STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

EUGENE A. CONTI, JR.
SECRETARY

November 20, 2012

National Park Service
Outer Banks Group
1401 National Park Drive
Manteo, NC 27954

ATTN: Mr. Steve Thompson
Permit Coordinator

SUBJECT: **Request for Necessary Permits for Construction and Demolition Activities**
Replacement of Bridge No. 11 over Oregon Inlet on NC 12 in Dare County, NC, TIP Project B-2500 (Phase I), Federal Aid Project Nos. BRNHF-0012 (48) and BRNHF-0012(36); WBS Element: 32635.1.4

Dear Mr. Thompson:

The North Carolina Department of Transportation (NCDOT) is in the process of replacing Bridge No. 11 over Oregon Inlet (TIP Project B-2500 (Phase I)) in Dare County, North Carolina. As portions of the Cape Hatteras National Seashore (Seashore) will be utilized either temporarily during construction or permanently, notification to your office is required. This letter is to request a Special Use Permit for the construction of the project and any associated temporary impacts, including temporary construction easements. A completed Special Use Permit Application (and appropriate site drawings) for the construction of the project is attached for your review and approval. A separate instrument entitled "Federal Highway Easement Deed for NCDOT Highway Project TIP B-2500 (Phase I)" is being coordinated between our two agencies for the necessary land transfer.

Phase I of B-2500 (Project) has been contracted to a Design-Build Team, selected to design and permit the Project and take it through construction once permits and approvals are issued. The contractor, PCL Civil Constructors, and their subcontractors and consultants have designed and will construct the new bridge and demolish the existing Bonner Bridge. This application focuses on the activities proposed to take place within the Seashore, as previously presented to Seashore staff and other state/federal agencies at several meetings over the past year.

The improvements involve replacement of the Bonner Bridge over Oregon Inlet and related approaches with a parallel bridge. The proposed 2.8 mile bridge will carry the two lane highway with a clear roadway width of 40 feet from barrier to barrier, except for approximately 330 feet at the southern end of the bridge where the width increases to 52 feet to accommodate a left turn lane. The existing bridge will be removed upon completion of the proposed bridge, except for an approximately 1050-foot portion at the southern end to be retained as a fishing pier. The Project is considered a bridge replacement/ redevelopment since no new lanes are being added and the new roadway ties into the existing roadway almost immediately on either end of the bridge. The total length of the Phase I Project is 3.55 miles, including roadway approaches.

Several documents and plansets are attached to this application for your reference. Included in these are permit impact sheets from the 404/401/CAMA permit application (Sheets 9 through 18 are those that are relevant to the Seashore), the U.S. Fish and Wildlife Service (USFWS) Biological and Conference Opinions for Endangered Species Act Section 7 consultation, and an easement drawing (Metes and Bounds Map #2).

Previous Coordination

NCDOT and FHWA completed the NEPA studies for B-2500 and issued a Record of Decision (ROD) in December 2010. Following the issuance of the ROD, NCDOT awarded a design-build contract for Phase I of B-2500 and requested that the Design-Build Team design the new bridge such that it reduces the amount of new easement needed within the Seashore and Pea Island National Wildlife Refuge (PINWR) from what was estimated in the ROD. Since the team began the final design process last summer, NCDOT has coordinated with your office on that design and its potential impacts to the Seashore. This permit application reflects this final design.

Your office has worked closely with NCDOT regarding the conditions to be attached to any permits issued by the Seashore. With regard to the parking lot on Pea Island that the Seashore manages, approximately 35% of the existing parking area is proposed to be used for staging for the Project, as well as the grassy area east-southeast of the parking lot. A temporary entrance will be added to accommodate public access to the parking lot during construction. A permanent pedestrian boardwalk will be constructed to provide access to the former USCG Station building from the parking lot. The details of these temporary and permanent measures were included by NCDOT in a Special Use Permit application to the Refuge for the Project.

Proposed Schedule

Based on the current anticipated schedule, the Project will begin construction in January 2013, with proposed completion of the new bridge by April 2015 and demolition of the old bridge by February 2016. The proposed schedule is subject to change, depending on permit approvals and the resolution of litigation related to the Project.

Easement Minimization

At every step of the design process, the Design-Build Team and NCDOT have closely coordinated to minimize impacts to the Seashore and lessen the easement requirements for the Project. The primary goal was to align the bridge as close to existing NC 12 as feasible while adhering to NCDOT and FHWA design standards.

<u>Permanent New Easement</u>

New easement within the Seashore is necessary for the northern approach to the new bridge. The northern approach, near the marina, was located to the west of the current bridge in order to allow for improved traffic control and safety during construction by reducing the proximity of construction activities to the current traffic flow. It also reduces the potential conflict with Seashore resources (such as the campground and access to Ramp 4) while avoiding the existing septic field.

A sliver of area between the existing and proposed bridge easements is being requested as a temporary construction easement from the Seashore for construction of B-2500 (Phase I). This area through the intertidal marsh will be used during construction for the temporary work trestle and associated activities. The approximate limits of this ~3-acre area are from Station 106+00 to 140+00. Per previous coordination with Seashore staff, use of this area would be written into the permit(s) issued from this Request.

NCDOT employs many strategies to avoid and minimize impacts to sensitive areas in all of its designs. Many of these strategies have been incorporated into Best Management Practice (BMP) documents that have been reviewed and approved by state and federal resource agencies, and which will be followed throughout construction. Wetland areas and environmentally sensitive areas immediately adjacent to but not affected by the Project will be protected from unnecessary encroachment using tree protection fencing or an equivalent measure. The Project will be consistent with those measures outlined in the Project Commitments of the ROD. Individual avoidance and minimization measures that affect the Seashore include the following:

Design Measures

- Span lengths throughout the bridge were maximized, especially through the navigation spans over Oregon Inlet, thereby minimizing the overall footprint of the bridge's substructure and reducing wetland, surface water and SAV impacts.
- The roadway alignment was shifted to overlap with the current NC 12 alignment to the greatest extent practical, allowing for fewer wetland impacts as well as less easement acquisition from the Seashore and PINWR.
- Stormwater will be collected on both bridge approaches (100' on northern end) and treated using roadside ditches and preformed scour holes, as concurred with by the NC Division of Water Quality.

Work Trestle Measures

- A work trestle from Bodie Island, extending far enough into Pamlico Sound/Oregon Inlet to allow safe barge mooring and minimize the need for dredging, will run parallel to and in between the existing and proposed bridges for temporary construction and demolition access.
- When necessary, construction equipment will be secured to the work trestle or evacuated during major storms to prevent equipment or spills from entering surface waters and wetlands.

Construction Staging Measures

Other than the aforementioned staging at the Pea Island parking lot, no construction staging will take place outside NCDOT's existing or proposed easements.

- All areas of Temporary Construction Easement will be returned to the conditions present before construction started or better. This is to include the portion of the parking lot and the adjacent grassy area to be temporarily used for staging.
- No staging of construction equipment or storage of construction supplies will be allowed in wetlands.
- Lighting required at the staging area will be coordinated along with other construction lighting to ensure no adverse effects to sea turtles and other aquatic species. The Design-Build Team intends to use modified LED lighting (as discussed at the July 2, 2012 on-site demonstration meeting) to achieve this measure.
- Fueling stations will be contained to avoid inadvertent spills reaching surface waters. Any spills will be controlled and reported as applicable.

Demolition Measures

Bridge demolition material will be shipped 2-5 miles offshore to one or more of four artificial reef sites that have been designated as acceptable disposal sites in the Atlantic Ocean, per North Carolina Division of Marine Fisheries (NCDMF). As weather and other circumstances will not always allow for these barge trips to take place at the preferred time, there will be occasions when demolition material will be brought to the designated staging areas for temporary storage. Coordination with NCDMF has occurred, and will continue through construction, as they are permitting the reef disposal activities themselves and will be overseeing disposal operations. In addition:

- Demolition will not involve explosives, and will use the work trestle and barges for all access in order to minimize footprint.
- NCDOT will implement Best Management Practices for Bridge Demolition and Removal.

General Construction Measures

- Oregon Inlet fishing access will be maintained on the catwalks at the southern end of the existing bridge as long as is safely feasible.
- NCDOT has elected to use more hand clearing rather than mechanized clearing where feasible to minimize impacts to wetlands.
- Special Sediment Control Fence and Environmentally Sensitive Area fencing (tree protection or equivalent) will be used where applicable.

Traffic

Traffic will be maintained on the existing bridge with lane closures during the times permitted by NCDOT and as coordinated with the Seashore, including brief stoppages periodically for material off-loading. A temporary detour road will be located just northeast of existing NC 12 within PINWR to convey traffic through the construction zone between SR 1257 and the parking lot area.

Regulatory Approvals

The NCDOT anticipates that these activities will also be authorized under the following permits:

- USACE Individual 404 Permit and Section 10 Permit
- NC Division of Water Quality 401 Individual Water Quality Certification (issued 09/07/2012)
- NC Division of Coastal Management CAMA Major Development Permit (draft issued 09/20/2012)
- US Coast Guard Bridge Permit
- USACE Nationwide 6 Permit for the proposed load test program, currently anticipated to begin mid-November 2012 (issued 08/15/2012)
- U.S. Fish and Wildlife Service Special Use Permit

If you have any questions or would like additional information, please contact Michael Turchy at maturchy@ncdot.gov or (919) 707-6157. A copy of this application will also be posted at https://connect.ncdot.gov/resources/Environmental.

Sincerely,

E. L. Lusk

for Gregory J. Thorpe, Ph.D., Manager
Project Development and Environmental Analysis Unit

Attachments

cc:
Mr. Bill Biddlecome, Washington Field Office, USACE
Mr. Gordon Wissinger, Southeast Acting Regional Director, NPS

NPS Form 10-930
OMB No. 1024-0026
NEW 10/00
Expires 6/30/2013

National Park Service
Outer Banks Group
1401 National Park Drive
Manteo, NC 27954
(252) 473-2111

Application for Special Use Permit

Please supply the information requested below. Attach additional sheets, if necessary, to provide required information. Allow AT LEAST 4 business days for processing (2 business days for First Amendment requests). You will be notified of the disposition of the application and the necessary steps to secure your final permit. Your permit may require the payment of site usage, cost recovery charges and proof of liability insurance naming the United States of America as also insured.

Applicant Name: NC Dept. of Transportation	**Organization Name:** NC Dept. of Transportation (NCDOT)
Social Security #: *not applicable*	**Tax ID #:** *not applicable*
Street/Address: 1020 Birch Ridge Road	**Street/Address:** 1020 Birch Ridge Road
City/State/Zip Code: Raleigh, NC 27610	**City/State/Zip Code:** Raleigh, NC 27610
Telephone #: (919) 707-6157	**Telephone #:** (919) 707-6157
Cell phone #: *not applicable*	**Cell phone #:** *not applicable*
Fax #: (919) 212-5785	**Fax#:** (919) 212-5785
E-mail: maturchy@ncdot.gov	**E-mail:** maturchy@ncdot.gov

Description of Proposed Activity (attach diagram, attach additional pages if necessary):

This request is for NCDOT Transportation Improvement Project No. B-2500 (Phase I), the replacement of Bridge No. 11 over the Oregon Inlet in Dare County. As has been thoroughly discussed with Seashore staff, the purpose of this application is for the construction of the replacement bridge and demolition of the existing bridge.

Requested Location: Land- and water-based areas along the existing and proposed bridge alignments/easements

Dates: *(subject to change, depending on permit approvals and the resolution of litigation related to the Project)*

Event set up will begin: (date and time)	Event will begin: (date and time)	Event will end: (date and time)	Removal will be done: (date and time)
n/a	Approx. January 2013	Approx. February 2016	Approx. February 2016

Maximum Number of Participants generally 120-150 people **(Please provide best estimate)**
Maximum Number of Vehicles Numerous vehicles, difficult to predict due to the varying conditions. Impacts to the Seashore and its visitors will be minimized and closely coordinated with Seashore and NCDOT Division 1 staff

Support Equipment (list all equipment; attach additional pages if necessary) Equipment includes:

cranes, barges, typical construction equipment, and trucks

List support personnel (contractors, etc. including addresses and telephones attach additional pages if necessary.

PCL Civil Constructors, 801 Corporate Center Dr, Suite 130, Raleigh,NC 27607;Ph: 919-859-5210 (CONTRACTOR)

HDR Engineering, 3733 National Dr. Suite 207, Raleigh, NC 27612; Ph: 919-785-1118 (DESIGNERS)

Other subcontractors will also be on-site, under the supervision of PCL

Individual in charge of event on site (include address, telephone and cell phone numbers):
Pablo Hernandez, NCDOT Division 1 Resident Engineer 349 Water Plant Road, Unit B Manteo, NC 27954

252-473-3637 (office) 252-423-0114 (cell)

Is this an exercise of First Amendment Rights? ☐Y ☒N
Are you familiar with/ have you visited the requested area? ☒Y ☐N
Have you obtained a permit from the National Park Service in the past? ☒Y ☐N
(If yes, provide a list of permit dates and locations on a separate page.)
Do you plan to advertise or issue a press release before the event? ☒Y ☐N
Will you distribute printed material? ☐Y ☒N
Is there any reason to believe there will be attempts to disrupt, protest or prevent your event? (If yes, please explain on a separate page.) ☐Y ☒N
Do you intend to solicit donations, engage in fundraising, or offer items for sale? (If yes, please explain on a separate page.) ☐Y ☒N

The applicant by his or her signature certifies that all the information given is complete and correct, and that no false or misleading information or false statements have been given.

Signature E. L. Fuhle for Gregory J. Thompson, PhD Date Nov 20, 2012

****

Information provided will be used to determine whether a permit will be issued. Certain activity and event permits are subject to cost recovery and administrative charges which must be paid before the permit is issued. You will be advised as to those charges if you application is approved. Assessed charges must be paid in advance of receiving the permit in the form of a check or money order payable to National Park Service. Payments are non-refundable.

This completed application should be mailed to the Park address found at the top of this application.

Note that this is an application only, and does not serve as permission to conduct any use of the park. If your request is approved, a permit containing applicable terms and conditions will be sent to the person designated on the application. The permit must be signed by the responsible person and returned to the park prior to the event.

NOTICES

Privacy Act Statement: The Privacy Act of 1974 (5 U.S.C. 552a) provides that you be furnished with the following information in connection with information required by this application. This information is being collected to allow the park manager to make a value judgment on whether or not to allow the requested use. Applicants are required to provide their social security or taxpayer identification number or activities subject to collection of fees by the National Park Service (31 U.S.C. 7701) Information from the application may be transferred to appropriate Federal, State, local agencies, when relevant to civil, criminal or regulatory investigations or prosecutions.

Paperwork Reduction Act Statement): This information is being collected subject to the Paperwork Reduction Act (44 U.S.C. 3501) to allow the park manager to make a value judgment on whether or not to allow the requested use. All applicable parts of the form must be completed. A Federal agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Estimated Burden Statement: Public reporting burden for this form is estimated to average 30 minutes per response including the time it takes to read, gather and maintain data, review instructions and complete the form. Direct comments regarding this burden estimate or any aspects of this form to the National Park Service, Special Park Uses Program Manager, 1849 C Street NW (2460), Washington, D.C. 20240

TIP PROJECT: B-2500

CONTRACT: C 202185

See Sheet 1-A For Index of Sheets

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

DARE COUNTY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-2500	1	
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
32635.1.4	BRNHF-0012(48)	CONSTRUCTION	
32635.3.GV3	BRNHF-0012(36)	CONSTRUCTION	

LOCATION: NC 12 – REPLACEMENT OF HERBERT C. BONNER BRIDGE ACROSS OREGON INLET FROM HATTERAS ISLAND TO BODIE ISLAND

TYPE OF WORK: DESIGN-BUILD AS SPECIFIED IN THE SCOPE OF WORK CONTAINED IN THE REQUEST FOR PROPOSALS

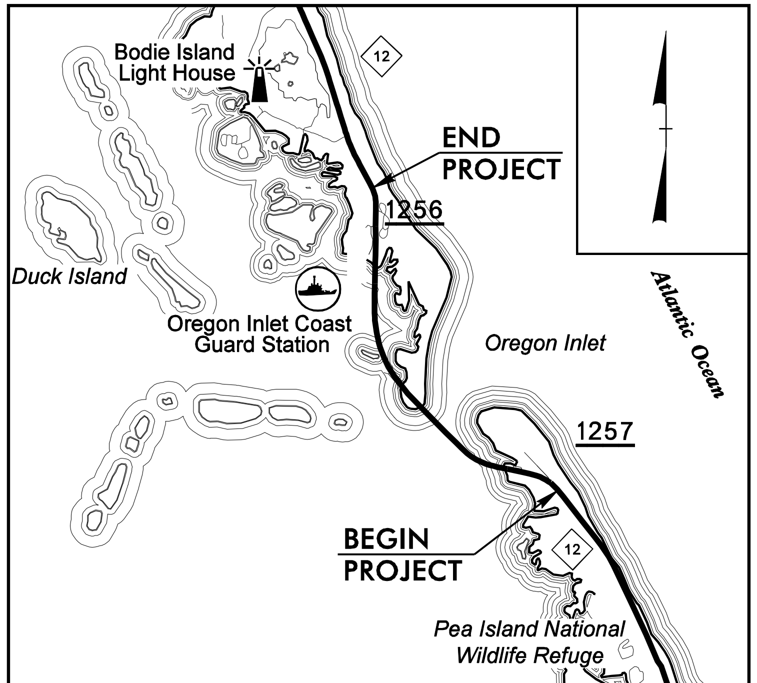
PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

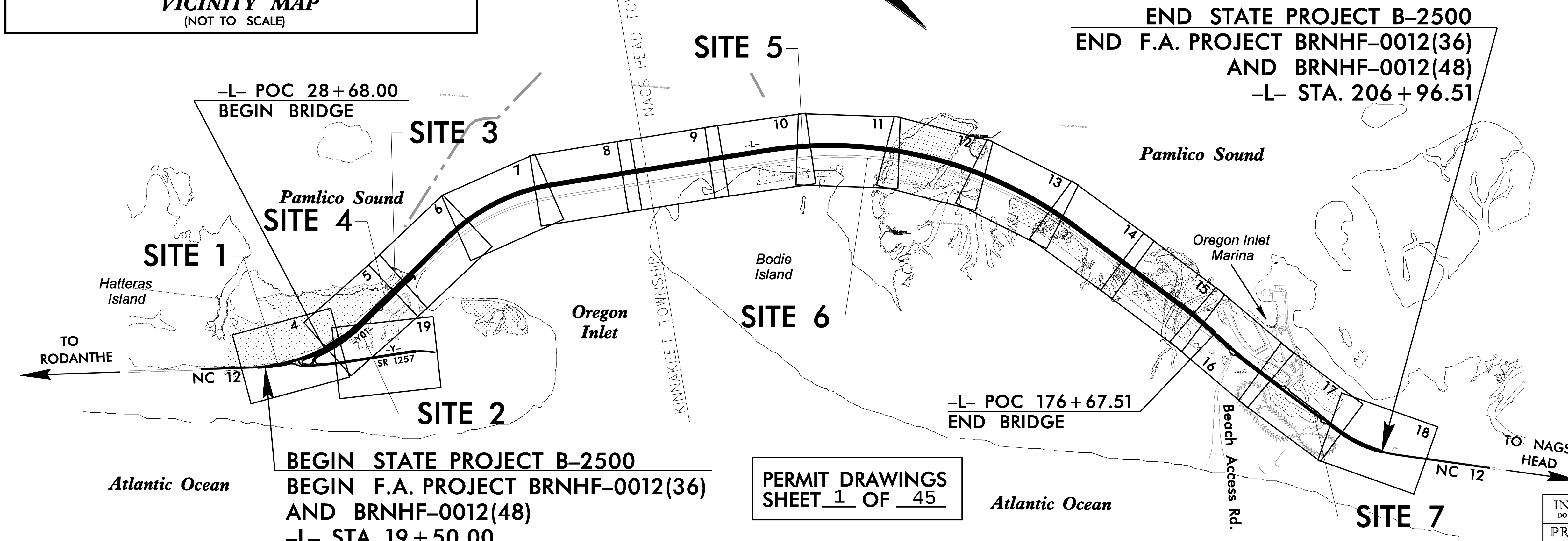
WETLAND AND STREAM IMPACTS SITE MAP

SUBMITTED: 04-27-2012

SUBMITTAL #D-027



VICINITY MAP
(NOT TO SCALE)



PERMIT DRAWINGS SHEET 1 OF 45

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III.

GRAPHIC SCALES

PLANS: 50 25 0 50 100
PROFILE (HORIZONTAL): 50 25 0 50 100
PROFILE (VERTICAL): 10 5 0 10 20

DESIGN DATA

ADT 2011 = 7,060
ADT 2035 = 11,420
DHV = 10 %
D = 50 %
T = 6 %
V = 60 MPH

FUNC CLASS = MAJOR COLLECTOR STATEWIDE TIER

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT B-2500	=	0.747 MILES
LENGTH STRUCTURE TIP PROJECT B-2500	=	2.803 MILES
TOTAL LENGTH TIP PROJECT B-2500	=	3.550 MILES

DIVISION OF HIGHWAYS
1000 Birch Ridge Dr., Raleigh NC, 27610

2006 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: DECEMBER 7, 2011

LETTING DATE: JULY 19, 2011

DOMENIC A. COLETTI, PE — PROJECT ENGINEER

DOMINIC M. WAINWRIGHT, PE — PROJECT DESIGN ENGINEER

NCDOT CONTACT: DAVID T. HERING, LG, PE — DESIGN-BUILD ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: P.E.

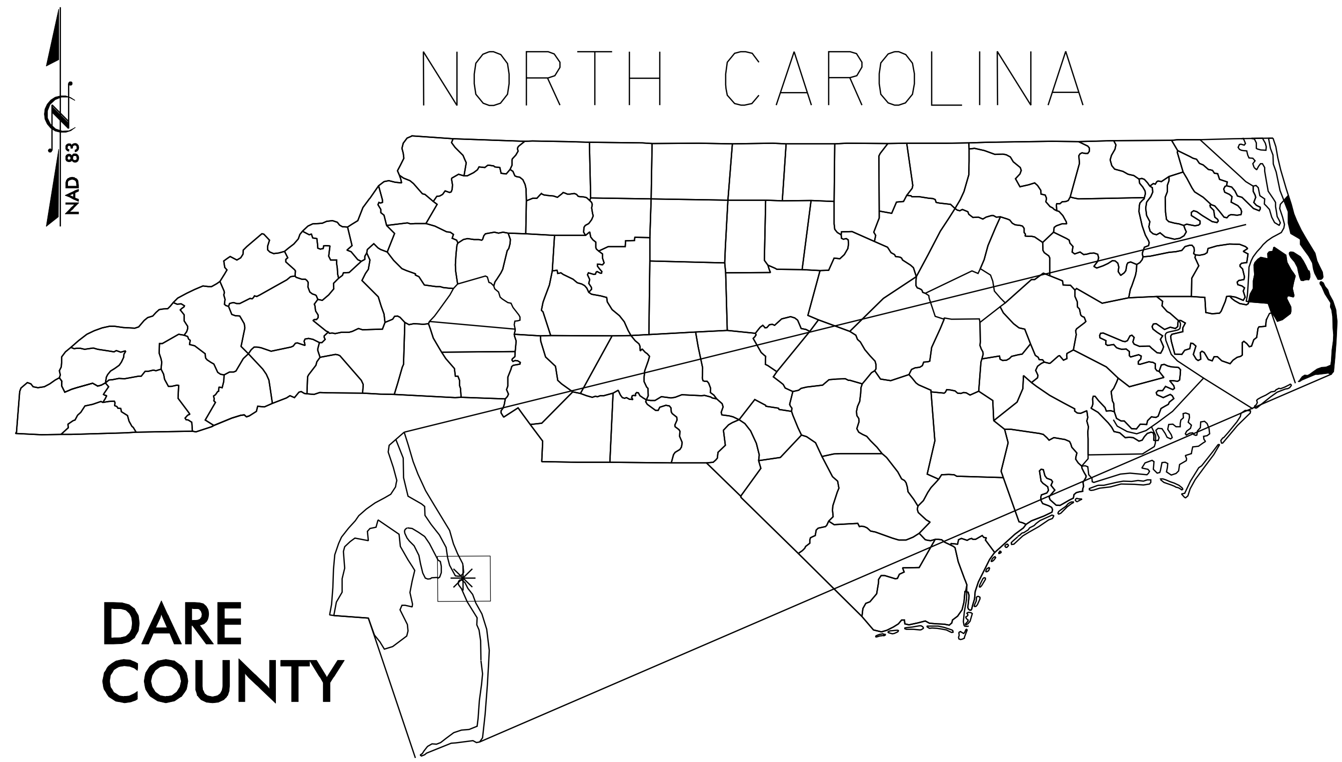
ROADWAY DESIGN ENGINEER

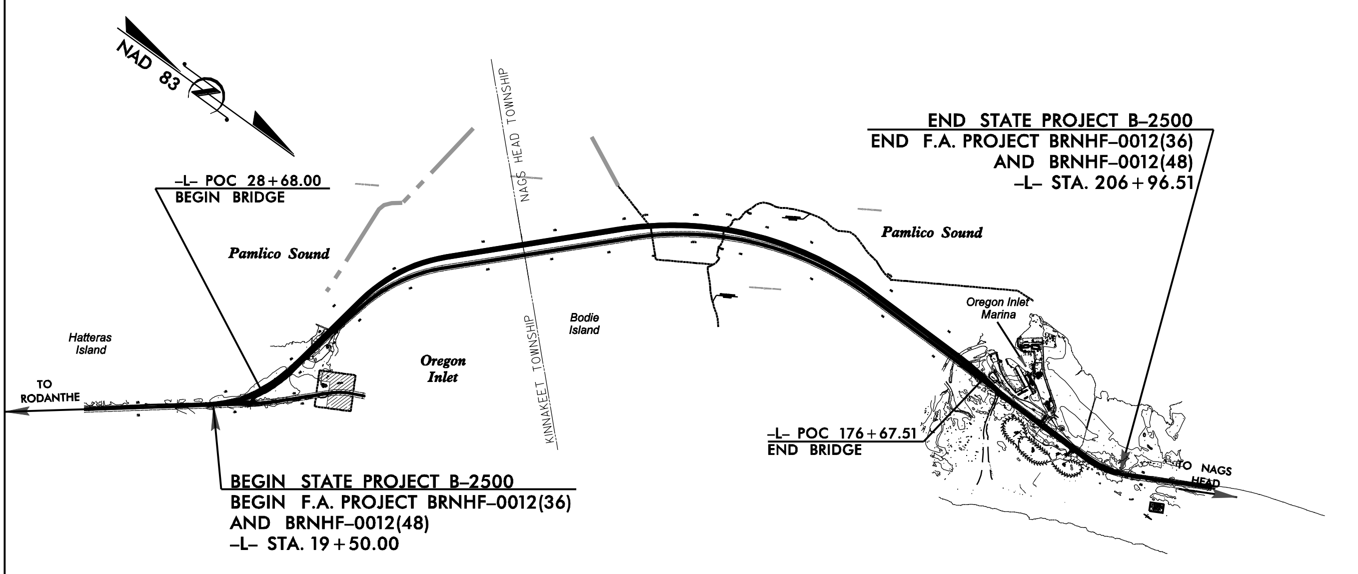
SIGNATURE: P.E.

DIVISION OF HIGHWAYS STATE OF NORTH CAROLINA

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY DESIGN ENGINEER P.E.





VICINITY MAPS

NCDOT

DIVISION OF HIGHWAYS

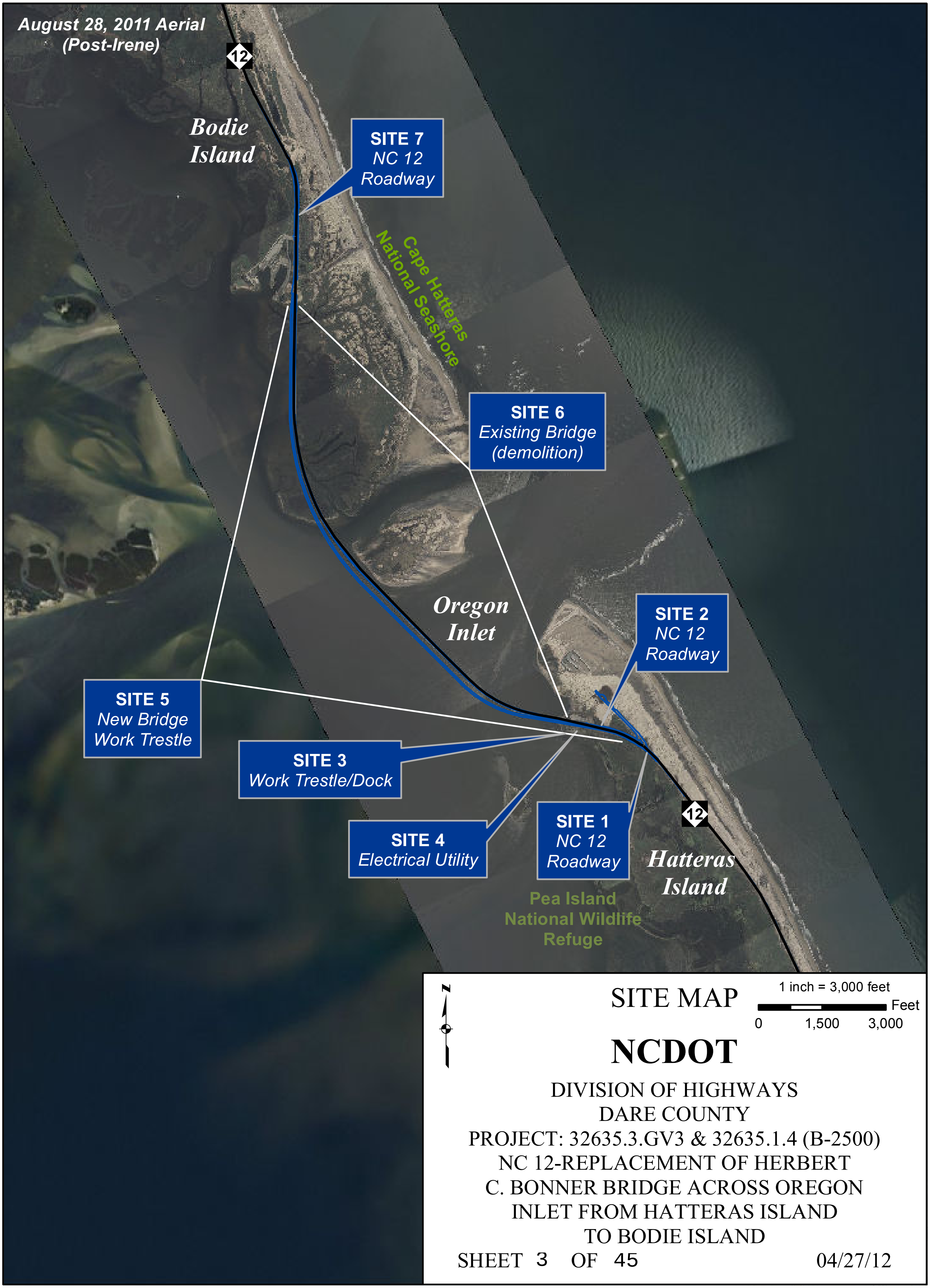
DARE COUNTY

PROJECT: 32635.3.GV3 AND 32635.1.4

(B-2500)

NC 12-REPLACEMENT OF HERBERT C. BONNER BRIDGE ACROSS OREGON INLET FROM HATTERAS ISLAND TO BODIE ISLAND

SHEET 2 OF 45 04/27/12



SITE MAP

NCDOT

DIVISION OF HIGHWAYS
DARE COUNTY
PROJECT: 32635.3.GV3 & 32635.1.4 (B-2500)
NC 12-REPLACEMENT OF HERBERT
C. BONNER BRIDGE ACROSS OREGON
INLET FROM HATTERAS ISLAND
TO BODIE ISLAND

SHEET 3 OF 45 04/27/12

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

DATUM DESCRIPTION

THE LOCALIZED COORDINATE SYSTEM DEVELOPED FOR THIS PROJECT IS BASED ON THE STATE PLANE COORDINATES ESTABLISHED BY NCDOT FOR MONUMENT "B2500-2"
WITH NAD 83 (CORS96) STATE PLANE GRID COORDINATES OF NORTHING: 751499.622(ft) EASTING: 3031964.117(ft)
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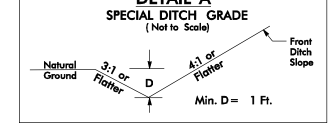
THE N.C. LAMBERT GRID BEARING AND LOCALIZED HORIZONTAL GROUND DISTANCE FROM "B2500-2" TO -L- STATION 19+50.00 IS S 47° 51' 59.63" E 698.91'
ALL LINEAR DIMENSIONS ARE LOCALIZED HORIZONTAL DISTANCES
VERTICAL DATUM USED IS NAVD 88

NAD 83/NSRS 2007

F F — DENOTES FILL IN WETLAND

HC HC — DENOTES HAND CLEARING

DETAIL A
SPECIAL DITCH GRADE (Not to Scale)



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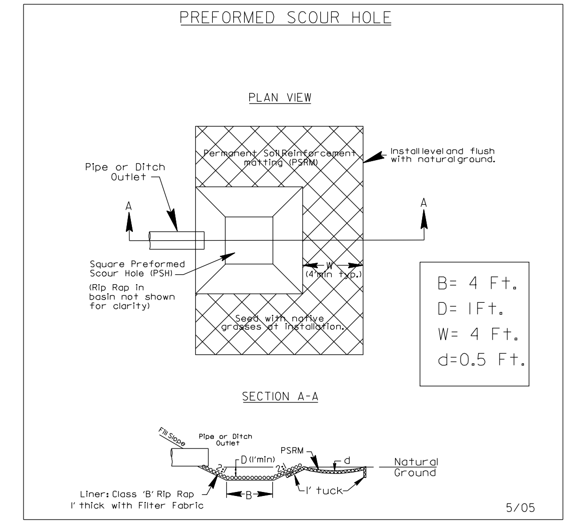
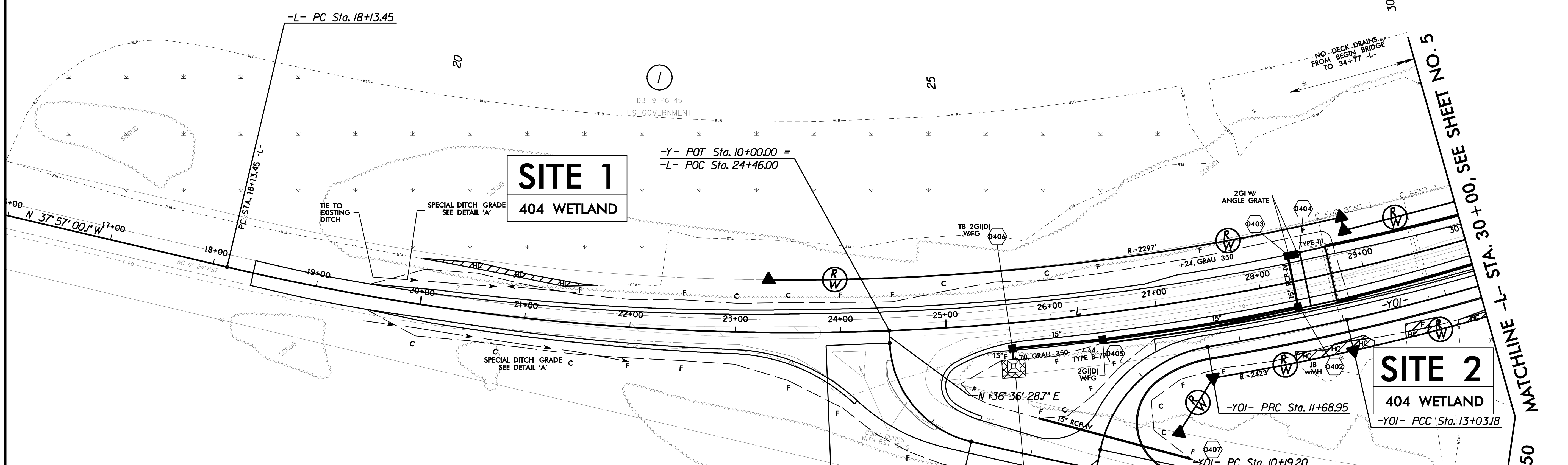
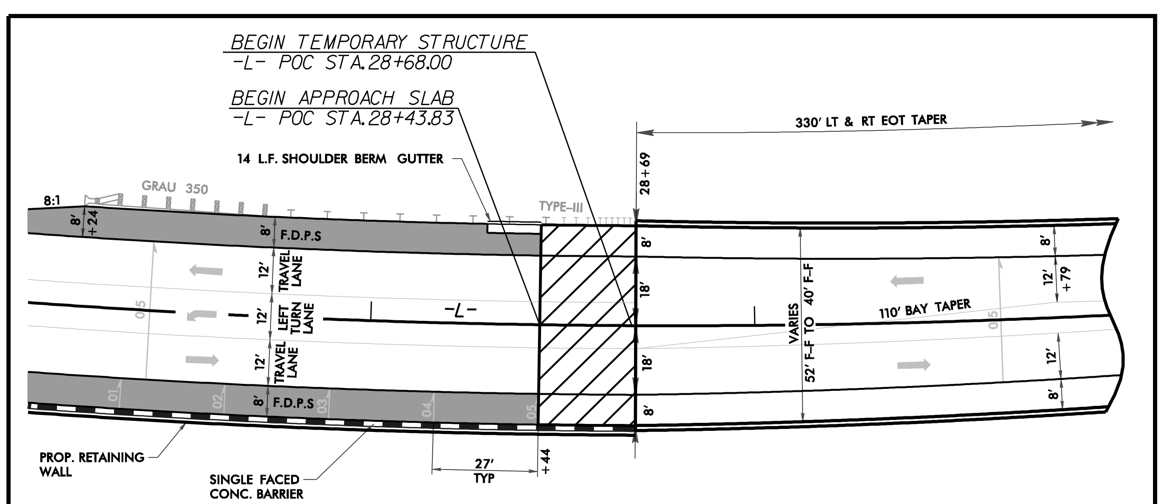
FROM STA. 20+75 TO STA. 21+50 -L- LT
FROM STA. 19+50 TO STA. 22+00 -L- RT
FROM STA. 13+00 TO STA. 16+00 -Y- RT
FROM STA. 16+00 TO STA. 17+50 -Y- RT

PREFORMED SCOUR HOLE







SKETCH SHOWING BRIDGE/PAVEMENT RELATIONSHIP

PERMIT DRAWINGS SHEET 4 OF 45

SEE SHEET NO. 20 FOR -L- PROFILE.
SEE SHEET NO. 30 FOR -Y- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

REVISIONS

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VERTICAL DATUM USED IS NAVD 88

NAD 83/NSRS 2007

F / F — DENOTES FILL IN WETLAND

HC / HC — DENOTES HAND CLEARING

DETAIL A

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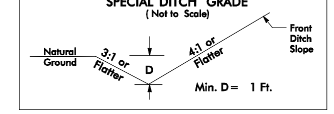

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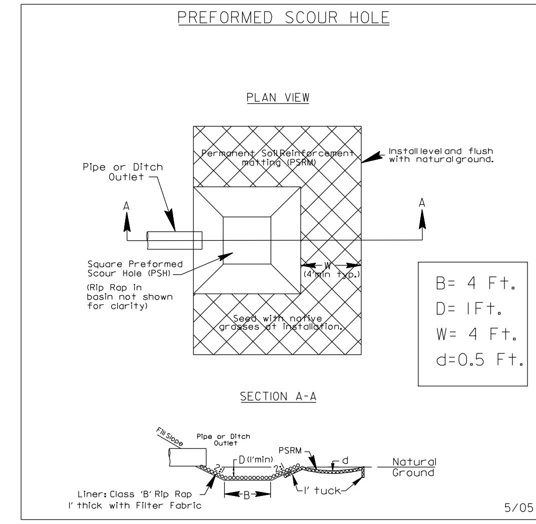
FROM STA. 16+00 TO STA. 17+50 -Y- RT

PREFORMED SCOUR HOLE



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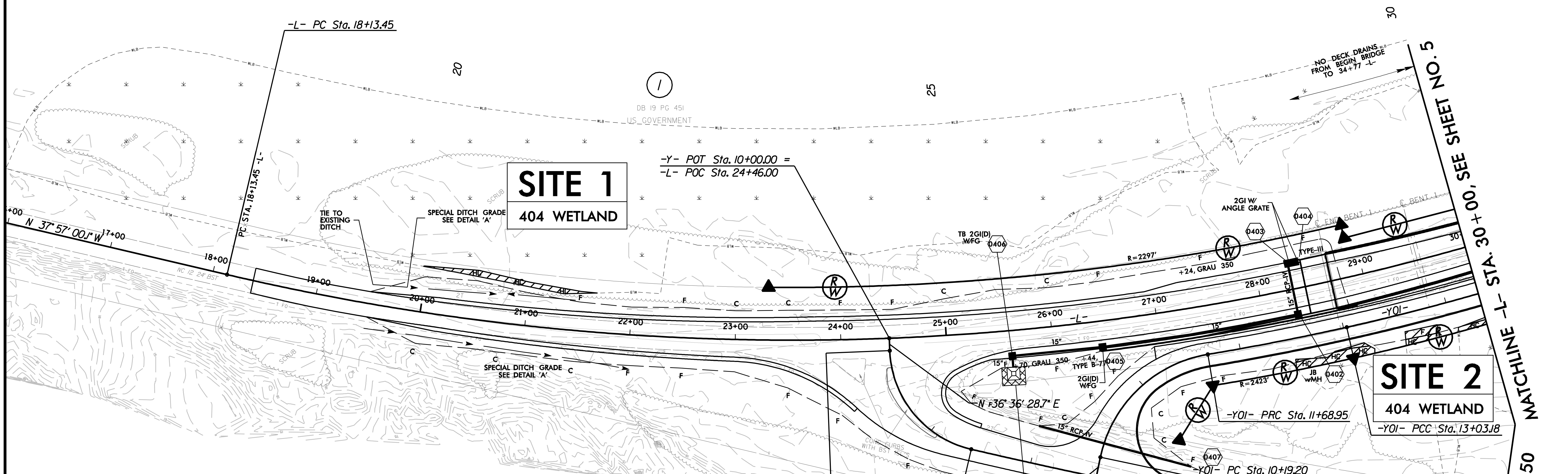
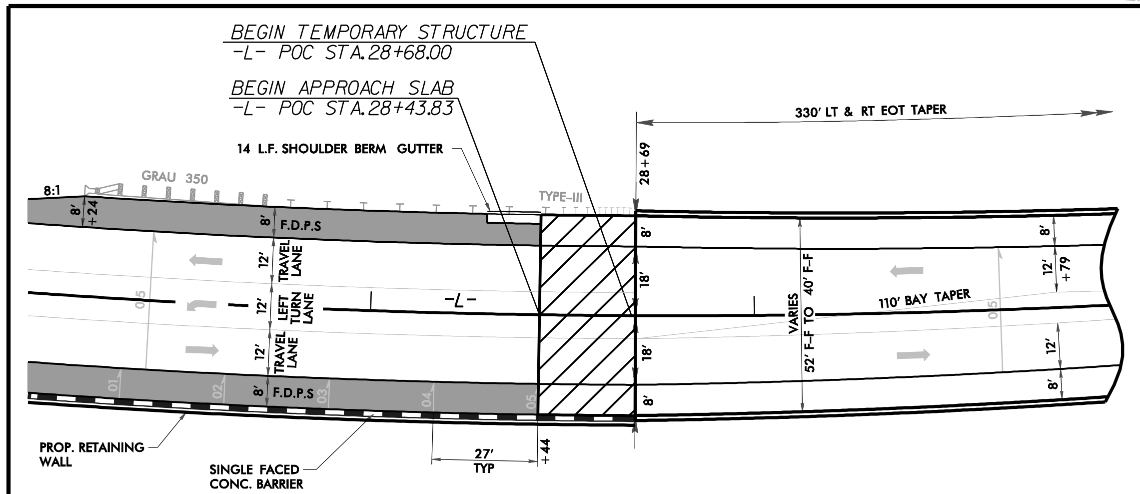
W= 4 Ft.
d=0.5 Ft.





SKETCH SHOWING BRIDGE/PAVEMENT RELATIONSHIP

PERMIT DRAWINGS
SHEET 5 OF 45

SEE SHEET NO. 20 FOR -L- PROFILE.
SEE SHEET NO. 30 FOR -Y- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

REVISIONS

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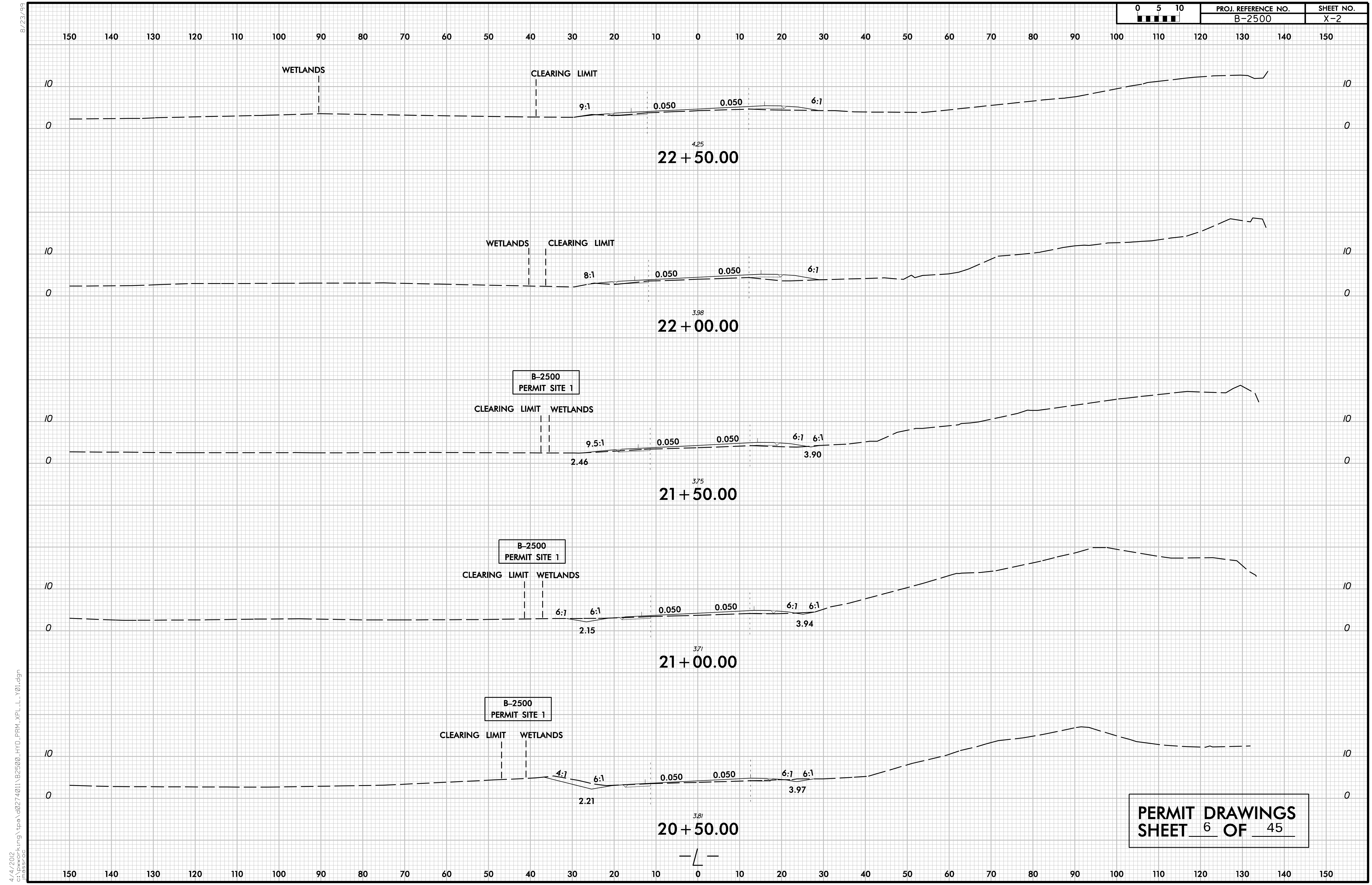

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0.050
6:1
4.25
22 + 50.00
WETLANDS
CLEARING LIMIT
8:1
0.050
0.050
6:1
3.98
22 + 00.00
B-2500
PERMIT SITE 1
CLEARING LIMIT
WETLANDS
9.5:1
0.050
0.050
6:1
6:1
2.46
3.90
3.75
21 + 50.00
B-2500
PERMIT SITE 1
CLEARING LIMIT
WETLANDS
6:1
6:1
0.050
0.050
6:1
6:1
2.15
3.94
3.71
21 + 00.00
B-2500
PERMIT SITE 1
CLEARING LIMIT
WETLANDS
4:1
6:1
0.050
0.050
6:1
6:1
2.21
3.97
3.81
20 + 50.00
-L-
PERMIT DRAWINGS
SHEET 6 OF 45
8/23/99
4/4/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_XPL_L_Y01.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

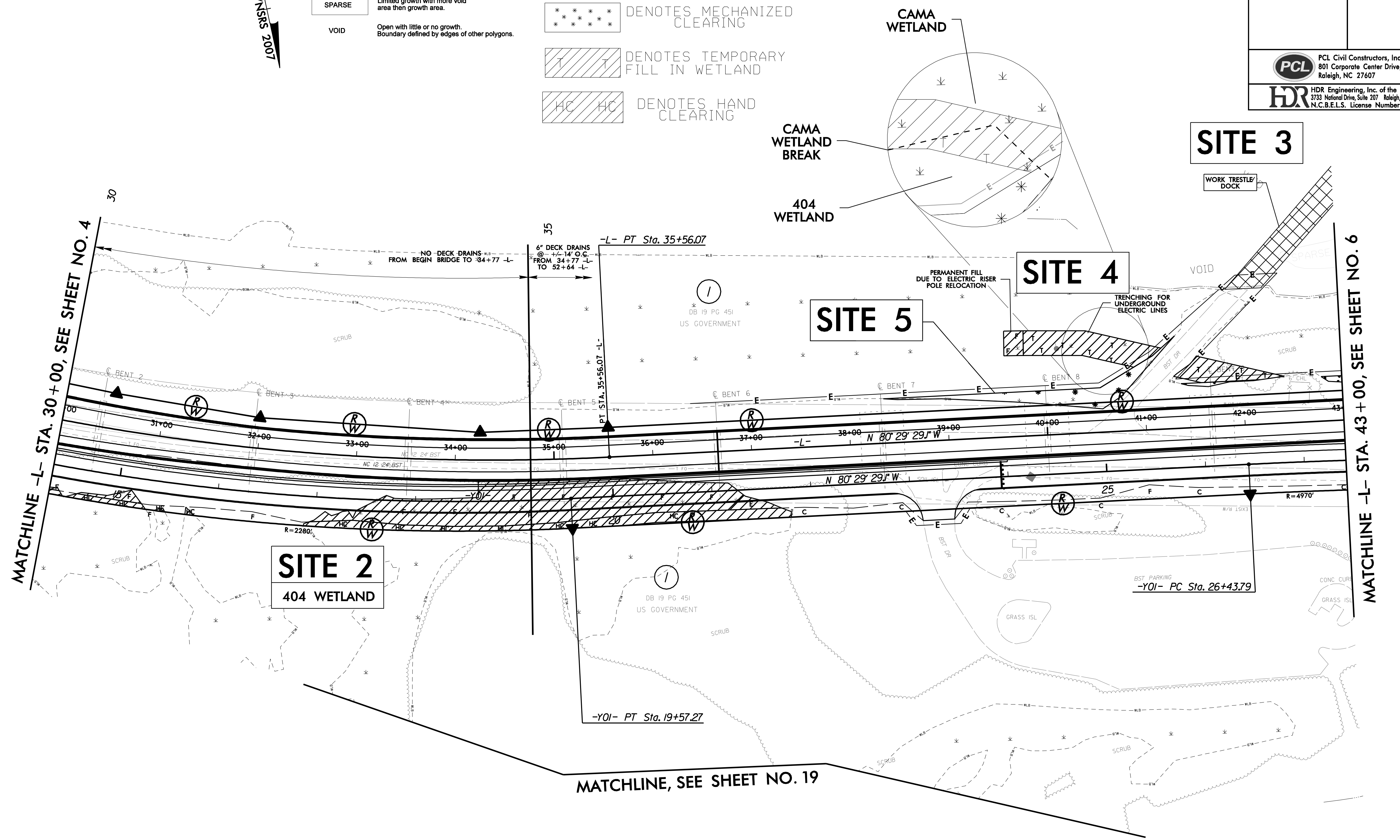
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

NAD 83/NSRS 2007

- F F — DENOTES FILL IN WETLAND
- E E — DENOTES EXCAVATION IN WETLAND
- DENOTES MECHANIZED CLEARING
- T T — DENOTES TEMPORARY FILL IN WETLAND
- HC HC — DENOTES HAND CLEARING



PERMIT DRAWINGS
SHEET 7 OF 45

SEE SHEET NO. 20 FOR -L- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

REVISIONS

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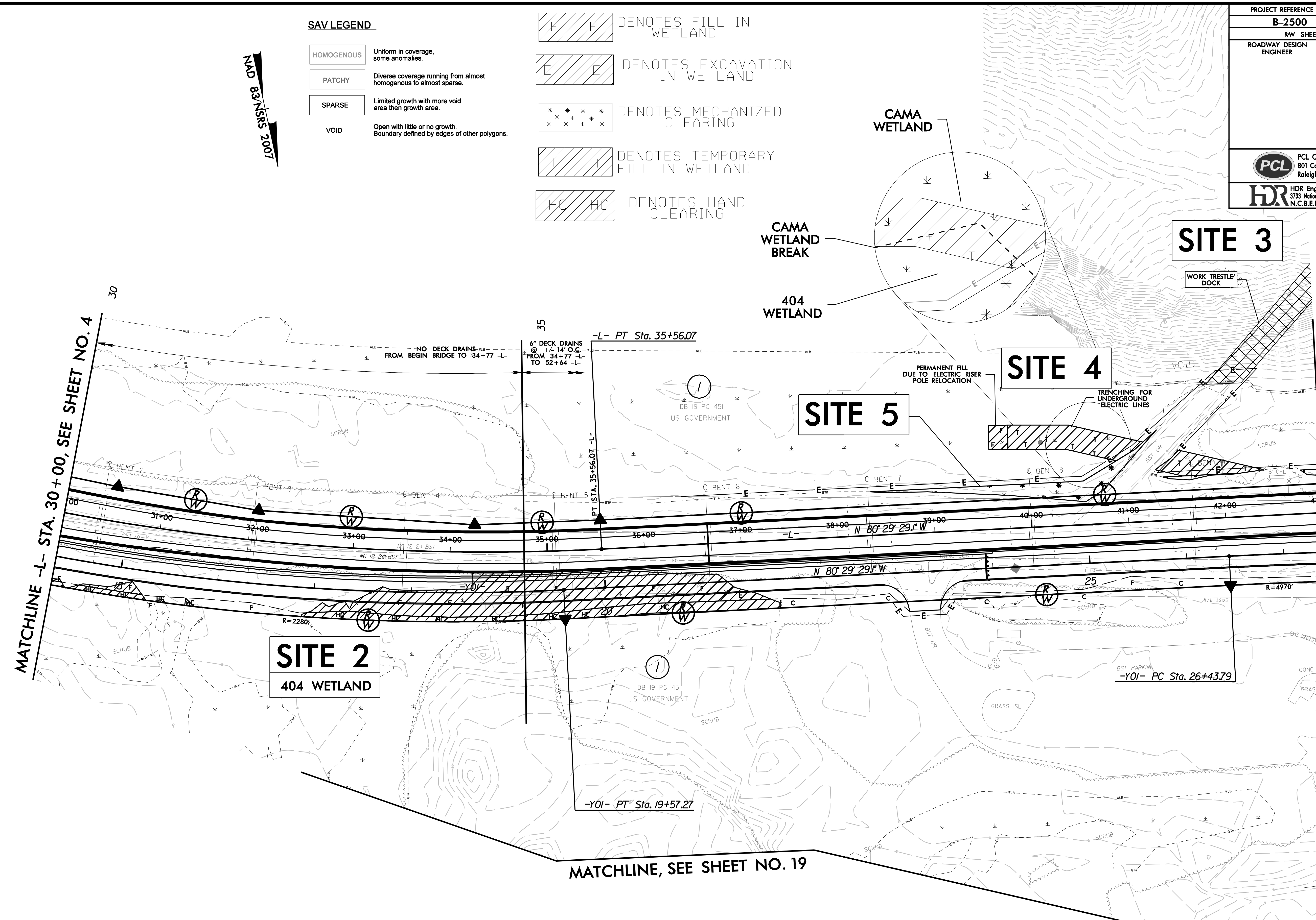
PROJECT REFERENCE NO.	SHEET NO.
B-2500	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



PERMIT DRAWINGS
SHEET 8 OF 45

SEE SHEET NO. 20 FOR -L- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

REVISIONS

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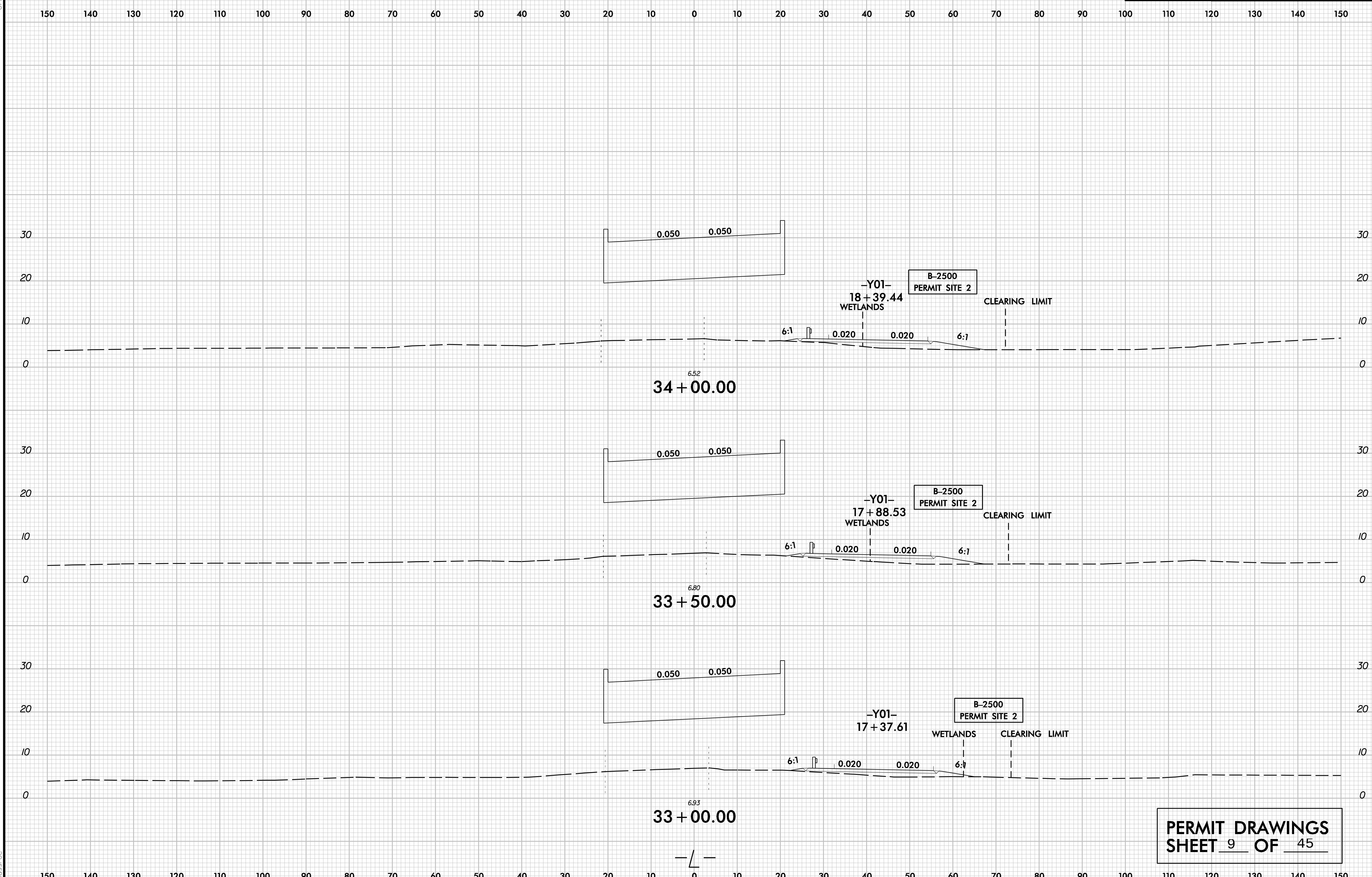
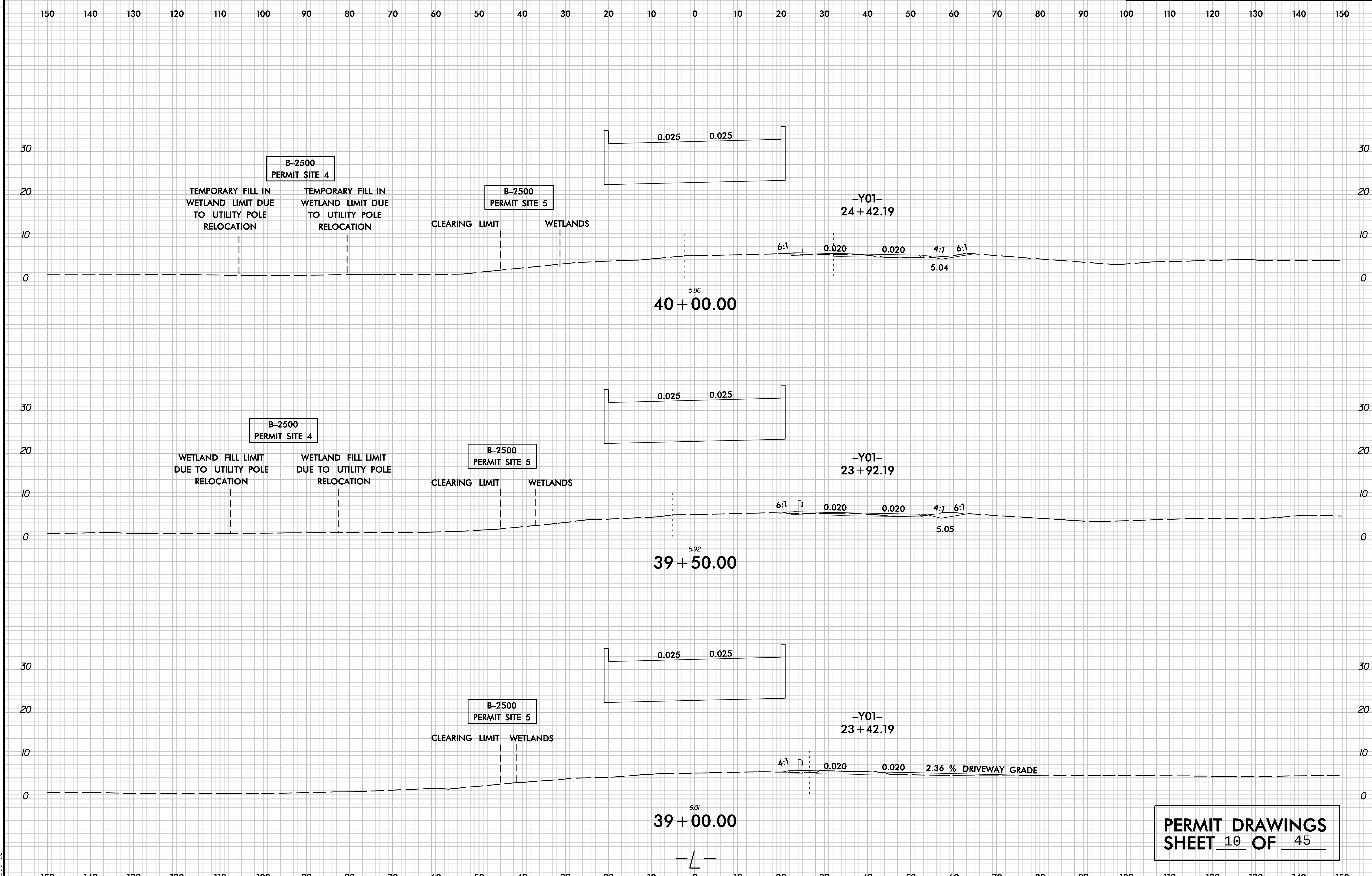
PROJ. REFERENCE NO.	SHEET NO.
B-2500	X-8



PERMIT DRAWINGS
SHEET 9 OF 45

PROJ. REFERENCE NO.	SHEET NO.
B-2500	X-12



PERMIT DRAWINGS
SHEET 10 OF 45

8/23/99

4/4/2012
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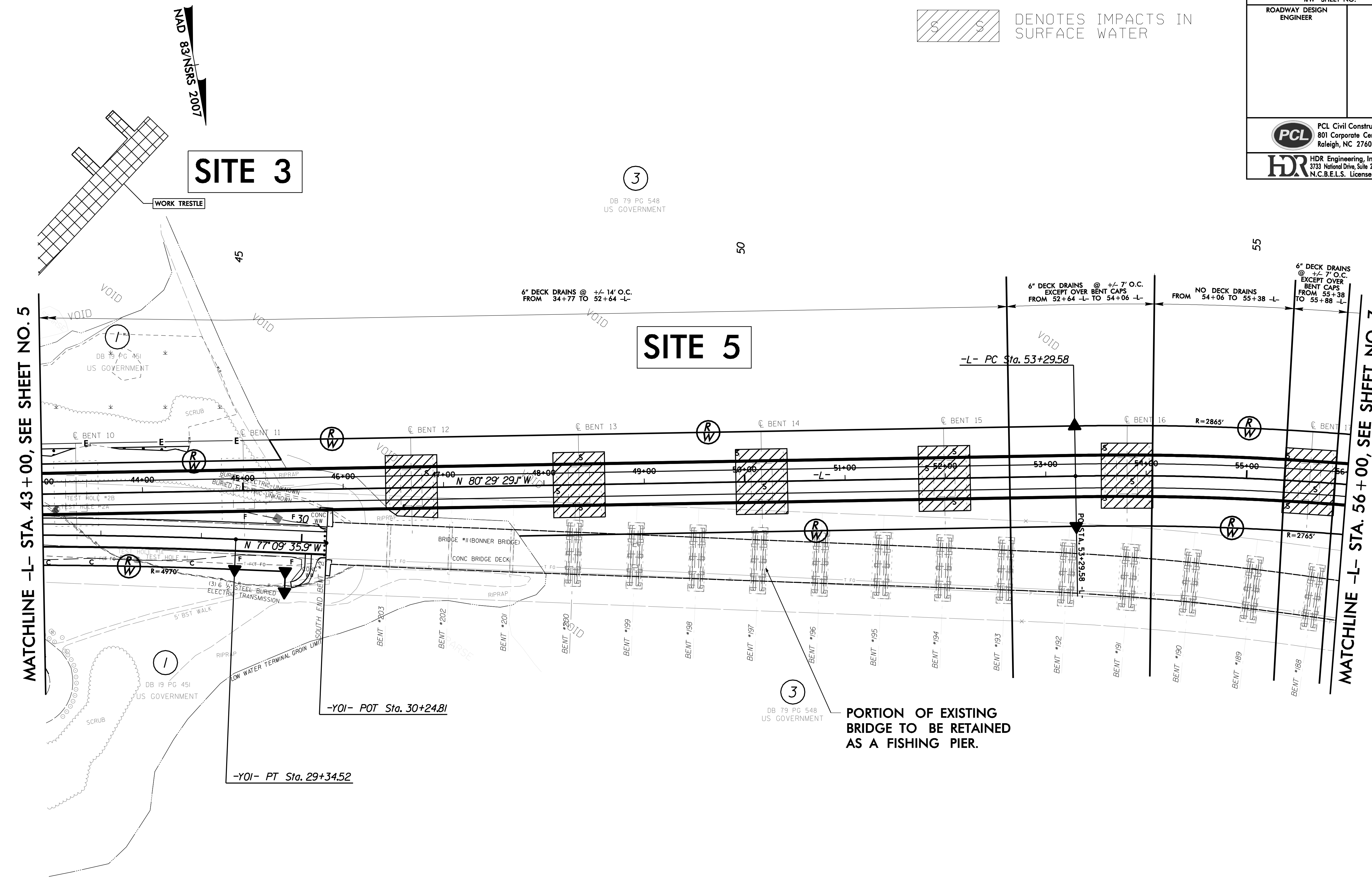
jmassroc

PROJECT REFERENCE NO.	SHEET NO.
B-2500	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

DENOTES IMPACTS IN SURFACE WATER



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 11 OF 45

SEE SHEET NO. 21 FOR -L- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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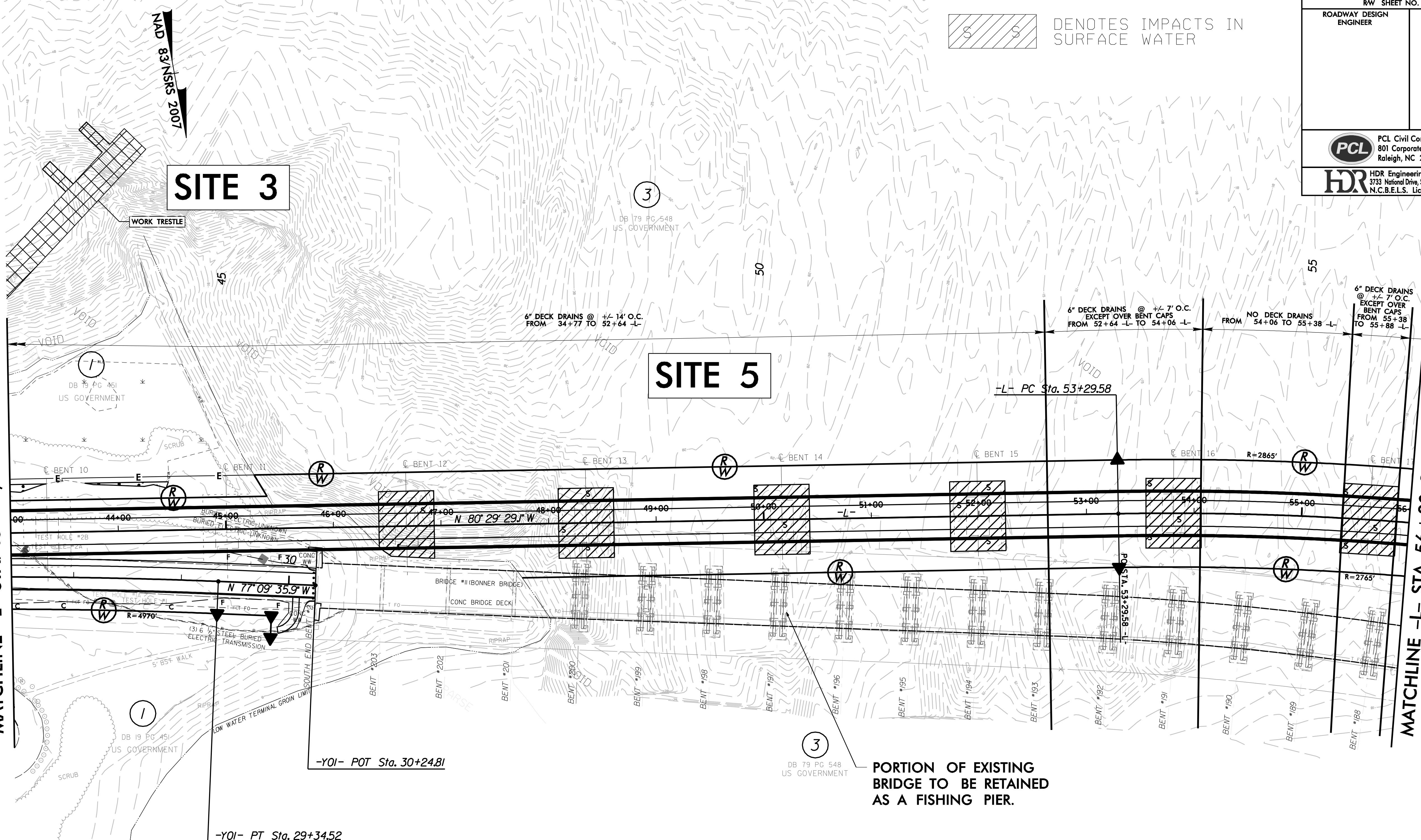
PROJECT REFERENCE NO.	SHEET NO.
B-2500	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

