



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

EUGENE A. CONTI, JR.
SECRETARY

June 21, 2012

Ms. Tracey Wheeler
U.S. Army Corps of Engineers
Regulatory Field Office
Post Office Box 1000
Washington, NC 27889-1000

Mr. Stephen Lane
N.C. Dept. of Environment and Natural Resources
Division of Coastal Management
400 Commerce Avenue
Morehead City, NC 28557

Dear Madam and Sir:

Subject: **Application for Section 404 and Section 10 Individual Permit, Section 401 Water Quality Certification, and CAMA Major Development Permit** for the proposed replacement of the Herbert C. Bonner Bridge over the Oregon Inlet on NC 12 from Hatteras Island to Bodie Island, Dare County, Federal Aid Projects BRNHF-0012 (48) and BRNHF-0012 (36), TIP B-2500 (Phase I). Debit \$570.00 from WBS 32635.1.4.

The North Carolina Department of Transportation (NCDOT), Division of Highways, in consultation with the Federal Highway Administration (FHWA), proposes to replace the existing Herbert C. Bonner Bridge (Bonner Bridge) and related approaches with a parallel 2.8 mile bridge to the west of the existing bridge.

The purpose of this letter is to request approval for a Clean Water Act (CWA) Section 404 Individual Permit and a Section 401 Water Quality Certification, Rivers and Harbors Act (RHA) Section 10 Permit, and a Coastal Area Management Act (CAMA) Major Development Permit. In addition to the cover letter, this application package includes the following: ENG Form 4345, CAMA MP-1 and MP-5 Forms, permit impact drawings, Concurrence Point 4B and 4C meeting minutes, referenced correspondence, wetland mitigation plan, Section 7 Biological and Conference Opinion, casting yard exhibit, jetting setup exhibit, and half size roadway plans.

1.0 Purpose and Need

The Bonner Bridge was built in 1962 and is approaching the end of its reasonable service life. Bonner Bridge is a part of NC 12 and serves as the only highway connection between Hatteras Island and Bodie Island. The replacement structure will serve the same function. As identified in the Record of Decision (ROD), the purposes of the proposed Project (B-2500, for which the Parallel Bridge Corridor with NC 12 Transportation Management Plan is the Selected Alternative) are to:

- Provide a new means of access from Bodie Island to Hatteras Island for its residents, businesses, services, and tourists prior to the end of Bonner Bridge's service life.

- Provide a replacement crossing that takes into account natural channel migration expected through year 2050 and provides the flexibility to let the channel move.
- Provide a replacement crossing that will not be endangered by shoreline movement through year 2050.

The replacement of the Bonner Bridge is Phase I of the overall Project, which includes the section of NC 12 between the community of Rodanthe and Oregon Inlet, a section of roadway that is at risk because of shoreline erosion. The overall Project will also provide a long-term approach to minimizing that risk through 2060.

2.0 Phase I Description

Phase I of the Project involves the replacement of the Bonner Bridge over Oregon Inlet and related approaches with a bridge parallel to and west of the current 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. Phase I 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 Phase I is 3.55 miles, including roadway approaches.

3.0 Summary of Impacts

Proposed impacts to 404 and CAMA jurisdictional areas total 0.51 acre of permanent wetland impacts, 1.09 acres of temporary wetland impacts, 1.00 acre of permanent surface water impacts, and 3.44 acres of temporary surface water impacts. A summary and breakdown of these impacts is provided in Tables 1 through 4 herein and on Sheet 45 of the permit impact drawings.

4.0 Summary of Mitigation

The proposed construction of B-2500 (Phase I) will permanently impact 0.48 acre of 404 jurisdictional wetlands and 0.02 acre of CAMA wetlands requiring mitigation. Additionally, a net total 1.28 acres of submerged aquatic vegetation (SAV) shading impacts will require compensatory mitigation.

5.0 Project Schedule

B-2500 (Phase I) has been contracted to a Design-Build Team, selected to design and permit Phase I and take it through construction once permits and approvals are issued. Based on the current anticipated schedule Phase I will go to construction in December 2012, with proposed completion of the new bridge by April 2015 and demolition of the old bridge by February 2016.

6.0 NEPA Document Status

6.1 Project History

6.1.1. 1993 Draft Environmental Impact Statement

In 1990, NCDOT began studying replacement alternatives for the Bonner Bridge (B-2500). The coordination for the project, including agency scoping, was initiated with a scoping letter to government agencies in May 1990 at the start of a Bonner Bridge replacement feasibility study. A Draft Environmental Impact Statement (DEIS) was released for review in November 1993. The DEIS assessed a single preferred alternative, the Parallel Bridge Corridor across Oregon Inlet. After the release of the DEIS, combined (corridor and design) Public Hearings were held in early 1994. Comments were received regarding the DEIS from the public and from federal, state, and local agencies.

A preliminary Final Environmental Impact Statement (FEIS) was prepared in 1996; however, it was never signed because formal consultation with the US Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act was not completed. Because it had been more than seven years since completion of the DEIS, a re-evaluation was conducted in 2001 to determine if the preliminary FEIS remained a valid assessment of project impacts. A decision was made in 2001 to prepare a Supplemental DEIS (SDEIS).

6.1.2. 2005 Supplemental Draft Environmental Impact Statement

Work on the SDEIS began in 2002 with a new study of potential Bonner Bridge replacement alternatives. The study area was expanded south to encompass NC 12 south to Rodanthe because NC 12 had begun to be regularly threatened by shoreline erosion and overwash. Three areas on NC 12, or “hot spots”, between Oregon Inlet and Rodanthe were identified as especially vulnerable. The SDEIS was completed and signed in September 2005. The SDEIS assessed five alternatives in two corridors, the Pamlico Sound Bridge Corridor and the Parallel Bridge Corridor. The Parallel Bridge Corridor alternatives are described in Section 3.1 of the ROD. Two Public Hearings were held in November 2005.

6.1.3. 2007 Supplement to the 2005 Supplemental Draft Environmental Impact Statement

A proposal made during the comment period following the release of the SDEIS led to the development of two additional Parallel Bridge Corridor alternatives, which are described in Section 3.1 of the ROD. These alternatives were assessed in the Supplement to the SDEIS (SSDEIS), which was signed on February 14, 2007. Two Public Hearings were held in March 2007.

6.1.4. 2008 Final Environmental Impact Statement

The FEIS was signed on September 17, 2008. It identified the Parallel Bridge Corridor with Phased Approach/Rodanthe Bridge as the Preferred Alternative and addressed comments received on the SDEIS and SSDEIS.

6.1.5. 2010 Environmental Assessment

Several modifications were made to the detailed study alternatives and the impact assessment after the release of the FEIS. These modifications were made to respond to comments on the FEIS and take into account factors related to the history of the creation and maintenance of NC 12 in the Cape Hatteras National Seashore (Seashore) and the Pea Island National Wildlife Refuge (Refuge). The purpose of the Environmental Assessment (EA) was to document these modifications and to determine whether there were any new significant issues not addressed in the FEIS and whether a Supplemental FEIS was needed; the EA was prepared and signed on May 7, 2010. The EA included the following:

- The decision to add a new detailed study alternative (Parallel Bridge Corridor with NC 12 Transportation Management Plan) and select it as the Preferred Alternative;
- Refinements made to the detailed study alternatives since the release of the September 2008 FEIS;
- The elimination of the Pamlico Sound Bridge Corridor alternatives as detailed study alternatives;
- An assessment of impacts for the new detailed study alternative and an assessment of changes to several of the remaining detailed study alternatives at the community of Rodanthe and at the northern end of Hatteras Island; and
- New information obtained since the publication of the FEIS.

Two Public Hearings were held in July 2010. FHWA and NCDOT carefully reviewed the impact analysis included in the FEIS and the EA and all of the comments received on those documents and at the 2010 public hearings. Based on this review, FHWA determined that the changes identified in the EA did not result in any new significant impacts not previously identified; therefore, a Supplemental FEIS was not required.

6.1.6. Record of Decision

Based on the EA and other NEPA documentation, FHWA issued a ROD on December 20, 2010 determining that implementation of the Selected Alternative is in the best overall public interest. The Parallel Bridge Corridor with NC 12 Transportation Management Plan Alternative (NC 12 TMP) was therefore approved for implementation in accordance with the provisions of the ROD.

6.2. Independent Utility

B-2500 (Phase I) is in compliance with both the Corps' independent utility definition as well as 23 CFR Part 771.111(f), which lists the FHWA characteristics of the independent utility of a project. Phase I of the Project meets the criteria for independent utility as listed below:

- Phase I has logical termini and independent utility and is of sufficient length to address environmental matters on a broad scope;
- Phase I is usable and a reasonable expenditure of funds, even if no additional transportation improvements are made in the area; and
- Phase I does not restrict consideration of alternatives for other reasonably foreseeable transportation improvements.

Section 2.3.5 of the May 2010 EA documents the independent utility of Phase I:

The NC 12 Transportation Management Plan Alternative has independent utility with the implementation of Phase I immediately, since the bridge is structurally deficient with a sufficiency rating of 4, and is vulnerable to damage from vessels because of short navigational spans. Even if no other transportation improvements are made along NC 12, the replacement of the bridge is a critical expenditure to ensure public safety. The implementation of subsequent phases also is necessary to provide continued safe, reliable transportation along the Parallel Bridge Corridor from Oregon Inlet to Rodanthe. Implementing the NC Transportation Management Plan Alternative does not alter the need to replace the Oregon Inlet bridge (Phase I). Therefore, the project has independent utility. Furthermore, the proposed project also does not restrict consideration of alternatives for other reasonably foreseeable transportation improvements within the Project study area, as no further improvements other than the NC 12 Transportation Management Plan Alternative are foreseen within the project study area, mainly because of the island's narrow configuration and the absence of any major cross streets along the corridor. In addition, the proposed project does not restrict consideration of alternatives for foreseeable transportation improvements proposed at two hot spots on Hatteras Island near Buxton and Hatteras Village, well south of the southern limit (Rodanthe) of this project.

As is discussed in the next section, Phase II of the Project was initiated in 2011. Decisions on Phase II will be guided by the NC 12 TMP and the NEPA/Section 404 Merger Process, as described in the ROD. The discussion of independent utility in the EA remains valid because, as noted above, implementing the NC 12 TMP does not alter the need to replace the Oregon Inlet bridge.

6.3. *Future Phases of B-2500*

B-2500 (Phase I) is limited to the replacement of the Bonner Bridge and related roadway approaches. The selected alternative, Parallel Bridge Corridor with NC 12 Transportation Management Plan (NC 12 TMP), as noted in the ROD, did not specify a particular action on Hatteras Island beyond the limits of Phase I because of the inherent uncertainty in predicting future conditions within the dynamic coastal barrier island environment. Instead, the alternative addresses the study and selection of future actions on Hatteras Island beyond the limits of Phase I through a comprehensive NC 12 Transportation Management Plan. The NC 12 TMP will guide the implementation of future phases of the Project through 2060. By actively monitoring the conditions and delaying decision-making as set forth in the NC 12 TMP, the environmental impacts beyond Phase I can be better quantified, minimized, and mitigated. This process is somewhat analogous to a tiered NEPA study, in that the entire end-to-end impacts have been studied but the detailed selection of a portion of the action is being delayed.

The NC 12 TMP includes the following measures:

- NCDOT will fund and implement a coastal monitoring program on Hatteras Island within the Project study area. The results of the monitoring program will be used to determine when planning of future phases of the Project should begin.

- NCDOT will fund and implement a periodic Refuge habitat/NC 12 vulnerability forecasting study in consultation with USFWS. Through this program NCDOT and USFWS will work together to develop and assess alternative future scenarios including possible site-specific events and remedies.
- NCDOT and FHWA will utilize the results of the coastal monitoring program and the periodic Refuge habitat/NC 12 vulnerability forecasting study to determine when the environmental review for each phase should be initiated and what alternative actions should be studied in detail.
- The NEPA/Section 404 Merger Process will be utilized to study, select, and finalize future phases. It is anticipated that future phases will be subject to various permitting requirements. NCDOT will be required to obtain and comply with all applicable permits prior to beginning construction of future phases.

The NC 12 TMP incorporates the baseline coastal conditions identified in the FEIS (in Section 3.6.2, “Existing Coastal Conditions”), and then provides a detailed plan to closely monitor the coastal conditions for environmental changes over the next 50 years along with changes in associated road maintenance activities. Formal reports of the monitoring findings and updates to the forecasted shoreline predictions will be generated annually. Regular coordination with interested federal, state, and local agencies and the public will be conducted. When the coastal monitoring program identifies specified conditions at a location, then the NC 12 TMP provides for the initiation of an environmental review of a future phase of action at that location. The NC 12 TMP then describes the process for decision-making regarding the future phase actions.

Due to post-Hurricane Irene coastal conditions assessments in August 2011, Phase II of the NC 12 TMP has been initiated, and NCDOT is diligently working with the Merger Team to identify a preferred alternative for that portion of NC 12. Permit applications for Phase II will be prepared and submitted as part of the Phase II selection process.

7.0 Resource Status

Phase I of the Project is located in the Pasquotank River Basin and lies within the U.S. Geological Survey’s Hydrologic Unit 03020105 (N.C. Division of Water Quality (NCDWQ) subbasins 03-01-55 and 03-01-56). The southern end of Bodie Island is in subbasin 56 and the northern end of Hatteras Island is in subbasin 55. This is within the Carolinian Barrier Islands and Coastal Marshes eco-region. Phase I crosses the Oregon Inlet and portions of Pamlico Sound and Motts Creek.

7.1 Wetland Delineations

Numerous studies have been performed on the Outer Banks by NCDOT over the years, several with overlapping study areas in the vicinity of Bonner Bridge. Initially, wetlands were delineated through aerial interpretation of July 12, 2002 color aerial photographs and field-verified during May and June 2003. Wetland delineations were also conducted during field investigations in March 2003 and May/June 2004 in association with NCDOT’s TIP Nos. R-3116D,E/F (NC 12 Interim Improvements) as well as November/December 2004 for TIP No. B-2500. Final delineated wetlands were mapped in June 2005 for detailed alignments, with ten wetland communities identified within the larger study area as described in the NRTR.

Jurisdictional determinations (JD's) were confirmed by the U.S. Army Corps of Engineers (USACE) on January 27, 2004 and April 26 and May 2, 2006 by Mr. William J. Biddlecome. The wetland delineation for Phase I was updated in January 2012 and field-verified in March 2012 by USACE and the N.C. Division of Coastal Management (DCM). An approved JD was issued by the USACE on May 4, 2012 (Action ID SAW-2012-00715). In an email dated May 30, 2012, Stephen Lane of DCM concurred with the CAMA wetland mapping per his March field review.

The 2012 updated delineation was used to calculate final jurisdictional and CAMA impacts in this application. The final design avoids and minimizes wetland impacts to the maximum extent practical, as described in Section 11.0. The initial wetland delineations within the NEPA study area were delineated based on the 1987 USACE Wetland Delineation Manual and the final JD also incorporated methodology from the USACE 2010 Atlantic and Gulf Coastal Plain Regional Supplement.

7.2. *Stream/Open Water/SAV Delineations*

Due to the location and nature of Phase I of the Project, open water is the predominant jurisdictional feature. Open water consists of either aquatic bottom (unconsolidated bottom, non-SAV) or SAV areas (aquatic bed). SAV habitat was mapped in detail in the June 2011 B-2500 (Phase I) SAV Survey. The most recent surveys delineated SAV beds as homogenous, patchy, sparse and void; however, for purposes of mitigation and permitting all categories except "void" were used equally in the final calculations. The attached permit impact sheets delineate those areas mapped in June 2011 within the Phase I corridor, as presented at the March 2012 Concurrence Point 4C Merger Meeting and included in the impacts referenced below.

Motts Creek, a tidal creek originating in the intertidal marsh and maritime shrub thickets at Bodie Island, was re-verified in the 2012 delineation. The extent of Motts Creek was derived from NCDOT's planimetrics mapping and the 2012 wetland delineation/biotic community updates, and is void of SAV habitat.

7.3. *Characterization of Jurisdictional Sites*

The Phase I corridor lies on barrier islands on the North Carolina coast, bridging the Oregon Inlet between Hatteras Island on the south and Bodie Island on the north. Ten wetland community types were mapped within the overall Phase I corridor, from brackish marsh to maritime shrub thicket. Wetlands associated with Oregon Inlet are generally subject to CAMA, while most of the wetlands in the interior portion of the islands are only subject to Section 404 regulations.

Neither Water Supply (WS-I or WS-II) nor Outstanding Resource Waters (ORW) occur within 1.0 mile of the Phase I study area. The waters of Pamlico Sound, Roanoke Sound, and Oregon Inlet are classified as SA waters (Market Shellfishing tidal salt waters) with a supplemental classification of HQW (High Quality Waters). Motts Creek is class SC (Secondary Recreation tidal salt water). None of the waters within the Phase I corridor are designated as a North Carolina Natural or Scenic Rivers or as National Wild and Scenic Rivers.

The southern portion of the Roanoke Sound adjacent to Big Tim Island (Assessment Unit 30-21j) was listed on the Final 2010 303(d) list of impaired waters as a prohibited shellfish growing area. It was closed for shellfish harvesting in 2002. This area is located approximately a quarter-mile to the west-northwest of the Phase I study area near the Oregon Inlet Fishing Center.

Per the above designations, NCDOT's Design Standards in Sensitive Watersheds will be implemented.

7.4. *Impacts to Jurisdictional Resources*

Impacts to 404 and CAMA wetlands as well as surface waters for B-2500 (Phase I) are summarized in Tables 1 through 4.

Table 1. Permanent Wetland Impacts

Permit Drawing Site Number	Wetland Biotic Communities from JD (2012)	Wetland Type *	Permanent 404 Impacts**	Permanent CAMA Impacts** (ac.)	Mitigable Impacts (ac.)
2 (Roadway)	Maritime Shrub Thicket/Maritime Grassland/Reed Stand	404 (Non-Riparian)	0.33	0	0.33
3 (Boardwalk)	Reed Stand	404 (Non-Riparian)	<0.01	0	0
4 (Utility Relocation)	Maritime Grassland and Shrub Thicket/ CAMA Marsh	404 and CAMA (Riparian)	0	0.01	0.01
5 (Mech. Clearing along Bridge)	Maritime Grassland/ CAMA Marsh	404 and CAMA (Riparian)	0.08	0.01	0.09
5 (Proposed Bridge)	Maritime Grassland/ CAMA Marsh	CAMA	0	0.01	0
7 (Roadway)	Maritime Grassland	404 (Non-Riparian)	0.07	0	0.07
Total:			0.48	0.03	0.50
			0.51		

* 404 represents non-coastal wetlands

** Permanent Impacts represent permanent excavation, fill, and mechanized clearing

Permanent Impacts: Proposed permanent impacts for B-2500 (Phase I) include fill, excavation, and mechanized clearing in wetlands. This includes fill impacts to 0.03 acre of CAMA wetlands, of which 0.01 acre are non-mitigable impacts. Fill impacts to 404 wetlands consist of 0.38 acre, of which all are mitigable impacts. Excavation impacts total 0.02 acre for 404 wetlands and no CAMA wetlands will be excavated. Mechanized clearing in 404 non-riparian wetlands is 0.08 acre and in CAMA wetlands is 0.01 acre. Total permanent mitigable wetland impacts total 0.50 acre. Proposed permanent impacts to surface waters are 1.00 acre, which includes the proposed bridge pile caps (projected in water). Surface waters also include SAV habitat areas, which are discussed in more detail in Sections 7.2 and 7.5. Stream impacts to Motts Creek are shown on the permit drawings as surface water impacts.

Utility Impacts: There will be 0.01 acre of permanent CAMA wetland impact due to fill associated with the erection of the relocated riser pole at Site 4. There will be 0.11 acre of temporary disturbance (excavation and mechanized access) due to the trenching of the underground electric lines to the new riser pole, of which 0.06 acre is CAMA and 0.05 acre is 404 wetland. These utility impact totals are included in the permanent and temporary impacts summarized in Tables 1 and 2.

Table 2. Temporary Wetland Impacts

Permit Drawing Site Number	Wetland Biotic Communities from JD (2012)	Wetland Type *	Temporary 404 Impacts** (ac.)	Temporary CAMA Impacts** (ac.)
4 (Utility Relocation)	Maritime Grassland and Shrub Thicket/ CAMA Marsh	404 and CAMA (Riparian)	0.05	0.06
5 (Proposed Bridge)	Maritime Grassland/ CAMA Marsh	CAMA (Riparian)	0	0.65
5 (Trestle)	Maritime Grassland/ CAMA Marsh	CAMA	0	0.02
6 (Demolition)	Maritime Grassland	CAMA	0	0.31***
Total:			0.05	1.04

* 404 represents non-coastal wetlands

** Temporary Impacts represent temporary fill (trenching for utilities), which is not mitigable

*** Temporary excavation due to demolition/pile removal of existing bridge

Temporary Impacts: There will be 1.09 acres of temporary wetland impacts due to utility relocation, work trestle, proposed bridge construction, and demolition of the existing bridge. There will be 3.44 acres of temporary surface water impacts to Oregon Inlet, Pamlico Sound and Motts Creek due to the work trestle/dock on Hatteras Island, proposed bridge, work trestle/platform on Bodie Island, and the existing bridge demolition (surface water impacts are summarized in Table 4). There will be 0.01 acre of temporary surface water impact in the barge canal at the contractor's casting yard in Hyde County for the installation of temporary pipe piles for a barge loading trestle.

Table 3. CAMA (Coastal) Wetland Impacts (included in Tables 1 & 2)

Permit Drawing Site Number	Wetland Biotic Communities from JD (2012)	Mitigable (for permanent)	Permanent Impacts* (ac.)	Temporary Impacts** (ac.)
4 (Utility Relocation)	CAMA Marsh	Yes	0.01	0.06
5 (Mech. Clearing along Bridge)	CAMA Marsh	Yes	0.01	0
5 (Proposed Bridge)	CAMA Marsh	No	0	0.65
5 (Bridge/Trestle Piles)	CAMA Marsh	No	0.01	0.02
6 (Demolition)	CAMA Marsh	No	0	0.31
Total:			0.03	1.04

* Permanent Impacts represents permanent excavation, fill, and mechanized clearing

** Temporary Impacts represent temporary fill (trenching for utilities), and disturbance,

Table 4. Surface Water Impacts

Permit Drawing Site Number	Waterbody	Mitigable	Permanent Impacts (ac.)	Temporary Impacts (ac.)
3 (Trestle)	Oregon Inlet	No	0	0.01
5 (Proposed Bridge)	Oregon Inlet/Pamlico Sound/Motts Creek	No	1.00	0.93
5 (Work Trestle/ Temp. Platforms)	Oregon Inlet/Pamlico Sound/Motts Creek	No	0	0.04
6 (Demolition)	Oregon Inlet/Pamlico Sound/Motts Creek	No	0	2.45
Casting Yard Trestle Piles	Barge Canal off Alligator River	No	0	0.01
Total:			1.00	3.44

7.4.1. Site 1 (Roadway)

Site 1 is located at the southern end of Phase I on Hatteras Island, between -L- Sta. 19+96 and Sta. 21+66 LT, on the southwestern side of the proposed alignment and south of the Lifeboat Station Road (SR 1257)/ NC 12 intersection. The impact was reduced to 0.01 acre of hand clearing in a 404 (non-riparian) wetland for construction of the roadway approach. This site was delineated as a maritime shrub thicket and is a 404 jurisdictional wetland.

7.4.2. Site 2 (Access Road -Y01-)

This site is located near the southern end of Phase I on Hatteras Island, between -Y01- Sta. 16+93 and Sta. 21+08 RT. The wetland impacts occur on the northeastern side of the proposed

alignment and are north of the Lifeboat Station Road (SR 1257)/ NC 12 intersection. Wetland impacts consist of 0.32 acre of permanent fill and 0.01 acre of excavation. Additionally, there will be 0.12 acre of hand clearing for the construction of the relocated access road to the parking area. All wetland impacts at Site 2 are 404 (non-riparian) wetlands. This site was delineated as a mix of maritime shrub thicket, maritime grasslands, and reed stand.

7.4.3. Site 3 (Work Trestle / Dock)

Site 3 impacts are located on Hatteras Island, primarily on the southwestern side of the proposed alignment between -L- Sta. 41+86 and Sta. 44+32 LT. This site encompasses temporary open water impacts associated with the work trestle and two associated boat slips extending off the side of the trestle. Impacts consist of less than 0.01 acre of temporary surface water impacts due to temporary pipe piles to support the trestle. This site also includes less than 0.01 acre of permanent wetland impact due to the proposed boardwalk crossing to provide pedestrian access to the former US Coast Guard Station.

7.4.4. Site 4 (Utility Relocation)

This site is located on Hatteras Island on the southwestern side of proposed alignment, between -L- Sta. 39+61 and Sta. 40+57 LT. Impacts at this site are associated with the relocation of the 115kV riser pole and trenching of underground electric conduit. Wetland impacts consist of 0.01 acre of permanent fill in CAMA wetlands due to the new pole's relocated pad. Temporary fill in wetlands total 0.11 acre, which consists of 0.06 acre of CAMA wetlands and 0.05 acre of 404 (non-riparian) wetlands for the trenching of the relocated underground conduit. Timber mats will be used through this area to minimize soil compaction and vegetation disturbance. These temporary impacts approximately follow the existing utility easement.

7.4.5. Site 5 (Proposed Bridge / Work Trestle / Temporary Platform)

This site is located between Hatteras Island and Bodie Island and spans the waters of Oregon Inlet, Pamlico Sound and Motts Creek, and their associated wetlands between -L- Sta. 38+36 and Sta. 176+68. This site encompasses permanent and temporary structures associated with the proposed Bonner Bridge replacement. Wetland impacts from the permanent bridge piles consist of 0.01 acre of non-mitigable fill in CAMA wetlands, 0.65 acre of temporary fill in CAMA wetlands due to temporary construction measures, and 0.09 acre of mechanized clearing in 404 and coastal wetlands along the southwestern side of the bridge on Hatteras Island. The 0.09 acre of mechanized clearing is due to the proximity of the wetlands to the edge of the proposed bridge. Clearance is needed between the wetlands and bridge to provide access for construction activities as well as future maintenance concerns. Less than 0.01 acre of this is clearing in CAMA wetlands, with 0.08 acre being in 404 wetlands. Surface water impacts are comprised of 1.00 acre of permanent impacts (from the proposed bridge piles) and 0.93 acre of temporary impacts (from temporary construction measures).

Temporary impacts associated with the work trestle and eight work platforms consist of 0.02 acre of fill in CAMA wetlands and 0.04 acre of temporary surface water impacts due to the installation and removal of steel pipe piles. The temporary work trestle and platform impacts occur between Sta. 107+25 and Sta. 172+40.

7.4.6. Site 6 (Existing Bridge Demolition)

This site consists of the existing Bonner Bridge between Hatteras Island and Bodie Island, between Sta. 56+40 and Sta. 172+10 RT. The impacts encompass the bridge pile windows (maximum horizontal extent of piles at the bed elevation extent of pile projection into the water) for the existing bridge. Impacts from demolition activities related to the removal of the existing bridge and its piles/foundations will include 0.31 acre of temporary disturbance (noted elsewhere as “fill” for lack of a more appropriate category) in CAMA wetlands and 2.45 acres of temporary surface water impacts.

7.4.7. Site 7 (Roadway)

Site 7 is located south of the National Park Service (NPS) campground entrance on Bodie Island, between Sta. 191+20 and Sta. 197+80. The wetland impacts occur on the east and west sides of the proposed alignment and are associated with roadway fill and ditch realignments. The impacts consist of 0.06 acre of fill in 404 (non-riparian) wetlands and 0.01 acre of excavation in 404 (non-riparian) wetlands. Additionally, there will be 0.13 acre of hand clearing in 404 (non-riparian) wetlands. The majority of the impacts at this site are west of the alignment, including all of the fill impacts. Excavation occurs only on the eastern side of alignment, due to the ditch relocation and tie-in at the relocated driveway pipe under the campground entrance road. Hand clearing impacts occur on both sides of the alignment.

7.4.8. Trestle Piles at Casting Yard

Less than 0.01 acre of surface water will be impacted by the installation of 30 temporary pipe piles at the southern end of the barge dredge canal at the contractor’s casting yard in Hyde County. These piles will support a temporary trestle to be used for loading pre-cast materials onto barges for transport to the bridge construction site. These piles will be removed when the casting yard is closed down by the contractor in 2015/2016. An attached drawing references the location and approximate layout of this trestle in the canal. Wetland impacts associated with this site are currently being permitted by the owner, as they are permanent and have independent utility from this application. Temporary piles permitted under this application will be removed from the site upon completion of the bridge.

7.5. Submerged Aquatic Vegetation

SAV shading effects will total 2.66 acres from the proposed bridge. SAV areas totaling 1.38 acres will be un-shaded due to the removal of the existing bridge, with 1.28 acres of net impacts to be mitigated. Surface water impacts described above include direct impacts to SAV areas but do not include shading effects.

8.0 Protected Species

The USFWS lists 13 federally protected species for Dare County as of the February 15, 2012 listing. The Atlantic sturgeon was listed by NOAA Fisheries effective April 6, 2012 (Table 5).

Table 5. Federally Protected Species in Dare County

Scientific Name	Common Name	Federal Status	Habitat Present	USFWS Biological Conclusion	NOAA Biological Conclusion
<i>Alligator mississippiensis</i>	American alligator	T(S/A)	No	n/a	n/a
<i>Chelonia mydas</i>	Green sea turtle	T	Yes	MALAA	MANLAA
<i>Eretmochelys imbricate</i>	Hawksbill sea turtle	E	Yes	n/a	MANLAA
<i>Lepidochelys kempii</i>	Kemp's ridley sea turtle	E	Yes	n/a	MANLAA
<i>Dermochelys coriacea</i>	Leatherback sea turtle	E	Yes	MALAA	MANLAA
<i>Caretta caretta</i>	Loggerhead sea turtle	T	Yes	MALAA	MANLAA
<i>Charadrius melodus</i>	Piping plover	T	Yes	MALAA	n/a
<i>Picoides borealis</i>	Red-cockaded woodpecker	E	No	No Effect	n/a
<i>Sterna dougallii dougallii</i>	Roseate tern	T	Yes	MANLAA	n/a
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	E	Yes	n/a	MANLAA
<i>Acipenser oxyrinchus oxyrinchus</i>	Atlantic sturgeon (Carolina distinct population segment)	E	Yes	n/a	MANLAA*
<i>Trichechus manatus</i>	West Indian manatee	E	Yes	MANLAA	MANLAA
<i>Canis rufus</i>	Red wolf	E (EXP)	No	No Effect	n/a
<i>Amaranthus pumilus</i>	Seabeach amaranth	T	Yes	MANLAA	n/a

E = Endangered; T = Threatened; T(S/A) = Threatened(Similarity of Appearance); EXP = (Experimental Population); MANLAA= May Affect, Not Likely to Adversely Affect; MALAA = May Affect, Likely to Adversely Affect; n/a = Not Applicable.

* - Anticipated Conclusion, pending further coordination.

In March 2008, a Biological Assessment with addendum was finalized. A Biological and Conference Opinion was issued July 10, 2008 by the USFWS for effects on piping plover, loggerhead sea turtle, green sea turtle, and leatherback sea turtle. Section 7 Consultation was tentatively resolved, pending the final design. NCDOT is providing a Section 7 update memo to USFWS to close design Consultation. NCDOT coordinated with NOAA Fisheries as documented in the FEIS, EA, and ROD with conservation measures adopted (see “Avoidance and Minimization” section) to mitigate any potential negative effects on aquatic species. Copies of the USFWS Biological and Conference Opinion and NOAA Fisheries concurrence letter are included with this application. Based on the previous coordination and NOAA Fisheries’ comments at the Concurrence Point 4C Meeting, we anticipate the new listing of Atlantic sturgeon would require the same conservation measures already adopted by NCDOT for shortnose sturgeon. Further coordination is occurring between NCDOT and NOAA Fisheries regarding Atlantic sturgeon to finalize consultation.

A review of the North Carolina Natural Heritage Program (NCNHP) database, updated January 2012, indicated two nesting occurrences of protected species within one mile of the Phase I study area. A piping plover nesting area was documented on Hatteras Island to the east of the Phase I alignment in 2008, between the terminal groin and the former USCG Station parcel. Another occurrence was also documented in 1997 on Bodie Island, approximately a half mile to the east of the alignment. No other protected species have been recorded in the NCNHP database.

Protected species moratoria and protection measures required for Phase I are detailed below under “Moratoria” and “Avoidance and Minimization”.

8.1. Bald and Golden Eagle Protection Act (BGPA)

In the July 9, 2007 Federal Register (72:37346-37372), the bald eagle was declared recovered, and removed (de-listed) from the Federal List of Threatened and Endangered Species. This delisting took effect August 8, 2007. After delisting, the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d) became the primary law protecting bald eagles. Surveys were conducted in March 2003 and May/June 2004 and found no nesting habitat, and consequently no nests, within 660 feet of the Phase I corridor. However, foraging habitat was present within the Phase I corridor. A biological conclusion of “May Affect – not likely to adversely affect” was determined in the FEIS.

8.2. Moratoria

Moratoria and/or protection measures for several species have been recommended for B-2500 (Phase I) through the NEPA/Section 404 Merger process. These species include loggerhead sea turtle, green sea turtle, leatherback sea turtle, hawksbill sea turtle, smalltooth sawfish (*Pristis pectinata*), West Indian manatee, and piping plover.

NCDOT will implement the following nondiscretionary measures that include the terms and conditions outlined in the July 10, 2008 USFWS Biological and Conference Opinions. These terms and conditions are specific to piping plover and the three species of sea turtles (Green, Leatherback and Loggerhead) with a MANLAA Biological Conclusion for this Project:

Piping Plover

- All construction equipment and personnel must avoid bird closure areas within the Cape Hatteras National Seashore.
- Mooring of construction barges will be prohibited 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.
- 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 piping plover. (*This is not expected to be encountered – no dredging is anticipated.*)
- Signage used on the Project will utilize alternative designs that are less conducive for perching on by avian predators. The Project’s signing will minimize and avoid the use of cantilever signs in favor of smaller and shorter designs.

Sea Turtles & Smalltooth Sawfish

- All construction equipment and personnel must avoid sea turtle nests and construction material and equipment staging areas must not be located seaward of the artificial dune.
- During the nesting season use of the minimum number and lowest wattage lights that are necessary for construction. These lights must be the low-pressure sodium-vapor type. (*Discussions are ongoing with USFWS to potentially use newer technologies to provide turtle-safe lighting while also reducing overall energy consumption.*)
- The USFWS will conduct a meeting to educate the contractor’s managers, supervisors, foremen and other key personnel and resident NCDOT personnel with oversight duties to the adverse effects of artificial lighting on nesting turtles and hatchlings and the importance of minimizing those effects. (*This meeting will be scheduled close to the commencement of construction.*)

- All conditions outlined in NOAA Fisheries' Sea Turtle and Smalltooth Sawfish Construction Conditions will be followed. In-water construction will cease if a protected species is sighted in the proximity of construction. This moratorium prohibits pile installation and removal and any activity associated with bridge construction and demolition when listed species are observed to be present. However, this moratorium does not restrict terrestrial activity. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported to NOAA Fisheries' Protected Resources Division (727-824-5312) and the Network for Endangered Sea Turtles (NEST) (252-441-8622).

West Indian Manatee

- All conditions outlined in the USFWS Guidelines for Avoiding Impacts to the West Indian Manatee: Precautionary Measures for Construction Activities in North Carolina Water will be adhered to. Equipment shut down will occur if a manatee is seen within 50 feet of the operational area of the equipment. Collision and/or injuries to a manatee will be reported immediately to USFWS (919-856-4520 ext. 16), NOAA Fisheries (252-728-8762) and N.C. Wildlife Resources Commission (252-448-1546).

In addition to those measures noted above, turbidity curtains will not be utilized in the open waters of Oregon Inlet during construction and demolition in order to avoid aquatic species entanglement and maximize worker safety. The fast moving current of the Inlet would make turbidity curtains minimally functional, and the process of installing and maintaining such curtains in the Inlet would be problematic at best and dangerous at worst. Additionally, the potential for aquatic species to get entangled in the curtains is a significant concern, especially for sea turtles, larger fish and mammals that use the Inlet and Sound.

9.0 Cultural Resources

As of June 10, 2009, Phase I was determined to have an Adverse Effect on the Pea Island National Wildlife Refuge (PINWR) and the (former) Oregon Inlet U.S. Coast Guard Station as historic resources. NCDOT, along with FHWA, State Historic Preservation Office (SHPO), Advisory Council on Historic Preservation (ACHP), and other consulting parties, developed a Programmatic Agreement (PA) stipulating measures that FHWA will carry out during the design and construction phase. The final PA was signed by FHWA, SHPO, ACHP and NCDOT on November 15, 2010, and was included as Appendix D in the ROD.

The (former) U.S. Coast Guard Station building is located at the northern end of Hatteras Island and is listed on the National Register of Historic Places. It will be protected during construction via a 50-foot buffer around the structure and tree protection fencing (or similar), and other previously agreed-to measures will be followed. Additionally, the visual effects of the bridge have been minimized, to include enclosure of the electric conduit within the segmental box that supports the bridge's superstructure through the navigation zone (reference the drawing attached to the Concurrence Point 4C Meeting minutes, included herein). A boardwalk is to be constructed as part of Phase I to provide public pedestrian access to the Station from the Pea Island parking lot. The intent is for the boardwalk to satisfy Stipulation III(A)(1) of the Section 106 Programmatic Agreement. NCDOT is in the process of carrying out the remaining stipulations of the PA as they apply to Phase I.

No archaeological sites were found within the Project's area of potential effects. Therefore, no additional archaeological investigation was recommended for this Project. The SHPO concurred with these findings in a letter dated June 21, 2005, which can be found in the FEIS Appendix A.

10.0 FEMA Compliance

Floodplains within and adjacent to Oregon Inlet are designated coastal flood zones. The remaining areas at the bridge approaches and in the intertidal marshes on Bodie and Hatteras Islands are 100-year floodplains. The Project has been coordinated with appropriate state and local officials and the Federal Emergency Management Agency (FEMA) to assure compliance with FEMA, state, and local floodway regulations.

11.0 Mitigation Options

The NCDOT is committed to incorporating all reasonable and practicable design features to avoid and minimize jurisdictional impacts, and to provide full compensatory mitigation of all remaining, unavoidable jurisdictional impacts. Avoidance and minimization measures were taken during the planning and NEPA compliance stages; additional minimization measures were incorporated as part of the design of Phase I. Impact minimization has also been balanced with limiting impacts to both the Seashore and Refuge, from which easements must be acquired for the new bridge and roadway alignment, in addition to limiting impacts to protected species and recreational users of the surrounding lands.

Post-construction visual inspection will ensure all temporary impacts maintain or re-attain jurisdictional status. Jetting containment areas will be inspected post-construction, and it is anticipated that the permitting agencies will visually determine re-attainment of jurisdictional status. In the event that a temporary impact area does not maintain or re-attain jurisdictional status, a plan will be implemented to restore the wetland to natural conditions.

11.1. Avoidance and Minimization

All jurisdictional features were delineated, field verified and surveyed within the corridor for B-2500 (Phase I). Using these surveyed features, preliminary designs were adjusted to avoid and/or minimize impacts to jurisdictional areas. NCDOT employs many strategies to avoid and minimize impacts to jurisdictional 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 the resource agencies, and which will be followed throughout construction. All wetland areas and environmentally sensitive areas not affected by construction will be protected from unnecessary encroachment using tree protection fencing or an equivalent measure. Individual avoidance and minimization measures include the following:

11.1.1. Design Measures

- Phase I was designed to avoid or minimize disturbance to aquatic life movements.
- Span lengths throughout the bridge were maximized, especially through the navigation zone over Oregon Inlet, thereby minimizing the overall footprint of the bridge's substructure and reducing wetland, surface water and SAV impacts.

- The proposed bridge's substructure does not require large pile caps at or below the mudline, thereby greatly decreasing the structure's permanent footprint in the intertidal marsh and SAV habitat.
- 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 Refuge.
- The proposed alignment was shifted east (approximately 330 feet at most) closer to the existing bridge to accommodate the use of one work trestle for both construction and demolition.
- Stormwater will be collected on both bridge approaches (500' on southern end and 100' on northern end) and treated using roadside ditches and preformed scour holes, as noted in attached email correspondence from NCDWQ dated December 20, 2011.
- Deck drains will be installed 14' on center, where feasible, throughout the majority of the bridge, and will be located such that outlets will be 12 feet or more off the ground.

11.1.2. Protected Species Measures

- A pre-construction lighting design coordination meeting to establish the parameters of the lighting set-up was held in May 2012, which refined the protective measures to be implemented by the contractor.
- An educational night lighting meeting will be scheduled with USFWS and all contractors in order to minimize disturbance to sea turtles and other protected species. Night lighting will meet the requirements specified in the attached USFWS Biological and Conference Opinions, unless otherwise specified by USFWS.
- No permanent light fixtures will be mounted on the proposed bridge and approaches except for navigational lighting.
- On-site personnel will implement the "Guidelines for Avoiding Impacts to the West Indian Manatee: Precautionary Measures for North Carolina Waters."
- On-site personnel will follow the NOAA Fisheries document "Sea Turtle and Smalltooth Sawfish Construction Conditions."
- Dredged materials, if needed, will be disposed of on existing material islands or to create new dredge-material islands for use by foraging plovers. (*However, no dredging is anticipated.*)
- No permanent lighting will be installed on the portion of the existing bridge to be retained as a fishing pier.

11.1.3. Work Trestle Measures

- A solid trestle deck will help to decrease the potential for spills to reach surface waters versus an open grate, and it enhances the effectiveness of the drip pans under equipment.
- Leapfrogging the solid deck work trestle will minimize long term shading effects of SAV and intertidal marsh areas along the northern approach spans, as it will gradually shift south during the first 18 months of construction. It will be located approximately 20' above the water. This is in lieu of a 6,700 foot long work trestle grated platform for the life of the construction. Trestle piles will remain in place while the deck is leapfrogged out and back.
- Dredging is not proposed or anticipated to be required for construction, and the work trestle has been designed to provide access across shallow areas in order to eliminate the need for

dredging. However, the potential for dredging cannot be completely eliminated due to changing conditions on-site.

- The southern extent of the Bodie Island work trestle has been extended over open water to avoid dredging, which in turn reduces the potential for temporary SAV shading on the final segments where leapfrogging of the deck will end.
- Between the Concurrence Point 4B and 4C meetings, it was determined dredging might be necessary for barge access at the southern end of the work trestle as planned. In order to avoid dredging in Pamlico Sound and Oregon Inlet for barge access, the work trestle was lengthened by more than 800 feet.
- During demolition of the existing bridge, the work trestle piles will be removed as the trestle is simultaneously deconstructed.
- A work trestle from Hatteras Island, extending far enough into Pamlico Sound to allow safe barge mooring, will utilize the previously-disturbed emergency ferry ramp for temporary open water access from the construction area.
- 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.

11.1.4. Construction Staging Measures

- No staging of construction equipment or storage of construction supplies will be allowed in wetlands.
- Staging will not occur within the state-owned 10-acre USCG Station parcel on Pea Island, other than that required to complete construction of the boardwalk and allow pedestrian access to/through the parcel for agency and/or construction personnel.
- Staging will occur at the existing NPS parking lot on the Refuge as well as along SR 1257 between NC 12 and the former USCG Station parcel, as agreed to by the USFWS. This will provide ample buffer for construction noise and line of sight from the eastern beach of Refuge, where sea turtle nesting and piping plover foraging/nesting habitat are present.
- The contractor will minimize traffic impacts to Seashore visitors, while also minimizing the footprint of personnel access (parking vehicles, etc.) by utilizing the staging areas, unopened bridge deck, and off-site parking lots.
- Lighting required at the staging areas will be coordinated along with other construction lighting to ensure no adverse effects to nesting sea turtles.
- Fueling stations will be contained to avoid inadvertent spills reaching surface waters. Any spills will be controlled and reported as applicable.

11.1.5. Jetting Measures

- Bridge piles will be jetted with an air/water mix, thereby minimizing the amount of water to be introduced into the operation. This will also reduce the potential for spoils to surface beyond the containment areas, as the spoils will tend to rise with the injected air, following the path of least resistance.
- In order to minimize the effects of the requisite jetting process for pile installation, the contractor will utilize primary and secondary containment systems to capture as much of the jetting water as possible and re-use it within the jetting operation. The primary and secondary containment systems will be used at bents 47 through 78 in wetland areas. Similar jetting

containment will be used in upland areas, but their setup may vary due to other constraints. *(A jetting exhibit is attached to this application, similar to the graphics shown at the March 2012 Concurrence Point 4C Meeting)*

- Jetting spoils will be placed inside hollow concrete pilings to minimize off-site disposal. Excess spoil will be disposed of according to NCDOT borrow/waste procedures at a pre-approved off-site location.
- Conservation measures to reduce turbidity and water quality degradation would be minimized by the use of “Baker tanks” or equivalent to capture and store jetting water prior to re-use, similar to that referenced during the Concurrence Point 4C Meeting.

11.1.6. Demolition Measures

- Demolition will not involve explosives, and will use the work trestle and barges for all access to minimize footprint.
- Acceptable bridge demolition debris will be used at four existing artificial reef locations in the Atlantic Ocean. (see Section 11.2.3)
- NCDOT will implement Best Management Practices for Bridge Demolition and Removal.

11.1.7. General Construction Measures

- NCDOT will carry out the stipulations in the Section 106 Programmatic Agreement that outlines mitigative measures pertaining to the Refuge and the (former) U.S. Coast Guard Station building.
- *Phragmites* surveys will be conducted in June/July 2012 to accurately assess current extent and mitigation needs, prior to implementation of the mitigative efforts.
- Oregon Inlet fishing access will be maintained on the catwalks 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.
- If dredging is needed, and in order to protect sea turtles, pipeline or clamshell dredging methods would be used. Hopper dredging will not be used for construction or demolition of the existing bridge.
- To the maximum extent practical, while ensuring travelling safety, NCDOT will limit or avoid the use of road signs or other potential predator perches adjacent to plover nesting and foraging areas. Large cantilever signs will be avoided in favor of smaller and shorter signs.
- To ensure that all borrow and waste activities occur on high ground, except as authorized by permit, the NCDOT shall require its contractors to identify all areas to be used to borrow material, or to dispose of dredged, fill or waste material. Documentation of the location and characteristics of all borrow and disposal sites associated with the construction of Phase I will be available to the USACE on request.
- Sediment and erosion control measures shall adhere to the Design Standards in Sensitive Watersheds during construction.
- Special Sediment Control Fence and Environmentally-Sensitive Area fencing will be used where applicable.

11.2. Substructure Removal/Bridge Demolition Plan

Bridge demolition is focused around minimization of impacts to the SAV and marsh areas as

well as meeting all commitments to the various agencies and stakeholders. The demolition plan complies with the USACE preference to first demolish the existing bridge within the proposed navigation zone. This will “open up” the navigation channel more quickly, thereby minimizing the potential need for continued dredging by the USACE of the existing channel. The contractor will employ proven demolition techniques to minimize impacts to the environment from demolition activities. The specific approach to demolition is divided between approach spans, navigation spans, and disposal.

11.2.1. Approach Spans

Bridge demolition of the low-level approach spans at the northern end of Phase I will be performed from the work trestle. The 1,050 feet of the existing bridge connected to Hatteras Island will be retained as a fishing pier, which includes bents 187 to 203. In all other areas, demolition will occur with the use of barges. The existing bridge will be cut into approximately 50-ton pieces to reduce the number of crane picks. The superstructure will be saw-cut and removed along beam lines with deck and barrier intact. Bent caps will be removed as one piece where feasible. The existing bridge piles in open water will be removed completely and piles located in SAV and marsh areas will be cutoff at the mudline. Specifically, piles at bents 7 to 87 will be cut at the mudline. Upland piles at bents 1 to 5 will be cut at ground level. Once removed from the structure, bridge elements will be appropriately sized and loaded onto a barge, awaiting transport to the artificial reef sites.

11.2.2. Navigation Spans

Bridge demolition at the navigation spans will be carried out via barge. Bridge elements will be sized to the maximum extent allowed by crane capacity (50-75 tons). They will be loaded directly onto barges for transport to the artificial reefs, although at times some pieces may be moved to the staging area to await disposal. The superstructure would be removed along beam lines with the deck and barrier intact (similar to the approach spans). The columns would be cut and removed in multiple pieces. After the footings have been cut into sections sized appropriately for the crane capacity, the piles would be cut using a wire-saw or other approved method. This will then allow the sections of footing to be removed with a crane. After complete removal of the footing, the pile would be extracted with a vibratory pile extractor and loaded onto barges for disposal.

11.2.3. Disposal

Bridge demolition material will be shipped to four offshore reef sites that have been designated as disposal sites for all acceptable demolition debris. The contractor has extensive experience disposing of demolition debris on off shore reefs and understands the challenges associated with properly disposing the debris in the correct location. The most likely method to safely and accurately deliver the materials to the reef will be to "slide" the debris off the barge by pumping water from one compartment to another inside the barge. As the water is transferred from one compartment to another, the center of gravity is shifted until such a point that the debris slides itself off the barge. By using remote controlled pumps operated from inside the tug boat, this operation can be safely performed without placing any personnel or equipment on the barge. All unsuitable demolition debris, including steel girders that contain lead paint will not be deposited at the off shore reefs and will be properly disposed off site. Loose debris will be removed from the bridge deck prior to demolition.

Coordination has occurred and will continue with North Carolina Division of Marine Fisheries per the Project commitment listed in the ROD (#6), as they are permitting the reef disposal activities themselves and will be overseeing disposal operations. Artificial reef deployment will adhere to the conditions of USACE General Permit #198500194.

11.3. Compensation

The NCDOT has avoided and minimized impacts to jurisdictional resources to the greatest extent possible as described above.

The unavoidable jurisdictional wetland impacts will be offset by wetland mitigation at the Bodie Island Lighthouse Pond approximately 1.5 miles north of the Project. This site was identified by the NPS as the highest priority from multiple options considered in the DEIS. The mitigation includes control of *Phragmites* sp. on approximately 50 acres at the Bodie Island Lighthouse Pond via aerial herbicide treatments and vegetative controlled burns and development of a long-term management plan. All details associated with the process are included in the attached mitigation plan.

The SAV impacts will be offset by onsite and offsite mitigation. Approximately 1.38 acres of SAV habitat will be unshaded by the removal of the existing structure. The remaining 1.28 acres of impact will be mitigated by in-kind off-site mitigation provided through funding of NOAA's Bonner Bridge Seagrass Restoration plan. Authored by Mark Fonseca, the outline for the restoration is in the mitigation plan, which is to be provided under separate cover.

12.0 Indirect and Cumulative Effects

Phase I of the proposed Project is the replacement of the existing Oregon Inlet bridge within the Parallel Bridge Corridor. Because Phase I of the proposed Project is a bridge replacement and does not add capacity to the transportation network, Phase I is expected to produce minimal indirect and cumulative effects. A bridge replacement with no additional capacity is unlikely to generate additional development or development that is not consistent with local goals for developable areas. New or changed use of environmental resources that can be associated with changes in development trends would not occur.

As discussed in the FEIS, the longer navigation zone of the new Oregon Inlet bridge (compared to the navigation zone of the existing bridge) would allow the navigation channel to move with the inlet's natural gorge. This will influence the USACE's future efforts to maintain the navigation channel. In addition, the terminal groin must be retained for Phase I of the project; retention of the terminal groin would allow the (former) US Coast Guard Station to remain in its current location on the north end of Hatteras Island.

The process for the study and implementation of future phases of the Project is discussed in Section 6.3 of this letter. Since the publication of the ROD and the coastal changes associated with Hurricane Irene in August 2011, NCDOT has initiated Phase II of the Project. At this time, studies are underway, and no decision has been made on alternatives for any phase beyond Phase I. However, future phases in these areas are reasonably foreseeable, and the likely impacts of construction in these areas have been evaluated in the NEPA documentation to date. The

selection of the Parallel Bridge Corridor could affect the environment of the Project area through any of the following activities which may occur as part of future phases, including: nourishment and artificial dunes, or the construction of bridges and/or new roads. Because the Parallel Bridge Corridor involves the replacement of an existing road, indirect impacts would be minimal. However, cumulative impacts of future phases could include:

- Changes in access to the Pea Island National Wildlife Refuge and Cape Hatteras National Seashore;
- The future disposition of the terminal groin, depending upon whether the design of future phases of the project changes the need for it to remain in place;
- The potential relocation of existing utility lines within the Refuge, in response to coastal conditions; and
- The impacts of habitat loss or change on the ecological integrity of the Outer Banks.

A detailed discussion of the indirect and cumulative effects of the Parallel Bridge Corridor is included in Section 4.12 of the FEIS.

13.0 Easement and Land Holdings

NCDOT has coordinated closely with both NPS and USFWS, as they are the two landowners for Phase I of the Project outside the State's existing land holdings. Both temporary and permanent easements have been agreed to for Phase I and final easement plats are being processed. Mitigative measures are outlined in the two agencies' respective Permit applications from NCDOT.

14.0 Construction Traffic

Traffic will be maintained on the existing bridge with lane closures during the times permitted by NCDOT's Request for Proposals and as coordinated with the NPS, including brief (~5-minute) stoppages periodically for material off-loading. A temporary construction easement will be required on the southern approach and will provide access to Lifeboat Station Road (SR 1257) and the NPS parking lot at the north end of the Refuge. This easement will accommodate a temporary detour alignment necessary for maintaining traffic while the proposed bridge is being constructed and tied to existing NC 12. The detour roadway provides adequate construction clearances and is designed with 11-foot lanes, 1-foot paved shoulders, and a 45 mph design speed. This detour will be completely removed and (outside of the proposed fishing pier access road) the underlying terrain restored to original conditions after construction. The majority of the 2,772-foot temporary detour roadway will be converted to the future service road serving the fish pier.

15.0 Regulatory Approvals

CWA Section 404: Application is hereby made for a USACE Individual 404 Permit as required for the above-described activities.

CWA Section 401: Application is hereby made for a Section 401 Water Quality Certification from the NCDWQ. We are providing five (5) copies of this application to the NCDWQ for their approval. Authorization to debit the \$570 Permit Application Fee from WBS 32635.1.4 is hereby given.

RHA Section 10: Application is hereby made for a USACE Section 10 Permit as required for the above-described activities.

CAMA: NCDOT requests that the proposed work be authorized under a CAMA Major Development Permit. The landowner receipts are provided with this permit application; the return receipts will be forwarded once they have been received.

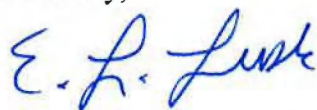
USCG: Under separate cover, NCDOT is submitting a request for a USCG bridge permit for B-2500 (Phase I).

Additionally, a separate USACE Nationwide 6 Permit will be necessary for the proposed load test program, currently anticipated for Fall 2012. NCDOT is proceeding with this application based on previous discussions with USACE and NCDWQ staff.

A copy of this permit application and its distribution list will be posted on the NCDOT website at: <http://www.ncdot.org/doh/preconstruct/pe/neu/permit.html>.

If you have any questions or need additional information, please contact Michael Turchy at 919-707-6157 or maturchy@ncdot.gov.

Sincerely,



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

cc:

NCDOT Permit Application Standard Distribution List
Scott McLendon, USACE Wilmington District

OMB APPROVAL NO. 0710-0003
EXPIRES: 31 AUGUST 2012

PRIVACY ACT STATEMENT

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

(ITEMS BELOW TO BE FILLED BY APPLICANT)

STATEMENT OF AUTHORIZATION

DATE _____

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

State Tax Parcel ID	Municipality
Section -	Township - Range -

17. DIRECTIONS TO THE SITE
Please see attached vicinity map.

18. Nature of Activity (Description of project, include all features)

The improvements involve replacement of the Bonner Bridge over Oregon Inlet and related approaches with a parallel bridge. The Herbert C. Bonner Bridge was built in 1962 and has approached the end of its reasonable service life. 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 project length is 3.55 miles, including roadway approaches. This project will provide a long-term approach to minimizing transportation risk over Oregon Inlet and serves as the only highway connection between Hatteras Island and Bodie Island.

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

The Herbert C. Bonner Bridge was built in 1962 and has approached the end of its reasonable service life. This project will provide a long-term approach to minimizing transportation risk over Oregon Inlet and serves as the only highway connection between Hatteras Island and Bodie Island.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Construction of roadway approaches and bridge replacement. See cover letter for additional details.

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

Type	Type	Type
Amount in Cubic Yards	Amount in Cubic Yards	Amount in Cubic Yards

Please see attached permit drawings

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

Acres 0.51 acre (permanent) and 1.09 acres (temporary) of wetland impact -- see attached cover letter for detailed impact breakdowns
or

Linear Feet NA

23. Description of Avoidance, Minimization, and Compensation (see instructions)

See attached cover letter.

24. Is Any Portion of the Work Already Complete? ☐ Yes ☒ No IF YES, DESCRIBE THE COMPLETED WORK

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

a. Address- PLEASE SEE LIST ATTACHED IN PERMIT DRAWING PACKAGE

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building, and flood plain permits

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


SIGNATURE OF APPLICANT

6.21.12
DATE

SIGNATURE OF AGENT

DATE

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

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



APPLICATION for Major Development Permit

(last revised 12/27/06)

North Carolina DIVISION OF COASTAL MANAGEMENT

1. Primary Applicant/ Landowner Information			
Business Name North Carolina Department Of Transportation		Project Name (if applicable) B-2500, Bonner Bridge Replacement (Dare County)	
Applicant 1: First Name Gregory	MI	Last Name Thorpe	
Applicant 2: First Name	MI	Last Name	
<i>If additional applicants, please attach an additional page(s) with names listed.</i>			
Mailing Address 1598 Mail Service Center		PO Box	City Raleigh
			State NC
ZIP 27699 -1598	Country USA	Phone No. 919 - 707 - 6157 ext.	FAX No. 919 - 250 - 4224
Street Address (if different from above) 1020 Birch Ridge Drive		City Raleigh	State NC
			ZIP 27610-
Email maturchy@ncdot.gov			

2. Agent/Contractor Information			
Business Name			
Agent/ Contractor 1: First Name	MI	Last Name	
Agent/ Contractor 2: First Name	MI	Last Name	
Mailing Address		PO Box	City
			State
ZIP		Phone No. 1 - - ext.	Phone No. 2 - - ext.
FAX No.	Contractor #		
Street Address (if different from above)		City	State
			ZIP -
Email			

<Form continues on back>

3. Project Location

County (can be multiple) Dare	Street Address Existing Herbert C. Bonner Bridge over Oregon Inlet on NC 12 from Bodie Island to Hatteras Island		State Rd. # NC 12
Subdivision Name N/A	City Nags Head	State NC	Zip 27959 -
Phone No. - - ext.		Lot No.(s) (if many, attach additional page with list) , , , ,	
a. In which NC river basin is the project located? Pasquotank		b. Name of body of water nearest to proposed project Pamlico Sound / Oregon Inlet / Motts Creek	
c. Is the water body identified in (b) above, natural or manmade? ☒ Natural ☐ Manmade ☐ Unknown		d. Name the closest major water body to the proposed project site. Pamlico Sound	
e. Is proposed work within city limits or planning jurisdiction? ☐ Yes ☒ No		f. If applicable, list the planning jurisdiction or city limit the proposed work falls within. NA	

4. Site Description

a. Total length of shoreline on the tract (ft.) 5,171 ft	b. Size of entire tract (sq.ft.) Approximate Project Area = 4,305,322 sq. ft (98.8 ac)
c. Size of individual lot(s) NA, (If many lot sizes, please attach additional page with a list)	d. Approximate elevation of tract above NHW (normal high water) or NWL (normal water level) 0.4 - 10 ft ☒ NHW or ☐ NWL
e. Vegetation on tract Brackish marsh, smooth cordgrass, maritime shrub thicket, salt/shrub grassland, maritime grassland, black needlerush, reed stands, beach, dunes and disturbed wetland and upland vegetation.	
f. Man-made features and uses now on tract Features include; NC 12 and Bonner Bridge, terminal groin, former USCG station, electric and water utility lines. Uses include; transportation, recreation and historic.	
g. Identify and describe the existing land uses <u>adjacent</u> to the proposed project site. Recreational (Cape Hatteras National Seashore and Pea Island National Wildlife Refuge), open space, open water and commercial (marina)	
h. How does local government zone the tract? Dare County - Historic Mill Landing (ML) for southern tip of Bodie Island. Hatteras Island is unzoned.	i. Is the proposed project consistent with the applicable zoning? (Attach zoning compliance certificate, if applicable) ☒ Yes ☐ No ☐ NA
j. Is the proposed activity part of an urban waterfront redevelopment proposal? ☐ Yes ☒ No	
k. Has a professional archaeological assessment been done for the tract? If yes, attach a copy. If yes, by whom?	☒ Yes ☐ No ☐ NA Tidewater Atlantic Research, Inc. 1992
l. Is the proposed project located in a National Registered Historic District or does it involve a National Register listed or eligible property? ☒ Yes ☐ No ☐ NA	

<Form continues on next page>

m. (i) Are there wetlands on the site?	☒ Yes ☐ No
(ii) Are there coastal wetlands on the site?	☒ Yes ☐ No
(iii) If yes to either (i) or (ii) above, has a delineation been conducted? (Attach documentation, if available)	☒ Yes ☐ No
n. Describe existing wastewater treatment facilities. The marina's septic field is located adjacent to the project on Bodie Island, but will be undisturbed by the project.	
o. Describe existing drinking water supply source. National Park Service potable water lines are located under NC 12 and provides service to the NPS campground, Marina and US Coast Guard Station. NPS purchases its water from the Town of Nags Head, who's source is groundwater wells.	
p. Describe existing storm water management or treatment systems. Stormwater from the bridge is discharged into the Oregon Inlet through 3" bridge deck drains. There are no defined stormwater collection systems on the roadway.	

5. Activities and Impacts

a. Will the project be for commercial, public, or private use?	☐ Commercial ☒ Public/Government ☐ Private/Community
b. Give a brief description of purpose, use, and daily operations of the project when complete. The improvements involve replacement of the Bonner Bridge over Oregon Inlet and related approaches with a parallel bridge. The Herbert C. Bonner Bridge was built in 1962 and has approached the end of its reasonable service life. 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 project length is 3.55 miles, including roadway approaches. This project will provide a long-term approach to minimizing transportation risk over Oregon Inlet and serves as the only highway connection between Hatteras Island and Bodie Island.	
c. Describe the proposed construction methodology, types of construction equipment to be used during construction, the number of each type of equipment and where it is to be stored. Proposed construction will utilize temporary work bridges, barges and staging areas. Typical construction equipment will include cranes, bulldozer, dump trucks, motor grader, etc. on both the work bridge and existing/proposed bridges, to include: three 235 ton crawler cranes on the trestle, two 275 ton cranes on barges, one 300 ton ringer crane on barge, one 235 ton crane on south loading dock and south land work, six barges (60'x180'), one barge (70'x250'), one 800 HP tug, one 1500 HP tug, three 60-80 ton RT support cranes. Trestle cranes would be stored on trestle, 275 ton cranes and ringer stored on barges, 235 ton crane stored on south dock. Typical roadway construction will include but is not limited to the following equipment; bulldozers, dump trucks and motor graders.	
d. List all development activities you propose. Replace an existing 2.4-mile bridge (33.4 feet wide) and related approaches with a parallel 2.8 mile bridge (42.7 feet wide) to the west of the existing bridge. There will be a temporary use of a portion of PINWR's parking lot for staging activities, and a temporary work bridge will be erected. The existing bridge will be demolished after opening of the new bridge.	
e. Are the proposed activities maintenance of an existing project, new work, or both?	Both
f. What is the approximate total disturbed land area resulting from the proposed project?	41.05 ☐ Sq.Ft or ☒ Acres
g. Will the proposed project encroach on any public easement, public accessway or other area that the public has established use of?	☒ Yes ☐ No ☐ NA

h. Describe location and type of existing and proposed discharges to waters of the state.

The existing Herbert C. Bonner bridge has deck drains spaced approximately 12' apart that allow deck water to discharge directly into the Oregon Inlet/Pamlico Sound. The proposed bridge will have an open deck drain system for the majority of the bridge except at the bridge approaches (southern end 500' and northern end 100') where the bridge is less than 12 feet above the ground. Deck drains (6" diameter open PVC pipes) will be spaced approximately 14' on center through the bridge deck where feasible. The stormwater runoff from the ends of the bridge will be collected at the end of the bridge deck and routed to pre-formed scour holes. Stormwater for the remaining roadway improvements will tie into the existing and proposed roadside ditches.

i. Will wastewater or stormwater be discharged into a wetland? ☒ Yes ☐ No ☐ NA

If yes, will this discharged water be of the same salinity as the receiving water? ☐ Yes ☒ No ☐ NA

j. Is there any mitigation proposed? ☒ Yes ☐ No ☐ NA

If yes, attach a mitigation proposal.

<Form continues on back>

6. Additional Information

In addition to this completed application form, (MP-1) the following items below, if applicable, must be submitted in order for the application package to be complete. Items (a) – (f) are always applicable to any major development application. Please consult the application instruction booklet on how to properly prepare the required items below.

a. A project narrative.

b. An accurate, dated work plat (including plan view and cross-sectional drawings) drawn to scale. Please give the present status of the proposed project. Is any portion already complete? If previously authorized work, clearly indicate on maps, plats, drawings to distinguish between work completed and proposed.

c. A site or location map that is sufficiently detailed to guide agency personnel unfamiliar with the area to the site.

d. A copy of the deed (with state application only) or other instrument under which the applicant claims title to the affected properties.

e. The appropriate application fee. Check or money order made payable to DENR.

f. A list of the names and complete addresses of the adjacent waterfront (riparian) landowners and signed return receipts as proof that such owners have received a copy of the application and plats by certified mail. Such landowners must be advised that they have 30 days in which to submit comments on the proposed project to the Division of Coastal Management.

Name SEE SHEET 44 (OF45) FOR LIST OF PROPERTY OWNERS

Phone No.

Address

Name

Phone No.

Address

Name

Phone No.

Address

g. A list of previous state or federal permits issued for work on the project tract. Include permit numbers, permittee, and issuing dates.

USACE, NWP 6 to NCDOT for geotechnical borings, SAW-2011-00107 (Issued 1/13/2011; Expired 3/18/2012)

USFWS, Special Use Permit to NCDOT for geotechnical investigation, 2011-016 (Issued 08/23/2011; Expired 3/18/2012)

National Park Service, Special Use Permit (General Field Activities) to NCDOT, GOV11-CAHA-2501-268 (Issued 10/24/2011; Expires 10/24/2015)

National Park Service, Special Use Permit (Geotechnical Investigations) to NCDOT, GOV11-CAHA-5700-259 (Issued 10/6/2011; Expired 02/14/2012)

h. Signed consultant or agent authorization form, if applicable.

i. Wetland delineation, if necessary.

j. A signed AEC hazard notice for projects in oceanfront and inlet areas. (Must be signed by property owner)

k. A statement of compliance with the N.C. Environmental Policy Act (N.C.G.S. 113A 1-10), if necessary. If the project involves expenditure of public funds or use of public lands, attach a statement documenting compliance with the North Carolina Environmental Policy Act.

7. Certification and Permission to Enter on Land

I understand that any permit issued in response to this application will allow only the development described in the application. The project will be subject to the conditions and restrictions contained in the permit.

I certify that I am authorized to grant, and do in fact grant permission to representatives of state and federal review agencies to enter on the aforementioned lands in connection with evaluating information related to this permit application and follow-up monitoring of the project.

I further certify that the information provided in this application is truthful to the best of my knowledge.

Date

6.21.12

Print Name

Gregory J. Thorne, PhD

Signature

E. J. Fush

Please indicate application attachments pertaining to your proposed project.

☐ DCM MP-2 Excavation and Fill Information

☒ DCM MP-5 Bridges and Culverts

☐ DCM MP-3 Upland Development

☐ DCM MP-4 Structures Information

BRIDGES and CULVERTS

Attach this form to Joint Application for CAMA Major Permit, Form DCM MP-1. Be sure to complete all other sections of the Joint Application that relate to this proposed project. Please include all supplemental information.

1. BRIDGES

☐ This section not applicable

- a. Is the proposed bridge:
☐ Commercial ☒ Public/Government ☐ Private/Community

- b. Water body to be crossed by bridge:
 Oregon Inlet/Pamlico Sound/Motts Creek

- c. Type of bridge (construction material):
 Concrete, mixed substructure design (see permit drawings)

- d. Water depth at the proposed crossing at NLW or NWL:
 1 - 31 feet

- e. (i) Will proposed bridge replace an existing bridge? ☒ Yes ☐ No
 If yes,
 (ii) Length of existing bridge: 2.4 miles
 (iii) Width of existing bridge: 33.4 feet
 (iv) Navigation clearance underneath existing bridge: 66 feet
 (v) Will all, or a part of, the existing bridge be removed?
 (Explain) The entire bridge will be removed with the exception of 1050 feet at the southern terminus with Hatteras Island. This portion of the bridge will be used as a fishing pier. All bridge piles in the Inlet open water will be pulled completely and those piles in wetlands and SAV areas will be cut at the mudline.

- f. (i) Will proposed bridge replace an existing culvert? ☐ Yes ☒ No
 If yes,
 (ii) Length of existing culvert: _____
 (iii) Width of existing culvert: _____
 (iv) Height of the top of the existing culvert above the NHW or NWL: _____
 (v) Will all, or a part of, the existing culvert be removed?
 (Explain)

Bridge demolition materials will be transferred via barge to four existing artificial reefs. All four sites are located in the Atlantic Ocean to the east of the Bonner Bridge. The closest reef site, AR-160, is in State waters and will receive approximately 55% of the materials. The other three sites, AR-130, AR-140 and AR-145, are in Federal waters and will each get 15% of the materials. NCDMF will oversee the reef disposal activities which will begin April 2015 and end February 2016.

- g. Length of proposed bridge: 2.8 miles

- h. Width of proposed bridge: 42.7 feet, predominantly

- i. Will the proposed bridge affect existing water flow? ☒ Yes ☐ No
 If yes, explain: With increased span lengths, the new bridge will restrict flow less than the existing bridge.

- j. Will the proposed bridge affect navigation by reducing or increasing the existing navigable opening? ☒ Yes ☐ No
 If yes, explain: The proposed bridge will increase the current horizontal navigation opening from 130 to 300 feet. In addition, it will provide multiple (up to 7) potential navigation openings to account for potential future shifts in the navigation channel.

- k. Navigation clearance underneath proposed bridge: 70 feet at navigation spans

- l. Have you contacted the U.S. Coast Guard concerning their approval? ☒ Yes ☐ No
 If yes, explain: A U.S. Coast Guard application will be submitted concurrently with the 404/401/CAMA permit. A

meeting was held with USCG on February 21, 2011 to discuss the application.

- m. Will the proposed bridge cross wetlands containing no navigable waters? ☒ Yes ☐ No

If yes, explain: The intertidal marsh wetlands under the northern half of the proposed bridge are not navigable, but are adjacent to navigable waters.

- n. Height of proposed bridge above wetlands: 22 feet along the 0% grade portion (northern half) of the bridge.

2. CULVERTS

☒ This section not applicable

- a. Number of culverts proposed: _____

- b. Water body in which the culvert is to be placed:
- _____

< Form continues on back >

- c. Type of culvert (construction material):
- _____

- d. (i) Will proposed culvert replace an existing bridge?

☐ Yes ☐ No

If yes,

(ii) Length of existing bridge: _____

(iii) Width of existing bridge: _____

(iv) Navigation clearance underneath existing bridge: _____

(v) Will all, or a part of, the existing bridge be removed? (Explain)

- e. (i) Will proposed culvert replace an existing culvert?

☐ Yes ☐ No

If yes,

(ii) Length of existing culvert(s): _____

(iii) Width of existing culvert(s): _____

(iv) Height of the top of the existing culvert above the NHW or NWL: _____

(v) Will all, or a part of, the existing culvert be removed? (Explain)

- f. Length of proposed culvert: _____

- g. Width of proposed culvert: _____

- h. Height of the top of the proposed culvert above the NHW or NWL.
- _____

- i. Depth of culvert to be buried below existing bottom contour.
- _____

- j. Will the proposed culvert affect navigation by reducing or increasing the existing navigable opening? ☐ Yes ☐ No

If yes, explain:

- k. Will the proposed culvert affect existing water flow?

☐ Yes ☐ No

If yes, explain:

3. EXCAVATION and FILL

☐ This section not applicable

- a. (i) Will the placement of the proposed bridge or culvert require any excavation below the NHW or NWL? ☒ Yes ☐ No

- b. (i) Will the placement of the proposed bridge or culvert require any excavation within coastal wetlands/marsh (CW), submerged

If yes,

(ii) Avg. length of area to be excavated: varies

(iii) Avg. width of area to be excavated: varies

(iv) Avg. depth of area to be excavated: varies

(v) Amount of material to be excavated in cubic yards: will vary depending on site conditions; no open water areas will be excavated; excavation below NHW elevation will be in low-lying upland areas. Jetting is not considered excavation and is not included in any calculated values. SEE PERMIT DRAWINGS.

aquatic vegetation (SAV), shell bottom (SB), or other wetlands (WL)? If any boxes are checked, provide the number of square feet affected.

☒ CW 2600 ☐ SAV _____ ☐ SB _____
☒ WL 3000 ☐ None

(ii) Describe the purpose of the excavation in these areas:

Excavation in WL will be due to the ditch relocations at Sites 2 and 7 (0.02 ac). Site 4 will involve a limited amount of temporary trenching for utility line relocation in both CW (0.06 ac) and WL (0.05 ac). Site 4 is not calculated as an excavation impact but a temporary fill and permanent fill in wetlands. See impact descriptions in cover letter.

c. (i) Will the placement of the proposed bridge or culvert require any high-ground excavation? ☒ Yes ☐ No

If yes,

(ii) Avg. length of area to be excavated: varies

(iii) Avg. width of area to be excavated: varies

(iv) Avg. depth of area to be excavated: varies

(v) Amount of material to be excavated in cubic yards: 9916 cy; SEE PERMIT DRAWINGS AND ROADWAY PLANS.

d. If the placement of the bridge or culvert involves any excavation, please complete the following:

(i) Location of the spoil disposal area: Waste soils will be taken off-site to an upland NCDOT-approved site, location not yet determined; demolition materials from the existing bridge to be taken into the ocean to 4 artificial reef sites

(ii) Dimensions of the spoil disposal area: NA

(iii) Do you claim title to the disposal area? ☐ Yes ☐ No (If no, attach a letter granting permission from the owner.)

