ESSENTIAL FISH HABITAT ASSESSEMENT

WILMINGTON TERMINAL
TURNING BASIN EXPANSION

NORTH CAROLINA STATE PORTS AUTHORITY

October 26, 2018

Prepared for:
North Carolina State Ports Authority
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EXECUTIVE SUMMARY

Dial Cordy and Associates Inc. (DC&A) has prepared this Essential Fish Habitat (EFH) Assessment for the North Carolina State Ports Authority (NCSPA), Port of Wilmington (POW), as requested by the Wilmington District United States Army Corps of Engineers (USACE) and National Marine Fisheries Service (NMFS) for widening of the Turning Basin to accommodate larger 14,000 TEU class size vessels, which plan on calling on the POW as early as next fall. Dial Cordy and Associates Inc. has evaluated potential effects on EFHs, managed, and associated species from proposed dredging and toe wall construction activities associated with this proposed project.

The primary purpose and need of the NCSPA at the POW is to expand the present turning basin to meet larger vessels calling on the POW in the late fourth quarter of 2019. In order to meet this need, the POW proposes to dredge the eastern and western sides of the present basin, deepening approximately 17.76 acres of shallow and deep unvegetated habitat to -45 feet (ft) Mean Low Low Water (MLLW), dredging 1.4 acres of coastal tidal marsh east of the channel, and installing a vertical submerged king or sheet pile toe wall along the eastern extents of the basin. Material will be placed in scows and hydraulically pumped to the Eagle Island confined disposal facility (CDF). There will be no impacts to the tidal marsh or Eagle Island disposal facility on the western side of the basin.

The international shipping community and clients that currently utilize the POW are expanding into a new class of freightliners to optimize shipping efficiency and global logistics. The new class of containerships are expected to be capable of carrying 14,000 Twenty-foot Equivalent Units (TEU) with an overall length of 1200-ft and a beam of 159-ft. Once the NCSPA's clients transition to this new class of vessel, they will be calling on ports that currently have the facilities and capabilities to safely handle turning, berthing and unloading. To prevent the loss in clientele and subsequent revenue, the POW must adapt by expanding the current 1,400-ft turning basin to meet the needs of the new class of vessels. The proposed project includes a 1,524-ft turning basin elongated to 500-ft along the eastern side of the Cape Fear River (CFR) with a 1416-ft long toe wall along the eastern edge of the project to stabilize the shoreline and maintain the basin width and navigable depth. It is expected that total dredging quantities to be removed during this project will reach 560,000 cubic yards (CY), which includes 370,000 CY on the east side and 190,000 CY on the west side.

The NCSPA has confirmed that the proposed construction depth of the CFR, -42 ft MLLW (+2, +1), is acceptable for the larger ships that are expected to call at the POW next year, including vessels from four carrier lines. In addition, the dock structures and the ship-to-shore cranes that exist at the POW are adequately sized to receive the larger vessels that will begin to deploy in 2019. Failure to be able to service these vessels through constructing a 1,500 ft diameter basin could have a severe economic impact on the POW and State of North Carolina as early as next fall. These improvements to the turning basin will support the larger carriers for many decades to come.

The construction schedule will require at least ten months for dredging and installation of the submerged toe wall. In order to be ready for use by larger carriers early next fall, construction must start in April 2019, with final completion of the dredging on the west side during the late fall/winter.

The proposed mechanical dredging will affect shallow and deep unvegetated mud bottom, tidal marsh, and water column EFHs east and west of the present channel off the Kinder Morgan property. These habitats are potentially used by various stages of managed species afforded protection under the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (16 U.S.C. 1801-1882), as amended in 2006 (Magnuson-Stevens Act). Section 10 Associated Species includes supplemental narrative for the shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*A. oxyrinchus oxyrinchus*) protected under the Endangered Species Act. The action area is also within proposed Critical Habitat for Atlantic Sturgeon and within a Primary Nursery Area (PNA) managed by the North Carolina Division of Marine Fisheries (NCDMF). A variance for dredging in PNAs will be required from the North Carolina Coastal Resource Commission. This EFH has been prepared at the request of the USACE Regulatory Division, NMFS, and in coordination with the North Carolina Division of Coastal Management, the NCDMF, the North Carolina Division of Water Quality, and the North Carolina Wildlife Resources Commission.

The proposed project, including dredging of 17.76 acres of softbottom habitat and 1.4 acres of tidal marsh, will result in the deepening of 1.68 acres of existing shallow water mud bottom EFH habitat located within state designated PNA, also considered a HAPC for some managed species (Figure 3). This will result in the loss of a portion of shallow water foraging habitat present along the Kinder Morgan Terminal to meet the NCSPA purpose and need for the project. A number of managed, associated, and prey species likely use this area for foraging activities during their juvenile and adult lifestages. However, this represents a very small amount of the available shallow water soft bottom habitat present in the lower CFR estuary. The newly dredged area can be used for foraging, however its depth, lack of light, and operational use by vessels will result in a less productive benthic community than presently resides at the present depth. While construction of the toe wall at -10 ft MLLW elevation will not result in any adverse effect on the water column, unvegetated mud bottom, or tidal marsh EFHs present at this site, dredging below and above the wall will. Adult and most juvenile fish can avoid the dredging operations. Managed invertebrate species population occurring here may be adversely effected during dredging; however, most being motile can escape the clamshell/bucket grab.

The potential indirect effects on the estuarine/riverine water column, tidal marsh and unvegetated mud bottoms would be spatially and temporally minimized through use of turbidity barriers around all dredging and pumping operations. There is no submerged aquatic vegetation, shellfish, or hardbottom habitat located within the proposed action area. A variance request for dredging in PNA has been submitted as part of the application package to the North Carolina Department of Environment and Natural Resources Coastal Resources Commission.

Conservation/mitigation measures have been proposed which includes the creation of 3.0 acres of tidal marsh in the lower CFR and the donation of $650,000 to the North Carolina Department of Environmental Quality for use in completing construction of the Lock and Dam #1 fish passage modification project. The latter is only offered if all permits and agency approvals can be completed in less than 120 days from the date of application (permitted by 1 April 2019). Other conservation measures include use of best management practices, good engineering practices, turbidity barriers, and project monitoring.

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AMD	Agitation Maintenance Dredging
ANAMAR	Anamar Environmental Consulting, Inc.
ASMFC	Atlantic States Marine Fisheries Commission
ATCA	Atlantic Tunas Convention Act
CAMA	Coastal Area Management Act
CDF	Confined Disposal Facility
CFR	Cape Fear River
CRC	Coastal Resources Commission
CY	Cubic Yards
DC&A	Dial Cordy and Associates Inc.
DCM	Division of Coastal Management
DNA	Deoxyribonucleic Acid
DO	Dissolved Oxygen
EFH	Essential Fish Habitat
FIFMP	Federally Implemented Fishery Management Plans
FMC	Fishery Management Councils
FMP	Fishery Management Plans
FT	Feet
GMFMC	Gulf of Mexico Fishery Management Council
HAPC	Habitat Areas of Particular Concern
HMS	Highly Migratory Species
LAW	Law Engineering and Environmental Services, Inc.
LCS	Large Coastal Sharks
MAFMC	Mid-Atlantic Fishery Management Council
MG/L	Milligrams/Liter
MLLW	Mean Low Low Water
NCAC	North Carolina Administrative Code
NCDCM	North Carolina Division of Coastal Management
NCDENR	North Carolina Department of Environment and Natural Resources
NCDEQ	North Carolina Department of Environmental Quality
NCDMF	North Carolina Division of Marine Fisheries
NCDWR	North Carolina Division of Water Resources
NCDWQ	North Carolina Division of Water Quality
NCFMPS	North Carolina Fishery Management Plan for Shrimp
NCMFC	North Carolina Marine Fisheries Commission
NCSPA	North Carolina State Ports Authority
NCWRC	North Carolina Wildlife Resources Commission
NEFSC	Northeast Fisheries Science Center
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAAFS	National Oceanic and Atmospheric Administration, Fisheries Service
NRC	National Research Council
NTU	Nephelometric Turbidity Unit
ODMDS	Ocean Dredged Material Disposal Site
PNA	Primary Nursery Area
POW	Port of Wilmington

PPM	Parts per Million
PPT	Parts per Thousand
SAFMC	South Atlantic Fishery Management Council
SAFMP	South Atlantic Fishery Management Plan
SAR	South Atlantic Region
SAV	Submerged Aquatic Vegetation
SCS	Small Coastal Sharks
TEU	Twenty-foot Equivalent
UOF	University of Florida
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	United State Environmental Protection Agency
YOY	Young of the Year

1.0 INTRODUCTION AND BACKGROUND

The North Carolina State Ports Authority (NCSPA) Port of Wilmington (POW) is located approximately 25 miles upstream from the Cape Fear River's (CFR) confluence with the Atlantic Ocean (Figure 1). The CFR basin drains 9,322 square miles including all or part of 26 counties and 115 municipalities [North Carolina Division of Water Resources (NCDWR) 2012]. The CFR is the only North Carolina major trunk estuary discharging directly into the Atlantic Ocean while transporting significant sediment loads of Piedmont clay soils (Riggs and Ames 2003).

The Wilmington Harbor's commercial water depth is congressionally authorized at -42 feet (ft) mean lower low water (MLLW). The Wilmington District, United States Army Corps of Engineers (USACE) maintains the federal channel depths by annually dredging (1 October through 31 January) specific reaches which have shoaled above the -42-foot contour. The NCSPA annually contracts with the USACE to maintain project depths next to POW's quays at Kinder Morgan and Berths 1-9. In an effort to maintain quay depths at a -42-foot depth year-round, the POW has implemented agitation maintenance dredging (AMD) since 1998 which augments the USACE annual hydraulic maintenance dredging.

In 2016, the NCSPA expanded the turning basin to a width of 1,400 ft to accommodate larger vessels. This improvement included dredging of the turning basin with deposition to the Eagle Island disposal facility, immediately west of the POW. Dredging was completed in August 2016 in time for the arrival of the new carriers. Sturgeon monitoring was performed during the clamshell dredging operation with no sighting of sturgeon or incidental take or observed harm. As part of a commitment to the National Marine Fisheries Service (NMFS) and conservation measures applied, the NCSPA contributed $750,000 to Bladen County for design and permitting of fish passage structures on Lock and Dams #2 and #3 on the CFR. This donation spawned the state legislature and other federal agencies to further commit funds for conversion of these dams to allow for fish passage on anadromous species. Design and studies are well underway, with a goal of obtaining agency approvals in 2019.

Project Purpose and Need and Description

The primary purpose and need of the NCSPA at the POW is to expand the present turning basin to meet larger vessels calling on the POW in the late fourth quarter of 2019 (Figure 1). In order to meet this need, the POW proposes to dredge the eastern and western sides of the present basin, deepening approximately 17.76 acres of shallow and deep unvegetated habitat to -45 ft MLLW, dredging 1.4 acres of coastal tidal marsh east of the channel, and installing a vertical submerged king or sheet pile toe wall along the eastern extents of the basin (Figures 2 and 3). Material will be placed in scows and hydraulically pumped to the Eagle Island confined disposal facility (CDF). There will be no impacts to the tidal marsh or the Eagle Island disposal facility on the western side of the basin.

The international shipping community and clients that currently utilize the POW are expanding into a new class of freightliners to optimize shipping efficiency and global logistics. The new class of containerships are expected to be capable of carrying 14,000 Twenty-foot Equivalent

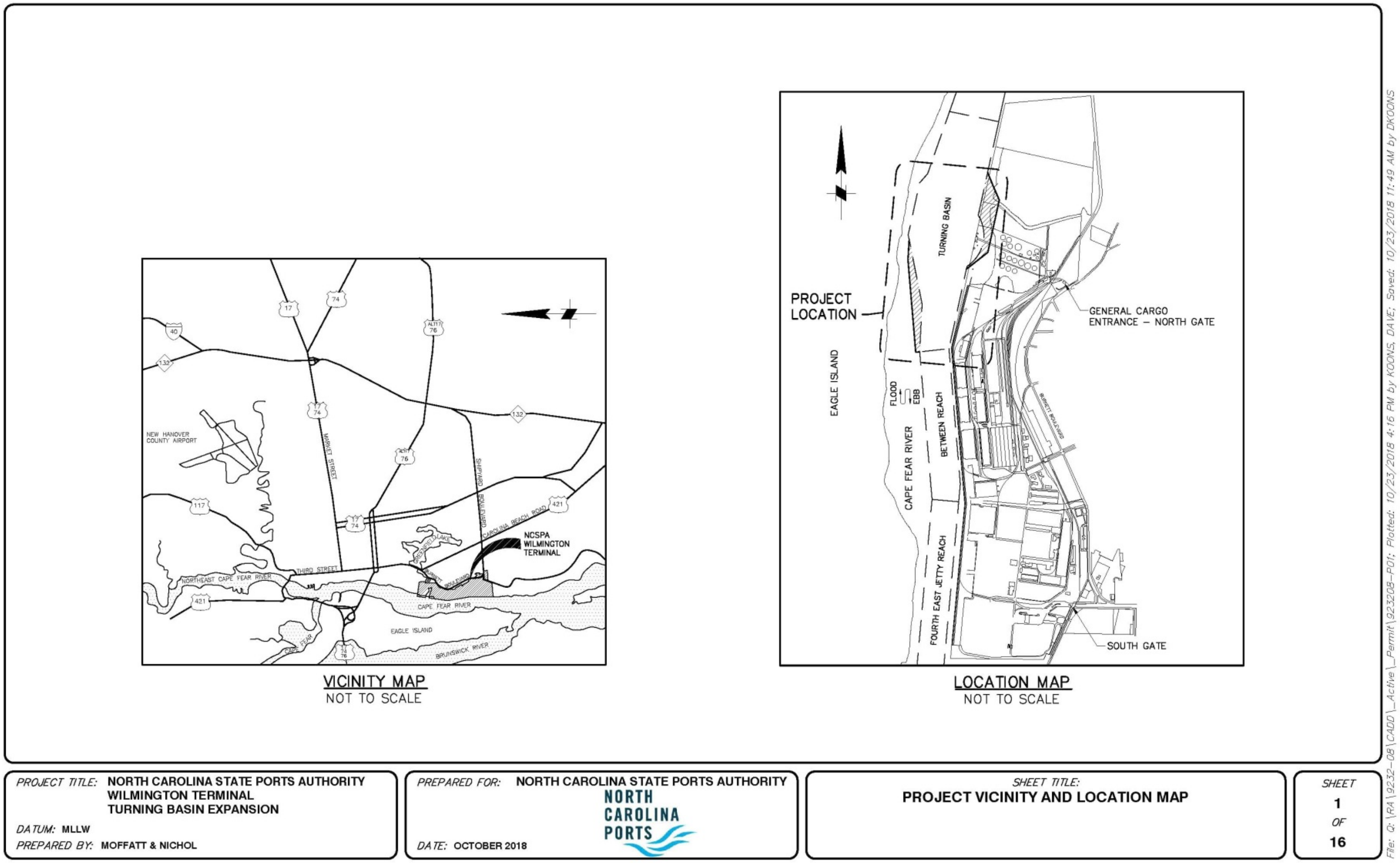


Figure 1. Location Map of Turning Basin Widening Project

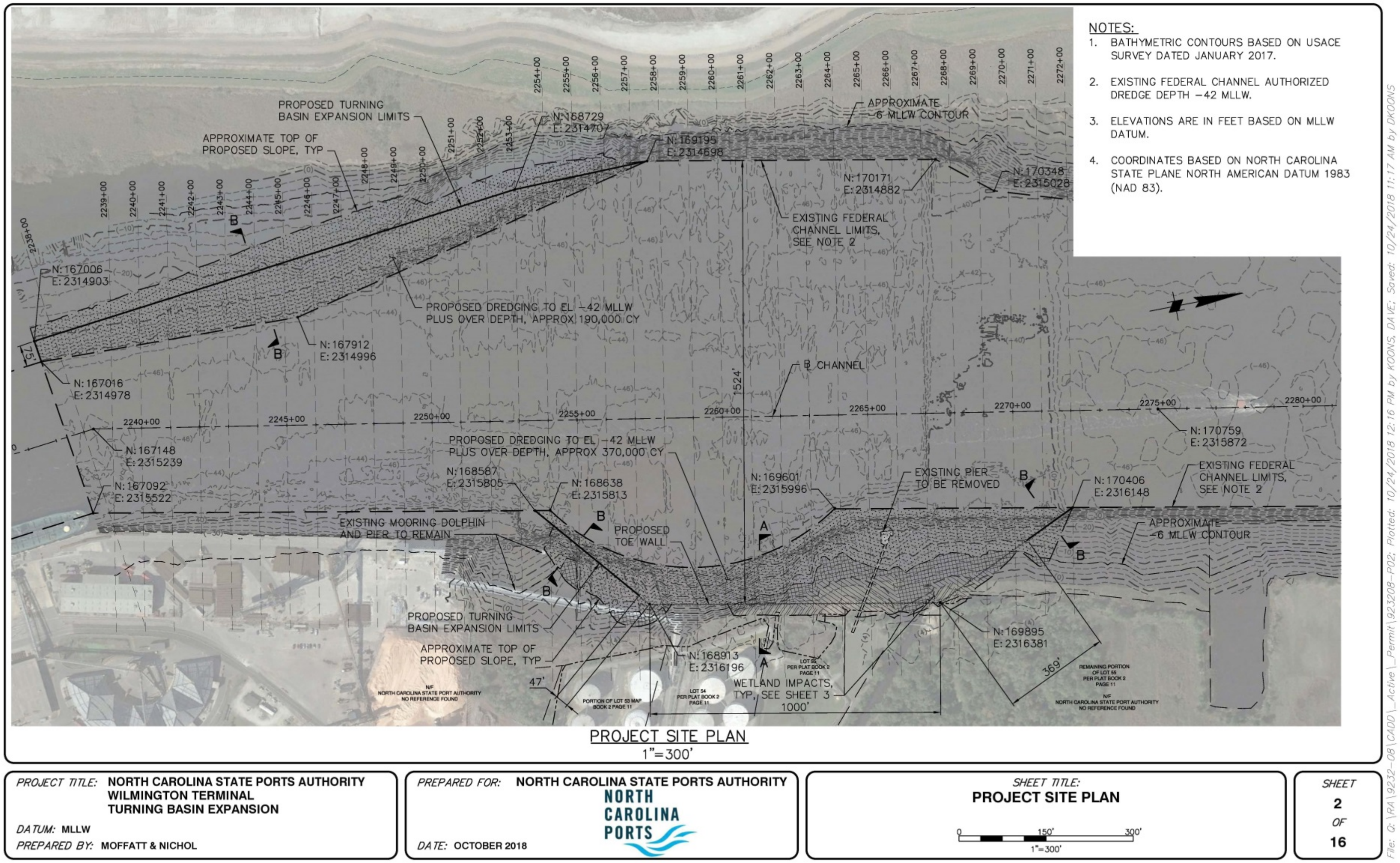


Figure 2. Project Site Plan for Turning Basin Expansion

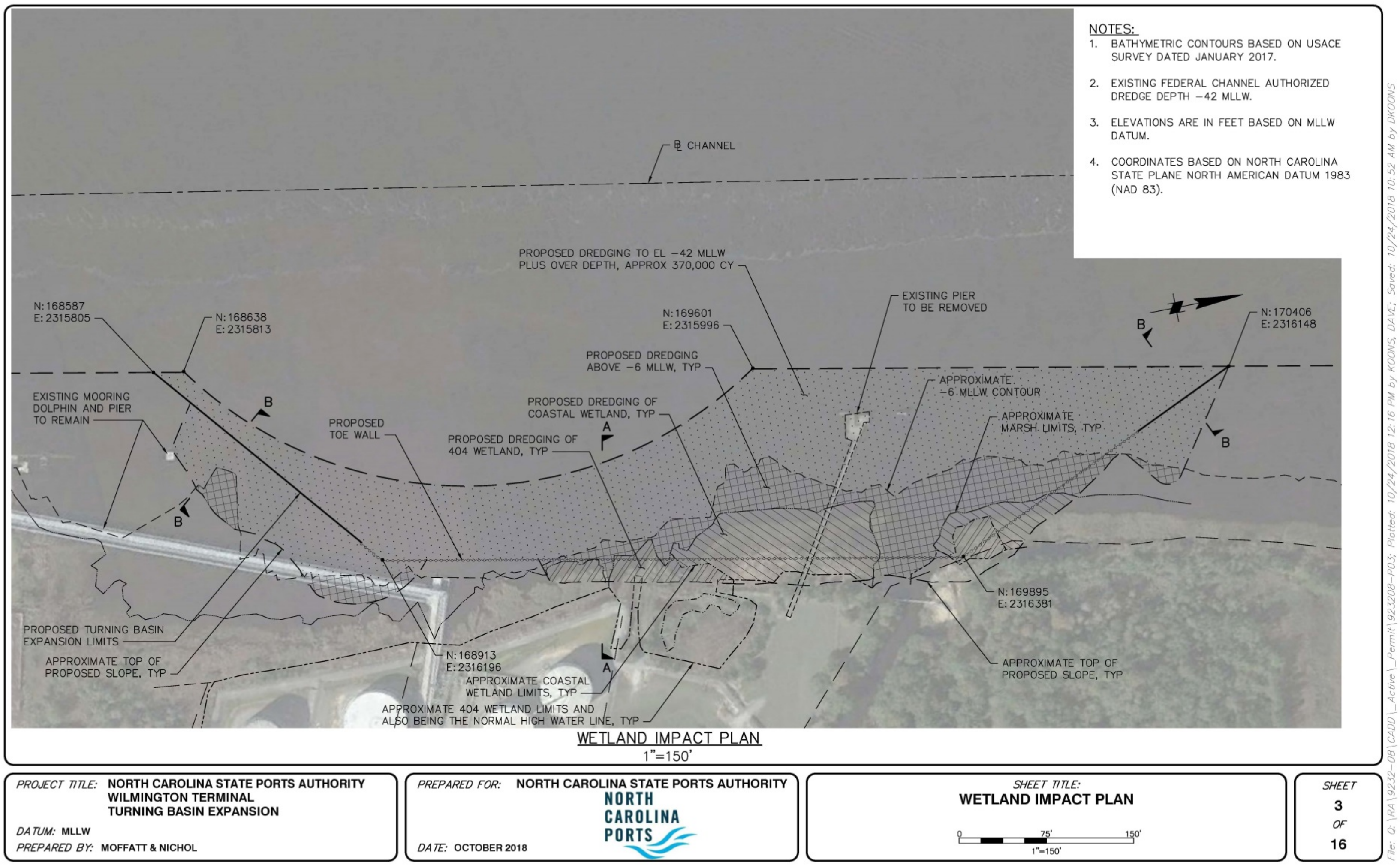


Figure 3. Wetland Impact Plan for Turning Basin Expansion

Units (TEU) with an overall length of 1200-ft and a beam of 159-ft. Once the NCSPA's clients transition to this new class of vessel, they will be calling on ports that currently have the facilities and capabilities to safely handle turning, berthing and unloading. To prevent the loss in clientele and subsequent revenue, the POW must adapt by expanding the current 1,400-ft turning basin to meet the needs of the new class of vessels.

The proposed project includes a 1,524-ft turning basin elongated to 500-ft along the eastern side of the CFR with a 1416-ft long toe wall along the eastern edge of the project to stabilize the shoreline and maintain the basin width and navigable depth (Figures 2 and 3). This toe wall will consist of an AZ52-700 interlocking steel sheet pile with protective coatings that are 70-ft long and will be driven into the marl layer (see Appendix A - Permit Plans/Drawings). This wall will be completely submerged, and additional H-piles will be installed in the recess of the sheet piles with solar powered navigation lights installed on top of the pile at EL+10-ft MLLW. This project requires dredging to -45 ft MLLW, which includes a two-ft over dredge to -44-ft MLLW and one-ft allowable. It is expected that total dredging quantities to be removed during this project will reach 560,000 cubic yards (CY), which includes 370,000 CY on the east side and 190,000 CY on the west side. A small portion of the eastern river bank on the Kinder Morgan property, including 1.4 acres of tidal wetland, will be dredged during this proposed turning basin expansion. The current “Chevron” pier will need to be removed; however the mooring dolphin for Berth 1 will remain. There will be no impacts to the existing slope on the Eagle Island dredge disposal facility berm or the fringing tidal marsh located on the west side of the river.

The NCSPA has confirmed that the proposed construction depth of the CFR, -42 ft MLLW (+2, +1), is acceptable for the larger ships that are expected to call at the POW next year, including vessels from four carrier lines. In addition, the dock structures and the ship-to-shore cranes that exist at the POW are adequately sized to receive the larger vessels that will begin to deploy in 2019. Failure to be able to service these vessels through constructing a 1,500 ft diameter basin could have a severe economic impact on the POW and State of North Carolina as early as next fall. These improvements to the turning basin will support the larger carriers for many decades to come.

The construction schedule will require at least ten months for dredging and installation of the submerged toe wall. In order to be ready for use by larger carriers early next fall, construction must start in April 2019, with final completion of the dredging on the west side during the late summer. Proposed plans for the project can be found in Appendix A.

The proposed mechanical dredging will affect shallow and deep unvegetated mud bottom, tidal marsh, and water column Essential Fish Habitats (EFHs) east and west of the present channel off the Kinder Morgan property (Figure 4). These habitats are potentially used by various stages of managed species afforded protection under the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (16 U.S.C. 1801-1882), as amended in 2006 (Magnuson-Stevens Act). Section 10 Associated Species includes supplemental narrative for the shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*A. oxyrinchus oxyrinchus*) protected under the Endangered Species Act. The action area is also within proposed Critical Habitat for Atlantic Sturgeon and within a Primary Nursery Area (PNA) managed by the North Carolina Division of Marine Fisheries (NCDMF). A variance for dredging in a PNA will be required from the North Carolina Coastal Resource Commission. This EFH has been prepared at the request of the USACE Regulatory Division, NMFS, and in coordination with the North Carolina Divisionof Coastal Management (NCDCM), the NCDMF, the North

Figure 4. Photograph of Mechanical Dredging

Carolina Division of Water Quality (NCDWQ), and the North Carolina Wildlife Resources Commission (NCWRC).

2.0 AUTHORIZATION

This EFH Assessment for the USACE Wilmington District associated with the NCSPA's application for permit approval for construction of the Turning Basin Expansion project. A pre-application meeting was held with the North Carolina Department of Environmental Quality Division of Coastal Management (NCDEQ-DCM) on 15 October 2018 and on 18 October with the Wilmington District. Based on the results of these meetings, this project will require a modification to the POW's Major Coastal Area Management Act (CAMA) permit from the NCDEQ-DCM, a variance from the Coastal Resources Commission (CRC) for dredging in a PNA and a Section 10/404 standard individual permit from the USACE, which requires concurrence from the federal and state resource agencies.

This document was prepared in compliance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976 [16 United States Code (U.S.C.) 1801-1882], as amended in 2006 (Magnuson-Stevens Act) and in coordination with the NMFS, the NCDMF, and the NCWRC in association with permit requests to allow dredging for the expanded Turning Basin, impacts to 1.4 acres of tidal wetlands and installation of a 1,416 ft toe wall along the eastern side. Construction plan drawings are located in Appendix A.

3.0 PROJECT GOALS

The primary purpose and need for widening of the POW Turning Basin is to facilitate vessel calls by larger 14,000 TEU Asian fleet vessels. In order to keep the POW's largest clients calling on the POW, it is critical to be able to accommodate their new vessels. A goal of this EFH Assessment is to assess the effects of the proposed dredging and construction activities on EFH resources and managed species.

Mechanical dredging has been selected as the preferred dredging method due to the ability to minimize environmental effects with this method as compared to hydraulic dredging. Construction of the toe wall will be done prior to dredging of the east side of the channel. The schedule calls for ten months of construction and must be started in April 2019 in order to be available for larger carriers by early next fall.

The potential EFH effects can be spatially and temporally managed by: 1) use of turbidity curtains and containment booms during construction, 2) restricting dredging operations in authorized dredging areas, and 4) placing an observer on board the dredge barge for monitoring occurrence and injury to managed or associated species, and 5) coordinating with the NCDCM, NCDMF, NCDWQ, NCWRC, and NMFS during construction, as needed.

4.0 MAGNUSON-STEVENS ACT

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) of 1976, with 1996 and 2006 amendments, mandates the identification and protection of essential marine and anadromous fish habitats by NMFS, regional Fishery Management Councils (FMC), and other federal agencies. The NMFS and FMCs define "essential fish habitat" for federally managed species, supporting a primary goal of maintaining sustainable fisheries. Through implementation of Fishery Management Plans (FMP), this goal requires appropriate fisheries' habitat quality and quantity. Federal permitting agencies whose actions could adversely affect managed species and their EFHs must consult with the NMFS regarding a project's potential EFH effects.

