US Army Corps of Engineers
Wilmington District®

Wilmington Harbor 403 EIS

Wilmington, North Carolina

Appendix F – NMFS Biological Assessment

09/12/2025

Draft

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APPENDIX F NMFS BIOLOGICAL ASSESSMENT

Section F.1 Introduction

This Biological Assessment (BA) has been prepared in accordance with Section 7 of the Endangered Species Act, as amended (ESA) [16 United States Code (USC) 1531 et seq.] to address the effects of the proposed Wilmington Harbor 403 project on threatened and endangered species and critical habitats under the jurisdiction of the National Marine Fisheries Service (NMFS). The proposed project would modify (deepen, widen, and re-align in various places) the existing federally authorized navigation channels from the lower end of the Anchorage Basin to the seaward limit of the ocean entrance channel, and create a new approximately (~) nine-mile seaward extension of the ocean entrance channel for purposes of accommodating vessels associated with Port of Wilmington expansion an improving navigation. This BA has been prepared in support of the Wilmington Harbor 403 Draft Environmental Impact Statement (EIS) and is an appendix. The EIS is an attachment to the Wilmington Harbor 403 Letter Report.

F.1.1 Background

The existing Wilmington Harbor Federal Navigation System (FNS) extends approximately 38.1 miles from the Atlantic Ocean offshore of Cape Fear River to the City of Wilmington and runs north to south (Figure 1). Construction of the FNS to its current dimensions was originally authorized as three separate projects under the Water Resources Development Act (WRDA) of 1986 [Public Law 99-662] and WRDA 1996 (Public Law 104-303). The Energy and Water Development Appropriations Act of 1998 (Public Law 105-62) combined the Wilmington Harbor Northeast Cape Fear River Project (WRDA 1986), the Wilmington Harbor Channel Widening Project (WRDA 1996), and the Cape Fear-Northeast Cape Fear Rivers Project (WRDA 1996) under a single project known as the Wilmington Harbor 96 Act Project. Improvements under the Wilmington Harbor 96 Act Project included deepening the Ocean Entrance Channel and the lower inner harbor channel up through the Battery Island reach from 40 to 44 feet below mean lower low water (MLLW) deepening the inner harbor channel from the Battery Island reach up to the Cape Fear Memorial Bridge from 38 to 42 feet below MLLW; and widening various channel reaches, turns, and bends. Additional authorized improvements to the -32-foot and -25-foot channel reaches that comprise the remainder of the FNS from the Cape Fear Memorial Bridge to the upper project limit in the Northeast Cape Fear River were deferred due to a marginal cost to benefit ratio.

The Port of Wilmington has experienced significant growth in cargo volume and in the size of vessels calling at the port since the last major channel improvements were completed under the Wilmington Harbor 96 Act Project. The North Carolina State Ports Authority (NCSPA) has made major investments in landside infrastructure to accommodate growth at the Port of Wilmington and the region that it serves. At the present time, the Port of Wilmington is the largest port in North Carolina (NC) and is a major component of the state's economy. Due to expansion of the Panama Canal and harbor deepening projects at all other major United States (US) East Coast ports, the US East Coast to Asia shipping alliances are transitioning to vessels that are substantially larger than those that the existing 42-feet below MLLW Wilmington Harbor FNS was designed to accommodate. Inadequate channel capacity is currently impacting trade at the Port of Wilmington and is projected to have a greater detrimental impact on trade in the future as ocean carriers continue to transition from the existing fleet of 8,000 Twenty-foot Equivalent Unit (TEU) vessels to a new fleet of larger 12,400 TEU vessels. The proposed improvements to the FNS would accommodate larger cargo vessels at Wilmington Harbor and enable the Port of Wilmington to continue as a port-of-call for shipping alliances with direct service to Asian markets.

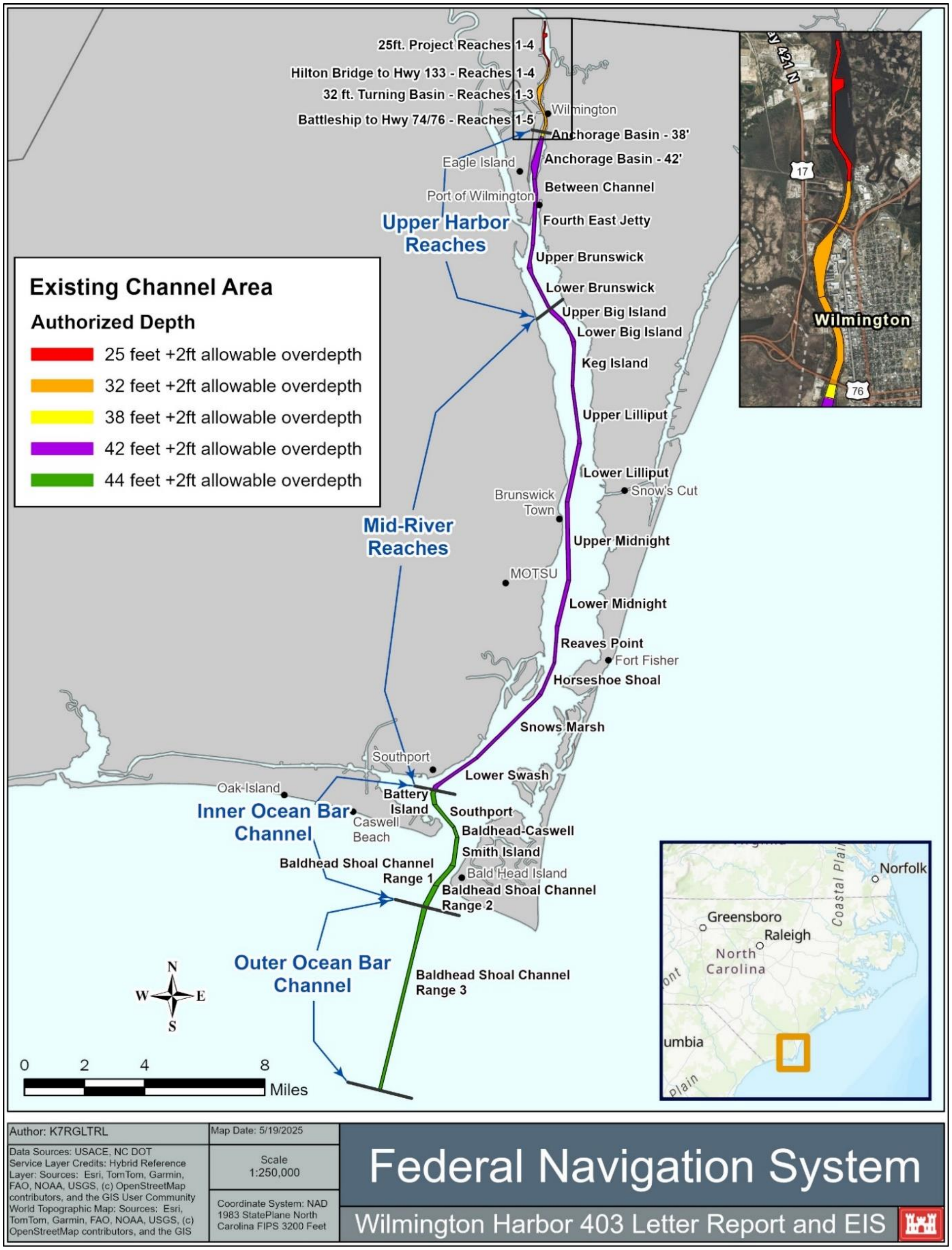

Figure 1. Existing Wilmington Harbor Federal Navigation System.

Table 1. Existing Channel Depths and Widths

Reach – North to South	Maintenance Segment	Existing Channel Width (FT)	Authorized Depth (FT)	Allowable Overdepth (FT)
Anchorage Basin	Upper Harbor	547-1200	42	44
Between Channel	Upper Harbor	500-550	42	44
Fourth East Jetty	Upper Harbor	450-550	42	44
Upper Brunswick	Upper Harbor	400-775	42	44
Lower Brunswick	Upper Harbor	400-775	42	44
Upper Big Island	Mid-River	540-700	42	44
Lower Big Island	Mid-River	400-700	42	44
Keg Island	Mid-River	400-700	42	44
Upper Lilliput	Mid-River	400-610	42	44
Lower Lilliput	Mid-River	600	42	44
Upper Midnight	Mid-River	600	42	44
Lower Midnight	Mid-River	600	42	44
Reaves Point	Mid-River	400-600	42	44
Horseshoe Shoal	Mid-River	400-610	42	44
Snows Marsh	Mid-River	400-610	42	44
Lower Swash	Mid-River	400-740	42	44
Battery Island	Inner Ocean Bar*	740	44	46
Southport	Inner Ocean Bar*	500-600	44	46
Baldhead - Caswell	Inner Ocean Bar*	500-650	44	46
Smith Island Channel	Inner Ocean Bar*	650-895	44	46
Baldhead Shoal Channel-Reach 1	Inner Ocean Bar*	750	44	46
Baldhead Shoal Channel-Reach 2	Inner Ocean Bar*	900	44	46
Baldhead Shoal Channel-Reach 3	Outer Ocean Bar*	500-900	44	46

*These reaches are collectively referred to as the Entrance Channel

F.1.2 Purpose and Need

The purpose of the proposed federal action is to contribute to national economic development (NED) by addressing transportation inefficiencies for the forecasted vessel fleet, consistent with protecting the Nation’s environment. Action is needed to address the constraints that contribute to inefficiencies in the existing navigation system’s ability to safely and efficiently serve the forecasted vessel fleet and process the forecasted cargo types and volumes. Additional details on the federal action are included below and are described in-depth in the EIS.

