 0.48cms (17cfs)
V10 = 0.82m/s (2.7ft/s)
REMOVE CONC. DITCH
600 CSP
RETAIN
-L- POT 6+20.000
-L- S 82°02' 31.7" E
S 82°02' 31.7" E
-L-TRANS
REMOVE EXIST GUARDRAIL
GRAU-350
MATCHLINE -L- STA. 9+00.000 SEE SHEET 5
2GI
COLLAR & EXTEND 600 CSP W/ HW
RETAIN CONC. DITCH
REMOVE EXISTING GUARDRAIL
REMOVE HW & 1.6m OF CONC DITCH
400 CSP W/ELBOWS W/ROD & LUG CONNECTORS W/SLEEVES
PSH SEE DETAIL SHEET 2-F
TOE PROTECTION 10.8 MTN CLASS B RIP RAP & 38.3m² F.F. STA 8+35 -L- RT. TO STA 8+50 -L- RT. SEE DETAIL 9
BEGIN STATE PROJECT R-2809A
STA. 7+40.000 -L-
BEGIN CONSTRUCTION
EXISTING R/W
R/W MON.
7+73.547
58.647 (187.27')
JEFFREY C. VOET & KATHERINE P. VOET
D.B. 8610 PG. 1209
BOM 1995 PG. 1846
JEFFREY C. VOET & KATHERINE P. VOET
D.B. 8182 PG. 133
BOM 1995 PG. 1846
SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 22 FOR PROFILES



PROJECT REFERENCE NO. R-2809A
SHEET NO. 4
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
METRIC
CONST.REV.
R/W REV. 12/15/05
THE DREES COMPANY
D.B. 8952 PG. 1358
BOM. 1999 PG. 2003
-L-TRANS
PI = 8+44.939
△ = 4°14' 30.2" (LT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
VDES = 100 KPH
NAD 83
-L- POT 7+40.000
-L-TRANS POT 7+40.000
(8.1m RT.)
-L-TRANS PC 7+59.763
ALLOWABLE IMPACTS ZONE 1
ALLOWABLE IMPACTS ZONE 2
EXISTING R/W
SITE 1
LATERAL 0.6m BASE DITCH W/ 1.5m BERM
W/ 28.0 MTN CLASS I RIP RAP & 53.5m² F.F.
EST. DDE = 12m³
-L- 9+00 TO 9+12 LT SEE DETAIL 13
Q2 = 0.40cms (14cfs)
V2 = 0.79m/s (2.6ft/s)
Q10 = 0.48cms (17cfs)
V10 = 0.82m/s (2.7ft/s)
REMOVE CONC. DITCH
600 CSP
RETAIN
REMOVE EXIST GUARDRAIL
-L-POT 6+20.000
-L- S 82° 02' 31.7" E
-L-TRANS
S 82° 02' 31.7" E
MATCHLINE -L- STA. 9+00.000 SEE SHEET 5
7+37.497
58.647 (192.41')
7+66.262
58.623 (192.33')
COLLAR & EXTEND 600 CSP W/ HW
RETAIN CONC. DITCH
REMOVE EXISTING GUARDRAIL
REMOVE HW & 1.6m OF CONC DITCH
400 CSP W/ELBOWS W/ROD & LUG CONNECTORS W/SLEEVES
PSH SEE DETAIL SHEET 2-F
TOE PROTECTION
10.8 MTN CLASS B RIP RAP & 38.3m² F.F.
STA 8+35 -L- RT. TO STA 8+50 -L- RT.
SEE DETAIL 9
BEGIN STATE PROJECT R-2809A
STA. 7+40.000 -L-
BEGIN CONSTRUCTION
JEFFREY C. VOET & KATHERINE P. VOET
D.B. 8610 PG. 1209
BOM 1995 PG. 1846
7+73.547
58.647 (187.27')
JEFFREY C. VOET & KATHERINE P. VOET
D.B. 8182 PG. 133
BOM 1995 PG. 1846
SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 22 FOR PROFILES
Buffer Drawing
Sheet 5 of 23



PROJECT REFERENCE NO.
R-2809A
SHEET NO.
X-7
2.5 0 2.5 5
METRIC
Wetland
L TRANS 9+60.224
103.898
0.0211
0.0208
0.0208
9+60.000
L TRANS 9+40.182
0.0208
0.0208
04403
103.617
Riparian Buffer
SITE 1
9+40.000
-L-
16-AUG-2007 07:25
6 38



PROJECT REFERENCE NO. R-2809A
SHEET NO. 5
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
METRIC
CONST. REV.
R/W REV. 12/15/05
-L-TRANS
PI = 8+44.939
Δ = 4°14' 30.2" (LT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
Vdes = 100 KPH
PI = 10+15.213
Δ = 4°14' 30.2" (RT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
Vdes = 100 KPH
-Y8-
PI = 10+67.525
Δ = 19° 25' 57.4" (LT)
L = 30.525
T = 15.410
R = 90.000
PAUL J. TERRICCIANO & PATRICIA M. TERRICCIANO DB 4821 PAGE 357 BM 1988 PAGE 970
DAVID E. SARTORE & COLLEEN R. SARTORE DB 6091 PAGE 738 BM 1988 PAGE 970
CHARLES B. SMITH & STEPHANIE M. SMITH DB 5441 PAGE 187 BM 1988 PAGE 970
THOMAS C. BOBBITT & SALLY W. BOBBITT DB 6399 PAGE 38 BM 1988 PAGE 970
DONALD WINSTEAD & KAREN K. DB 9365 PAGE 375
ALLOWABLE IMPACTS ZONE 1
ALLOWABLE IMPACTS ZONE 2
SITE 1
NAD 83
LATERAL 0.6m BASE DITCH W/ 1.5m BERM W/ 28.0 MTN CLASS I RIP RAP & 53.5m² F.F EST. DDE = 12m³ -L- 9+00 TO 9+12 LT SEE DETAIL 13
CLASS 'I' RIP RAP 14.5 MTN & 39.4m² F.F. (ON BANKS ONLY) SEE DETAIL 12
TOE PROTECTION 43.3 MTN CLASS B RIP RAP & 153.1m² F.F. STA 9+20 -L- LT. TO STA 9+80 -L- LT. SEE DETAIL 9
LATERAL 0.6m BASE DITCH W/1.5m BERM 128.6 MTN CLASS B RIP RAP & 361.7m² F.F. EST. DDE = 220m³ -L- 9+80 TO 10+70 LT SEE DETAIL 14
SPECIAL LATERAL V-DITCH W/ 64.7 MTN CLASS 'B' RIP RAP & 176.4m² F.F -L- 10+70 TO 11+11 LT SEE DETAIL 1
-L-TRANS PT 11+00.311
-L- POT 11+00.000 (4.500 LT.)
-Y8- PT 10+82.639
-Y8- PC 10+52.114
N 11° 45' 29.1" E
PSH SEE DETAIL SHEET 2-F
Q10 = 0.06cms (2.1cfs)
END DITCH +80
BDO
JB W/MH
400 CSP W/ELBOWS W/ROD & LUG CONNECTORS W/SLEEVES
REMOVE CONC. DITCH
RETAIN 1000 mm CMP
REMOVE CONC. DITCH
-L-TRANS PRC 9+30.037
CLASS 'B' RIP RAP 0.9 MTN CLASS B RIPRAP 4.2m² F.F.
-L-TRANS
S 82°02' 31.7" E
NC 98 SR 1923 DURHAM RD
2GI W/FLAT GRATE
400 CSP W/ELBOWS
PSH SEE DETAIL SHEET 2-F
1050 mm CMP
EXISTING R/W (VARIABLE)
-L- POT 11+21.529
-Y8- POT 10+00.000
FS
2-GI
CLASS B RIP RAP 1.8m MTN 5.9m² F.F.
STANDARD BERM DITCH -L- 11+60 TO 13+40 RT
TIE TO EXISTING LATERAL DITCH
SPECIAL LATERAL V-DITCH W/ CLASS B RIP RAP 80.5mTN 210.0m F.F. -L- 11+20 TO 11+60 RT SEE DETAIL 1
REMOVE
MATCHLINE -L- STA. 9+00.000 SEE SHEET 4
MATCHLINE -L- STA. 12+40.000 SEE SHEET 6
MICHAEL K. SHEPPARD & JENNIFER L. SHEPPARD D.B. 8644 PG. 196 BOM 1995 PG. 1846
ROBERT C. WEAVER & TERRI L. WEAVER DB 6143 PAGE 445 BM 1988 PAGE 971
MICHAEL K. PERRY DB 4798 PAGE 008 BM 1988 PAGE 971
RONNIE G. VAUGHT & DORIS D. VAUGHT DB 4815 PAGE 282 BM 1988 PAGE 971
BZ 1
BZ 2
SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 22 FOR -L- PROFILES
SEE SHEET 26 FOR -L-TRANS & -Y8- PROFILES

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
CONST.REV.	
R/W REV. 12/15/05	

METRIC 5 0 10

-L-TRANS

PI = 8+44.939
Δ = 4°14'30.2" (LT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
Vdes. = 100 KPH

PI = 10+15.213
Δ = 4°14'30.2" (RT)
L = 170.274
T = 85.176
R = 2,300.000
SE = 0.02
Vdes. = 100 KPH

-Y8-

PI = 10+67.525
Δ = 19°25'57.4" (LT)
L = 30.525
T = 15.410
R = 90.000

PAUL J. TERRICCIANO & PATRICIA M. TERRICCIANO
DB 4821 PAGE 357
BM 1988 PAGE 970

DAVID E. SARTORE & COLLEEN R. SARTORE
DB 6091 PAGE 738
BM 1988 PAGE 970

CHARLES B. SMITH & STEPHANIE M. SMITH
DB 5441 PAGE 187
BM 1988 PAGE 970

ALLOWABLE IMPACTS ZONE 1

ALLOWABLE IMPACTS ZONE 2

SITE 1

-L-TRANS PT 11+00.311
-L- POT 11+00.000
(4.500 LT.)