(iv) Will the disposal area be available for future maintenance? ☐ Yes ☐ No

(v) Does the disposal area include any coastal wetlands/marsh (CW), submerged aquatic vegetation (SAVs), other wetlands (WL), or shell bottom (SB)?

☐ CW ☐ SAV ☐ WL ☐ SB ☒ None

If any boxes are checked, give dimensions if different from (ii) above.

(vi) Does the disposal area include any area below the NHW or NWL? ? ☒ Yes ☐ No

If yes, give dimensions if different from (ii) above. dimensions of artifical reef sites vary, this will be permitted separately by the NC Division of Marine Fisheries as part of their Artificial Reef Program

e. (i) Will the placement of the proposed bridge or culvert result in any fill (other than excavated material described in Item d above) to be placed below NHW or NWL? ☒ Yes ☐ No

If yes,

(ii) Avg. length of area to be filled: varies

(iii) Avg. width of area to be filled: varies

(iv) Purpose of fill: SEE PERMIT DRAWINGS

f. (i) Will the placement of the proposed bridge or culvert result in any fill (other than excavated material described in Item d above) to be placed within coastal wetlands/marsh (CW), submerged aquatic vegetation (SAV), shell bottom (SB), or other wetlands (WL)? If any boxes are checked, provide the number of square feet affected.

☒ CW 492 ☐ SAV _____ ☐ SB _____
☒ WL 19,999 ☐ None

(ii) Describe the purpose of the excavation in these areas:

Fill will be used for roadway fill and the utility riser pole relocation. Fill in CW amounts to 0.01 acre. CW fill is needed for the the electric utility riser pole relocation. WL fill is for roadway construction.

- g. (i) Will the placement of the proposed bridge or culvert result in any fill (other than excavated material described in Item **d** above) to be placed on high-ground? ☒ Yes ☐ No

If yes,

(ii) Avg. length of area to be filled: varies

(iii) Avg. width of area to be filled: varies

(iv) Purpose of fill: SEE PERMIT DRAWINGS

4. GENERAL

- a. Will the proposed project require the relocation of any existing utility lines? ☒ Yes ☐ No

If yes, explain: A 115 kV electric riser pole will be relocated at Site 4. The underground lines will be extended to reach the new pole at Site 4, requiring additional temporary trenching. Other water and electric lines will be relocated within uplands as part of the project.

If this portion of the proposed project has already received approval from local authorities, please attach a copy of the approval or certification.

- b. Will the proposed project require the construction of any temporary detour structures? ☐ Yes ☒ No

If yes, explain:

< Form continues on back >

- c. Will the proposed project require any work channels? ☐ Yes ☒ No

If yes, complete Form DCM-MP-2.

- d. How will excavated or fill material be kept on site and erosion controlled?

Pile jetting materials will be collected using a primary and secondary containment system. Material recovered from the containment system during the jetting process will be recycled back into the hollow concrete piles and any excess material will be disposed of at acceptable off-site locations. A description of the containment system is explained in the joint application cover letter. Otherwise, standard NCDOT sediment and erosion control measures and BMP's will be used.

- e. What type of construction equipment will be used (for example, dragline, backhoe, or hydraulic dredge)?

Combined air/water jetting system will be used to jet the proposed bridge piles. Temporary piles for the two work trestles and eight platforms will be driven. Typical heavy highway and bridge equipment will be utilized otherwise.

- f. Will wetlands be crossed in transporting equipment to project site?

☒ Yes ☐ No

If yes, explain steps that will be taken to avoid or minimize environmental impacts.

A work trestle will be built paralleling the northern approach between the proposed and existing bridge. Temporary work platforms will be erected on piles in open water to store pre-cast materials rather than bringing them on-shore. A second work trestle will be erected on Hatteras Island to provide deep water access from the construction area without wetland impacts. Timber mats will be used where applicable to minimize temporary impacts.

- g. Will the placement of the proposed bridge or culvert require any shoreline stabilization? ☐ Yes ☒ No

If yes, complete form MP-2, Section 3 for Shoreline Stabilization only.

6.21.12

Date

B-2500, Bonner Bridge Replacement

Project Name

Gregory Thorpe

Applicant Name

Applicant Signature

E. L. Luck for

OCEAN HAZARD AEC NOTICE

Project is in an: X Ocean Erodible Area X High Hazard Flood Area X Inlet Hazard Area

Property Owner: N. C. Department of Transportation

Property Address: Between the addresses of 98 NC Hwy 12 (Oregon Inlet Fishing Ctr. & 0 NC Hwy 12
(Former US Coast Guard Station)

Date Lot Was Platted: _____

This notice is intended to make you, the applicant, aware of the special risks and conditions associated with development in this area, which is subject to natural hazards such as storms, erosion and currents. The rules of the Coastal Resources Commission require that you receive an AEC Hazard Notice and acknowledge that notice in writing before a permit for development can be issued.

The Commission's rules on building standards, oceanfront setbacks and dune alterations are designed to minimize, but not eliminate, property loss from hazards. By granting permits, the Coastal Resources Commission does not guarantee the safety of the development and assumes no liability for future damage to the development. Permits issued in the Ocean Hazard Area of Environmental Concern include the condition that structures be relocated or dismantled if they become imminently threatened by changes in shoreline configuration. The structure(s) must be relocated or dismantled within two (2) years of becoming imminently threatened, and in any case upon its collapse or subsidence.

The best available information, as accepted by the Coastal Resources Commission, indicates that the annual long-term average ocean erosion rate for the area where your property is located is up to 16 feet per year.

The rate was established by careful analysis of aerial photographs of the coastline taken over the past 50 years.

Studies also indicate that the shoreline could move as much as 80 feet landward in a major storm.

The flood waters in a major storm are predicted to be about 11 feet deep in this area.

Preferred oceanfront protection measures are beach nourishment and relocation of threatened structures. Hard erosion control structures such as bulkheads, seawalls, revetments, groins, jetties and breakwaters are prohibited. Temporary sand bags may be authorized under certain conditions.

The applicant must acknowledge this information and requirements by signing this notice in the space below. Without the proper signature, the application will not be complete.

E. L. Lust for Gregory J. Thayer, PhD
Applicant Signature Date

SPECIAL NOTE: This hazard notice is required for development in areas subject to sudden and massive storms and erosion. Permits issued for development in this area expire on December 31 of the third year following the year in which the permit was issued. Shortly before work begins on the project site, the Local Permit Officer must be contacted to determine the vegetation line and setback distance at your site. If the property has seen little change since the time of permit issuance, and the proposed development can still meet the setback requirement, the LPO will inform you that you may begin work. Substantial progress on the project must be made within 60 days of this setback determination, or the setback must be re-measured. Also, the occurrence of a major shoreline change as the result of a storm within the 60-day period will necessitate re-measurement of the setback. It is important that you check with the LPO before the permit expires for official approval to continue the work after the permit has expired. Generally, if foundation pilings have been placed and substantial progress is continuing, permit renewal can be authorized. It is unlawful to continue work after permit expiration.

For more information, contact:

Paul C. Williams, Jr., DOT Field Rep.

Local Permit Officer

1367 US 17 South, Elizabeth City, NC 27909

Address

NCDOT Division 1

Locality

252-264-3901

Phone Number

BEFORE YOU BUILD

Setting Back for Safety: A Guide to Wise Development Along the Oceanfront

When you build along the oceanfront, you take a calculated risk. Natural forces of water and wind collide with tons of force, even on calm days.

Man-made structures cannot be guaranteed to survive the force of a hurricane. Long-term erosion (or barrier island migration) may take from two to ten feet of the beach each year, and, sooner or later, will threaten oceanfront structures. These are the facts of life for oceanfront property owners.

The Coastal Resources Commission (CRC) has adopted rules for building along the oceanfront. The rules are intended to avoid an unreasonable risk to life and property, and to limit public and private losses from storm and long-term erosion. These rules lessen but do not eliminate the element of risk in oceanfront development.

As you consider building along the oceanfront, the CRC wants you to understand the rules and the risks. With this knowledge, you can make a more informed decision about where and how to build in the coastal area.

The Rules

When you build along the oceanfront, coastal management rules require that the structure be sited to fit safely into the beach environment.

Structures along the oceanfront, less than 5,000 square feet in size, must be behind the frontal dune, landward of the crest of the primary dune, and set back from the first line of stable natural vegetation a distance equal to 30 times the annual erosion rate (a minimum of 60 feet). The setback calculation increases as the size of the structure increases [15A NCAC 7H.0306(a)(2)]. For example: A structure between 5,000 and 10,000 square feet would require a setback from the first line of stable, natural vegetation to a distance equal to 60 times the annual erosion rate (a minimum of 120 feet). The graduated setback continues to increase through structure sizes greater than 100,000 square feet.

The Reasons

The beachfront is an ever-changing landform. The beach and the dunes are natural "shock absorbers," taking the beating of the wind and waves and protecting the inland areas. By incorporating building setbacks into the regulations, you have a good chance of enjoying the full life of the structure. At first, it seems very inviting to build your dream house as close to the beach as possible, but in five years you could find the dream has become a nightmare as high tides and storm tides threaten your investment.

The Exception

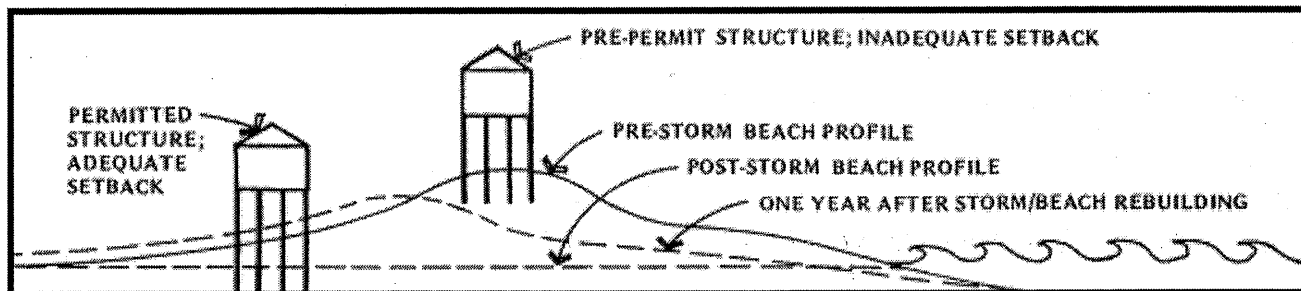
The Coastal Resources Commission recognized that these rules, initially passed in June 1979, might prove a hardship for some property owners. Therefore, they established an exception for lots that cannot meet the setback requirement. The exception allows buildings in front of the current setback, if the following conditions apply:

- 1) the lot must have been platted as of June 1, 1979, and is not capable of being enlarged by combining with adjoining land under the same ownership;
- 2) development must be constructed as far back on the property as possible and in no case less than 60 feet landward of the vegetation line;
- 3) no development can take place on the frontal dune;
- 4) special construction standards on piling depth and square footage must be met; and
- 5) all other CAMA, state and local regulations must be met.

The exception is not available in the Inlet Hazard Area.

To determine eligibility for the exception the Local Permit Officer will make these measurements and observations:

- _____ required setback from vegetation line
- _____ exception setback (maximum feasible)
- _____ rear property line setback
- _____ max. allowable square footage on lowest floor



After the storm, the house on the dune will be gone. The other house has a much better chance of survival.



Meeting Minutes

Subject: Interagency 4B Concurrence Meeting for B-2500, Bonner Bridge Replacement

Meeting Location: NCDOT Century Center Structures Conference Room

Meeting Date:: Thursday 12/15/2011

Meeting Time: 3:00 pm EST

Merger Team Members Present:

Bill Biddlecome, USACE
Clarence Coleman, FHWA
Renee Gledhill-Earley, SHPO
Kevin Hart, NCDMF
Doug Huggett, NCDOT
Gary Jordan, USFWS
Chris Militscher, EPA
Ron Sechler, NMFS
Beth Smyre, NCDOT PDEA
Dennis Stewart, USFWS Pea Island
David Wainwright, NCDWQ
Travis Wilson, NCWRC

Other Participants:

Cathy Brittingham, NCDOT
Steve Lambert, Albemarle RPO
Ron Lucas, FHWA
Amy Simes, NCDENR
Kevin Wright, FHWA

Bob Capehart, NCDOT Division 1
Marshall Clawson, NCDOT Hydraulics
David Hering, NCDOT DB Unit
Kathy Herring, NCDOT BSG
Jerry Jennings, NCDOT Division 1
Brittney Kelly, NCDOT
Mark Laugisch, NCDOT REU
Jerry Lindsey, NCDOT Hydraulics
Elizabeth Lusk, NCDOT NES
Steve Mitchell, NCDOT BSG
Kerry Morrow, NCDOT TPB
LeiLani Paugh, NCDOT NES
Chris Rivenbark, NCDOT NES
Mark Staley, NCDOT REU
Greg Thorpe, NCDOT PDEA
Michael Turchy, NCDOT NES
Morgan Weatherford, NCDOT NES
Brian Yamamoto, NCDOT PDEA

Domenic Coletti, HDR
Bryce Faust, PCL
Jonathan Henderson, HDR
John Jamison, HDR
Brian Keaney, HDR
Phil May, Carolina Ecosystems
Ken Trefzger, HDR
Marty Grem, PCL
Jim Schneiderman, PCL
Kirk Stull, HDR
Jessica Tisdale, HDR
Tom Warren, PCL
John Yadlosky, HDR

Introductions were made by all in attendance.

Project Overview

David Hering, NCDOT introduced the Bonner Bridge Replacement (B-2500) project and the PCL/HDR Design-Build Team Design Manager, Domenic Coletti.

Mr. Coletti gave a project overview with a short video animation describing how the bridge will be constructed. Mr. Coletti also described the schedule for the proposed bridge building and existing bridge demolition. No questions were posed concerning the project overview.

30% Hydraulic Design

Ken Trefzger, HDR Hydraulic Design Engineer explained the hydraulic conditions of the inlet, existing bridge stormwater runoff, and 30% hydraulic plans for the proposed replacement bridge. Through hydraulic plansheets, Mr. Trefzger highlighted how stormwater runoff would be captured on the southern (approximately 500') and northern (approximately 100') ends of the bridge. Water collected from both locations will be directed to pre-formed scour holes and then dissipated through the sandy soils. The length of bridge without deck drains is shorter on the northern end due to the transition to the existing roadway causing increased spread that must be kept out of the travel lanes. Deck drains (6" diameter open PVC pipes) will be spaced approximately 14 feet on center throughout the remainder of the bridge deck where feasible to increase dispersion. The stormwater runoff from the remaining roadway improvements will tie into the existing roadside ditches and will be treated by the surrounding vegetated swales along both sides of the existing NC 12 roadway. Discharges are routed either to pre-formed scour holes or existing outfalls. The basic design retains the existing stormwater conditions with slight reshaping/relocating of existing drainage ditches. No new ditches or outfalls are proposed. The majority of the bridge will discharge directly into open water or marsh. The deck drains start at approximately 20 feet above ground on the south side and 14 feet above ground on the north side. With the constant windy conditions and sandy soils, this will aid in dispersion and infiltration of the stormwater.

David Wainwright asked if the temporary work bridge will be on the final hydraulic plans. Mr. Trefzger responded that this could be added to the final plans.

Chris Militscher asked the length of stormwater collection on the north end of the bridge. Mr. Trefzger stated that the north end of the bridge collection system is approximately 100 feet and the south end is approximately 500 feet.

Compensatory Mitigation

LeiLani Paugh gave an overview of NCDOT's mitigation plan for the project. NCDOT is considering several alternatives for submerged aquatic vegetation (SAV) mitigation including creation of oyster reefs, removal of the existing bridge and its shading effects, and funding of research projects. Steve Mitchell has been coordinating with the many partners involved and he is the point of contact for SAV mitigation. A more detailed package of SAV mitigation options will be provided and feedback from the agencies is needed to complete the plan for inclusion in the permit application package for the project.

Kevin Hart stated that in-kind mitigation for SAV impacts is preferred. Ron Sechler concurred with this. Ms. Paugh stated that she understood this preference, but NCDOT's preference for this project is out-of-kind due to the many uncertainties associated with SAV in-kind mitigation.

Travis Wilson asked if the mitigation report will go into detail regarding quantities of SAV mitigation and success criteria. Ms. Paugh responded that numbers will be included, such as the acreage of existing bridge removal. Ms. Paugh also stated that the acreages for SAVs are

constantly changing due to the dynamic nature of the estuarine environment and that the numbers will be based on current existing conditions.

Ms. Paugh then discussed proposed mitigation for the jurisdictional wetland impacts. Phragmites control, including herbicide treatments at the Bodie Island Lighthouse Pond, are proposed. Initially the National Park Service (NPS) was opposed to aerial application, but the proposed use of new, more targeted technologies have resulted in NPS reversing that decision. The mitigation plan will detail the application process and monitoring of results. Natural Heritage Program (NHP) staff reviewed areas within the pond of known occurrences of listed species. The areas were now dominated by phragmites and no listed species were found. NCDOT/NHP plan to re-survey the sites in June/July of 2012. Ms. Paugh noted that these areas have recently been affected by Irene storm debris build up. NPS will take over herbicide application after treatments have been established. In 2008 phragmites covered 35 acres and as of October 21, 2011, 51.7 acres are infested. Aggressive treatment is needed to control and reverse this trend.

Gary Jordan asked if there would be any follow up other than the application of herbicides.

Ms. Paugh stated that NCDOT is proposing to spray, followed by a burn, then another spray application. Upon conclusion of the process, the maintenance program would be turned over to the NPS. Adaptive management would be implemented to monitor the results of each application and adjust subsequent applications to reflect the changes.

Mr. Jordan asked if NCDOT will be monitoring and filling in the "holes" where spray was not applied.

Ms. Paugh stated that a marker is included in the spray so the applicators can immediately see if any areas were missed.

Mr. Sechler asked if toxicity information on the spray and marker would be included in the mitigation plan.

Ms. Paugh stated that this information would be included and that Mr. Militscher had also provided a flyer summarizing new EPA regulations regarding spraying activities under the National Pollutant Discharge Elimination System (NPDES). NCDOT is working on implementing this requirement under the NCDENR General Permit or applying for a discharge permit.

Mr. Militscher summarized the new requirements. As of October 31, 2011 there are no exemptions for this activity under NPDES. NPDES implementation is delegated to NCDENR.

Ms. Paugh mentioned that details regarding this issue are being worked on including thresholds, parties involved as applicants, etc.

Mr. Wilson asked when the updated mitigation plan will be available.

Ms. Paugh noted that the SAV information will be sent soon and the phragmites plan is likely to be sent in January or February of 2012.

Mr. Militscher stated that a Notice of Intent would be required for the NPDES permit.

Cathy Brittingham asked if the phragmites control is all the wetland mitigation being proposed.

Ms. Paugh said that was correct.

Doug Huggett asked if burning will be employed before or after issuance of the permit for the bridge construction.

Ms. Paugh responded that it will occur after the permit for bridge construction is received.

Mr. Huggett stated that it could be included in the permit application in that case.

Easements

John Jamison gave an overview of the temporary and permanent easements on the project. He mentioned that a right of entry may need to be granted if the land transfer is not final before construction commences. Currently NCDOT is drafting a deed for both NPS and USFWS. A map of the temporary and permanent easements at the southern portion of the bridge was shown and discussed. Areas of new easement, areas proposed to be given back to the federal government, and areas of temporary impacts were highlighted.

Staging and Personnel Access

Mr. Jamison stated that the intent of the staging and access plan is to minimize the impacts to the Seashore and Refuge. Workers will be transported from the staging area (next to the former USGS station) by vans to the bridge. Parking will be available for workers at the staging area and it is possible that private lands will be utilized for parking north of the bridge. The southern emergency ramp will be used to get workers to their work area by boat.

Mr. Jamison described the staging area features such as the berm, sand stockpile, parking, trailers, and laydown yard. Mr. Jamison asked if the berm dimensions could be adjusted to reflect the usage of the staging area and reduce the footprint of the berm.

Dennis Stewart stated that the berm needs to be more northwest than is currently shown on the graphic. The height should be determined in part by the height of equipment in the staging site to prevent disturbance of nesting habitat. He also noted that areas where the sand stockpile is located in the figure is close to an area where plovers have roosted.

Mr. Stewart asked if dunes would be leveled to create the staging area.

Mr. Jamison responded that some grading would be required.

Mr. Jordan asked where the piping plover nested last year.

Mr. Stewart stated that the nest was north and east of the site but relatively close.

Mr. Jordan stated that the berm does not cover the concerns that were instigated by the piping plover nest.

Mr. Wilson asked what the dimensions were of the staging area and if the Design Team will provide plan sheets of the staging area.

Mr. Jamison responded that the dimensions have not been accurately determined yet as the plan is conceptual. A plansheet covering the proposed staging area will be added to the meeting minutes package.

Mr. Jordan asked if cranes will be operating in the staging area.

Jim Schneiderman responded that during demolition cranes will be in the staging area.

Section 106

Mr. Jamison reviewed the bridge railing plans and showed some examples.

Mr. Wilson asked if there has been any more coordination as to who will maintain the fishing pier.

Mr. Hering stated that currently NCDOT will maintain the pier.

Mr. Stewart inquired about the height of the bridge railing for the pier.

Mr. Coletti responded that it would be 54 inches in height.

Mr. Stewart noted that substantial migratory bird mortality can occur when railing is low enough to allow birds to fly at the height of traffic. Higher railing would help birds pass over the traffic.

Renee Gledhill-Earley stated that this is the tallest railing currently used.

Mr. Jordan asked if this is part of the list of mitigative measures provided for the compatibility determination.

Mr. Stewart stated that it was part of the mitigative measures.

Mr. Jordan stated that NCDOT has not provided feedback on final measures.

Mrs. Gledhill-Earley stated that the SHPO MOA includes the proposed railing.

Beth Smyre suggested that USFWS get together to talk further about mitigative measures.

Work Trestle / Dredging / Barge Access

Mr. Jamison noted 1500 feet of work trestle will be leapfrogging out and only piles will be left throughout the construction phase.

Mr. Wainwright asked how equipment would be removed during a hurricane.

Bryce Faust stated that most equipment would be secured to the workbridge in the event of a hurricane.

Tom Warren responded that barge access will be available to get the equipment out if needed.

Mr. Jamison stated that the Design Team recommends using solid decking as this is required for operating cranes and each piece of decking will not be in place for a long period of time, therefore limiting the effects of shading.

Mr. Sechler asked how long the decking will be in place.

Mr. Schneiderman stated that 30 foot sections of the decking will be moving every 3 to 4 weeks.

Mr. Sechler agreed that this would have limited effect on vegetation.

Mr. Jamison noted that decking will be left in place for 6 months at the southernmost extent of the workbridge. This would occur primarily during the winter and outside of the growing season.

Mr. Sechler asked if we could measure impacts of the workbridge that would be left in place for 6 months.

Mr. Jamison stated that this would be coordinated with NCDOT at a later date.

Mr. Wilson asked about the height and width of the workbridge.

Mr. Warren stated that it would be approximately 30 to 40 feet wide and 20 feet high.

Mr. Huggett asked if there would be dredging on the project.

Mr. Jamison stated that the current plan is not to dredge. The workbridge has been extended so that barges will moor in deep water with no dredging. However, the project area is rather dynamic and therefore limited dredging cannot be eliminated from consideration if shoaling occurs during permitting or construction.

Mr. Jamison went on to explain that the southern emergency ferry ramp, created 20+ years ago, will be used as a temporary construction access and the current plans call for a haul road and trestle to be installed. Mr. Jamison stated that the design of the trestle will be similar to the work trestle on the north side.

Mr. Stewart discussed the current state of the former emergency ferry ramp. Currently, the spur road has an expired permit, and is an illegal road on the Refuge. NCDOT requested that they be released from the ramp removal condition of the A-jacks Special Use Permit, but then rescinded that request. Mr. Stewart asked for clarification as to what NCDOT wants to do about the emergency ramp. He does not see a problem with using it for temporary easement for the proposed work trestle area.

A general discussion of the current conditions of the emergency ramp ensued.

Ms. Brittingham asked if fill would be placed for the access.

Mr. Jamison stated that limited fill may be required to tie into the required height of the work trestle.

Mr. Hering noted that the temporary trestle portion would likely start over upland.

Mr. Warren concurred that this was the case.

Mr. Jamison stated that the first activities on the ground will be the load testing. A NWP 6 will be sought from the USACE and the timeframe will be from October to December 2012.

Mr. Wainwright recommended confirming that all the requirements of DWQ's NWP 6 general certification are met.

Mr. Huggett noted that these load testing activities are typically exempt from CAMA permitting. He asked that a letter be sent to DCM to inform them of the load testing activities. DCM will then send a return email or letter stating concurrence that no permit is required.

Mr. Jamison stated that the 404/401/CAMA permit applications will be submitted in May and asked when the agencies would like to see the NWP 6 application.

Bill Biddlecome stated that new NWP's will be issued in March 2012. Notification is not always required for the NWP 6, and since this load test program is in uplands and open water it may not require notification.

Mr. Hering stated that typically notification is required for this project as it is on a barrier island.

Chris Rivenbark suggested that the NWP 6 PCN could be submitted prior to the NWP renewals in March 2012 and this would allow the load test program one year to be completed.

Mr. Biddlecome agreed that this would be acceptable. The Team will continue to coordinate with NCDOT and USACE on this activity's permitting needs.

Jetting Process

Mr. Jamison described the approach the Design Team is proposing for the containment and disposal of jetting material. He noted there will be primary and secondary mechanisms for containing turbid waters and spoil. All spoil will be disposed of in an approved waste area. More details of the containment systems will be provided at the 4C meeting or before.

No comments or questions were raised about jetting.

Demolition

Mr. Jamison stated that demolition will begin at the northern approach and the navigation spans. He showed a graphic of the four reef disposal sites and noted that this is scheduled to occur from April 2015 to February 2016.

Mr. Hart asked if NCDOT was in contact with Jim Francesconi of NCDMF (the artificial reef coordinator).

Mr. Jamison stated that a separate meeting will be scheduled for this with DCM and Mr. Francesconi.

Mr. Huggett asked if the artificial reefs were in federal or state waters.

Mr. Jamison responded that the northern three sites are in federal waters and the southern site (AR-160) was in state waters. This site would be included in the CAMA permit.

Mr. Wainwright asked how close AR-160 is to the coast.

Mr. Jamison stated that it is within 2 to 3 miles of the coast.

Mr. Wainwright noted that the concrete for the reefs has to be clean of oil and grease and that he would check into specific standards for concrete used in reefs.

Mr. Mitchell stated that there are strict requirements for the concrete disposal related to oil and grease.

Ms. Gledhill-Earley asked if we looked at submerged resources.

Ms. Paugh stated that the sites are existing created reefs.

Mr. Huggett asked if any of the existing bridge would be left in place.

Mr. Hering stated that the removal would meet USCG requirements to remove hindrances to navigation down to potential scour depth. Piles above that elevation would be removed.

Mr. Huggett stated that DCM may have different concerns as they define navigation differently from the USCG.

Ms. Brittingham asked how we will know what substructures, piles and other underwater bridge features are present and need removal.

Mr. Hering stated that NCDOT has as-builts for the existing bridge.

Mr. Huggett stated that the CAMA permit would likely include a condition that all remnants of the existing bridge be removed. If there are portions of the structure that are to remain in place they should be specifically mentioned in the permit application.

Mr. Hering noted that scour protection such as riprap will undoubtedly not be able to be recovered as it would likely be buried.

Mr. Huggett concurred that the removal of material such as riprap would likely cause increased disturbance and therefore it would be acceptable to leave that in place.

Section 7 Consultation

Mr. Jamison briefly reviewed several minor changes to the project that may require coordination with NCDOT and USFWS related to Section 7.

Mr. Jordan stated that the initial Section 7 consultation was an "Appended Programmatic Consultation". This is a broad consultation that assumes in each phase of the project more consultation could occur as more detailed information is provided. USFWS would review each phase of the project to ensure all effects were covered under the previous consultation and the incidental take determination was still valid. The review would include an evaluation that reasonable and prudent measures have been taken to minimize effects. This would include items such as the staging area berm previously discussed.

Mr. Jamison stated that the Design Team has begun coordinating with NCDOT on updated information related to the project.

Mr. Jordan stated that this information should be submitted through the FHWA.

Clarence Coleman stated that the information would be provided for each phase of the project individually.

Mr. Jordan agreed that this was acceptable.

Casting Yard & Batch Plant

Mr. Jamison discussed the proposed location of the casting yard. The plan is to use an existing disturbed area that was an old chip mill and is still used as a granary for the Mattamuskeet Farms. Some site improvements would be required including grading of the chip mill area and installation of a dock in the canal. The site is in private ownership and the owner has intended to develop the old chip mill site as an industrial area. PCL would be the initial tenant on this site. The owner has had discussions with the USACE regarding the jurisdiction of areas within the chip mill.

Ms. Brittingham asked if dredging would be required.

Mr. Jamison stated that the owner has an existing dredge permit.

Mr. Huggett recommended ensuring that the existing dredge permit is deep enough for the barges being used on the project. A change in depth of dredging would require a new permit.

Ms. Brittingham asked if the area was High Quality Waters.

Mr. Wilson stated that it was not likely.

Mr. Biddlecome stated that the impacts may need to be included under the NCDOT permit.

Ms. Brittingham asked what acreage of wetland impacts would occur.

Mr. Jamison stated that this was not clear at this time. There is some question as to what is Corps jurisdictional in the area due to all the prior disturbance and current conditions.

Mr. Biddlecome stated that more coordination on this site will be needed prior to the permit application.

Mr. Jamison provided a brief overview of several potential concrete batch plant sites.

Noise, Utilities, Schedule & Lighting

Mr. Jamison then provided a summary of potential construction noise and utility relocations issues. A riser power pole on the south end of the bridge will need to be relocated to avoid conflicting with construction and the new bridge alignment. The current plan is to do this in Spring of 2013. Impacts related to utilities would be included in the 401/404 permit application.

Mr. Jamison then reviewed the schedule for the project including planned submission of the permit in May 2012 and several proposed coordination and site meetings with regulatory agencies.

Mr. Huggett asked when construction was proposed to begin.

Mr. Jamison stated that construction is planned for December 2012.

Mr. Huggett asked if the USCG is going to allow joint processing of the permits.

Mr. Jamison stated that the USCG will allow the applications to be submitted concurrently, but that the USCG cannot issue their permit until the CAMA permit is issued.

Mr. Jordan asked when the lighting and wildlife education meeting is planned.

Mr. Jamison stated that this was tentatively proposed for February 2012.

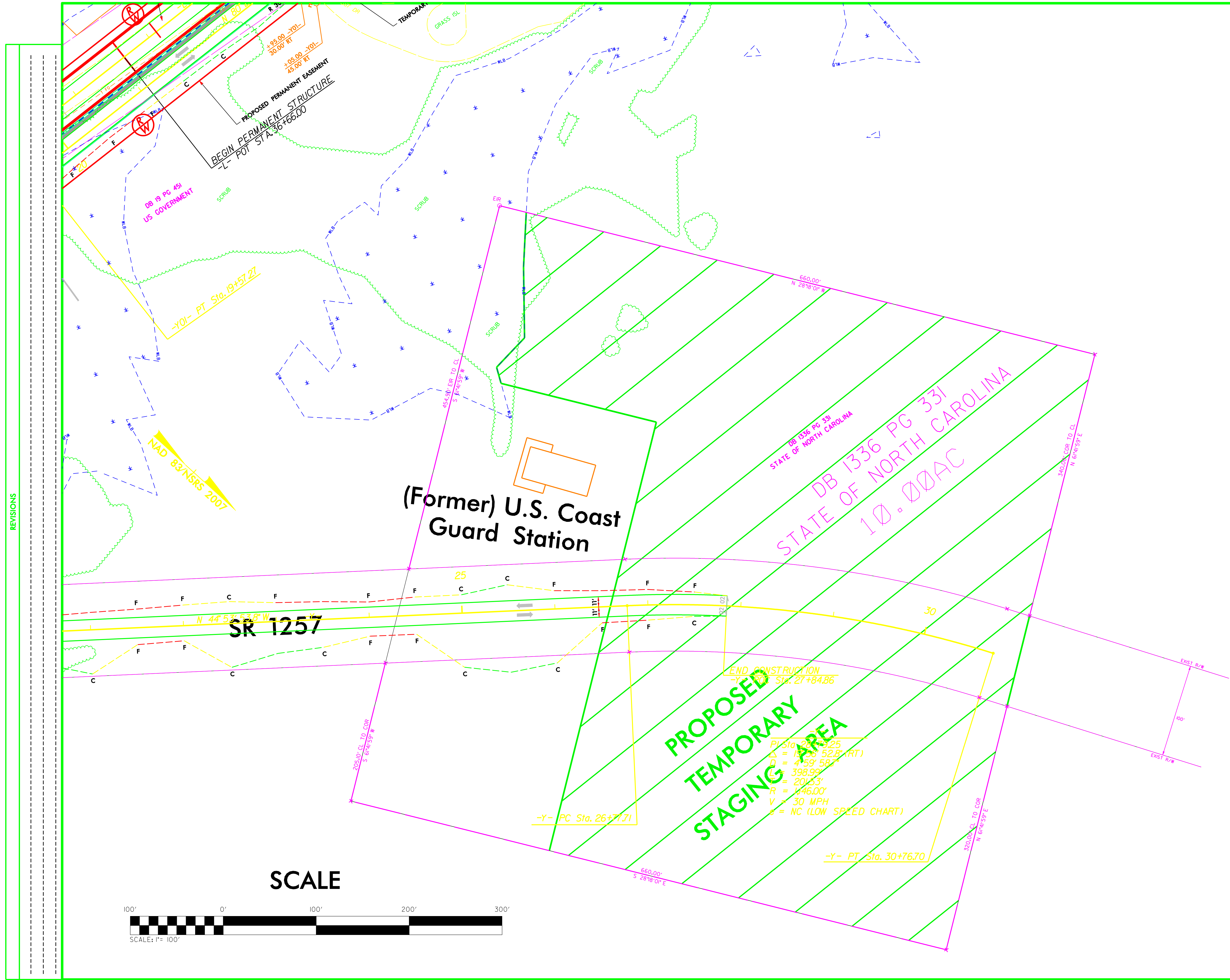
Mr. Jordan requested that this meeting be moved as close to construction as possible. He would like all contractors who would be responsible for construction to be present, especially anyone responsible for lighting.

Mr. Jamison stated that this could be done as a pre-construction meeting later in 2012.

Meeting Adjourned.

HDR CHECK PRINT									
NO.:					DATE:				
DRAWING MADE BY:	INITIALS	DATE	INITIALS	DATE	INITIALS	DATE	INITIALS	DATE	INITIALS
10/2/2011	DMW	10/2/2011	CHECKED BY:		CORRECTIONS CHECKED BY:		CHANGES MADE BY:		CHANGES VERIFIED BY:

PROJECT REFERENCE NO.		SHEET NO.	
B-2500			
R/W SHEET NO.			
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER		
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION			
 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. 30 FOR -Y- PROFILE.

Meeting Minutes

Subject: Interagency 4C Concurrence Meeting for B-2500, Bonner Bridge Replacement

Meeting Location: NCDOT BOT Conference Room – Transportation Building

Meeting Date: Wednesday, 3/21/2012

Meeting Time: 1:00 pm EST

Merger Team Members Present:

Bill Biddlecome, USACE
Renee Gledhill-Earley, SHPO
Kevin Hart, NCDMF
Doug Huggett, NCDOT
Gary Jordan, USFWS
Ron Lucas, FHWA
Chris Militscher, EPA
Mike Murray, NPS
Ron Sechler, NOAA Fisheries
Beth Smyre, NCDOT PDEA
Dennis Stewart, USFWS Pea Island
David Wainwright, NCDWQ
Travis Wilson, NCWRC

Other Participants:

Cathy Brittingham, NCDOT
Stephen Lane, NCDOT
Brad Hibbs, FHWA
Amy Simes, NCDENR
Pace Wilber, NOAA Fisheries (via phone)
Paul Williams, NCDOT
Brian Wrenn, DWQ (via phone)

Lonnie Brooks, NCDOT Structures
Bob Capehart, NCDOT Division 1
Marshall Clawson, NCDOT Hydraulics
Dara Demi, NCDOT Communications
Kevin Fischer, NCDOT Structures
Rob Hanson, NCDOT PDEA
Phil Harris, NCDOT NES
David Hering, NCDOT DB Unit
Pablo Hernandez, NCDOT Division 1
Jerry Jennings, NCDOT Division 1
Brittney Kelly, NCDOT PDEA
Chris Kreider, NCDOT Geotechnical
Jerry Lindsey, NCDOT Hydraulics
Elizabeth Lusk, NCDOT NES
Steve Mitchell, NCDOT BSG
LeiLani Paugh, NCDOT NES
Greg Perfetti, NCDOT Structures
Chris Rivenbark, NCDOT NES
Mark Staley, NCDOT REU
Greg Thorpe, NCDOT PDEA
Michael Turchy, NCDOT NES
Michael Valiquette, NCDOT Geotechnical
Morgan Weatherford, NCDOT NES
Clay Willis, NCDOT Division 1
Brian Yamamoto, NCDOT PDEA

Domenic Coletti, HDR
Bryce Faust, PCL
Beth Howey, HDR
John Jamison, HDR
Josh Massrock, HDR
Phil May, Carolina Ecosystems
Jim Schneiderman, PCL
Kirk Stull, HDR
Jessica Tisdale, HDR
Ken Trefzger, HDR
Tom Warren, PCL

Introductions were made by all in attendance.

Project Overview

David Hering of NCDOT introduced the Bonner Bridge Replacement (B-2500 – Phase I) project. Domenic Coletti discussed the purpose of the meeting and the amount of information being provided, and introduced John Jamison to discuss the permit impacts and construction approach.

Permit Impact Sheets

Mr. Jamison began by reviewing the materials that were handed out and presenting a PowerPoint presentation to the group. He began by explaining the overall layout of the seven permit impact sites. A draft summary of impacts to wetlands was presented.

Doug Huggett asked about the mechanized clearing and excavation wetland impact acreage and if they were CAMA wetlands or 404 wetlands. Mr. Jamison responded that they were mostly 404 wetlands.

Cathy Brittingham asked if CAMA wetlands will increase or decrease due to the re-verification of wetlands currently in process. Mr. Jamison stated that HDR is waiting for the final re-verification files to be submitted from CZR. However, based on the draft information from their field work there seems to be a general trend toward CAMA wetlands.

Bill Biddlecome asked if the impact numbers and plan sheets were based on the original delineation. Mr. Jamison confirmed that they were, as the current delineation has not yet been finalized.

Mr. Biddlecome stated that the largest changes will occur at Site 2 from what he noticed during the recent field review.

Individual Permit Impact Sheets were then reviewed.

Sheet 4 (Site 1, NC12 roadway south of the proposed bridge):

Mr. Jamison noted that Site 1 is a 404 wetland currently, but may convert over to a CAMA wetland with the revised mapping. Impacts may be reduced down to just hand clearing based on the revised wetland boundaries.

David Wainwright asked where the pre-formed scour hole drains to at station 25+50. Ken Trefzger responded that it discharges in a relatively flat and sandy area, then drains through a 15" pipe north to a low area. Mr. Trefzger also noted that the 15" pipe has adequate capacity and that the system design does not rely on infiltration through the sandy soils.

Sheet 5 (Site 2, -Y01- service road to parking lot):

Mr. Jamison described the fill impacts and handclearing at Site 2. He stated that mechanized clearing was not necessary at this site, so the impact was recently changed to hand clearing. He also stated that this section of the parallel access road will have a guard rail since it is very close to the new NC 12 bridge and would provide a safer driving environment in this tight area. Previous plans have shown concrete barrier but based on a request from USFWS this has been changed to an open rail.

No comments were received on Site 2.

Sheet 5 (Site 3, southern work trestle/dock):

Mr. Jamison explained the work trestle impacts at the former emergency ferry ramp at Site 3. Since submittal of plans to the agencies, two boat slips have been added to the plans to accommodate docking of vessels on the south end of the bridge.

No comments were received on Site 3.

Sheet 5 (Site 4, electric utility relocation):

Site 4 is the relocation of the electric utility pole to the south. Both permanent and temporary impacts are shown for this site. Permanent impact will be associated with the pole location which will be of similar size to the existing pole. Temporary impacts will occur along the existing utility corridor for construction access and trenching for the line.

No comments were received on Site 4.

Sheet 5 (Site 5, proposed bridge – clearing impacts):

Site 5 encompasses the new bridge piling footprint and a work trestle at the northern end of the bridge, as well as a small sliver of mechanized clearing in wetlands at the southern approach. The latter impact is on Sheet 5. This is a small 2' to 4' wide mechanized clearing area necessary for bridge construction and maintenance.

No comments were received on Site 5.

Sheet 6 (Site 3):

Mr. Jamison noted this sheet shows the docking slips added to the plans on the southern work trestle since the 4C agency plan sets were distributed.

No comments were received on Site 3.

Sheet 6 (Site 5, proposed bridge):

Mr. Jamison noted this is where the bridge begins spanning the open water section of the inlet, although the bridge itself starts well south of the existing bridge. The surface water impacts for the new bridge construction encompass the area of the pile cap plus the “pile window” or outermost extent of any battered (or angled) piles at the bottom of the pile. This is therefore a conservative maximum estimate of impact, and the actual impact area at the surface of the water would be smaller.

No comments were received on Sheet 6.

Sheet 7 (Sites 5 and 6, proposed bridge and existing bridge demolition):

Mr. Jamison noted that the new bridge surface water impacts change due to the different pile configurations required. The navigation spans begin on this sheet. He also noted that the existing bridge demolition begins and is calculated in a similar manner to the proposed bridge footprint.

No comments were received on Sheet 7.

Sheet 8 (Sites 5 and 6)

Mr. Jamison stated that this sheet continues the navigation spans of the bridge. Also, the existing A-jacks locations are shown on this sheet. These scour protection devices will not be removed, as they are buried in the substrate and do not pose a navigation hazard.

No comments were received on Sheet 8.

Sheet 9 (Sites 5 and 6):

Mr. Jamison noted that the existing navigation channel is shown on this sheet. The fender system protecting the current bridge will be removed entirely. Some of this fender system may be removed prior to bridge demolition so it does not interfere with construction. This will be coordinated with the USCG and USACE as needed.

Mr. Wainwright asked if there will be a fender system on the new bridge.

Mr. Coletti stated that there would not be a fender system, but the pile caps will have a non-sparking protective surface.

Mr. Brooks stated that each foundation has been designed for vessel impact.

Sheet 10 (Sites 5 and 6):

Mr. Jamison noted the closer spacing of demolition activities along the existing bridge on this sheet are in the area where the bridge was repaired in the 1990's. Eight work platforms (approximately 40' x 10') that will be used for storage of materials have been added to Sheets 10 and 11 since the 4C agency plan set was distributed. This storage over the open water will help reduce the footprint on land and the need for double handling of materials or standby time for the barges delivering the materials.

No comments were received on Sheet 10.

Sheet 11 (Sites 5 and 6, work trestle):

Mr. Jamison mentioned that the work trestle had been extended 800 feet further south since this area of the project has been developing shoals and is too shallow for barge access. This is a minimization effort in order to avoid dredging on the project.

Mr. Wainwright asked if the temporary impacts associated with the piles for the work bridge have been accounted for as the exact pile locations are not shown on the plans. Mr. Jamison stated that these were included in the impact numbers. Mr. Wainwright asked that these impacts be specified in the permit application.

Kevin Hart asked if the work trestle would be an open grate design. Mr. Jamison and Mr. Warren explained that the work trestle would be a 1500-foot leapfrogging design. The extension of the trestle an additional 800 feet (approximately) is over open water (not SAV habitat) and therefore would lessen the shading impact at the end of the workbridge. Mr. Sechler concurred that the extension area is not over SAV habitat. *(Note: the trestle to be used is not an open grate design, but the leapfrogging is proposed in order to minimize any shading impacts due to the closed grate design.)*

Sheet 12 (Sites 5 and 6):

Mr. Jamison described the primary and secondary containment system locations between bents 48 and 78. These systems will be located within the SAV and marsh areas. Additional detail on this containment will be presented in the slides to follow. The impacts shown account for both the permanent piles and the temporary containment structures. He stated that the bridge's existing piles will be cut at the mud line in the SAV and marsh areas and that the piles in open water will be removed completely.

Ms. Brittingham asked that the permit application clarify which piles will be cut at the mud line. Mr. Jamison stated that this information would be provided.

Sheet 13 (Sites 5 and 6):

Mr. Jamison stated that this is a continuation of the construction of the bridge over SAV and marsh habitat similar to Sheet 12.

No comments were received on Sheet 13.

Sheet 14 (Sites 5 and 6):

Mr. Jamison stated that this is a continuation of the construction of the bridge over SAV and marsh habitat similar to previous sheets.

No comments were received on Sheet 14.

Sheet 15 (Sites 5 and 6):

Mr. Jamison stated that this sheet shows where the bridge is approaching land and crossing several fingers of open water near the northern end of the bridge. Containment of jetting spoils would continue throughout this area.

No comments were received on Sheet 15.

Profile Sheets PFL-1 through PFL-10

Mr. Jamison reviewed the profile sheets showing the proposed bridge and existing bridge to be retained as a fishing pier.

Ms. Brittingham asked what the term “long term bed elevation” and “contraction scour” mean. Mr. Coletti stated that the long term bed elevation is the profile of the overall channel scour anticipated over the life of the bridge. Contraction scour is the scour anticipated to occur locally around each bent. Mr. Huggett summarized these terms as being the natural and human-induced scour potential. It was noted that the scour profiles shown on the plan are those prescribed for bridge design by the NCDOT contract and are generally more conservative (deeper) than scour depths which have been calculated by the design team via extensive modeling efforts.

Correction: “Long Term Bed Elevation” is the profile reflecting the deepest elevations expected to be experienced naturally by the channel, including consideration of natural meandering/migration of the deeper parts of the channel over the width of the bridge opening. “Contraction Scour” is the profile reflecting the overall lowering of the channel bed caused by obstructing the natural width of the flow through the bridge opening since the proposed bridge opening does not significantly constrict the flow through the opening, the Long Term Bed Elevation and the Contraction Scour profiles are virtually identical. “Total Scour” is the profile reflecting the scour anticipated to occur locally around each bent. The definitions provided at the meeting included the correct definition of “Long Term Bed Scour,” but erroneously presented the definition of “Total Scour” when Ms. Brittingham had actually asked for the definition of “Contraction Scour.”

Sheet 17 (Site 7):

Mr. Jamison stated that the mechanized clearing impact at Site 7 was converted to hand clearing, which has been minimized to reduce easement impacts. The current delineation has potentially identified more 404 wetlands on the western side of the road in the vicinity of the current Site 7 impact, so the permit application will likely have additional impacts shown at this location. A ditch is being relocated along the existing roadway at this location.

Mike Murray asked which sheet is before the sheet where Site 7 is located. Mr. Jamison stated this would be Sheet 16 of the roadway plans and that this particular sheet is not included in the

permit impact sheets since no impacts occur at that location. A full set of roadway plans was provided to Mr. Murray.

Mr. Jamison followed the permit impact sheet review with a PowerPoint presentation on a variety of topics related to the design and construction of the project.

Staging & Personnel Access (3 slides)

Mr. Jamison discussed the construction access and staging area plan for the project. A graphic of the staging area on Hatteras Island (state property surrounding the former US Coast Guard Station) was shown and explained at length. He stated that coordination with the USFWS to determine the size of the wildlife berm (requested in order to shield endangered species from light and noise impacts) was ongoing. Fencing around the periphery of the staging area is being discussed due to potential public safety concerns. Seventy to eighty parking spots will be on-site in addition to construction trailers, a sand stock pile yard and a lay down yard. The existing sand in the laydown yard area will possibly be used to construct the berm.

Mr. Biddlecome asked about the blue and green areas south of the staging area. Mr. Jamison stated that it was a wetland area located to the south of the staging area and was discolored due to the aerial photograph colors underneath the wetland data layer. Mr. Biddlecome stated that this area is likely to change based on the new delineation. Mr. Jamison stated that the staging area would be designed to avoid impacts to wetlands.

Mr. Wilson asked what the restoration plan for the staging area will look like. Mr. Hering stated that the site will be turned back to existing conditions, but that the final disposition of the site will be dependent upon ongoing permit negotiations with the USFWS and NC Aquariums. Mr. Stewart stated that the existing sand dunes in the area are 20 to 30 feet in height within and surrounding the staging area. Mr. Jamison stated that during project construction access to the terminal groin will be maintained.

Work Trestle & Platform (5 slides)

Mr. Jamison explained the work trestle on sheets 11-15 had been lengthened to accommodate the shoaling that has occurred at the location of the recent breach. Mr. Sechler asked where the example photos of the work trestle were located. Mr. Jamison replied that they were from a previous PCL project in South Carolina.

Mr. Wainwright asked if the piles on the work trestle are solid or hollow. Mr. Warren replied that the design has not progressed far enough to determine this design feature, but they would likely prefer to drive hollow pile.

Mr. Jamison clarified the plans for the emergency ramp would entail post-construction restoration of the area. The ramp was built 20 years ago and has never been fully returned to its original condition (partial restoration was completed in Fall 2011). This project will restore the area to previous conditions in coordination with the Refuge staff.

Jetting & Containment (4 slides)

Mr. Jamison then went on to describe the jetting process. He stated 4 jets will likely be used per pile and that the water would be recirculated and spoils contained within the marsh and SAV areas.

Mr. Huggett requested that the permit application specify exactly which bent locations would have the containment devices.

Mr. Jamison proceeded to explain the primary and secondary containments systems through the use of two PowerPoint graphics.

Mr. Sechler asked how long the containment boxes will be in place. Mr. Warren replied they will be in place for approximately one week at each bent. Mr. Jamison added that they may have other additional features such as baffles or sub-boxes within the larger box frame.

Mr. Murray asked if the boxes will be above water or on the ground. Mr. Warren replied that they would be on the ground. Mr. Hering stated that the boxes will be placed only in the SAV and marsh areas and they will be touching the bottom of the substrate. Mr. Warren explained that temporary piles will be in place under the boxes and will be pulled after the box is removed.

Ms. Brittingham asked what the weight of the boxes was and how much water they could hold. Mr. Warren replied that they could hold tens of thousands of pounds of water, and a final number on the weight of the steel box was undetermined at this time. Mr. Hering explained that the piles would be driven, and stated that the bottom is undulating and it would be difficult to only place them on the substrate surface. Mr. Jamison stated that the contractors would use more piles if necessary to accommodate for weight and the current substrate conditions.

Phil May reiterated that the areas of the containment boxes are depicted on the permit impact sheets. Ms. Brittingham requested to know if these boxes are shown as a permanent or temporary impact. Mr. Jamison stated that they were shown as temporary impacts.

Ms. Brittingham stated that it would be a good idea to monitor the secondary containment box impacts to make sure that they are truly temporary impacts or if the areas do not return to original conditions. Mr. Huggett asked if the 0.74 acre of temporary fill in wetlands represents the impact from these boxes. Mr. Jamison stated that the majority of the area was from the boxes but not all. Mr. Huggett asked that these temporary impacts be broken up into 404 and CAMA wetlands in the permit application.

Mr. Sechler asked how the temporary impacts will be monitored. Mr. Huggett suggested possibly needing to monitor these areas for three years to ensure that they will only be temporary impacts. Mr. Wainwright stated that this monitoring typically involves visual monitoring. Mr. Huggett stated that NCDWM would most likely include a specific permit condition to make sure the boxes and temporary impact areas would be monitored and restored if necessary.

Mr. Stewart asked if there had been any calculations done to determine the weight of the box, water, and sediment to address the soil compaction. Mr. Warren noted that those calculations have not been finalized to date, but the piles are there to help alleviate the potential for compaction and for stabilization of the frame.

Ms. Brittingham asked what percentage of the temporary fill in wetlands is due to the boxes. Mr. Jamison stated that 0.67 acre is due to the containment boxes. Ms. Brittingham asked if the wetland impacts included SAV areas. Mr. Jamison stated that SAV areas were included under surface water impacts (0.90 acre).

Brian Wrenn asked how the compartment boxes in the primary containment system will be removed. Mr. Warren stated that the piles will be placed on a larger frame and will be holding multiple boxes. A crane will be able to lift the boxes out and clean the sediment from them. Most of the sediment will be recycled back into the hollow piles and the Design Build Team estimates approximately 40 to 50 cubic yards of spoils will remain. Mr. Wrenn asked if disposal

areas for the spoils have been identified yet. Mr. Warren stated that this has not been determined at this time.

Fishing Pier (1 slide)

Mr. Jamison explained that the conversion of a section of the existing bridge into a fishing pier will not create any further wetland or open water impacts. However, future rehabilitation or maintenance work may be required. Mr. Huggett asked if any upland development such as new roads or parking lots will be built to accommodate the public who visit the pier. Mr. Jamison stated that no new parking lots would be built and the public would use the existing parking area.

Mr. Hering stated that approximately 1240 feet of the existing bridge would be retained for use as a fishing pier, though that length may be reduced to approximately 1045 feet. He stated that the length could change based on discussions with the Corps.

Ms. Brittingham asked if a reduced length of the fishing pier would impact fishing. Mr. Hering stated that the length would not affect fishing but is related to the Corps requirement for maintaining a training structure to help stabilize Davis Slough and the south side of the inlet.

Mr. Sechler asked who will maintain the fishing pier. Mr. Hering answered that NCDOT will maintain the fishing pier.

Gary Jordan asked if park benches, kiosks, and lighting will be part of the fishing pier design. Mr. Jamison stated that this had not been pursued. Mr. Jordan stated that this was originally presented as part of the project and would be an issue for USFWS. Mr. Jamison stated that no lighting would be included on the fishing pier. Mr. Hering confirmed that NCDOT decided not to pursue these amenities based on prior USFWS comments.

Demolition & Reef Disposal Slides (2 slides)

Mr. Jamison described the process and coordination with NCDMF regarding bridge demolition and disposal at the artificial reef sites. PCL has estimated that 30 barge trips are needed in order to dispose of the old bridge. Primary disposal would be at site AR-160 with the other locations used when conditions and materials favored those more remote sites.

Ms. Brittingham asked if Division of Marine Fisheries is applying for the permits. Mr. Jamison confirmed that NCDMF would be responsible for the reef permits, and that the demolition schedule leaves adequate time for this to occur. Mr. Jamison proceeded to discuss bridge demolition. He stated that the existing bridge piles would be cut at the mud line within SAV and marsh areas.

SAV & Mitigation (3 slides)

SAV impacts were presented including 2.66 acres of shading from the new bridge and 1.38 acres of un-shading by the removal of the existing bridge. Mr. Jamison stated that 1.28 acres of net impacts will be mitigated for. Mr. Jamison mentioned that Mr. Mitchell has been working on this and coordinating with the agencies.

Mr. Jamison briefly summarized the Seagrass Restoration plan NCDOT is proposing to use for Phase I SAV mitigation.

LeiLani Paugh stated that a separate meeting will be held with the agencies to follow up on the proposed mitigation plans relatively soon in order for the plans to be finalized in time for the permit application.

Navigation (1 slide)

Mr. Jamison discussed vessel navigation during construction. He stated existing navigation channels will be utilized for all construction barge traffic to/from the site, and no additional dredging is proposed. The Design Build Team plans to coordinate closely with the USCG to avoid any potential conflict.

Casting Yard (3 slides)

The Fairfield casting yard for the project was discussed thoroughly by Mr. Jamison. The landowner has applied for an individual permit through the USACE/DWQ/DCM to account for wetland impacts. Mr. Jamison stated that the landowner has long term plans for the site to be used in an industrial manner and therefore was pursuing the permit independent of this project. An example site plan, detailing the site layout and dock within the canal was shown. Features on the drawing included material storage areas, pile beds, production area, and bridge segment casting areas. Mr. Jamison stated that the canal dock will be temporary and will include finger piers so that barges can dock safely.

Mr. Jamison asked if the permit application should include the pile impacts for the canal dock.

Ms. Brittingham asked how long the pier would be in place. Mr. Warren stated that it would be required for approximately two years. Mr. Huggett asked if the landowner did not want it permanently. Mr. Jamison stated that the landowner did not need the dock and that PCL was not willing at this time to leave the dock in place.

Mr. Biddlecome and Mr. Huggett suggested a separate off-line discussion would be appropriate to resolve the permit approach for this project.

Note: After the conclusion of the meeting, NCDWM representatives (Ms. Brittingham, Mr. Huggett, Mr. Lane, & Mr. Williams) determined that the dock pile impacts would not require a separate CAMA permit and could be included in the temporary impacts associated with this project in the Major CAMA Permit application. Mr. May stated that the area would be minimal and may not change the actual surface water impacts due to rounding to hundredths of an acre.

Concrete Supply (1 slide)

Mr. Jamison stated PCL contractors plan to buy concrete from a local supplier in Wanchese. Mr. Murray asked if the concrete would be transported to the Fairfield casting site. Mr. Jamison stated that this source would only be used for fresh pours on the new bridge and a separate facility would be permitted at the casting yard site.

Mr. Wainwright inquired whether there will be a stormwater discharge at the casting yard site. Mr. Jamison replied yes and that it would be permitted accordingly.

Utility Relocation (1 slide)

The power utility relocation was discussed by Mr. Jamison. He stated that permit impacts are shown to stay within the known utility easement based on current knowledge of its bounds.

Renee Gledhill-Earley asked how the utility line would be mounted to the bridge. Mr. Coletti stated that it will not be visible in the navigation spans and can only be seen from under the deck in other areas. It will be placed in a concrete conduit within the bridge approaches. Ms. Gledhill-Earley asked if a picture could be provided to show where it will be mounted on the approaches and within the navigation spans. Mr. Hering stated that the new utility line will be less visible than what the utility line on the existing bridge. Mr. Coletti agreed to supply a diagram of the electric line.

Mr. Wainwright asked when the utility relocation will be carried out. Mr. Jamison stated that it will be executed in early spring of 2013 to comply with windows of opportunity for the utility company to minimize the effects of power disruptions to the island. Mr. Wainwright asked for confirmation that utility relocation will occur after the permits are issued by the agencies. Mr. Jamison affirmed that utility relocation would occur after permits were issued.

Load Test Program (1 slide)

Mr. Jamison described the load test program that is planned for the Fall of 2012. Two locations will be tested, one in an upland and the other in water near the current navigation zone. He explained that this procedure is basically an engineering testing process that produces important data to further determine final design details of the bridge and would last approximately 1 to 2 months. He stated that the load test program will be permitted through a NWP #6 and the existing NPS general field activities Special Use Permit would be amended to include this activity.

Upcoming Milestones (1 slide)

Mr. Jamison reviewed upcoming meetings including NCDOT field meeting prior to the permit application, NPS and USFWS Special Use Permit pre-application meetings (if necessary), and a pre-construction meeting with USFWS to discuss lighting and wildlife management. The permit application is planned for May 2012.

Mr. Jordan stated that the Section 7 consultation process requires re-evaluation of the project to determine if any significant changes have occurred since the Biological Opinion was issued in 2008. He stated that the incidental take finding should still apply to the current project. Mr. Jamison stated that the NCDOT has a draft memo that addresses these issues and this would be submitted to USFWS relatively soon via FHWA. Ms. Gledhill-Earley asked why lighting was an issue. Mr. Jordan discussed the effect of lighting on sea turtles. Mr. Stewart stated that construction is likely to occur 365 days a year, 24 hours a day, for 7 days a week and wanted to know why lighting was not specifically addressed in the slides. Mr. Warren stated that PCL contractors will be having meetings next week to further explore the lighting to be used on the project. Mr. Jordan stated that Florida has sea turtle lighting standards that he recommended the Design Build Team look into. Mr. Hering asked if another lighting meeting between the Design Build Team and USFWS should be scheduled in the next few months in addition to the educational lighting meeting schedule prior to construction in the fall of 2012. It was agreed this would be useful and will be coordinated through NCDOT. Mr. Murray mentioned that NPS sometimes adds conditions to NCDOT activities regarding lighting; they would like to ensure their conditions do not conflict with other agencies' permit conditions.

Ron Sechler mentioned that the Atlantic sturgeon listing would be revised in the upcoming months and this should be kept in mind during the design and discussion of lighting.

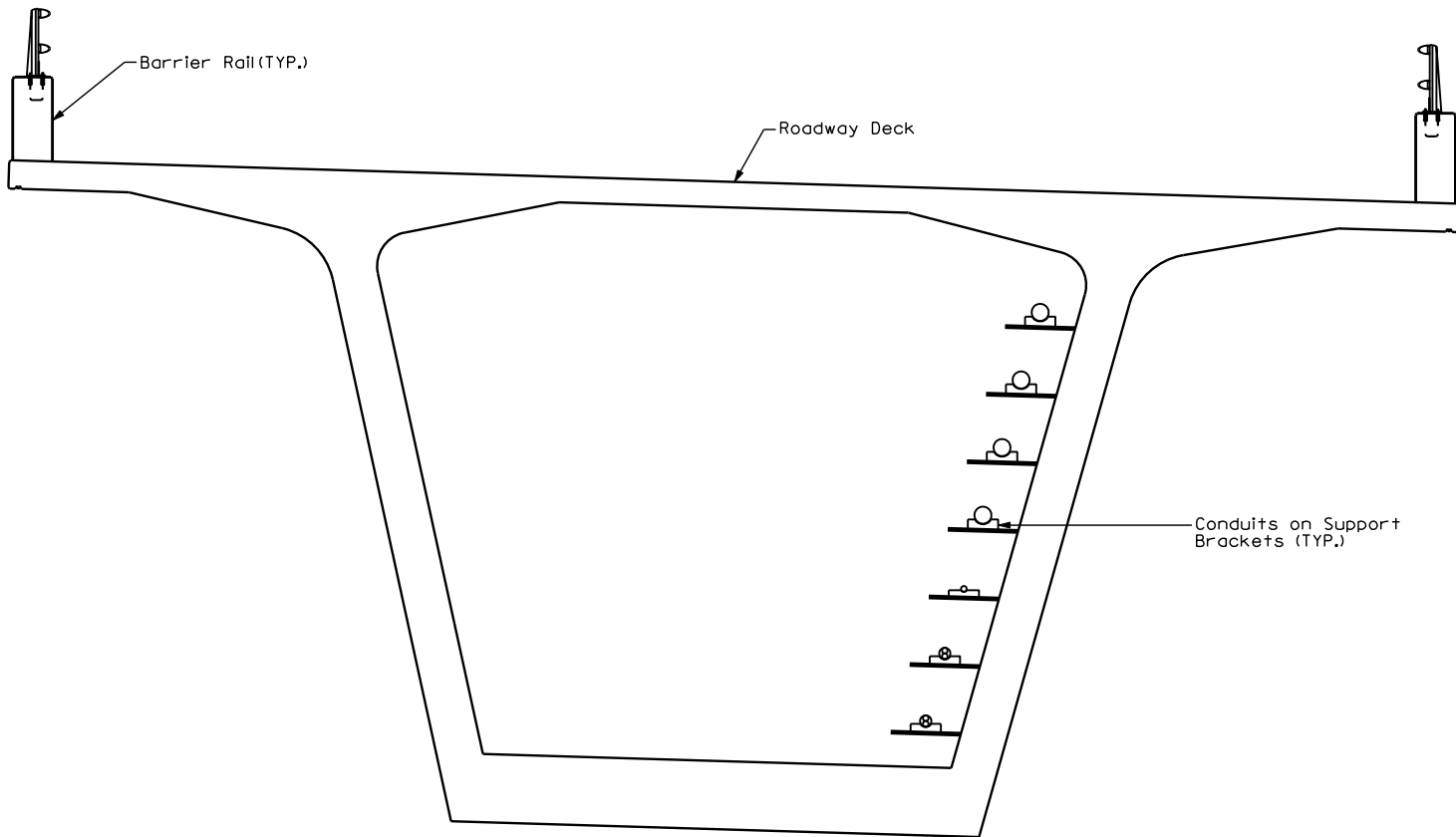
Mr. Stewart discussed the issues surrounding the fishing pier and asked questions of other agencies and NCDOT regarding the necessity of retaining the structure. Mr. Hering noted that the request was actually to provide a "training structure" on the south side of the inlet; this "training structure" would prevent further southern migration of the natural deep channel in Oregon Inlet. Mr. Hering further noted that in previous discussions between NCDOT and the USACE- Operations Branch, the USACE stated that if a training structure were provided, the required Navigation Zone width would be 2400 feet, but if the existing Bonner Bridge were totally removed and no training structure were provided, the Navigation Zone required width would be approximately 5000 feet. Mr. Brooks noted that without the training structure the required 5000 foot Navigation Zone width would need to extend to landfall at the north end of Pea Island. The bridge also would be required to have 70' vertical clearance over the entire

5000 foot Navigation Zone width, and thus the bridge would be much taller and potentially extend further into the Refuge. Mr. Hering and Mr. Brooks noted that the decision to provide a training structure (via retaining the south end of the existing Bonner Bridge) reflected the desire to reduce the cost of the bridge and also to reduce impacts in the Refuge. Ms. Smyre stated the intent to convert to a fishing pier was determined by both the department's commitment to maintain fishing access to the inlet (see Commitment #7 in the project's Record of Decision) as well as stabilization of the inlet channel.

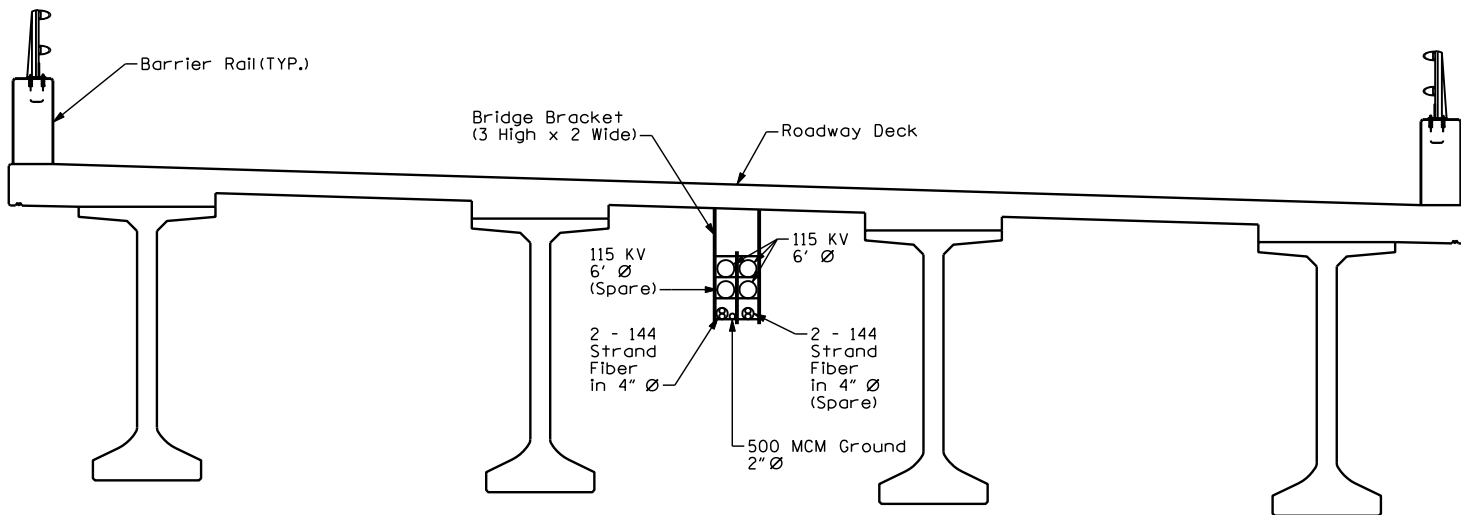
Note: The 9/18/2008 USACE letter actually states 4500 feet in navigation span length, not 5000 feet as mentioned at the meeting.

Ms. Paugh stated that another B-2500 meeting to discuss mitigation will likely be scheduled on the April 10, 2012 eastern area concurrence date. Ms. Smyre stated that she would likely be adding a Phase II meeting on that date as well.

Meeting Adjourned at 2:50 PM



SEGMENTAL BOX GIRDER
(Navigation Section)



96" DEEP GIRDER
(Approach Spans)

Note: Splice boxes and other attachments associated with the utilities will not extend below the bottom of the bridge girders.

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

UTILITY CONDUIT LOCATIONS

REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

Revised Draft Wetland Mitigation Plan NC 12 Replacement of Herbert C. Bonner Bridge (Bridge No. 11) over Oregon Inlet

Federal-Aid No. BRS-2358(15)

NCDOT Project Definition: 32635

TIP Project No. B-2500

Dare County, North Carolina

Prepared by

United States National Park Service

North Carolina Department of Transportation

May 17, 2012

TABLE OF CONTENTS

BASILINE INFORMATION	3
MITIGATION GOALS AND OBJECTIVES	4
MITIGATION OBJECTIVES	5
AFFECTED WETLANDS AND MITIGATION	8
INTENDED COMPENSATION CONTRIBUTION	8
ONSITE MITIGATION	8
EFFECTS OF PHRAGMITES INVASION OF COASTAL MARSHES.....	10
TREATMENT OPTIONS	12
PROPOSED MITIGATION	13
WORK PLAN.....	13
ADAPTIVE MANAGEMENT.....	15
SITE PROTECTION AND MAINTENANCE	20
FINANCIAL ASSURANCES	20
PROJECT COMMITMENTS.....	21

BASELINE INFORMATION

This Wetland Mitigation Plan details the proposed mitigation to be performed by the North Carolina Department of Transportation (NCDOT) for wetland impacts associated with the NC 12 Replacement of the Herbert C. Bonner Bridge over Oregon Inlet. Impacts to Section 404 jurisdictional wetlands on Federally owned lands managed by the National Park Service (NPS) and by the United States Fish and Wildlife Service (USFWS), within the Cape Hatteras National Seashore (the Seashore), will occur during Phase I of the bridge replacement. The proposed mitigation will be used to offset impacts for Phase I and for future phases as appropriate. Section 404 jurisdictional wetland impacts associated with Phase I of the Selected Alternative will be approximately 0.50 acres, of which 0.02 acres are considered CAMA jurisdictional wetlands.

The NPS worked with NCDOT to identify potential compensatory mitigation sites for the anticipated impacts to Section 404 jurisdictional wetlands. Several mitigation options were explored and prioritized. These options are discussed in detail in the Final Environmental Impact Statement (FEIS) dated September 17, 2008.

The NPS identified restoration of high-quality wetland communities designated as Significant Natural Heritage Areas (SNHAs) within the NPS property as the highest priority mitigation option. Many sites with high-quality or rare natural communities, rare species, and special animal habitats have been identified by the NPS and North Carolina Heritage Program (NCNHP) as being important for conservation of the State's biodiversity. The ecological significance of these areas has been documented through a 1987 Registry agreement, as amended, for the protection and management of Significant Natural Heritage Areas (SNHAs).

The NPS has identified the Bodie Island Lighthouse Pond SNHA as one such area (vicinity of 35°49'7.07"N, 75°33'48.60"W). NCDOT field surveys and mapping efforts estimated that approximately 50 acres of formerly *Spartina*-dominated marsh habitat has been displaced by the invasion of the exotic plant *Phragmites* in an area surrounding the Bodie Island Lighthouse. This *Draft Wetland Mitigation Plan* identifies the proposed work plan and performance measures to guide the restoration of the former marsh habitat through exotic plant control measures in this area of high management priority within the Seashore.

MITIGATION GOALS AND OBJECTIVES

The goal of this proposed mitigation plan is to compensate for unavoidable wetland impacts by developing a single proposal that (a) meets the compensation requirements of both the Executive Order 11990: Protection of Wetlands and the USACE Section 404 permit procedures (33 CFR 320-330); and (b) meets the NPS goal of “no net loss of wetlands” on NPS property.

Compensatory mitigation means the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved. Restoration should generally be the first option considered because the likelihood of success is greater and the impacts to potentially ecologically important uplands are reduced compared to establishment, and the potential gains in terms of aquatic resource functions are greater, compared to enhancement and preservation.

Mitigation options are defined below according to **COMPENSATORY MITIGATION FOR LOSSES OF AQUATIC RESOURCES, 33 CFR PART 332:**

1. **Restoration** means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation.
 - a. **Re-establishment** means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.
 - b. **Rehabilitation** means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

2. **Establishment** (creation) means the manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area and functions.
3. **Enhancement** means the manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.
4. **Preservation** means the removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

MITIGATION OBJECTIVES

The proposed on-site mitigation, defined as restoration above, provides for the rehabilitation of the integrity of natural resources, native vegetation mosaic, and habitat values at the Bodie Island Lighthouse Pond. In a December 2010 meeting with NCDOT, the NPS identified this site as a high management priority within the Seashore. Examples of high management priority areas are areas that have been jointly identified by NPS and the North Carolina Natural Heritage Program (NCNHP) and are Registered Significant Natural Heritage Areas (SNHAs). Registration of SNHAs means that the NPS and NCNHP have signed a Registry agreement that documents their joint interest and commitment to protect the integrity of natural resources within a particular area. The 1987 Registry agreement states that the NPS will:

....refrain from making or permitting changes that negatively affect the natural values for which [these areas were] registered....Specifically, the National Park Service agrees to manage and maintain the designated natural areas for the

perpetuation and protection of their primary biological resources. In some cases, manipulation—by burning, mowing, cutting, control of exotic species, managed water levels, or placement of dredged materials—may be appropriate to control natural vegetational succession and maintain habitats for rare or special-interest species...A monitoring program will be maintained for endangered and threatened species of animals and plants.

Each SNHA profile includes specific management action recommendations. The following management goals in this plan are based on those identified in national invasive species guidance, including the *National Invasive Species Management Plan* (National Invasive Species Council, 2008). Each goal has a set of related management objectives, which are statements of purpose that describe what must be accomplished for the plan to be considered a success in the Seashore. Adaptive management, an integral part of this plan, is a process that allows for decision making in spite of uncertainty, with an aim to reduce uncertainty over time via system monitoring. This process allows resource objectives to be met while information is gathered and lessons are learned, in hopes of continually improving future management.

Independent of the specific project location, the following goals and management objectives are applicable to exotic plant control efforts within the Seashore:

Goal 1: Inventory – Initiate a comprehensive and systematic exotic plant inventory to establish a baseline from which to measure progress.

Management Objectives:

- Document the abundance and distribution of exotic plants in the target areas
- Provide a foundation for prioritizing threats and for carrying out management planning efforts
- Provide a foundation for the development of short- and long-term programmatic plans

Goal 2: Treatment – Treat exotic plant populations that pose the greatest threat to park resources.