Essential Fish Habitat is defined in the Magnuson-Stevens Act as, "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." An EFH is further clarified with the following definitions: *waters* - aquatic areas and their associated physical, chemical, and biological properties used by fish, and may include aquatic areas historically used by fish; *substrate* - sediment, hardbottom, underlying structures, and associated biological communities; *necessary* - the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and *spawning, breeding, feeding, or growth to maturity* - stages representing a species' full life cycle where any EFH may be a subset occupied by species during life cycles [South Atlantic Region (SAR) 2008a].

5.0 FISHERY MANAGEMENT COUNCILS

As mandated in the Magnuson-Stevens Act and in coordination with the NMFS, several FMCs including the South Atlantic Fishery Management Council (SAFMC), Mid-Atlantic Fishery Management Council (MAFMC), and the Atlantic States Marine Fishery Commission (ASMFC) oversee and manage species and EFHs found in North Carolina. The SAFMC manages estuarine EFHs including emergent wetlands, submerged aquatic vegetation (SAV), oyster reefs and shell banks, intertidal flats, palustrine emergent and forested wetlands, aquatic beds, and the estuarine water column; as well as many marine features such as live/hardbottoms, coral and coral reefs, artificial/manmade reefs, *Sargassum*, and the marine water column. Similarly, the MAFMC manages estuarine EFHs including seagrass, creeks, mud bottom, and the estuarine water column as well as the marine water column (SAR 2008a, MAFMC 2011). The ASMFC coordinates conservation and management between states sharing nearshore fishery resources while working cooperatively with the United States East Coast Fishery Management Councils (ASMFC 2012a).

Management of EFH is further accomplished through the development and implementation of FMPs for marine finfish and invertebrates; applicable fishery councils and FMPs are defined in Table 1. Species determined commercially and recreationally important are managed for sustainability, conservation and management issues, sociological and economic issues, and regulatory issues [National Oceanic Atmospheric Administration (NOAA) 2012a]. Essential fish habitats can include multiple habitats supporting managed species' at various life stages. These various life stages may utilize many different habitats supporting reproduction, juvenile and adult development, feeding, protection, and shelter (NOAA 2012a and 2012b).

Table 1. Fishery management plans, councils, and species.

Fishery Management Plan	Fishery Council	Example Species
Shrimp	SAFMC	White, Pink, and Brown shrimp, Spiny lobster
Red drum	ASMFC	Red drum
Bluefish	MAFMC	Bluefish
Summer flounder, Scup, Black sea bass	MAFMC	Summer flounder, Black sea bass
Coastal Migratory Pelagics	SAFMC	King/Spanish mackerel and Cobia
Dolphinfish/Wahoo	SAFMC	Dolphinfish/Wahoo
Snapper/Grouper	SAFMC	Snappers/Groupers
Highly Migratory Species	Federally Implemented Fishery Management Plans (FIFMP)	Tunas, Billfish, Marlins
Highly Migratory Species	FIFMP	Small coastal sharks
Highly Migratory Species	FIFMP	Large coastal sharks
Highly Migratory Species	FIFMP	Prohibited/Research sharks
Dogfish	MAFMC	Spiny/Smooth dogfish

Source: NMFS 2009a, SAR 2008a

6.0 HABITAT AREAS OF PARTICULAR CONCERN

An additional habitat designation authorized by the FMCs is Habitat Areas of Particular Concern (HAPCs). Habitat Areas of Particular Concern are EFH partitions of rare, ecologically important, highly susceptible to human degradation, or environmentally stressed areas. Habitat Areas of Particular Concern frequently include habitats used for migration, spawning, and rearing of fish and shellfish; offshore areas of high habitat value or vertical relief; and high value intertidal and estuarine habitats (SAR 2008a). Habitat Areas of Particular Concern are considered atypical, particularly ecologically important, susceptible to anthropogenic degradation, or located in environmentally challenged or stressed areas. The Magnuson-Stevens Act does not provide any additional regulatory protection to HAPCs; however, if HAPCs are potentially adversely affected, additional recommendations and conservation guidance may result during the NMFS consultation (SAR 2008a).

The SAFMC has designated several HAPCs within North Carolina waters. South Atlantic Area Wide HAPCs are "state-designated areas of importance to managed species." North Carolina's state-designated nursery areas as depicted in Figure 5 are considered HAPCs for post larvae/juvenile and subadult white shrimp (*Litopenaeus setiferus*) and brown shrimp (*Farfantepenaeus aztecus*). North Carolina's tidal inlets, state-designated nursery areas, and SAV are considered HAPCs for red drum (*Sciaenops ocellatus*) (SAR 2008a). The POW's location in the CFR's turbid riverine reaches lacks submerged aquatic vegetation habitat (Deaton et.al. 2010). The CFR also provides spawning and foraging habitat for anadromous species (Figures 6 and 7).

The fringing smooth cordgrass marsh located along portions of the eastern shoreline that will be adversely impacted from dredging (Figure 3) is within the HAPC and provides habitat for post larvae/juvenile and subadult white shrimp and brown shrimp, other managed species of finfish and a wider diversity of benthic invertebrates than typically found in the unvegetated soft bottom habitat. Loss of the 1.4 acres of coastal tidal marsh and associated wetland habitat could directly affect the diversity and abundance of prey species foraged on by sturgeon that may rarely migrate along the eastern shore near the active port.

The wetland impact area encompasses salt and brackish marshes on the contiguous tidal floodplain of the CFR (Figures 2 and 3). The tidal marshes form a continuous fringe along the river shoreline that is interrupted only by the mouth of Greenfield Creek. The landward boundary of tidal wetlands within the project area is marked by an existing man-made upland berm that extends continuously along the river shoreline and ties to a tidal gate across the mouth of Greenfield Creek. The berm functions as an artificial shoreline that has effectively reduced the width of the tidally influenced floodplain to approximately 100 ft. The normal high water mark and the Section 404 wetland-upland boundary are both located along the waterward toe of the berm. The tidal floodplain encompasses a mix of relatively natural salt/brackish marshes, disturbed brackish marshes consisting of dense common reed (*Phragmites australis*) stands on shallow fill deposits, and unvegetated tidal mud flats in shallow depressional areas. The entire area waterward of the berm toe, including the common reed stands, is inundated at high tide. The natural tidal marshes consist predominantly of monospecific stands of smooth cordgrass (*Spartina alterniflora*). The smooth cordgrass marshes occur primarily on the relatively undisturbed lower portion of the tidal floodplain along the river. A few small areas of natural brackish marsh occur along the upper margins of the smooth cordgrass marshes. The

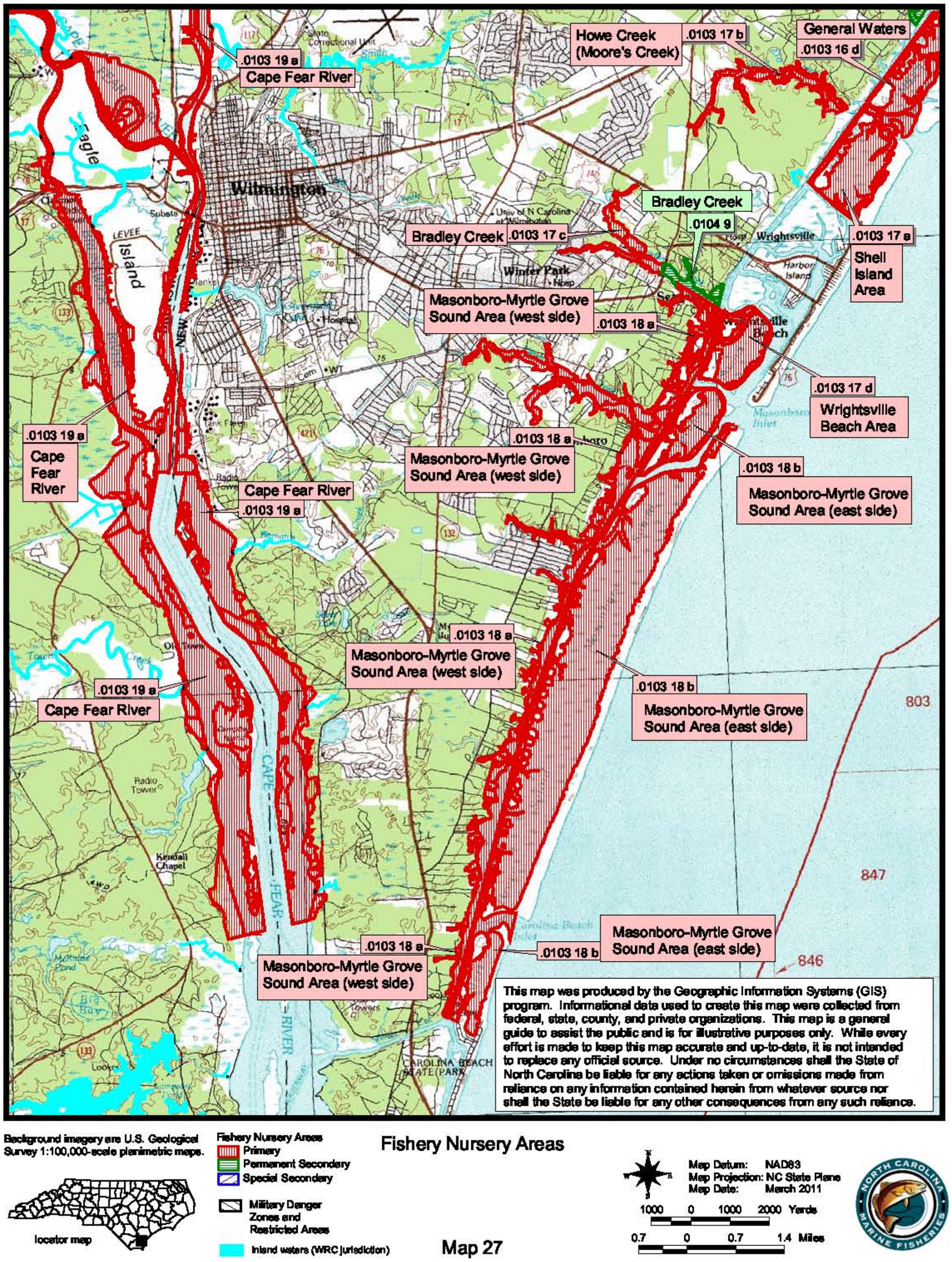


Figure 5. Cape Fear River Primary Nursery Areas

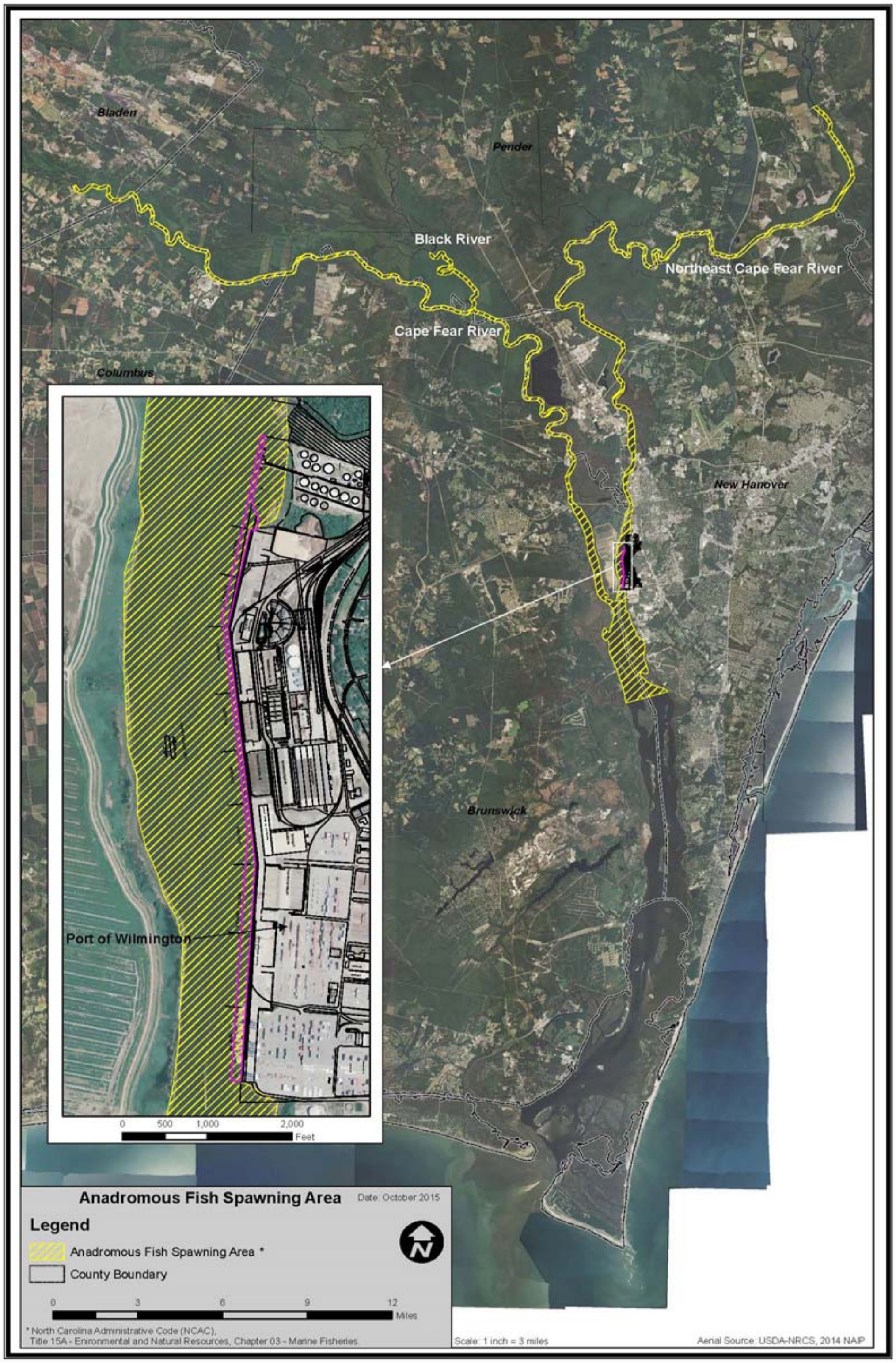


Figure 6. Anadromous Fish Spawning Areas

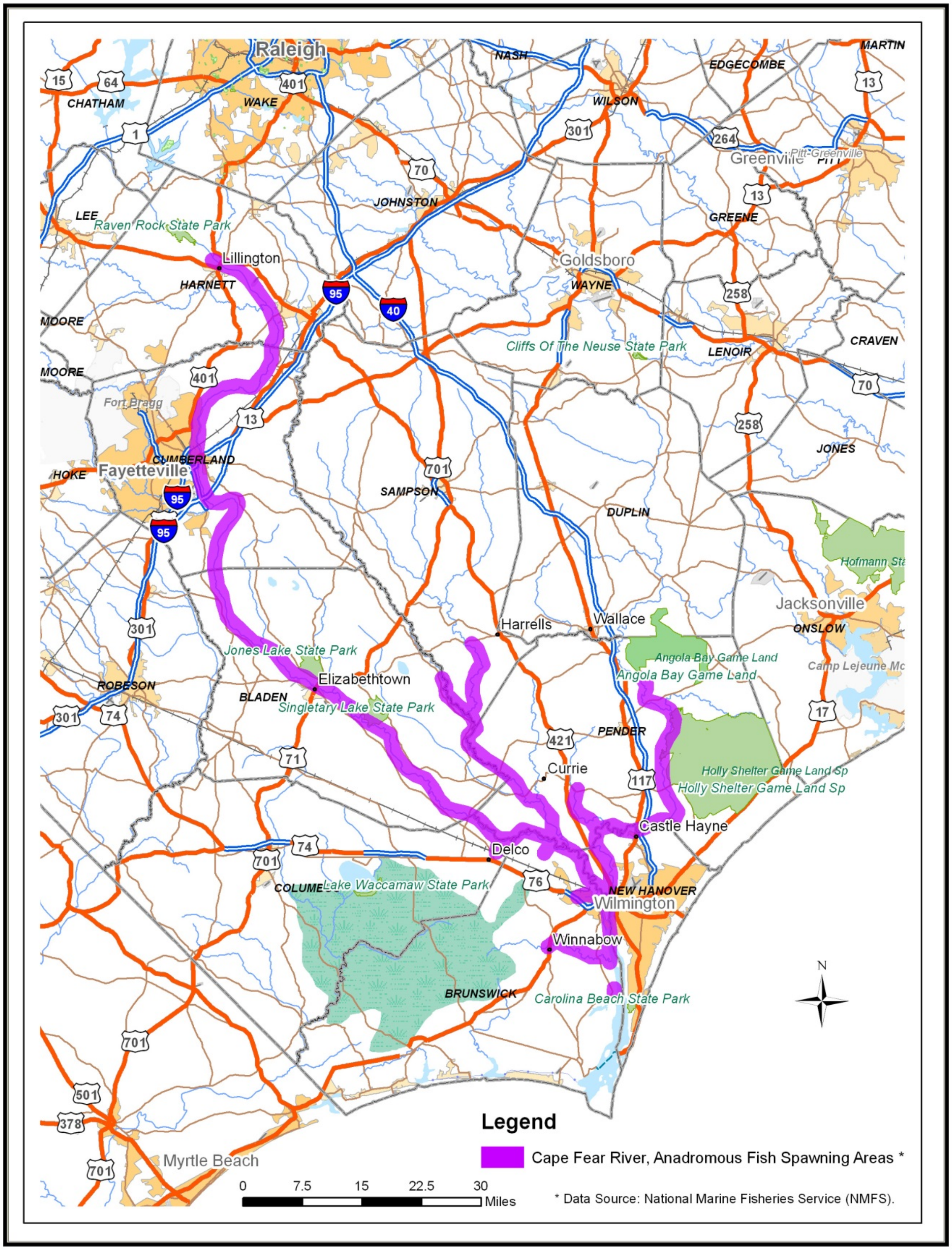


Figure 7. Cape Fear River Anadromous Fish Spawning Areas

brackish marshes are dominated by big cordgrass (*Spartina cynosuroides*) and other brackish species such as narrow-leaved cattail (*Typha angustifolia*), salt marsh aster (*Symphyotrichum tenuifolium*), bull-tongue arrowhead (*Sagittaria lancifolia*), and water primrose (*Ludwigia bonariensis*). Large dense monospecific stands of common reed occur on shallow fill deposits that generally extend waterward onto to the floodplain from the upland berm. The lower extent of the fill deposits and their associated common reed stands marks the boundary between Section 404 and CAMA coastal wetlands. Unvegetated tidal mud flats occur in very shallow linear depressions that appear to be natural features associated with tidal flow.

Mechanical clamshell dredging could potentially indirectly affect the estuarine/riverine water column and unvegetated mud bottoms in shallower water adjacent to the dredging operations. A potential temporary effect would be a tidally dispersed sediment plume. Dredging induced far-field dispersion plumes are often controlled by specialized dredging equipment with managed production rates. Though successful in reducing sediment plume concentrations, such efforts do not eliminate sediment resuspension. The sediment plume's movement is primarily tied to gravitational settling and local horizontal advection effects. The gravitational settling rates are dependent on both the sediment composition and suspended sediment concentration. Several estuarine dredging projects have shown sediment settling rates ranging from centimeters/second to meters/second resulting in settlement primarily within the dredge site's immediate vicinity (Bohlen 2002). The larger grain sizes within the plume settle more rapidly and this stage is referred to as the dynamic phase. Coarse sands (>2 millimeters) and gravels settle almost immediately, often within a distance of less than 50 meters from the dredger (Challinor 2000).

The shallow water benthic habitat likely supports some foraging use by invertebrate managed species, post-larval and juvenile managed finfish species and potentially by sturgeon, although infrequently. Conversion of the tidal marsh to shallow soft bottom shallow habitat would result in the loss of ecological functions and values attributable to tidal marsh and result in the loss of habitat for managed invertebrate and finfish species. Due to the high frequency of vessels transiting this area of the river near the POW, it is not likely that the sturgeon or many other managed species utlilize this location too frequently.

While the present turning basin is within the "maintained channel" and as such excluded from being an HAPC, the widening area is within CFR's PNA and as such presently considered an HAPC for managed shrimp species and for post-larvae, juvenile, and adult gray snapper. As such, a variance is required from the North Carolina Department of Environment and Natural Resources (NCDENR)/CRC for dredging in the designated PNA. Additionally, there are no known SAVs or oyster bars within the proposed action area. However, the project area is within an associated species spawning area as delineated in 15A NCAC (North Carolina Administrative Code) 03R .0115 and 15A NCAC 10C .0603 Anadromous Fish Spawning Areas (Figures 5 and 6). .

The CFR's southern estuary contains approximately 37,800 acres of soft bottom habitat in waters <6 ft and 188,549 acres in waters >6 ft (Deaton et.al. 2010). The 17.76 acres of proposed dredging includes both shallow (1.68 acres) and deep water unvegetated mud bottom (16.08 acres). This represents a very small area of potential impact as compared to the abundance of this resource. The loss of 1.4 acres of tidal marsh represents a loss of 0.01 percent of this resource in the CFR watershed, based upon recent wetland mapping in the lower CFR which shows 12,300 acres of smooth cordgrass dominated tidal wetlands (DC&A,

unpublished data, 2018). Based on the results of past water quality studies, water quality is not likely to be significantly effected in the CFR as a result of this project. Therefore, no significant indirect effects on HAPCs or associated species spawning areas are anticipated.

Since the stages of dredging and construction of the toe wall will take up to ten months or more to complete, there could be temporal effects in adjacent HAPCs on managed species. However, since clamshell dredging is being proposed, mobile species can quickly avoid plumes of elevated turbidity and the mechanical operations, even when migrating up river or foraging in shallow areas. Pile driving for the toe wall construction could disrupt migrating species such as sturgeon temporarily.

7.0 ESSENTIAL FISH HABITAT DESIGNATION

7.1 Introduction

The POW berths and private marine terminals berths are located on the CFR, approximately 25 miles from the Atlantic Ocean. The POW's federally authorized channel depth is -42 ft MLLW. The mean tide range at the POW is approximately 3.8 ft with a river current velocity of approximately 2.3 to 3.5 miles per hour. The POW maintains this working depth along nine bulk, breakbulk, and container berths (approximately 6,800 linear ft) and the northern adjacent liquid bulk facility owned by Kinder Morgan. The federally authorized and maintained anchorage/turning basin (-42-foot depth, 1,400-foot diameter) is located west northwest of Berths 1, 2, and Kinder Morgan (NCSPA 2012). The Turning Basin is proposed to be expanded from 1,400 ft. to 1,524 ft. Widening would include up to 560,000 CY of mechanical dredging with hydraulic pumping from scows disposal in the Eagle Island CDF and construction of a 1,416 ft toe wall along the Kinder Morgan property (Figure 2).

The EFHs, with potential direct effects from dredging operations, include the estuarine/riverine water column, tidal marsh, and unvegetated mud bottom. Potential indirect effects are possible within the federal channel and adjacent water column, shallow unvegetated bottom and tidal marsh.

7.2 Estuarine/Riverine Water Column

Water column properties such as salinity, temperature, and nutrients are essential to a managed species' long-term survival and success. The transient boundaries of this EFH are maintained by wind and tide driven inlet and ocean sea water mixing with upland freshwater sources and land surface runoff. Freshwater rivers and stream inflows provide estuarine areas organic matter, nutrients, and finer grained sediments; whereas, the ocean driven tides provide coarser sediments and a transport mechanism for estuarine using species. Salinity, temperature, dissolved organic matter, dissolved inorganic nitrogen, and oxygen are components normally used to describe the water column. The CFR is the major North Carolina source of direct river discharge into the Atlantic Ocean. March is known for large freshwater discharges affecting the water column's salinity and temperature (Deaton et. al. 2010). Even with elevated nutrient levels in the lower CFR, algal blooms are rare; as subject to turbidity and color restricting photosynthesis in concert with the river's high volume flushing (Mallin et. al. 2001). As reported by the Lower Cape Fear River Program from a CFR mainstem water quality monitoring station located downstream of downtown Wilmington and the POW, salinity was characterized as higher but more variable as compared to sites upstream of Wilmington. Salinity ranged from 0 parts per thousand (ppt) to 10 ppt averaging 5.2 ppt with higher salinity readings during summer low flows. Water temperatures ranged from 8.4 degrees Celsius (^{o}C) to 28.2^{o}C and dissolved oxygen (DO) averaged 8.9 parts per million (ppm) in the winter and 4.8 ppm in summer months (Mallin et. al 2000). Other descriptors such as adjacent structures (e.g. shoals, channels, marshes, outcrops), water depth, available wind distances or fetch, and turbidity are used to further describe the water column EFH habitats (SAFMC 1998a).

Riverine transport factors determining sediment spatial distribution include freshwater discharge volumes, channel cross-section and slope dimensions, tidal flow characteristics, the riverine/estuarine geometrics, as well as wind/wave effects [National Research Council (NRC) 1985]. The EFH water column provides both migratory and residential species of varying life stages the opportunity to survive in a productive, active, unpredictable, and at times strenuous environment. As the transport medium for nutrients and organisms between the ocean and estuarine systems, the water column is as essential a habitat as any marsh, seagrass bed, or reef (SAFMC 1998a).

Estuarine/Riverine Water Column Effects

The continued downstream or upstream movement of the unconsolidated alluvial material by means of mechanical dredging may potentially have direct effects on the water column as well as managed/associated species. Indirect turbidity effects could occur within the adjacent federal navigation channel and surrounding embayment and shorelines during dredging operations. Mechanical dredging resuspends finer alluvial material when lifting the clamshell or bucket to the scow as well as exposing finer sediment along the bottom to be picked up and transported. Most resuspension of sediment from mechanical dredging occurs near the bottom as the clamshell digs and first lifts the dredged material. As loaded scows will be transported to the opposing shoreline for mixing with water for hydraulic pumping to the CDFs, care must be taken to minimize overflows of the scows, which can increase the discharge of fine sediments into the water column.

While mechanical dredging can result in more impact in water quality than agitation dredging, the impacts of both types of activities are generally lower in the water column than on the surface. The only dredging method where water quality has been monitored at the POW is for agitation dredging. Water quality monitoring during the testing of the three agitation methods included sampling prior to, during, and after dredging [Law Engineering and Environmental Services (LAW) 1998, 1999a-f]. Sampling stations were located at the dredging initiation point and downstream, with sampling at the surface, mid-depth and near bottom depths. Parameters included turbidity [Nephelometric Turbidity Units (NTU)], temperature, and DO concentration [milligrams/Liter (mg/L)]. Of the three methods tested, none had any significant effect on temperature or DO, with the latter ranging from 4 to 6 ppm during the sled and beam tests, and 7 to 8 ppm during the jetting test monitoring. Observed effects on turbidity were short-lived and/or only showed insignificant (assuming ±2 NTUs standard error for sampling equipment) to minor increases at the mid-depth and/or near surface depths downstream. Downstream near bottom turbidity levels actually decreased following most of the agitation dredging tests. A permit condition requiring dredging to be maximized during a falling tide helps alleviate short-term effects due to the flushing effect of the ebb tide.

On the basis of these agitation tests, monitoring events in 1998 and 1999, and past studies on effects of mechanical dredging, it can be concluded that mechanical dredging is not likely to result in any adverse impact on water quality downstream of the POW. While short-term elevations in turbidity will likely be observed at the dredging location, no long-term or large spatial impacts as a result of dredging are expected to occur from dredging. Given that the berths and federal channel are dredging hydraulically on an annual basis with no negative effect, it is not likely that a single dredging event of this scale would result in any adverse effect.

While the area proposed for dredging is considered new dredging, the applicant is not proposing to discharge dredged material in the offshore Ocean Dredged Material Disposal Site (ODMDS) and as such should not require testing of sediment per the United States Environmental Protection Agency's (USEPA) normal screening. However, sediment toxicity screening is underway through coordination with the Wilmington District USACE. All material will be placed in scows, transported, slurried and pumped to the Eagle Island CDF.

The CFR's southern estuary contains approximately 37,800 acres of soft bottom habitat in waters <6 ft and 188,549 acres in waters >6 ft (Deaton et.al. 2010). Significant indirect effects of mechanical dredging on EFH habitats or managed species are not anticipated considering that the turning basin widening mud bottom area is only 0.002 (1.68 acres) percent of the shallow river bottom from the POW to the inlet, and based on the conclusions of water quality monitoring in the CFR. The project's minimal spatial and temporal extents and good engineering/best management practices would minimize the potential direct, indirect, and cumulative effects of proposed dredging on the estuarine water column HAPC.

The general operational procedures and methods for mechanical dredging ensure that fine sediments are predominantly released near the bottom, thereby ensuring mixing with the water column while taking advantage of falling tide currents and the river's narrowing geometry. This management strategy thereby perpetuates the continuation of the natural downstream transport of suspended river sediment when dredging during falling tides. The expanded turning basin would be serviced by commercial vessels that, by their volume displacement alone, routinely affect the water column. The expanded area for the turning basin (19.16 acres) is a minor percentage of the CFR's potential water column volume thereby leaving the majority of the water column free for biological transport and/or natural avoidance responses. Considering the dredging method chosen, the limited affected area, and previous water quality monitoring/testing results, the proposed dredging is not anticipated to have significant effects on the estuarine/riverine water column EFH within the CFR. Cumulative effects of potential annual maintenance dredging of the expanded turning basin area, along with the ongoing annual channel and berth maintenance are not anticipated.