-Y8- PT 10+82.639

-Y8- PC 10+52.114

LATERAL 0.6m BASE DITCH W/ 1.5m BERM W/ 28.0 MTN CLASS I RIP RAP & 53.9m² F.F
EST. DDE = 12m³
-L- 9+00 TO 9+12 LT SEE DETAIL 13

CLASS 'I' RIP RAP 91.5 MTN & 38.4m² F.F. ION BANKS ONLY) SEE DETAIL 12

TOE PROTECTION 43.3 MTN CLASS B RIP RAP & 153.1m² F.F.
STA 9+20 -L- LT. TO STA 9+80 -L- LT. SEE DETAIL 9

LATERAL 0.6m BASE DITCH W/1.5m BERM 128.6 MTN CLASS B RIP RAP & 361.7m² F.F.
EST. DDE = 220m³
-L- 9+80 TO 10+70 LT
SEE DETAIL 14

SPECIAL LATERAL V-DITCH W/ 64.1 MTN CLASS 'B' RIP RAP & 176.4m² F.F
-L- 10+70 TO 11+81LT SEE DETAIL 1

CLASS 'B' RIP RAP 0.9 MTN CLASS B RIPRAP 4.2m² F.F.

REMOVE CONC. DITCH

-L-TRANS PRC 9+30.037

400 CSP W/ELBOWS W/ROD & LUG CONNECTORS W/SLEEVES

PSH SEE DETAIL SHEET 2-F

END DITCH +80

JB W/MH

-L-TRANS

2GI W/FLAT GRATE

400 CSP W/ELBOWS

EXISTING R/W (VARIABLE)

TIE TO EXISTING LATERAL DITCH

SPECIAL LATERAL V-DITCH W/ CLASS B RIP RAP 80.5m TN 210.0m F.F. -L- 11+20 TO 11+60 RT SEE DETAIL 1

-L- POT 11+21.529
-Y8- POT 10+00.000

CLASS B RIP RAP 1.8m MTN 5.9m² F.F.

STANDARD BERM DITCH -L- 11+60 TO 13+40 RT

REMOVE

THOMAS C. BOBBITT & SALLY W. BOBBITT
DB 6399 PAGE 38
BM 1988 PAGE 970

DONALD WINSTEAD & KAREN K.
DB 9365 PAGE 375

MICHAEL K. SHEPPARD & JENNIFER L. SHEPPARD
D.B. 8644 PG. 196
BOM 1995 PG. 1846

ROBERT G. WEAVER & TERRIL. WEAVER
DB 6143 PAGE 445
BM 1988 PAGE 971

RONNIE G. VAUGHT & DORIS D. VAUGHT
DB 4815 PAGE 282
BM 1988 PAGE 971

MICHAEL K. PERRY
DB 4798 PAGE 008
BM 1988 PAGE 971

NC 98 SR 1923 DURHAM RD 7.3 BST 18 BST 14 BST

SEE DETAIL SHEET 4
MATCHLINE -L- STA. 9+00.000

MATCHLINE -L- STA. 12+40.000
SEE SHEET 6

SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 22 FOR -L- PROFILES
SEE SHEET 26 FOR -L-TRANS & -Y8- PROFILES

NAD 83

2.5	0	2.5	5

METRIC

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	X-14

111.691
14+60.000

108.794
14+40.000

108.398
14+20.000

108.751
14+00.000

Riparian Buffer

SITE 2

-L-

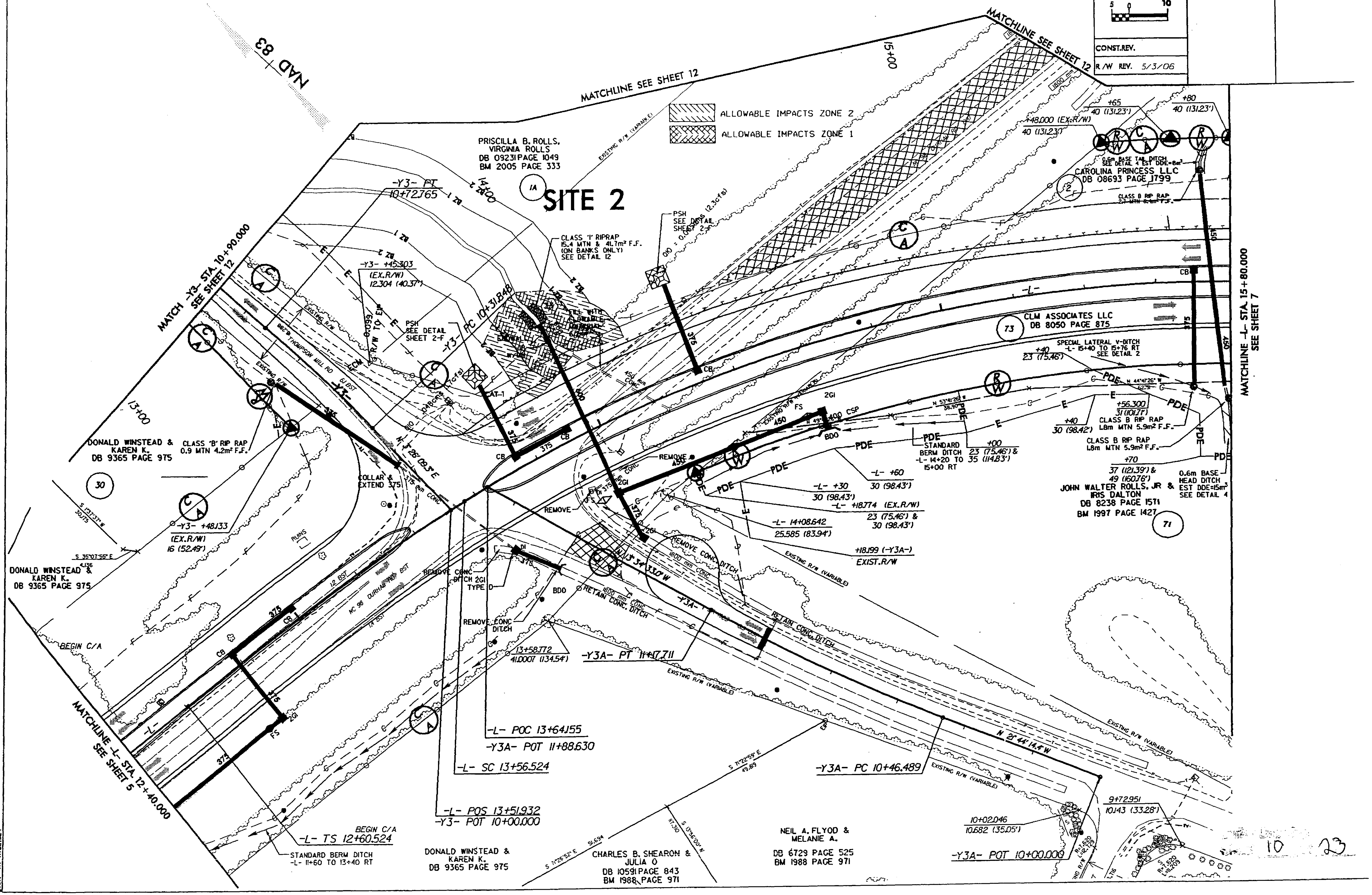
16-AUG-2007 07:15
c:\projects\2809a.prn_xpl1.dgn