DENOTES IMPACTS IN SURFACE WATER



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 12 OF 45

SEE SHEET NO. 21 FOR -L- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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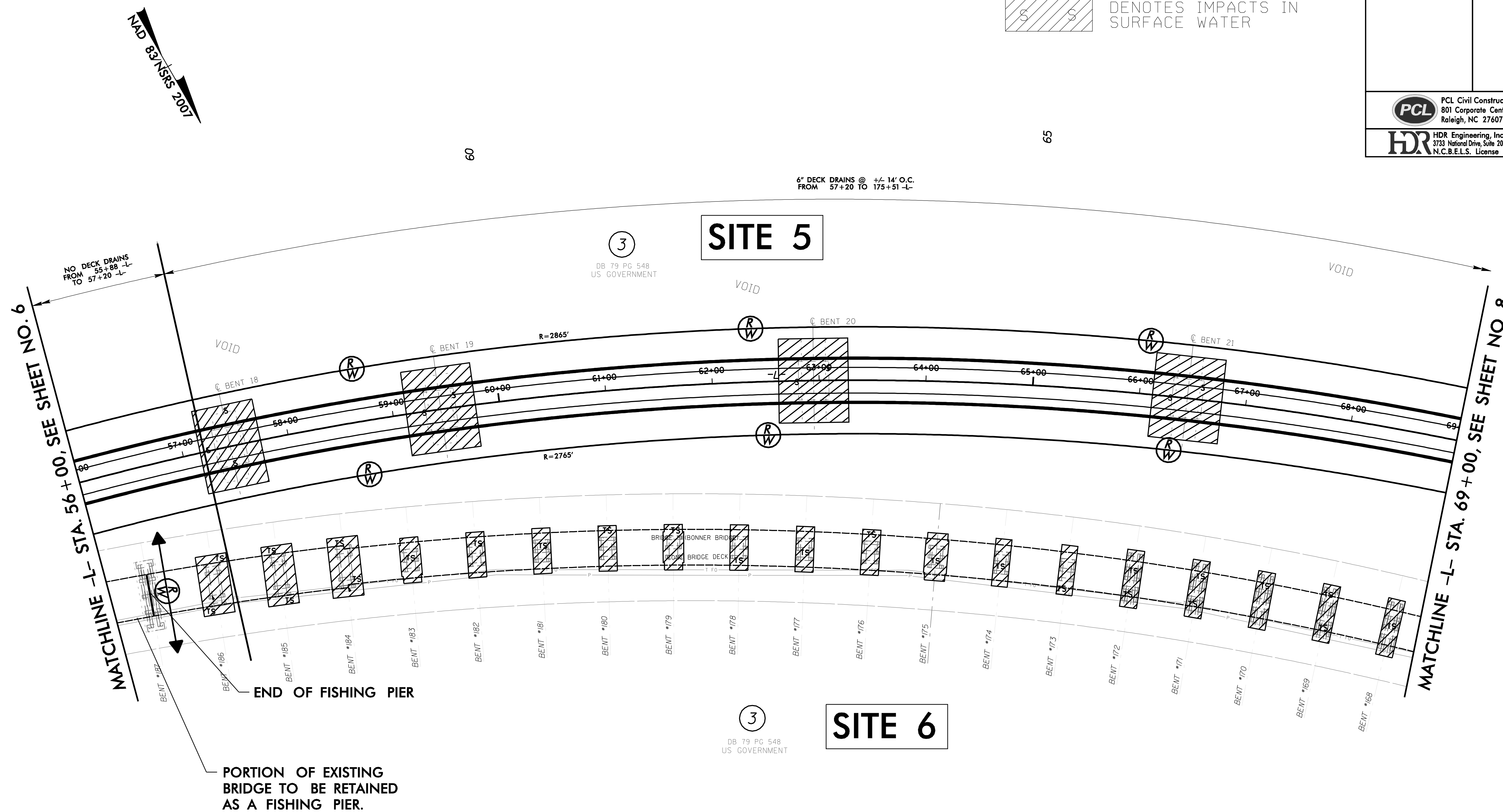
PROJECT REFERENCE NO.	SHEET NO.
B-2500	7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

S S DENOTES IMPACTS IN SURFACE WATER



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 13 OF 45

SEE SHEET NO. 22 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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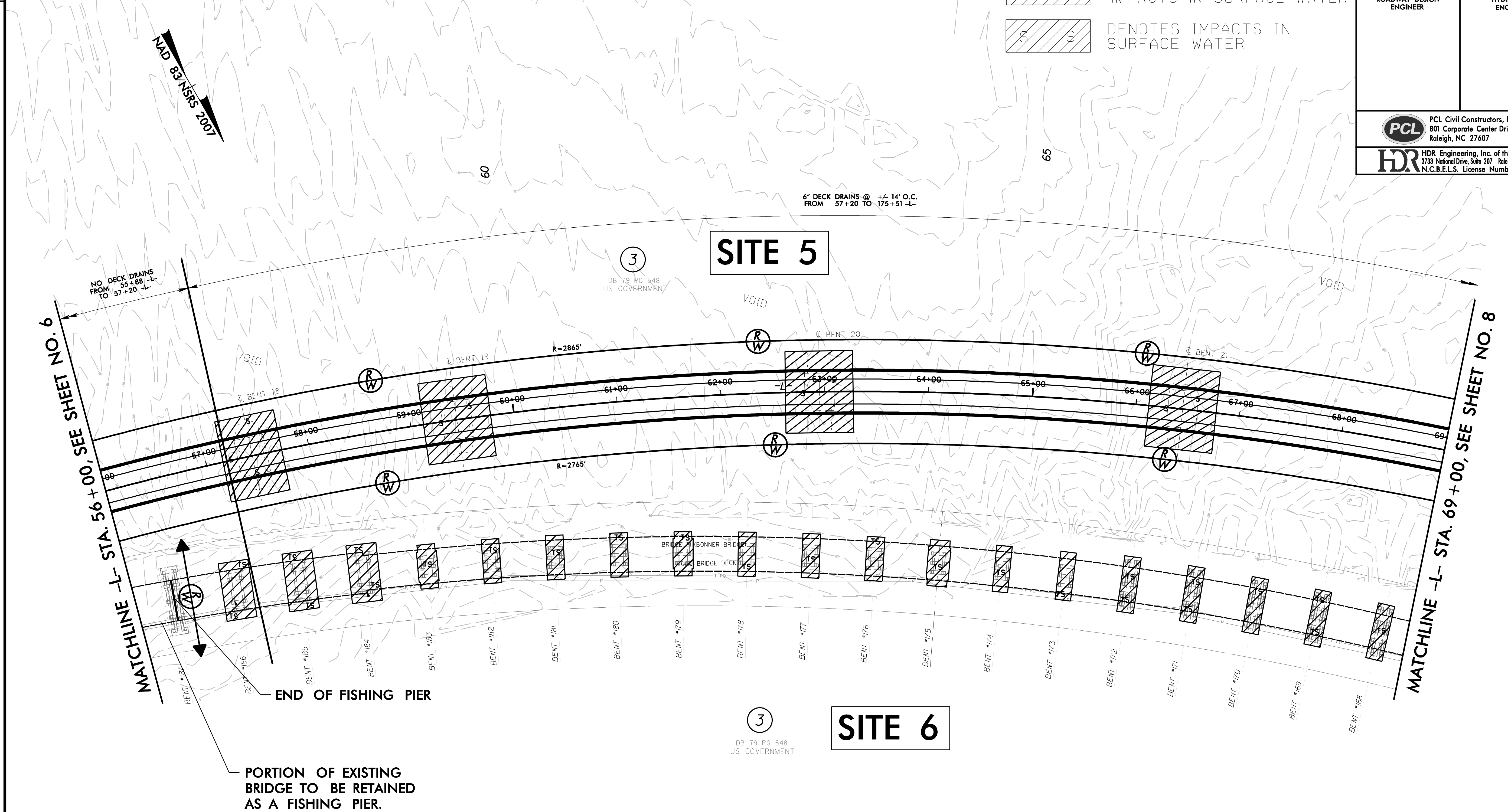
PROJECT REFERENCE NO.	SHEET NO.
B-2500	7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

TS / TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

S / S — DENOTES IMPACTS IN SURFACE WATER



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 14 OF 45

SEE SHEET NO. 22 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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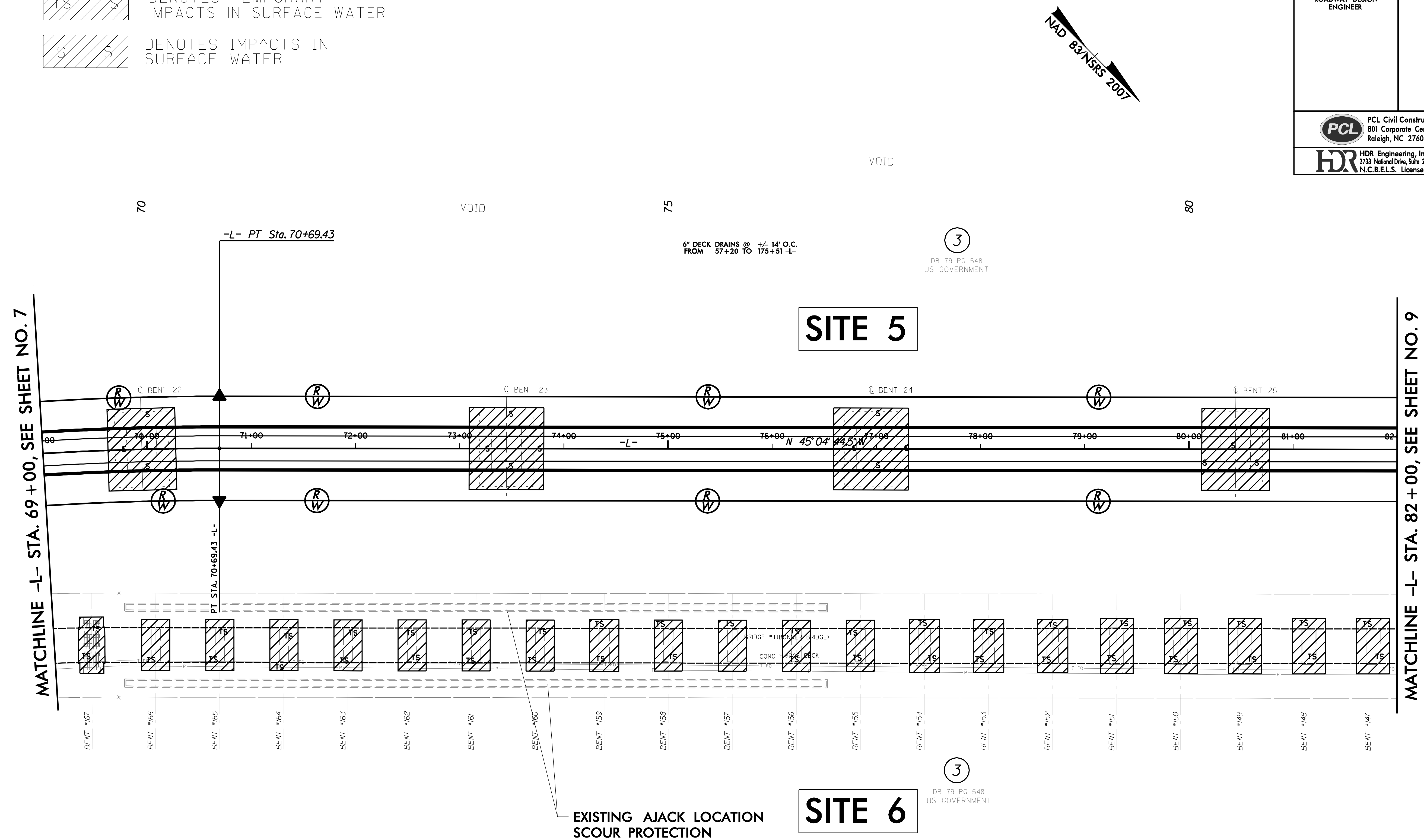
PROJECT REFERENCE NO.	SHEET NO.
B-2500	8
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

S S — DENOTES IMPACTS IN SURFACE WATER



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 15 OF 45

SEE SHEET NO. 23 FOR -L- PROFILE.

REVISIONS

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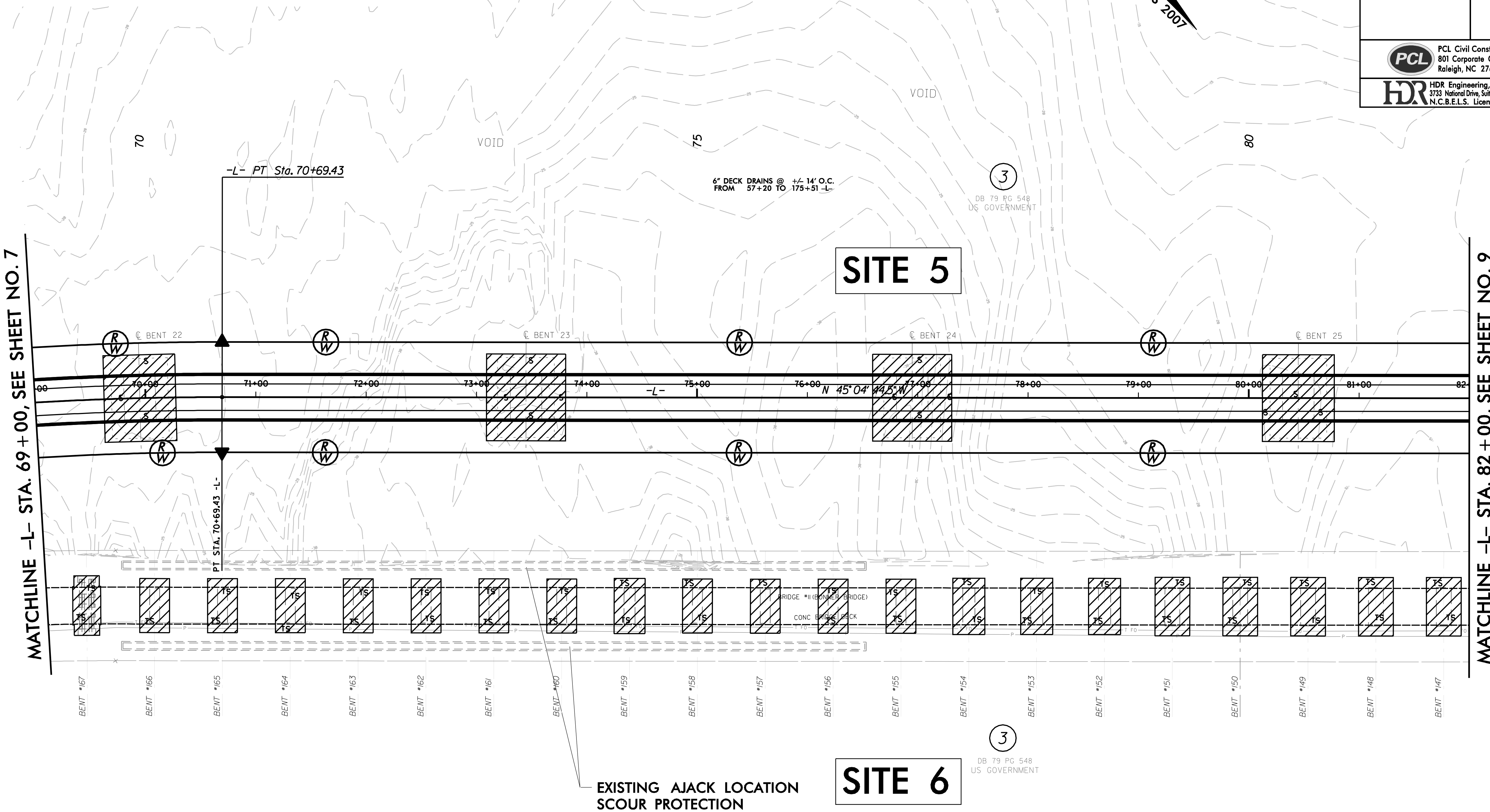
PROJECT REFERENCE NO.	SHEET NO.
B-2500	8
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

S S — DENOTES IMPACTS IN SURFACE WATER



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 16 OF 45

SEE SHEET NO. 23 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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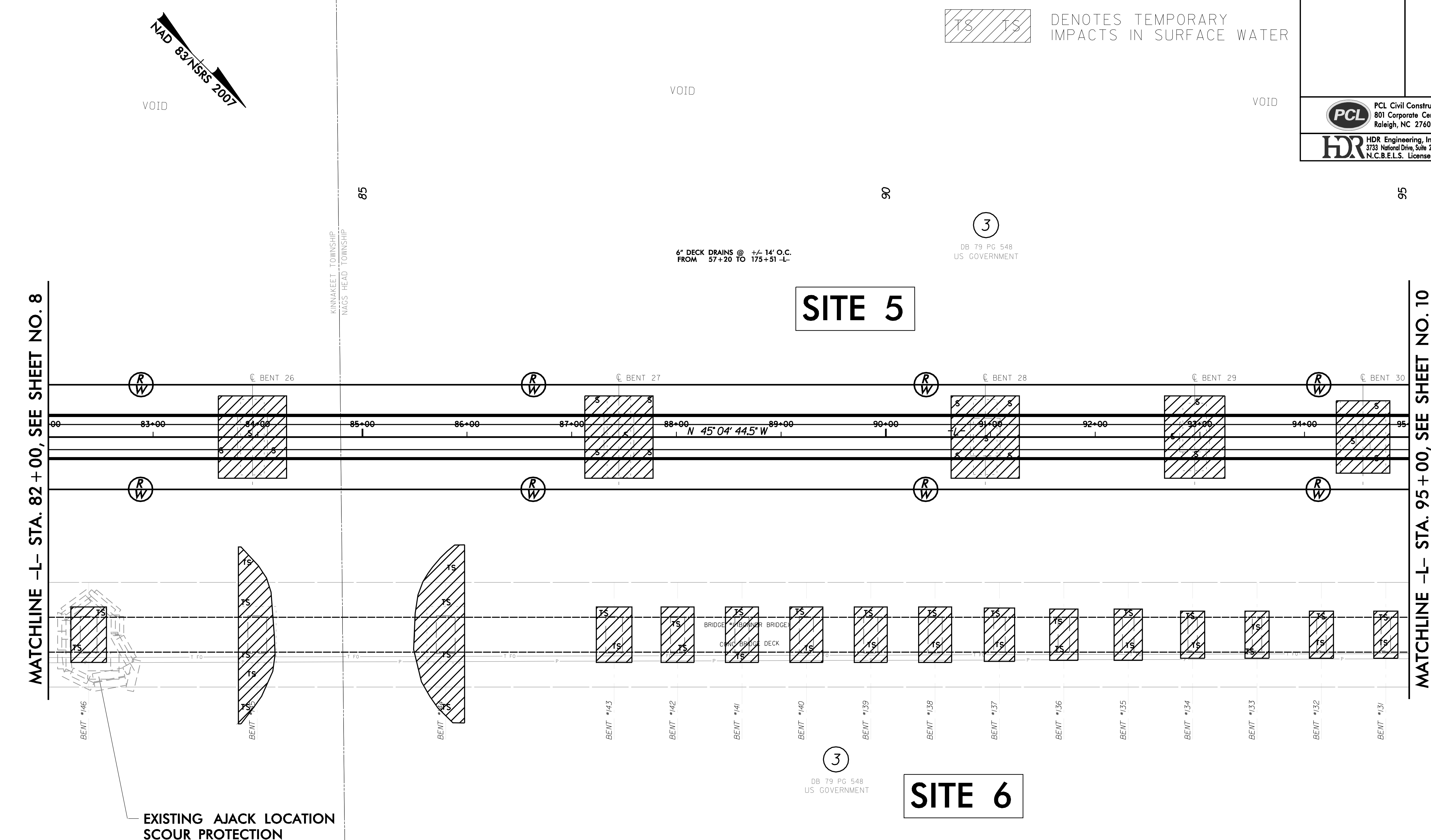
PROJECT REFERENCE NO.	SHEET NO.
B-2500	9
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

DENOTES IMPACTS IN SURFACE WATER

DENOTES TEMPORARY IMPACTS IN SURFACE WATER



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 17 OF 45

SEE SHEET NO. 24 FOR -L- PROFILE.

REVISIONS

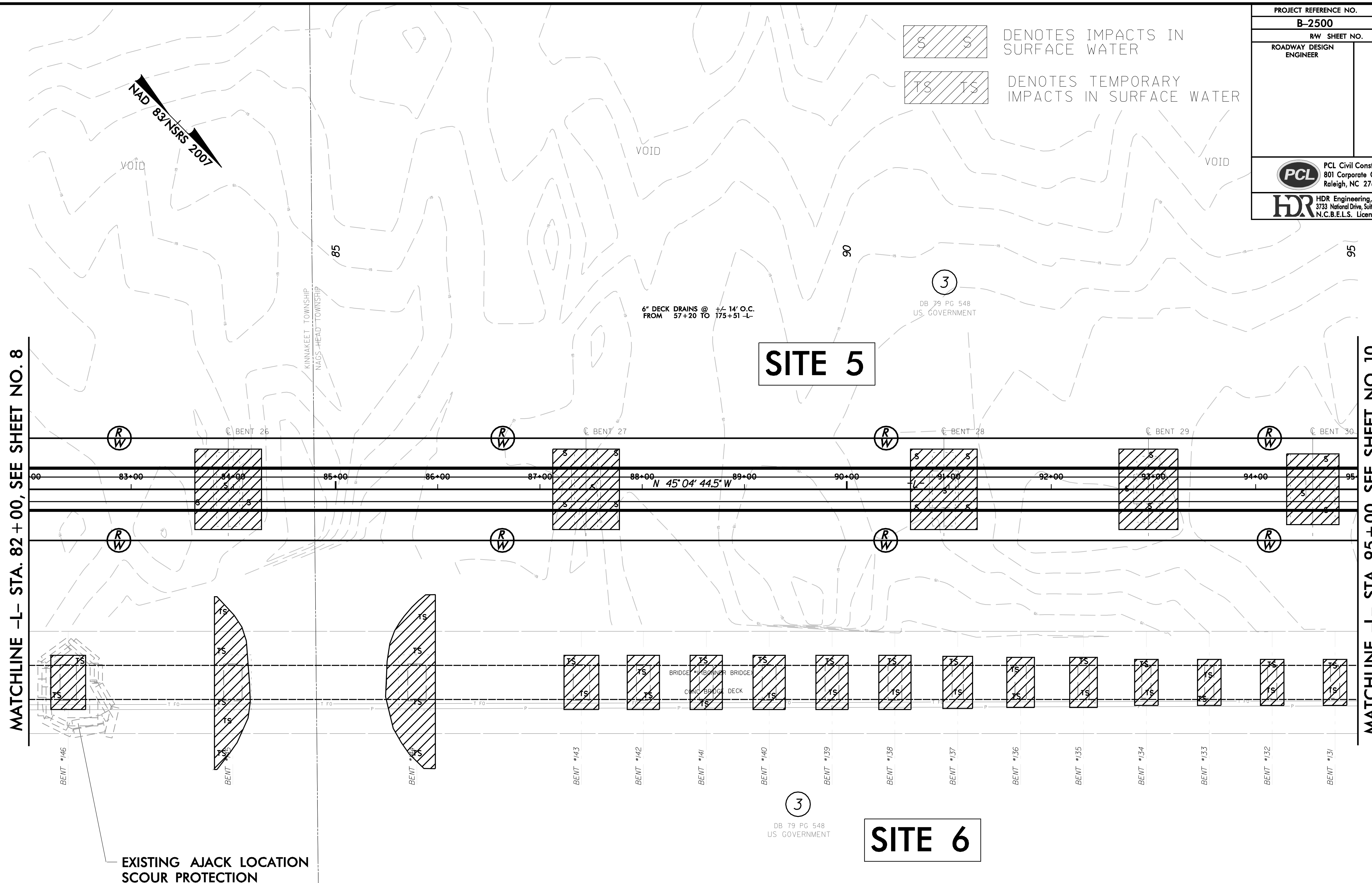
PROJECT REFERENCE NO.	SHEET NO.
B-2500	9

R/W SHEET NO.

ROADWAY DESIGN ENGINEER | HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 18 OF 45

SEE SHEET NO. 24 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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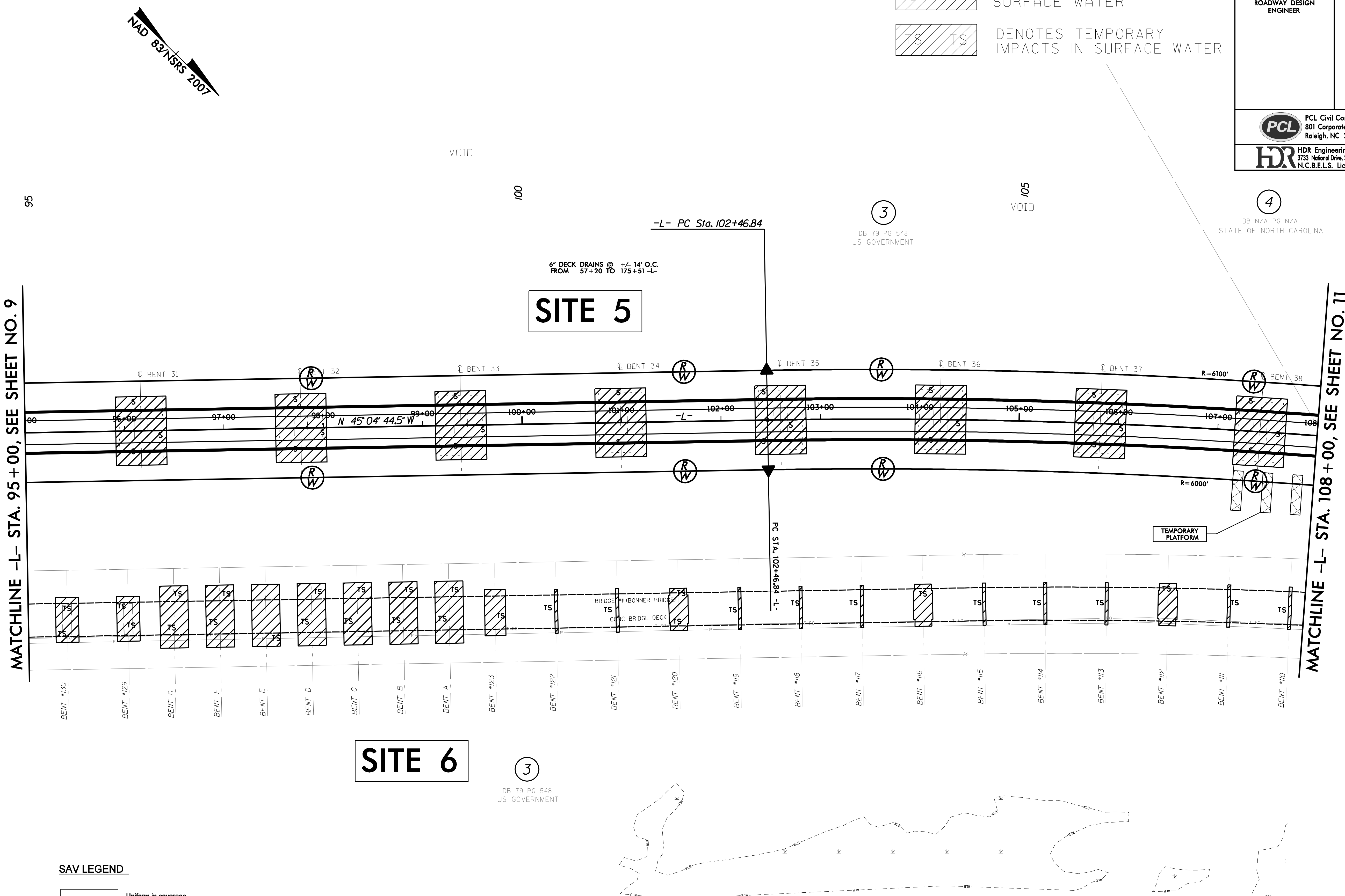
PROJECT REFERENCE NO.	SHEET NO.
B-2500	10
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

S S — DENOTES IMPACTS IN SURFACE WATER

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 19 OF 45

SEE SHEET NO. 25 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT.pdf.color_eng.100.plt PENTABLE: NCDOT.permits.tbl
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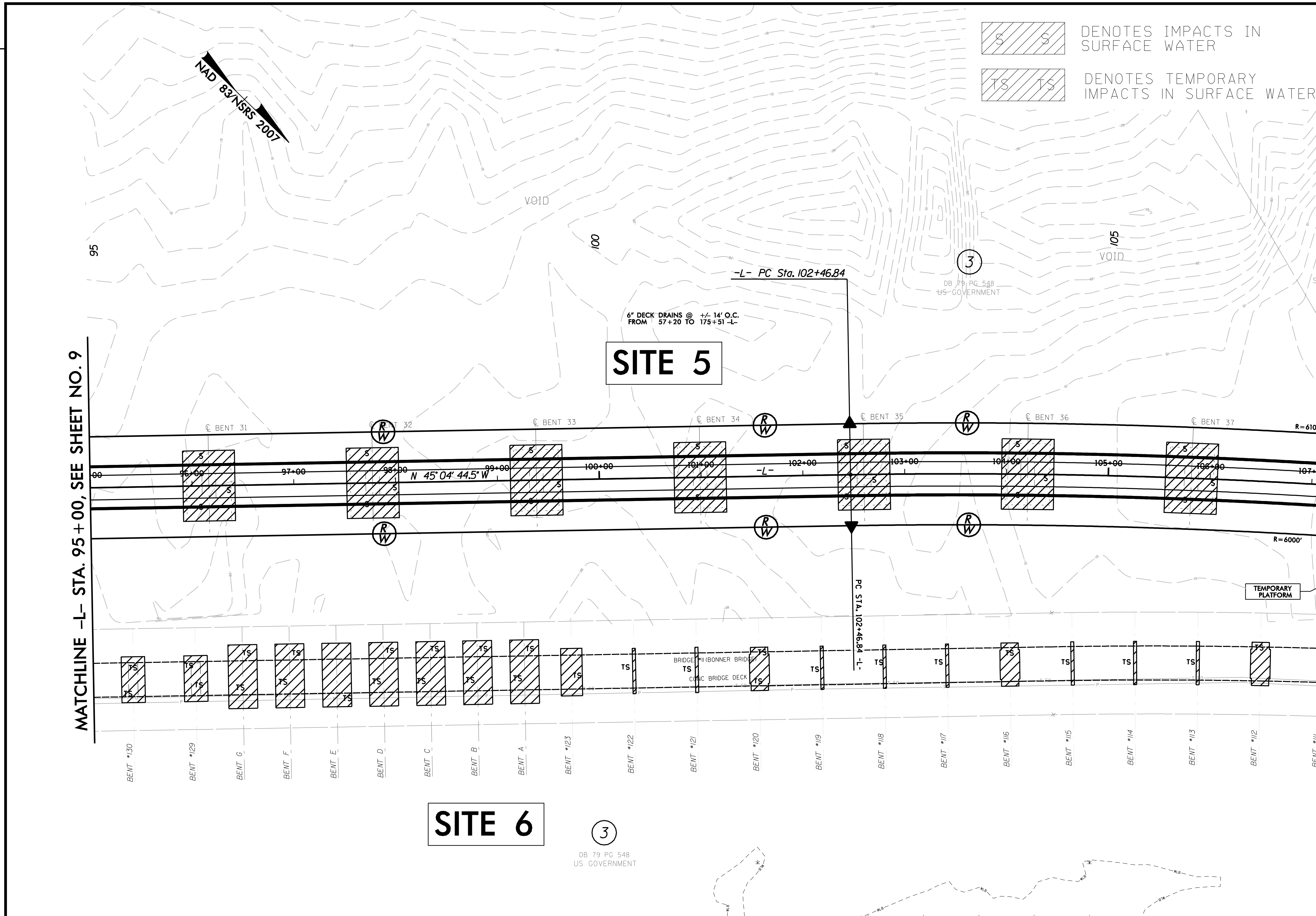

PROJECT REFERENCE NO.	SHEET NO.
B-2500	10
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 20 OF 45

SEE SHEET NO. 25 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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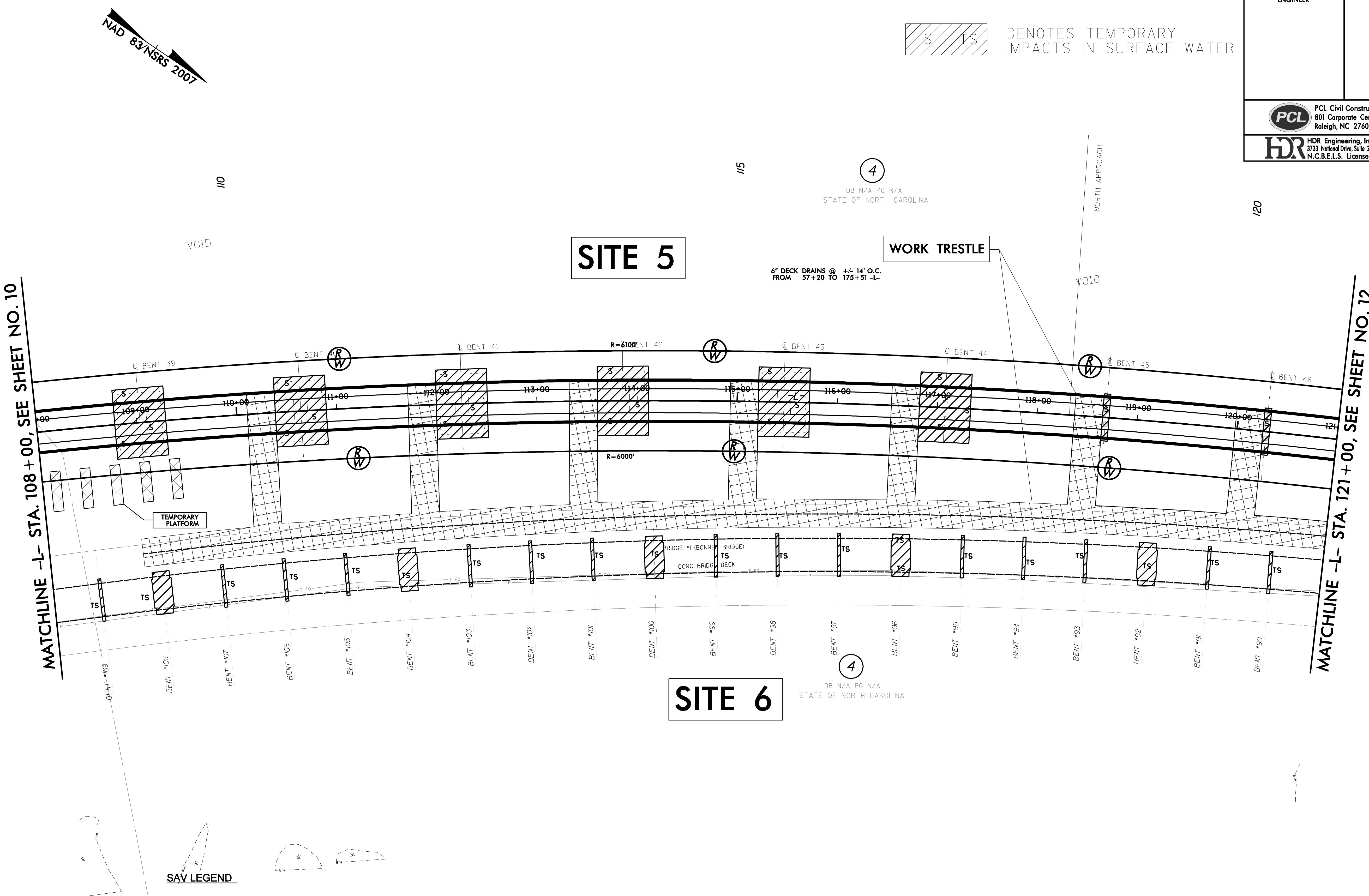
PROJECT REFERENCE NO.	SHEET NO.
B-2500	11
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 21 OF 45

SEE SHEET NO. 26 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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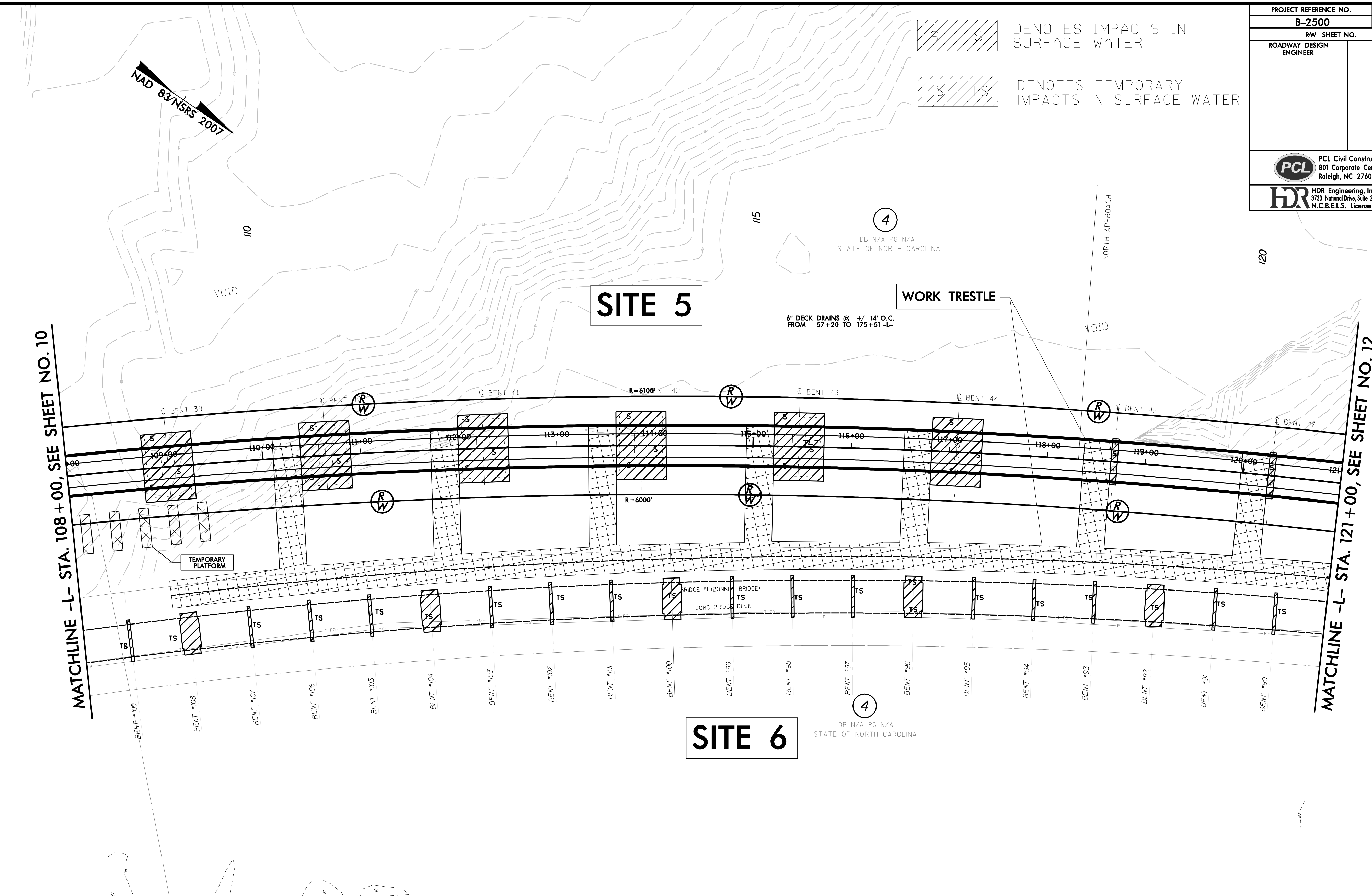
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_11.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	11
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 22 OF 45

SEE SHEET NO. 26 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_11.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	12
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

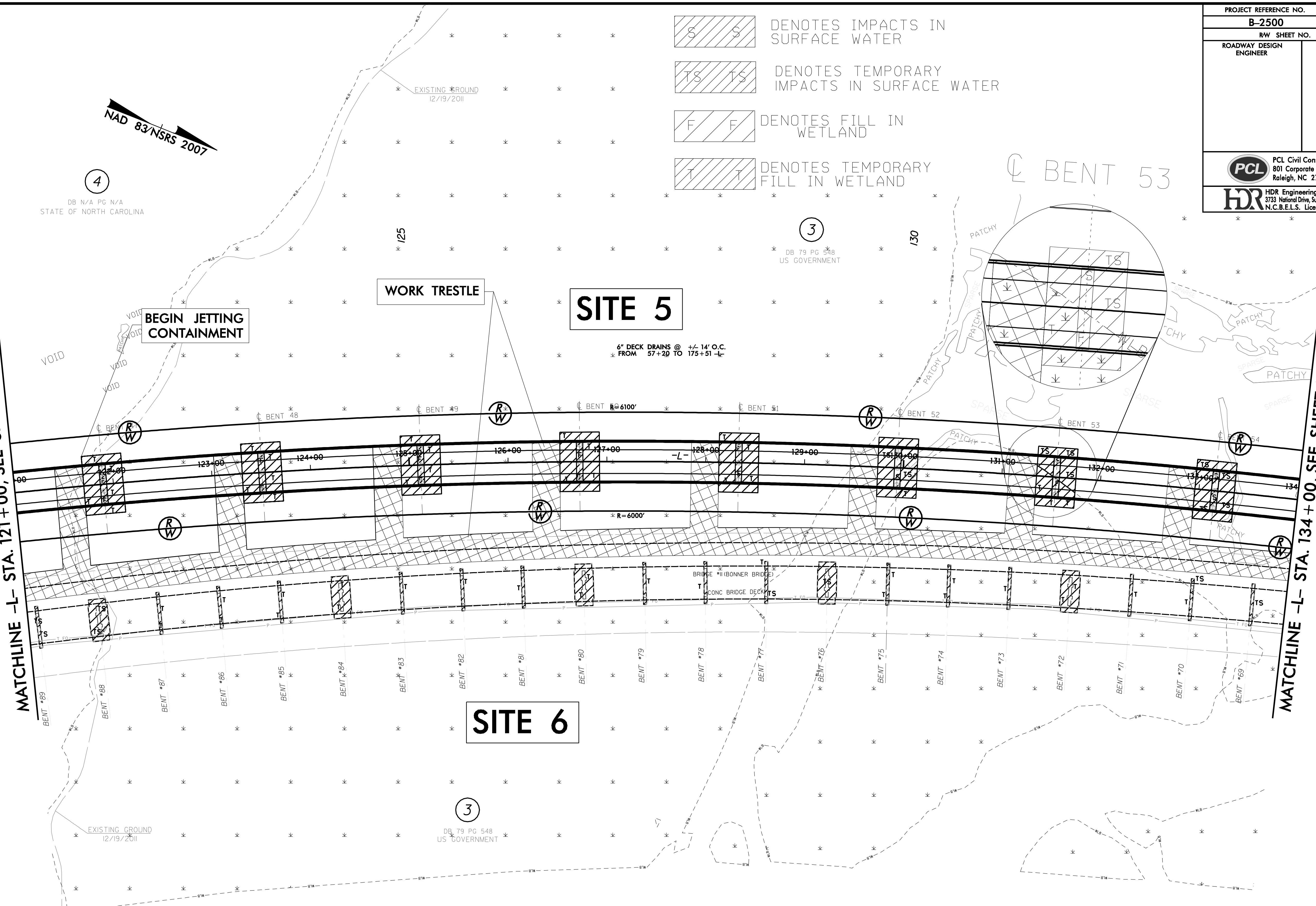
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

DENOTES IMPACTS IN SURFACE WATER

DENOTES TEMPORARY IMPACTS IN SURFACE WATER

DENOTES FILL IN WETLAND

DENOTES TEMPORARY FILL IN WETLAND



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS SHEET 23 OF 45

SEE SHEET NO. 26 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
USER: jmassroc DATE: 4/25/2012 TIME: 8:21:13 AM
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PROJECT REFERENCE NO.	SHEET NO.
B-2500	12
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

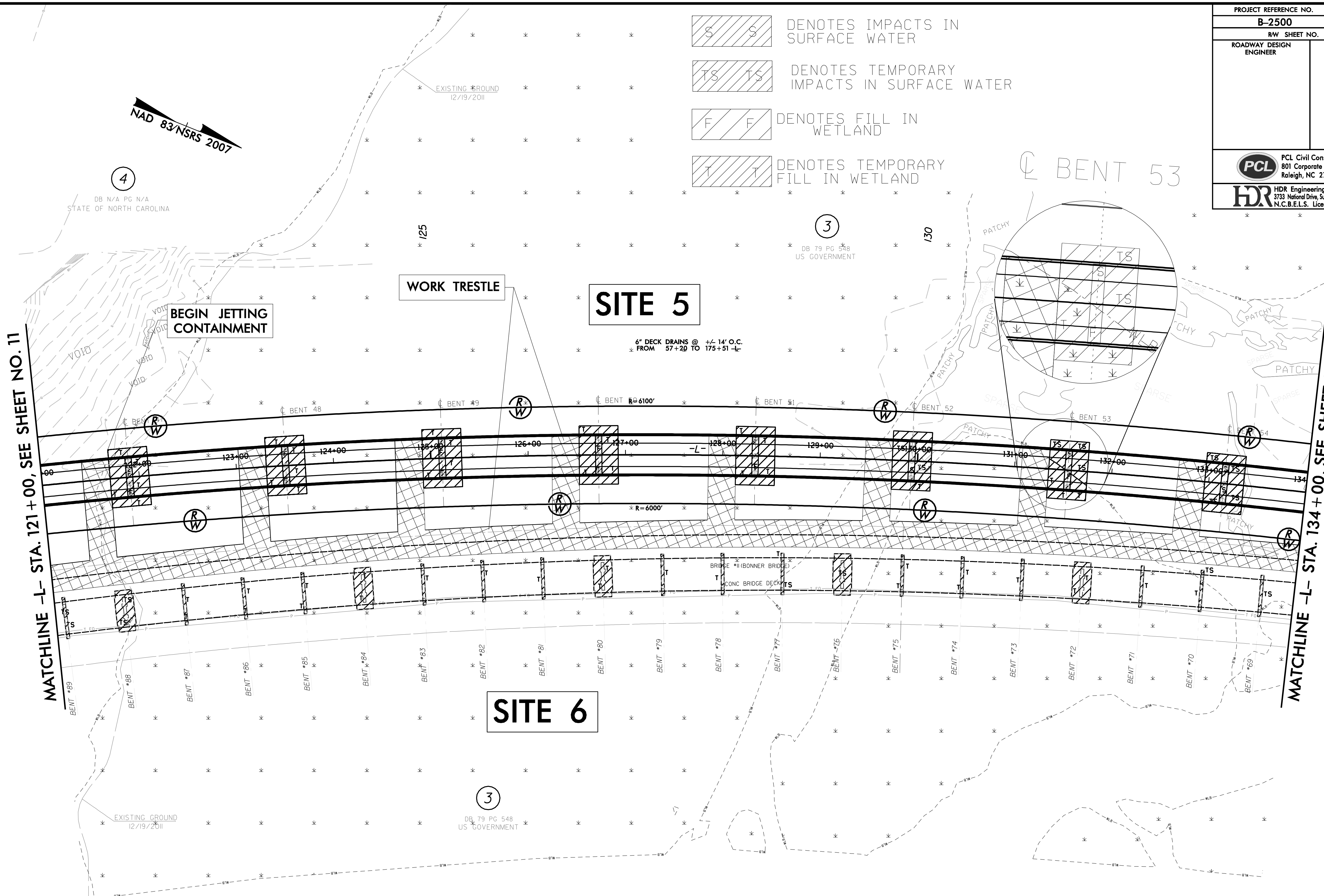
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

F F DENOTES FILL IN WETLAND

T T DENOTES TEMPORARY FILL IN WETLAND



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
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SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS SHEET 24 OF 45

SEE SHEET NO. 26 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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PROJECT REFERENCE NO.	SHEET NO.
B-2500	13
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

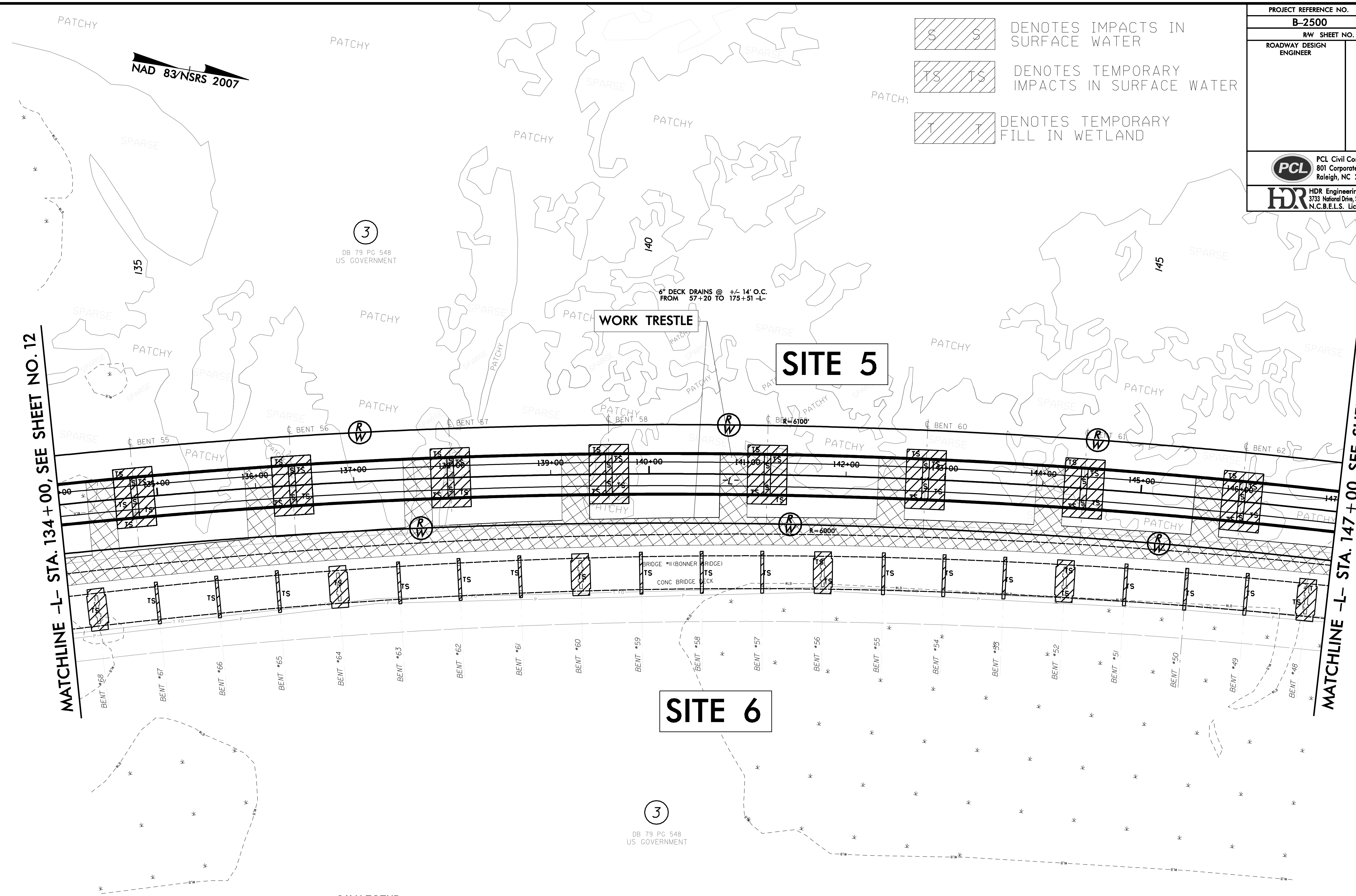
PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

DENOTES IMPACTS IN SURFACE WATER

DENOTES TEMPORARY IMPACTS IN SURFACE WATER

DENOTES TEMPORARY FILL IN WETLAND



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS SHEET 25 OF 45

SEE SHEET NO. 27 FOR -L- PROFILE.

REVISIONS

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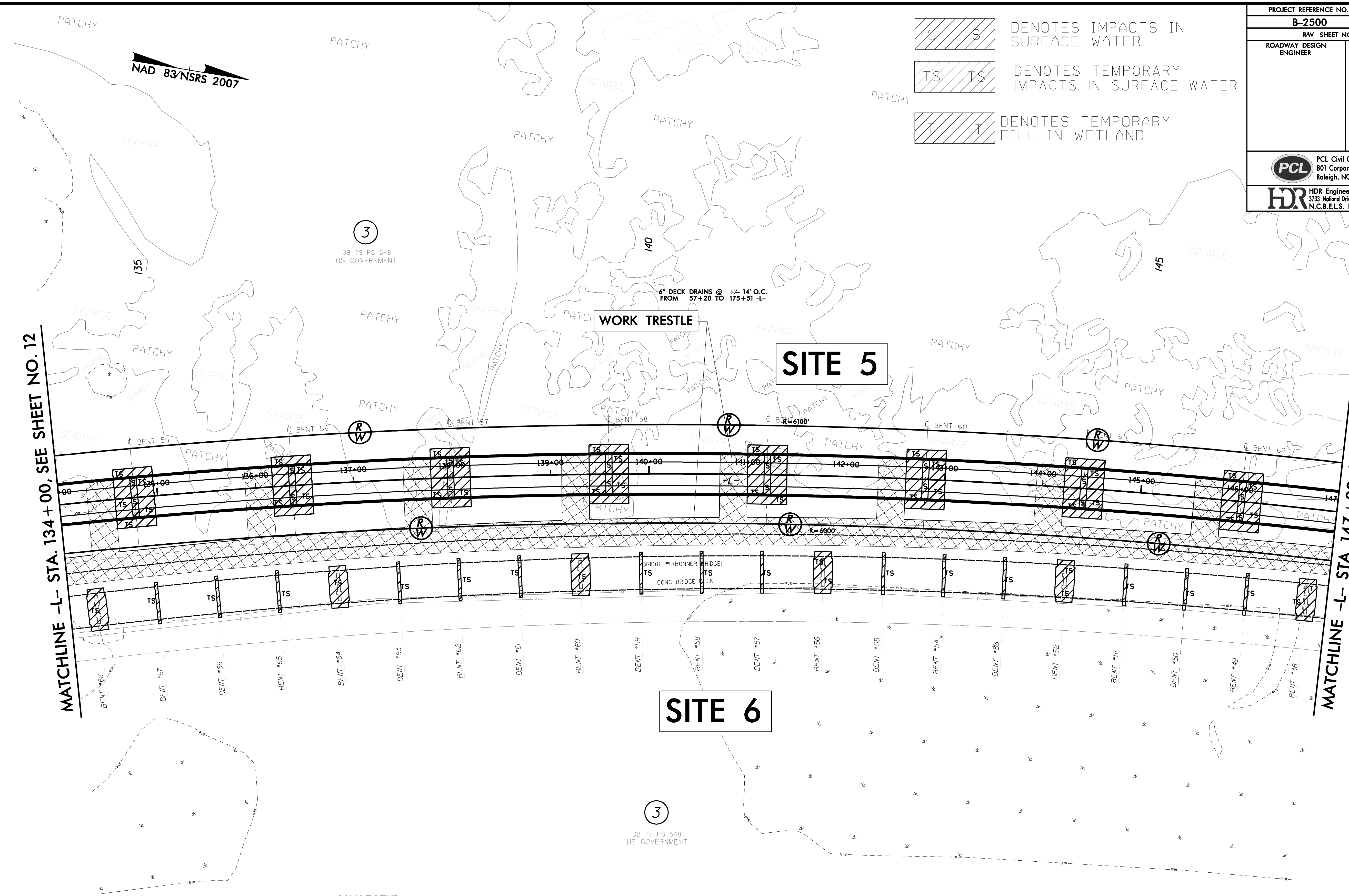
PROJECT REFERENCE NO.	SHEET NO.
B-2500	13
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 26 OF 45

SEE SHEET NO. 27 FOR -L- PROFILE.

REVISIONS

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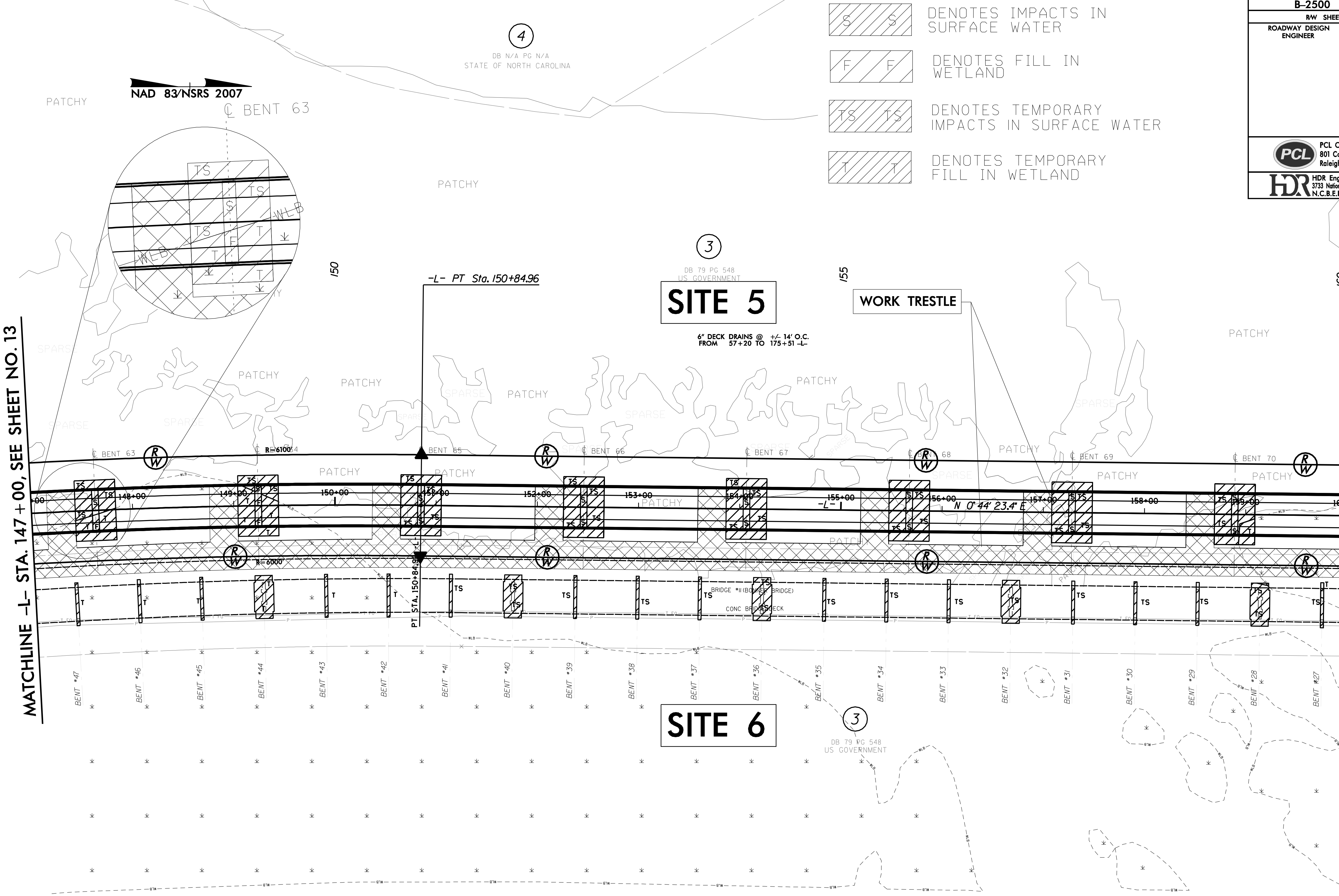
PROJECT REFERENCE NO.	SHEET NO.
B-2500	14
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 27 OF 45

SEE SHEET NO. 27 FOR -L- PROFILE.

REVISIONS

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PROJECT REFERENCE NO.	SHEET NO.
B-2500	14
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

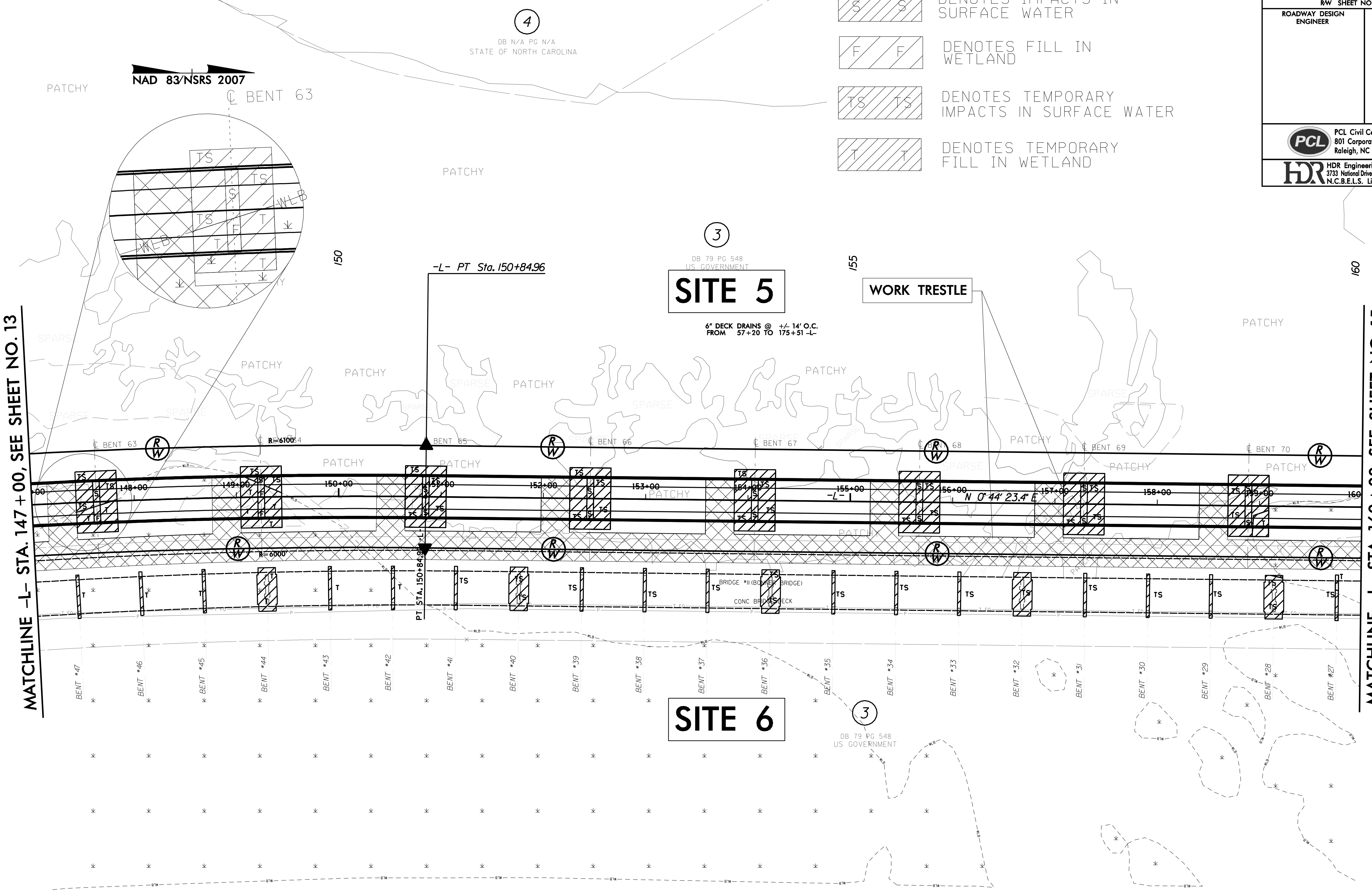
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

DENOTES IMPACTS IN SURFACE WATER

DENOTES FILL IN WETLAND

DENOTES TEMPORARY IMPACTS IN SURFACE WATER

DENOTES TEMPORARY FILL IN WETLAND



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS SHEET 28 OF 45

SEE SHEET NO. 27 FOR -L- PROFILE.

REVISIONS

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PROJECT REFERENCE NO.	SHEET NO.
B-2500	15
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

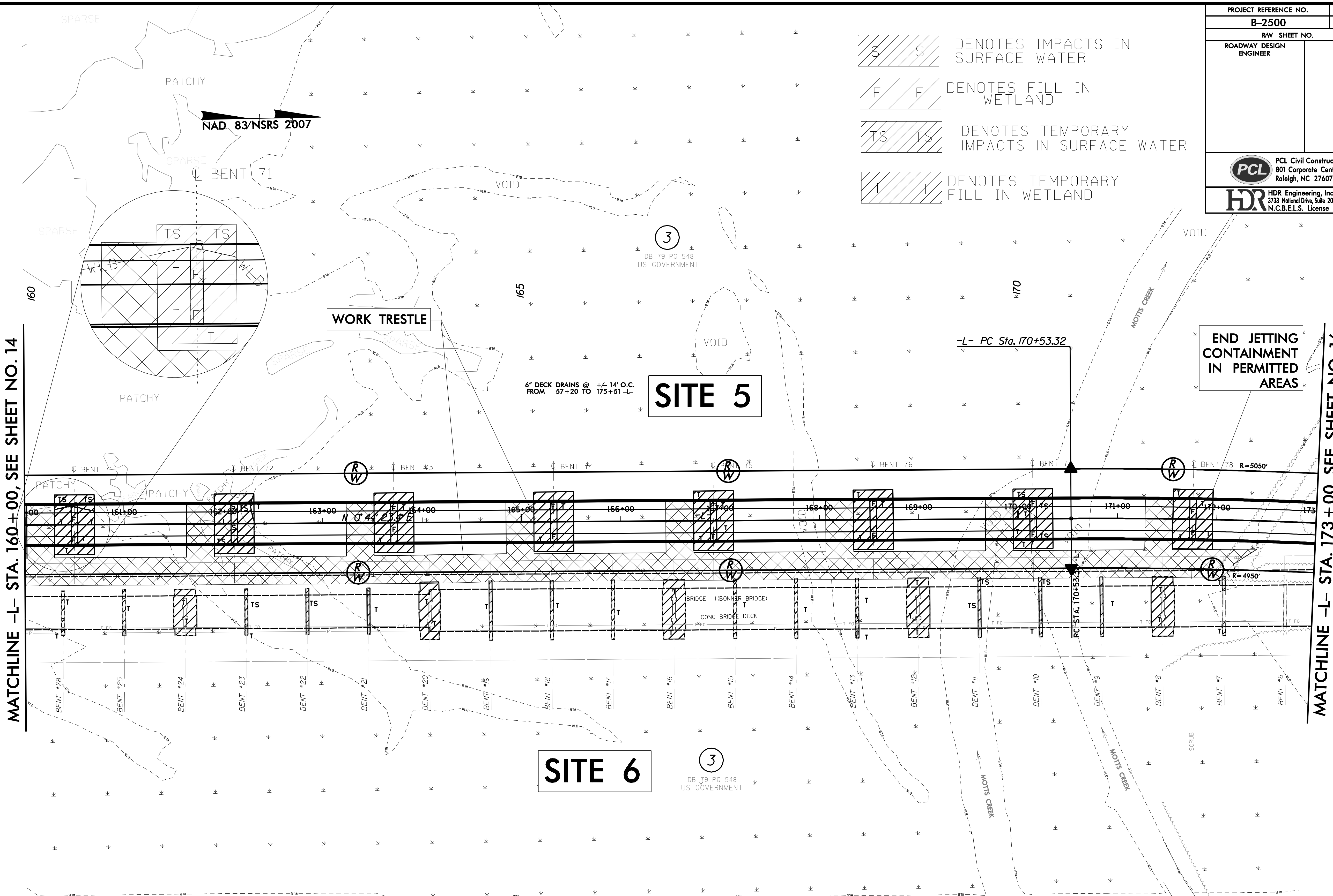
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

S S DENOTES IMPACTS IN SURFACE WATER

F F DENOTES FILL IN WETLAND

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

T T DENOTES TEMPORARY FILL IN WETLAND



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS SHEET 29 OF 45

SEE SHEET NO. 28 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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PROJECT REFERENCE NO.	SHEET NO.
B-2500	15
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

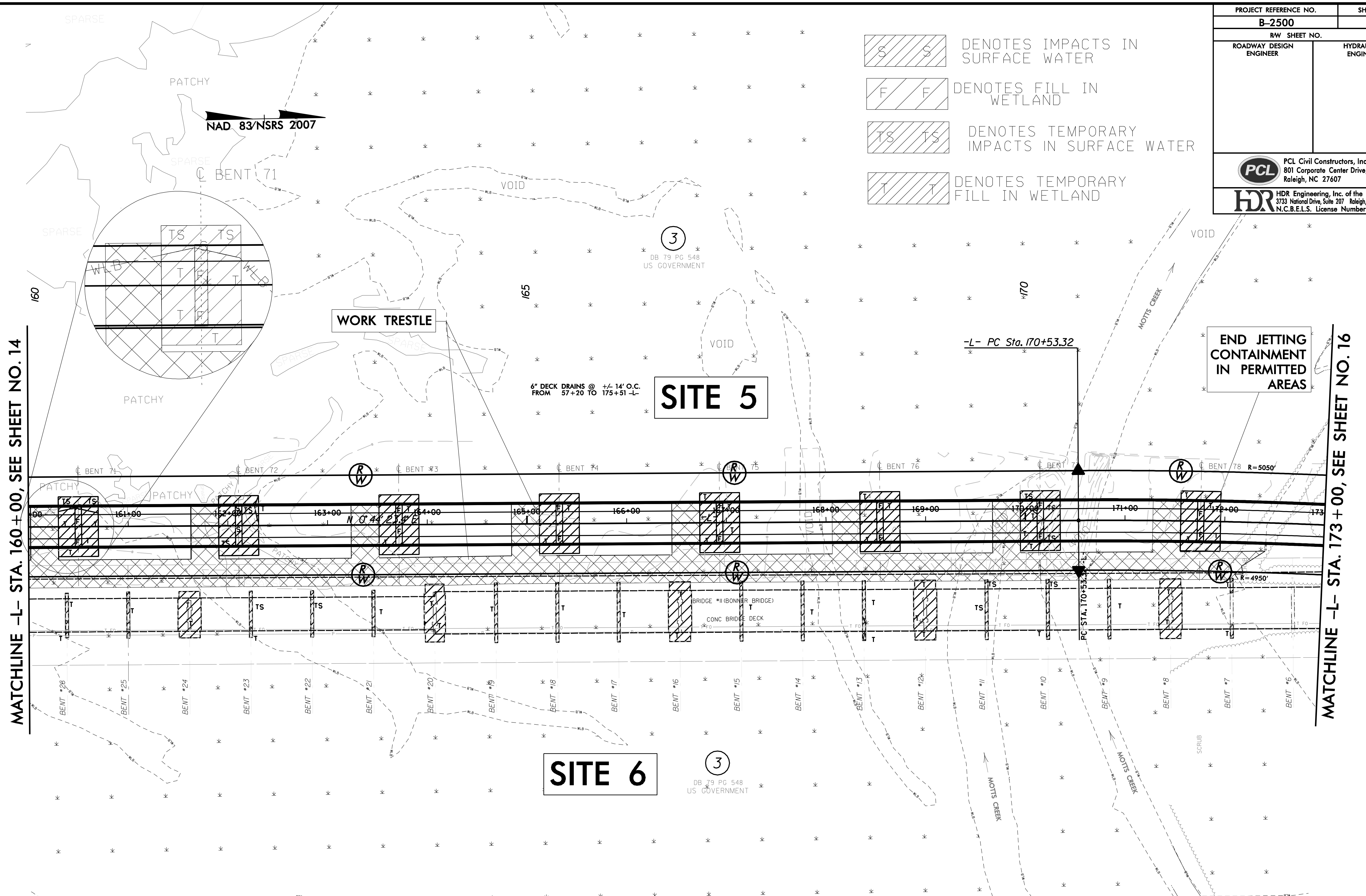
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

S S DENOTES IMPACTS IN SURFACE WATER

F F DENOTES FILL IN WETLAND

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

T T DENOTES TEMPORARY FILL IN WETLAND



SEE SHEET NO. 28 FOR -L- PROFILE.

SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 30 OF 45

REVISIONS

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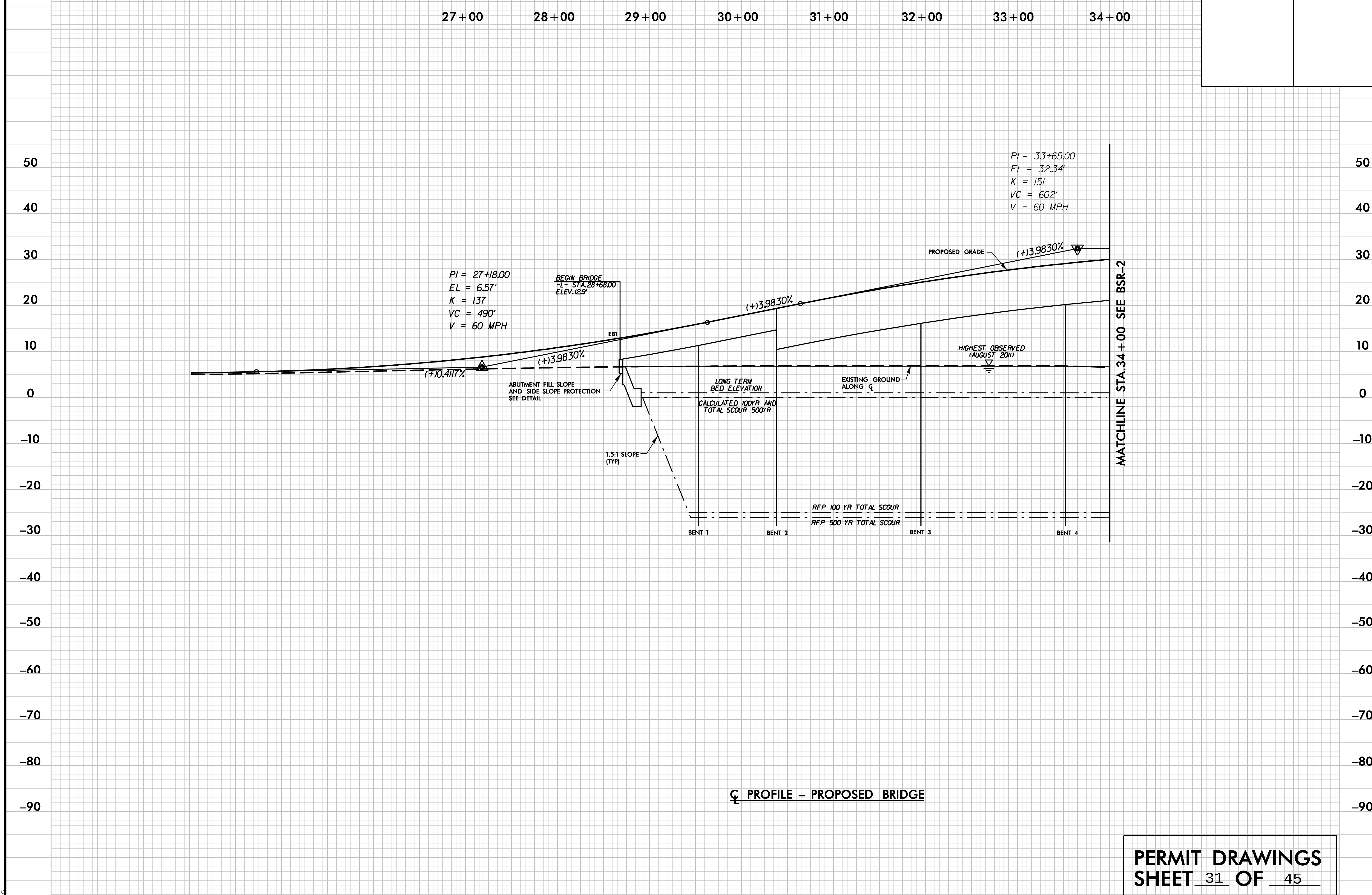
PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-1

ROADWAY DESIGN ENGINEER

HYDRAULICS ENGINEER



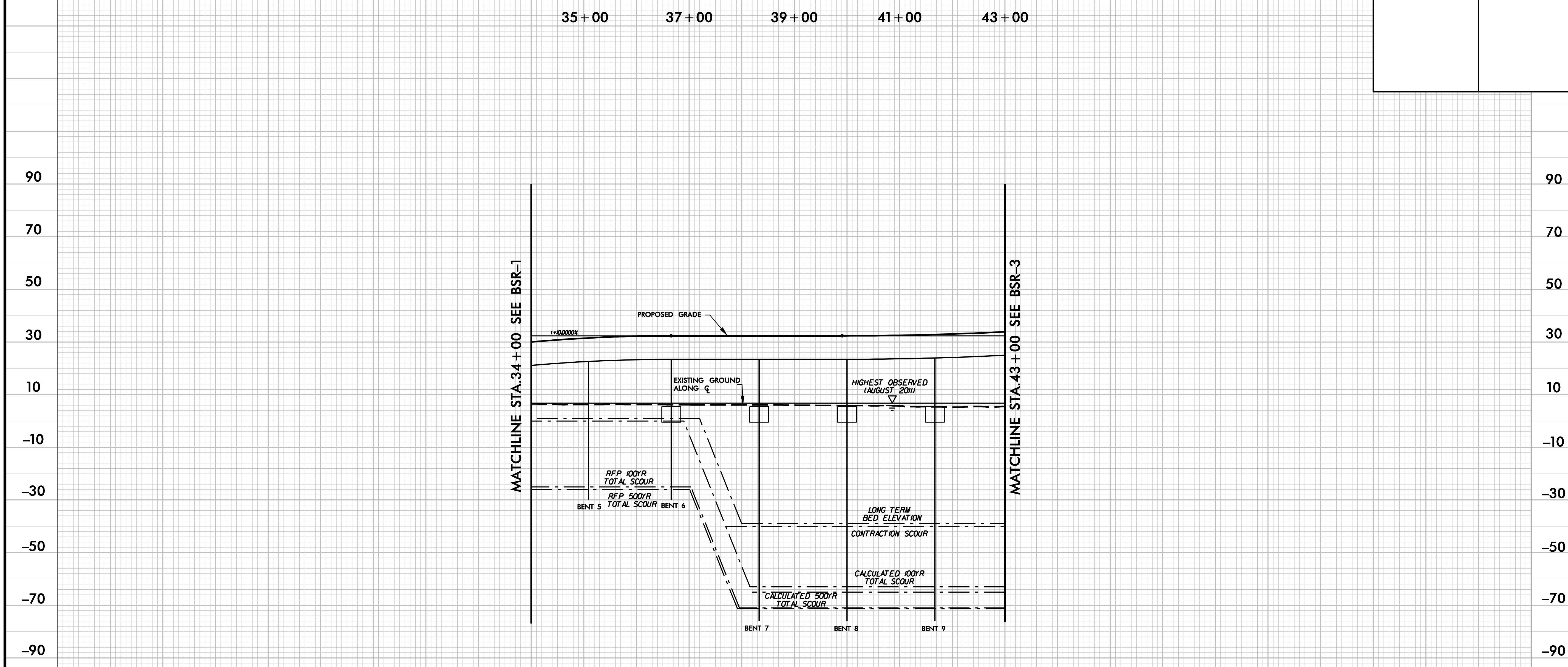
℄ PROFILE - PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 31 OF 45

5/14/99

4/24/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_PFL.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-2
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



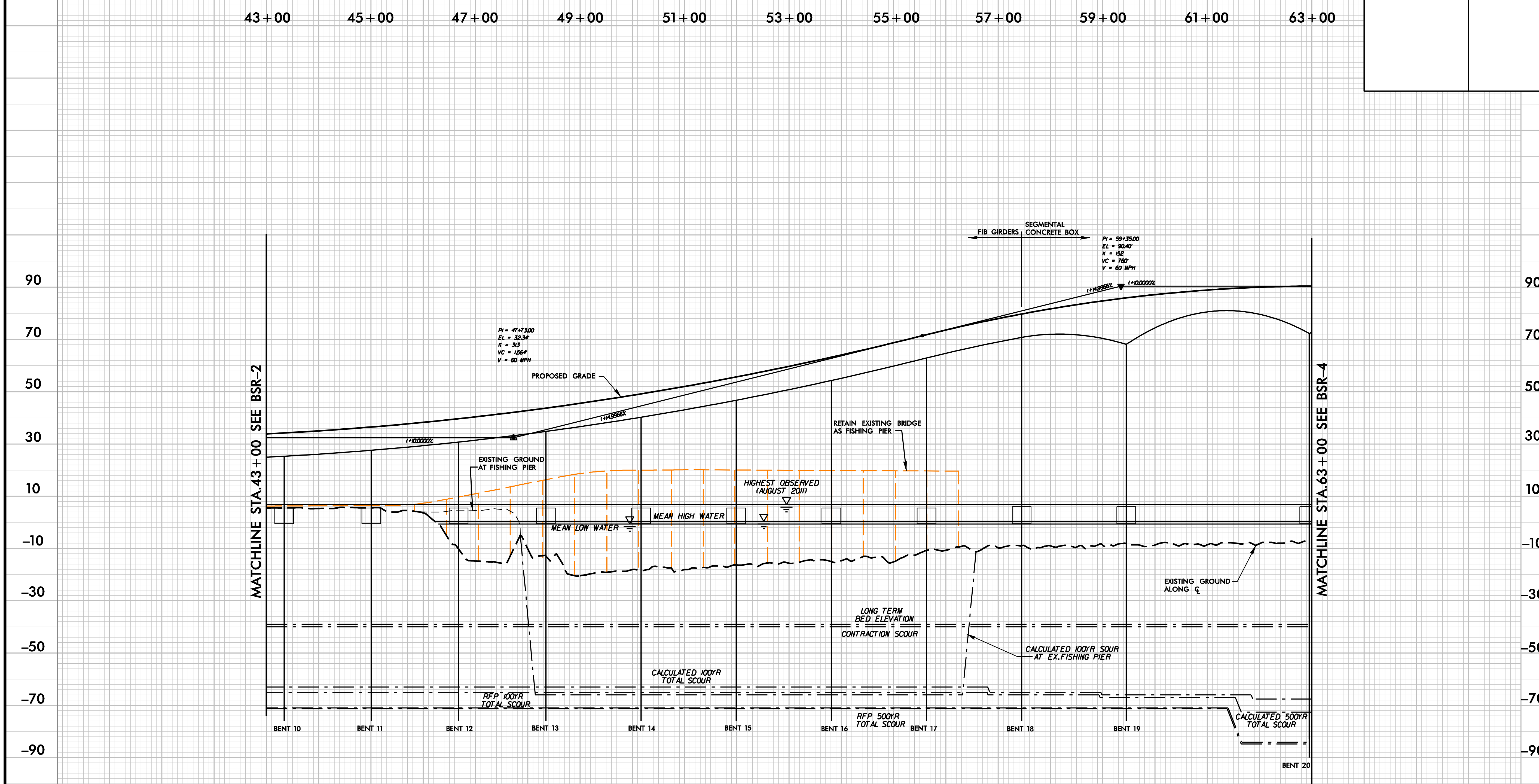
℄ PROFILE – PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 32 OF 45

5/14/99

4/24/2012
c:\pwworking\tpo\d0274011\B2500_HYD_PRM_PFL.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-3
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



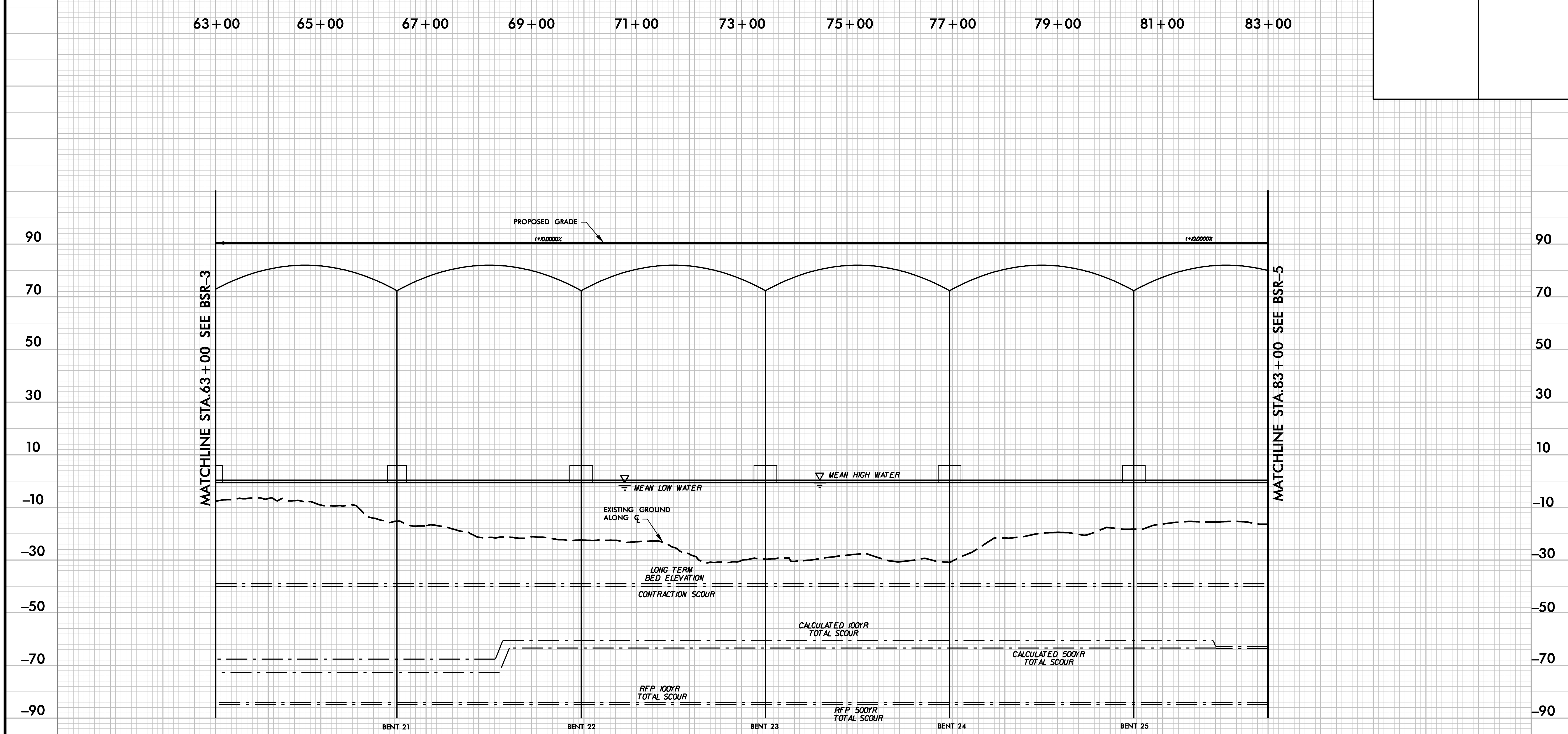
℄ PROFILE - PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 33 OF 45

5/14/99

4/24/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_PFL.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



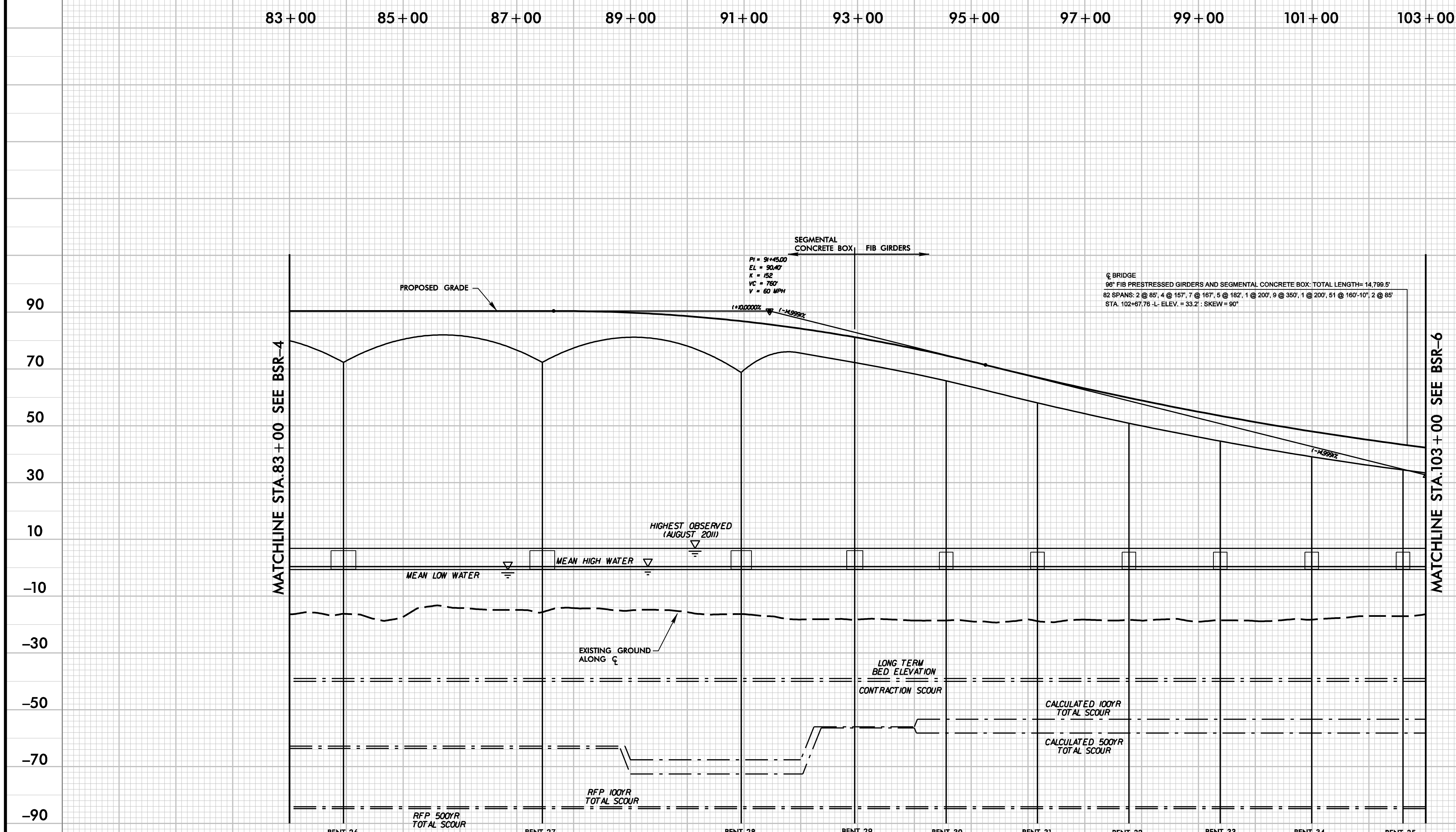
℄ PROFILE – PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 34 OF 45

4/24/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_PFL.dgn

5/14/99

PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-5
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



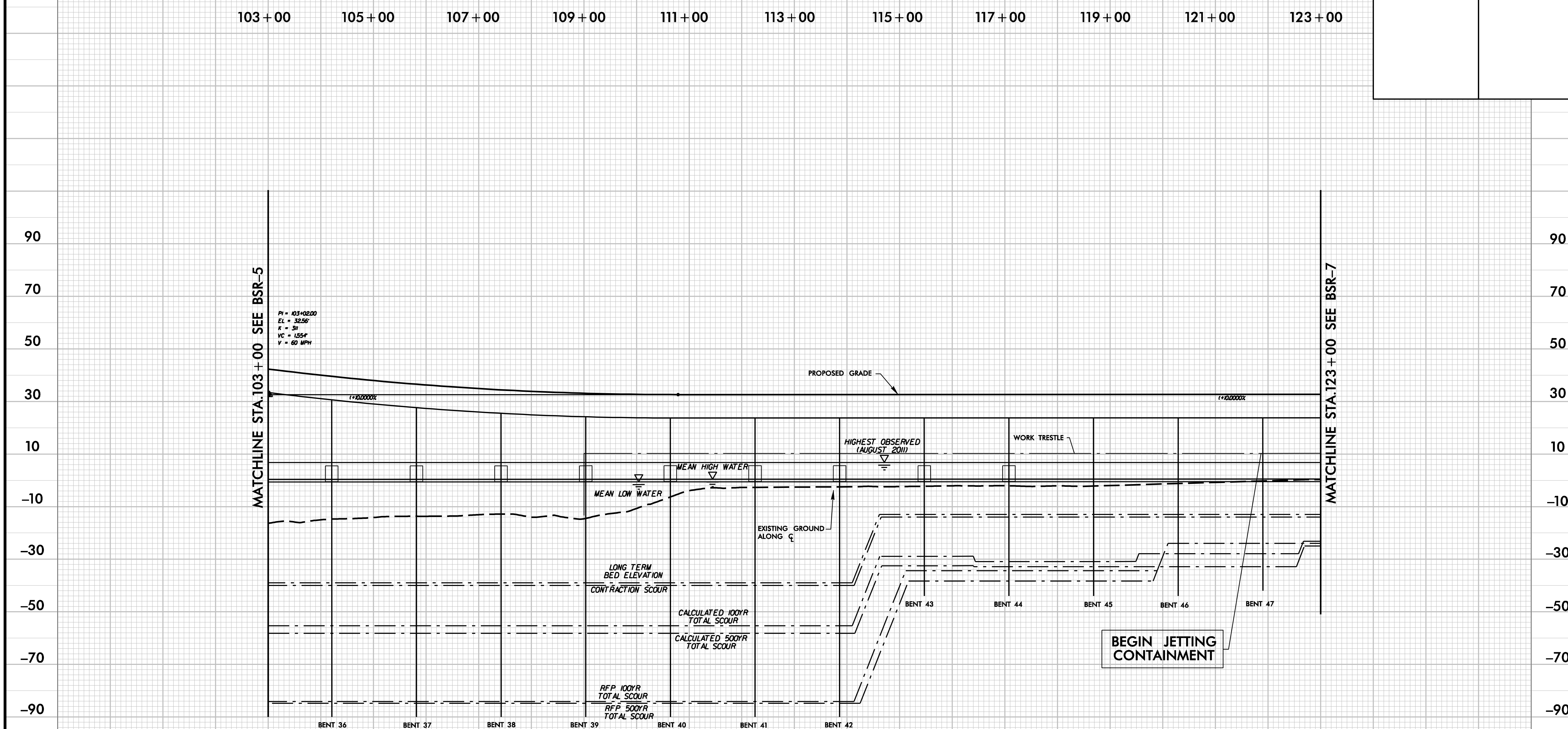
℄ PROFILE – PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 35 OF 45

5/14/99

4/24/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_PFL.dgn

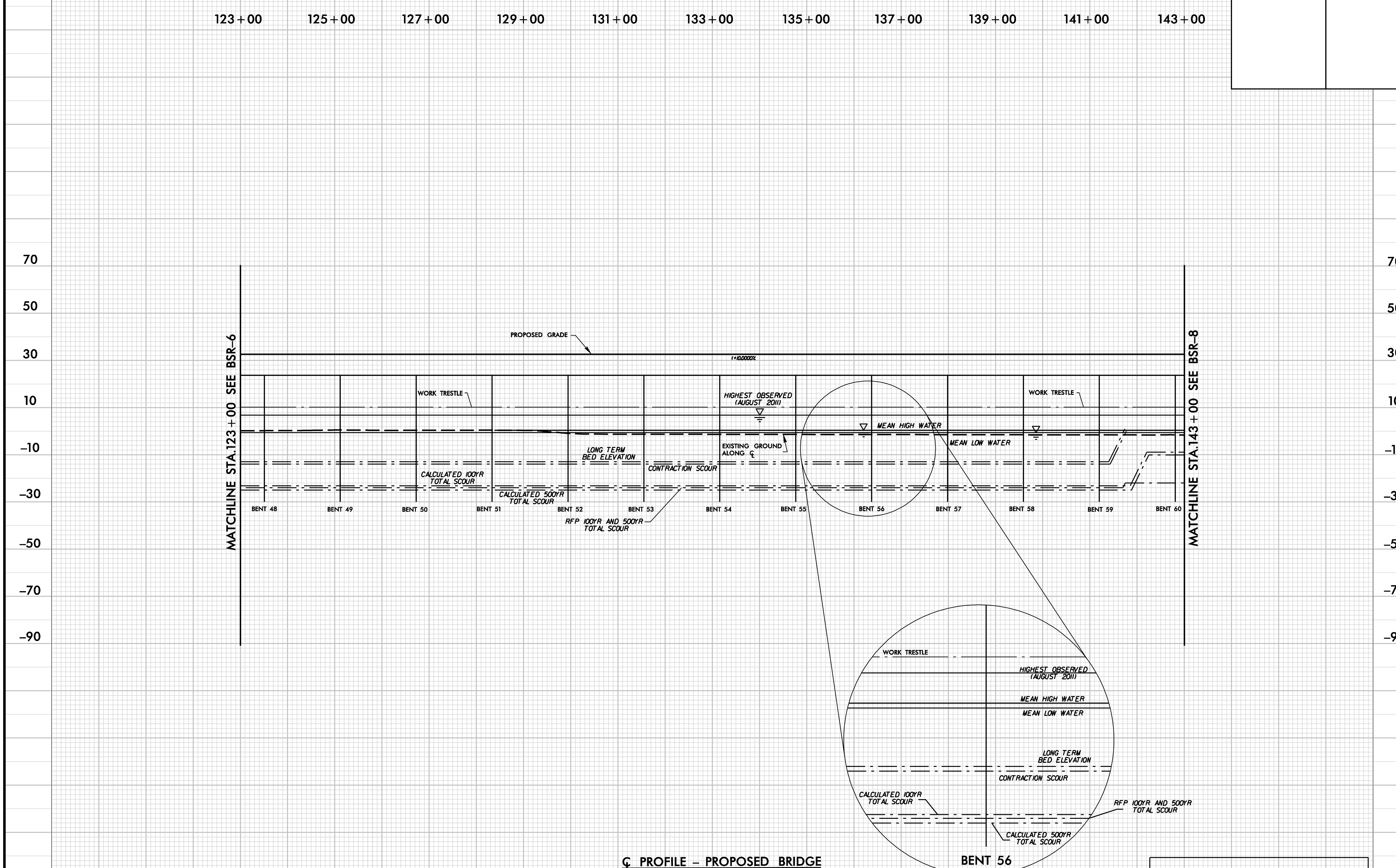
PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-6
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



℄ PROFILE – PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 36 OF 45

PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-7
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

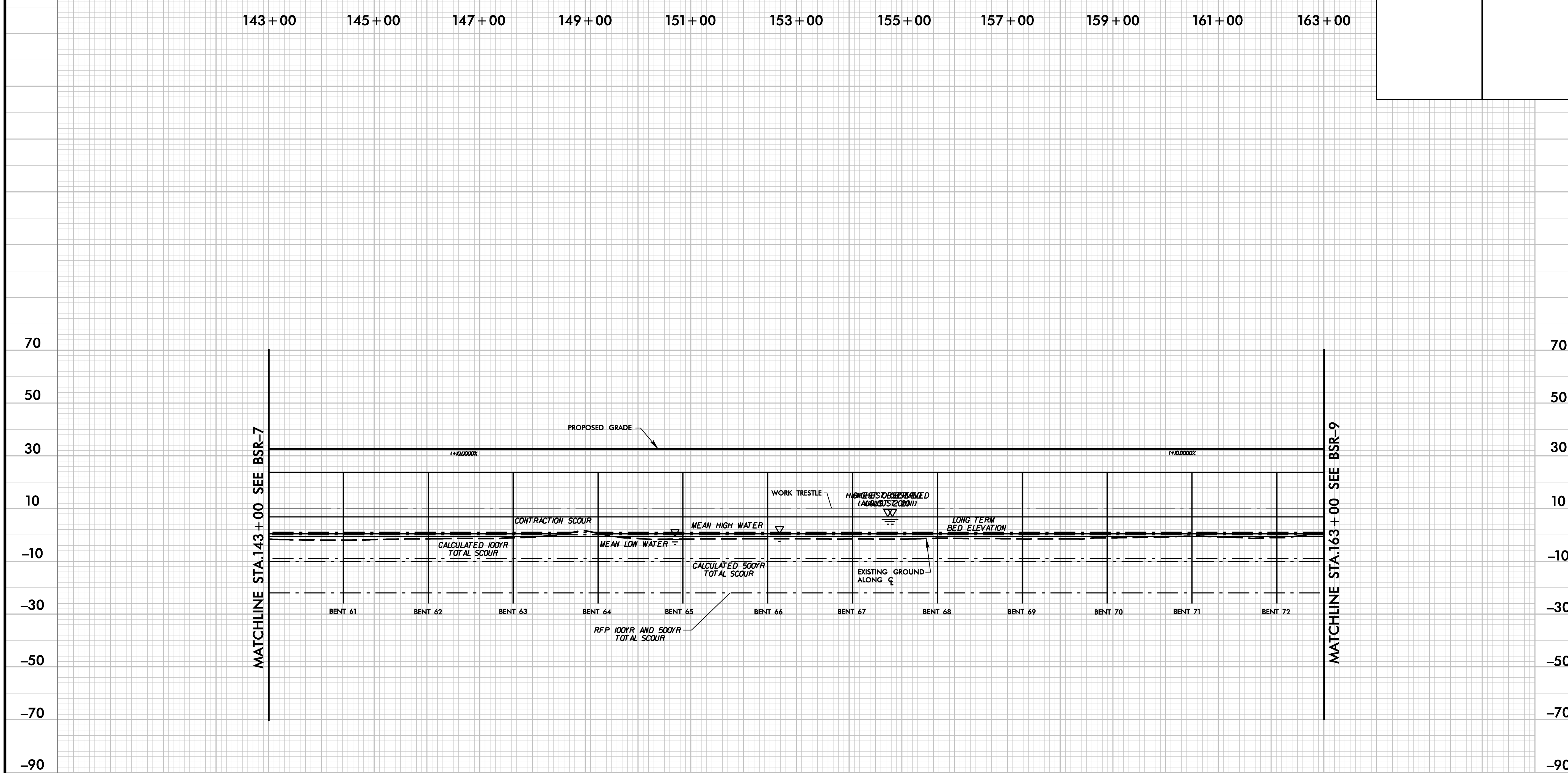


℄ PROFILE – PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 37 OF 45

5/14/99
4/24/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_PFL.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-8
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



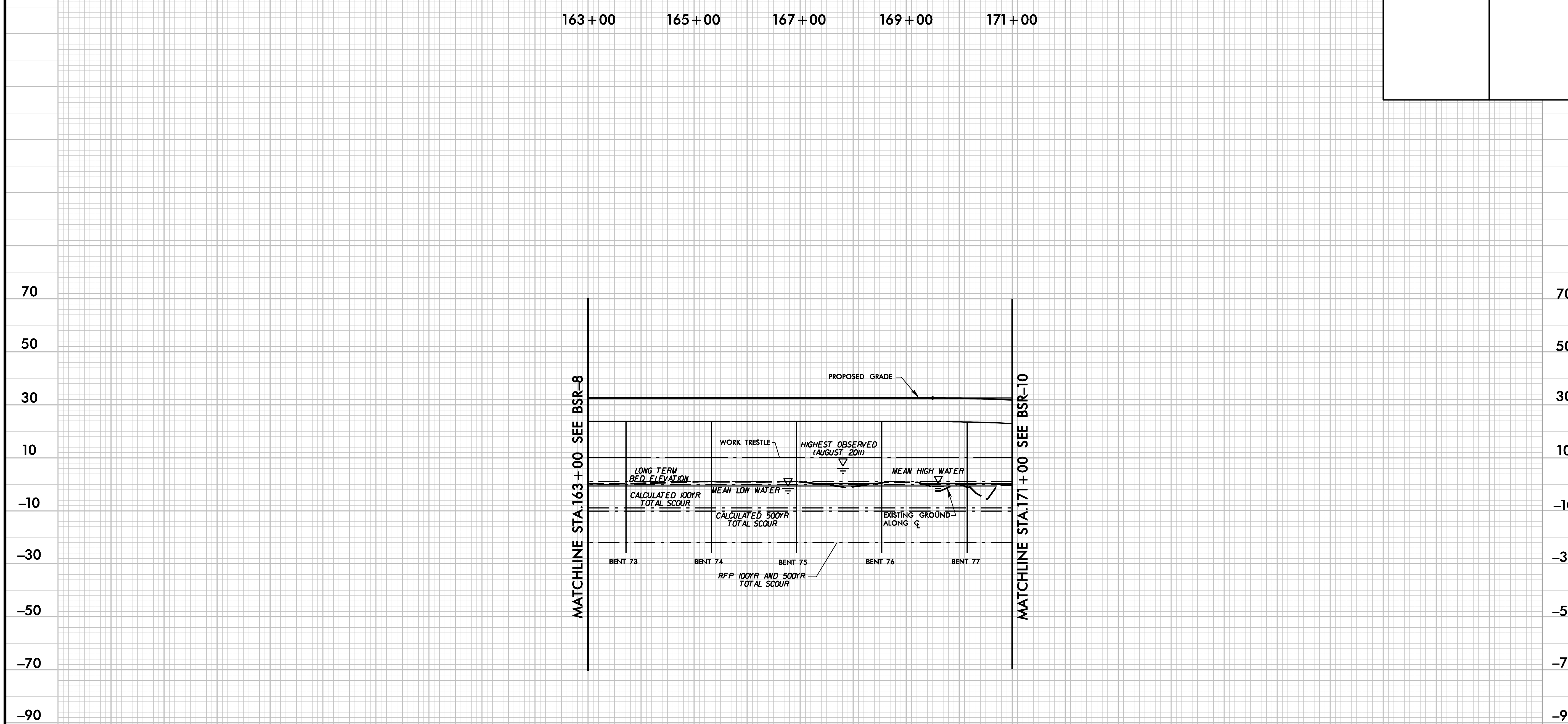
℄ PROFILE – PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 38 OF 45

5/14/99

4/24/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_PFL.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-9
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



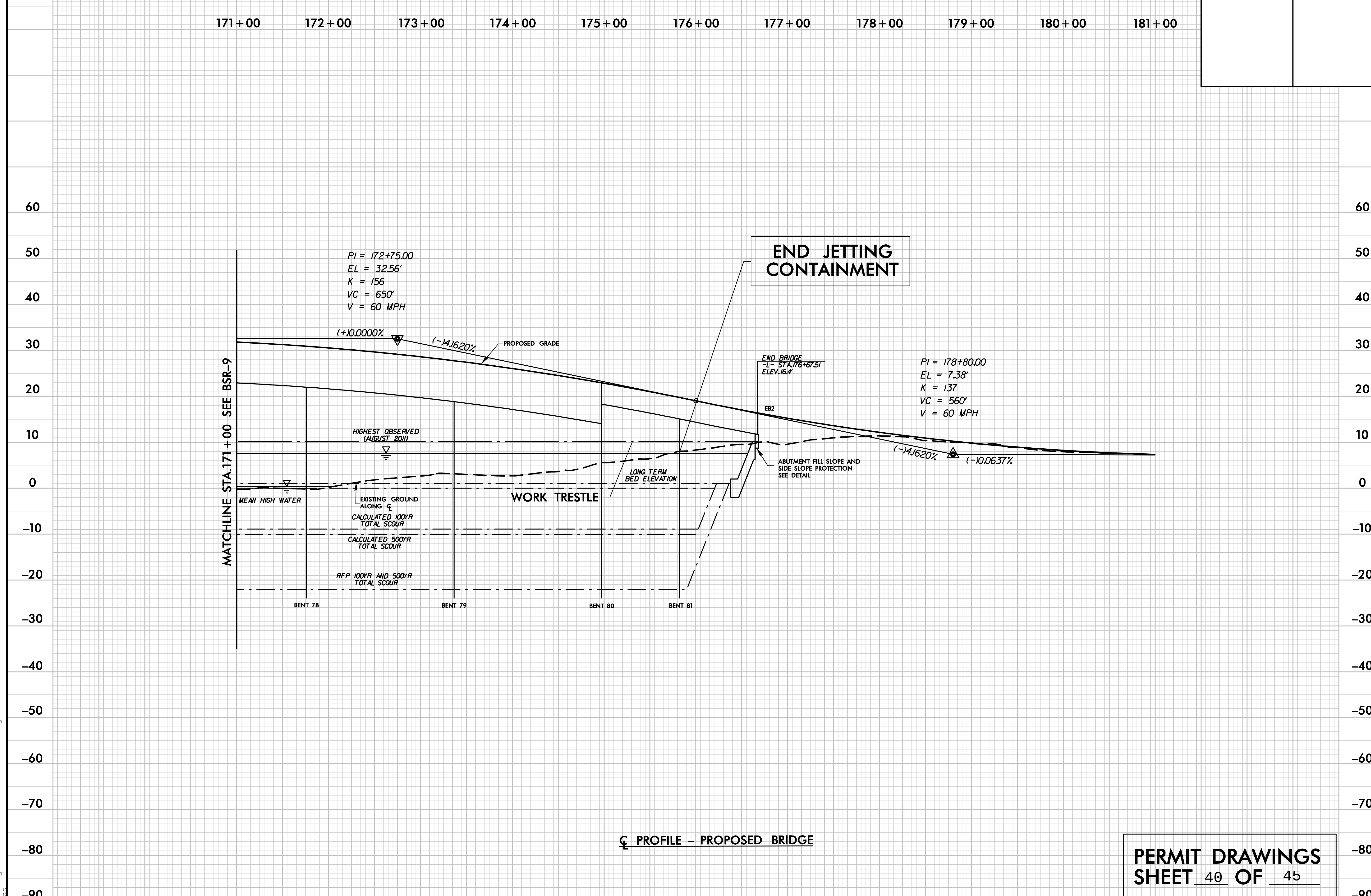
℄ PROFILE – PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 39 OF 45

5/14/99

4/24/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_PFL.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	PFL-10
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



℄ PROFILE – PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 40 OF 45

5/14/99
4/24/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_PFL.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	17
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

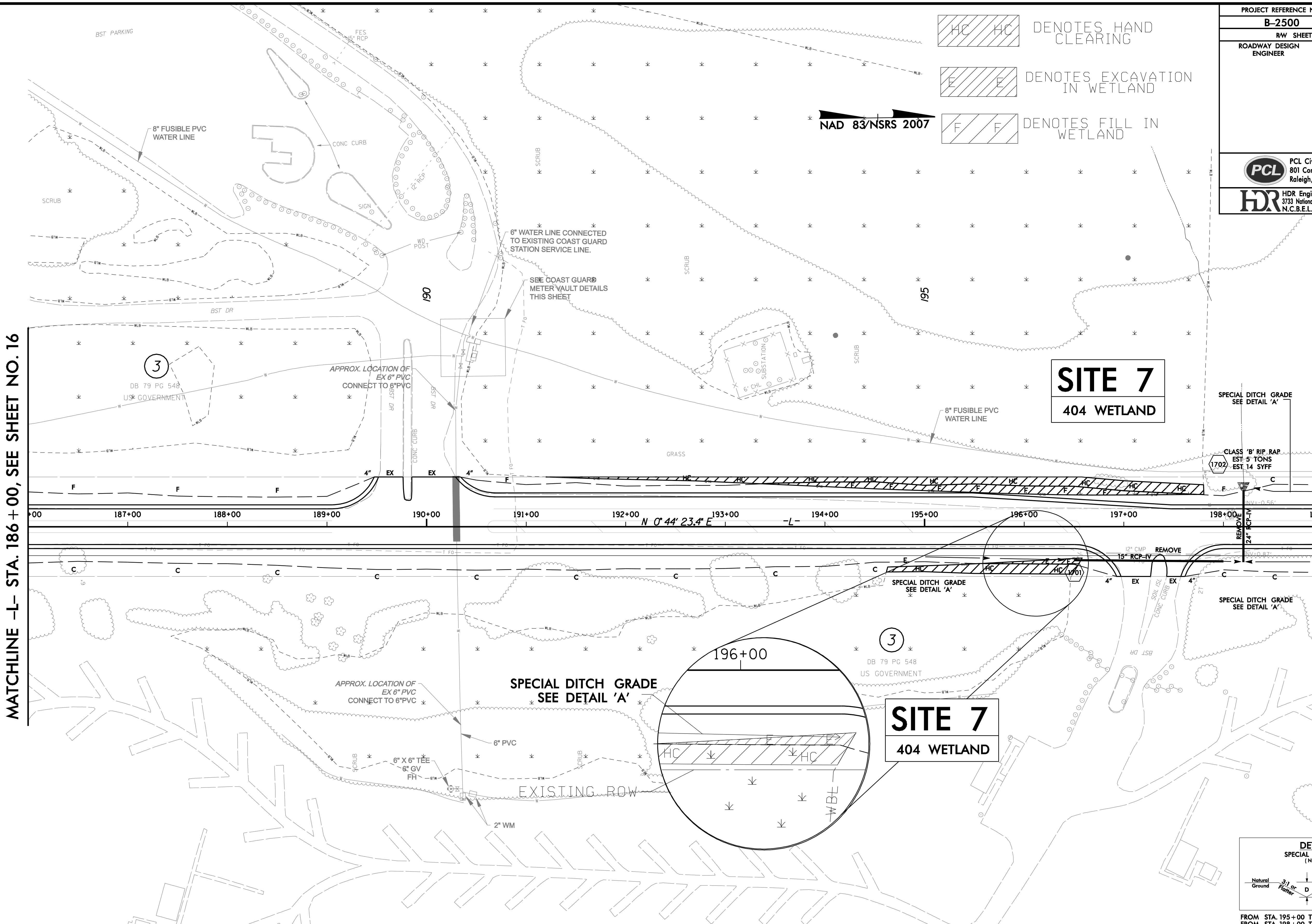
PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

HC HC DENOTES HAND CLEARING

E E DENOTES EXCAVATION IN WETLAND

F F DENOTES FILL IN WETLAND



DETAIL A
SPECIAL DITCH GRADE
(Not to Scale)

Natural Ground — 3:1 or Flatter — D — 4:1 or Flatter — Front Ditch Slope

Min. D= 1 Ft.

FROM STA. 195+00 TO STA. 196+50 -L- RT
FROM STA. 198+00 TO STA. 198+20 -L- RT
FROM STA. 198+20 TO STA. 206+97 -L- RT
FROM STA. 198+20 TO STA. 206+97 -L- LT

SEE SHEET NO. 29 FOR -L- PROFILE.

PERMIT DRAWINGS
SHEET 41 OF 45

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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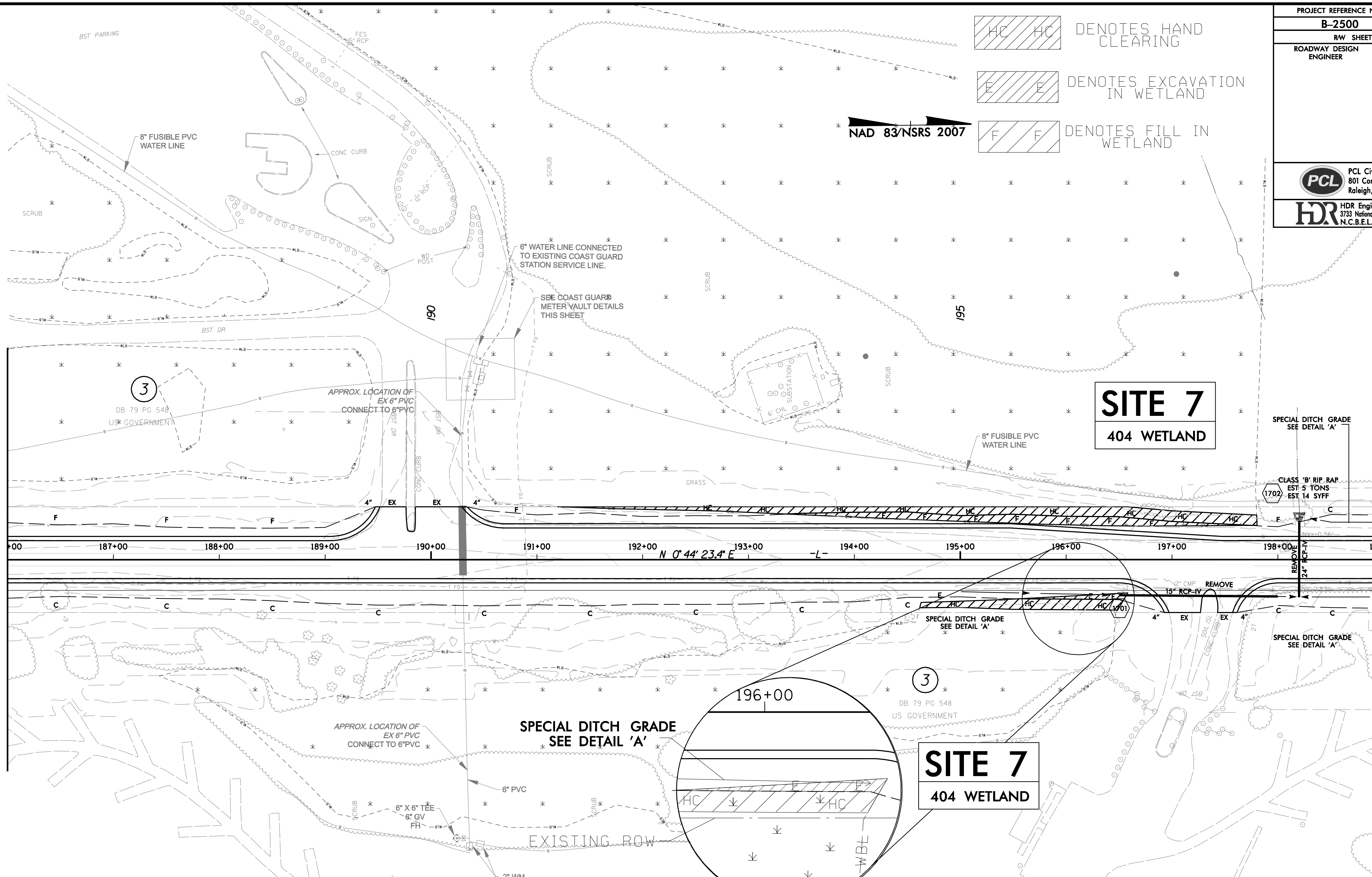
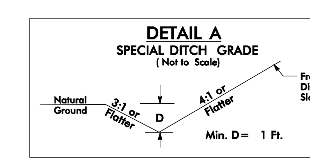
PROJECT REFERENCE NO.	SHEET NO.
B-2500	17
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116





FROM STA. 195+00 TO STA. 196+50 -L- RT
FROM STA. 198+00 TO STA. 198+20 -L- RT
FROM STA. 198+20 TO STA. 206+97 -L- RT
FROM STA. 198+20 TO STA. 206+97 -L- LT

SEE SHEET NO. 29 FOR -L- PROFILE.

PERMIT DRAWINGS
SHEET 42 OF 45

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_permits.tbl
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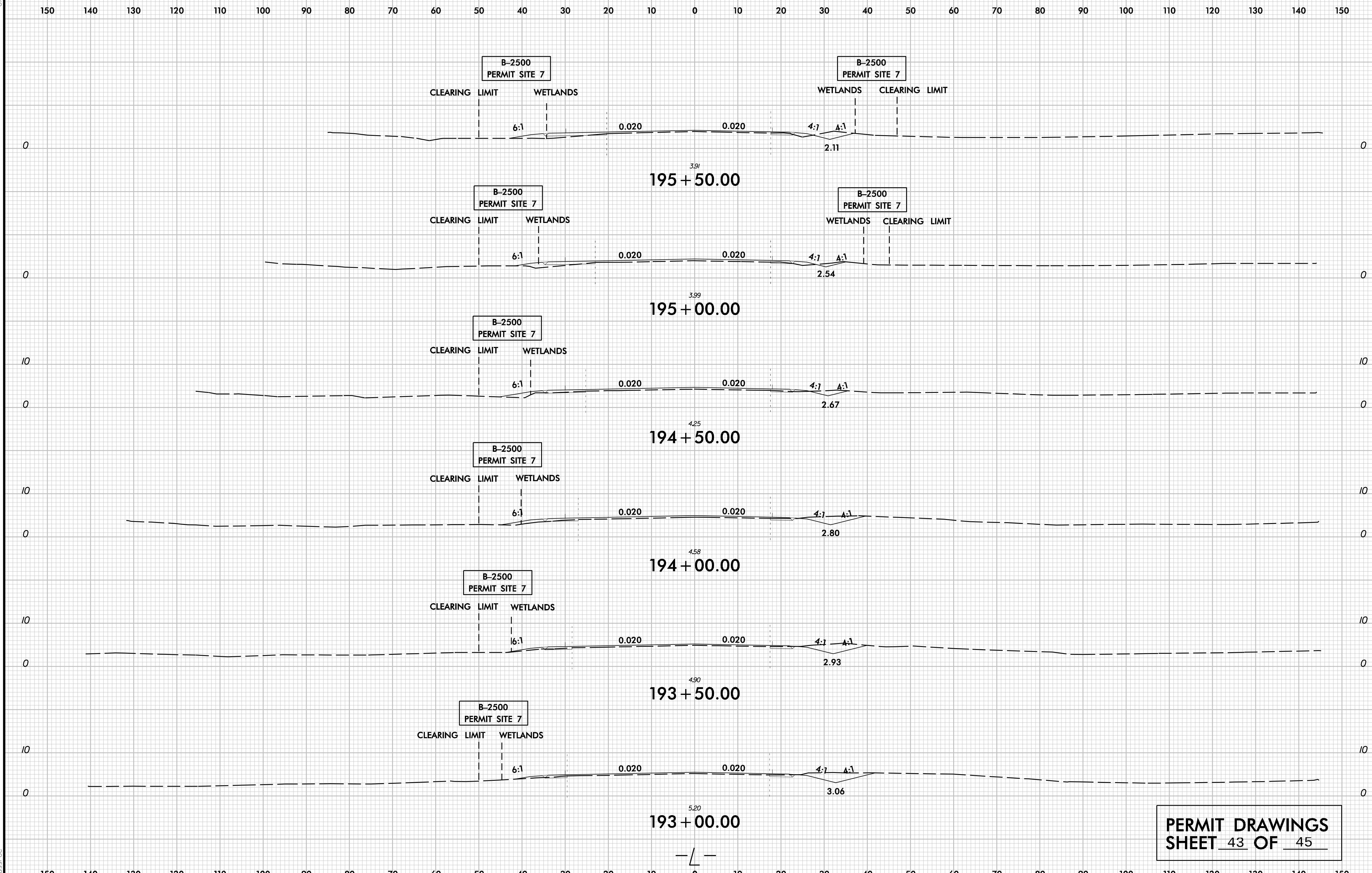
PROJ. REFERENCE NO.	SHEET NO.
B-2500	X-41



PERMIT DRAWINGS
SHEET 43 OF 45

4/4/2012
c:\pwworking\tpa\d0274011\B2500_HYD_PRM_XPL_L_Y01.dgn
8/23/99

PROPERTY OWNERS

NAMES AND ADDRESSES

PARCEL NO.	NAMES	ADDRESSES	SITE NO.
1	US GOVERNMENT	PEA ISLAND NATIONAL WILDLIFE REFUGE P.O. BOX 1969 MANTEO, NC 27954	1,2,3,4
3	US GOVERNMENT	CAPE HATTERAS NATIONAL SEASHORE 1401 NATIONAL PARK DR. MANTEO, NC 27954	5,6,7
4	STATE OF NORTH CAROLINA	NA	5,6

NORTH CAROLINA

DIVISION OF HIGHWAYS
DARE COUNTY

PROJECT: 32635.3.GV3 AND 32635.1.4
(B-2500)

NC 12-REPLACEMENT OF HERBERT C. BONNER BRIDGE ACROSS OREGON INLET FROM HATTERAS ISLAND TO BODIE ISLAND

SHEET 44 OF 45 04/27/12

WETLAND PERMIT IMPACT SUMMARY

Site No.	Station (From/To)	Structure Size / Type	Wetland Restoration	Permanent Fill In Wetlands (ac)	Temp. Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in Wetlands (ac)	SURFACE WATER IMPACTS: Permanent SW impacts (ac)	Temp. SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
1	-L- 19+96 TO 21+66 LT	Roadway						0.01					
2	-Y01- 12+49 TO 21+80 RT	Roadway		0.32		0.01		0.12					
3	-L- 41+86 TO 44+32 LT	Work Trestle/Dock								***			
4	-L- 39+61 TO 40+57 LT	Utility Relocation		0.01	0.11								
*5	-L- 38+36 TO 176+68	Prop. Bridge		***	0.65		0.09		***	0.93			
		Work Trestle			***					***			
		Temp. Platform								***			
**6	-L- 56+40 TO 172+10 RT	Exist. Bridge Demo			***					***			
7	-L- 191+20 TO 197+80	Roadway		0.06		0.01		0.13					
	Casting Yard	Trestle								0.01			
TOTALS:				0.39	0.76	0.02	0.09	0.26	0.00	0.94	0	0	0

* Permanent surface water and permanent fill in wetland impacts were calculated based on the type of foundation. If the foundation has a pile cap then the cap would be in the water ~ 1.0' based on the mean high water elevation, so the cap dimensions were used instead of the individual pile sizes (giving us a larger footprint). If the foundation has 54" circular piles with no pile cap then the pile surface area was used to calculate the impact, plus a small area immediately around the pile.

**The impacts for the removal of the existing bridge were calculated using the pile window (the extent that the piles project into the water) and not individual pile sizes. The demolition/pile removal in wetlands was considered "Temporary Fill" because "Temporary Excavation" is not a category.

*** Impacts for the temporary work trestle, work bridge, and work platform were calculated as pile impacts. The piles being proposed are 24" circular piles The work trestle, platforms, and bridge all require two piles per span and spans will be spaced every 32 feet apart.

CAMA vs 404 Wetland Impacts
Mech. Clearing in CAMA Wetlands = 0.01 AC.
Mech. Clearing in 404 Wetlands = 0.08 AC.
Perm. Fill in CAMA Wetlands = 0.01 AC
Perm. Fill in 404 Wetlands = 0.38 AC
Perm. Excavation in 404 Wetlands = 0.02 AC

*** Bent Impacts

Work Trestle/Dock	Proposed Bridge	Work Trestle/Platform	Existing Bridge Demo
Temp. SW Impacts = <0.01 AC	Perm. Fill in CAMA Wetlands = 0.01 AC Perm. SW Impacts = 0.54 AC	Temp. Fill in CAMA Wetlands = 0.02 AC Temp. SW Impacts = 0.04 AC	Temp. Fill in CAMA Wetlands = 0.31 AC Temp. SW Impacts = 2.45 AC

NC DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS
DARE COUNTY

WBS - 32635.3.GV3 AND 32635.1.4 (B-2500)

Replacement of Herbert C. Bonner Bridge Across Oregon Inlet from Hatteras Island to Bodie Island

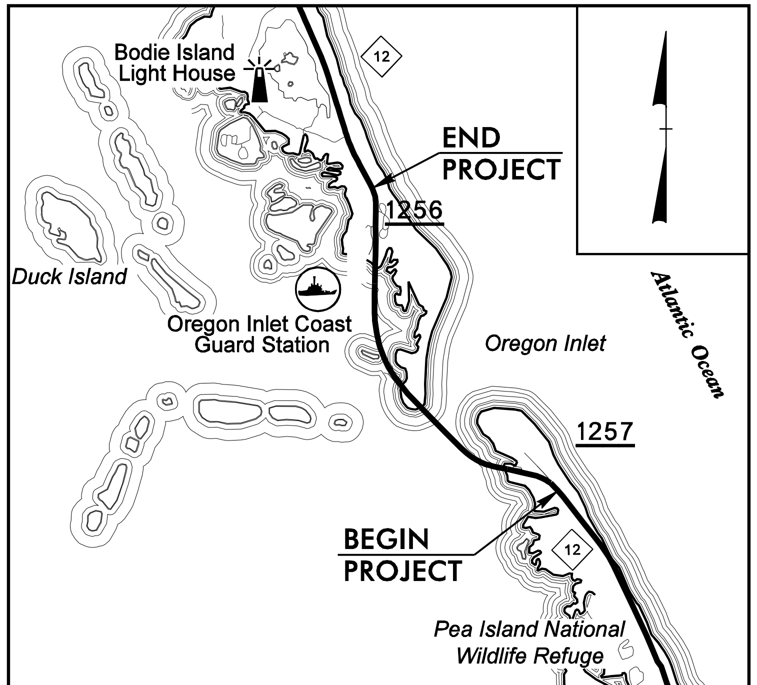
TIP PROJECT: B-2500

CONTRACT: C 202185

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-2500	1	

STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION
32635.1.4	BRNHF-0012(48)	CONSTRUCTION
32635.3.GV3	BRNHF-0012(36)	CONSTRUCTION

See Sheet 1-A For Index of Sheets



VICINITY MAP
(NOT TO SCALE)

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

DARE COUNTY

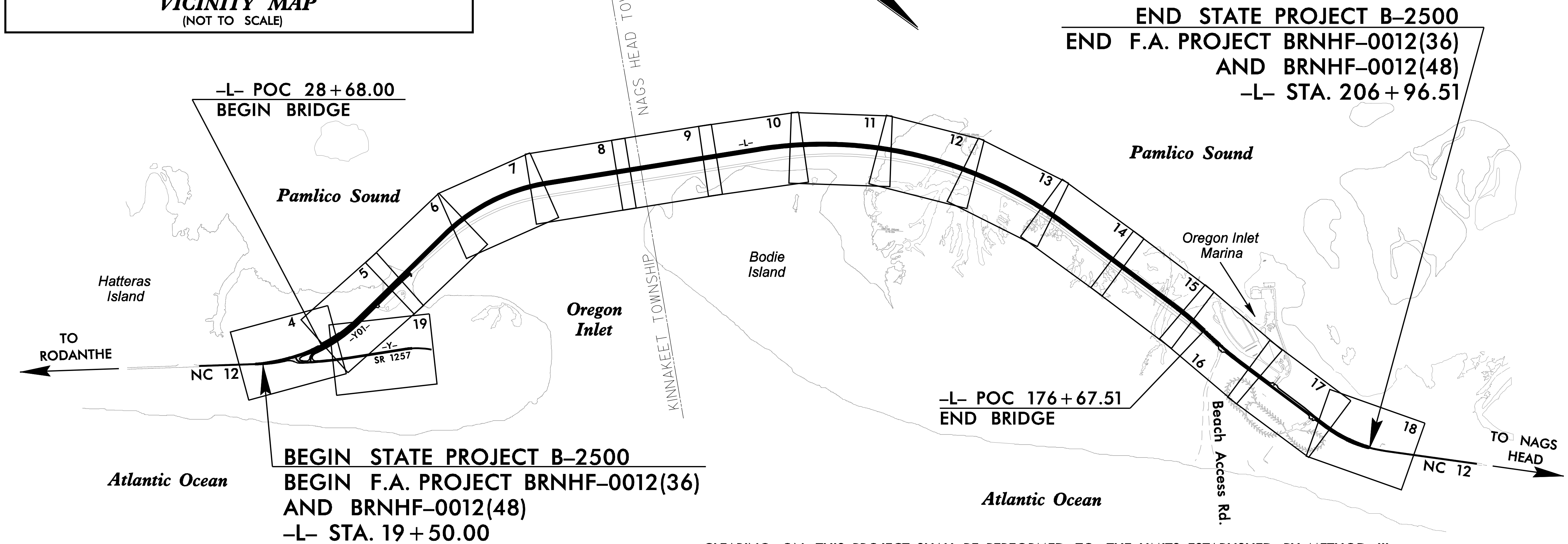
LOCATION: NC 12 – REPLACEMENT OF HERBERT C. BONNER BRIDGE ACROSS OREGON INLET FROM HATTERAS ISLAND TO BODIE ISLAND

TYPE OF WORK: DESIGN-BUILD AS SPECIFIED IN THE SCOPE OF WORK CONTAINED IN THE REQUEST FOR PROPOSALS

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

60% ROADWAY PLANS
SUBMITTED: 02-17-2012
SUBMITTAL #D-020



CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III.

GRAPHIC SCALES

50 25 0 50 100 — PLANS

50 25 0 50 100 — PROFILE (HORIZONTAL)

10 5 0 10 20 — PROFILE (VERTICAL)

DESIGN DATA

ADT 2011 = 7,060
ADT 2035 = 11,420
DHV = 10 %
D = 50 %
T = 6 %
V = 60 MPH

FUNC CLASS = MAJOR COLLECTOR STATEWIDE TIER

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT B-2500	=	0.747 MILES
LENGTH STRUCTURE TIP PROJECT B-2500	=	2.803 MILES
TOTAL LENGTH TIP PROJECT B-2500	=	3.550 MILES

DIVISION OF HIGHWAYS
1000 Birch Ridge Dr., Raleigh NC, 27610

2006 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: DECEMBER 7, 2011

LETTING DATE: JULY 19, 2011

NCDOT CONTACT:

DOMENIC A. COLETTI, PE — PROJECT ENGINEER

DOMINIC M. WAINWRIGHT, PE — PROJECT DESIGN ENGINEER

DAVID T. HERING, LG, PE — DESIGN-BUILD ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: P.E.

DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

P.E.
STATE HIGHWAY DESIGN ENGINEER

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09/08/99

PROJECT REFERENCE NO.	SHEET NO.
B-2500	1-A

ROADWAY DESIGN ENGINEER

INDEX OF SHEETS

EFF. 07-18-06

REV. 01-02-07

2006 ROADWAY ENGLISH STANDARD DRAWINGS

The following Roadway Standards as appear in "Roadway Standard Drawings" Highway Design Branch - N. C. Department of Transportation - Raleigh, N. C., Dated July 18, 2006 are applicable to this project and by reference hereby are considered a part of these plans:

STD.NO.	TITLE
DIVISION 2 - EARTHWORK	
200.03	Method of Clearing - Method III
225.02	Guide for Grading Subgrade - Secondary and Local
225.04	Method of Obtaining Superelevation - Two Lane Pavement
DIVISION 3 - PIPE CULVERTS	
310.02	Parallel Pipe End Section - Precast Concrete Section for 15" to 24" Pipe
310.03	Cross Pipe End Section - Precast Concrete Section for 18" to 30" Pipe
310.10	Driveway Pipe Construction
DIVISION 4 - MAJOR STRUCTURES	
422.10	Reinforced Bridge Approach Fills
DIVISION 5 - SUBGRADE, BASES AND SHOULDERS	
560.01	Method of Shoulder Construction - High Side of Superelevated Curve - Method I
DIVISION 6 - ASPHALT BASES AND PAVEMENTS	
654.01	Pavement Repairs
DIVISION 8 - INCIDENTALS	
815.03	Pipe Underdrain and Blind Drain
840.18	Concrete Grated Drop Inlet Type 'B' - 12" thru 36" Pipe
840.19	Concrete Grated Drop Inlet Type 'D' - 12" thru 36" Pipe
840.29	Frames and Narrow Slot Flat Grates
840.31	Concrete Junction Box - 12" thru 66" Pipe
840.33	Angled Vane Grates and Frames
840.35	Traffic Bearing Grated Drop Inlet - for Cast Iron Double Frame and Grates
840.36	Traffic Bearing Grated Drop Inlet - for Steel (840.37) Double Frame and Grates
840.37	Steel Grate and Frame
840.45	Precast Drainage Structure
840.46	Traffic Bearing Precast Drainage Structure
840.54	Manhole Frame and Cover
840.66	Drainage Structure Steps
846.04	Drop Inlet Installation in Shoulder Berm Gutter
848.02	Driveway Turnout - Radius Type
852.01	Concrete Islands
852.06	Method for Placement of Drop Inlets in Concrete Islands
857.01	Precast Reinforced Concrete Barrier - 41" Single Faced
862.01	Guardrail Placement
862.02	Guardrail Installation
862.03	Structure Anchor Units
876.02	Guide for Rip Rap at Pipe Outlets

GENERAL NOTES:

2006 SPECIFICATIONS
EFFECTIVE: 07-18-06
REVISED: 07-30-08

GRADING AND SURFACING OR RESURFACING AND WIDENING:

THE GRADE LINES SHOWN DENOTE THE FINISHED ELEVATION OF THE PROPOSED SURFACING AT GRADE POINTS SHOWN ON THE TYPICAL SECTIONS. WHERE NO GRADE LINES ARE SHOWN, THE PROFILES SHOWN DENOTE THE TOP ELEVATION OF THE EXISTING PAVEMENT ALONG THE CENTER LINE OF SURVEY ON WHICH THE PROPOSED RESURFACING WILL BE PLACED. GRADE LINES MAY BE ADJUSTED BY THE ENGINEER IN ORDER TO SECURE A PROPER TIE-IN.

CLEARING:

CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III.

SUPERELEVATION:

ALL CURVES ON THIS PROJECT SHALL BE SUPERELEVATED IN ACCORDANCE WITH STD. NO. 225.04 USING THE RATE OF SUPERELEVATION AND RUNOFF SHOWN ON THE PLANS. SUPERELEVATION IS TO BE REVOLVED ABOUT THE GRADE POINTS SHOWN ON THE TYPICAL SECTIONS.

SHOULDER CONSTRUCTION:

ASPHALT, EARTH, AND CONCRETE SHOULDER CONSTRUCTION ON THE HIGH SIDE OF SUPERELEVATED CURVES SHALL BE IN ACCORDANCE WITH STD. NO. 560.01.

SIDE ROADS:

THE CONTRACTOR WILL BE REQUIRED TO DO ALL NECESSARY WORK TO PROVIDE SUITABLE CONNECTIONS WITH ALL ROADS, STREETS, AND DRIVES ENTERING THIS PROJECT. THIS WORK WILL BE PAID FOR AT THE CONTRACT UNIT PRICE FOR THE PARTICULAR ITEMS INVOLVED.

UNDERDRAINS:

UNDERDRAINS SHALL BE CONSTRUCTED IN ACCORDANCE WITH STD. NO. 815.03 AT LOCATIONS DIRECTED BY THE ENGINEER.

DRIVEWAYS:

DRIVEWAYS SHALL BE CONSTRUCTED IN ACCORDANCE WITH STD. 848.02 USING 10' RADII OR RADII AS SHOWN ON THE PLANS. LOCATIONS OF DRIVES WILL BE AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

GUARDRAIL:

THE GUARDRAIL LOCATIONS SHOWN ON THE PLANS MAY BE ADJUSTED DURING CONSTRUCTION AS DIRECTED BY THE ENGINEER. THE CONTRACTOR SHOULD CONSULT WITH THE ENGINEER PRIOR TO ORDERING GUARDRAIL MATERIAL.

END BENTS:

THE ENGINEER SHALL CHECK THE STRUCTURE END BENT PLANS, DETAILS, AND CROSS-SECTION PRIOR TO SETTING OF THE SLOPE STAKES FOR THE EMBANKMENT OR EXCAVATION APPROACHING A BRIDGE.

UTILITIES:

UTILITY OWNERS ON THIS PROJECT ARE CAPE HATTERAS EMC, DOMINION POWER, CENTURY-LINK TELEPHONE, AND NATIONAL PARK SERVICE.

ANY RELOCATION OF EXISTING UTILITIES WILL BE ACCOMPLISHED BY OTHERS, EXCEPT AS SHOWN ON THE PLANS.

RIGHT-OF-WAY MARKERS:

ALL RIGHT-OF-WAY MARKERS ON THIS PROJECT SHALL BE PLACED BY CONTRACT.