Management Objectives:

- Use the most effective and appropriate tool, or combination of tools, to eradicate or reduce the impact of exotic plants
- Reduce the impact of exotic plants on sites of cultural, scenic, and high ecological value, including habitat for special status species
- Restore ecosystems and key ecological processes that have been affected by invasive species to meet desired future conditions
- Integrate ecological restoration practices in exotic plant control treatments to guard against reinfestation
- Minimize secondary impacts from control efforts
- Protect human health and safety of persons potentially affected by the exotic plant control treatments

Goal 3: Monitoring – Ensure that the exotic plant control program is regularly monitored and improved, environmentally safe, and supported by science and research.

Management Objectives:

- Monitor and evaluate the overall program effectiveness to inform management regarding whether the program is of sufficient scope to meet program goals
- Monitor and evaluate the effectiveness of control techniques by species and adapt as necessary, based on results
- Monitor effects on native plant communities, based on results, adapt control techniques
- Identify vectors of spread to determine ways of preventing new species and populations from becoming established in targeted areas
- Promote research in the park upon which to base future management decisions

Goal 4: Educate, Outreach, and Research – Educate, inform, consult, and collaborate with stakeholders (e.g., NPS and other government agencies,

organizations, concessioners, visitors, partners, private property owners, and gateway communities) to share information and address exotic plant issues.

Management Objectives:

- Continue developing partnerships to encourage participation in the management of exotic plants throughout the Outer Banks region
- Expand collaborative efforts among park neighbors, park partners, gateway communities, and the public to share methods of preventing and controlling the spread of exotic plants
- Ensure that interested parties are well-informed about the timing and locations of upcoming exotic plant control treatments
- Educate and inform park visitors on exotic plants
- Provide stewardship opportunities for the public
- Continue to support and develop exotic plant research

AFFECTED WETLANDS AND MITIGATION

INTENDED COMPENSATION CONTRIBUTION

The proposed construction of B-2500 will permanently impact 0.50 acre of jurisdictional wetlands, which includes 0.01 acre CAMA jurisdictional wetlands.

Individual impact sites and acres are summarized in the wetland impact sheet included in the permit application. Specific community descriptions and wetland types are described in detail in the Final Environmental Impact Statement dated September 2008.

ONSITE MITIGATION

To date, the NPS has identified the rehabilitation of approximately 50 acres of wetland within the Bodie Island Lighthouse Pond SNHA as the highest priority site for the proposed on-site mitigation for wetland impacts. The NPS and NCNHP identified control of exotic plant species is essential to prevent the degradation or loss of function of this SNHA.

Bodie Island Lighthouse Pond SNHA (Site Id #1134)

The Bodie Island Lighthouse Pond is located on the Oregon Inlet 7.5 USGS topographic quad map, approximately 3 miles north of Oregon Inlet. It is the largest pond in the Seashore, measuring nearly one mile long and 0.4 mile wide. This fresh to slightly brackish pond is likely not a natural body of water. It was probably created by a waterfowl hunt club by placing a dam on a small outlet stream to the Pamlico Sound. However, the history of the pond is poorly known, and it predates the designation of the Cape Hatteras National Seashore.

Today, the Lighthouse Pond is primarily used for nature study. Large numbers of birdwatchers and sightseers visit the pond each year, accessing the Pond area on a recently upgraded (now handicap-accessible) wildlife viewing platform. Hunting and fishing are prohibited.

The site was described by the NCNHP as having significance due to its outstanding collection of water birds, with several rare plant and animal species. Historically, the pond was bordered by a diverse, though somewhat narrow, border of fresh-brackish marsh. Several rare plants occurred in the marsh. The Lighthouse Pond is habitat for very large numbers of waterbirds, making it one of the best bird watching sites in North Carolina (Buchanan 2009). For most of the year, thousands of waterbirds forage in the mud and shallow water at the pond. Several species of waterfowl nest in the vegetation at the edge of the pond, including black duck, gadwall, and blue-winged teal. During the warmer months a large variety of shorebirds, herons, egrets, and ibises forage at the pond. Several uncommon shorebird species occur annually, including Hudsonian godwit and Wilson's phalarope. From early autumn into spring, the pond is often covered with waterfowl including tundra swans, Canada geese, and snow geese. Peregrine falcons pass through the area in fall migration, and one or two individuals are often present in the vicinity of the pond in fall or winter.

The following lists the special status species of plants and animals known to occur in the vicinity of the pond:

- Black-necked stilt (*Himantopus mexicanus*), State Significantly Rare
- Peregrine falcon (*Falco peregrinus*), State Endangered
- Black rail (*Laterallus jamaicensis*), State Species of Concern
- Saltmarsh spikerush (*Eleocharis halophila*), State Threatened
- Beaked spikerush (*Eleocharis rostellata*), State Threatened
- Olney's three-square (*Schoenoplectus americanus*), State Watch List

The 1987 Registry agreement includes specific management and protection recommendations for the Bodie Island Lighthouse Pond SNHA. The site will continue to be a visitor destination within the Seashore, for birdwatchers and lighthouse tourists alike. However, the NPS is presently neither managing the water level for the benefit of the bird populations nor is the NPS presently monitoring or managing infestations of exotic plant species, with a specific emphasis on *Phragmites australis*.

The European genotype of the common reed (*P. australis*) occurs in large bands around the edge of the pond; this is an exotic species which is now abundant in habitats once occupied by the genotype native to the United States. Population decline and local extinctions of the native genotypes may be a result of competitive displacement by the exotic genotype and/or anthropogenic disturbance. Approximately 900 acres of marsh are infested by the exotic *P. australis* throughout the entire Seashore. In 2008, the NPS originally estimated and mapped approximately 35 acres of marsh infested by the exotic *P. australis* within the Bodie Island Lighthouse Pond SNHA. In 2011, NCDOT in coordination with NPS mapped 51.73 acres of phragmites within the marsh at Bodie Island Lighthouse pond.

EFFECTS OF PHRAGMITES INVASION OF COASTAL MARSHES

Phragmites australis is a tall perennial grass which can attain heights of up to 4.5 m (USACE 2005), significantly greater than that of native marsh species, such as *Spartina alterniflora*, *Spartina patens*, *Juncus roemarianus*, and *Typha latifolia*. Although it is a prolific seed producer, *Phragmites* most often spreads locally through vigorous growth of rhizomes and stolons, which can grow up to 2 m per year (Batterson and Hall 1984).

Phragmites can eventually sustain stem densities of up to 300 culms per square meter through development of a dense root mat (Hara et al. 1993). In addition to vigorous biomass growth, *Phragmites* is also reported to release the allelopathic chemical gallic acid into the soil, which inhibits the establishment and growth of other marsh species (Rudrappa et al. 2007). As a result of these physiological characteristics, *Phragmites*, once established, frequently develops dense, monospecific colonies over extensive areas and can exclude shorter native marsh species (USACE 2005). The Virginia Department of Conservation and Recreation (2009) reported that aggressive *Phragmites* colonies threatened the habitat of 29 rare plant species in Virginia.

The effect of *Phragmites* invasion on communities of associated wildlife has been most pronounced with respect to birds. While the observed effect on populations of native fish, benthic infauna, aquatic invertebrates, and decapod crustaceans has been variable (Posey et al. 2003, Hanson et al. 2002, Able and Hagan 2000, Fell et al. 1998), the shift in habitat from native low marsh vegetation to monotypic stands of *Phragmites* has demonstrated a more consistent effect on bird populations. In a study of marsh birds in Connecticut, it was demonstrated that there were fewer species present in *Phragmites*-dominated stands than in native short-grass marshes, particularly among rare bird species (Benoit and Askins 1999). The authors concluded that the dense, monotypic stands of *Phragmites* reduce the structural habitat heterogeneity and plant diversity needed by many species. In addition, the height and density of the thick *Phragmites* stems may physically exclude waterfowl and wading birds from the marsh interior, or substantially reduce hunting efficiency, rendering these sites unproductive. Similarly, Bontje (1987) found increased bird richness in restored cordgrass marshes compared with reference *Phragmites*, and Paxton (2007) reported that avian marsh species in Virginia rarely utilized stands of *Phragmites*. *Phragmites* has been reported to negatively affect the habitat of 22 rare animal species including 13 birds in the state of Virginia (VDCR 2009).

Some researchers have suggested that changes in vegetation growth form and structure between native marsh grasses and invasive *Phragmites* may affect soil and hydrology characteristics of wetland sites. *Phragmites* colonies typically have fewer but significantly

larger stems than native species, which may affect water flow through the marsh, sediment deposition rates and processes, detrital production and accumulation rates, sediment organic content, and nutrient cycling (Meyerson et al. 2000, Talley and Levin 2001, Rooth and Stevenson 2000, Windham 2001, Leonard et al. 2002). Windham and Lathrop (1999) stated that *Phragmites* stands may increase detritus accumulation over time, and thus, may elevate the substrate surface and smooth surface microtopography. Such gradual aggradation of the substrate surface may ultimately eliminate surface hydrology features relevant to aquatic species. *Phragmites* stands have demonstrated significantly greater rates of internal nitrogen cycling (both immobilization and mineralization) as compared to stands of native *Spartina patens* (Windham and Ehrenfeld 2003). *Phragmites* sequestered more nitrogen in live biomass and detritus compared to *Spartina patens*, but simultaneously stimulated microbial nitrogen mineralization at an equivalent rate, potentially affecting total nitrogen pools within the wetland along with pathways of nitrogen export. Similarly, Findlay et al. (2003) demonstrated that the ability of wetlands to serve as a nitrogen sink was reduced when former *Phragmites* stands were restored to a more diverse plant community.

TREATMENT OPTIONS

Throughout the United States and Europe, a full suite and combination of physical and chemical techniques have been tested experimentally in laboratory and field conditions to gain insight into the control and eradication of exotic *P. australis*. Experimental control efforts have varying degrees of success, and no singular effective technique has been identified as the best approach to managing *P. australis* infestations. Physical controls tested include manual and mechanical means of inducing stress (e.g., shading, drowning, mowing, burning), alteration of site hydrology (e.g., filling ditches, creating ditches, creating ponds), and excavation of root systems.

Minchinton and Bertness (2003) demonstrated that alteration of vegetation adjacent to *P. australis* plots and nutrient pulses each resulted in increased density, height, and biomass of *P. australis* shoots. The combination of these treatments also resulted in an

increase in the distance that shoots expanded and their reproductive output. Thus, limiting disturbance of native vegetation and reducing nutrient loading are critical to preventing the spread of existing *P. australis* infestations.

Chemical controls include herbicide application, typically in combination with some form of physical control for well-established infestations in large areas. Chemical control of *P. australis* has been achieved most frequently with a foliar application of imazapyr or glyphosate, a non-selective herbicide, applied in July to mid-September. (Mozdzer et al, 2008) Herbicide application followed by burning has shown to be relatively effective and may stimulate the native plant community recovery (Boone et al, 1987)

The NPS has completed an Environmental Assessment for the Outer Banks Group Fire Management Plan (2001) and a Finding of No Significant Impact (FONSI) was received (2002) to allow the Seashore to use prescribed burning to manage hazardous fuel loads. The Seashore conducted a prescribed burn in early 2012.

PROPOSED MITIGATION

The NCDOT proposes to restore of approximately 50 acres of phragmites dominated wetland within the Bodie Island Lighthouse Pond SNHA by rehabilitation to its former function as a brackish marsh. NCDOT proposes a 5:1 ratio for this onsite wetland restoration to offset wetland impacts associated with Phase I of B-2500. Remaining assets on the site must have regulatory agency approval prior to use as mitigation on other projects.

WORK PLAN

Goal 1: Inventory

The NPS identified that control of exotic plant infestation in the Bodie Island SNHAs is the highest priority site for the proposed mitigation for wetland impacts resulting from the bridge replacement project.. In 2008, the NPS preliminarily estimated and mapped

approximately 35 acres infested by the exotic *P. australis* within this SNHA. In 2011, NCDOT mapped 51.73 acres based on field surveys and photogrammetric analysis as shown in Figure 1 below.

Prior to site treatment, fixed photo points and vegetation survey plots will be established within the marsh area. Photo points will be established near the edges of phragmites stands. Fourteen (14) 1 square-meter plots will be randomly located within the surveyed phragmites stands outlined in yellow on Figure 1 below. Additional plots will be located outside the phragmites stands as control plots. Vegetation plots will be inventoried for % aerial coverage of phragmites within each plot. Native vegetation will also be recorded.

Figure 1



Goal 2: Treatment

The use of herbicide treatment(s) (initial and spot treatments) is recommended as the primary control method and the first step toward effective control. After the initial herbicide treatment, one or more follow-up methods at each site will be required.

NCDOT and NPS treatment plan follows procedures established in *A Guide to the Control and Management of Invasive Phragmites*, 2nd Edition published by the Michigan Department of Natural Resources in cooperation with several other state and federal agencies. The guide presents a compilation of techniques, based on four years of research and more than ten years of land managers' on-the-ground experience, to control the nonnative variety of phragmites.

NCDOT will follow the Guide's specific recommendations of Approach 2 management strategy for large, dense stands of phragmites on a wet site:

1. Treat phragmites stands with Imazapyr and Glyphosate herbicides in mid-summer or late summer. Wait at least two weeks to allow plant exposure.
2. Conduct the prescribed fire in the year following herbicide treatment either in winter (January until prior to spring green-up), if prescribed fire cannot be accomplished during the summer.
3. Check site the following growing season for phragmites regrowth and spot-treat with herbicide if needed.

ADAPTIVE MANAGEMENT

Controlling *Phragmites* infestations has proven to be a challenging and unpredictable undertaking for resource managers and landowners across the country. Therefore, adaptive management is crucial for this wetland restoration project to be successful. Adaptive management is a process that allows for decision making in spite of uncertainty, with an aim to reduce uncertainty over time via system monitoring. Our goal is that NCDOT and NPS Resource Management (RM) staff at CAHA keeps open communication throughout the duration

of the mitigation project in order to achieve success. The following outline is proposed for the duration of the monitoring period to allow for annual adjustment in the treatment plan based on success criteria.

- January-March, annually
 - Prepare and submit NPS Pesticide Use Proposal (PUP) must be submitted by NPS on annual basis, requesting authorization to apply specific herbicide.
 - NPS will notify NCDOT of authorization to apply herbicides via PUP approval from the NPS Southeast Regional Office.
 - NPS authorizes herbicides on individual basis; therefore, there shall be no substitution of herbicide without written authorization via PUP approval.
 - Submit copy of current NC Certified Applicator License(s) must be submitted to NPS annually and prior to application of herbicide
- March-June, annually
 - Identify areas aerial treatment proposed to occur
 - Initial aerial treatment area includes the entire band of marsh around the Lighthouse pond (except where spot treatment preferred)
 - Subsequent aerial treatment areas will be determined by annual evaluation
 - Identify areas spot treatment proposed to occur
 - Initial spot treatment areas include areas in close proximity of listed species as identified by field surveys and areas in close proximity to visitor use as identified by NPS
 - Subsequent spot treatment areas will be determined by annual evaluation
 - Evaluate recover of target species
 - Identify areas not on target to meet success criteria for recover of target species (bare areas)
 - Determine if supplemental planting is appropriate

- Mid Summer through mid-November, annually
 - Conduct aerial or spot application of aquatic herbicide in identified areas
 - Herbicide must be stored, handled, applied, and disposed of by a NC Certified Applicator in accordance with the label and MSDS
 - NC Certified Applicator must be on-site when herbicides are being applied
 - NC Certified Applicator is accountable for any and all individuals working under Applicator's License
 - Daily Pesticide Use Log must be maintained by applicator
- By December 31, annually
 - Pesticide Use Log must be submitted to NPS
 - Monitoring report must be submitted to NPS and agencies

AVOIDANCE MEASURES

In order to minimize adverse impacts to the resources at Bodie Island Lighthouse Pond, several mitigation measures must be put in place for proposed activities. These include, but are not limited to:

- Avoid impacts of herbicides to rare plants:
 - Physical cover for individual stems
 - Establish buffer zones around sizeable populations of rare plants
 - Minimize drift by applying herbicides with proper technique and under proper conditions through contract specifications. Table 1 below relates droplet size and expected drift.

Accuflow nozzles allow the user to customize the orifice size to accommodate different spray jobs. Each nozzle has an array of 32 needle outlets in a circular configuration. The system operates with 20 psi boom pressure and under 5 psi nozzle pressure. This boom/nozzle combination produces droplet sizes of 1000 - 1500 microns, depending on which orifice used.

Table 1: Influence of droplet size on distance of drift. (Klingman, Potts, Akesson, Yates)

Droplet diameter (microns)	Type of Droplet	Time Required to fall 10 feet	Lateral distance droplets travel in a 3 mph wind
5	Fog	66 minutes	3 miles
20	Very fine spray	4.2 minutes	1,100 feet
100	Fine spray	10 seconds	44 feet
240	Medium spray	6 seconds	28 feet
400	Coarse spray	2 seconds	8.5 feet
1,000	Fine rain	1 second	4.7 feet

- Avoid impacts to wetland soils/hydrology:
 - Use aerial application for initial treatments
 - Convert to backpack application after control established
- Avoid impacts to water quality:
 - Use herbicides that are safe for application in standing water
 - Prevent spills of contaminants from entering water bodies or wetlands
- Avoid impacts to visitor experience:
 - Perform herbicide application and prescribed burns when visitor use in the area is as minimal as possible (CAHA staff will provide preferred timeline)
 - Inform public of activities through posting signs, press releases, etc.
- Actions must be consistent with NC Coastal Area Management Act
- Prescribed burn actions must be consistent with Minimum Impact Suppression Tactics (MIST) practices and follow an approved burn plan

Goal 3: Monitoring

Monitoring the results of *Phragmites* control treatments provides critical information that will allow NPS and NCDOT to assess the efficacy of their actions at the site. NCDOT will be responsible for all monitoring activities, including coordination with NPS and NHP.

- Fixed photo points will be established across the site at edges or boundaries of phragmites stands.
- Fourteen (14) 1 square-meter plots will be randomly located within the surveyed phragmites stands as shown on Figure 1. This density is less than recommended in the NMFS guidelines but data will be supplemented by aerial photo interpretation. Three (3) additional plots will be located outside the phragmites stands as control plots.
- The vegetation component of the wetland site will be deemed successful if the following criteria are met:
 - After the first year treatment, the total aerial coverage of dense phragmites stands decreases from the current 50 acres mapped as shown on Figure 1. This will be reported in the Spring of the following year.
 - This trend of decreased aerial coverage of mapped phragmites will continue each treatment year.
 - At the end of the final monitoring year, the total aerial coverage of dense phragmites stands will be 10 acres or less with stems less than three feet tall.
- Annual reports will be prepared and distributed at the end of each treatment year.
- Subsequent year treatment areas and type of treatment (aerial or spot) will be mapped and reported in the Spring of each year.

Goal 4: Educate, Outreach, and Research

The project will provide an educational opportunity for NPS by incorporating invasive species issues into the interpretive programs provided to visitors. According to NPS, the goal of these programs “is to provide memorable and meaningful learning and recreational experiences, foster

development of a personal stewardship ethic, and broaden public support for preserving park resources. Such programs will be successful when they forge emotional and intellectual connections among park resources, visitors, the community, and park management”. Visitors may learn how to identify phragmites, the cause and effects of invasive species in our state’s natural communities and how they can help to prevent the spread of invasive species. NCDOT will continue to coordinate with NPS to notify all stakeholders and potential visitors when treatment will take place. Additionally, as large stands of phragmites die-off, it will be important to provide the visitors an explanation of what may temporarily appear as destructive, is actually crucial to restoring the natural community. To this end, NCDOT will explore installing interpretive signage with NPS near the lighthouse illustrating the needs and goals of the restoration process.

An adaptive management plan will provide a valuable site specific opportunity for the NCDOT, NPS and other stakeholders to learn and understand the best methods of treatment and how the natural community responds. This information will help provide an effective method of treatment to ensure the long-term success of phragmites control that may also be applied to other areas of the Seashore and surrounding coastal areas. Specific details regarding methods, rates and timing of pesticide application, prescribed burns and effectiveness will be recorded and available to the public and stakeholders.

SITE PROTECTION AND MAINTENANCE

The site is located completely on National Park Service land and is afforded long-term protection under federal laws and maintained under NPS regulations.

FINANCIAL ASSURANCES

NCDOT is held by permit conditions associated with B-2500 to complete the mitigation and monitoring plan for this site. NCDOT has established funds for each project and within each Division to monitor the mitigation site.

PROJECT COMMITMENTS

NCDOT will work with NPS to solicit grant funding for long term management of the site by NPS. NCDOT will also coordinate with Division and Utility companies to minimize encroachment of phragmites from outside the site along the eastern boundary.

DRAFT

REFERENCES

- Able, K.W. and Hagan, S.M. 2000. Effects of common reed (*Phragmites australis*) invasion on marsh surface macrofauna: response of fishes and decapod crustaceans. *Estuaries* 23(5): 633-646.
- Batterson, T.R. and Hall, D.W. 1984. Common reed – *Phragmites australis* (Cav.) Trin. ex Steudel. *Aquatics* 6(2): 16-17, 20.
- Benoit, L.K. and Askins, R.A. 1999. Impact of the spread of *Phragmites* on the distribution of birds in Connecticut tidal marshes. *Wetlands* 19(1): 194-208.
- Bertness, M.D., P.J. Ewanchuk, and B.R. Silliman. 2002. Anthropogenic modification of New England salt marsh landscapes. *Proceedings of the National Academy of Science* 99: 1395-1398.
- Bontje, M.P. 1987. The application of science and engineering to restore a salt marsh. pp. 16-23 *In* Proceedings of the 15th Annual Conference on Wetlands Restoration and Creation. Hillsborough Community College, Tampa, FL, USA.
- Boone, J.L., C.E. Furbish, and K. Turner. 1987. Control of *Phragmites communis*. Results of burning, cutting, and covering with plastic in a North Carolina salt marsh. Institute of Ecology, University of Georgia, CPSU Technical Report No. 42.
- Chambers, R.M., L.A. Meyerson, and K. Saltonstall. 1999. Expansion of *Phragmites australis* into tidal wetlands of North America. *Aquatic Botany* 64: 261-273.
- Fell, P. Weissbach, S.P., Jones, D.A., Fallon, M.A., Zeppieri, J.A., Faison, E.K., Lennon, K.A., Newberry, K.J., Reddington, L.K. 1998. Does invasion of oligohaline tidal marshes by reed grass, *Phragmites australis* (Cav.) Trin. ex Steud., affect the availability of prey sources for the

mummichog, *Fundulus heteroclitus* L. Journal of Experimental Marine Biology and Ecology 222: 59-77.

Findlay, S., Groffman, P., Dye, S. 2003. Effects of *Phragmites australis* removal on marsh nutrient cycling. Wetlands Ecology and Management 11(3): 157-165.

Hanson, S.R., Osgood, D.T., Yozzo, D.J. 2002. Nekton use of a *Phragmites australis* marsh on the Hudson River, New York. Wetlands 22(2): 326-337.

Hara, T., van der Toorn, J., Mook, J.H. 1993. Growth dynamics and size structure of shoots of *Phragmites australis*, clonal plant. Journal of Ecology 81: 47-60.

Leonard, L.A., Wren, P.A., Beavers, R.L. 2002. Flow dynamics and sedimentation in *Spartina alterniflora* and *Phragmites australis* marshes of the Chesapeake Bay. Wetlands 22: 415-424.

Meyerson, L.A., K. Saltonstall, L. Windham, E. Kiviat, and S. Findlay. 2000. A comparison of *Phragmites australis* in freshwater and brackish environments in North America. Wetlands Ecology and Management 8: 89-103.

Minchinton, T. E. and M. D. Bertness. 2003. Disturbance-Mediated Competition and the Spread of *Phragmites australis* in a Coastal Marsh. Ecological Applications 13(5): 1400-1416.

Mozdzer, T.J., C. J. Hutto, P.A. Clarke, and D. P. 2008. Field Efficacy of Imazapyr and Glyphosate in the Control of Non-Native *Phragmites australis*. Restoration Ecology, 16(2): 221-224.

National Invasive Species Council. 2008. 2008-2012 National Invasive Species Management Plan. 35 pp.

National Park Service. 2002. Director's Order #77-1: Wetland Protection. Available on the internet at: <http://www.nps.gov/policy/DOrders/DO77-1-Reissue.htm>

National Park Service. 2012. National Park Service Procedural Manual #77-1: Wetland Protection. Available on the internet at:

http://www.nature.nps.gov/water/wetlands/assets/docs/DO_77-1_PROC_MANUAL_2012_Revision_FINAL.pdf

Paxton, B. 2007. Potential impact of common reed expansion on threatened high-marsh bird communities on the seaside: breeding bird surveys of selected high-marsh patches. Center for Conservation Biology Technical Report Series, CCBTR-07-03. College of William and Mary, Williamsburg, VA. 19 pp.

Posey, M.H., Alphin, T.D., Meyer, D.L., and Johnson, J.M. 2003. Benthic communities of common reed *Phragmites australis* and marsh cordgrass *Spartina alterniflora* marshes in Chesapeake Bay. Marine Ecology Progress Series 261: 51-61.

Rooth, J.E., Stevenson, J.C. 2000. Sediment deposition patterns in *Phragmites australis* communities: implications for coastal areas threatened by rising sea level. Wetlands Ecol. and Manag. 8: 173-183.

Rudrappa, T., Bonsall, J., Gallagher, J., Seliskar, D., Bais, H. 2007. Root-secreted allelochemical in the noxious weed *Phragmites australis* deploys a reactive oxygen species response and microtubule assembly disruption to execute rhizotoxicity. Journal of Chemical Ecology 33: 1898-1919.

Talley, T.S., Levin, L.A. 2001. Modification of sediments and macrofauna by an invasive marsh plant. Biol. Invasions 3: 51-68.

U.S. Army Corps of Engineers. 2005. Environmental Assessment for Control of *Phragmites australis* in South Carolina. 49 pp.

Virginia Department of Conservation and Recreation. 2009. Management Plan for *Phragmites australis* on the Seaside of Virginia's Eastern Shore. Nat. Heritage Tech. Rep. 09-04. 81 pp.

Windham, L. and Ehrenfeld, J.G. 2003. Net impact of a plant invasion on nitrogen-cycling processes within a brackish tidal marsh. *Ecological Applications* 13(4): 883-896.

Windham, L. 2001. Comparison of biomass production and decomposition between *Phragmites australis* (common reed) and *Spartina patens* (salt hay grass) in brackish tidal marshes of New Jersey, USA. *Wetlands* 21: 179-188.

Windham, L. and Lathrop, R. 1999. Effects of *Phragmites australis* (common reed) invasion on above-ground biomass and soil properties in brackish tidal marsh of the Mullica River, New Jersey. *Estuaries* 22: 927-935.

US Army Corps of Engineers and US Environmental Protection Agency. 2003. Memorandum to the Field: Model Compensatory Mitigation Plan Checklist for Aquatic Resource Impacts Under the Corps Regulatory Program Pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Dated November 7, 2003. Available on the internet at <http://www.mitigationactionplan.gov/checklist.pdf>

Appendix A: Material Safety Data Sheets

Habitat – Imazapyr

Rodeo – Glyphosate

DRAFT



The Chemical Company

Safety Data Sheet

HABITAT HERBICIDE

Revision date : 2012/03/08

Version: 1.5

Page: 1/9

(30235835/SDS CPA US/EN)

1. Product and Company Identification

Company

BASF CORPORATION
100 Park Avenue
Florham Park, NJ 07932, USA

24 Hour Emergency Response Information

CHEMTREC: 1-800-424-9300
BASF HOTLINE: 1-800-832-HELP (4357)

Substance number:	000000063383
Molecular formula:	C(13) H(15) N(3) O(3). C(3) H(9) N
Chemical family:	imidazole derivative
Synonyms:	Isopropylamine salt of imazapyr

2. Hazards Identification

Emergency overview

CAUTION:
KEEP OUT OF REACH OF CHILDREN.
Avoid contact with the skin, eyes and clothing.
Avoid inhalation of mists/vapours.

See Product Label for additional precautionary statements.

State of matter: liquid
Colour: blue, clear
Odour: ammonia-like, faint odour

Potential health effects

Primary routes of exposure:

Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Acute toxicity:

Relatively nontoxic after single ingestion. Slightly toxic after short-term skin contact. Relatively nontoxic after short-term inhalation.

Irritation / corrosion:

May cause slight but temporary irritation to the eyes. May cause slight irritation to the skin.

Sensitization:

Skin sensitizing effects were not observed in animal studies.

Potential environmental effects

Safety Data Sheet

HABITAT HERBICIDE

Revision date : 2012/03/08

Version: 1.5

Page: 2/9

(30235835/SDS_CPA_US/EN)

Aquatic toxicity:

There is a high probability that the product is not acutely harmful to fish. There is a high probability that the product is not acutely harmful to aquatic invertebrates. Acutely harmful for aquatic plants.

Terrestrial toxicity:

With high probability not acutely harmful to terrestrial organisms.

3. Composition / Information on Ingredients

<u>CAS Number</u>	<u>Content (W/W)</u>	<u>Chemical name</u>
81510-83-0	$\geq 27.77 - \leq 27.8$ %	Isopropylamine salt of imazapyr
	72.2 %	Proprietary Ingredients

4. First-Aid Measures

General advice:

First aid providers should wear personal protective equipment to prevent exposure. Remove contaminated clothing. Move person to fresh air. If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or physician for treatment advice. Have the product container or label with you when calling a poison control center or doctor or going for treatment.

If inhaled:

Remove the affected individual into fresh air and keep the person calm. Assist in breathing if necessary.

If on skin:

Rinse skin immediately with plenty of water for 15 - 20 minutes.

If in eyes:

Hold eyes open and rinse slowly and gently with water for 15 to 20 minutes. Remove contact lenses, if present, after first 5 minutes, then continue rinsing.

If swallowed:

Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to by a poison control center or doctor. Never induce vomiting or give anything by mouth if the victim is unconscious or having convulsions.

Note to physician

Treatment: Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-Fighting Measures

Flash point:

Non-flammable.

Self-ignition temperature:

not self-igniting

Suitable extinguishing media:

foam, dry powder, carbon dioxide, water spray

Hazards during fire-fighting:

carbon monoxide, carbon dioxide, nitrogen oxide, nitrogen dioxide, Hydrocarbons,

If product is heated above decomposition temperature, toxic vapours will be released. The substances/groups of substances mentioned can be released if the product is involved in a fire.

Protective equipment for fire-fighting:

Firefighters should be equipped with self-contained breathing apparatus and turn-out gear.

Safety Data Sheet

HABITAT HERBICIDE

Revision date : 2012/03/08

Version: 1.5

Page: 3/9

(30235835/SDS CPA US/EN)

Further information:

Evacuate area of all unnecessary personnel. Contain contaminated water/firefighting water. Do not allow to enter drains or waterways.

6. Accidental release measures

Personal precautions:

Take appropriate protective measures. Clear area. Shut off source of leak only under safe conditions. Extinguish sources of ignition nearby and downwind. Ensure adequate ventilation. Wear suitable personal protective clothing and equipment.

Environmental precautions:

Do not discharge into the subsoil/soil. Do not discharge into drains/surface waters/groundwater. Contain contaminated water/firefighting water.

Cleanup:

Dike spillage. Pick up with suitable absorbent material. Place into suitable containers for reuse or disposal in a licensed facility. Spilled substance/product should be recovered and applied according to label rates whenever possible. If application of spilled substance/product is not possible, then spills should be contained, solidified, and placed in suitable containers for disposal. After decontamination, spill area can be washed with water. Collect wash water for approved disposal.

7. Handling and Storage

Handling

General advice:

RECOMMENDATIONS ARE FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS. PESTICIDE APPLICATORS & WORKERS must refer to the Product Label and Directions for Use attached to the product for Agricultural Use Requirements in accordance with the EPA Worker Protection Standard 40 CFR part 170. Ensure adequate ventilation. Provide good ventilation of working area (local exhaust ventilation if necessary). Keep away from sources of ignition - No smoking. Keep container tightly sealed. Protect contents from the effects of light. Protect against heat. Protect from air. Handle and open container with care. Do not open until ready to use. Once container is opened, content should be used as soon as possible. Avoid aerosol formation. Avoid dust formation. Provide means for controlling leaks and spills. Do not return residues to the storage containers. Follow label warnings even after container is emptied. The substance/product may be handled only by appropriately trained personnel. Avoid all direct contact with the substance/product. Avoid contact with the skin, eyes and clothing. Avoid inhalation of dusts/mists/vapours. Wear suitable personal protective clothing and equipment.

Protection against fire and explosion:

The relevant fire protection measures should be noted. Fire extinguishers should be kept handy. Avoid all sources of ignition: heat, sparks, open flame. Sources of ignition should be kept well clear. Avoid extreme heat. Keep away from oxidizable substances. Electrical equipment should conform to national electric code. Ground all transfer equipment properly to prevent electrostatic discharge. Electrostatic discharge may cause ignition.

Storage

General advice:

Keep only in the original container in a cool, dry, well-ventilated place away from ignition sources, heat or flame. Protect containers from physical damage. Protect against contamination. The authority permits and storage regulations must be observed.

Storage incompatibility:

General advice: Segregate from incompatible substances. Segregate from foods and animal feeds. Segregate from textiles and similar materials.

Temperature tolerance

Protect from temperatures below: 0 °C

Changes in the properties of the product may occur if substance/product is stored below indicated temperature for extended periods of time.

Safety Data Sheet

HABITAT HERBICIDE

Revision date : 2012/03/08

Version: 1.5

Page: 4/9

(30235835/SDS CPA US/EN)

Protect from temperatures above: 40 °C

Changes in the properties of the product may occur if substance/product is stored above indicated temperature for extended periods of time.

8. Exposure Controls and Personal Protection

Users of a pesticidal product should refer to the product label for personal protective equipment requirements.

Advice on system design:

Whenever possible, engineering controls should be used to minimize the need for personal protective equipment.

Personal protective equipment

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

Respiratory protection:

Wear respiratory protection if ventilation is inadequate. Wear a NIOSH-certified (or equivalent) TC23C Chemical/Mechanical type filter system to remove a combination of particles, gas and vapours. For situations where the airborne concentrations may exceed the level for which an air purifying respirator is effective, or where the levels are unknown or Immediately Dangerous to Life or Health (IDLH), use NIOSH-certified full facepiece pressure demand self-contained breathing apparatus (SCBA) or a full facepiece pressure demand supplied-air respirator (SAR) with escape provisions.

Hand protection:

Chemical resistant protective gloves, Protective glove selection must be based on the user's assessment of the workplace hazards.

Eye protection:

Safety glasses with side-shields. Tightly fitting safety goggles (chemical goggles). Wear face shield if splashing hazard exists.

Body protection:

Body protection must be chosen depending on activity and possible exposure, e.g. head protection, apron, protective boots, chemical-protection suit.

General safety and hygiene measures:

Wear long sleeved work shirt and long work pants in addition to other stated personal protective equipment. Work place should be equipped with a shower and an eye wash. Handle in accordance with good industrial hygiene and safety practice. Personal protective equipment should be decontaminated prior to reuse. Gloves must be inspected regularly and prior to each use. Replace if necessary (e.g. pinhole leaks). Take off immediately all contaminated clothing. Store work clothing separately. Hands and/or face should be washed before breaks and at the end of the shift. No eating, drinking, smoking or tobacco use at the place of work. Keep away from food, drink and animal feeding stuffs.

9. Physical and Chemical Properties

Form:	liquid	
Odour:	ammonia-like, faint odour	
Colour:	blue, clear	
pH value:	6.6 - 7.2	
Freezing point:	approx. 0 °C	(1,013.3 hPa) Information applies to the solvent.
Boiling point:	approx. 100 °C	(1,013.3 hPa) Information applies to the solvent.
Vapour pressure:	approx. 23.3 hPa	(20 °C) Information applies to the solvent.
	< 100 hPa	(50 °C) Information applies to the solvent.

Safety Data Sheet

HABITAT HERBICIDE

Revision date : 2012/03/08

Page: 5/9

Version: 1.5

(30235835/SDS_CPA_US/EN)

Density:	1.04 - 1.09 g/ml	
	1.0956 g/cm3	(15 °C)
	1.0755 g/cm3	(50 °C)
Vapour density:		not determined
Viscosity, dynamic:	approx. > 1 mPa.s	(20 °C)
Solubility in water:		miscible
Molar mass:	320.4 g/mol	

10. Stability and Reactivity

Conditions to avoid:

Avoid all sources of ignition: heat, sparks, open flame. Avoid prolonged storage. Avoid electro-static discharge. Avoid contamination. Avoid prolonged exposure to extreme heat. Avoid extreme temperatures.

Substances to avoid:

oxidizing agents, reducing agents

Hazardous reactions:

The product is chemically stable.

Decomposition products:

Hazardous decomposition products: No hazardous decomposition products if stored and handled as prescribed/indicated., Prolonged thermal loading can result in products of degradation being given off.

Thermal decomposition:

Possible thermal decomposition products:

carbon monoxide, carbon dioxide, nitrogen oxide

Stable at ambient temperature. If product is heated above decomposition temperature toxic vapours may be released. If product is heated above decomposition temperature hazardous fumes may be released.

Corrosion to metals:

Corrosive effect on: mild steel brass

Oxidizing properties:

not fire-propagating

Not an oxidizer.

11. Toxicological information

Acute toxicity

Oral:

Type of value: LD50

Species: rat (male/female)

Value: > 5,000 mg/kg

Inhalation:

Type of value: LC50

Species: rat (male/female)

Value: > 5.3 mg/l (OECD Guideline 403)

Exposure time: 4 h

An aerosol was tested.

Dermal:

Type of value: LD50

Species: rabbit (male/female)

Value: > 2,000 mg/kg

Irritation / corrosion

Safety Data Sheet

HABITAT HERBICIDE

Revision date : 2012/03/08

Version: 1.5

Page: 6/9

(30235835/SDS_CPA_US/EN)

Skin:

Species: rabbit

Result: mildly irritating

Method: Primary skin irritation test

Eye:

Species: rabbit

Result: non-irritant

Sensitization:

Skin sensitization test

Species: guinea pig

Result: Skin sensitizing effects were not observed in animal studies.

Genetic toxicity

Information on: imazapyr

No mutagenic effect was found in various tests with microorganisms and mammals.

Carcinogenicity

Information on: imazapyr

In long-term studies in rats and mice in which the substance was given by feed, a carcinogenic effect was not observed.

Reproductive toxicity

Information on: imazapyr

The results of animal studies gave no indication of a fertility impairing effect.

Development:

Information on: imazapyr

No indications of a developmental toxic / teratogenic effect were seen in animal studies.

12. Ecological Information

Fish

Information on: imazapyr

Acute:

Oncorhynchus mykiss/LC50 (96 h): > 100 mg/l

Aquatic invertebrates

Information on: imazapyr

Acute:

Daphnia magna/EC50 (48 h): > 100 mg/l

Aquatic plants

Toxicity to aquatic plants:

other swollen duckweed/EC50 (14 d): 0.0228 mg/l

The product has not been tested. The statement has been derived from products of a similar structure or composition.

Safety Data Sheet

HABITAT HERBICIDE

Revision date : 2012/03/08

Version: 1.5

Page: 7/9

(30235835/SDS_CPA_US/EN)

Non-Mammals

Information on: imazapyr

Other terrestrial non-mammals:

mallard duck/LC50: > 5,000 ppm

With high probability not acutely harmful to terrestrial organisms.

Honey bee/LD50: > 100 ug/bee

With high probability not acutely harmful to terrestrial organisms.

Degradability / Persistence

Biological / Abiological Degradation

Evaluation:

Not readily biodegradable (by OECD criteria).

Other adverse effects:

The ecological data given are those of the active ingredient. Do not release untreated into natural waters.

13. Disposal considerations

Waste disposal of substance:

Pesticide wastes are regulated. Improper disposal of excess pesticide, spray mix or rinsate is a violation of federal law. If pesticide wastes cannot be disposed of according to label instructions, contact the State Pesticide or Environmental Control Agency or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container disposal:

Rinse thoroughly at least three times (triple rinse) in accordance with EPA recommendations. Consult state or local disposal authorities for approved alternative procedures such as container recycling. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

RCRA:

This product is not regulated by RCRA.

14. Transport Information

Land transport

USDOT

Not classified as a dangerous good under transport regulations

Sea transport

IMDG

Hazard class:

9

Packing group:

III

ID number:

UN 3082

Hazard label:

9, EHSM

Marine pollutant:

YES

Proper shipping name:

ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.
(contains IMAZAPYR 23%)

Air transport

IATA/ICAO

Hazard class:

9

Safety Data Sheet

HABITAT HERBICIDE

Revision date : 2012/03/08

Version: 1.5

Page: 8/9

(30235835/SDS_CPA_US/EN)

Packing group:	III
ID number:	UN 3082
Hazard label:	9, EHSM
Proper shipping name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (contains IMAZAPYR 23%)

15. Regulatory Information

Federal Regulations

Registration status:

Crop Protection TSCA, US released / exempt

Chemical TSCA, US blocked / not listed

OSHA hazard category: Chronic target organ effects reported; ACGIH TLV established

EPCRA 311/312 (Hazard categories): Acute; Chronic

State regulations

CA Prop. 65:

There are no listed chemicals in this product.

16. Other Information

Refer to product label for EPA registration number.

Recommended use: herbicide

NFPA Hazard codes:

Health: 1 Fire: 1 Reactivity: 1 Special:

We support worldwide Responsible Care® initiatives. We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to Responsible Care is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products, and minimizing the impact of our operations on society and the environment during production, storage, transport, use and disposal of our products.

MSDS Prepared by:

BASF NA Product Regulations

msds@basf.com

MSDS Prepared on: 2012/03/08

IMPORTANT: WHILE THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION CONTAINED HEREIN ARE PRESENTED IN GOOD FAITH AND BELIEVED TO BE ACCURATE, IT IS PROVIDED FOR YOUR GUIDANCE ONLY. BECAUSE MANY FACTORS MAY AFFECT PROCESSING OR APPLICATION/USE, WE RECOMMEND THAT YOU MAKE TESTS TO DETERMINE THE SUITABILITY OF A PRODUCT FOR YOUR PARTICULAR PURPOSE PRIOR TO USE. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT

Safety Data Sheet

HABITAT HERBICIDE

Revision date : 2012/03/08

Page: 9/9

Version: 1.5

(30235835/SDS CPA US/EN)

INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE. FURTHER, YOU EXPRESSLY UNDERSTAND AND AGREE THAT THE DESCRIPTIONS, DESIGNS, DATA, AND INFORMATION FURNISHED BY OUR COMPANY HEREUNDER ARE GIVEN GRATIS AND WE ASSUME NO OBLIGATION OR LIABILITY FOR THE DESCRIPTION, DESIGNS, DATA AND INFORMATION GIVEN OR RESULTS OBTAINED, ALL SUCH BEING GIVEN AND ACCEPTED AT YOUR RISK.
END OF DATA SHEET

MATERIAL SAFETY DATA SHEET



Emergency Phone: 800-992-5994
Dow AgroSciences LLC
Indianapolis, IN 46268

RODEO* HERBICIDE

Effective Date: 3/23/04
Product Code: 84825
MSDS: 006694

1. PRODUCT AND COMPANY IDENTIFICATION:

PRODUCT: Rodeo* Herbicide

COMPANY IDENTIFICATION:

Dow AgroSciences LLC
9330 Zionsville Road
Indianapolis, IN 46268-1189

2. COMPOSITION/INFORMATION ON INGREDIENTS:

Glyphosate IPA:	CAS # 038641-94-0	53.8%
N-(phosphono-methyl) glycine, Isopropylamine Salt		
Balance, Total		46.2%

3. HAZARDOUS IDENTIFICATIONS:

EMERGENCY OVERVIEW

Clear, pale yellow liquid. May cause eye irritation. Slightly toxic to aquatic organisms.

EMERGENCY PHONE NUMBER: 800-992-5994

4. FIRST AID:

EYE: Flush eyes thoroughly with water for several minutes. Remove contact lenses after initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.

SKIN: Wash skin with plenty of water.

INGESTION: No emergency medical treatment necessary.

INHALATION: Remove person to fresh air; if effects occur, consult a physician.

NOTE TO PHYSICIAN: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE FIGHTING MEASURES:

FLASH POINT: >214°F (>101°C)

METHOD USED: Setaflash

FLAMMABLE LIMITS:

LFL: Not applicable

UFL: Not applicable

EXTINGUISHING MEDIA: Foam, CO₂, Dry Chemical

FIRE AND EXPLOSION HAZARDS: Foam fire extinguishing system is preferred because uncontrolled water can spread possible contamination. Toxic irritating gases may be formed under fire conditions.

FIRE-FIGHTING EQUIPMENT: Use positive-pressure, self-contained breathing apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES:

ACTION TO TAKE FOR SPILLS: Absorb small spills with an inert absorbent material such as Hazorb, Zorball, sand, or dirt. Report large spills to Dow AgroSciences on 800-992-5994.

7. HANDLING AND STORAGE:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:

Keep out of reach of children. Do not swallow. Avoid contact with eyes, skin, and clothing. Avoid breathing vapors and spray mist. Handle concentrate in ventilated area. Wash thoroughly with soap and water after handling and before eating, chewing gum, using tobacco, using the toilet or smoking. Keep away from food, feedstuffs, and water supplies. Store in original container with the lid tightly closed. Store above 10°F (-12°C) to keep from crystallizing.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION:

These precautions are suggested for conditions where the potential for exposure exists. Emergency conditions may require additional precautions.

EXPOSURE GUIDELINES: None established

ENGINEERING CONTROLS: Good general ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations.

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

EYE/FACE PROTECTION: Use safety glasses.

SKIN PROTECTION: No precautions other than clean body-covering clothing should be needed.

MATERIAL SAFETY DATA SHEET



Emergency Phone: 800-992-5994
Dow AgroSciences LLC
Indianapolis, IN 46268

RODEO* HERBICIDE

Effective Date: 3/23/04
Product Code: 84825
MSDS: 006694

RESPIRATORY PROTECTION: For most conditions, no respiratory protection should be needed; however, if discomfort is experienced, use a NIOSH approved air-purifying respirator.

APPLICATIONS AND ALL OTHER HANDLERS: Please refer to the product label for personal protective clothing and equipment.

9. PHYSICAL AND CHEMICAL PROPERTIES:

APPEARANCE: Clear, pale yellow liquid

DENSITY: 10.0 - 10.5 lbs/gal

pH: 4.8 - 5.0

ODOR: None

SOLUBILITY IN WATER: Miscible

SPECIFIC GRAVITY: 1.21 gm/L

FREEZING POINT: -7°F - -10°F (-21°C - -25°C)

10. STABILITY AND REACTIVITY:

STABILITY: (CONDITIONS TO AVOID) Stable under normal storage conditions.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Galvanized or unlined steel (except stainless steel) containers or spray tanks may produce hydrogen gas which may form a highly combustible gas mixture.

HAZARDOUS DECOMPOSITION PRODUCTS: None known.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION:

EYE: May cause slight temporary eye irritation. Corneal injury is unlikely.

SKIN: Essentially non-irritating to skin. Prolonged skin contact is unlikely to result in absorption of harmful amounts. The LD₅₀ for skin absorption in rabbits is >5000 mg/kg. Did not cause allergic skin reactions when tested in guinea pigs.

INGESTION: Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts. The oral LD₅₀ for rats is >5000 mg/kg.

INHALATION: Brief exposure (minutes) is not likely to cause adverse effects. The aerosol LC₅₀ for rats is >6.37 mg/L for 4 hours.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: For a similar material, glyphosate, in animals, effects have been reported on the following organ: liver.

CANCER INFORMATION: A similar material, glyphosate, did not cause cancer in laboratory animals.

TERATOLOGY (BIRTH DEFECTS): For glyphosate IPA, available data are inadequate for evaluation of potential to cause birth defects.

REPRODUCTIVE EFFECTS: For glyphosate IPA, available data are inadequate to determine effects on reproduction.

MUTAGENICITY: For a similar material, glyphosate, in-vitro and animal genetic toxicity studies were negative.

12. ECOLOGICAL INFORMATION:

ENVIRONMENTAL DATA:

ECOTOXICOLOGY:

Material is practically non-toxic to aquatic organisms on an acute basis (LC₅₀ or EC₅₀ is >100 mg/L in most sensitive species tested).

Acute LC₅₀ for rainbow trout (*Oncorhynchus mykiss*) is >2500 mg/L.

Acute immobilization EC₅₀ in water flea (*Daphnia magna*) is 918 mg/L.

Material is practically non-toxic to birds on an acute basis (LD₅₀ is >2000 mg/kg).

Acute oral LD₅₀ in bobwhite (*Colinus virginianus*) is >2000 mg/kg.

The LC₅₀ in earthworm *Eisenia foetida* is >1000 mg/kg.

Acute contact LD₅₀ in honey bee (*Apis mellifera*) is >100 µg/bee.

Acute oral LD₅₀ in honey bee (*Apis mellifera*) is >100 µg/bee.

Growth inhibition EC₅₀ in green alga (*Selenastrum capricornutum*) is 127 mg/L.

Growth inhibition EC₅₀ in duckweed (*Lemna sp.*) is 24.4 mg/L.

13. DISPOSAL CONSIDERATIONS:

DISPOSAL METHOD: If wastes and/or containers cannot be disposed of according to the product label directions, disposal of this material must be in accordance with your local or area regulatory authorities.

MATERIAL SAFETY DATA SHEET



Emergency Phone: 800-992-5994
Dow AgroSciences LLC
Indianapolis, IN 46268

RODEO* HERBICIDE

Effective Date: 3/23/04
Product Code: 84825
MSDS: 006694

This information presented below only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations.

If the material as supplied becomes a waste, follow all applicable regional, national and local laws and regulations.

14. TRANSPORT INFORMATION:

U.S. DEPARTMENT OF TRANSPORTATION (DOT) INFORMATION:

For all package sizes and modes of transportation:
This material is not regulated for transport.

15. REGULATORY INFORMATION:

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

U.S. REGULATIONS

SARA 313 INFORMATION: To the best of our knowledge, this product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Not to have met any hazard category

TOXIC SUBSTANCES CONTROL ACT (TSCA): All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

STATE RIGHT-TO-KNOW: This product is not known to contain any substances subject to the disclosure requirements of

New Jersey
Pennsylvania

OSHA HAZARD COMMUNICATION STANDARD: This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND): To the best of our knowledge, this product contains no chemical subject to reporting under CERCLA.

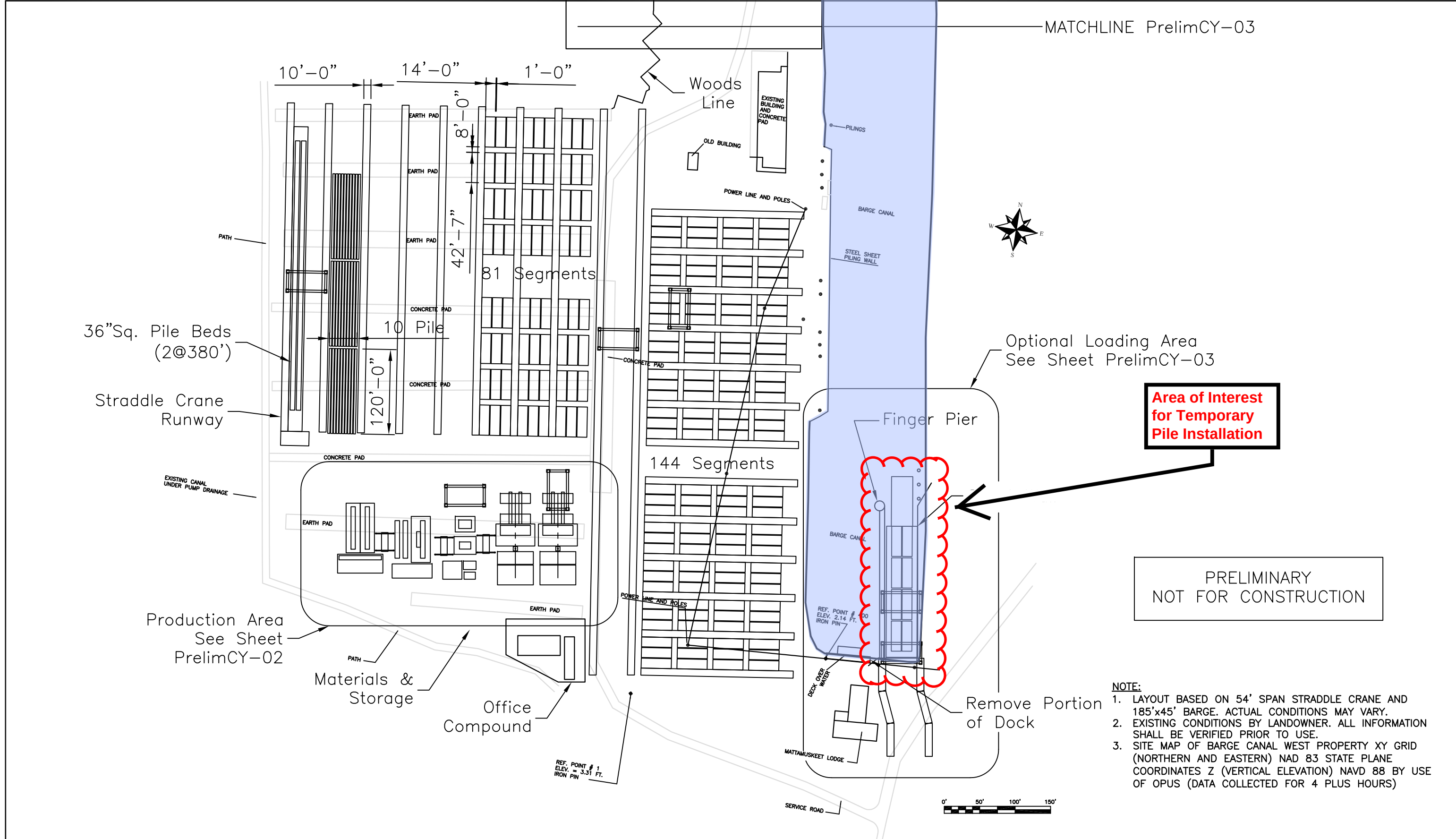
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

CATEGORY	RATING
Health	1
Flammability	1
Reactivity	0

16. OTHER INFORMATION:

MSDS STATUS: Revised Sections: 3,4,11,12,13,14 & 15
Reference: DR-0361-8028
Replaces MSDS Dated: 1/12/00
Document Code: D03-148-002
Replaces Document Code: D03-148-001

The Information Herein Is Given In Good Faith, But No Warranty, Express Or Implied, Is Made. Consult Dow AgroSciences For Further Information.



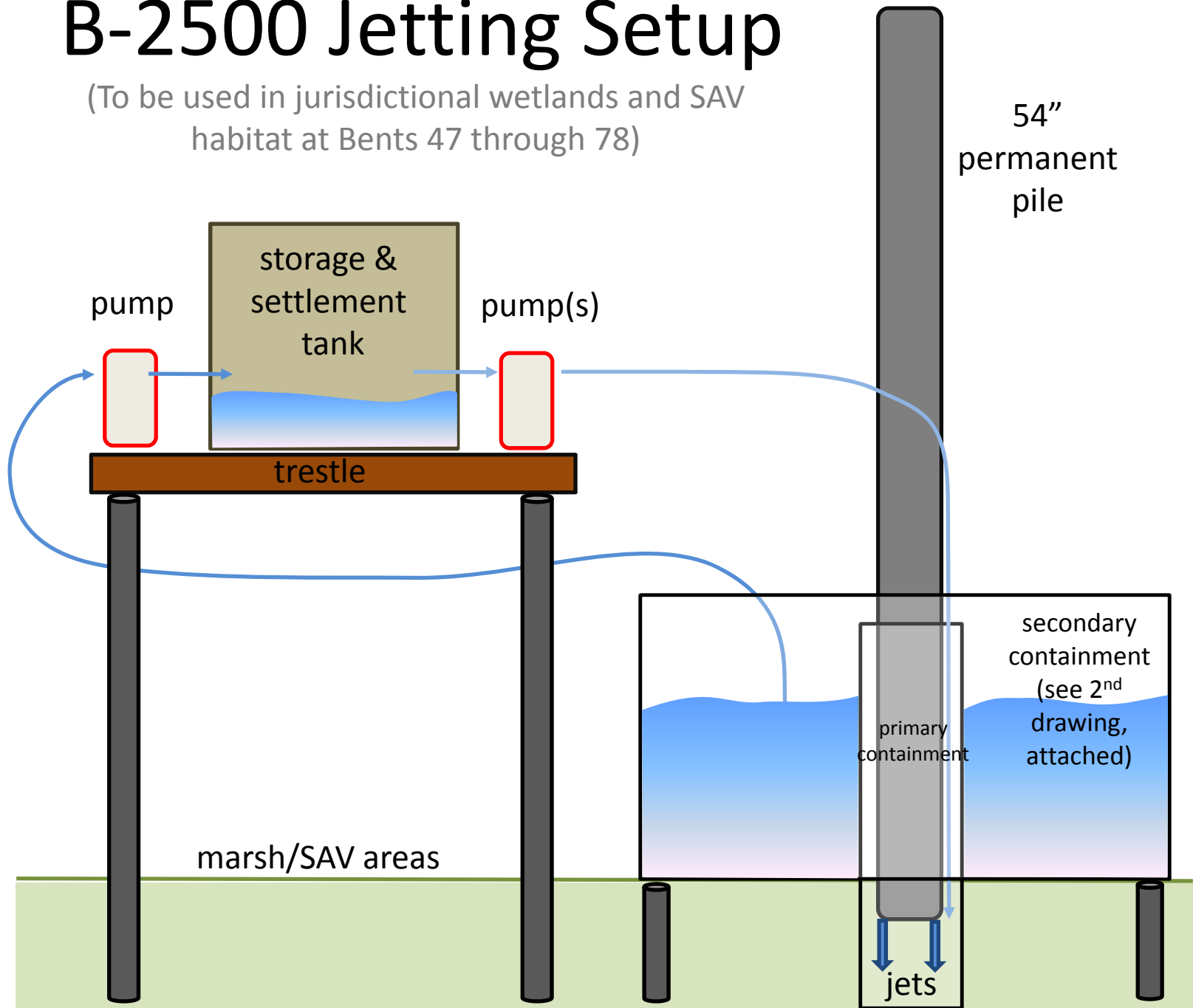
- NOTE:
1. LAYOUT BASED ON 54' SPAN STRADDLE CRANE AND 185'x45' BARGE. ACTUAL CONDITIONS MAY VARY.
 2. EXISTING CONDITIONS BY LANDOWNER. ALL INFORMATION SHALL BE VERIFIED PRIOR TO USE.
 3. SITE MAP OF BARGE CANAL WEST PROPERTY XY GRID (NORTHERN AND EASTERN) NAD 83 STATE PLANE COORDINATES Z (VERTICAL ELEVATION) NAVD 88 BY USE OF OPUS (DATA COLLECTED FOR 4 PLUS HOURS)

DESIGNED	msg	10/19/11	REVISIONS				SPECIFICATIONS AND REFERENCE DRAWINGS		 PCL Civil Constructors, Inc. 3737 Glenwood Ave, Ste. 100 Raleigh, NC 27612	BONNER BRIDGE DARE COUNTY NCDOT	SEAL	PRELIMINARY CASTING YARD LAYOUT	
DRAWN	msg	10/19/11	REV	DATE	DESCRIPTION	BY	CHKD	SPECIFICATION or DRAWING					
		DATE	-										
CHECKED													
		DATE											
APPROVED													
		DATE											

PCL Civil JOB No. 5511004	DRAWING No. PrelimCY-01
SUPERSEDES PRINTS OF THIS DRAWING WITH REVISIONS PREVIOUS TO →	

B-2500 Jetting Setup

(To be used in jurisdictional wetlands and SAV habitat at Bents 47 through 78)



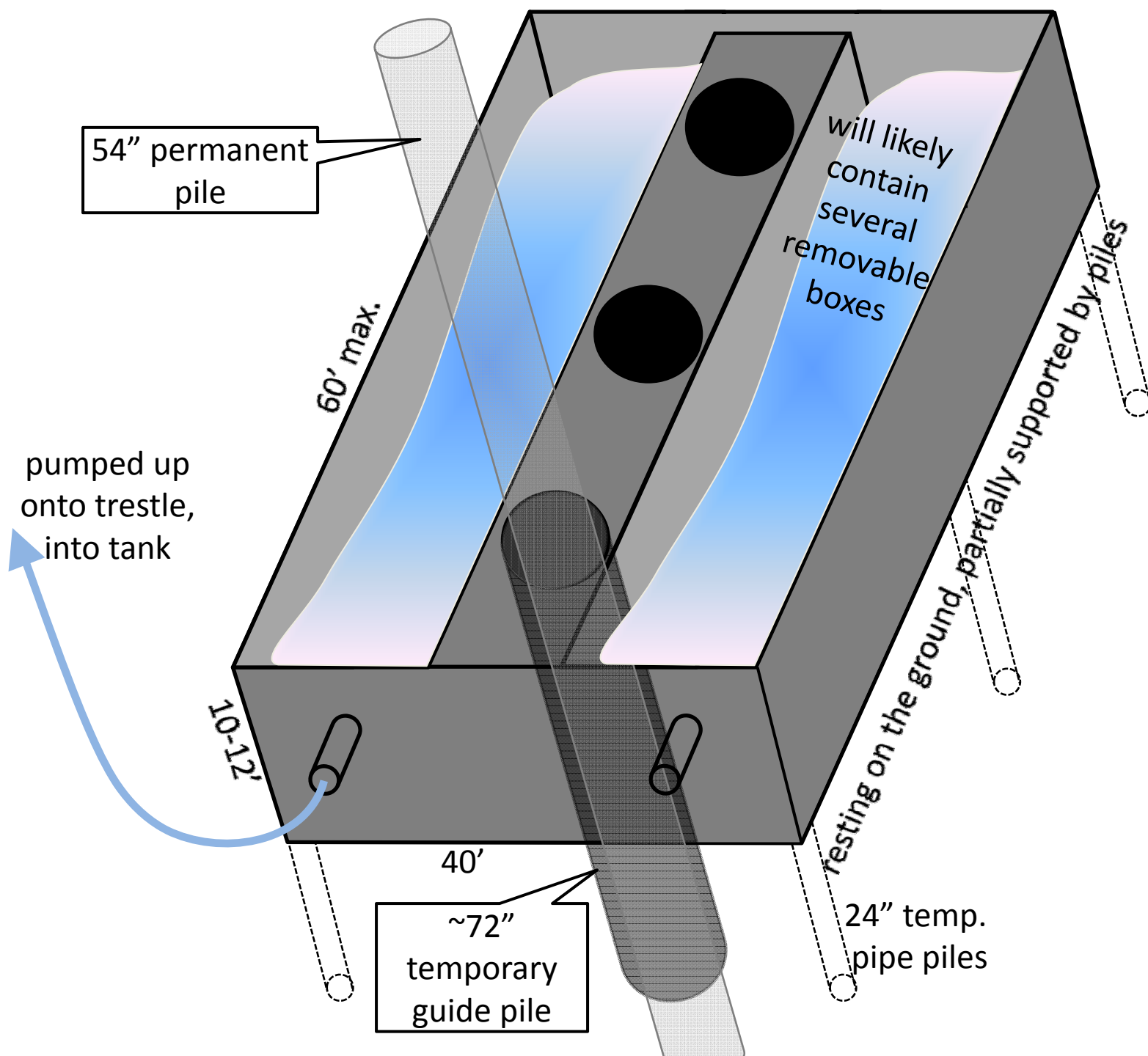


Table 1. Summary Comparison of Impacts for All Phases of Selected Alternative

	Nourishment	Road North/Bridge South	All Bridge	Phased Approach/ Rodanthe Bridge	Phased Approach/ Rodanthe Nourishment
	NC 12 Transportation Management Plan Alternative (Selected) ¹				
Community and Visual Impacts					
Residential Relocations	0	2	2	6	0
Business Relocations	0	5	5	7	0
Cemetery Impacts	None	Proposed right-of-way would cross cemetery, but no known gravesites would be affected.		None	
Anticipated Need for Refuge Compatibility Determination	Compatibility Determination expected (for all alternatives that use Refuge lands outside the existing NC 12 easement).			No Compatibility Determination required.	Compatibility Determination expected (for all alternatives that use Refuge lands outside the existing NC 12 easement).
Economic Impact of a Breach in Hatteras Island	The economic impact (measured as a reduction in retail sales) of a breach open for three months would be \$5.7, \$46.3, and \$146.7 million in the off-peak, middle, and peak seasons, respectively. Jobs and tax revenue also would be lost.				
Rodanthe Community Cohesion and Accessibility	No impact.			0.8 mile (1.3 kilometers) of bridge would bisect community and make vehicle access circuitous.	0.3 mile (0.5 kilometer) of bridge would bisect community and make vehicle access circuitous.
Noise Impact	2 residential receptors exceeding FHWA NAC	3 residential receptors exceeding FHWA NAC, and 3 residential receptors (including 1 of the 3 exceeding FHWA NAC) and 1 business receptor with substantial noise increases		3 residential receptors exceeding FHWA NAC	2 residential receptors exceeding FHWA NAC
Utilities Cost to Relocate (in millions)	\$12.1	\$15.0	\$17.4	\$17.4	\$17.4
Visual Impact	Sizable visual intrusion into the Phase I (Oregon Inlet) area because the bridge is higher and longer than the existing structure. No visual impacts in the Refuge or Rodanthe outside of the Phase I area.	Sizable visual intrusion into the Phase I (Oregon Inlet) area because the bridge is higher and longer than the existing structure. Panoramic views of Pamlico Sound from homes along shoreline in Rodanthe would be affected.	Sizable visual intrusion into the Phase I (Oregon Inlet) area because the bridge is higher and longer than the existing structure. Sizable visual intrusion into the landscape of the Refuge over the entire length of the alternative. Panoramic views of Pamlico Sound from homes along shoreline in Rodanthe would be affected.	Sizable visual intrusion into the Phase I (Oregon Inlet) area because the bridge is higher and longer than the existing structure. Sizable visual intrusion into the landscape of the Refuge over the entire length of the alternative. 0.8 mile (1.3 kilometers) of elevated structure would substantially affect views in Rodanthe.	Sizable visual intrusion into the Phase I (Oregon Inlet) area because the bridge is higher and longer than the existing structure. Sizable visual intrusion into the landscape of the Refuge over the entire length of the alternative. 0.3 mile (0.5 kilometer) of elevated structure would substantially affect views in Rodanthe near its border with the Refuge.

Table 1 (continued). Summary Comparison of Impacts for All Phases of Selected Alternative

	Nourishment	Road North/Bridge South	All Bridge	Phased Approach/ Rodanthe Bridge	Phased Approach/ Rodanthe Nourishment
NC 12 Transportation Management Plan Alternative (Selected) ¹					
Cultural Resource Impacts					
Section 4(f) Resources Affected					
• (Former) Oregon Inlet US Coast Guard Station	No use.				
• Seashore on Bodie Island	Approximately 6.3 acres (2.6 hectares) affected; however, Section 4(f) is not applicable, as the impacts resulting from relocating NC 12 from its current alignment through the Seashore would not be considered a use as defined in 23 CFR 774.17.				
• Seashore on Hatteras Island and Refuge	3.2 acres (1.3 hectares) with Phase I, then 19.9 acres (8.1 hectares) used primarily for new dunes plus periodic nourishment of 6.3 miles (10.1 kilometers) of seashore.	93.2 acres (37.7 hectares) used primarily for new highway easement, including 3.2 acres (1.3 hectares) with Phase I.	92.2 acres (37.3 hectares) used primarily for new highway easement, including 3.2 acres (1.3 hectares) with Phase I.	3.2 acres (1.3 hectares) with Phase I, then no additional permanent use (constructive use within Refuge), future phases contained within existing highway easement.	3.2 acres (1.3 hectares) with Phase I, then minor amount used for periodic nourishment of 1,500 feet (457 meters) of seashore; generally contained within existing highway easement.
• Rodanthe Historic District	No use.				
Parks and Recreation Impacts					
General Refuge Access	Little change in access. Refuge facilities protected from future beach erosion.	Paved road at grade through northern portion of Refuge would maintain existing unrestrained access to the Refuge areas with visitor facilities, but bridge in southern portion of Refuge would reduce access in that area.	Access focused on three points; direct access to some Refuge visitor facilities lost.	Access focused on two points; direct access to some Refuge visitor facilities lost.	
Refuge Fishing Access	No fishing catwalks; alternate access to be provided; beach fishing access unaffected.	No fishing catwalks; alternate access to be provided; beach fishing access maintained except at southern end.	No fishing catwalks; alternate access to be provided; beach fishing access limited to 3 locations.	No fishing catwalks; alternate access to be provided; beach fishing access limited to 2 locations.	
Coastal Conditions Impacts					
Need for Terminal Groin Retention	Retain.				
Potential for Breach and Need for Closing Breach to Maintain NC 12	Nourishment would reduce the risk of a breach. Any breaches through the Refuge would need to be closed.	Breaches in northern portions of the Refuge are not expected through 2060, but if they occur would need to be closed; area potentially affected by sound-side erosion at the northern end of Hatteras Island bridged.	Potential breach areas bridged. No need to close future breaches.		

Table 1 (concluded). Summary Comparison of Impacts for All Phases of Selected Alternative

	Nourishment	Road North/Bridge South	All Bridge	Phased Approach/ Rodanthe Bridge	Phased Approach/ Rodanthe Nourishment
NC 12 Transportation Management Plan Alternative (Selected) ¹					
Natural Resources Impacts					
Biotic Communities Fill and Pile Impacts, acres (hectares)					
• Submerged Aquatic Vegetation (SAV)	0.2 (0.1)	0.3 (0.1)	0.3 (0.1)	0.2 (0.1)	0.2 (0.1)
• Wetlands	2.4 (1.0)	50.8 (20.6)	9.7 (3.9)	1.7 (0.7)	1.5 (0.6)
• Uplands – Natural and Man Dominated	25.5 (10.3)	18.0 (7.3)	8.5 (3.4)	11.9 (4.8)	7.8 (3.2)
• Impoundments	0.0 (0.0)	23.0 (9.3)	0.1 (0.0)	0.0 (0.0)	0.0 (0.0)
• Aquatic Bottom	2.3 (0.9)	4.1 (1.7)	3.6 (1.5)	2.1 (0.9)	2.2 (0.9)
• Total	30.4 (12.3)	96.2 (39.0)	22.2 (8.9)	15.9 (6.5)	11.7 (4.8)
Allow for Natural Shoreline Movement once all phases are complete	No	Generally except for groin retention and some dunes.	Yes, except for groin retention.		Generally, except for groin retention and some nourishment.
Protected Species Adversely Affected					
• Piping Plover and Critical Habitat	Likely disturbance to nesting on beach.				
• Leatherback Sea Turtle/ Green Sea Turtle/Loggerhead Sea Turtle	Likely disturbance to nesting on beach; not likely to adversely affect in ocean.				
• Seabeach Amaranth	Beach nourishment could affect habitat.	Not likely to adversely affect.			Beach nourishment could affect habitat.

¹The impacts shown for the six Parallel Bridge Corridor alternatives reflect the range of reasonably foreseeable impacts associated with the Selected Alternative.



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, NCDWM, 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 (Loefering 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 Trinidad 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; Tröng 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 reneest 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 (Loevinger 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, Loevinger 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, Loevinger 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.

Loevinger 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 Loevinger 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 Elcna 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 Trustum 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 (McConaughy 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).

Factors affecting sea turtles during portions of their life cycle

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 effects 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 kempi*) 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 primarily 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 effect 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 leatherback 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 effects 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 effects 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 detectable. 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 killdeer. *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. McConnaughey, 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. Hitepuw, M. Zein, S.R. Benson, G. Petro, J. Pita, V. Rei, L. Ambio, and J. Bakarbesy. 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 Pcte 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&dctype=article](http://research.myfwc.com/engine/download_redirection_process.asp?file=Statewide_Totals_1979_-_2006.pdf&objid=11812&dctype=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. Bakarbesy. 2007. Population status and interesting 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. Zeveloff and C.E. Zeveloff (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.
- Loefering, 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.
- Loefering, 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.

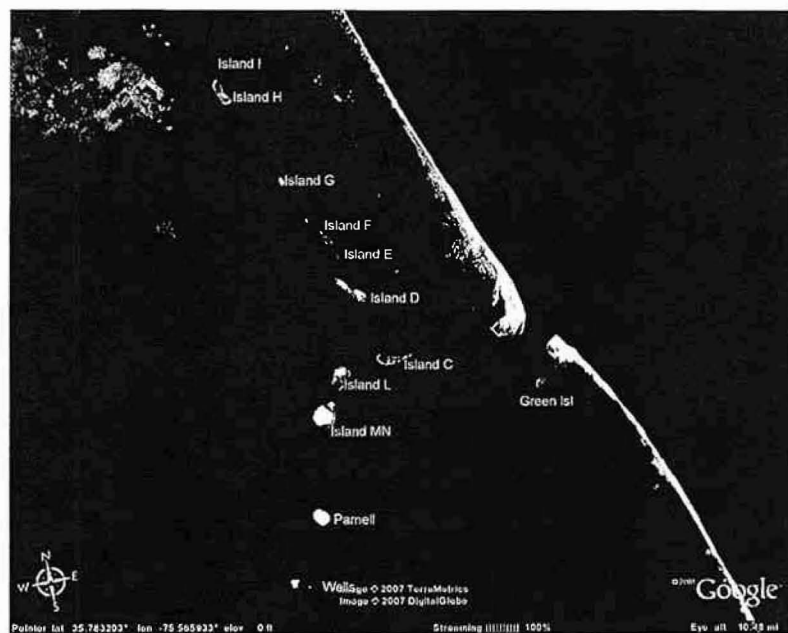
- Philibosian, R. 1976. Disorientation of hawksbill turtle hatchlings (*Eretmochelys imbricata*) by stadium lights. *Copeia* 1976:824.
- Plissner, J.H., and S.M. Haig. 1997. 1996 international piping plover census. Report to U.S. Geological Survey, Biological Resources Division, Forest and Rangeland 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.L., 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 synthèse des recherches relatives au pluvier siffleur (*Charadrius melodus*) effectuées aux Iles-de-la-Madeleine de 1987 à 1991. Association québécoise 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 palliatus*) 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.
- Snoover, 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/Spacecounts_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 abundance 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. Saunders 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 off-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-SEFSC-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-SEFSC-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.