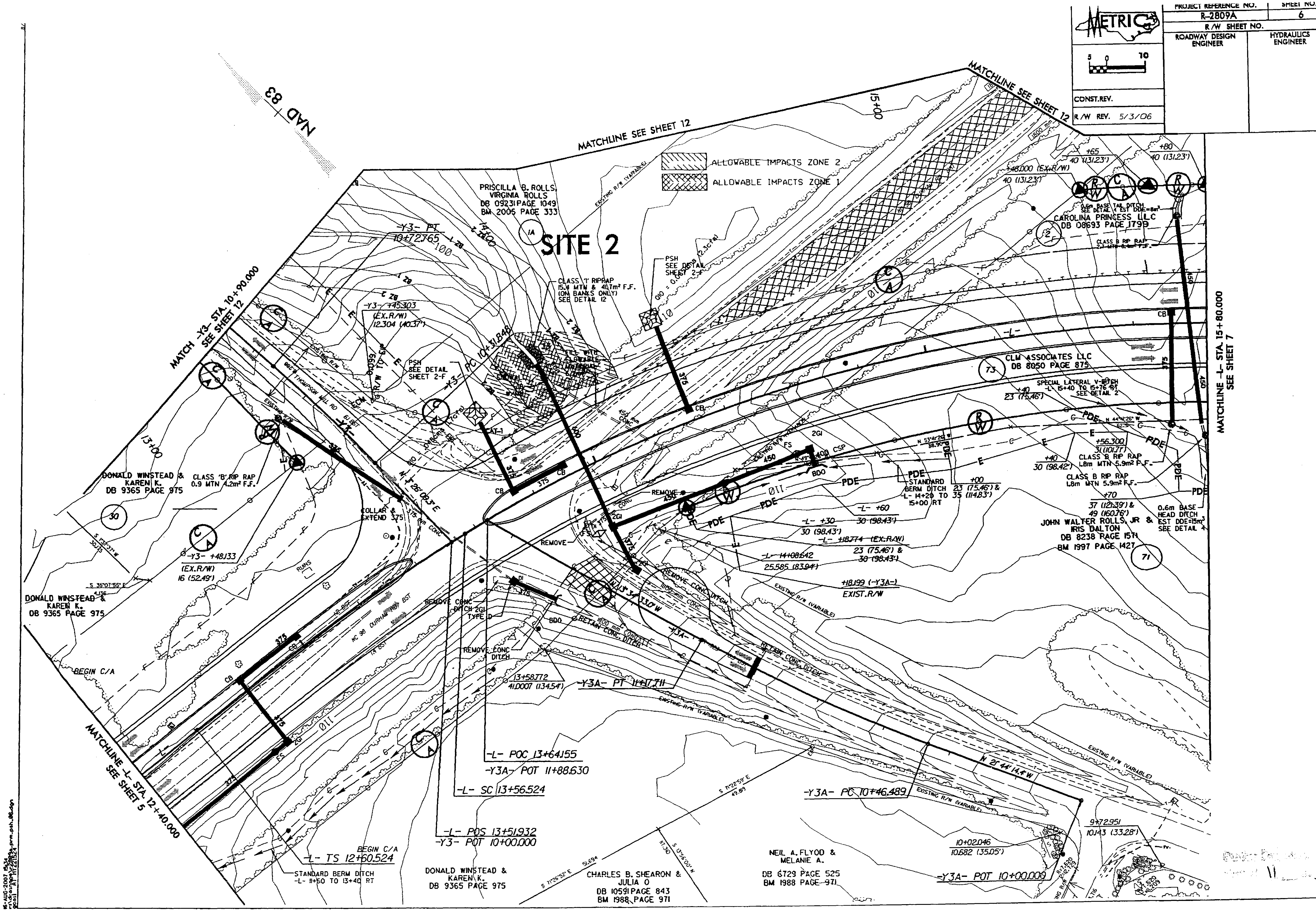
PROJECT REFERENCE NO.	SHEET NO.
R-2809A	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

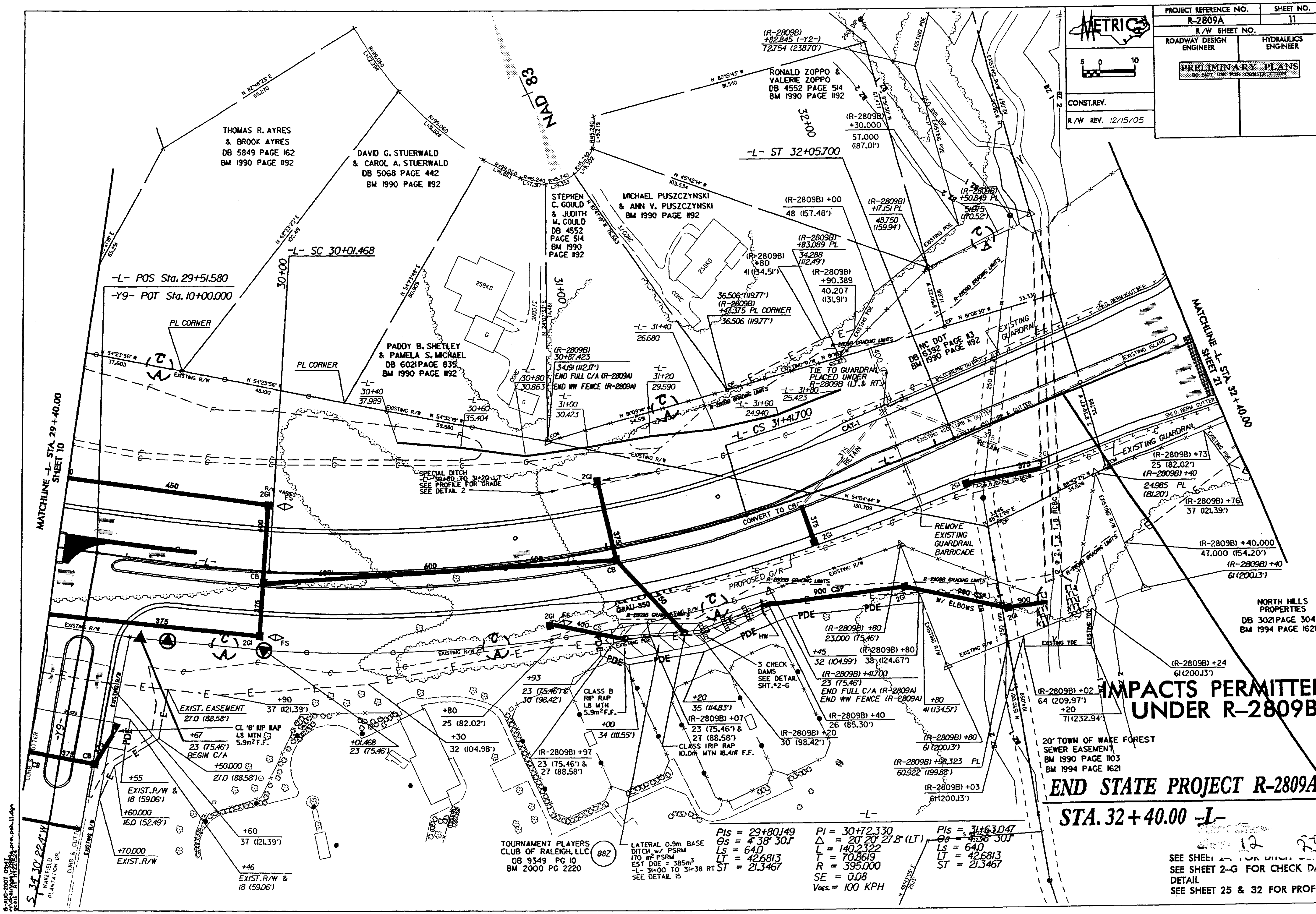
METRIC

CONST.REV.

R/W REV. 5/3/06




METRIC
PROJECT REFERENCE NO. R-2809A
SHEET NO. 6
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
CONST. REV.
R/W REV. 5/3/06
NAD 83
SITE 2
MATCHLINE SEE SHEET 12
ALLOWABLE IMPACTS ZONE 2
ALLOWABLE IMPACTS ZONE 1
PRISCILLA B. ROLLS, VIRGINIA ROLLS
DB 0923 PAGE 1049
BM 2005 PAGE 333
CAROLINA PRINCESS LLC
DB 08693 PAGE 1799
CLM ASSOCIATES LLC
DB 8050 PAGE 875
MATCH -Y3- STA. 10+90.000 SEE SHEET 12
MATCHLINE -L- STA. 15+80.000 SEE SHEET 7
MATCHLINE -L- STA. 12+40.000 SEE SHEET 5
DONALD WINSTEAD & KAREN K.
DB 9365 PAGE 975
JOHN WALTER ROLLS, JR & IRIS DALTON
DB 8238 PAGE 1571
BM 1997 PAGE 1427
CHARLES B. SHEARON & JULIA O
DB 10591 PAGE 843
BM 1988 PAGE 971
NEIL A. FLYOD & MELANIE A.
DB 6729 PAGE 525
BM 1988 PAGE 971
-Y3- PT 10+72.765
-Y3- PC 10+31.848
-Y3A- PT 11+17.711
-Y3A- PC 10+46.489
-Y3A- POT 10+00.000
-L- POC 13+64.155
-Y3A- POT 11+88.630
-L- SC 13+56.524
-L- POS 13+51.932
-Y3- POT 10+00.000
-L- TS 12+60.524
BEGIN C/A
STANDARD BERM DITCH -L- 11+50 TO 13+40 RT
CLASS 'I' RIPRAP 15.4 MTN & 40.7m² F.F. (ON BANKS ONLY) SEE DETAIL 12
CLASS 'B' RIP RAP 0.9 MTN 4.2m² F.F.
SPECIAL LATERAL V-DITCH -L- 15+40 TO 15+76 RT SEE DETAIL 2
REMOVE CONC DITCH
RETAIN CONC. DITCH