Section F.2 Description of the Proposed Action

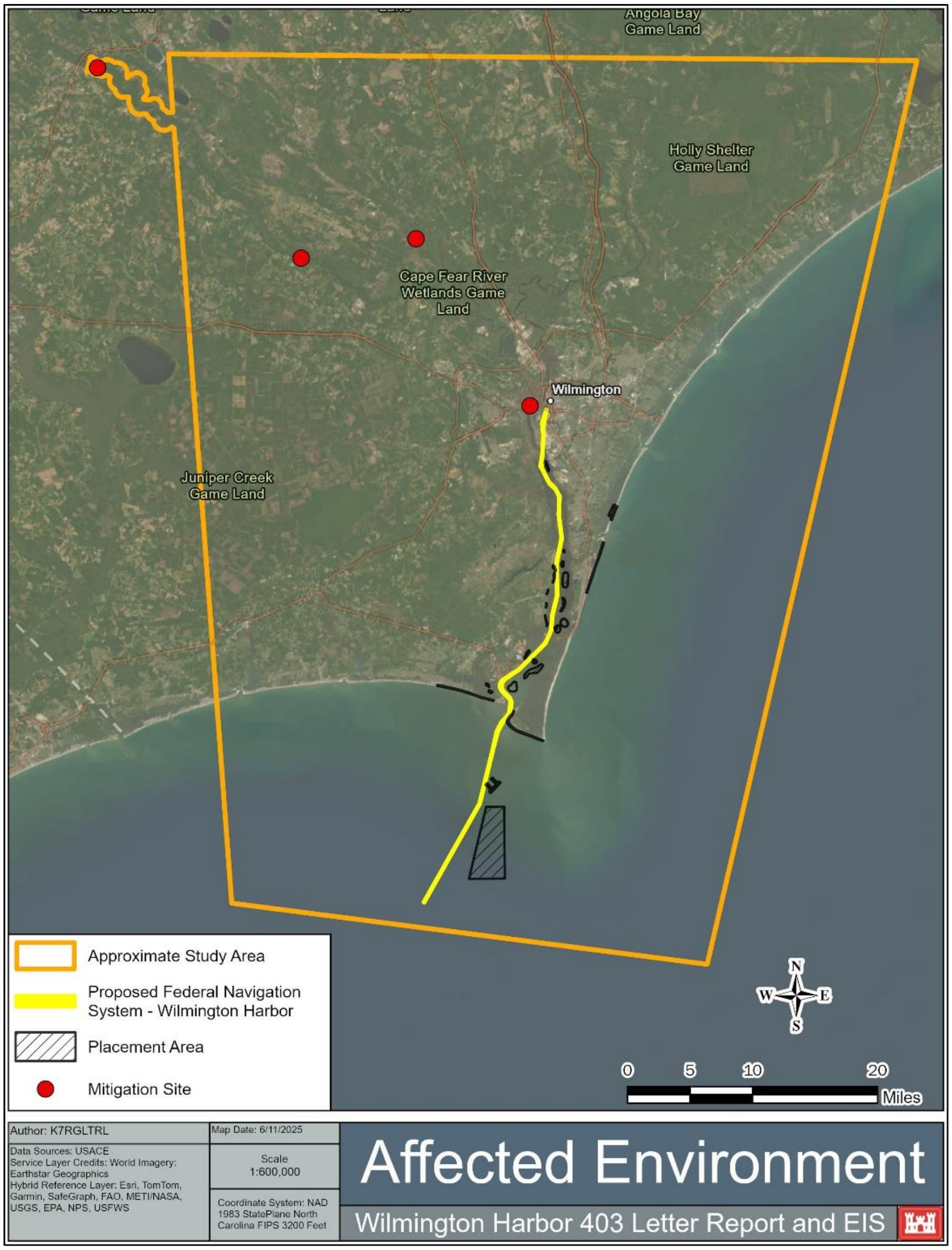

Figure 2. Proposed Federal action area.

The proposed federal action is to modify the existing FNS from the lower end of the Anchorage Basin at the Port of Wilmington to the seaward limit of the ocean Entrance Channel and create an approximately nine-mile seaward expansion of the ocean Entrance Channel (Figure 1). The action being considered would deepen most of the existing Wilmington Harbor navigation channel from its current authorized depth of -42 feet MLLW to a new depth of -47 feet below MLLW and widen and realign the channel in some areas (Figure 2). The Entrance Channel reaches would be authorized to an additional 2 feet of depth to account for ocean conditions. The proposed federal action would also expand the width of several of the reaches along the channel and add an additional reach to the Outer Ocean Bar, Baldhead Shoal Reach 4.

Table 2. Channel Modifications of Proposed Action

Reach – North to South	Maintenance Segment	Existing Channel Width (Ft)	Proposed Channel Width (Ft)	Proposed Authorized Depth (Ft)	Proposed Allowable Overdepth1 (Ft)	With Required Rock Overdepth (Ft)
Anchorage Basin	Upper Harbor	547-1200	547 - 1509	47	49	50
Between Channel	Upper Harbor	500-550	575-625	47	49	50
Fourth East Jetty	Upper Harbor	450-550	550-575	47	49	50
Upper Brunswick	Upper Harbor	400-775	500-925	47	49	50
Lower Brunswick	Upper Harbor	400-775	500-925	47	49	50
Upper Big Island	Mid-River	540-700	560-700	47	49	50
Lower Big Island	Mid-River	400-700	500-795	47	49	50
Keg Island	Mid-River	400-700	500-795	47	49	50
Upper Lilliput	Mid-River	400-610	500-685	47	49	50
Lower Lilliput	Mid-River	600	600-660	47	49	50
Upper Midnight	Mid-River	600	600	47	49	49 no rock overdepth
Lower Midnight	Mid-River	600	600	47	49	49 no rock overdepth
Reaves Point	Mid-River	400-600	500-600	47	49	49 no rock overdepth
Horseshoe Shoal	Mid-River	400-610	500-710	47	49	49 no rock overdepth
Snows Marsh	Mid-River	400-610	500-710	47	49	50
Lower Swash	Mid-River	400-740	500-1230	47	49	50
Battery Island	Inner Ocean Bar	740	1150 - 1300	49	51	52

Reach – North to South	Maintenance Segment	Existing Channel Width (Ft)	Proposed Channel Width (Ft)	Proposed Authorized Depth (Ft)	Proposed Allowable Overdepth1 (Ft)	With Required Rock Overdepth (Ft)
Southport	Inner Ocean Bar	500-600	800-1150	49	51	52
Baldhead - Caswell	Inner Ocean Bar	500-650	800	49	51	51 no rock overdepth
Smith Island Channel	Inner Ocean Bar	650-895	900	49	51	51 no rock overdepth
Baldhead Shoal Channel- Reach 1	Inner Ocean Bar	750	750-900	49	51	51 no rock overdepth
Baldhead Shoal Channel- Reach 2	Inner Ocean Bar	900	900	49	51	51 no rock overdepth
Baldhead Shoal Channel - Reach 3	Outer Ocean Bar	500-900	600 - 900	49	51	52
Baldhead Shoal Channel- Reach 4 (Proposed Entrance Channel Extension)	Outer Ocean Bar	N/A	600	49	51	51 no rock overdepth

[1] Proposed Allowable Overdepth includes two feet additional dredging depth allowed (not required) based on dredging imprecision and efficiency.
[2] Proposed Total Depth is Authorized Depth plus Required Rock Overdepth of one foot (where rock is present) plus Allowable Overdepth

Furthermore, the proposed federal action includes the placement of dredged material in the Ocean Dredged Material Placement Site (ODMDS), the Wilmington Offshore Fisheries Enhancement Structure (WOFES), Baldhead Island Beach, Caswell Beach, Oak Island Beach, Ferry Slip Island, South Pelican Island, and additional areas for beneficial use, which is detailed further in Appendix D: Beneficial Use Plan.

We have categorized 6 types of activities for the proposed action

1. Construction of the Channel Modifications
2. Long term impact from channel modification
3. Dredge Material Placement

4. Mitigation Impacts
5. G&G surveys performed by or authorized by the USACE necessary to complete dredging and material placement projects.
6. Maintenance Dredging- will be covered by 2020 SARBO incorporated by reference.

F.2.1 Channel Design

The 47-foot Action Alternative proposes to extend and deepen the entrance channel in combination with channel deepening and widening sections within the inner harbor channels. The proposed navigation improvements include:

- Extend the existing entrance channel. The new channel would be dredged and extend approximately 48,000 feet (9.1 miles) seaward from Baldhead Shoal Channel - Reach 3 to waters that are consistently deeper than the currently maintained channel depth of -49 feet MLLW. The reach offshore of the existing pilot boarding station (Sta 490+00) would have a heading of approximately 30 degrees (inbound), which is an approximate 16-degree shift from the Baldhead Shoal Channel - Reach 3 (14-degree). This heading change would take advantage of the most direct navigation path, which is an existing deeper natural channel, minimizing dredging volumes and environmental impacts, while reducing construction and maintenance costs.
- Deepen the existing entrance channel from the Battery Island reach to the pilot boarding station (Sta 490+00). The depth would increase from -44 feet to -49 feet MLLW to allow for adequate underkeel clearance for anticipated container vessels in areas affected by ocean waves.
- Construct side slopes of 5:1 (horizontal to vertical) from the Entrance channel to Battery Island.
- Deepen the existing inner harbor navigation channels, all reaches from Lower Swash to the Anchorage Basin from -42 feet to -47 feet MLLW.
- Widen the existing inner harbor navigation channel as described in Table 2.
- Construct side slopes of approximately 3:1 (horizontal to vertical) from Lower Swash to the Anchorage Basin. Over time, the slope will settle into a stable condition at 3:1.
- Side slopes for existing channel configurations are 3H:1V from Lower Swash to Anchorage Basin and 5H:1V for Baldhead Shoal Reach 3 to Battery Island.