Estuarine/Riverine Water Column Conservation Measures

The primary conservation measures minimizing potential direct, indirect, and cumulative effects within the water column include managing mechanical dredging to minimize discharge in the upper water column, minimizing discharge of dredged material overboard from scows when adding water for hydraulic pumping to the CDF, dredging as much as practicable during falling tides, use of turbidity barriers around the dredge and scows at all time while dredging (Figure 4), and use of precision navigation to ensure only authorized areas are dredged. The clamshell bucket dredging tends to generate higher suspended loads near the bottom stratum, thereby minimizing upwelling of bottom sediments into the mid and surface water column strata. Use of a mechanical dredge rather than a hydraulic cutterhead dredge affords less risk to managed and prey species. Bottom DO levels will likely be much lower following conversion of about 1.68 acres of shallow water habitat to deeper depths along the new side slope, however, levels will not likely decline to lower than 5 mg/L, except during late summer months when values below 5mg/L do on occasion occur. Managed species migrating along the river during construction are mobile and can avoid the dredging activity and turbidity plumes. The project's minimal spatial and temporal extents, as well as good engineering/best management practices, should minimize any potential direct, indirect, and cumulative effects of mechanical dredging on the water column EFH.

7.3 Estuarine/Riverine Unvegetated Mud Bottoms

The CFR basin drains 9,322 square miles including all or part of 26 counties and 115 municipalities (NCDWR 2012). The CFR is the only North Carolina major trunk estuary discharging directly into the Atlantic Ocean and transporting significant sediment loads of Piedmont clay soils (Riggs and Ames 2003). Sediment flocculation and the widening and slowing of the CFR in proximity of the POW results in USACE's annual removal of approximately 1.2 million CY of maintenance dredge material from the anchorage/turning basin and adjacent reaches near the POW.

Unvegetated mud bottoms, or soft bottom habitats, are characterized by variable salinities, water depths, hydrographic setting, sediment types, and geomorphology. Such soft bottoms can be further differentiated as freshwater (rivers, creeks, lake bottoms, and unvegetated shorelines) as well as estuarine (subtidal rivers, sounds, creek bottoms, and unvegetated shoreline/intertidal flats). The CFR's southern estuary contains approximately 37,800 acres of soft bottom habitat in waters <6 ft and 188,549 acres in waters >6 ft (Deaton et.al. 2010).

As described by Anamar (2010), POW sediments and adjacent Wilmington Harbor anchorage basin sediments were similar consisting of silts, clays, and small percentages of sands (Table 2). Sediment data from the proposed Turning Basin widening is limited, however, it is anticipated that grain-size distribution and the percent of fine fraction will be similar.

The POW sediments are relatively soft and unconsolidated. Of the sediment samples taken by Anamar, the POW material had the highest percentage of silt and clay at 54.7 percent and 41.0 percent, respectively, with 4.3 percent sand (Anamar 2010).

The primary factors affecting the estuarine benthic community species occurrence, distribution and abundance includes sediment grain-size and organic content, sediment depositional rates, DO and salinity. Mallin et.al. (2000) described the infaunal benthic diversity and richness as constant, as sampled over a four-year period downstream of downtown Wilmington and the POW. These samples were dominated by a variety of taxa, including oligochaetes and amphipods (*Gammarus, Lembos*, and *Monoculodes* spp.) and by polychaetes (*Maranzellaria*, at

Table 2. Sediment characterization for all marine terminals.

Sediment Type	Sediment Gradation (millimeters)	POW Sediment (%)
Gravel	Particles ≥ 4.75	0.0
Sand	Particles ≥ 0.075 but ≤ 4.75	4.3
Silt	Particles ≤ 0.075	54.7
Clay	Particles ≤ 0.075	41.0

Mediomastus, and *Streblospio* spp.). These taxa were considered relatively opportunistic species typical of oligohaline to mesohaline areas. These species are considered proficient recovering from bottom disturbances. Epibenthic species living on the sediment generally include gastropods, amphipods, and some insect larvae. Other more motile epibenthic such as juvenile fish, crabs, and shrimp vertically migrate within the water column on a daily basis. The general condition of an area is reflected in the benthic community's health; whereas, the epibenthic community present provides insight on the movement and timing of post-larvae and juvenile fish species important both commercially and recreationally (Mallin et.al. 2000).

Mechanical clamshell bucket dredging physically disturbs the bottom sediments as grabs are taken, with little water left in the bucket as sediment is placed in nearby scows (Figure 4). While some fine material is winnowed out of the bucket or clamshell following the grab, a majority of the sediment is captured for placement in the scow. It is estimated that dredging will take up to ten months to complete both the east and western areas Scows will be towed to the west shoreline and proceed to slurry the dredged material for pumping into the CDF. Turbidity booms will be used and monitored during both dredging and pumping operations.

7.4 Estuarine/Riverine Unvegetated Mud Bottom Effects

Important considerations when evaluating potential effects to the benthic community include: the ability of the community to recolonize the area after a disturbance; restoration of some measure of community parameters (e.g., species richness and diversity); and the functional property of the community to higher trophic levels (i.e., resident and migratory fish). Natural ecosystem processes and physical variations make it difficult to distinguish between natural and anthropogenic disturbances (Grober 1992). Production within a benthic community is tied to sediment grain size, light availability, temperature, and community biomass. Light availability is considered a primary factor attributed to benthos primary production rates (Deaton et.al. 2010). Benthic monitoring within the CFR mainstem downstream of downtown Wilmington and the POW described most of the dominating taxa as relatively opportunistic species found within oligohaline to mesohaline areas and capable of recovery from bottom affecting disturbances (Mallin et.al. 2000).

Widening of the turning basin through mechanical dredging, as proposed, would result in the conversion of 1.68 acres of shallow unvegetated mud bottom habitat to deeper unvegetated mud bottom habitat, representing 0.002 percent of the 37,800 acres of shallow water benthic habitat present in the lower CFR estuary. This results in a loss of suitable foraging habitat for some managed species and their prey, as shallower water within the photic zone is much more productive, supporting a richer array of infaunal and epibenthic prey species than the deeper unvegetated mud bottoms.

Dredging will temporarily remove the present benthic community within the 17.76 acres of shallow water benthic habitat, resulting in colonization of the deeper sediments within the proposed Turning Basin widening area. The benthic community productivity levels at the dredged channel depths are typically limited and comprised of opportunistic species capable of tolerating frequent disturbances as occurs during commercial vessel use and at depths with no or little light. Following dredging, recolonization of the benthic community will occur from adjacent mud bottom benthic communities and from pelagic larval settlement. Recovery from dredging in estuaries generally takes from 6 to 12 months, depending upon the degree and frequency of disturbances present and time of year of the dredging. Motile invertebrates such as clams and shrimp may actually avoid capture, as may juvenile and adult demersal fish and invertebrate species.

Of the total acreage of dredging proposed in mud bottom habitat (17.76 acres) 1.68 acres of shallow water habitat will be dredged deeper, while 16.08 acres of existing deeper mud bottom habitat will be dredged even deeper. While this does represent a reduction in foraging habitat for managed and prey species, it is not likely utilized to the fullest extent practicable due to present commercial vessel activity in and around the POW. Construction of the toe wall and rebuilding of the slope above the wall location at -10 ft MLLW will result in the temporary loss of benthic resources for foraging by managed species. Once the slope to the shore at the south end of the property is constructed, colonization by benthic infaunal species will occur rapidly, followed by active use by managed invertebrate and finfish species

Estuarine/Riverine Unvegetated Soft Bottoms Conservation Measures

The primary conservation measures minimizing potential direct, indirect, and cumulative effects by mechanical dredging within the shallow soft bottom habitats are the proposed use of turbidity barriers around the dredging and pumping operations and managing dredging operations to minimize turbidity. The proposed dredging area is a very small percentage of the available shallow water riverine/estuarine bottoms from the CFR's inlet mouth to the POW. With a goal of maximizing dredging with a falling tide, unconsolidated sediment is diffused along the bottom and continues downstream. This action also reduces potential benthic effects. The limited spatial area and temporal duration of the event (six month dredging schedule), as well as good engineering/best management practices, should minimize the potential effects of dredging on soft bottom habitat present adjacent to the proposed dredging area. Dredging will result in a direct loss of shallow water unvegetated mud bottom, thereby reducing the availability of 1.68 acres of suitable shallow water foraging habitat for managed and prey species as it is deepened for the side slope or to channel depths for the turning basin.

7.5 Estuarine/Riverine Tidal Marsh Effects

Estuarine marshes are normally nature's margins of bays and sounds and can include estuarine forests, estuarine shrub/scrub, and salt/brackish marsh. A coastal marsh is defined by the NCDCM by the on-site vegetation. These riparian vegetated communities provide critical functions for various finfish life stages including: refuge, foraging, and development. However, most juvenile finfish found in the riparian marsh nurseries were spawned offshore and transported into the estuary through tidal inlets.

The delineated Section 404 wetland-upland boundary is located along the toe of a man-made upland berm that runs the entire length of the property (Figure 2 and 3). The area waterward of the berm toe is positioned entirely on the tidal floodplain of the CFR. The floodplain encompasses a mix of relatively natural salt and brackish marshes, dense common reed (*Phragmites australis*) stands, and unvegetated mud flats. Salt marshes consisting of monospecific stands of smooth cordgrass (*Spartina alterniflora*) occur predominantly on the relatively undisturbed lower portion of the tidal floodplain along the river. Brackish marshes are restricted to a few small areas along the upper margins of the cordgrass marshes. The brackish marshes are dominated by big cordgrass and other brackish species such as salt marsh aster (*Symphyotrichum tenuifolium*), bull-tongue arrowhead (*Sagittaria lancifolia*), and water primrose (*Ludwigia bonariensis*). Dense monospecific stands of common reed occur on shallow fill deposits that extend waterward onto to the floodplain from the upland berm. The lower extent of the fill deposits and their associated common reed stands marks the boundary between Section 404 and CAMA coastal wetlands. The entire area waterward of the berm toe, including the common reed stands, is inundated at high tide.

The directly impacted estuarine/riverine tidal marshes include 1.01 acres of smooth cordgrass marsh along the lower edge of the tidal floodplain and 0.39 acre of brackish marsh (Figure 3). These wetland resources will be lost due to widening for the basin.

The fringing smooth cordgrass marsh located along portions of the shoreline that will be adversely impacted from dredging (Figure 3) provides foraging habitat as well for both species of sturgeon, preying on a wider diversity of benthic invertebrates than typically found in the unvegetated soft bottom habitat. Loss of the 1.4 acres of coastal tidal marsh and associated wetland habitat will directly affect the diversity and abundance of prey species foraged on by sturgeon. Diversity of benthic macroinvertebrates within the coastal wetlands is likely much higher than within the adjacent unvegetated mud bottom habitat.

7.6 Estuarine/Riverine Tidal Marsh Conservation Measures

The primary conservation measures minimizing potential direct, indirect, and cumulative effects by mechanical dredging/ toe wall construction within the shallow wetlands remaining on-site and those located north and south of the Kinder Morgan property habitats include, the proposed use of turbidity barriers around the dredging and pumping operations and managing dredging operations to minimize turbidity. Silt screens will be staked along the upland and remaining wetlands to minimize deposition of material in wetlands. The limited spatial area and temporal duration of event (ten month dredging schedule), as well as good engineering/best management practices, should minimize the potential effects of dredging on the remaining wetland on-site and offsite adjacent to the proposed dredging area.

7.7 Potential Indirect Effects on Essential Fish Habitat

The potentially affected estuarine/riverine marshes include the remaining wetland fringe inshore on the Kinder Morgan property and Eagle Islands' wetland fringe west of the channel. The greatest potential indirect effect on tidal marshes would be a tidally migrating sediment dispersion plume. As dredged material will be managed from placement in a scow through rehydrating and pumping to the CDF, as well as booms maintained around the operation; the deposition of sediment within the shallow fringing marshes is highly unlikely. Due to the high use by vessels transiting this area, naturally elevated turbidities are common.

Considered HAPCs, the proposed dredging area is within NCDMF designated PNA (Figure 5). Due to the river's high tidal velocity, the high sediment carrying capacity of the river, and the short dredging schedule; sediment accumulation within the adjacent or downstream wetland fringes and/or significantly affecting downstream PNAs is not anticipated. As depicted in Figures 5 and 6, the North Carolina Marine Fisheries Commission (NCMFC) and NCWRC have designated areas from the POW upstream into Columbus, Bladen, Pender, and other inland North Carolina Piedmont counties as anadromous fish spawning areas. The structural area displacement and the supporting vessel's activities would evoke natural evasive response mechanisms from managed species and juvenile prey species, thereby avoiding the active dredging and construction areas. As a result of the low temporal use and minimal spatial area of dredging, and the extensive area designated as anadromous spawning areas; potential adverse effects on anadromous fish within the CFR from dredging is considered minor. A separate Biological Assessment addressing effects of proposed dredging and construction on the two sturgeon species present has been prepared (DC&A 2018).

7.8 Potential Cumulative Effects on Essential Fish Habitat

Potential cumulative effects are those resulting from any or all past, present, and reasonably foreseeable actions, including the potential incremental effects from the authorized dredging. Uses of adjacent waters and water courses by various North Carolina military installations, commercial and recreational fishing, recreational boaters, and international trade will continue influencing the CFR's estuarine/riverine EFHs, managed, and associated species. Dredging of the federally authorized channel occurs annually with dredging of the quays and berths generally occurring every one to two years as piggybacking on the dredging contractor while present in the harbor. Since the July 1998 NCDCM authorization for agitation dredging, all operational stipulations have been adhered and each (an average of one event per year) "out of window" action has been coordinated with the NCDCM, NCDMF, NCDWQ, NCWRC and NMFS. The operational techniques and frequency have not changed as referenced in NOAA's 2006, 2012 and 2014 consultation and the POW's purpose and need for maintaining federally authorized quay depths year-round remains a constant in the POW marine terminals' ability to market and maintain their customer base. The minimal spatial and temporal extents of proposed dredging as well as good engineering/best management practices will continue to minimize the potential for cumulative effects within the CFR's EFH. The only cumulative effect likely would be if multiple terminals were dredging during the same falling tide event; however, this is highly unlikely due to the limited frequency of dredging at the NCSPA and private terminals. Since the proposed dredging of 19.16 acres for the expanded Turning Basin is a one-time event that is not anticipated to occur again for many decades if ever, it is not expected that this project along with the other annual dredging events will result in a negative cumulative effect. The proposed loss of 1.4 acres of tidal wetlands is the only time the NCSPA has requested such authorization in the recent past associated with proposed basin/channel improvements and is not likely to be needed within the foreseeable future for channel and basin improvements. Therefore, there is not likely to be any significant cumulative effect of dredging activities on associated EFH.

8.0 MANAGED SPECIES

8.1 Introduction

The NMFS, SAFMC, MAFMC, and ASMFC are responsible for managing specific species/life stages that may occur within the CFR and/or near the POW. Table 3 identifies those species and their lifestage(s) potentially occurring in the vicinity of the POW. The EFH species data was provided by the NMFS Habitat Conservation Division, Beaufort, North Carolina (NOAA 2012a and Appendix B).

Table 3. Essential fish habitat species.

Species		Life Stages
Common Name	**Scientific Name**	**Cape Fear River to US 421**
INVERTEBRATES		
Brown shrimp	*Farfantepenaeus aztecus*	L, J, A
White shrimp	*Litopenaeus setiferus*	L, J, A
Pink shrimp	*Farfantepenaeus duorarum*	L, J, A
COASTAL DEMERSALS		
Red drum	*Sciaenops ocellatus*	E, L, J, A
Bluefish	*Pomatomus saltatrix*	J, A
Summer flounder	*Paralichthys dentatus*	L, J, A
COASTAL PELAGICS		
Spanish mackerel	*Scomberomorus maculatus*	J, A
King mackerel	*Scomberomorus cavalla*	J, A
Cobia	*Rachycentron canadum*	J, A
SNAPPERS/GROUPERS		
Black sea bass	*Centropristis striata*	J
Rock sea bass	*Centropristis philadelphica*	J
Gag grouper	*Mycteroperca microlepis*	J
Red grouper	*Epinephelus morio*	J
Black grouper	*Mycteroperca bonaci*	J
Lane snapper	*Lutjanus synagris*	J
Mutton snapper	*Lutjanus analis*	J
Gray snapper	*Lutjanus griseus*	J
Yellow jack	*Carangoides bartholomaei*	J

Table 3. (concluded).

Species		Life Stages
Common Name	**Scientific Name**	**Cape Fear River to US 421**
Blue runner	*Caranx crysos*	J
Crevalle jack	*Caranx hippos*	J
Bar jack	*Caranx ruber*	J
Atlantic spadefish	*Chaetodipterus faber*	J
Sheepshead	*Archosargus probatocephalus*	J, A
SHARKS		
Smooth dogfish	*Mustelus canis*	J
SMALL COASTAL SHARKS		
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	J, A
Finetooth shark	*Carcharhinus isodon*	J, A
Blacknose shark	*Carcharhinus acronotus*	J, A
Bonnethead shark	*Sphyrna tiburo*	J, A
LARGE COASTAL SHARKS		
Silky shark	*Carcharhinus falciformis*	J, A
Tiger shark	*Galeocerdo cuvieri*	J, A
Blacktip shark	*Carcharhinus limbatus*	J, A
Spinner shark	*Carcharhinus brevipinna*	J, A
Bull shark	*Carcharhinus leucas*	J, A
Lemon shark	*Negaprion brevirostris*	J, A
Nurse shark	*Ginglymostoma cirratum*	J, A
Scalloped hammerhead	*Sphyrna lewini*	J, A
Great hammerhead	*Sphyrna mokarran*	J, A
Smooth hammerhead	*Sphyrna zygaena*	J, A

Legend: E, Egg; L, Larval; J, Juvenile; A, Adult
Source: Habitat Protection Division, Pivers Island, North Carolina

8.2 Invertebrates

Major North Carolina rivers, North Carolina's southern coast, Pamlico Sound, and Core Sound are major shrimping areas. These locations provide annual crops of brown, white, and pink shrimp; all are managed by the SAFMC [South Atlantic Fisheries Management Plan (SAFMP) 2004]. The more common North Carolina species are the brown and pink; while the white shrimp is more established in southeastern coastal North Carolina, South Carolina, Georgia, and Florida [North Carolina Fishery Management Plan for Shrimp (NCFMPS) 2006]. The loss or degradation of juvenile nursery habitat is the most serious threat to stocks; specifically salt marsh for brown and white shrimp, and the inshore seagrass for pink shrimp. River mouths and inlet entrances, specifically into Core and Pamlico Sounds, are particularly important to North Carolina's shrimp estuarine recruitment (NCFMPS 2006). All coastal inlets and state-designated nursery habitats are of particular importance to shrimp. In North Carolina, all primary and secondary nursery areas meet the criteria for EFH-HAPCs (SAFMP 2004).

Brown Shrimp *(Farfantepenaeus aztecus)*

Brown shrimp support an important commercial fishery along the South Atlantic coast, primarily in North and South Carolina; however, they do occur from Massachusetts, around the Florida Keys, and into the Gulf of Mexico. Brown shrimp are found throughout North Carolina's estuaries, with a higher abundance in the Neuse tributaries; Core Sound; Stump Sound; and in Brunswick County's Intracoastal Waterway. This species spawns in deep ocean waters during late winter or early spring, reaching sexual maturity at a 5.5 to 5.7 inch length. Brown shrimp may occur seasonally along the Mid-Atlantic coast; however, breeding populations seemingly do not range north of North Carolina. Carried by currents and wind into estuaries, the larvae develop into post-larvae within ten to 17 days. Juveniles develop in four to six weeks, continuing into rapid sub-adult development depending on salinities and temperatures. As they increase in size, they move to deeper and saltier waters of the sound, until returning to the sea in late fall. They have a maximum life span of 18 months. Brown shrimp are omnivores and prefer muddy and peat bottoms, but can be found on sand, silt, or clay mixed shell hash bottoms (SAFMP 2004, NCFMPS 2006).

White Shrimp *(Litopenaeus setiferus)*

White shrimp are found along the Atlantic coast from New York to Florida. In North Carolina, white shrimp are mostly concentrated in the CFR estuary, Brunswick County estuaries, New River, and tributaries of Pamlico Sound. White shrimp reproduce offshore from March to November and post-larvae move inshore on tidal currents, entering the estuaries two to three weeks after hatching. Shallow muddy bottoms in low to moderate salinities are the optimum nursery areas for these benthic juvenile white shrimp. By June or July, the juveniles move to deeper creeks, rivers, and sounds. During fall and early winter, white shrimp migrate south; providing a valuable fishery in southern North Carolina, South Carolina, and Georgia. White shrimp are omnivores, preferring soft muddy bottoms in areas of expansive brackish marshes (SAFMP 2004, NCFMPS 2006).

Pink Shrimp *(Farfantepenaeus duorarum)*

Pink shrimp can be found from southern Chesapeake Bay, around the Florida Keys, and into the Gulf of Mexico. Major numbers of pink shrimp are found off North Carolina and along the northeast Florida coast, with the large populations off southwestern Florida. Pink shrimp ocean-spawn during April through July, and are transported by wind-driven currents into the estuaries. North Carolina maintains the northernmost reproducing population; with female pink shrimp reaching sexual maturity at 3.35 inches. Within the estuarine nursery areas, pink shrimp experience rapid growth; as they increase in size, they move to deeper and saltier waters of the sound. Appreciable numbers of pink shrimp over-winter in North Carolina estuaries before entering the ocean; pink shrimp have a maximum life span of about two years. Pink shrimp are primarily bottom feeders and feed essentially among shallow water marine plants. Submerged aquatic vegetation are particularly critical as a nursery area for juvenile pink shrimp; abundance appears greater in estuarine SAV beds as compared to soft bottoms, marsh edges, or shell bottoms (NCFMPS 2006).

Potential Project Effects on Invertebrates

The dredging may affect the managed invertebrate species using the estuarine/riverine water column EFH and will affect the unvegetated mud bottom EFH. The water column EFH acts as the transport medium between the ocean and estuarine/riverine systems. The managed invertebrate species reproduce offshore during the spring and early summer months and larvae are then carried by wind and tidal currents into the estuaries. These earlier life stages have the least capability for avoiding water column disturbances, such as during dredging. The adult and juvenile motility would allow for operation avoidance during late fall migrations. Potential larval effects from turbidity may occur during dredging operations; however, the minimized operational window goal, and small dredging area would minimize the potential for effects. Due to the deepening of shallow water unvegetated mud bottom EFH within the PNA, there will be a loss of 1.68 acres of potential nursery and foraging area for managed invertebrate species. In addition, the loss acres of 1.4 acres of tidal marsh would result in the loss of foraging area and cover for shrimp. Other than this direct loss of shallow water benthic habitat, there would be limited spatial and temporal impacts outside of the direct dredging area.

The dredging operation could have potential indirect effects on estuarine/riverine marshes and PNAs adjacent to the project area and west of the channel; each providing potential shelter and foraging habitats for the developing shrimp life stages. A potential invertebrate indirect effect could be a tidally migrating sediment dispersion plume. Significant turbidity effects from mechanical dredging operations on these habitats are not anticipated. There are no SAV or oyster rock habitats within or near the proposed dredging area. Since the dredging area is within designated PNA, a variance has been requested from the NCDENR. Use of turbidity barriers and good engineering/best management practices will minimize the potential for effects on managed invertebrate species elsewhere within the CFR.

8.3 Coastal Demersal Species

Demersal fish are primarily bottom feeders compared to pelagic species living in the open water column away from the bottom. Most demersal species have a flat ventral body region facilitating their substrate positioning. Many demersal species exhibit an inferior mouth (pointed downward) for substrate feeding. Managed coastal demersal species potentially found within the existing and or proposed AMD area EFHs are red drum, bluefish, and summer flounder, each which are discussed below.

Red Drum *(Sciaenops ocellatus)*

The red drum is a coastal and estuarine species found in the Gulf of Mexico from southwest Florida to Tuxpan, Mexico and along the United States east coast from Key West to Massachusetts. In 1971, North Carolina's General Assembly designated the red drum as the state's official salt water fish (Case 2007). The red drum, unlike the black drum, has no chin barbells but does have a sub-terminal or inferior mouth facilitating bottom feeding (SAFMC 2012a). Producing up to two million eggs a season, red drum females spawn in nearshore waters at night during summer and fall. Hatching within three days, larvae are transported into estuarine areas by wind and tidal currents. Zooplankton, small crabs, and shrimp make up the juvenile and sub-adult diet; and with maturation, larger invertebrates and fish become the diet staples. Adults seasonally migrate offshore or south during the winter. Males mature between age one and four, while females between age three and six. Red drum may live 60 years and reach greater than 90 pounds (ASMFC 2012b).

Bluefish *(Pomatomus saltatrix)*

Bluefish are found throughout most temperate coastal regions and along the United States Atlantic coast from Maine to Florida. Bluefish are one of the most sought after recreational species along the Atlantic coast (ASMFC 2012c). Bluefish spawn offshore from Massachusetts through Florida in distinct groups referred to by the season; spring-spawned or summer-spawned. Eggs are externally fertilized, pelagic, and highly buoyant; they are released in open ocean waters hatching within 48 hours with immediate larval development. As developing juveniles, bluefish move into coastal sounds and estuaries of the Mid-Atlantic Bight and to a lesser degree the South Atlantic Bight (MAFMC 1990). Juveniles prefer sandy bottom habitats; but will use a mud or silty bottom as well as vegetated SAV areas, seaweed, and marsh grass. Bluefish are insatiable carnivores and will eat almost anything they can catch and swallow. Bluefish stomach contents have revealed over 70 species of fish including: butterfish (*Peprilus triacanthus*), alewife (*Alosa pseudoharengus*), silverside (*Menidia menidia*), and spot (*Leiostomus xanthurus*). Bluefish are sexually mature by year two, and can live up to 12 years reaching three feet in length and exceeding 30 pounds (MAFMC 1990, ASMFC 2012c).

Summer Flounder (*Paralichthys dentatus*)

The summer flounder's ecological range includes shallow estuarine and outer continental shelf waters from Nova Scotia to Florida and the northern Gulf of Mexico [Northeast Fisheries Science Center (NEFSC) 1999]. From late spring through early fall, summer flounder are concentrated in estuaries and sounds until migrating to the offshore outer continental shelf wintering grounds (NEFSC 1999, ASFMC 2012d). During fall and early winter, offshore spawning occurs and the larvae are carried by wind currents into coastal areas. Post larvae and juvenile development occurs principally within the estuaries and sounds (NEFSC 2012a). Summer flounder eggs are pelagic, buoyant, and spherical with a transparent rigid shell with the yolk occupying approximately 95 percent of the egg volume (ASFMC 2012d and 2012e). Larvae migrate to inshore coastal areas from October to May where they bury into the sediment and develop into juveniles. Late larval and juvenile summer flounder are active predators; preying on crustaceans, copepods, and polychaete parts (NEFSC 1999). Juveniles inhabit marsh creeks, mud flats, and seagrass beds; preferring primarily sandy shell substrates. Juveniles often remain in North Carolina sounds for 18 to 20 months. Males reach maturity at a length of approximately 9.8 inches while female reach maturity at approximately 11 inches (NEFSC 1999, ASFMC 2012e). Adults primarily inhabit sandy substrates, but have been documented in seagrass beds, marsh creeks, and sand flats (ASFMC 2012d and 2012e, NEFSC 1999). Adults are active during daylight hours and normally inhabit shallow, warm, coastal estuarine waters before wintering offshore on the outer continental shelf. Some research suggests that some older individuals may remain offshore year-round (NEFSC 1999).

Potential Project Effects on Coastal Demersal Species

Dredging may have effects on coastal demersal species managed and potentially found within the project area. Deeping of 1.68 acres of shallow water mud bottom habitat and the impacts to 1.4 acres of tidal marsh could result in the loss of larvae or small juveniles from a number of demersal species during dredging. While many could escape the dredging, some would be entrained in the clamshell/bucket grab. Bluefish and summer flounder reproduce offshore during the winter and larvae are then carried by wind and tidal currents into the estuaries. However, due to the limited area of dredging, the actual loss would be expected to be minimal. The juveniles and adults would avoid operational areas during migrational periods. Red drum spawns primarily close to inlets during the late summer and fall, peaking in September and October. The red drum's pelagic eggs and larvae are then transported by currents into the estuarine nursery areas (ASMFC 2012f). Some larval effects (turbidity) may occur during dredging; however, the timing and size of the affected area would minimize potential effects. Dredging would displace potential benthic prey resources commonly found in shallow water mud bottom and tidal marsh habitats; however, the spatial effects would be minimal considering available adjacent foraging bottoms. Given the large water column available for movement and small area impacted by the dredging operations, there would be limited effects on migrating species.