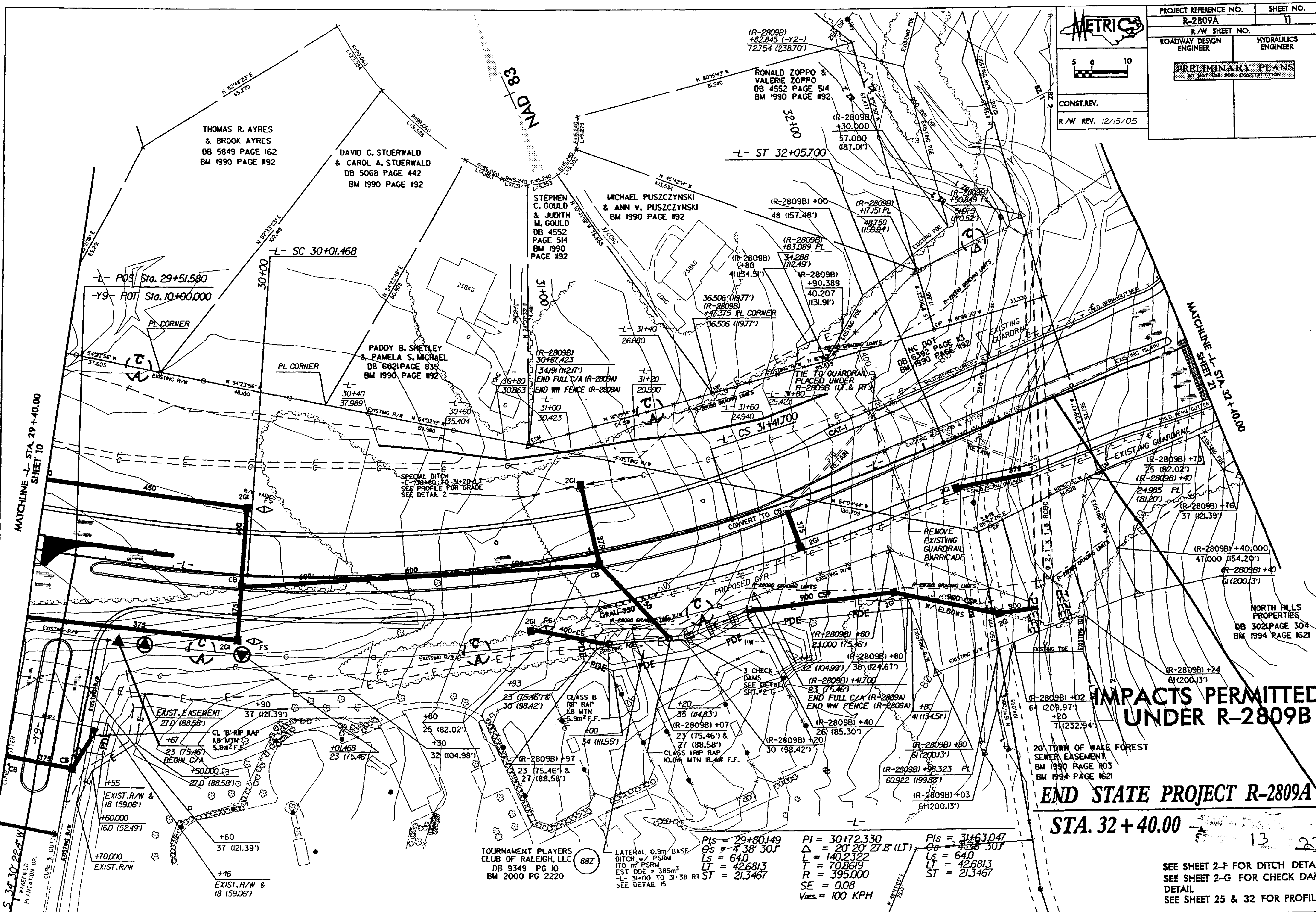

PROJECT REFERENCE NO. R-2809A
SHEET NO. 11
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
METRIC
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
CONST.REV.
R/W REV. 12/15/05
NAD 83
THOMAS R. AYRES
& BROOK AYRES
DB 5849 PAGE 162
BM 1990 PAGE 1192
DAVID G. STUERWALD
& CAROL A. STUERWALD
DB 5068 PAGE 442
BM 1990 PAGE 1192
STEPHEN C. GOULD & JUDITH M. GOULD
DB 4552 PAGE 514
BM 1990 PAGE 1192
MICHAEL PUSZCZYNSKI
& ANN V. PUSZCZYNSKI
BM 1990 PAGE 1192
RONALD ZOPPO &
VALERIE ZOPPO
DB 4552 PAGE 514
BM 1990 PAGE 1192
PADDY B. SHETLEY
& PAMELA S. MICHAEL
DB 6021 PAGE 835
BM 1990 PAGE 1192
NC DOT
DB 6392 PAGE 113
BM 1990 PAGE 1192
NORTH HILLS PROPERTIES
DB 3021 PAGE 304
BM 1994 PAGE 1621
TOURNAMENT PLAYERS CLUB OF RALEIGH, LLC
DB 9349 PG 10
BM 2000 PG 2220
-L- POS Sta. 29+51.580
-Y9- POT Sta. 10+00.000
-L- SC 30+01.468
-L- ST 32+05.700
-L- CS 31+41.700
MATCHLINE -L- STA. 29+40.00 SHEET 10
MATCHLINE -L- STA. 32+40.00 SHEET 21
SPECIAL DITCH
SEE PROFILE FOR GRADE
SEE DETAIL 2
CONVERT TO CB
REMOVE EXISTING GUARDRAIL BARRICADE
TIE TO GUARDRAIL PLACED UNDER R-2809B (LT.& RT.)
EXISTING GUARDRAIL
PROPOSED G/R
3 CHECK DAMS SEE DETAIL SHT. #2-G
CLASS B RIP RAP
CLASS I RIP RAP
EXIST. EASEMENT
LATERAL 0.9m BASE DITCH w/ PSRM
IMPACTS PERMITTED UNDER R-2809B
20' TOWN OF WAKE FOREST SEWER EASEMENT
BM 1990 PAGE 1103
BM 1994 PAGE 1621
END STATE PROJECT R-2809A
STA. 32+40.00 -L-
PIs = 29+80.149
Θs = 4°38' 30.1"
Ls = 64.0
LT = 42.6813
ST = 21.3467
PI = 30+72.330
Δ = 20°20' 27.8" (LT)
L = 140.2322
T = 70.8619
R = 395.000
SE = 0.08
Vdes = 100 KPH
PIs = 31+63.047
Θs = 4°38' 30.1"
Ls = 64.0
LT = 42.6813
ST = 21.3467
SEE SHEET 2-G FOR CHECK DAM DETAIL
SEE SHEET 25 & 32 FOR PROFILE

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	11
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

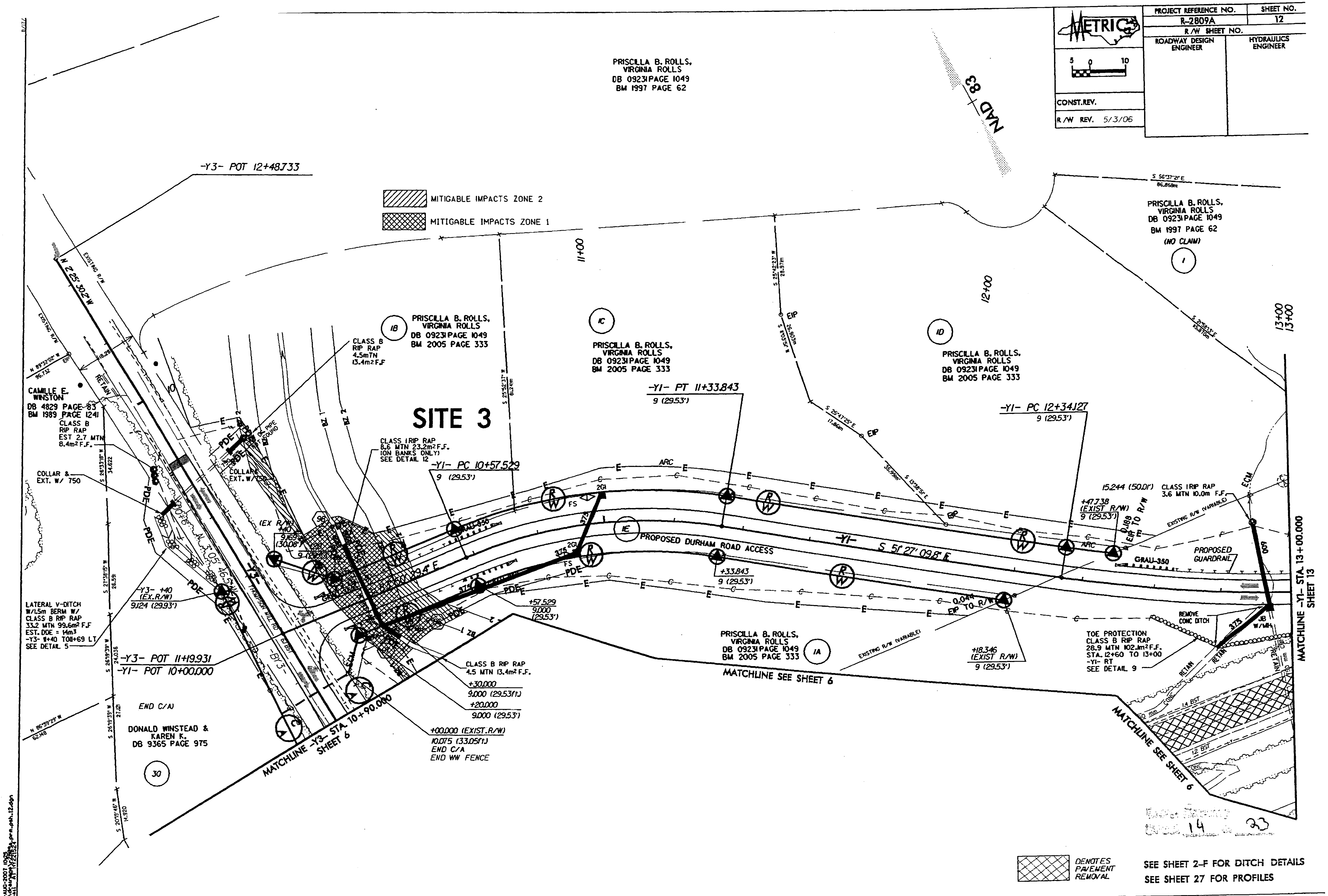
CONST.REV.