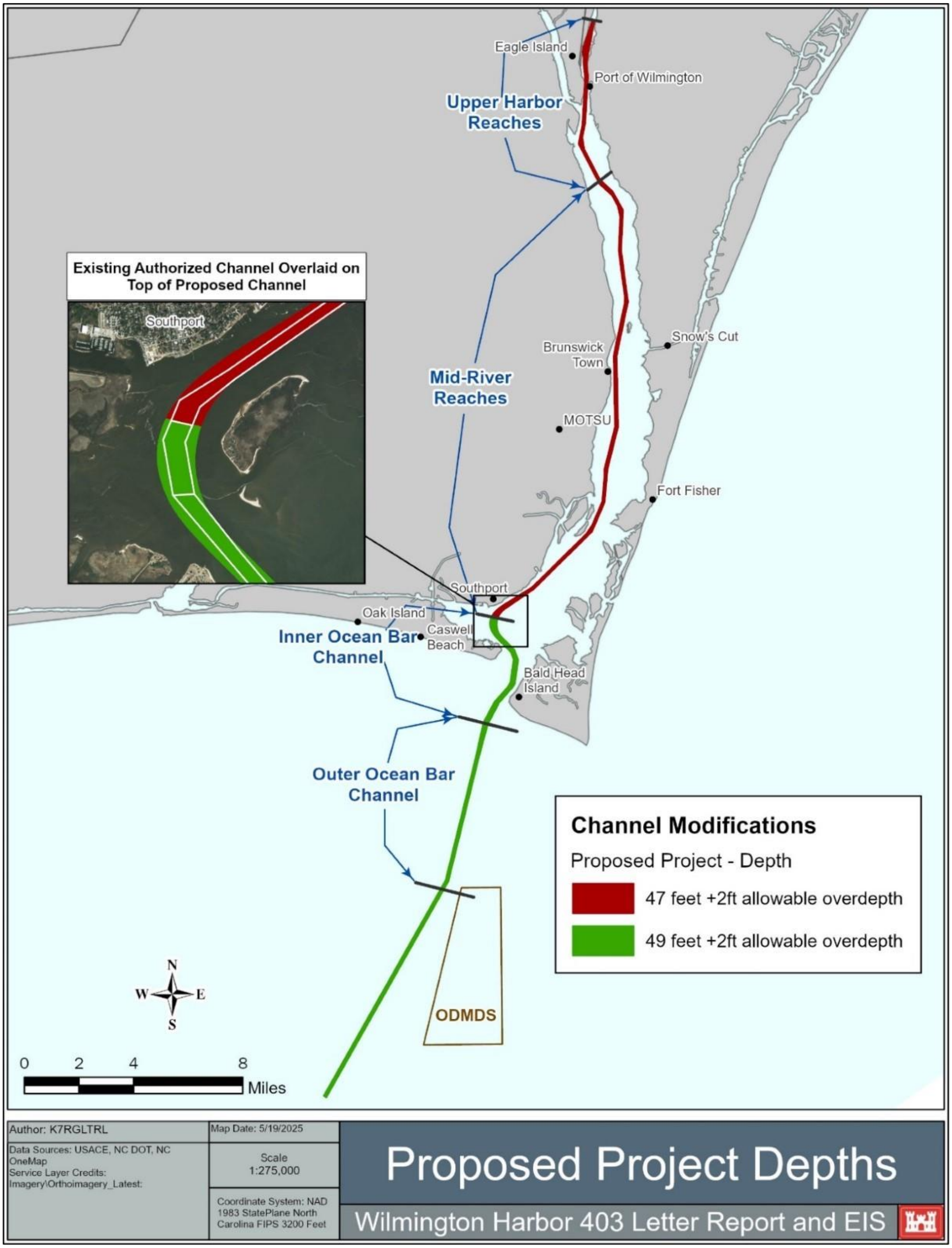

Figure 3. Proposed Project Depths for the Proposed Project

F.2.2 Construction

Construction of the proposed action at Wilmington Harbor would employ hydraulic pipeline (cutterhead), mechanical (bucket), and hopper dredges. It is expected hopper dredges would be used for the outer Baldhead Shoal 2 and 3 Entrance Channel reaches and the proposed Entrance Channel extension. However, if determined appropriate by USACE and the contractor hopper dredges may be used on any portion of channel construction. Construction of the remaining channel reaches would be accomplished predominantly by cutterhead dredges. Mechanical (bucket) dredges would be used for the specific purpose of removing pre-treated rock from the ~4.4-mile Keg Island to Lower Brunswick channel reach.

Table 1. Types of Dredges to be Used Based on Reach, Location, and Timing

Reach Name from South to North	Total Quantity (CY)	Non-Rock (CY)	Rock (Cutterhead) (CY)	Rock (Blasting) (CY)	Segment	Type of Dredge	Type of Sediment (New Work)	Estimate Duration of Construction (Day)
Baldhead Shoal Channel - Reach 4 (Proposed Entrance Channel Extension)	1,634,666	1,634,666	0	0	Outer Ocean Bar	Hopper	Unknown[1]	100
Baldhead Shoal Channel- Reach 3	6,065,204	5,733,635	331,569	0	Outer Ocean Bar	Hopper & Cutterhead	Clays/Silts	478
Baldhead Shoal Channel - Reach 2	1,096,108	1,096,108	0	0	Inner Ocean Bar	Cutterhead to Beach[2]/Hopper to ODMDS	Clays/Silts	82
Baldhead Shoal Chanel- Reach 1	888,938	888,938	0	0	Inner Ocean Bar	Cutterhead to Beach[2]/Hopper to ODMDS	Clays/Silts	67
Smith Island	1,073,055	1,073,055	0	0	Inner Ocean Bar	Cutterhead to Beach/Hopper to ODMDS	Sand	56
Baldhead-Caswell	172,654	172,654	0	0	Inner Ocean Bar	Cutterhead to Beach/Hopper to ODMDS	Sand	10
Southport	552,585	550,107	2,478	0	Inner Ocean Bar	Cutterhead to Beach/Hopper to ODMDS	Sand	30
Battery Island	1,322,487	1,101,429	221,058	0	Inner Ocean Bar	Cutterhead	Sand	85

Reach Name from South to North	Total Quantity (CY)	Non-Rock (CY)	Rock (Cutterhead) (CY)	Rock (Blasting) (CY)	Segment	Type of Dredge	Type of Sediment (New Work)	Estimate Duration of Construction (Day)
Lower Swash	2,106,332	1,861,207	245,125	0	MidRiver	Cutterhead	Clays/Silts & Silty/Clayey Sands	118
Snows Marsh	1,959,499	1,821,272	138,227	0	MidRiver	Cutterhead	Clays/Silts	103
Horseshoe Shoal	783,188	783,188	0	0	MidRiver	Cutterhead	Sand & Silty/Clayey Sand	39
Reaves Point	953,750	953,750	0	0	MidRiver	Cutterhead	Silty/Clayey Sand	49
Lower Midnight	986,874	986,874	0	0	MidRiver	Cutterhead	Clays/Silts & Sand	47
Upper Midnight	1,710,712	1,710,712	0	0	MidRiver	Cutterhead	Silty/Clayey Sand	83
Lower Lilliput	1,939,817	1,870,183	69,634	0	MidRiver	Cutterhead	Sand	102
Upper Lilliput	1,747,351	1,431,347	316,004	0	MidRiver	Cutterhead	Silty/Clayey Sand	104
Keg Island	1,430,866	1,089,004	183,344	158,518	MidRiver	Cutterhead + Blasting + Mechanical	Silty/Clayey Sand	166
Lower Big Island	897,799	507,606	0	390,193	MidRiver	Cutterhead + Blasting + Mechanical	Silty/Clayey Sand	295
Upper Big Island	817,838	390,552	0	427,286	MidRiver	Cutterhead + Blasting + Mechanical	Silty/Clayey Sand	306
Lower Brunswick	1,556,967	1,167,708	222,654	166,605	Anchorage Basin	Cutterhead + Blasting + Mechanical	Silty/Clayey Sand	194
Upper Brunswick	931,419	781,440	149,979	0	Anchorage Basin	Cutterhead	Silty/Clayey Sand	55

Reach Name from South to North	Total Quantity (CY)	Non-Rock (CY)	Rock (Cutterhead) (CY)	Rock (Blasting) (CY)	Segment	Type of Dredge	Type of Sediment (New Work)	Estimate Duration of Construction (Day)
Fourth East Jetty	1,165,438	660,565	504,873	0	Anchorage Basin	Cutterhead	Silty/Clayey Sand	76
Between	458,986	246,852	212,134	0	Anchorage Basin	Cutterhead	Clays/Silts	32
Anchorage Basin Station 8+00 to 84+81	2,948,659	1,996,833	951,826	0	Anchorage Basin	Cutterhead	Clays/Silts	200

[1] The classification of subsurface sediments will take place during PED. Top of rock was delineated during the 203 study and additional assessment of subsurface data will be conducted in PED. Preliminary data in the offshore indicate silty/clayey sands (not suitable for beach placement).
[2] Although the new work states Clays/Silts the O&M work will be placed on the beach. Beach placement will use a cutterhead while ODMDS placement will use a hopper.

The type of dredge is subject to change based on the most cost-effective method.

In addition to dredging the federal navigation channel, there are reaches where rock would need to be removed to modify the FNS. As part of the previous deepening effort in the early 2000s, rock pretreatment (blasting) was conducted from Lower Brunswick to Keg Island to achieve the currently authorized depths. Therefore, it is anticipated that some form of pretreatment may be required again to deepen this portion of the project. Pretreatment methods may include blasting or mechanical techniques to break apart the rock prior to removal by a clamshell dredge. During PED, additional geotechnical and geophysical data will be collected to better characterize rock strengths throughout the channel. This information will be shared with prospective contractors, who will determine the appropriate means and methods for rock removal within the shipping channel.

Confined underwater blasting may be used as a pre-treatment measure to break up hardened rock for subsequent removal by cutterhead and mechanical (bucket) dredges. Areas potentially requiring confined blasting encompass approximately 158 acres of rock surface area within the Keg Island, Lower Big Island, Upper Big Island, and Lower Brunswick channel reaches (Figure 3). These reaches required blasting during the 96 Act deepening effort, and it is expected that blasting may be needed again to deepen these reaches to their specified project depth. Additional geotechnical and geophysical information will be collected in Planning, Engineering, and Design phase to further refine the rock surface. If it is determined that blasting is needed, USACE would employ avoidance and minimization measures. The Conceptual Blast Mitigation Plan (Appendix L to the EIS) catalogs best management practices (BMPs) that are standardly applied during blasting activity to minimize underwater noise impacts on protected species. The Comprehensive Blast Plan is developed later during the pre-construction phase and will be a more detailed document, which will provide the specific mitigation, monitoring, and reporting measures that would be implemented during blasting activities within the Wilmington Harbor channel. Confined underwater blasting operations would be conducted from 1 August to 31 January.