E-67



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701-5505
(727) 824-5312, FAX 824-5309
<http://sero.nmfs.noaa.gov>

AUG - 4 2008

F/SER31:SKB-EH

John F. Sullivan, III, P.E.
Division Administrator
North Carolina Division
U.S. Department of Transportation
Federal Highway Administration
310 New Bern Avenue, Ste. 410
Raleigh, NC 27601

Dear Mr. Sullivan:

This responds to your May 30, 2008, letter and March 2008 Biological Assessment (BA), requesting informal Endangered Species Act (ESA) section 7 consultation by the National Marine Fisheries Service (NMFS) regarding construction of a new bridge (and demolition of the currently-existing bridge) over Oregon Inlet in Dare County, North Carolina. The North Carolina Department of Transportation (NCDOT) has determined that the proposed action may affect, but is unlikely to adversely affect, sea turtles and shortnose sturgeon under NMFS' jurisdiction. This consultation is being conducted with NCDOT as designated by the Federal Highway Administration, North Carolina Division (letter dated April 8, 2003), pursuant to 50 CFR 402.08. NMFS' determinations regarding the effects of the proposed action are based on the description of the action in this informal consultation. You are reminded that any changes to the proposed action may negate the findings of the present consultation and may require reinitiation of consultation with NMFS.

NCDOT proposes to replace the Herbert C. Bonner Bridge and then remove the existing structure. Bonner Bridge is part of state highway NC 12 and provides a highway connection between Hatteras Island and Bodie Island. The bridge replacement and removal is Phase I of the Rodanthe Bridge Alternative Project that includes elevating an additional 12.5 miles of NC 12 over Pea Island (Phases II to IV). This consultation includes and is limited to the impacts of Phase I, the demolition and replacement of Bonner Bridge, as it is the only portion of the project that involves in-water work that may impact species listed under the ESA under NMFS' purview.

The mid-span of the existing bridge is located at approximately 35.770594°N, 75.534906°W. The new Bonner Bridge will begin at the southern terminus of the existing structure on Hatteras Island and extend north across Oregon Inlet for 2.6 miles, ending near the northern terminus of the existing structure on Bodie Island. Sixteen to 24 piles (66-inch diameter, pre-stressed concrete cylinder) will be used per bridge foundation; a total of 46 foundations are estimated for

the bridge span. An additional eight piles will be required at each of the two approach spans (16 total). Piles will be placed by a combination of jetting and driving. The total pile footprint for the Bonner Bridge is estimated at approximately 0.5 acre. No de-watering is required; no cofferdams will be utilized during construction. Total construction duration and timing associated with Phase I of the project is 3.5 years (42 months) including 32 months of underwater work from 2009 to 2013 (BA, p. 7). No time-of-year restrictions are assumed during project construction and demolition of Bonner Bridge.

After the new bridge is constructed, the old structure will be removed. The substructure will be mechanically removed to at least 25 feet below the mean low water. The superstructure concrete dock will be broken into smaller pieces by sawing and jack hammering. Deck pieces and superstructure beams and girders will be loaded onto a barge by a crane and towed, or placed onto trucks and transported via the work bridge. No debris or components from either structure will be allowed to enter into the water or remain on the benthos following construction or demolition. No explosives will be used. In-water disposal of the concrete superstructure is not authorized.

Temporary work bridges may be constructed. While there are numerous alternatives for work-bridge construction and removal, normal activities include: driving of piles, installation of wooden deck materials, and mechanical removal of support piles by either cutting them off at the substrate or pulling up via cranes. Further, materials or debris are not permitted to enter the water at any time, or remain on the benthos following construction or demolition. The applicant specifies that the NCDOT Standard Specifications will be followed; Section 402 specifies that leaving remnant materials in place is not permitted, and removal of components from the water is to be done in such a fashion as to minimize siltation. Work bridges are expected to be constructed over wetlands as well as open water, and turbidity will be minimized when possible and practicable in the areas of known submerged aquatic vegetation (SAV).

For much of the project area, construction barges will float above the bottom of the inlet without the need for dredging a flotation channel. Dredging will be required in areas where water depths are less than 6 feet; where dredging is needed for a barge channel (120 feet wide), it will be done to a depth of -8 feet. It is expected that the barge channel will require continuous dredging to maintain; dredging will be conducted with either a pipeline or cutterhead dredge, hopper dredges are not authorized. Dredged work channels would be restricted to open water or nearby unvegetated shallow-water areas to the greatest extent practicable. Materials dredged from the channel may be deposited in-water, but SAV and hardbottom areas will be avoided. Following Phase I, the channel will refill naturally.

NCDOT will implement a special provision for the protection of threatened and/or endangered species; it will comply with NMFS' March 23, 2006, Sea Turtle and Smalltooth Sawfish Construction Conditions (enclosed) that restrict in-water activities when listed species are observed in the project area. However, NMFS agrees with NCDOT that bridge construction or demolition activities do not need to stop when a protected species is sighted in the proximity of construction *if the construction activities are not in the water* (see NCDOT response letter dated May 30, 2008, Response 1). The in-water moratorium prohibits pile installation and removal



and activities associated with bridge construction and demolition when listed species are present, but does not restrict terrestrial activity.

Federally-listed species that may occur in the area of this project are below. No other listed species under the jurisdiction of NMFS occur in the action area, nor is designated critical habitat present.

Common Name	Scientific Name	Status
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	Endangered
hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered
green sea turtle ¹	<i>Chelonia mydas</i>	Threatened
loggerhead sea turtle	<i>Caretta caretta</i>	Threatened
leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered
shortnose sturgeon	<i>Acipenser brevirostrum</i>	Endangered

Among the five species of sea turtles that may occur in or near the project area, some sea turtle species are much more likely to be present in the project area than others. The loggerhead sea turtle is the most common species in the project area, and green and Kemp's ridley sea turtles also occur in the project area, though considerably less frequently. Leatherbacks and hawksbills are very unlikely to be present due to their foraging and life history characteristics. Leatherbacks are primarily pelagic feeders, foraging mostly on jellyfish in deeper, offshore waters, though they will occasionally follow their wind-driven prey closer inshore. Sponges, the preferred foraging habitat for hawksbills, are likely sparse in the vicinity of Bonner Bridge, so hawksbill presence is likely to be very rare. These species will not be considered further in this consultation. Shortnose sturgeon have been largely extirpated from North Carolina waters. NMFS believes shortnose sturgeon are unlikely to be present in the project area (S. Bolden, pers. comm. to NCDOT, November 19, 2007); this species will not be considered further in this consultation.

Project impacts to foraging habitat differ between the three sea turtle species that may be affected by the proposed action. Adult green turtles are known to feed on seagrasses; therefore, they may be found in the nearshore area on the leeward side of Bodie Island where they may be encountered by the dredge maintaining the channel. Kemp's ridley and loggerhead sea turtles may be found foraging in the vicinity of the dredged channel and other project areas, as they are known to forage in any area with adequate food availability, including hard-bottom, submerged aquatic vegetation, oyster reefs, and sand and mud substrates, consuming crabs and other invertebrates.

NMFS believes that the project is not likely to adversely affect sea turtles under our purview (see 50 CFR 224.101(c) that delineates jurisdiction for sea turtles to NMFS while they are in the water, and to U.S. Fish and Wildlife Service while on land). We have analyzed the proposed action and believe the only routes of potential effects to sea turtles are from interactions with construction machinery, temporary construction-associated turbidity, avoidance of the area

¹ Green turtles in U.S. waters are listed as threatened except for the Florida breeding population that is listed as endangered.

resulting in lost nesting or foraging opportunities, disruption of hatchling sea-finding behavior, and obstructed passage through Oregon Inlet during bridge demolition/construction. These potential effects will be discountable and/or insignificant based on the following: 1) Implementation of construction guidelines will aid in preventing interaction with any turtles that may pass through the project site; 2) sea turtles are highly mobile and will be able to avoid the area during the period of construction; 3) hopper dredges will not be used (rapidly-moving hopper dredges are known to entrain sea turtles in their suction dragheads; however, NMFS has previously determined that non-hopper-type dredging methods (e.g., clamshell, cutterhead, and hydraulic pipeline dredging) are unlikely to adversely affect these species, presumably because turtles are able to detect and move away from the noisy and/or slowly-approaching draghead and thus avoid entrainment); 4) sea turtles will still be able to forage underneath the bridge post-construction, and the project will impact only a very small portion of the available foraging habitat (sea turtles will be able to forage in nearby areas even during demolition and construction); 5) the area does not provide habitat that would be considered of outstanding or higher value than alternative, nearby habitat available to sea turtles, such that long-term avoidance of the entire project area (which is highly unlikely) would have detrimental effects on them, even over the project life (3.5 years); 6) turbidity associated with construction would be limited to that occurring during dredging for barge access and pile driving, and occur in a relatively small portion of Oregon Inlet at any one time; and 7) due to the broad width of Oregon Inlet where the bridge spans it, sea turtle passage into or out of the inlet will not be significantly impeded during demolition, construction, or by the finished construction.

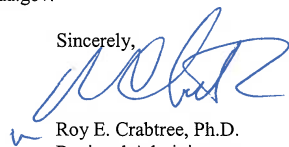
There is potential sea turtle nesting habitat near the project area; however, NMFS believes that bridge demolition and construction activities will have discountable and/or insignificant effects on sea turtles' in-water behavior, including mating, nesting females' approaches to potential nesting sites, and emergent hatchlings' sea-finding behavior or ability. No permanent light fixtures would be installed on the bridge or the approaches, and correct light management would include the use of low-wattage, long-wavelength lighting, which is either shielded, such that the light is visible only on the road, or embedded in the roadway itself (BA, p. 43). Furthermore, NCDOT has completed ESA section 7 consultation with the U.S. Fish and Wildlife Service on potential project impacts to nesting sea turtles.

This concludes NCDOT's consultation responsibilities under the ESA for species under NMFS' purview. Be advised that the consultation must be initiated if a take occurs or new information reveals effects of the action not previously considered, or the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action.

We have enclosed information on other statutory requirements that may apply to this action, and on NMFS' Public Consultation Tracking System that allows you to track the status of ESA consultations. We look forward to continued cooperation with NCDOT in conserving our endangered and threatened resources.

If you have any questions, please contact Dr. Stephanie Bolden, fisheries biologist, at (727) 824-5312, or by e-mail at stephania.bolden@noaa.gov.

Sincerely,



Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosures (2)

cc: F/SER47 – R. Sechler

File: 1514-22.L.2 NCDOT
Ref: I/SER/2008/03396

**PCTS Access and Additional Considerations for ESA Section 7 Consultations
(Revised 5-13-2008)**

Public Consultation Tracking System (PCTS) Guidance: PCTS is an online query system at <https://pcts.nmfs.noaa.gov/> that allows federal agencies and U.S. Army Corps of Engineers' (COE) permit applicants and their consultants to ascertain the status of NMFS' Endangered Species Act (ESA) and Essential Fish Habitat (EFH) consultations, conducted pursuant to ESA section 7, and Magnuson-Stevens Fishery Conservation and Management Act's (MSA) sections 305(b)2 and 305(b)(4), respectively. Federal agencies are required to enter an agency-specific username and password to query the Federal Agency Site. The COE "Permit Site" (no password needed) allows COE permit applicants and consultants to check on the current status of Clean Water Act section 404 permit actions for which NMFS has conducted, or is in the process of conducting, an ESA or EFH consultation with the COE.

For COE-permitted projects, click on "Enter Corps Permit Site." From the "Choose Agency Subdivision (Required)" list, pick the appropriate COE district. At "Enter Agency Permit Number" type in the COE district identifier, hyphen, year, hyphen, number. The COE is in the processing of converting its permit application database to PCTS-compatible "ORM." An example permit number is: SAJ-2005-000001234-IPS-1. For the Jacksonville District, which has already converted to ORM, permit application numbers should be entered as SAJ (hyphen), followed by 4-digit year (hyphen), followed by permit application numeric identifier with no preceding zeros. For example: SAJ-2005-123; SAJ-2005-1234; SAJ-2005-12345.

For inquiries regarding applications processed by COE districts that have not yet made the conversion to ORM (e.g., Mobile District), enter the 9-digit numeric identifier, or convert the existing COE-assigned application number to 9 numeric digits by deleting all letters, hyphens, and commas; converting the year to 4-digit format (e.g., -04 to 2004); and adding additional zeros in front of the numeric identifier to make a total of 9 numeric digits. For example: AL05-982-F converts to 200500982; MS05-04401-A converts to 200504401. PCTS questions should be directed to Eric Hawk at Eric.Hawk@noaa.gov. Requests for username and password should be directed to PCTS.Usersupport@noaa.gov.

EFH Recommendations: In addition to its protected species/critical habitat consultation requirements with NMFS' Protected Resources Division pursuant to section 7 of the ESA, prior to proceeding with the proposed action the action agency must also consult with NMFS' Habitat Conservation Division (HCD) pursuant to the MSA requirements for EFH consultation (16 U.S.C. 1855 (b)(2) and 50 CFR 600.905-.930, subpart K). The action agency should also ensure that the applicant understands the ESA and EFH processes; that ESA and EFH consultations are separate, distinct, and guided by different statutes, goals, and time lines for responding to the action agency; and that the action agency will (and the applicant may) receive separate consultation correspondence on NMFS letterhead from HCD regarding their concerns and/or finalizing EFH consultation.

Marine Mammal Protection Act (MMPA) Recommendations: The ESA section 7 process does not authorize incidental takes of listed or non-listed marine mammals. If such takes may occur an incidental take authorization under MMPA section 101 (a)(5) is necessary. Contact Ken Hollingshead of our NMFS Headquarters' Protected Resources staff at (301) 713-2323 for more information on MMPA permitting procedures.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

- a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.
- b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.
- c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.
- d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.
- e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.
- f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.
- g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006

O:\forms\Sea Turtle and Smalltooth Sawfish Construction Conditions.doc



Jamison, John R.

From: Coletti, Domenic
Sent: Wednesday, December 21, 2011 7:38 AM
To: Stull, Kirk A.; Jamison, John R.; Trefzger, Kenneth
Cc: Jim Schneiderman; Tom Warren
Subject: FW: B-2500 Offsite Stormwater Treatment

See below... offsite mitigation issue is closed. No offsite mitigation needed.

From: Clawson, Marshall W [mailto:mclawson@ncdot.gov]
Sent: Tuesday, December 20, 2011 12:33 PM
To: Hering, David T; Coletti, Domenic; Rochelle, Rodger D; Smyre, Elizabeth A; Paugh, Leilani Y
Subject: FW: B-2500 Offsite Stormwater Treatment

FYI

From: Wainwright, David
Sent: Tuesday, December 20, 2011 12:07 PM
To: Lauffer, Matthew S
Cc: Chang, David S; Thorpe, Gregory J; Clawson, Marshall W; Vinson, Scott; Wrenn, Brian; Randall, Mike
Subject: RE: B-2500 Offsite Stormwater Treatment

Matt,

Thank you for your response. We have considered the information you have provided in response to our request to provide additional stormwater treatment beyond what was initially proposed. We have had internal discussions with staff members regarding the information you have provided and find your response to be acceptable. Therefore, based on current policies and the information provided, we find that the currently proposed stormwater management plan is acceptable and will be adequate to protect surface waters.

David Wainwright

NCDENR, Division of Water Quality
Transportation Permitting Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
Phone: (919)807-6405 Fax: (919) 807-6494
David.Wainwright@ncdenr.gov

Email correspondence to and from this address is subject to the North Carolina Public Records Law and may be disclosed to third parties unless the content is exempt by statute or other regulation.



Please consider the environment before printing this email.

From: Lauffer, Matthew S
Sent: Wednesday, November 30, 2011 3:30 PM
To: Wainwright, David
Cc: Chang, David S; Thorpe, Gregory J; Clawson, Marshall W; Vinson, Scott; Wrenn, Brian; Randall, Mike
Subject: RE: B-2500 Offsite Stormwater Treatment

David,

Thank you for your continued coordination and facilitation of the Bonner Bridge Project. NCDOT is concerned about the environmental impact of stormwater from the Bonner Bridge replacement project; however, NCDOT does not believe that mitigation is warranted on this project since the project is redevelopment and direct discharges to the open water do not pose a threat to water quality standards.

As you know NCDOT and DWQ are continuing to work on a Post-Construction Stormwater Control Program to identify the appropriate level stormwater controls for transportation projects based upon context of project, hydrologic design parameters and available practices in the NCDOT BMP Toolbox. The current threshold that has been identified to differentiate between redevelopment and development is the addition of a travel lane or equivalent and an addition of an acre of built upon area. The project does not exceed the travel lane threshold or the built-upon area threshold based upon the following:

- o The first is not adding a travel lane.
 - The existing bridge has (2) 12 ft. travel lanes and (2) 2 ft. shoulders for a total width of 28 ft. curb to curb. The structure is 33 ft. from rail to rail. The proposed bridge has (2) 12 ft. travel lanes and (2) 8 ft. shoulders for a total width of 40 feet curb to curb. The structure is 42.6 ft. wide from rail to rail. Therefore less than a travel lane is being added ($42.6 - 33 = 9.6$ ft.)
- o The second is no more than 1 Acre of new built upon area
 - New built upon area for this project is associated with the new fishing pier access road where it does not coincide with the existing NC 12 pavement and the left turn lane for SR 1257. New pavement associated with the new fishing pier access road totals 0.81 acres and the left turn lane additional pavement is 0.15 acres for a total of 0.96 acres. Included with the left turn lane is a median stripping. The median strip is less than a travel lane in width and therefore was not counted as part of the new built upon area. The total area of the median strip is 0.05 acres.

The direct discharges from the proposed bridge project will not significantly increase stormwater pollutant concentrations in the vicinity of the project, given the unique location, surrounding soils, and historical sampling results and therefore does not pose a threat to water quality standards.

- o Approximately 364,000 acre-ft of water moves in and out of the inlet during a typical day. Given this large amount of continual flushing, the concentration of any pollutant is immediately diminished.
- o During a first flush rainfall event (1.5 inches) approximately 19.9 acre-ft of water will drain directly into the surface waters from the proposed bridge. This is 0.0055% of the amount of water that moves through the inlet during a typical day.
- o Currently during a first flush rainfall event approximately 13.7 acre-ft of water drains directly into the surface water and there is no indication of impaired surface waters. The new bridge will increase the first flush volume by 6.2 acre-ft which is 0.0025% of the amount of water that moves through the inlet during a typical day.
- o The surrounding sandy soils are ideal for allowing dispersed stormwater to infiltrate into the soil, and the windy conditions are well suited to disperse any potential concentrated flow.
- o On March 16, 2007 the DWQ Intensive Survey Unit collected bridge deck runoff samples from the existing bridge and analyzed them for parameters of concern. Results of this sampling did not indicate immediate or long-term effect.

While NCDOT understands that stormwater mitigation may be needed in certain circumstances, NCDOT does not believe that the Bonner Bridge Project warrants mitigation based upon the project being redevelopment and no indication that discharges from the bridge will have an adverse impact to water quality.

Sincerely,

Matthew (Matt) Lauffer, PE, CPM

Project Manager
Highway Stormwater Program
Hydraulics Unit
North Carolina Department of Transportation

Mail:

1590 Mail Service Center
Raleigh, NC 27699-1590

Delivery:

1020 Birch Ridge Dr.
Raleigh, NC 27610

Phone: 919-707-6733

Cell: 919-621-0443

Fax: 919-250-4108

Email: mslauffer@ncdot.gov

Website: <http://ncdot.org/programs/environment/stormwater/>

Matt

From: Wainwright, David
Sent: Monday, October 31, 2011 12:08 PM
To: John.Jamison@hdrinc.com
Cc: Lauffer, Matthew S; Wrenn, Brian
Subject: B-2500 Offsite Stormwater Treatment

John,

Thank you meeting with NCDENR last Thursday. We appreciate the efforts taken thus far to treat stormwater from the bridge. During the meeting, the DWQ asked if any off-site mitigation measures had been considered. The answer was essentially "no." As an act to further mitigate for the portion of stormwater that will not be able to be treated, DWQ would like to request that HDR and NCDOT further consider some type of offsite mitigation. Two types we would like to see considered are stormwater retrofits and/or the purchase of property to be used as a permanent conservation easement; however, creativity may lead to other opportunities. It is obvious that any measures would need to occur off of PINWR or other Park Service property. Perhaps some possibilities exist in Manteo, Roanoke Island, or Rodanthe.

David Wainwright

NCDENR, Division of Water Quality
Transportation Permitting Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
Phone: (919)807-6405 Fax: (919) 807-6494
David.Wainwright@ncdenr.gov

Email correspondence to and from this address is subject to the North Carolina Public Records Law and may be disclosed to third parties unless the content is exempt by statute or other regulation.



Please consider the environment before printing this email.



North Carolina Department of Transportation

Highway Stormwater Program
STORMWATER MANAGEMENT PLAN
FOR LINEAR ROADWAY PROJECTS

(Version 1.2; Released September 2011)

Project/TIP No.: B-2500 (PHASE I)

County(ies): Dare

Page 1 of 4

General Project Information

Project No.:	B-2500 (PHASE I)	Project Type:	Bridge Replacement	Date:	5/24/2012
NCDOT Contact:	Marshall Clawson	Contractor / Designer:	HDR Engineering Inc. of the Carolinas		
Address:	1020 Birch Ridge Road Raleigh, NC, 27610	Address:	3733 National Drive, Suite 207 Raleigh, NC 27612		
	Phone:		(919) 707-6713	Phone:	(919) 785-1118
	Email:		mclawson@ncdot.gov	Email:	kenneth.trefzger@hdrinc.com
City/Town:	Nags Head	County(ies):	Dare		
River Basin(s):	Pasquotank	CAMA County?	Yes		
Primary Receiving Water:	Pamlico Sound	NCDWQ Stream Index No.:	30-22		
NCDWQ Surface Water Classification for Primary Receiving Water	Primary:	Class SA			
	Supplemental:	High Quality Waters (HQW)			
Other Stream Classification:					
303(d) Impairments:	None				
Buffer Rules in Effect	Other				

Project Description

Project Length (lin. Miles or feet):	3.55 miles	Surrounding Land Use:	South Side - Pea Island Wildlife Refuge, and the North Side - Oregon Inlet Marina and Campground		
	Proposed Project		Existing Site		
Project Built-Upon Area (ac.)	21.05 ac.		15.69 ac.		
Typical Cross Section Description:	Bridge - 24 feet wide travel way with 8 feet wide shoulders - total 40 feet curb to curb Roadway - 24 feet wide travel way with 4' wide paved shoulders - total 32 feet		Bridge - 24 feet wide travel way with 2 feet wide shoulders - total 28 feet curb to curb. Roadway - 24 feet wide travel way with 4' wide paved shoulders - total 32 feet		
Average Daily Traffic (veh/hr/day):	Design/Future:	11,420 (2035)	Existing:	7,060 (2011)	

General Project Narrative: The existing bridge is over the Oregon Inlet which is one of the connections between the Pamlico Sound and the Atlantic Ocean. The average flow through the inlet during a 6 hour tidal cycle ranges from 232,471 cfs to 134,342 cfs. The average volume of water that moves in and out of the inlet during a 24 hour period is 364,000 acre-ft. The mean high water (MHW) = 0.39 ft. NAVD and the mean low water (MLW) = -0.49 ft. NAVD. The highest observed water elevation was in March 1962 with an elevation of 7.0 ft. NAVD. The second highest observed water elevation was on August 28, 2011 with an elevation of 6.8 ft. NAVD. The existing bridge is 2.4 miles long with 150 ft over land on south side; 7000 ft over the Inlet/Sound; 5100 ft over SAV and 410 ft over land on north side. The proposed bridge parallels the existing bridge and roadway and is 2.8 miles long with 1750 ft over land on south side; 7500 ft over the Inlet/Sound; 5150 ft over SAV and 420 ft over land on north side. The first 6 spans (798 feet) are considered temporary. These spans will likely be removed and the bridge lengthened during the next phase of NC 12 improvements. The existing bridge will be removed except for approximately 1,050 feet on the south side which will remain in place and used as a fishing pier. An access road will be constructed to access the fishing pier. This access road will be used as the temporary detour while the new bridge is constructed. The National Park Service and Pea Island National Wildlife Refuge grant NCDOT an easement to construct and maintain NC 12. A substantial amount of effort and cost has been spent minimizing the permanent easement and the temporary area of disturbance through the project corridor. The existing bridge currently freely discharges stormwater runoff through bridge deck drains and there are no defined stormwater collection systems on the roadway. Currently approximately 9.17 acres of the existing bridge drains directly into the surface waters and the remaining impervious area drains to the natural sandy soils. During a first flush rainfall event (1.5 inches) this equates to approximately 1.15 acre-ft of water which is .0003 percent of the total volume of water that is flushed through the inlet over a 24-hour period. Once the proposed bridge is built and the existing bridge removed, approximately 13.28 acres will discharge directly into the inlet or sound. During a first flush rainfall event this equates to approximately 1.66 acre-ft of water which is .0005 percent of the total volume of water that is flushed through the inlet over a 24-hour period. The remaining impervious area drains to the natural sandy soils. To increase the ability of the natural soils to infiltrate the stormwater runoff, bridge deck drains will be spaced 14 feet apart where feasible to reduce the amount of water that discharges through each deck drain. In addition, the deck drains will be installed vertically where feasible to increase the surface area and decrease the unit discharge through each deck drain. Where the deck drain outlets are less than 12 feet above the ground which occurs near the bridge ends, no deck drains are proposed and the stormwater runoff is collected at the end of the bridge and discharged to a preformed scour hole that will dissipate the energy and promote infiltration. On the south side, the first 604 feet of the bridge has no deck drains and on the north side, the last 117 feet of the bridge has no deck drains. On the south side the no deck drain limit was able to be extended due to the super cross slope and this minimizes the drains that must extend through the girder flanges. On the north side the no deck drain limit could not be extended due to spreading constraints. The remaining impervious surfaces sheet through vegetated fill slopes or grass channels. See the Comments on the Environmental Summary sheet for additional information.



North Carolina Department of Transportation

Highway Stormwater Program
STORMWATER MANAGEMENT PLAN
FOR LINEAR ROADWAY PROJECTS



(Version 1.2; Released September 2011)

Project/TIP No.: B-2500 (PHASE I) County(ies): Dare Page 2 of 4

Project Environmental Summary

Surface Water Impacts

Sheet No.	Station (From / To)	Feature Impacted	Water / Wetland / Buffer Type	Receiving Surface Water Name	NRTR Map ID	NCDWQ Stream Index	NCDWQ Surface Water Classification	303(d) Impairments	Type of Impact	Existing SCM	Proposed SCM
5-6	41+98 -L- LT	Open Water	Sound	Oregon Inlet / Pamlico Sound	N/A	30-22-1 / 30-22	SA, HQW	None	Fill	N/A	
	44+32 -L- LT										
6-15	28+68 -L-	Open Water	Sound	Pamlico Sound	N/A	30-22	SA, HQW	None	Fill	N/A	
	176+68 -L-										
7-15	58+35 -L- RT	Open Water	Sound	Pamlico Sound	N/A	30-22	SA, HQW	None	Excavation	N/A	
	176+50 -L- RT										

* List all stream and surface water impact locations regardless of jurisdiction or size.

Equalizer Pipes to be noted as a minimization of impacts.

All proposed SCMs listed must also be listed under Swales, Preformed Sour Holes and other Energy Dissipators, or Other Stormwater Control Measures.

Description of Minimization of Impacts or Mitigation

Two other options were investigated to mitigate the potential erosion from the stormwater discharging freely out of the bridge deck drains. Option 1 included a 6 feet wide strip of Class B stone keyed into the existing ground to dissipate the energy and allow the water to spread across the existing sandy soils and Option 2 was a 4 feet wide swale protected with Class B stone that dissipated the energy and provided some storage volume. These options were not recommended for the following reasons

- Questionable effectiveness given the windy conditions at the site
- Wind driven sand will likely continually fill in the swale
- Storm surge will likely wash features away
- Standing water in the swale could result in bird concentrations and increased fecals.

Strucural BMPs were not recommended for the following reasons.

- This would require collecting the stormwater runoff. Recent research has shown that collection systems have increased the bacteria concentrations over the concentrations that typically run off a bridge and the 0% grade on the bridge limits the extent of a collection system.
- A structural BMP is not feasible on the southern end due to the high groundwater table. Soil borings reflected a consistent groundwater table around elevation 2 to 3 feet and the highest ground around the bridge is at 6 feet with most of the surrounding area between 4 and 5 feet except for the dunes.
- Considerable effort and cost has been spent to minimize the easement with the National Park Service and Pea Island National Wildlife Refuge. A BMP would require additional easement.

References



(Version 1.2; Released September 2011)

Page 3 of 4

Wetland Impacts

* List all stream and surface water impact locations regardless of jurisdiction or size.
Equalizer Pipes to be noted as a minimization of impacts.
All proposed SCMs listed must also be listed under Swales, Preformed Sour Holes and other Energy Dissipators, or Other Stormwater Control Measures.

Description of Minimization of Impacts or Mitigation

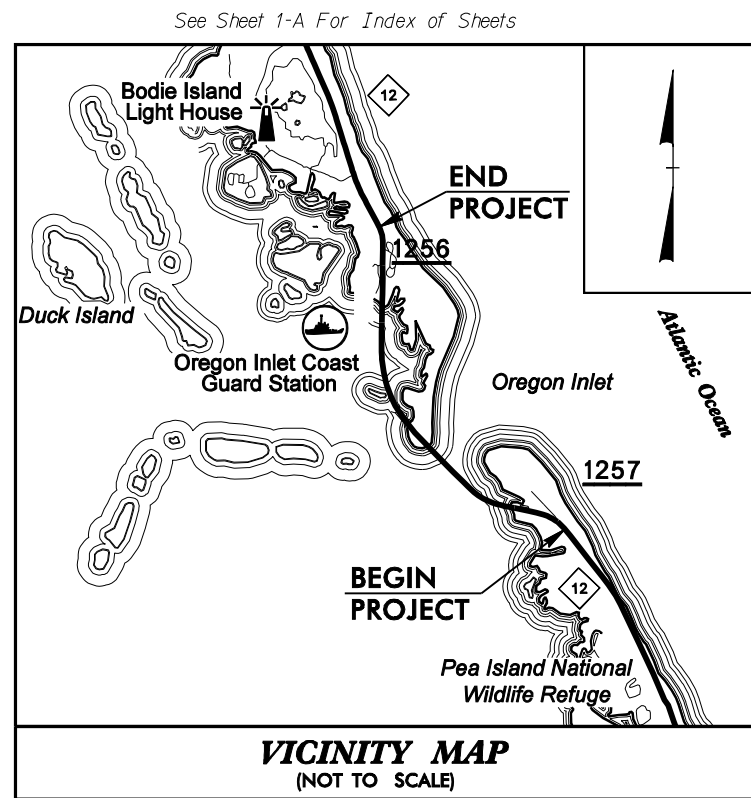


* Refer to the NCDOT Best Management Practices Toolbox, Version 1 (March 2008), NCDOT Standard Details, the Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 14 (HEC-14), Third Edition, Hydraulic Design of Energy Dissipators for Culverts and Channels (July 2006), as applicable, for design guidance and criteria.

09/08/99

PLOT DRIVER: NCDOT_pnf_color_eng_100.plt
PENTABLE: NCDOT_permit's.tbl
USER: jmasrcc
DATE: 6/4/2012
TIME: 9:47:20 AM
FILE: PCL_Civil_Const\B-2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500\Hydraulics\PERMITS\Environmental\Drawings\B2500_HYD_PRM_TSH.DGN

CONTRACT: C 202185 TIP PROJECT: B-2500 (PHASE I)



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

**WETLAND AND STREAM IMPACTS
SITE MAP**

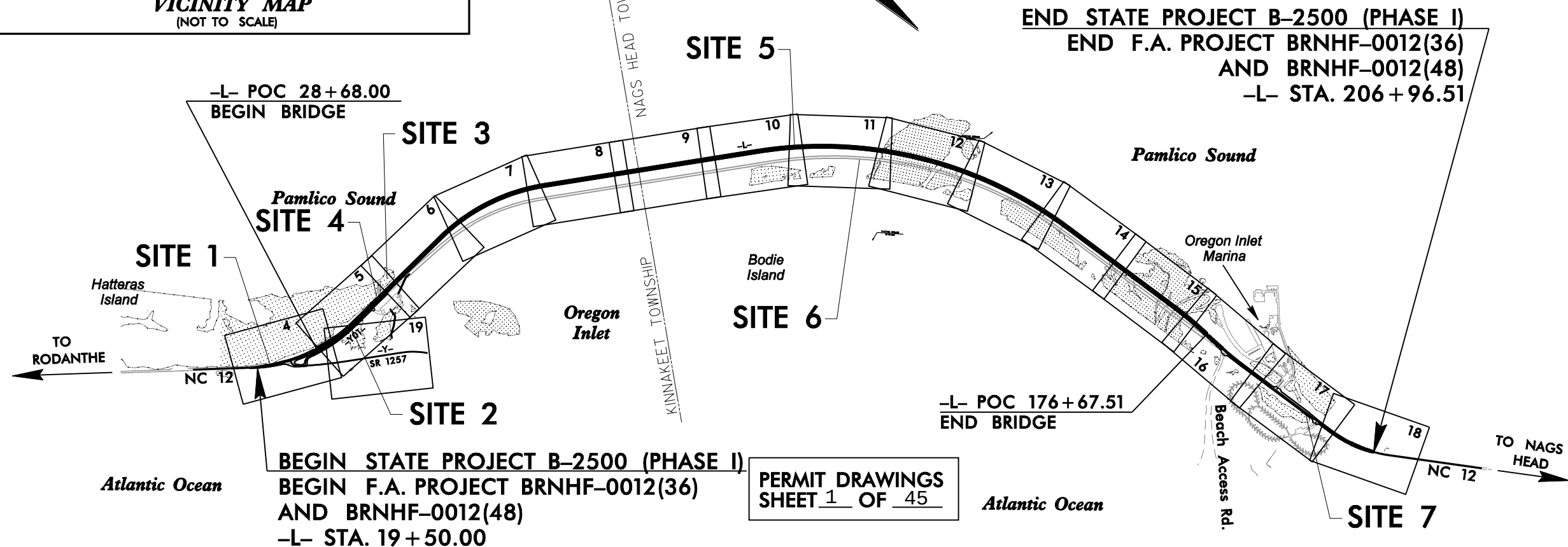
SUBMITTED: 06-05-2012

SUBMITTAL #D-035

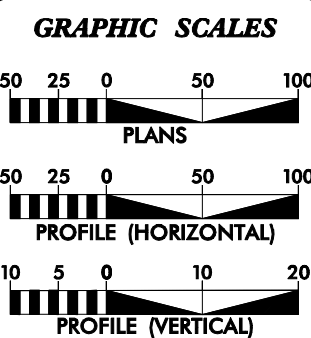
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-2500 (PHASE I)	1	
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
32635.1.4	BRNHF-0012(48)	CONSTRUCTION	
32635.3.GV3	BRNHF-0012(36)	CONSTRUCTION	

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

HDR 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



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



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	=	0.747 MILES
TIP PROJECT B-2500 (PHASE I)	=	
LENGTH STRUCTURE	=	2.803 MILES
TIP PROJECT B-2500 (PHASE I)	=	
TOTAL LENGTH	=	3.550 MILES
TIP PROJECT B-2500 (PHASE I)	=	

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

ROADWAY DESIGN ENGINEER

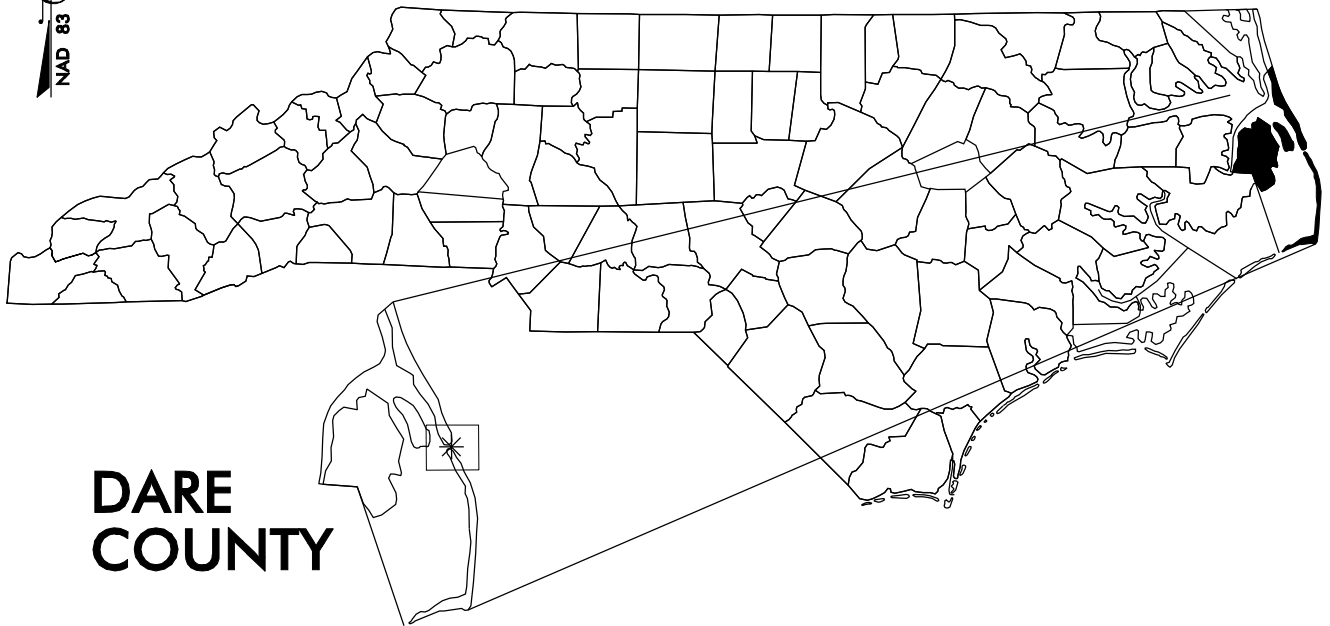
STATE HIGHWAY DESIGN ENGINEER

**DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA**

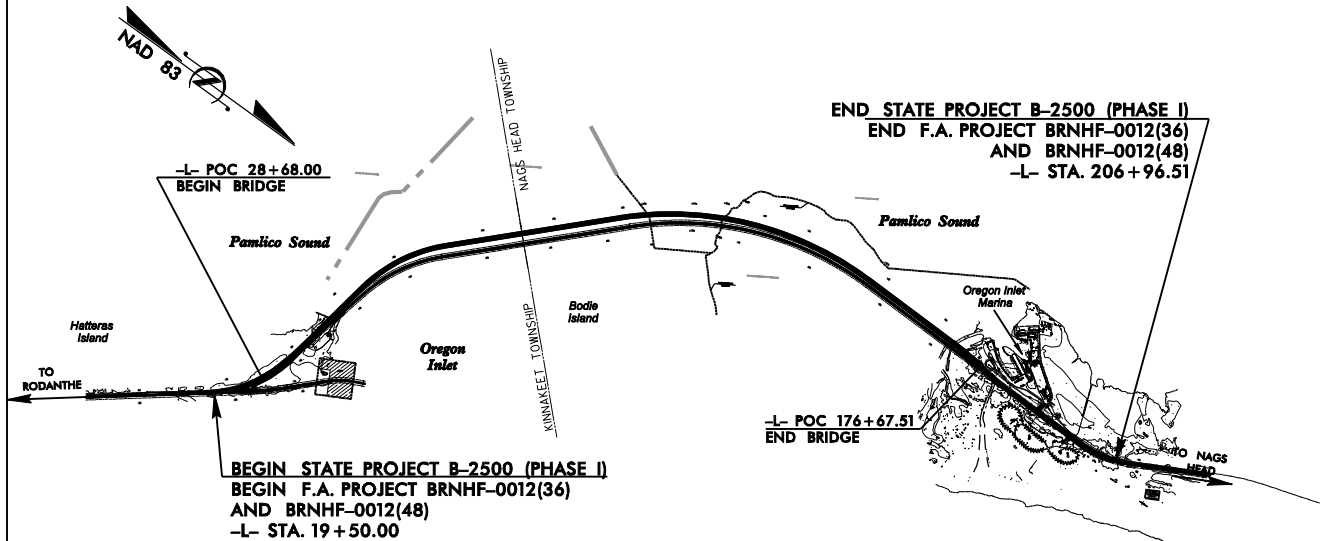
STATE HIGHWAY DESIGN ENGINEER



NORTH CAROLINA



DARE COUNTY



VICINITY MAPS

NCDOT

DIVISION OF HIGHWAYS
DARE COUNTY

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

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

SHEET 2 OF 45 05 / 24 / 12

August 28, 2011 Aerial
(Post-Irene)

**Bodie
Island**

SITE 7
NC 12
Roadway

Cape Hatteras
National Seashore

SITE 6
Existing Bridge
(demolition)

**Oregon
Inlet**

SITE 2
NC 12
Roadway

SITE 5
New Bridge
Work Trestle
Temp. Platform

SITE 3
Work Trestle/Dock

SITE 4
Utility Relocation

SITE 1
NC 12
Roadway

Pea Island
National Wildlife
Refuge

**Hatteras
Island**



SITE MAP

1 inch = 3,000 feet
0 1,500 3,000 Feet

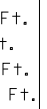
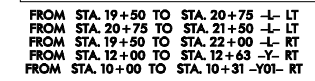
NCDOT

DIVISION OF HIGHWAYS
DARE COUNTY

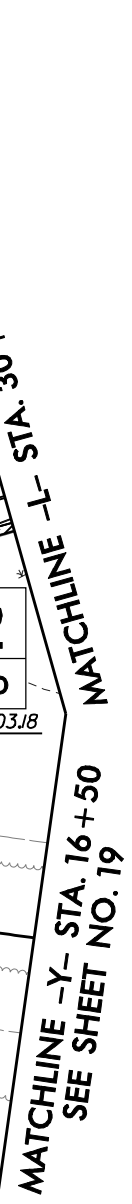
PROJECT: 32635.1.4 & 32635.3.GV3 (B-2500 Phase I)
NC 12-REPLACEMENT OF HERBERT
C. BONNER BRIDGE ACROSS OREGON
INLET FROM HATTERAS ISLAND
TO BODIE ISLAND
SHEET 3 OF 45

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 (CDRS96) STATE PLANE GRID COORDINATES OF
NORTHING: 715499.622(1) EASTING: 3031964.117(1)
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

 HC HC DENOTES HAND CLEARING



PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	4
RAW 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 4 OF 45

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

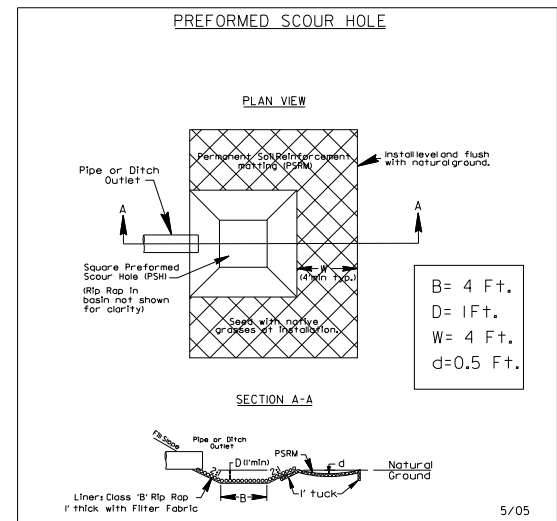
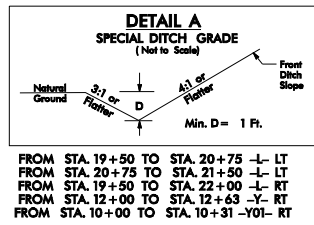
PLOT DRIVER: NCD07_pdf_color_eng_100.plt
PENTABLE: NCD07_permits.tbl
USER: jmassroc
DATE: 6/13/2012
TIME: 3:57:03 PM
FILE: PCL_Civil_Const\B_2500_Bonner_Bridge_Replacement\06.00.NCD07_File_Structure\B-2500\Roadway\Proj\B2500.RDY_PSH_04.dgn

PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassroc
FILE: PCL_Civil_Constr\B-2500_Bonner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_R0Y_PSH_04.dgn
PENTABLE: NCDOT_permits.tbl
TIME: 6/13/2012 3:56:33 PM

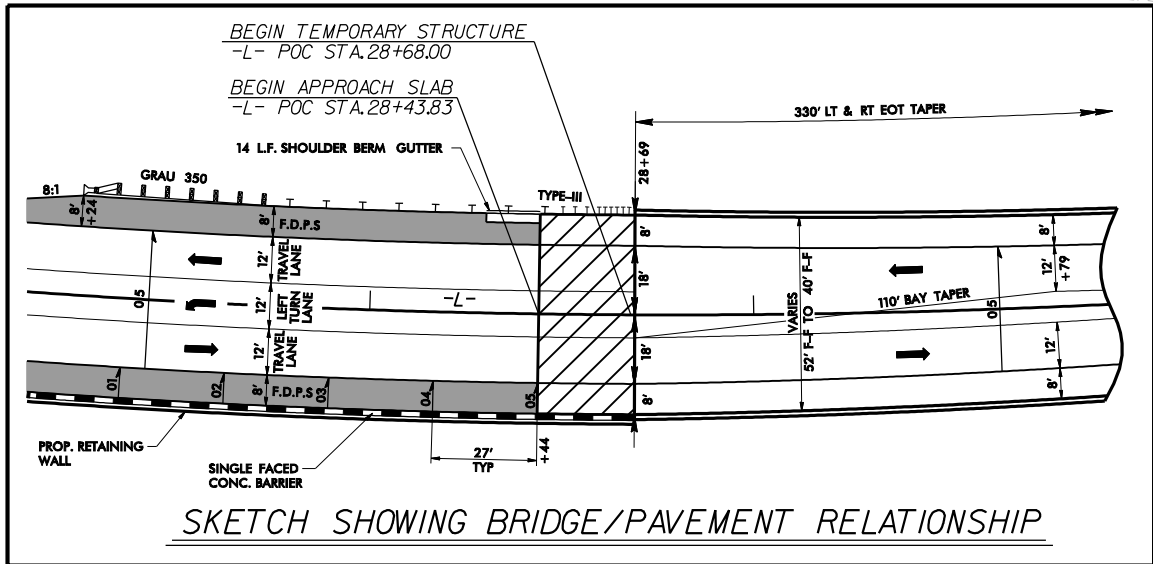
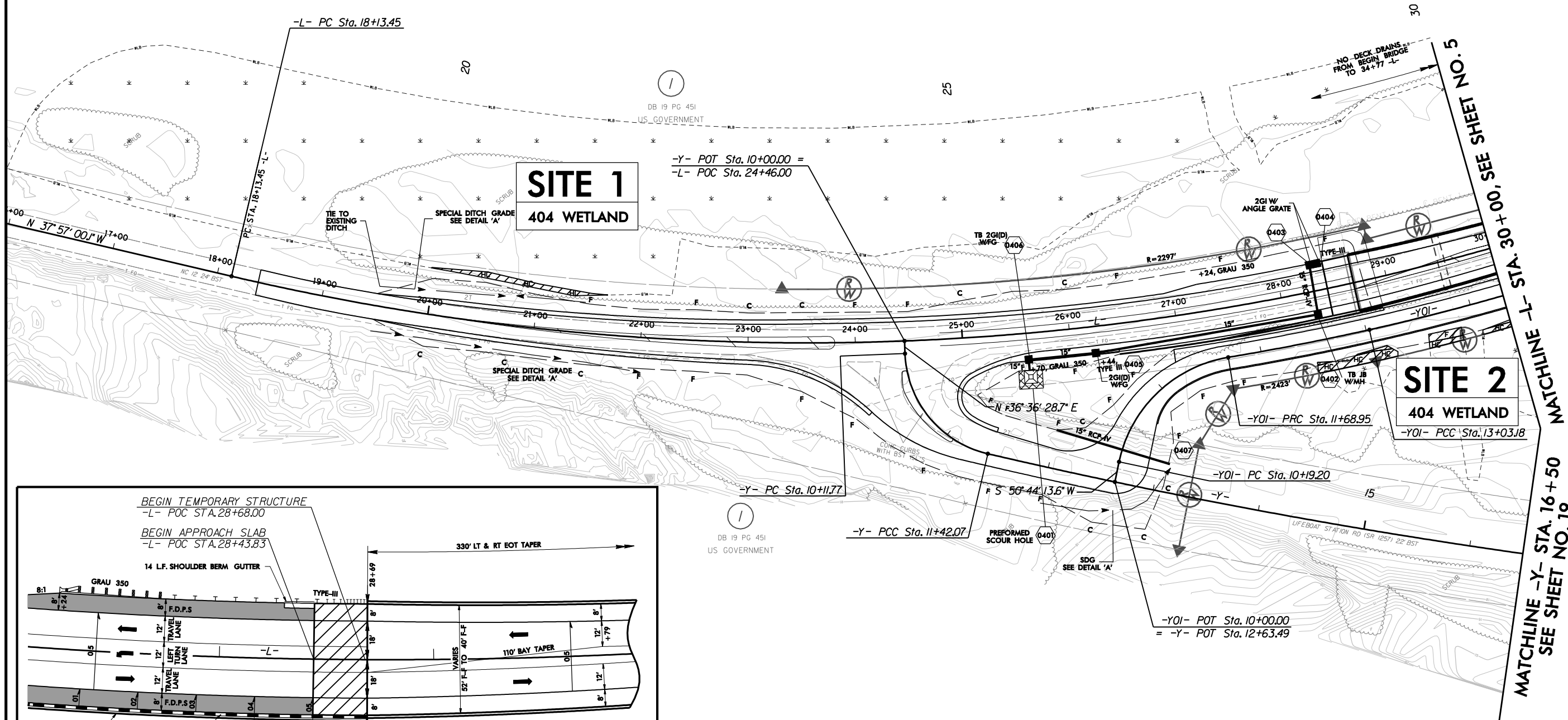
DATUM DESCRIPTION
THE LOCALIZED COORDINATE SYSTEM DEVELOPED FOR THIS PROJECT IS BASED ON THE STATE PLANE COORDINATES ESTABLISHED BY NCDOT FOR MONUMENT "B2500-2" WITH NAD 83 (CORS96) STATE PLANE GRID COORDINATES OF NORTHING: 751499.622(ft) EASTING: 3031964.117(ft) THE AVERAGE COMBINED GRID FACTOR USED 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

F F DENOTES FILL IN WETLAND
HC HC DENOTES HAND CLEARING



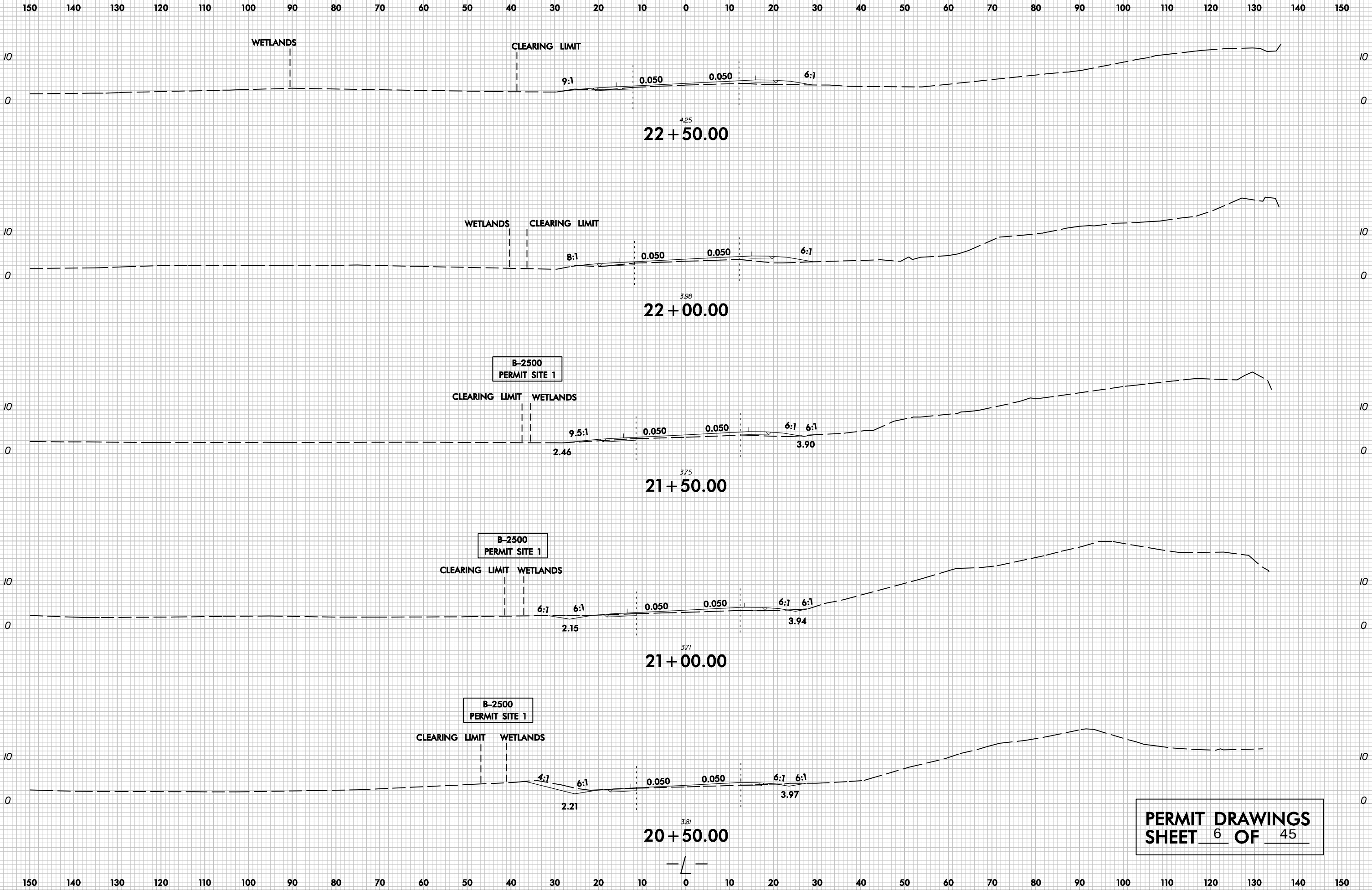
PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	4
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
PCL Civil Constructors, Inc. 801 Corporate Center Drive, Suite 130 Raleigh, NC 27607	
HDR Engineering, Inc. of the Carolinas 3733 National Drive, Suite 207 Raleigh, N.C. 27612 N.C.B.E.L.S. License Number: F-0116	



PERMIT DRAWINGS
SHEET 5 OF 45

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

8/23/99



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 than growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.



DENOTES FILL IN WETLAND



DENOTES EXCAVATION IN WETLAND



DENOTES MECHANIZED CLEARING

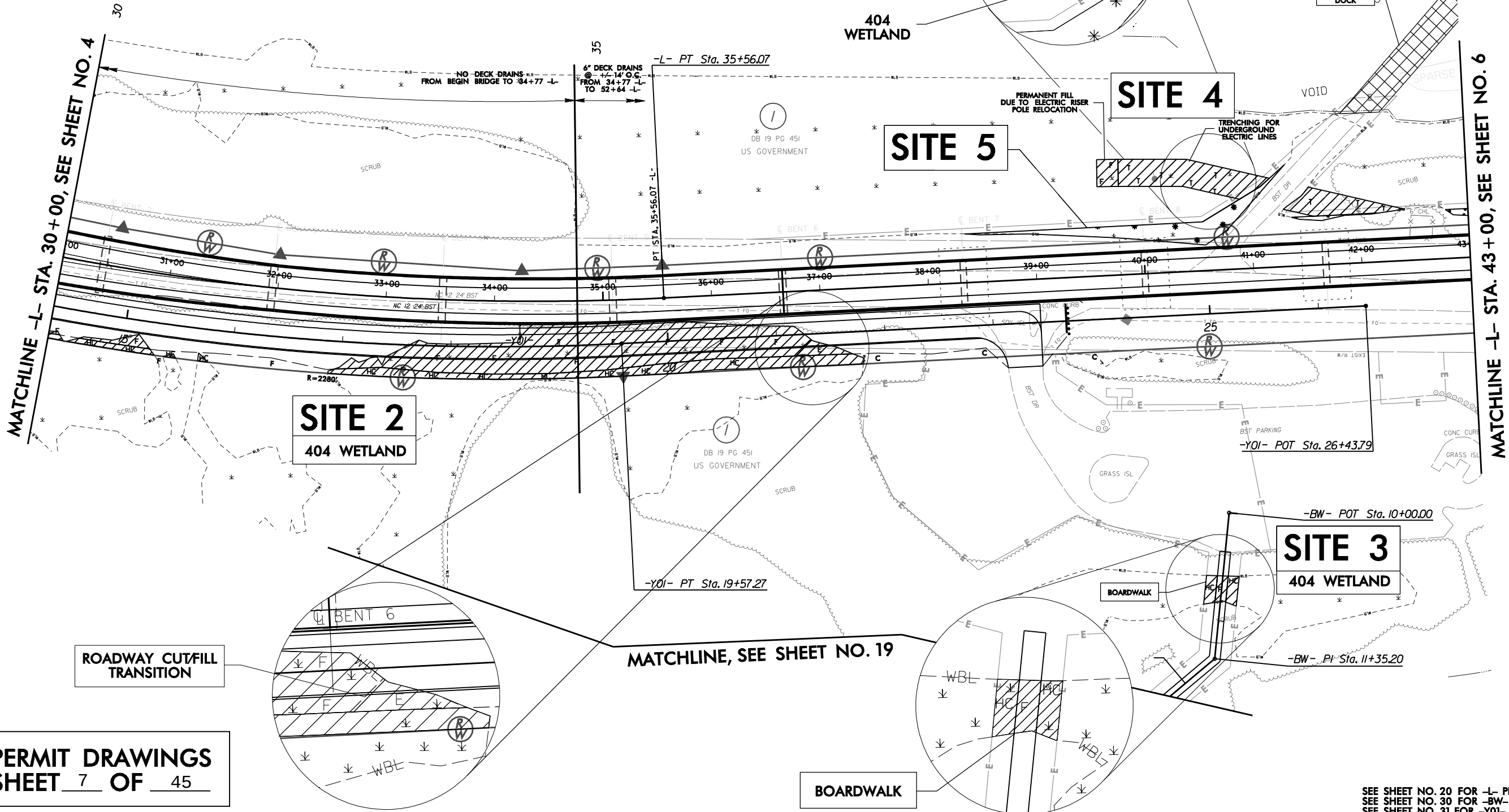


DENOTES TEMPORARY FILL IN WETLAND



DENOTES HAND CLEARING

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	5
RW 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 7 OF 45

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

PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassroc
FILE: PCL_Civil_Constr\B-2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_NCDOT_PSH_05.dgn
PENTABLE: NCDOT_permits.tbl
TIME: 8:34:36 AM
DATE: 6/5/2012

REVISIONS

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

HOMOGENEOUS

PATCHY

SPARSE

VOID

Uniform in coverage,
some anomalies.

Diverse coverage running from almost
homogenous to almost sparse.

Limited growth with more void
area then growth area.

Open with little or no growth.
Boundary defined by edges of other polygons.

 DENOTES HAND
CLEARING

43
MATCHLINE -L- STA. 43 + 00, SEE SHEET NO. 6

PERMIT DRAWINGS
SHEET 8 OF 45

SITE 2
404 WETLAND

SITE 5

SITE 4

SITE 3

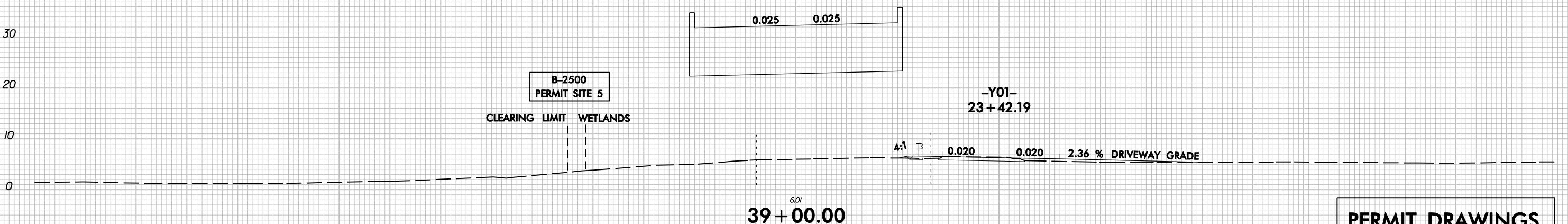
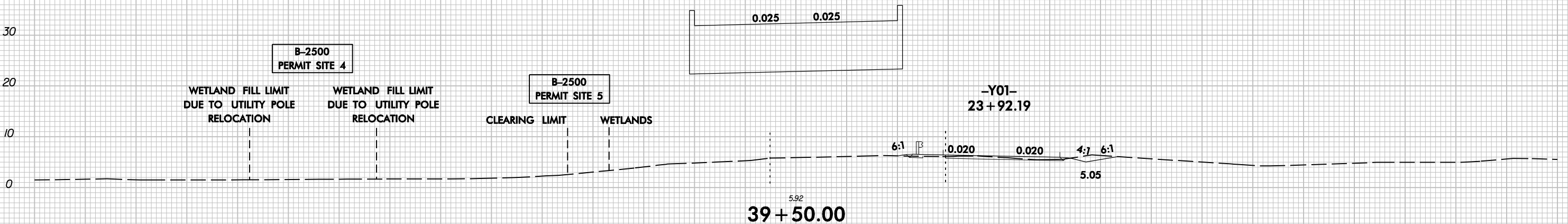
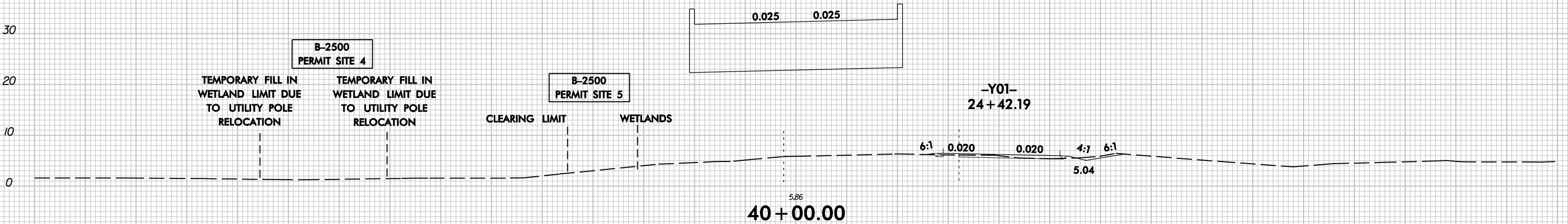
SITE 3
404 WETLAND

MATCHLINE, SEE SHEET NO. 19

BOARDWALK

8/23/99

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

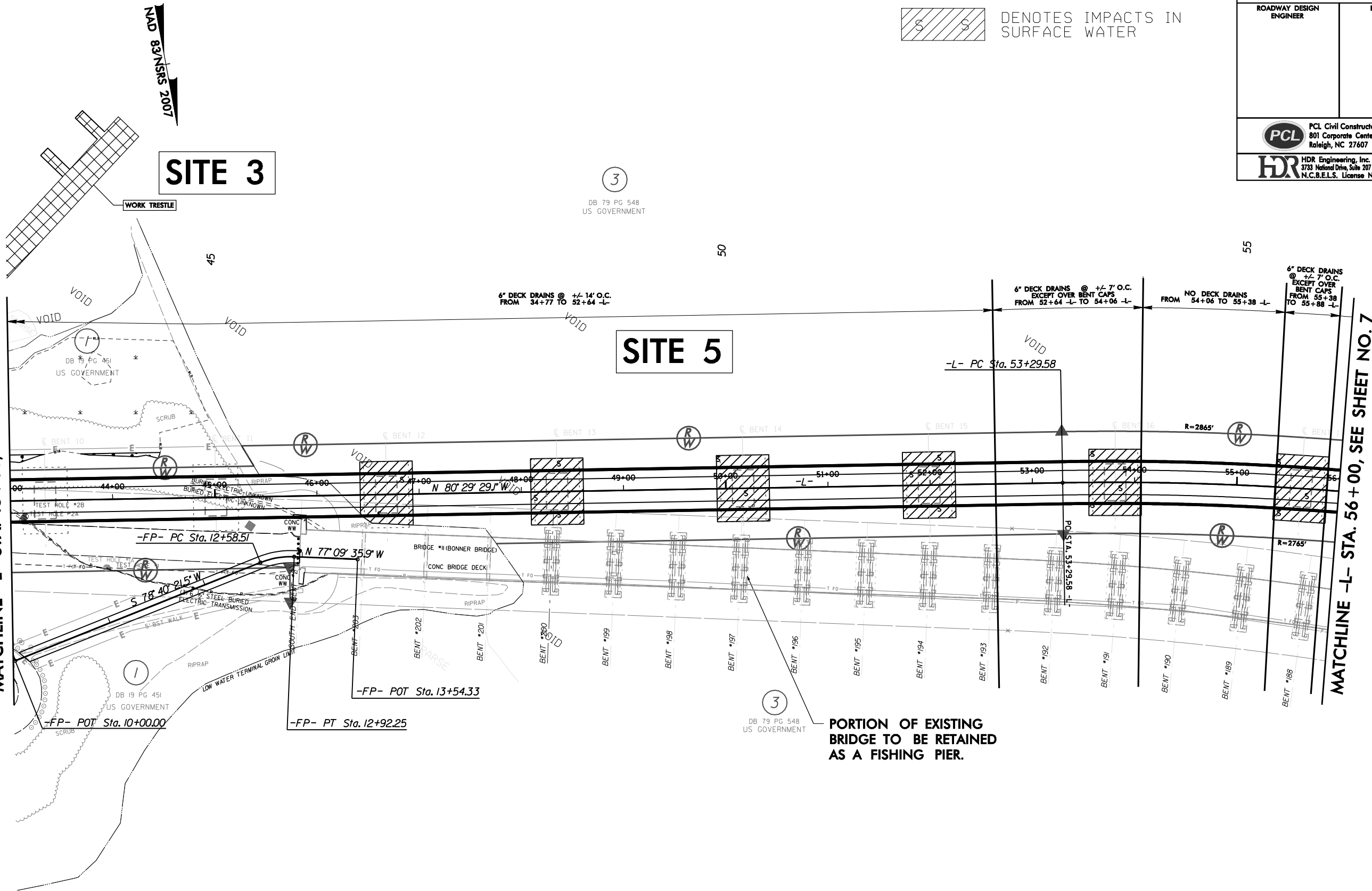


PERMIT DRAWINGS
SHEET 10 OF 45

PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassroc
FILE: PCL_Civil_Constr\B-2500_Bonner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_06.dgn
PENTABLE: NCDOT_permits.tbl
DATE: 5/31/2012
TIME: 12:17:35 PM

REVISIONS

MATCHLINE -L- STA. 43+00, SEE SHEET NO. 5



§ § DENOTES IMPACTS IN SURFACE WATER

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		6	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	

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 than growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 11 OF 45

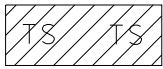
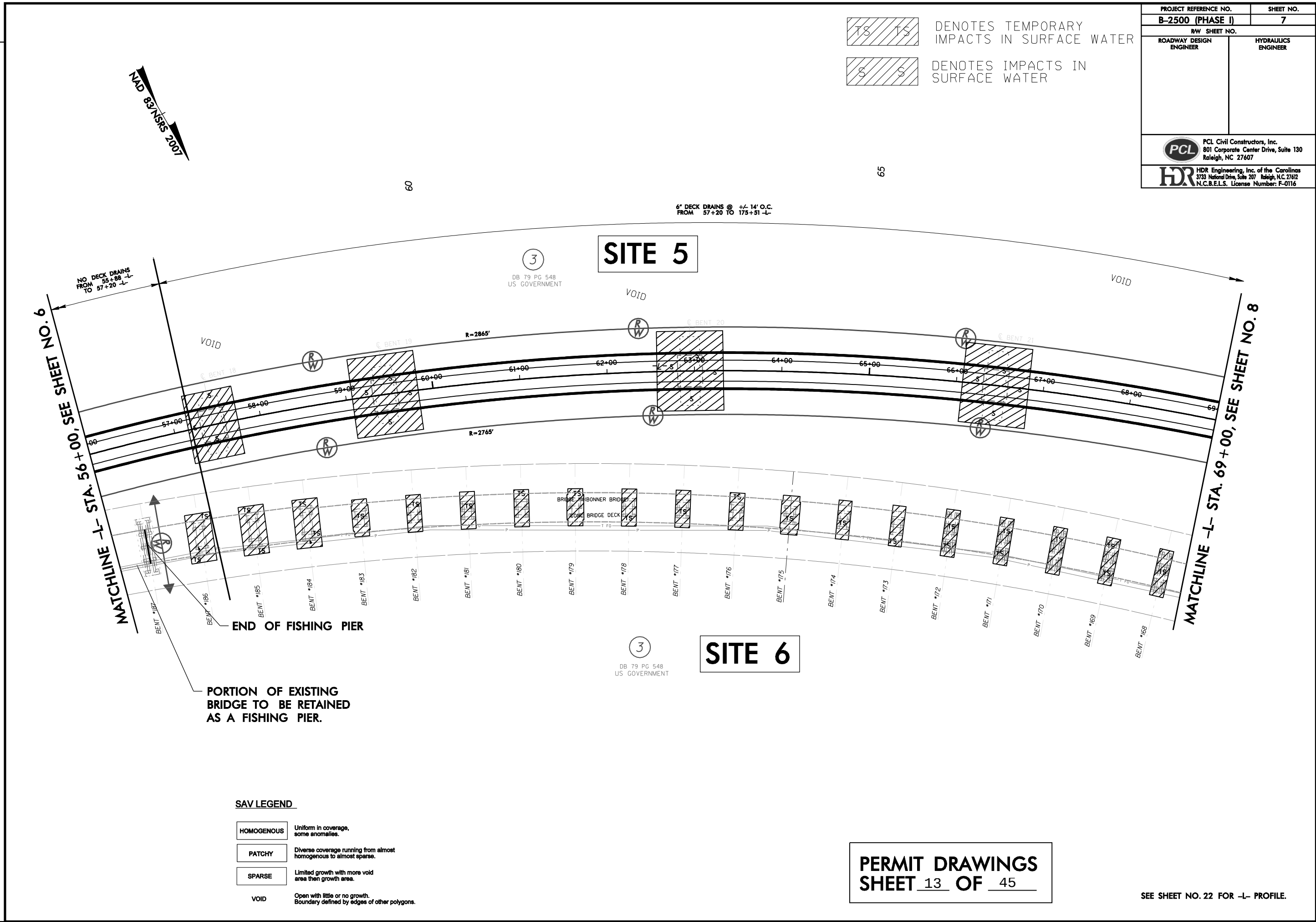
SEE SHEET NO. 21 FOR -L- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.