R/W REV. 12/15/05



METRIC
NAD 83
THOMAS R. AYRES
& BROOK AYRES
DB 5849 PAGE 162
BM 1990 PAGE 1192
DAVID G. STUERWALD
& CAROL A. STUERWALD
DB 5068 PAGE 442
BM 1990 PAGE 1192
STEPHEN C. GOULD & JUDITH M. GOULD
DB 4552 PAGE 514
BM 1990 PAGE 1192
MICHAEL PUSZCZYNSKI
& ANN V. PUSZCZYNSKI
BM 1990 PAGE 1192
RONALD ZOPPO &
VALERIE ZOPPO
DB 4552 PAGE 514
BM 1990 PAGE 1192
PADDY B. SHETLEY
& PAMELA S. MICHAEL
DB 6021 PAGE 835
BM 1990 PAGE 1192
NC DOT
DB 6392 PAGE 83
BM 1990 PAGE 1192
-L- SC 30+01.468
-L- POS Sta. 29+51.580
-Y9- POT Sta. 10+00.000
-L- CS 31+41.700
-L- ST 32+05.700
MATCHLINE -L- STA. 29+40.00 SHEET 10
MATCHLINE -L- STA. 32+40.00 SHEET 21
NORTH HILLS PROPERTIES
DB 3021 PAGE 304
BM 1994 PAGE 1621
IMPACTS PERMITTED UNDER R-2809B
20' TOWN OF WAKE FOREST SEWER EASEMENT
BM 1990 PAGE 1103
BM 1994 PAGE 1621
END STATE PROJECT R-2809A
STA. 32+40.00
TOURNAMENT PLAYERS CLUB OF RALEIGH, LLC
DB 9349 PG 10
BM 2000 PG 2220
LATERAL 0.9m BASE DITCH w/ PSRM
170 m² PSRM
EST DDE = 385m³
-L- 31+00 TO 31+38 RT
SEE DETAIL 15
Pls = 29+80.149
Θs = 4°38' 30.1"
Ls = 64.0
LT = 42.6813
ST = 21.3467
PI = 30+72.330
Δ = 20°20' 27.8" (LT)
L = 140.2322
T = 70.8619
R = 395.000
SE = 0.08
Vdes = 100 KPH
Pls = 31+63.047
Θs = 4°38' 30.1"
Ls = 64.0
LT = 42.6813
ST = 21.3467

SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 2-G FOR CHECK DAM DETAIL
SEE SHEET 25 & 32 FOR PROFILE



PROJECT REFERENCE NO.
SHEET NO.
R-2809A
12
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
METRIC
CONST.REV.
R/W REV. 5/3/06
NAD 83
PRISCILLA B. ROLLS, VIRGINIA ROLLS DB 0923I PAGE 1049 BM 1997 PAGE 62
-Y3- POT 12+48.733
MITIGABLE IMPACTS ZONE 2
MITIGABLE IMPACTS ZONE 1
11+00
12+00
13+00
PRISCILLA B. ROLLS, VIRGINIA ROLLS DB 0923I PAGE 1049 BM 1997 PAGE 62 (NO CLAIM)
PRISCILLA B. ROLLS, VIRGINIA ROLLS DB 0923I PAGE 1049 BM 2005 PAGE 333
SITE 3
CAMILLE E. WINSTON DB 4829 PAGE 83 BM 1989 PAGE 1241
CLASS B RIP RAP EST 2.7 MTN 8.4m² F.F.
CLASS B RIP RAP 4.5mTN 13.4m² F.F
CLASS I RIP RAP 8.6 MTN 23.2m² F.F. (ON BANKS ONLY) SEE DETAIL 12
COLLAR & EXT. W/ 750
-Y1- PC 10+57.529 9 (29.53')
-Y1- PT 11+33.843 9 (29.53')
-Y1- PC 12+34.127 9 (29.53')
PROPOSED DURHAM ROAD ACCESS
-Y1- S 51° 27' 09.8" E
15.244 (50.01')
CLASS I RIP RAP 3.6 MTN 10.0m F.F.
+47.738 (EXIST R/W) 9 (29.53')
PROPOSED GUARDRAIL
+33.843 9 (29.53')
LATERAL V-DITCH W/1.5m BERM W/ CLASS B RIP RAP 33.2 MTN 99.6m² F.F EST. DDE = 14m³ -Y3- 11+40 TO 8+69 LT SEE DETAIL 5
-Y3- +40 (EX.R/W) 9.124 (29.93')
+57.529 9.000 (29.53')
-Y3- POT 11+19.931
-Y1- POT 10+00.000
CLASS B RIP RAP 4.5 MTN 13.4m² F.F.
+30.000 9.000 (29.53ft)
+20.000 9.000 (29.53')
+00.000 (EXIST.R/W) 10.075 (33.05ft) END C/A END WW FENCE
PRISCILLA B. ROLLS, VIRGINIA ROLLS DB 0923I PAGE 1049 BM 2005 PAGE 333
+18.346 (EXIST R/W) 9 (29.53')
MATCHLINE SEE SHEET 6
TOE PROTECTION CLASS B RIP RAP 28.9 MTN 102.1m² F.F. STA. 12+60 TO 13+00 -Y1- RT SEE DETAIL 9
MATCHLINE -Y1- STA. 13+00.000 SHEET 13
END C/A
DONALD WINSTEAD & KAREN K. DB 9365 PAGE 975
MATCHLINE -Y3- STA. 10+90.000 SHEET 6
MATCHLINE SEE SHEET 6
DENOTES PAVEMENT REMOVAL
SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 27 FOR PROFILES
14
33

METRIC	PROJECT REFERENCE NO.	SHEET NO.
5 0 10	R-2809A	12
	R/W SHEET NO.	
CONST.REV.	ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
R/W REV. 5/3/06		

PRISCILLA B. ROLLS,
VIRGINIA ROLLS
DB 0923I PAGE 1049
BM 1997 PAGE 62

NAD 83

-Y3- POT 12+48.733

MITIGABLE IMPACTS ZONE 2

MITIGABLE IMPACTS ZONE 1

11+00

12+00

13+00

S 56°37'21" E
86.868m

PRISCILLA B. ROLLS,
VIRGINIA ROLLS
DB 0923I PAGE 1049
BM 1997 PAGE 62
(NO CLAIM)

1

N 29°30'29" W

EXISTING R/W

RETAIN

CAMILLE E. WINSTON
DB 4829 PAGE 83
BM 1989 PAGE 1241

CLASS B RIP RAP
EST 2.7 MTN
8.4m² F.F.

COLLAR & EXT. W/ 750

PDE

END

-Y3- +40 (EX.R/W)
9.124 (29.93')

-Y3- POT 11+19.931
-Y1- POT 10+00.000

END C/A

DONALD WINSTEAD & KAREN K.
DB 9365 PAGE 975

30

LATERAL V-DITCH W/1.5m BERM W/ CLASS B RIP RAP
33.2 MTN 99.6m² F.F
EST. ODE = 14m³
-Y3- 84+40 TO 84+69 LT
SEE DETAIL 5

MATCHLINE -Y3- STA. 10+90.000
SHEET 6

1B

PRISCILLA B. ROLLS,
VIRGINIA ROLLS
DB 0923I PAGE 1049
BM 2005 PAGE 333

CLASS B RIP RAP
4.5m TN
13.4m² F.F.

1C

PRISCILLA B. ROLLS,
VIRGINIA ROLLS
DB 0923I PAGE 1049
BM 2005 PAGE 333

-Y1- PT 11+33.843
9 (29.53')

1D

PRISCILLA B. ROLLS,
VIRGINIA ROLLS
DB 0923I PAGE 1049
BM 2005 PAGE 333

-Y1- PC 12+34.127
9 (29.53')

SITE 3

CLASS A RIP RAP
8.6 MTN 23.2m²/F.F.
(ON BANKS ONLY)
SEE DETAIL 12

-Y1- PC 10+57.529
9 (29.53')

+40
9.165
(30.06')

+57.529
9.000
(29.53')

1E

PROPOSED DURHAM ROAD ACCESS

+33.843
9 (29.53')

-Y1- S 51°27'09.8" E

+17.738
(EXIST R/W)
9 (29.53')

15.244 (50.0m) CLASS A RIP RAP
3.6 MTN 10.0m F.F.

PROPOSED GUARDRAIL

GRAU-350

REMOVE CONC DITCH

TOE PROTECTION
CLASS B RIP RAP
28.9 MTN 102.1m² F.F.
STA. 12+60 TO 13+00
-Y1- RT
SEE DETAIL 9

PRISCILLA B. ROLLS,
VIRGINIA ROLLS
DB 0923I PAGE 1049
BM 2005 PAGE 333

1A

+18.346
(EXIST R/W)
9 (29.53')

CLASS B RIP RAP
4.5 MTN 13.4m² F.F.
+30.000
9.000 (29.53ft.)
+20.000
9.000 (29.53')