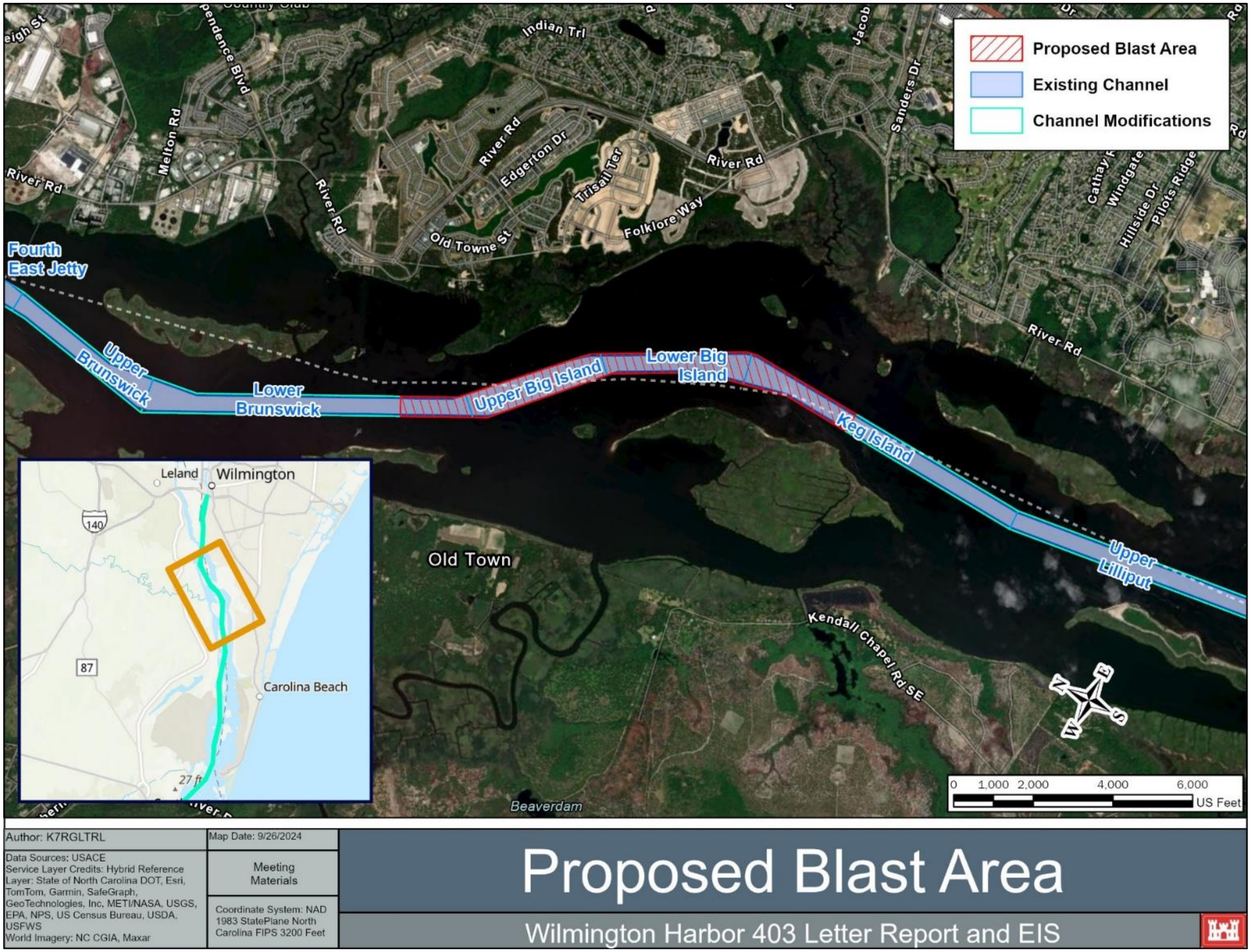

Figure 4. Potential Rock Pre-Treatment Areas

F.2.3 Dredged Material Disposal and Placement

Table 4 provides a breakdown of the proposed project's dredging and placement operations by equipment type and channel reach. The estimated total volume of material to be dredged in constructing the channel improvements (i.e. deepening, widening, and realigning in certain areas) is 35.1 million cubic yards. Dredged material volume estimates are based on the proposed channel dimensions with an additional one-foot required overdepth to reaches where rock is likely to be encountered, and an additional two feet of allowable overdepth for all reaches. Additional annual shoaling of O&M material due to the channel modifications is approximately 1,500,000 cubic yards (34%). This slight increase in O&M material is not expected to result in increased dredging frequency. For more detailed information on channel reach dimensions and quantities, please see Appendix A: General Engineering.

Under the proposed action, approximately 50% of all material taken out of the FNS with the initial modification effort will be used for beneficial use projects. Beneficial uses of dredged material would include (1) intertidal placement of material along riverbanks, back barrier areas, surrounding bird island areas, and adjacent to marshes in the Cape Fear River; (2) beach nourishment of sand in New Hanover and Brunswick Counties; (3) bird island placement of sand to historic footprints (renourishment); and (4) fish habitat rock placement at the existing (Wilmington Offshore Fisheries Enhancement Structure (WOFES). These four categories of beneficial use would utilize all types of sediment obtained from the dredging activities, including but not limited to: non-beach quality sediment (fine-grained material including organics, ≤90% sand); beach quality sediment (sand and minimal organics, ≥90% sand); soft rock (rock not requiring blasting that can be removed by cutter-head dredge); and hard rock (may require blasting or fracturing before removal). The methodologies for material placement, location, ecological effects, and the general plan for this material are further described in the Beneficial Use Plan in the Wilmington Harbor EIS (Appendix D). and direct hydraulic (cutterhead) pipeline placement to the beaches of Bald Head Island and Oak Island and waterbird nesting islands in the lower estuary.

All dredged material other than beneficial use material would be taken offshore for disposal in the Wilmington ODMDS. Estimated construction and maintenance volumes are well within the capacity of the ODMDS. Associated placement operations would include hydraulic (cutterhead) loading of barges for offshore transport to the ODMDS, mechanical (bucket dredge) scow loading for offshore transport to the ODMDS, direct transport to the ODMDS via self-propelled hopper dredges.

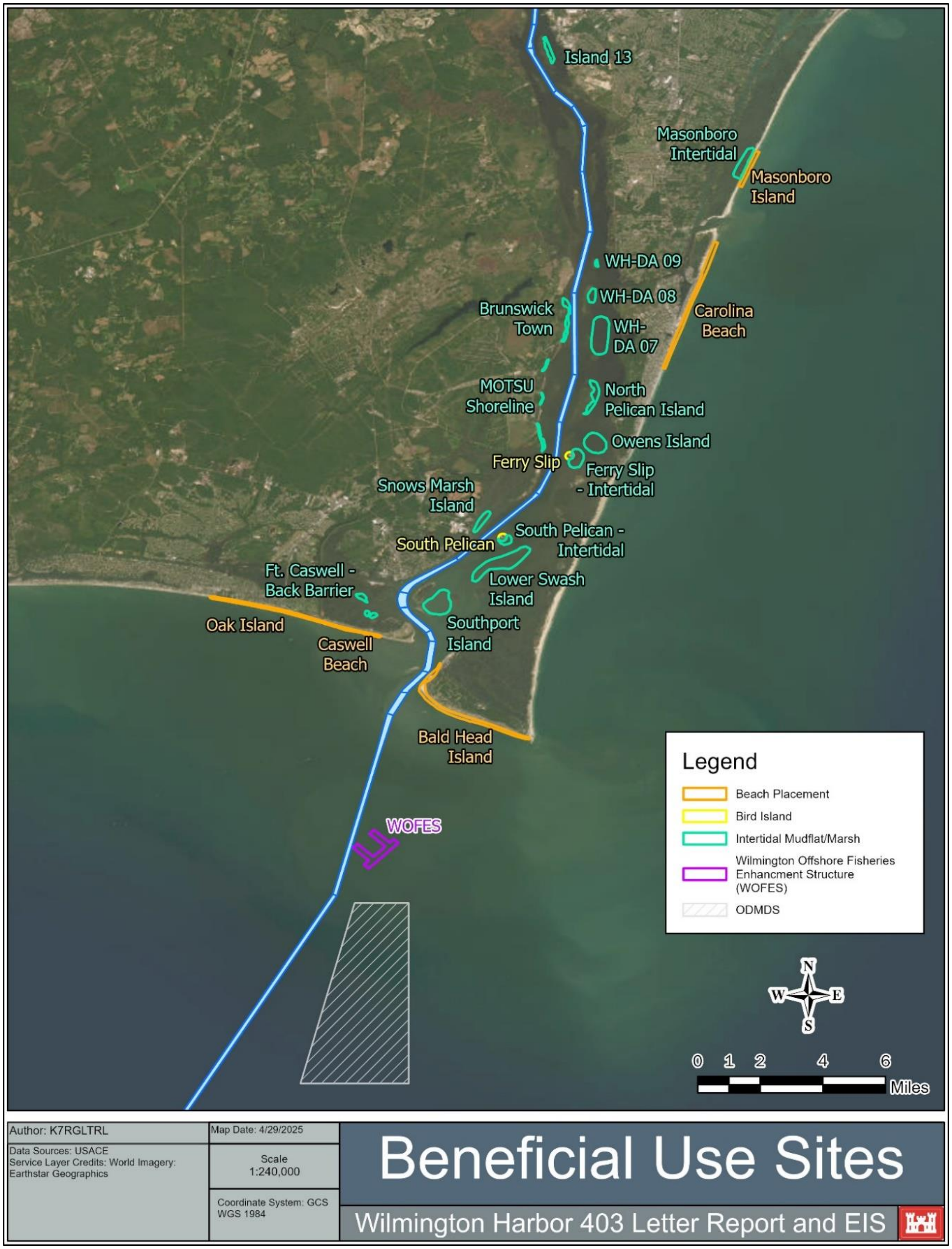

Figure 5. Map of Proposed Beneficial Use Sites and ODMDS

F.2.4 Construction Schedule

The proposed improvements to the Wilmington Harbor FNS would be constructed over a period of six years. The proposed project construction schedule is included in Section 2.7 of the EIS.

Table 4. Proposed Action Dredging and Placement Summary Detailing the Reach, Material Types, Dredge Plants, and Placement Locations.