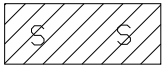
PERMIT DRAWINGS
SHEET 12 OF 45

PLOT DRIVER: NCDOT_color_eng-100.plt
USER: jmassroc
FILE: PCL-CivilConst\B-2500_Bonner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_07.dgn
PENTABLE: NCDOT_permits.tbl
DATE: 5/24/2012
TIME: 10:38:20 AM

REVISIONS



DENOTES TEMPORARY
IMPACTS IN SURFACE WATER



DENOTES IMPACTS IN
SURFACE WATER

PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 7	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
</			

SAV LEGEND

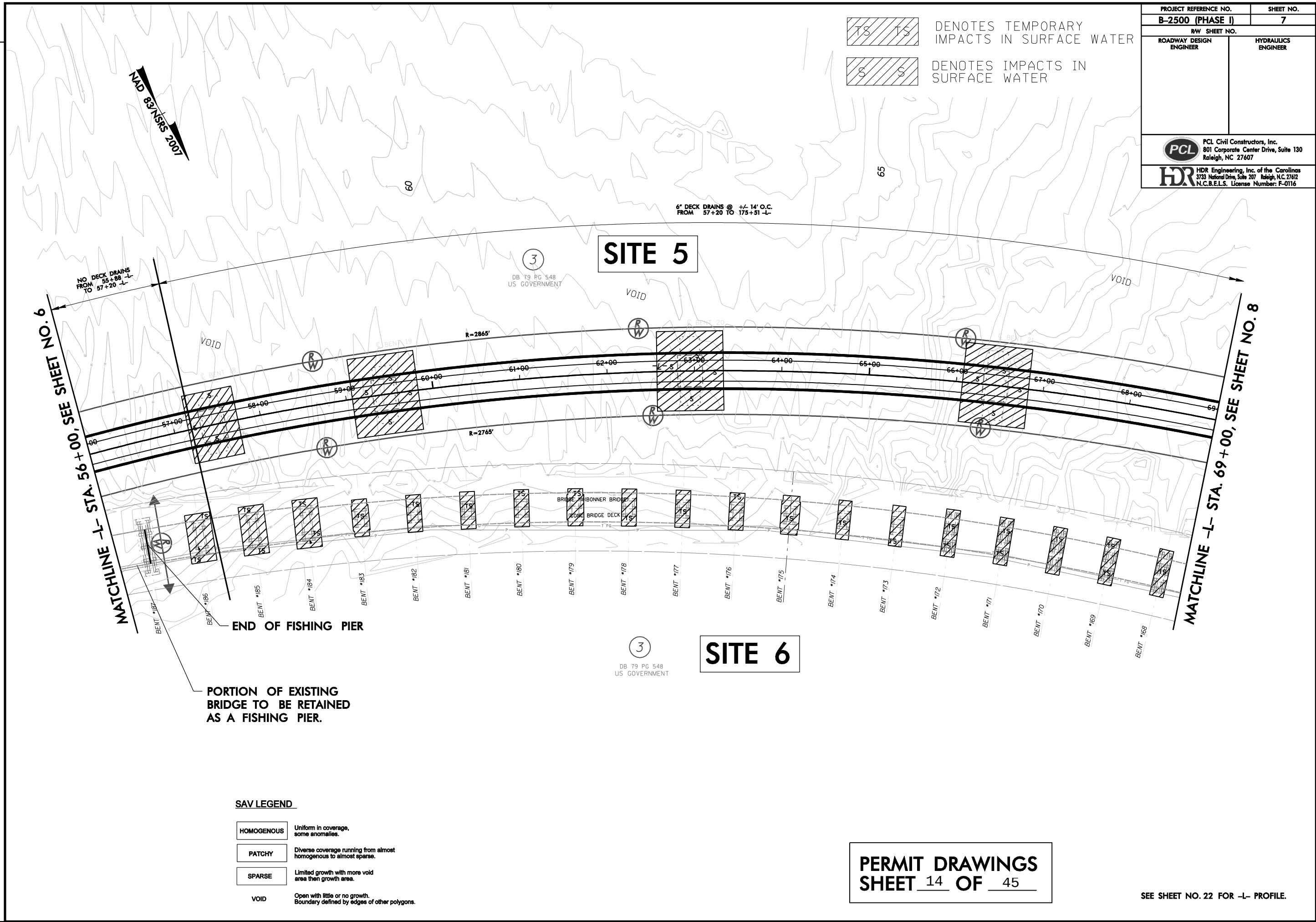
HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area than growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 13 OF 45

SEE SHEET NO. 22 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_color_eng-100.plt
USER: jmassroc
FILE: PCL_Civil_Const\B-2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_07.dgn
PENTABLE: NCDOT_permits.tbl
DATE: 5/24/2012
TIME: 10:37:58 AM

REVISIONS



PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		7	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
</			

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 than growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

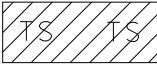
PERMIT DRAWINGS
SHEET 14 OF 45

SEE SHEET NO. 22 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_color_eng-100.plt
USER: jmassroc
FILE: PCL-CivilConst\B-2500_Borner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_08.dgn

PENTABLE: NCDOT_permits.tbl
DATE: 5/24/2012
TIME: 10:41:58 AM

REVISIONS

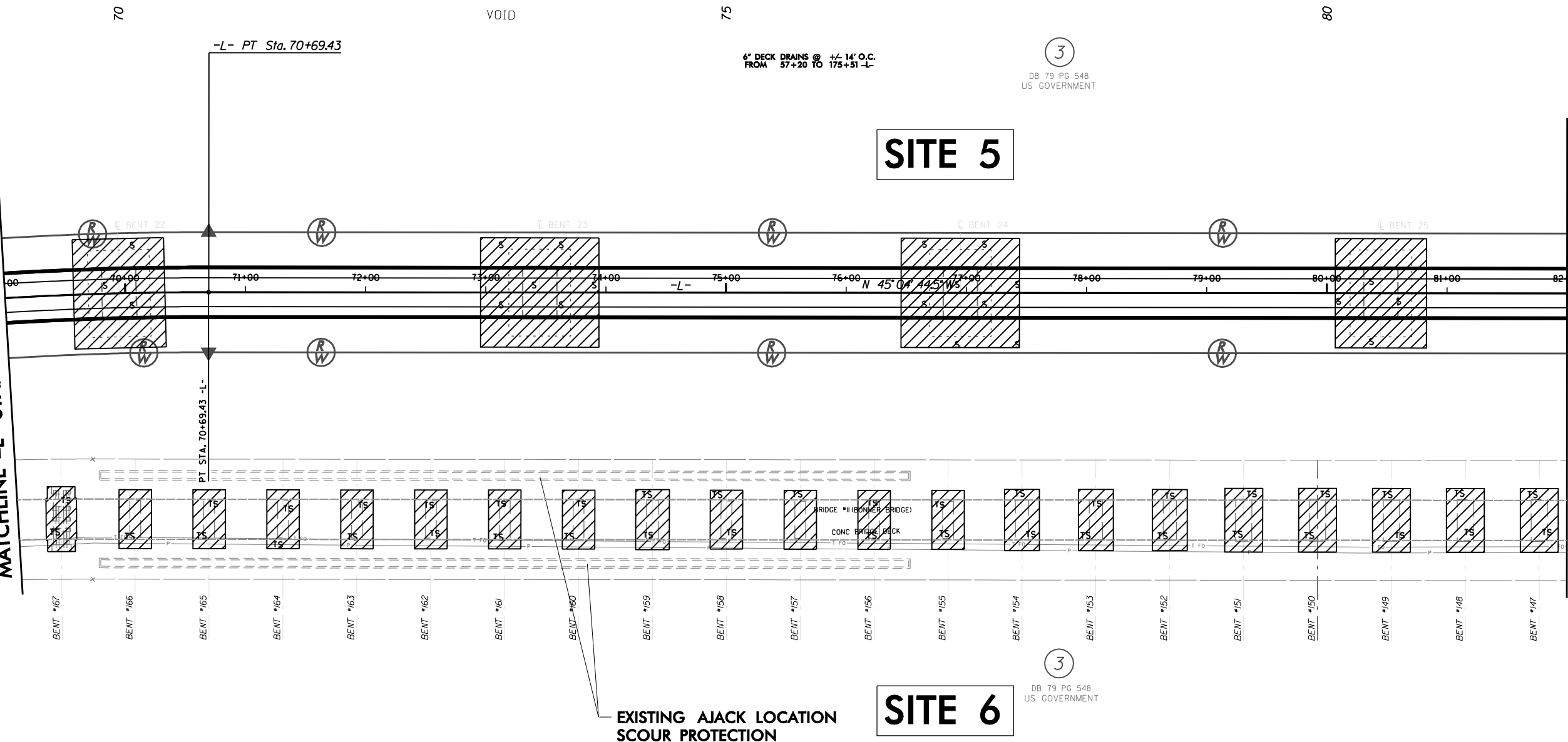
 DENOTES TEMPORARY IMPACTS IN SURFACE WATER

 DENOTES IMPACTS IN SURFACE WATER

NAD 83/NRS 2007

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		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		

MATCHLINE -L- STA. 69 + 00, SEE SHEET NO. 7



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 than 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.

PLOT DRIVER: NCDOT_color_eng-100.plt
USER: jmassroc
FILE: PCL-CivilConst\B-2500_Borner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_08.dgn

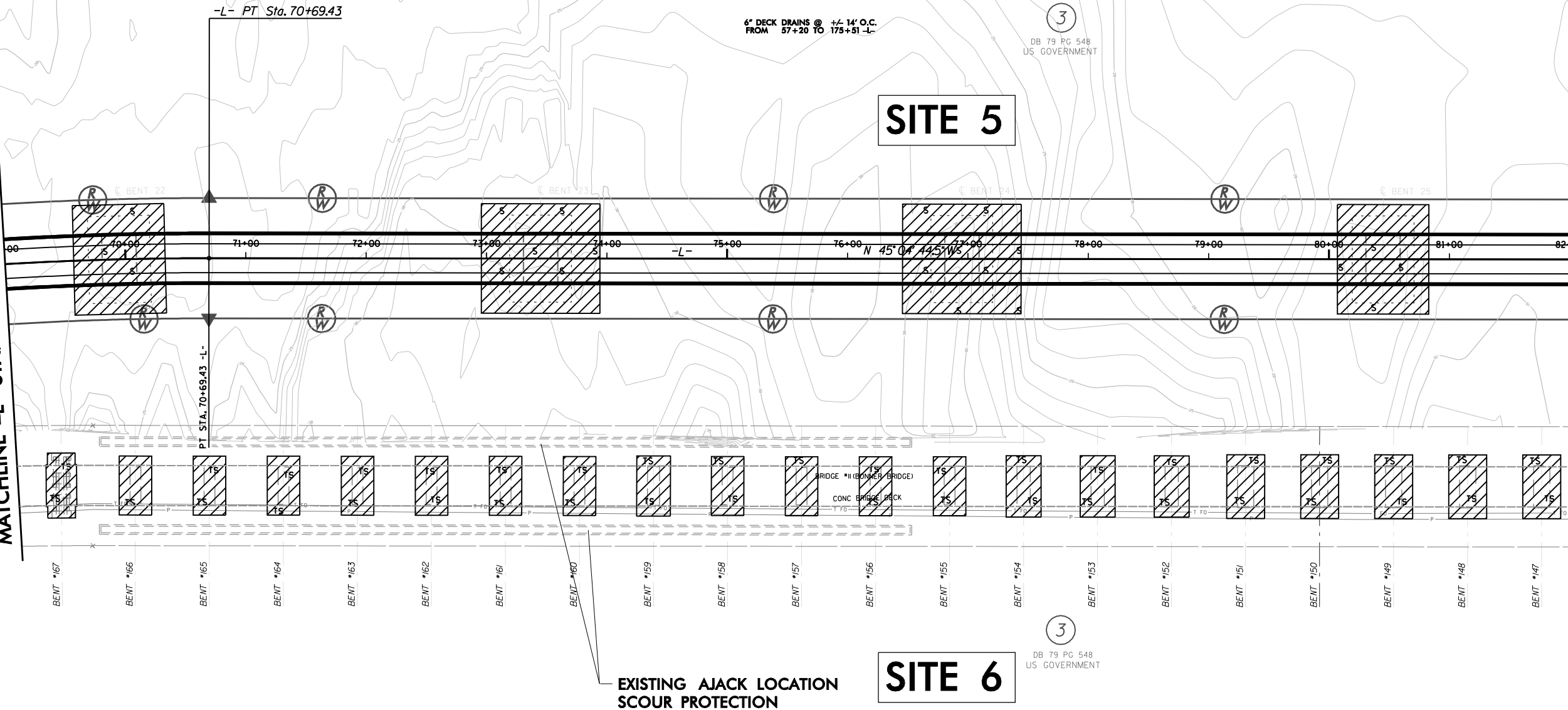
PENTABLE: NCDOT_permits.tbl
DATE: 5/24/2012
TIME: 10:41:13 AM

REVISIONS

MATCHLINE -L- STA. 69+00, SEE SHEET NO. 7

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 than growth area.
- VOID** Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 16 OF 45

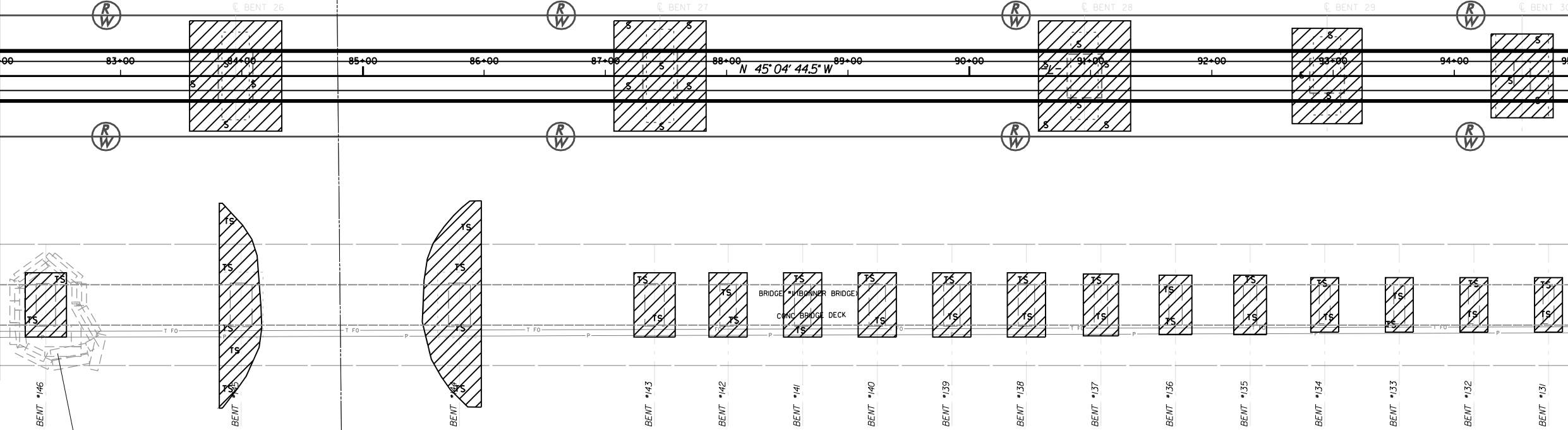
SEE SHEET NO. 23 FOR -L- PROFILE.

PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 8	
RW SHEET NO.		HYDRAULICS ENGINEER	
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	

PLOT DRIVER: NCDOT_pdf_color_eng-100.plt
PENTABLE: NCDOT_permits.tbl
USER: jmassroc
DATE: 5/24/2012
TIME: 10:42:15 AM
FILE: PCL\Civil\Const\B-2500_Borner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_09.dgn

REVISIONS

MATCHLINE -L- STA. 82 + 00, SEE SHEET NO. 8



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 than growth area.
- VOID** Open with little or no growth. Boundary defined by edges of other polygons.

EXISTING AJACK LOCATION
SCOUR PROTECTION

SITE 5

SITE 6

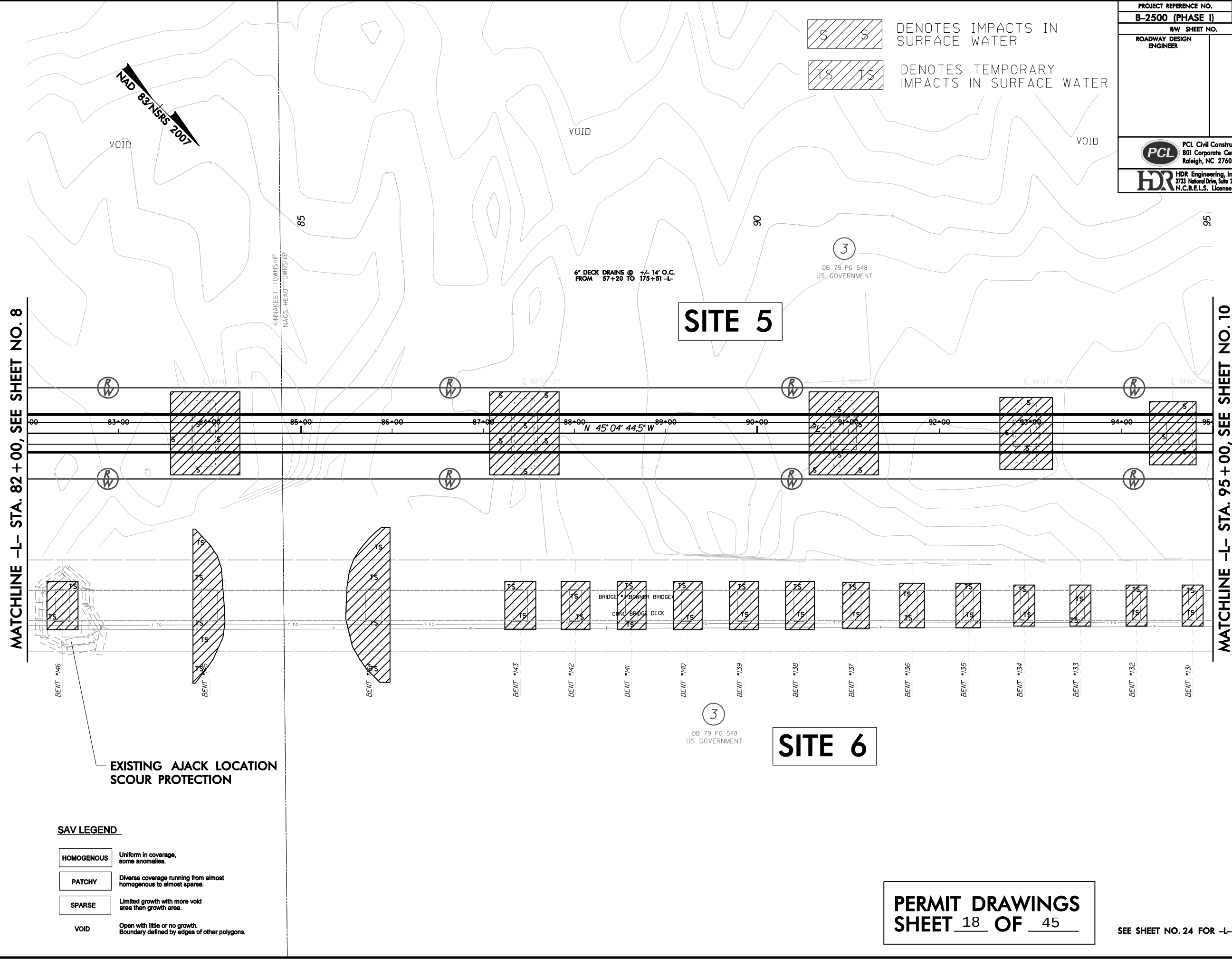
PERMIT DRAWINGS
SHEET 17 OF 45

SEE SHEET NO. 24 FOR -L- PROFILE.

MATCHLINE -L- STA. 95 + 00, SEE SHEET NO. 10

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		9	
RW 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



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.

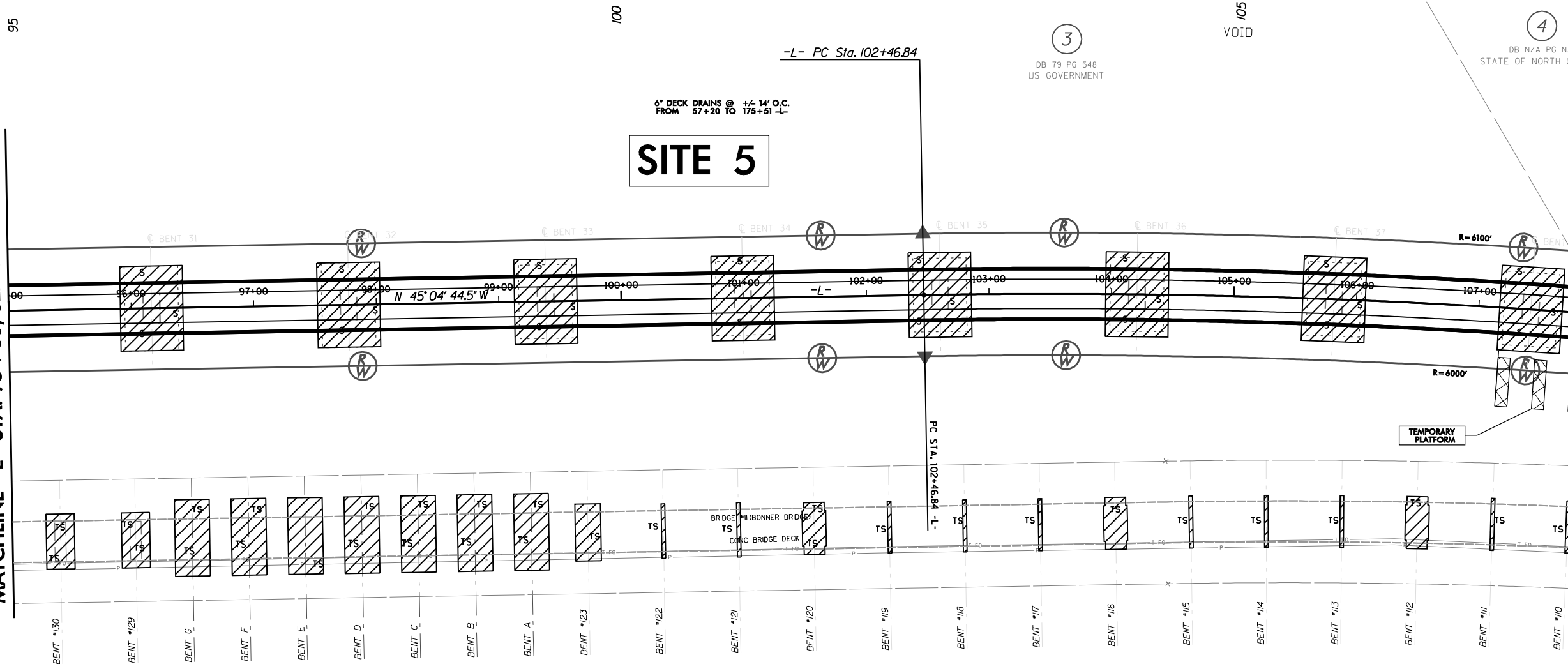
SITE 6

SEE SHEET NO. 24 FOR -L- PROFILE.

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		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

MATCHLINE -L- STA. 95+00, SEE SHEET NO. 9



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 than growth area.
- VOID** Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 19 OF 45

SITE 5

SITE 6



DENOTES IMPACTS IN SURFACE WATER



DENOTES TEMPORARY IMPACTS IN SURFACE WATER

PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 10
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

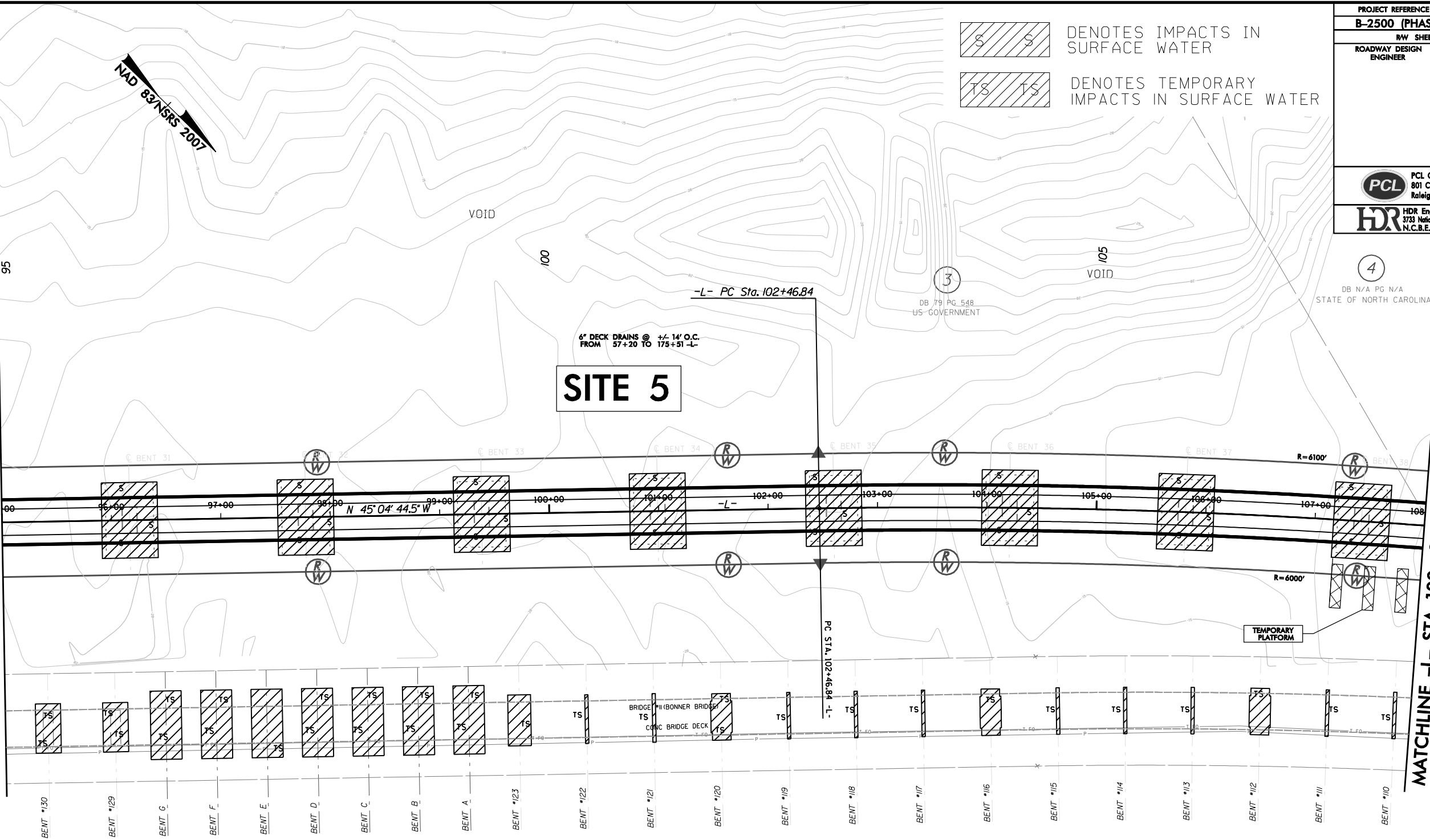
DB N/A PG N/A
STATE OF NORTH CAROLINA

MATCHLINE -L- STA. 108+00, SEE SHEET NO. 11

SEE SHEET NO. 25 FOR -L- PROFILE.

REVISIONS

MATCHLINE -L- STA. 95+00, SEE SHEET NO. 9



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 than growth area.
- VOID** Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 20 OF 45

3
DB 79 PG 548
US GOVERNMENT

S S DENOTES IMPACTS IN SURFACE WATER
TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 10	
RW SHEET NO.		HYDRAULICS ENGINEER	
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	

4
DB N/A PG N/A
STATE OF NORTH CAROLINA

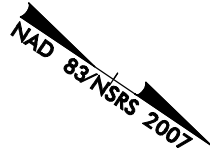
MATCHLINE -L- STA. 108+00, SEE SHEET NO. 11

SEE SHEET NO. 25 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_color_eng-100.plt
PENTABLE: NCDOT_permits.tbl
USER: jmassroc
DATE: 5/23/2012
TIME: 2:54:53 PM
FILE: PCL-Civil-Const\B-2500-Bonner-Bridge-Replacement\06.00.NCDOT_File_Structure\B-2500-Roadway\Proj\B2500_RDY_PSH-11.dgn

REVISIONS

MATCHLINE -L- STA. 108+00, SEE SHEET NO. 10



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 than growth area.
- VOID** Open with little or no growth. Boundary defined by edges of other polygons.

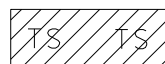
3
DB 79 PG 548
US GOVERNMENT

SITE 5

SITE 6



DENOTES IMPACTS IN SURFACE WATER



DENOTES TEMPORARY IMPACTS IN SURFACE WATER

6" DECK DRAINS @ +/- 14' O.C.
FROM 57+20 TO 175+51 -L-

WORK TRESTLE

VOID

NORTH APPROACH

120

MATCHLINE -L- STA. 121+00, SEE SHEET NO. 12

PERMIT DRAWINGS
SHEET 21 OF 45

SEE SHEET NO. 26 FOR -L- PROFILE.

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		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		

REVISIONS

MATCHLINE -L- STA. 108+00, SEE SHEET NO. 10

NAD 83/NSRS 2007

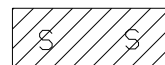
SAV LEGEND

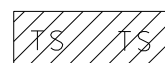
- HOMOGENOUS** Uniform in coverage, some anomalies.
- PATCHY** Diverse coverage running from almost homogenous to almost sparse.
- SPARSE** Limited growth with more void area than growth area.
- VOID** Open with little or no growth. Boundary defined by edges of other polygons.

3
DB 79 PG 548
US GOVERNMENT

SITE 5

SITE 6

 DENOTES IMPACTS IN SURFACE WATER

 DENOTES TEMPORARY IMPACTS IN SURFACE WATER

WORK TRESTLE

6" DECK DRAINS @ +/- 14' O.C.
FROM 57+20 TO 175+51 -L-

4
DB N/A PG N/A
STATE OF NORTH CAROLINA

4
DB N/A PG N/A
STATE OF NORTH CAROLINA

PERMIT DRAWINGS
SHEET 22 OF 45

SEE SHEET NO. 26 FOR -L- PROFILE.

MATCHLINE -L- STA. 121+00, SEE SHEET NO. 12

120

NORTH APPROACH

VOID

VOID

BENT #109

BENT #108

BENT #107

BENT #106

BENT #105

BENT #104

BENT #103

BENT #102

BENT #101

BENT #100

BENT #99

BENT #98

BENT #97

BENT #96

BENT #95

BENT #94

BENT #93

BENT #92

BENT #91

BENT #90

R=6100'

R=6000'

BRIDGE #11 (BONNER BRIDGE)
CONC BRIDGE DECK

R=6100'

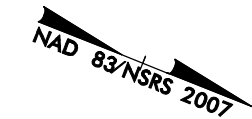
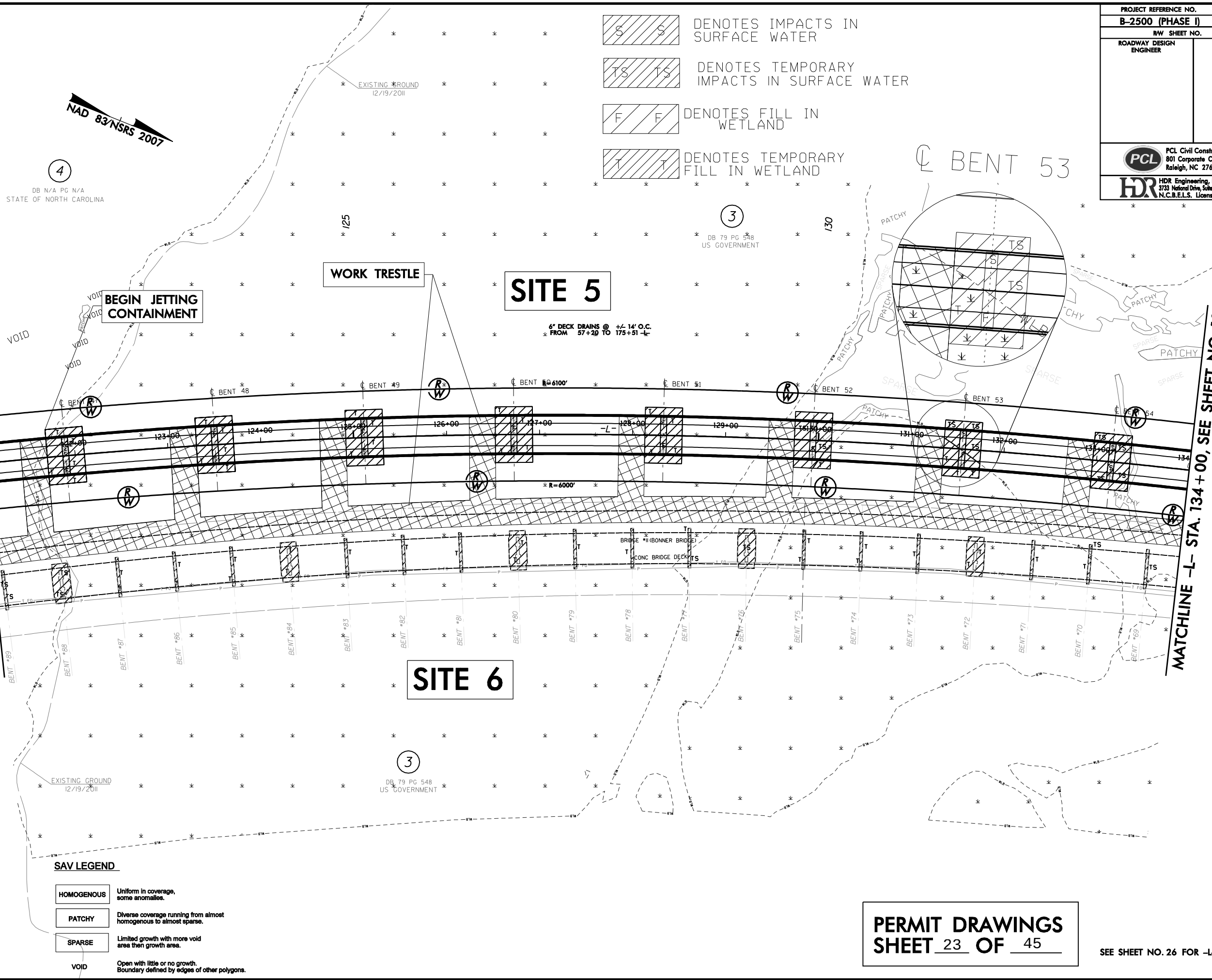
R=6000'

BRIDGE #11 (BONNER BRIDGE)
CONC BRIDGE DECK

REVISIONS

MATCHLINE -L- STA. 121+00, SEE SHEET NO. 11

MATCHLINE -L- STA. 134+00, SEE SHEET NO. 13



4

DB N/A PG N/A
STATE OF NORTH CAROLINA

WORK TRESTLE

SITE 5

6" DECK DRAINS @ +/- 14' O.C.
FROM 57+20 TO 175+51

3

DB 79 PG 548
US GOVERNMENT

BENT 53

SITE 6

3

DB 79 PG 548
US GOVERNMENT

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 than growth area.
- VOID** Open with little or no growth. Boundary defined by edges of other polygons.

- S** DENOTES IMPACTS IN SURFACE WATER
- TS** DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- F** DENOTES FILL IN WETLAND
- T** DENOTES TEMPORARY FILL IN WETLAND

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		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		

PERMIT DRAWINGS
SHEET 23 OF 45

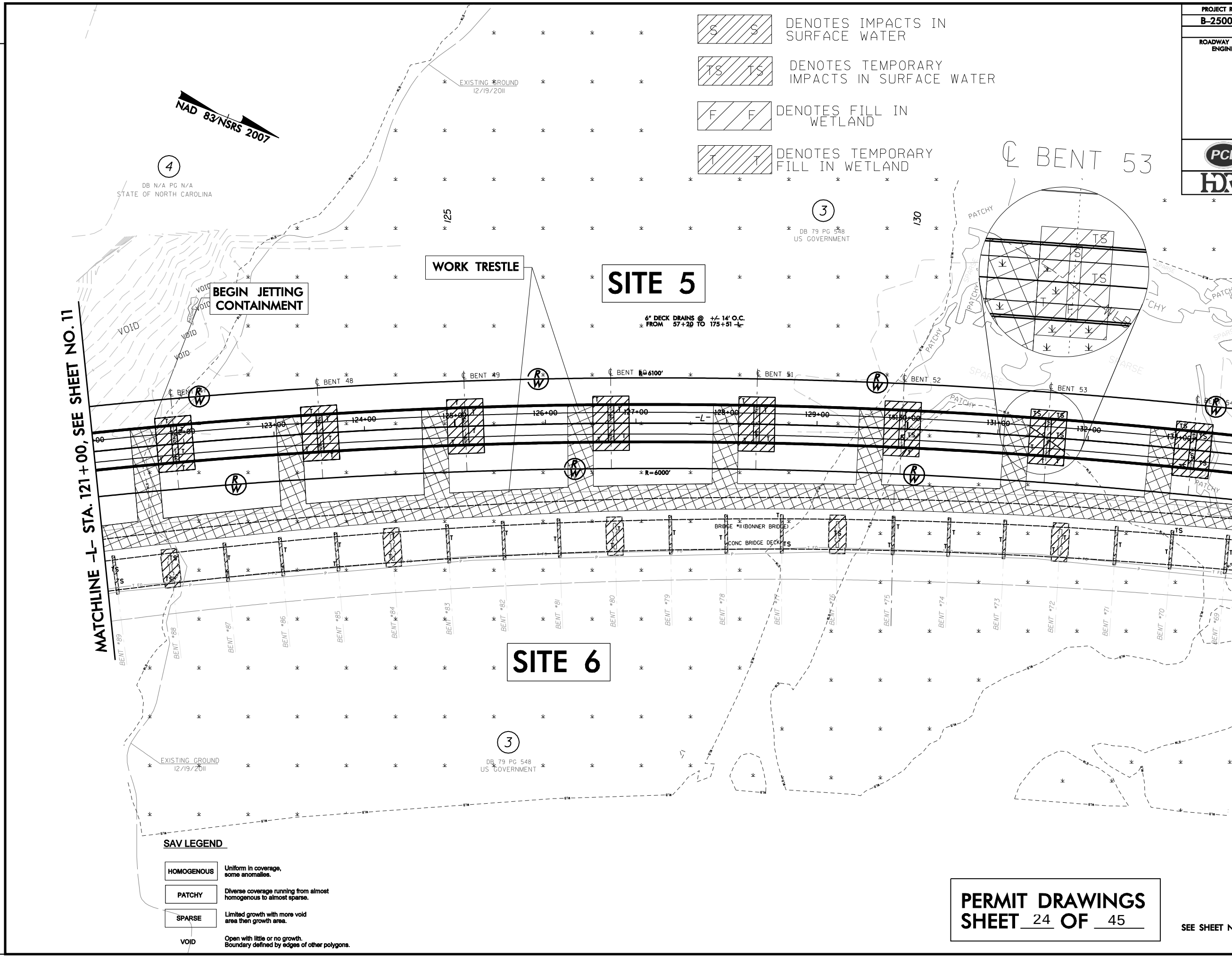
SEE SHEET NO. 26 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_color_eng-100.plt
USER: jmassroc
FILE: PCL-Civil-Const\B-2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_R0Y_PSH-12.dgn
PENTABLE: NCDOT_permits.tbl
DATE: 5/23/2012
TIME: 2:52:55 PM

REVISIONS

MATCHLINE -L- STA. 121+00, SEE SHEET NO. 11

MATCHLINE -L- STA. 134+00, SEE SHEET NO. 13



- DENOTES IMPACTS IN SURFACE WATER
- DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- DENOTES FILL IN WETLAND
- DENOTES TEMPORARY FILL IN WETLAND

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		12
RW SHEET NO.		
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER
		</

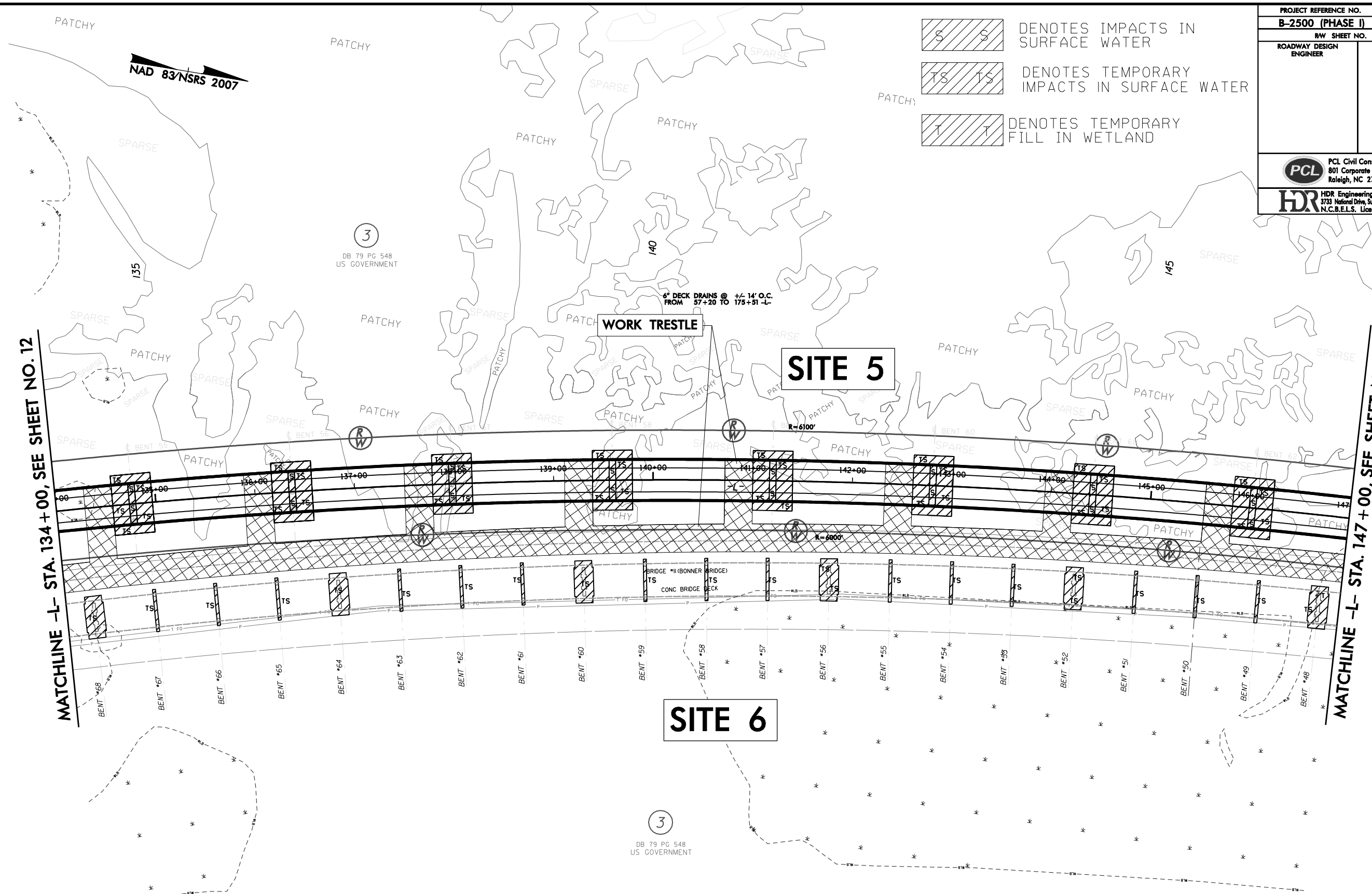
PERMIT DRAWINGS
SHEET 24 OF 45

SEE SHEET NO. 26 FOR -L- PROFILE.

REVISIONS

MATCHLINE -L- STA. 134 + 00, SEE SHEET NO. 12

MATCHLINE -L- STA. 147 + 00, SEE SHEET NO. 14



- DENOTES IMPACTS IN SURFACE WATER
- DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- DENOTES TEMPORARY FILL IN WETLAND

PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 13
RW 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 than growth area.
 - VOID** Open with little or no growth. Boundary defined by edges of other polygons.

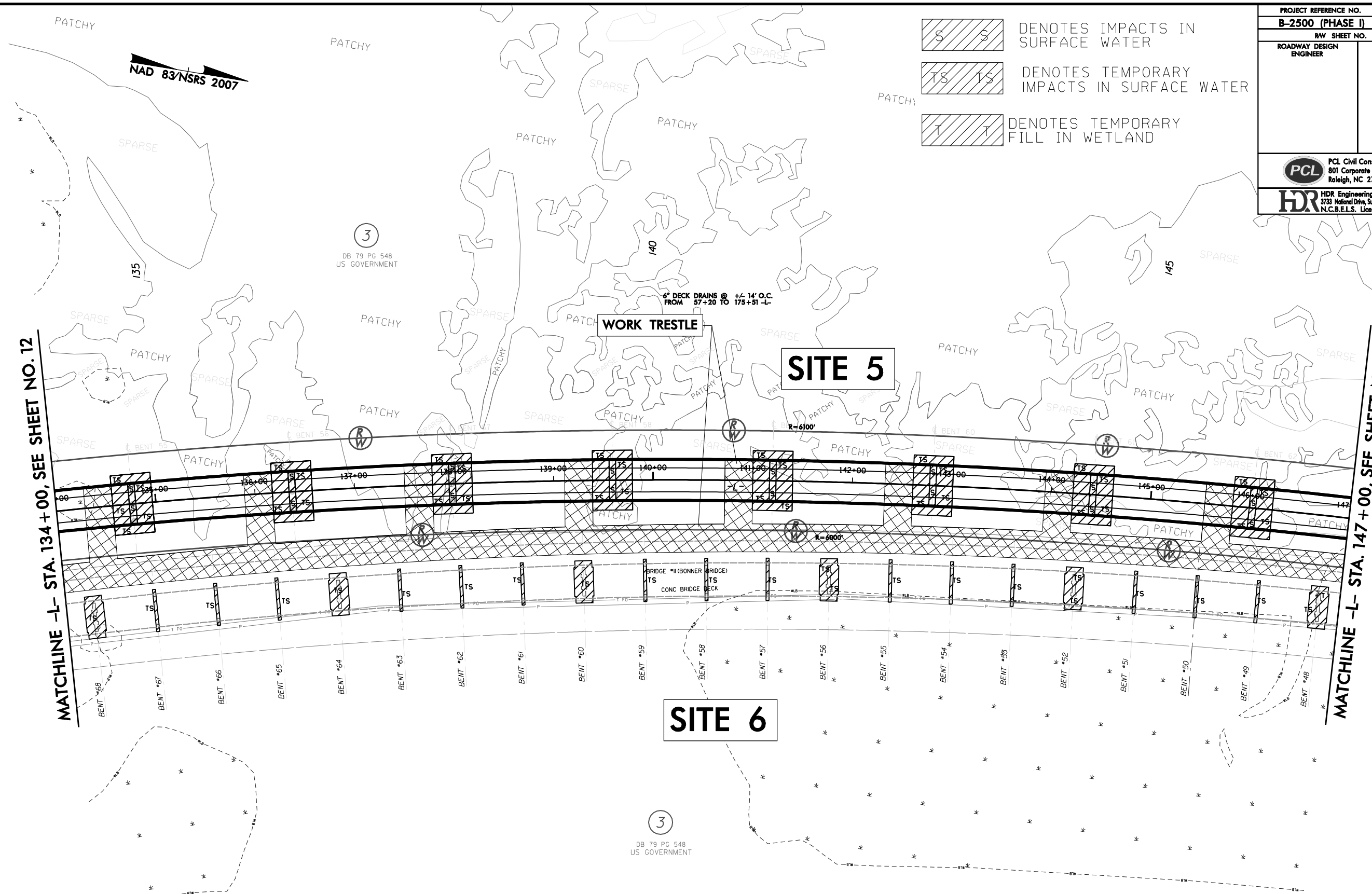
PERMIT DRAWINGS
SHEET 25 OF 45

SEE SHEET NO. 27 FOR -L- PROFILE.

REVISIONS

MATCHLINE -L- STA. 134 + 00, SEE SHEET NO. 12

MATCHLINE -L- STA. 147 + 00, SEE SHEET NO. 14



- DENOTES IMPACTS IN SURFACE WATER
- DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- DENOTES TEMPORARY FILL IN WETLAND

PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 13	
RW SHEET NO.		HYDRAULICS ENGINEER	
ROADWAY DESIGN ENGINEER			

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

HDR 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

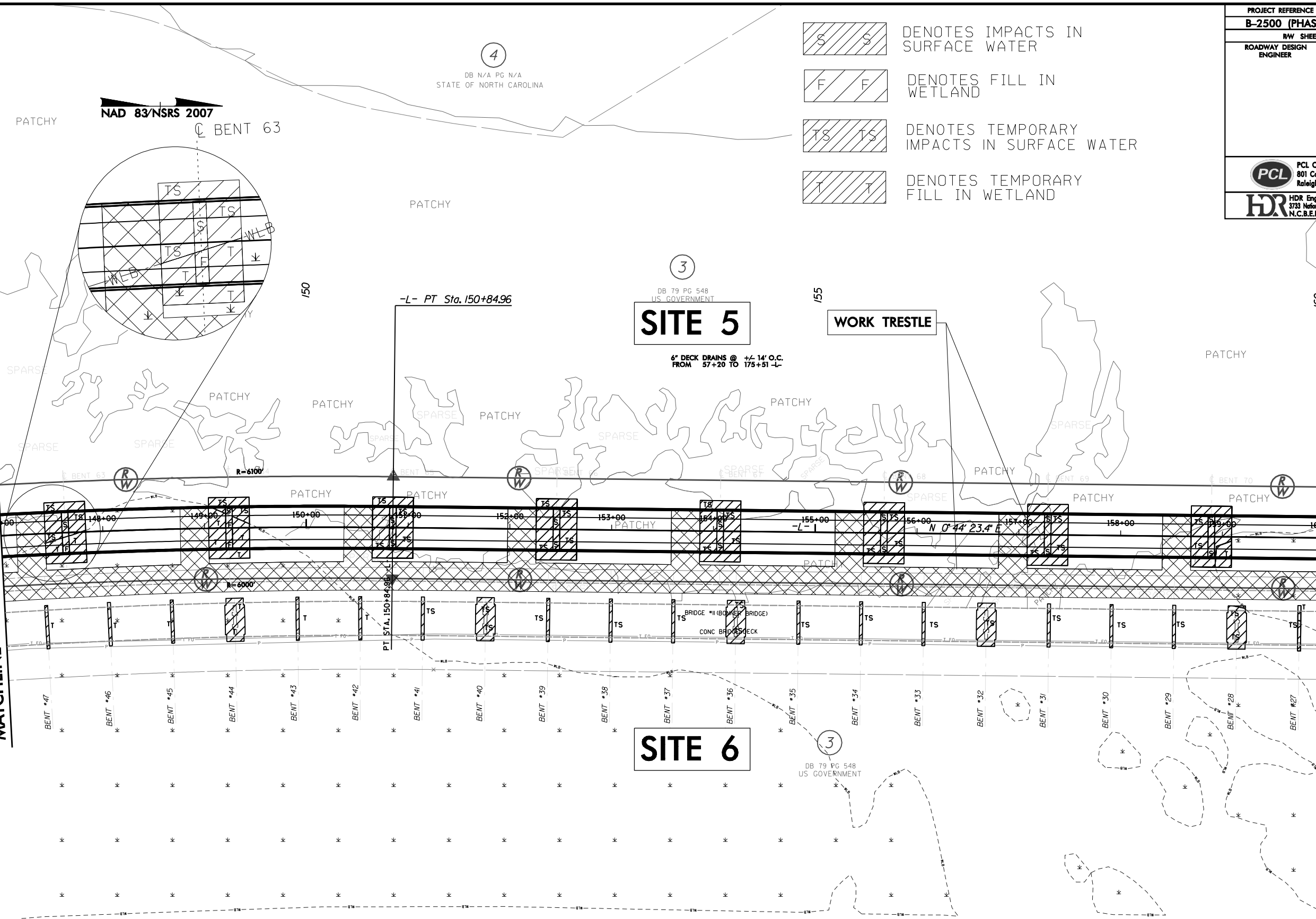
- SAV LEGEND**
- HOMOGENEOUS Uniform in coverage, some anomalies.
 - PATCHY Diverse coverage running from almost homogenous to almost sparse.
 - SPARSE Limited growth with more void area than growth area.
 - VOID Open with little or no growth. Boundary defined by edges of other polygons.

PERMIT DRAWINGS
SHEET 26 OF 45

SEE SHEET NO. 27 FOR -L- PROFILE.

REVISIONS

MATCHLINE -L- STA. 147+00, SEE SHEET NO. 13



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 than growth area.
- VOID** Open with little or no growth. Boundary defined by edges of other polygons.

- DENOTES IMPACTS IN SURFACE WATER
- DENOTES FILL IN WETLAND
- DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- DENOTES TEMPORARY FILL IN WETLAND

SITE 5

SITE 6

PERMIT DRAWINGS
SHEET 27 OF 45

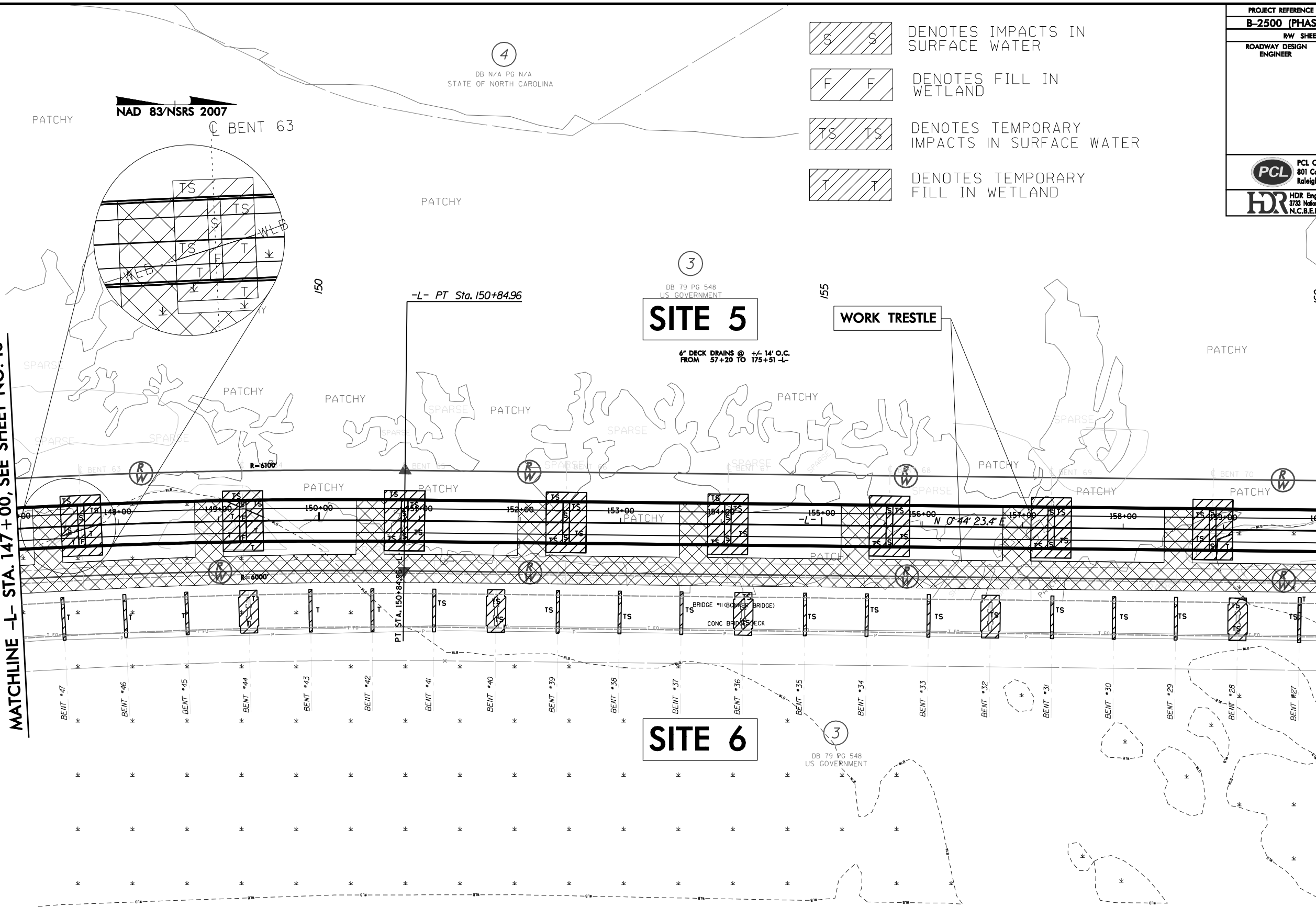
SEE SHEET NO. 27 FOR -L- PROFILE.

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		14
RW 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		

MATCHLINE -L- STA. 160+00, SEE SHEET NO. 15

REVISIONS

MATCHLINE -L- STA. 147+00, SEE SHEET NO. 13



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 than growth area.
- VOID** Open with little or no growth. Boundary defined by edges of other polygons.

- DENOTES IMPACTS IN SURFACE WATER
- DENOTES FILL IN WETLAND
- DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- DENOTES TEMPORARY FILL IN WETLAND

SITE 5
DB 79 PG 548
US GOVERNMENT

SITE 6
DB 79 PG 548
US GOVERNMENT

PERMIT DRAWINGS
SHEET 28 OF 45

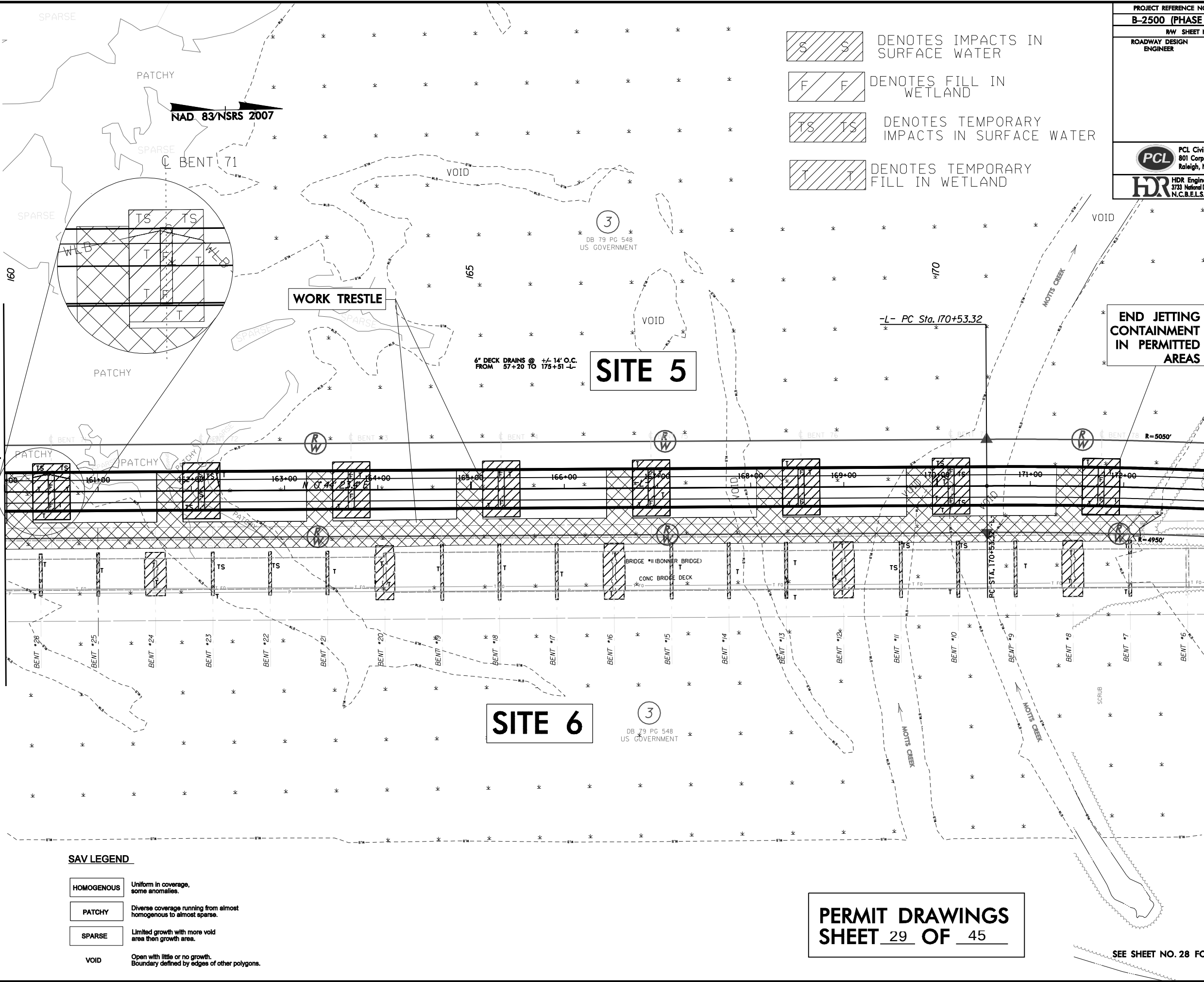
SEE SHEET NO. 27 FOR -L- PROFILE.

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		14	
RW 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	

MATCHLINE -L- STA. 160+00, SEE SHEET NO. 15

REVISIONS

MATCHLINE -L- STA. 160+00, SEE SHEET NO. 14



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 than growth area.
- VOID Open with little or no growth. Boundary defined by edges of other polygons.

- 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

SITE 5

SITE 6

END JETTING CONTAINMENT IN PERMITTED AREAS

PERMIT DRAWINGS
SHEET 29 OF 45

SEE SHEET NO. 28 FOR -L- PROFILE.

MATCHLINE -L- STA. 173+00, SEE SHEET NO. 16

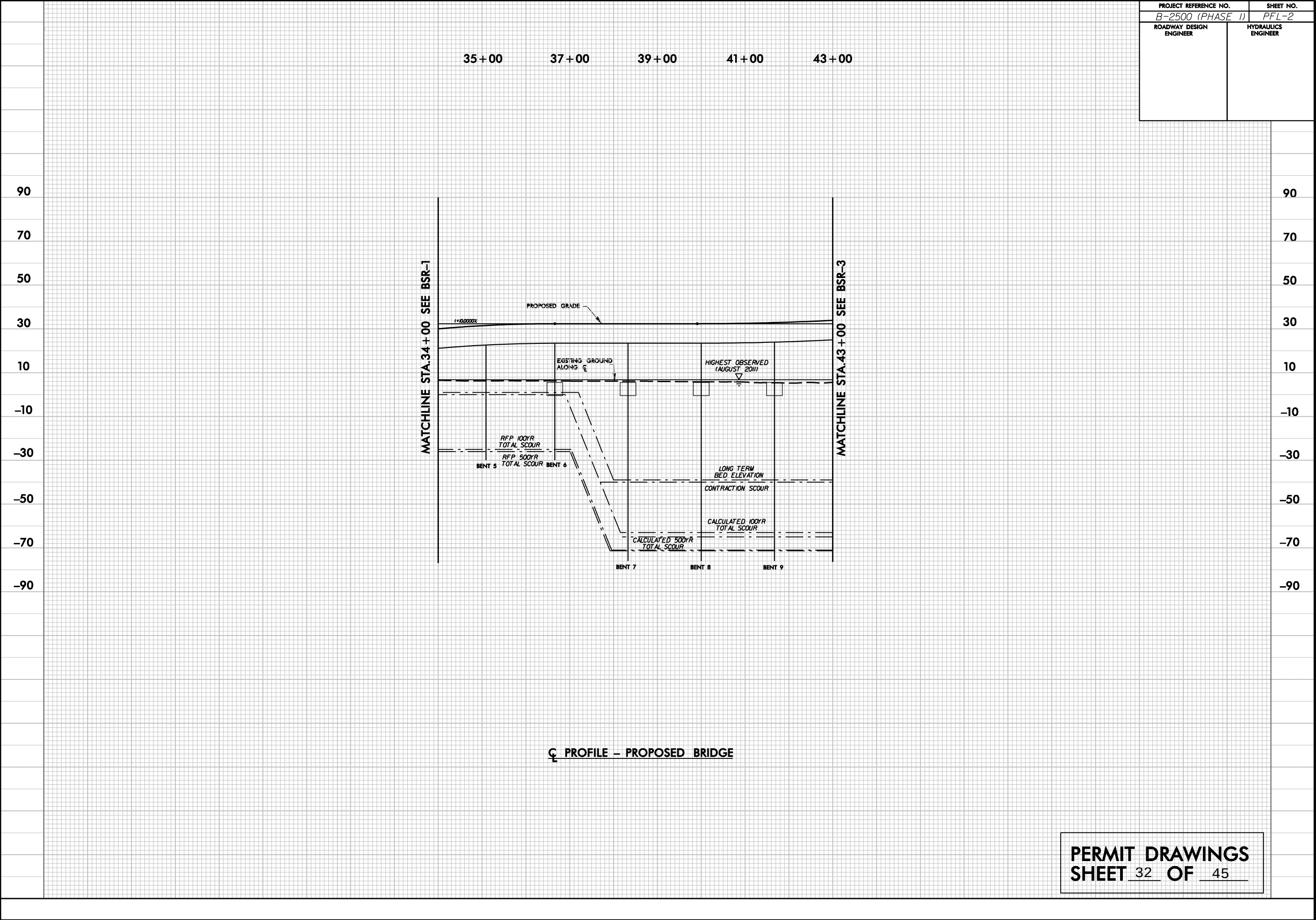
PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 15	
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
PCL Civil Constructors, Inc. 801 Corporate Center Drive, Suite 130 Raleigh, NC 27607		HDR Engineering, Inc. of the Carolinas 3733 National Drive, Suite 207 Raleigh, N.C. 27612 N.C.B.E.L.S. License Number: F-0116	



5/14/99

5/23/2012
C:\csw\king\tpa\0274011\B2500_HYD_PRM_PFL.dgn
J:\ASSOC

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE 1)	PFL-2
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



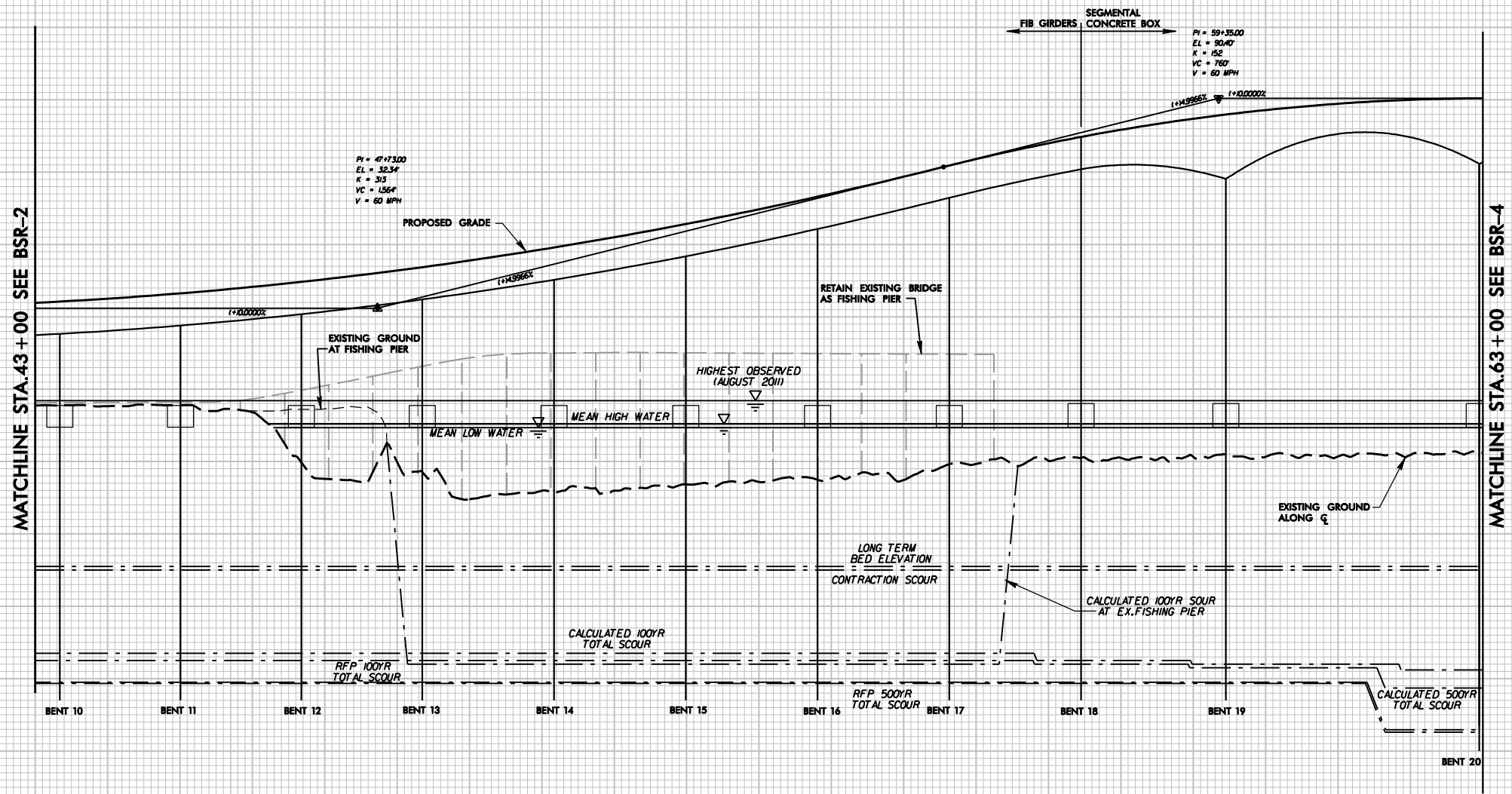
PERMIT DRAWINGS
SHEET 32 OF 45

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE 1)	PFL-3
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

43+00 45+00 47+00 49+00 51+00 53+00 55+00 57+00 59+00 61+00 63+00

90
70
50
30
10
-10
-30
-50
-70
-90

90
70
50
30
10
-10
-30
-50
-70
-90



CL PROFILE - PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 33 OF 45

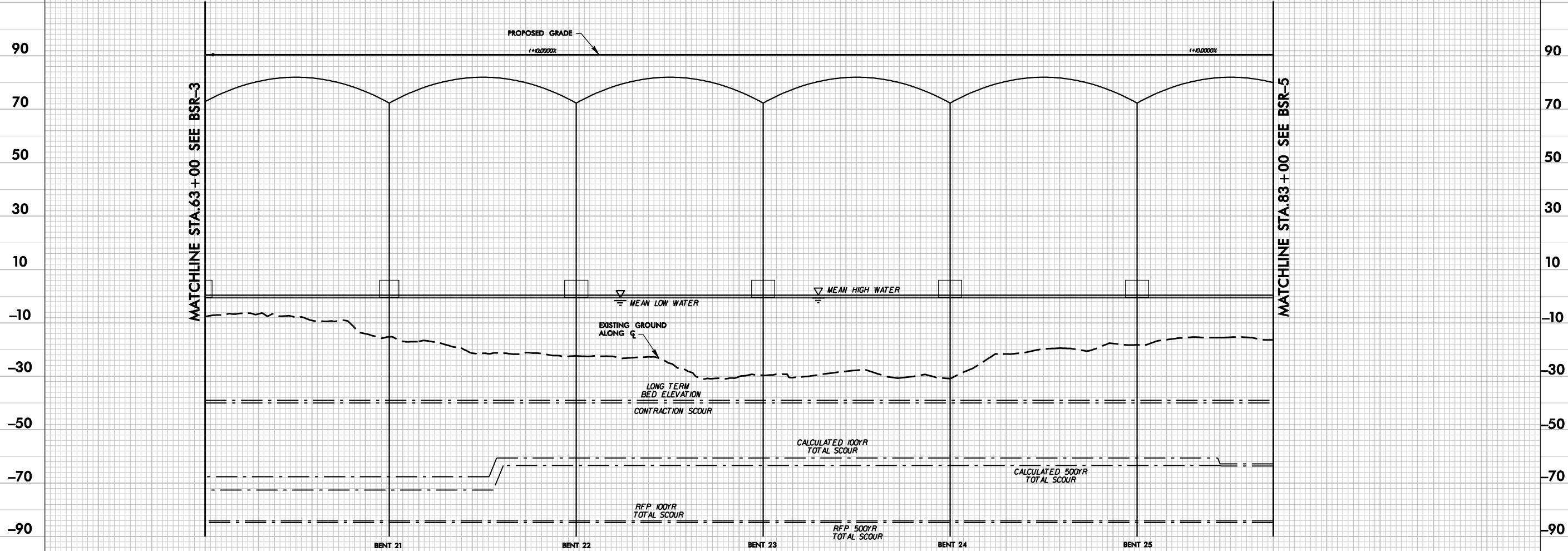
5/14/99

5/23/2012
C:\working\tpa\0274011\B2500_HYD_PFM_PFL.dgn
jmassoc

5/14/99

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		PFL-4	
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	

63+00 65+00 67+00 69+00 71+00 73+00 75+00 77+00 79+00 81+00 83+00



C PROFILE - PROPOSED BRIDGE

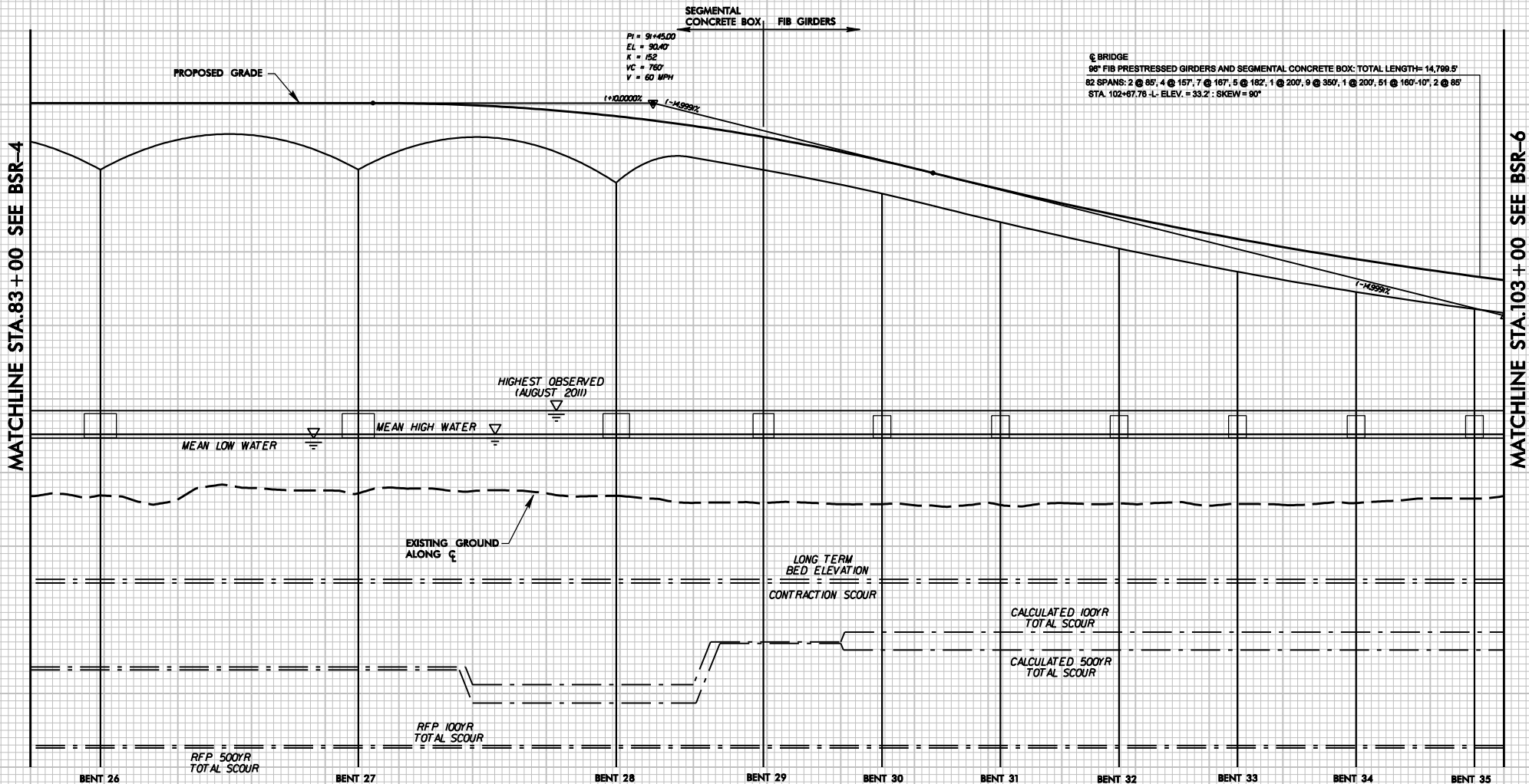
PERMIT DRAWINGS
SHEET 34 OF 45

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE 1)		PFL-5
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER	