Note: Not to Scale

***S.U.E. = Subsurface Utility Engineering**

PROJECT REFERENCE NO.	SHEET NO.
B-2500	I-B

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL PLAN SHEET SYMBOLS

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin — EIP
- Property Corner
- Property Monument — ECM
- Parcel/Sequence Number — (23)
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary — WLB
- Proposed Wetland Boundary — WLB
- Existing Endangered Animal Boundary — EAB
- Existing Endangered Plant Boundary — EPB

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign — S
- Well — W
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream — JS
- Buffer Zone 1 — BZ 1
- Buffer Zone 2 — BZ 2
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch — FLOW
- False Sump

RAILROADS:

- Standard Gauge — CSX TRANSPORTATION
- RR Signal Milepost — MILEPOST 35
- Switch — SWITCH
- RR Abandoned
- RR Dismantled

RIGHT OF WAY:

- Baseline Control Point
- Existing Right of Way Marker
- Existing Right of Way Line
- Proposed Permanent Easement Line
- Proposed Permanent Easement Line with Iron Pin and Cap Marker
- Proposed Right of Way Line with Concrete or Granite Marker
- Existing Control of Access
- Proposed Control of Access
- Existing Easement Line — E
- Proposed Temporary Construction Easement — E
- Proposed Temporary Drainage Easement — TDE
- Proposed Permanent Drainage Easement — PDE
- Proposed Permanent Drainage / Utility Easement — DUE
- Proposed Permanent Utility Easement — PUE
- Proposed Temporary Utility Easement — TUE
- Proposed Permanent Easement with Iron Pin and Cap Marker

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut — C
- Proposed Slope Stakes Fill — F
- Proposed Wheel Chair Ramp — WCR
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

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

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert — CONC
- Bridge Wing Wall, Head Wall and End Wall — CONC WW

MINOR:

- Head and End Wall — CONC HW
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB — CB
- Paved Ditch Gutter
- Storm Sewer Manhole — S
- Storm Sewer — S

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole — P
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole — HH
- H-Frame Pole
- Recorded U/G Power Line — P
- Designated U/G Power Line (S.U.E.*) — P

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole — T
- Telephone Booth
- Telephone Pedestal — T
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole — HH
- Recorded U/G Telephone Cable — T
- Designated U/G Telephone Cable (S.U.E.*) — T
- Recorded U/G Telephone Conduit — TC
- Designated U/G Telephone Conduit (S.U.E.*) — TC
- Recorded U/G Fiber Optics Cable — T FO
- Designated U/G Fiber Optics Cable (S.U.E.*) — T FO

WATER:

- Water Manhole — W
- Water Meter
- Water Valve
- Water Hydrant
- Recorded U/G Water Line
- Designated U/G Water Line (S.U.E.*)
- Above Ground Water Line — A/G Water

TV:

- TV Satellite Dish
- TV Pedestal — C
- TV Tower
- U/G TV Cable Hand Hole — HH
- Recorded U/G TV Cable — TV
- Designated U/G TV Cable (S.U.E.*) — TV
- Recorded U/G Fiber Optic Cable — TV FO
- Designated U/G Fiber Optic Cable (S.U.E.*) — TV FO

GAS:

- Gas Valve
- Gas Meter
- Recorded U/G Gas Line — G
- Designated U/G Gas Line (S.U.E.*) — G
- Above Ground Gas Line — A/G Gas

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line — SS
- Above Ground Sanitary Sewer — A/G Sanitary Sewer
- Recorded SS Forced Main Line — FSS
- Designated SS Forced Main Line (S.U.E.*) — FSS

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box — S
- Utility Unknown U/G Line — ?UTL
- U/G Tank; Water, Gas, Oil
- A/G Tank; Water, Gas, Oil
- U/G Test Hole (S.U.E.*)
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

09/28/09
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PROJECT REFERENCE NO.	SHEET NO.
B-2500	2
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

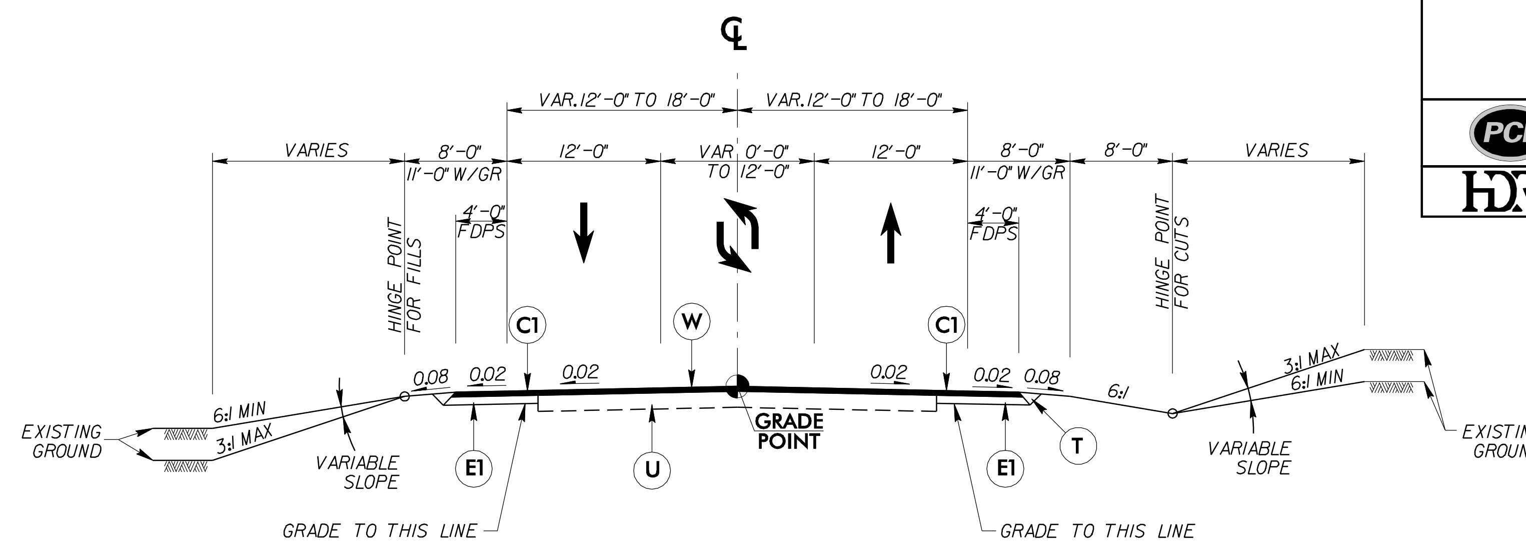
PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

PAVEMENT SCHEDULE

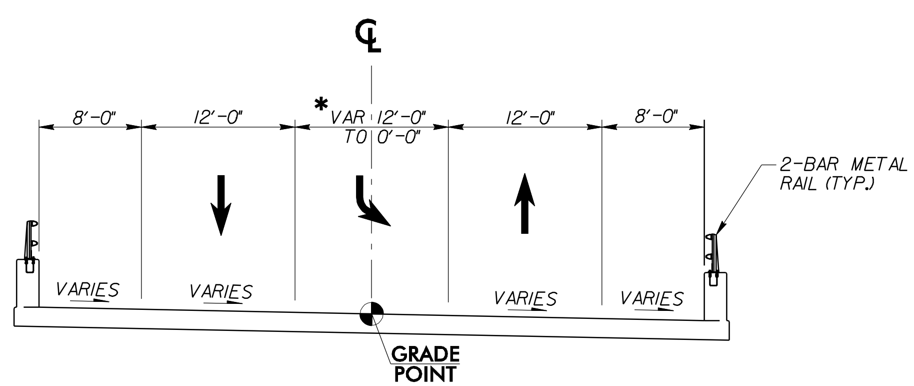
C1	PROP. APPROX. 3.0" ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 168 LBS. PER SQ. YD. IN EACH OF TWO LAYERS.
C2	PROP. VAR. DEPTH ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 112 LBS. PER SQ. YD. PER 1" DEPTH TO BE PLACED IN LAYERS NOT LESS THAN 1.5" IN DEPTH OR GREATER THAN 2" IN DEPTH.
E1	PROP. APPROX. 5.0" ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 570 LBS. PER SQ. YD.
E2	PROP. VAR. DEPTH ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 114 LBS. PER SQ. YD. PER 1" DEPTH TO BE PLACED IN LAYERS NOT LESS THAN 3.0" IN DEPTH OR GREATER THAN 5½" IN DEPTH.
T	EARTH MATERIAL
U	EXISTING PAVEMENT
W	VARIABLE DEPTH ASPHALT PAVEMENT (SEE WEDGING DETAIL ON SHEET 2-A)
R1	SINGLE FACED CONCRETE BARRIER
R2	DOUBLE FACED CONCRETE BARRIER, TYPE IV
R3	PORTABLE CONCRETE BARRIER

NOTE: PAVEMENT EDGE SLOPES ARE 1:1 UNLESS SHOWN OTHERWISE



TYPICAL SECTION NO. 1

LINE	FROM STATION	TO STATION
-L-	19+50.00	25+75.00
-L-	179+00.00	206+96.51

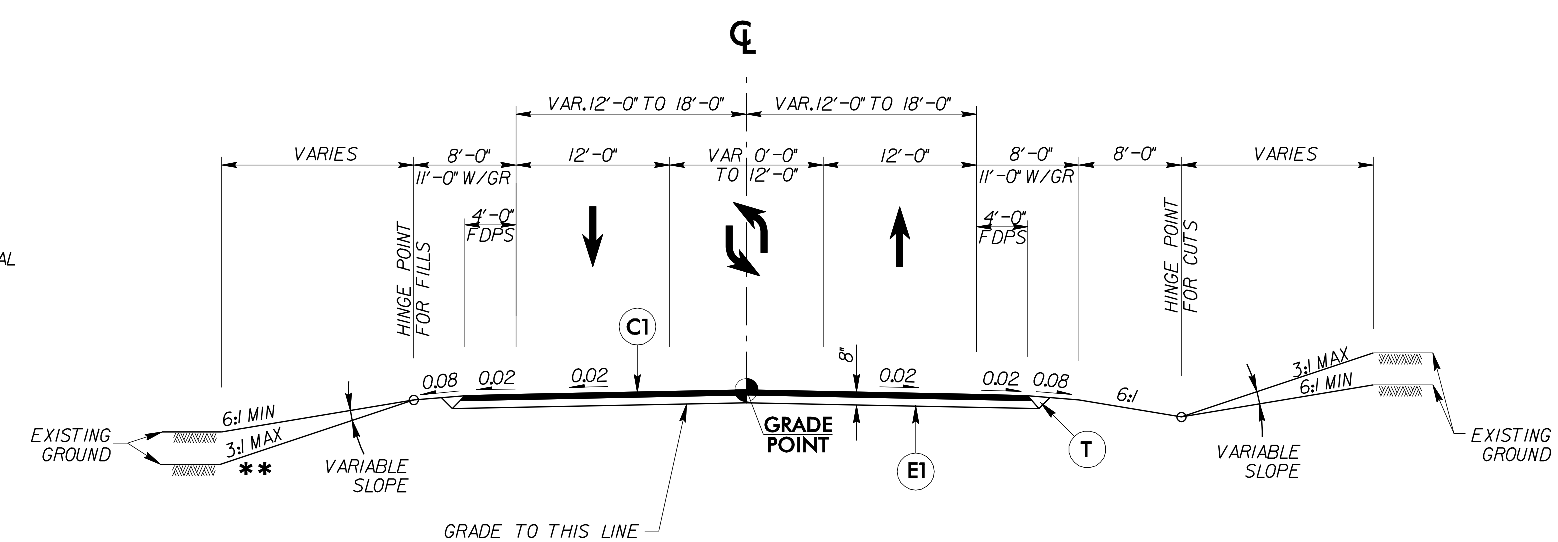


STRUCTURE TYPICAL SECTION

TYPICAL SECTION NO. 3

LINE	FROM STATION	TO STATION
-L-	28+68.00	176+67.51

* NOTE: LANE WIDTH VARIES 12'-0" TO 0'-0" FROM -L- STA. 28+69.00 TO 31+99.00



TYPICAL SECTION NO. 2

LINE	FROM STATION	TO STATION
-L-	25+75.00	26+44.00
-L-	176+67.51	179+00.00

** NOTE: SLOPES STEEPER THAN 3:1 FROM -L- STA. 176+67.51 TO 178+00 +/- LT. REQUIRE REINFORCED SIDE SLOPES

PROJECT REFERENCE NO.	SHEET NO.
B-2500	2-A
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

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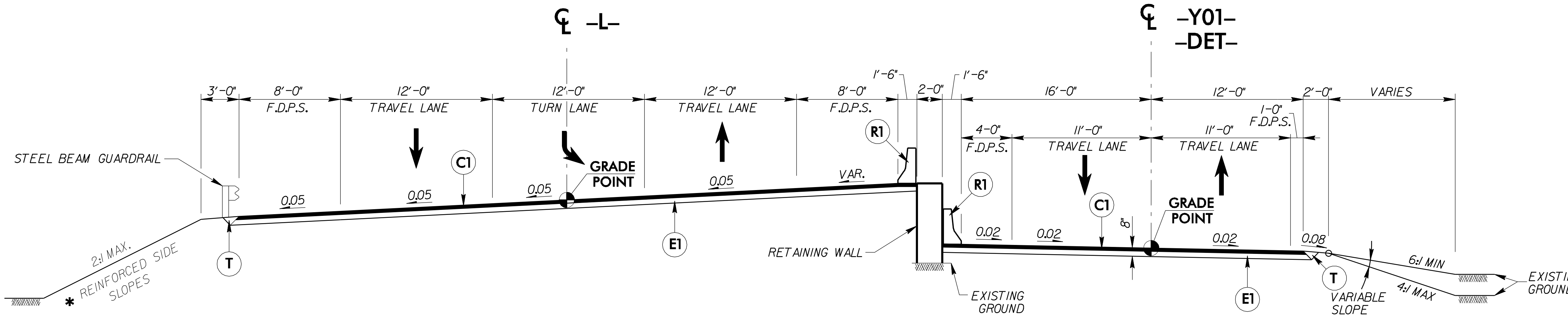


TYPICAL SECTION NO. 4

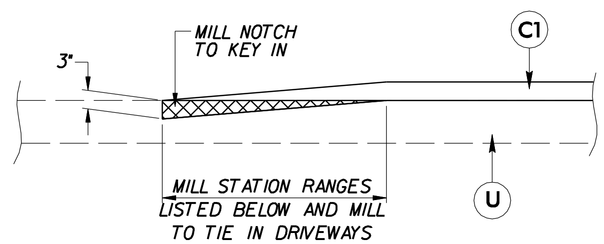
LINE	FROM STATION	TO STATION
-L-	26+44.00	28+68.00
-Y01-	11+25.00	12+98.00
-DET-	10+69.00	12+98.00

* NOTE: SLOPES STEEPER THAN 3:1 FROM -L- STA.27+50 +/- TO 28+68.00 LT. REQUIRE REINFORCED SIDE SLOPES

PAVEMENT SCHEDULE

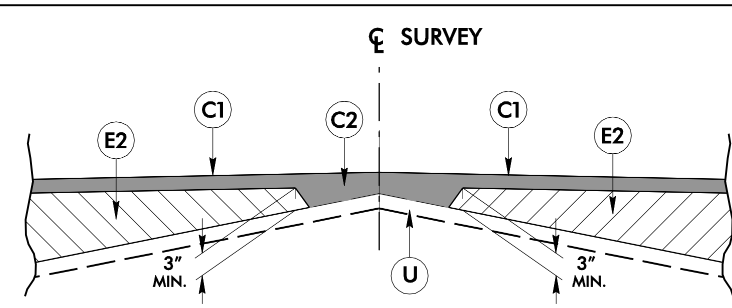
C1	3.0" S9.5B
C2	VAR. S9.5B
E1	5.0" B25.0B
E2	VAR. B25.0B
T	EARTH MATERIAL
U	EXISTING PAVEMENT
W	WEDGING (SEE SHEET 2-A)
R1	SINGLE FACED BARRIER
R2	DOUBLE FACED BARRIER
R3	PORTABLE CONC. BARRIER

NOTE: PAVEMENT EDGE SLOPES ARE 1:1 UNLESS SHOWN OTHERWISE

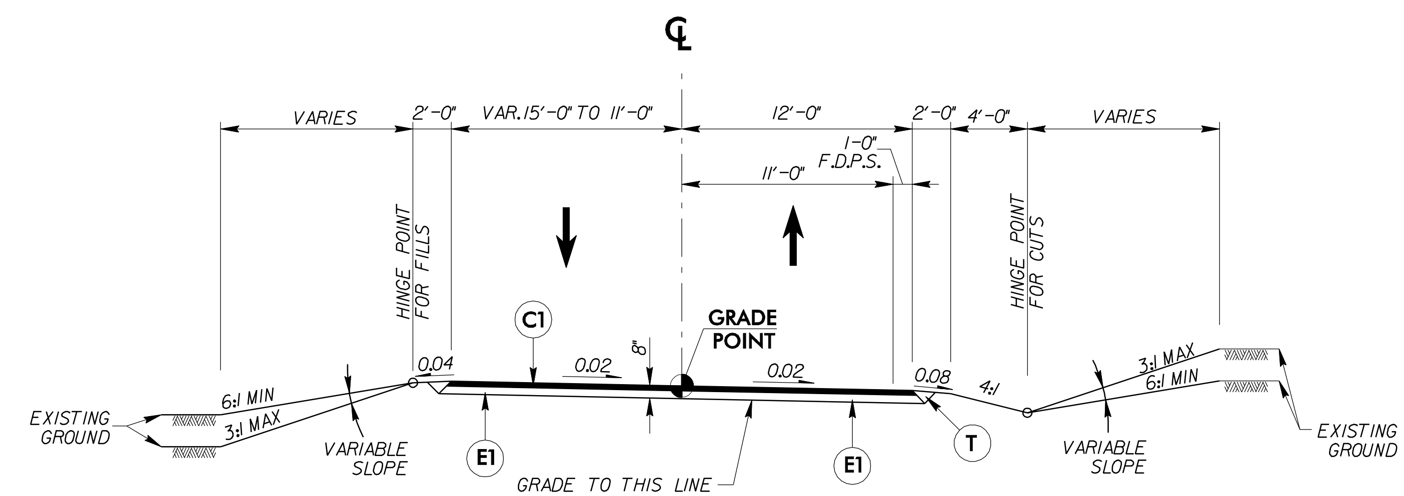


MILLING

LINE	FROM STATION	TO STATION
-L-	19+50.00	21+00.00
-L-	180+25.00	181+75.00
-L-	203+75.00	206+96.51



Detail Showing Method of Wedging



TYPICAL SECTION NO. 5

LINE	FROM STATION	TO STATION
-Y01-	10+13.44	11+25.00

PROJECT REFERENCE NO.	SHEET NO.
B-2500	2-B
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

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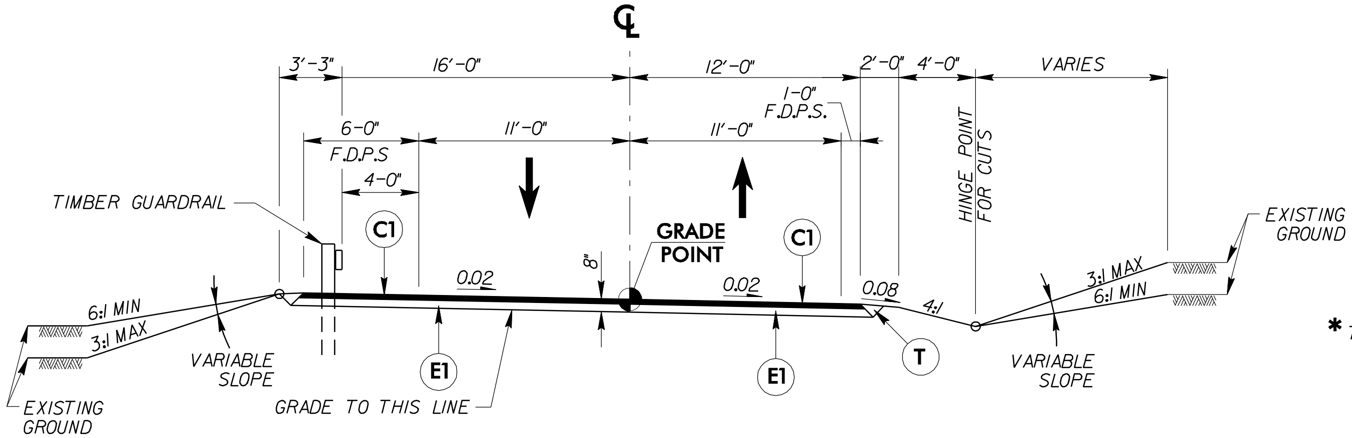
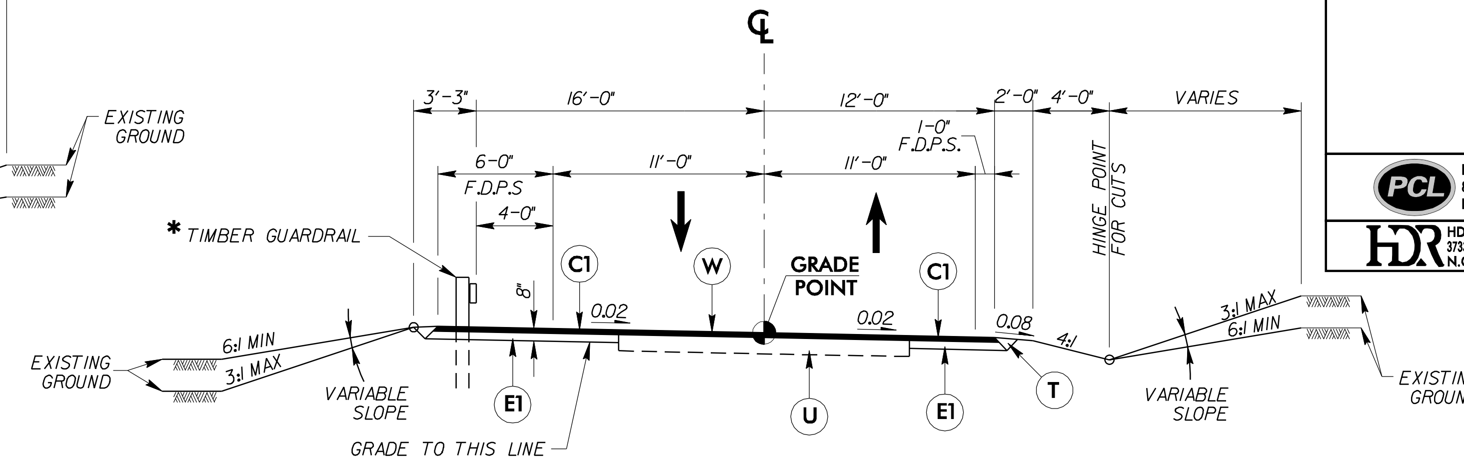


TYPICAL SECTION NO. 6

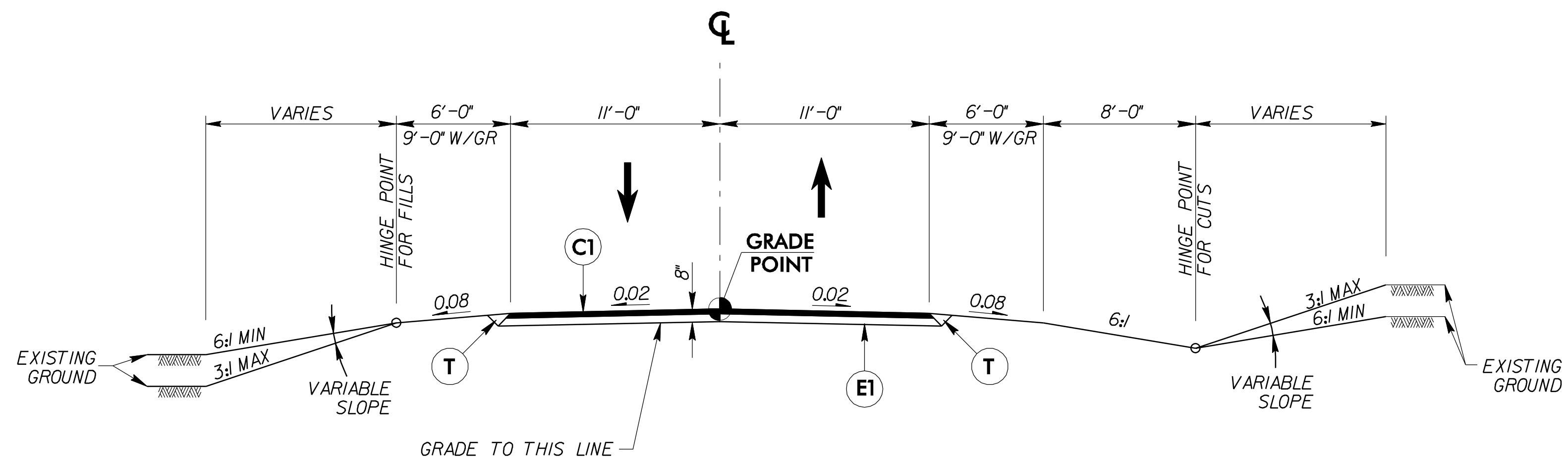
LINE	FROM STATION	TO STATION
-Y01-	12+98.00	23+00.00



TYPICAL SECTION NO. 7

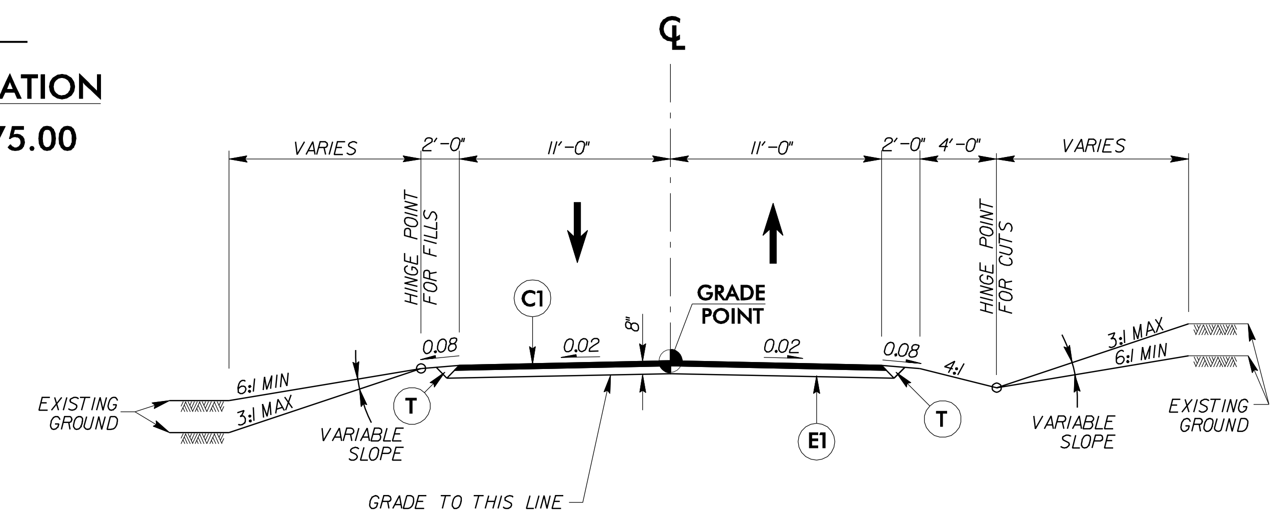
LINE	FROM STATION	TO STATION
-Y01-	23+00.00	30+24.81

* USE TIMBER GUARDRAIL FROM -Y01- STA.23+00.00 TO 24+00.00



TYPICAL SECTION NO. 8

LINE	FROM STATION	TO STATION
-Y-	10+18.00	12+75.00



TYPICAL SECTION NO. 9

LINE	FROM STATION	TO STATION
-Y-	12+75.00	27+84.86

PAVEMENT SCHEDULE

C1	3.0" S9.5B
C2	VAR. S9.5B
E1	5.0" B25.0B
E2	VAR. B25.0B
T	EARTH MATERIAL
U	EXISTING PAVEMENT
W	WEDGING (SEE SHEET 2-A)
R1	SINGLE FACED BARRIER
R2	DOUBLE FACED BARRIER
R3	PORTABLE CONC. BARRIER

NOTE: PAVEMENT EDGE SLOPES ARE 1:1 UNLESS SHOWN OTHERWISE

6/2/99

PROJECT REFERENCE NO.	SHEET NO.
B-2500	2-C
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

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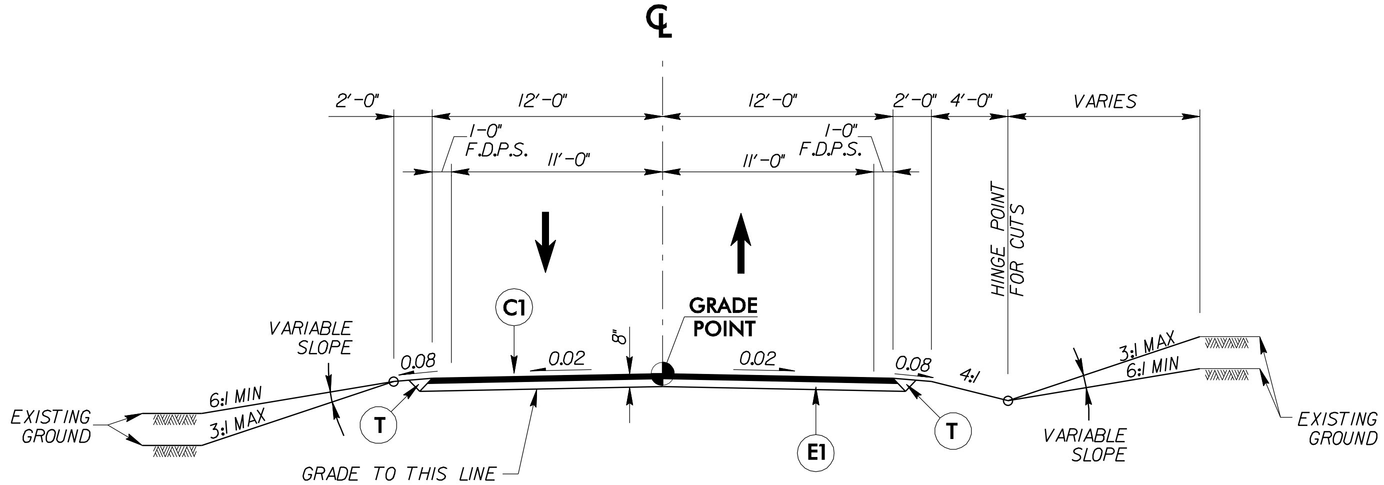
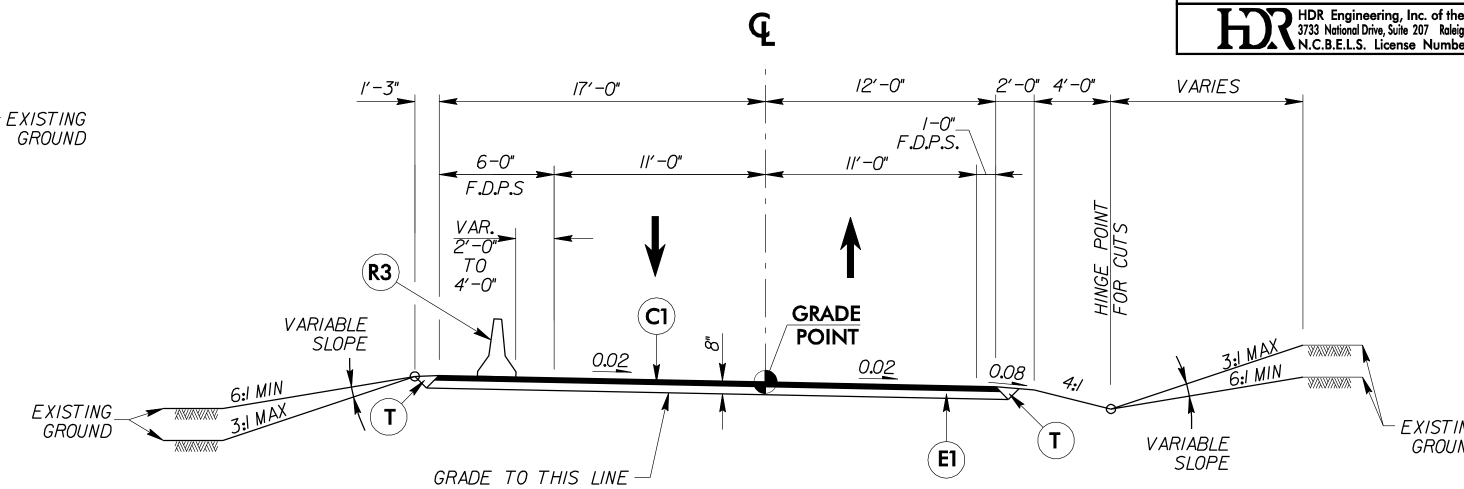


TYPICAL SECTION NO. 10

LINE	FROM STATION	TO STATION
-DET-	4+69.04	9+64.00

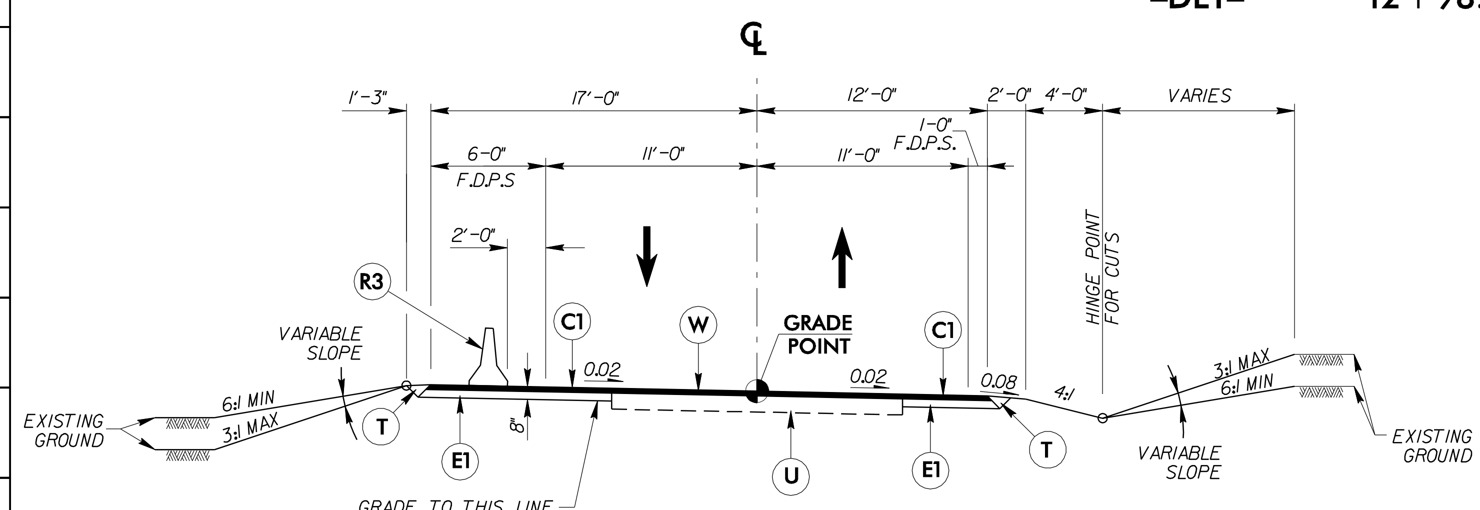


TYPICAL SECTION NO. 11

LINE	FROM STATION	TO STATION
-DET-	9+64.00	10+69.00
-DET-	12+98.00	23+00.00

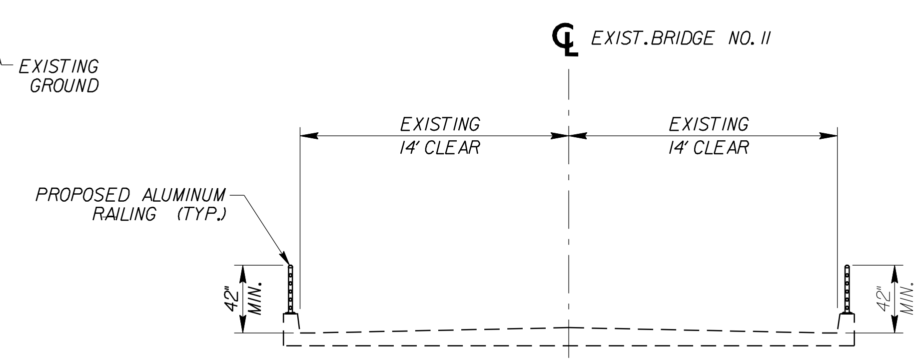
PAVEMENT SCHEDULE	
C1	3.0" S9.5B
C2	VAR. S9.5B
E1	5.0" B25.0B
E2	VAR. B25.0B
T	EARTH MATERIAL
U	EXISTING PAVEMENT
W	WEDGING (SEE SHEET 2-A)
R1	SINGLE FACED BARRIER
R2	DOUBLE FACED BARRIER
R3	PORTABLE CONC. BARRIER

NOTE: PAVEMENT EDGE SLOPES ARE 1:1 UNLESS SHOWN OTHERWISE



TYPICAL SECTION NO. 12

LINE	FROM STATION	TO STATION
-DET-	23+00.00	30+24.81



FISHING PIER TYPICAL SECTION

TYPICAL SECTION NO. 13

NOTE: SEE SHEET NO.6 AND NO.7 FOR LIMITS OF EXISTING BRIDGE NO. 11 TO BE RETAINED AS FISHING PIER.

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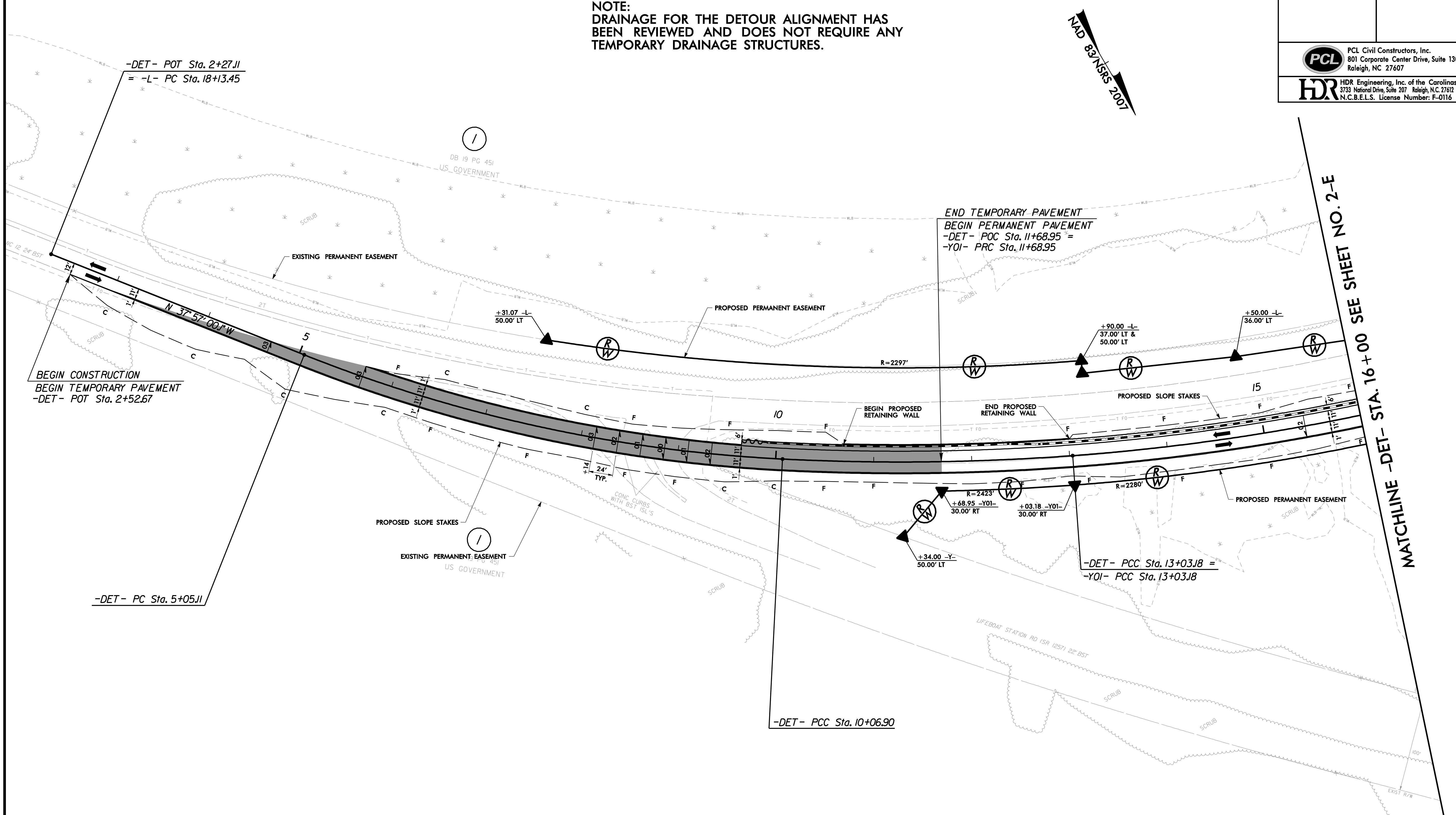
DETOUR ALIGNMENT

NOTE:
DRAINAGE FOR THE DETOUR ALIGNMENT HAS BEEN REVIEWED AND DOES NOT REQUIRE ANY TEMPORARY DRAINAGE STRUCTURES.



-DET-

PI Sta 7+58.28	PI Sta 11+55.23	PI Sta 16+32.55
Δ = 18° 47' 29.1" (LT)	Δ = 7° 05' 37.7" (LT)	Δ = 16° 39' 22.3" (LT)
D = 3° 44' 41.4"	D = 2° 23' 39.5"	D = 2° 32' 47.3"
L = 501.80'	L = 296.28'	L = 654.09'
T = 253.17'	T = 148.33'	T = 329.37'
R = 1,530.00'	R = 2,393.00'	R = 2,250.00'
V = 45 MPH	V = 45 MPH	V = 45 MPH
e = 0.03	e = -0.02	e = -0.02

SEE SHEET NO. 32 FOR -DET- PROFILE.

REVISIONS

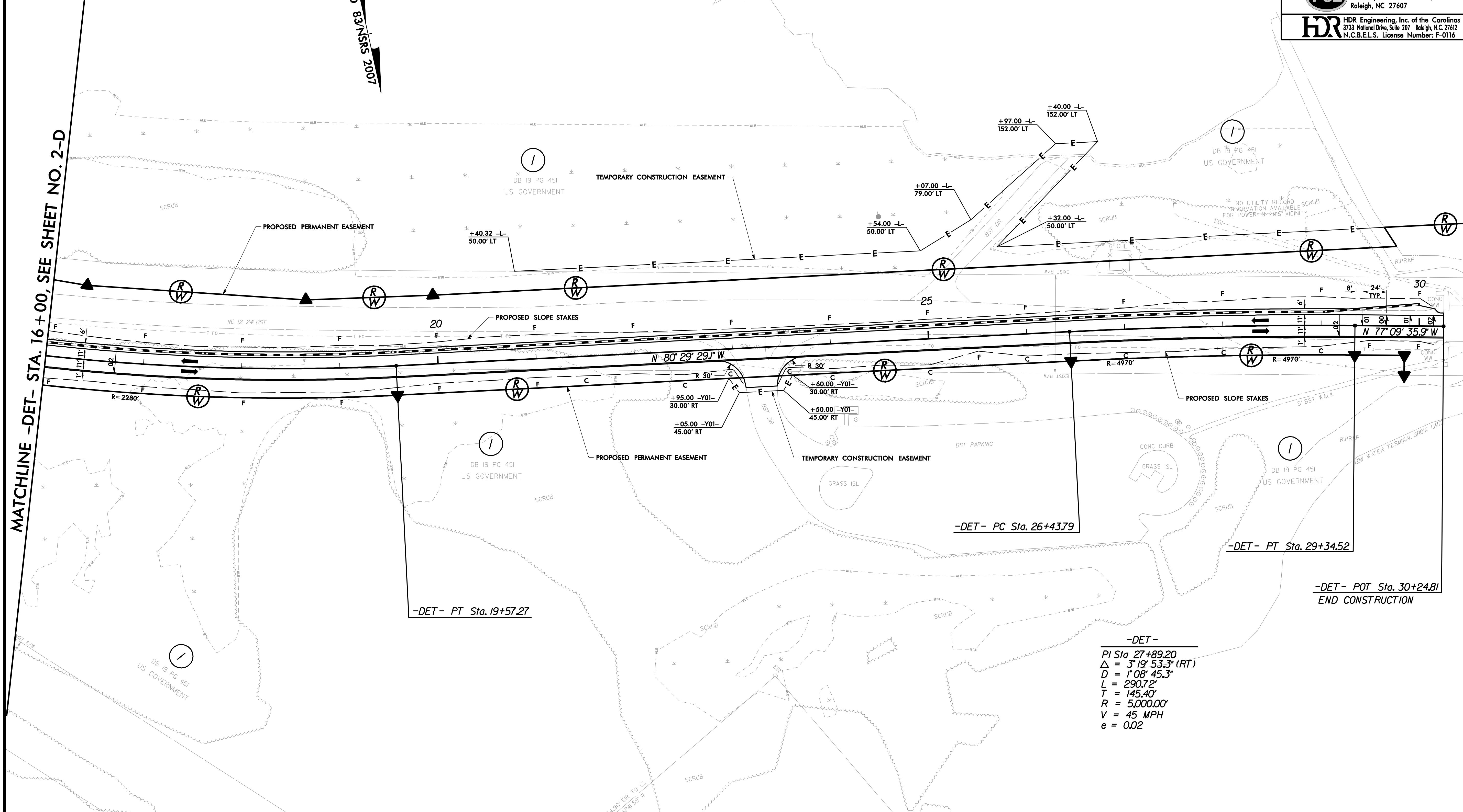
PROJECT REFERENCE NO.	SHEET NO.
B-2500	2-E
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

DETOUR ALIGNMENT

NOTE:
DRAINAGE FOR THE DETOUR ALIGNMENT HAS BEEN REVIEWED AND DOES NOT REQUIRE ANY TEMPORARY DRAINAGE STRUCTURES.



-DET-
PI Sta 27+89.20
Δ = 3° 19' 53.3" (RT)
D = 1° 08' 45.3"
L = 290.72'
T = 145.40'
R = 5,000.00'
V = 45 MPH
e = 0.02

SEE SHEET NO. 32 FOR -DET- PROFILE.

REVISIONS

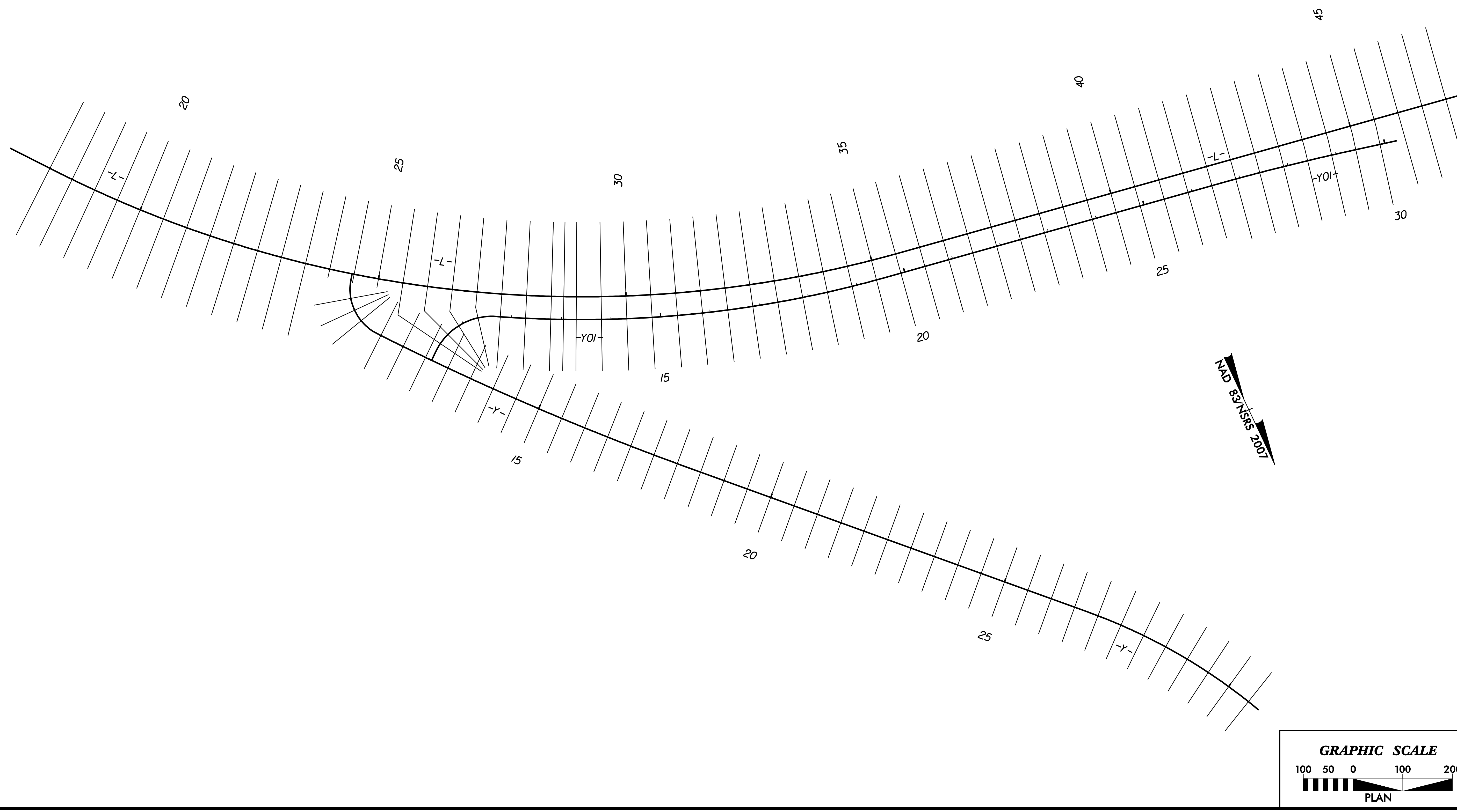
PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassroc DATE: 4/20/2012 TIME: 2:05:50 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_DET_2.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	2-F
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

CROSS-SECTION LAYOUT DETAIL



REVISIONS

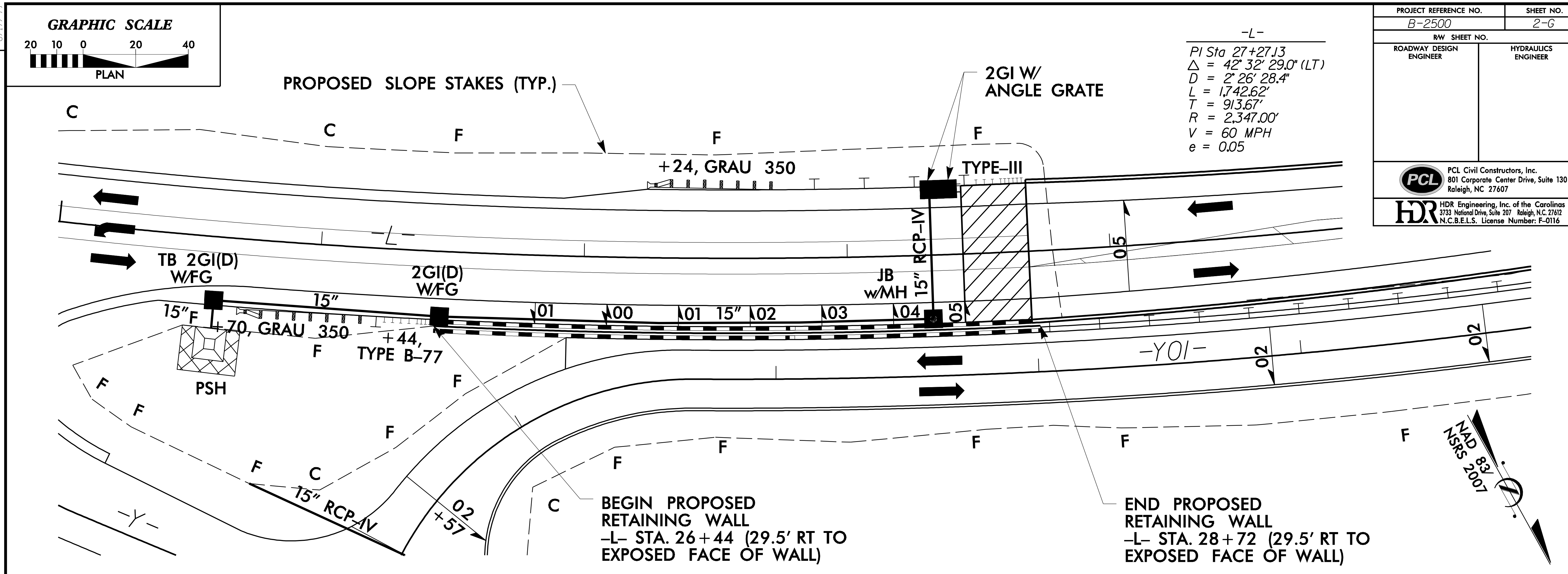
PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassroc DATE: 4/20/2012 TIME: 2:06:02 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_XSC_LAYOUT.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	2-G
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

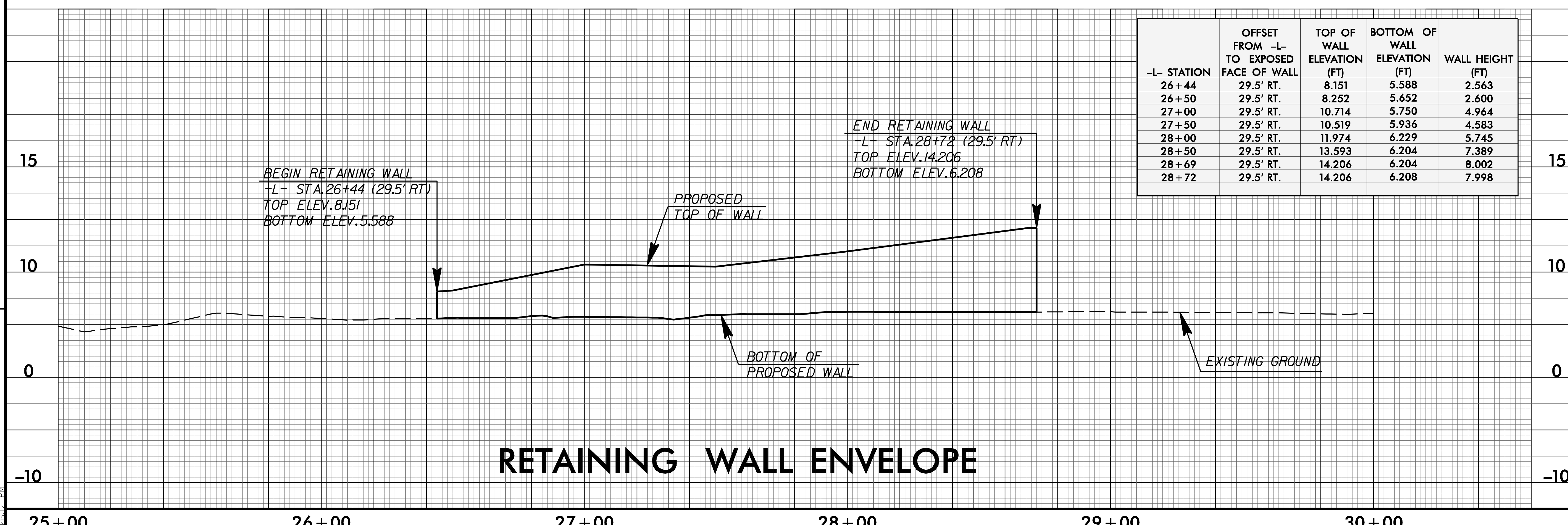
PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

-L-
PI Sta 27+27.13
△ = 42° 32' 29.0" (LT)
D = 2° 26' 28.4"
L = 1,742.62'
T = 913.67'
R = 2,347.00'
V = 60 MPH
e = 0.05



-L- STATION	OFFSET FROM -L- TO EXPOSED FACE OF WALL	TOP OF WALL ELEVATION (FT)	BOTTOM OF WALL ELEVATION (FT)	WALL HEIGHT (FT)
26+44	29.5' RT.	8.151	5.588	2.563
26+50	29.5' RT.	8.252	5.652	2.600
27+00	29.5' RT.	10.714	5.750	4.964
27+50	29.5' RT.	10.519	5.936	4.583
28+00	29.5' RT.	11.974	6.229	5.745
28+50	29.5' RT.	13.593	6.204	7.389
28+69	29.5' RT.	14.206	6.204	8.002
28+72	29.5' RT.	14.206	6.208	7.998



RETAINING WALL ENVELOPE

REVISIONS

8/17/99

4/20/2012
B2500_RDY_PSH_WALL.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

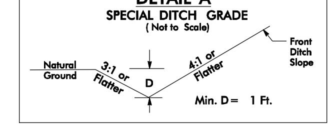
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

DATUM DESCRIPTION

THE LOCALIZED COORDINATE SYSTEM DEVELOPED FOR THIS PROJECT IS BASED ON THE STATE PLANE COORDINATES ESTABLISHED BY NCDOT FOR MONUMENT "B2500-2" WITH NAD 83 (CORS96) STATE PLANE GRID COORDINATES OF NORTHING: 751499.622(ft) EASTING: 3031964.117(ft) THE AVERAGE COMBINED GRID FACTOR USED ON THIS PROJECT (GROUND TO GRID) IS: 0.99991846 THE N.C. LAMBERT GRID BEARING AND LOCALIZED HORIZONTAL GROUND DISTANCE FROM "B2500-2" TO -L- STATION 19+50.00 IS S 47° 51' 59.63" E 698.91' ALL LINEAR DIMENSIONS ARE LOCALIZED HORIZONTAL DISTANCES VERTICAL DATUM USED IS NAVD 88

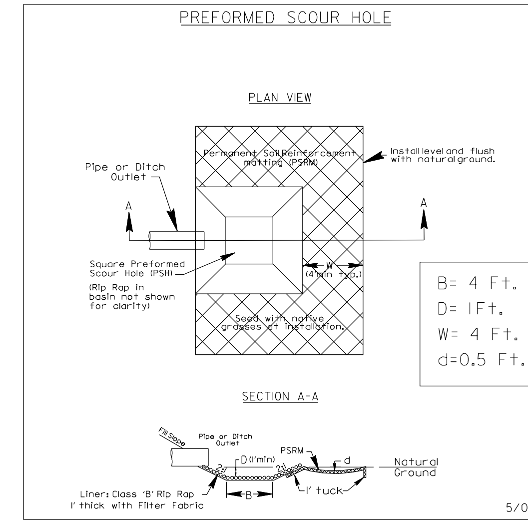
NAD 83/NSRS 2007

DETAIL A
SPECIAL DITCH GRADE (Not to Scale)



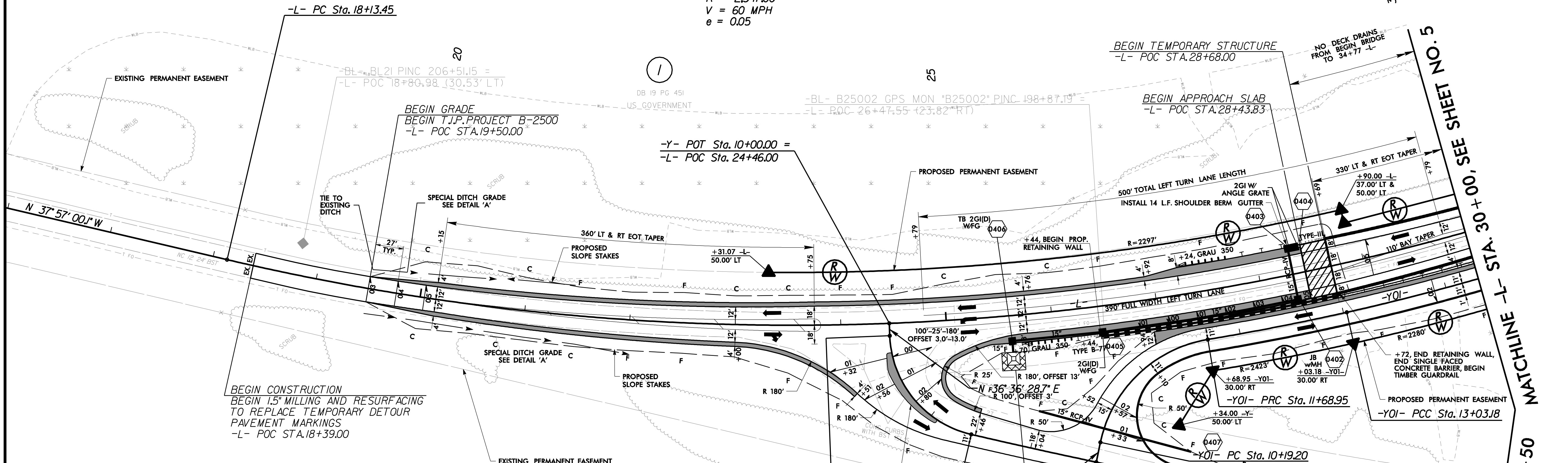
FROM STA. 19+50 TO STA. 20+75 -L- LT
FROM STA. 20+75 TO STA. 21+50 -L- LT
FROM STA. 19+50 TO STA. 22+00 -L- RT
FROM STA. 13+00 TO STA. 16+00 -Y- RT
FROM STA. 16+00 TO STA. 17+50 -Y- RT

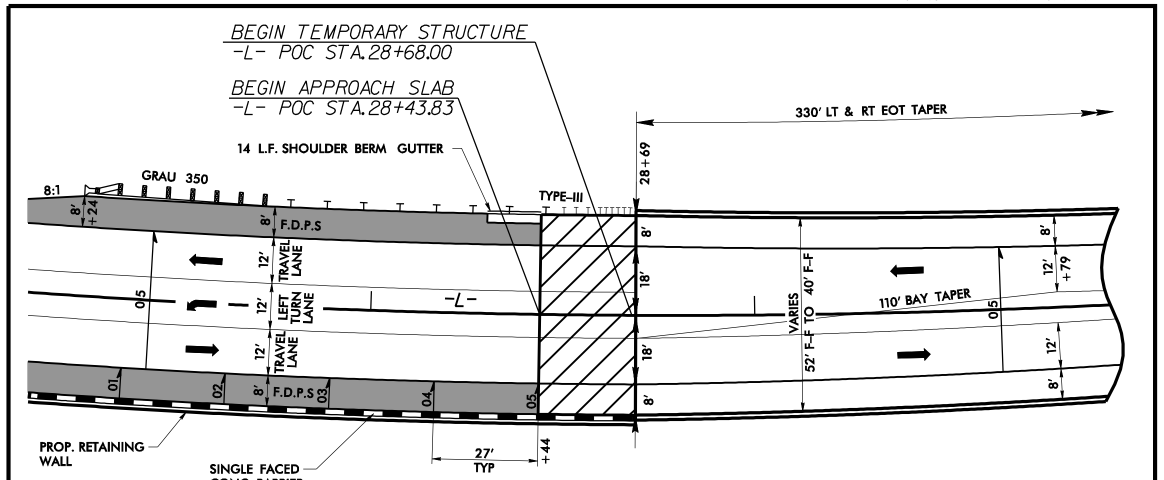
PREFORMED SCOUR HOLE



B= 4 Ft.
D= 1Ft.
W= 4 Ft.
d=0.5 Ft.

-L-
PI Sta 27+27.13
Δ = 42° 32' 29.0" (LT)
D = 2° 26' 28.4"
L = 1,742.62'
T = 913.67'
R = 2,347.00'
V = 60 MPH
e = 0.05





SKETCH SHOWING BRIDGE/PAVEMENT RELATIONSHIP

-Y-
PI Sta 10+88.03
Δ = 74° 39' 24.0" (LT)
D = 57° 17' 44.8"
L = 130.30'
T = 76.26'
R = 100.00'
V = 20 MPH
e = NC

-Y-
PI Sta 14+84.96
Δ = 6° 50' 58.5" (LT)
D = 1° 00' 00.0"
L = 684.96'
T = 342.89'
R = 5,729.58'
V = 30 MPH
e = NC

-Y01-

PI Sta 11+04.54	PI Sta 12+36.09	PI Sta 16+32.55
Δ = 68° 38' 29.4" (RT)	Δ = 3° 12' 49.8" (LT)	Δ = 16° 39' 22.3" (LT)
D = 45° 50' 11.8"	D = 2° 23' 39.5"	D = 2° 32' 47.3"
L = 149.75'	L = 134.23'	L = 654.09'
T = 85.34'	T = 67.13'	T = 329.37'
R = 125.00'	R = 2,393.00'	R = 2,250.00'
V = 20 MPH	V = 25 MPH	V = 25 MPH
e = 0.02	e = -0.02	e = -0.02

SEE SHEET NO. 20 FOR -L- PROFILE.
SEE SHEET NO. 30 FOR -Y- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassrac DATE: 4/20/2012 TIME: 2:06:33 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_04.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

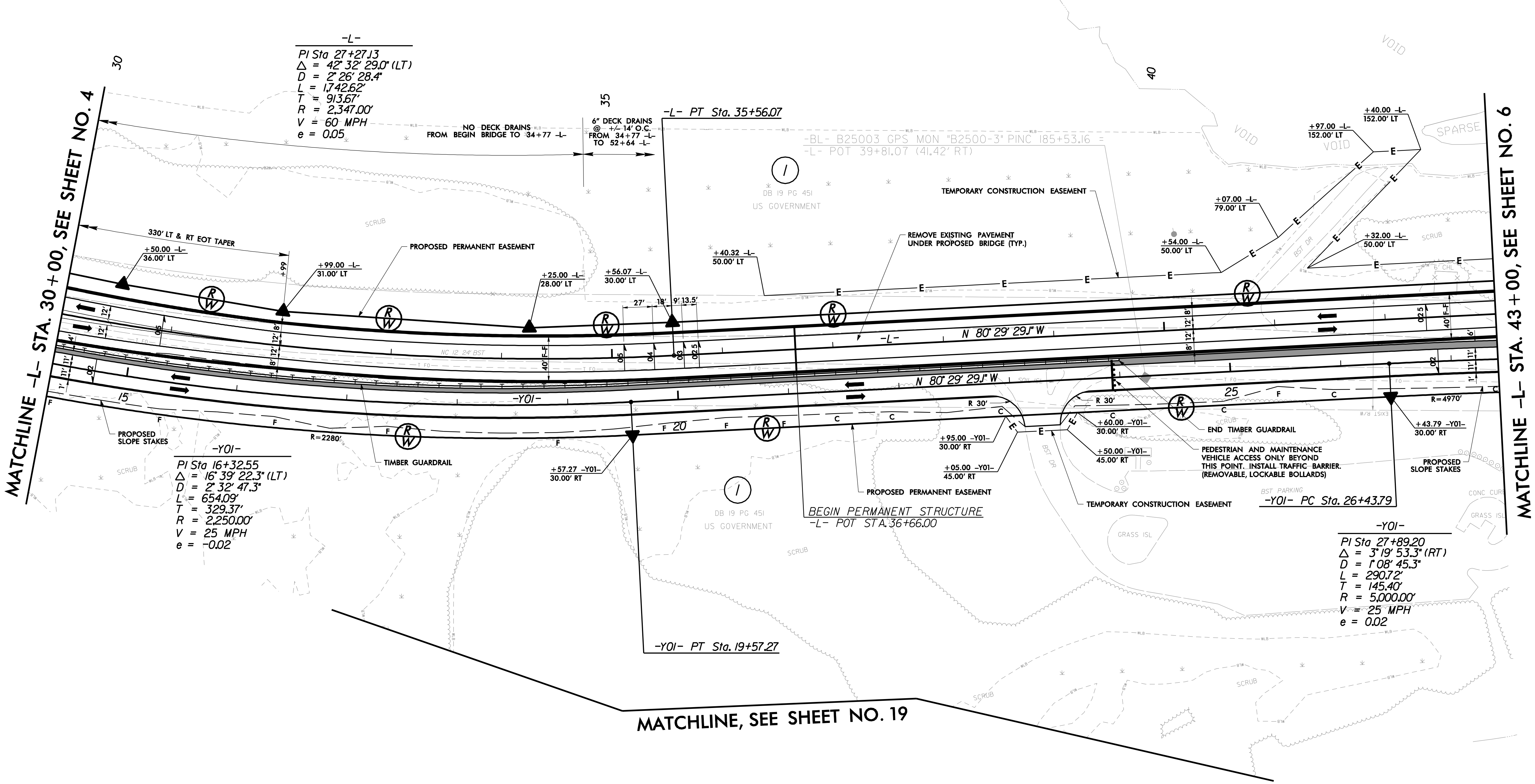
PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

NAD 83/NSRS 2007



SEE SHEET NO. 20 FOR -L- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

REVISIONS

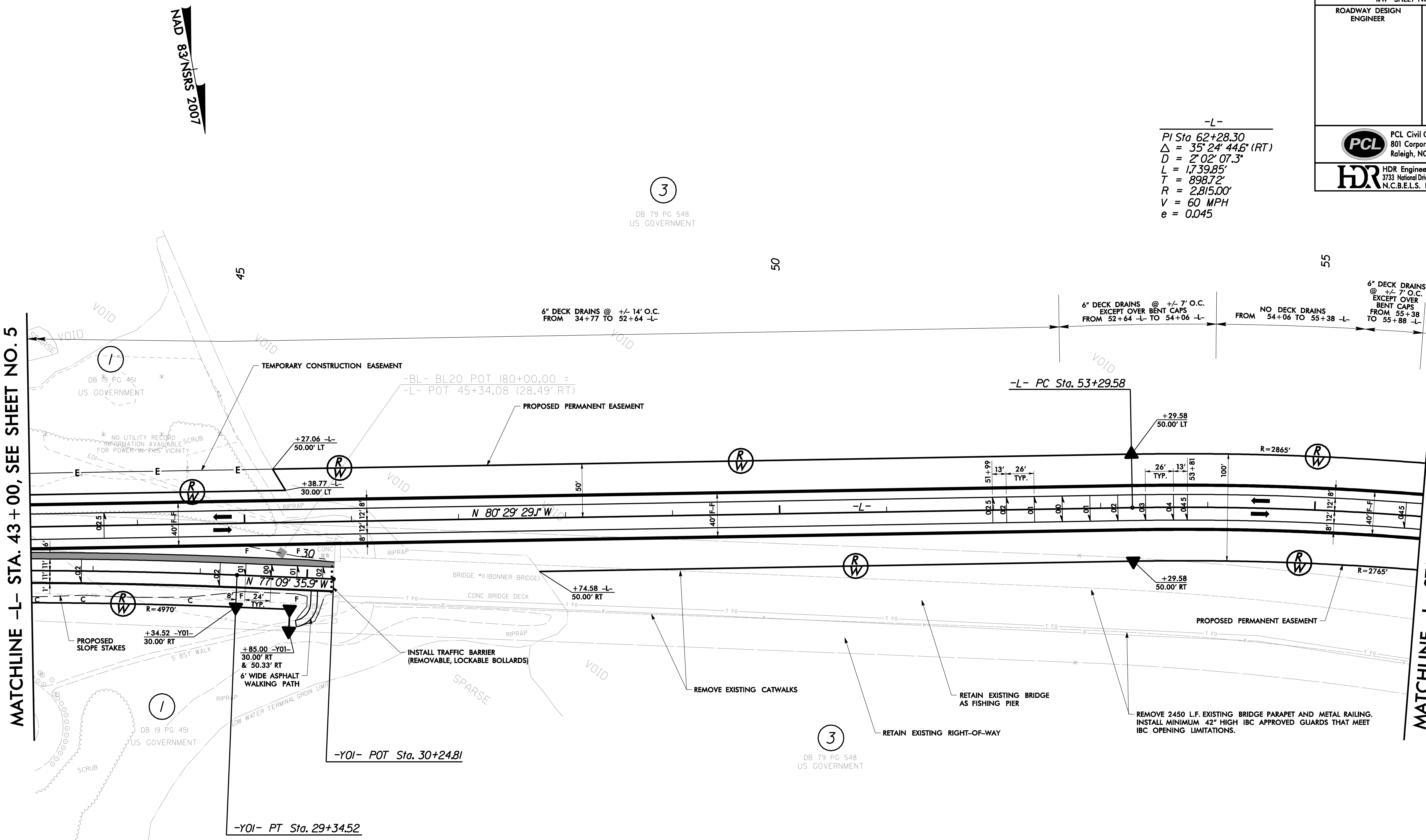
PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassroc DATE: 4/20/2012 TIME: 2:06:59 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_05.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

-L-
PI Sta 62+28.30
Δ = 35° 24' 44.6" (RT)
D = 2° 02' 07.3"
L = 1,739.85'
T = 898.72'
R = 2,815.00'
V = 60 MPH
e = 0.045



-Y01-
PI Sta 27+89.20
Δ = 3° 19' 53.3" (RT)
D = 1° 08' 45.3"
L = 290.72'
T = 145.40'
R = 5,000.00'
V = 25 MPH
e = 0.02

SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 21 FOR -L- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

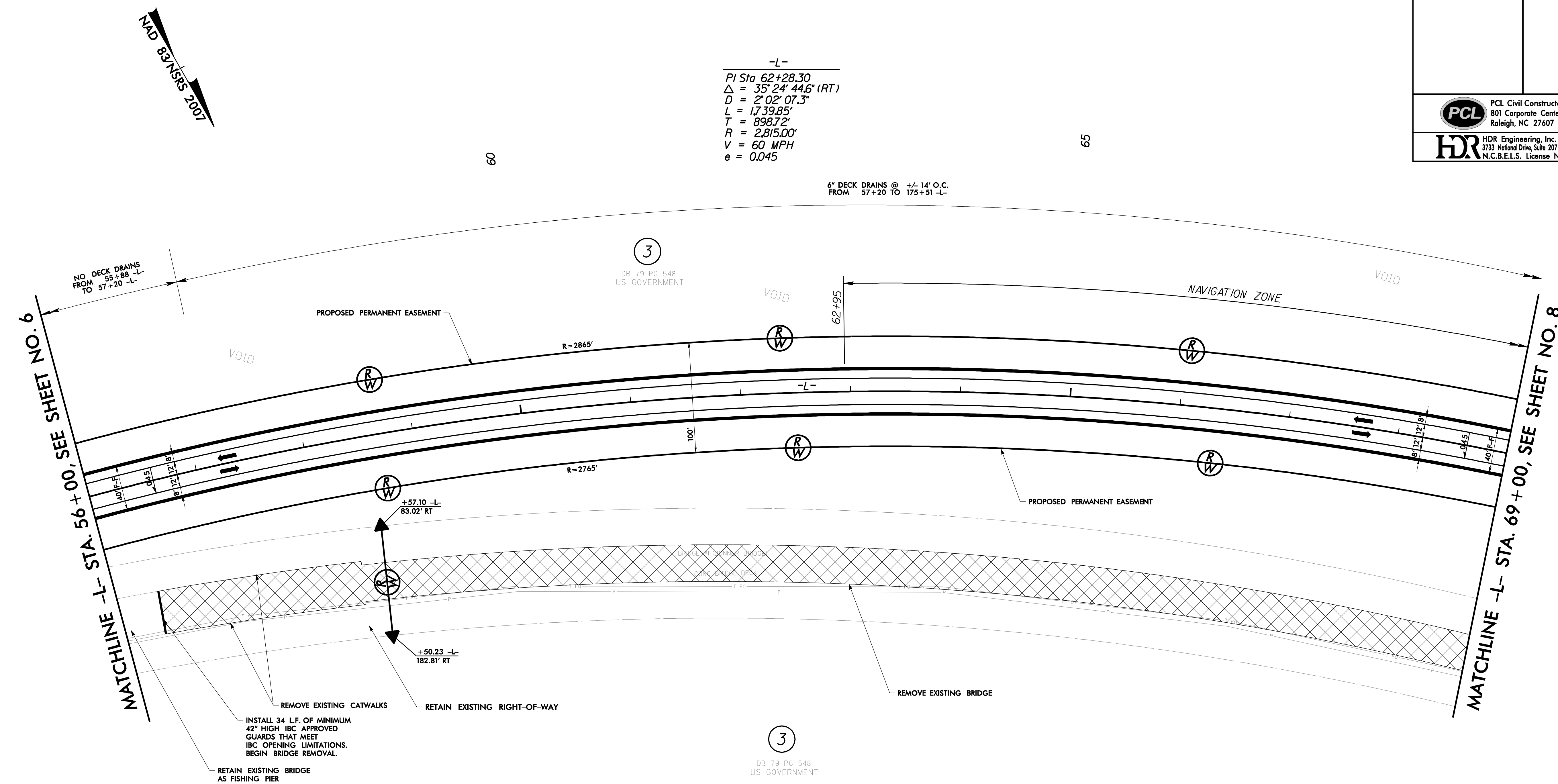
REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmossroc DATE: 4/20/2012 TIME: 2:07:24 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_06.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 22 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
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FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_07.dgn

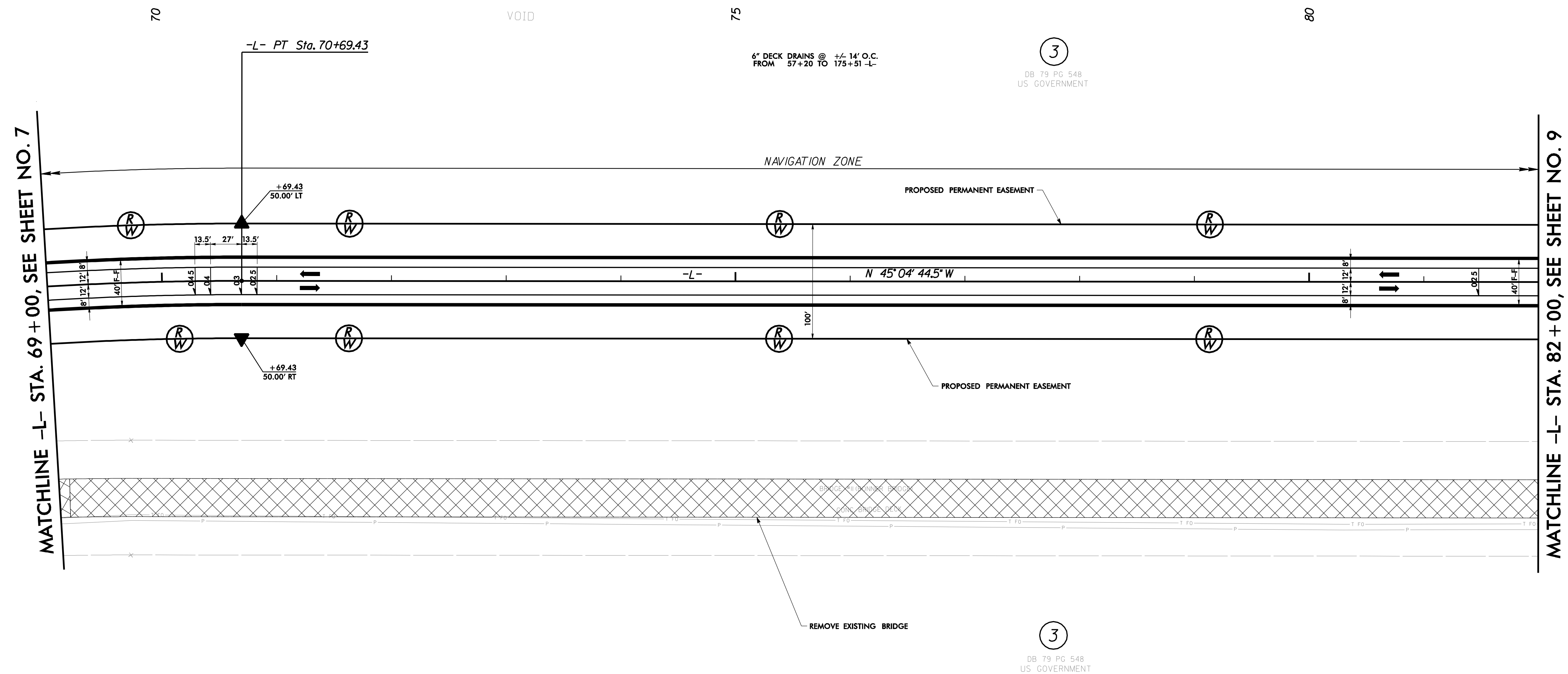
PROJECT REFERENCE NO.	SHEET NO.
B-2500	8
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

NAD 83/NSRS 2007

-L-
PI Sta 62+28.30
Δ = 35° 24' 44.6" (RT)
D = 2° 02' 07.3"
L = 1,739.85'
T = 898.72'
R = 2,815.00'
V = 60 MPH
e = 0.045



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 23 FOR -L- PROFILE.