The dredging operation could have potential indirect effects on estuarine/riverine marshes and PNAs; each providing potential shelter and foraging habitats for the coastal demersal life stages. A potential indirect effect could be a tidally migrating sediment dispersion plume. Significant turbidity effects from mechanical dredging operations on these habitats are not anticipated. There are no SAV or oyster rock habitats within or near the proposed dredging area. Since the dredging area is within designated PNA, a variance has been requested from NCDENR. Due to the deepening of shallow water mud bottom habitat with PNA, there will be a loss of potential nursery and foraging area for coastal demersal species. Other than this direct loss of habitat, there will limited spatial and temporal impacts outside of the direct dredging area. Use of turbidity barriers and good engineering/best management practices would serve to minimize the potential effects on managed coastal demersal species and their prey adjacent to the proposed dredging area.

All North Carolina coastal inlets and state designated primary/secondary nursery areas are considered HAPCs for many managed species including red drum, bluefish, and summer flounder (SAFMC 1998b). Dredging could have indirect effects on proximal wetland fringes, downstream water columns, and PNAs each providing potential pathways and foraging habitats for coastal demersal developmental stages; however, significant turbidity effects would not be anticipated. The spatial and temporal extents of the proposed dredging, as well as good engineering/best management practices minimize the potential for indirect effects on managed coastal demersal species within the CFR and near the POW.

8.4 Coastal Pelagic Species

Coastal pelagic species potentially found near the POW include king mackerel, Spanish mackerel, and cobia. Each species is generally distributed from New England to Brazil. These highly sought after game fish have common attributes; such as extended spawning periods, rapid growth, and early maturation. These species are also fast swimming and schooling predators with insatiable feeding habits. Regarding Spanish and king mackerel, the SAFMC and the Gulf of Mexico Fishery Management Council (GMFMC) distinguish two separate migratory groups (NMFS 2009a, NOAA 1983).

Spanish Mackerel (*Scomberomorus maculatus*)

Spanish mackerel management has resulted in a steady stock abundance increase since 1995; and based on previous data, the population is not over-fished. This species prefers open waters, but can be found over deep reefs, grass beds, and estuarine shallows (ASMFC 2012g). Smaller than its relative the king mackerel, the Spanish mackerel's average weight is two to three pounds reaching lengths of three feet. Spanish mackerel are a fast-growing species, with both sexes capable of reproduction by the second or third year (SAFMC 2012b and Mercer et.al. 1990). Spanish mackerel have a life span of five to eight years (ASMFC 2012g). Spanish mackerel spawn in groups over the inner continental shelf, and spawning starts off the Carolinas in April. Females grow faster and larger than males; and by age two, females may release up to 1.5 million eggs (Mercer et.al. 1990). Larvae grow quickly and may be found inshore at shallow depths less than 30 ft. Juveniles use estuaries as nursery areas but most remain in nearshore ocean waters. The continental shelf, tidal estuaries, and coastal waters are all habitats for adult Spanish mackerel; however, the adults spend most of their life in the open ocean (ASMFC 2012g and 2012h, and Mercer et.al.1990). Spanish mackerel are carnivores and primarily piscivorous as juveniles and adults (Mercer et.al. 1990).

King Mackerel (*Scomberomorus cavalla*)

Elongated and laterally compressed, the king mackerel can reach lengths of 5.5 feet and weigh up to 100 pounds. Juvenile king markings can be confused for large Spanish; however, the sharply dipping lateral line clearly distinguishes the king mackerel (GMFMC and SAFMC 1983 and SAFMC 2012c). Primarily a coastal species, the king mackerel's range is from Brazil to Maine including the Gulf of Mexico. Migration movements are tied to water temperature changes and may vary with age and size. Smaller individuals of similar size form significant schools congregating in areas of bottom relief or reefs; where larger solitary individuals prefer anthropogenic structures and/or wrecks. Reproductive maturity occurs in males at age four and females at age three. A well-defined spawning area has not been determined in that larvae and juvenile have been seen from May to November off Miami, Canaveral, and the Carolinas. King mackerel may reach an age of at least 14 years (GMFMC & SAFMC 1983).

Cobia (*Rachycentron canadum*)

Cobias are prominent in warm seasonal east coast waters from Chesapeake Bay south through the Gulf of Mexico, migrating from tropical waters in the winter to warm temperate waters in the spring through fall. As a migratory pelagic fish, cobia are found around offshore reefs and over the continental shelf; preferring structures, platforms, and flotsam. Cobia also inhabit inshore inlets and bays near piers, piles, and inshore structure [University of Florida (UoF) 2012a, Fish4Fun 2011]. Cobias spawn off North Carolina's coast in May and June, releasing eggs and sperm into offshore open waters; however, cobias have also been documented to spawn in estuaries and bays. After 24 to 36 hours following fertilization, larvae are released and move inshore to lower salinities. Cobia documented off North Carolina had maximum ages of 14 years for males and 13 years for females; both reaching sexual maturity at ages two and three, respectively. Cobia average 20 to 40 pounds, but may reach up to 130 pounds (SAFMC 1983, UoF 2012a, and SAFMC 2012d). Cobias are carnivores, feeding on small fish such as mullet, pinfish (*Lagodon rhombodies*), Atlantic croakers (*Micropogonias undulatus*), and Atlantic herring (*Clupea harengus*), as well as crustaceans and cephalopods, with crab being a favorite prey. Cobia will follow or track sharks, turtles, and rays scavenging available orts (SAFMC 1983, UoF 2012a).

Potential Project Effects on Coastal Pelagics

Proposed dredging may affect North Carolina coastal pelagic species, but likely would have minimal to no species' population consequences. Each of the three potential species spawns offshore starting in the spring and into early fall as in the case of king mackerel. Wind and tides transport the larvae into the estuaries and potentially up the CFR. All North Carolina coastal inlets and state designated primary/secondary nursery areas are considered HAPCs for many managed species (SAFMC 1998b). The species' juvenile and adult lifestages (lifestages potentially to occur near the POW) would employ natural avoidance responses minimizing potential effects during dredging. The probability of directly impacting juveniles while dredging within the PNA shallow water mud bottom and tidal marsh habitat is unlikely given the low probability of occurrence near the port.

Mechanical dredging could have potential indirect effects on proximal soft bottoms, wetland fringes, and downstream water columns each providing potential pathways and foraging habitats for coastal pelagic juveniles and adults. Potential turbidity effects on these habitats would not be anticipated. The minimal spatial and temporal extents of proposed dredging, as well as good engineering/best management practices would continue to minimize the potential for indirect effects on managed coastal pelagic species within the CFR and near the POW.

8.5 Snapper/Grouper Complex

The snapper/grouper complex is a large assemblage of 73 species whose similarities revolve around a life cycle stage dependent/coupled with hardbottoms and reef fishery habitats. The diversity within the complex results in considerable differences of habitat use and life history (NOAA 2012c). Essential Fish Habitat for nearshore and estuarine dependent species includes hardbottoms, artificial reefs, estuarine emergent marshes, oyster rocks, and SAV. All North Carolina inlets, primary and secondary nursery areas are considered HAPCs for snapper/grouper species. Offshore bottom areas with high to medium elevation grades such as The Point, Big Rock, and the Ten Fathom Ledge are also HAPCs where spawning and periodic spawning aggregations occur (NOAA 2012d). Many members of the snapper/grouper complex are long-lived, late maturing, and slow growing; exacerbating management strategies. Stock rebuilding efforts can take years to achieve stock recovery (SAFMC 2012e). For the purposes of this document, succinct biological descriptions are provided for example species whose multiple life stages potentially use the POW's agitation maintenance dredging areas.

Black Sea Bass (*Centropristis striata*)

Black sea bass are distributed from Nova Scotia to Florida and into the Gulf of Mexico, with Cape Hatteras serving as a geographic boundary between overlapping northern and southern stocks (ASMFC 2012i). Black sea bass, a temperate reef fish, prefer a habitat of structures such as oyster beds, wrecks, rock bottom piles, or reefs (SAFMC 2012f, ASMFC 2012i). Black sea bass may achieve sizes up to 23.5 inches, weigh up to eight pounds, and reach a maximum age of 15 to 20 years (NEFSC 2012b). Black sea bass will spend summers inshore and as coastal water temperatures decline, they migrate and winter in offshore waters (ASMFC 2012j). Black sea bass spawn from February to May on the continental shelf and these ocean waters are EFH for black sea bass eggs and larvae (NOAA 2012e). Not yet fully understood, black sea bass will change their sex from female to male (protogynous hermaphroditic). Though born as females, individuals will change sex between the ages of two and five (ASMFC 2012i). A two to five year old black sea bass can produce 280,000 eggs, which float within the water column until hatching a few days after fertilization. Young black sea bass will migrate into estuaries and bays, seeking shelter in various habitats such as oyster reefs, anthropogenic structures, and SAVs (ASMFC 2012i). Estuarine habitats provide post-larvae and juveniles an environment suitable for development and growth. Rough shell/sandy bottoms, SAVs, and man-made structures are EFH for juvenile black sea bass (NOAA 2012e). Offshore structures, man-made or natural, are EFHs to offshore wintering black sea bass (NOAA 2012e).

Gag Grouper (*Mycteroperca microlepis*)

The gag grouper is a widely distributed species with adults ranging from North Carolina to Brazil and into the Gulf, with juveniles found in estuaries from Massachusetts to Cape Canaveral. Spawning takes place offshore the North Carolina coast in February producing transparent and pelagic eggs. The kite-shaped larvae/post larvae migrate inshore to oyster reefs, salt marshes, and SAVs. Juveniles remain in these protected areas for three to five months before moving to offshore structures. Like the black sea bass, gag groupers are protogynous hermaphrodites (beginning life as females and following multiple spawns some change to males). Adults school from five to 50 individuals, but are routinely found as solitary individuals. All fish less than 35 inches tail length are females while most are male at or beyond 45 inches. Juveniles less than eight inches in length feed on crustaceans found in shallow SAVs, while adults may weigh up to 80 pounds and can live up to 26 years; preying on squid, shrimp, crabs, snappers, grunts, and sardines (SAFMC 2012g, UoF 2012b).

Gray Snapper (*Lutjanus griseus*)

Gray snapper occurs in marine and estuarine waters from North Carolina to Bermuda (NOAA 2012f). Early stages can be found in marine and estuarine areas, with bottom types varying from marl mud with shell, seagrass flats, shallow basins with seagrass, to mud banks. The gray snapper is found within the inter- and sub-tidal zones and is considered a commercial, recreational, and prey species (SAFMC 1998a). Spawning occurs offshore during the summer and early fall; eggs and larvae are planktonic and the larval interval is estimated at 25 to 40 days. Gray snapper settlement sizes range, but seem able to settle at an age of three-to-five weeks (NOAA 2012f). Specifically in Middle Marsh of Carteret County, North Carolina, gray snapper preferred shell bottom adjacent to SAVs; allowing access to both habitats for prey and refuge (Street et.al. 2005). Late juveniles moving offshore will use nearshore hardbottom areas as an intermediate nursery habitat (Street et.al. 2005). Adults are euryhaline and prefer deeper marine habitats; such as offshore hardbottoms, channel ledges, and artificial structures (NOAA 2012f). The gray snapper habitat varies from offshore irregular bottoms at depths of about 300 ft to inshore habitat over smooth bottoms usually near structure or seagrass beds (SAFMC 2012h). An adult's maximum age is estimated at up to 21 years; gray snapper may weigh up to 25 pounds (NOAA 2012f, SAFMC 2012h). Juveniles have been documented as far north as Massachusetts, with transforming larvae having been collected at Ocracoke and Oregon Inlets during ichthyoplankton sampling events (Burton 2000). Adults and juveniles are late afternoon or nocturnal predators, primarily consuming fish; but will take crabs and shrimp (NOAA 2012f, SAFMC 2012h).

<u>Crevalle Jack</u> (*Caranx hippos*)

The crevalle jack ranges as far north as Nova Scotia, southward to Uruguay, and includes the northern Gulf of Mexico. Crevalle jack can be found in riverine, estuarine, and oceanic locations dictated primarily by life stages. Spawning occurs offshore in the southeast Atlantic during early March to early September. The crevalle jack spawn in both subtropical and tropical waters and their larvae are transported into estuarine nursery areas. Larger adults are normally found over the continental shelf; larvae and young can be found in shallower brackish estuaries. Adults and juvenile school; however, larger individuals may become solitary. Crevalle jacks can reach 55 pounds and live up to 19 years; females are typically larger. Sexual maturity can occur by age four and five for males and females respectively. They are diurnal predators with a diet composed of shrimp, small fish, and other invertebrates (SAFMC 2012i, UoF 2012c).

<u>Sheepshead</u> (*Archosargus probatocephalus*)

Sheepshead is found along North America's Atlantic coast from Nova Scotia to Cedar Key, Florida; with two subspecies in the western Gulf and south to Rio de Janeiro. Sheepshead is euryhaline, but prefers brackish water and normally is found inshore near pier, jetties, and rock pilings, but also within tidal creeks. Spawning occurs offshore during late winter and early spring followed by the adults returning to nearshore and estuarine waters. Their dark pelagic eggs develop into larvae that make their way to inshore nursery areas where juveniles use seagrass flats and mud bottoms (SAFMC 2012j, UoF 2012d). At a few inches in length, young sheepsheads leave the SAV and join the adults near structure. Sheepshead is an omnivorous species with younger individuals eating midge larvae, zooplankton, and polychaetes; however, juveniles and larger adults prey on small fish, clams, oysters, blue crab, and barnacles. Sheepshead commonly reach one to eight pounds, but can attain up to 22 pounds and have a maximum lifespan or approximately 20 years (UoF 2012d).

<u>Potential Project Effects on the Snapper/Grouper Complex</u>

Mechanical dredging will have direct effects within the unvegetated mud bottom and tidal marsh EFH's due to the loss of shallow water nursery habitat where post-larvae, juvenile, and adult fish within this species group on occasion forage for invertebrates such as clams and crabs.

Although the area is small, it is likely subject to use by members of this group. There are likely to be minimal effects on the snapper/grouper complex in the estuarine/riverine water column during dredging. The members of the snapper/grouper complex potentially seen within the dredging area spawn offshore during the winter with their pelagic eggs and post-larvae being transported by wind and tidal currents into the estuaries. North Carolina's estuarine SAVs, macro-algae beds, and oyster rocks are considered HAPCs for larvae and juvenile of many managed species within the snapper/grouper complex (SAR 2008b). Juveniles and sub-adults, the lifestages potentially seen within the dredging area, are motile and would likely exhibit natural evasive movement if encountering equipment. Inlets and state designated primary/secondary nursery areas are considered HAPCs for many managed snapper/grouper species. The area proposed for dredging resides in a PNA and would as such be considered an HAPC (SAFMC 1998a).

Mechanical dredging could have potential indirect effects on proximal soft bottoms, wetland fringes, and downstream water columns each providing potential pathways and foraging habitats for snapper/grouper juveniles. Potential turbidity effects on these managed species and habitats would not be anticipated. The limited spatial and temporal extents of dredging, as well as good engineering/best management practices would minimize the potential for indirect effects on managed snapper/grouper species within the CFR and near the POW

8.6 Highly Migratory Species

Many Highly Migratory Species (HMS) are identified as “overfished” [e.g. bluefin tuna (*Thunnus thynnus*), bigeye tuna (*Thunnus obesus*), swordfish (*Xiphias gladius*), and large coastal sharks (LCS)]. The management challenges are exacerbated by enforcement and oversight inconsistencies among several nations [National Oceanic and Atmospheric Administration, Fisheries Service (NOAAFS) 2010]. The Magnuson-Stevens Act and the Atlantic Tunas Convention Act (ATCA) have dual management responsibilities for HMS. The final HMS FMP combined the management of Atlantic HMS into one FMP, combining and simplifying objectives (NMFS 2006). Within the vicinity of the POW’s agitation maintenance dredging, several sharks are noted under a Secretarial/FIFMP EFH management council (Table 4). For the purposes of this document, succinct biological descriptions are provided for example species of small coastal sharks (SCS), LCS, and the smooth dogfish shark, whose life stages potentially use the agitation maintenance dredging areas.

Based on the managed species listing for the “CFR to US421” provided by the Habitat Conservation Division of NOAA on Pivers Island, Beaufort, North Carolina (Appendix B); Pelagic, Prohibited, and Research sharks are not likely to be encountered near the POW and therefore, not addressed in this EFH assessment.

Table 4. Shark management groups.

Large Coastal	Small Coastal
Silky shark	Atlantic sharpnose shark
Tiger shark	Finetooth shark
Blacktip shark	Blacknose shark
Spinner shark	Bonnethead shark
Bull shark	
Lemon shark	
Nurse shark	
Scalloped Hammerhead shark	
Great Hammerhead shark	
Smooth Hammerhead shark	

Source: NMFS 2006

Sharks

The diversity in behavior, reproduction, feeding habits, and size has resulted in the shark's evolutionary success. Compared to other marine fish, sharks have a low reproductive potential and in some species an extended life span living up to 40 years. Slow growth, one-to-two year reproductive cycles, late sexual maturity, and a small number of young per brood result in many shark species being vulnerable to overfishing. Sharks' reproductive adaptations are grouped in three manners: oviparity (eggs hatch outside body), ovoviviparity (eggs hatch inside body), and viviparity (live birth). Nurseries are normally shallow coastal or estuarine waters supporting fewer predators and copious fish and crustaceans. Young leave these nursery areas as winter approaches and water temperatures drop (NMFS 2006, NMFS 2009b).

Along the United States Atlantic coast, the Gulf, and Caribbean; many species of shark are known to exist. Thirty-nine are managed under the HMS and are divided into four species management groups: LCS, SCS, pelagic sharks, and prohibited sharks (NMFS 2006 and Cortés 2002). Brief species specific narratives are provided for LCS, SCS, and the smooth dogfish shark (*Mustelus canis*). .

Large Coastal Sharks

Many LCS are considered important commercial species thereby supporting justification for management. Large coastal shark examples described below include nurse, bull, great hammerhead, and sandbar sharks (NMFS 2006, NMFS 2009b).

Nurse shark (*Ginglymostoma cirratum*): Inhabiting tropical and subtropical waters, nurse sharks can be found in the western Atlantic from Cape Hatteras to Brazil. Preferring shallow waters, nurse sharks are often found under or near rocks/coral reefs and are known to congregate in large numbers. A nurse shark's range does not vary in that they may spend their entire life within a few hundred square miles. Their gestation period is approximately five to six months with litters consisting of 20 to 30 pups. Nurseries include shallow turtle grass (*Thalassia testudinum*) as well as shallow coral reefs (NMFS 2009b).

Bull shark (*Carcharhinus leucas*): The bull shark is found in warm seas and estuaries. A large shark, bulls are a shallow water species and the only shark species physiologically able to spend extensive time in freshwater. Bull sharks have an estimated gestation period of ten to 11 months with varying birth sizes and litters ranging from one to ten pups. Nursery areas are in reduced salinity estuaries such as coastal lagoons and bays. Juveniles and adults are documented along the United States East Coast from Florida to the Carolinas (NMFS 2009b).

Great hammerhead shark (*Sphyrna mokarran*): The great hammerhead is a very large shark found worldwide in warm shallow coastal waters as well as in open oceans. The great hammerhead is normally solitary unlike the more common scalloped hammerhead known to school in large numbers. Their unique head morphology is thought to aid in lateral prey recognition and mobility. Great hammerheads have biennial reproduction cycles with gestation periods of approximately 11 months and litters ranging from 20 to 40 pups. Young of the year (YOY), juveniles, and adults are found in United States east coast waters from the Florida Keys to New Jersey (NMFS 2009b).

Sandbar shark (*Carcharhinus plumbeus*): The sandbar shark is a common species found in many warm temperate and tropical coastal habitats. Migrating seasonally, the sandbar shark is found from Cape Cod to the western Gulf. The sandbar is a benthic dwelling shark preferring depths of 60 to 100 ft. The sandbar shark is slow growing, giving birth from March to July with litters averaging nine pups. Nursery areas are normally shallow coastal waters from Cape Canaveral to Delaware Bay including waters off Cape Hatteras. The Outer Banks, areas of Pamlico Sound, and adjacent waters of Hatteras and Ocracoke Islands are classified as a HAPC nursery area. The sandbar shark is considered very susceptible to overfishing based on its slow maturation and significant fishing pressures (NMFS 2009b).

Small Coastal Sharks

Several of these SCS are commercially targeted; however, many numbers of these species are lost as by-catch in an assortment of fisheries particularly the shrimp trawl fishery (NMFS 2002, NMFS 2006 and Cortés 2002).

Atlantic sharpnose shark (*Rhizoprionodon terraenovae*): The Atlantic sharpnose are year-round inhabitants of the Gulf of Mexico; along the coasts of Florida and South Carolina; and are routinely found during summer months off the Virginia coast. Atlantic sharpnose sharks school by uniform size and sex and are considered very plentiful, yet are the most exploited SCS in the United States Atlantic and Gulf waters. Off South Carolina in shallow coastal waters, young are born in late May in litters ranging from four to seven pups. Young of the Year and juveniles can be found in seagrass beds as well as over sand and/or mud bottoms. Juvenile Atlantic sharpnose are thought not to exhibit philopatry (returning to a specific breeding location) but facilitate an area's coastal bay/estuarine system (NMFS 2009b).

Finetooth shark (*Carcharhinus isodon*): This coastal species is common off South Carolina during summer months, yet spend winter months off Florida. Finetooth sharks often form large schools consisting of adults and juveniles. With a gestation period of approximately 12 months, finetooth are viviparous giving live birth in late May to mid-June of one to six pups (UOF 2012e).

Blacknose shark (*Carcharhinus acronotus*): Blacknose are a common coastal species found from North Carolina to southeast Brazil. They are abundant during fall and summer from parts of the Gulf, Florida, up to North Carolina. Blacknose tolerate varying levels of DO in a variety of bottom habitats. Blacknose are extremely philopatric and habitats are shared between juveniles and adults. Blacknose are abundant in coastal waters off South Carolina from May to October; however, data suggests that nearshore waters are not used as a nursery; blacknose litters can range from three to six pups. YOY, juveniles, and adults are found from Louisiana to Cape Hatteras (NMFS 2009b).

Bonnethead shark (*Sphyrna tiburo*)*:* Bonnetheads do not exhibit distant migratory patterns, preferring warmer shallow coastal waters. Adults are documented from the mid-coast of Florida up to Cape Lookout. Feeding primarily on mollusks and crustaceans, bonnetheads are found over muddy and/or sandy bottoms. Bonnetheads have one of sharks' shortest gestation periods and reproduce annually with litters of 8 to 12 pups. A United States aquarium proved through deoxyribonucleic acid (DNA) testing, a female bonnethead underwent parthenogenesis (development of an embryo from an egg without male genetic contribution) giving birth to a healthy female pup. Bonnetheads are not a commercially targeted, but are a bycatch in gill netting fisheries (NMFS 2009b).

Smooth Dogfish Shark (*Mustelus canis*): A common coastal species, smooth dogfish sharks are found from Massachusetts to Argentina. Smooth dogfish are normally found on continental shelves in water depths down to approximately 500 ft. Wintering offshore of North Carolina and the Chesapeake Bay, smooth dogfish are migratory species responding to water temperatures and moving along the east coast as bottom waters warm. Smooth dogfish prey on invertebrates focusing on crabs; but also consume lobsters, menhaden, porgies, puffers, and wrasses. Mating occurs between May and September with an 11 to 12 month gestation period, producing 3 to 18 pups per litter. Marsh creeks are very important nursery areas for newborns during the summer months and YOY grow rapidly before migrating out of the estuaries in late fall (NMFS 2010).

Within a 2010 Final EIS, NOAA proposed the inclusion of smooth dogfish shark under NOAA's Fisheries Service management beginning in 2012. This action would require recreational and commercial fishermen obtain federal fishing permits for smooth dogfish before the 2012 season (NOAA 2010).

<u>Potential Project Effects on the Highly Migratory Species</u>

Several specific HMS (sharks) life stages use the CFR Inlet for access into the estuaries and up the CFR. Potential significant effects on Atlantic HMS would be unlikely as a result of dredging operations. Many of these species life stages utilize offshore habitats; however, some species do utilize the nearshore and inshore waters during their YOY and juvenile stages. Many HMS species have YOY, juvenile, and adult EFH designations over North Carolina's continental shelf areas. North Carolina's estuarine SAVs, creeks, and oyster rocks are considered nursery areas for many HMS YOY and juveniles (NMFS 2010). Dredging may have minimal effects on the area's estuarine/riverine water column; however, significant effects to these species would not be anticipated. These potential effects could result from potential interference with the dredging equipment as certain shark species' YOY migrate inside to nursery areas including SAVs, coastal creeks, and estuarine/riverine muddy/sandy bottoms. Potential YOY and juvenile effects may occur during dredging operations; however, the timing would significantly limit potential effects and are further lessened by the species' ability to avoid water column and bottom disturbances. The deepening of the shallow unvegetated mud bottom by dredging could result in the loss of foraging area, albeit minimally.

Mechanical dredging could have potential indirect effects on proximal soft bottoms, wetland fringes and downstream water columns each providing potential pathways and foraging habitats for potential shark juveniles and adults. Potential turbidity effects on these managed species and habitats would not be anticipated. The spatial and temporal extents of dredging, as well as good engineering/best management practices would minimize the potential for effects on managed shark species within the CFR and near the POW.

9.0 ASSOCIATED SPECIES

Associated species occur in conjunction with the EFHs, managed species, as well as marine mammals. These living resources would include primary prey species and other flora and fauna occupying EFHs or nearby habitats. A potential for effects on associated species would be a tidally migrating sediment dispersion plume and temporary loss of benthic foraging areas.

The benthic community reflects an area's general condition; whereas, the epibenthic community provides insight to fishery species migrations and movements. There are predator benthic species, yet most found in the CFR system are facultative or obligate detritivores or herbivores. These taxa are important food resources for many juvenile fish in estuarine/riverine systems (Mallin et.al. 2000). Epibenthic sampling sleds indicate several species such as Atlantic croakers and spot move into the area of the POW during late winter and early spring. These fish species rely on benthic food resources and their arrivals coincide with a high abundance of some benthic and epibenthic organisms (Mallin et. al. 2000).

Many commercial and/or recreational fish species would be included as associated species. The project area is within a spawning area as delineated in 15A NCAC 03R .0115 and 15A NCAC 10C .0603 Anadromous Fish Spawning Areas. The NCWRC and NCMFC have designated most of the CFR's mainstem as a Primary and an Inland PNA (Deaton et.al. 2010) (Figures 5, 6, and 7). The ASMFC oversees and manages many of these commercially and recreationally important anadromous species such as American shad (*Alosa sapidissima*), alewife, hickory shad (*A. mediocris*) and blueback herring (*A. aestivalis*) (ASMFC 2012a). The above-mentioned species represent the common taxa found in the epibenthic sampling; however, a total of 150 taxa have been identified from the CFR epibenthic sampling (Mallin et.al. 2000).

<u>Protected Anadromous Species</u>

There are two anadromous fish species potentially found within the proposed dredging area which are protected under the Endangered Species Act.

Shortnose Sturgeon (*Acipenser brevirostrum*)

The shortnose sturgeon inhabits large Atlantic coast rivers from the St. Johns River in northeastern Florida to the St. John River in New Brunswick, Canada. Shortnose sturgeons occur primarily in slower moving rivers or nearshore estuaries associated with large river systems. Adults in southern rivers are estuarine anadromous, foraging at the freshwater-saltwater interface and moving upstream to spawn in the early spring. Shortnose sturgeons spend most of their life in their natal river systems and rarely migrate to marine environments. Spawning habitats include river channels with gravel, gravel/boulder, rubble/boulder, and gravel/sand/log substrates. Spawning in southern rivers begins in later winter or early spring and lasts from a few days to several weeks. Juveniles typically move upstream during the spring and summer and downstream during the winter, with movements occurring above the freshwater-saltwater interface. In southern rivers, both adults and juveniles are known to congregate in cool, deep thermal refugia during the summer. Shortnose sturgeons are benthic omnivores, feeding on crustaceans, insect larvae, worms, and mollusks. Juveniles randomly vacuum the bottom and consume mostly insect larvae and small crustaceans. Adults are more selective feeders, feeding primarily on small mollusks (NMFS 1998).

Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

On 6 February 2012, the NMFS published the Final Listing Rules for five distinct Atlantic sturgeon population segments along the Atlantic Coast (77 FR 5914, 77 FR 5880). The New York Bight, Chesapeake Bay, Carolina, and South Atlantic distinct population segments were listed as endangered; and the Gulf of Maine distinct population segment was listed as threatened. The historic range of the Atlantic sturgeon included estuarine and riverine systems from Labrador, Canada to the St. Johns River in Florida. The historical distribution in the United States included approximately 38 rivers from the St. Croix River in Maine to the St. Johns River in Florida, including spawning populations in at least 35 rivers. The current distribution in the United States includes 35 rivers, with spawning known to occur in at least 20 rivers. Atlantic sturgeons spawn in freshwater, but spend most of their adult life in the marine environment. Spawning adults generally migrate upriver in the spring/early summer. A fall spawning migration may also occur in some southern rivers. Spawning is believed to occur in flowing water between the salt front and fall line of large rivers. Post-larval juvenile sturgeons move downstream into brackish waters, and eventually move to estuarine waters where they reside for a period of months or years. Subadult and adult Atlantic sturgeons emigrate from rivers into coastal waters, where they may undertake long range migrations. Migratory subadult and adult sturgeons are typically found in shallow (33-164 ft) near shore waters with gravel and sand substrates. Although extensive mixing occurs in coastal waters, Atlantic sturgeons return to their natal river to spawn (ASSRT 2007).