+00.000 (EXIST.R/W)
10.075 (33.05ft.)
END C/A
END WW FENCE

MATCHLINE SEE SHEET 6

MATCHLINE -Y1- STA. 13+00.000
SHEET 13

Buffer Drawing
Sheet 15 of 35

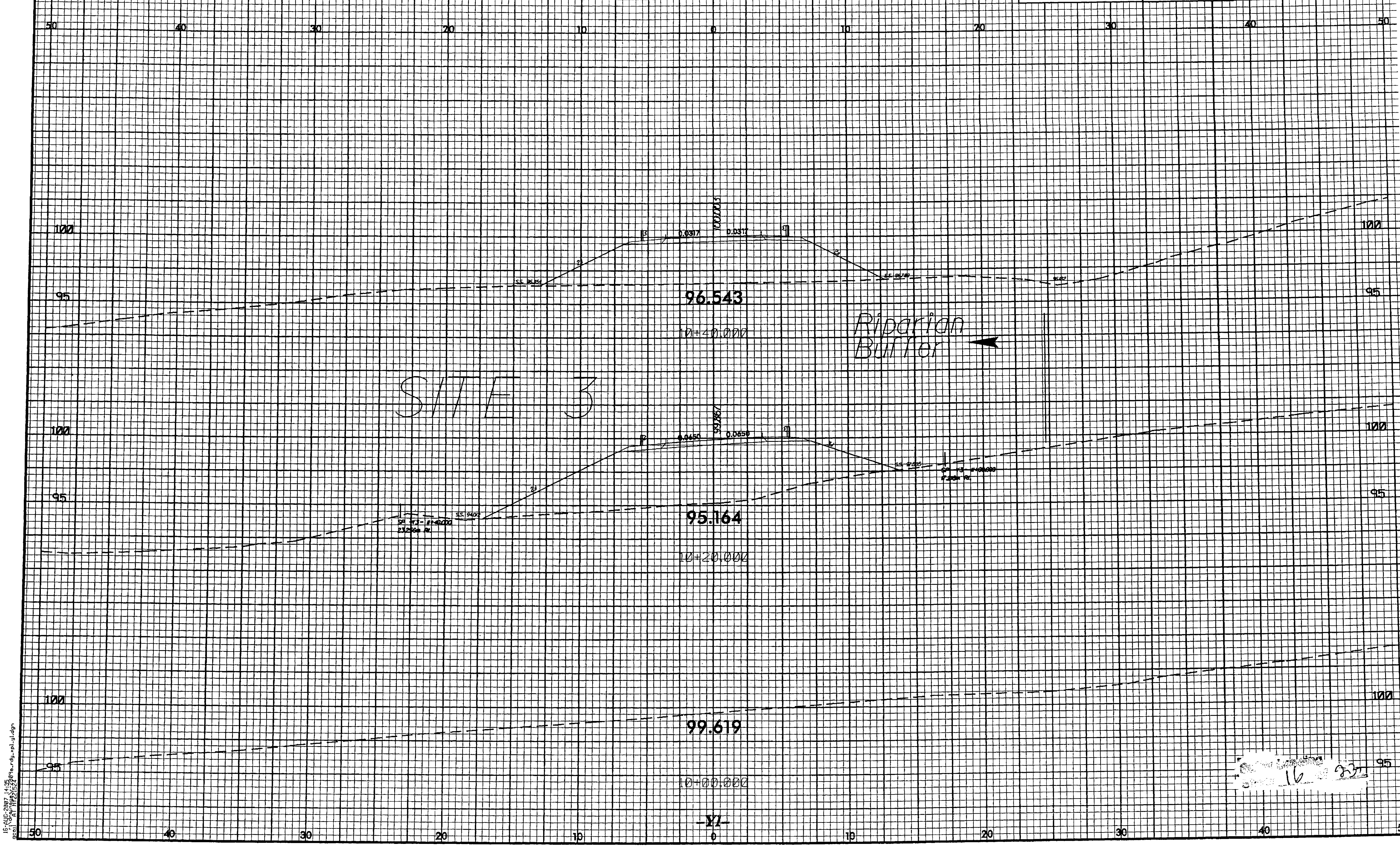
DENOTES PAVEMENT REMOVAL

SEE SHEET 2-F FOR DITCH DETAILS
SEE SHEET 27 FOR PROFILES

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	X-88

METRIC

2.5 0 2.5 5



BUFFER IMPACTS SUMMARY

SITE NO.	STRUCTURE SIZE / TYPE	STATION (FROM/TO)	IMPACT									BUFFER REPLACEMENT	
			TYPE			ALLOWABLE			MITIGABLE				
			ROAD CROSSING	BRIDGE	PARALLEL IMPACT	ZONE 1 (ft^2)	ZONE 2 (ft^2)	TOTAL (ft^2)	ZONE 1 (ft^2)	ZONE 2 (ft^2)	TOTAL (ft^2)	ZONE 1 (ft^2)	ZONE 2 (ft^2)
1	48" RCP	-L- 9+25 LT	X			5651	3283	8934					
2	24" CSP	-L- 14+00 LT	X			4338	2788	7126					
3	30" RCP	-Y1- 10+30	X						7556	4198	11754		
TOTAL:						9989	6071	16060	7556	4198	11754		

Site 3 Impacts 154' of stream

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY
PROJECT: 34503.1.1 (R-2809A)

August-07
SHEET 17 OF 23

Rev. May 2006

BUFFER IMPACTS SUMMARY

			IMPACT								BUFFER REPLACEMENT	
			TYPE		ALLOWABLE			MITIGABLE				
SITE NO.	STRUCTURE SIZE / TYPE	STATION (FROM/TO)	ROAD CROSSING	PARALLEL IMPACT	ZONE 1 (m^2)	ZONE 2 (m^2)	TOTAL (m^2)	ZONE 1 (m^2)	ZONE 2 (m^2)	TOTAL (m^2)	ZONE 1 (m^2)	ZONE 2 (m^2)
1	1200 RCP	-L- 9+25 LT	X		525.0	305.0	830.0					
2	600 CSP	-L- 14+00 LT	X		403.0	259.0	662.0					
3	750 RCP	-Y1- 10+30	X					702.0	390.0	1092.0		
TOTAL:					928.0	564.0	1492.0	702.0	390.0	1092.0		

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY
PROJECT: 34503.1.1 (R-2809A)

August-07

R-2809A Wake Forest Bypass. Affected Buffer Areas **Site #1** Date: 8/15/2007

Discharge is considered to be treated if it meets the following criteria: Dsn. By: FFF

100 ft. of grass swale for every 1 acre of drainage area. AND Check: SDG

2 yr. velocity is less than or equal to 2 ft./sec.

SHT.	Structure	Station	Type	Total D.A. ha	Total D.A. (ac)	Required length for treatment (ft.)	Required length for treatment (m.)	Actual Length (m)	Channel Slope (m/m)	Side Slopes	Treated Discharge?	Q2 cfs	Q2 vel. fps	Q10 cfs	Q10 vel. fps	Treatment Provided	Remarks
5	9	8+60 MED	CB	0.17	0.4	40.8	12	0	0	NA	**NO**	0.02	NA	0.03	NA	PSH	
5	10	10+00 MED	2GI	0.29	0.7	71.7	22	0	0	NA	**NO**	2.0	NA	2.65	NA	PSH	

2GI = 2 GRATED INLET
SBG = SHOULDER BERM GUTTER
CB = CATCH BASIN
DDB = DRY DETENTION BASIN
B = BASIN
GS = GRASS SWALE

BDOS = BERM DRAINAGE OUTLET STRUCTURE
OTCB = OPEN THROAT CATCH BASIN
OPEN = OPEN END PIPE
PSH = PRE FORMED SCOUR HOLE
LS = LEVEL SPREADER

R-2809A Wake Forest Bypass. Affected Buffer Areas **Site #2**

Date: 8/15/2007
Dsn. By: FFF
Check: SDG

Discharge is considered to be treated if it meets the following criteria:
100 ft. of grass swale for every 1 acre of drainage area. AND
2 yr. velocity is less than or equal to 2 ft./sec.

SHT.	Structure	Station	Type	Total D.A. ha	Total D.A. (ac)	Required length for treatment (ft.)	Required length for treatment (m.)	Actual Length (m)	Channel Slope (m/m)	Side Slopes	Treated Discharge?	Q2 cfs	Q2 vel. fps	Q10 cfs	Q10 vel. fps	Treatment Provided	Remarks
6	25	13+90 Med.	CB	0.09	0.2	22.2	7	NA	NA	NA	**NO**	0.94	NA	1.30	NA	PSH	
6	26	13+75 Med	CB	0.04	0.1	9.9	3	NA	NA	NA	**NO**	0.42	NA	0.58	NA	PSH	
6	30	13+60 RT	2GI	0.51	1.3	126.0	38	75	0.003	4:/6:1	**YES**	2.38	0.43	3.27	0.52	GS	
6	31	13+95 RT	2GI	0.16	0.4	40.3	12	60	0.003	4:/6:1	**YES**	1.23	0.85	1.70	1.02	GS	
6	28	13+95 RT	2GI	0.50	1.2	123.6	38	OFFSITE OR CROSS DRAINAGE									
6	34	14+30 RT	CB	0.18	0.4	44.5	14	NA	NA	NA	**NO**	1.89	1.51	2.60	1.57	GS	

2GI = 2 GRATED INLET
SBG = SHOULDER BERM GUTTER
CB = CATCH BASIN
DDB = DRY DETENTION BASIN
B = BASIN
GS = GRASS SWALE

BDOS = BERM DRAINAGE OUTLET STRUCTURE
OTCB = OPEN THROAT CATCH BASIN
OPEN = OPEN END PIPE
PSH = PRE FORMED SCOUR HOLE
LS = LEVEL SPREADER

20 23

R-2809A Wake Forest Bypass. Affected Buffer Areas **Site #3**

Date: 8/15/2007
Dsn. By: FFF
Check: SDG

Discharge is considered to be treated if it meets the following criteria:
100 ft. of grass swale for every 1 acre of drainage area. AND
2 yr. velocity is less than or equal to 2 ft./sec.

SHT.	Structure	Station	Type	Total D.A. ha	Total D.A. (ac)	Required length for treatment (ft.)	Required length for treatment (m.)	Actual Length (m)	Channel Slope (m/m)	Side Slopes	Treated Discharge?	Q2 cfs	Q2 vel. fps	Q10 cfs	Q10 vel. fps	Treatment Provided	Remarks
12	95	11+00	2GI	0.2	0.5	46.5	14	60	.029	4:1/6:1	YES	0.12	1.97	0.17	2.03	GS	
12	96	10+90	2GI	0.2	0.6	56.8	17	75	.029	4:1/6:1	YES	0.15	1.97	0.21	2.03	GS	

2GI = 2 GRATED INLET
SBG = SHOULDER BERM GUTTER
CB = CATCH BASIN
DDB = DRY DETENTION BASIN
B = BASIN
GS = GRASS SWALE

BDOS = BERM DRAINAGE OUTLET STRUCTURE
OTCB = OPEN THROAT CATCH BASIN
OPEN = OPEN END PIPE
PSH = PRE FORMED SCOUR HOLE
LS = LEVEL SPREADER

R-2809A Wake Forest Bypass. Affected Buffer Areas

Discharge is considered to be treated if it meets the following criteria:
100 ft. of grass swale for every 1 acre of drainage area. AND
2 yr. velocity is less than or equal to 2 ft./sec.