Reach	Material Type	Dredge Plants	Placement Location
Baldhead Shoal - Reach 4 (Entrance)	Unknown	Hopper	ODMDS
Baldhead Shoal - Reach 3	Clays/Silts/Sand	Hopper	ODMDS
Baldhead Shoal - Reach 2	Clays/Silts/Sand	Hopper - ODMDS; Pipeline Dredge to Beaches	BC Beaches; ODMDS
Baldhead Shoal - Reach 1	Clays/Silts/Sand	Hopper - ODMDS; Pipeline Dredge to Beaches	BC Beaches; ODMDS
Smith Island Channel	Sand	Pipeline Dredge to Beaches	BC Beaches
Baldhead - Caswell	Sand	Pipeline Dredge to Beaches	BC Beaches
Southport	Sand	Pipeline Dredge to Beaches	BC Beaches
Battery Island	Sand/Clay/Silt/Rock	Pipeline to Beaches and BU Site; Cutterhead ODMDS	Lower Swash Island
			BC Beaches
Lower Swash	Clays/Silts & Silty/Clayey Sands	Pipeline Dredge to BU Site	Southport Island
			Lower Swash Island
Snows Marsh	Clays/Silts	Pipeline Dredge to BU Site	Snows Marsh Island
			Lower Swash Island
Horseshoe Shoal	Sand & Silty/Clayey Sand	Pipeline Dredge to BU Site	South Pelican
			Ferry Slip - Intertidal
			Owens Island
Reaves Point	Silty/Clayey Sand	Pipeline Dredge to BU Site	South Pelican Intertidal
			Owens Island
Lower Midnight	Clays/Silts & Sand	Pipeline Dredge to BU Site	Ferry Slip
			Ferry Slip Intertidal
			North Pelican Island
			Owens Island
Upper Midnight	Silty/Clayey Sand	Pipeline Dredge to BU Site	WH-DA-07
			Brunswick Town
			MOTSU Shoreline

Reach	Material Type	Dredge Plants	Placement Location
Lower Lilliput	Sand/Rock	Pipeline Dredge to BU Site; Cutterhead to ODMDS	WH-DA-07; ODMDS
			WH-DA-09; ODMDS
			WH-DA-08; ODMDS
			North Pelican Island
Upper Lilliput	Silty/Clayey Sand/Rock	Pipeline Dredge to BU Site; Cutterhead to ODMDS	WH-DA-07; ODMDS
Keg Island	Silty/Clayey Sand/Rock	Pipeline Dredge to BU Site; Blasting and Mechnical Dredge to BU Site	WH DA-08; ODMDS
			WOFES; ODMDS
Lower Big Island	Silty/Clayey Sand/Rock	Cutterhead to ODMDS; Blasting and Mechnical Dredge to BU Site	WOFES; ODMDS
Upper Big Island	Silty/Clayey Sand/Rock	Cutterhead to ODMDS; Blasting and Mechnical Dredge to BU Site	WOFES; ODMDS
Lower Brunswick	Silty/Clayey Sand/Rock	Cutterhead to ODMDS; Blasting and Mechnical Dredge to BU Site	WOFES; ODMDS
Upper Brunswick	Silty/Clayey Sand/Rock	Pipeline Dredge to BU Site; Cutterhead to ODMDS	Island 13; ODMDS
Fourth East Jetty	Silty/Clayey Sand/Rock	Cutterhead to ODMDS	ODMDS
Between Channel	Clays/Silts/Rock	Cutterhead to ODMDS	ODMDS
Anchorage Basin - 8+00 to 84+85	Clays/Silts/Rock	Cutterhead to ODMDS	ODMDS

F.2.5 Mitigation and Minimization Measures

F.2.5.1 Mitigation Measures

An assessment of impacts was completed for this project, and a need for compensatory mitigation was identified for wetland and aquatic resources. Appendix M (Mitigation Plan) to the Wilmington Harbor EIS describes the identified impacts to significant resources and the mitigation measures that have been proposed for this project. These measures include:

- Fish bypass channel at Lock and Dam 1 of the Cape Fear River
- Fish passage improvements at Lock and Dam 2 of the Cape Fear River
- Wetland preservation site on Black River
- Wetland restoration (i.e. *Phragmites australis* removal, tidal creek improvement, wetland preservation areas) at Eagle Island

More information on the construction of these measures is available in Appendix M of the Wilmington Harbor EIS.

F.2.5.2 Minimization Measures

The project will follow Project Design Criteria that are included in the SARBO as described by species in section F.5 below. The SARBO

Regarding blasting, the Conceptual Blast Mitigation Plan (Appendix L) outlines the following:

- Potential frequency of blast events- Section L.2, pg. 4.
- Protective conditions-
    - Time of year restrictions- Section L.5 and L.5.3, pg. 10-14.
    - Coordination- Section L.6.3, pg. 17.
    - Safety/clearance zones- Section L.5.1, pg. 11-13.
    - Watch programs- Section L.5.2, pg. 12-14
    - Protected Species Observers- Section L.5.1, L.5.2, pg. 11-14
    - Monitoring protocol- Section L.5.1, L.5.2, L.5.3, and L.6.1, pg. 11-17.

Section F.3 Description of the Action Area

The action area (defined in 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action") encompasses areas potentially affected by proposed FNS modifications and associated dredged material placement activities; including the Cape Fear River estuary, the barrier island beaches of Bald Head Island and Oak Island, and offshore areas encompassing the ocean entrance channel and Wilmington ODMDS (Figure 6.). As defined for purposes of this document, the Cape Fear River estuary encompasses the tidally affected river systems and wetlands of the lower Cape Fear River basin; including the mainstem Cape Fear River from the Atlantic Ocean up to Lock and Dam 1 at Kelly, NC (~60 river miles), the Northeast Cape Fear River from its confluence with the Cape Fear River up to NC HWY 53 (~48 river miles), and the Black River from its confluence with the Cape Fear River up to NC HWY 53 (~24 river miles).

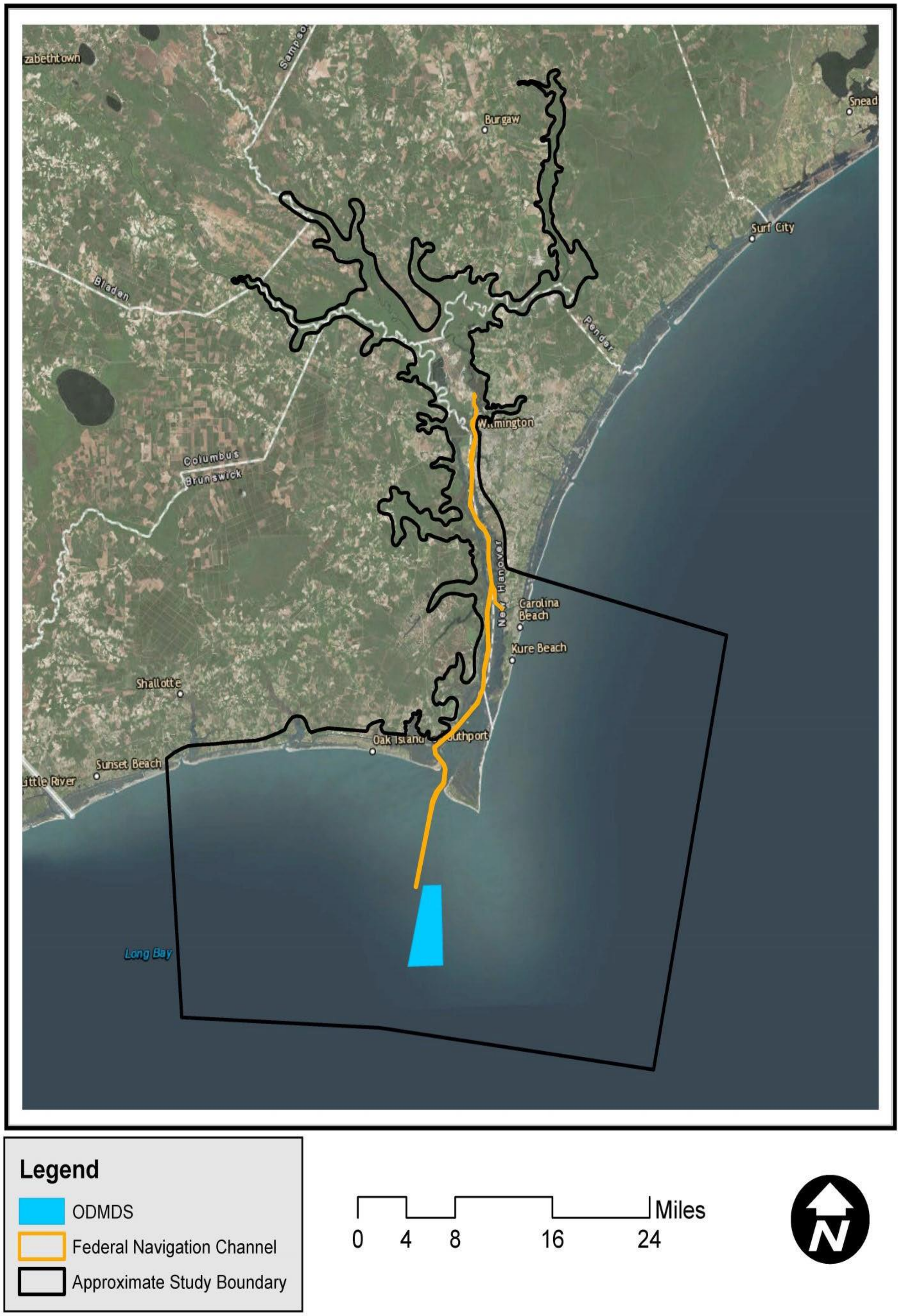

Figure 6. Action Area for the Proposed Project

Section F.4 Potentially Affected NMFS ESA-Listed Species and Critical Habitat

The USACE has assessed the listed species that may be present in the action area. Determination of the project's potential effects to them as shown in Table 5 below.