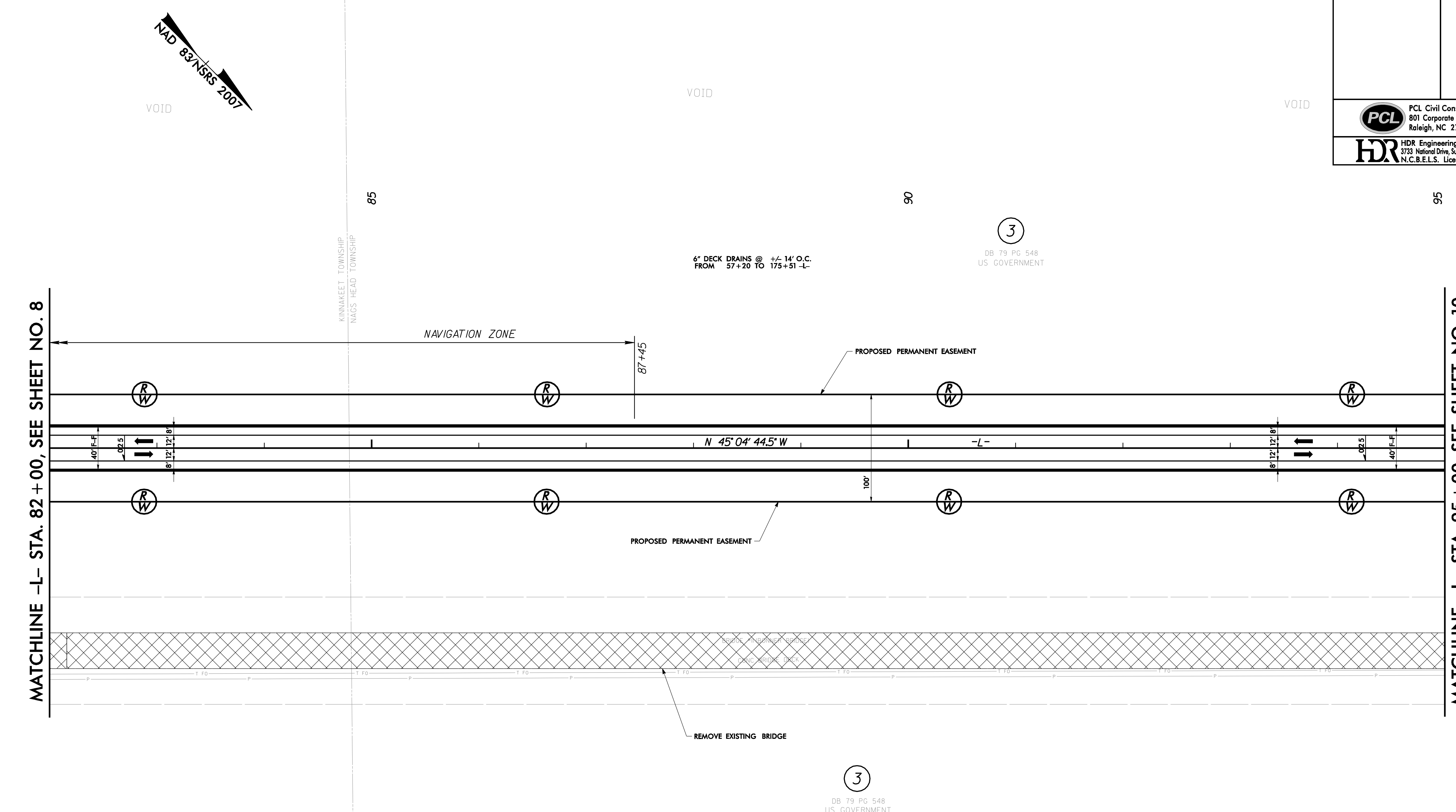
REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassroc DATE: 4/20/2012 TIME: 2:08:04 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_08.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	9
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



REVISIONS

SAV LEGEND

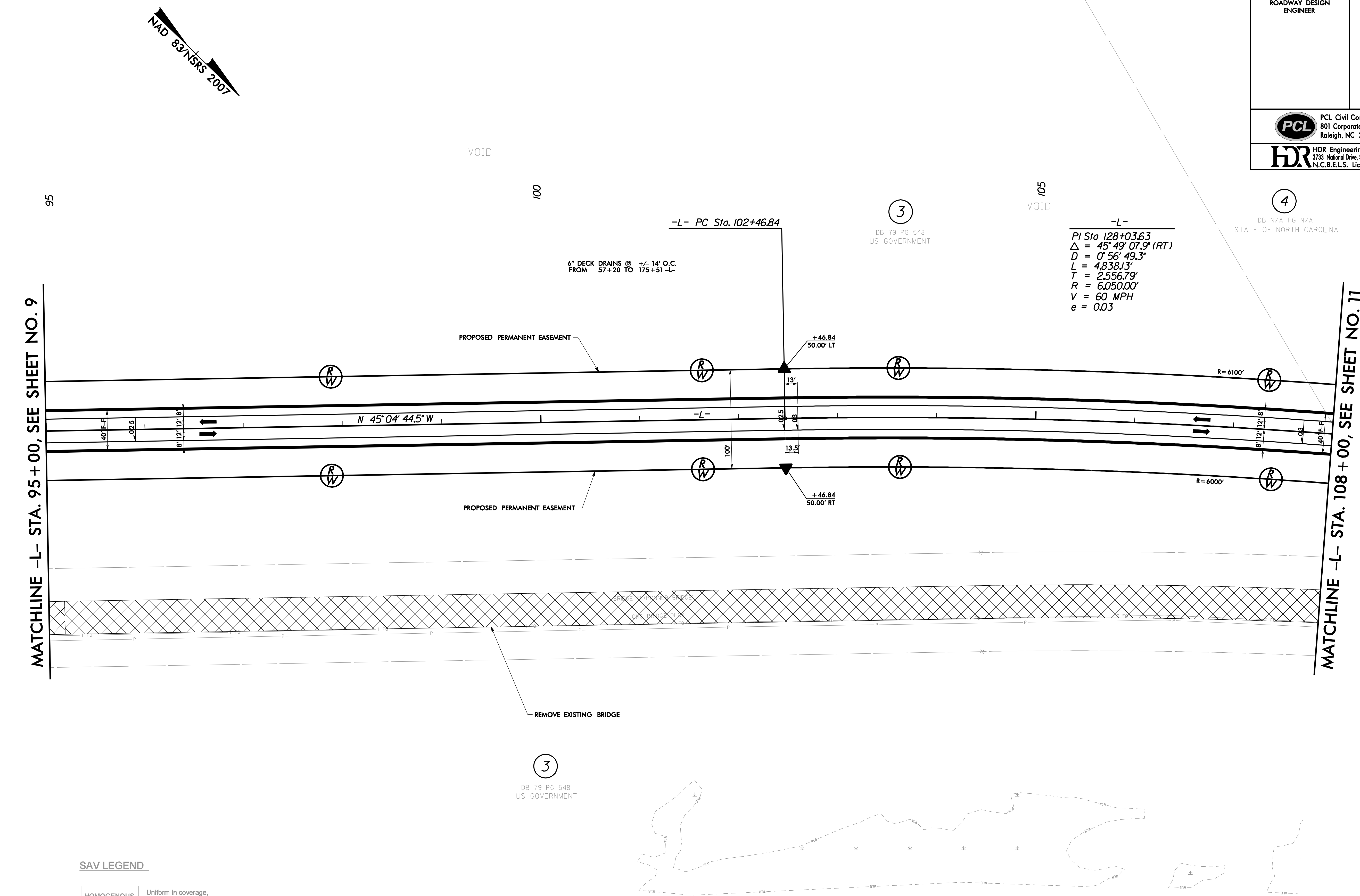
HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 24 FOR -L- PROFILE.

PROJECT REFERENCE NO.	SHEET NO.
B-2500	10
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 25 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassroc DATE: 4/20/2012 TIME: 2:08:46 PM
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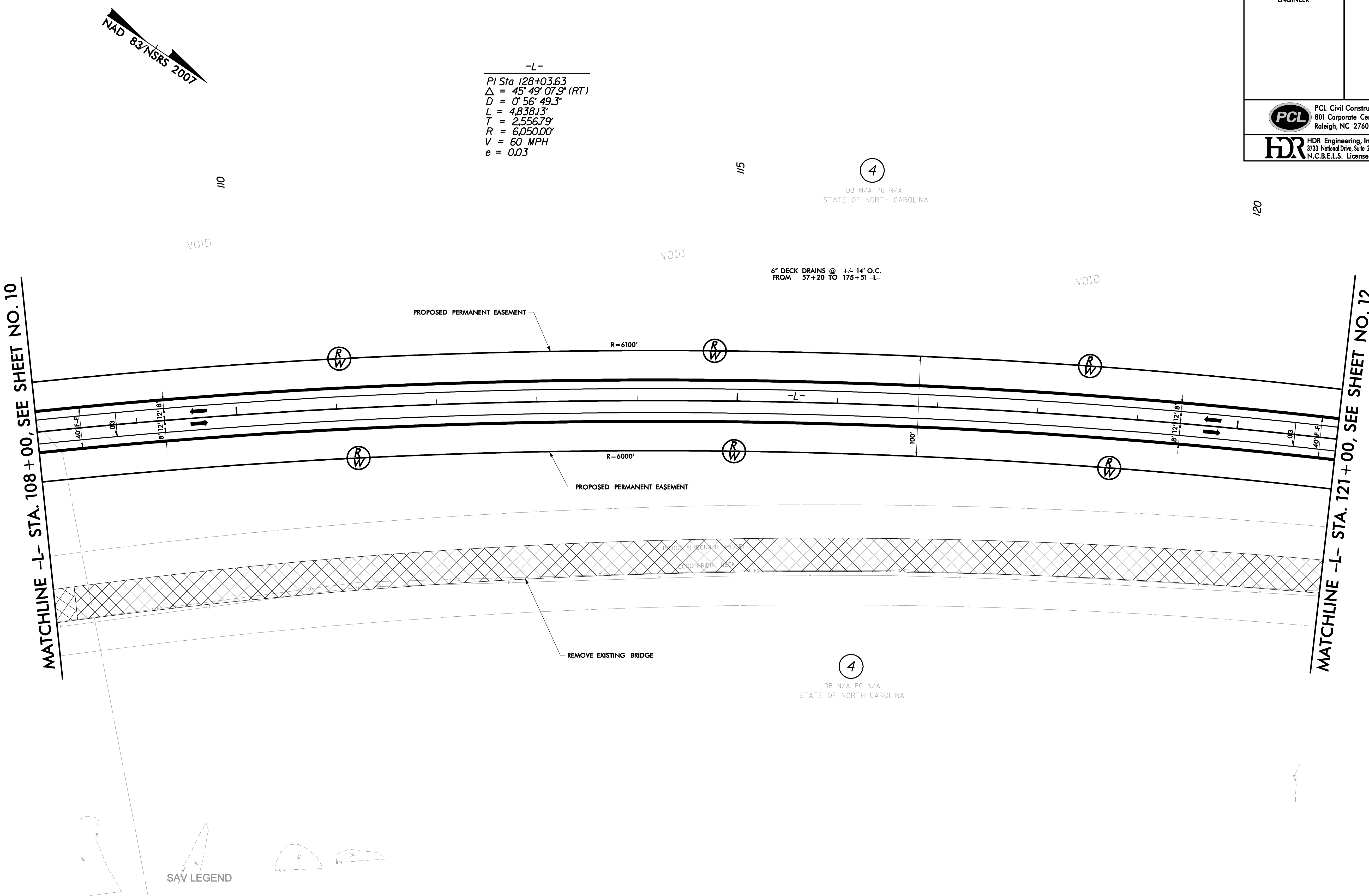
PROJECT REFERENCE NO.	SHEET NO.
B-2500	11
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 26 FOR -L- PROFILE.

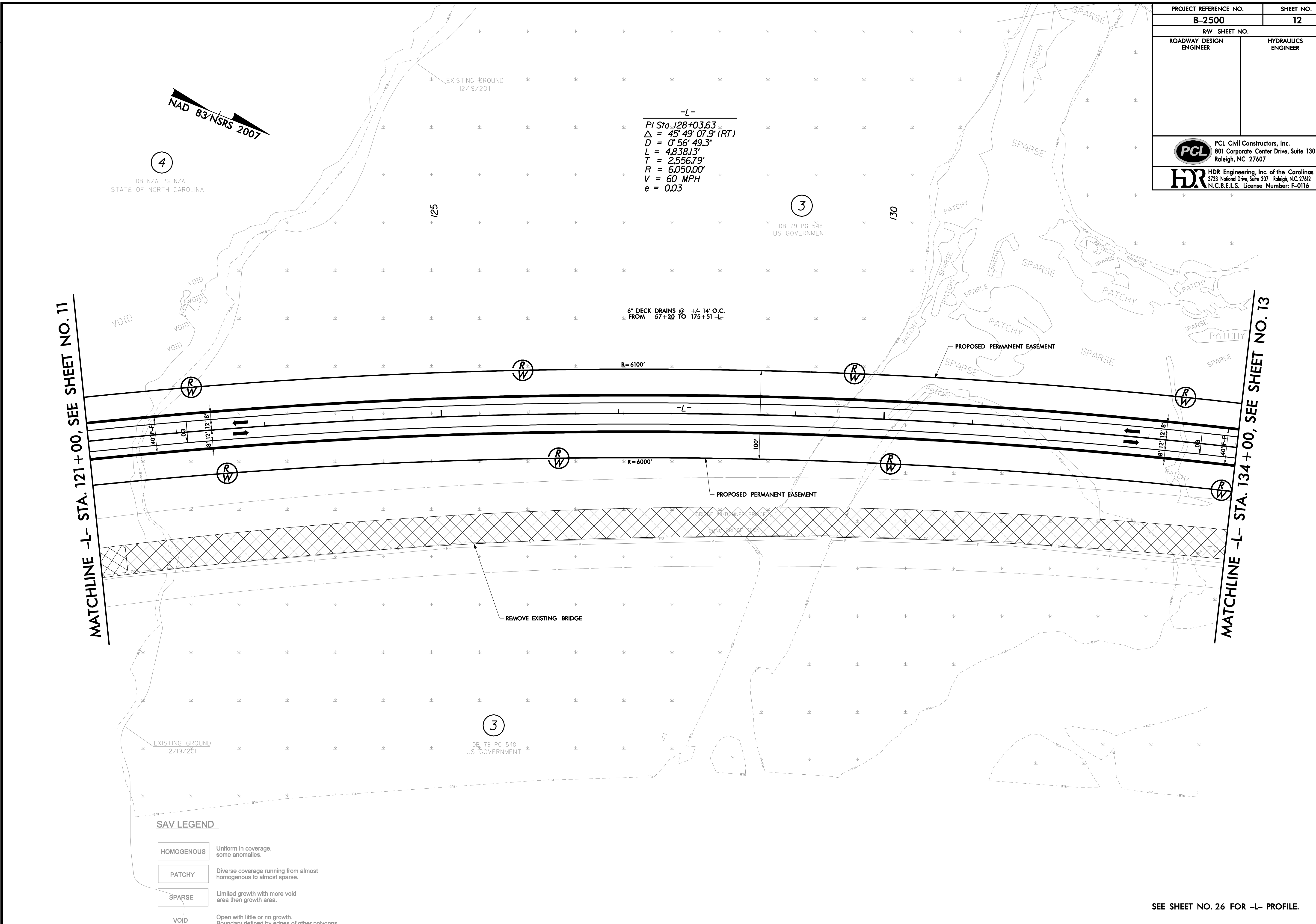
REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassroc DATE: 4/20/2012 TIME: 2:09:07 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_11.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	12
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



SEE SHEET NO. 26 FOR -L- PROFILE.

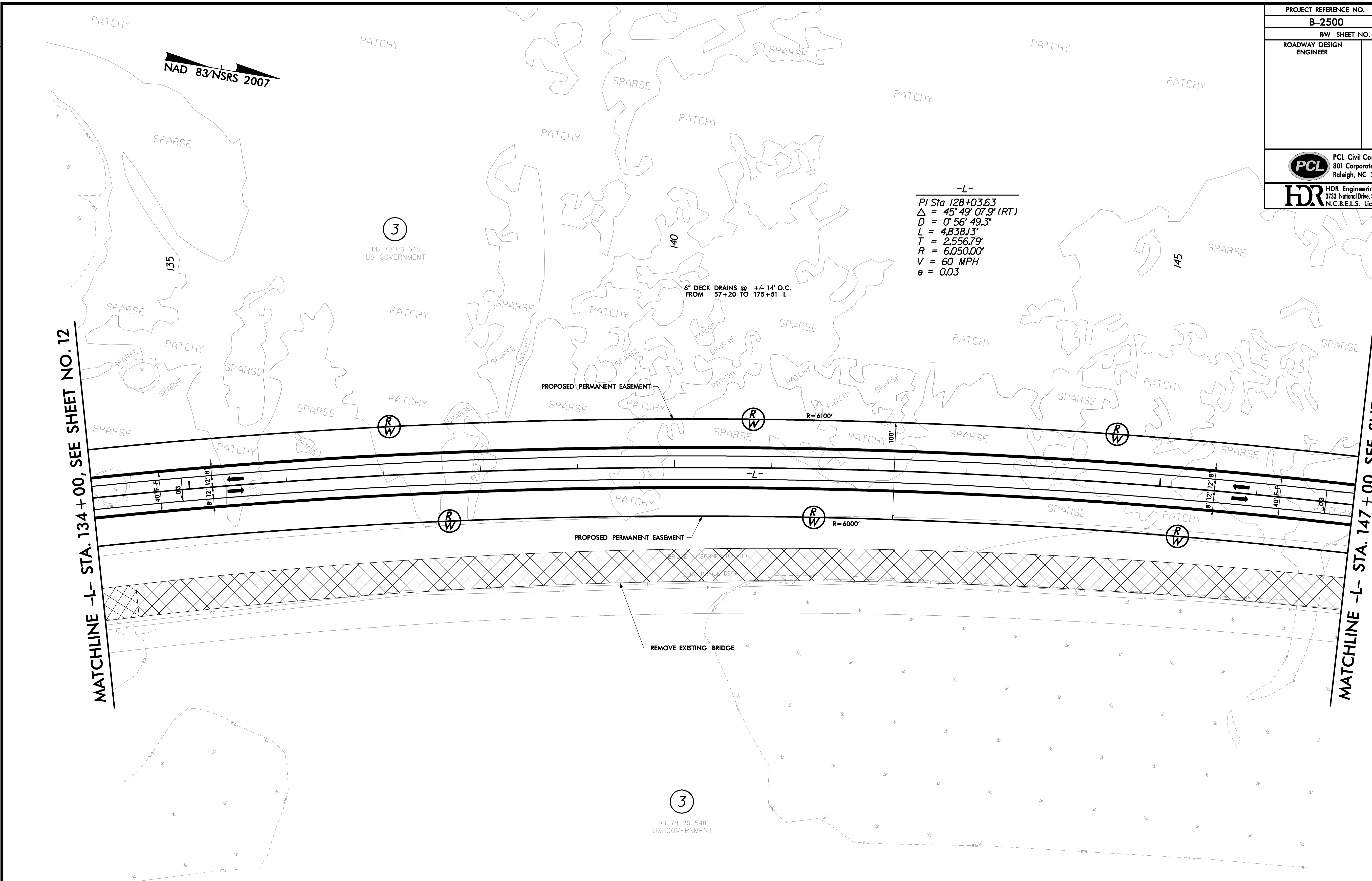
REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassroc DATE: 4/20/2012 TIME: 2:09:26 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_12.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	13
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



REVISIONS

SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

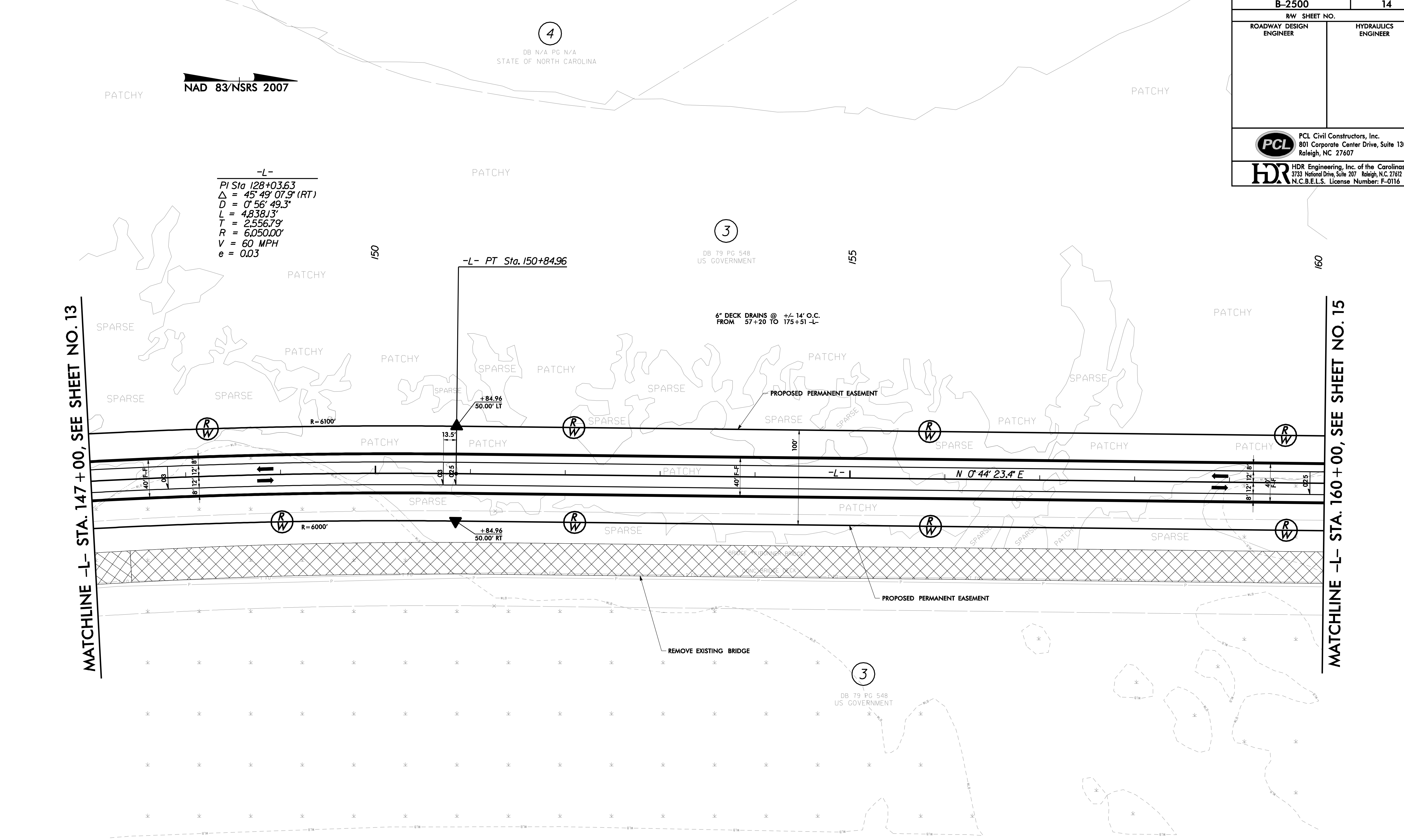
SEE SHEET NO. 27 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassroc DATE: 4/20/2012 TIME: 2:09:47 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_13.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	14
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 27 FOR -L- PROFILE.

REVISIONS

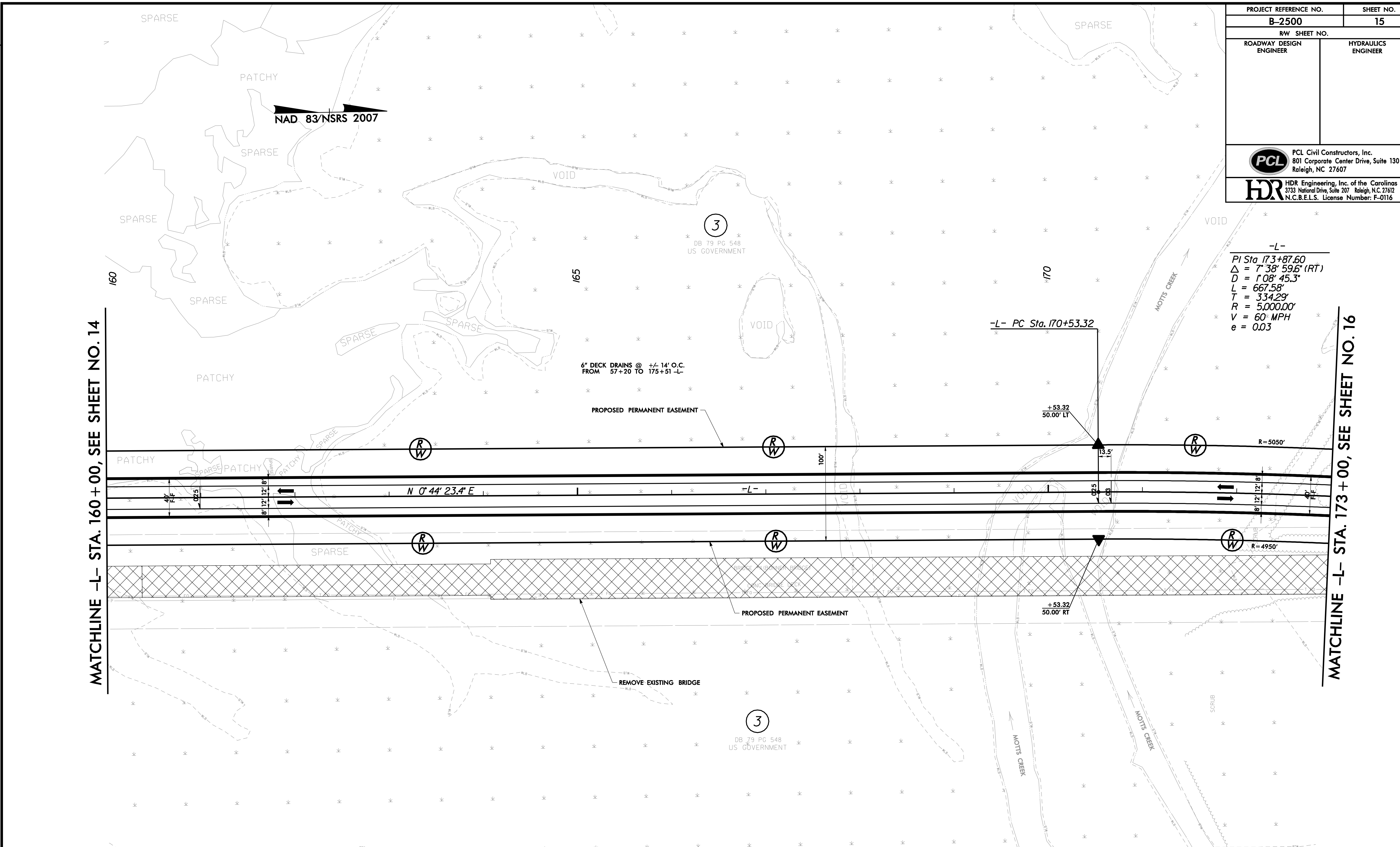
PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
USER: jmassroc DATE: 4/20/2012 TIME: 2:10:07 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_14.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	15
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116

REVISIONS



SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 28 FOR -L- PROFILE.

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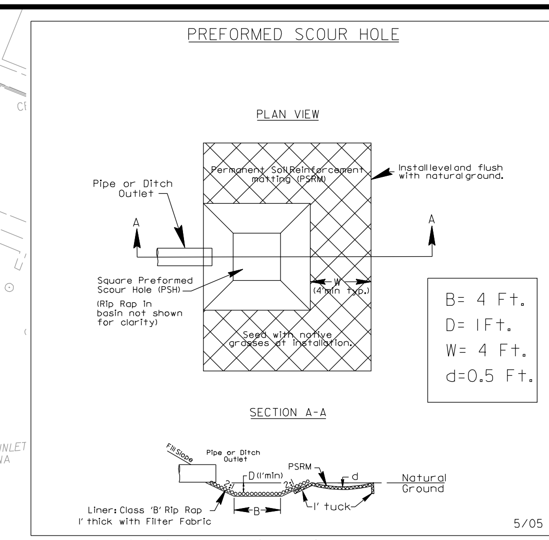
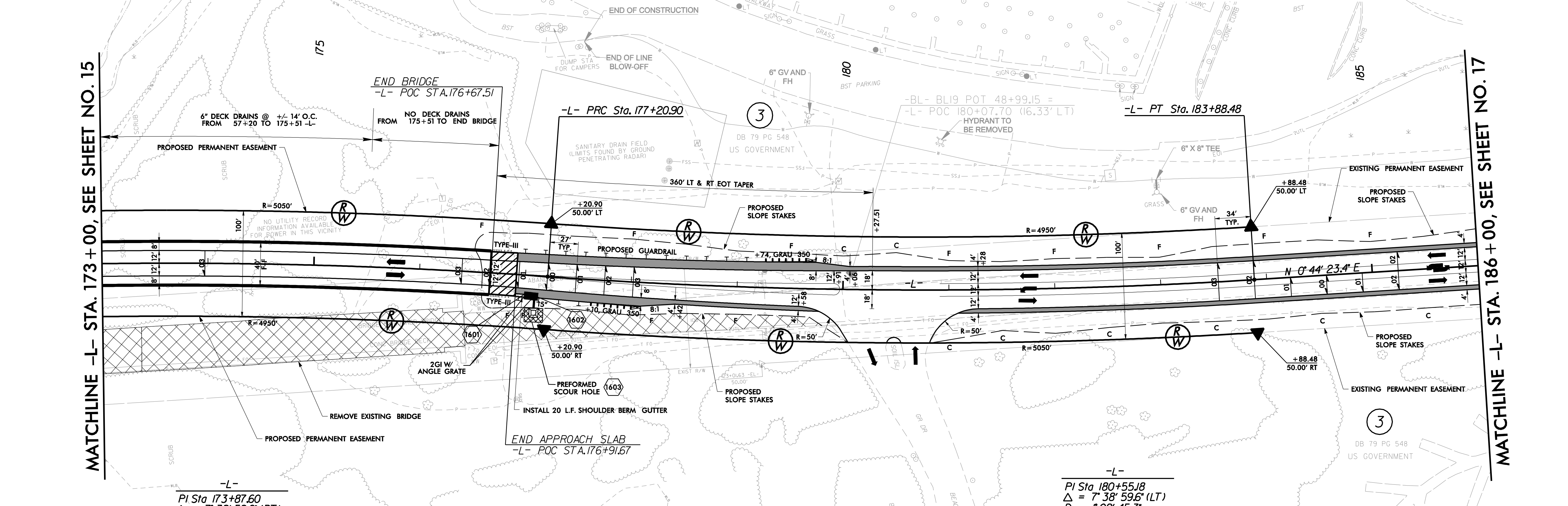
PROJECT REFERENCE NO.	SHEET NO.
B-2500	16
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



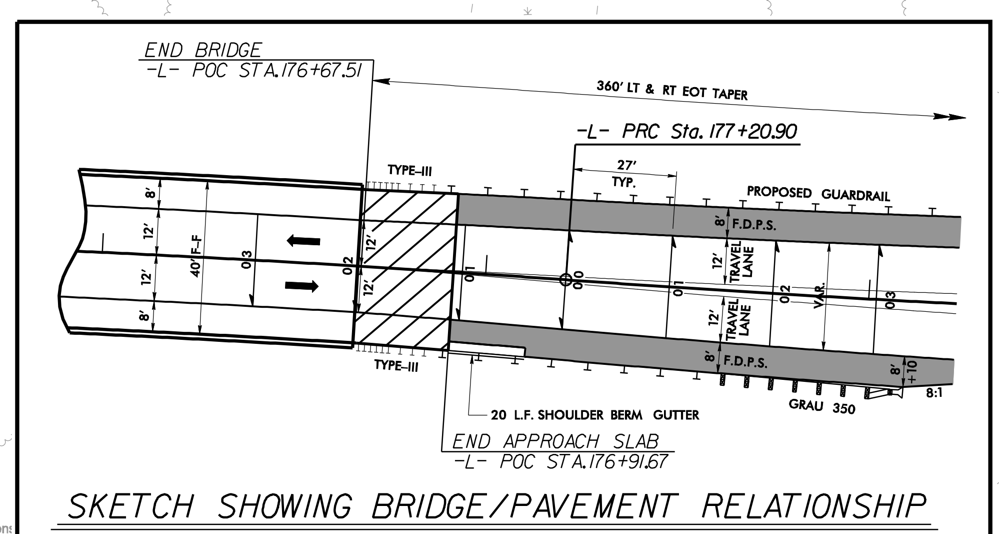


-L-
PI Sta 173+87.60
Δ = 7° 38' 59.6" (RT)
D = 1° 08' 45.3"
L = 667.58'
T = 334.29'
R = 5,000.00'
V = 60 MPH
e = 0.03

-L-
PI Sta 180+55.18
Δ = 7° 38' 59.6" (LT)
D = 1° 08' 45.3"
L = 667.58'
T = 334.29'
R = 5,000.00'
V = 60 MPH
e = 0.03

SAV LEGEND

HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area then growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons



SKETCH SHOWING BRIDGE/PAVEMENT RELATIONSHIP

SEE SHEET NO. 28 FOR -L- PROFILE.

REVISIONS

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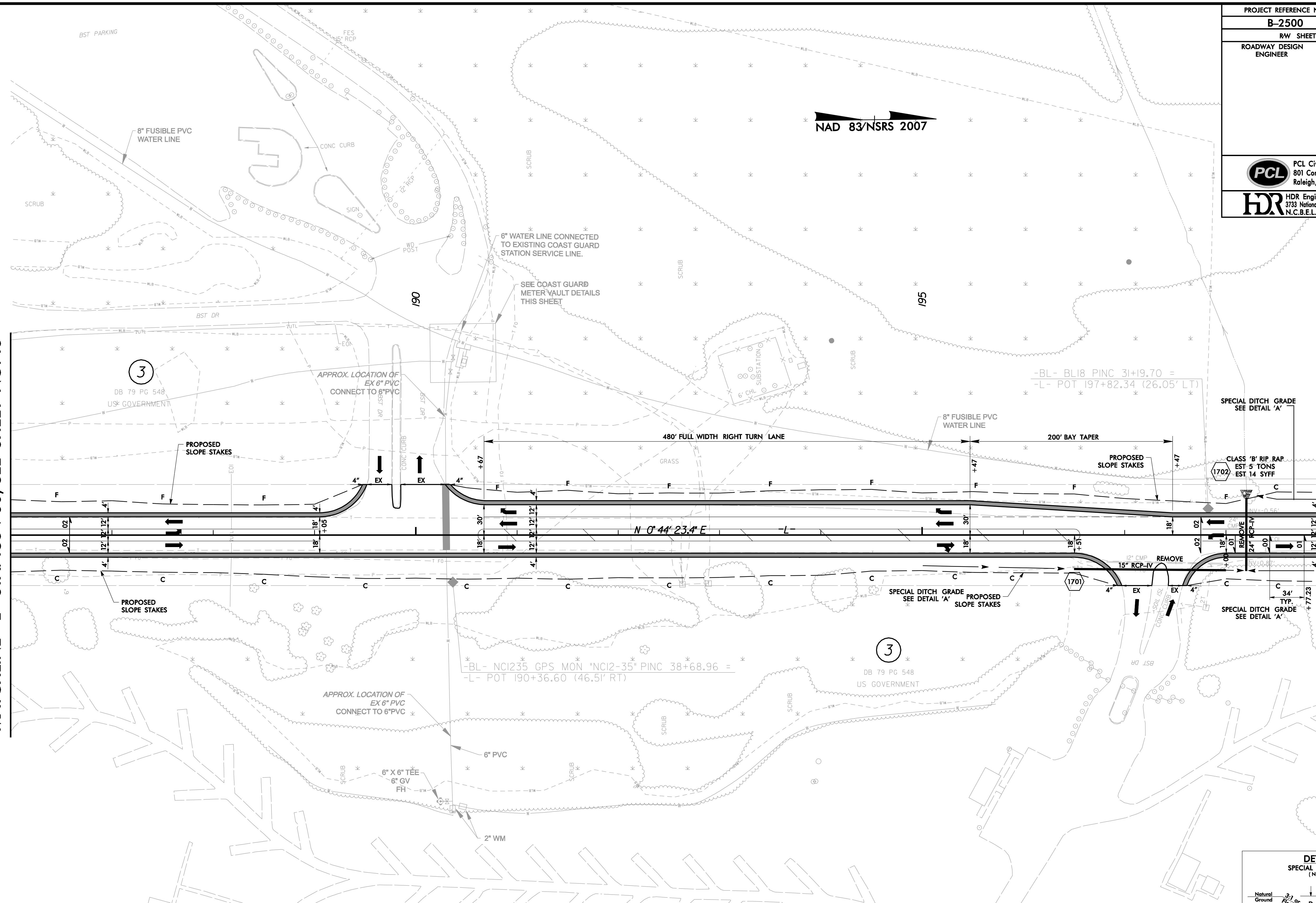
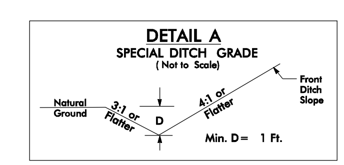
PROJECT REFERENCE NO.	SHEET NO.
B-2500	17
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116





FROM STA. 195+00 TO STA. 196+50 -L- RT
FROM STA. 198+00 TO STA. 198+20 -L- RT
FROM STA. 198+20 TO STA. 206+97 -L- RT
FROM STA. 198+20 TO STA. 206+97 -L- LT

SEE SHEET NO. 29 FOR -L- PROFILE.

REVISIONS

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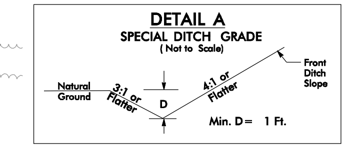
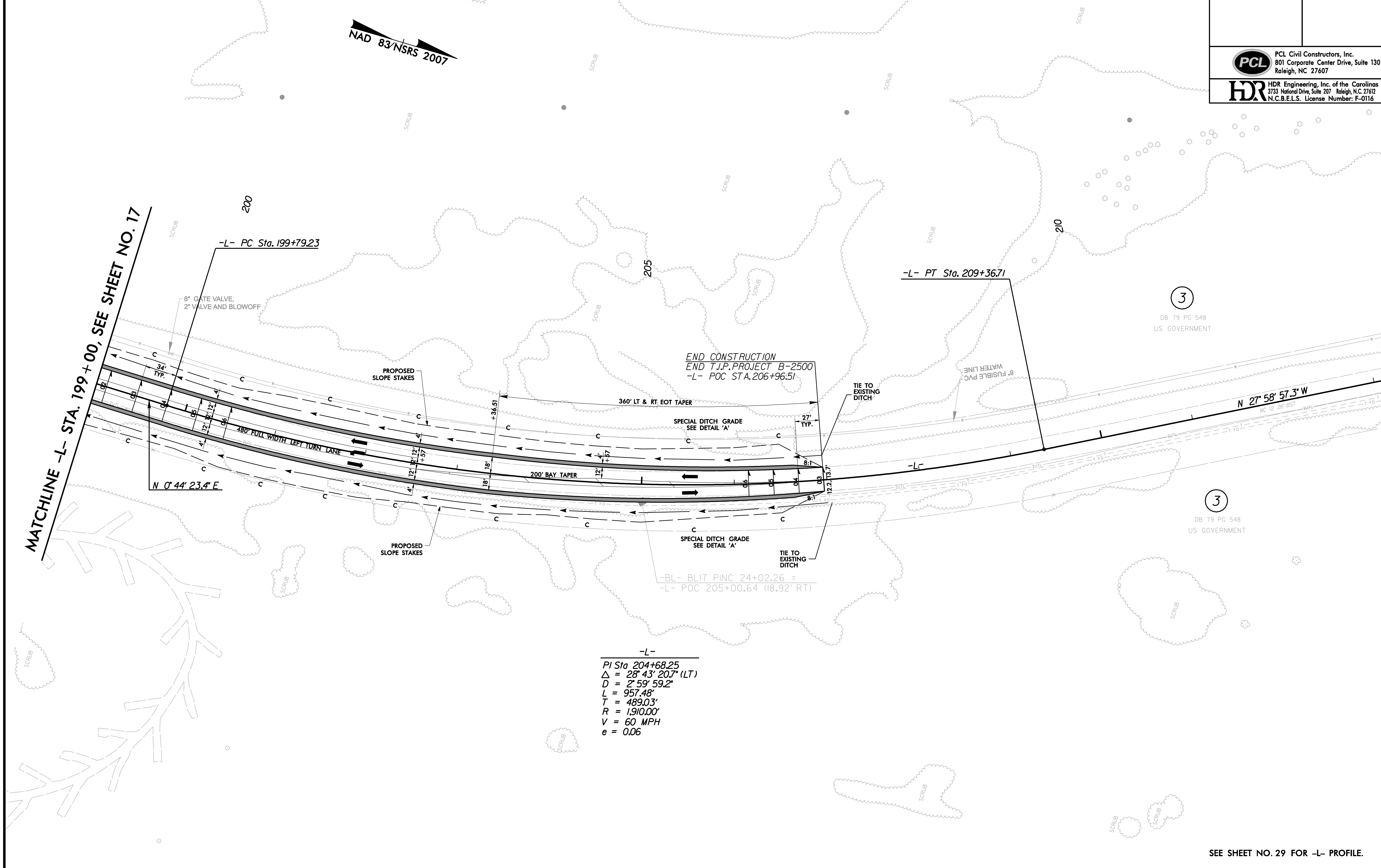
PROJECT REFERENCE NO.	SHEET NO.
B-2500	18
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



FROM STA. 198+20 TO STA. 206+97 -L- LT
FROM STA. 198+20 TO STA. 206+97 -L- RT



-L-
PI Sta 204+68.25
Δ = 28° 43' 20.7" (LT)
D = 2° 59' 59.2"
L = 957.48'
T = 489.03'
R = 1,910.00'
V = 60 MPH
e = 0.06

SEE SHEET NO. 29 FOR -L- PROFILE.

REVISIONS

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt PENTABLE: NCDOT_pshpfl.tbl
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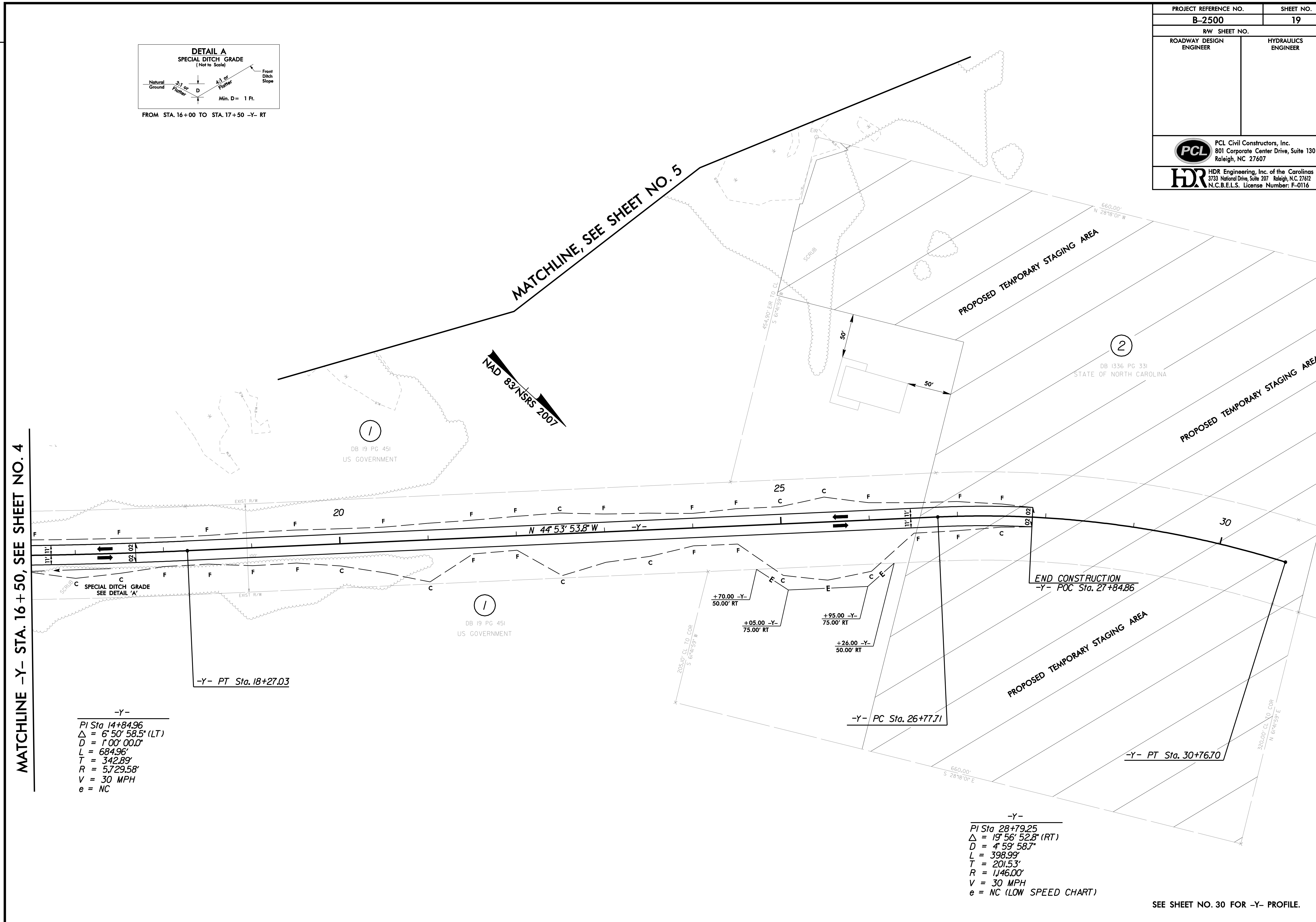

REVISIONS

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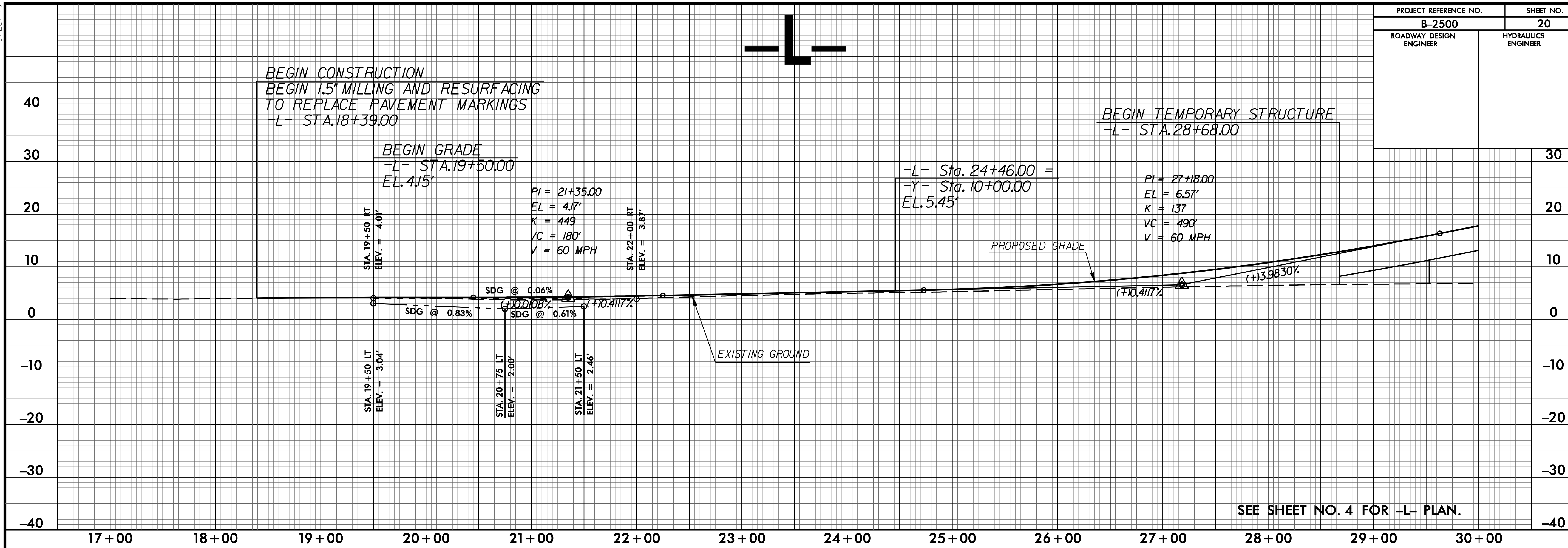
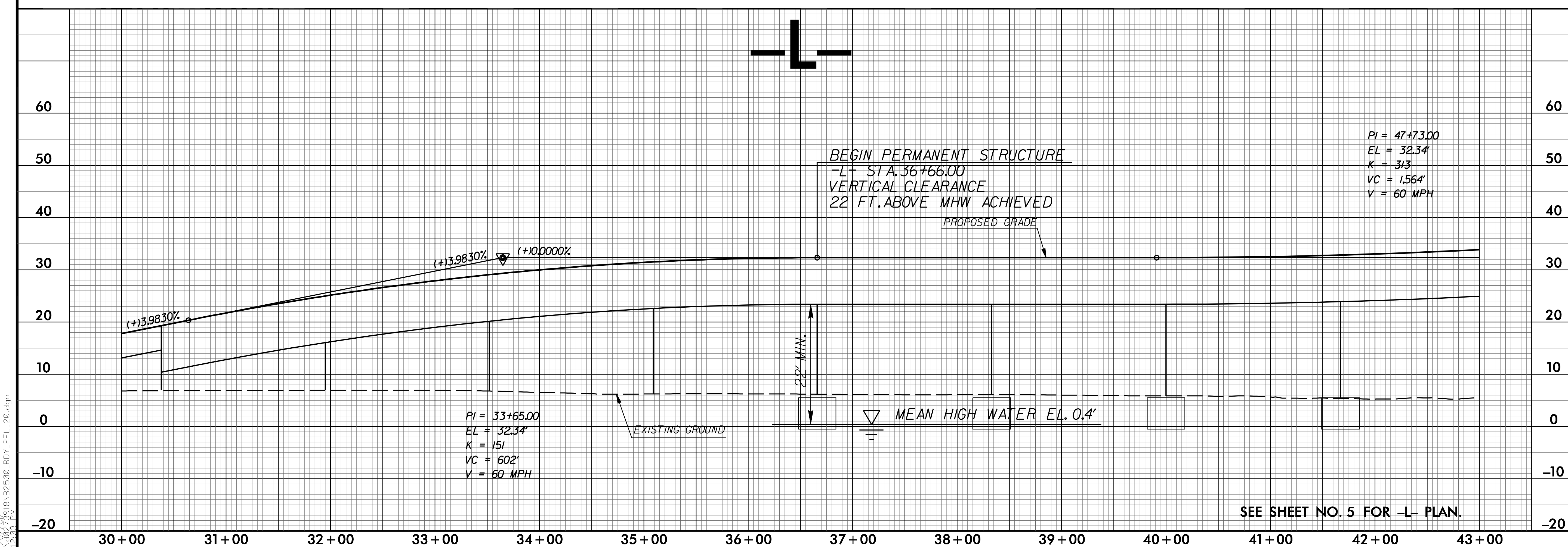
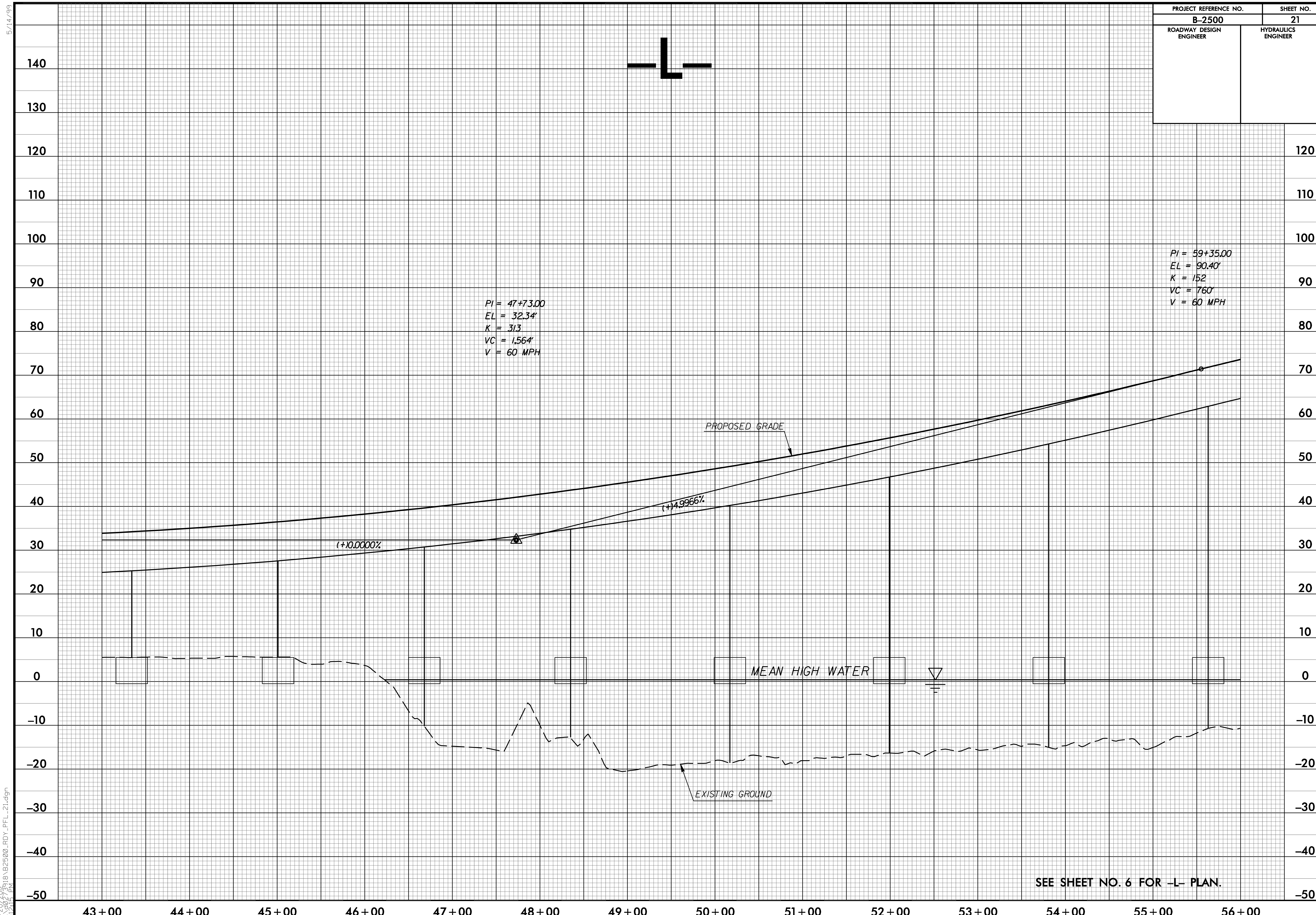
PROJECT REFERENCE NO.	SHEET NO.
B-2500	20
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER





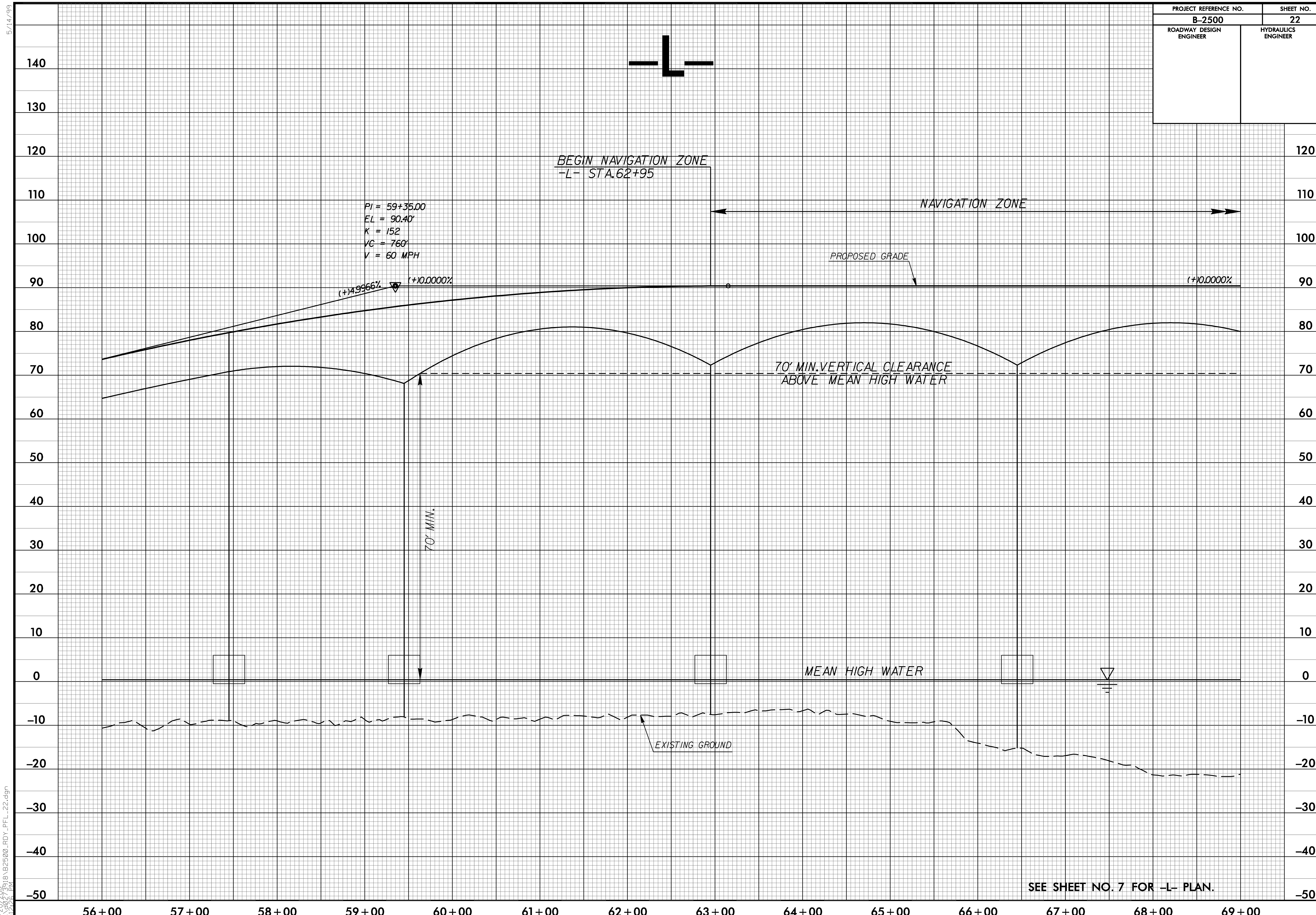
5/28/99

PROJECT REFERENCE NO.	SHEET NO.
B-2500	21
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



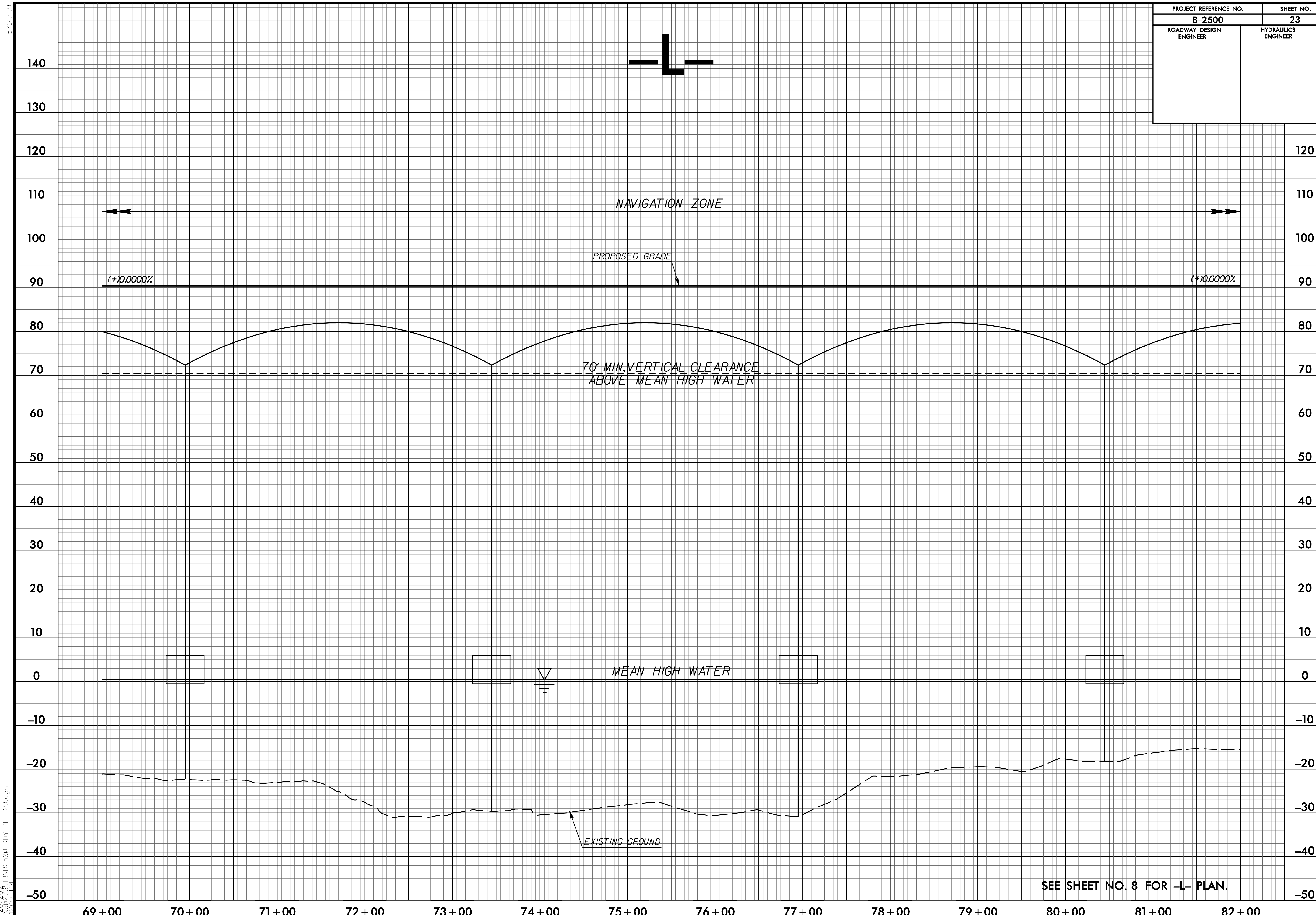
SEE SHEET NO. 6 FOR -L- PLAN.

PROJECT REFERENCE NO.	SHEET NO.
B-2500	22
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



PROJECT REFERENCE NO.	SHEET NO.
B–2500	23

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



SEE SHEET NO. 8 FOR –L– PLAN.

5/14/99

4/20/2012
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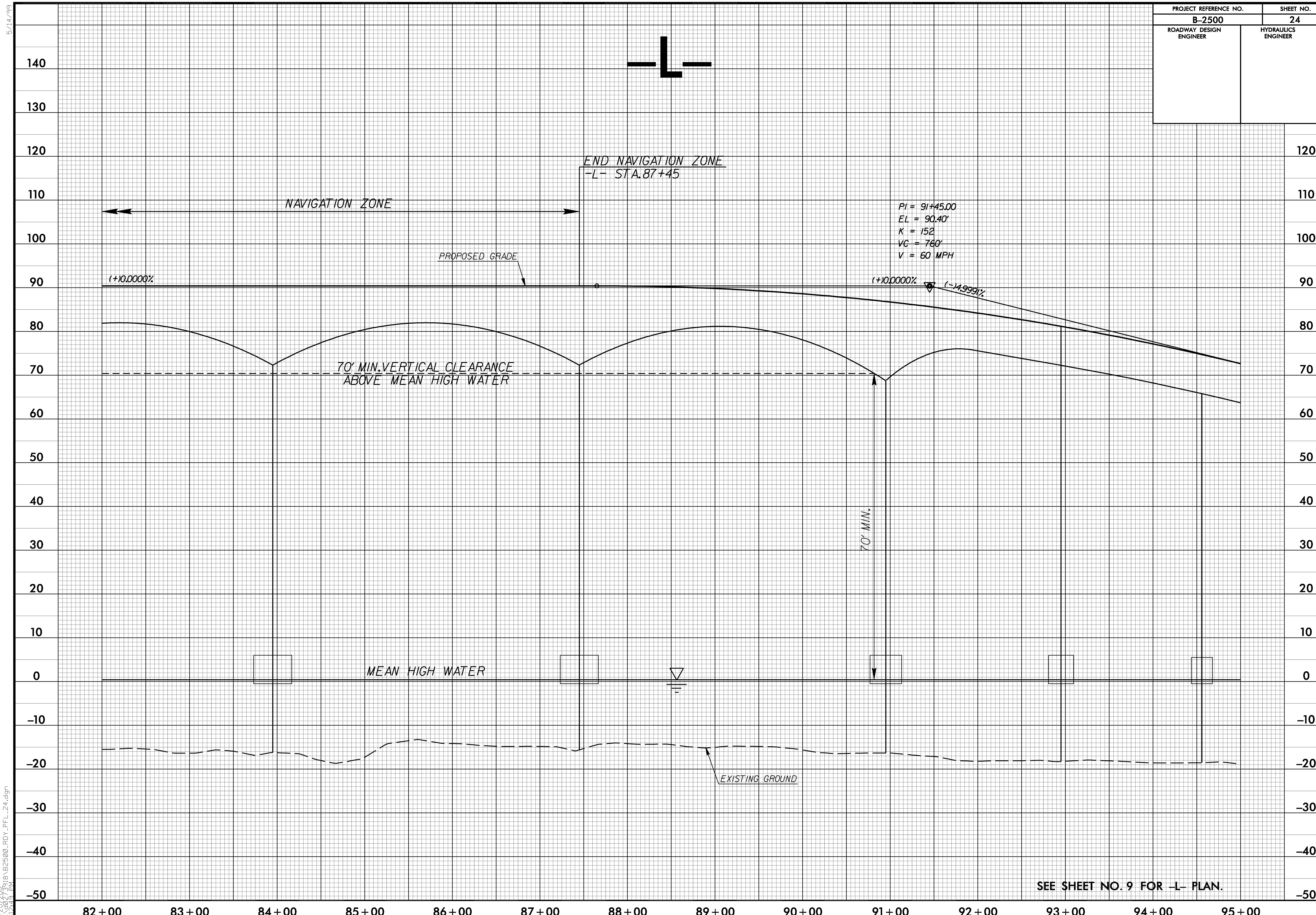
PROJECT REFERENCE NO.	SHEET NO.
B-2500	24
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

-L-

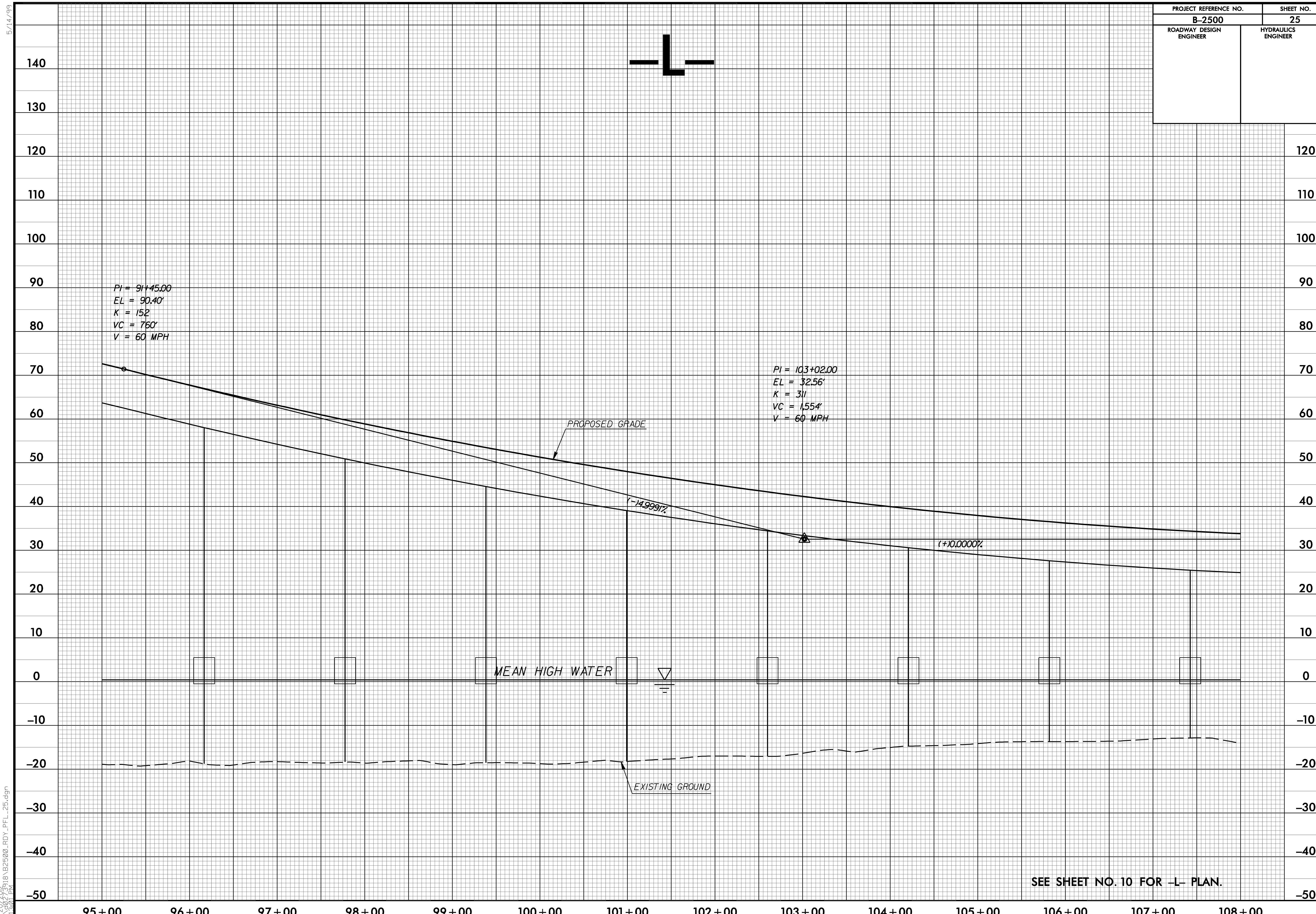


SEE SHEET NO. 9 FOR -L- PLAN.

5/14/99

PROJECT REFERENCE NO.	SHEET NO.
B-2500	25

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



SEE SHEET NO. 10 FOR -L- PLAN.