83+00 85+00 87+00 89+00 91+00 93+00 95+00 97+00 99+00 101+00 103+00

90
70
50
30
10
-10
-30
-50
-70
-90

90
70
50
30
10
-10
-30
-50
-70
-90



CL PROFILE - PROPOSED BRIDGE

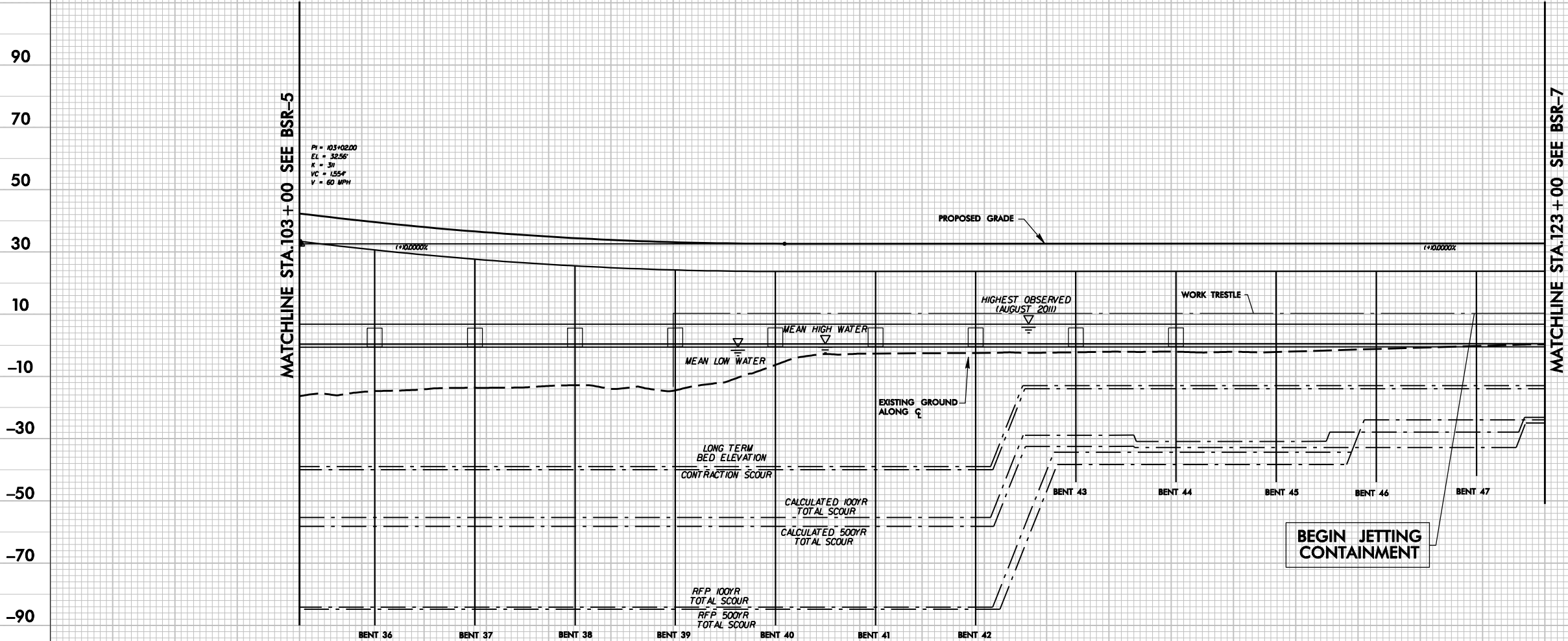
PERMIT DRAWINGS
SHEET 35 OF 45

5/14/99

5/23/2012
C:\working\tpa\0274011\B2500_HYD_PFM_PFL.dgn
jmb3505

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE 1)	PFL-6
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

103+00 105+00 107+00 109+00 111+00 113+00 115+00 117+00 119+00 121+00 123+00



CL PROFILE - PROPOSED BRIDGE

5/14/99

5/23/2012
C:\working\tpa\0274011\B2500_HYD_PFM_PFL.dgn
jmb:scg

5/14/99

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE 1)		PFL-7
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER	

123+00 125+00 127+00 129+00 131+00 133+00 135+00 137+00 139+00 141+00 143+00

70

50

30

10

-10

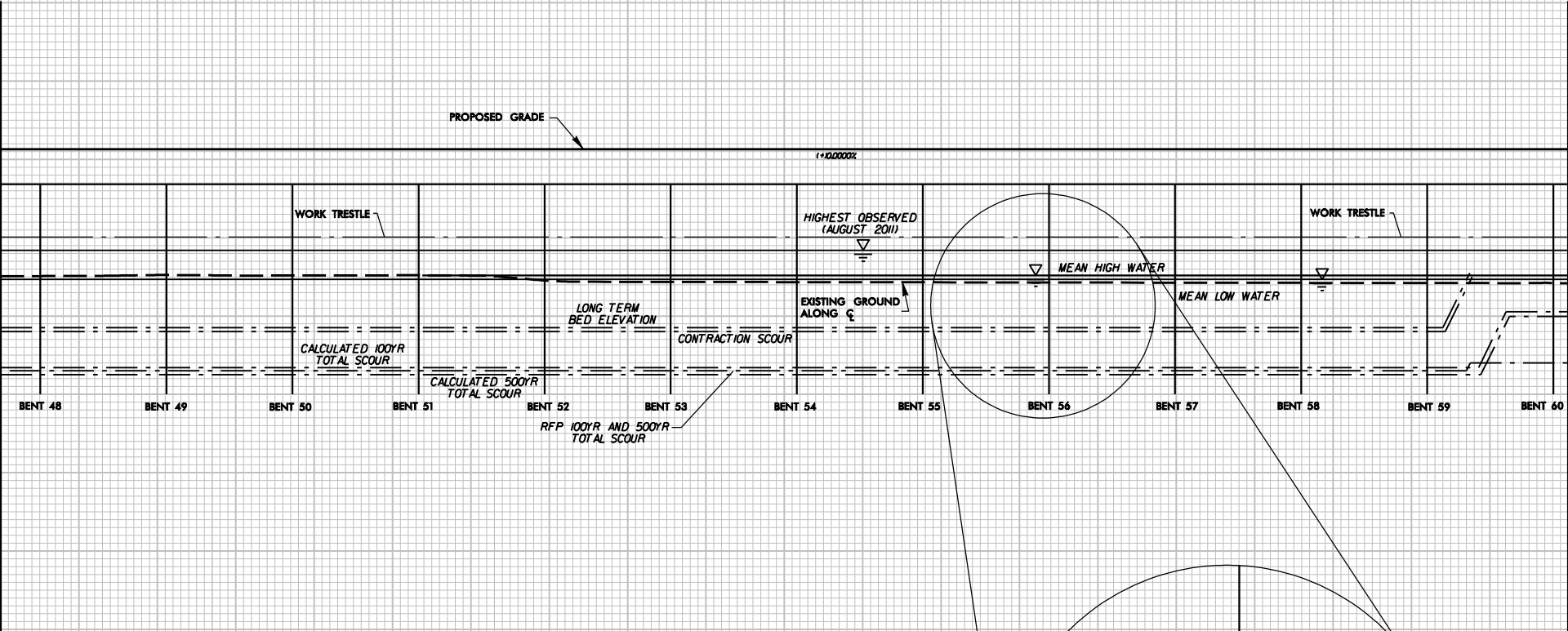
-30

-50

-70

-90

MATCHLINE STA. 123+00 SEE BSR-6



MATCHLINE STA. 143+00 SEE BSR-8

70

50

30

10

-10

-30

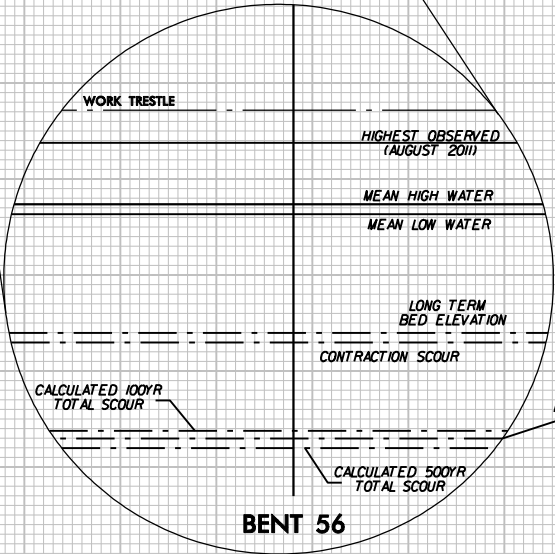
-50

-70

-90

C PROFILE - PROPOSED BRIDGE

BENT 56



PERMIT DRAWINGS
SHEET 37 OF 45

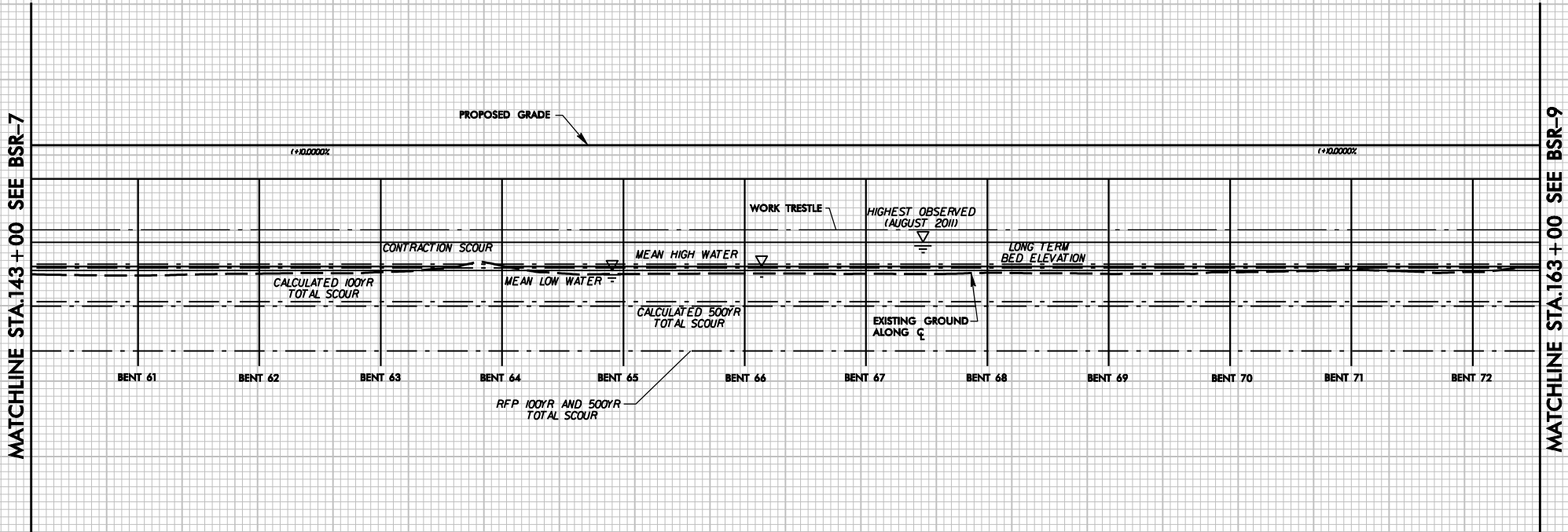
5/14/99
6/14/2012
c:\pwworking\tpa\0274011\B2500_HYD_PFM_PFL.dgn
jms

PROJECT REFERENCE NO.		SHEET NO.
B-2500 PHASE 1)		PFL-8
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER

143+00 145+00 147+00 149+00 151+00 153+00 155+00 157+00 159+00 161+00 163+00

70
50
30
10
-10
-30
-50
-70
-90

70
50
30
10
-10
-30
-50
-70
-90



CL PROFILE - PROPOSED BRIDGE

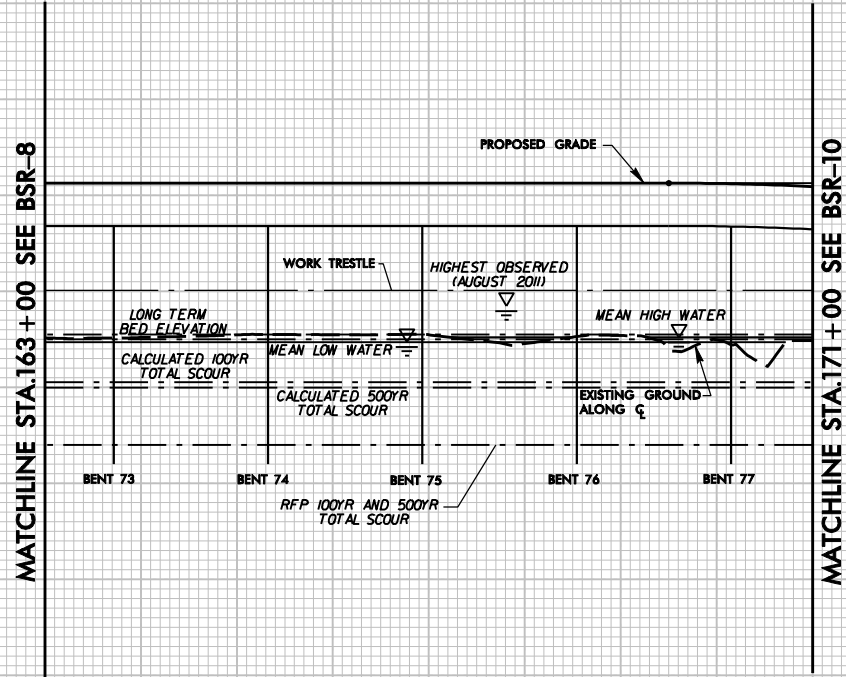
5/14/99
5/23/2012
C:\working\tpa\0274011\B2500_HYD_PRM_PFL.dgn
JHASSOC

PROJECT REFERENCE NO.		SHEET NO.
B-2500 PHASE 1)		PFL-9
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER

163+00 165+00 167+00 169+00 171+00

70
50
30
10
-10
-30
-50
-70
-90

70
50
30
10
-10
-30
-50
-70
-90



C PROFILE - PROPOSED BRIDGE

5/14/99

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE 1)		PFL-10
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER

171+00 172+00 173+00 174+00 175+00 176+00 177+00 178+00 179+00 180+00 181+00

60

50

40

30

20

10

0

-10

-20

-30

-40

-50

-60

-70

-80

-90

60

50

40

30

20

10

0

-10

-20

-30

-40

-50

-60

-70

-80

-90

MATCHLINE STA.171+00 SEE BSR-9

PI = 172+75.00
EL = 32.56'
K = 156
VC = 650'
V = 60 MPH

(+10.0000%)

(-14.620%)

PROPOSED GRADE

HIGHEST OBSERVED
(AUGUST 2011)

MEAN HIGH WATER

EXISTING GROUND
ALONG Q

CALCULATED 100YR
TOTAL SCOUR

CALCULATED 500YR
TOTAL SCOUR

RFP 100YR AND 500YR
TOTAL SCOUR

BENT 78

BENT 79

BENT 80

BENT 81

WORK TRESTLE

LONG TERM
BED ELEVATION

END JETTING
CONTAINMENT

END BRIDGE
-L- STA.176+67.51
ELEV.16.4'

EB2

ABUTMENT FILL SLOPE AND
SIDE SLOPE PROTECTION
SEE DETAIL

PI = 178+80.00
EL = 7.38'
K = 137
VC = 560'
V = 60 MPH

(-14.620%)

(-10.0637%)

Q PROFILE - PROPOSED BRIDGE

PERMIT DRAWINGS
SHEET 40 OF 45

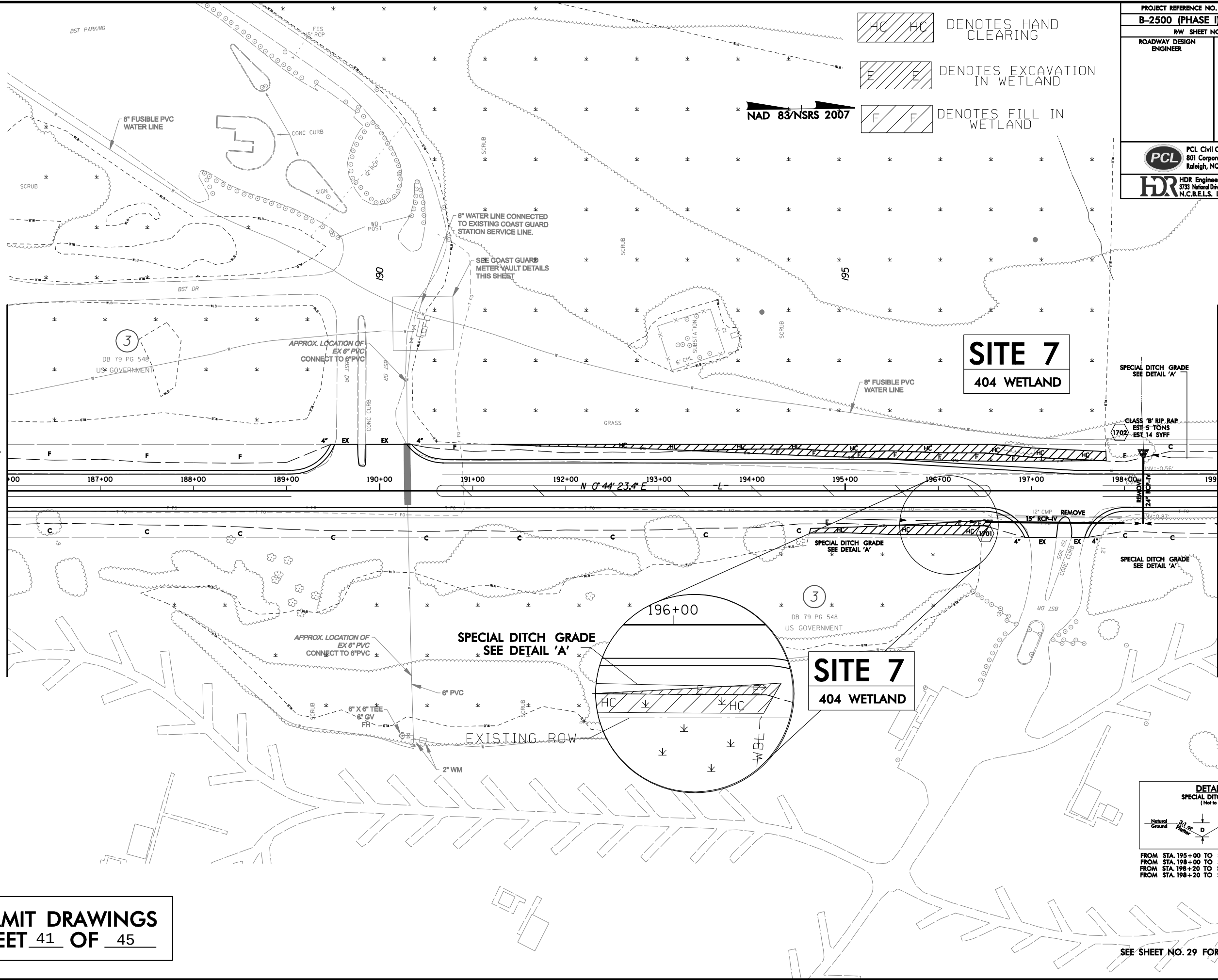
5/23/2012
C:\working\tpa\027401\B2500_HYD_PFM_PFL.dgn
jmb5505

PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassroc
FILE: PCL-CivilConst\B-2500\Borner-Bridge-Replacement\06.00.NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH-17.dgn
PENTABLE: NCDOT_permits.tbl
DATE: 5/24/2012
TIME: 11:41:46 AM

REVISIONS

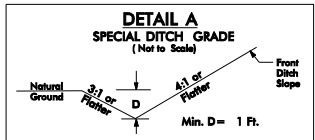
PERMIT DRAWINGS
SHEET 41 OF 45

MATCHLINE -L- STA. 186 + 00, SEE SHEET NO. 16



MATCHLINE -L- STA. 199 + 00, SEE SHEET NO. 18

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		17
RW SHEET NO.		
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER
</		



FROM STA. 195+00 TO STA. 194+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

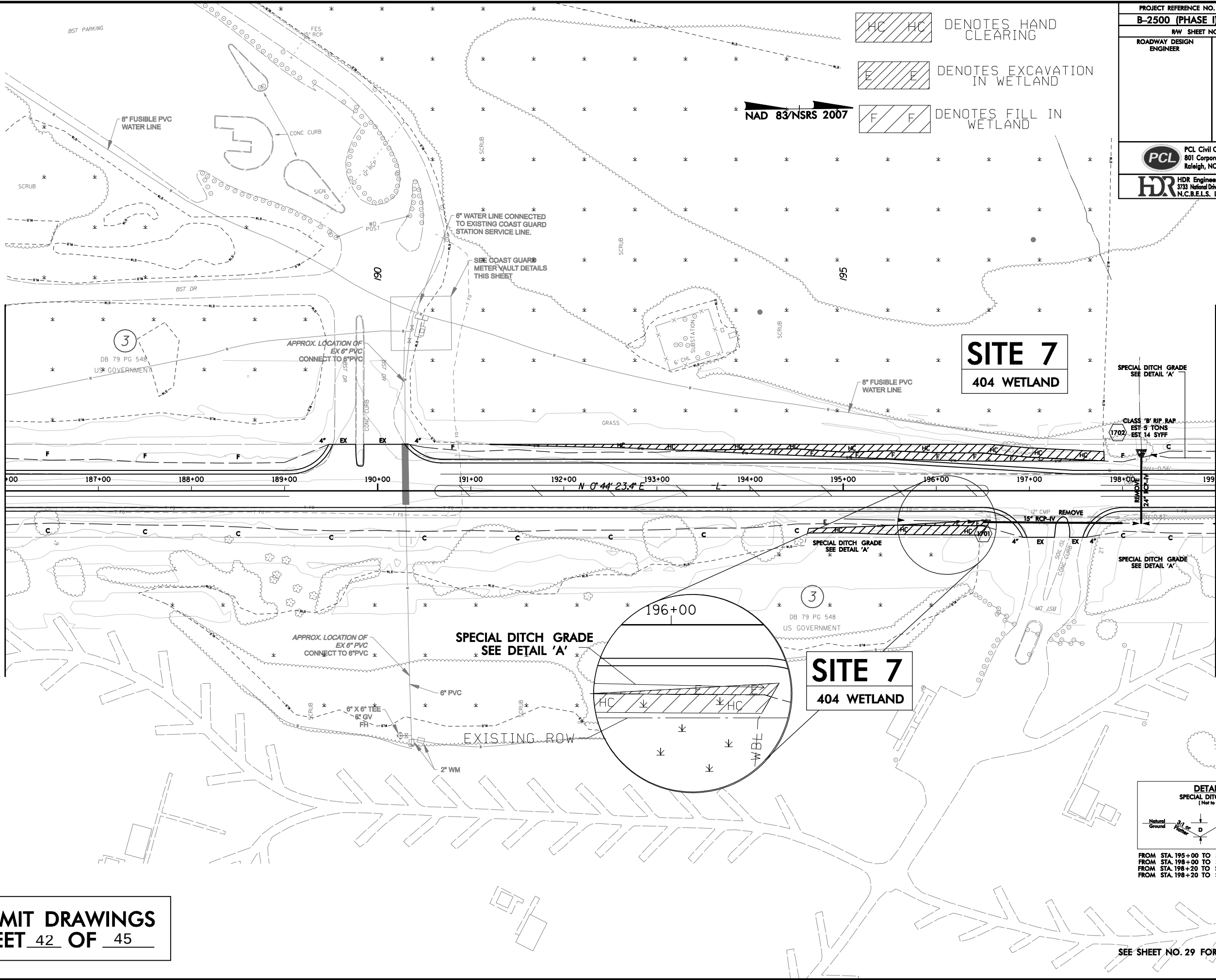
SEE SHEET NO. 29 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassoc
FILE: PCL-CivilConst\B-2500\Roadway\Proj\B2500_RDY_PSH-17.dgn
PENTABLE: NCDOT_permits.tbl
DATE: 5/24/2012
TIME: 11:41:25 AM

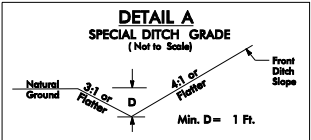
REVISIONS

PERMIT DRAWINGS
SHEET 42 OF 45

MATCHLINE -L- STA. 186 + 00, SEE SHEET NO. 16



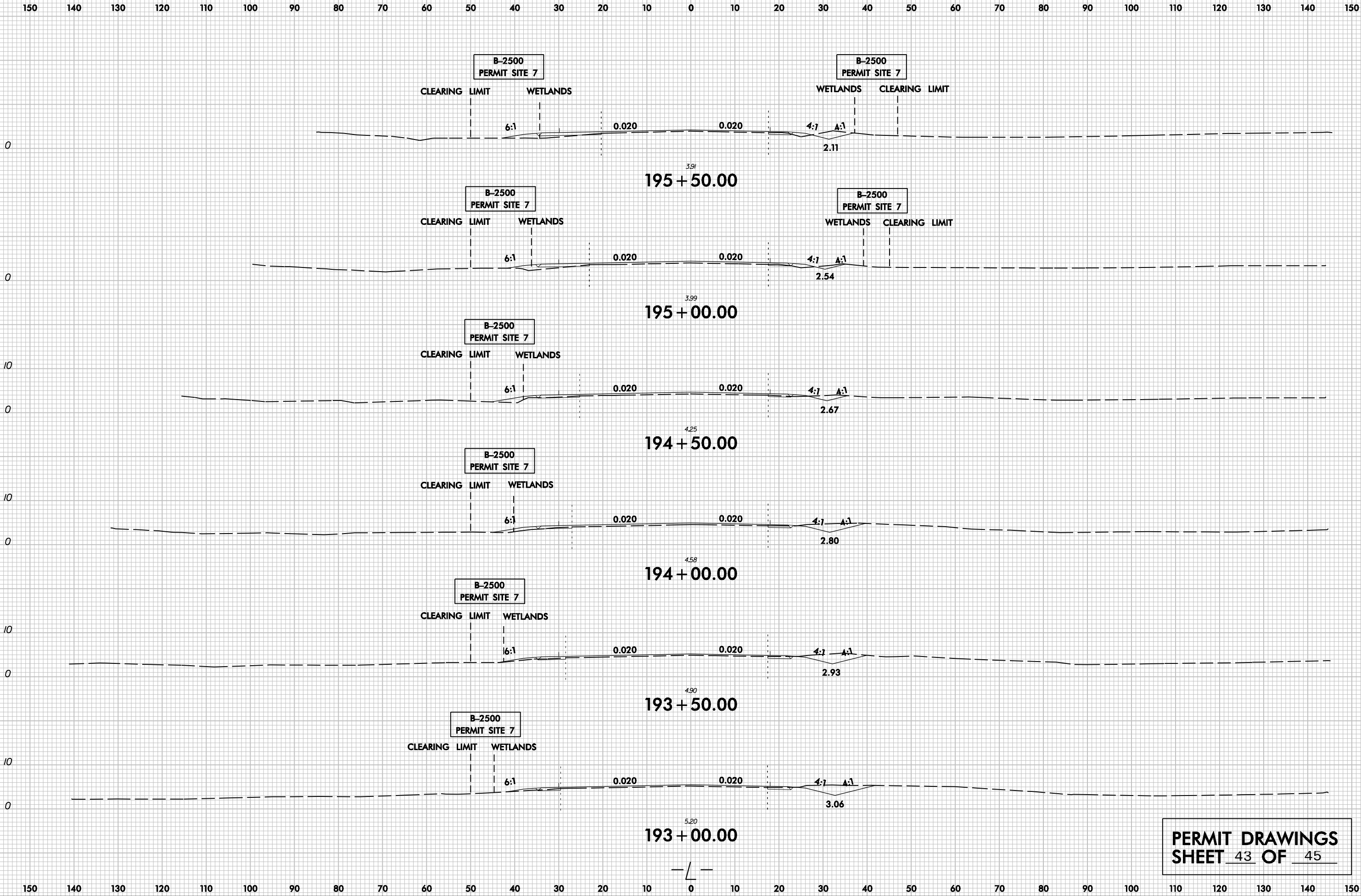
PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		17	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	



FROM STA. 195+00 TO STA. 194+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.

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: 32635.1.4 AND 32635.3.GV3
 B-2500 (PHASE I)
 NC 12-REPLACEMENT OF HERBERT C.
 BONNER BRIDGE ACROSS OREGON
 INLET FROM HATTERAS ISLAND
 TO BODIE ISLAND
 SHEET 44 OF 45

05 / 24 / 12

WETLAND PERMIT IMPACT SUMMARY													
Site No.	Station (From/To)	Structure Size / Type	Wetland Restoration						SURFACE WATER IMPACTS				
				Permanent Fill In Wetlands (ac)	Temp. Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in Wetlands (ac)	Permanent SW impacts (ac)	Temp. SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
1	-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								***			
	-BW- 10+58 TO 10+85	Boardwalk		***				0.01					
****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	0.27	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. The boardwalk impacts are calculated as the entire footprint of the 10' wide boardwalk.

**** The underground trenching for the utility relocation in wetlands was considered "Temporary Fill" because "Temporary Excavation" is not a category. The permanent fill in wetlands is due to the relocation of the utility tower.

CAMA vs 404 Wetland Impacts		*** Bent 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						
	Boardwalk	Work Trestle/Dock	Proposed Bridge	Work Trestle/Platform	Existing Bridge Demo	
	Perm. Fill in 404 Wetlands = <0.01 AC	Temp. SW Impacts = <0.01 AC	Perm. Fill in CAMA Wetlands = 0.01 AC Perm. SW Impacts = 1.00 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 - 32635.1.4 and 32635.3.GV3
 B-2500 (Phase I)

 Replacement of Herbert C. Bonner Bridge Across
 Oregon Inlet from Hatteras Island to Bodie Island
 SHEET 45 OF 45

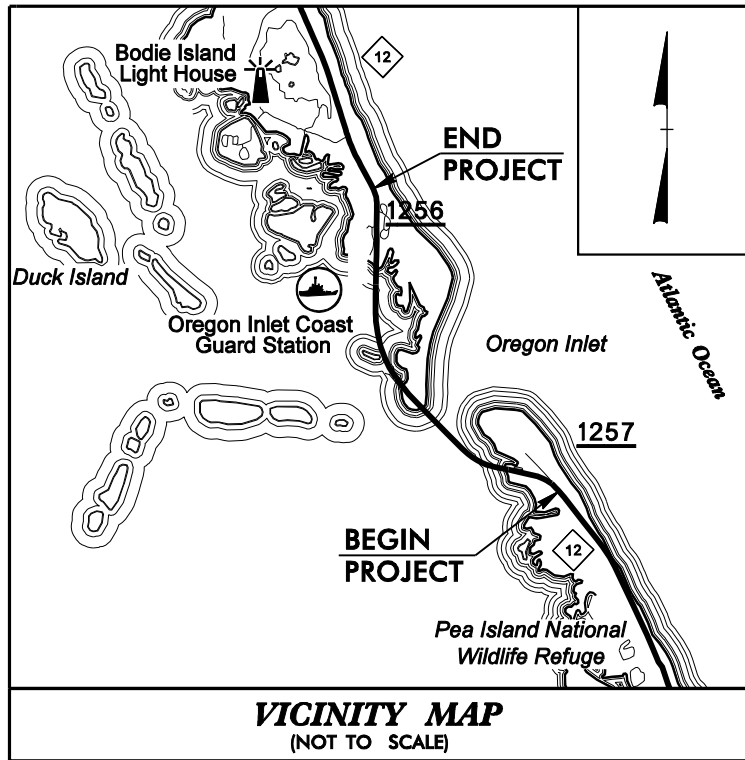
09/08/99

PENTABLE: NCDOT_pshpfl.tbl
TIME: 8:24:11 AM

PLOT DRIVER: NCDOT_pdf_color_eng_100.plt
USER: jmasroc
DATE: 6/1/2012
FILE: PCL_Civil_Const\B-2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500_Roadway\Pro\B2500_RDY_TSH.DGN

CONTRACT: C 202185 TIP PROJECT: B-2500 (PHASE I)

See Sheet 1-A For Index of Sheets



STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS
DARE COUNTY

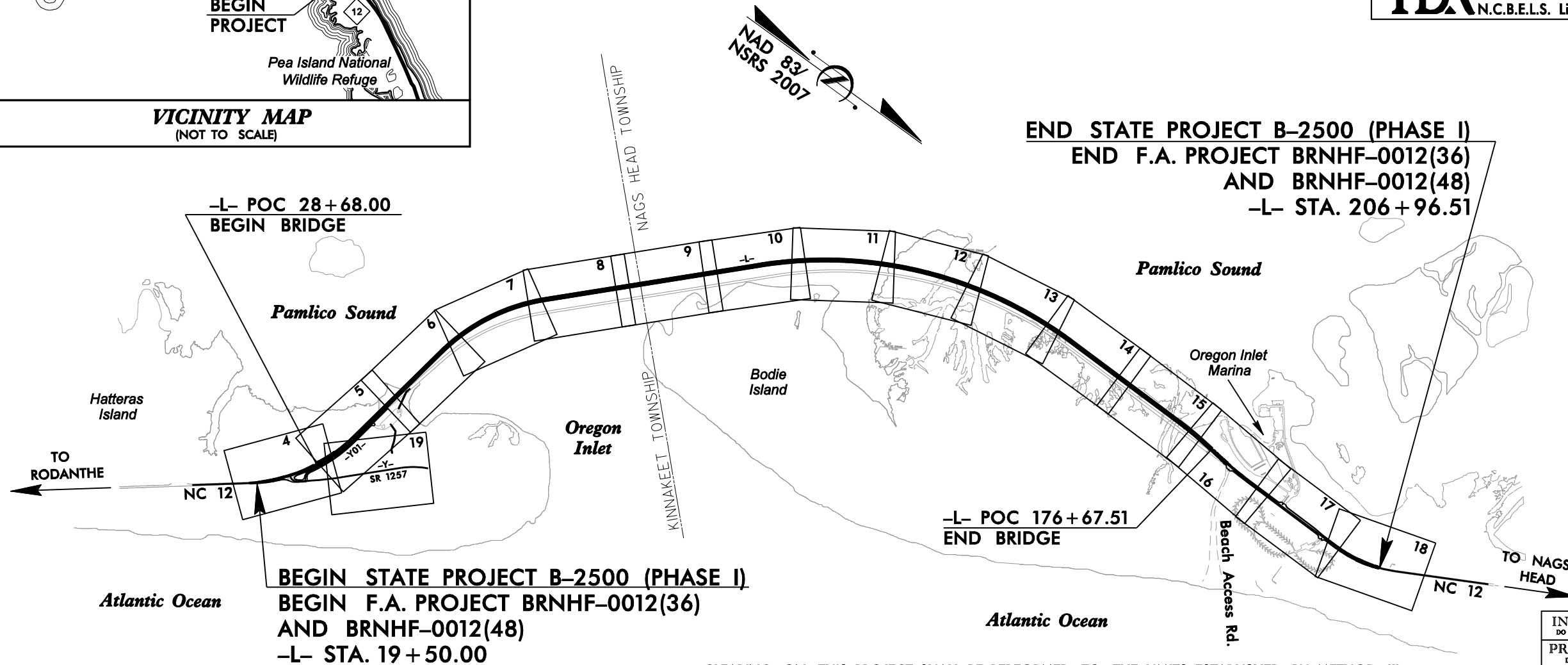
LOCATION: NC 12 - REPLACEMENT OF HERBERT C. BONNER BRIDGE ACROSS OREGON INLET FROM HATTERAS ISLAND TO BODIE ISLAND

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

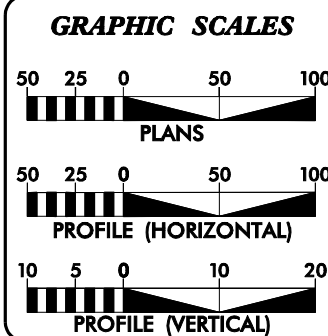
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-2500 (PHASE I)	1	
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
32635.1.4	BRNHF-0012(48)	CONSTRUCTION	
32635.3.GV3	BRNHF-0012(36)	CONSTRUCTION	

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



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



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 (PHASE I)	= 0.747 MILES
LENGTH STRUCTURE TIP PROJECT B-2500 (PHASE I)	= 2.803 MILES
TOTAL LENGTH TIP PROJECT B-2500 (PHASE I)	= 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

ROADWAY DESIGN ENGINEER

STATE HIGHWAY DESIGN ENGINEER

DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA

STATE HIGHWAY DESIGN ENGINEER

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

INDEX OF SHEETS	
SHEET NUMBER	SHEET
1	TITLE SHEET
1-A	INDEX OF SHEETS, GENERAL NOTES, AND LIST OF STANDARD DRAWINGS
1-B	CONVENTIONAL SYMBOLS
1-C	CENTERLINE COORDINATE LIST
2 THRU 2-C	PAVEMENT SCHEDULE, TYPICAL SECTIONS, AND WEDGING DETAILS
2-D THRU 2-E	DETOUR ALIGNMENT
2-F	CROSS-SECTION LAYOUT DETAIL
2-G	RETAINING WALL ENVELOPE
2-H THRU 2-I	METHOD OF PIPE INSTALLATION DETAILS
2-J	ANCHORAGE FOR FRAMES DETAIL
3	PARCEL INDEX SHEET
4 THRU 19	PLAN SHEETS
20 THRU 32	PROFILE SHEETS
X-1 THRU X-80	CROSS-SECTIONS

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' RADIUS OR RADIUS 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.

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	I-A

ROADWAY DESIGN ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

Note: Not to Scale
***S.U.E. = Subsurface Utility Engineering**

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	⊙ EP
Property Corner	-----
Property Monument	ECM
Parcel/Sequence Number	(23)
Existing Fence Line	-x-x-x-
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	⊙
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	⊕
False Sump	⊕

RAILROADS:

Standard Gauge	-----
RR Signal Milepost	-----
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	⊕
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	⊕

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	⊕
Storm Sewer	-S-

UTILITIES:

POWER:	
Existing Power Pole	⊕
Proposed Power Pole	⊕
Existing Joint Use Pole	⊕
Proposed Joint Use Pole	⊕
Power Manhole	⊕
Power Line Tower	⊕
Power Transformer	⊕
U/G Power Cable Hand Hole	⊕
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	⊕
Telephone Booth	⊕
Telephone Pedestal	⊕
Telephone Cell Tower	⊕
U/G Telephone Cable Hand Hole	⊕
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 Manhole	⊕
Water Meter	⊕
Water Valve	⊕
Water Hydrant	⊕
Recorded U/G Water Line	-W-
Designated U/G Water Line (S.U.E.*)	-W-
Above Ground Water Line	-A/G Water-

TV:

TV Satellite Dish	⊕
TV Pedestal	⊕
TV Tower	⊕
U/G TV Cable Hand Hole	⊕
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	⊕
Utility Unknown U/G Line	-ZUL-
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.

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CENTERLINE COORDINATE LIST

PROJ. REFERENCE NO.	SHEET NO.
B-2500	1-C



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

Point #	Chain	Station	Northing (Y)	Easting (X)
1	L	10+00.00	750284.1373	3033069.7240
2	L	11+00.00	750362.9920	3033008.2266
3	L	12+00.00	750441.8468	3032946.7292
4	L	13+00.00	750520.7015	3032885.2318
5	L	14+00.00	750599.5562	3032823.7344
6	L	15+00.00	750678.4110	3032762.2370
7	L	16+00.00	750757.2657	3032700.7396
8	L	17+00.00	750836.1204	3032639.2422
9	L	18+00.00	750914.9752	3032577.7448
10	L	19+00.00	750992.8332	3032515.0012
11	L	20+00.00	751067.9729	3032449.0277
12	L	21+00.00	751140.2343	3032379.9135
13	L	22+00.00	751209.4863	3032307.7840
14	L	23+00.00	751275.6030	3032232.7703
15	L	24+00.00	751338.4646	3032155.0084
16	L	25+00.00	751397.9568	3032074.6395
17	L	26+00.00	751453.9718	3031991.8095
18	L	27+00.00	751506.4079	3031906.6687
19	L	28+00.00	751555.1698	3031819.3717
20	L	29+00.00	751600.1690	3031730.0770
21	L	30+00.00	751641.3239	3031638.9465
22	L	31+00.00	751678.5598	3031546.1458
23	L	32+00.00	751711.8091	3031451.8432
24	L	33+00.00	751741.0115	3031356.2100
25	L	34+00.00	751766.1138	3031259.4197
26	L	35+00.00	751787.0706	3031161.6481
27	L	36+00.00	751804.2498	3031063.1379
28	L	37+00.00	751820.7693	3030964.5118
29	L	38+00.00	751837.2888	3030865.8857
30	L	39+00.00	751853.8084	3030767.2596
31	L	40+00.00	751870.3279	3030668.6335
32	L	41+00.00	751886.8474	3030570.0074
33	L	42+00.00	751903.3669	3030471.3814
34	L	43+00.00	751919.8865	3030372.7553
35	L	44+00.00	751936.4060	3030274.1292
36	L	45+00.00	751952.9255	3030175.5031
37	L	46+00.00	751969.4450	3030076.8770
38	L	47+00.00	751985.9646	3029978.2509
39	L	48+00.00	752002.4841	3029879.6248
40	L	49+00.00	752019.0036	3029780.9987
41	L	50+00.00	752035.5231	3029682.3726
42	L	51+00.00	752052.0426	3029583.7466
43	L	52+00.00	752068.5622	3029485.1205
44	L	53+00.00	752085.0817	3029386.4944
45	L	54+00.00	752102.4686	3029288.0210
46	L	55+00.00	752123.1896	3029190.1968
47	L	56+00.00	752147.3720	3029093.1701
48	L	57+00.00	752174.9851	3028997.0636
49	L	58+00.00	752205.9941	3028901.9984
50	L	59+00.00	752240.3600	3028808.0946
51	L	60+00.00	752278.0393	3028715.4705
52	L	61+00.00	752318.9846	3028624.2431
53	L	62+00.00	752363.1440	3028534.5275
54	L	63+00.00	752410.4620	3028446.4369
55	L	64+00.00	752460.8789	3028360.0825
56	L	65+00.00	752514.3309	3028275.5731
57	L	66+00.00	752570.7507	3028193.0155
58	L	67+00.00	752630.0670	3028112.5138
59	L	68+00.00	752692.2051	3028034.1697
60	L	69+00.00	752757.0864	3027958.0818
61	L	70+00.00	752824.6292	3027884.3464
62	L	71+00.00	752894.6311	3027812.9387
63	L	72+00.00	752965.2442	3027742.1305
64	L	73+00.00	753035.8573	3027671.3224
65	L	74+00.00	753106.4704	3027600.5143
66	L	75+00.00	753177.0835	3027529.7061
67	L	76+00.00	753247.6965	3027458.8980
68	L	77+00.00	753318.3096	3027388.0898
69	L	78+00.00	753388.9227	3027317.2817
70	L	79+00.00	753459.5358	3027246.4736
71	L	80+00.00	753530.1489	3027175.6654
72	L	81+00.00	753600.7619	3027104.8573
73	L	82+00.00	753671.3750	3027034.0491
74	L	83+00.00	753741.9881	3026963.2410
75	L	84+00.00	753812.6012	3026892.4329
76	L	85+00.00	753883.2143	3026821.6247
77	L	86+00.00	753953.8274	3026750.8166
78	L	87+00.00	754024.4404	3026680.0084
79	L	88+00.00	754095.0535	3026609.2003
80	L	89+00.00	754165.6666	3026538.3922
81	L	90+00.00	754236.2797	3026467.5840
82	L	91+00.00	754306.8928	3026396.7759

Point #	Chain	Station	Northing (Y)	Easting (X)
83	L	92+00.00	754377.5058	3026325.9677
84	L	93+00.00	754448.1189	3026255.1596
85	L	94+00.00	754518.7320	3026184.3515
86	L	95+00.00	754589.3451	3026113.5433
87	L	96+00.00	754659.9582	3026042.7352
88	L	97+00.00	754730.5713	3025971.9270
89	L	98+00.00	754801.1843	3025901.1189
90	L	99+00.00	754871.7974	3025830.3108
91	L	100+00.00	754942.4105	3025759.5026
92	L	101+00.00	755013.0236	3025688.6945
93	L	102+00.00	755083.6367	3025617.8863
94	L	103+00.00	755154.2496	3025547.2436
95	L	104+00.00	755224.8627	3025477.6505
96	L	105+00.00	755295.4758	3025407.0574
97	L	106+00.00	755366.0889	3025336.4643
98	L	107+00.00	755436.7020	3025265.8712
99	L	108+00.00	755507.3151	3025195.2781
100	L	109+00.00	755577.9282	3025124.6850
101	L	110+00.00	755648.5413	3025054.0919
102	L	111+00.00	755719.1544	3024983.4988
103	L	112+00.00	755790.7675	3024912.9057
104	L	113+00.00	755861.3806	3024842.3126
105	L	114+00.00	755932.9937	3024771.7195
106	L	115+00.00	756003.6068	3024701.1264
107	L	116+00.00	756074.2199	3024630.5333
108	L	117+00.00	756144.8330	3024559.9402
109	L	118+00.00	756215.4461	3024489.3471
110	L	119+00.00	756286.0592	3024418.7540
111	L	120+00.00	756356.6723	3024348.1609
112	L	121+00.00	756427.2854	3024277.5678
113	L	122+00.00	756497.8985	3024206.9747
114	L	123+00.00	756568.5116	3024136.3816
115	L	124+00.00	756639.1247	3024065.7885
116	L	125+00.00	756709.7378	3023995.1954
117	L	126+00.00	756780.3509	3023924.6023
118	L	127+00.00	756850.9640	3023854.0092
119	L	128+00.00	756921.5771	3023783.4161
120	L	129+00.00	756992.1902	3023712.8230
121	L	130+00.00	757062.8033	3023642.2299
122	L	131+00.00	757133.4164	3023571.6368
123	L	132+00.00	757204.0295	3023501.0437
124	L	133+00.00	757274.6426	3023430.4506
125	L	134+00.00	757345.2557	3023359.8575
126	L	135+00.00	757415.8688	3023289.2644
127	L	136+00.00	757486.4819	3023218.6713
128	L	137+00.00	757557.0950	3023148.0782
129	L	138+00.00	757627.7081	3023077.4851
130	L	139+00.00	757698.3212	3023006.8920
131	L	140+00.00	757768.9343	3022936.2989
132	L	141+00.00	757839.5474	3022865.7058
133	L	142+00.00	757910.1605	3022795.1127
134	L	143+00.00	757980.7736	3022724.5196
135	L	144+00.00	758051.3867	3022654.9265
136	L	145+00.00	758121.9998	3022584.3334
137	L	146+00.00	758192.6129	3022513.7403
138	L	147+00.00	758263.2260	3022443.1472
139	L	148+00.00	758333.8391	3022372.5541
140	L	149+00.00	758404.4522	3022301.9610
141	L	150+00.00	758475.0653	3022231.3679
142	L	151+00.00	758545.6784	3022160.7748
143	L	152+00.00	758616.2915	3022090.1817
144	L	153+00.00	758686.9046	3022020.5886
145	L	154+00.00	758757.5177	3021949.9955
146	L	155+00.00	758828.1308	3021879.4024
147	L	156+00.00	758898.7439	3021808.8093
148	L	157+00.00	758969.3570	3021738.2162
149	L	158+00.00	759040.9701	3021667.6231
150	L	159+00.00	759111.5832	3021597.0300
151	L	160+00.00	759182.1963	3021526.4369
152	L	161+00.00	759252.8094	3021455.8438
153	L	162+00.00	759323.4225	3021385.2507
154	L	163+00.00	759394.0356	3021314.6576
155	L	164+00.00	759464.6487	3021244.0645
156	L	165+00.00	759535.2618	3021173.4714
157	L	166+00.00	759605.8749	3021102.8783
158	L	167+00.00	759676.4880	3021032.2852
159	L	168+00.00	759747.1011	3020961.6921
160	L	169+00.00	759817.7142	3020891.0990
161	L	170+00.00	759888.3273	3020820.5059
162	L	171+00.00	759958.9404	3020749.9128
163	L	172+00.00	760029.5535	3020679.3197
164	L	173+00.00	760100.1666	3020608.7266

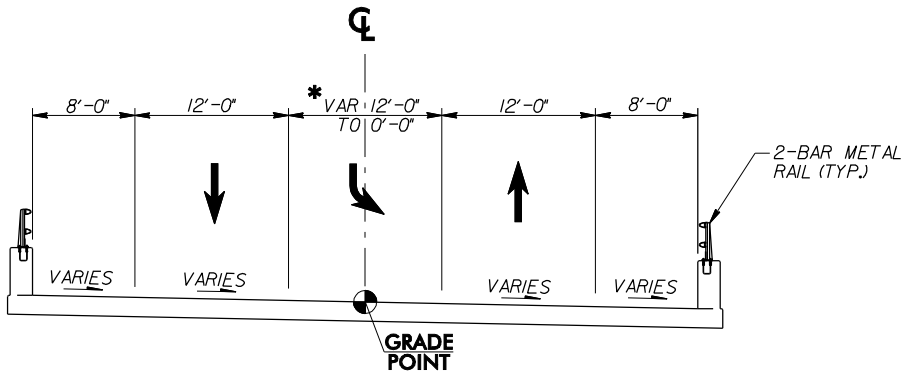
Point #	Chain	Station	Northing (Y)	Easting (X)
165	L	174+00.00	760170.7797	3020538.1335
166	L	175+00.00	760241.3928	3020467.5404
167	L	176+00.00	760312.0059	3020396.9473
168	L	177+00.00	760382.6190	3020326.3542
169	L	178+00.00	760453.2321	3020255.7611
170	L	179+00.00	760523.8452	3020185.1680
171	L	180+00.00	760594.4583	3020114.5749
172	L	181+00.00	760665.0714	3020043.9818
173	L	182+00.00	760735.6845	3019973.3887
174	L	183+00.00	760806.2976	3019902.7956
175	L	184+00.00	760876.9107	3019832.2025
176	L	185+00.00	760947.5238	3019761.6094
177	L	186+00.00	761018.1369	3019691.0163
178	L	187+00.00	761088.7500	3019620.4232
179	L	188+00.00	761159.3631	3019549.8301
180	L	189+00.00	761229.9762	3019479.2370
181	L	190+00.00	761300.5893	3019408.6439
182	L	191+00.00	761371.2024	3019338.0508
183	L	192+00.00	761441.8155	3019267.4577
184	L	193+00.00	761512.4286	3019196.8646
185	L	194+00.00	761583.0417	3019126.2715
186	L	195+00.00	761653.6548	3019055.6784
187	L	196+00.00	761724.2679	3018985.0853
188	L	197+00.00	761794.8810	3018914.4922

6/2/99

6/1/2012 4:02:39 PM B2500_R0Y_TYP.dgn

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

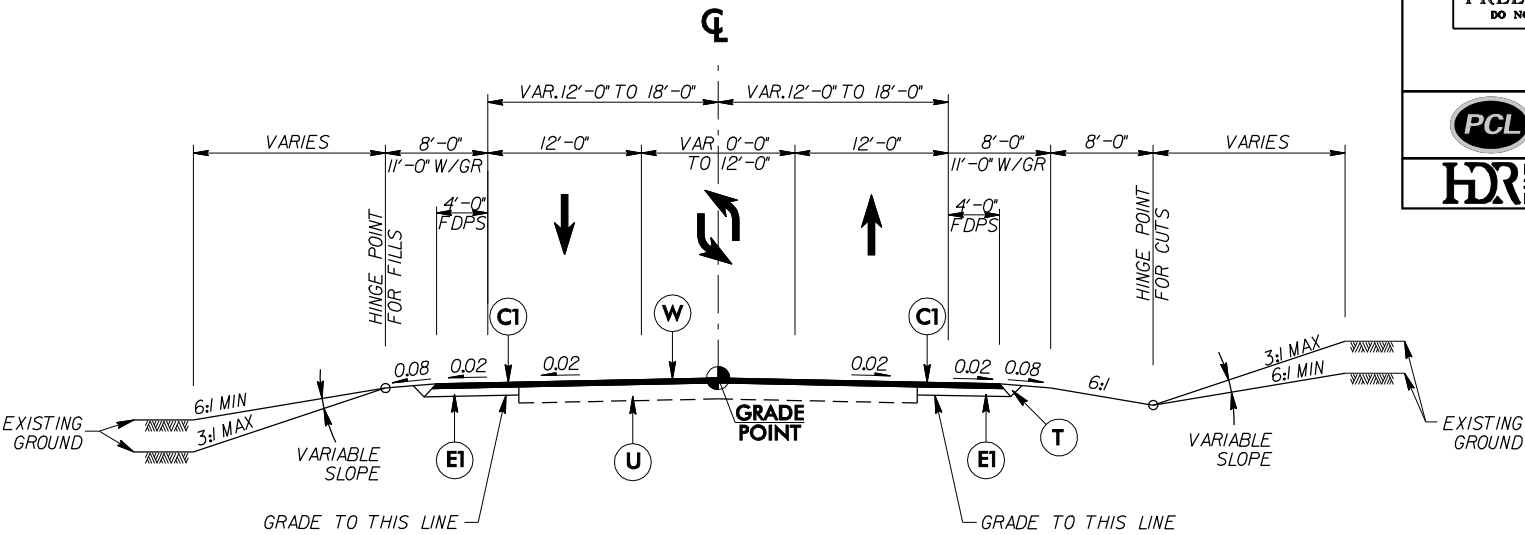


STRUCTURE TYPICAL SECTION

TYPICAL SECTION NO. 3

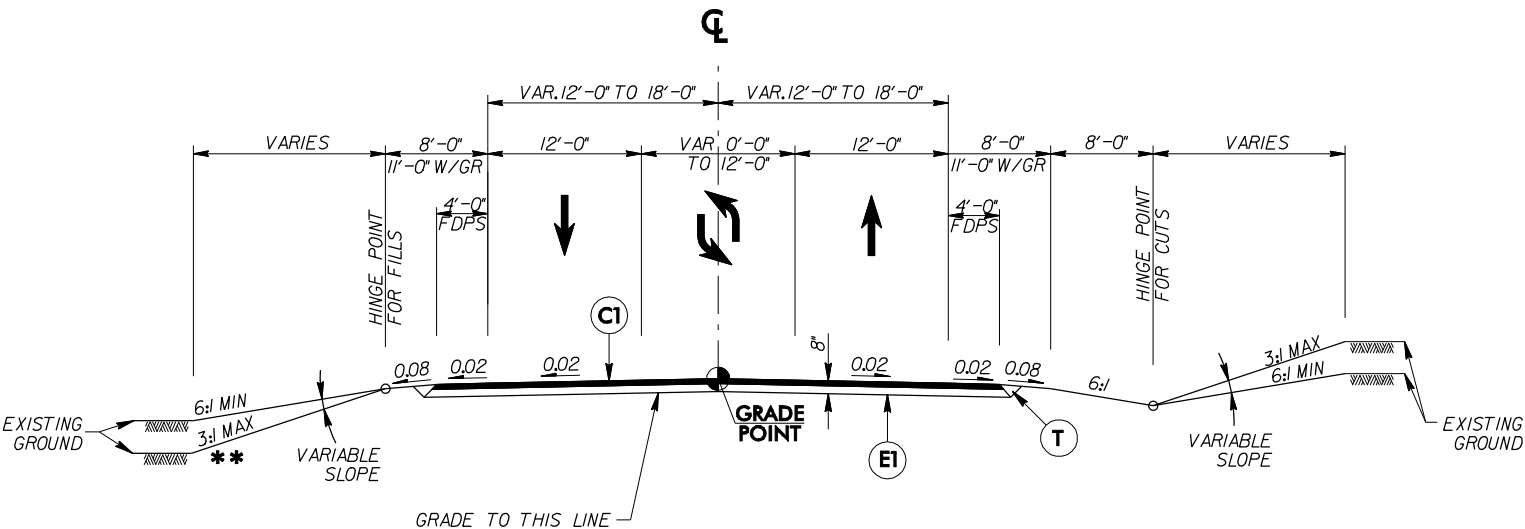
LINE	FROM STATION	TO STATION
-L-	28 + 68.00	176 + 67.51

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



TYPICAL SECTION NO. 1

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



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.
B-2500 (PHASE 1)

SHEET NO.
2

ROADWAY DESIGN
ENGINEER

PAVEMENT DESIGN
ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

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

HDR
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

6/2/99

PROJECT REFERENCE NO.
B-2500 (PHASE 1)

SHEET NO.
2-A

ROADWAY DESIGN
ENGINEER

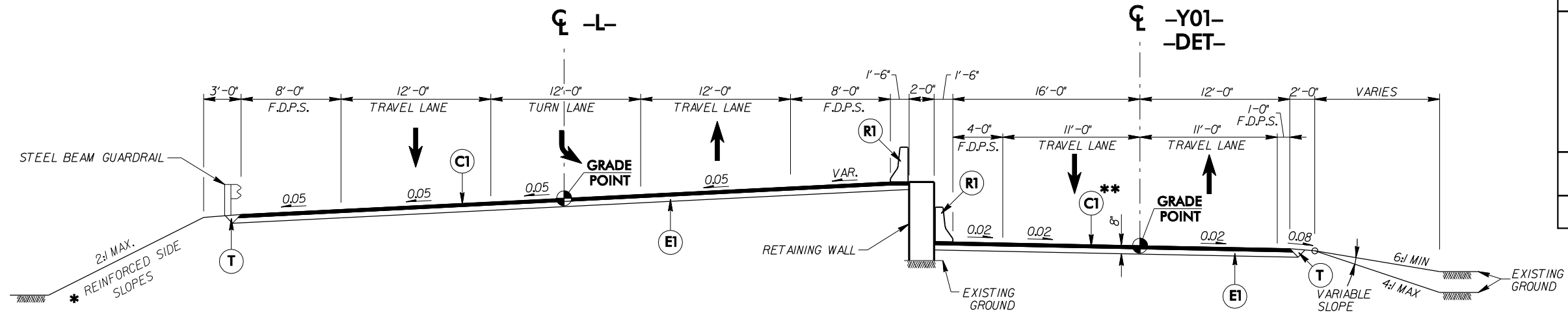
PAVEMENT DESIGN
ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR A/C ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

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



TYPICAL SECTION NO. 4

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

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

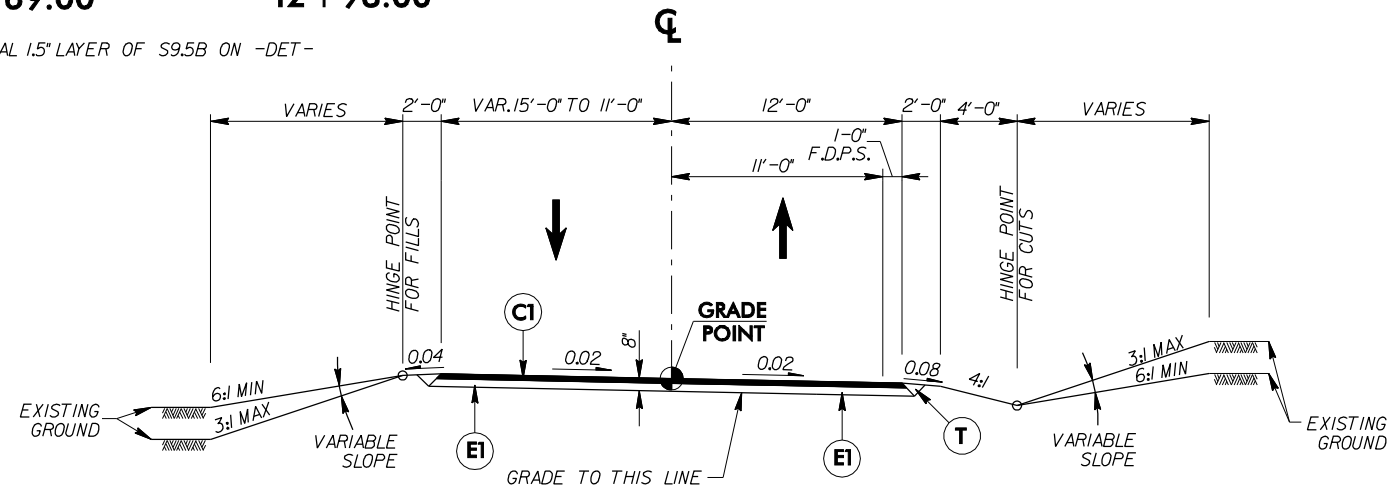
** NOTE: DO NOT PLACE FINAL 1.5" LAYER OF S9.5B ON -DET-

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

Diagram showing a cross-section of a road with a mill notch to key in. The mill station ranges are listed below and mill to tie in driveways.

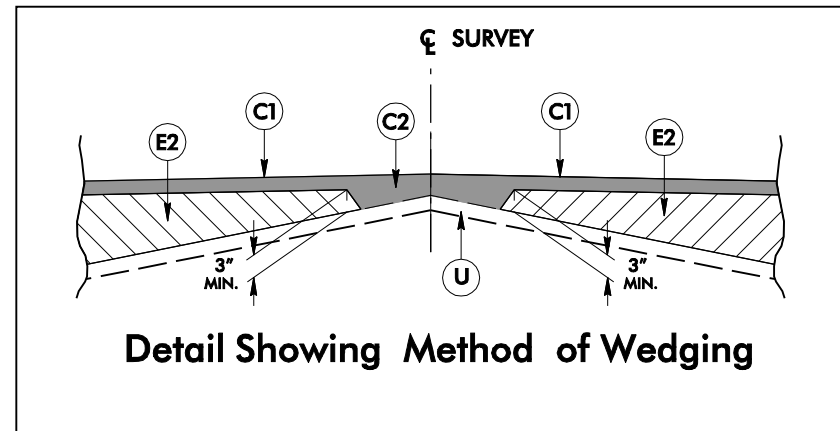
LINE	FROM STATION	TO STATION
-L-	19 + 50.00	21 + 00.00
-L-	180 + 25.00	181 + 75.00
-L-	203 + 75.00	206 + 96.51

MILLING

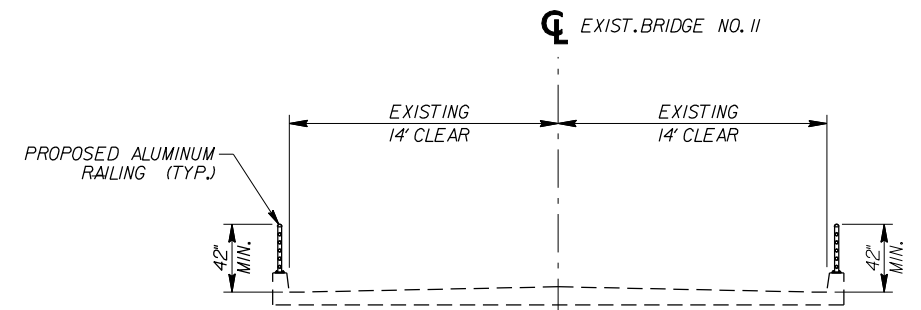


TYPICAL SECTION NO. 5

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



Detail Showing Method of Wedging



FISHING PIER TYPICAL SECTION
TYPICAL SECTION NO. 6

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

6/1/2012 4:02:39 PM B2500_RDY_TYP.dgn

6/2/99

PROJECT REFERENCE NO.
B-2500 (PHASE 1)

SHEET NO.
2-B

ROADWAY DESIGN ENGINEER

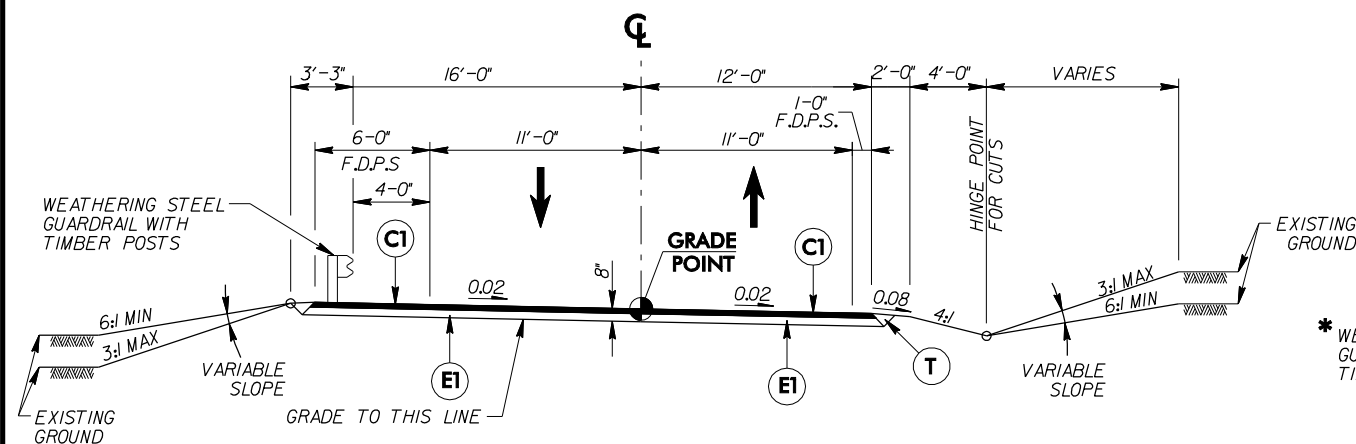
PAVEMENT DESIGN ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

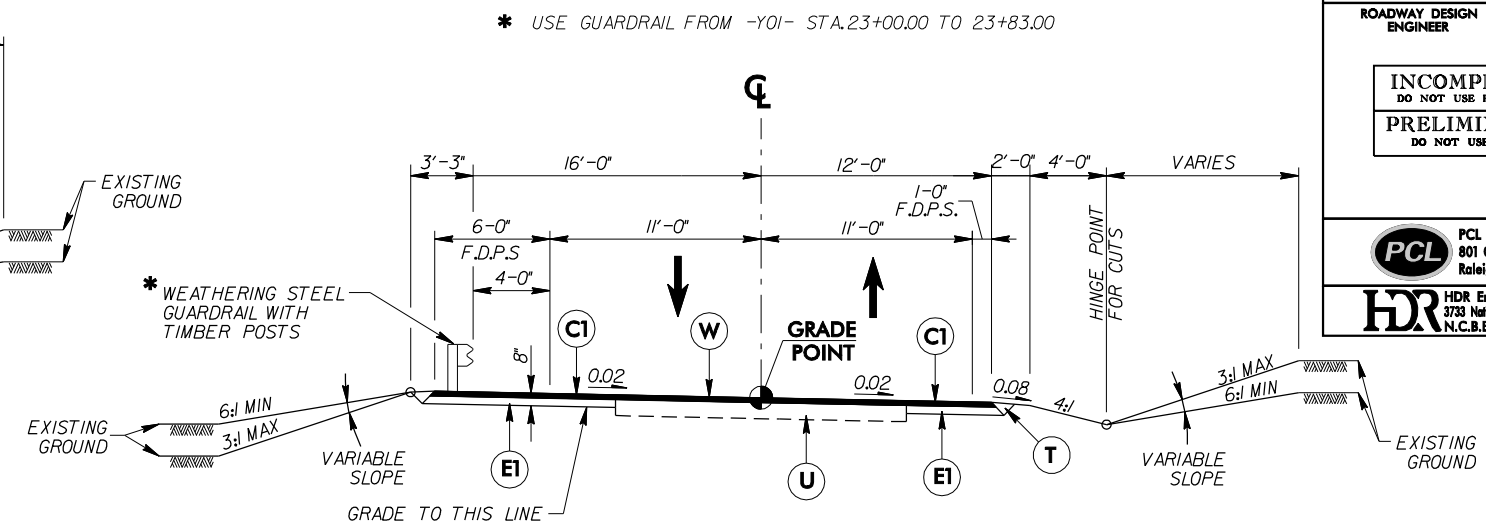
PCL Civil Constructors, Inc.
801 Corporate Center Drive, Suite 130
Raleigh, NC 27607

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



TYPICAL SECTION NO. 7

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

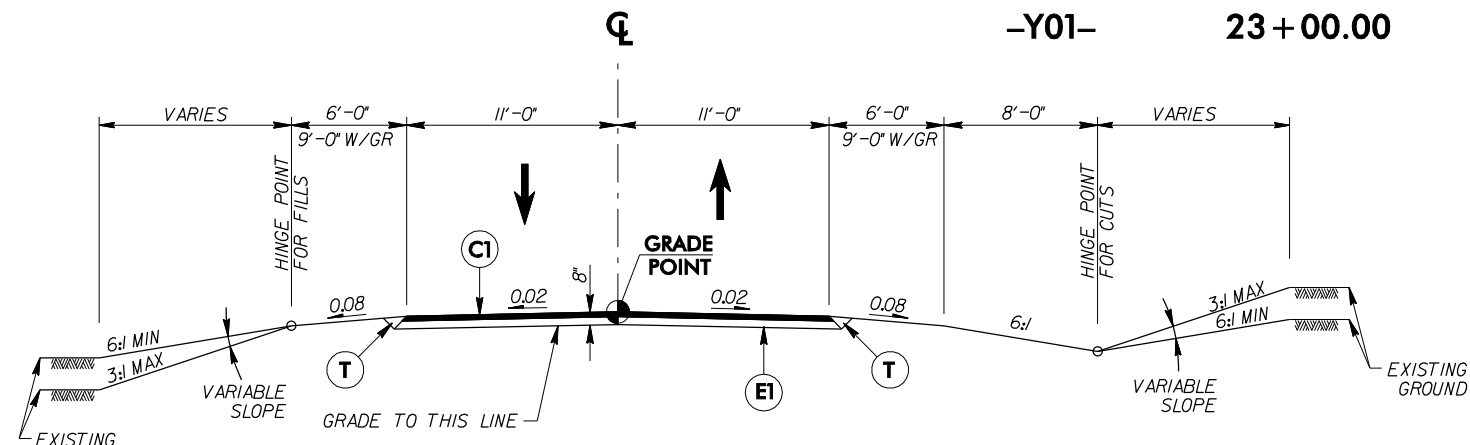


TYPICAL SECTION NO. 8

LINE -Y01- FROM STATION 23 + 00.00 TO STATION 23 + 44.00

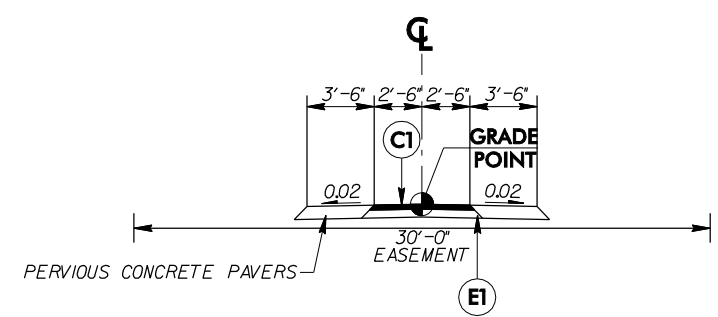
PAVEMENT SCHEDULE	
C1	3.0" S9.5B
C2	VAR. S9.5B
E1	5.0" B25.0B
E2	VAR. B25.0B
T	EARTH MATERIAL
U	EXISTING PAVEMENT
W	WEDGING (SEE SHEET 2-A)
R1	SINGLE FACED BARRIER
R2	DOUBLE FACED BARRIER
R3	PORTABLE CONC. BARRIER

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



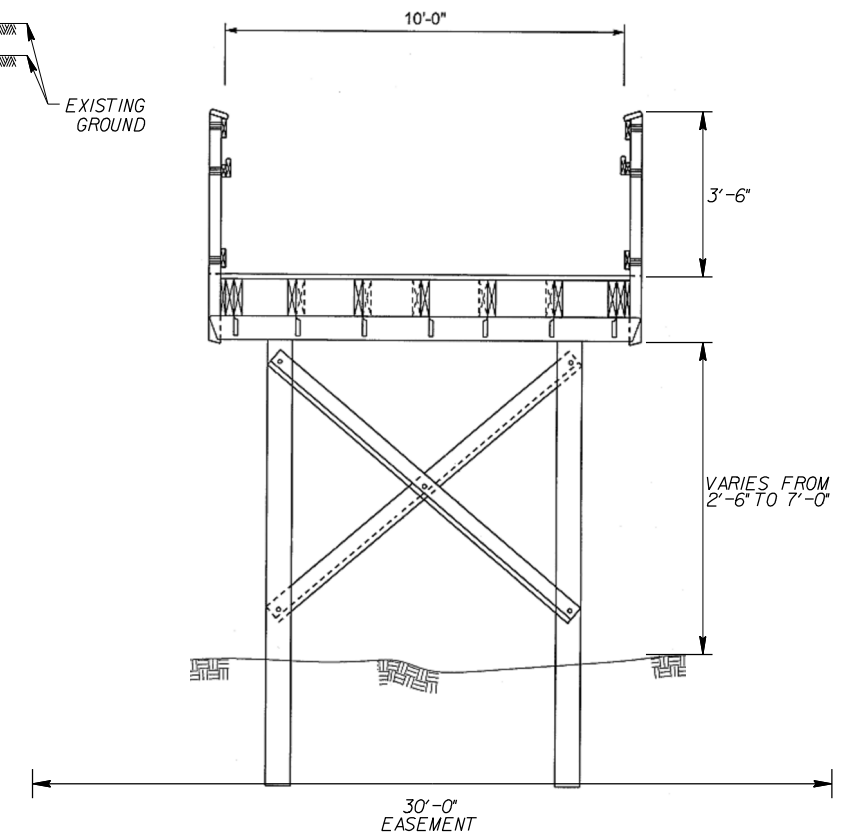
TYPICAL SECTION NO. 9

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



TYPICAL SECTION NO. 10

LINE -FP- FROM STATION 10 + 09.64 TO STATION 12 + 97.66



TYPICAL SECTION NO. 11

LINE -BW- FROM STATION 10 + 36.00 TO STATION 14 + 63.00

6/5/2012 10:02:39 AM B2500_RDY_TYP.dgn

PROJECT REFERENCE NO.
B-2500 (PHASE 1)

SHEET NO.
2-C

ROADWAY DESIGN
ENGINEER

PAVEMENT DESIGN
ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR A/W ACQUISITION

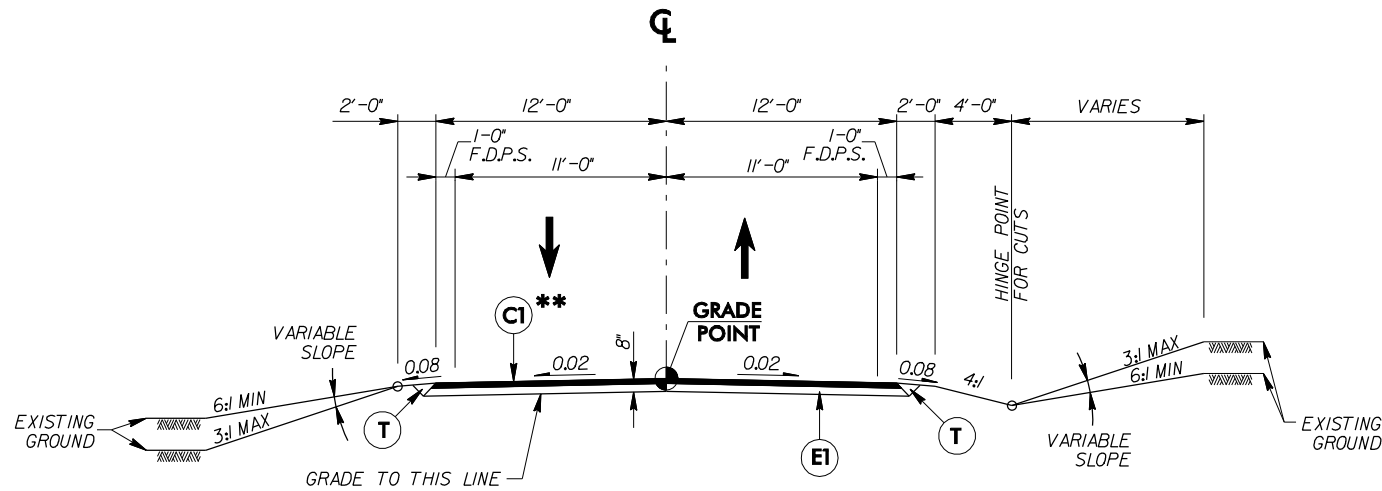
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

PCL

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

HDR

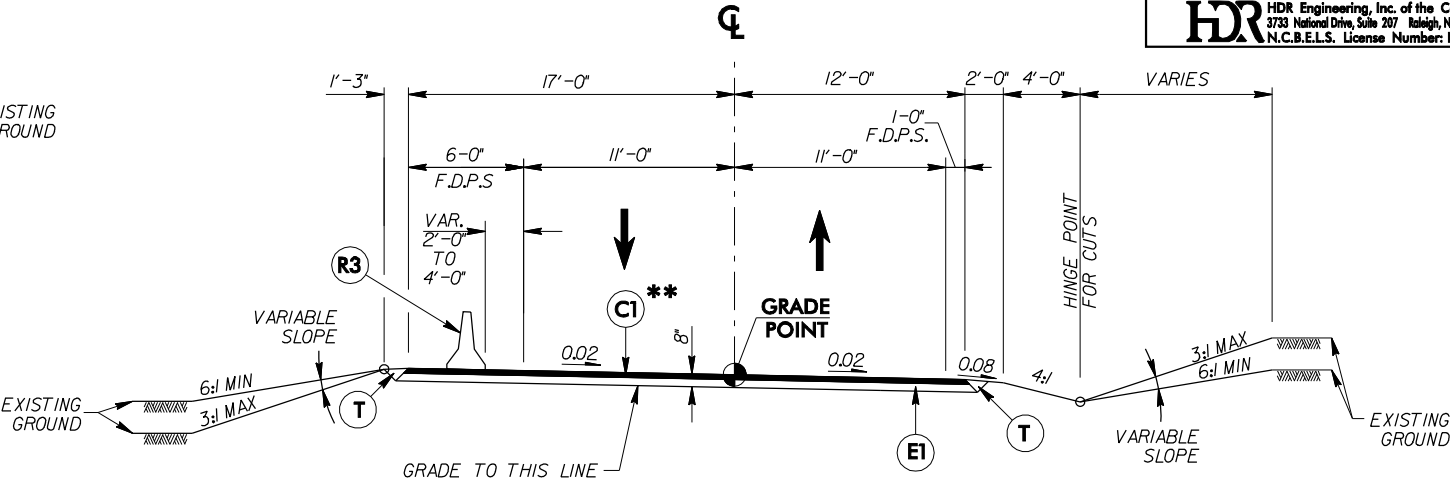
HDR Engineering, Inc. of the Carolinas
3733 National Drive, Suite 207 Raleigh, N.C. 27612
N.C.B.E.L.S. License Number: F-0116



TYPICAL SECTION NO. 12

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

** NOTE: DO NOT PLACE FINAL 1.5" LAYER OF S9.5B ON -DET-.
TOTAL PAVEMENT THICKNESS ON TEMPORARY DETOUR = 6.5".
DEPTH FROM GRADE POINT TO SUBGRADE = 8".