Site @ End R-2809A &Begin R-2809B @ Existing RCBC

Dsn. By: FFF
Check: SDG
Date: 8/15/2007

SHT.	Structure	Station	Type	Total D.A. ha	Total D.A. (ac)	Required length for treatment (ft.)	Required length for treatment (m.)	Actual Length (m)	Channel Slope (m/m)	Side Slopes	Treated Discharge?	Q2 cfs	Q2 vel. fps	Q10 cfs	Q10 vel. fps	Treatment Provided	Remarks
10	72	26+60 rt	2GI	0.42	1.0	103.8	32	160	0.018	4:1/2:1	YES	0.19	1.5	0.26	2.2	GS	
10	73	26+60 lt.	2GI	0.79	2.0	195.2	60	160	0.018	4:1/2:1	YES	0.26	1.8	0.35	2.2	GS	
10	74	27+70 lt.	2GI	0.44	1.1	108.7	33	110	0.018	4:1/2:1	YES	0.21	1.7	0.29	2.2	GS	
10	75	27+70 lt.	Open	OFFSITE DRAINAGE								0.00		0.00			
10	76	27+70 rt.	2GI	0.44	1.1	108.7	33	110	0.018	4:1/2:1	YES	0.14	0.9	0.20	1.1	GS	
10	169	29+20 rt.	2GI	0.46	1.1	113.7	35	140	0.018	4:1/2:1	YES	0.15	0.9	0.21	1.1	GS	
11	77	30+00 Lt.	2GI	0.33	0.8	81.5	25	200	0.018	4:1/2:1	YES	0.13	1.8	0.17	2.2	GS	
11	78	30+00 Med	CB	0.09	0.2	21.5	7	0			NO	0.05		0.06		CD	*
11	79	30+00 Rt.	2GI	0.69	1.7	170.5	52	200	0.018	4:1/2:1	YES	0.34	2.0	0.46	2.3	GS	
11	83	30+80 Rt.	2GI	0.12	0.3	29.7	9	100	0.003	4:1/2:1	YES	0.06	0.3	0.09	0.8	GS	
11	80	31+02 Med	CB	0.15	0.4	37.1	11	0			NO	0.08		0.11		CD	*
11	81	31+02 Lt.	2GI	0.33	0.8	81.5	25	100	0.003	4:1/2:1	YES	0.23	0.4	0.31	0.9	GS	
11	170	10+60 -Y9-RT	CB	0.18	0.4	44.5	14	0			**	0.00	0.0	0.00	0.0	**SEE 172	
11	171	10+60 -Y9-LT	CB	0.03	0.1	7.4	2	0			**	0.00	0.0	0.00	0.0	**SEE 172	
11	172	10+50-Y9-LT	OUTLET	0.21	0.5	51.9	16	57	0.018	4:1/2:1	YES	0.20	0.4	3.03	0.9	GS	

*STRUCTURE NO.'S 78 & 83 OUTLET INTO A DITCH WITH THREE PROPOSED CHECK DAMS. THESE DAMS REDUCE THE SLOPE OF THE DITCH TO ACHIEVE 2.0'/SEC AND THEREFORE TREATMENT OF THESE INLETS. THE REQUIRED LENGTH OF TREATMENT FOR THESE TWO INLETS IS 18M. THE ACTUAL LENGTH IS 23M.

2GI = 2 GRATED INLET
SBG = SHOULDER BERM GUTTER
CB = CATCH BASIN
DDB = DRY DETENTION BASIN
B = BASIN
GS = GRASS SWALE

BDOS = BERM DRAINAGE OUTLET STRUCTURE
OTCB = OPEN THROAT CATCH BASIN
OPEN = OPEN END PIPE
PSH = PRE FORMED SCOUR HOLE
LS = LEVEL SPREADER
CD= CHECK DAMS

List of Property Owners:

SITE #	PROPERTY OWNER	ADDRESSES
1	NCDOT	
2	NCDOT	
3	PRISCILLA ROLLS	7104 THOMPSON MILL ROAD WAKE FOREST, NC 27587

NC DEPARTMENT OF TRANSPORTION
DIVISION OF HIGHWAYS
WAKE COUNTY
34503.1.1 (R-2809A)
WAKE FOREST BYPASS

Sheet 23of 23 August-07

R-2809C - Revised

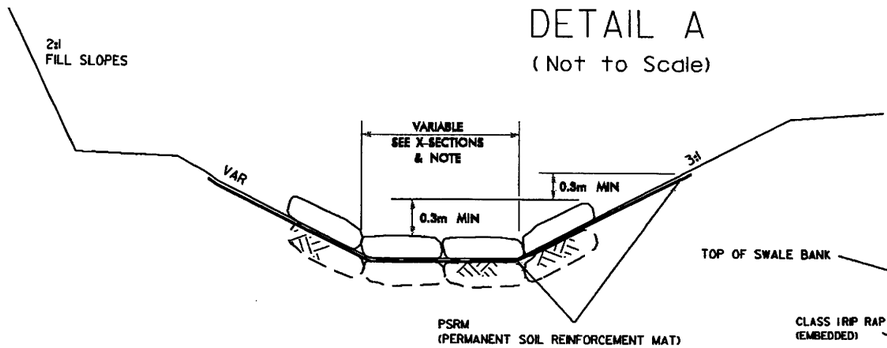
050197

REVISIONS

	SHEET NO.
R-2809A	2-L
	HYDRAULICS ENGINEER

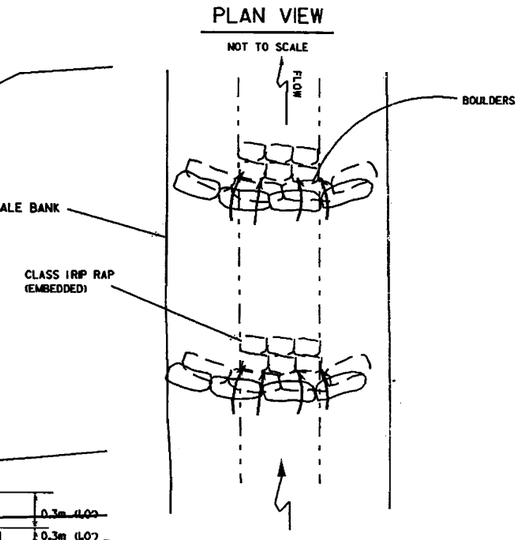
LATERAL SWALE/DITCH W/ROCK CHECKS
STA 82+21 TO 82+95 -L- RT
& STA 83+80 TO STA 84+20 -L- LT

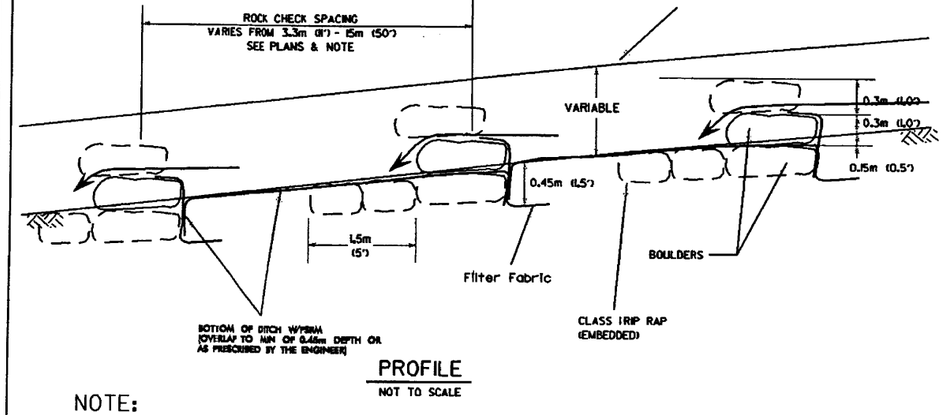
DETAIL A
(Not to Scale)



TYPICAL CROSS SECTION

NOT TO SCALE





PROFILE

NOT TO SCALE

NOTE:

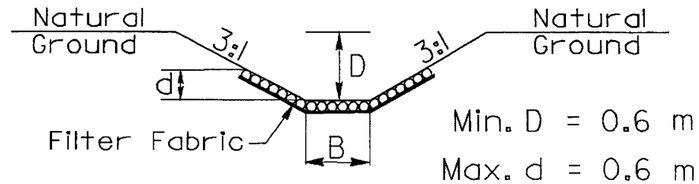
BOULDERS SHOULD BE ANGULAR AND OBLONG WITH APPROXIMATE DIMENSIONS OF 0.6m x 0.45m x 0.45m (2' x 1.5' x 1.5'). ROCK SHOULD FIT TIGHTLY TOGETHER WITH MINIMAL VOIDS. STAGGER BOULDER JOINTS.

ROCK CHECK SPACING IS DEPENDENT ON DITCH GRADES AT 1' DROP INTERVALS OR SLOPE CONTROL.

DITCH WIDTHS VARY. WIDEN TO EXTENT PRACTICAL WITHIN R/W LIMITS. SEE X-SECTIONS.