5/14/99

4/20/2012
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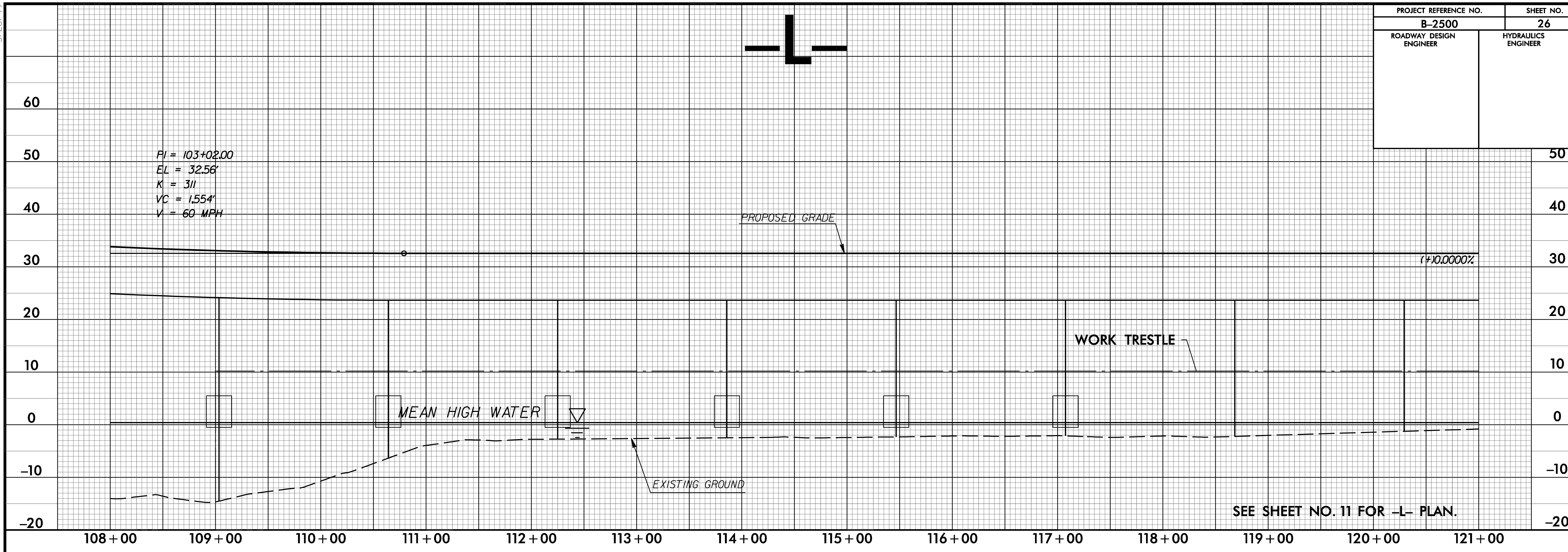
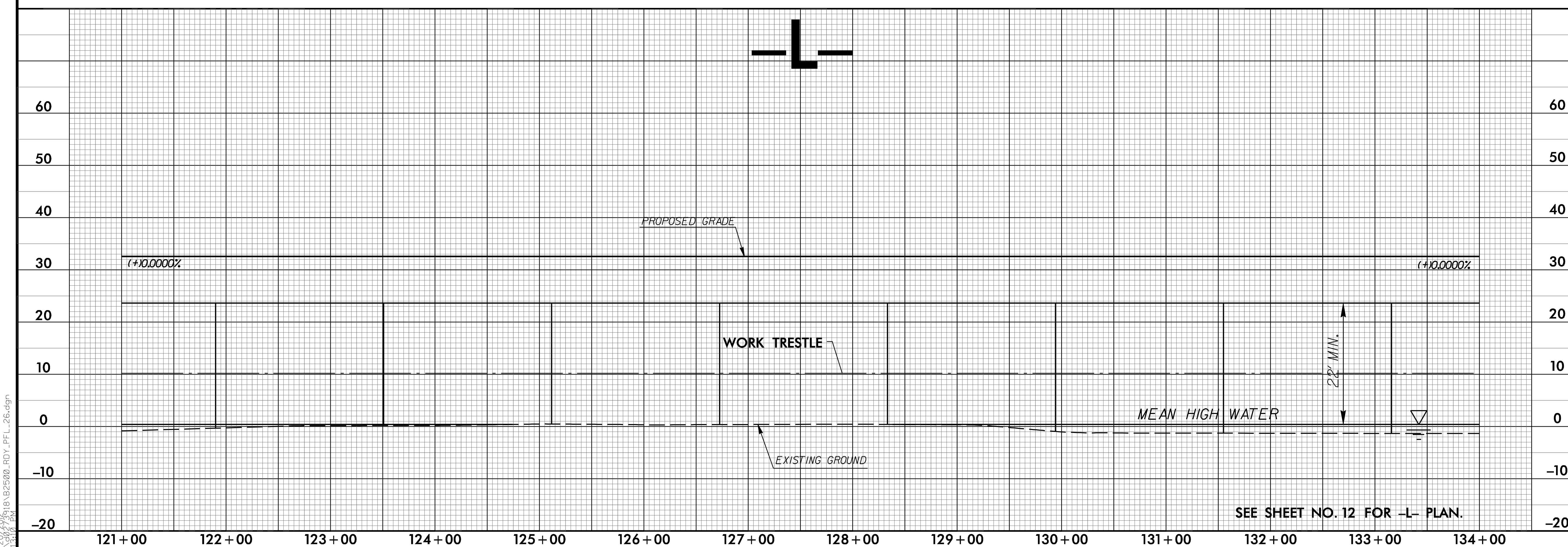
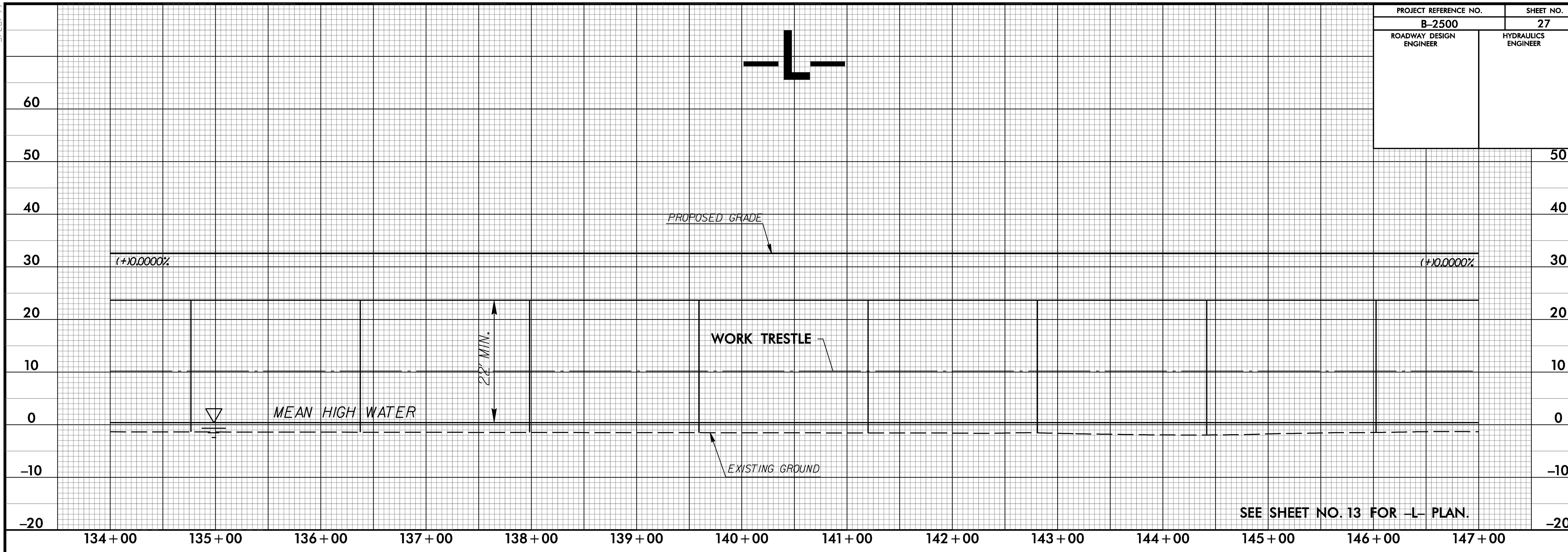
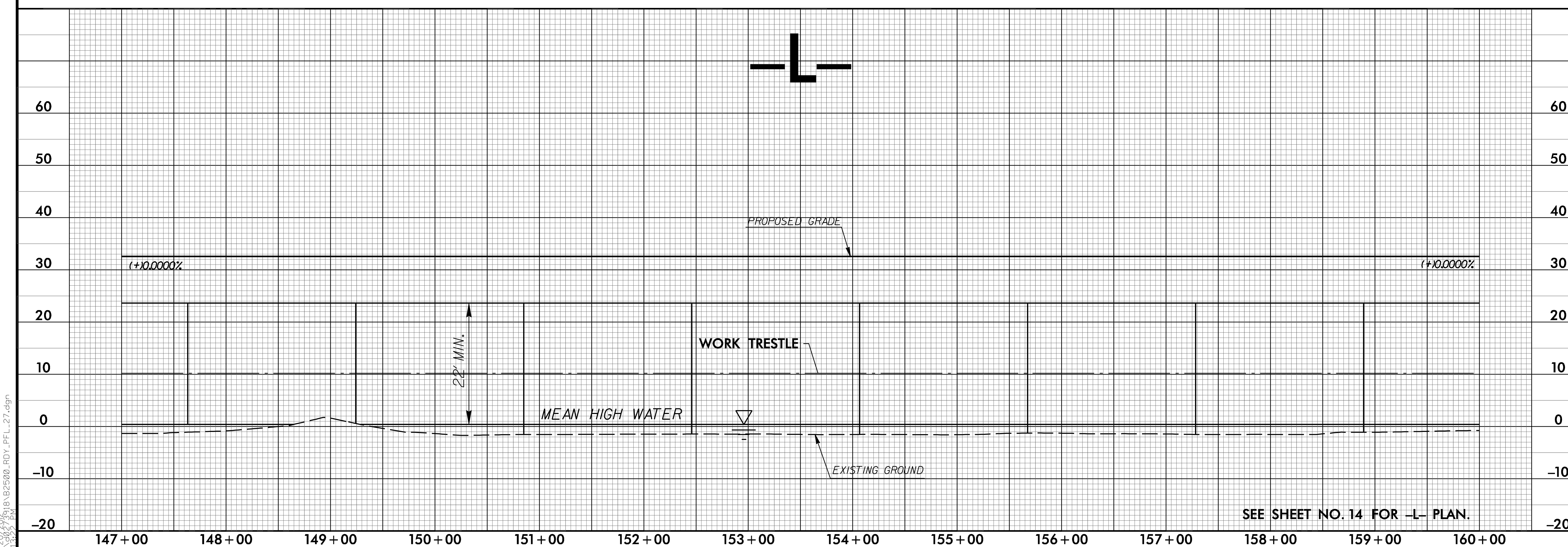
PROJECT REFERENCE NO.	SHEET NO.
B-2500	26
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



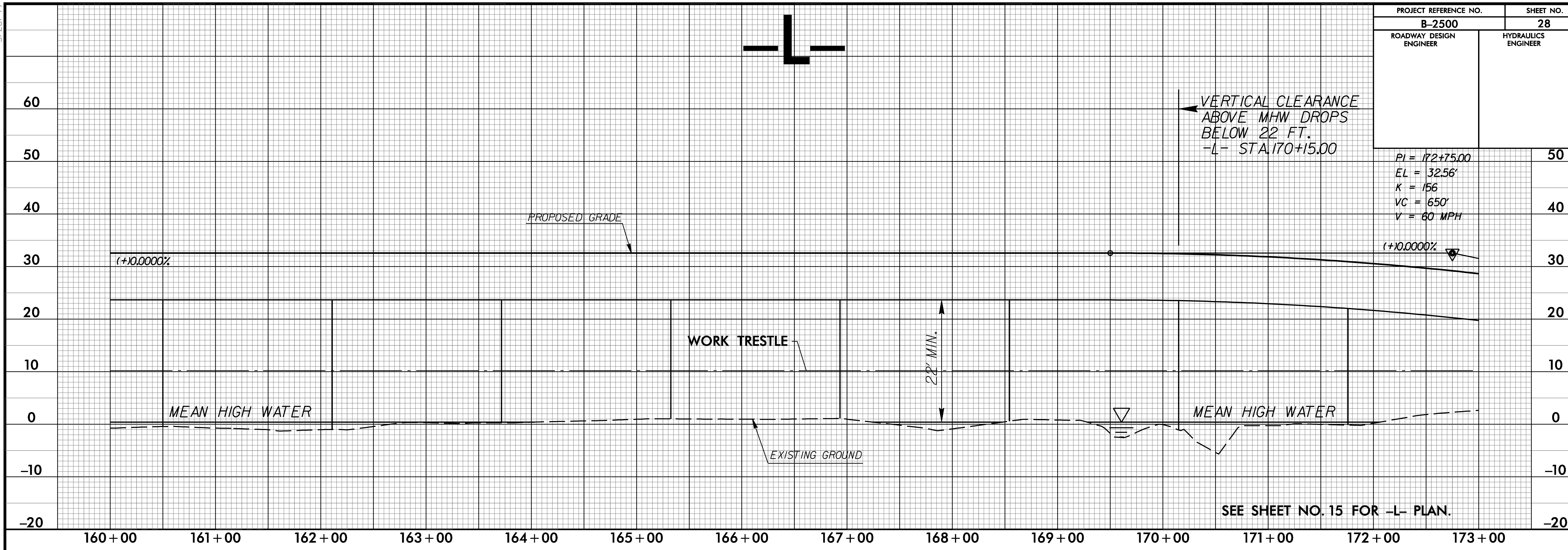


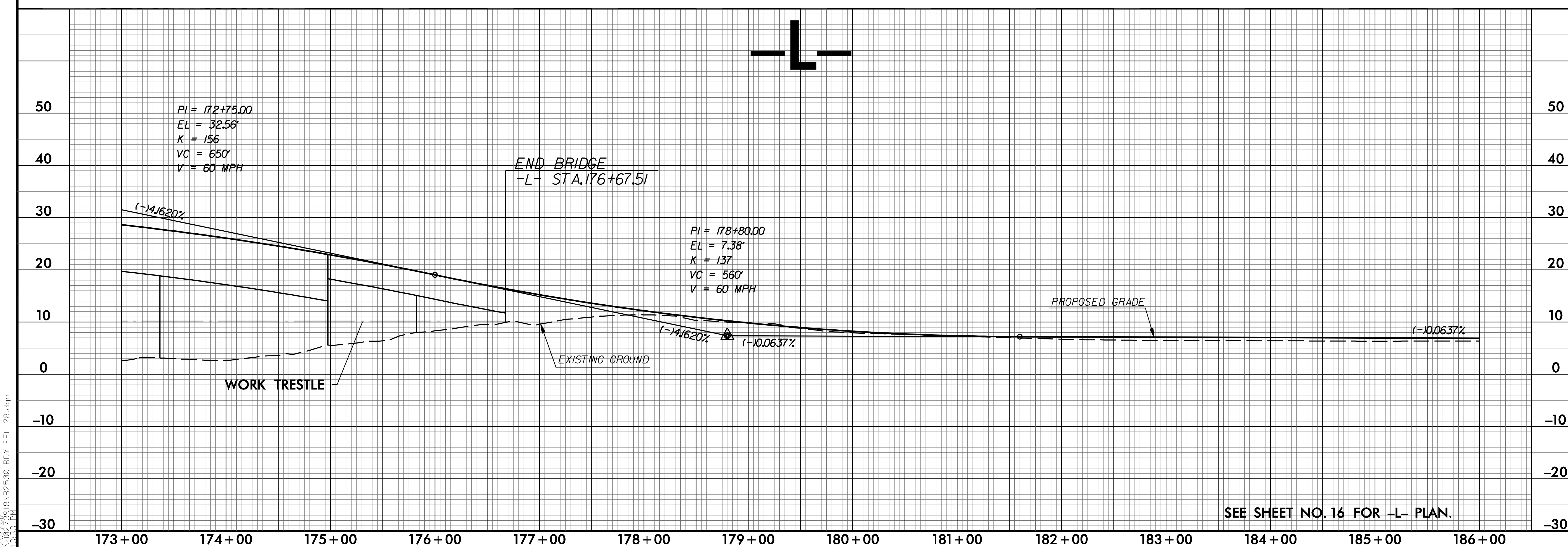
PROJECT REFERENCE NO.	SHEET NO.
B-2500	27
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER





PROJECT REFERENCE NO.	SHEET NO.
B-2500	28
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

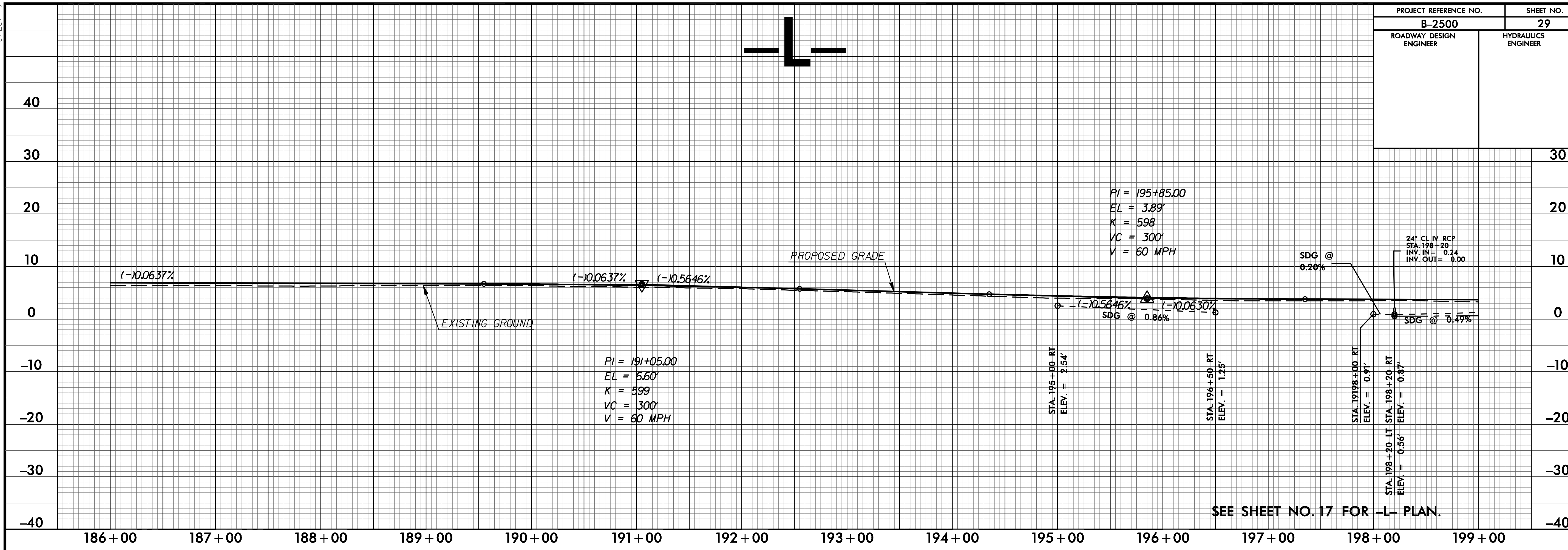


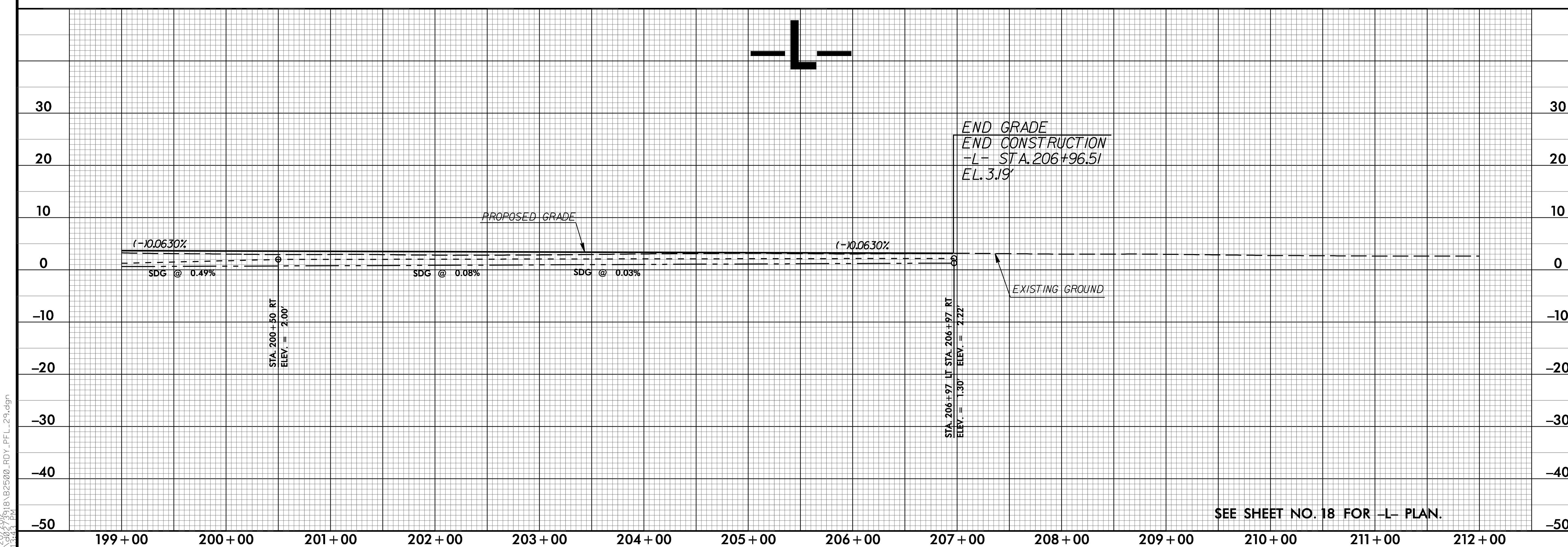


5/28/99

4/20/2012 B2500_RDY_PFL_28.dgn

PROJECT REFERENCE NO.	SHEET NO.
B-2500	29
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER





5/28/99

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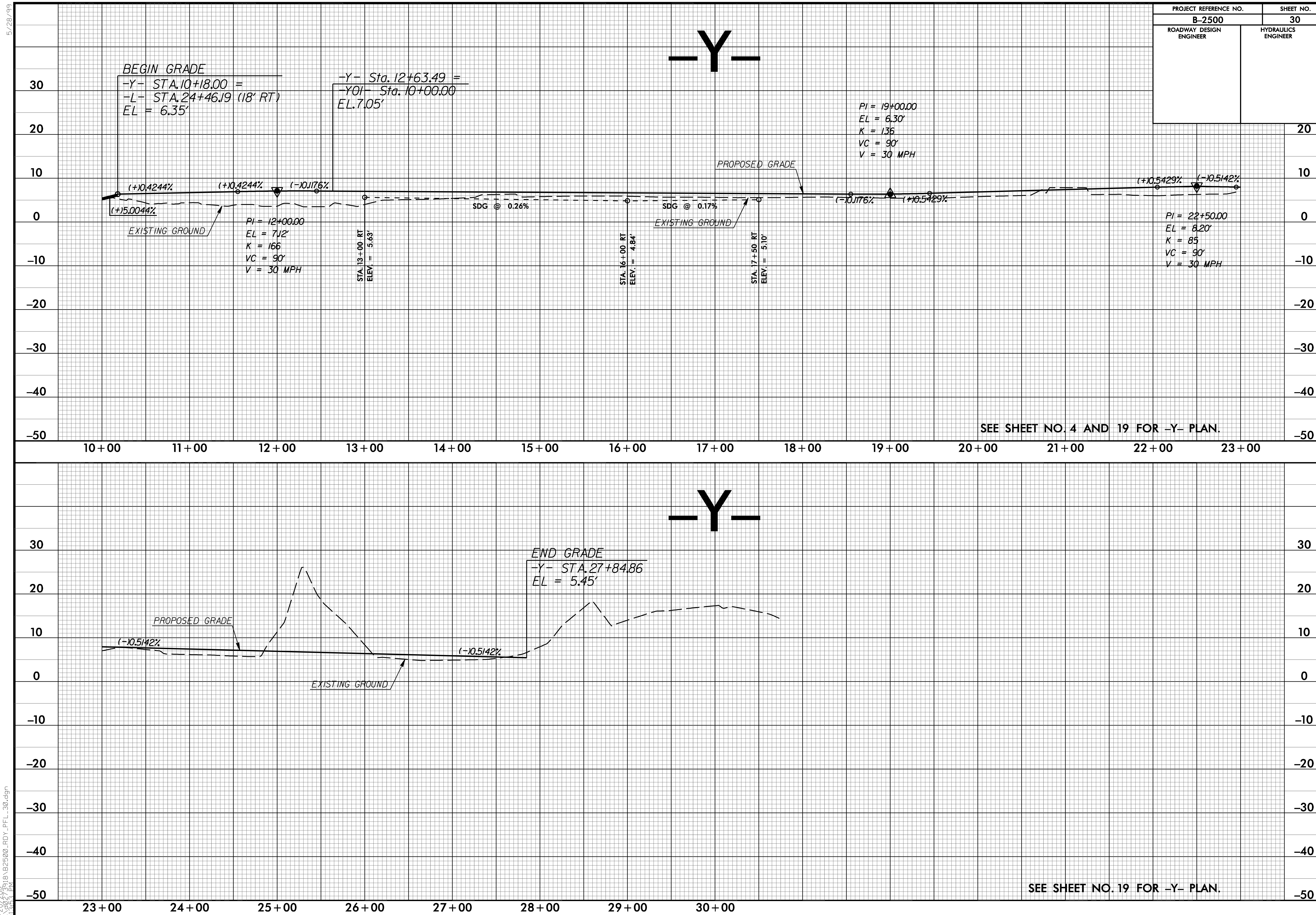
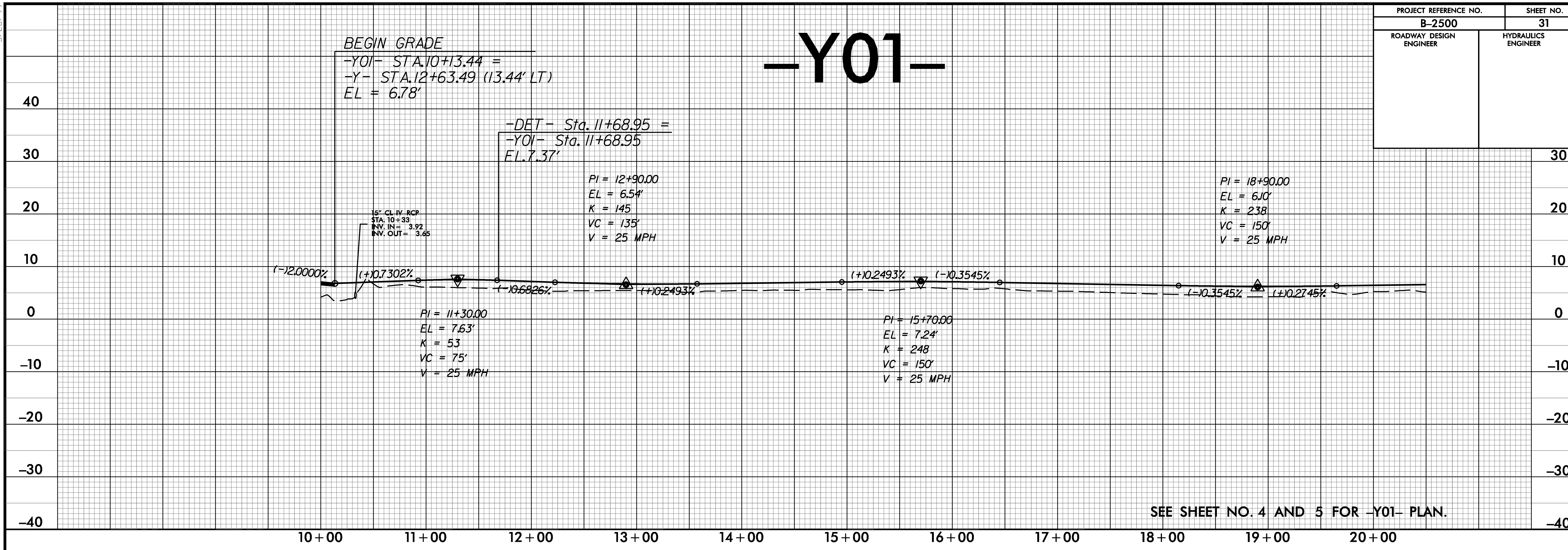
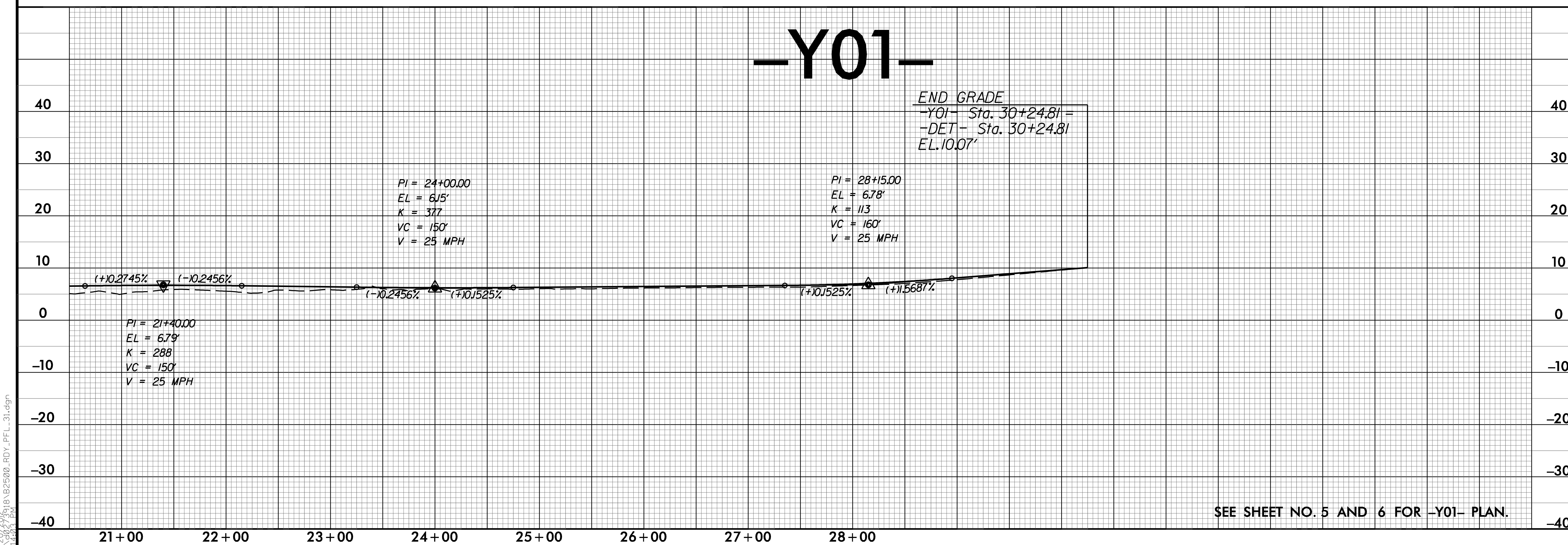


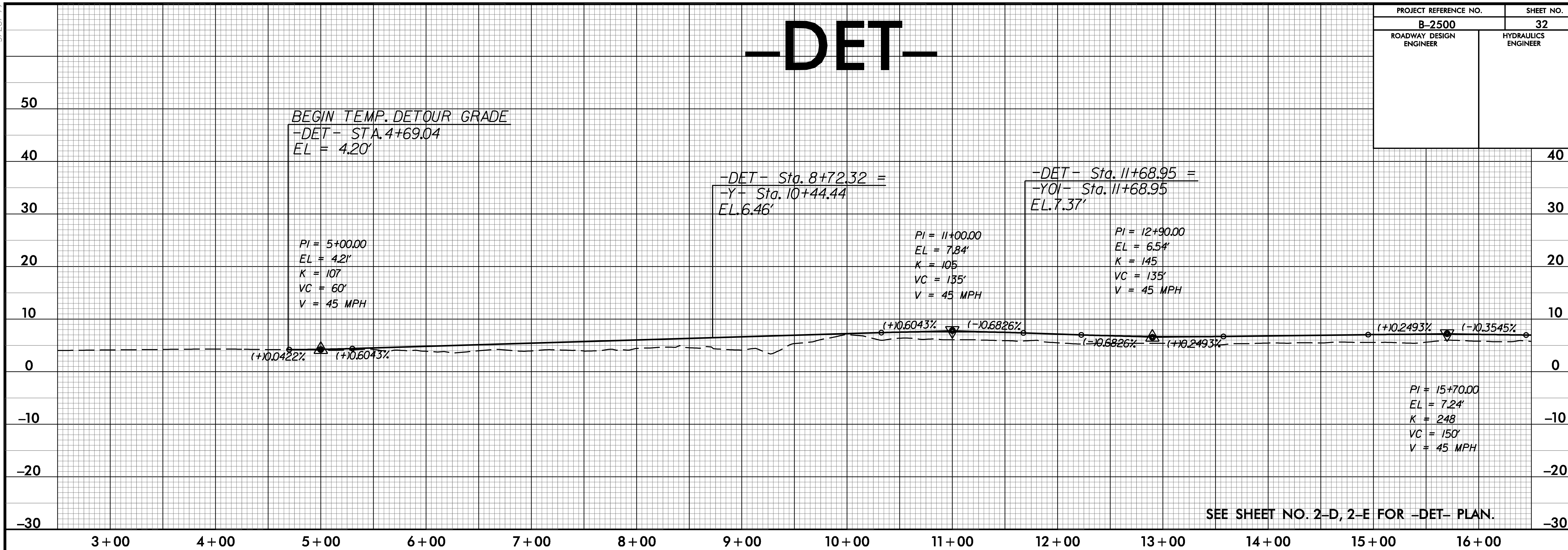
PROJECT REFERENCE NO.
B-2500
SHEET NO.
30
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
-Y-
BEGIN GRADE
-Y- STA.10+18.00 =
-L- STA.24+46.19 (18' RT)
EL = 6.35'
-Y- Sta. 12+63.49 =
-Y01- Sta. 10+00.00
EL.7.05'
PI = 19+00.00
EL = 6.30'
K = 136
VC = 90'
V = 30 MPH
PROPOSED GRADE
(+)0.4244%
(+)0.4244%
(-)0.1176%
(+)5.0044%
EXISTING GROUND
PI = 12+00.00
EL = 7.12'
K = 166
VC = 90'
V = 30 MPH
STA. 13+00 RT
ELEV. = 5.63'
SDG @ 0.26%
STA. 16+00 RT
ELEV. = 4.84'
SDG @ 0.17%
EXISTING GROUND
STA. 17+50 RT
ELEV. = 5.10'
(-)0.1176%
(+)0.5429%
(+)0.5429%
(-)0.5142%
PI = 22+50.00
EL = 8.20'
K = 85
VC = 90'
V = 30 MPH
SEE SHEET NO. 4 AND 19 FOR -Y- PLAN.
30
20
10
0
-10
-20
-30
-40
-50
10+00
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
19+00
20+00
21+00
22+00
23+00
-Y-
END GRADE
-Y- STA.27+84.86
EL = 5.45'
PROPOSED GRADE
(-)0.5142%
(-)0.5142%
EXISTING GROUND
SEE SHEET NO. 19 FOR -Y- PLAN.
23+00
24+00
25+00
26+00
27+00
28+00
29+00
30+00
5/28/99
4/20/2012
B2500_RDY_PFL_30.dgn

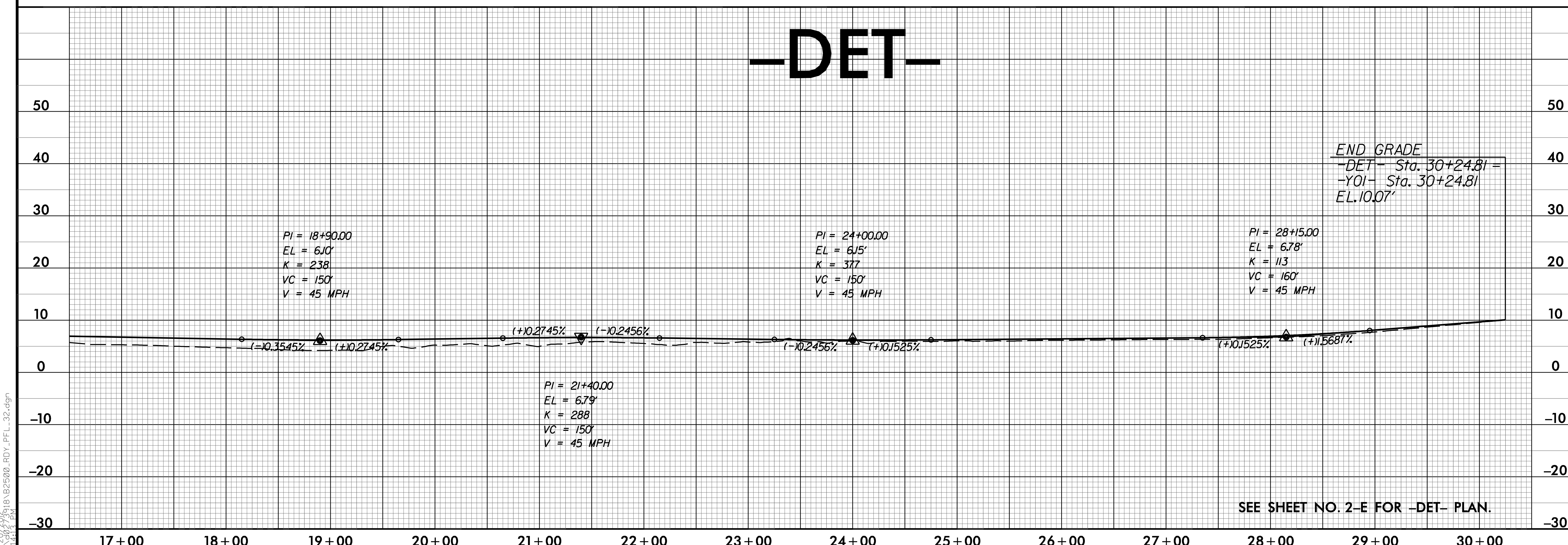
PROJECT REFERENCE NO.	SHEET NO.
B–2500	31
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER





PROJECT REFERENCE NO.	SHEET NO.
B-2500	32
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER





United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

July 10, 2008

John F. Sullivan, III, P.E.
Federal Highway Administration
310 New Bern Avenue, Suite 410
Raleigh, North Carolina 27601

Dear Mr. Sullivan:

This transmits the U.S. Fish and Wildlife Service (USFWS) Raleigh Field Office's biological and conference opinions based on our review of the proposed replacement of the Herbert C. Bonner Bridge (Bridge No. 11 over Oregon Inlet) in Dare County, North Carolina (TIP No. B-2500). These opinions assess the effects of the project on the piping plover (*Charadrius melodus*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*), and proposed critical habitat for wintering piping plovers. These opinions are provided in accordance with section 7(a)(2) of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*). This document addresses the requirements of the ESA but does not address other environmental statutes such as the National Environmental Policy Act or Fish and Wildlife Coordination Act. Your March 5, 2008 request for formal consultation was received on March 6, 2008.

Since the proposed project is a multi-phased project which will be staggered over more than 24 years, and since final designs for each phase are not yet developed, the USFWS plans to proceed with a form of a programmatic consultation known as an appended consultation. In this appended programmatic consultation, the USFWS has conducted the required analysis of the entire project based on what is known at the present time, and one programmatic biological and conference opinion has been developed for the overall project. In the following opinions we have determined that the project is not likely to jeopardize the continued existence of the piping plover, loggerhead sea turtle, green sea turtle, and leatherback sea turtle, and is not likely to destroy or adversely modify proposed critical habitat for wintering piping plovers. The USFWS has issued incidental take for these species which reflect the maximum potential take for the entire project over the proposed extended timeframe of the project.

As additional design information is developed for subsequent phases of the project, this information must be provided to us so that it may be appended to the existing biological opinion. The USFWS will then analyze the new information for each subsequent phase of the project to insure that the take associated with each future phase, cumulatively, does not exceed the maximum amount of take authorized in the incidental take statement included in this biological opinion. If the scope of future phases of the project should differ significantly from the conceptual design information, or if the cumulative amount of take should exceed that authorized, then consultation will need to be reinitiated. The reasonable and prudent measures, and associated terms and conditions, contained within this biological opinion apply to the overall project; however, as designs for subsequent phases are developed, additional reasonable and prudent measures may be necessary to minimize the level of take.

If you have any questions concerning this biological opinion, please contact me at (919) 856-4520 (Ext. 11).

Sincerely,

Pete Benjamin
Field Supervisor

Attachment

cc: Ken Graham, USFWS, Atlanta, GA
Ann Hecht, USFWS, Sudbury, MA
Sandy MacPherson, USFWS, Jacksonville, FL
Mike Bryant, USFWS, Manteo, NC
Bill Biddlecome, USACE, Washington, NC
Greg Thorpe, NCDOT, Raleigh, NC
Logan Williams, NCDOT, Raleigh, NC
Clay Willis, NCDOT, Edenton, NC
David Harris, NCDOT, Raleigh, NC
Chris Militscher, USEPA, Raleigh, NC
Travis Wilson, NCWRC, Creedmoor, NC
Cathy Brittingham, NCDCM, Raleigh, NC
David Wainwright, NCDWQ, Raleigh, NC

The following opinions are based on information provided in the March 2008 biological assessment (BA)(FHWA and NCDOT 2008a), the April 8, 2008 addendum to the BA (FHWA and NCDOT 2008b, *in litt.*), the *Supplement to the 2005 Supplemental Draft Environmental Impact Statement and Draft Section 4(f) Evaluation* (SSDEIS)(FHWA and NCDOT 2007), meetings, telephone conversations, emails, field investigations, and other sources of information. A complete administrative record of this consultation is on file at this office.

CONSULTATION HISTORY

1997 – The Federal Highway Administration (FHWA) initiates formal consultation on an earlier version of the proposed project.

1998 – After several months of discussions between the USFWS and the North Carolina Department of Transportation (NCDOT), both parties agreed that formal consultation was premature.

December 12, 2007 – The USFWS met with FHWA and NCDOT to discuss the preparation of a BA.

March 6, 2008 – The USFWS received a letter from the FHWA, dated March 5, 2008, with the attached BA, requesting formal consultation for the replacement of the Herbert C. Bonner Bridge.

March 13, 2008 – The USFWS sent a letter to FHWA stating that all information required for initiation of consultation was either included with their March 5, 2008 letter or was otherwise available.

April 9, 2008 – The USFWS received an addendum to the BA dated April 8, 2008. The addendum clarified several issues and provided revised Figures 1 and 4.

June 4, 2008 – The USFWS provided the FHWA and NCDOT with a draft biological opinion.

June 11, 2008 – The USFWS met with the FHWA and NCDOT to discuss the draft biological opinion and reasonable and prudent measures.

July 9, 2008 – The USFWS met with NCDOT to discuss the draft reasonable and prudent measures.

BIOLOGICAL AND CONFERENCE OPINIONS

I. DESCRIPTION OF PROPOSED ACTION

The existing Bonner Bridge is a two-lane bridge that takes NC 12 across Oregon Inlet and connects Bodie Island with Hatteras Island in Dare County, North Carolina. Bonner Bridge is 2.4 miles long and is located at the northern end of the action area. Existing NC 12 within the action area is a two-lane paved road extending southward from the southern end of the bridge for approximately 13.5 miles to the southern project terminus at Rodanthe. The total length of the project from the north terminus to the south terminus is 16.1 miles long. However, construction will only occur along approximately 14.0 miles. The proposed action, known as the Phased Approach/Rodanthe Bridge Alternative, is a four-phased project which includes the following:

- Phase I – replace the existing Bonner Bridge with a new 2.6 mile long bridge slightly to the west of the existing bridge – approximate construction timeframe 2009-2013
- Phase II – elevate approximately 5.6 miles of NC 12 onto three bridges – to begin approximately 2013-2015
- Phase III – elevate approximately 1.9 miles of NC 12 onto one bridge – to begin approximately 2019-2020
- Phase IV – elevate approximately 2.6 miles of NC 12 onto two bridges – to begin approximately 2029-2030

On Hatteras Island, NCDOT asserts that construction will be confined to the existing NC 12 right-of-way. A more detailed project description of the Phased Approach/Rodanthe Bridge Alternative can be found in Section 2.2 of the SSDEIS (FHWA and NCDOT 2007).

The timing of the construction of Phases II to IV is based on assumptions corresponding to forecast shoreline erosion trends and maintaining minimum 230-foot buffer distance between the existing NC 12 edge of pavement and the active shoreline. These assumptions are based on worst-case scenario modeling of shoreline erosion and the location and likelihood of future breaches on Hatteras Island. Since these are forecasts only, the exact timing and scope of each phase could change based on the reality of future shoreline erosion. As such, project descriptions of Phases II, III and IV should be viewed as approximations. The USFWS suspects that one substantial hurricane in the interim could dramatically change the predictions of worst-case scenario modeling. Although Phases II to IV will initially be built over land ostensibly within existing NCDOT right-of-way, based on shoreline erosion models, up to 8.0 miles of the bridges may ultimately be in open water by 2060.

Action Area

The action area lies within the North Carolina Outer Banks and is comprised of a dynamic barrier island system formed by wind and wave action. The barrier islands that make up the Outer Banks are sand ridges with underlying layers of limestone, sand, and clay. The action area extends from Rodanthe on Hatteras Island north to the southern end of Bodie Island and includes that portion of Hatteras Island (from the east to west shore), the area of the Atlantic Ocean one-half mile east of the Hatteras Island shoreline, portions of Oregon Inlet, and the southern tip of Bodie Island. It passes through the Cape Hatteras National Seashore (CAHA) and encompasses the Pea Island National Wildlife Refuge (PINWR). Though largely undeveloped, most of the action area consists of natural vegetation communities that have been influenced by past and present human disturbances. The construction and maintenance of an artificial sand berm along the seaward side of NC 12 has significantly interrupted the natural barrier island ecosystem processes (e.g. limiting overwash and disrupting island migration).

Conservation Measures

Conservation measures represent actions, pledged in the project description, that the action agency will implement to minimize the effects of the proposed action and further the recovery of the species under review. Such measures should be closely related to the action and should be achievable within the authority of the action agency. Since conservation measures are part of the proposed action, their implementation is required under the terms of the consultation. The FHWA and NCDOT have proposed the following conservation measures.

- The Phased Approach/Rodanthe Bridge Alternative will allow natural shoreline migration and the formation of new inlet habitats to occur.
- The project will incorporate the most current BMPs to reduce habitat degradation from stormwater runoff pollution.
- Phase I of the project will be built at least 125 feet farther west of the Bonner Bridge and currently occupied piping plover habitat.
- NCDOT does not anticipate the use of explosives during construction or demolition of the existing bridge.
- The NCDOT contractor will use pipeline or clamshell dredging, rather than a hopper dredge to minimize effects to sea turtles.
- No permanent light fixtures will be installed on the bridge or the approaches (with the exception of navigation lights as required by the U.S. Coast Guard).
- Seabeach amaranth surveys will be conducted at least one year prior to initiating bridge construction activities.
- Temporary facilities such as haul roads that affect proposed critical habitat will be removed as soon as possible.

II. STATUS OF THE SPECIES/CRITICAL HABITAT

A. Species/critical habitat description

Piping plover

The piping plover is a small, pale-colored shorebird, about seven inches long with a wingspan of about 15 inches (Palmer 1967). On January 10, 1986, the piping plover was listed as endangered in the Great Lakes watershed and threatened elsewhere within its range, including migratory routes outside of the Great Lakes watershed and wintering grounds (USFWS 1985). Piping plovers were listed principally because of habitat destruction and degradation, predation, and human disturbance. Protection of the species under the ESA reflects the species' precarious status range-wide. Three separate breeding populations have been identified, each with its own recovery criteria: the Northern Great Plains (threatened), the Great Lakes (endangered), and the Atlantic Coast (threatened). The piping plover winters in coastal areas of the U.S. from North Carolina to Texas, and along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the Bahamas (Elliott-Smith and Haig 2004). Information from observation of color-banded piping plovers indicates that the winter ranges of the breeding populations overlap to a significant degree.

The recovery objective for the Great Lakes population includes:

> at least 150 pairs (300 individuals), for at least five consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states; five-year average fecundity is within the range of 1.5-2.0 fledglings per pair, per year, across the breeding distribution, and ten-year population projections indicate the population is stable or continuing to grow above the recovery goal; ensure protection and long-term maintenance of essential breeding and wintering habitat, sufficient in quantity, quality, and distribution to support the recovery goal of 150 pairs (300 individuals); genetic diversity within the population is deemed adequate for population persistence and can be maintained over the long-term; and, agreements and funding mechanisms are in place for long-term protection and management activities in essential breeding and wintering habitat (USFWS 2003).

The recovery objective for the northern Great Plains population includes:

> sustaining 2,300 pairs of birds for at least 15 years, meeting recovery objectives for birds in prairie Canada, and providing long term protection of essential breeding and wintering habitat.

The recovery objective for the Atlantic Coast population includes:

> verification of the adequacy of a 2,000-pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term; achieve five-year average productivity of 1.5 fledged chicks per pair in each of the four recovery units; institute long-term agreements among cooperating agencies, landowners, and conservation organizations to assure protection and management sufficient to maintain the target populations in each recovery unit and average productivity; and, ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population (USFWS 1996).

The recovery plan for the Atlantic Coast population of the piping plover (USFWS 1996) delineates four recovery units within the population: Atlantic Canada, New England, New York-New Jersey, and Southern (Delaware, Maryland, Virginia, and North Carolina). Extensive efforts to observe and report sightings of greater than 1,400 Atlantic Coast piping plovers color-banded in Virginia, Maryland, Massachusetts, and five Eastern Canadian provinces between 1985 and 2003 have documented many inter-year movements among sites within recovery units, but few records of plovers breeding outside the recovery unit where they were banded (Loegering 1992, Cross 1996, USFWS 1996, Amirault et al. 2005), supporting the premise that immigration and emigration have relatively little influence on abundance trends at the scale of the recovery unit.

Recovery criteria established within the recovery plan defined population and productivity goals for each recovery unit, as well as for the population as a whole. The recovery objective for the Atlantic Coast population is to increase and maintain for five years a total of 2,000 breeding pairs, distributed among the four recovery units – Atlantic Canada, 400 pairs; New England, 625 pairs; New York-New Jersey, 575 pairs; and, Southern, 400 pairs. Attainment of these goals for each recovery unit is an integral part of a piping plover recovery strategy that seeks to reduce the probability of extinction for a population with low rates of inter-regional dispersal by: (1) contributing to the population total, (2) reducing vulnerability to environmental variation (including catastrophes such as hurricanes, oil spills, or disease), (3) increasing likelihood of genetic interchange among subpopulations, and (4) promoting re-colonization of any sites that experience declines or local extirpations due to low productivity or temporary habitat succession. The plan further states: "A premise of this plan is that the overall security of the Atlantic Coast piping plover population is profoundly dependent upon attainment and maintenance of the minimum population levels for the four recovery units. Any appreciable reduction in the likelihood of survival of a recovery unit will also reduce the probability of persistence of the entire population."

The USFWS has designated critical habitat for the piping plover on three occasions. Two of these designations protected different breeding populations of the piping plover. Critical habitat for the Great Lakes breeding population was designated May 7, 2001 (USFWS 2001a), and critical habitat for the northern Great Plains breeding population was designated September 11, 2002 (USFWS 2002). The USFWS designated critical habitat for wintering piping plovers on July 10, 2001 (USFWS 2001b). Wintering piping plovers may include individuals from the Great Lakes and northern Great Plains breeding populations as well as birds that nest along the Atlantic coast. The three separate designations of piping plover critical habitat demonstrate the diversity of constituent elements among the two breeding populations and wintering piping plovers.

Designated critical habitat for wintering piping plovers originally included approximately 1,798 miles of mapped shoreline and 165,211 acres of mapped area along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

The primary constituent elements for piping plover wintering habitat are those biological and physical features that are essential to the conservation of the species. These areas typically include those coastal areas that support intertidal beaches and flats and associated dune systems and flats above annual high tide (USFWS 2001b). Primary constituent elements of wintering piping plover critical habitat include sand or mud flats or both with no or sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting piping plovers (USFWS 2001b). The units designated as critical habitat are those areas that have consistent use by piping plovers and that best meet the biological needs of the species. The amount of wintering habitat included in the designation appears sufficient to support future recovered populations, and the existence of this habitat is essential to the conservation of the species. Additional information on each specific unit included in the designation can be found at 66 Federal Register 36038 (USFWS 2001b).

Since the designation of wintering critical habitat, four units in North Carolina were vacated and remanded back to the USFWS for reconsideration by Court order (Cape Hatteras Access Preservation Alliance v. U.S. Department of Interior (344 F. Supp. 2d 108 (D.D.C. 2004)). The four critical habitat units vacated were NC-1, NC-2, NC-4, and NC-5, and all occurred within CAHA. On June 12, 2006, the USFWS proposed to amend and re-designate these four units as critical habitat for wintering piping plover (USFWS 2006a). These units encompass the primary constituent elements found at Bodie Island Spit, Cape Point, Hatteras Spit and Ocracoke Spit within CAHA. On May 15, 2008, the USFWS proposed a revised designation of critical habitat which would add areas to units NC-1 and NC-4 (USFWS 2008d).

Loggerhead sea turtle

The loggerhead sea turtle, listed as a threatened species on July 28, 1978 (NMFS and USFWS 1978), inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead turtles nest within the continental U.S. from Louisiana to Virginia. Major nesting concentrations are found on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida (Hopkins and Richardson 1984).

Adults and sub-adults have a reddish-brown carapace (top of shell). Scales on the top and sides of the head and top of the flippers are also reddish-brown, but have yellow borders. The neck, shoulders and limb bases are dull brown on top and medium yellow on the sides and bottom. The plastron (underside of shell) is also medium yellow. Adult average size is 36 inches straight carapace length; average weight is 253 pounds. Hatchlings are dull brown in color. Average size at hatching is 1.8 inches long; average weight is 0.7 ounces. Mating takes place from late March to early June, and eggs are laid throughout the summer (NMFS and USFWS 1991b).

The recovery objectives for the southeastern U.S. population of the loggerhead turtle (NMFS and USFWS 1991b) include:

> over a period of 25 years, the adult female population in Florida is increasing, and in North Carolina, South Carolina, and Georgia nesting numbers are returning to pre-listing levels. For North Carolina, that equates to 800 nests per year. For South Carolina and Georgia nesting numbers must be 10,000 and 2,000 nests per year, respectively. These above conditions must be met with data from standardized surveys which will continue for at least five years after recovery. Furthermore, at least 25 percent of all available nesting beaches must be in public ownership, distributed over the entire nesting range and encompassing at least 50 percent of the nesting activity within each state. In addition, all priority one tasks identified in the recovery plan must be successfully implemented (NMFS and USFWS 1991b).

No critical habitat has been designated for the loggerhead turtle. However, on March 5, 2008, the National Marine Fisheries Service (NMFS) announced a 90-day finding for a petition to reclassify loggerhead turtles in the western North Atlantic Ocean as a Distinct Population Segment with endangered status and designate critical habitat (NMFS 2008).

Green sea turtle

The green sea turtle was federally listed as a protected species on July 28, 1978 (NMFS and USFWS 1978). Breeding populations of the green turtle in Florida and along the Pacific Coast of Mexico are listed as endangered; all other populations are listed as threatened. The green turtle has a worldwide distribution in tropical and subtropical waters. Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, Suriname, and Trindade Island, Brazil.

Adult green turtles may reach a size of 39 inches in length and weigh 397 pounds. The carapace is smooth and is gray, green, brown, and black. The plastron is yellowish white. Hatchlings weigh about 0.9 ounces and are about two inches long. Hatchlings are black on top and white on the bottom (NMFS and USFWS 1991a).

Within the U.S., green turtles nest in small numbers in the U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties (NMFS and USFWS 1991a). Nesting also has been documented along the Gulf coast of Florida from Escambia County through Franklin County in Northwest Florida and from Pinellas County through Collier County in Southwest Florida (FFWCC 2006b). Green turtles have been known to nest in Georgia, but only on rare occasions (GDNR 2004). The green turtle also nests sporadically in North Carolina and South Carolina (Woodson and Webster 1999, South Atlantic Fishery Management Council 2008).

Recovery objectives for the U.S. population of the green turtle (NMFS and USFWS 1991a) include:

> over a period of 25 years, that the level of nesting in Florida has increased to an average of 5,000 nests per year for at least six years where nesting data are based on standardized surveys; at least 25 percent of all available nesting beaches is in public ownership and encompasses at least 50 percent of the nesting activity; and a reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds. In addition, all priority one tasks identified in the recovery plan must be successfully implemented (NMFS and USFWS 1991a).

Critical habitat for the green sea turtle has been designated for the water surrounding Culebra Island, Puerto Rico and its outlying keys.

Leatherback sea turtle

The leatherback sea turtle, listed as an endangered species on June 2, 1970 (USFWS 1970), nests on shores of the Atlantic, Pacific, and Indian Oceans. Non-breeding animals have been recorded as far north as the British Isles and the Maritime Provinces of Canada and as far south as Argentina and the Cape of Good Hope (Pritchard 1992). Nesting grounds are distributed circumglobally, with the Pacific Coast of Mexico once supporting the world's largest known concentration of nesting leatherbacks (Pritchard 1982). The largest nesting colonies in the wider Caribbean region are found in Suriname/French Guiana, Trinidad, Costa Rica, Panama, Colombia, and Guyana (NMFS and USFWS 1992; National Research Council 1990; Troëng et al. 2004).

The leatherback is the largest living turtle, and is so distinctive as to be placed in a separate taxonomic family, Dermochelyidae. The carapace is distinguished by a rubber-like texture, about 1.6 inches thick, and made primarily of tough, oil-saturated connective tissue. No sharp angle is formed between the carapace and the plastron, resulting in the animal being somewhat barrel-shaped. The average curved carapace length for adult turtles is 61 inches and weight ranges from 441 to 1,543 pounds. Hatchlings are mostly black on top and are covered with tiny scales; the flippers are edged in white, and rows of white scales appear as stripes along the length of the back. Hatchlings average 2.4 inches long and 1.6 ounces in weight. In the adult, the skin is black and scaleless. The undersurface is mottled pinkish-white and black. The front flippers are proportionally longer than in any other sea turtle, and may span 106 inches in an adult. In both adults and hatchlings, the upper jaw bears two tooth-like projections (NMFS and USFWS 1992).

The leatherback regularly nests in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida (NMFS and USFWS 1992). Leatherback turtles have been known to nest in Georgia, South Carolina, and North Carolina, but only on rare occasions (Rabon et al. 2003, GDNR 2004). Leatherback nesting also has been reported on the northwest coast of Florida (LeBuff 1990.

The recovery objective for U.S. population of the leatherback turtle include:

> when the adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico, St. Croix, U.S. Virgin Islands, and along the east coast of Florida, and nesting habitat encompassing at least 75 percent of nesting activity in the U.S. Virgin Islands, Puerto Rico, and Florida is in public ownership. In addition, all priority one tasks identified in the recovery plan must be successfully implemented (NMFS and USFWS 1992).

Critical habitat has been designated for the leatherback sea turtle in the U.S. Virgin Islands.

B. Life History

Piping plover

Piping plover breeding activity begins in mid-March when birds begin returning to their nesting areas (Coutu et al. 1990, Cross 1990, Goldin et al. 1990, MacIvor 1990, Hake 1993). Males establish and defend territories and court females (Cairns 1982). Piping plovers are monogamous, but usually shift mates between years (Wilcox 1959, Haig and Oring 1988, MacIvor 1990) and less frequently between nesting attempts in a given year (Haig and Oring 1988, MacIvor 1990, Strauss 1990). Plovers may begin breeding as early as one year of age (MacIvor 1990, Haig 1992); however, the percentage of birds that breed in their first adult year is unknown. Observations suggest that this species exhibits a high degree of nest site fidelity (Wilcox 1959, Haig 1985, Haig and Oring 1988).

Piping plover nests can be found above the high tide line on coastal beaches, on sand flats at the ends of sand spits and barrier islands, on gently sloping foredunes, in blowout areas behind primary dunes, and in washover areas cut into or between dunes. The birds may also nest on areas where suitable dredge material has been deposited. Nest sites are shallow, scraped depressions in substrates ranging from fine-grained sand to mixtures of sand and pebbles, shells or cobble (Bent 1929, Burger 1987a, Cairns 1982, Patterson 1988, MacIvor 1990, Strauss 1990, Flemming et al. 1992). Nests are usually found in areas with little or no vegetation; although, on occasion, piping plovers will nest under stands of American beachgrass or other vegetation (Patterson 1988, MacIvor 1990, Flemming et al. 1992). Plover nests may be very difficult to detect, especially during the 6 to 7 day egg-laying phase when the birds generally do not incubate (Goldin 1994).

Eggs may be present on the beach from early April through late July. Clutch size for an initial nest attempt is usually four eggs, one laid every other day. Eggs are pyriform in shape, and variable buff to greenish brown in color, marked with black or brown spots. The incubation period usually lasts 27 to 28 days. Full-time incubation usually begins with the completion of the clutch and is shared equally by both sexes (Wilcox 1959, Cairns 1977, MacIvor 1990). Eggs in a clutch usually hatch within 4 to 8 hours of each other, although the hatching period of one or more eggs may be delayed by up to 48 hours (Cairns 1977, Wolcott and Wolcott 1999).

Piping plovers generally fledge only a single brood per season, but may renest several times if previous nests are lost. Chicks are precocial (Wilcox 1959, Cairns 1982). They may move hundreds of yards from the nest site during their first week of life (see Table 1 in USFWS 1996), and chicks may increase their foraging range up to 3,000 feet before they fledge (Loegering 1992). Chicks remain together with one or both parents until they fledge at 25 to 35 days of age. Depending on date of hatching, flightless chicks may be present from mid-May until late August, although most fledge by the end of July (Patterson 1988, Goldin et al. 1990, MacIvor 1990, Howard et al. 1993).

Cryptic coloration is a primary defense mechanism for this species; nests, adults, and chicks all blend in with their typical beach surroundings. Chicks sometimes respond to vehicles and/or pedestrians by crouching and remaining motionless (Cairns 1977, Tull 1984, Goldin 1993b, Hoopes 1993). Adult piping plovers also respond to intruders (avian and mammalian) in their territories by displaying a variety of distraction behaviors, including squatting, false brooding, running, and injury feigning. Distraction displays may occur at any time during the breeding season but are most frequent and intense around the time of hatching (Cairns 1977).

Plovers feed on invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent 1929, Cairns 1977, Nicholls 1989). Important feeding areas include intertidal portions of ocean beaches, washover areas, mudflats, sand flats, wrack lines, sparse vegetation, and shorelines of coastal ponds, lagoons, or salt marshes (Gibbs 1986, Coutu et al. 1990, Hoopes et al. 1992, Loegering 1992, Goldin 1993a, Elias-Gerken 1994). Studies have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986, Coutu et al. 1990, McConnaughey et al. 1990, Loegering 1992, Goldin 1993a, Hoopes 1993, Elias-Gerken 1994) and by stage in the breeding cycle (Cross 1990). Adults and chicks on a given site may use different feeding habitats in varying proportion (Goldin et al. 1990). Feeding activities of chicks are particularly important to their survival. Most time budget studies reveal that chicks spend a high proportion of their time feeding. Cairns (1977) found that piping plover chicks typically tripled their weight during the first two weeks post-hatching; chicks that failed to achieve at least 60 percent of this weight gain by the twelfth day were unlikely to survive.

During courtship, nesting, and brood rearing, feeding territories are generally contiguous to nesting territories (Cairns 1977), although instances where brood-rearing areas are widely separated from nesting territories are common. Feeding activities of both adults and chicks may occur during all hours of the day and night (Staine and Burger 1994), and at all stages in the tidal cycle (Goldin 1993a, Hoopes 1993).

Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (USFWS 1996). Some mid-continent breeders travel up or down the Atlantic Coast before or after their overland movements (Stucker and Cuthbert 2006). Use of inland stopovers during migration is also documented (Pompei and Cuthbert 2004). The pattern of both fall and spring counts at many Atlantic Coast sites demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (NPS 2003, Noel et al. 2005, Stucker and Cuthbert 2006). In addition, this species exhibits a high degree of both intra- and inter-annual wintering site fidelity (Drake et. al. 2001, Noel et al. 2005, Stucker and Cuthbert 2006).

A growing body of information shows that overwash-created and -perpetuated habitats, including accessible bayside flats, unstabilized and recently healed inlets, and moist sparsely vegetated barrier flats are especially important to piping plover productivity and carrying capacity in the New York-New Jersey and Southern recovery units.

In New Jersey, Burger (1994) studied piping plover foraging behavior and habitat use at three sites that offered the birds: ocean, dune, and backbay habitats. The primary focus of the study was on the effect of human disturbance on habitat selection, and it found that both habitat selection and foraging behavior correlated inversely with the number of people present. In the absence of people on an unstabilized beach, plovers fed in ocean and bayside habitats in preference to the dunes.

Loegering and Fraser (1995) found that chicks on Assateague Island, Maryland that were able to reach bay beaches and the island interior had significantly higher fledgling rates than those that foraged solely on the ocean beach. Higher foraging rates, percentage of time spent foraging, and abundance of terrestrial arthropods on the bay beach and interior island habitats supported their hypothesis that foraging resources in interior and bayside habitats are key to reproductive rates on that site. Their management recommendations stressed the importance of sparsely vegetated cross-island access routes maintained by overwash, and the need to restrict or mitigate activities that reduce natural disturbance during storms.

Dramatic increases in plover productivity and breeding population on Assateague since the 1991-1992 advent of large overwash events corroborate Loegering and Fraser's conclusions. Piping plover productivity, which had averaged 0.77 chicks per pair during the five years before the overwash, averaged 1.67 chicks/pair in 1992-96. The nesting population on the northern five miles of the island also grew rapidly, doubling by 1995 and tripling by 1996, when 61 pairs nested there (MacIvor 1996). Habitat use is primarily on the interior and bayside.

In Virginia, Watts et al. (1996) found that piping plovers nesting on 13 barrier islands between 1986 and 1988 were not evenly distributed along the islands. Beach segments used by plovers had wider and more heterogeneous beaches, fewer stable dunes, greater open access to bayside foraging areas, and proximity to mudflats. They note that characteristics of beaches selected by plovers are maintained by frequent storm disturbance.

At Cape Lookout National Seashore in North Carolina, 13 to 45 pairs of plovers have nested on North and South Core Banks each year since 1992 (NPS 2007d). While these unstabilized barrier islands total 44 miles long, nesting distribution is patchy, with all nests clustered on the dynamic ends of the barrier islands, recently closed and sparsely vegetated "old inlets," expansive barrier mudflats, or new ocean-to-bay overwashes. During a 1990 study, 96 percent of brood observations were on bay tidal flats, even though broods had access to both bay and ocean beach habitats (McConnaughey et al. 1990).

At CAHA, distribution of nesting piping plovers is also "clumped," with nesting areas characterized by a wide beach, relatively flat intertidal zone, brackish ponds, and temporary pools formed by rainwater and overwash (Coutu et al. 1990).

Notwithstanding the importance of bayside (soundside) flats, ephemeral pools, and sparsely vegetated barrier flats for piping plover nest site selection and chick foraging, ocean intertidal zones are also used by chicks of all ages. For example, between 1993 and 1996 on the Maryland end of Assateague Island, four to 12 percent of annual observations of plover broods occurred on the ocean beach (NPS and Maryland DNR 1993-1996). A three-year study of piping plover chick foraging activity at six sites on four Virginia barrier islands (Cross and Terwilliger 2000) documented chick use of the ocean intertidal zone at three of six study sites. Intensive observations at Chincoteague National Wildlife Refuge Overwash Zone in 2004, where chicks had unimpeded access to a large undisturbed bayside flat, documented occasional visits to the ocean intertidal zone by six of eleven broods ranging in age from one to 24 days (Hecht 2004, *in litt.*).

Wintering and migrating piping plovers on the Atlantic Coast are generally found at the accreting ends of barrier islands, along sandy peninsulas, and near coastal inlets. Wintering piping plovers appear to prefer sand flats adjacent to inlets or passes, sandy mud flats along prograding spits (areas where the land rises with respect to the water level), and overwash areas as foraging habitats. These substrate types may have a richer infauna than the foreshore of high energy beaches and often attract large numbers of shorebirds. Roosting plovers are generally found along inlet and adjacent ocean and estuarine shorelines and their associated berms and on nearby exposed tidal flats (Nicholls and Baldassarre 1990). Since tidal conditions and weather often cause plovers to move among habitat patches, diverse habitat patches may be especially important to plovers and may concentrate wintering piping plovers when roosting and feeding areas are adjacent (Johnson and Baldassarre 1988, Nicholls and Baldassarre 1990, Drake et al. 2001). Wintering plovers with small home ranges which contain safe roosts and abundant food should experience low commuting costs, and would be expected to have higher survival (Drake et al. 2001).

Cohen et al. (in press) conducted a study on wintering piping plovers at and near the Oregon Inlet during the winter of 2005/2006. They found that all plover habitat use fell into one of three habitat zones: ocean beach, sound beach, and sound island (dredged material, shoal, and other marsh and mudflat/sandflat islands). In the study, plovers were more likely to use sound islands than ocean beach or sound beach when the intertidal area of sound islands was exposed during low tide. Plovers using ocean beach spent less time foraging (18%) than when on sound beaches (88%) and sound islands (83%).

Factors affecting the piping plover during its life cycle

Predation has been identified as a major factor limiting piping plover reproductive success at many Atlantic Coast sites (Burger 1987a, MacIvor 1990, Cross 1991, Patterson et al. 1991, Elias-Gerken, 1994). As with other limiting factors, the nature and severity of predation is highly site specific. Predators of piping plover eggs and chicks include foxes, skunks, raccoons, rats, opossums, crows, gulls, grackles, American kestrels, domestic and feral dogs and cats, and ghost crabs.

Substantial evidence exists that human activities are affecting types, numbers, and activity patterns of predators, thereby exacerbating natural predation. Non-native species such as feral cats and rats are considered significant predators at some sites (Goldin et al. 1990, Post 1991). Humans have also indirectly influenced predator populations by abetting the expansions in the populations and/or range of other species such as gulls (Drury 1973). Strauss (1990) found that the density of fox tracks on a beach area was higher during periods of more intensive human use.

Predation and nest abandonment because of predators have been implicated as a cause of low reproductive success (Cooper 1990, Coutu et al. 1990, Kuklinski et al. 1996). Predator trails (of foxes, dogs, and cats) have been seen around areas of the last known location of piping plover chicks. Predatory birds also are relatively common during their fall and spring migration along the Atlantic Ocean coastline, and there is a possibility they may occasionally take plovers.

Piping plover habitats (breeding and non-breeding) are dependent on natural forces of creation and renewal. However, storms and severe cold weather are believed to take their toll on plovers. After an intense snowstorm swept the entire North Carolina coast in late December 1989, high mortality of many coastal bird species was noted (Fussell 1990). Piping plover numbers decreased significantly from about 30 to 40 birds down to 15 birds. While no dead piping plovers were found, circumstantial evidence suggests that much of the decrease was mortality (Fussell 1990). Hurricanes may also result in direct mortality or habitat loss, and if piping plover numbers are low enough or if total remaining habitat is sparse relative to historical levels, population responses may be impaired even through short-term habitat losses. Wilkinson and Spinks (1994) suggest that, in addition to the unusually harsh December 1989 weather, low plover numbers seen in South Carolina in January 1990 (11 birds, compared with more than 50 during the same time period in 1991 to 1993) may have been influenced by effects on habitat and food availability caused by Hurricane Hugo in September 1989. Hurricane Elena struck the Alabama coast in September 1985 and subsequent surveys noted a reduction of intertidal foraging habitat on Dauphin and Little Dauphin Islands (Johnson and Baldassarre 1988). Birds were observed foraging at Sand Island, a site that was used little prior to the hurricane.

Unrestricted use of motorized vehicles on beaches is a serious threat to piping plovers and their habitats. Vehicles can crush eggs (Wilcox 1959, Tull 1984, Burger 1987b, Patterson et al. 1991, Shaffer and Laporte 1992) as well as adults and chicks. However, the mobility of newly hatched chicks and adults does not lessen the susceptibility to mortality by vehicles. For example, in Massachusetts and New York, biologists documented 14 incidents in which 18 chicks and two adults were killed by vehicles between 1989 and 1993 (Melvin et al. 1994). Goldin (1993b) compiled records of 34 chick mortalities (30 on the Atlantic Coast and four on the northern Great Plains) due to vehicles. Biologists that monitor and manage piping plovers believe that many more chicks are killed by insufficiently-managed vehicles than are found and reported (Melvin et al. 1994). Beaches used by vehicles during nesting and brood-rearing periods generally have fewer breeding plovers than available nesting and feeding habitat can support. In contrast, plover abundance and productivity has increased on beaches where vehicle restrictions during chick-rearing periods have been combined with protection of nests from predators (Goldin 1993b).