<u>Potential Project Effects on Protected Sturgeons</u>

Between 1990 and 2007, dredging operations along the North Atlantic Coast and South Atlantic Coast resulted in the take of 11 Atlantic sturgeons and 11 shortnose sturgeons. All of the shortnose sturgeon takes occurred in rivers along the North Atlantic Coast (Delaware River and Kennebec River). Shortnose sturgeons were taken by cutterhead (5), hopper (5) and clamshell (1) dredges. Atlantic sturgeon takes included two along the North Atlantic Coast and nine along the South Atlantic Coast. Atlantic sturgeons were taken by hopper (9) and clamshell (2) dredges (USACE 2008). A clamshell/bucket dredge is proposed to be used for dredging. It is important to note that the proposed dredging areas within unvegetated soft bottom and tidal marsh habitats do not contain gravel, rubble, or high percentages of sand. Considering the sturgeons' mobility, the affected area's small size, and the availability of alternative foraging habitat; significant effects on sturgeons are not anticipated. Dredging could have potential indirect effects on proximal soft bottoms, wetland fringes and downstream water columns; each providing potential pathways and foraging habitats for potential sturgeon juveniles and adults. Significant turbidity and bottom effects on these protected species and habitats would not be anticipated. The minimal spatial and temporal extent of dredging as well as good engineering/best management practices would minimize the potential for effects on protected sturgeon species within the CFR and near the POW.

The loss of shallow water mud bottom habitat due to deepening could temporarily affect higher trophic levels' foraging patterns in a localized area. Dredging activities would temporarily increase turbidity levels within the action area. Turbidity can affect light scattering which can impede fish predation (Benfield 1996). Both juvenile and adult fish are primarily visual feeders. Consequently, the visual effects of turbidity as outlined above would apply. Suspended sediment can impair feeding ability by clogging the gill rakers' inter-raker space or the mucous layers of filter feeding species (Gerking 1994). However, because these fish have the ability to migrate away from dredging activities then potential temporary effects from turbidity plumes would be minimal. Consequently, dredging operations would have minimal effects on juvenile and adult managed and non-managed fish in the area. The reduction in benthic epifaunal and infaunal prey in the immediate proposed dredging area would have minimal and short-term effects on juvenile and adult fishes. These lifestages can migrate to, and forage in, adjacent locations that are not within the active dredged area. Installation of the toe wall through pile driving would likely deter any sturgeon from coming close to the barge and construction area due to acoustic noise emitted by the pile driving equipment.

Dredging could have potential indirect temporary effects on proximal soft bottoms, wetland fringes and downstream water columns, each providing potential pathways and foraging habitats for associated species. Significant turbidity effects on these associated species and habitats would not be anticipated. The minimal spatial and temporal extents of dredging, as well as good engineering/best management practices would minimize the potential effects on associated species within the CFR and the POW.

10.0 CONSERVATION MEASURES

The NCSPA at the POW have successfully managed dredging projects for many years with strict adherence to environmental windows (unless high shoaling rates resulted in necessity to dredge), permit conditions, use of best management practices, and permit required monitoring. No known incidental takes of sturgeon species have occurred during dredging operations.

For this proposed project, the POW is asking for approval to dredge 17.76 acres of shallow and deeper unvegetated mud bottom EFH and 1.4 acres of tidal marsh EFH habitat, and construct a toe wall along the eastern side of the basin, located within PNA and an HAPC for some managed species groups. This will result in the loss of foraging habitat for juvenile lifestages of some managed species and associated species. Indirect effects will be limited to altering fish movements during dredging, short-term effects of the water column EFH and managed species due to generation of higher sediment loads and turbidity during dredging.

The NCSPA has offered the following conservation/mitigation measures to compensate for unavoidable effects and habitat loss associated with the proposed project and to avoid or minimize effects on EFH resources, managed species, and associated species. These measures include creation of tidal marsh off Shellbed Island in the lower CFR and payment of $650,000 towards construction of the Lock and Dam #1 Fish Passage modification on the CFR. Along with the funds already appropriated, this will allow for completion of all services needed to construct the fish passage modification project within two years*.* ***The latter measure is only proposed as an incentive to NMFS to provide a Biological Opinion for Section 7 consultation in less than 120 days from the initial date of application (26 October 2018***). A brief description of each measure is provided below. More detailed information on the marsh creation can be found in the Mitigation Plan, submitted as a separate document.

10.1 Mitigation/Conservation Measures

Tidal Wetland Creation
To compensate for the unavoidable loss of 1.4 acres of tidal wetlands on the Kinder Morgan property the applicant proposes to create three acres of marsh adjacent to Shellbed Island in the lower CFR. This site has been selected due to the high probability of success and as additional augmentation to ongoing oyster restoration in the same location by Audubon North Carolina (funded by the United States Fish and Wildlife Service and the National Fish and Wildlife Foundation). *Spartina alterniflora* marsh will be planted in 12 0.25 acre patches within the shallow intertidal flats adjacent to the island and within the patchwork of proposed new oyster reefs. Design will include planting 4-inch plugs of *S. alternaflora* two-foot on center within each of the 12 planting sites.

In the event the oyster reef restoration project does not obtain approval by early next summer the wetland sites will be sited landward of the existing oyster reefs which will serve to dampen any wave activity. A total of 12 *S.alterniflora* planting areas will be installed within six months of receipt of required permits for the project. If stabilization is needed, bags of staked oyster shells will be placed along the windward side of the planting areas. A full description of the affected wetlands, North Carolina Wetlands Assessment Method functional assessment, mitigation requirements, success criteria and a three-year monitoring plan proposed for the mitigation project are included in the separate Mitigation Plan document (DC&A 2018).

Donation of Funds for Construction of Lock and Dam #1 Fish Passage Modification

The NCSPA will donate $650,000 towards construction of the proposed modification to the Lock and Dam #1 Rock Ramp Fish Passage project if the NMFS can provide their Biological Opinion no later than 120 days from receipt of the application by the Wilmington District Corps of Engineers. This amount will fulfill the total cost required to move forward with construction in 2019. The project redesign will enhance the rock structures and increase the success rate for striped bass and other anadromous species to move through the rock ramp and above the dam. Funds will be provided to the NCDEQ for their use in contracting the construction of the project.

Conservation measures to avoid and or minimize additional effects on managed and associated species within their associated EFH in the project area includes the following:

- Turbidity booms would be deployed around dredging and pumping operations at all times to minimize movement of suspended sediments and turbidity.
- Turbidity booms would be monitored by the POW to ensure compliance with the above requirement.
- Best management practices would be used throughout construction to minimize turbidity and any indirect effects on managed and associated species.
- Due to the performance of mechanical dredging during the higher activity and migration period of the year for sturgeons, the applicant agrees to place an observer on the clamshell barge to observe for sturgeons either entrained in the bucket dredge or injured/killed during dredging. Weekly reports would be provided to the NCDENR and the NMFS as to weekly observations.

11.0 CONCLUSIONS

The proposed project, including dredging of 17.76 acres of softbottom habitat and 1.4 acres of tidal marsh, will result in the deepening of 1.68 acres of existing shallow water mud bottom EFH habitat located within state designated PNA, also considered a HAPC for some managed species (Figure 3). This will result in the loss of a portion of shallow water foraging habitat present along the Kinder Morgan Terminal to meet the NCSPA purpose and need for the project. A number of managed, associated, and prey species likely use this are for foraging activities during their juvenile and adult lifestages. However, this represents a very small amount of the available shallow water soft bottom habitat present in the lower CFR estuary. The newly dredged area can be used for foraging, however its depth, lack of light, and operational use by vessels will result in a less productive benthic community than presently resides at the present depth. While construction of the toe wall at -10 ft MLLW elevation will not result in any adverse effect on the water column, unvegetated mud bottom, or tidal marsh EFHs present at this site, dredging below and above the wall will. Adult and most juvenile fish can avoid the dredging operations. Managed invertebrate species population occurring here may be adversely effected during dredging; however, most being motile can escape the clamshell/bucket grab.

The potential indirect effects on the estuarine/riverine water column, tidal marsh and unvegetated mud bottoms would be spatially and temporally minimized through use of turbidity barriers around all dredging and pumping operations. There are no SAVs, shellfish, or hardbottom habitat located within the proposed action area. A variance request for dredging in PNA has been submitted as part of the application package to the NCDENR/CRC.

Conservation/mitigation measures have been proposed which includes the creation of 3.0 acres of tidal marsh in the lower CFR and the donation of $650,000 to NCDEQ for use in completing construction of the Lock and Dam #1 fish passage modification project. The latter is only offered if all permits and agency approvals can be completed in less than 120 days from the date of application (permits in hand by 1 April 2019). Other conservation measures include use of best management practices, good engineering practices, turbidity barriers, and project monitoring.

12.0 REFERENCES

Anamar Environmental Consulting, Inc. 2010. Northeast Cape Fear River Turning Basin and North Carolina State Port Authority Maintenance Dredging Wilmington Harbor, North Carolina. Evaluations Pursuant to Section 103 Marine Protection, Research and Sanctuaries Act of 1972, as Amended. August 2010

Atlantic States Marine Fisheries Commission (ASMFC). 2012a. 1050 North Highland Street Suite 200A-N Arlington, VA 22201 Accessed March 2012. Available online at http://www.asmfc.org.

ASMFC. 2012b. Managed Species Red Drum, Species Profile. January 2010. Washington, D.C. Accessed March 2012. Available online at http://www.asmfc.org/speciesDocuments /SouthAtlanticSpecies/redDrum/redDrumProfile.pdf.

ASMFC. 2012c. Managed Species Bluefish, Species Profile. April 2011. Washington, D.C. Accessed March 2012. Available online at www.asmfc.org.

ASMFC. 2012d. Managed Species Summer Flounder, Habitat Fact Sheet. Washington, D.C. Accessed March 2012. Available online at www.asmfc.org.

ASMFC. 2012e. Managed Species Summer Flounder, Species Profile. September 2008. Washington, D.C. Accessed March 2012. Available online at www.asmfc.org.

ASMFC. 2012f. Managed Species Red Drum, Habitat Fact Sheet, Life History and Habitat Needs. Washington, D.C. Accessed March 2012. Available online at http://www.asmfc.org/speciesDocuments/southAtlanticSpecies/redDrum/redDrumHabitatFactsheet.pdf.

ASMFC. 2012g. Managed Species Spanish Mackerel, Species Profile. August 2006. Washington, D.C. Accessed March 2012. Available online at www.asmfc.org.

ASMFC. 2012h. Managed Species Spanish Mackerel, Habitat Fact Sheet. Washington, D.C. Accessed March 2012. Available online at www.asmfc.org.

ASMFC. 2012i. Managed Species Black Sea Bass, Species Profile. August 2009. Washington, D.C. Accessed March 2012. Available online at www.asmfc.org.

ASMFC. 2012j. Managed Species Black Sea Bass, Habitat Fact Sheet, Life History and Habitat Needs. Washington, D.C. Accessed March 2012. Available online at www.asmfc.org.

Atlantic Sturgeon Status Review Team (ASSRT). 2007. Status Review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007.

Benfield, M.C. and T.J. Minello. 1996. Relative effects of turbidity and light intensity on reaction distance and feeding of an estuarine fish. Environmental Biology of Fishes 46:211-216.

Bohlen, W. 2002. Gravitational Flows and the Dispersion of Dredged Resuspended Sediments: The Forgotten Factor? University of Connecticut, Department of Marine Sciences. Accessed February 2012. Available online at http://massbay.mit.edu/marinecenter/conference/abstracts01.html

Burton, L.M. 2000. Age, growth, and mortality of gray snapper, *Lutjanus griseus*, from the east coast of Florida. Coastal Fisheries and Habitat Research. National Marine Fisheries Service. Beaufort, North Carolina. November 2000. Available online at http://fishbull.noaa.gov/992/bur.pdf.

Case, S. 2007. Salt Water Fish, Channel Bass. NCpedia. June 1, 2007. Accessed March 2011. Available online at http://ncpedia.org/symbols/saltwaterfish.

Challinor, John S.A. 2000. "Scoping the assessment of sediment plumes from dredging." Construction Industry Research and Information Association. CIRIA Publication C547. Accessed February 2012. Available online at http://www.goodmarine.com /article.aspx?id=18&navid=5.

Cortés, E. 2002. Sustainable Fisheries Division Contribution SFD-01/02-152. National Marine Fisheries Service Southeast Fisheries Science Center Panama City Laboratory. Panama City, FL. March 2002. Accessed March 2012. Available online at http://www.nmfs.noaa.gov/sfa/hms/SCS_assessment_rev2.pdf.

Deaton, A.S., W.S. Chappell, K. Hart, J. O'Neal, B. Boutin. 2010. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources. Division of Marine Fisheries, NC. 639 pp.

Dial Cordy and Associates Inc. (DC&A). 2015. Biological Assessment, Relocation of Liquid Bulk Pier and Widening of the Turning Basin, Port of Wilmington, Wilmington, North Carolina. Report prepared for North Carolina State Ports Authority.

Fish4Fun. 2011. Fish Species, Cobia. Jacksonville, Florida. Accessed March 2012. Available online at www.fish4fun.com/cobia.htm.

Gerking, S.D. 1994. Feeding Ecology of Fish. Academic Press, San Diego, CA. 416 pp.

Grober, L.E. 1992. The Ecological Effects of Beach Replenishment. Master's thesis, Duke University, Durham, NC, 88 p.

Gulf of Mexico Fishery Management Council and South Atlantic Fishery Management Council. 1983. Fishery Mgt Plan, Final Enviro. Impact Statement Regul. Impact Review Final Regulations For Coastal Pelagic Resources (Mackerels) In The Gulf of Mexico and South

Atlantic Region. February 1983. Available on line at http://www.safmc.net /Portals/6/Library/FMP/Mackerel/MackerelFMP.pdf.

Law Engineering and Environmental Services, Inc. (LAW). August 1998. Agitation Sled Dredging Water Quality Assessment Berth 1 and 2, Port of Wilmington. Report Date 18 August 1998; Sample Events 6-7 July 1998 and 11-12 July 1998.

LAW. January 1999a. Agitation Sled Dredging Water Quality Assessment Berth 1 and 2, Port of Wilmington. Report Date 1 January 1999; Sample Dates 16-20 November 1998, 3 December 1998, and 5 December 1998.

LAW. February 1999b. Agitation Sled Dredging Water Quality Assessment Berth 1 and 2, Port of Wilmington. Report Date 4 February 1999; Sample Dates 14-15 January 1999.

LAW. February 1999c. Agitation Sled Dredging Water Quality Assessment Berth 1 and 2, Port of Wilmington. Report Date 18 February 1999; Sample Dates 1-2 February 1999.

LAW. March 1999d. Agitation Sled Dredging Water Quality Assessment Berth 1 and 2, Port of Wilmington. Report Date 8 March 1999; Sample Date 27 February 1999.

LAW. June 1999e. Agitation Sled Dredging Water Quality Assessment Berth 1 and 2, Port of Wilmington. Report Date 7 June 1999; Sample Dates 17-20 May 1999 and 24-27 May 1999.

LAW. August 1999f. Agitation Sled Dredging Water Quality Assessment Berth 1 and 2, Port of Wilmington. Report Date 25 August 1999; Sample Dates 9-13 August 1999.

Mallin. A. Michael, M. H. Posey, M. R. McIver, S. H. Ensign, T. Alphin, M. Williams, M. Moser, and J. Merritt. 2000. Environmental Assessment Of The Lower Cape Fear River System, 1999-2000. 4.0 Benthic Community Patterns in the Lower Cape Fear River System. Center for Marine Science, University of North Carolina at Wilmington. Accessed March 2012. Available on line at http://www.uncw.edu/cms/aelab/LCFRP/ and http://www.uncw.edu/cms/aquaticecology/Laboratory/LCFRP/WQ%20Reports/99-00/Report.htm

Mallin, M. A., M.H. Posey, T.E. Lankford, M.R. McIver, S.H. Ensign, T.D. Alphin, M.S. Williams, M.L. Moser, and J.F. Merritt. 2001. Environmental Assessment Of The Lower Cape Fear River System, 2000-2001. Center for Marine Science Research, University of North Carolina at Wilmington. Accessed March 2012. Available on line at http://www.uncw.edu/cms/aelab/LCFRP/

Mercer, L. P., L.R. Phalen, and J.R. Maiolo. 1990. Fishery Management Plan For Spanish Mackerel, Fisheries Management Report No. 18 of the Atlantic States Marine Fisheries Commission Washington, DC. North Carolina Department of Environment, Health, and Natural Resources Morehead City, NC. and East Carolina University Department of Sociology and Anthropology Greenville, NC. November 1990. Accessed March 2012. Available online at www.asmfc.org.

Mid-Atlantic Fishery Management Council (MAFMC). 1990. Fishery Management Plan for the Bluefish Fishery, Prepared by Mid-Atlantic Fishery Management Council and the Atlantic State Marine Fisheries Commission in cooperation with the National Marine Fisheries Service, the New England Fishery Management Council, and the South Atlantic Management Council. Dover, Delaware. Updated February 2009; Accessed March 2012. Available online at www.mafmc.org/mid-atlantic/fmp/pdf/Bluefish_FMP.pdf.

MAFMC. 2011. Suite 201, 800 N. State St Dover, Delaware. Updated 1 March 2012; Accessed March 2012. Available online at http://mafmc.org/.

National Marine Fisheries Service (NMFS). 1998. Recovery Plan for the Shortnose Sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, MD.

NMFS. 2002. Stock Assessment of Small Coastal Sharks in the U.S. Atlantic and Gulf of Mexico

NMFS. 2006. Final Consolidated Atlantic Highly Migratory Species Fishery Management Plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. pp. 1600. July 2006. Accessed March 2012 and available online at http://www.nmfs.noaa.gov/sfa/hms/FMP/Consolidated_FMP.htm.

NMFS. 2009a. Our Living Oceans. Report on the status of U.S. Living Marine Resources', Appendix 2, 6th Edition. U.S. Department of Commerce. Accessed March 2012. Available online at http://spo.nwr.noaa.gov/olo99.htm.

NMFS. 2009b. Amendment 1 to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan Essential Fish Habitat Amendment 1 to the Consolidated HMS FMP Chapter 5 June 2009 64 Essential Fish Habitat. Silver Springs, MD. June 2009. Accessed March 2012. Available online at http://www.nmfs.noaa.gov/sfa/hms/EFH/index.htm and http://www.nmfs.noaa.gov/sfa/hms/EFH/Final/FEIS_Amendment_1_Chapter5.pdf#page=9.

NMFS. 2010. Final Amendment 3 to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan. Highly Migratory Species Management Division. Office of Sustainable Fisheries. National Marine Fisheries Service. Silver Spring, MD. March 2010. Accessed March 2012. Available online at http://www.nmfs.noaa.gov/sfa/hms/FMP/AM3_FEIS/Chapter_11.pdf.

National Oceanic and Atmospheric Administration (NOAA). 1983. Fishery Management Plan Final Environmental Impact Statement Regulatory Impact Review Final Regulations For The Coastal Migratory Pelagic Resources (Mackerels). Gulf and South Atlantic Fishery Management Councils (GSAFMC). Accessed March 2012. Available online at http://www.safmc.net/Library/CoastalMigratoryPelagicsMackerel/tabid/387/Default.aspx.

NOAA. 2010. Announces Measures to Rebuild Blacknose Sharks, Manage Smooth Dogfish and End Overfishing of Shortfin Mako Sharks. Silver Springs, MD. Press Release Date

19 March 2010. Accessed February 2012. Available online at http://www.nmfs.noaa.gov/mediacenter/docs/shark_release_031610.pdf.

NOAA. 2012a. Southeast Regional Office St. Petersburg, FL. Habitat Conservation Division, Essential Fish Habitat. Updated January 7, 2011. Accessed February 2012. Available online at http://sero.nmfs.noaa.gov/hcd/efh.htm.

NOAA. 2012b. Office of Habitat Conservation, Habitat Protection Division. Accessed February 2012. Available online at www.nmfs.noaa.gov/habitat/habitatprotection/efh/index_a.htm.

NOAA. 2012c. National Marine Fisheries Habitat Conservation/Habitat Protection. Silver Springs, Maryland. Accessed February 2012. Available online at http://www.habitat.noaa.gov/protection/efh/newInv/index.html. and http://ocean.florida.marine.org/efh_coral/pdfs/Habitat_Plan/HabitatPlan195-210.pdf#page=3.

NOAA. 2012d. EFH Text Descriptions & GIS Data Inventory, NOAA Habitat Program. Silver Springs, Maryland. Accessed February 2012. Available online at http://www.habitat.noaa.gov/protection/efh/newInv/index.html. and http://ocean.florida.marine.org/efh_coral/pdfs/Comp_Amend/EFHAmendSect4.0.pdf#page=17.

NOAA. 2012e. Office of Habitat Conservation, Habitat Protection Division South Atlantic, Black Sea Bass. Accessed February 2012. Available online at www.nmfs.noaa.gov/habitat/habitatprotection/efh/GIS_inven.htm.

NOAA. 2012f. Office of Habitat Conservation, Habitat Protection Division South Atlantic Snapper-Grouper (All Species). Accessed February 2012. Available online at www.nmfs.noaa.gov/habitat/habitatprotectionefh/GIS_inven.htm.

National Oceanic and Atmospheric Administration, Fisheries Service. 2010. Office of Sustainable Fisheries, Atlantic Highly Migratory Species. Silver Spring, Maryland. Accessed February 2012. Available online at http://www.nmfs.noaa.gov/sfa/hms/intro_HMS.htm.

National Research Council. 1985. Dredging Coastal Ports, An Assessment of the Issues. Marine Board, Commission on Engineering and Technical Systems, National Research Council. Washington D.C. 1985. Accessed March 2012. Available on line at http://www.nap.edu/openbook.php?record_id=608&page=117.

North Carolina Division of Water Resources. 2012. Cape Fear River Basin Water Supply Planning. Last modified 21 February 2012. Accessed February 2012. Available on line at http://www.ncwater.org/basins/Cape_Fear/.

North Carolina Fishery Management Plan for Shrimp. 2006. North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, April 2006. Morehead City, N.C. Accessed February 2012. Available online at www.ncfisheries.net/download/shrimpfmp2004finial.pdf.

North Carolina State Ports Authority. 2012. NCSPA Port Facilities, Port of Wilmington. Accessed February 2012. Available on line at http://www.ncports.com/port_of_wilmington_facilities.htm.

Northeast Fisheries Science Center (NEFSC). 1999. Essential Fish Habitat Source Document: Summer Flounder, *Paralichthys dentatus*, Life History and Habitat Characteristics. Woods Hole, Massachusetts. September 1999. Accessed March 2012. Available online at www.nefsc.noaa.gov/nefsc/publications/tm/tm151/tm151.pdf.

NEFSC. 2012a. Status of Fishery Resources off the Northeastern US, Resource Evaluation and Assessment Division. Woods Hole, Massachusetts. Modified March 2009, Accessed March 2012. Available online at http://www.nefsc.noaa.gov/sos/spsyn/fldrs/summer/.

NEFSC. 2012b. Status of Fishery Resources off the Northeastern US, Resource Evaluation and Assessment Division. Woods Hole, Massachusetts. Modified March 2009, Accessed March 2012. Available online at http://www.nefsc.noaa.gov/sos/spsyn/og/seabass/.

Riggs, S. R. and D.V. Ames. 2003. Drowning the North Carolina coast: sea level rise and estuarine dynamics. North Carolina Sea Grant, Raleigh, NC, 152p.

South Atlantic Fishery Management Council (SAFMC). 1998a. Final Habitat Plan for the South Atlantic Region: Essential Fish Habitat Requirements for Fishery Management Plans of the South Atlantic Fishery Management Council. The Shrimp Fishery Management Plan, The Red Drum Fishery Management Plan, The Snapper Grouper Fishery Management Plan, The Golden Crab Fishery Management Plan, The Spiny Lobster Fishery Management Plan, The Coral, Coral Reefs, and Live/Hardbottom Habitat Fishery Management Plan, The Sargassum Habitat Fishery Management Plan, and The Calico Scallop Fishery Management Plan. Charleston, South Carolina. Prepared by South Atlantic Fishery Management Council. October 1998. Copyright 2009. Accessed February 2012. Available online at www.safmc.net/Default.aspx?tabid=80.

SAFMC. 1998b. Final Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region: Amendment 3 to the Shrimp Fishery Management Plan, Amendment 1 to the Red Drum Fishery Management Plan, Amendment 10 to the Snapper Grouper Fishery Management Plan, Amendment 10 to the Coastal Migratory Pelagics Fishery Management Plan, Amendment 1 to the Golden Crab Fishery management Plan, Amendment 5 to the Spiny Lobster Fishery Management Plan, and Amendment 4 to the Coral, Coral Reefs, and Live/Hard Bottom Habitat Fishery Management Plan (Including a Final EA/SEISm RIR & SIA/FIS). Charleston, South Carolina. Prepared by South Atlantic Fishery Management Council. October 1998. Copyright 2009. Accessed March 2012. Available online at http://ocean.floridamarine.org/efh_coral/pdfs/Comp_Amend/EFHAmendSect4.0.pdf.

SAFMC. 2012a. Regulations by Species, Red Drum. Accessed March 2012. Available online at http://www.safmc.net/FishIDandRegs/RegulationsbySpecies/RedDrum/tabid/312/Default.aspx.

SAFMC. 2012b. Regulations by Species, Spanish Mackerel. Accessed March 2012. Available online at www.safmc.net/FishIDandRegs/FishGallery/SpanishMackerel/tabid/329/Default.aspx

SAFMC. 2012c Regulations by Species, King Mackerel. Accessed March 2012. Available online at http://www.safmc.net/FishIDandRegs/FishGallery/KingMackerel/tabid/297/Default.aspx.

SAFMC. 2012d. Regulations by Species, Cobia. Accessed March 2012. Available online at www.safmc.net/FishIDandRegs/FishGallery/Cobia/tabid/280/Default.aspx.

SAFMC. 2012e. Library, Snapper/Grouper. Accessed March 2012. Available online at http://www.safmc.net/Library/SnapperGrouper/tabid/415/Default.aspx.

SAFMC. 2012f. Regulations by Species, Black Sea Bass. Accessed March 2012. Available online at www.safmc.net/FishIDandRegs/FishGallery/BlackSeaBass/tabid/272/Default.aspx.

SAFMC. 2012g. Regulations by Species, Gag Grouper. Accessed March 2012 Available online at http://www.safmc.net/FishIDandRegs/FishGallery/GagGrouper/tabid/287/Default.aspx.

SAFMC. 2012h. Regulations by Species, Gray Snapper. Accessed March 2012. Available online at www.safmc.net/FishIDandRegs/RegulationsbySpecies/GraySnapper/tabid/291/Default.aspx.

SAFMC. 2012i. The Fishery Ecosystem Plan, Volume II South Atlantic Habitats and Species. Charleston, South Carolina. Accessed March 2012. Available online at http://www.safmc.net/ecosystem/Home/EcosystemHome/tabid/435/Default.aspx and http://www.safmc.net/Portals/0/FEP/VolII_SnapperGrouper.pdf.

SAFMC. 2012j. Regulations by Species, Sheepshead. Accessed March 2012. Available online at http://www.safmc.net/FishIDandRegs/FishGallery/Sheepshead/tabid/326/Default.aspx.

South Atlantic Fisheries Management Plan (SAFMP). 2003. South Atlantic Fishery Management Council. Fishery Management Plan for the Dolphin and Wahoo Fishery of the Atlantic Including a Final Environmental Impact Statement, Regulatory Impact Review, Initial Regulatory Flexibility Analysis, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council In Cooperation with the New England Fishery Management Council, Mid-Atlantic Fishery Management Council. JANUARY 2003. Charleston, South Carolina. Accessed March 2012. Available online at http://www.safmc.net/Portals/6/Library/FMP/DolphinWahoo/DolphinWahooFMP.pdf

SAFMP. 2004. South Atlantic Fishery Management Council. Final Amendment 6 to the Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region Including a Final Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, Social Impact Assessment/Fishery Impact Statement and Biological Assessment. December 2004. Charleston, South Carolina. Accessed March

2012. Available online at www.safmc.net/Portals/6/Library/FMP/Shrimp/ShrimpAmend6.pdf.

South Atlantic Region (SAR). 2008a. National Marine Fisheries Service Habitat Conservation Division; Southeast Regional Office. St. Petersburg, Florida. Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies. Revision Date August 2008. Accessed February 2012. Available online at http://sero.nmfs.noaa.gov/hcd/pdfs/efhdocs/sa_guide_2008.pdf.