Table 5. Federally Listed Threatened and Endangered Species Potentially Occurring in the Project Area

Species	ESA Listing Status[1]	Listing Rule/Date	Most Recent Recovery Plan/Outline Date
Green (North Atlantic [NA] distinct population segment [DPS])	T	81 FR 20057/ April 6, 2016	October 1991
Kemp's ridley	E	35 FR 18319/ December 2, 1970	September 2011
Leatherback	E	35 FR 8491/ June 2, 1970	April 1992
Loggerhead (Northwest Atlantic [NWA] DPS)	T	76 FR 58868/ September 22, 2011	December 2008
Hawksbill	E	35 FR 8491/ June 2, 1970	December 1993
Shortnose sturgeon	E	32 FR 4001/ March 11, 1967	December 1998
Atlantic sturgeon (SA DPS and Carolina DPS)	E	77 FR 5914/ February 6, 2012	2018
Giant manta ray	T	83 FR 2916/ January 22, 2018	2019
Oceanic whitetip shark	T	83 FR 4153/ January 30, 2018	2018
North Atlantic right whale	E	35 FR 18319/ December 2, 1970	June 2005
Blue whale	E	35 FR 18319/ December 2, 1970	July 1998
Fin whale	E	35 FR 12222/ December 2, 1970	August 2010
Sei whale	E	35 FR 12222/ December 2, 1970	December 2011
Sperm whale	E	35 FR 12222/ December 2, 1970	December 2010

The oceanic white tip, blue whale, fin whale, sei whale, and sperm whale are not addressed in this BA due to a lack of suitable habitat for the species within the proposed project area.

The USACE has assessed the critical habitat that overlap with the action area. Determination of the project's potential effects to them as shown in Table 6 below.

Table 6. Critical Habitats that Overlap with the Project Area

Species	Critical Habitat in the Action Area	Critical Habitat Rule/Date
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	LOGG-N-05 Nearshore Reproductive Habitat LOGG-N-02 Winter Habitat	79 FR 39856/ July 10, 2014
Atlantic sturgeon (Carolina DPS)	Unit 4. Cape Fear River and Northeast Cape Fear River	82 FR 39160/ August 17, 2017
North Atlantic right whale	Unit 2. Southeastern U.S. Calving Area	81 FR 4837/ January 27, 2016

F.4.1 Sea Turtles

Table 7. Sea turtle nests in Southeast North Carolina in the past 10 years by species (NCWRC, 2025).

Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Green	11	0	8	6	7	5	3	1	10	2	2
Kemp's Ridley	0	1	0	0	0	0	1	2	0	1	1
Loggerhead	111	400	420	344	231	718	448	410	593	494	375
Hawksbill	ND	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
Leatherback	ND	ND	ND	ND	1	ND	ND	ND	2	0	0
Other/Unknown	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL	**122**	**401**	**428**	**350**	**238**	**723**	**452**	**413**	**605**	**497**	**378**

Includes all nests observed between Lockwood Folly inlet and Mason inlet (Bald Head Island, Carolina, Fort Fisher, Kure, Masonboro, Wrightsville, Oak, and Caswell beaches).
ND= No Data

F.4.1.1 Green Sea Turtle

Status and Distribution

The green sea turtle (*Chelonia mydas*) was initially listed as endangered and threatened under the ESA on 28 July 1978 (43 FR 32800). Breeding populations in Florida and along the Mexican Pacific Coast were listed as endangered, while all other populations throughout the species' range were listed as threatened. In 2011, the green sea turtle's ESA status was revised to threatened and endangered based on the recognition of eight Distinct Population Segments (DPSs) (81 FR 20057). All green sea turtles in the North Atlantic were listed as threatened under the North Atlantic Ocean DPS.

In US waters, green sea turtles are distributed along the Atlantic and Gulf Coasts from Massachusetts to Texas (NMFS and USFWS 2007a). Post-hatchlings migrate to oceanic waters and begin an oceanic juvenile phase of development. Oceanic phase juveniles appear to move with the predominant ocean gyres for several years before returning to neritic waters, the relatively shallow part of the ocean above the drop-off of the continental shelf, where juvenile development continues to adulthood. Neritic phase juveniles inhabit shallow estuarine waters and nearshore continental shelf waters that are rich in seagrasses and/or marine macroalgae. Adults generally remain in relatively shallow foraging habitats with abundant seagrasses and macroalgae but may enter the oceanic zone when migrating between foraging grounds and nesting beaches.

Nesting in the US is primarily limited to Florida, although nesting occurs in small numbers along the southeast coast from Georgia to NC and the Gulf Coast of Texas. Nesting turtles appear to prefer high wave energy barrier island beaches with coarse sands, steep slopes, and prominent foredunes. The highest nesting densities occur on sparsely developed beaches that have minimal levels of artificial lighting (Witherington et al. 2006). Green sea turtles nest in relatively small numbers along the NC coast, with reported nesting from 2014-2024 averaging 39 nests per year (NCWRC, 2025). Annual NC nest totals from 2014-2024 ranged from 16 to 96 nests. Nesting has increased since 2014, with the two highest nest totals on record occurring during 2019 and 2023 with 61 and 96 nests, respectively. Green sea turtle nesting is concentrated along the barrier islands of Cape Lookout National Seashore (CALO) and Cape Hatteras National Seashore (CAHA). Along the southern NC coast, areas supporting consistent nesting in small numbers include Bald Head Island, Topsail Island, and Onslow Beach. Nesting along the remainder of the NC coast has generally occurred sporadically in very small numbers. North Carolina nesting data show a peak in nesting activity from the last week of June through the third week of August, with 79% of all nesting occurring during this period. A total of five green sea turtle nests were recorded on Bald Head Island from 2014-2024.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the over-exploitation of green sea turtles for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern US, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside US jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green sea turtles from human-related causes in the US. These threats include beach armoring, erosion control, artificial lighting, beach disturbance (e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, other human activities, and interactions with fishing gear. Sea sampling coverage in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles.

F.4.1.2 Kemp's Ridley Sea Turtle

Status and Distribution

The Kemp's ridley sea turtle (*Lepidochelys kempii*) was listed as endangered throughout its range on 2 December 1970 (35 FR 18320). Kemp's ridley sea turtles occur primarily in coastal waters of the Gulf of America and the western North Atlantic Ocean. Data indicate that adults utilize coastal habitats of the Gulf of America and the southeastern US. Adults inhabit nearshore waters and are commonly found over crab-rich sandy or muddy bottoms (NMFS and USFWS 2007c). Hatchlings migrate to the oceanic zone where they are carried by currents into various areas of the Gulf of America and the North Atlantic Ocean. At approximately two years of age, juveniles leave the oceanic zone and move to coastal benthic habitats in the Gulf of America and the Atlantic Ocean along the eastern US. During this stage, juveniles occupy protected coastal waters such as bays, estuaries, and nearshore waters less than 165 feet deep. Juveniles utilize a wide range of bottom substrates but apparently depend on an abundance of crabs and other invertebrates (NMFS and USFWS 2007c).

Nesting is primarily restricted to coastal beaches along the Mexican states of Tamaulipas and Veracruz, although a small number of turtles consistently nest along the Texas coast (Turtle Expert Working Group (TEWG) 1998). Rare nesting events have also occurred along the coasts of NC, South Carolina, Georgia, Florida, and Alabama. Kemp's ridley nesting is relatively rare in NC compared to other sea turtle species, with 60 nests reported during the period of 2014-2024. Of the 60 nests, eight were reported from the northern Outer Banks. Reported Kemp's ridley nesting in the action area is limited to one nest at Fort Fisher in 2015. Kemp's ridley nesting in NC ranges from May 25 to June 23 each year.

Threats

Kemp's Ridleys face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold stunning. Although cold stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound.

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's Ridleys, this species is also affected by other sources of anthropogenic impacts similar to those for green and loggerhead sea turtles. For example, in the spring of 2000, five Kemp's Ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gill net fishery operating offshore in the preceding weeks.

In addition to gill net fisheries, other causes of mortality include predation, parasitism, disease, environmental changes, effects of beach manipulations on eggs and hatchlings, collisions with boats, power plant entrainments, ingestion of plastics and toxic substances, illegal poaching of nests and degradation of foraging habitat by physical damage caused by trawlers over live bottoms.

Dredging of harbors and beach renourishment projects are inherent dangers to all sea turtles in the project area. Of all the sea turtles taken by four USACE Divisions (Mississippi Valley, North Atlantic, South Atlantic, and Southwestern), less than 13 percent were Kemp’s Ridleys.

Critical Habitat

No critical habitat has been designated for this species in the proposed project area.

F.4.1.3 Leatherback Sea Turtle

Status and Distribution

The leatherback sea turtle (*Dermochelys coriacea*) was listed as endangered throughout its range on 2 June 1970 (35 FR 8491). The leatherback has a global oceanic distribution that extends north and south into sub-polar regions. Leatherbacks undertake extensive migrations between northern foraging grounds and tropical and subtropical nesting beaches (NMFS and USFWS 2007e). Little is known of the distribution and developmental habitat requirements of leatherbacks from hatchling to adulthood (NMFS and USFWS 2013). The leatherback sea turtle is primarily a pelagic species preferring deep, offshore waters. Leatherbacks may be present in nearshore ocean waters during certain times of the year; however, they rarely enter estuarine waters. Epperly (1995b) reported the appearance of significant numbers of leatherback turtles in nearshore ocean waters during May, coincident with the appearance of jellyfish prey. Sightings declined sharply after four weeks and only a few sightings were reported after late June. Leatherbacks were infrequently observed in estuarine waters during this period. The surveys conducted by Goodman et al. (2007) recorded only one leatherback observation, during the summer in the nearshore ocean south of Cape Hatteras. Epperly et al. (1995a) reported the occurrence of three leatherbacks in Core and Pamlico Sounds during December 1989.

Nesting in the US for leatherback sea turtles is primarily restricted to Florida, Puerto Rico, and the US Virgin Islands encompassing at least 75% of all nesting activity (NMFS and USFWS 1992). However, nesting occurs in small numbers along the Gulf Coast of Texas and the southeastern US Atlantic Coast from Georgia to NC. Leatherback nesting is rare in NC, with just 20 nests reported from 2014 through 2024. Nesting records span the entire NC coast but are heavily concentrated along the northern barrier islands of CALO and CAHA. Leatherback nesting in the southern region from 2014-2024 was limited to one nest each on Fort Fisher, Oak Island, and Sunset

Beach. Reported leatherback nest establishment dates in NC range from 16 April to 30 July.