Typical behaviors of piping plover chicks increase their vulnerability to vehicles. Chicks frequently move between the upper berm or foredune and feeding habitats in the wrack line and intertidal zone. These movements place chicks in the paths of vehicles driving along the berm or through the intertidal zone. Chicks stand in, walk, and run along tire ruts, and sometimes have difficulty crossing deep ruts or climbing out of them (Strauss 1990, Eddings 1991, Howard et al. 1993). Chicks sometimes stand motionless or crouch as vehicles pass by, or do not move quickly enough to get out of the way (Tull 1984, Hoopes et al. 1992, Goldin 1993b).

Vehicles also significantly degrade piping plover habitat or disrupt normal behavior patterns. They may harm or harass plovers by crushing wrack into the sand and making it unavailable as cover or a foraging substrate (Hoopes et al. 1992, Goldin 1993b), by creating ruts that can trap or impede movements of chicks (Jacobs 1988, *in litt.*), and by preventing plovers from using habitat that is otherwise suitable (MacIvor 1990, Strauss 1990, Hoopes et al. 1992, Goldin 1993b, Hoopes 1994). Zonick (2000) found that ORV density negatively correlated with abundance of roosting, nonbreeding plovers on the ocean beach in Texas. Studies elsewhere (e.g. Wheeler 1979) demonstrate adverse effects of ORV driving on soundside beaches on the abundance of infauna essential to piping plover foraging requirements.

Lighting may also negatively affect piping plovers. While the extent that artificial lighting (including vehicle lights) affects piping plovers is unknown, there is evidence that American oystercatcher (*Haematopus palliatus*) chicks and adults are attracted to vehicle headlights and may move toward areas of ORV activity. During a 2005 study at Cape Lookout National Seashore, adult and chick oystercatchers were observed running or flying directly into the headlights of oncoming vehicles, and two two-day old oystercatcher chicks were run over by an all-terrain vehicle after being observed foraging with the adults near the high tide line at night (Simons et al. 2005).

Pedestrian and non-motorized recreational activities can be a source of both direct mortality and harassment of piping plovers. There are a number of potential sources for pedestrians on the beach, including those individuals driving and subsequently parking on the beach, those originating from off-beach parking areas (hotels, motels, commercial facilities, beachside parks, etc.), and those from beachfront and nearby residences.

Pedestrians on beaches may crush eggs (Burger 1987b, Shaffer and Laporte 1992, NPS 1993), or flush plovers from nests exposing their eggs to predators. Concentrations of pedestrians may also deter piping plovers from using otherwise suitable habitat. Ninety-five percent of Massachusetts plovers (n = 209) observed by Hoopes (1993) were found in areas that contained less than one person per 2 acres of beach. Elias-Gerken (1994) found that piping plovers on Jones Beach Island, New York, selected beachfront that had less pedestrian disturbance. Sections of beach at Trustom Pond National Wildlife Refuge in Rhode Island were colonized by piping plovers within two seasons of their closure to heavy pedestrian recreation. Burger (1991, 1994) found that the presence of people at several New Jersey sites caused plovers to shift their habitat use away from the ocean front to interior and bayside habitats; the time plovers devoted to foraging decreased and the time spent alert increased when more people were present. Burger (1991) also found that when plover chicks and adults were exposed to the same number of people, the chicks spent less time foraging and more time crouching, running away from people, and being alert than did the adults.

Pedestrians may flush incubating plovers from nests, exposing eggs to excessive temperatures. Repeated exposure of shorebird eggs on hot days may cause overheating, killing the embryos (Bergstrom 1989); excessive cooling may kill embryos or retard their development, delaying hatching dates (Welty 1982). Pedestrians can also displace unfledged chicks (Strauss 1990, Burger 1991, Hoopes et al. 1992, Loegering 1992, Goldin 1993b), forcing them out of preferred habitats, decreasing available foraging time, and causing expenditure of energy.

Fireworks are highly disturbing to piping plovers (Howard et al. 1993). Plovers are also intolerant of kites, particularly as compared to pedestrians, dogs, and vehicles; biologists believe this may be because plovers perceive kites as potential avian predators (Hoopes et al. 1992).

Noncompliant pet owners who allow their dogs off leash have the potential to flush piping plovers and these flushing events may be more prolonged than those associated with pedestrians or pedestrians with dogs on leash. Unleashed dogs may chase plovers (McConnaughey et al. 1990), destroy nests (Hoopes et al. 1992), and kill chicks (Cairns and McLaren 1980, Boyagian 1994, *in litt.*).

Demographic models for piping plovers indicate that even small declines in adult and juvenile survival rates will cause very substantial increases in extinction risk (Melvin and Gibbs 1994, Larson et al. 2000, Wemmer et al. 2001, Calvert et al. 2006). Furthermore, insufficient protection of non-breeding piping plovers has the potential to quickly undermine the progress toward recovery achieved at breeding sites. For example, a banding study conducted between 1998 and 2004 in Atlantic Canada found lower return rates of juvenile (first year) birds to the breeding grounds than was documented for Massachusetts (Melvin and Gibbs 1994), Maryland (Loegering 1992), and Virginia (Cross 1996) breeding populations in the mid-1980s and very early 1990s. This is consistent with failure of the Atlantic Canada population to increase abundance despite very high productivity (relative to other breeding populations) and extremely low rates of dispersal to the U.S. (Calvert et al. 2006). This suggests that maximizing productivity does not ensure population increases; management must focus simultaneously on all sources of stress on the population within management control.

Loggerhead sea turtle

Loggerheads are known to nest on average about four times within a nesting season, ranging from one to seven times (Talbert et al. 1980, Lenarz et al. 1981, Richardson and Richardson 1982, Murphy and Hopkins 1984). The interval between nesting varies around a mean of about 14 days (Dodd 1988). Mean clutch size varies from about 100 to 126 eggs per nest along the southeastern U.S. coast (NMFS and USFWS 1991b). The loggerhead returns at intervals of two to three years, but the number can vary from one to seven years (Dodd 1988). Age at sexual maturity is likely to be greater than 30 years (Snover 2002).

Green sea turtle

Green turtles deposit from one to nine clutches within a nesting season, but the overall average is about 3.3. The interval between nesting varies around a mean of about 13 days (Hirth 1997). Mean clutch size varies widely among populations. Average clutch size reported for Florida was 136 eggs in 130 clutches (Witherington and Ehrhart 1989). Only occasionally do females produce clutches in successive years. Usually two to four years intervene between breeding seasons (NMFS and USFWS 1991a). Age at sexual maturity is believed to be 20 to 50 years (Hirth 1997).

Leatherback sea turtle

Leatherbacks nest an average of five to seven times within a nesting season, with an observed maximum of 11 (NMFS and USFWS 1992). The interval between nesting is about nine to ten days. Clutch size averages 101 eggs on Hutchinson Island, Florida (Martin 1992). Most leatherbacks return at two to three-year intervals based on data from the Sandy Point National Wildlife Refuge, St. Croix, U.S. Virgin Islands (McDonald and Dutton 1996). Leatherbacks are believed to reach sexual maturity in six to ten years (Zug and Parham 1996).

<u>Factors affecting sea turtles during portions of their life cycle</u>

Artificial lighting is one of the most significant impacts on sea turtle survival, especially of post-emergent hatchlings (Mann 1977, Ehrhart and Witherington 1987, Witherington 1992). Visual cues are the primary sea-finding mechanism for hatchlings (Mrosovsky and Carr 1967, Mrosovsky and Shettleworth 1968, Dickerson and Nelson 1989, Witherington and Bjorndal 1991). Hatchlings show a tropotactic response to light upon emergence, so any visual stimulus in the field of vision has some effect on the direction chosen by the hatchlings (Mrosovsky 1970). Hatchlings instinctively orient to the brightest horizon, which, in the absence of artificial lights, is usually the ocean horizon. It is possible to attract hatchlings out of the surf with a bright light, demonstrating the importance of light stimulus in hatchling behavior (Carr and Ogren 1960, Ehrhart and Witherington 1987).

Artificial lighting cues can cause misorientation (hatchlings travel along a consistent course toward a light source) or disorientation (hatchlings are not able to set a particular course and wander aimlessly) (Philibosian 1976, Mann 1977, Witherington 1990). Hatchlings are frequently attracted to point source lights on buildings and roadways in urban areas (McFarlane

1963, Philibosian 1976, Mann 1978, Witherington 1992). Urban areas may also have a non-point source nighttime glow which may disorient hatchlings from otherwise dark sections of beach (Witherington 1993, Tuxbury and Salmon 2005). Light intensities from sky measurements taken on the beach can be higher than the ocean horizon (Salmon et al. 1995a).

Once disoriented, turtles often enter conflicting light environments as they head landward. As hatchlings approach buildings and roads, they encounter obstacles that may screen the source of artificial light (Salmon et al. 1995b). They may then re-orient themselves correctly toward the ocean or continue along the obstruction (e.g. seawall, deep ruts, buildings) until they can see the original or perhaps another source of artificial light. If the obstructions are high enough and continuous enough to prevent the hatchlings from leaving the beach, the lightening sky as sunrise approaches often becomes a dominant influence and attracts the hatchlings to the surf. Mann (1977) also found that most turtles in artificial light-dominated areas oriented correctly on brightly moonlit nights. On moonless nights, hatchlings were more easily disoriented by artificial lights.

The correlation between level of light-caused disruption and survivorship has not, however, been identified. It has been demonstrated that there are relative degrees of sub-lethal and lethal effects, ranging from mild misorientation of a few hatchlings to strong disorientation of a whole clutch resulting in mortality for many hatchlings (Salmon et al. 1995a, Witherington et al. 1996).

Both Mann (1977) and Ehrhart and Witherington (1987) found high mortality in the emergences where the majority of the hatchlings were strongly disoriented. If the hatchlings do not manage to enter the surf, they may enter the vehicle corridor where they are subject to being run over, trapped in tire ruts and become vulnerable to predators, or become irretrievably lost from finding their way to the surf. The protracted wanderings of disoriented hatchlings also lengthens the time they are susceptible to predation from raccoons, ghost crabs, seabirds, fish crows, night herons and possibly dogs and cats. The prolonged exposure can exhaust and/or dehydrate the turtles to the point of death or limit their chance of survival once in the water. Weakened hatchlings that eventually reach the water may be more vulnerable to marine predators, which are abundant in nearshore waters (Wyneken et al. 1994).

Research has also documented significant reduction in sea turtle nesting activity on beaches illuminated with artificial lights (Witherington 1992). Lights may deter females from coming ashore to nest or disorient females trying to return to the surf after a nesting event. However, artificial lighting does not appear to be as problematic for nesting adult female sea turtles as compared to hatchlings. They seem to use a straight-ahead method to select a nest site. They do not appear to be affected as much by artificial lights along the beach as they are by bright lights immediately in front of them upon emerging from the surf (Salmon et al. 1995b, Witherington 1992). Distant point sources and urban glow are more likely to affect hatchlings than adult females (Salmon et al. 1995b). The effects of lights on the female's decision of where to emerge remain unknown.

Hurricanes and other storms during late summer and fall on the east coast of the U.S. create conditions that often result in beach erosion and the subsequent loss of sea turtle nests. Nests may be washed out or inundated long enough to result in egg mortality. In the last several years, numerous hurricanes and tropical storms have resulted in substantial impacts to the coastal environment along most of the eastern United States. Erosion resulted in a reduction of beach profile in some areas and an accretion of sand in others. High tides and storm surges from these tropical systems overwashed, washed out, buried, or inundated sea turtle nests. Due to nesting chronology, most of the nests lost to storm events will be loggerhead and a few green sea turtle nests. Leatherback sea turtles typically nest earlier in the season and most, if not all, nests have hatched prior to the peak of the tropical storm season.

The use of ORVs on sea turtle nesting beaches can adversely affect the egg, hatchling, and nesting life stages of sea turtles. Vehicles can directly impact sea turtles by running over nesting females and hatchlings making their way to the ocean; crushing nests; deterring females from nesting and approaching nesting beaches; and changing the beach profile and nesting habitat (e.g., compacting sand and making nest excavation difficult, producing ruts in the sand that trap hatchlings, and creating escarpments that prevent females from accessing the beach). Vehicles on beaches, especially during night hours, run the risk of striking adult females emerging on the beach to nest or hatchlings making their way towards the surf after emerging from the nest (National Research Council 1990).

Driving on dune systems alters beach habitat for turtle nesting. Vehicles change the character of the beach profile (Hosier and Eaton 1980), thus increasing the chance of unsuitable nesting habitat for turtles and reducing the number of nests laid and/or hatchlings produced. Erosion can increase in areas with vehicular traffic (National Research Council 1990), which can create escarpments that prevent females from reaching the nesting area of the beach or act as obstacles to hatchlings trying to reach the ocean.

Ruts caused by ORVs reduce the number of hatchlings that make it to the ocean (Lamont et al. 2002). The ruts act as barriers which trap hatchlings making them prone to desiccation and predation. Live and desiccated turtles have been observed in deep vehicle ruts (LeBuff 1990). The ruts can also act as pathways, leading hatchlings away from the ocean. Apparently, hatchlings become diverted not necessarily because they cannot physically climb out of the rut (Arianoutsou 1988, Hughes and Caine 1994), but because the sides of the track cast a shadow and the hatchlings lose their line of sight to the ocean horizon (Mann 1977). If hatchlings are detoured along vehicle ruts, they are at greater risk to vehicles, predators, fatigue, and desiccation. However, hatchling turtles also have a greater probability of overturning when they have to maneuver over ruts in the sand (Hosier 1981; Hosier et al. 1981), which can expose them to desiccation and predation. At least two studies have confirmed hatchling disorientation by vehicular ruts (Cox et al. 1994, Hosier et al. 1981).

Sand compaction resulting from ORVs may increase the length of time required for female sea turtles to excavate nests. If sediments become too compacted, a female turtle may have difficulty excavating an egg chamber of adequate depth or dimensions (Raymond 1984, Ryder 1990, Carthy 1994). Compression of sand by vehicles also causes reduced hatching success of loggerhead turtle nests (Mann 1977). Nesting areas with vehicle traffic have a lower hatchling emergence due to egg chamber cave-ins, making it harder for hatched turtles to emerge to the surface (Mann 1977). Mortality while hatching out of eggs is also higher on beaches open to public access than beaches with restricted access (Kudo et. al. 2003).

Pedestrian traffic on the beach can have a wide variety of adverse affects on sea turtles. People often walk on beaches at night seeking encounters with nesting female sea turtles. These interactions can interfere with the successful excavation of a nest chamber and/or deposition of eggs and may result in abandonment of nesting attempts (McFarlane 1963, Johnson et al. 1996). Once a turtle leaves the beach, she may return to the same location or select a new site later that night or the following night. However, repeated interruption of nesting may cause a turtle to construct her nest in a sub-optimal incubation environment, postpone nesting for several days, prompt movement many miles from the original chosen nesting site, or cause the turtle to shed her eggs at sea (Murphy 1985). Studies of pedestrian impacts on loggerhead sea turtle nests in Japan have shown that beaches with full pedestrian access have significantly lower emergence success, compared to nests laid on beaches with restricted pedestrian access (Kudo et al. 2003). The full extent to which nighttime beach use by humans may affect sea turtles is not known.

Increased pedestrian use increases the amount of trash left behind on the beach. This waste becomes a threat to hatchlings and adult turtles on the beach and in the water. Sea turtles ingest waste products, especially plastics, due to their resemblance to jellyfish, a turtle food source (National Research Council 1990). Bugoni et al. (2001) found as much as 60 percent of the turtles investigated had ingested marine debris. Beach trash can also impede the movement of hatchlings to the ocean.

Dogs running freely on beaches have been identified as potential predators of eggs, hatchlings and even adult sea turtles (Dodd 1988, Santos and Godfrey 2001).

C. Population dynamics

Piping plover

Great Lakes Population

The Great Lakes plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario. Russell (1983) reviewed historical records to estimate the pre-settlement populations of the plover throughout this range. While estimates may be high for some Great Lakes states, no other historic estimates are available. Total population estimates ranged from 492 to 682 breeding pairs in the Great Lakes region; Michigan alone may have had the most with as many as 215 pairs. When listed, the Great Lakes population numbered only 17 known breeding pairs that nested in northern Michigan. Gradual increases in this population have been documented since listing and these birds are now known to have expanded to the south and west (USFWS 2003). Twenty-nine breeding pairs were observed in 2001 (Ferland and Haig 2002). As of 2007, there were an estimated 63 nesting pairs (Dingledine 2008, *in litt.*).

Great Lakes piping plovers nest on wide, flat, open, sandy or cobble shoreline with very little grass or other vegetation. Reproduction is adversely affected by human disturbance of nesting areas and predation by foxes, gulls, crows and other avian species. Shoreline development, such as the construction of marinas, breakwaters, and other navigation structures, has adversely affected nesting and brood rearing.

Northern Great Plains Population

The Northern Great Plains plover breeds from Alberta to Manitoba, Canada and south to Nebraska; although some nesting has recently occurred in Oklahoma. Currently the most westerly breeding piping plovers in the United States occur in Montana and Colorado.

Nesting occurs on sand flats or bare shorelines of rivers and lakes, including sandbar islands in the upper Missouri River system, and patches of sand, gravel, or pebbly-mud on the alkali lakes of the northern Great Plains. Breeding surveys in the early 1980s reported 2,137 to 2,684 adult plovers in the northern Great Plains/Prairie region (Haig and Oring 1985). In 1991, 2,032 adult plovers were observed in the U.S. portion of the northern Great Plains (Haig and Plissner 1993). The number declined to 1,599 in 1996 (Plissner and Haig 1997), a reduction of 21 percent from 1991. Part of this reduction may be an artifact of increased numbers of plovers nesting in Canada in 1996 due to high water levels in the U.S. (Plissner and Haig 1997). Overall in both the U.S. and Canadian portion of the northern Great Plains, 3,469 adult piping plovers were observed in 1991; 3,286 were observed in 1996; and 2,953 were observed in 2001 (Ferland and Haig 2002). The 2001 figure includes 1,291 breeding pairs.

The decline of piping plovers on rivers in the Northern Great Plains has been largely attributed to the loss of sandbar island habitat and forage base due to dam construction and operation. While piping plovers do nest on shorelines of reservoirs created by the dams, reproductive success is often low and reservoir habitat is not available in many years due to high water levels or vegetation. Dams operated with steady constant flows allow vegetation to grow on potential nesting islands, making these sites unsuitable for nesting. Population declines in alkali wetlands are attributed to wetland drainage, contaminants, and predation.

Atlantic Coast Population

The Atlantic Coast piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. Historical population trends for the Atlantic Coast piping plover have been reconstructed from scattered, largely qualitative records. Nineteenth-century naturalists, such as Audubon and Wilson, described the piping plover as a common summer resident on Atlantic Coast beaches (Haig and Oring 1987). However, by the beginning of the 20th Century, egg collecting and uncontrolled hunting, primarily for the millinery trade, had greatly reduced the population, and in some areas along the Atlantic Coast, the piping plover was close to extirpation. Following passage of the Migratory Bird Treaty Act (40 Stat. 775; 16 U.S.C. 703-712) in 1918, and changes in the fashion industry that no longer exploited wild birds for feathers, piping plover numbers recovered to some extent (Haig and Oring 1985).

Available data suggest that the most recent population decline began in the late 1940s or early 1950s (Haig and Oring 1985). Reports of local or statewide declines between 1950 and 1985 are numerous, and many are summarized by Cairns and McLaren (1980) and Haig and Oring (1985). While Wilcox (1939) estimated more than 500 pairs of piping plovers on Long Island, New

York, the 1989 population estimate was 191 pairs (see Table 4, USFWS 1996). There was little focus on gathering quantitative data on piping plovers in Massachusetts through the late 1960s because the species was commonly observed and presumed to be secure. However, numbers of piping plover breeding pairs declined 50 to 100 percent at seven Massachusetts sites between the early 1970s and 1984 (Griffin and Melvin 1984). Piping plover surveys in the early years of the recovery effort found that counts of these cryptically colored birds sometimes went up with increased census effort, suggesting that some historic counts of piping plovers by one or a few observers may have underestimated the piping plover population. Thus, the magnitude of the species decline may have been more severe than available numbers imply.

The Atlantic Coast population has increased from 790 pairs since listing to a preliminary estimate of 1,887 pairs in 2007 (USFWS 2008a)(final 2006 estimate of 1,749 pairs, USFWS 2006b). Population growth has been greatest in the New England and New York-New Jersey recovery units, with a more modest and recent increase in the Southern unit and an even smaller increase in Atlantic Canada. Periodic rapid declines in abundance of breeding pairs at the level of the recovery unit, including a 68 percent decline in the southern half of the Virginia barrier island chain and North Carolina between 1995 and 2001, illustrate continued population vulnerability. As of 2007, the Southern recovery unit had 333 nesting pairs (USFWS 2008a). The abundance objectives for the Atlantic Coast population and the Southern recovery unit are 2,000 and 400 breeding pairs, respectively, and must be sustained for five years (USFWS 1996).

Species as a whole

The 2001 International Piping Plover Breeding Census resulted in 2,747 breeding pairs distributed across all three breeding populations (Ferland and Haig 2002). Total population numbers have fluctuated over time with some areas experiencing increases and others decreases.

Loggerhead sea turtle

From 1989 to 1998, total estimated loggerhead nesting in the southeastern U.S. ranged from approximately 53,000 to 92,000 nests per year, with well over 90% of the nests occurring in Florida (Turtle Expert Working Group 2000). In 1998, 85,988 nests were documented in Florida alone. However, that number had declined to 49,776 nests in 2006 (FFWCC 2006a). An analysis of nesting data from the Florida Index Nesting Beach Survey (INBS) Program from 1989 to 2007, a more consistent and accurate index survey that includes a subset of the total Florida beach length, showed an overall decrease in loggerhead nesting of 37% (FFWCC 2007).

Standardized monitoring of nearly all ocean-facing beaches in North Carolina was implemented in the mid-1990s. Data collected to date on annual numbers of nests in North Carolina are insufficient to detect a trend. An analysis of a longer-term dataset available for several nesting beaches in the southern reach of North Carolina showed that there was no increasing or decreasing trend in annual nest numbers (Hawkes et al. 2005). Additional, long-term nesting data are needed to determine whether current declines in nesting are part of the inherent variability in sea turtle nesting patterns or the result of other factors.

From a global perspective, the southeastern U.S. nesting aggregation is of importance to the survival of the species and is second in size only to that which nests on islands in the Arabian Sea off Oman (Ross 1982, Ehrhart 1989, NMFS and USFWS 1991b). The status of the Oman loggerhead nesting population, reported to be the largest in the world (Ross 1979), is uncertain because of the lack of long-term standardized nesting or foraging ground surveys and its vulnerability to increasing development pressures near major nesting beaches and threats from fisheries interactions on foraging grounds and migration routes (Possardt 2005, *in litt.*). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia have been estimated to account for about 88 percent of nesting worldwide (NMFS and USFWS 1991b).

Green sea turtle

Based on an analysis of 46 green turtle nesting concentrations worldwide, approximately 109,000 to 151,000 females nest annually (NMFS and USFWS 2007a). However, this is a crude estimate since not all nesting sites are included, and some data are not fully verifiable. Since 1989, approximately 579 to 9,642 green turtles have annually nested in Florida, with the all-time high number occurring in 2005 (FFWCC 2006a). Green turtles sporadically nest in North Carolina, South Carolina and Georgia in small numbers. In 2007, 15 green turtles nests were observed in North Carolina (SCDNR 2007). In the U.S. Pacific, over 90 percent of nesting throughout the Hawaiian archipelago occurs at the French Frigate Shoals, where about 200 to 700 females nest each year (NMFS and USFWS 1998). Elsewhere in the U.S. Pacific, nesting takes place at scattered locations in the Commonwealth of the Northern Marianas, Guam, and American Samoa. In the western Pacific, the largest green turtle nesting aggregation in the world occurs on Raine Island, Australia, where tens of thousands of females nest nightly in an average nesting season (Limpus et al. 1993). In the Indian Ocean, major nesting beaches occur in Oman where 30,000 females are reported to nest annually (Ross and Barwani 1995).

Leatherback sea turtle

Pritchard (1982) estimated 115,000 female leatherback turtles worldwide, of which 60% nested along the Pacific coast of Mexico. Spotila et al. (1996) later estimated that only 34,500 females (with confidence limits of 26,200 to 42,900) remained worldwide. The most recent population size estimate for North America alone is from 34,000 to 94,000 adult leatherbacks (Turtle Expert Working Group 2007). A dramatic drop in nesting numbers has been recorded on major nesting beaches along the Pacific Ocean, although a sizeable nesting population exists in Papua-Indonesia (Dutton et al. 2007, Hitipeuw et al. 2007). Severe declines in leatherback nesting have occurred over the last two decades along the Pacific coasts of Mexico and Costa Rica (Spotila et al. 2000). The Pacific Mexican leatherback nesting population, once considered to be the world's largest leatherback nesting population (historically estimated to be 65 percent of worldwide population), is now less than one percent of its estimated size in 1980 (Pritchard 1982, Sarti Martinez et al. 2007). The Malaysian nesting population has collapsed and is near extirpation (Chan and Liew 1996). In the Atlantic Ocean, overall, there appears to be an increasing or stable population trend in all regions except the Western Caribbean and West Africa (for the latter, no long-term data are available)(Turtle Expert Working Group 2007).

The largest nesting populations at present occur in the western Atlantic Ocean in Trinidad and Suriname/French Guiana (4,500 to 7,500 females nesting/year) and in the eastern Atlantic Ocean in Gabon (Billes et al. 2000). In the U.S., most nesting occurs in Florida, U.S. Virgin Islands and Puerto Rico. From 1989 to 2006, 98 to 935 nests were observed in Florida (FFWCC 2006a). An analysis of the Florida Index Nesting Beach Survey shows an overall increase in leatherback nesting from 1989 to 2006 (FFWCC 2007). The U.S. Virgin Islands and Puerto Rico nesting populations also appear to be increasing (Dutton et al. 2005, Turtle Expert Working Group 2007). Leatherback nesting is low in number and sporadic in North Carolina. In 2007, 10 leatherbacks nested in North Carolina (SCDNR 2007)

D. Status and distribution

Piping plover

Populations of piping plovers have declined from historic numbers. Unregulated hunting drove plovers to near extinction in the early 1900s, but protective legislation resulted in population recovery by the mid-1920s. However, piping plover numbers declined again in the 1940s and 1950s due to shoreline development. River flow alteration, channelization, and reservoir construction also contributed to declines during this period.

The endangered Great Lakes population is at a low level. From an all-time low of 12 nesting pairs in 1990, the population has increased to an estimated 63 nesting pairs in 2007 (Dingledine 2008, *in litt.*). During this period most nesting occurred in Michigan, but recently, as many as five pairs have nested along the Lake Superior shoreline in Wisconsin. Also, in 2007 the first successful nesting pair in over 30 years was recorded in the Great Lakes region of Ontario, Canada (Dingledine 2008, *in litt.*).

The Northern Great Plains breeding population continues to decline. Overall, there were an estimated 1,291 northern Great Plains nesting pairs in the U.S. and Canada in 2001. Current estimates of piping plover survival rates are limited, but most mortality was thought to occur during migration or on wintering grounds (Root et al. 1992). The decline of this population has been attributed to the construction of reservoirs that result in the loss of sandbar habitat.

The Atlantic Coast breeding population has experienced an overall increase since listing, but these increases are regionally variable with some areas continuing to experience periodic population declines (USFWS 2008b). The Atlantic Coast population of piping plovers has increased from 790 nesting pairs in 1986 to a preliminary estimate of 1,887 nesting pairs in 2007 (USFWS 2008a). However, the increase is unevenly distributed (with most pairs occurring in New England and New York-New Jersey). Growth of the Atlantic Coast population has followed intensive, expensive, and sustained protection of breeding pairs by USFWS, Canadian Wildlife Service, state, and provincial wildlife agencies; federal, state, municipal, and private landowners; non-government organizations, academic organizations, and interested individuals.

Much of the plover's historic habitat along the Atlantic Coast has already been destroyed or permanently degraded by development and human use. The construction of houses and commercial buildings on and adjacent to barrier beaches directly removes plover habitat and results in increased human disturbance. Additional disturbance comes in the form of recreational use of beach habitats. While legal restrictions on coastal development may slow the future pace of physical habitat destruction, the trend in habitat availability for this species is inexorably downward. Furthermore, habitat availability for the species is compromised by the ever increasing human access to, and recreational use of, these coastal habitats. The decrease in habitat availability, especially with regard to the dynamic nature of these coastal areas, may force birds to nest in suboptimal habitats, the effects of which could manifest itself in poor future reproductive success.

The decrease in the functional suitability of the plover's habitat due to accelerating recreational activity on the Atlantic Coast may impact productivity. Functional habitat loss occurs when suitable nesting sites are made unusable because high human and/or animal use precludes the birds from successfully nesting. Population growth along both the U.S. and Canadian coasts fosters an ever increasing demand for beach recreation. In 2004, about 30 percent of the U.S. Atlantic Coast population of piping plovers nested on federally owned beaches where some protection is afforded under section 7 of the ESA. The remaining 70 percent of the birds nested on state, town, or privately-owned beaches where plover managers are implementing protections in the face of increasing disturbance from recreation and development. Unfortunately for the piping plover, recreational activities and public use of federally owned beaches have also increased. Pressure on Atlantic Coast beach habitat from development and human disturbance continues (USFWS 1996).

Piping plovers winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Birds from the three breeding populations overlap in their use of wintering habitat. In 2001, 2,389 piping plovers, accounting for approximately 40 percent of the known breeding birds recorded during a breeding census were located during a winter census (Haig et al. 2005). While only 16 percent of all nonbreeding birds counted during the 2001 census were found on the Atlantic Coast, observations of banded migrating and wintering piping plovers from the Great Lakes and Atlantic Canada breeding populations were heavily concentrated on the southern U.S. Atlantic Coast (Amirault et al. 2005, Stucker and Cuthbert 2006). The status of wintering piping plovers is difficult to assess, but threats to piping plover wintering habitat identified by the USFWS during its designation of critical habitat continue to affect the species. Unregulated motorized and pedestrian recreational use, inlet and shoreline stabilization projects, beach maintenance and nourishment, and pollution affect most wintering areas. Conservation efforts at some locations have likely resulted in the enhancement of wintering habitat.

We are aware of the following site-specific conditions that affect the status of several wintering piping plover habitats, including critical habitat units. In Texas, one critical habitat unit was afforded greater protection due to the acquisition of adjacent upland properties by the local Audubon chapter. In another unit in Texas, vehicles were removed from a portion of the beach, thus decreasing the likelihood of automobile disturbance to plovers. In Florida, land acquisition has been initiated within portions of one critical habitat unit in the panhandle. The USFWS remains in a contractual agreement with the U.S. Department of Agriculture for predator control within limited coastal areas in the panhandle, including portions of some critical habitat units. Continued removal of potential terrestrial predators is likely to enhance survivorship of wintering piping plovers. In North Carolina, one critical habitat unit was afforded greater protection when the local Audubon chapter agreed to manage the area specifically for piping plovers and other shorebirds following the relocation of the nearby inlet channel.

Loggerhead sea turtle

Genetic research involving analysis of mitochondrial DNA has identified five different loggerhead subpopulations/nesting aggregations in the western North Atlantic:

- Northern subpopulation occurring from North Carolina to around Cape Canaveral, Florida (about 29° N.);
- South Florida subpopulation occurring from about 29° N on Florida's east coast to Sarasota on Florida's west coast;
- Dry Tortugas, Florida, subpopulation;
- Northwest Florida subpopulation occurring at Eglin Air Force Base and the beaches near Panama City; and
- Yucatán subpopulation occurring on the eastern Yucatán Peninsula, Mexico.

These data indicate that maternally based gene flow between these five regions is very low. If nesting females are extirpated from one of these regions, regional dispersal will not be sufficient to rapidly replenish the depleted nesting subpopulation (Bowen 1995, *in litt*; Bowen et al. 1993; Encalada et al. 1998; Pearce 2001).

The Northern subpopulation has declined substantially since the early 1970s. Standardized ground surveys of 11 North Carolina, South Carolina and Georgia nesting beaches showed a significant declining trend of 1.9% annually from 1983 to 2005 (NMFS and USFWS 2007b). Nest totals from aerial surveys conducted by the South Carolina Department of Natural Resources showed a 3.1% annual decline from 1980 to 2002 (NMFS and USFWS 2007b). Although long-term data are not available for all beaches in North Carolina, an analysis of annual nest totals on beaches in the southern part of NC showed no discernable increasing or decreasing trend (Hawkes et al. 2005).

An analysis of nesting data from the Florida Index Nesting Beach Survey (INBS) Program from 1989 to 2007 showed an overall decrease in loggerhead nesting of 37% (FFWCC 2007). The Florida Panhandle subpopulation shows a significant declining trend of 6.8% annually from 1995 to 2005 (NMFS and USFWS 2007b).

Current threats include loss or degradation of nesting habitat from coastal development and beach armoring; confusion of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; disease; and incidental take from channel dredging and commercial trawling, longline, and gill net fisheries. There is particular concern about the extensive incidental take of juvenile loggerheads in the eastern Atlantic by longline fishing vessels from several countries (Lutcavage et al. 1997, Lewison et al. 2004).

Green sea turtle

Total population estimates for the green turtle are unavailable, and trends based on nesting data are difficult to assess because of large annual fluctuations in numbers of nesting females. Some nesting localities appear to be stable or increasing, while others appear to be declining. Trend data are unavailable for many locations (NMFS and USFWS 2007a). The endangered Florida nesting population appears to have increased from 1989 to 2006. This may partially be due to increased protections through state legislation in Florida (NMFS and USFWS 2007a).

A major factor contributing to the green turtle's decline worldwide has been commercial harvest for eggs and food. Fibropapillomatosis, a disease of sea turtles characterized by the development of multiple tumors on the skin and internal organs, is also a mortality factor and has seriously impacted green turtle populations in Florida, Brazil, Hawaii, and other parts of the world. The tumors interfere with swimming, eating, breathing, vision, and reproduction. Heavy tumor burdens are fatal to the turtles (Herbst 1994). Other threats include loss or degradation of nesting habitat from coastal development and beach armoring; confusion of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and incidental take from channel dredging and commercial fishing operations (Lutcavage et al. 1997).

Leatherback sea turtle

Leatherbacks are less common in the Indian Ocean and in very low numbers in the western Pacific Ocean. The East Pacific and Malaysia leatherback populations have collapsed. Using an age-based demographic model, Spotila et al. (1996) determined that leatherback populations in the Indian Ocean and western Pacific Ocean cannot withstand even moderate levels of adult mortality. They concluded that leatherbacks are on the road to extinction and further population declines can be expected unless action is taken to reduce adult mortality and increase survival of eggs and hatchlings. The largest populations are in the Atlantic Ocean, in Suriname/French Guiana, Gabon, Trinidad and Costa Rica/Panama (Troëng et al. 2004). The North Atlantic population is estimated at 34,000 to 94,000 adults (Turtle Expert Working Group 2007) and appears stable.

The crash of the Pacific leatherback population is believed primarily to be the result of exploitation by humans for the eggs and meat, as well as incidental take in numerous commercial fisheries of the Pacific (Chan and Liew 1996, Spotila et al. 2000). Other factors threatening leatherbacks globally include loss or degradation of nesting habitat from coastal development, confusion of hatchlings by beachfront lighting, excessive nest predation by native and non-native predators, degradation of foraging habitat, marine pollution and debris, and watercraft strikes (Lutcavage et al. 1997).

E. Analysis of the species/critical habitat likely to be affected

Piping plovers

Piping plovers from the Atlantic Coast population are the focus of these biological and conference opinions when referencing breeding birds. Since recovery units have been established in an approved recovery plan for the piping plover (USFWS 1996), these biological and conference opinions will also consider the effects of the proposed project on plovers in the Southern recovery unit. Piping plovers from all three breeding populations are referenced when discussing effects of the proposed action on migrating and wintering plovers. The proposed action has the potential to adversely affect nesting and non-nesting adults, eggs, chicks, and juveniles during the nesting season, and adults and juveniles during the migrating and wintering seasons within the proposed project area

Sea turtles - all species

The proposed action has the potential to adversely affect nesting females, eggs, hatchlings, and post-hatchling washbacks within the action area. The effects of the proposed action on sea turtles will be considered further in the remaining sections of these biological and conference opinions. For loggerhead turtles, specifically, the focus of these biological and conference opinions will consider the effects of the proposed action on nesting loggerheads from North Carolina and the Northern subpopulation, as well as the southeastern U.S. population as a whole.

Other Species

In addition to the four species and proposed critical habitat that are the subject of this formal consultation and conference, the FHWA has determined that, based on lack of habitat, the project will have no effect on the red-cockaded woodpecker (*Picoides borealis*) and red wolf (*Canis rufus*). We concur with these determinations. Also, the FHWA has determined that the project may affect, but is not likely to adversely affect the roseate tern (*Sterna dougallii*), West Indian manatee (*Trichechus manatus*) and seabeach amaranth (*Amaranthus pumilus*). Based on available information, the USFWS concurs with these determinations. The hawksbill sea turtle (*Eretmochelys imbricata*) and Kemp's ridley sea turtle (*Lepidochelys kempii*) do not normally nest in North Carolina, but occur in waters off the North Carolina coast. These two turtle species, along with the shortnose sturgeon (*Acipenser brevirostrum*), fall within the purview of the NMFS. The species discussed in this paragraph will not be considered further in this consultation.

III. ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the ESA, when considering the "effects of the action" on federally listed species, the USFWS is required to take into consideration the environmental baseline. The environmental baseline includes past and ongoing natural factors and the past and present impacts of all federal, state, or private actions and other activities in the action area (50 CFR 402.02), including federal actions in the area that have already undergone section 7 consultation, and the impacts of state or private actions which are contemporaneous with the consultation in process.

A. Status of the Species Within the Action Area

Piping Plover

Piping plover habitat within the action area occurs within an area affected by dynamic coastal processes and ongoing human uses. Suitable piping plover habitat appears to be present at and near Oregon Inlet, Green Island and along the ocean shoreline. Along the existing NC 12, artificial berms are constructed and maintained to protect NC 12 from rising high tide lines and erosion. The longshore transport of sediments continues to operate, but not the cross-island transport that maintains optimal piping plover habitat. This may result in the species currently concentrating near Oregon Inlet.

There is minimal piping plover breeding activity within the action area. Breeding activity has only been observed along both sides of Oregon Inlet. One breeding pair has been recorded at Bodie Island Spit on the north side of Oregon Inlet during five out of the last ten years (2001, 2002, 2004, 2006 and 2007)(Cameron 2008a, *in litt.*; NCWRC 2008b). During this same timeframe, one nest was observed in each of the years 2001, 2002, 2004 and 2007. In 2007, three chicks hatched, and one fledged, from a nest on Bodie Island Spit approximately 1700 feet northeast of the existing Bonner Bridge (NPS 2007a, NPS 2007b). One or two breeding pairs were observed on the south side of Oregon Inlet on PINWR during each of the years from 1998 to 2003 (Cameron 2008a, *in litt.*; NCWRC 2008b), with one nest being observed in 2001 and 2002 (Sue Cameron, NCWRC waterbird biologist, pers. comm. March 24, 2008). Vegetation succession on the south side of Oregon Inlet has reduced favorable nesting habitat there. In 2007, the action area accounted for only 1.6% of piping plover breeding activity within North Carolina (one out of 61 breeding pairs)(Cameron 2008b, *in. litt.*; NCWRC 2008c).

The number of piping plovers within the action area during the winter or migration is more difficult to assess. Regular surveys have not been conducted for non-breeding (including migrating and overwintering) plovers. However, non-breeding piping plovers have been observed within the action area, primarily at Bodie Island Spit (Cameron 2008, *in litt.*; NCWRC 2008a, NPS 2007a, NPS 2006b). Cohen et al. (in press) found that wintering plovers used ocean beach, sound beach and sound islands near Oregon Inlet. They estimated a minimum total wintering population of 11 birds in the vicinity of Oregon Inlet (including Green Island) during the winter of 2006/2007.

Proposed critical habitat for wintering piping plovers, Unit NC-1 Oregon Inlet, lies within the action area (USFWS 2008d). This unit contains a mix of intertidal beach and sand and/or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand and/or mud flats above annual high tide. Unit NC-1 is the northernmost critical habitat unit proposed within the wintering range of the piping plover. Consistent use by wintering plovers has been reported at Oregon Inlet dating from the mid-1960s. As many as 39 plovers have been reported from single day surveys during the fall migration (NCWRC 2008a). Cohen et al. (in press) reported wintering birds using portions of the proposed Unit NC-1. Recent surveys have also recorded use of proposed Unit NC-1 by at least one banded piping plover from the endangered Great Lakes breeding population, with at least nine other birds recorded at other sites within the Dare County portion of the Outer Banks (Stucker and Cuthbert 2006). Until recently, limited banding has been done in the Great Plains population, so it is uncertain whether or to what extent birds from this population winter in this unit.

Loggerhead sea turtle

Loggerhead turtles usually nest from late April or early May through mid-September (Meylan et al. 1995). From 1996 to 2006, there were a total 126 loggerhead nests observed within the action area, averaging 11.5 nests per year (Godfrey 2008, *in litt.*).

Green sea turtle

Green turtles usually nest from late May or early June to early or mid-September (Woodson and Webster 1999). From 1996 to 2006, there were 5 or 6 green turtle nests observed within the action area, averaging 0.5 nests per year (Godfrey 2008, *in litt.*; USFWS 2008c, *in litt.*).

Leatherback sea turtle

Nesting by leatherback turtles is rare in North Carolina, with only 10 nests documented statewide in 2007 (SCDNR 2007). From 1996 to 2006, no leatherback nests were documented within the action area (Godfrey 2008, *in litt.*).

Summary of the status of sea turtles at within the action area

From 2000 to 2006, the extent of sea turtle nesting within the action area annually represented 0.9 to 2.3% of total sea turtle nesting in North Carolina (Godfrey 2008, *in litt.*; NPS 2007c). Although the USFWS recognizes sea turtles can occur and will nest within the action area, the total number of turtle nests potentially affected is relatively small when compared to the recovery and survival needs of each species.

B. Factors affecting species environment within the action area

A number of ongoing anthropogenic and natural factors may affect the species addressed in these biological and conference opinions. Many of these effects have not been evaluated with respect to biological impacts on the species. In addition, some are interrelated and the effects of one cannot be separated from others. Known or suspected factors affecting the species addressed in these biological and conference opinions are discussed below.

Manteo (Shallowbag) Bay Project

The Army Corps of Engineers (COE) completed formal consultation, pursuant to section 7 of the ESA, with the USFWS in December 1990 for maintenance dredging at Oregon Inlet that would place about 1.5 million cubic yards of dredged sediments per year on the ocean beaches at

PINWR. The COE subsequently reinitiated consultation four times, with the USFWS subsequently providing amendments to the original biological opinion on July 12, 1991; August 1, 2001; June 11, 2002; and May 22, 2008. The June 2002 amendment addressed the modification of the inlet dredging to include the removal of 1.3 to 1.8 million cubic yards of sediments from the inlet and the southern end of Bodie Island spit and disposal of the material on the beaches of PINWR. The biological opinion allowed incidental take of up to one sea turtle nest. This take could take the form of burial or crushing of a nest, or inhibition of nesting due to beach disturbance or scarp formation associated with the placement of dredge material on the beach.

Terminal Groin

Oregon Inlet is part of a migrating barrier island system. Oregon Inlet is migrating south-southwest and historically was eroding the north end of Hatteras Island. In order to protect the Bonner Bridge, the NCDOT completed the construction of a terminal groin on the north end of Hatteras Island in 1991. This structure armored the north shore of Hatteras Island and ended the migration of the north end of the island. As a result, the natural barrier island processes which create piping plover habitat have stopped at the south side of Oregon Inlet. Furthermore, armoring the shore has resulted in increased vegetation coverage and succession which reduces the quantity and quality of piping plover habitat.

Sand Berm Construction

The NCDOT regularly reconstructs the sand berms along portions of NC 12 in PINWR and CAHA. The project varies in scale and scope, but typically entails placing sand that has washed or blown from the seaward dune onto the road back into the footprint of the seaward dune, and is intended to maintain access along NC Highway 12. Typically, the federal nexus for these projects are the required special use permits issued by PINWR and CAHA. Before a special use permit can be issued, the appropriate office must first consult with the USFWS's Raleigh Field Office under the provisions of the ESA.

The sand berm construction occurs in areas potentially used by piping plovers for foraging. Anticipated impacts of sand berm construction on piping plovers include:

- harassment in the form of disturbing foraging, migrating or wintering birds;
- preclusion of cross-island transport processes that form and maintain optimal habitat; and,
- destruction of foraging habitat.

Sand berm construction also occurs in areas used by sea turtles for nesting. Anticipated impacts of sand berm construction on sea turtles include:

- destruction of sea turtle nests and deposited eggs that may have been missed by a nest survey and egg relocation program;
- reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site;

- harassment in the form of disturbing or interfering with female sea turtles attempting to nest within the construction area or adjacent beaches as a result of construction activities;
- disorientation of hatchling sea turtles on beaches adjacent to the construction area as they emerge from nests and crawl to the water because of project lighting; and
- limiting the width of the nesting beach.

Lighting

The extent that lighting affects piping plovers is unknown. However, there is evidence that American oystercatcher (*Haematopus palliatus*) chicks and adults are attracted to vehicle headlights and may move toward areas of ORV activity. During a 2005 study at Cape Lookout National Seashore, adult and chick oystercatchers were observed running or flying directly into the headlights of oncoming vehicles, and two two-day old oystercatcher chicks were run over by an all-terrain vehicle after being observed foraging with the adults near the high tide line at night (Simons et al. 2005). ORV driving is prohibited within most of the action area, being limited to the northernmost portion of the action area on the southern end of Bodie Island at Oregon Inlet, and approximately 1.1 miles of beach southward from the southern boundary of PINWR.

Although extensive monitoring of the effects of lighting on sea turtles has not been conducted within the action area, the southern end of the action may be affected by light originating from the village of Rodanthe.

Predation

Predation of piping plovers has not been directly observed within the action area, but predation and nest abandonment because of predators have been implicated as a cause of low reproductive success at CAHA (Cooper 1990, Coutu et al. 1990, Kuklinski et al. 1996). Mammalian and avian predators are relatively common within the action area. Red foxes (*Vulpes vulpes*) are relatively recent arrivals within the action area. Red foxes were first observed within CAHA on Bodie Island in 1996 and on Hatteras Island in 2000 (NPS 2001). Due to the presence of tracks, red foxes are suspected in disappearances of piping plovers and nest abandoning. Predation of sea turtle nests and hatchlings at CAHA has been documented. Red foxes and ghost crabs (*Ocypode* spp.) have been known to depredate sea turtle nests (NPS 2007c).

Stochastic (Random) Events

The impacts of tropical storms and associated coastal erosion on piping plovers within the action area have not been assessed. However, such events have the potential to destroy nests. Extremely cold temperatures may also adversely affect wintering birds.

High tides and storm surges from tropical weather systems can overwash, wash out, or inundate sea turtle nests. In the last several years, hurricanes and tropical storms have resulted in substantial impacts to the coastal environment along the action area. Erosion resulted in a reduction of beach profile in some areas and an accretion of sand in others. In the last ten years

(1998 to 2007), zero to nine sea turtle nests per year were lost within PINWR to storms and inundation (USFWS 2008c).

Habitat Management and Protection

With the exception of the southern terminus of the action area near Rodanthe, the coastline of the action area is under public ownership, either as CAHA or PINWR. Public ownership confers some conservation benefit to listed species, but land use decisions by the government agencies managing these lands ultimately determines the extent of conservation value these areas will have for threatened or endangered species.

In all cases, public ownership removes some threats that might otherwise be present if the properties were owned by private landowners and subsequently developed according to existing zoning regulations. In most cases, public ownership precludes the need for coastal armoring or beach nourishment, since these activities on public lands are rarely deemed appropriate (but see **Manteo Bay Project** section above). Thus, adverse effects to sea turtles and piping plovers associated with these activities are avoided or minimized on public lands. Public ownership also minimizes the likelihood that light pollution from homes and other development will become a significant problem since no commercial and residential development will occur on public lands. Therefore, along the shoreline of public parcels, disorientation of adult or hatchling sea turtles or piping plovers due to artificial lighting of homes or businesses will have been avoided or greatly reduced with public ownership.

Vehicle Use on the Beach

Oregon Inlet is one of the first beach access points for ORVs within CAHA when traveling from the developed coastal communities of Nags Head, Kill Devil Hills, Kitty Hawk, and Manteo. As such, the inlet spit is a popular area for ORV users to congregate. A recent visitor use study of the park reported that Oregon Inlet is the second most popular ORV use area in the park (Vogelsong 2003). As a result, sandy beach and mud and sand flat habitat being proposed as critical habitat in this unit may require special management considerations or protection. The Bodie Island Spit and an approximately 1.1 mile section of beach south of the southern boundary of PINWR are the only portions of the action area where vehicles are allowed on the beach.

Vehicles can significantly degrade piping plover habitat and disrupt normal behavior patterns of the birds. ORV users routinely violate bird closure areas (NPS 2006a, NPS 2007a). While there are no records of plover mortality at Oregon Inlet due to vehicles or tire ruts, the prospects of finding a dead, small, sand-colored bird or chick is unlikely. During the winter of 2005/2006, Cohen et al. (in press) found that when piping plovers used ocean beach habitat at Oregon Inlet, plovers were far more likely to use the PINWR side of Oregon Inlet (96% of the time; no ORV use) than the Bodie Island side (4% of the time). The lesser use of the Bodie Island side coincides with the ORV use there. They also found that piping plovers commonly roosted on the PINWR side, but only rarely roosted on the Bodie Island side, despite the fact that the Bodie Island side was closer to their foraging sites. They recommended controlled management experiments to determine if recreational disturbance drives roost site selection at Oregon Inlet, and if control of disturbance might lead to increased use of the northern beach as a roost area.

As a result of a recent lawsuit in federal court, a settlement was agreed upon that would increase protection for breeding plovers within CAHA. Terms of the consent decree will result in buffers being established during portions of the spring and summer around bird breeding and nesting areas, including creating a 1000 meter vehicle perimeter around piping plover chicks until they have fledged (NPS 2008b).

The use of ORVs on sea turtle nesting beaches can adversely affect the egg, hatchling, and nesting life stages of sea turtles. There are no specific records of vehicles colliding with nesting turtles or hatchlings within the action area, but the potential exists since ORV users have been reported to violate closed areas (NPS 2007c). Impacts from vehicles running over sea turtle nests have been reported at other locations within CAHA (NPS 2007c).

Vehicular ruts create obstacles for sea turtle hatchlings moving from the nest to the ocean. Possible mortality of hatchlings can occur due to being trapped in tire ruts. In addition, indirect effects may occur from weakened individuals dying at sea or made more vulnerable to predators. CAHA implements measures (including closures around known nests) to manage these effects. Another potential indirect effect of vehicular traffic is compaction of beach sediments under the weight of vehicles, thus creating suboptimal nesting habitat conditions.

Pedestrian Use of the Beach

Though no statistics exist to quantify the amount of pedestrian traffic on the beaches within the action area, evidence exist that people walking on the beach affects nesting and wintering piping plovers and nesting sea turtles and their nests, eggs, and hatchlings. Closure areas are established to protect plovers and sea turtles, but pedestrians sometimes violate these (NPS 2008a, NPS 2007a, NPS 2007c). Pedestrians have been documented harassing nesting sea turtles within CAHA (e.g. crowding around nesting turtle and taking flash photographs) and digging within turtle nests (NPS 2007c). Pedestrian use is allowed day and night within CAHA, but only during the day within PINWR.

Dog Use on the Beach

Dogs on a leash are allowed within both CAHA and PINWR, except in designated areas where no dogs are allowed. However, violations occur and enforcement is difficult because of the limited number of NPS and USFWS staff. Dogs running freely on beaches are potential predators of piping plover eggs and chicks, and can harass nesting, migrating or wintering adults. Dogs are also potential predators of sea turtle eggs, hatchlings, and even adult sea turtles. Unleashed dogs have been observed digging into nests. However, the extent of the effects from these actions to plovers and sea turtles within the action area is unknown.

IV. EFFECTS OF THE ACTION

Under section 7(a)(2) of the Act, "effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. The federal agency is responsible for analyzing these effects. The effects of the proposed action are added to the environmental baseline to determine the future baseline, which serves as the basis for the determination in these biological and conference opinions. Should the effects of the federal action result in a situation that would jeopardize the continued existence of the species, we may propose reasonable and prudent alternatives that the federal agency can take to avoid a violation of section 7(a)(2). The discussion that follows is our evaluation of the anticipated direct and indirect effects of the proposed project. Indirect effects are those caused by the proposed action that occur later in time but are still reasonably certain to occur (50 CFR 402.02).

A. Factors to be considered

Piping plovers

Proximity of the action: The proposed action occurs within the nesting range of the Atlantic Coast piping plover breeding population. Since recovery units have been established in an approved recovery plan, these biological and conference opinions consider the effects of the proposed project on plovers in the Southern recovery unit, as well as the Atlantic Coast population and the entire species. The proposed action also occurs within the migrating and overwintering range of all three breeding populations of the piping plover. Additionally, the proposed action would occur within one proposed critical habitat unit for wintering plovers.

Distribution: The expected disturbance from the proposed action is likely to occur throughout the action area, but in a staggered manner over time.

Timing: The proposed action will occur throughout the year. Specifically, the proposed action will occur during the breeding, migrating and wintering seasons of the piping plover.

Nature of the effect: The project may affect breeding, nesting, migrating, roosting, or foraging activities of piping plovers. This may take the form of habitat loss, new habitat creation, preclusion of habitat utilization, harassment/disturbance resulting in behavior modification, and mortality in the form of egg, chick or adult death. Also considered are the potential effects on the primary constituent elements within one proposed critical habitat unit.

Duration/Disturbance frequency: The proposed project will be built in four phases, with Phase I beginning in 2009 and Phase IV beginning approximately 2029 or 2030. Each phase will involve 3 – 3.5 years of construction. The construction of each phase will be continuous from start to finish, operating year-round. Therefore, construction will be staggered over an approximately 25 year time span, with gaps of no construction between each phase. Each phase will only affect a portion of the action area at any one time.

The phasing of the construction of Phases II to IV is based on assumptions corresponding to forecast shoreline erosion trends and maintaining minimum 230-foot buffer distance between the existing NC 12 edge of pavement and the active shoreline. These assumptions are based on worst-case scenario modeling of shoreline erosion and the location and likelihood of future breaches on Hatteras Island. Since these are forecasts only, the exact timing and scope of each phase could change based on the reality of future shoreline erosion. As such, the duration of the construction should be viewed as an approximation. Since piping plovers may be present throughout the year, plovers could be affected at any time during any of the phases or during subsequent maintenance of the facility.

Although construction activity will be a temporary affect, the new structures will permanently alter the habitat for piping plovers, although not necessarily all negatively in the long-term. Natural barrier island processes, which are currently precluded along much of the action area by the maintenance of NC 12, will be allowed to resume to an extent. Also, maintenance of the facility will be an ongoing activity on both a periodic and as-needed basis.

Disturbance intensity: Although the potential for disturbance to the piping plovers throughout the action area is high, the intensity of the disturbance is only expected to be high at and near Oregon Inlet. The rest of the action area currently has relatively little use by plovers. Therefore, Phase I has the greatest potential to affect plovers. The intensity of disturbance will likely be greatest for nesting piping plovers (April 1 through August 31) since they are tied to a point on the landscape with a nest, or when rearing young that have not yet fledged. However, relatively little nesting occurs within the action area. The intensity of disturbance may also be high for wintering plovers at Oregon Inlet. However, the small loss of proposed critical wintering habitat will likely have a discountable effect.

Disturbance severity: Although Phase I has the potential to affect nesting piping plovers, the severity of the affect, considering all the Atlantic Coast nesting, is relatively minor. Impacts to wintering plovers are of particular concern for the endangered Great Lakes breeding population. At least one individually identifiable Great Lakes piping plover has been observed at Oregon Inlet (Stucker and Cuthbert 2006).

Sea turtles – all species

Proximity of the action: The proposed action occurs within the northern nesting range of the loggerhead, green, and leatherback sea turtles. Specifically, the proposed action occurs within the range of the Northern subpopulation of the loggerhead turtle.

Distribution: The expected disturbance from the proposed action is likely to occur on all ocean facing beaches throughout the action area.

Timing: The proposed action will occur throughout the year. Any effects to sea turtles are expected to occur primarily during the sea turtle nesting and hatching seasons from May 1 through November 15. The greatest effects may occur at night from construction lighting and lights from vehicles traveling on the finished facility.

Nature of the effect: The project may affect nesting sea turtles, eggs, and hatchlings. This may take the form of habitat alteration, new habitat formation, preclusion of habitat utilization, harassment/disturbance resulting in behavior modification, and mortality in the form of egg, hatchling or adult death. Based on nesting records for the last ten years, we expect approximately 96% of all effects to sea turtles will involve loggerhead sea turtles and 4% will involve green and leatherback sea turtles.

Duration/ Disturbance frequency: The duration/disturbance frequency to sea turtles is similar to that described above for piping plovers; except that the effects will primary occur during nesting and hatching seasons from May 1 through November 15.

Disturbance intensity: The potential for disturbance to the sea turtle populations throughout the action area is highest for possible effects of construction lighting at night and lights from vehicles traveling on the finished facility.

Disturbance severity: Since nearly all the sea turtle nesting that occurs within the action area is by loggerheads, the severity of the disturbance to green and leatherback turtles is expected to be minimal. However, the effects to loggerheads could lessen the contribution of those turtles to the recovery goal for the northern nesting subpopulation of loggerheads. However, this may be balanced by possible habitat creation resulting from allowing natural barrier island processes to occur within more of the action area.

B. Analysis for effects of the action

Beneficial effects:

Since NCDOT maintains an artificial berm along the seaward side of NC 12 through most of the project area, natural barrier island processes such as ocean overwash, island migration and inlet formation have been mostly precluded, thus severely limiting the formation of new habitat for piping plovers. Elevating most of NC 12 onto a bridge will allow for the maintenance of the artificial berm to be discontinued, thus allowing the natural barrier island processes to resume. Ocean overwash and possible new inlets would likely create new potential habitat for plovers. Eventually, westward migration of the island would result in some portion of the bridges to be in the ocean eastward of the beach.

Similarly, elevating NC 12 onto bridges may potentially improve sea turtle nesting habitat. Currently, most of the beach along the seaward side of NC 12 is narrow, steep and subject to high wave energy. The potential nesting area is constrained to a narrow width along much of the action area by the artificial berm along NC 12. Elevating most of NC 12 onto bridges would allow the natural barrier island processes to widen the beach area available for nesting; however, as portions of the beach migrate westward underneath the bridge, some of the beach may not be suitable nesting habitat for some period of time as it would be underneath the bridge and subject to shading effects (thus affecting hatching and sex ratios). Eventually, portions of the beach would migrate westward beyond the bridge and potentially provide suitable nesting habitat. Turtles would have to crawl or swim between bridge piles in order to utilize the newly widened beach. The effect that the bridge piles would have on emerging sea turtles is expected to be minimal. Bouchard et al. (1998) found that simulated piles did not totally preclude nesting activity of loggerhead and green sea turtles at Melbourne Beach, Florida, but did reduce nesting in an area with piles on the beach by 41%. However, the simulated piles used in the study were spaced 17 feet apart, whereas the piles for the Phase II, III and IV bridges will be 100-120 feet apart. This wider distance would likely have a much lesser affect on nesting activity.

Piping plover

Direct effects:

The most quantifiable effect on piping plovers pertains to breeding. The only nesting activity recorded within the action area has occurred at Oregon Inlet. Although no breeding pairs have been observed at the north end of Hatteras Island near the Inlet since 2003 (Cameron 2008a, *in litt.*; NCWRC 2008b), and habitat quality for nesting has declined in recent years due to vegetation encroachment, habitat quality can improve quickly with severe storms, so the site still has the potential for nesting activity. At the Bodie Island Spit, a single nest in each of the years 2001, 2002, 2004 and 2007 has been observed >0.25 mile east of the existing Bonner Bridge (NPS 2007b). The new bridge will be constructed 125-500 feet farther west of the existing bridge, thus farther from the known nesting sites. However, demolition of the old bridge will require the presence of heavy equipment and noise ~0.25 mile from the known nesting area. Although it is unlikely that any nesting habitat would be physically disturbed, it is possible that the presence of construction equipment, construction activity and associated noise may preclude or disrupt breeding behaviors, including courtship, egg laying, incubation, and chick rearing on part or all of Bodie Island Spit or the northern end of Hatteras Island for some portion of the construction of Phase I and demolition of the existing Bonner Bridge. In addition, the northern end of Phase II may have similar effects to the potential nesting area on the north end of Hatteras Island. These effects will be temporary, covering a subset of each of the estimated 3-3.5 year construction timeframes for Phases I and II. However, it is uncertain that any breeding pairs would be precluded from nesting. Anecdotal evidence implies that some or all of the preferred nesting sites may be sufficiently distant from the work zones to avoid disturbance effects. Phases III and IV will not be located near any currently suitable plover nesting habitat.

Due to fill and pile placement in Phase I, there will be a direct loss of <0.1 acre of beach that is potential foraging and roosting habitat. It is not anticipated that the presence of the completed new bridge will preclude piping plovers from foraging since plovers currently forage at the existing Bonner Bridge. Phases II, III and IV will not result in the direct loss of any current foraging or roosting habitat.

Perhaps the most likely and most widespread, but the least quantifiable, direct effect is disturbance and/or flushing of foraging or roosting plovers during the construction of each of the phases. The presence of heavy equipment, construction activity and associated noise will be in close proximity to potential foraging and roosting habitat. Phase I and the northern end of Phase II have the greatest likelihood of disturbing foraging or roosting plovers and/or precluding foraging/roosting habitat from being used on portions of Bodie Island Spit and the north end of Hatteras Island. Also, Phase I comes within 0.3 mile of soundside ephemeral intertidal shoals or flats that are used by foraging plovers. The rest of Phase II and all of Phases III and IV have the potential to effect foraging or roosting plovers, however these phases are located adjacent to portions of the action area that currently have less foraging/roosting activity. This effect will be temporary and staggered over time and location, lasting for some subset of the estimated 3-3.5 year construction timeframe for each phase.

The biological effects of disturbance to foraging or roosting plovers are difficult to quantify. In general, however, we know that plovers require food and shelter. Any actions that limit their ability to feed or shelter probably have adverse effects on individual birds because flushed birds expend energy to avoid disturbance (Stillman et al. 2007). The degree that piping plovers are adversely affected depends largely on how much time they are precluded from feeding or sheltering in relation to the amount of time they would feed or shelter if they were not flushed. To evaluate the biological effects of flushing, the identity of individual piping plovers would have to be known and the amount and extent of flushing would need to be documented consistently over time for each bird. Furthermore, these individual birds would need to be followed throughout the year to determine if their survival rates or nesting success were lower than other birds not subjected to flushing. Given there are other factors that affect the survival or reproductive success of piping plovers (predation, weather, food availability and quality, etc.) it would be difficult to isolate the effects of flushing. A large number of individual birds would have to be studied over a relatively long period in order to attempt to quantify the effects of flushing. We are aware of no such long term and statistically robust studies.

Effects to proposed critical habitat:

Proposed critical habitat Unit NC-1 currently supports the primary constituent elements essential for the conservation of the species and does support consistent use by wintering piping plovers. Although the new bridge in Phase I will cross through approximately 1700 feet of proposed critical habitat on Bodie Island, the direct loss to fill and pile placement is <0.1 acre. The existing Bonner Bridge crosses through approximately 3680 feet of proposed critical habitat on Bodie Island, but is not part of the proposed critical habitat. The demolition of the existing bridge and the construction of the new bridge will likely have temporary direct effects to primary constituent elements (e.g. haul roads, ruts, hydrological effects, etc.). After construction and demolition are completed, all temporary structures will be removed and the habitat restored to pre-disturbance conditions. Therefore, the effect will be short-term (i.e. considerably less than the estimated 3.5 years for completion of Phase I). A portion of Phase II on Hatteras Island will occur adjacent to proposed critical habitat, but not within it.

Interrelated and interdependent effects:

The effects of the action under consultation are analyzed together with the effects of other activities that are interrelated to, or interdependent with, that action. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

Periodic bridge maintenance or repair activities may require the presence of inspectors and equipment to operate in the vicinity of potential piping plover habitat, thus causing disturbance to foraging/roosting plovers or precluding the use of habitat. These effects are difficult to quantify. Disturbance from human recreation is already present, and thus the effect of maintenance and repair work would be additive to an existing level of disturbance.

In addition, the maintenance or repair activities may have temporary effects to the primary constituent elements of the proposed critical habitat. However, these effects would likely be short in duration since all disturbed areas would be restored to pre-disturbance conditions once the maintenance or repair is completed.

Indirect effects:

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. If, by the elevation of much of NC 12 onto bridges and allowing natural barrier island processes to resume, new piping plover habitat is created in the future (see **Beneficial Effects** above), new conditions will exist for indirect effects. These indirect effects will be identical to the direct effects described above (i.e. effects on nesting, disturbance/flushing of foraging/roosting plovers, and precluding habitat use) during maintenance or repair activities; however, they will be to plovers using habitat that does not currently exist. If new piping plover habitat is created, portions of the beach will eventually move westward underneath the new bridges. The effect of having a bridge immediately overhead or adjacent to potential nesting habitat is unknown. Foraging under or adjacent to bridges is not expected to preclude foraging since plovers currently forage adjacent to the existing Bonner Bridge.

Depending on final design of each bridge, the new bridges could provide perches for predators (e.g. gulls, crows, etc.) that may prey on piping plover adults, chicks or eggs. However, these predators currently fly over piping plover habitat, so the extent of any additional effect would be difficult to determine.

Sea Turtles - All Species

Direct effects:

None of the project will be built within existing sea turtle nesting habitat; therefore, there will be no direct loss of turtle nesting habitat. However, all four phases will be built in close proximity to turtle nesting beaches. The greatest potential direct effects will likely be those caused by the use of construction lighting.

The USFWS recognizes that lights have the potential to disorient both hatchlings and nesting females. Artificial lighting can cause misorientation or disorientation (Philibosian 1976, Mann 1977, Witherington 1990). Misorientation can result in fatigue, dehydration, and increased likelihood of predation (Witherington et al. 1996). The correlation between level of light-caused disruption and survivorship has not, however, been identified. It has been demonstrated that there are relative degrees of sub-lethal and lethal effects (Salmon et al. 1995a; Witherington et al. 1996).

The effects of construction lighting will be temporary and staggered over space and time as each of the four phases is built. The effect will be year-round during the 3-3.5 year construction timeframe for each phase, with periods of no effect between each phase. There will be no permanent lighting on bridge.

Other possible direct effects include disturbance of nesting females from noise or vibration from construction equipment. These effects would also be temporary and staggered over space and time.

Interrelated and interdependent effects:

Periodic bridge maintenance or repair activities may require the presence of inspectors and equipment to operate in the vicinity of potential sea turtle nesting habitat, thus causing disturbance to nesting females or emerging hatchlings, or precluding the use of nesting habitat. It is assumed that maintenance or repair activities would not occur at night, therefore minimizing the level of effects. When, in the future, portions of the beach migrate west of the bridge and sea turtle nesting beach is adjacent to the bridge, any vehicles or equipment driving on the beach for maintenance or repair activities could run over undetected turtle nests.

Indirect effects:

If, by the elevation of much of NC 12 onto bridges and allowing natural barrier island processes to resume, new sea turtle nesting habitat is created in the future, or if existing sea turtle nesting beach is widened and improved in quality (see **Beneficial Effects** above), new conditions will exist for indirect effects. Sea turtle nesting beach is currently limited in width by the artificial berm along the seaward side of NC 12. In Phases II, III and IV, the berm will be incrementally eliminated, and sea turtles may nest farther inland on the newly widened beach. This may result in sea turtles nesting near, under or beyond the new bridges. The presence of bridge piles and bridge superstructure overhead will alter light levels, beach morphology, and sand characteristics. It is important to note that the following indirect effect would occur to sea turtle nesting habitat that does not currently exist, but would be expected to exist sometime in the future.

From 2020 to 2060, it is estimated that up to 1.8 miles of NC 12 will be over dry beach at any one time, shading up to 9.5 acres of potential turtle nesting habitat. Shading would provide overall less desirable nesting conditions since beach sands shaded by the bridge would be expected to have a lower temperature. Temperature is negatively correlated with egg development time, so eggs under the bridge may display increased incubation time thus potentially exposing them to increased threats (e.g. predation, tidal inundation). Temperature also strongly determines gender of the hatchlings (Yntema and Mrosovsky 1982, Standora and Spotila 1985). Higher temperatures produce females, while lower temperatures produce males. Therefore beach shading by the bridge may alter the sex ratio of hatchlings. Since most nesting females emerge from the ocean at night, females may not be aware they are nesting underneath a bridge. These effects would be temporary since the beach would be expected to continue migrating westward.

As beach migration continues westward, portions of the nesting beach will eventually be located landward of the bridges. Turtles would have to crawl or swim between bridge piles in order to utilize the newly widened beach. Over the life of the project, up to 3.3 miles of beach could have piles at any one time, thus potentially causing some level of deterrent to nesting. The effect that the bridge piles would have on emerging sea turtles is expected to be minimal. Bouchard et al. (1998) found that simulated piles did not totally preclude nesting activity of loggerhead and green sea turtles at Melbourne Beach, Florida, but did reduce nesting in an area with piles on the beach by 41%. However, the simulated piles used in the study were spaced 17 feet apart, whereas the piles for the Phase II, III and IV bridges will be 100-120 feet apart. This wider distance would likely have a much lesser affect on nesting activity. Again, this effect would be on nesting habitat that does not currently exist.

As portions of the beach migrate westward of the bridge, some bridge piles will be located within the nearshore waters. These bridge piles may attract and concentrate predatory fish. Predation on turtle hatchlings can be high in nearshore waters (Stancyk 1982, Wyneken and Salmon 1996). However, with bridge bents spaced 100-120 feet apart, increased predation due to the presence of bridge piles will likely be minimal.

Another indirect effect is that of vehicle lights traveling on the finished bridges. It is unknown whether vehicle lights moving parallel to the beach would discourage the emergence of nesting females. It is also unknown whether vehicle lights would misorient or disorient turtle hatchlings. Vehicle lights would not be a stationary source of light and would vary with differing levels of traffic. However, a higher traffic volume would likely occur during the summer tourist season, which overlaps with turtle nesting season. The height of the bridges and height of bridge barriers may mitigate some of the negative effects.

C. Species' response to proposed action

Piping plover

Numbers of individuals/populations in the action area affected: One breeding pair has been recorded at Bodie Island Spit on the north side of Oregon Inlet during five out of the last ten years (2001, 2002, 2004, 2006 and 2007)(Cameron 2008a, *in litt.*; NCWRC 2008b). During this same timeframe, one nest was observed in each of the years 2001, 2002, 2004 and 2007. In 2007, three chicks hatched, and one fledged, from a nest on Bodie Island Spit approximately 1700 feet northeast of the existing Bonner Bridge (NPS 2007a, NPS 2007b). One or two breeding pairs were observed on the south side of Oregon Inlet on PINWR during each of the years from 1998 to 2003 (Cameron 2008a, *in litt.*; NCWRC 2008b), with one nest being observed in 2001 and 2002 (Sue Cameron, NCWRC waterbird biologist, pers. comm. March 24, 2008). In 2007, the action area accounted for only 1.6% of piping plover breeding activity within North Carolina (one out of 61 breeding pairs)(Cameron 2008b, *in. litt.*; NCWRC 2008c). Overall, 0-3 breeding pairs have been observed in the action area for each of the last ten years.

The number of piping plovers within the action area during the winter or migration is more difficult to assess. Regular surveys have not been conducted for non-breeding (including migrating and overwintering) plovers. Cohen et al. (in press) estimated a minimum total wintering population of 11 birds in the vicinity of Oregon Inlet (including Green Island) during the winter of 2006/2007. As many as 39 piping plovers have been reported from single day surveys during the fall migration at Bodie Island Spit, and as many as 41 plovers have been reported from single day Christmas Bird Counts at Oregon Inlet (NCWRC 2008a).

The total amount of proposed critical habitat to be permanently lost is <0.1 acre. An unknown acreage (though likely small amount) of proposed critical habitat will be temporarily affected during the construction phase.

Sensitivity to change: Piping plovers are sensitive to negative impacts during the breeding and non-breeding periods. Plovers may be deterred from nesting in given area where disturbance occurs. Sensitivity to change for non-breeding birds is difficult to assess. However, effects could be more detrimental for non-breeding plovers from the endangered Great Lakes population. Stucker and Cuthbert (2006) recorded at least one identifiable individual from the Great Lakes population wintering at Oregon Inlet, with at least nine other individuals of that population observed within CAHA outside the action area.