SAR. 2008b. National Marine Fisheries Service Habitat Conservation Division; Southeast Regional Office. Summary of EFH Requirements for Species Managed by the South Atlantic Fishery Management Council Appendix 6. St. Petersburg, Florida. Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies. Revision Date August 2008. Accessed March 2012. Available online at http://sero.nmfs.noaa.gov/hcd/pdfs/efhdocs/sa_guide_2008.pdf.

Street, M.W., A.S. Deaton, W.S. Chappell, and P.D. Mooreside. 2005. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, NC. 656 pp.

U.S. Army Corps of Engineers. 2008. South Atlantic Regional Biological Assessment (SARBA) for Dredging Activities in the Coastal Waters, Navigation Channels [including designated Ocean Dredged Material Disposal Sites (ODMDS)], and Sand Mining Areas in the South Atlantic Ocean. U.S. Army Corps of Engineers, South Atlantic Division. September 2008

University of Florida (UoF). 2012a. Gainsville, Florida Museum of Natural History; Ichthyology. Biological Profiles; Cobia. Gainesville, Florida. Accessed March 2012. Available online at www.flmnh.ufl.edu/fish/gallery/Descript/Cobia/Cobia.html.

UoF. 2012b. Gainsville, Florida Museum of Natural History; Ichthyology. Biological Profiles; Gag Grouper. Gainesville, Florida. Accessed March 2012. Available online at http://www.flmnh.ufl.edu/fish/Gallery/Descript/GagGrouper/GagGrouper.html.

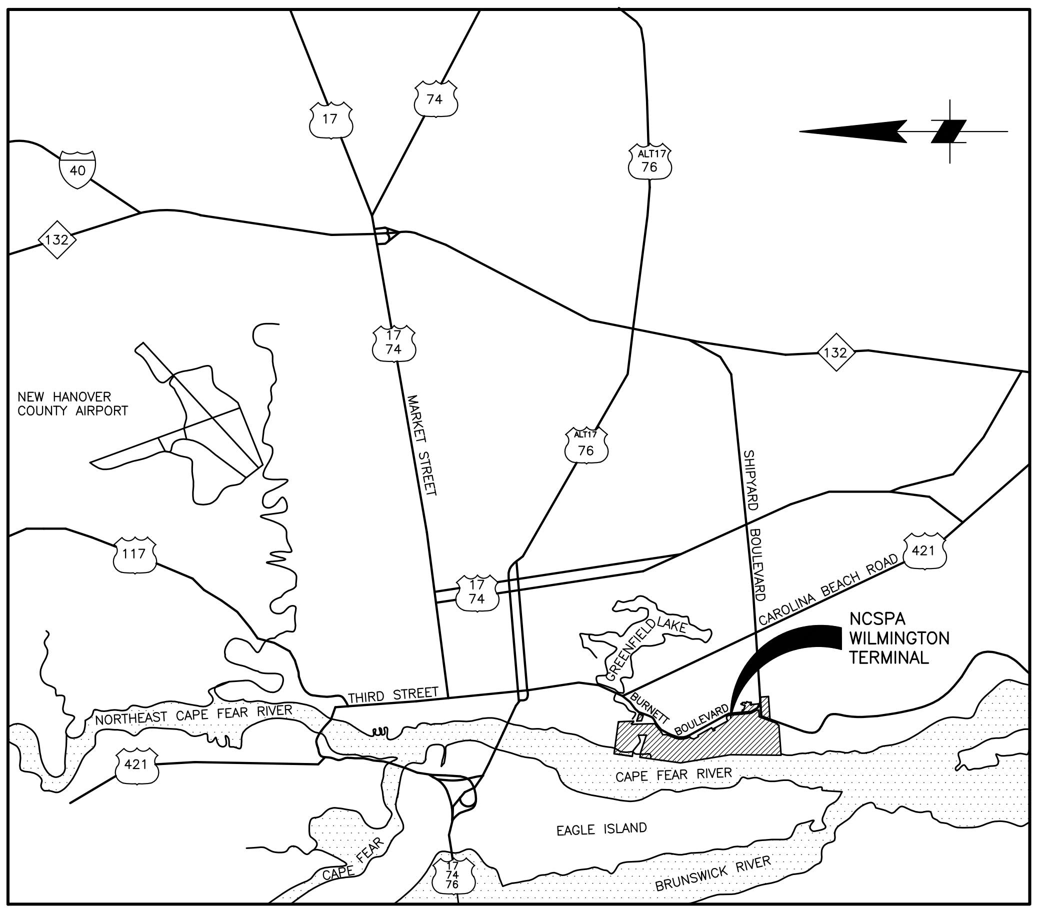
UoF. 2012c. Gainsville, Florida Museum of Natural History; Ichthyology. Biological Profiles; Crevalle Jack. Gainesville, Florida. Accessed March 2012. Available online at http://www.flmnh.ufl.edu/fish/Gallery/Descript/CrevalleJack/CrevalleJack.html.

UoF. 2012d. Gainsville, Florida Museum of Natural History; Ichthyology. Biological Profiles; Sheepshead. Gainesville, Florida. Accessed March 2012. Available online at http://www.flmnh.ufl.edu/fish/Gallery/Descript/Sheepshead/Sheepshead.html.

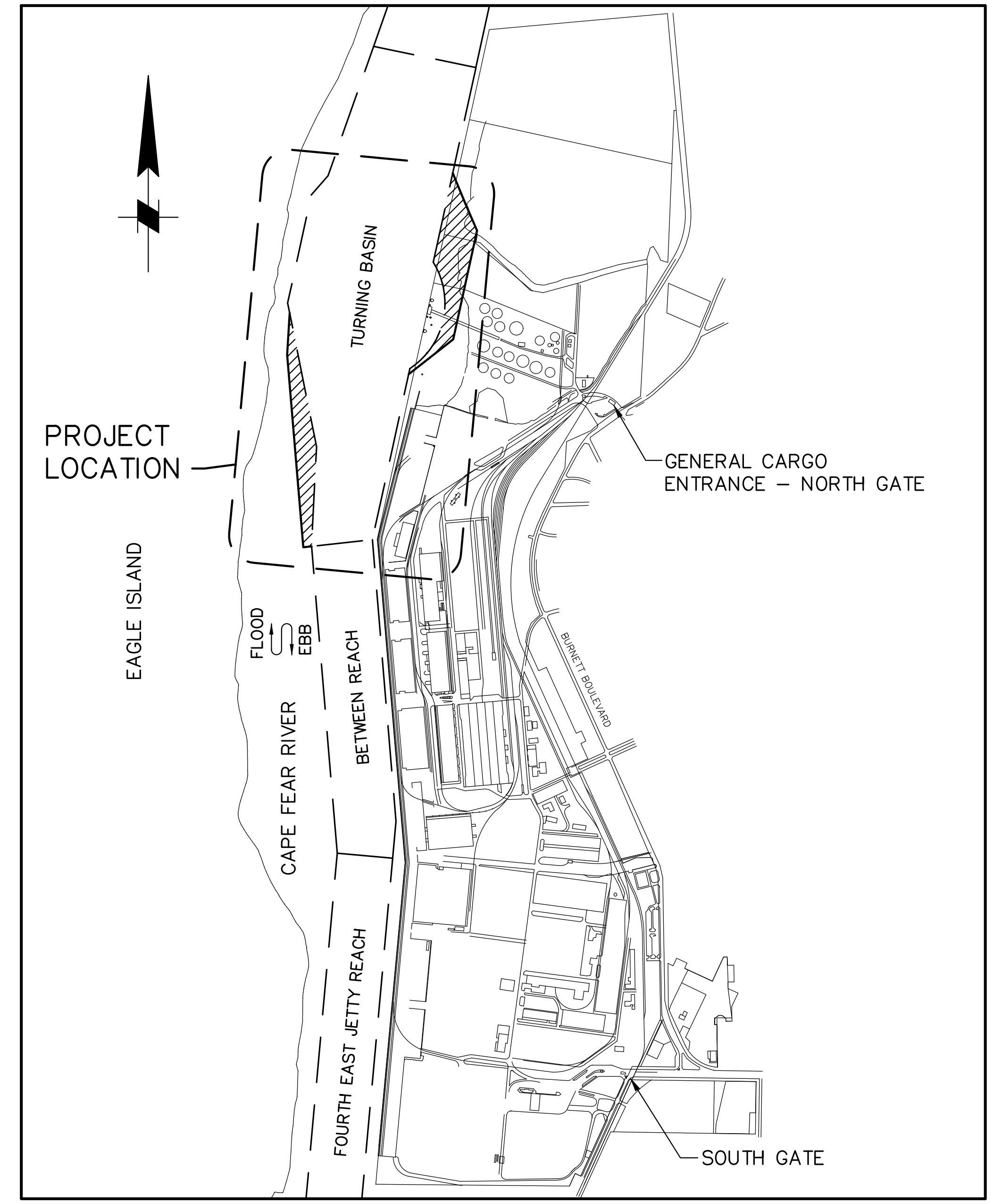
UoF. 2012e. Gainsville, Florida Museum of Natural History; Ichthyology. Biological Profiles; Finetooth Shark. Gainesville, Florida. Accessed March 2012. Available online at http://www.flmnh.ufl.edu/fish/Gallery/Descript/finetoothshark/finetoothshark.html.

APPENDIX A

Permit Plans/Drawings



VICINITY MAP
NOT TO SCALE



LOCATION MAP
NOT TO SCALE

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY WILMINGTON TERMINAL TURNING BASIN EXPANSION** *DATUM:* **MLLW** *PREPARED BY:* **MOFFATT & NICHOL**	*PREPARED FOR:* **NORTH CAROLINA STATE PORTS AUTHORITY** NORTH CAROLINA PORTS *DATE:* **OCTOBER 2018**	*SHEET TITLE:* **PROJECT VICINITY AND LOCATION MAP**	*SHEET* **1** *OF* **16**

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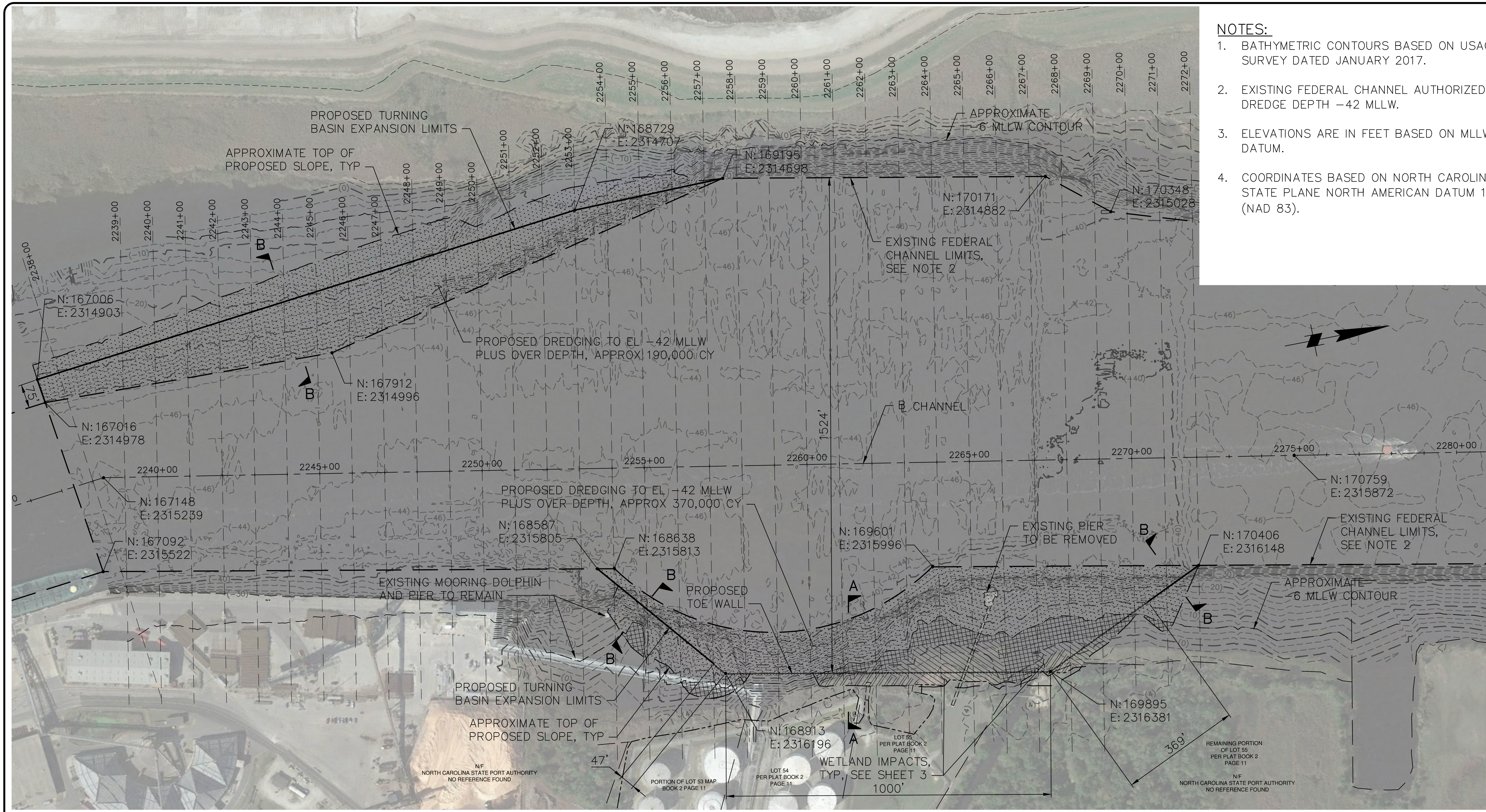


NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. EXISTING FEDERAL CHANNEL AUTHORIZED DREDGE DEPTH -42 MLLW.
3. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.
4. COORDINATES BASED ON NORTH CAROLINA STATE PLANE NORTH AMERICAN DATUM 1983 (NAD 83).

PROJECT SITE PLAN
1"=300'

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

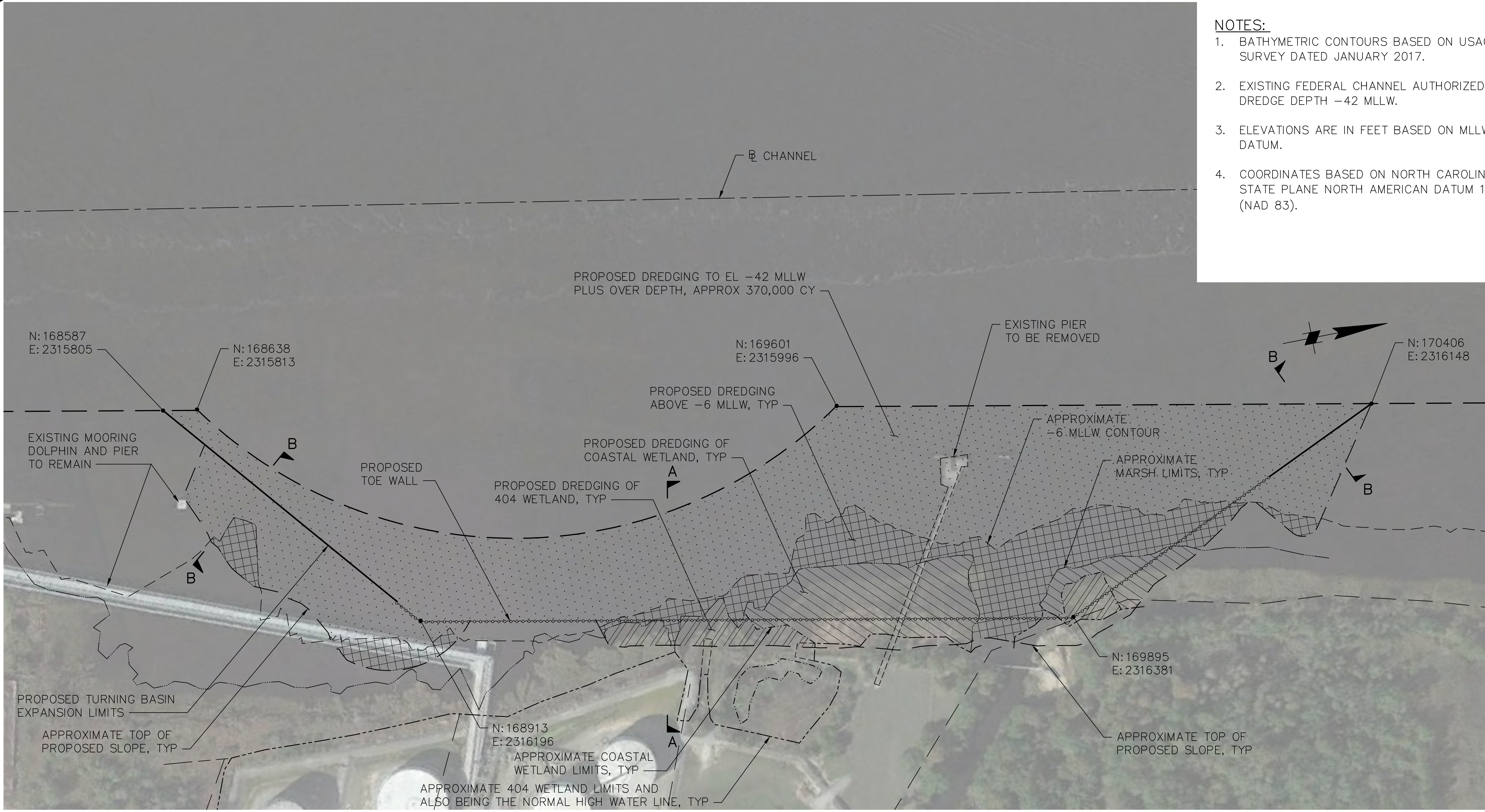
PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

DATE: **OCTOBER 2018**

SHEET TITLE: **PROJECT SITE PLAN**

0 150' 300'
1"=300'

SHEET **2** OF **16**



NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. EXISTING FEDERAL CHANNEL AUTHORIZED DREDGE DEPTH −42 MLLW.
3. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.
4. COORDINATES BASED ON NORTH CAROLINA STATE PLANE NORTH AMERICAN DATUM 1983 (NAD 83).

WETLAND IMPACT PLAN

1"=150'

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

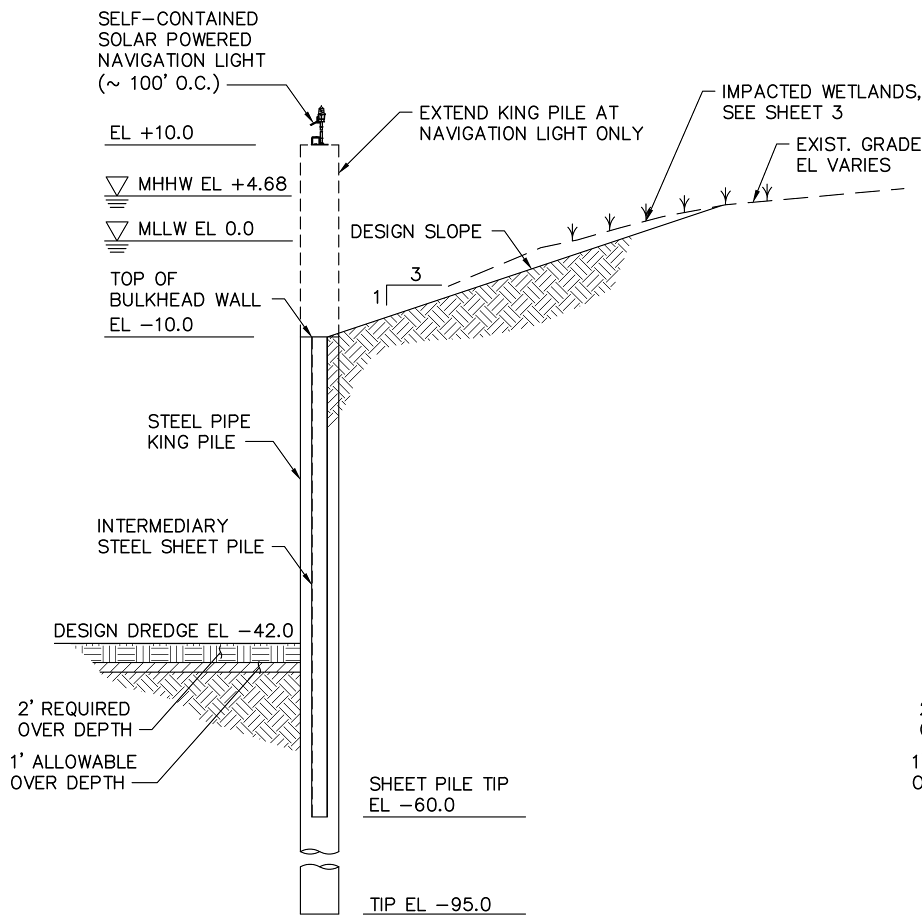
SHEET TITLE:

WETLAND IMPACT PLAN

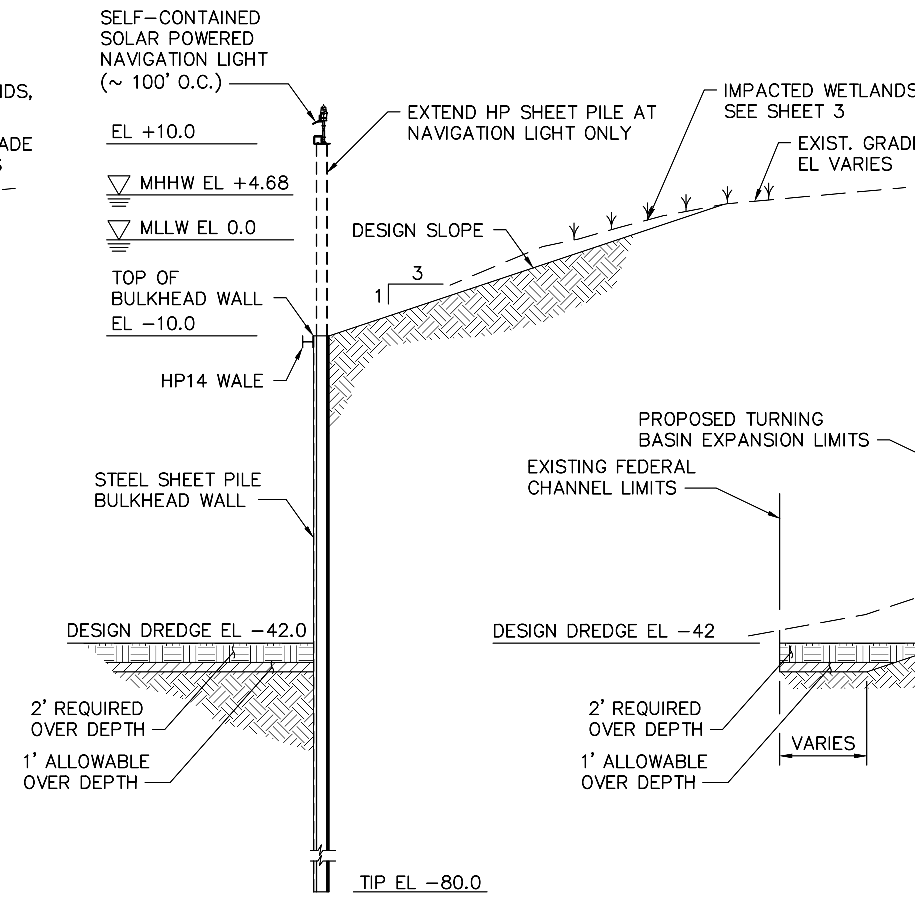
0 75' 150'
1"=150'

SHEET 3 *OF* 16

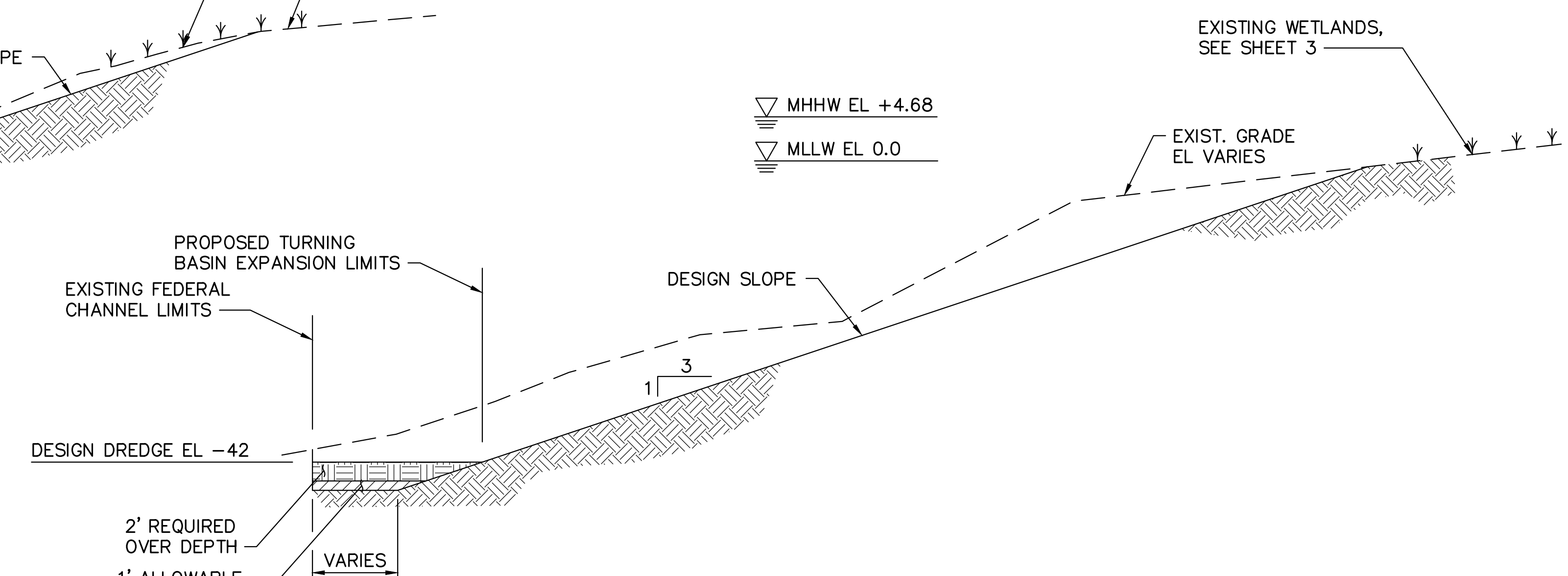
File: Q:\RA\9232-08\CADD_Active_Permit\923208-P03; Plotted: 10/24/2018 12:16 PM by KOONS, DAVE; Saved: 10/24/2018 10:52 AM by DKOONS



SECTION A–A
KING PILE WALL
1"=20'



SECTION A–A
SHEET PILE WALL ALTERNATIVE
1"=20'



SECTION B–B
1"=20'

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

SHEET TITLE:
TYPICAL SECTIONS

0 10' 20'
1"=20'

SHEET
4
OF
16

NOTES:
1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND
APPROXIMATE EXISTING GRADE
PROPOSED DREDGING

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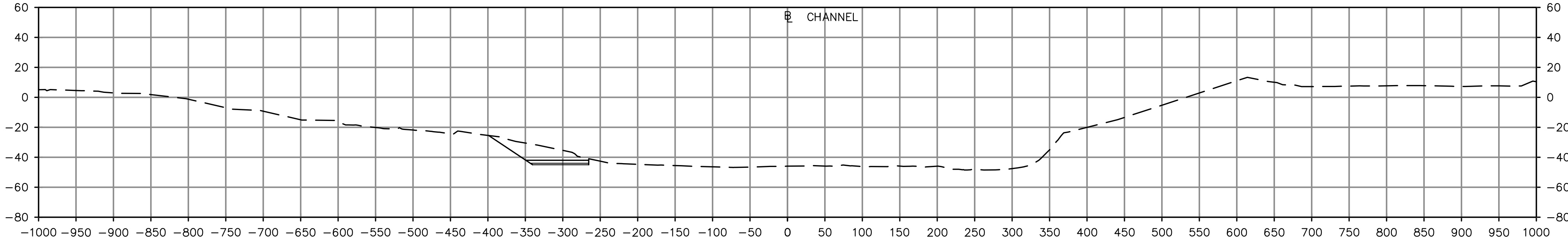

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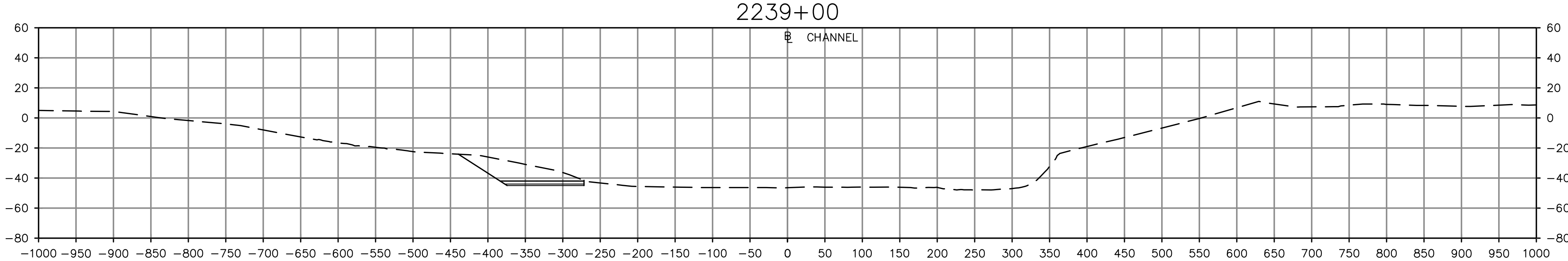