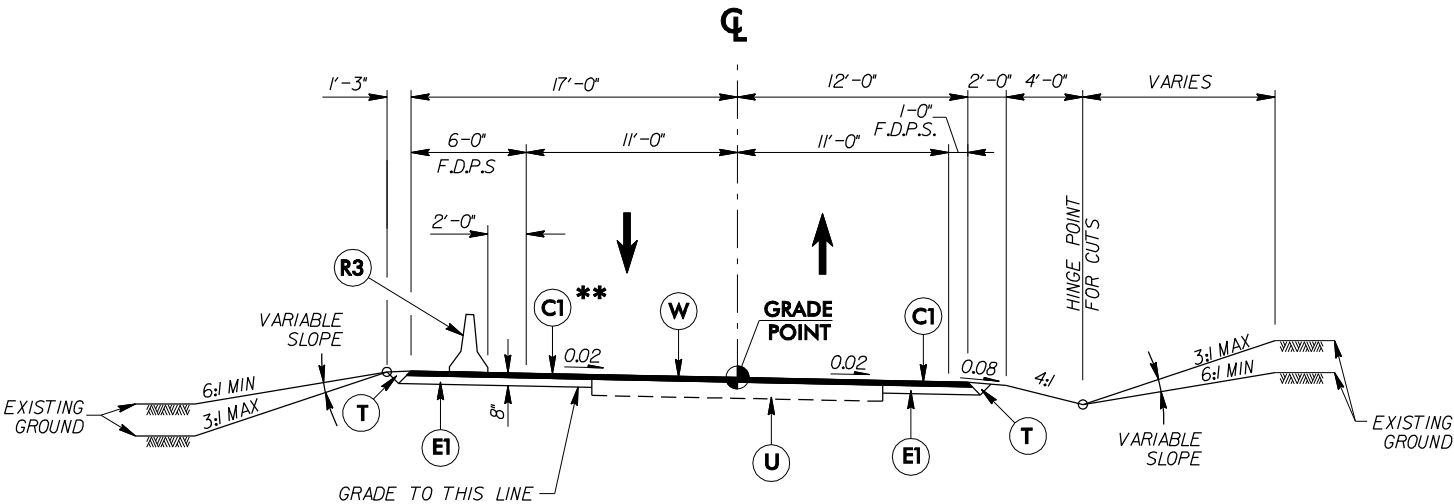
TYPICAL SECTION NO. 13

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

** NOTE: DO NOT PLACE FINAL 1.5" LAYER OF S9.5B ON -DET-.
TOTAL PAVEMENT THICKNESS ON TEMPORARY DETOUR = 6.5".
DEPTH FROM GRADE POINT TO SUBGRADE = 8".

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



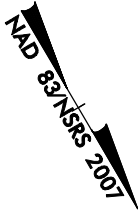
TYPICAL SECTION NO. 14

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

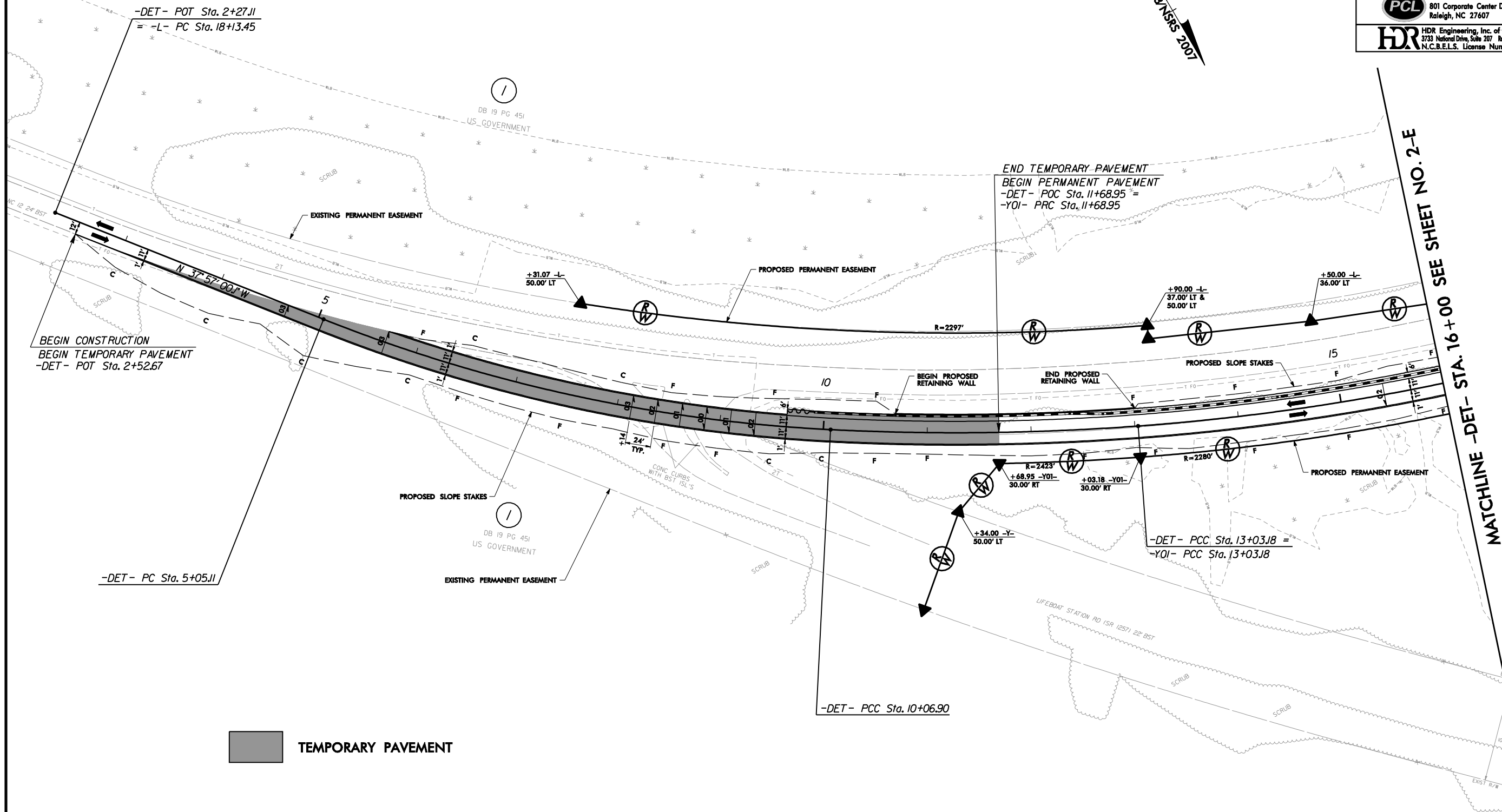
** NOTE: DO NOT PLACE FINAL 1.5" LAYER OF S9.5B ON -DET-.
TOTAL PAVEMENT THICKNESS ON TEMPORARY DETOUR = 6.5".
DEPTH FROM GRADE POINT TO SUBGRADE = 8".

DETOUR ALIGNMENT

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



PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		2-D
RW SHEET NO.		
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION		
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION		
 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		



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

SEE SHEET NO. 32 FOR -DET- PROFILE.

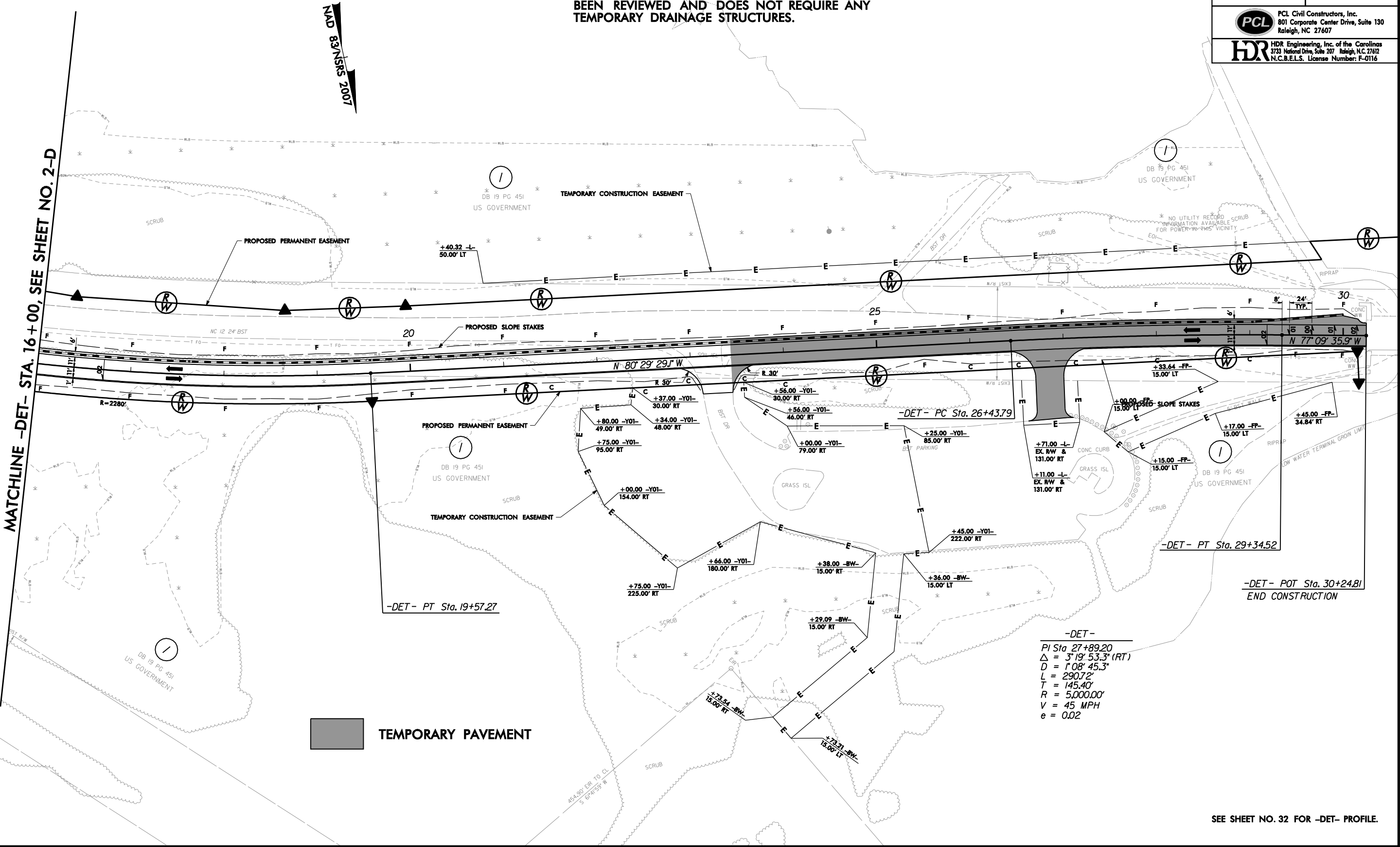
PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassoc
FILE: PCL-CivilConst\B-2500_Bonner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_DET_1.dgn
PENTABLE: NCDOT_pshp.fltd
TIME: 8:24:54 AM
DATE: 6/1/2012

REVISIONS

DETOUR ALIGNMENT

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

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	2-E
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
 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	



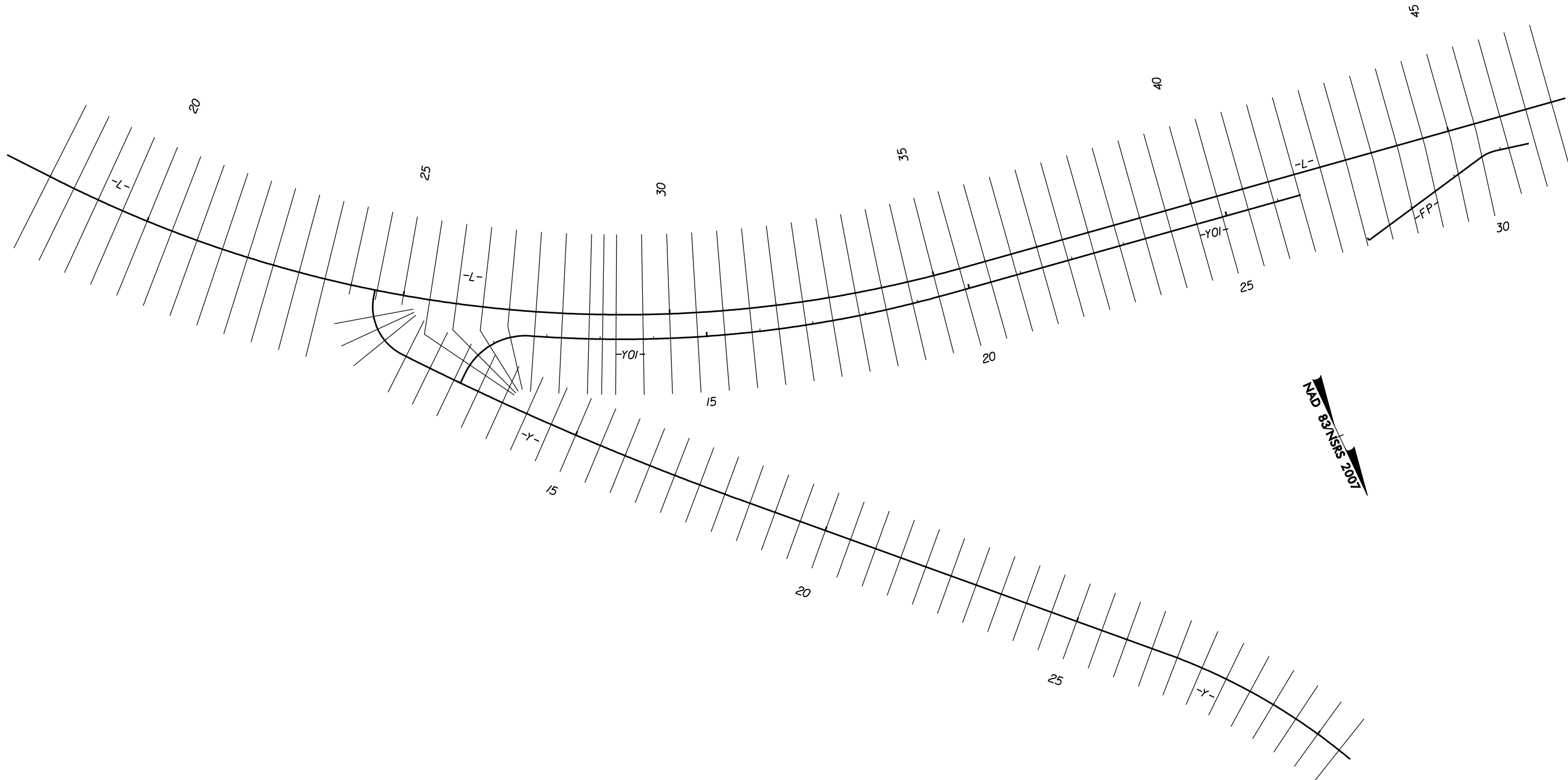
SEE SHEET NO. 32 FOR -DET- PROFILE.

PLOT DRIVER: NCDOT_color_eng-100.plt
USER: jmassoc
FILE: PCL-CivilConst\B-2500_Borner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_R0Y_PSH-DET_2.dgn
PENTABLE: NCDOT_pshp.fltd
TIME: 8:25:10 AM
DATE: 6/1/2012

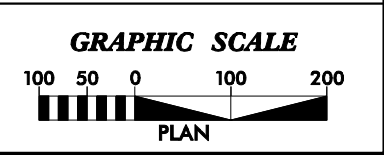
REVISIONS

REVISIONS

CROSS-SECTION LAYOUT DETAIL

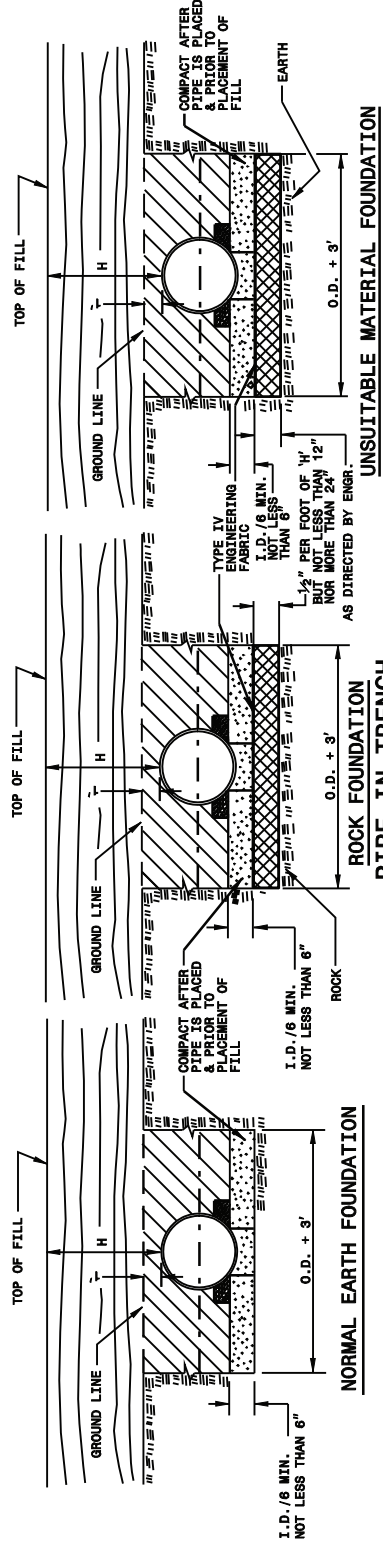


PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	2-F
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
 PCL Civil Constructors, Inc. 801 Corporate Center Drive, Suite 130 Raleigh, NC 27607  HDR Engineering, Inc. of the Carolinas 3733 National Drive, Suite 207 Raleigh, N.C. 27612 N.C.B.E.L.S. License Number: F-0116	



STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

7-06



ENGLISH DETAIL DRAWING FOR
METHOD OF PIPE INSTALLATION

FLEXIBLE PIPE

ENGLISH DETAIL DRAWING FOR
METHOD OF PIPE INSTALLATION

FLEXIBLE PIPE

SHEET 1 OF 3

300D01

GENERAL NOTES:

I.D. = THE MAXIMUM HORIZONTAL INSIDE DIAMETER DIMENSION.

O.D. = THE MAXIMUM HORIZONTAL OUTSIDE DIAMETER DIMENSION.

H = THE FILL HEIGHT MEASURED VERTICALLY AT ANY POINT ALONG THE PIPE FROM THE TOP OF THE PIPE TO THE TOP OF THE EMBANKMENT AT THAT POINT.

LOOSELY PLACED SELECT MATERIAL CLASS III OR CLASS II, TYPE 1 FOR PIPE BEDDING. LEAVE SECTION DIRECTLY BENEATH PIPE UNCOMPACTED AS PIPE SEATING AND BACKFILL WILL ACCOMPLISH COMPACTION.

DO NOT OPERATE HEAVY EQUIPMENT OVER ANY PIPE CULVERT UNTIL THE PIPE CULVERT HAS BEEN PROPERLY BACKFILLED AND COVERED WITH AT LEAST 3 FEET OF APPROVED MATERIAL.

--- SPRINGLINE OF PIPE

SELECT BACKFILL MATERIAL CLASS III OR CLASS II, TYPE 1 ABOVE AND BELOW SPRINGLINE.

APPROVED SUITABLE LOCAL MATERIAL.

UNDISTURBED EARTH MATERIAL

SELECT MATERIAL CLASS V OR VI FOR FOUNDATION CONDITIONING. ENCAPSULATE WITH ENGINEERING FABRIC AS DIRECTED BY THE ENGINEER.

DO NOT OPERATE HEAVY EQUIPMENT OVER ANY PIPE CULVERT UNTIL THE PIPE CULVERT HAS BEEN PROPERLY BACKFILLED AND COVERED WITH AT LEAST 3 FEET OF APPROVED MATERIAL.

--- SPRINGLINE OF PIPE

SELECT BACKFILL MATERIAL CLASS III OR CLASS II, TYPE 1 ABOVE AND BELOW SPRINGLINE.

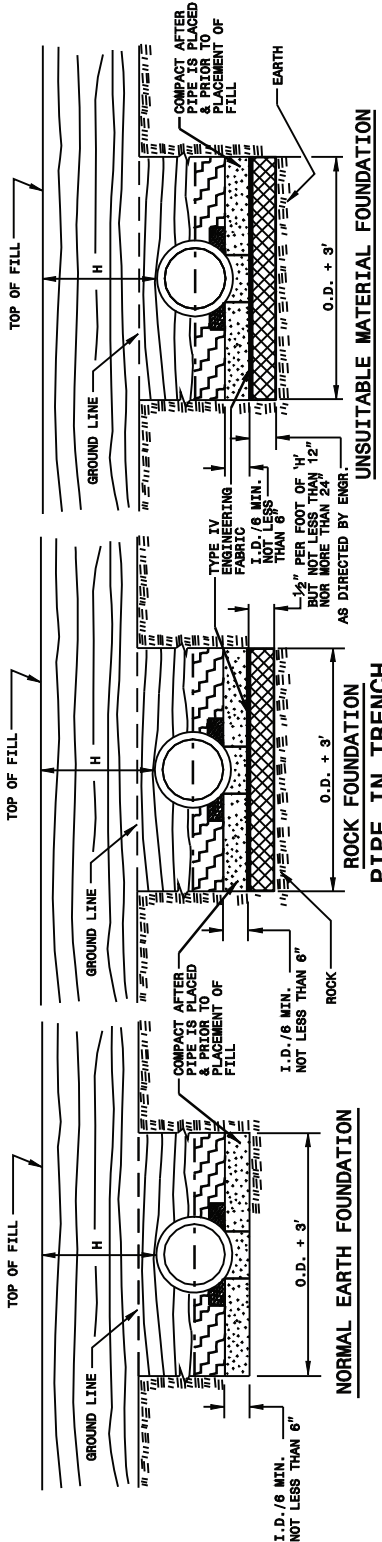
APPROVED SUITABLE LOCAL MATERIAL.

UNDISTURBED EARTH MATERIAL

SELECT MATERIAL CLASS V OR VI FOR FOUNDATION CONDITIONING. ENCAPSULATE WITH ENGINEERING FABRIC AS DIRECTED BY THE ENGINEER.

STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

7-06



ENGLISH DETAIL DRAWING FOR
METHOD OF PIPE INSTALLATION

RIGID PIPE

ENGLISH DETAIL DRAWING FOR
METHOD OF PIPE INSTALLATION

RIGID PIPE

SHEET 2 OF 3

300D01

GENERAL NOTES:

I.D. = THE MAXIMUM HORIZONTAL INSIDE DIAMETER DIMENSION.

O.D. = THE MAXIMUM HORIZONTAL OUTSIDE DIAMETER DIMENSION.

H = THE FILL HEIGHT MEASURED VERTICALLY AT ANY POINT ALONG THE PIPE FROM THE TOP OF THE PIPE TO THE TOP OF THE EMBANKMENT AT THAT POINT.

LOOSELY PLACED SELECT MATERIAL CLASS III OR CLASS II, TYPE 1 FOR PIPE BEDDING. LEAVE SECTION DIRECTLY BENEATH PIPE UNCOMPACTED AS PIPE SEATING AND BACKFILL WILL ACCOMPLISH COMPACTION.

DO NOT OPERATE HEAVY EQUIPMENT OVER ANY PIPE CULVERT UNTIL THE PIPE CULVERT HAS BEEN PROPERLY BACKFILLED AND COVERED WITH AT LEAST 3 FEET OF APPROVED MATERIAL.

--- SPRINGLINE OF PIPE

SELECT BACKFILL MATERIAL CLASS III OR CLASS II, BELOW SPRINGLINE.

APPROVED SUITABLE LOCAL MATERIAL ABOVE SPRINGLINE.

UNDISTURBED EARTH MATERIAL

SELECT MATERIAL CLASS V OR VI FOR FOUNDATION CONDITIONING. ENCAPSULATE WITH ENGINEERING FABRIC AS DIRECTED BY THE ENGINEER.

PROJECT SERVICES UNIT
STANDARDS AND SPECIAL DESIGN
Office 919-250-4128 FAX 919-250-4119

SEE PLATE FOR TITLE

ORIGINAL BY: KKempf DATE: 5-15-09
MODIFIED BY: DATE:
CHECKED BY: DATE:
FILE SPEC:\eroward\stds\stdstodetails\30001\0300d01.dgn

PROJECT REFERENCE NO.
B-2500

SHEET NO.
2-H

STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

7-06

ENGLISH DETAIL DRAWING FOR
METHOD OF PIPE INSTALLATION

FILL HEIGHT TABLES

SHEET 3 OF 3

300D01

FLEXIBLE PIPE

Round Corrugated Steel Pipe 2 2/3 x 1/2 corrugation **						
Diameter (inches)	Minimum cover (inches)	(Ga)	16	14	12	10
12	12	204	256	216	180	144
15	12	162	204	174	144	117
18	12	135	169	144	117	99
21	12	115	145	126	108	90
24	12	100	126	108	90	72
30	12	79	100	84	66	54
36	12	65	83	66	54	42
42	12	55	70	54	42	36
48	12	48	61	48	36	30
54	12	42	54	42	30	24
60	12	36	48	36	24	18
66	12	30	42	30	18	12
72	12	24	36	24	12	6
84	12	18	30	18	6	0

HDPE - * (Minimum fill) 2' for pipe diameters ≥ 12" and ≤ 60"
* (Maximum fill) 20' for pipe diameters ≤ 24"
17' for pipe diameters ≥ 30" and ≤ 60"

PVC - * (Minimum fill) 2' for pipe diameters ≥ 12" and ≤ 36"
* (Maximum fill) 30' for pipe diameters ≥ 12" and ≤ 36"

* FILL HEIGHT IS MEASURED FROM THE TOP OF THE PIPE
TO THE BOTTOM OF THE PAVEMENT STRUCTURE

RIGID PIPE

RCP - * (Minimum fill) 1' for Class IV & CLASS V
2' for Class III & Class II

* (Maximum fill) 10' - Class II pipe
20' - Class III pipe
30' - Class IV pipe
40' - Class V pipe

(For fills > 40' & < 80' use LRFD Direct Design Method)

* FILL HEIGHT IS MEASURED FROM THE TOP OF THE PIPE
TO THE BOTTOM OF THE PAVEMENT STRUCTURE

SHEET 3 OF 3

300D01

STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

7-06

ENGLISH DETAIL DRAWING FOR
METHOD OF PIPE INSTALLATION

FILL HEIGHT TABLES

SHEET 3 OF 3

300D01

PROJECT SERVICES UNIT
STANDARDS AND SPECIAL DESIGN
Office 919-250-4128 FAX 919-250-4119

SEE PLATE FOR TITLE

ORIGINAL BY: KKempf DATE: 5-15-09
MODIFIED BY: DATE:
CHECKED BY: DATE:
FILE SPEC:\ericward\stds\stdstodetails\30001\0300d01.dgn

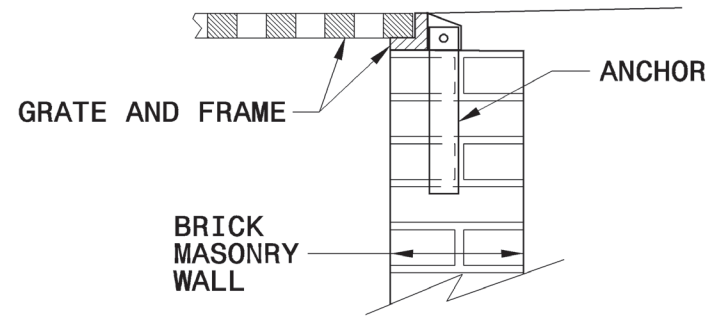
PROJECT REFERENCE NO.
B-2500

SHEET NO.
2-I

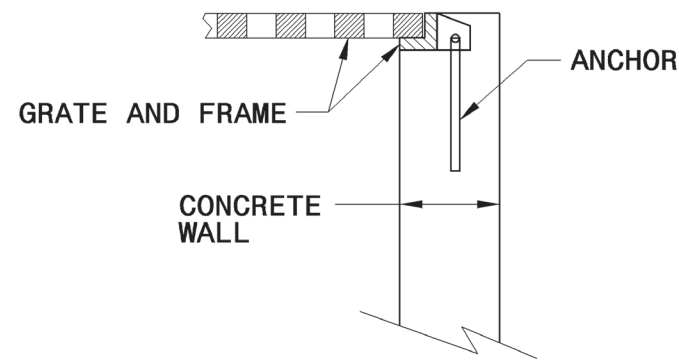
STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH DETAIL DRAWING FOR
ANCHORAGE FOR FRAMES
BRICK/CONCRETE/PRECAST CONCRETE

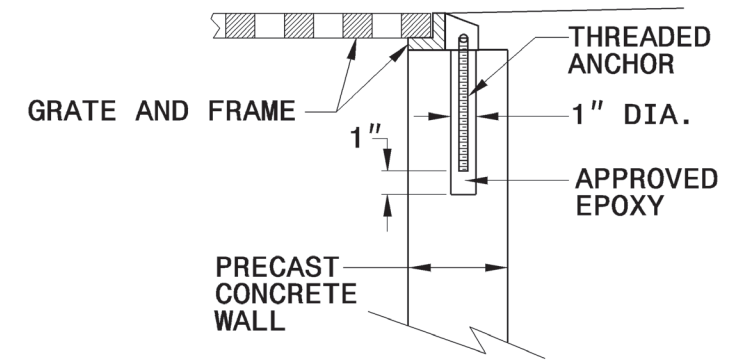
SHEET 1 OF 1
840D25



**BRICK MASONRY
CONSTRUCTION**



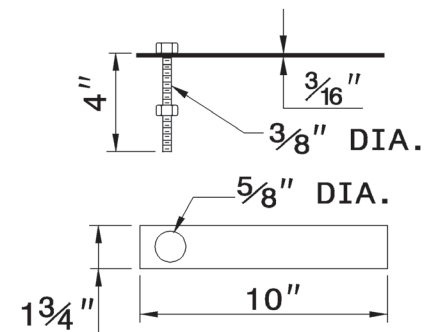
**CONCRETE
CONSTRUCTION**



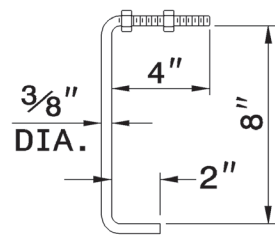
**PRECAST CONCRETE
CONSTRUCTION**

**DETAIL SHOWING ANCHORAGE OF
FRAME FOR GRATED DROP INLET**

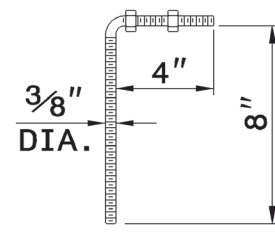
NOTE:
CONSTRUCT GRATED DROP INLET TO COINCIDE WITH NORMAL
OR SUPERELEVATED SHOULDER OR PAVEMENT SLOPE.



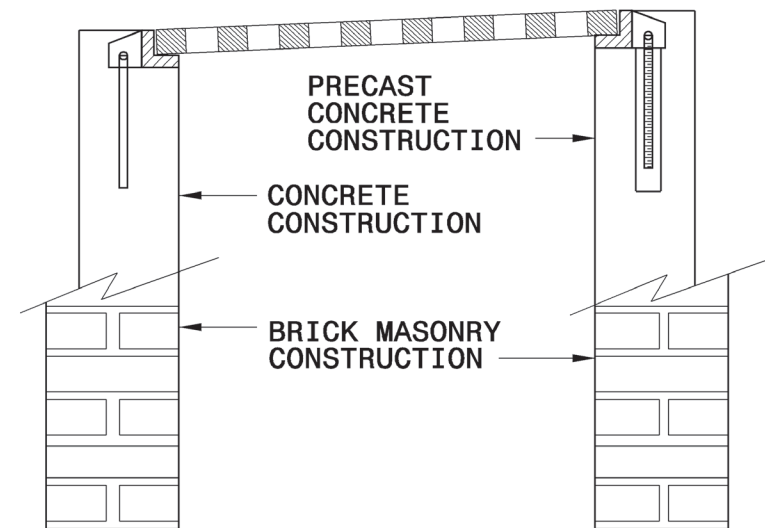
MASONRY ANCHOR
3/8" DIA. BOLT WITH PLATE



CONCRETE ANCHOR
3/8" DIA. BENT BAR



**PRECAST
CONCRETE ANCHOR**
3/8" DIA. BENT BAR



**FRAME AND GRATE INSTALLATION
FOR NORMAL CROWN AND
SUPERELEVATED SECTIONS**

STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH DETAIL DRAWING FOR
ANCHORAGE FOR FRAMES
BRICK/CONCRETE/PRECAST CONCRETE

SHEET 1 OF 1
840D25

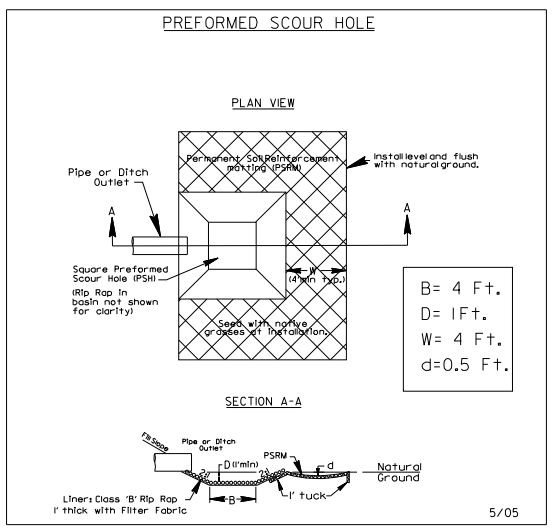
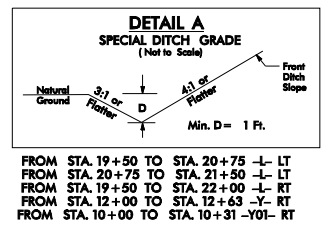
PROJECT SERVICES UNIT
STANDARDS AND SPECIAL DESIGN
Office 919-250-4128 FAX 919-250-4119

SEE PLATE FOR TITLE

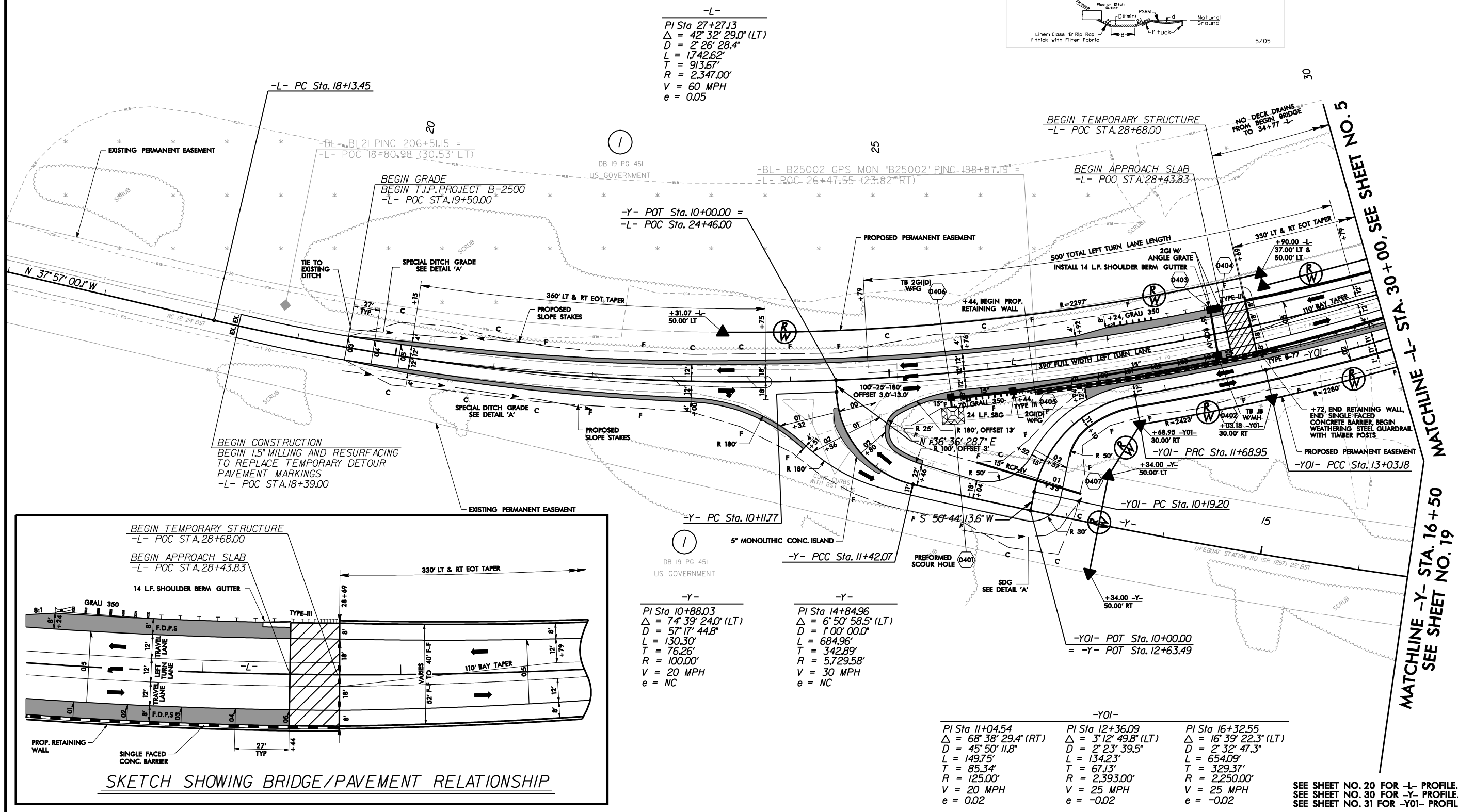
ORIGINAL BY: 2006 STD 840.25 DATE: 07/18/06
MODIFIED BY: E.E. WARD DATE: 9/25/06
CHECKED BY: DATE:
FILE SPEC.:

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



PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	4
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR A/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
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	



PLOT DRIVER: NCDOT.pdf_color_eng_100.plt
USER: jmassroc
FILE: PCL-CivilConst\B-2500_Bonner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_R0Y_PSH_04.dgn
PENTABLE: NCDOT_pshp.fl.tbi
TIME: 2:55:27 PM
DATE: 6/13/2012

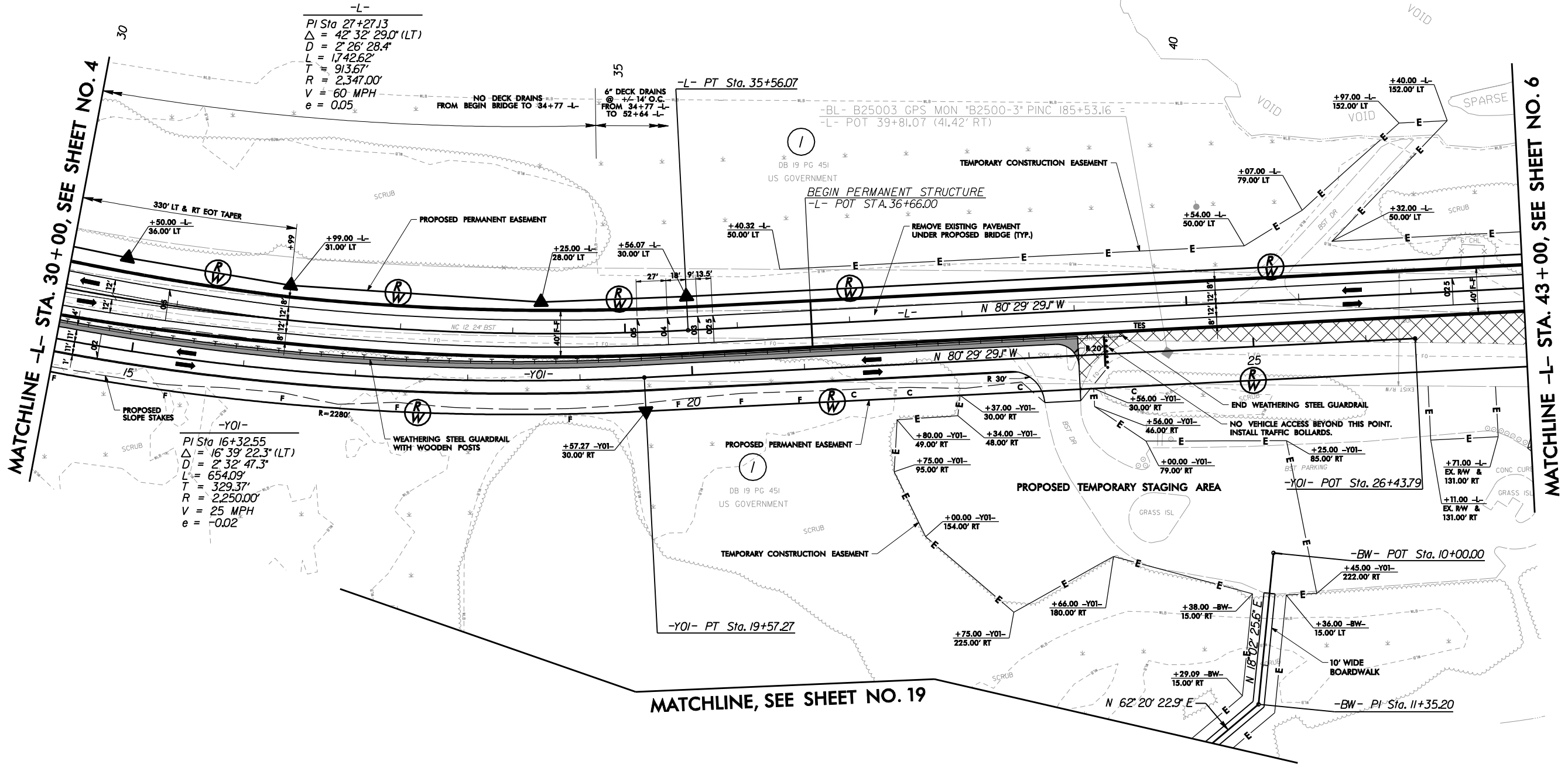
SEE SHEET NO. 20 FOR -L- PROFILE.
SEE SHEET NO. 30 FOR -Y- PROFILE.
SEE SHEET NO. 31 FOR -Y01- PROFILE.

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 than growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

NAD 83/NSRS 2007

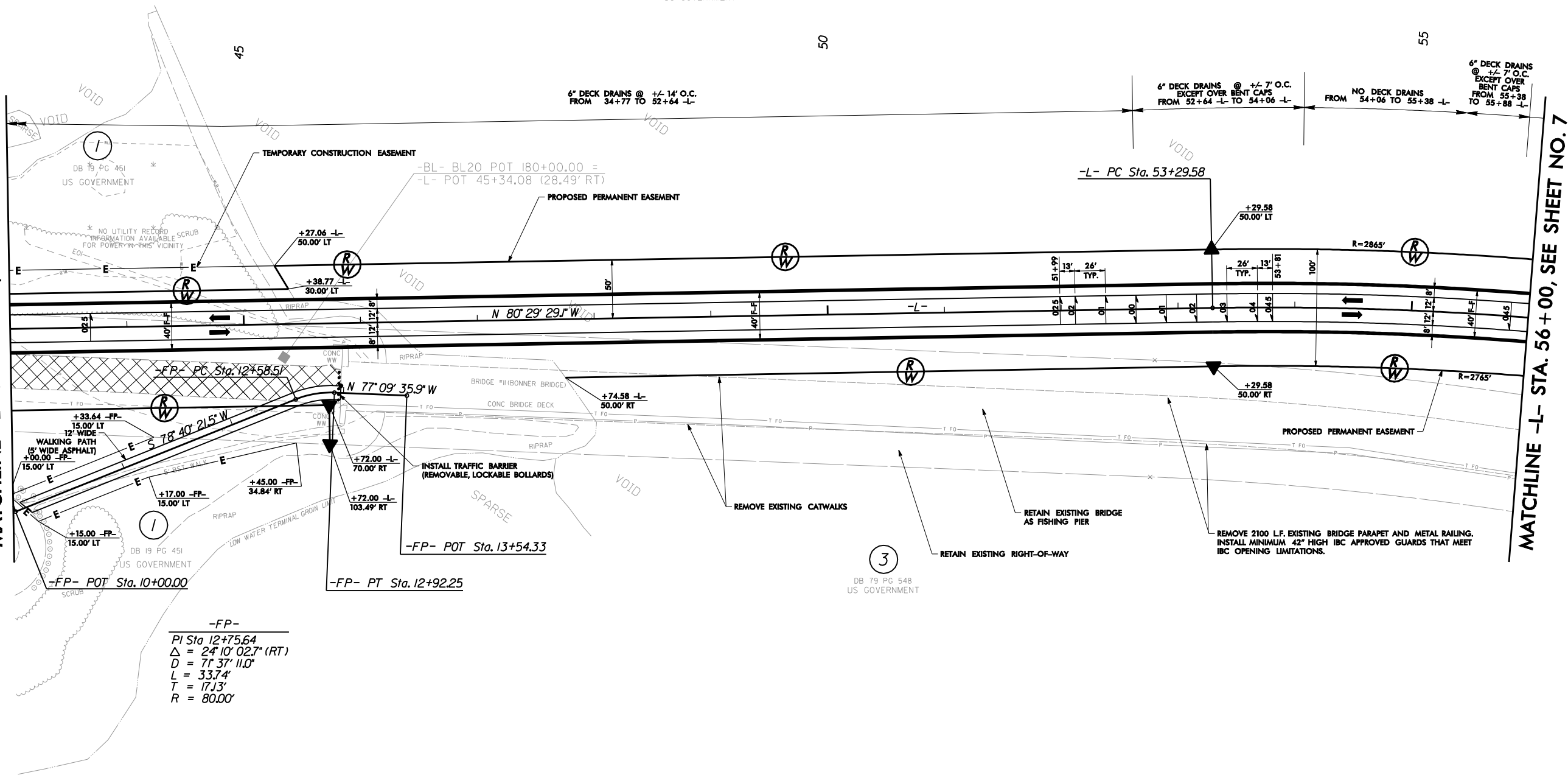
PROJECT REFERENCE NO. B-2500 (PHASE I)	SHEET NO. 5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
PCL PCL Civil Constructors, Inc. 801 Corporate Center Drive, Suite 130 Raleigh, NC 27607	
HDR HDR Engineering, Inc. of the Carolinas 3733 National Drive, Suite 207 Raleigh, N.C. 27612 N.C.B.E.L.S. License Number: F-0116	



PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassroc
FILE: PCL_Civil_Constr\B-2500_Bonner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_06.dgn
PENTABLE: NCDOT_pshp.fl.tbl
TIME: 8:28:00 AM
DATE: 6/1/2012

REVISIONS

MATCHLINE -L- STA. 43 + 00, SEE SHEET NO. 5



NAD 83/NSRS 2007

3

DB 79 PG 548
US GOVERNMENT

-L-
PI Sta 62+28.30
 $\Delta = 35^\circ 24' 44.6''$ (RT)
 $D = 2^\circ 02' 07.3''$
 $L = 1,739.85'$
 $T = 898.72'$
 $R = 2,815.00'$
 $V = 60$ MPH
 $e = 0.045$

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		6	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION			
 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

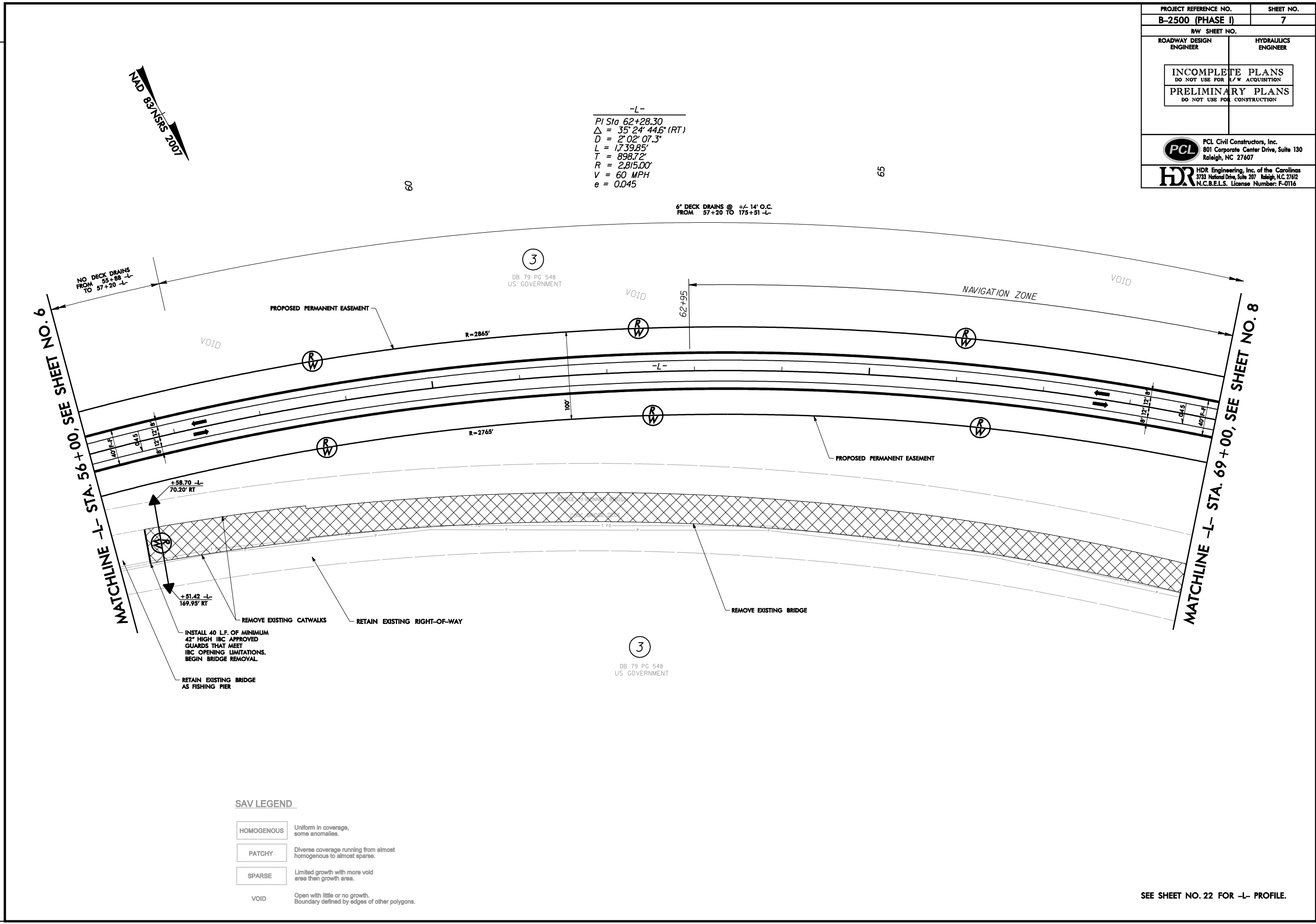
HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area than growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 21 FOR -L- PROFILE.
SEE SHEET NO. 30 FOR -FP- PROFILE.

MATCHLINE -L- STA. 56 + 00, SEE SHEET NO. 7

PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassroc
FILE: PCL_Civil_Const\B-2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_07.dgn
PENTABLE: NCDOT_pshp.flx.tbl
TIME: 8:28:20 AM
DATE: 6/1/2012

REVISIONS



NAD 83/NRS 2007

-L-
PI Sta 62+28.30
 $\Delta = 35^\circ 24' 44.6" (RT)$
 $D = 2^\circ 02' 07.3"$
 $L = 1739.85'$
 $T = 898.72'$
 $R = 2815.00'$
 $V = 60 \text{ MPH}$
 $e = 0.045$

PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 7	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION			
 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 than growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

SEE SHEET NO. 22 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassroc
FILE: PCL\Civil\Const\B-2500.Borner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500.Roadway\Proj\B2500_RDY_PSH_08.dgn

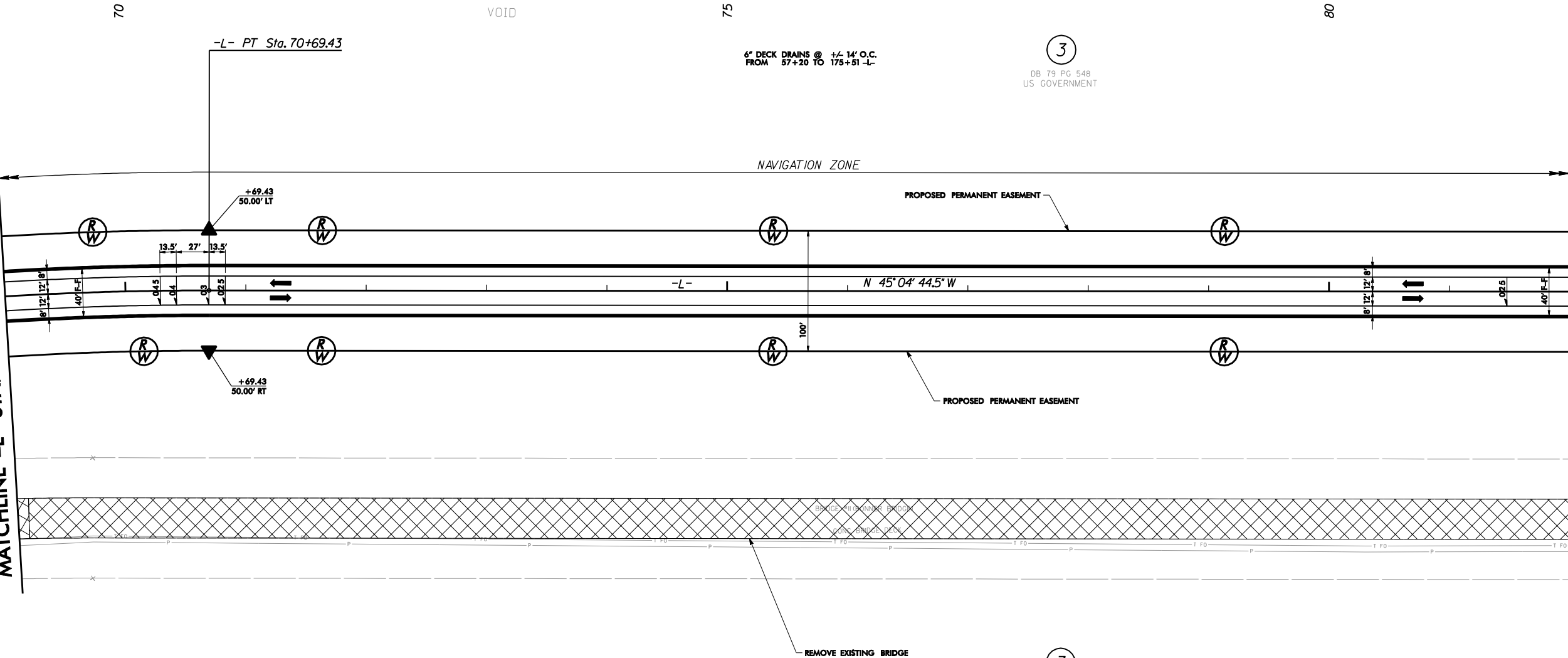
PENTABLE: NCDOT_pshp.flx.tbl

DATE: 6/1/2012

TIME: 8:28:38 AM

REVISIONS

MATCHLINE -L- STA. 69+00, SEE SHEET NO. 7



-L-
PI Sta 62+28.30
 $\Delta = 35^\circ 24' 44.6''$ (RT)
 $D = 2^\circ 02' 07.3''$
 $L = 1,739.85'$
 $T = 898.72'$
 $R = 2,815.00'$
 $V = 60$ MPH
 $e = 0.045$

-L- PT Sta. 70+69.43

+69.43
50.00' LT

+69.43
50.00' RT

6" DECK DRAINS @ +/- 14' O.C.
FROM 57+20 TO 175+51 -L-

VOID

3

DB 79 PG 548
US GOVERNMENT

3

DB 79 PG 548
US GOVERNMENT

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.

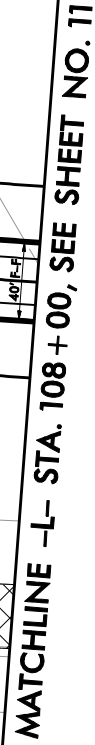
SEE SHEET NO. 23 FOR -L- PROFILE.

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		8	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION			
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION			
		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. 24 FOR -L- PROFILE.



REVISIONS



PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	10
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
 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	

PLOT DRIVER: NCDOT_color_eng_100.plt
PENTABLE: NCDOT_pshp.fl.tbl
USER: jmassroc
DATE: 6/1/2012
TIME: 8:29:33 AM
FILE: PCL\Civil\Const\B-2500.Borner.Bridge.Replacement\06.00.NCDOT_File_Structure\B-2500.Roadway\Proj\B2500_RDY_PSH_11.dgn

REVISIONS

MATCHLINE -L- STA. 108+00, SEE SHEET NO. 10

NAD 83/NSRS 2007

-L-
PI Sta 128+03.63
 $\Delta = 45^{\circ} 49' 07.9''$ (RT)
 $D = 0^{\circ} 56' 49.3''$
 $L = 4,838.13'$
 $T = 2,556.79'$
 $R = 6,050.00'$
 $V = 60$ MPH
 $e = 0.03$

115

4

DB N/A PG N/A
STATE OF NORTH CAROLINA

120

6" DECK DRAINS @ +/- 14' O.C.
FROM 57+20 TO 175+51 -L-

VOID

PROPOSED PERMANENT EASEMENT

R=6100'

R=6000'

PROPOSED PERMANENT EASEMENT

REMOVE EXISTING BRIDGE

SAV LEGEND

HOMOGENOUS
PATCHY
SPARSE

Uniform in coverage,
some anomalies.
Diverse coverage running from almost
homogenous to almost sparse.
Limited growth with more void
area than growth area.

VOID
Open with little or no growth.
Boundary defined by edges of other polygons.

3

DB 79 PG 548
US GOVERNMENT

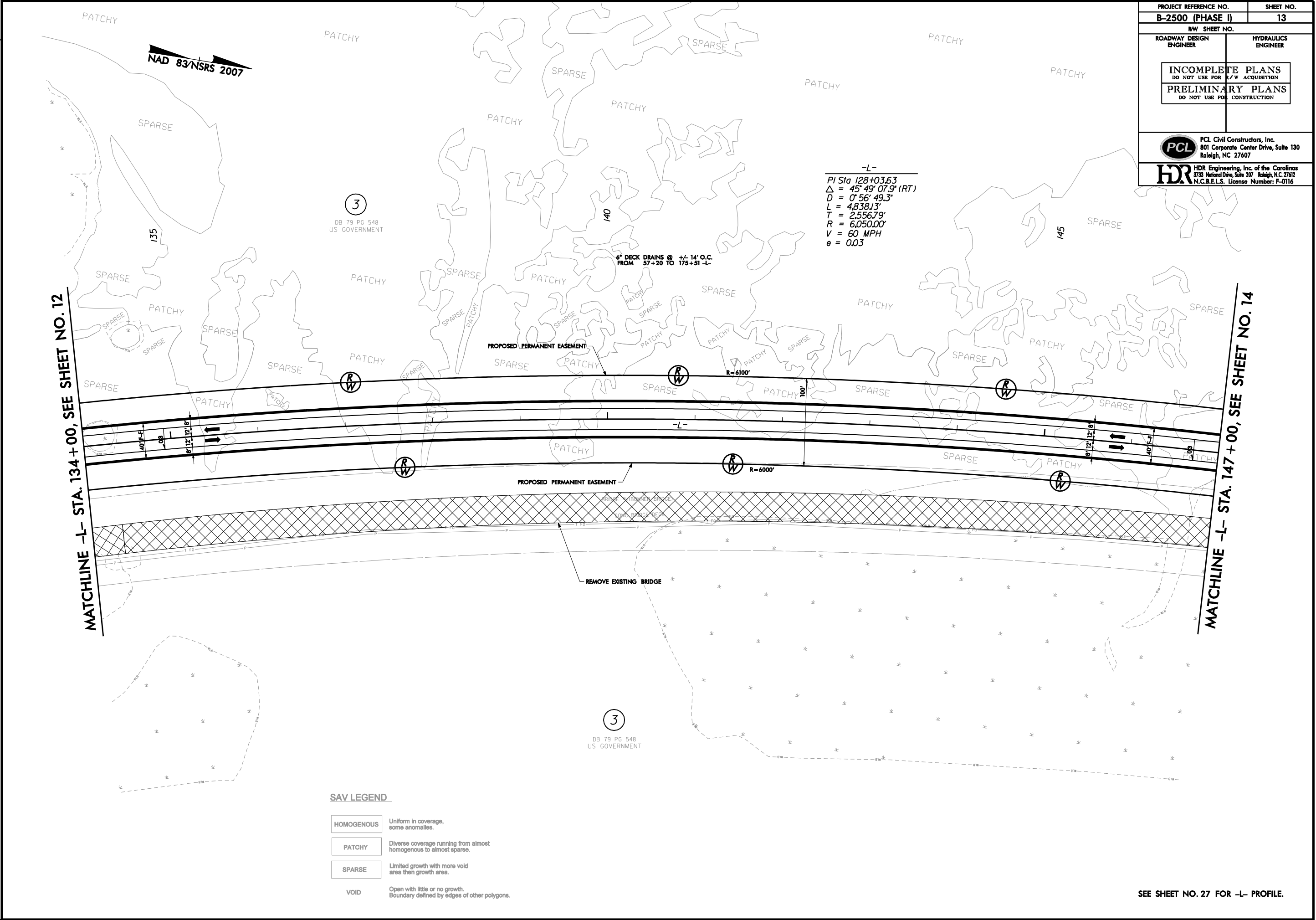
SEE SHEET NO. 26 FOR -L- PROFILE.

MATCHLINE -L- STA. 121+00, SEE SHEET NO. 12

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	11
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
PCL PCL Civil Constructors, Inc. 801 Corporate Center Drive, Suite 130 Raleigh, NC 27607	
HDR 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

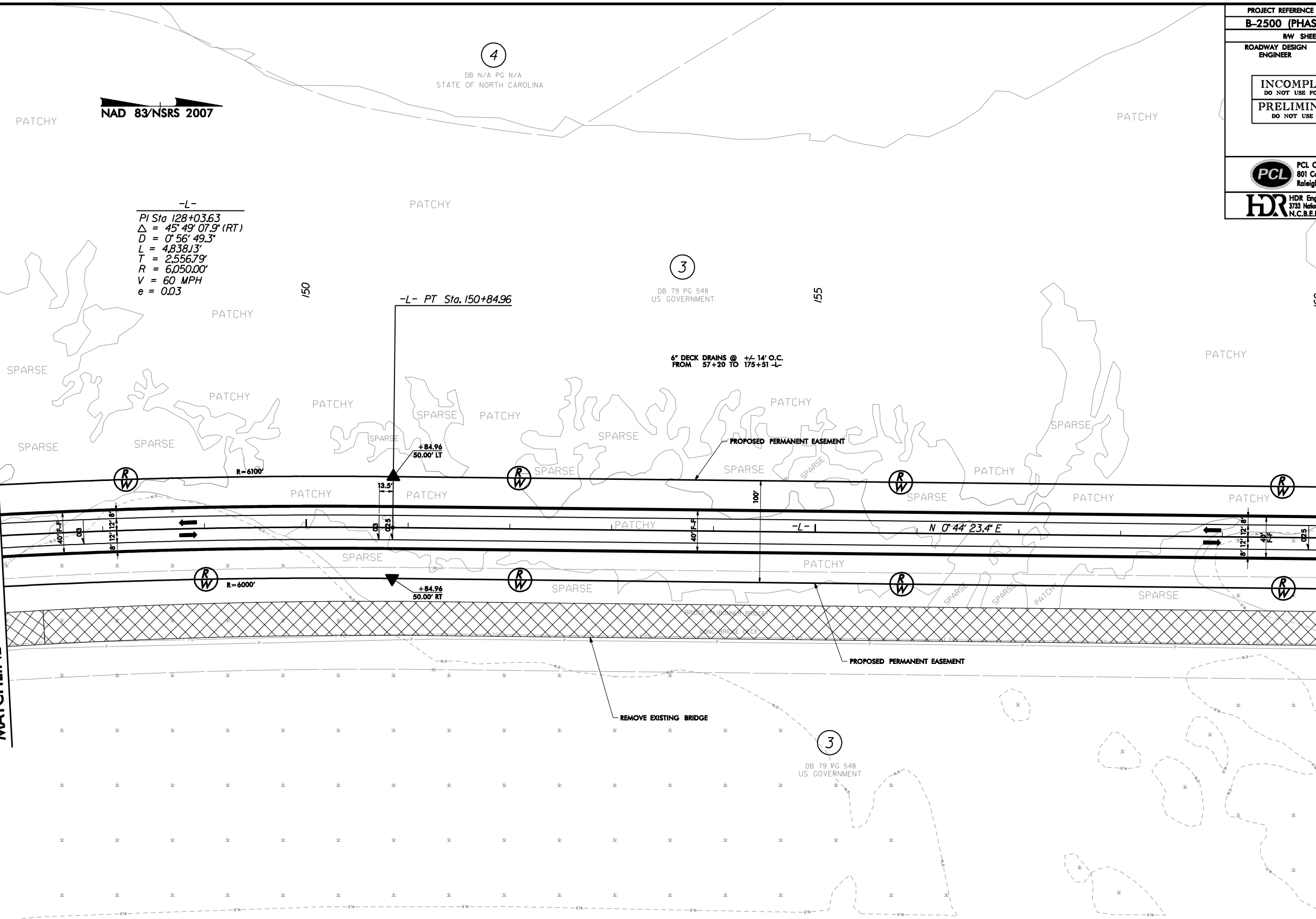


SEE SHEET NO. 27 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassroc
FILE: PCL_Civil_Const\B-2500_Bonner_Bridge_Replacement\06.00_NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_14.dgn
PENTABLE: NCDOT_pshpfl.tbl
TIME: 6/1/2012 8:30:40 AM

REVISIONS

MATCHLINE -L- STA. 147+00, SEE SHEET NO. 13



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 than growth area.
- VOID: Open with little or no growth. Boundary defined by edges of other polygons.

PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 14	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION		PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
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			

MATCHLINE -L- STA. 160+00, SEE SHEET NO. 15

SEE SHEET NO. 27 FOR -L- PROFILE.



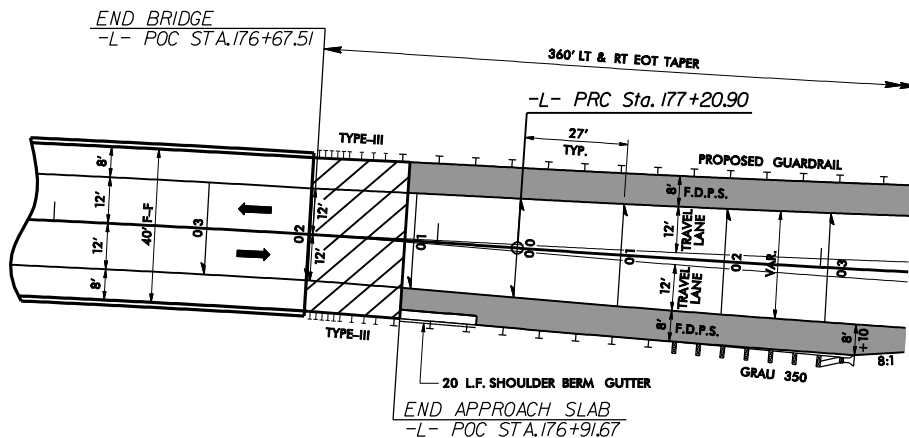
REVISIONS

MATCHLINE -L- STA. 173+00, SEE SHEET NO. 15

SAV LEGEND

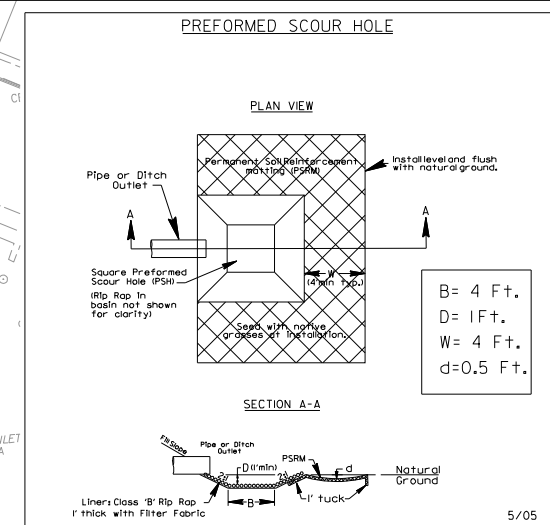
HOMOGENOUS	Uniform in coverage, some anomalies.
PATCHY	Diverse coverage running from almost homogenous to almost sparse.
SPARSE	Limited growth with more void area than growth area.
VOID	Open with little or no growth. Boundary defined by edges of other polygons.

-L-
PI Sta 173+87.60
 $\Delta = 7^{\circ} 38' 59.6"$ (RT)
D = 1' 08' 45.3"
L = 667.58'
T = 334.29'
R = 5,000.00'
V = 60 MPH
e = 0.03



SKETCH SHOWING BRIDGE/PAVEMENT RELATIONSHIP

NAD 83/NSRS 2007



PROJECT REFERENCE NO. B-2500 (PHASE I)	SHEET NO. 16
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
PCL PCL Civil Constructors, Inc. 801 Corporate Center Drive, Suite 130 Raleigh, NC 27607	
HDR 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	

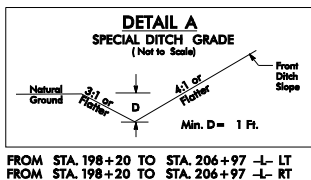
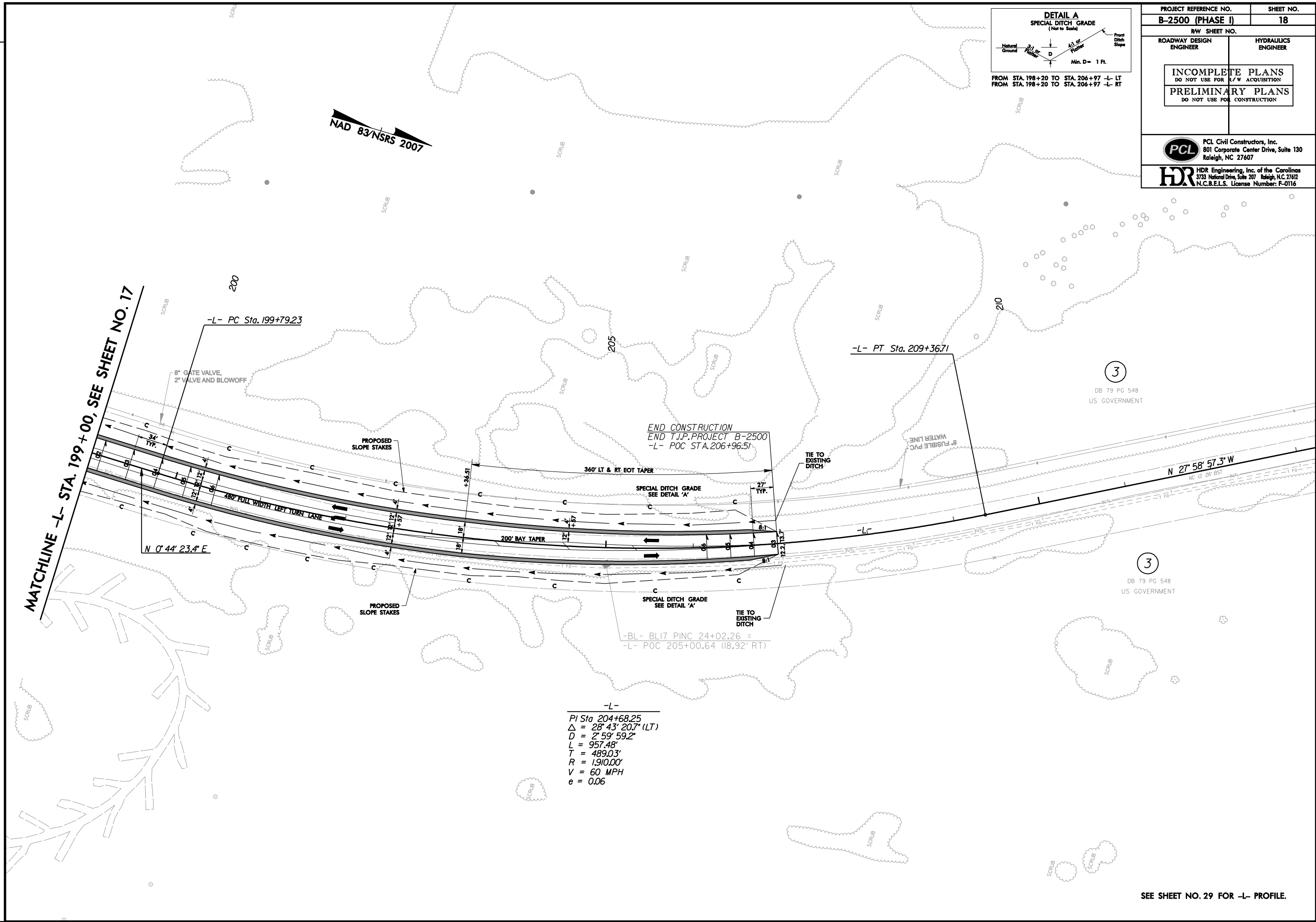
MATCHLINE -L- STA. 186+00, SEE SHEET NO. 17

SEE SHEET NO. 28 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_color_eng_100.plt
USER: jmassroc
FILE: PCL_Civil_Const\B-2500_Bonner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500_Roadway\Proj\B2500_RDY_PSH_18.dgn

PENTABLE: NCDOT_pshp.flx.tbl
TIME: 8:32:03 AM
DATE: 6/1/2012

REVISIONS



PROJECT REFERENCE NO. B-2500 (PHASE I)		SHEET NO. 18	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR A/W ACQUISITION		PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
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 204+68.25
 $\Delta = 28^\circ 43' 20.7''$ (LT)
 $D = 2^\circ 59' 59.2''$
 $L = 957.48'$
 $T = 489.03'$
 $R = 1,910.00'$
 $V = 60$ MPH
 $e = 0.06$

SEE SHEET NO. 29 FOR -L- PROFILE.