Threats

The main threat to leatherback populations in the Atlantic is the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches. Other important ongoing threats to the population include pollution, loss of nesting habitat, and boat strikes.

Of sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, possibly their method of locomotion, and perhaps their attraction to the lightsticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets and pot/trap lines (used in various fisheries) and capture in trawl gear (e.g., shrimp trawls).

Leatherback interactions with the southeast Atlantic shrimp trawl fishery, which operates predominately from North Carolina through southeast Florida (NMFS, 2002b), have also been a common occurrence. Leatherbacks, which migrate north annually, are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast from Cape Canaveral, Florida, to the Virginia/North Carolina border. Leatherbacks also interact with the Gulf of America shrimp fishery. For many years, Turtle Excluder Devices (TEDs) required for use in these fisheries were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, the NMFS issued a final rule to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks and large and sexually mature loggerhead and green turtles.

Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (Lutcavage et al. 1997, Shoop and Kenney 1992). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44 percent of the 16 cases examined) contained plastic (Mrosovsky 1981). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object might resemble a food item by its shape, color, size or even movement as it drifts about, and induce a feeding response in leatherbacks. It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range.

Critical Habitat

No critical habitat has been designated for leatherback sea turtles in the project area.

F.4.1.4 Loggerhead Sea Turtle

Status and Distribution

The loggerhead sea turtle (*Caretta caretta*) was initially listed under the ESA as threatened throughout its range on 28 July 1978 (43 FR 32800). In 2011, the loggerhead's ESA status was revised to threatened and endangered based on the recognition of nine DPSs. DPSs encompassing populations in the Northwest Atlantic Ocean, South Atlantic Ocean, Southwest Indian Ocean, and Southeast Indo-Pacific Ocean were reclassified as threatened, while the remaining five populations in the Northeast Atlantic Ocean, Mediterranean Sea, North Pacific Ocean, South Pacific Ocean, and North Indian Ocean were reclassified as endangered.

Adult female loggerheads return to the beach where they were born and have a tendency to return to the same beaches during their initial reproductive season, typically nesting during within zero to three miles of the initial nesting site in later years (Miller et al. 2003). A variety of different substrates and beach slopes are used for nesting, but loggerheads appear to prefer relatively narrow, steeply sloped, coarse-grained beaches (Provancha and Ehrhart 1987). Loggerheads require deep, clean, relatively loose sand above the high-tide line for successful nest construction (Hendrickson 1982).

Nesting in the US occurs along the Atlantic and Gulf coasts from southern Virginia to Texas but is concentrated from NC through Alabama (NMFS and USFWS 2008). Nesting populations along the southeastern US coast from southern Virginia to the Florida-Georgia border comprise the Northern Recovery Unit, one of five designated recovery units within the Northwest Atlantic DPS (USFWS 2009). Nesting in the Northern Recovery Unit had been declining at an annual rate of 1.3% through 2007; however, nesting has increased substantially since 2008, with the three highest annual nest totals on record occurring in 2012, 2013, and 2015. Similar nesting increases throughout the Northwest Atlantic DPS since 2007 indicate that the population may be stabilizing (USFWS 2015b). A total of 38 terrestrial critical habitat units encompassing ~245 miles of nesting beaches have been designated within the Northern Recovery Unit; including eight units (~96 miles) in NC, 22 units (~79 miles) in South Carolina, and eight units (~69 miles) in Georgia (79 FR 39756). Nesting in these 38 units comprises approximately 86% of all loggerhead nesting within the Northern Recovery Unit.

Loggerhead nesting occurs along the entire NC coast but is concentrated along three sections of the coast, including the Cape Fear region from Holden Beach to Fort Fisher, Topsail Island, and Onslow Beach, and the barriers that comprise CALO and CAHA. Collectively, these sections of the coast accounted for 86% of all loggerhead nesting in NC from 2014-2024. Nesting in NC is typically restricted to the period of 1 May to 15 September. Relatively few nests are recorded during the first three weeks of May, but nesting increases rapidly from late May onward, peaking from mid-June through the end of July. Nesting declines abruptly after July, and few nests are recorded after the third week of August. The Cape Fear region from Holden Beach to Fort Fisher supports the highest concentration of loggerhead nesting in NC, accounting for 54% of all loggerhead nests recorded in the state from 2014-2024. A total of 1,038 loggerhead nests were recorded on Bald Head Island from 2014-2024, while 1,833 nests were recorded on Caswell Beach/Oak Island. Annual nesting from 2000-2016 averaged 94 nests per year on Bald Head and 167 nests per year on Caswell Beach/Oak Island.

Threats

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand erosion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. Other sources of natural mortality include cold stunning and biotoxin exposure. The largest cause of mortality to hatchlings is predation by feral hogs, ghost crabs, raccoons, and occasionally fire ants and humans.

Anthropogenic factors that impact hatchlings and adult female turtles on land, or the success of nesting and hatching include: beach erosion, beach armoring, beach nourishment, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, beach driving, coastal construction and fishing piers, exotic dune and beach vegetation, and poaching. An increase in human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g., raccoons, and opossums) which raid and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the North Carolina coast, other areas along these coasts have limited or no formal protection. Sea turtle nesting and hatching success on unprotected beaches along the coast of North Carolina are affected by all of the above threats.

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, transportation, marine pollution, underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. Loggerheads in the benthic environment in waters off the coastal United States are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook and line, gill net, pound net, longline, and trap fisheries. Specific threats as a potential outcome of this study include dredging, dredged material placement, and habitat displacement.

Critical Habitat

The critical habitat for loggerhead sea turtles was created in 2014. The critical habitat encompasses all nearshore ocean waters from the MHW line out to 1.6 km along the designated terrestrial units are encompassed by a single nearshore reproductive critical habitat unit (LOGG- N-05) that extends continuously from Carolina Beach Inlet to Shallotte Inlet. Nearshore reproductive marine critical habitat units encompass reproductive habitat along nesting beaches that is used by hatchlings for egress to the open ocean and by nesting females for movements between beaches and the open ocean during the nesting season. Critical nearshore reproductive habitat primary constituent elements include nearshore waters directly off the highest density nesting beaches and their adjacent beaches, waters sufficiently free of obstructions and artificial lighting to allow transit through the surf zone to open water, and waters with minimal manmade structures that could promote predators, disrupt wave patterns necessary for orientation, and/or create excessive longshore currents (79 FR 39855). An additional winter critical habitat unit (LOGG-N-02) encompasses offshore waters between the 20-m and 100-m bathymetric contours from Cape Fear to Cape Hatteras. The inner boundary (20-m contour) of LOGG-N-02 is located ~11 nm (13 m) seaward of the east-facing beaches to the north of Cape Fear. Winter critical habitat encompasses warm waters near the western edge of the Gulf Stream that are used by a high concentration of juveniles and adults during the winter. Primary constituent elements include water temperatures above 10°C from November through April, continental shelf waters in proximity to the boundary of the Gulf Stream, and water depths between 20 and 100 m.

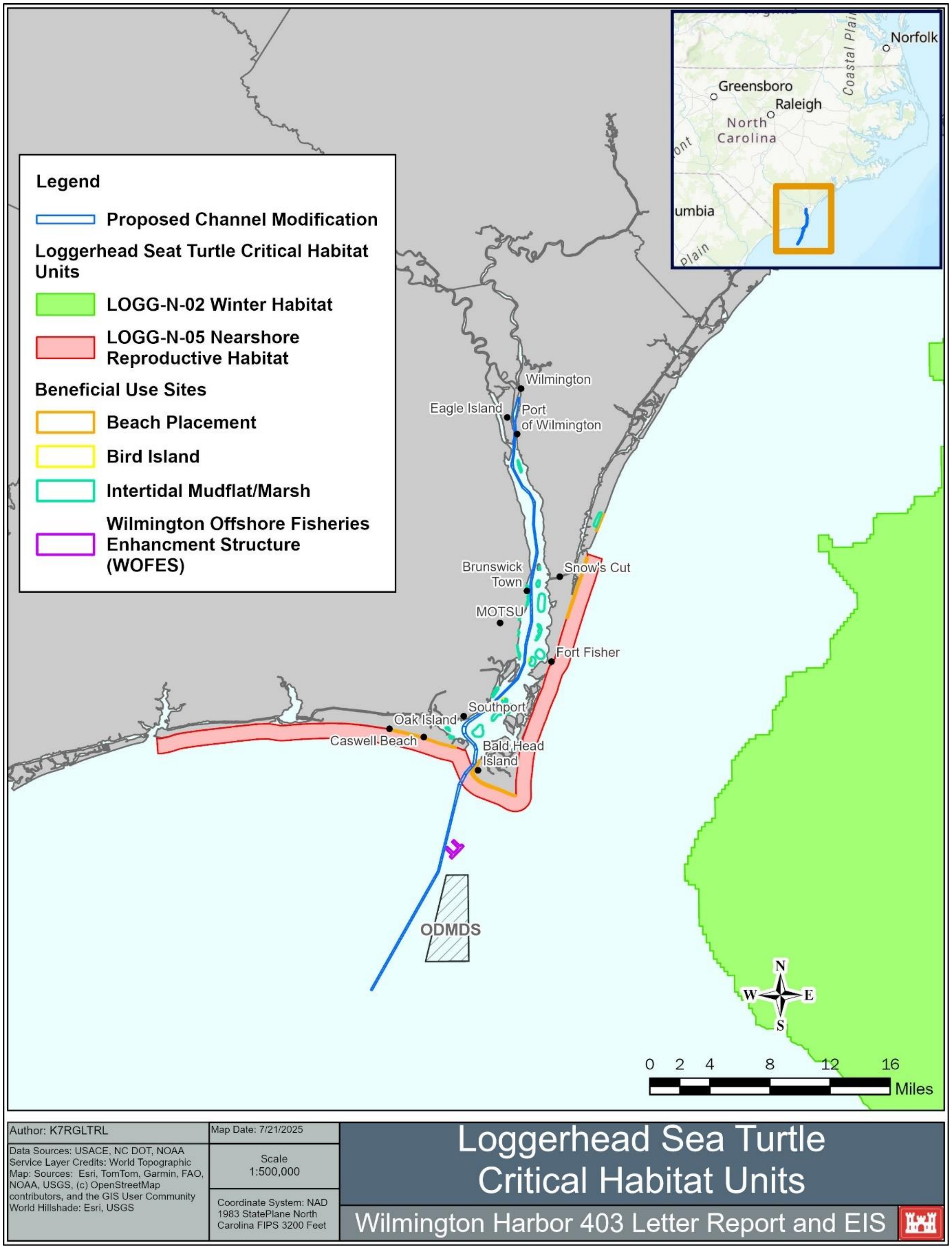

Figure 7. Loggerhead Nearshore Reproductive Critical Habitat

F.4.1.5 Hawksbill Sea Turtle

Status and Distribution

The hawksbill sea turtle (*Eretmochelys imbricate*) was listed as endangered throughout its range on 2 June 1970 (35 FR 8491). Hawksbill sea turtles are globally distributed in tropical and to a lesser extent subtropical waters of the Atlantic, Indian, and Pacific Oceans. In US waters, hawksbills have been reported along the Atlantic and Gulf Coasts from Massachusetts through Texas; however, sightings north of Florida are rare. Hatchlings are carried by currents to the oceanic zone where they reside in major ocean gyres. Juveniles eventually depart the oceanic zone and move to nearshore habitats. Juveniles and adults are primarily associated with coral reef habitats, but may use other habitats such as hardbottoms, seagrass beds, algal beds, mangrove bays and creeks, and mud flats. Adults undertake extensive migrations between foraging grounds and nesting beaches (NMFS and USFWS 2007d).