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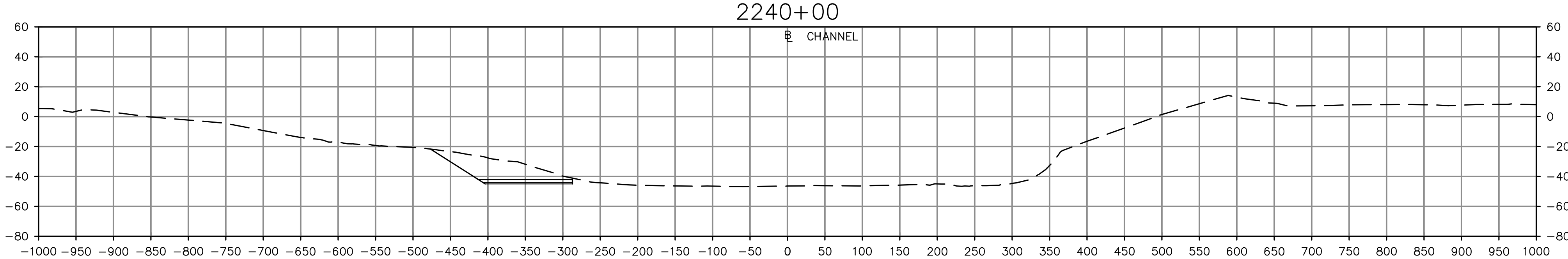

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY WILMINGTON TERMINAL TURNING BASIN EXPANSION**

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

SHEET TITLE: **CROSS SECTIONS 1 OF 12**

0 100' 200' 1"=200' HORIZONTAL

0 50' 100' 1"=100' VERTICAL

SHEET **5** OF **16**

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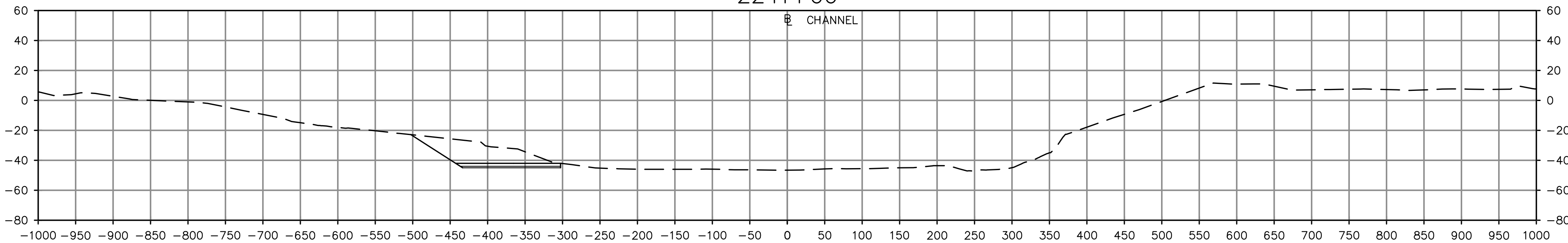
2241+00



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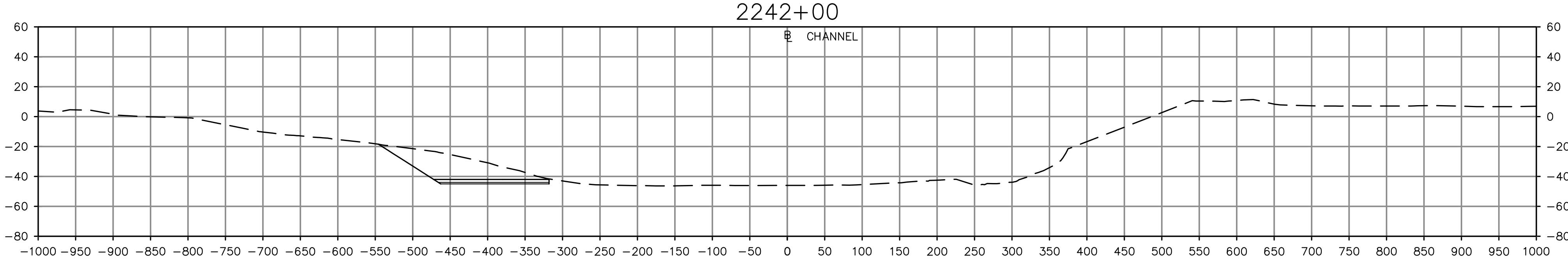

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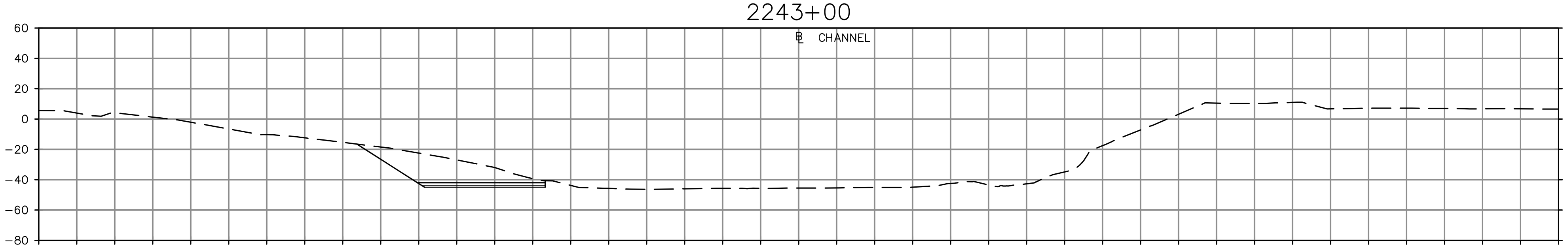


NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

— — — — — APPROXIMATE EXISTING GRADE

———————— PROPOSED DREDGING

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY WILMINGTON TERMINAL TURNING BASIN EXPANSION**

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

SHEET TITLE:

CROSS SECTIONS

2 OF 12

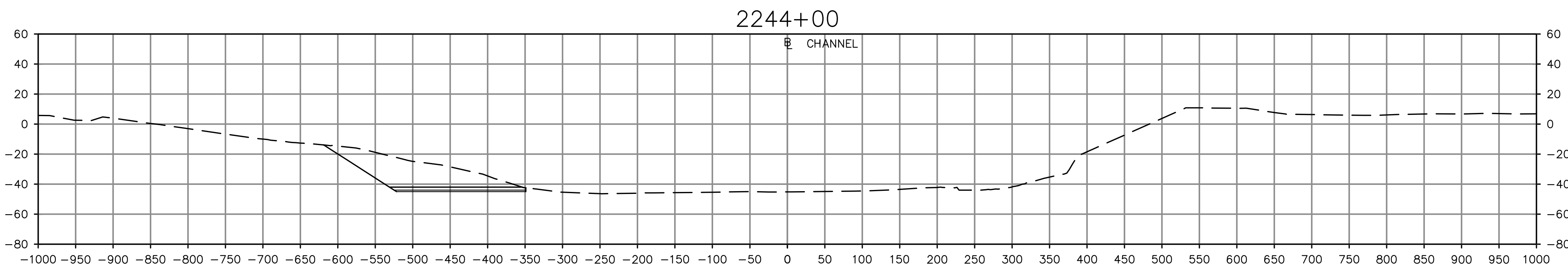
0 100' 200'

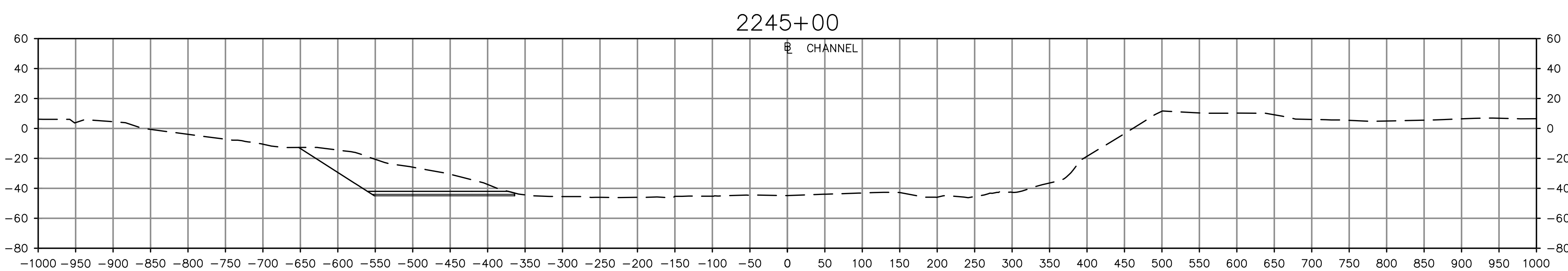
1"=200' HORIZONTAL

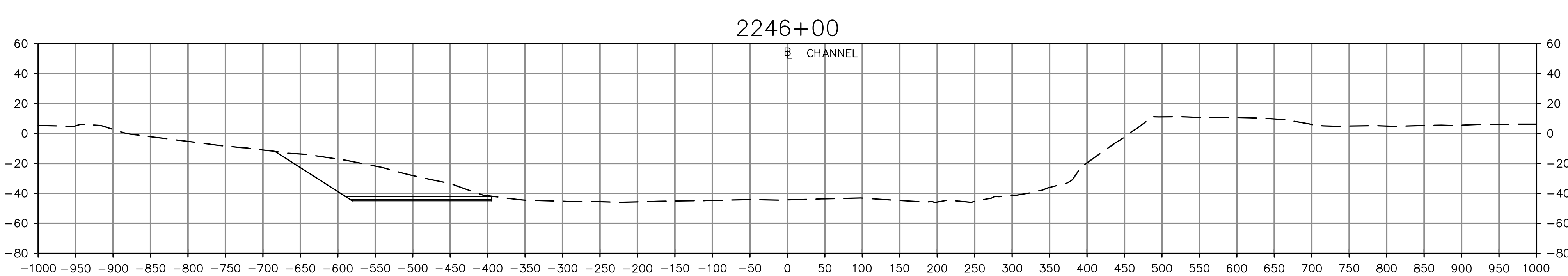
0 50' 100'

1"=100' VERTICAL

SHEET **5** *OF* **16**







NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

— — — — — — — APPROXIMATE EXISTING GRADE

——————— PROPOSED DREDGING

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

SHEET TITLE:
CROSS SECTIONS
3 OF 12

0 100' 200'
1"=200' HORIZONTAL

0 50' 100'
1"=100' VERTICAL

SHEET **7** *OF* **16**

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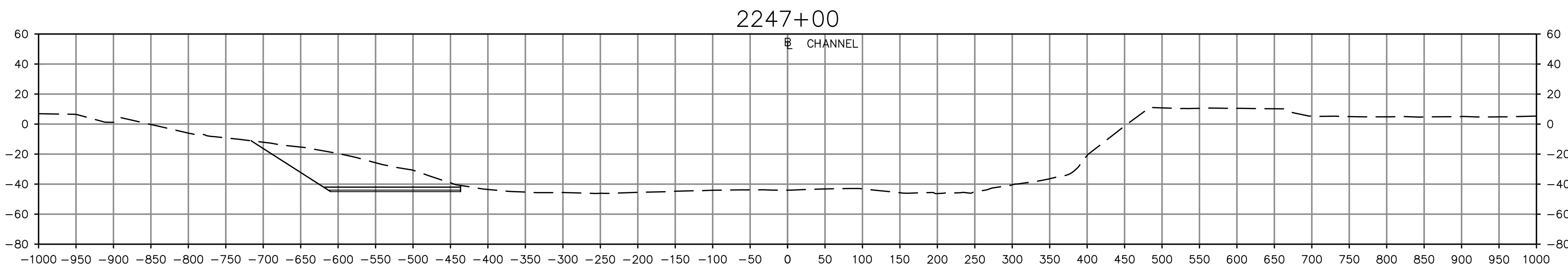

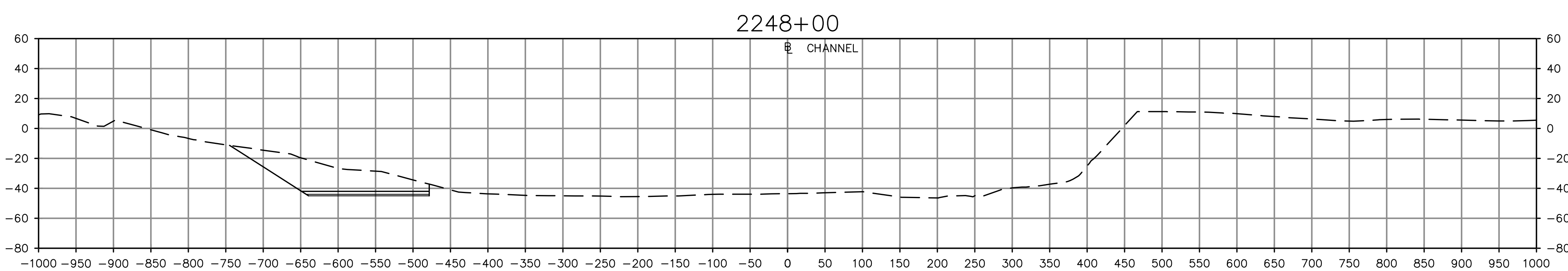

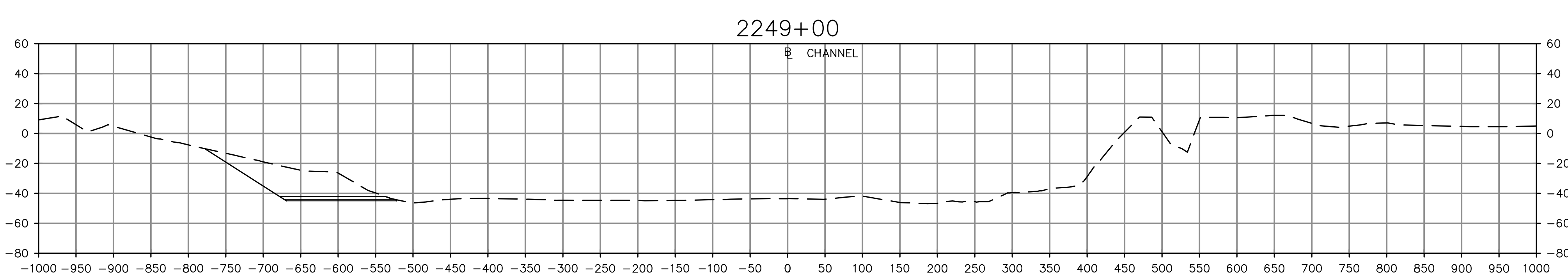

NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

APPROXIMATE EXISTING GRADE

PROPOSED DREDGING

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

SHEET TITLE:
CROSS SECTIONS
4 OF 12

0 100' 200'
1"=200' HORIZONTAL

0 50' 100'
1"=100' VERTICAL

SHEET **8** OF **16**

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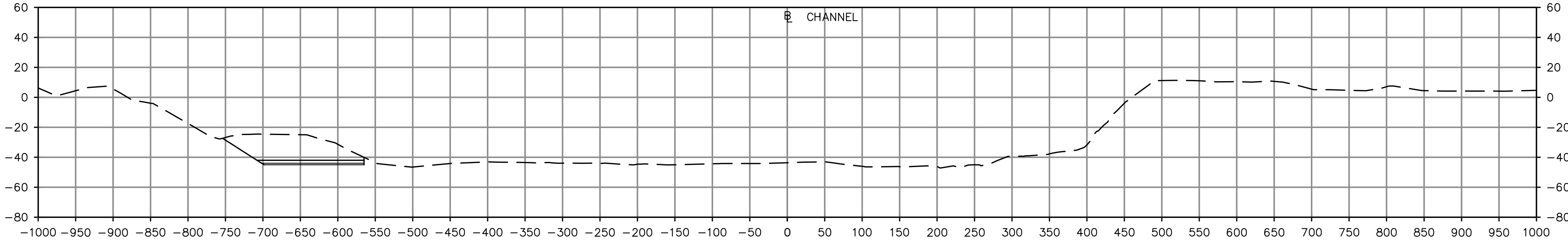
2250+00



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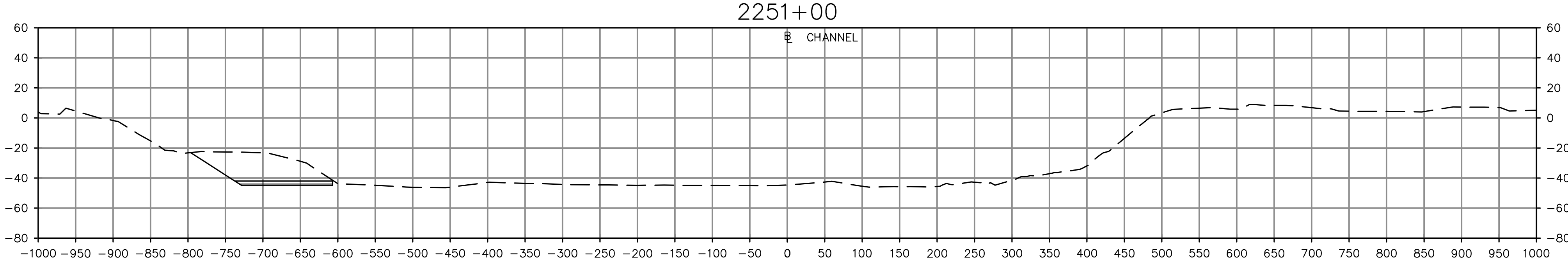

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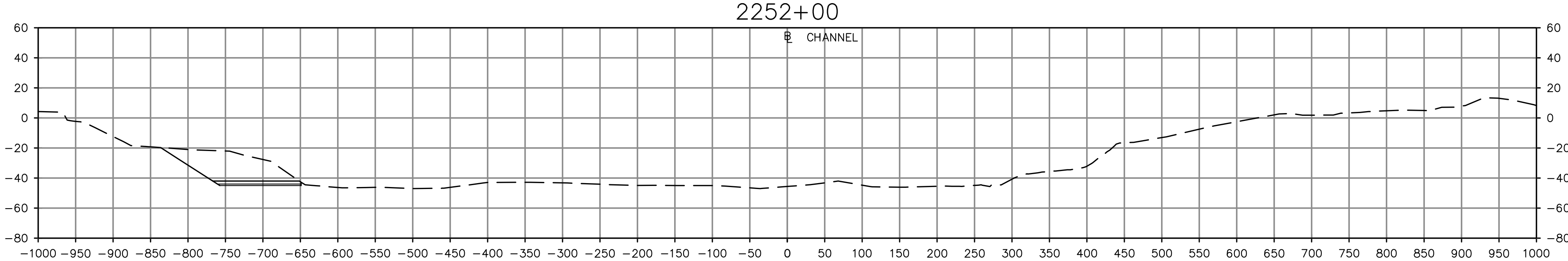


NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

— — — — APPROXIMATE EXISTING GRADE

———— PROPOSED DREDGING

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY WILMINGTON TERMINAL TURNING BASIN EXPANSION**

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

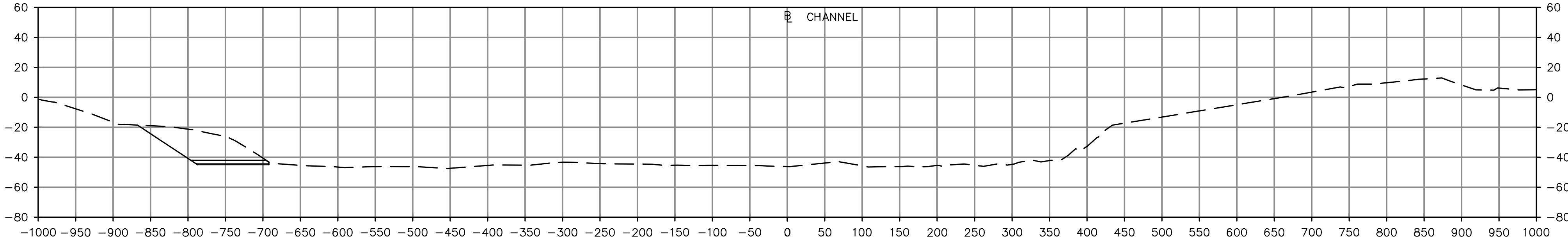
SHEET TITLE:
CROSS SECTIONS 5 OF 12

0 100' 200'
1"=200' HORIZONTAL

0 50' 100'
1"=100' VERTICAL

SHEET **9** *OF* **16**

2253+00



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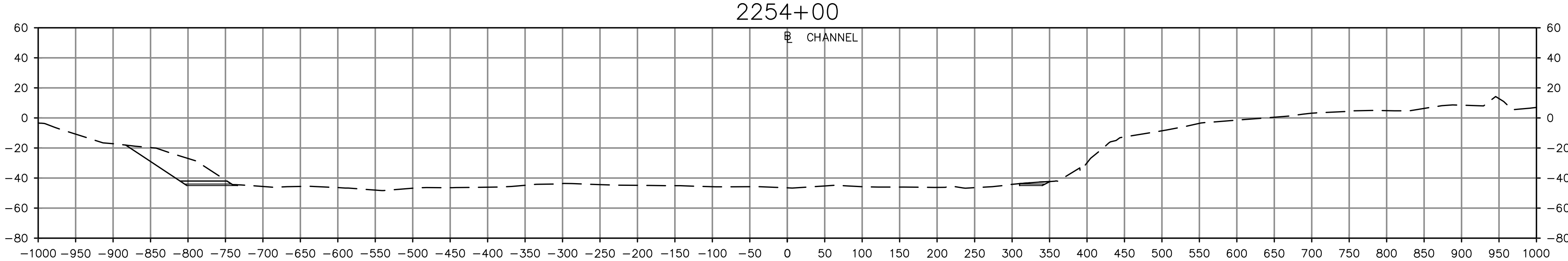

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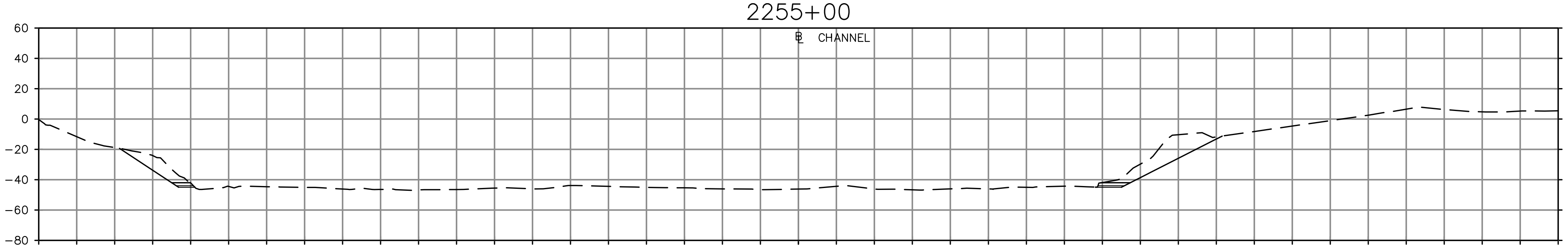


NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

— — — — — APPROXIMATE EXISTING GRADE

——————— PROPOSED DREDGING

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

SHEET TITLE:
CROSS SECTIONS
6 OF 12

0 100' 200'
1"=200' HORIZONTAL

0 50' 100'
1"=100' VERTICAL

SHEET
10
OF
16

File: Q:\RA\9232-08\CADD_Active_Permit\923208-P10; Plotted: 10/24/2018 12:17 PM by KOONS, DAVE; Saved: 10/23/2018 10:38 AM by DKOONS

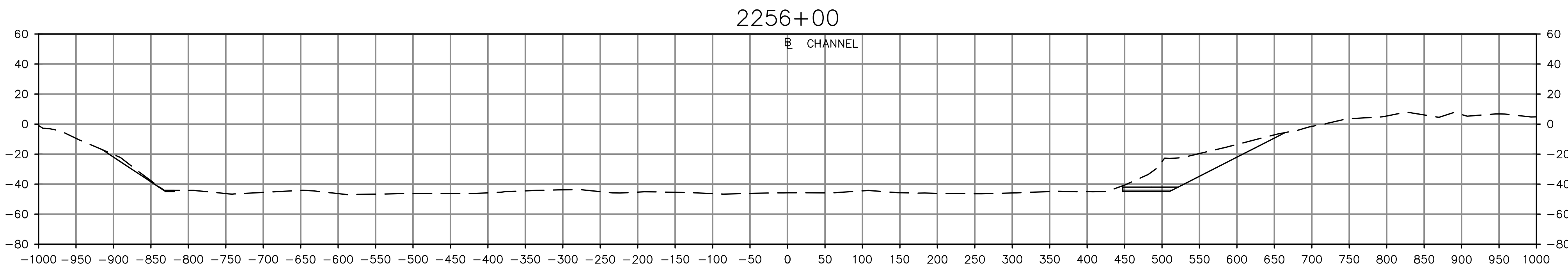
NOTES:

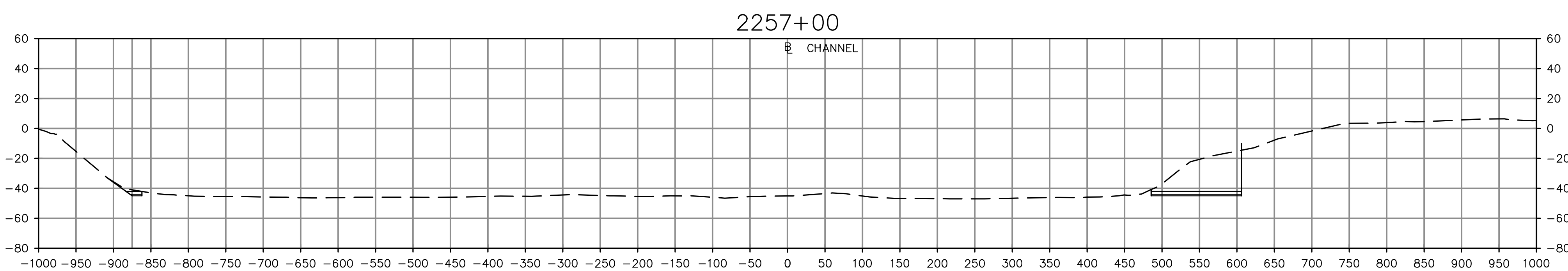
1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

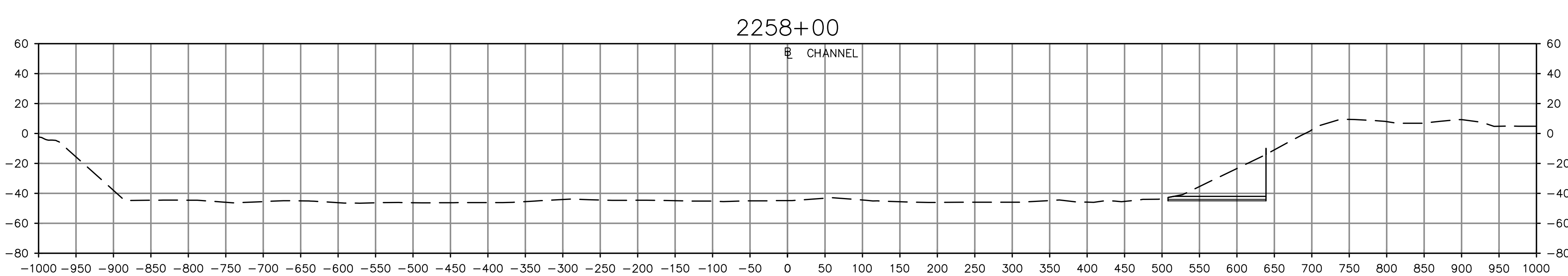
LEGEND

— — — — — APPROXIMATE EXISTING GRADE

———— PROPOSED DREDGING







PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

SHEET TITLE:
CROSS SECTIONS
7 OF 12

1"=200' HORIZONTAL

1"=100' VERTICAL

SHEET **11** *OF* **16**

File: Q:\RA\9232-08\CADD_Active_Permit\923208-P11; Plotted: 10/24/2018 12:17 PM by KOONS, DAVE; Saved: 10/23/2018 10:38 AM by DKOONS