PLOT DRIVER: NCDOT_.pdf_color_eng_100.plt
USER: jmassroc
FILE: PCL\Civil\Const\B-2500_Borner_Bridge_Replacement\06.00.NCDOT_File_Structure\B-2500\Roadway\Proj\B2500_RDY_PSH_19.dgn

PENTABLE: NCDOT_pshp.fltd

TIME: 8:32:17 AM

DATE: 6/1/2012

REVISIONS

MATCHLINE -Y- STA. 16 + 50, SEE SHEET NO. 4

-Y-
PI Sta 14+84.96
 $\Delta = 6^{\circ}50'58.5"$ (LT)
D = 1,000.00'
L = 684.96'
T = 342.89'
R = 5,729.58'
V = 30 MPH
e = NC

-Y- PT Sta. 18+27.03

DB 19 PG 451
US GOVERNMENT

DB 19 PG 451
US GOVERNMENT

MATCHLINE, SEE SHEET NO. 5

NAD 83/NRS 2007

-Y- PC Sta. 26+77.71

-Y-
PI Sta 28+79.25
 $\Delta = 19^{\circ}56'52.8"$ (RT)
D = 4,593.58'
L = 398.99'
T = 201.53'
R = 1,146.00'
V = 30 MPH
e = NC (LOW SPEED CHART)

-Y- PT Sta. 30+76.70

320.00' CL TO COR
N 61°41'59" E

660.00'
S 28°18'01" E

205.00' CL TO COR
S 61°41'59" W

N 44°53'53.8" W

25

30

660.00'
N 28°18'01" W

HISTORIC COAST
GUARD STATION

10' WIDE
BOARDWALK

-BW- POT Sta. 14+73.88

-BW- PI Sta. 14+11.18

-BW- PI Sta. 12+75.99

+73.21 -BW-
15.00' LT

+73.54 -BW-
15.00' RT

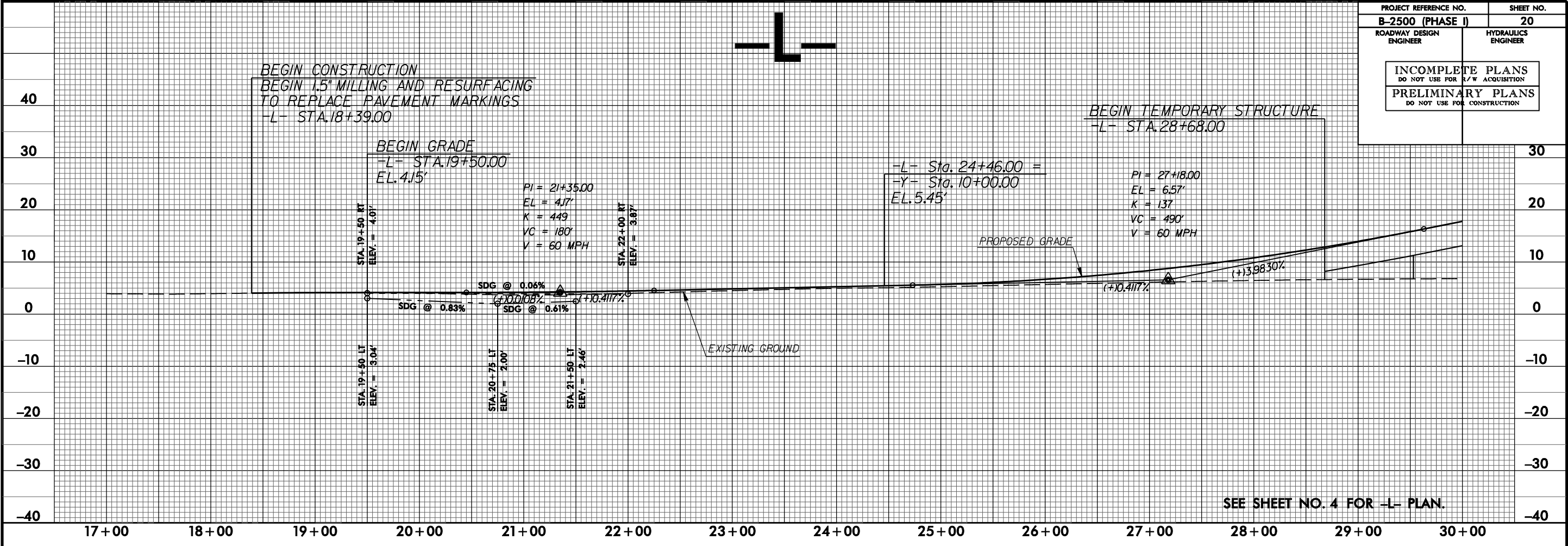
PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		19	
RW SHEET NO.			
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION		PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
PCL PCL Civil Constructors, Inc. 801 Corporate Center Drive, Suite 130 Raleigh, NC 27607			
HDR 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			

2
DB 1336 PG 331
STATE OF NORTH CAROLINA

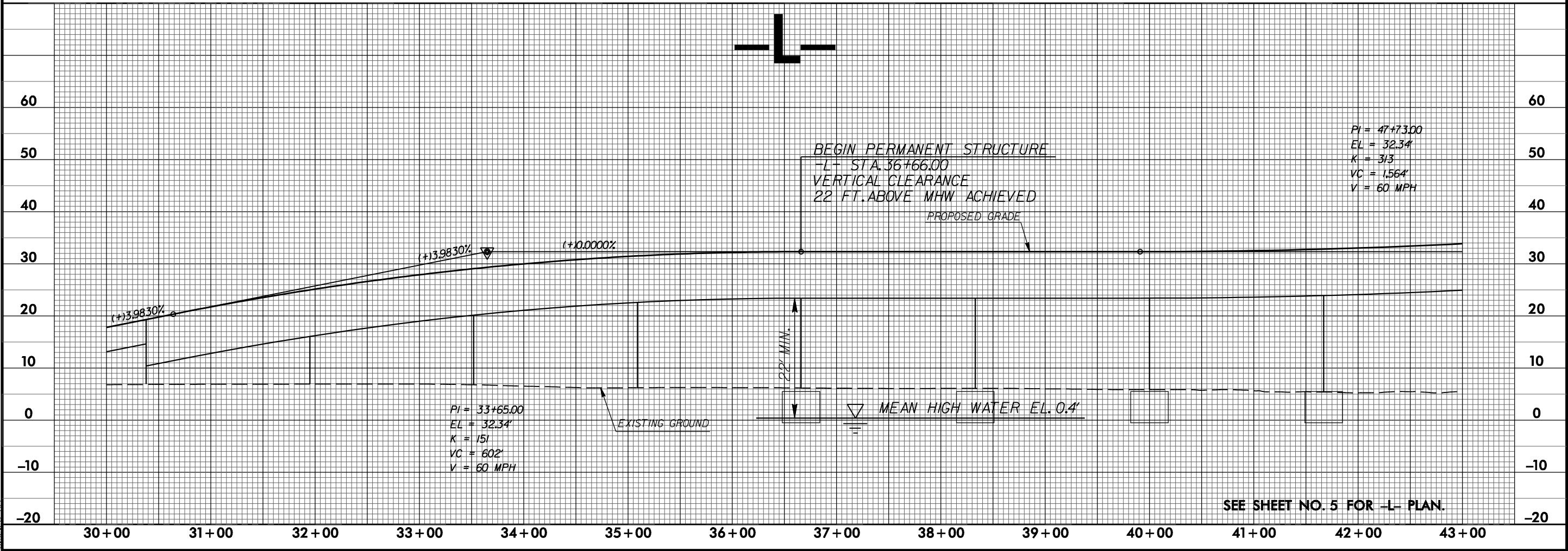
SEE SHEET NO. 30 FOR -Y- PROFILE.
SEE SHEET NO. 30 FOR -BW- PROFILE.

5/28/99

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		20
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION		
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION		

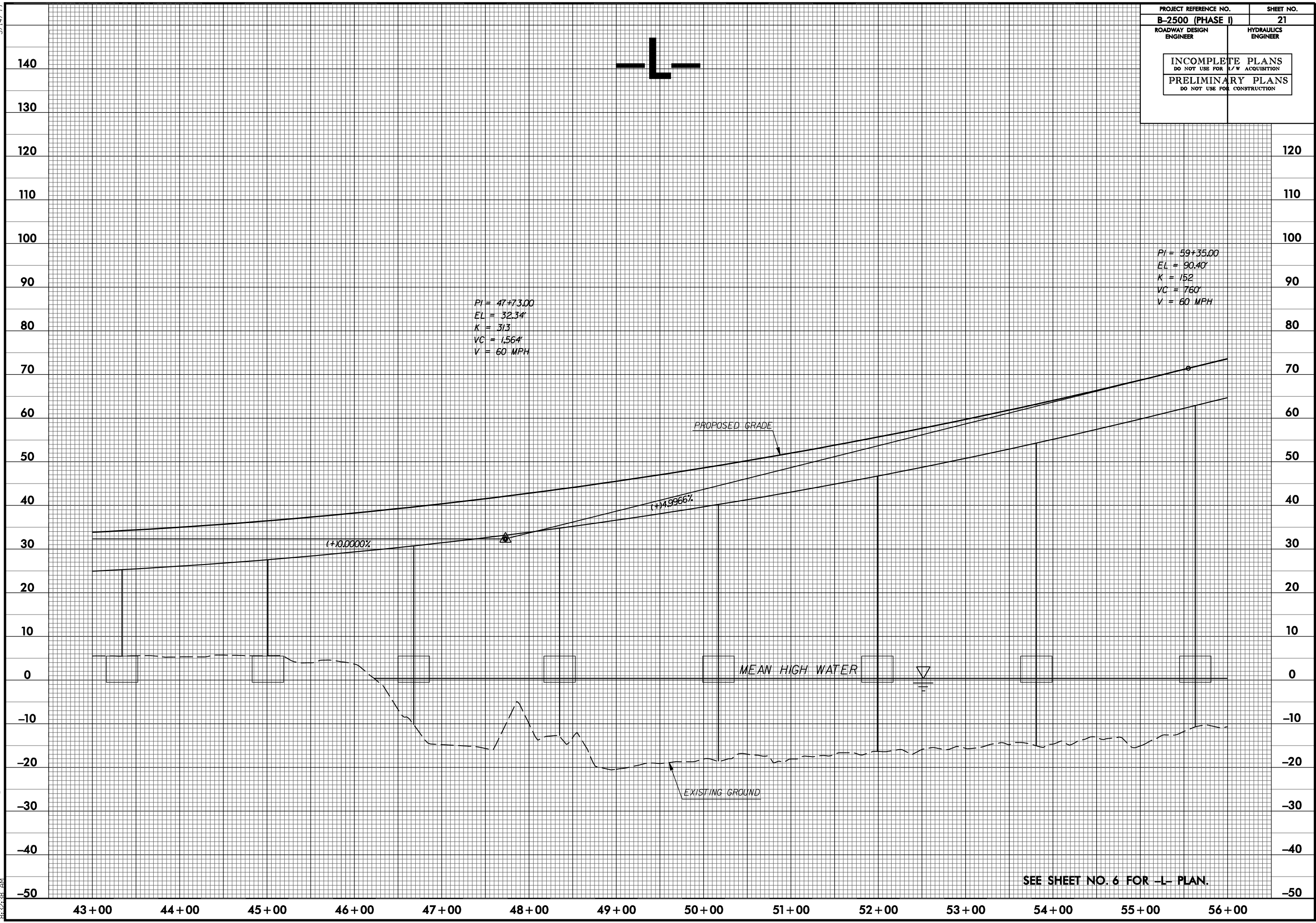


6/1/2002 3:18:39 PM B2500.RDY_PFL_20.dgn



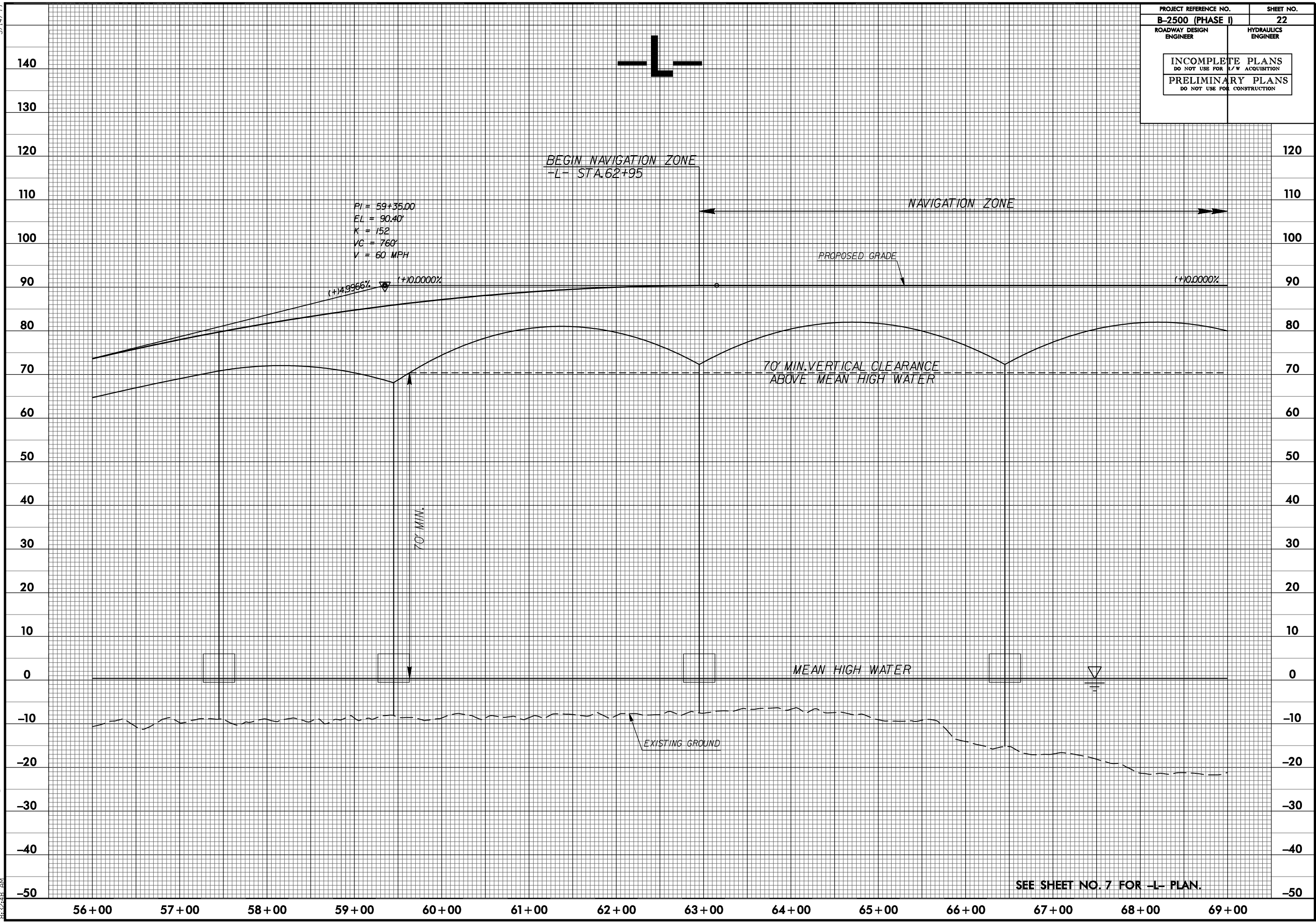
5/14/99
6/1/2002 3:18:38 PM
B:\2002\3918\B2500.RDY_PFL_21.dgn

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		21
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION		
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION		



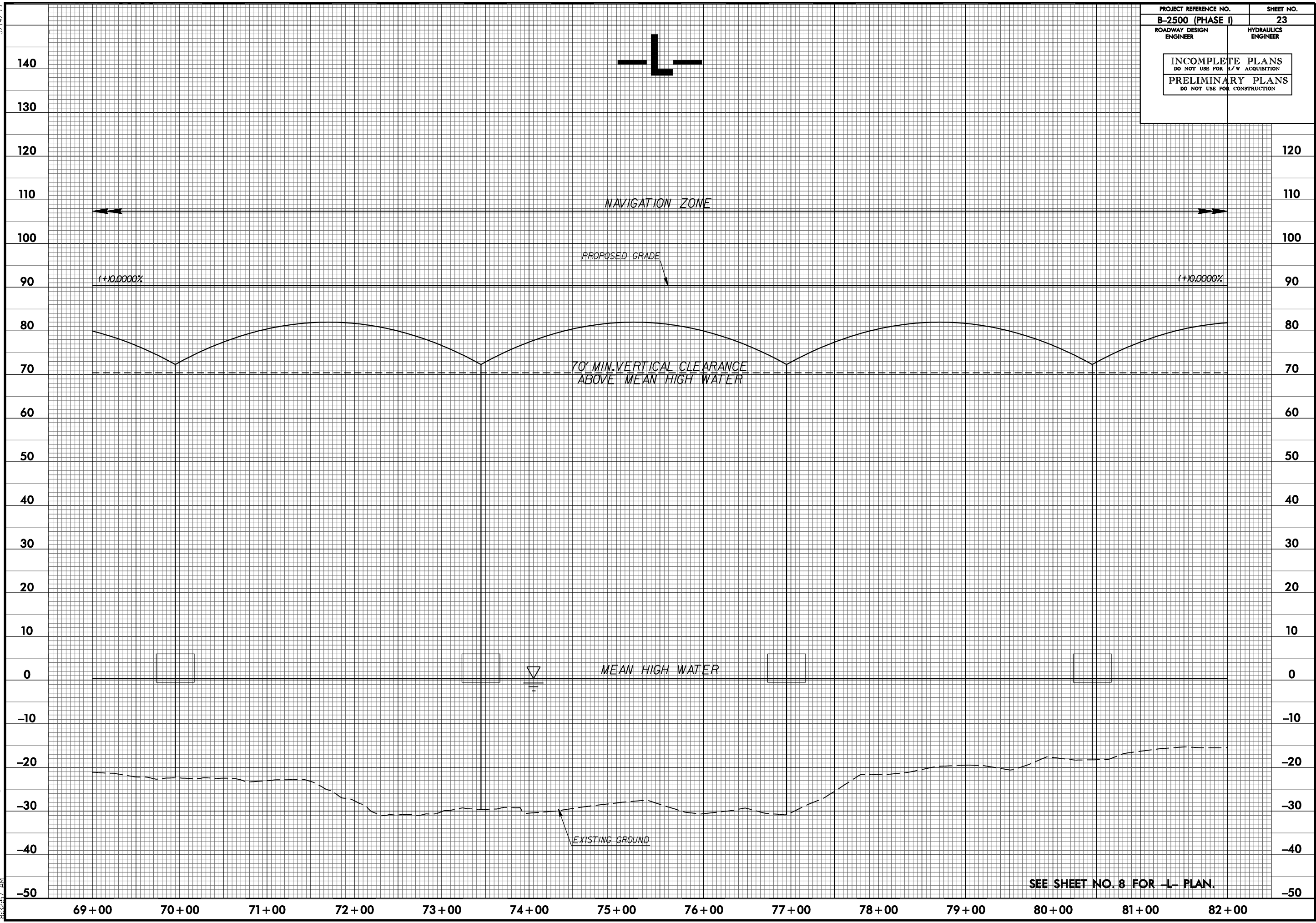
5/14/99
6/1/2002 3:18:39 PM B:\2500\B2500.RDY_PFL_22.dgn
8:32:48 AM

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	22
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	



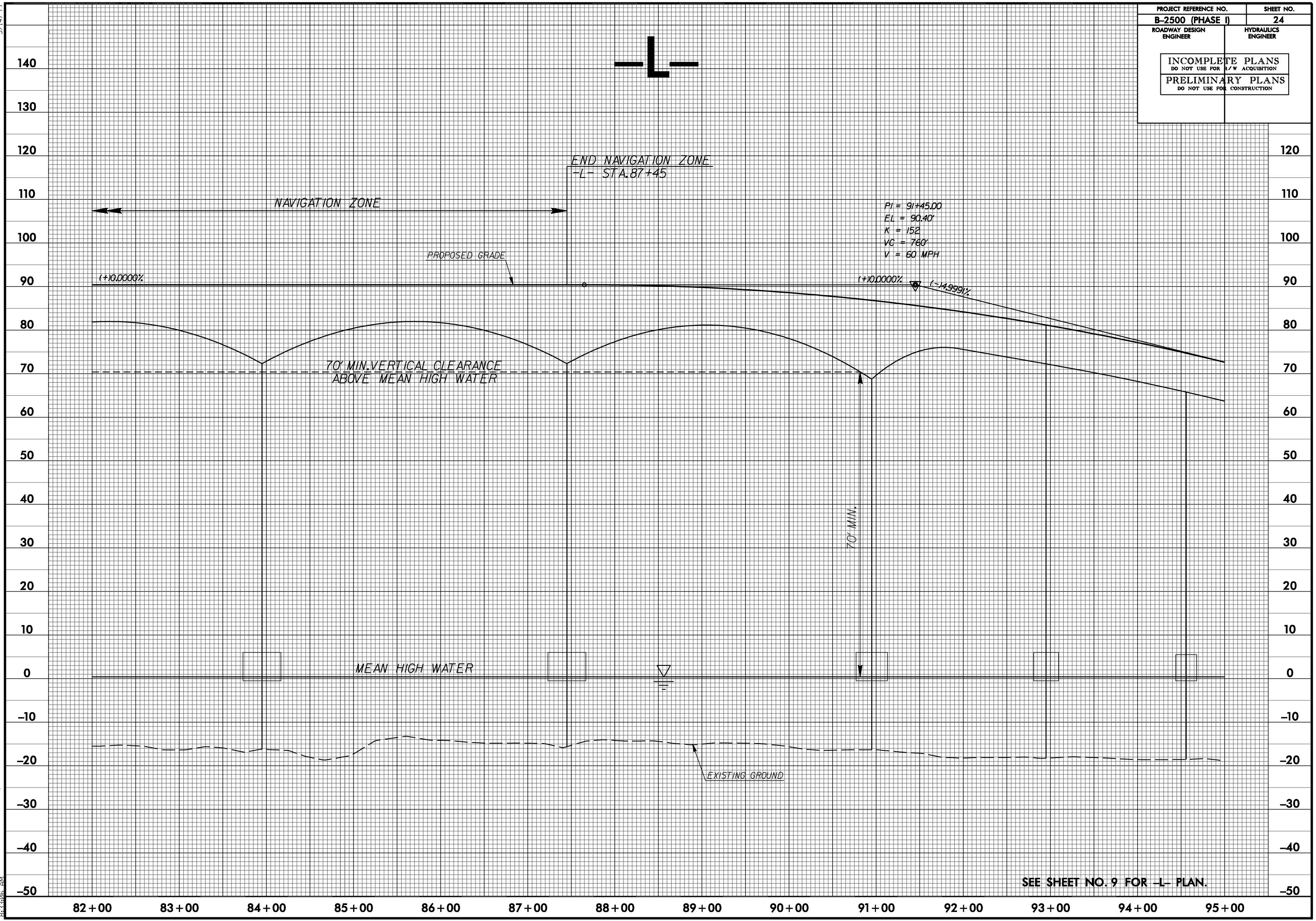
5/14/99
6/1/2002 3:18:39 PM
C:\2500\B2500.RDY_PFL_23.dgn

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		23	
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION		PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	



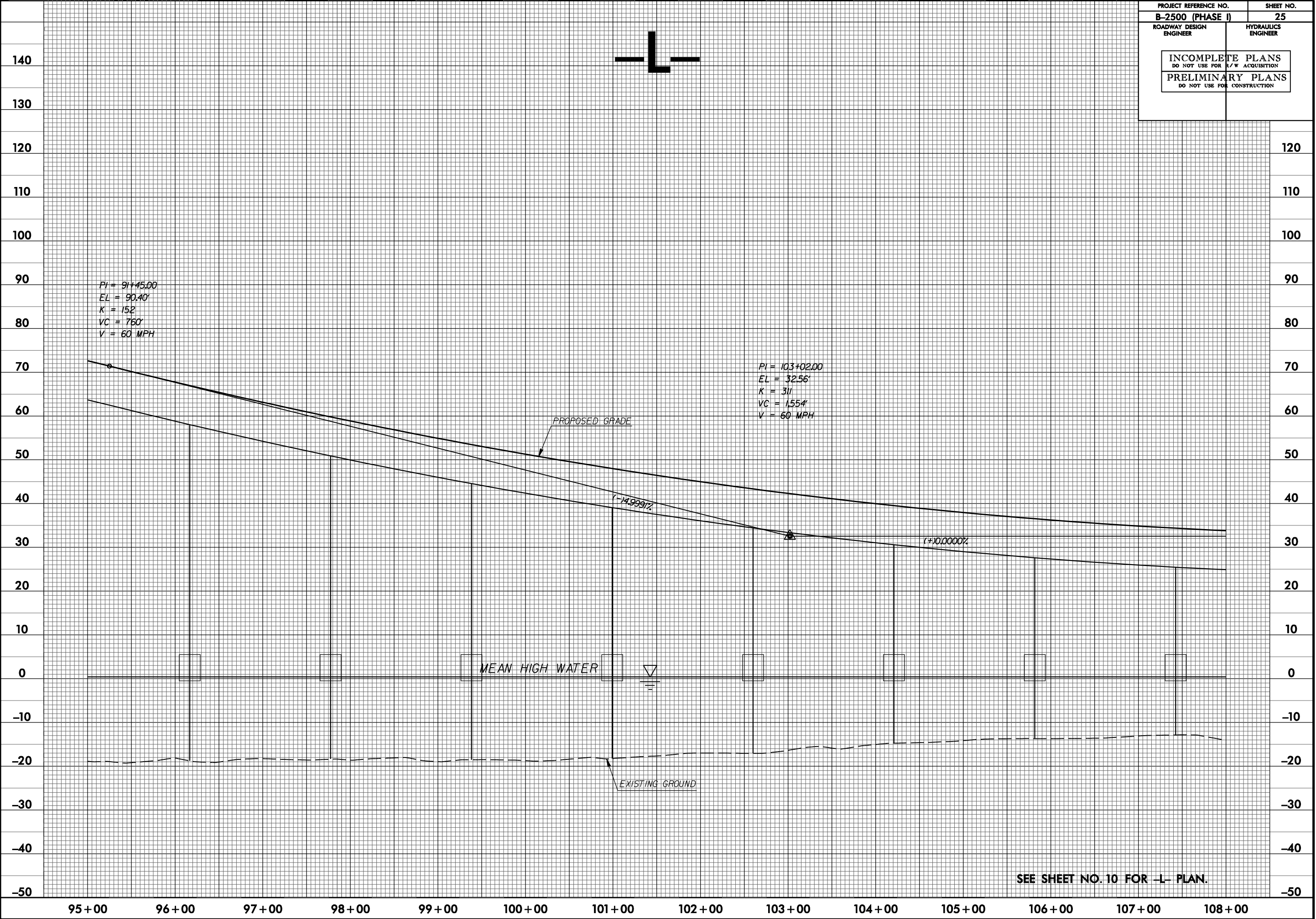
5/14/99
6/1/2002 3:18:39 PM B2500.RDY_PFL_24.dgn
8:33:05 AM

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	24
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	



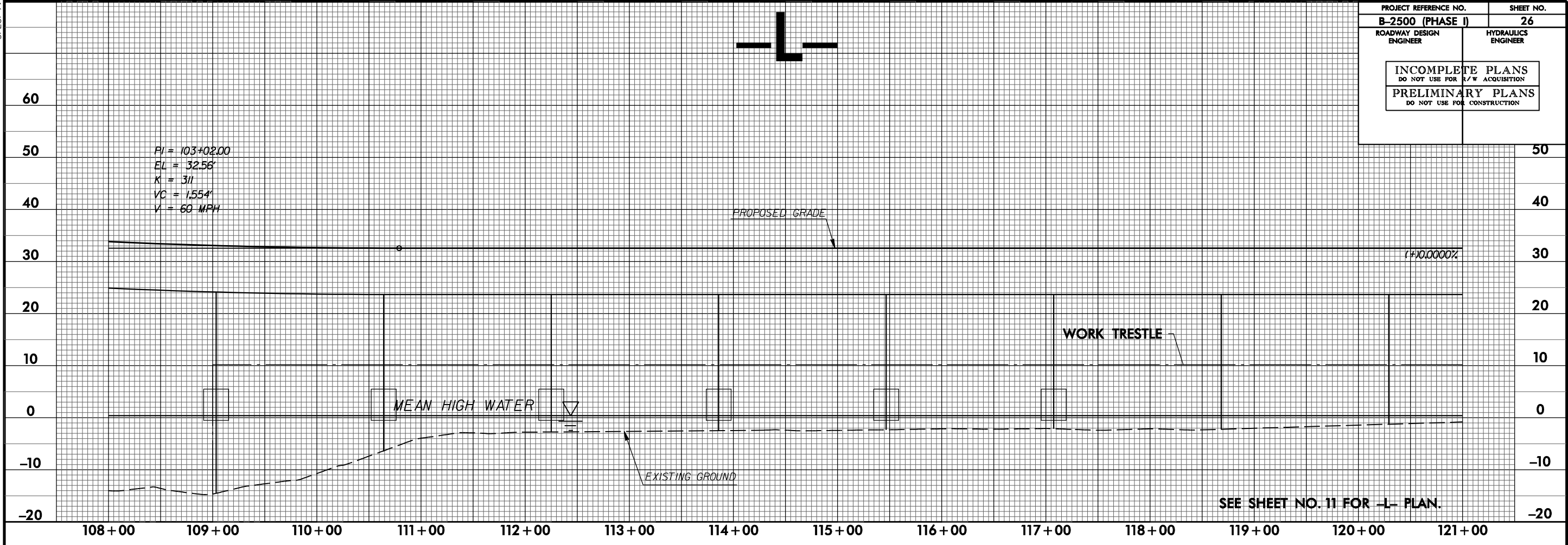
5/14/99

6/1/2002 3:31:18 PM B2500.PLT 25.dgn

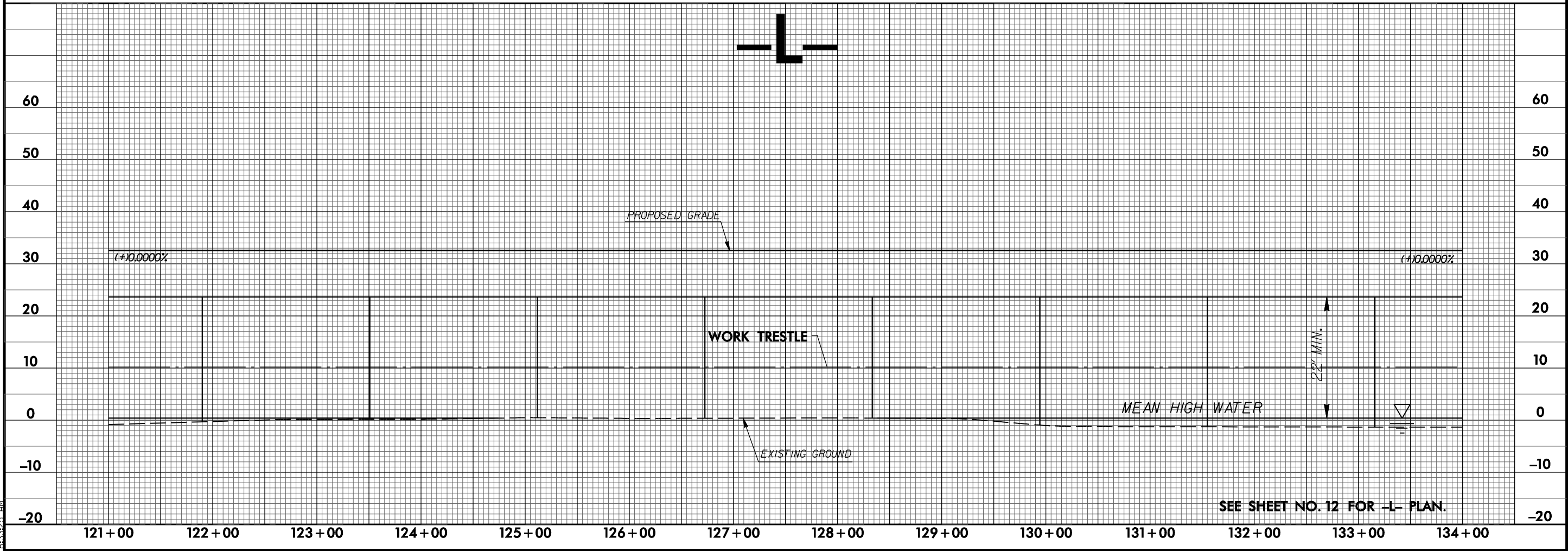


5/28/99

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	26
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	

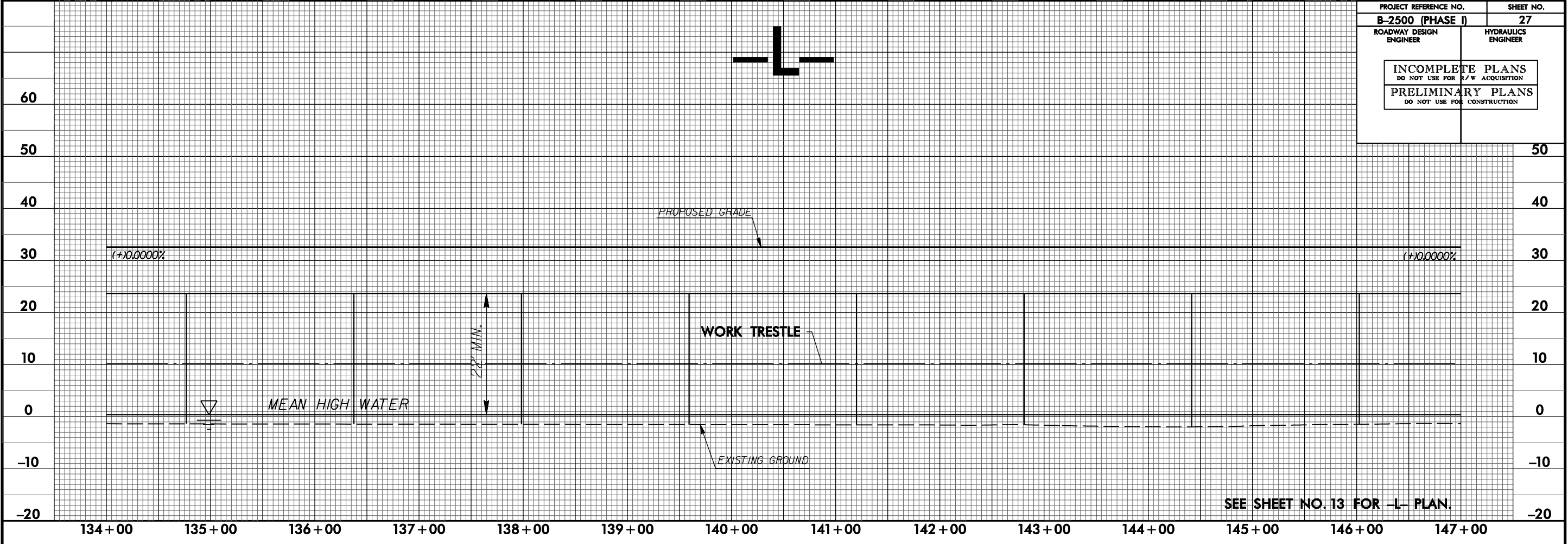


6/1/2002 3:31:18 PM B2500.RDY_PFL_26.dgn

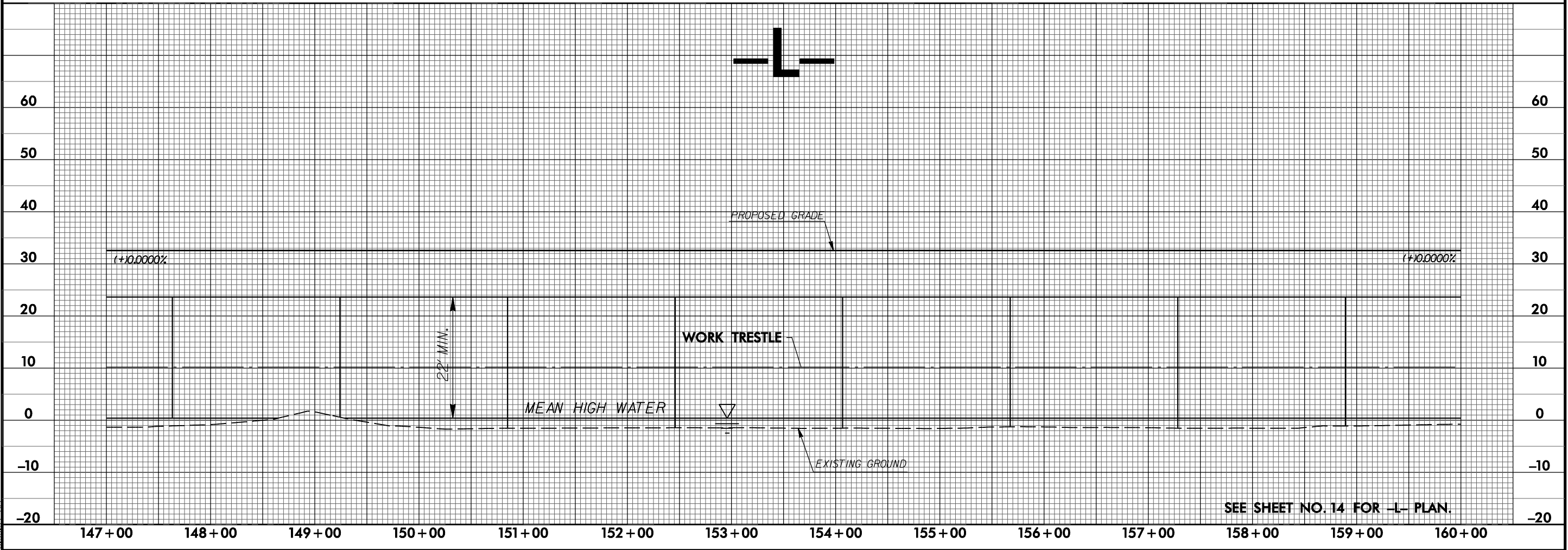


5/28/99

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		27	
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION		PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	

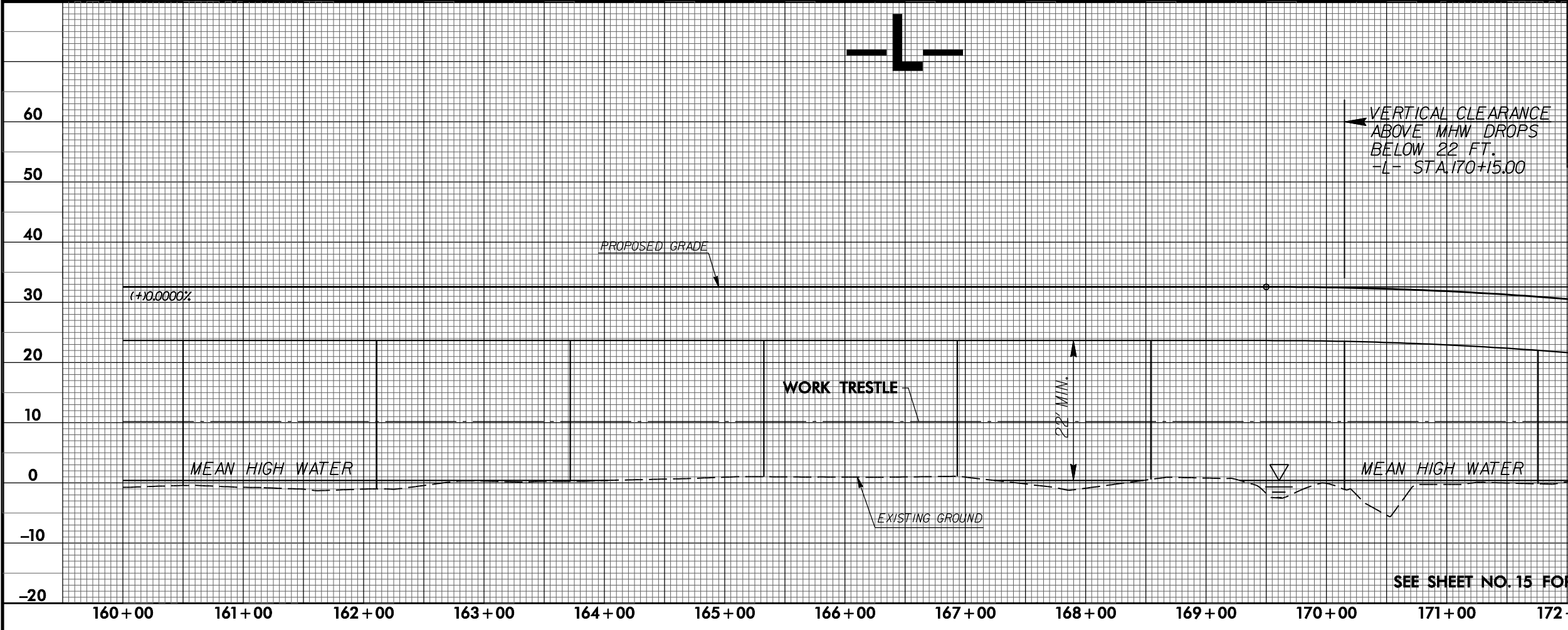


6/1/2002 3:33:34 AM
C:\2002\3918\B2500.RDY_PFL_27.dgn



5/28/99

PROJECT REFERENCE NO.		SHEET NO.	
B-2500 (PHASE I)		28	
ROADWAY DESIGN ENGINEER		HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION		PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	



PI = 172+75.00
EL = 32.56'
K = 156
VC = 650'
V = 60 MPH

50

40

30

20

10

0

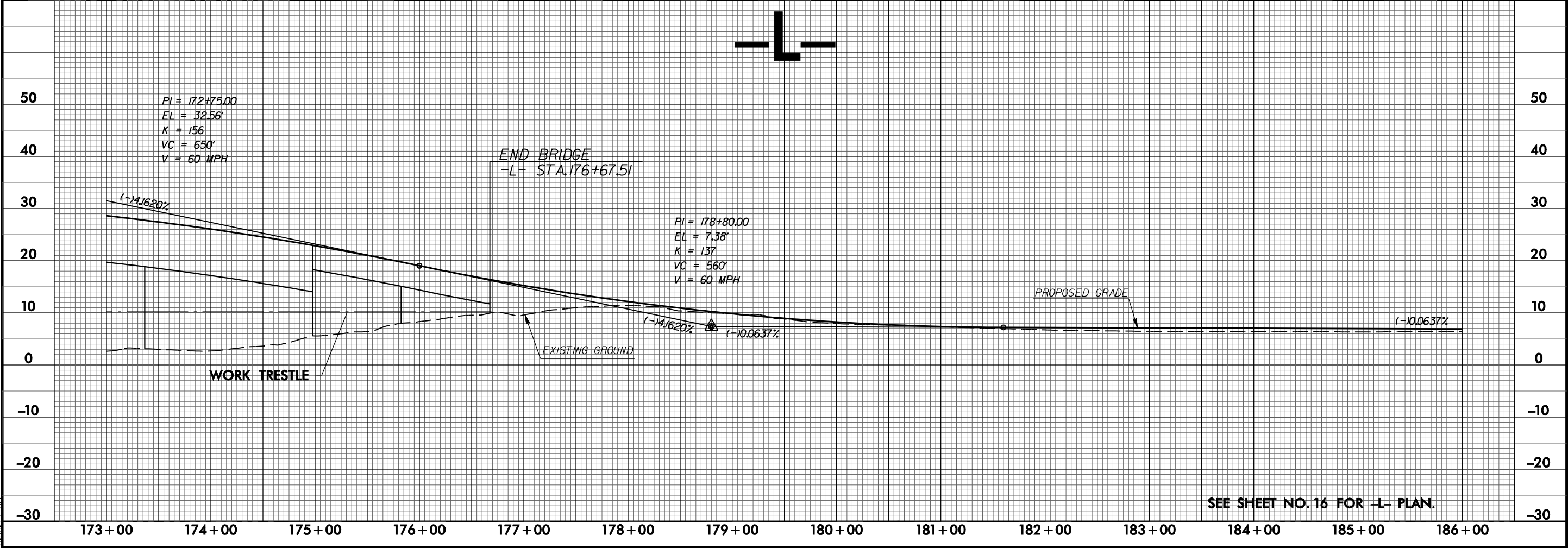
-10

-20

160+00 161+00 162+00 163+00 164+00 165+00 166+00 167+00 168+00 169+00 170+00 171+00 172+00 173+00

SEE SHEET NO. 15 FOR -L- PLAN.

6/1/2002 3:39:18 PM B2500.RDY_PFL_28.dgn



PI = 172+75.00
EL = 32.56'
K = 156
VC = 650'
V = 60 MPH

PI = 178+80.00
EL = 7.38'
K = 137
VC = 560'
V = 60 MPH

50

40

30

20

10

0

-10

-20

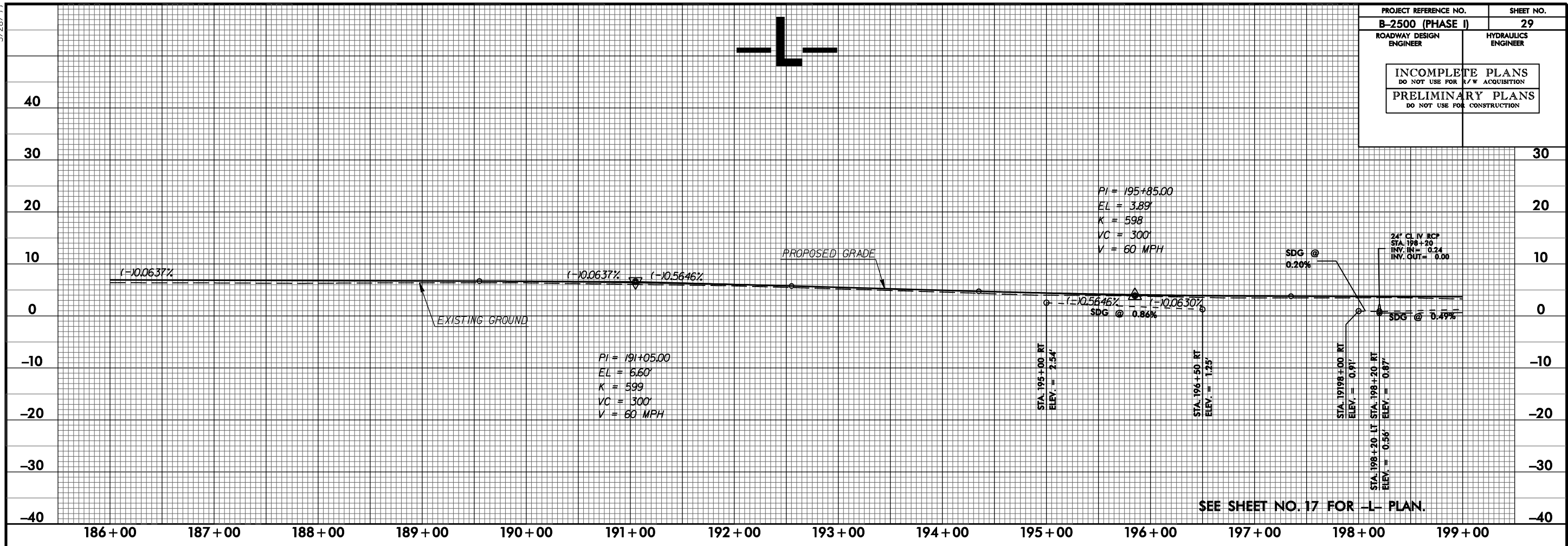
-30

173+00 174+00 175+00 176+00 177+00 178+00 179+00 180+00 181+00 182+00 183+00 184+00 185+00 186+00

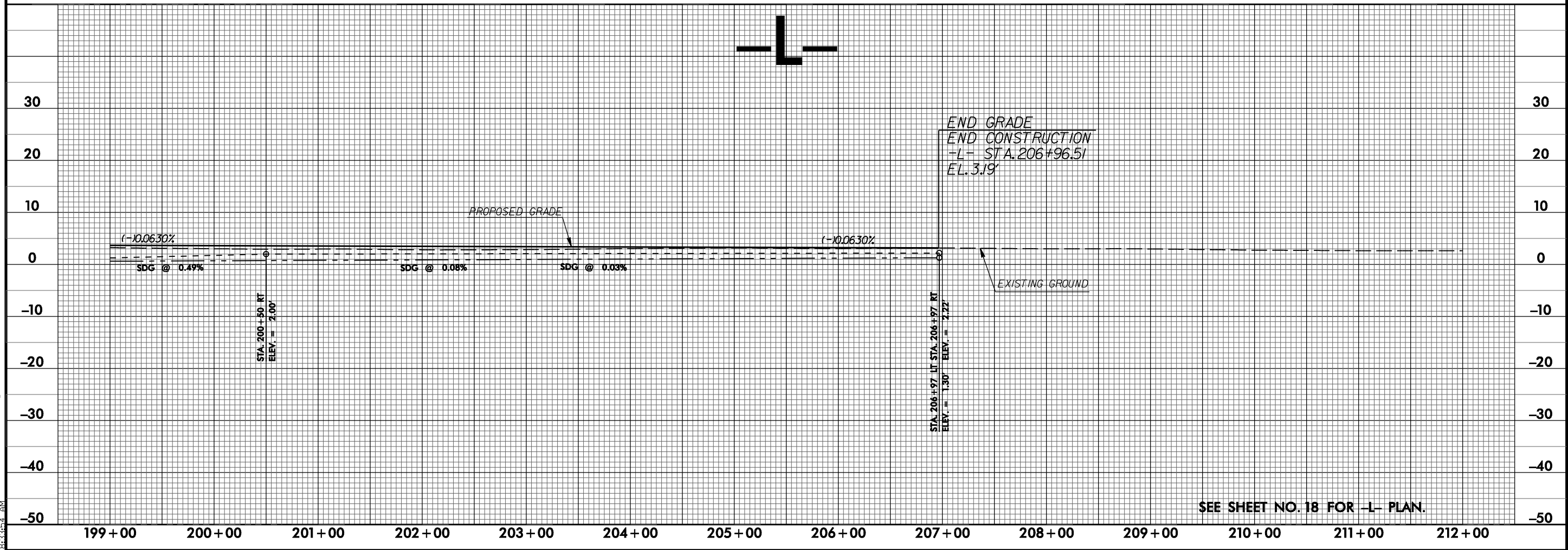
SEE SHEET NO. 16 FOR -L- PLAN.

5/28/99

PROJECT REFERENCE NO.		SHEET NO.
B-2500 (PHASE I)		29
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER	
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION		
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION		

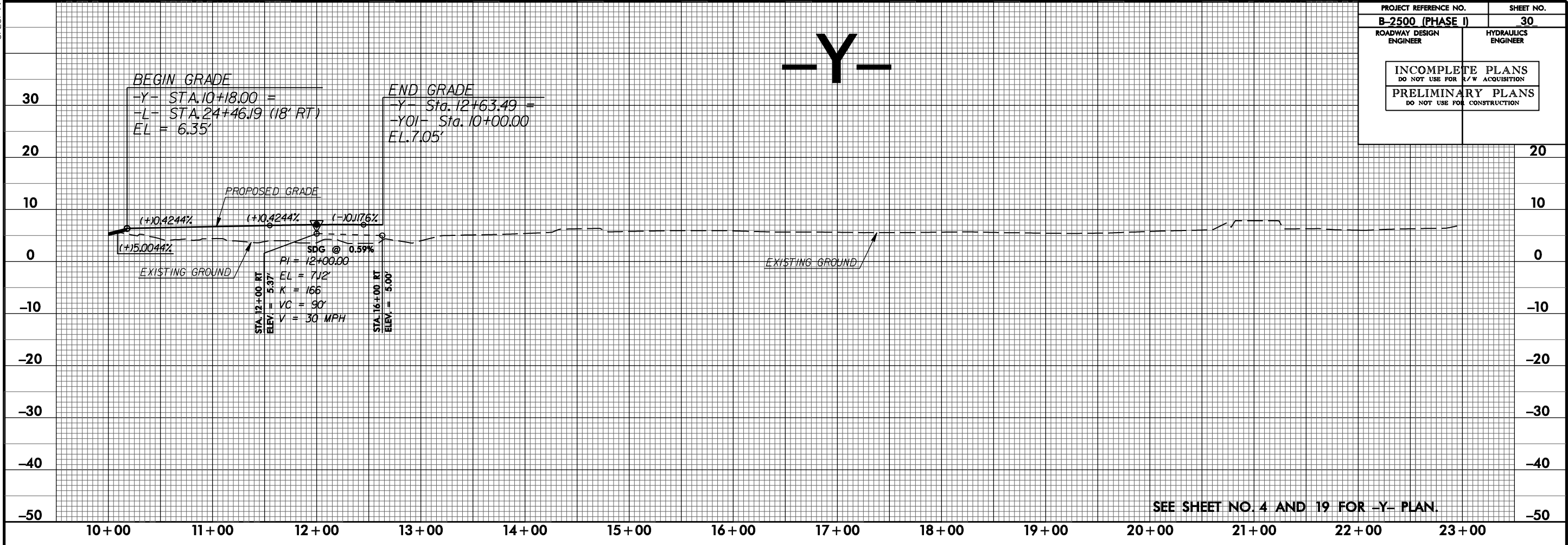


6/1/2002 3:31:18 PM B2500.RDY_PFL_29.dgn



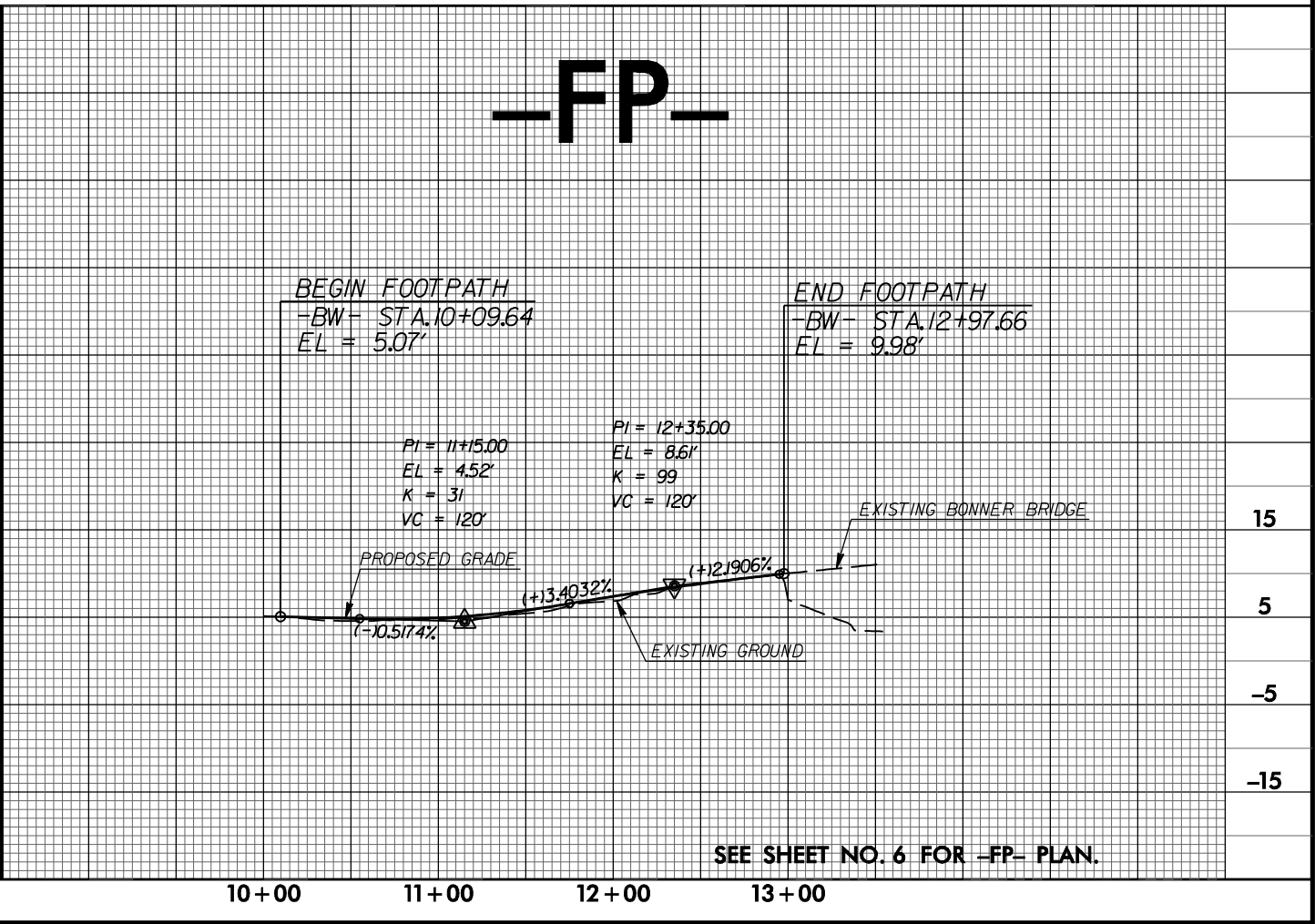
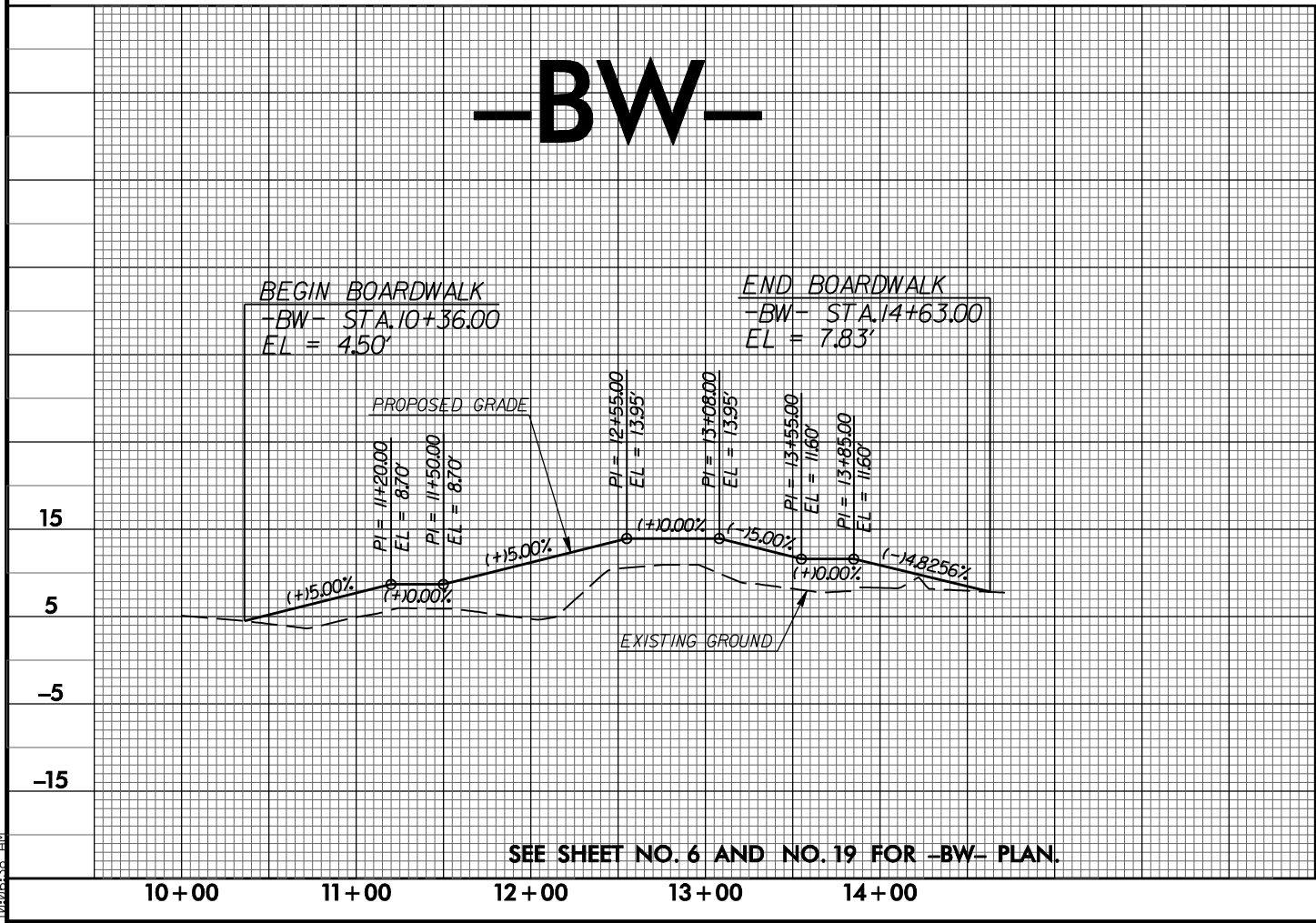
5/28/99

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	30
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	



-BW-

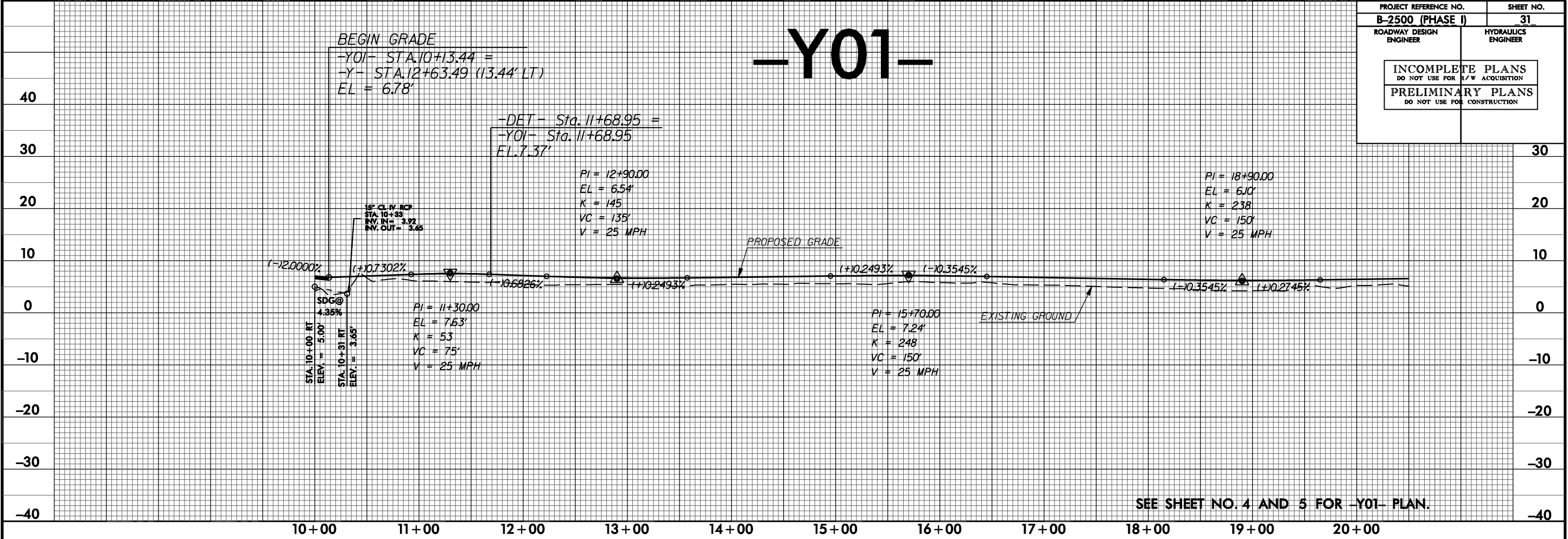
-FP-



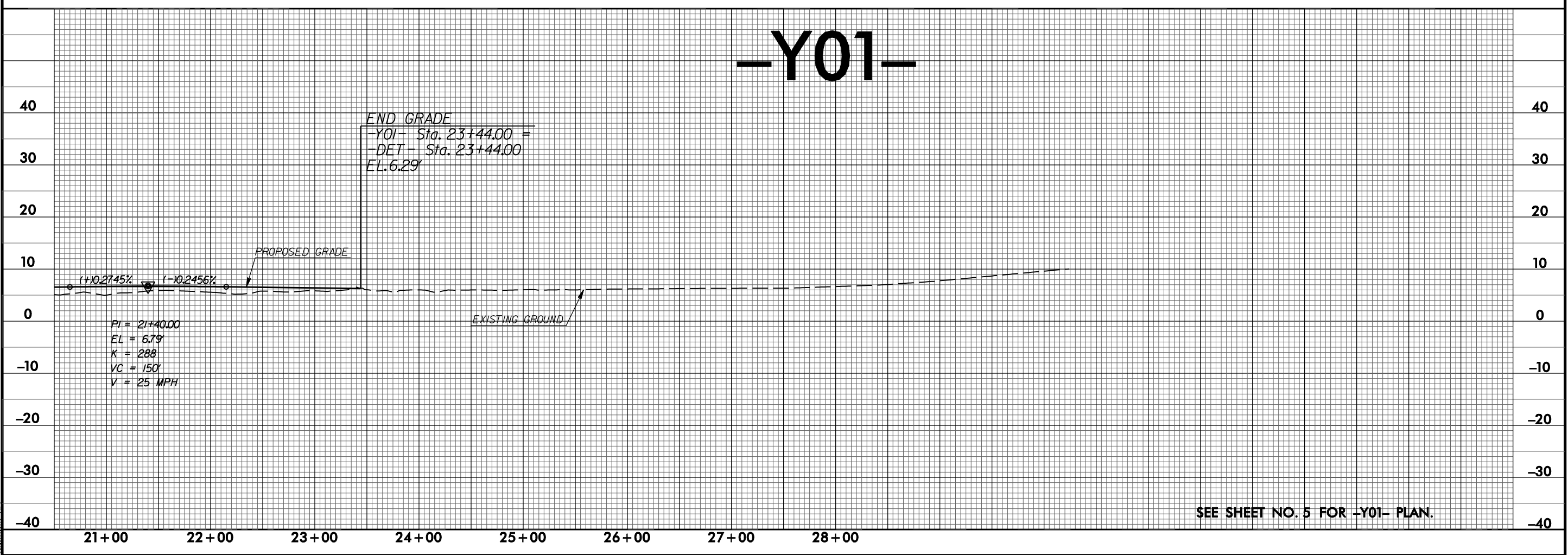
6/13/2013 3:18:18 PM B2500.RDY_PFL_30.dgn
10:06:38 AM

5/28/99

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	31
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	



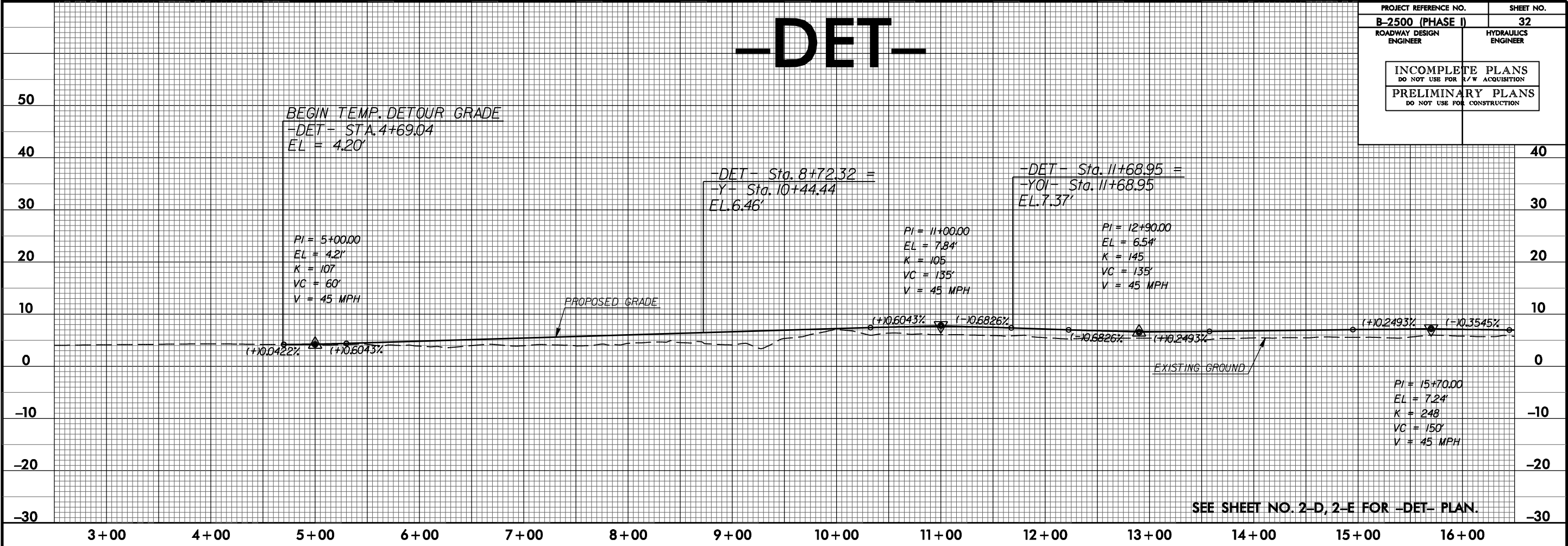
6/13/2013 3:18:18 PM B2500.RDY_PFL_31.dgn



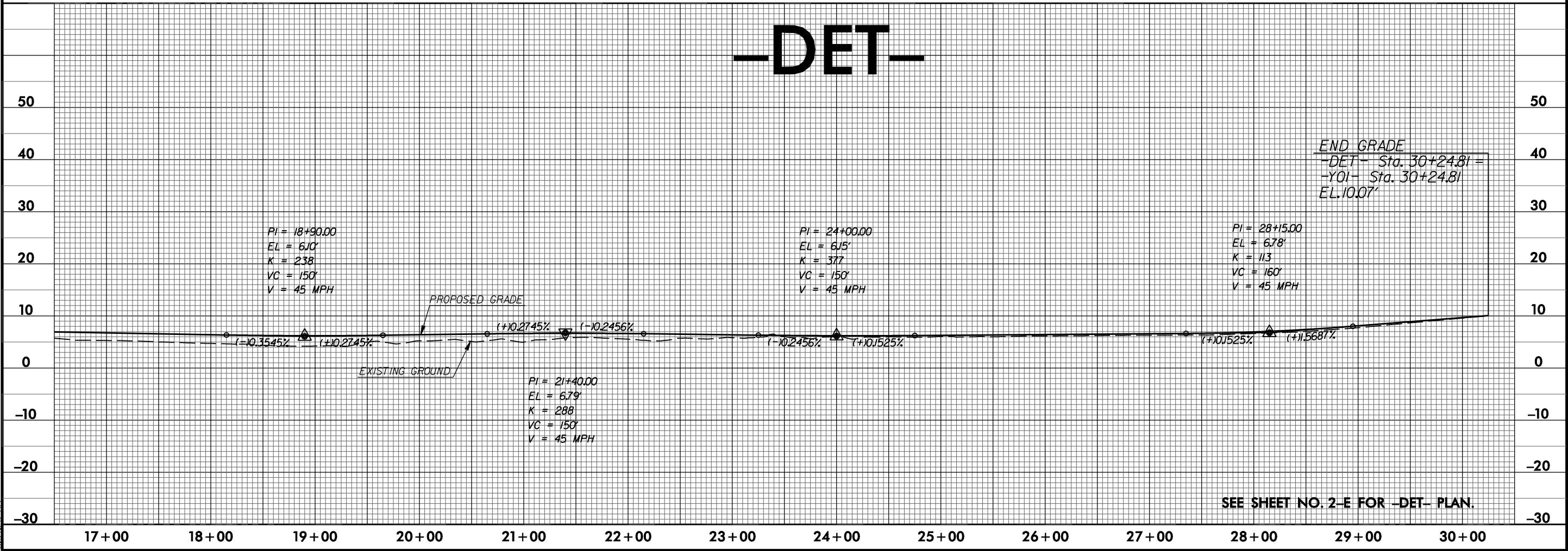
5/28/99

-DET-

PROJECT REFERENCE NO.	SHEET NO.
B-2500 (PHASE I)	32
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	



-DET-



6/1/2002 3:18:39 PM
B:\2500\B2500.RDY_PFL_32.dgn