STANDARD BASE DITCH
STA 85+36 TO 85+51 -L- LT
STA 85+80 TO 86+36 -L- LT

DETAIL B
STANDARD BASE DITCH
(Not to Scale)



Min. D = 0.6 m

Max. d = 0.6 m

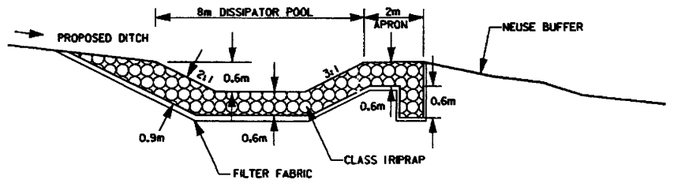
B = 1.5-2.4 m

* When B is < 1.8m

Type of Liner = CLASS IRIP RAP

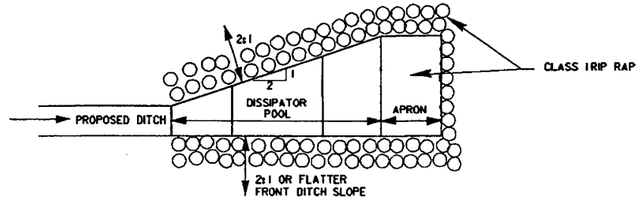
NOT TO SCALE

DETAIL C
ENERGY DISSIPATOR



PROFILE

NOT TO SCALE



PLAN VIEW

NOT TO SCALE

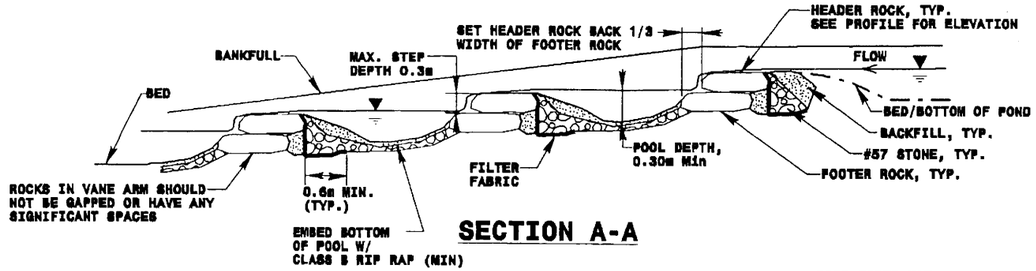
Sta 84+30-L-LT.

REVISIONS

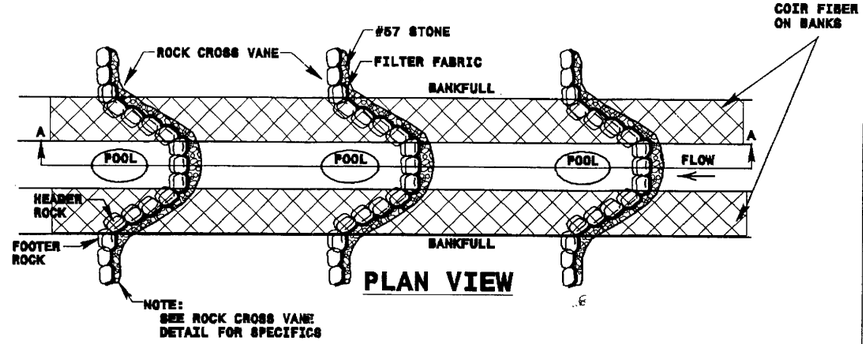
PROJECT REFERENCE NO.	SHEET NO.
R-2809A	2-M
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

R-2809C
Sta 84+63 to 84+80 -L- Lt

STEP POOL DETAIL
NOT TO SCALE



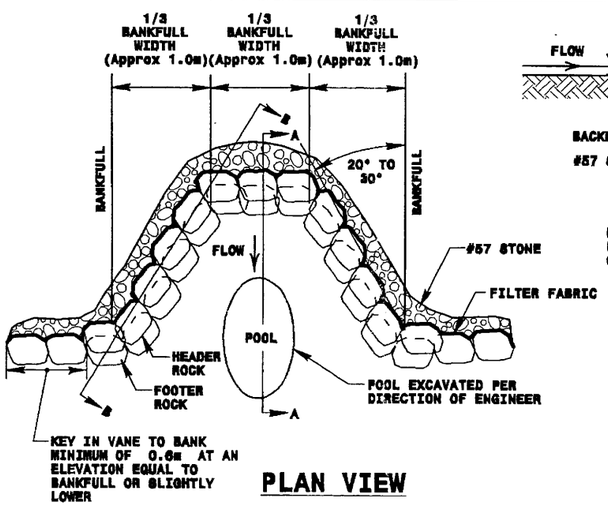
SECTION A-A



PLAN VIEW

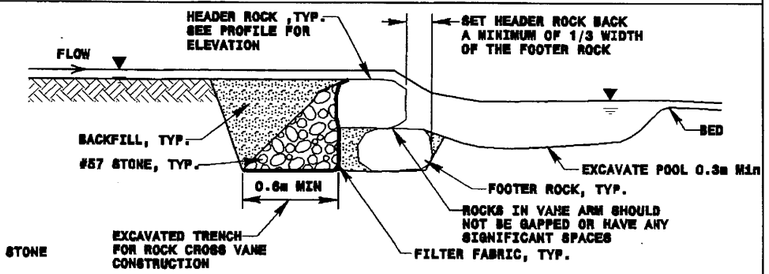
NOTES:
1. STEPS TO BE SHORT, FREQUENT, AND CLOSELY SPACED.
2. POOL SPACING SHALL BE INVERSELY PROPORTIONAL TO STREAM SLOPE, AND DIRECTLY PROPORTIONAL TO BANKFULL WIDTH.(APPROX 6.4m)
3. POOL DEPTHS AT BANKFULL ELEVATION SHALL BE TYPICALLY 2 TO 3 TIMES DEEPER THAN STEP DEPTHS AT BANKFULL ELEVATION.
4. ADEQUATE NUMBER OF FOOTER BOULDERS TO BE USED IN ORDER TO HOLD UP THE BOULDERS AT HEAD OF STEPS DURING HIGH ENERGY/HIGH FLOW EVENTS.
5. STEP POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.

ROCK CROSS VANE DETAIL FOR STEP POOL
NOT TO SCALE

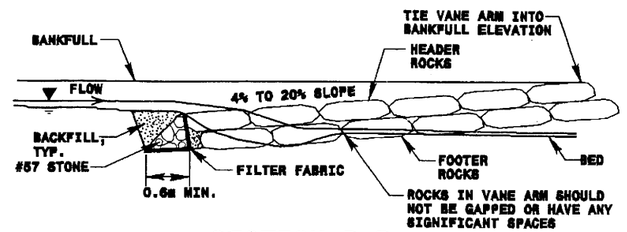


PLAN VIEW

	BOULDER DIMENSIONS (meters)		
STATION	HEIGHT	LENGTH	WIDTH
PER VANE	0.6m	0.9m	0.6m



SECTION A-A



SECTION B-B

NOTES:
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO BANKFULL.
2. DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER BOULDERS.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
4. COMPACT BANKFULL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5. POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.

7/2/99

14-AUG-2007 16:15
C:\projects\R2809c supp work\step pool.dgn
$$$$USERNAME$$$$

PROJECT REFERENCE NO.	SHEET NO.
R-2809A	2-N

METRIC

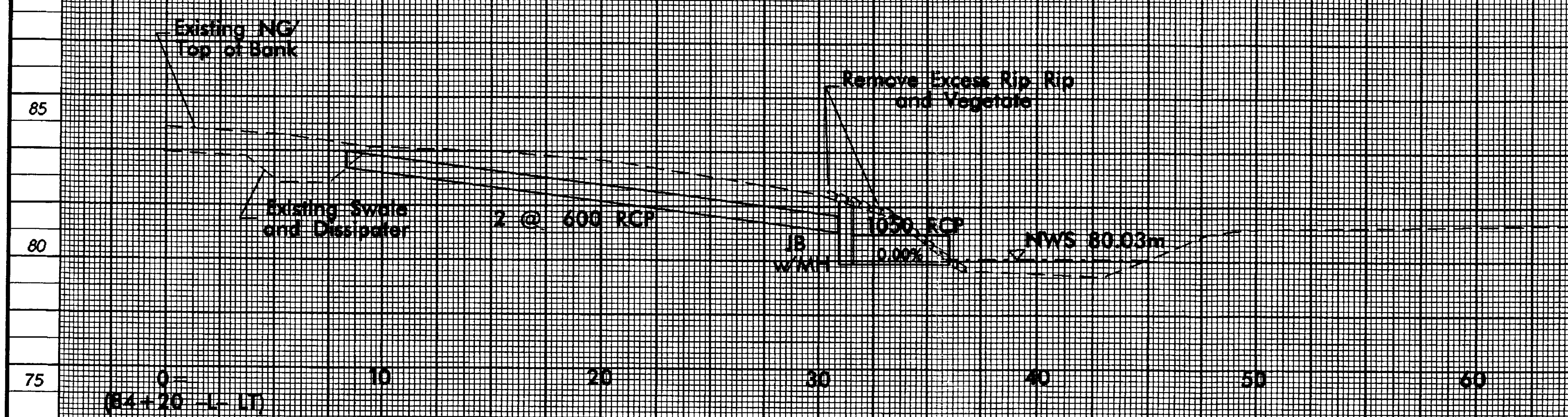
ROADWAY DESIGN ENGINEER

HYDRAULICS ENGINEER

CONST.REV.

R /W REV.

Section at West Bank Drainage System



Stream Step Pool Profile