Resilience: Unless new inlets form within the action area, the breeding population of piping plovers is likely to remain low. However, elevating much of NC 12 onto bridges would allow natural barrier island processes to resume, potentially creating new inlets and plover habitat. Piping plover productivity has historically been low in all of North Carolina (NCWRC 2008c). However, improved protective measures and substantial decreases in disturbance to promote nesting opportunities and protect established nests and chicks could increase productivity.

The proposed critical wintering habitat within the action area is highly dynamic and resilient. Temporary disturbances will be unrecognizable in a short time.

Recovery rate: Piping plover habitat is inherently dynamic and carrying capacity fluctuates accordingly. The breeding population within the action has varied from zero to three pairs over the last ten years. At these low population levels, extirpation may occur for any number of reasons, including factors unrelated to the proposed action. While the specific recovery rate of piping plovers within the action area is unknown, the recovery rate is expected to be moderate if the birds are protected from all stressors. For example, several areas within the Atlantic Coast breeding population quadrupled their population size in as few as five years (USFWS 1996).

The specific effects of disturbance on non-breeding plovers are less well understood. However, reduced ability to rest and decreased food abundance could reduce survivorship of migrating and wintering birds. Demographic models for piping plovers, including two Atlantic Coast studies (Melvin and Gibbs 1994, Amirault et al. 2005), show that even small declines in adult and juvenile survival rates will cause substantial increases in extinction risk.

Other than the minimal amount of proposed critical habitat that would be permanently lost, the primary constituent elements within temporarily affected proposed critical habitat would recover very quickly after project construction ends.

Sea turtles – all species

Numbers of individuals/populations in the action area affected: From 1996 to 2006, there were a total 126 loggerhead nests observed within the action area, averaging 11.5 nests per year. From 1996 to 2006, there were 5 or 6 green turtle nests observed within the action area, averaging 0.5 nests per year. From 1996 to 2006, there were no leartherback turtle nests observed (Godfrey 2008, *in litt.*; USFWS 2008c, *in litt.*). From 2000 to 2006, the extent of sea turtle nesting within the action area annually represented 0.9 to 2.3% of total sea turtle nesting in North Carolina (Godfrey 2008, *in litt.*; NPS 2007c).

Sensitivity to change: Sea turtles are relatively sensitive to changes in the nesting environment, especially artificial light. There is high potential for nesting females and hatchlings to be misoriented or disoriented by construction lighting and possibly vehicle lights from the finished bridges. Sea turtle eggs are also sensitive to the nesting environment. The sex of an embryonic sea turtle is determined by the temperature of the nest environment. Shading effects on beach that has migrated underneath the bridges may change the nest environment by lowering sand temperature and changing the sex ratio.

Resilience: If fewer sea turtle hatchlings reach the ocean after hatching due to misorientation or disorientation from artificial light, fewer females will then return to nest at that location in the future. Also, loggerhead nests on North Carolina beaches (and in the Northern subpopulation) produce a greater proportion of males than do beaches in the southern part of the species' range. A reduction in the number of males contributed to the greater population may have adverse affects on future reproduction in the population. However, the extent of this effect is unknown.

Recovery rate: In general, the recovery rate of sea turtles is slow. Sea turtles reach sexual maturity at different ages depending on the species. Leatherback turtles can reach sexual maturity as early as six or seven years of age. However, loggerhead and green sea turtles do not reach sexual maturity until 20 to 50 years of age. If there is a reduction in the number of nests laid within the action area, and a subsequent reduction in the number of hatchlings produced, it may take decades before those hatchlings are contributing reproductively to the population.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, local, or private actions that are reasonably certain to occur in the action area considered in these biological and conference opinions. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Any maintenance activities on existing NC 12 that are conducted entirely within the NCDOT right-of-way do not have any federal nexus. These activities are most likely to occur after storm events in which sand is blown or washed over the road. Removal of the sand and reconstruction of the existing artificial berm would not be conducted within either piping plover or sea turtle habitat; however, the activities would be immediately adjacent to potential habitat. Disturbance from presence of heavy equipment, noise and vibration may flush piping plovers and preclude foraging, roosting or nesting. This disturbance may also disturb nesting female sea turtles. Lights from construction equipment may misorient or disorient sea turtle hatchlings. These effects would be expected to be short in duration for each maintenance event, but have historically occurred several times a year. As portions of NC 12 are elevated onto bridges in Phases II, III and IV, these types of maintenance events would decrease.

The relocation of the former Oregon Inlet US Coast Guard Station may also have a similar short-term effect on piping plovers and sea turtles. However, this would be a one-time event.

VI. CONCLUSION

After reviewing the current status of the piping plover, loggerhead sea turtle, green sea turtle and leatherback sea turtle; the environmental baseline for the action area; and all effects of the proposed project, it is the USFWS's biological and conference opinion that the proposed replacement of the Bonner Bridge and subsequent phases of elevating portions of NC 12 onto bridges (TIP No. B-2500), as proposed, is not likely to jeopardize the continued existence of these species, and is not likely to destroy or adversely modify proposed critical wintering habitat for piping plover. No critical habitat has been designated for the loggerhead sea turtle; therefore, none will be affected. Critical habitat has been designated for the green sea turtle in Puerto Rico, and critical habitat has been designated for the leatherback sea turtle in the U.S. Virgin Islands; however, this action does not affect these areas and no destruction or adverse modification of that critical habitat is anticipated.

This non-jeopardy opinion is based, in part, on the following facts:

Piping plover

The Atlantic Coast nesting population of piping plover is a component of the entity listed as threatened which encompasses all breeding piping plovers except the Great Lakes breeding population. The Atlantic Coast population has increased from 790 pairs since listing to a preliminary estimation of 1,887 pairs in 2007 (USFWS 2008a). While the Great Plains populations experienced a decline of about 13 percent between 1991 and 2001, the overall status of the listed entity is likely to be increasing. The Southern recovery unit has gained 163 pairs since listing. As of 2007, the Southern recovery unit had 333 breeding pairs (USFWS 2008a). The abundance component of the recovery objective for the Atlantic Coast population and the Southern recovery unit is 2,000 and 400 breeding pairs, respectively (USFWS 1996).

The current number of breeding pairs using the action area (0-3 in the past ten years) is only a small part of the breeding population of the Southern recovery unit and the overall Atlantic Coast breeding population. In an unlikely worst case scenario, up to three breeding pairs could be precluded from nesting. However, it is uncertain that any breeding pairs would be precluded from nesting. Some or all of the preferred nesting sites may be sufficiently distant from the work zones to avoid disturbance effects.

The current number of piping plovers using the action area during migration and winter is significant, and the action area is an important migratory stopover site and over winter destination. Although the action area is relatively large, the adverse affects due to disturbance from construction will be staggered over space and time; therefore, only portions of the action area will see disturbance at any one time. The effects may contribute to a lessening of survivorship; however, this would be extremely difficult to determine.

Although uncertain, the project may have significant beneficial effects for piping plovers. As Phases II, III, and IV are constructed; the artificial berm along existing NC 12 will no longer be maintained, thus allowing natural barrier island processes such as island overwash, island migration and inlet formation to resume. At some point new habitat may be created for breeding, migrating, and wintering plovers via these natural processes.

Sea turtles

From 2000 to 2006, the extent of sea turtle nesting within the action area annually represented 0.9 to 2.3% of total sea turtle nesting in North Carolina (Godfrey 2008, *in litt.*; NPS 2007c). Over the past ten years, the action area averaged only 11.5 loggerhead nests and 0.5 green turtle nests per year. No leatherback turtles have been observed to nest within the action area (Godfrey 2008, *in litt.*). For loggerheads, the number represents only a miniscule contribution to the Northern subpopulation.

Other than the chance of a future maintenance or repair activity crushing an undetected nest, it is unlikely that any sea turtle nests will be directly lost. The most likely effect involves artificial lighting affecting nesting females and hatchlings during project construction. The total extent of this effect is unknown. However, artificial light from construction will be temporary and staggered throughout the action area over space and time. There will be no permanent light fixtures on the bridge. The permanent effect of vehicle lights traveling parallel to the beach is unknown. Other causes of disturbance due to construction will also be temporary.

Though uncertain, the project may have significant beneficial effects for nesting sea turtles. As Phases II, III, and IV are constructed; the artificial berm along existing NC 12 will no longer be maintained, thus allowing natural barrier island processes such as island overwash and island migration to resume. The existing beach along much of the action area is narrow, steep and subject to high energy wave action. With the elimination of the artificial berm along NC 12, the beach will widen and flatten out. Although the quality of the widened beach habitat may not be ideal for some period of time (i.e. while the bridge is overhead), and the permanent effects of vehicle lights overhead are unknown, there is the potential to eventually provide additional beach nesting opportunities where nests are less likely to be destroyed due to inundation and severe wave action.

Proposed species/critical habitat

The one proposed critical habitat unit for wintering piping plovers within the action area will continue to support primary constituent elements essential for the conservation of the species. The total permanent loss of proposed critical habitat will be <0.1 acre. Due to the dynamic nature of the primary constituent elements, all temporary effects to the proposed unit will be indiscernible soon after construction is completed. For this reason it is our conference opinion that the proposed action is not likely to destroy or adversely modify proposed critical habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations pursuant to Section 4(d) of the ESA prohibit the taking of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding or sheltering. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the FHWA so that they may become binding conditions of any grant or permit issued to the NCDOT, as appropriate, for the exemption in section 7(o)(2) to apply. The FHWA has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the FHWA (1) fails to assume and implement the terms and conditions or (2) fails to require the NCDOT to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the FHWA or the NCDOT must report the progress of the action and any impact on the species to the USFWS.

Amount or Extent of Take Anticipated

Piping plovers

- Breeding piping plovers: The USFWS expects incidental take of breeding plovers will be difficult to detect. The take would be the lost potential for nesting due to disturbance of breeding pairs at the nesting sites from nearby construction activity. It would be impossible to determine whether the lack of nesting or the absence of breeding pairs was due to the project or some other unrelated factor. It would only be possible to infer that the project directly caused the loss of a nest if an established nest was abandoned at the time construction began in the vicinity. Also, plover nests are cryptic and easily overlooked. However, this undetected level of take may occur near Oregon Inlet at historical nesting locations. Based on historical nesting data, the maximum level of incidental take is three breeding pairs per year precluded from nesting or caused to abandon nests during construction for Phases I and II during each nesting season (i.e. April 1 to July 15) and the harassment of the associated breeding pairs.

- Migrating and wintering piping plovers: The USFWS expects incidental take of non-breeding plovers will be difficult to detect for the following reasons: sub-lethal effects are not easily determined; harassment which contributes to lessened survivorship may only be apparent on the breeding grounds the following year; and dead plovers may not be detectible. However, take of all migrating and wintering plovers throughout the extent of suitable habitat within the action area can be anticipated in all four phases of the project by the disturbance of feeding or roosting plovers from nearby construction activity.

Sea turtles - all species

The USFWS expects incidental take of all species of sea turtles will be difficult to detect for the following reasons:

- the turtles nest primarily at night and all nests are not found because (a) natural factors, such as rainfall, wind, and tides may obscure crawls and (b) human-caused factors, such as pedestrian and vehicular traffic, may obscure crawls;
- the total number of hatchlings per undiscovered nest is unknown;
- an unknown number of females may avoid the project beach and be forced to nest in a less than optimal area; and
- lights may misdirect an unknown number of hatchlings and cause death

However, take of all sea turtles throughout the extent of nesting habitat within the action area can be anticipated in all four phases of the project by harm or harassment due to the effects of artificial light and disturbance from construction and future maintenance and repair activities on nesting females and hatchlings. Also, as portions of the beach migrate westward, take of all undetected nests throughout the extent of the nesting habitat can be anticipated from future maintenance or repair activities that may crush undetected nests. Finally, as portions of the beach migrate westward, take of all nesting sea turtles throughout the extent of nesting habitat within the action area can be anticipated from reduced nesting by females deterred by bridge piles on the beach and by shading effects on sex ratios of eggs in nests constructed underneath the bridges.

Effect of the Take

In the accompanying biological and conference opinions, the USFWS determined that this level of anticipated take is not likely to result in jeopardy to the species, or destruction or adverse modification of designated or proposed critical habitat.

Reasonable and Prudent Measures

The USFWS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the piping plover, loggerhead sea turtle, green sea turtle, and leatherback sea turtle. These nondiscretionary measures include, but are not limited to, the terms and conditions outlined in this biological and conference opinion.

Piping plover

1. Avoid disturbing nesting piping plovers.

2. To the extent possible, avoid disturbing foraging and roosting plovers.

3. To minimize the effect of harassment on foraging plovers, provide alternative foraging areas.

4. Avoid or minimize opportunities for avian predator perches.

Sea turtles – all species

1. Avoid disturbing nesting sea turtles, nests and hatchlings.

2. Educate construction contractors and pertinent NCDOT staff as to the adverse effects of artificial lighting on sea turtles.

3. Minimize the effects of construction lighting on nesting sea turtles and hatchlings.

4. Minimize the effects of vehicle headlights from the completed bridge.

5. Avoid permanent light fixtures.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the NCDOT must comply with the following terms and conditions, which implement the reasonable and prudent measures described previously. These terms and conditions are nondiscretionary.

Piping plover

1. All construction equipment and personnel must avoid all bird closure areas within CAHA and PINWR.

   All future routine maintenance activities of bridge structures that would occur within or adjacent to current or future plover nesting areas must occur outside the nesting season (April 1 – July 15).

   All future repair work on bridge structures that would occur within or adjacent to current or future plover nesting areas must occur outside the nesting season (April 1 – July 15) unless emergency or human safety considerations require otherwise. In this event, the area must be surveyed for nesting plovers and avoided to the extent possible.

2. During the construction of Phases II, III and IV, keep all construction equipment and activity within the existing right-of-way.

   Do not moor any construction barges within 300 feet of the following islands: Green Island, Wells Island, Parnell Island, Island MN, Island C, the small unnamed island immediately east of Island C, Island D, and Island G (see figure 1).

3. All dredge spoil excavated for construction barge access must be used to augment either existing dredge-material islands or to create new dredge-material islands for use by foraging plovers. This must be accomplished as per the specifications of the North Carolina Wildlife Resources Commission. The point of contact is Sue Cameron at 910-325-3602. If the dredge material is used outside the current defined action area, the action area is assumed to be expanded to cover the beneficial placement of the material.

4. To the maximum extent practical, while ensuring the safety of the traveling public, limit or avoid the use of road signs or other potential predator perches adjacent to plover nesting or foraging areas. Where signs or other structures are necessary, determine if alternative designs would be less conducive for perching on by avian predators (gulls, crows, grackles, hawks, etc.). For example, minimize or avoid the use of large cantilever signs in favor of smaller and shorter designs.

Sea turtles – all species

1. All construction equipment and personnel must avoid all marked sea turtle nests.

   Construction material and equipment staging areas must not be located seaward of the artificial dune.

   All future routine maintenance activities of bridge structures that would occur within or adjacent to current or future sea turtle nesting habitat, and which would require vehicles or equipment on the beach or the use of night lighting (excluding navigation lights required by the U.S. Coast Guard), must occur outside the nesting season (May 1 – November 15).

   All future repair work of bridge structures that would occur within or adjacent to current or future sea turtle nesting habitat, and which would require vehicles or equipment on the beach or the use of night lighting (excluding navigation lights required by the U.S. Coast Guard) must occur outside the nesting season (May 1 – November 15) unless emergency or human safety considerations require otherwise. In this event, the area must be surveyed for sea turtle nests and avoided to the extent possible.

2. Provide an opportunity for the USFWS or an USFWS designee to educate construction contractor managers, supervisors, foremen and other key personnel and resident NCDOT personnel with oversight duties (division engineer, resident engineer, division

environmental officer, etc.) as to adverse effects of artificial lighting on nesting sea turtles and hatchlings, and to the importance of minimizing those effects.

3. During turtle nesting season (May 1 – November 15), use the minimum number and the lowest wattage lights that are necessary for construction.

   During turtle nesting season, portable construction lighting must be of the low-pressure sodium-vapor type.

   During turtle nesting season, utilize directional shields on all portable construction lights, and avoid directly illuminating the turtle nesting beach at night.

   During turtle nesting season, all portable construction lights must be mounted as low to the ground as possible.

   During turtle nesting season, turn off all lights when not needed.

4. For Phases II, III and IV, on the ocean side, design the bridge structure in a manner which will shield the beach on the east side from direct light emanating from passenger vehicle headlights. For the small portion of Phase I over land on Hatteras Island, retrofit the bridge structure at the time that Phase II connects with Phase I. The specific design of the bridge will be developed in consultation with the USFWS prior to re-evaluation of the environmental document for Phase II.

5. Avoid retrofitting the bridges and approach roads with permanent light fixtures in the future (excluding navigation lights required by the U.S. Coast Guard).

Coordination of Incidental Take Statements with Other Laws, Regulations, and Policies

The USFWS will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 USC § 703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. The following conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or proposed critical habitat, to help implement recovery plans, or to develop information.

Piping plovers

The FHWA and/or NCDOT could contribute funding to the current CAHA predator removal program or any future PINWR predator removal program.

The pond located behind the terminal groin at the north end of Hatteras Island has historically provided foraging habitat for plovers whenever NCDOT has mined sand from it. The NCDOT could continue to utilize this pond as a source of sand for construction/maintenance purposes. The NCDOT could remove the sand such that the elevation and shape of the mined area is restored to a moist/wet sand habitat conducive to plover foraging. This should be coordinated with the PINWR. The point of contact is Dennis Stewart at 252-473-1131 ext. 231.

Sea turtles – all species

The FHWA and/or NCDOT could contribute funding to the Network for Endangered Sea Turtles (N.E.S.T.), a nonprofit organization dedicated to the preservation and protection of sea turtle habitat in the Outer Banks from the Virginia border to Oregon Inlet. N.E.S.T. monitors this area for nesting activity.

In order for the USFWS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

REINITIATION/CLOSING STATEMENT

This concludes formal consultation on the action outlined in your March 5, 2008 request for formal consultation. As provided in 50 CFR section 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

You may ask the USFWS to confirm the conference opinion as a biological opinion issued through formal consultation, if the critical habitat is designated. The request must be in writing. If the USFWS reviews the proposed action and finds that there have been no significant changes in the action as planned or information used during the conference, the USFWS will confirm the conference opinion as a biological opinion on the project and no further section 7 consultation will be necessary.

Literature Cited

Amirault, D.L., F. Shaffer, K. Baker, A. Boyne, A. Calvert, J. McKnight, and P. Thomas. 2005. Preliminary results of a five year banding study in Eastern Canada – support for expanding conservation efforts to non-breeding sites? Unpublished Canadian Wildlife Service report.

Arianoutsou, M. 1988. Assessing the impacts of human activities on nesting of loggerhead sea turtles (*Caretta caretta* L.) on Zákynthos Island, Western Greece. Environmental Conservation 15:327-334.

Bent, A.C. 1929. Life histories of North American shorebirds. U.S. Natural Museum Bulletin 146:236-246.

Bergstrom, P.W. 1989. Incubation temperatures of Wilson's plovers and killdeers. Condor 91:634-641.

Billes, A., J. Moundemba, and S. Gontier. 2000. Campagne Nyamu 1999-2000: Rapport de fin de saison. Protomac, Libreville, Gabon.

Bouchard, S., K. Moran, M. Tiwari, D. Wood, A. Bolten, P. Eliazar, and K. Bjorndal. 1998. Effects of exposed pilings on sea turtle nesting activity at Melbourne Beach, Florida. Journal of Coast Research 14(4):1343-1347.

Bowen, B. 1995. October 26, 1995 letter to Sandy MacPherson, National Sea Turtle Coordinator, U.S. Fish and Wildlife Service, Jacksonville, Florida. Director, Genetic Analysis Core, Biotechnology for the Evolutionary, Ecological, and Conservation Sciences, University of Florida, Gainesville, Florida.

Bowen, B., J.C. Avise, J.I. Richardson, A.B. Meylan, D. Margaritoulis, and S.R. Hopkins-Murphy. 1993. Population structure of loggerhead turtles (*Caretta caretta*) in the northwestern Atlantic Ocean and Mediterranean Sea. Conservation Biology 7:834-844.

Boyagian, Z. 1994. Written communication with Anne Hecht. Piping plover incident report 7-16-94, South Beach, Chatham, MA. Piping plover monitor, Massachusetts Audubon Society, Chatham, Massachusetts.

Bugoni, L., L. Krause, and M.V. Petry. 2001. Marine debris and human impacts on sea turtles in southern Brazil. Marine Pollution Bulletin 42:1330-1334.

Burger, J. 1987a. Physical and social determinants of nest site selection in piping plover in New Jersey. Condor 98:811-818.

Burger, J. 1987b. New Jersey endangered beach-nesting bird project: 1986 research. Unpublished report to New Jersey Department of Environmental Protection, Trenton, New Jersey.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (*Charadrius melodus*). Journal of Coastal Research 7:39-52.

Burger, J. 1994. The effect of human disturbance on foraging behavior and habitat use in piping plover (*Charadrius melodus*). Estuaries 17:695-701.

Cairns, W.E. 1977. Breeding biology and behaviour of the piping plover *Charadrius melodus* in southern Nova Scotia. M.S. Thesis. Dalhousie University, Halifax, Nova Scotia.

Cairns, W.E. 1982. Biology and behavior of breeding piping plovers. Wilson Bulletin 94:531-545.

Cairns, W.E., and I.A. McLaren. 1980. Status of the piping plover on the east coast of North America. American Birds 34:206-208.

Calvert, A.M., D.L. Amirault, F. Shaffer, R. Elliot, A. Hanson, J. McKnight, and P.D. Taylor. 2006. Population assessment of an endangered shorebird: the piping plover (*Charadrius melodus melodus*) in eastern Canada. Avian Conservation and Ecology 1(3): 4. Accessed on April 30, 2008 at http://www.ace-eco.org/vol1/iss3/art4/

Cameron, S. 2008a. March 24, 2008 email from Sue Cameron to Gary Jordan. Piping plover observation and breeding activity data. North Carolina Wildlife Resources waterbird biologist.

Cameron, S. 2008b. March 24, 2008 email from Sue Cameron to Gary Jordan. Piping plover breeding activity data. North Carolina Wildlife Resources waterbird biologist.

Carr, A.F., and L. Ogren. 1960. The ecology and migrations of sea turtles IV. The green turtle in the Caribbean Sea. Bulletin of the American Museum of Natural History 121:4-48.

Carthy, R.R. 1994. Loggerhead nest morphology: effects of female body size, clutch size, and nesting medium on nest chamber size. Pages 25-27 *in* Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and P.J. Eliazar (Compilers). Proceedings of the fourteenth annual symposium on sea turtle biology and conservation. NOAA Technical Memorandum NMFS-SEFSC-351.

Chan, E., and H. Liew. 1996. Decline of the leatherback population in Terengganu, Malaysia, 1956-1995. Chelonia Conservation and Biology 2(2):196-203.

Cohen, J.B., S.M. Karpanty, D.H. Catlin, J.D. Fraser, and R.A. Fischer. In Press. Winter ecology of piping plovers at Oregon Inlet, North Carolina. Waterbirds.

Cooper, S. 1990. Notes on piping plover nesting at Cape Hatteras National Seashore during 1987. Chat 54:1-6.

Coutu, S.D., J.D. Fraser, J.L. McConnaughy, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Hatteras National Seashore. Unpublished report to the National Park Service.

Cox, J.H., H.F. Percival, and S.V. Colwell. 1994. Impact of vehicular traffic on beach habitat and wildlife at Cape San Blas, Florida. Florida Cooperative Fish and Wildlife Research Unit Technical Report Number 50.

Cross, R.R. 1990. Monitoring, management and research of the piping plover at Chincoteague National Wildlife Refuge, summer 1990. Unpublished report. Virginia Department of Game and Inland Fisheries, Richmond, Virginia.

Cross, R.R. 1991. Monitoring, management, and research of the piping plover at Chincoteague National Wildlife Refuge, summer 1991. Unpublished report. Virginia Department of Game and Inland Fisheries, Richmond, Virginia.

Cross, R.R. 1996. Breeding ecology, success, and population management of the piping plover at Chincoteague National Wildlife Refuge, Virginia. M.S. Thesis. College of William and Mary, Virginia.

Cross, R.R., and K. Terwilliger. 2000. Piping plover chicks: prey base, activity budgets, and foraging rates in Virginia. Final report to the Virginia Department of Game and Inland Fisheries, Richmond, VA.

Dickerson, D.D., and D.A. Nelson. 1989. Recent results on hatchling orientation responses to light wavelengths and intensities. Pages 41-43 *in* Eckert, S.A., K.L. Eckert, and T.H. Richardson (compilers). Proceedings of the 9th annual workshop on sea turtle conservation and biology. NOAA Technical Memorandum NMFS-SEFC-232.

Dingledine, J. 2008. Email to Gary Jordan regarding piping plover nesting updates for Great Lakes region. Great Lakes piping plover coordinator, U.S. Fish and Wildlife Service, East Lansing, Michigan.

Dodd, C.K., Jr. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service Biological Report 88(14).

Drake, K.R, J.E. Thompson, K.L. Drake, and C. Zonick. 2001. Movements, habitat use, and survival of nonbreeding piping plovers. Condor 103:259-267.

Drury, W. H. 1973. Population changes in New England seabirds. Bird Banding 44:267-313.

Dutton, D.L., P.H. Dutton, M. Chaloupka, and R.H. Boulon. 2005. Increase of a Caribbean leatherback turtle *Dermochelys coriacea* nesting population linked to long-term nest protection. Biological Conservation 126:186-194.

Dutton, P.H., C. Hitipeuw, M. Zein, S.R. Benson, G. Petro, J. Pita, V. Rei, L. Ambio, and J. Bakarbessy. 2007. Status and genetic structure of nesting populations of leatherback turtles (*Dermochelys coriacea*) in the Western Pacific. Chelonian Conservation and Biology 6:47–53.

Eddings, K.J. 1991. Productivity, activity patterns, limiting factors, and management of piping plovers at Sandy Hook, Gateway National Recreation Area, New Jersey. M.S. Thesis. Colorado State University, Fort Collins, Colorado.

Ehrhart, L.M. 1989. Status report of the loggerhead turtle. Pages 122-139 *in* Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds.). Proceedings of the 2nd Western Atlantic turtle symposium. NOAA Technical Memorandum NMFS-SEFC-226.

Ehrhart, L.M., and B.E. Witherington. 1987. Human and natural causes of marine turtle nest and hatchling mortality and their relationship to hatchling production on an important Florida nesting beach. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program, Technical Report No. 1. Tallahassee, Florida.

Elias-Gerken, S.P. 1994. Piping plover habitat suitability on central Long Island, New York barrier islands. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Elliott-Smith, E., and S.M. Haig. 2004. Piping plover (Charadrius melodus), the birds of North America online (Poole, A., Ed.). Ithaca: Cornell Lab of Ornithology. Accessed on April 7, 2008 at http://bna.birds.cornell.edu/bna/species/002/articles/introduction

Encalada, S.E., K.A. Bjorndal, A.B. Bolten, J.C. Zurita, B. Schroeder, E. Possardt, C.J. Sears, and B.W. Bowen. 1998. Population structure of loggerhead turtle (*Caretta caretta*) nesting colonies in the Atlantic and Mediterranean as inferred from mitochondrial DNA control region sequences. Marine Biology 130:567-575.

Ferland, C.L., and S.M. Haig. 2002. 2001 International piping plover census. U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center. Corvallis, Oregon.

Flemming, S.P., R. D. Chiasson, and P.J. Austin-Smith. 1992. Piping plover nest-site selection in New Brunswick and Nova Scotia. Journal of Wildlife Management 56:578-583.

[FHWA and NCDOT] Federal Highway Administration and North Carolina Department of Transportation. 2007. Supplement to the 2005 supplemental draft environmental impact statement and draft section 4(f) evaluation. NC 12 replacement of Herbert C. Bonner Bridge.

[FHWA and NCDOT] Federal Highway Administration and North Carolina Department of Transportation. 2008a. Biological assessment for NC 12 replacement of Herbert C. Bonner Bridge. Bridge No. 11 over Oregon Inlet.

[FHWA and NCDOT] Federal Highway Administration and North Carolina Department of Transportation. 2008b. April 9, 2008 email from Rob Ayers (FHWA) to Pete Benjamin (USFWS) with attached BA addendum in the form of memo from Beth Smyre (NCDOT) to Rob Ayers.

[FFWCC] Florida Fish and Wildlife Conservation Commission. 2006a. Statewide sea turtle nesting database, unpublished data. Accessed on March 31, 2008 at http://research.myfwc.com/engine/download_redirection_process.asp?file=Statewide_Totals_1979_-_2006.pdf&objid=11812&dltype=article

[FFWCC] Florida Fish and Wildlife Conservation Commission. 2006b. Florida statewide nesting beach survey data – 2006 season. Accessed on April 10, 2008 at http://research.myfwc.com/features/print_article.asp?id=11812

[FFWCC] Florida Fish and Wildlife Conservation Commission. 2007. Long-term monitoring program reveals a continuing loggerhead decline, increases in green turtle and leatherback nesting. Accessed March 31, 2008 at http://research.myfwc.com/features/print_article.asp?id=27537

Fussell, J.O. 1990. Census of piping plovers wintering on the North Carolina Coast, 1989-1990. Unpublished report to the North Carolina Wildlife Resources Commission.

[GDNR] Georgia Department of Natural Resources. 2004. Accessed April 10, 2008 at http://crd.dnr.state.ga.us/content/displaycontent.asp?txtDocument=365

Gibbs, J.P. 1986. Feeding ecology of nesting piping plovers in Maine. Unpublished report to Maine Chapter, The Nature Conservancy, Topsham, Maine.

Godfrey, M. 2008. March 17, 2008 email from Matthew Godfrey to Gary Jordan. Sea turtle nesting data within action area.

Goldin, M.R. 1993a. Piping Plover (*Charadrius melodus*) management, reproductive ecology, and chick behavior at Goosewing and Briggs Beaches, Little Compton, Rhode Island, 1993. The Nature Conservancy, Providence, Rhode Island.

Goldin, M.R. 1993b. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts.

Goldin, M.R. 1994. Breeding history of, and recommended monitoring & management practices for piping plovers (*Charadrius melodus*) at Goosewing Beach, Little Compton, Rhode Island (with discussion of Briggs Beach). Unpublished report to U.S. Fish and Wildlife Service, Hadley, Massachusetts.

Goldin M.R., C. Griffin, and S. Melvin. 1990. Reproductive and foraging ecology, human disturbance, and management of piping plovers at Breezy Point, Gateway National Recreation Area, New York, progress report - 1989. Unpublished report to National Park Service Cooperative Research Unit, Rutgers University, New Brunswick, New Jersey.

Griffin, C.R. and S.M. Melvin. 1984. Research plan on management, habitat selection, and population dynamics of piping plovers on outer Cape Cod, Massachusetts. University of

Massachusetts. Research proposal submitted to U.S. Fish and Wildlife Service, Newton Corner, Massachusetts.

Haig, S.M. 1985. The status of the piping plover in Canada. A status update prepared for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Ottawa, Ontario.

Haig, S.M. 1992. Piping plover. *In* Poole, A., P. Stettenheim, and F. Gill (eds.), The birds of North America, No. 2. The Academy of Natural Sciences of Philadelphia.

Haig, S.M., and L.W. Oring. 1985. The distribution and status of the piping plover throughout the annual cycle. Journal of Field Ornithology 56:334-345.

Haig, S.M., and L.W. Oring. 1987. The piping plover. Audubon Wildlife Report. Pp. 509-519.

Haig, S.M., and L.W. Oring. 1988. Mate, site and territory fidelity in piping plovers. Auk 105:268-277.

Haig, S.M., and J.H. Plissner. 1993. Distribution and abundance of piping plovers: Results and implications of the 1991 International census. Condor 95:145-156.

Haig, S.M., C.L. Ferland, F.J. Cuthbert, J. Dingledine, J.P. Goossen, A. Hecht, and N. McPhillips. 2005. A complete species census and evidence for regional declines in piping plovers. Journal of Wildlife Management 69:160-173.

Hake, M. 1993. 1993 summary of piping plover management program at Gateway NRA Breezy Point district. Unpublished report to Gateway National Recreation Area, Long Island, New York.

Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2005. Status of nesting loggerhead turtles *Caretta caretta* at Bald Head Island (North Carolina, USA) after 24 years of intensive monitoring and conservation. Oryx 39:65-72.

Hecht, A. 2004. Email sent to David Rabon. Use of ocean intertidal zone by piping plover chicks for foraging. Atlantic Coast piping plover coordinator, U.S. Fish and Wildlife Service, Sudbury, Massachusetts.

Herbst, L.H. 1994. Fibropapillomatosis of marine turtles. Annual Review of Fish Diseases 4:389-425.

Hirth, H.F. 1997. Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758). U.S. Fish and Wildlife Service, Biological Report 97(1).

Hitipeuw, C., P.H. Dutton, S. Benson, J. Thebu, and J. Bakarbessy. 2007. Population status and internesting movement of leatherback turtles, Dermochelys coriacea, nesting on the northwest coast of Papua, Indonesia. Chelonian Conservation and Biology 6(1):28–36.

Hoopes, E.M. 1993. Relationships between human recreation and piping plover foraging ecology and chick survival. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts.

Hoopes, E.M. 1994. Breeding ecology of piping plovers nesting at Cape Cod National Seashore - 1994. National Park Service, South Wellfleet, Massachusetts.

Hoopes, E.M., C.R. Griffin, and S.M. Melvin. 1992. Relationships between human recreation and piping plover foraging ecology and chick survival. Unpublished report to U.S. Fish and Wildlife Service.

Hopkins, S.R., and J.I. Richardson (eds.). 1984. Recovery plan for marine turtles. National Marine Fisheries Service, St. Petersburg, Florida.

Hosier, P.E. 1981. Striking a balance: off-road vehicle use and coastal preservation. Sea Grant Today 11:10-12.

Hosier, P.E., and T.E. Eaton. 1980. The impact of vehicles on dune and grassland vegetation on a south-eastern North Carolina barrier beach. Journal of Applied Ecology 17:173-182.

Hosier, P.E., M. Kochhar, and V. Thayer. 1981. Off-road vehicle and pedestrian track effects on the sea-approach of hatchling loggerhead turtles. Environmental Conservation 8:158-161.

Howard, J.M., R.J. Safran, and S.M. Melvin. 1993. Biology and conservation of piping plovers at Breezy Point, New York. Unpublished report. Department of Forestry and Wildlife Management, University of Massachusetts, Amherst.

Hughes, A.L., and E.A. Caine. 1994. The effect of beach features on hatchling loggerhead sea turtles. Page 237 *in* Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and P.J. Eliazar (Compilers). Proceedings of the fourteenth annual symposium on sea turtle biology and conservation. NOAA Technical Memorandum NMFS-SEFSC-351.

Jacobs, J. 1988. Memorandum to Anne Hecht. Observations of piping plovers south of Indian River Inlet following U.S. Army Corps of Engineers project. Biologist, U.S. Fish and Wildlife Service, Annapolis, Maryland.

Johnson, C.M., and G.A. Baldassarre. 1988. Aspects of the wintering ecology of piping plovers in coastal Alabama. Wilson Bulletin 100:214-233.

Johnson, S.A., K.A. Bjorndal, and A.B. Bolten. 1996. Effects of organized turtle watches on loggerhead (*Caretta caretta*) nesting behavior and hatchling production in Florida. Conservation Biology 10:570-577.

Kudo, H., A. Murakami, and S. Watanabe. 2003. Effects of sand hardness and human beach use on emergence success of loggerhead sea turtles on Yakushima Island, Japan. Chelonian Conservation and Biology 4:695-696.

Kuklinski, M.L., L.M. Houghton, and J.D. Fraser. 1996. Piping plover breeding ecology on Cape Hatteras National Seashore with special reference to the effect of temperature on productivity. Department of Fisheries and Wildlife, Virginia Polytechnic Institute and State University, Blacksburg, VA.

Lamont, M.M., H.F. Percival, and S.V. Colwell. 2002. Influence of vehicle tracks on loggerhead hatchling seaward movement along a northwest Florida beach. Florida Field Naturalist 30:77-82.

Larson, M.A., M.R. Ryan, and R.K. Murphy. 2002. Population viability of piping plovers: effects of predator exclosures. Journal of Wildlife Management 66:361-371.

LeBuff, C.R., Jr. 1990. The loggerhead turtle in the eastern Gulf of Mexico. Caretta Research, Inc. Sanibel Island, Florida.

Lewison, R.L., S.A. Freeman, and L.B. Crowder. 2004. Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. Ecological Letters 7:221–231.

Lenarz, M.S., N.B. Frazer, M.S. Ralston, and R.B. Mast. 1981. Seven nests recorded for loggerhead turtle *Caretta caretta* in one season. Herpetological Review 12:9.

Limpus, C., J.D. Miller, and C.J. Parmenter. 1993. The northern Great Barrier Reef green turtle *Chelonia mydas* breeding population. Pages 47-50 *in* Smith, A.K. (compiler), K.H. Zevering and C.E. Zevering (editors). Raine Island and Environs Great Barrier Reef: quest to preserve a fragile outpost of nature. Raine Island Corporation and Great Barrier Reef Marine Park Authority, Townsville, Queensland, Australia.

Loegering, J.P. 1992. Piping plover breeding biology, foraging ecology and behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Loegering, J.P. and J.D. Fraser. 1995. Factors affecting piping plover chick survival in different brood-rearing habitats. Journal of Wildlife Management 59:646-655.

Lutcavage, M.E., P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtle survival. Pages 387-409 *in* Lutz, P.L. and J.A. Musick (editors). The biology of sea turtles. CRC Press. Boca Raton, Florida.

MacIvor, L.H. 1990. Population dynamics, breeding ecology, and management of piping plovers on outer Cape Cod, Massachusetts. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts.

MacIvor, L.H. 1996. Biological assessment for Ocean City water resources feasibility study, immediate restoration of Assateague Island. Woodlot Alternatives, Inc., Topsham, Maine.

Mann, T.M. 1977. Impact of developed coastline on nesting and hatchling sea turtles in southeastern Florida. M.S. thesis. Florida Atlantic University, Boca Raton, Florida.

Mann, T.M. 1978. Impact of developed coastline on nesting and hatchling sea turtles in southeastern Florida. Pages 53-55 *in* Henderson, G.E. (ed.). Proceedings of the Florida and interregional conference on sea turtles, July 24-25, 1976, Jensen Beach, Florida. Florida Marine Research Publication No. 33.

Martin, R.E. 1992. Turtle nest relocation on Jupiter Island, Florida: an evaluation. Presentation to the fifth annual national conference on beach preservation technology, February 12-14, 1992, St. Petersburg, Florida.

McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report to National Park Service.

McDonald, D.L., and P.H. Dutton. 1996. Use of PIT tags and photoidentification to revise remigration estimates of leatherback turtles (*Dermochelys coriacea*) nesting in St. Croix, U.S. Virgin Islands, 1979-1995. Chelonian Conservation and Biology 2:148-152.

McFarlane, R.W. 1963. Disorientation of loggerhead hatchlings by artificial road lighting. Copeia 1:153.

Melvin, S.M. 2006. May 10, 2006 email from Scott Melvin to Ann Hecht. Piping plover abundance and productivity on beaches with vehicle restrictions. Senior zoologist, Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts.

Melvin, S.M., and J.P. Gibbs. 1994. Appendix E: Population viability analysis *in* U.S. Fish and Wildlife Service. 1996. Piping plover (*Charadrius melodus*), Atlantic Coast population, revised recovery plan. Hadley, Massachusetts.

Melvin, S.M., A. Hecht, and C.R. Griffin. 1994. Piping plover mortalities caused by off-road vehicles on Atlantic coast beaches. Wildlife Society Bulletin 22:409-414.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-1992. Florida Marine Research Publications Number 52. St. Petersburg, Florida.

Mrosovsky, N. 1970. The influence of the sun's position and elevated cues on the orientation of hatchling sea turtles. Animal Behavior 18:648-651.

Mrosovsky, N. and A. Carr. 1967. Preference for light of short wavelengths in hatchling green sea turtles (*Chelonia mydas*), tested on their natural nesting beaches. Behavior 28:217-231.

Mrosovsky, N. and S.J. Shettleworth. 1968. Wavelength preferences and brightness cues in water finding behavior of sea turtles. Behavior 32:211-257.

Murphy, T.M. 1985. Telemetric monitoring of nesting loggerhead sea turtles subject to disturbance on the beach. Paper presented at the Fifth Annual Sea Turtle Research Workshop, February 13-16, 1985, Waverly, Georgia.

Murphy T.M., and S.R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the southeast region. Unpublished report to National Marine Fisheries Service.

[NMFS] National Marine Fisheries Service. 2008. Listing endangered and threatened wildlife and designating critical habitat; 90–day finding for a petition to reclassify the loggerhead turtle in the western North Atlantic Ocean. Federal Register 73(44):11849-11851.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1978. Endangered and Threatened Wildlife and Plants; Listing and protecting loggerhead sea turtles as "threatened species' and populations of green and olive ridley sea turtles as threatened species or "endangered species." Federal Register 43(146):32800-32811.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991a. Recovery plan for U.S. population of Atlantic green turtle. National Marine Fisheries Service, Washington, D.C.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991b. Recovery plan for U.S. population of loggerhead turtle. National Marine Fisheries Service, Washington, D.C.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1992. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998. Recovery plan for U.S. Pacific populations of the green turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Spring, Maryland.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2007a. Green sea turtle (*Chelonia mydas*): 5-year review: summary and status. Silver Spring, Maryland and Jacksonville, Florida.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2007b. Loggerhead sea turtle (*Caretta caretta*): 5-year review: summary and status. Silver Spring, Maryland and Jacksonville, Florida.

[NPS] National Park Service. 1993. Piping plover nest found trampled by pedestrian. News release. Cape Cod National Seashore, South Wellfleet, Massachusetts.

[NPS] National Park Service. 2001. 2001 Piping plover breeding activities: Cape Hatteras National Seashore. Manteo, NC.

[NPS] National Park Service. 2003. Abundance and distribution of non-nesting piping plovers (*Charadrius melodus*) at Cape Lookout National Seashore, North Carolina, 2000-2003. Unpublished report. Cape Lookout National Seashore, Harkers Island, NC.

[NPS] National Park Service. 2006a. Piping Plover (*Charadrius melodus)* monitoring at Cape Hatteras National Seashore: 2006 annual report. Manteo, NC.

[NPS] National Park Service. 2006b. Piping Plover (*Charadrius melodus)* monitoring at Cape Hatteras National Seashore: 2006 annual report. Appendix B. Manteo, NC.

[NPS] National Park Service. 2007a. Cape Hatteras National Seashore 2007 annual piping plover (*Charadrius melodus)* report. Manteo, NC.

[NPS] National Park Service. 2007b. Cape Hatteras National Seashore 2007 annual piping plover (*Charadrius melodus)* report: Map 4. Manteo, NC.

[NPS] National Park Service. 2007c. Cape Hatteras National Seashore 2007 sea turtle annual report. Manteo, NC.

[NPS] National Park Service. 2007d. Piping plover (*Charadrius melodus*) monitoring at Cape Lookout National Seashore. 2007 summary report. Harkers Island, NC.

[NPS] National Park Service. 2008a. Park to establish pre-nesting areas for 2008 breeding season. March 21, 2008 news release. Manteo, NC.

[NPS] National Park Service. 2008b. Agreement reached to preserve wildlife and recreation opportunities on Cape Hatteras National Seashore. April 30, 2008 news release. Washington, D.C.

[NPS and Maryland DNR] National Park Service and Maryland Department of Natural Resources. 1993. Management and monitoring of the piping plover at Assateague Island National Seashore, Maryland: 1993 summary report. Unpublished report.

[NPS and Maryland DNR] National Park Service and Maryland Department of Natural Resources. 1994. Management and monitoring of the piping plover at Assateague Island National Seashore, Maryland: 1994 summary report. Unpublished report.

[NPS and Maryland DNR] National Park Service and Maryland Department of Natural Resources. 1995. Management and monitoring of the piping plover at Assateague Island National Seashore, Maryland: 1995 summary report. Unpublished report.

[NPS and Maryland DNR] National Park Service and Maryland Department of Natural Resources. 1996. Management and monitoring of the piping plover at Assateague Island National Seashore, Maryland: 1996 summary report. Unpublished report.

National Research Council. 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C.

Nicholls, J.L. 1989. Distribution and other ecological aspects of piping plovers (*Charadrius melodus*) wintering along the Atlantic and Gulf Coasts. M.S. Thesis. Auburn University, Auburn, Alabama.

Nicholls, J.L. and G.A. Baldassarre. 1990. Habitat associations of piping plovers wintering in the United States. Wilson Bulletin 102:581-590.

Noel, B.L., C.R. Chandler, and B. Winn. 2005. Report on migrating and wintering piping plover activity on Little St. Simons Island, Georgia in 2003-2004 and 2004-2005. Report to U.S. Fish and Wildlife Service.

[NCWRC] North Carolina Wildlife Resources Commission. 2008a. Unpublished piping plover observation data.

[NCWRC] North Carolina Wildlife Resources Commission. 2008b. Unpublished piping plover breeding activity data.

[NCWRC] North Carolina Wildlife Resources Commission. 2006c. Unpublished statewide piping plover breeding pair database.

Palmer, R.S. 1967. Piping plover. Pages 168-169 *in* Stout, G.D. (ed.). The shorebirds of North America. Viking Press, New York.

Patterson, M.E. 1988. Piping plover breeding biology and reproductive success on Assateague Island. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Patterson, M.E., J.D. Fraser, and J.W. Roggenbuck. 1991. Factors affecting piping plover productivity on Assateague Island. Journal of Wildlife Management 55:525-531.

Pearce, A.F. 2001. Contrasting population structure of the loggerhead turtle (*Caretta caretta*) using mitochondrial and nuclear DNA markers. M.S. Thesis. University of Florida, Gainesville, Florida.

Philibosian, R. 1976. Disorientation of hawksbill turtle hatchlings (*Eretmochelys imbricata*) by stadium lights. Copeia 1976:824.

Plissner, J.H., and S.M. Haig. 1997. 1996 international piping plover census. Report to U.S. Geological Survey, Biological Resources Division, Forest and Rangeland Ecosystem Science Center, Corvallis, Oregon.

Pompei, V.D., and F.J. Cuthbert. 2004. Spring and fall distribution of piping plovers in North America: implications for migration stopover conservation. Unpublished report submitted to U.S. Army Corps of Engineers.

Possardt, E. 2005. Oman marine turtle trip reports provided to Sandy MacPherson, international sea turtle coordinator, U.S. Fish and Wildlife Service, Jacksonville, Florida.

Post, T. 1991. Reproductive success and limiting factors of piping plovers and least terns at Breezy Point, New York, 1990. New York State Department of Environmental Conservation, Long Island City, New York.

Pritchard, P.C.H. 1982. Nesting of the leatherback turtle, *Dermochelys coriacea*, in Pacific Mexico, with a new estimate of the world population status. Copeia 1982:741-747.

Pritchard, P.C.H. 1992. Leatherback turtle *Dermochelys coriacea*. Pages 214-218 *in* Moler, P.E. (ed.). Rare and endangered biota of Florida, volume III. Reptiles and amphibians. University Press of Florida, Gainesville, Florida.

Rabon, D.R., Jr., S.A. Johnson, R. Boettcher, M. Dodd, M. Lyons, S. Murphy, S. Ramsey, S. Roff, and K.R. Stewart. 2003. Confirmed leatherback turtle (*Dermochelys coriacea*) nests from North Carolina, with a summary of leatherback nesting activities north of Florida. Marine Turtle Newsletter 101:4-8.

Raymond, P.W. 1984. The effects of beach restoration on marine turtles nesting in south Brevard County, Florida. M.S. Thesis. University of Central Florida, Orlando, Florida.

Richardson, J.I., and T.H. Richardson. 1982. An experimental population model for the loggerhead sea turtle *Caretta caretta*. Pages 165-176 *in* Bjorndal, K.A. (ed.). Biology and conservation of sea turtles. Smithsonian Institution Press. Washington, D.C.

Root, B.G., M.R. Ryan, and P.M. Mayer. 1992. Piping plover survival in the Great Plains. Journal of Field Ornithology 63:10-15.

Ross, J.P. 1979. Sea turtles in the Sultanate of Oman. World Wildlife Fund Project 1320. May 1979 report.

Ross, J.P. 1982. Historical decline of loggerhead, ridley, and leatherback sea turtles. Pages 189-195 *in* Bjorndal, K.A. (ed.). Biology and conservation of sea turtles. Smithsonian Institution Press, Washington, D.C.

Ross, J.P., and M.A. Barwani. 1995. Review of sea turtles in the Arabian area. Pages 373-383 in Bjorndal, K.A. (ed.). Biology and conservation of sea turtles. Revised edition. Smithsonian Institution Press, Washington, D.C.

Russell, R., 1983. The piping plover in the Great Lakes region. American Birds 37(6):951–955.

Ryder, C.E. 1990. The effect of beach renourishment on sea turtle nesting and hatch success, Sebastian Inlet State Recreation Area, east-central, Florida. Unpublished report submitted to the Sebastian Inlet Tax District to fulfill permit requirements of the Florida Department of Environmental Regulation and the Army Corps of Engineers.

Salmon, M., R. Reiners, C. Lavin, and J. Wyneken. 1995a. Behavior of loggerhead sea turtles on an urban beach. Part 1, correlates of nest placement. Journal of Herpetology 29:560-567.

Salmon, M., M. Garro Tolbert, D. Pender Painter, M. Goff, and R. Reiners. 1995b. Behavior of loggerhead sea turtles on an urban beach. Part 2, hatchling orientation. Journal of Herpetology 29:568-576.

Santos, A.S., and M.H. Godfrey. 2001. Caretta caretta and Eretmochelys imbricata: Predation. Herpetological Review 32:37.

Sarti-Martinez, L., A.R. Barragan, D.G. Munoz, N. Garcia, P. Huerta, and F. Vargas. 2007. Conservation and biology of the leatherback turtle in the Mexican Pacific. Chelonian Conservation and Biology 6:70–78.

Shaffer, F., and P. Laporte. 1992. Rapport synthése des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuées aux Iles-de-la-Madeleine de 1987 a 1991. Association québèçoise des groupes d'ornithologues et Service canadien de la faune.

Simons, T., S. Schulte, C. McGowan, J. Cordes, M. Lyons, and W. Golder. 2005. American oystercatcher (*Haematopus palliates*) research and monitoring in North Carolina, 2005 annual report. Unpublished report. North Carolina Cooperative Fish and Wildlife Research Unit, Department of Zoology, North Carolina State University.

Snover, M.L. 2002. Growth and ontogeny of sea turtles using skeletochronology: methods, validation and application to conservation. Ph.D. dissertation. Duke University, Durham, North Carolina.

South Atlantic Fishery Management Council. 2008. Accessed on April 10, 2008 at http://www.safmc.net/Portals/0/ProtRes/New_PR/Spaccounts_sptable/pdf%20versions/Green%20Sea%20Turtle.pdf.

[SCDNR] South Carolina Department of Natural Resources. 2007. Loggerheadlines. Accessed March 27, 2008 at http://www.dnr.sc.gov/seaturtle/Loggerheadlines/lhdec07.pdf

Spotila, J. R., A. E. Dunham, A. J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? Chelonian Conservation and Biology 2:290-222.

Spotila, J.R., R.D. Reina, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. Nature 405:529-530.

Staine, K.J., and J. Burger. 1994. Nocturnal foraging behavior of breeding piping plovers (*Charadrius melodus*) in New Jersey. Auk 111:579-587

Stancyk, S.E. 1982. Non-human predators of sea turtles and their controls. Pages 139-152 in Bjorndal, K.A. (ed.). 1982. Biology and conservation of sea turtles. Smithsonian Institution Press, Washington D.C.

Standora, E.A., and J.R. Spotila. 1985. Temperature dependent sex determination in sea turtles. Copeia 1985:711-722.

Stillman, R.A., A.D. West, R.W.G. Caldow, S.E.A. le V. dit Durell. 2007. Predicting the effect of disturbance on coastal birds. Ibis 149:73-81.

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of piping plovers subjected to human disturbance. Ph.D. Dissertation. Tufts University, Medford, Massachusetts.

Stucker, J.H., and F.J. Cuthbert. 2006. Distribution of non-breeding Great Lakes piping plovers along Atlantic and Gulf of Mexico coastlines: 10 years of band resightings. Report to U.S. Fish and Wildlife Service.

Talbert, O.R., Jr., S.E. Stancyk, J.M. Dean, and J.M. Will. 1980. Nesting activity of the loggerhead turtle *Caretta caretta* in South Carolina I: a rookery in transition. Copeia 1980:709-719.

Troëng, S., D. Chacon, and B. Dick. 2004. Possible decline in leatherback turtle Dermochelys coriacea nesting along the coast of Caribbean Central America. Oryx 38:395-403.

Tull, C.E. 1984. A study of nesting piping plovers of Kouchibouguac National Park 1983. Unpublished report to Parks Canada, Kouchibouguac National Park, Kouchibouguac, New Brunswick.

Turtle Expert Working Group. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444.

Turtle Expert Working Group. 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555.

Tuxbury, S.M., and M. Salmon. 2005. Competitive interactions between artificial lighting and natural cues during seafinding by hatchling marine turtles. Biological Conservation 121:311-316.

[USFWS] U.S. Fish and Wildlife Service. 1970. United States list of endangered native fish and wildlife. Federal Register 35:8491-8498.

[USFWS] U.S. Fish and Wildlife Service. 1985. Endangered and threatened wildlife and plants; determination of endangered and threatened status for the piping plover. Federal Register 50:50726-50734.

[USFWS] U.S. Fish and Wildlife Service. 1996. Piping plover (*Charadrius melodus*), Atlantic Coast population, revised recovery plan. Hadley, Massachusetts.

[USFWS] U.S. Fish and Wildlife Service. 2001a. Endangered and threatened wildlife and plants; final determination of critical habitat for the Great Lakes breeding population of the piping plover. Federal Register 66:22938-22969.

[USFWS] U.S. Fish and Wildlife Service. 2001b. Endangered and threatened wildlife and plants; final determinations of critical habitat for wintering piping plovers. Federal Register 66:36038-36143.

[USFWS] U.S. Fish and Wildlife Service. 2002. Endangered and threatened wildlife and plants; designation of critical habitat for the northern Great Plains breeding population of the piping plover; final rule. Federal Register 67:57637-57717.

[USFWS] U.S. Fish and Wildlife Service. 2003. Recovery plan for the Great Lakes piping plover (*Charadrius melodus*). Fish and Wildlife Service, Fort Snelling, Minnesota.

[USFWS] U.S. Fish and Wildlife Service. 2006a. Endangered and threatened wildlife and plants; amended designation of critical habitat for the wintering population of the piping plover. Federal Register 71:33703-33721.

[USFWS] U.S. Fish and Wildlife Service. 2006b. 2006 Atlantic coast piping plover abundance and productivity estimates. Accessed April 30, 2008 at http://www.fws.gov/northeast/pipingplover/pdf/final06.pdf

[USFWS] U.S. Fish and Wildlife Service. 2008a. Preliminary 2007 Atlantic coast piping plover abudance and productivity estimates. Accessed April 30, 2008 at http://www.fws.gov/northeast/pipingplover/pdf/preliminary07.pdf

[USFWS] U.S. Fish and Wildlife Service. 2008b. Status updates: Atlantic coast piping plover population. Accessed April 30, 2008 at http://www.fws.gov/northeast/pipingplover/status/index.html

[USFWS] U.S. Fish and Wildlife Service. 2008c. Cumulative sea turtle nesting summary report. Unpublished data from PINWR.

[USFWS] U.S. Fish and Wildlife Service. 2008d. Endangered and threatened wildlife and plants; revised designation of critical habitat for the wintering population of the piping plover in North Carolina. Federal Register 73:28084-28093.

Vogelsong, H. 2003. Cape Hatteras National Seashore visitor use study. Unpublished study for the National Park Service, Cape Hatteras National Seashore.

Watts, B.D., D.S. Bradshaw, and R.R. Cross. 1996. Annual plover survey of the Virginia barrier islands: a ten year summary. Raven 67:84-89.

Welty, J.C. 1982. The life of birds. Sauders College Publishing, Philadelphia, Pennsylvania.

Wemmer, L.C., U. Ozesmi, and F.J. Cuthbert. 2001. A habitat-based population model for the Great Lakes population of the piping plover (*Charadrius melodus*). Biological Conservation 99:169-181.

Wheeler, N.R. 1979. Effects of of-road vehicles on the infauna of Hatches Harbor, Cape Cod National Seashore. Unpublished report to University of Massachusetts, National Park Service Cooperative Research Unit, Amherst, Massachusetts. UM-NPSCRU Report No. 28.

Wilcox, L. 1939. Notes on the life history of the piping plover. Birds of Long Island 1:3-13.

Wilcox, L. 1959. A twenty year banding study of the piping plover. Auk 76:129-152.

Wilkinson, P.M., and M. Spinks. 1994. Winter distribution and habitat utilization of piping plovers in South Carolina. Chat 58:33-37.

Witherington, B.E. 1990. Photopollution on sea turtle nesting beaches: problems and next-best solutions. Pages 43-45 *in* Richardson, T.H., J.I. Richardson, and M. Donnelly (compilers). 1990. Proceedings of the tenth annual workshop on sea turtle biology and conservation. NOAA Technical Memorandum NMFS-SEFC-278.

Witherington, B.E. 1992. Behavioral responses of nesting sea turtles to artificial lighting. Herpetologica 48:31-39.

Witherington, B.E. 1993. An analysis of reported sea turtle hatchling disorientation events for Florida, 1992. Florida Marine Research Institute, Florida Department of Natural Resources. Tequesta, Florida.

Witherington, B.E., and L.M. Ehrhart. 1989. Status and reproductive characteristics of green turtles (*Chelonia mydas*) nesting in Florida. Pages 351-352 *in* Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds.).

Proceedings of the second western Atlantic turtle symposium. NOAA Technical Memorandum NMFS-SEFC-226.

Witherington, B.E. and K.A. Bjorndal. 1991. Influences of artificial lighting on the seaward orientation of hatchling loggerhead turtles (*Caretta caretta*). Biological Conservation 55:139-149.

Witherington, B., C. Crady, and L. Bolen. 1996. A "hatchling orientation index" for assessing orientation disruption from artificial lighting. Pages 344-347 *in* Keinath, J.A., D.E. Barnard, J.A. Musick, and B.A. Bell. Proceedings of the fifteenth annual symposium on sea turtle biology and conservation. NOAA Technical Memorandum NMFS-SEFSC-387.

Wolcott, D.L., and T.G. Wolcott. 1999. High mortality of piping plovers on beaches with abundant ghost crabs: correlation, not causation. Wilson Bulletin 111:321-329.

Woodson, H.M., and W.D. Webster. 1999. *Chelonia mydas* (Green Sea Turtle). Nesting distribution. Herpetological Review 30:224-225.

Wyneken, J., M. Goff, and L. Glenn. 1994. The trials and tribulations of swimming in the near-shore environment. Pages 169-171 *in* Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and P.J. Eliazar (compilers). 1994. Proceedings of the fourteenth annual symposium on sea turtle biology and conservation. NOAA Technical Memorandum NMFS-SEFSC-351.

Wyneken J., and M. Salmon. 1996. Aquatic predation, fish densities, and potential threats to sea turtle hatchlings from open-beach hatcheries: final report. Technical Report 96-04, Florida Atlantic University, Boca Raton, Florida.

Yntema, C.L., and N. Mrosovsky. 1982. Critical periods and pivotal temperatures for sexual differentiation in loggerhead sea turtles. Canadian Journal of Zoology 60:1012-1016.

Zonick, C.A. 2000. The winter ecology of the piping plover (*Charadrius melodus*) along the Texas Gulf Coast. Ph.D. Dissertation. University of Missouri, Columbia, Missouri.

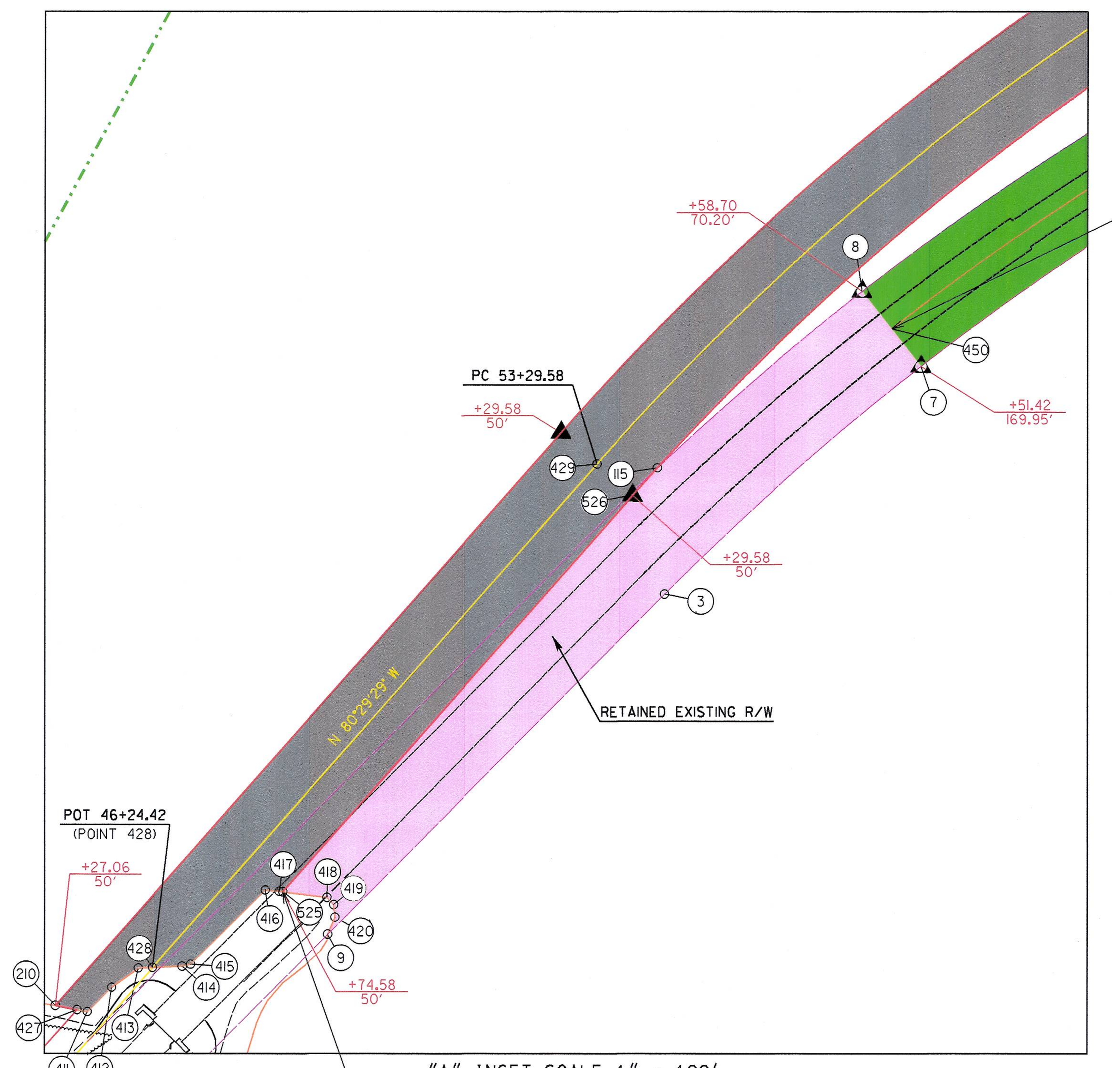
Zug, G. R., and J. F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea* (Testudines: Dermochelyidae): A skeletochronological analysis. Chelonian Conservation and Biology 2:244-249.

Figure 1.

Island I
Island H
Island G
Island F
Island E
Island D
Island C
Island L
Green Isl
Island MN
Parnell
N
W
E
S
Wells
Image © 2007 TerraMetrics
Image © 2007 DigitalGlobe
Google
Pointer lat 35.783203° lon -75.565933° elev 0 ft
Streaming |||||||||| 100%
Eye alt 10.48 mi

METES AND BOUNDS DESCRIPTION of NC 12 PROPOSED EASEMENTS FROM PEA ISLAND TO BODIE ISLAND

CAPE HATTERAS NATIONAL SEASHORE
MAP #2



"A" INSET SCALE 1" = 100'

TIE TO RETAINED EXISTING R/W IS
NCDOT B2500-2 [Monument Coordinates are as Such:
N = 751499.622 E = 3031964.117
NCDOT B2500-2 TO 525 N 75°02'33" W 2,123.10'

TABLES OF METES AND BOUNDS

NEW NC 12 CENTERLINE

COURSE	BEARING	DISTANCE	ARC	RADIUS
NCDOT B2500-2 TO POT 46+24.42 (428)	N 76°04'33" W	1969.19'		
428 - 429	N 80°29'29" W	705.16'		
429 - 430	N 62°47'07" W	1712.29'	1739.85'R	2815.0000'
430 - 431	N 45°04'44" W	3177.41'		
431 - 432	N 22°10'11" W	4710.23'	4838.12'R	6050.0000'
432 - 433	N 00°44'23" E	1968.36'		
433 - 434	N 04°33'53" E	667.08'	667.58'R	5000.0000'
434 - (435) PT 183+88.48	N 04°33'53" E	667.08'	667.58'L	5000.0000'

TOTAL NEW R/W 1,376,251 SQ. FT. ____ 31.594 AC.

OLD NC 12 CENTERLINE

COURSE	BEARING	DISTANCE	ARC	RADIUS
NCDOT B2500-2 - 450	N 74°56'18" W	2993.52'		
450 - 522	N 57°28'51" W	1229.75'	1239.39'R	2864.7890'
522 - 523	N 45°04'45" W	3469.07'		
523 - 524	N 22°10'11" W	4460.77'	4581.89'R	5729.5780'
524 - 435	N 00°44'23" E	3257.91'		

TOTAL AREA TO BE REVERTED 1,152,949 SQ. FT. ____ 26.468 AC.
OVERLAP AREA ______________ 102,186 SQ. FT. _____ 2.346 AC.

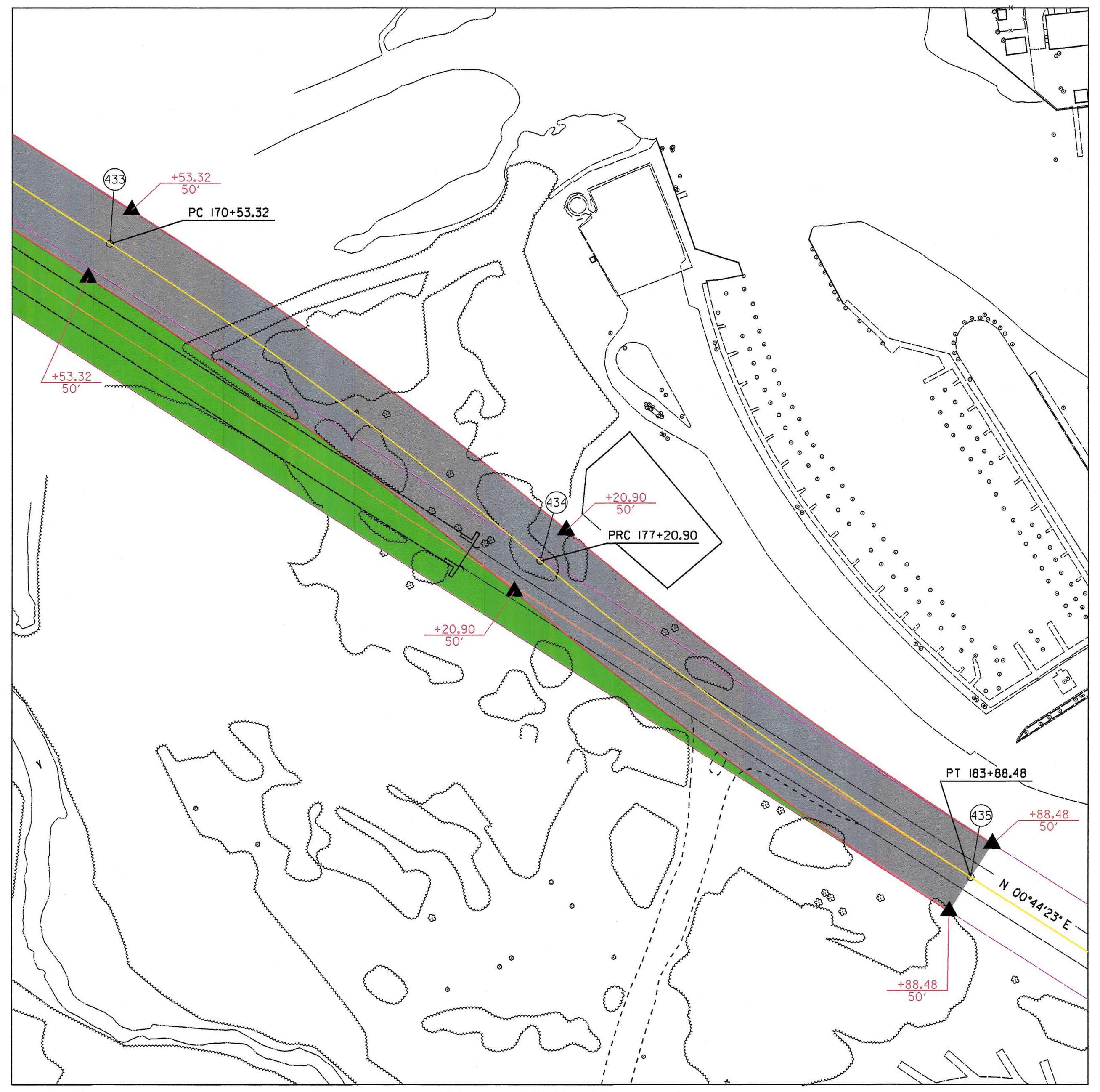
RETAINED EXISTING R/W

COURSE	BEARING	DISTANCE	ARC	RADIUS
NCDOT B2500-2 - 525	N 75°02'33" W	2123.10'		
525 - 526	N 80°29'29" W	555.00'		
526 - 115	N 80°05'24" W	38.83'	38.83'R	2765.0000'
115 - 8	N 72°40'02" W	284.00'	284.11'R	2914.7890'
8 - 7	N 20°07'30" E	100.00'		
7 - 3	S 73°32'43" E	360.40'	360.65'L	2814.7890'
3 - 9	S 77°12'57" E	502.32'		
9 - 420	S 80°57'39" W	19.40'		
420 - 419	S 52°23'56" W	13.25'		
419 - 418	S 15°53'45" W	10.38'		
418 - 525	S 24°25'26" E	46.70'		

TOTAL AREA 75,260 SQ. FT. _____ 1.728 AC.

NEW R/W LINE WITH TERMINAL GROIN

COURSE	BEARING	DISTANCE
45+27.06 / 50.00' LT. = 210		
210 - 427	N 20°50'30" W	23.18'
427 - 411	N 20°50'30" W	10.94'
411 - 412	N 77°17'03" W	36.08'
412 - 413	N 67°38'48" W	34.55'
413 - 428	N 34°17'17" W	15.04'
428 - 414	N 34°17'17" W	31.14'
414 - 415	N 44°48'08" W	9.16'
415 - 416	N 76°48'48" W	110.54'
416 - 417	N 26°40'27" W	14.71'
417 - 525	N 24°25'26" W	3.87'
47+74.58 / 50.00' RT. = 525		



"B" INSET SCALE 1" = 100'

LOCALIZED PROJECT COORDINATES ARE BASED ON THE NAD83(CORS96)(EPOCH 2002.00) STATE PLANE COORDINATES FOR "B2500-2" - N: 751499.622 (US FT) E: 3031964.117 (US FT) - USING AN AVERAGE COMBINED GRID FACTOR (LOCALIZED TO GRID) OF 0.99991846. ALL LINEAR DIMENSIONS ARE LOCALIZED HORIZONTAL DISTANCES, UNITS ARE "US SURVEY FOOT". VERTICAL DATUM IS NAVD88 (GEOID03).

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Date: 4/18/2012

NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-3314 CHARLES W. BROWN

This map has been prepared by the NC Department of Transportation, in compliance with North Carolina General Statute (NC GS) 136-106, from available ground evidence and highway design plans. The fieldwork, office computations, and CADD compilations have been performed under the supervision of NCDOT personnel, or the Location & Surveys Unit.
This map is not intended to comply with GS 47-30. This map is not for recordation.

CHARLES W. BROWN, PE, PLS

Scale 1" = 200'

LEGEND
PROPOSED R/W ACCESS
RETAINED EXISTING R/W
REVERTED R/W ACCESS

REVISED 04/17/2012