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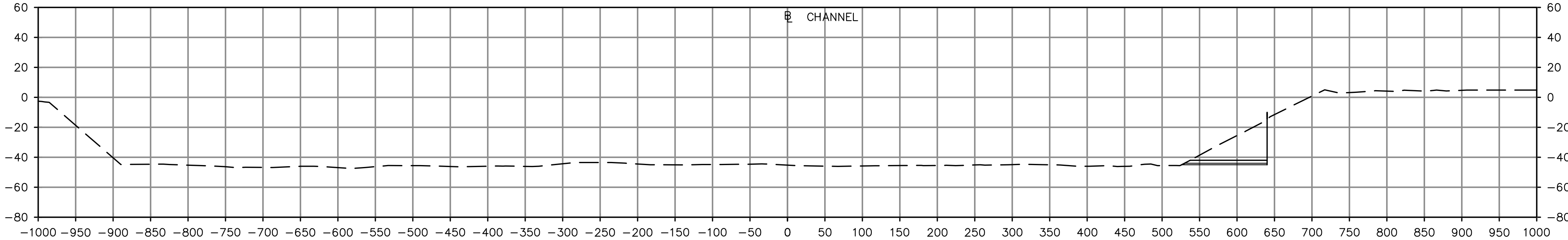

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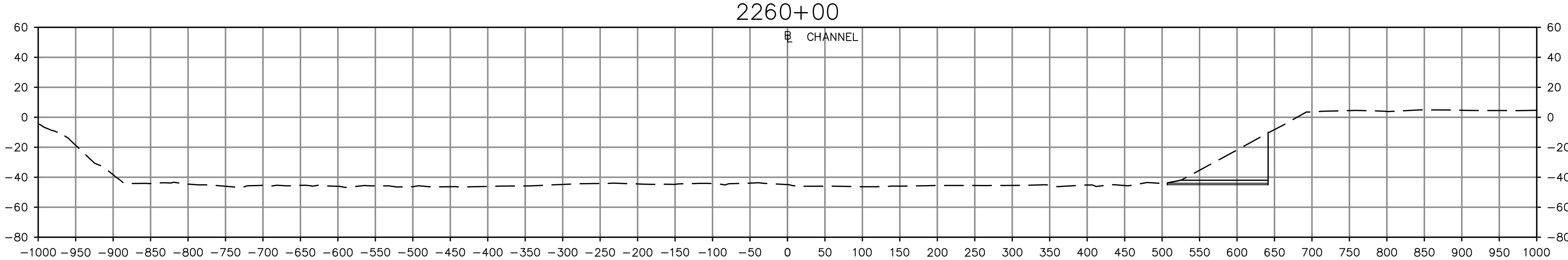

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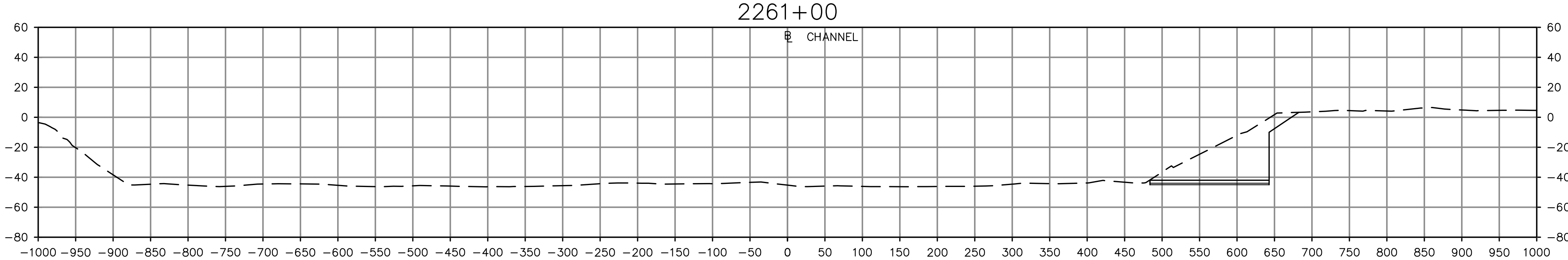


NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

APPROXIMATE EXISTING GRADE

PROPOSED DREDGING

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY WILMINGTON TERMINAL TURNING BASIN EXPANSION**

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

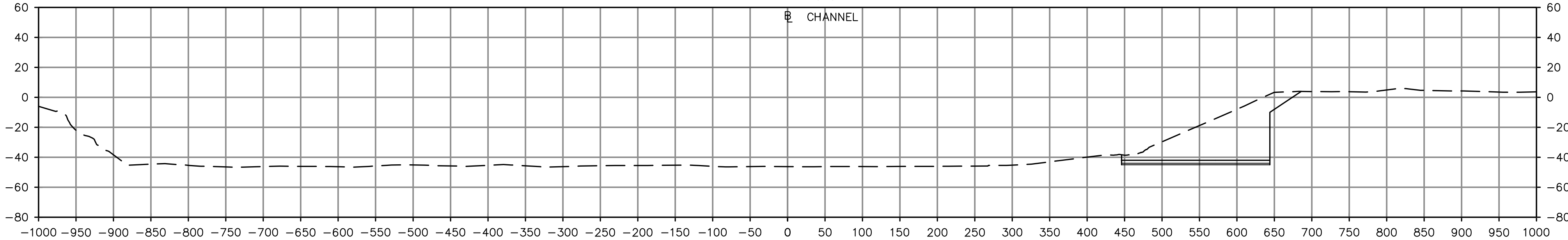
SHEET TITLE: **CROSS SECTIONS 8 OF 12**

0 100' 200'
1"=200' HORIZONTAL

0 50' 100'
1"=100' VERTICAL

SHEET **12** *OF* **16**

2262+00



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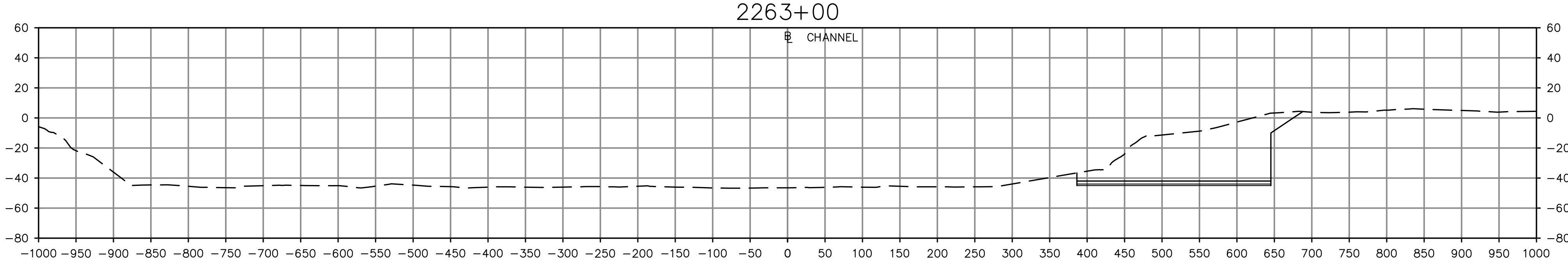

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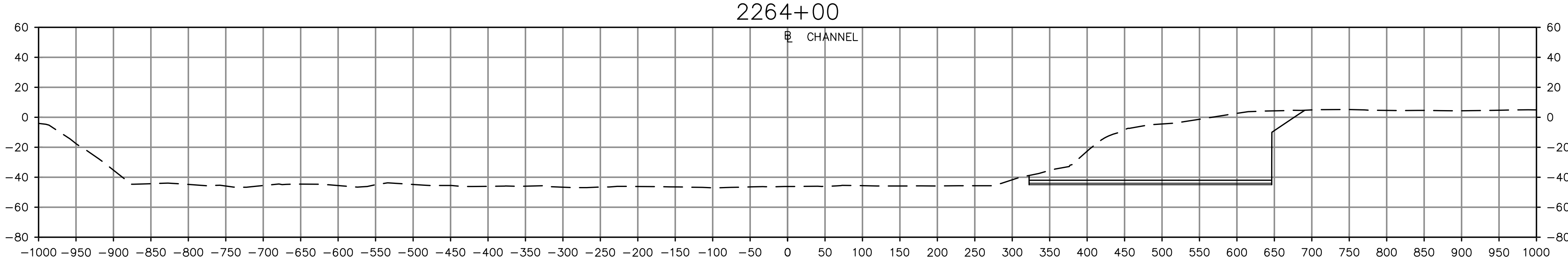


NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

— — — — — — APPROXIMATE EXISTING GRADE

———————— PROPOSED DREDGING

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

DATE: **OCTOBER 2018**

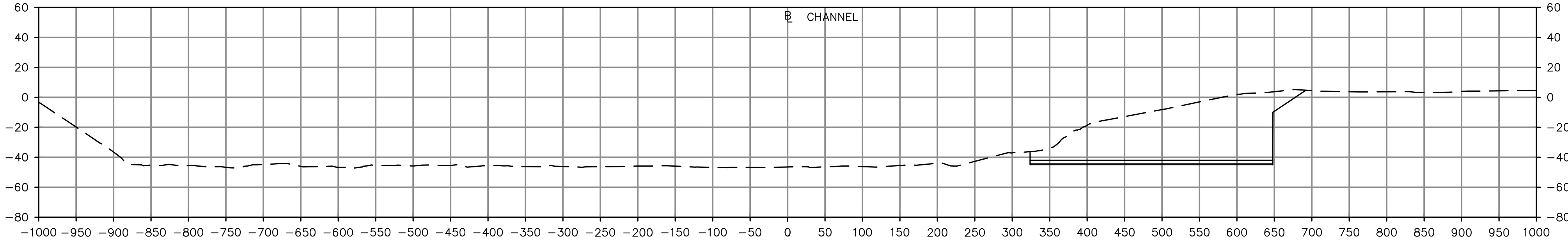
SHEET TITLE:
CROSS SECTIONS
9 OF 12

0 100' 200' 1"=200' HORIZONTAL

0 50' 100' 1"=100' VERTICAL

SHEET **13** *OF* **16**

2265+00



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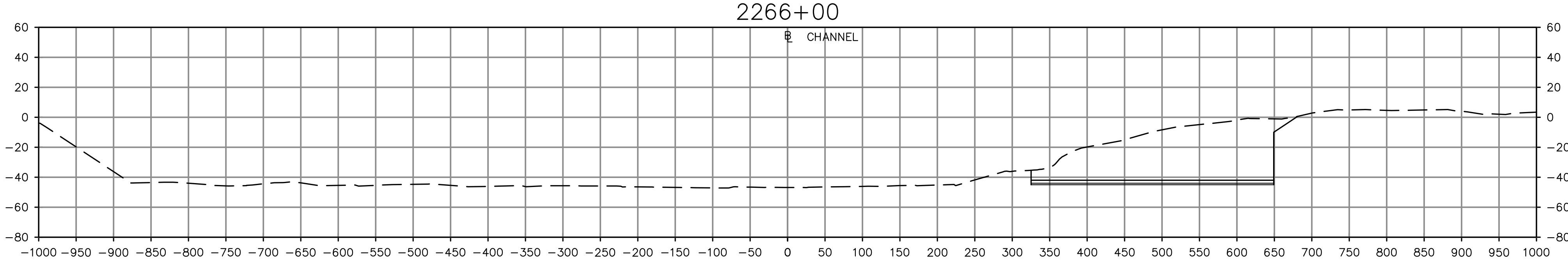
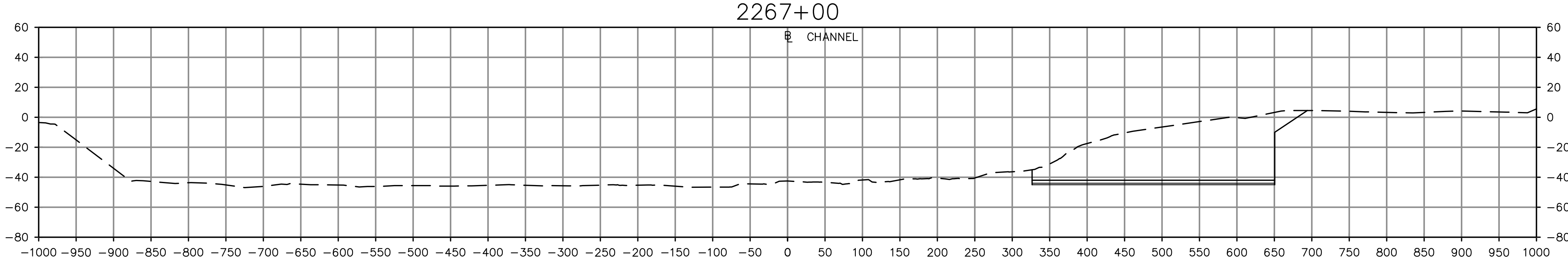


2267+00



NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

— — — — — — — APPROXIMATE EXISTING GRADE

———————— PROPOSED DREDGING

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

SHEET TITLE:
CROSS SECTIONS
10 OF 12

0 100' 200'
1"=200' HORIZONTAL

0 50' 100'
1"=100' VERTICAL

SHEET
14
OF
16

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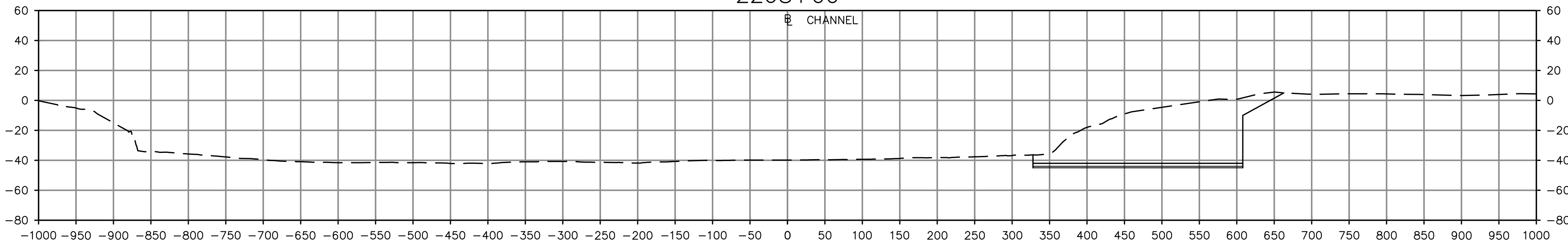
2268+00



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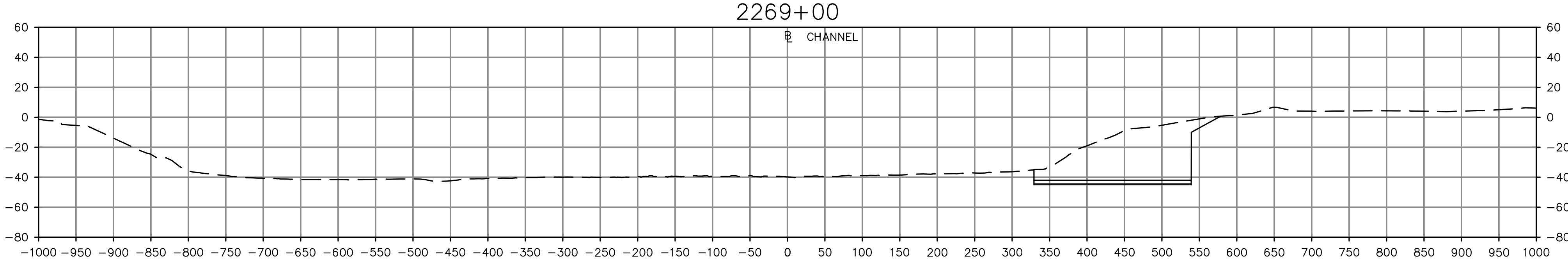

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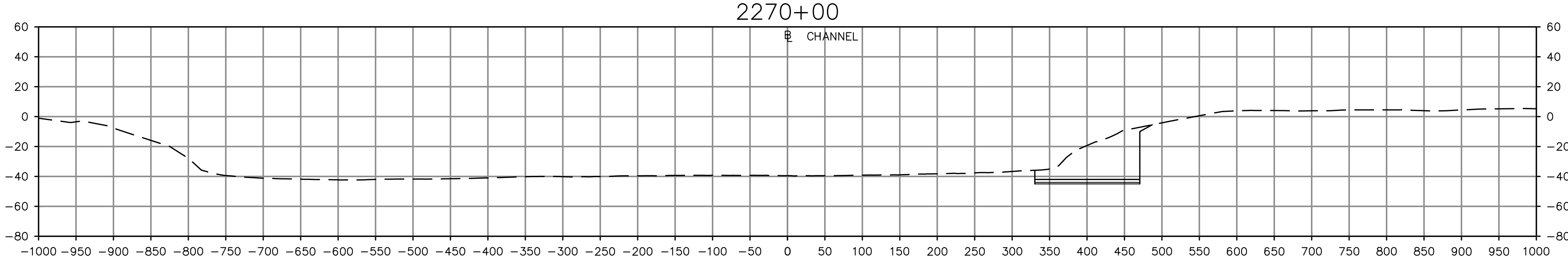


NOTES:

1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

— — — — APPROXIMATE EXISTING GRADE

———— PROPOSED DREDGING

PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY WILMINGTON TERMINAL TURNING BASIN EXPANSION**

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

DATE: **OCTOBER 2018**

SHEET TITLE:

CROSS SECTIONS
11 OF 12

0 100' 200' — 1"=200' HORIZONTAL

0 50' 100' — 1"=100' VERTICAL

SHEET **15** *OF* **16**

File: Q:\RA\9232-08\CADD_Active_Permit\923208-P15; Plotted: 10/24/2018 12:17 PM by KOONS, DAVE; Saved: 10/23/2018 10:39 AM by DKOONS

NOTES:

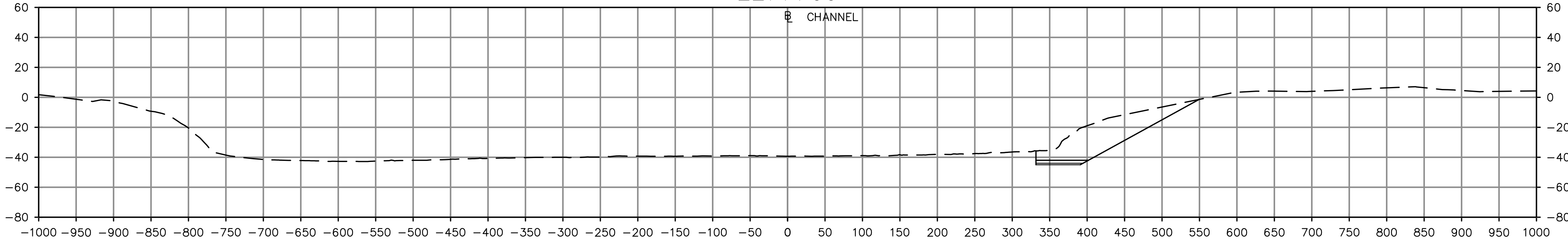
1. BATHYMETRIC CONTOURS BASED ON USACE SURVEY DATED JANUARY 2017.
2. ELEVATIONS ARE IN FEET BASED ON MLLW DATUM.

LEGEND

— — — — — APPROXIMATE EXISTING GRADE

———— PROPOSED DREDGING

2271+00



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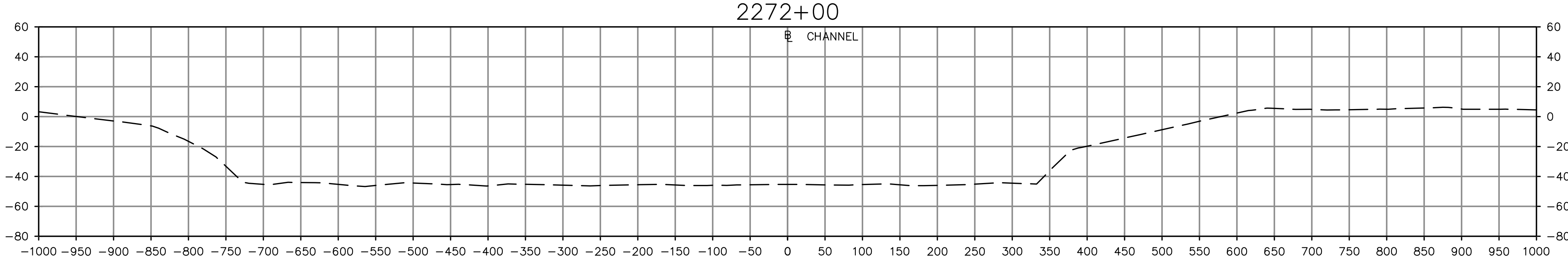
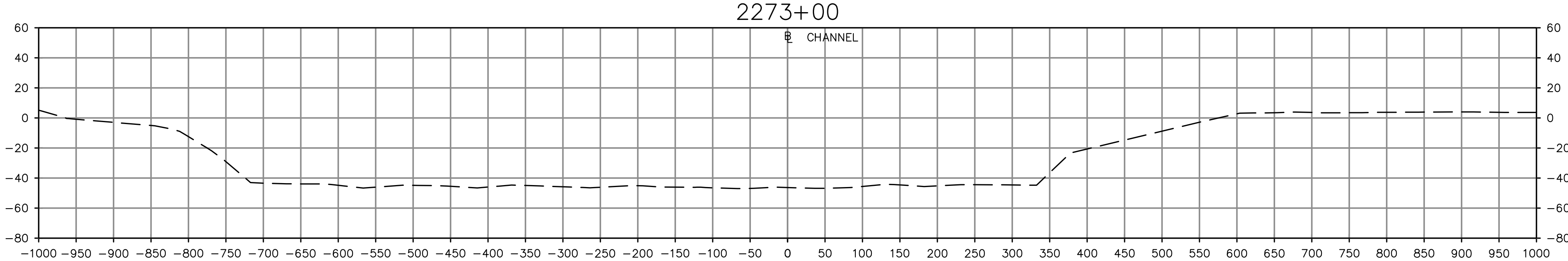


2273+00



PROJECT TITLE: **NORTH CAROLINA STATE PORTS AUTHORITY**
WILMINGTON TERMINAL
TURNING BASIN EXPANSION

DATUM: **MLLW**

PREPARED BY: **MOFFATT & NICHOL**

PREPARED FOR: **NORTH CAROLINA STATE PORTS AUTHORITY**

NORTH CAROLINA PORTS

DATE: **OCTOBER 2018**

SHEET TITLE:
CROSS SECTIONS
12 OF 12

0 100' 200' 1"=200' HORIZONTAL

0 50' 100' 1"=100' VERTICAL

SHEET **16** *OF* **16**

APPENDIX B

EFH Habitat Species by Water Body in North Carolina

List of Essential Fish Habitat Species by Waterbody in North Carolina
July 2009

E-EGGS L-LARVAL J-JUVENILE A-ADULT N/A-NOT FOUND		Cape Fear River to US 421	NE Cape Fear River to US 117	Lockwoods Folly to NC 211	Shallotte River to US 17	Little River Inlet	Calabash River	Atlantic Ocean North of Cape Hatteras	Atlantic Ocean South of Cape Hatteras			
COASTAL DEMERSALS												
Red Drum		E L J A	E L J A	E L J A	E L J A	E L J A	E L J A	J A	J A			
Bluefish		J A	J A	J A	J A	J A	J A	E L J A	E L J A			
Summer Flounder		L J A	L J A	L J A	L J A	L J A	L J A	E L J A	E L J A			
INVERTEBRATES												
Brown Shrimp		L J A	L J A	L J A	L J A	L J A	L J A	E L J A	E L J A			
Pink Shrimp		L J A	L J A	L J A	L J A	L J A	L J A	E L J A	E L J A			
White Shrimp		L J A	L J A	L J A	L J A	E L J A	L J A	E L J A	E L J A			
Calico Scallop		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
COASTAL PELAGICS												
Dolphinfish		N/A	N/A	N/A	N/A	J A	N/A	E L J A	E L J A			
Cobia		J A	J A	J A	J A	L J A	J A	E L J A	E L J A			
King Mackerel		J A	N/A	J A	J A	J A	J	E L J A	E L J A			
Spanish Mackerel		J A	J	J A	J A	L J A	J A	E L J A	E L J A			
HIGHLY MIGRATORY												
Bigeye Tuna		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
Bluefin Tuna		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	J A			
Skipjack Tuna		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	J A			
Yellowfin Tuna		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
Swordfish		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
Blue Marlin		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
White Marlin		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
Sailfish		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
Little Tunny		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			

List of Essential Fish Habitat Species by Waterbody in North Carolina
July 2009

E-EGGS L-LARVAL J-JUVENILE A-ADULT N/A-NOT FOUND		Cape Fear River to US 421	NE Cape Fear River to US 117	Lockwoods Folly to NC 211	Shallotte River to US 17	Little River Inlet	Calabash River	Atlantic Ocean North of Cape Hatteras	Atlantic Ocean South of Cape Hatteras			
SHARKS												
Spiny Dogfish		N/A	N/A	J A	N/A	J A	N/A	J A	J A			
Smooth Dogfish		J	N/A	J	J	J A	J	J A	J A			
Small Coastal Sharks		J A	J A	J A	J A	J A	J A	J A	J A			
Large Coastal Sharks		J A	N/A	N/A	N/A	J A	N/A	J A	J A			
Pelagic Sharks		N/A	N/A	N/A	N/A	N/A	N/A	J A	J A			
Prohibited/Research Sharks		N/A	N/A	N/A	N/A	J A	N/A	J A	J A			
SNAPPER/GROUPER												
Black Sea Bass		J	N/A	J	J	J	J	E L J A	E L J A			
Bank Sea Bass		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Rock Sea Bass		J	N/A	J	J	J	J	L J	E L J A			
Gag		J	J	J	J	J	J	E L J A	E L J A			
Graysby		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Speckled Hind		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Yellowedge Grouper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Coney		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Red Hind		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Goliath Grouper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Red Grouper		J	N/A	N/A	N/A	J	N/A	N/A	E L J A			
Misty Grouper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Warsaw Grouper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Snowy Grouper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			

List of Essential Fish Habitat Species by Waterbody in North Carolina
July 2009

E-EGGS L-LARVAL J-JUVENILE A-ADULT N/A-NOT FOUND		Cape Fear River to US 421	NE Cape Fear River to US 117	Lockwoods Folly to NC 211	Shallotte River to US 17	Little River Inlet	Calabash River	Atlantic Ocean North of Cape Hatteras	Atlantic Ocean South of Cape Hatteras			
Yellowmouth Grouper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Black Grouper		J	N/A	N/A	N/A	J	N/A	N/A	E L J A			
Scamp		N/A	N/A	N/A	N/A	J A	N/A	N/A	E L J A			
Blackfin Snapper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Red Snapper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Cubera Snapper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Lane Sanpper		J	N/A	N/A	N/A	J	N/A	N/A	E L J A			
Silk Snapper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Vermillion Snapper		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Mutton Snapper		J	N/A	N/A	N/A	J	N/A	N/A	E L J A			
Gray Snapper		J	J	J	J	J	J	J A	E L J A			
Gray Triggerfish		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Yellow Jack		J	N/A	J	J	J	N/A	J A	E L J A			
Blue Runner		J	N/A	J	J	J	N/A	J A	E L J A			
Crevalle Jack		J	J	J	J	J	J	J A	E L J A			
Bar Jack		J	N/A	J	J	J	J	J A	E L J A			
Greater Amberjack		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
Almaco Jack		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
Banded Rudderfish		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
Atlantic Spadefish		J	N/A	J	J	J	J	E L J A	E L J A			
White Grunt		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Tomtate		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Hogfish		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Puddingwife		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Sheepshead		J A	N/A	J A	J A	E L J A	J	J A	E L J A			

List of Essential Fish Habitat Species by Waterbody in North Carolina
July 2009

		Cape Fear River to US 421	NE Cape Fear River to US 117	Lockwoods Folly to NC 211	Shallotte River to US 17	Little River Inlet	Calabash River	Atlantic Ocean North of Cape Hatteras	Atlantic Ocean South of Cape Hatteras			
Red Porgy		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Scup		N/A	N/A	N/A	N/A	N/A	N/A	E L J A	E L J A			
Blueline Tilefish		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
Sand Tilefish		N/A	N/A	N/A	N/A	N/A	N/A	N/A	E L J A			
MORE BELOW												

List of Essential Fish Habitat Species by Waterbody in North Carolina
July 2009

SMALL COASTAL SHARKS		PROHIBITED SHARKS	
	Atlantic Sharpnose Shark		
	Finetooth Shark		Sand Tiger
	Blacknose Shark		Bigeye Sand Tiger
	Bonnethead		Whale Shark
			Basking Shark
LARGE COASTAL SHARKS			White Shark
	Silky Shark		Dusky Shark
	Tiger Shark		Bignose Shark
	Blacktip Shark		Galapagos Shark
	Spinner Shark		Night Shark
	Bull Shark		Reef Shark
	Lemon Shark		Narrowtooth Shark
	Nurse Shark		Carribean Sharpnose Shark
	Scalloped hammerhead		Smalltail Shark
	Great Hammerhead		Atlantic Angel Shark
	Smooth Hammerhead		Longfin mako
			Bigeye Thresher
PELAGIC SHARKS			Sharpnose Sevengill shark
	Shortfin Mako		Bluntnose sixgill Shark
	Porbeagle		Bigeye Sixgill Shark
	Thresher Shark		
	Oceanic Whitetip Shark		
	Blue Shark	RESEARCH SHARKS	
			Sandbar Shark