Nesting occurs on sandy beaches throughout the tropical and subtropical regions of the Atlantic, Pacific, and Indian Oceans. Nesting in the US is primarily limited to Florida and the US Caribbean (NMFS and USFWS 1993). Nesting events in the continental US are restricted to the southeastern coast of Florida and the Florida Keys, although two hawksbill nests were confirmed in NC (NPS 2015). Although documented nesting in the continental US is extremely rare, hawksbill tracks are difficult to differentiate from those of the loggerhead and may not be recognized by surveyors. Hawksbill nesting records for NC are limited to two nests that were identified at CAHA in 2015 through DNA testing (NPS 2015). However, the similarity of hawksbill tracks to those of the loggerhead suggests that some hawksbill nesting may go undetected along the southeastern US coast (USFWS 2015b, Meylan et al. 1995).

Threats

Hawksbill sea turtles face a multitude of anthropogenic and environmental threats that have led to severe population declines. One of the primary threats is the illegal trade of their shells, often referred to as "tortoiseshell," which are highly valued for decorative purposes. Habitat loss due to coastal development and degradation of coral reef ecosystems further imperils the species. Additionally, hawksbills are highly susceptible to entanglement in fishing gear, such as gillnets and longlines, resulting in injury or mortality. Pollution, particularly ingestion of marine debris like plastics, and exposure to oil spills and toxic contaminants, also negatively impact their health and reproductive success. Conservation efforts must address these diverse threats through a combination of habitat protection, international trade regulation, sustainable fisheries management, and public education

Critical Habitat

No critical habitat has been designated for this species in the project area.

F.4.2 Giant Manta Ray

F.4.2.1 Status and Distribution

On January 22, 2018, NMFS issued a final rule to list the giant manta ray (*Manta birostris*) as threatened species under the Endangered Species Act. On November 22, 2023, NMFS issued a direct final rule to revise the scientific name of the giant manta ray to *Mobula birostris* to reflect the scientifically accepted taxonomy and nomenclature of this species.

The distribution of the giant manta ray is worldwide in tropical and temperate ocean waters. The giant manta rays are distributed throughout the Southeast US, occurring in the Western North Atlantic, Gulf of America, and Caribbean. Within these areas, they are sighted at continental shelf-edges, upwelling areas, and in productive coastal areas, including inshore locations such as inlets, intracoastal waterways, bays, and estuaries. Giant manta rays do not occur in freshwater or marsh habitats (e.g., freshwater lakes and rivers, tidal and non-tidal marshes, mangroves, riparian areas); therefore, it is not necessary to consider them for activities that occur within these habitats.

Threats

The primary threats to Manta species are targeted fishing and fishery bycatch. Additionally, vessel traffic, both recreational and commercial, has been documented to adversely affect protected species such as the giant manta ray. Giant manta rays spend considerable time basking, traveling, and feeding in surface waters, where they are susceptible to vessel strikes. In addition, giant manta rays are at greater risk of vessel strike if they occur near areas of high human use (e.g., inlets, coastal areas, beaches).

Dredging and offshore sand placement activities occurring within the marine environment will likely result in habitat degradation, avoidance, and displacement of giant manta rays from the action area. It is unknown whether hopper dredges pose a risk of entrainment for giant manta rays. However, records suggest that giant manta rays have been captured in relocation trawls. We do not anticipate that these interactions would result in mortalities given the limited trawl times associated with relocation trawling. Refer to the South Atlantic Regional Biological Assessment (SARBO) for additional information.

Critical Habitat

There is no critical habitat designated for this species within the proposed project area.

F.4.3 North Atlantic Right Whale

F.4.3.1 Status and Distribution

North Atlantic right whale (NARW) populations in the North Atlantic and North Pacific were originally listed as a single endangered species in June 1970 (35 FR 8495) under the Endangered Species Conservation Act (a predecessor to the ESA of 1973). In 2008, the two populations were reclassified as separate endangered species; the North Atlantic right whale (Eubalaena glacialis) and the North Pacific right whale (E. japonica) were listed as two separate endangered species under the ESA (73 FR 12024). The most recent stock status assessment in 2017 estimated the size of the North Atlantic right whale population at 458 individuals (NMFS 2018). North Atlantic right whales calve in warm subtropical waters during winter, and migrate to feeding grounds in highly productive cold temperate and subpolar waters in spring and summer (Greene and Pershing 2004). The majority of the western North Atlantic population ranges from wintering and calving areas in coastal waters off the southeastern US to summer feeding grounds in coastal waters off New England (Massachusetts Bay, Cape Cod Bay, and the Great South Channel) and Canada (Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence). Waters along the southeastern US coast constitute the only known calving habitat for North Atlantic right whales (Kraus et al. 1986, Knowlton et al. 1994, and Reeves et al. 2001). Reproductive females typically arrive in the calving areas during late November and early December after migrating south from feeding grounds in the northeastern US and Canada (Fujiwara and Caswell 2001, Garrison 2007, and Hamilton et al. 2007). Mothers and newborn calves reside within the southeast through winter and generally depart the calving grounds by the end of March or early April (Reeves et al. 2001). Other members of the population spend the winter on the northern feeding grounds, and a substantial portion of the population may spend the winter in several northern areas such as the Gulf of Maine and Cape Cod Bay (Cole et al. 2013, Clark et al. 2010, and Mussoline et al. 2012). Currently designated critical habitats for the right whale include northeastern feeding grounds in the Gulf of Maine/Georges Bank region, and southeastern nearshore ocean calving habitats from central Florida to Cape Fear, NC (81 FR 4838) (Figure 8).

Threats

Ship collisions and fishing gear entanglements are the principal anthropogenic causes of North Atlantic right whale mortality. A total of 22 mortalities were attributed to ship strikes between 1970 and 2004, and it is estimated that approximately 60% of all right whales have scars associated with fishing gear entanglement (NMFS 2005). For the period of 2011 through 2015, the average minimum rate of annual human-caused right whale mortality and serious injury was 5.36 per year; including incidental fishery entanglements at an average rate of 4.55 per year and vessel strikes at an average rate of 0.81 per year (NMFS 2018). Analyses of whale-vessel interactions indicate that the probability of vessel strikes and the probability of serious injuries from vessel strikes both increase with ship speed (NMFS 2008). In an effort to reduce ship strikes, the NMFS published the Right Whale Ship Strike Reduction Rule (50 CFR 224.105). The Ship Strike Reduction Rule established Seasonal Management Areas (SMAs) with mandatory large vessel (≥65 ft) speed restrictions. The southernmost Mid-Atlantic SMA encompasses waters within a 20-nm radius of MCH and a continuous 20 nm zone along the southeastern US coast from Wilmington, NC, to Brunswick, Georgia (Figure 9). Vessels ≥65 feet in length are restricted to speeds of ten knots or less in the Mid-Atlantic SMA from 1 November to 30 April (73 FR 60173). Additional federal regulations prohibit the approach of any vessel within 500 yards of a right whale [50 CFR

224.103(c)]. Although instances of lethal whale-dredge interactions (i.e., vessel collisions) have not been documented, a non-lethal interaction was reported in 2005 when a hopper dredge collided with an apparent right whale along the Georgia coast near the Brunswick Harbor entrance channel (NMFS 2012b).

Critical Habitat

The coastal waters of the Carolinas are part of the migratory corridor for the North Atlantic right whale (Winn et al. 1986, Knowlton et al. 2002). In an effort to better define the geographic and temporal extent of the right whale migratory corridor, Knowlton et al. (2002) analyzed 489 right whale sightings that occurred along the mid-Atlantic coast between 1974 and 2002. The largest number of sightings (34.4%) occurred within five nautical miles (nm) of shore, and well over half of the sightings (63.8%) occurred within ten nm of shore. Nearly all of the sightings (94.1%) were within 30 nm of shore. Despite extensive survey effort, sightings farther offshore were very rare. Sightings near Wilmington, NC, occurred from October through April with a peak during February and March (Knowlton et al. 2002). A total of 18 sightings occurred within a 40 nm radius of the entrance to Wilmington Harbor; including 14 sightings within a 20 nm radius of the harbor entrance. At Morehead City Harbor, 17 sightings occurred within a 35-nm radius of the harbor entrance, including 15 sightings within 20 nm of the harbor entrance. Surveys conducted off the southern NC coast during the winters of 2001 and 2002 sighted eight calves, including four calves that were not sighted by surveys conducted farther south (McLellan et al. 2003). The NC calve sightings suggest that the right whale calving grounds may extend north to southern NC waters. In 2016, Southeastern Calving Area Critical Habitat for the right whale was extended north to Cape Fear. The essential features of the southeastern calving critical habitat include physical oceanographic conditions that support calving and nursing, including calm sea surface conditions, sea surface temperatures of 45 degrees Fahrenheit (°F) to 63°F, and water depths of 20 feet to 92 feet below MLLW.

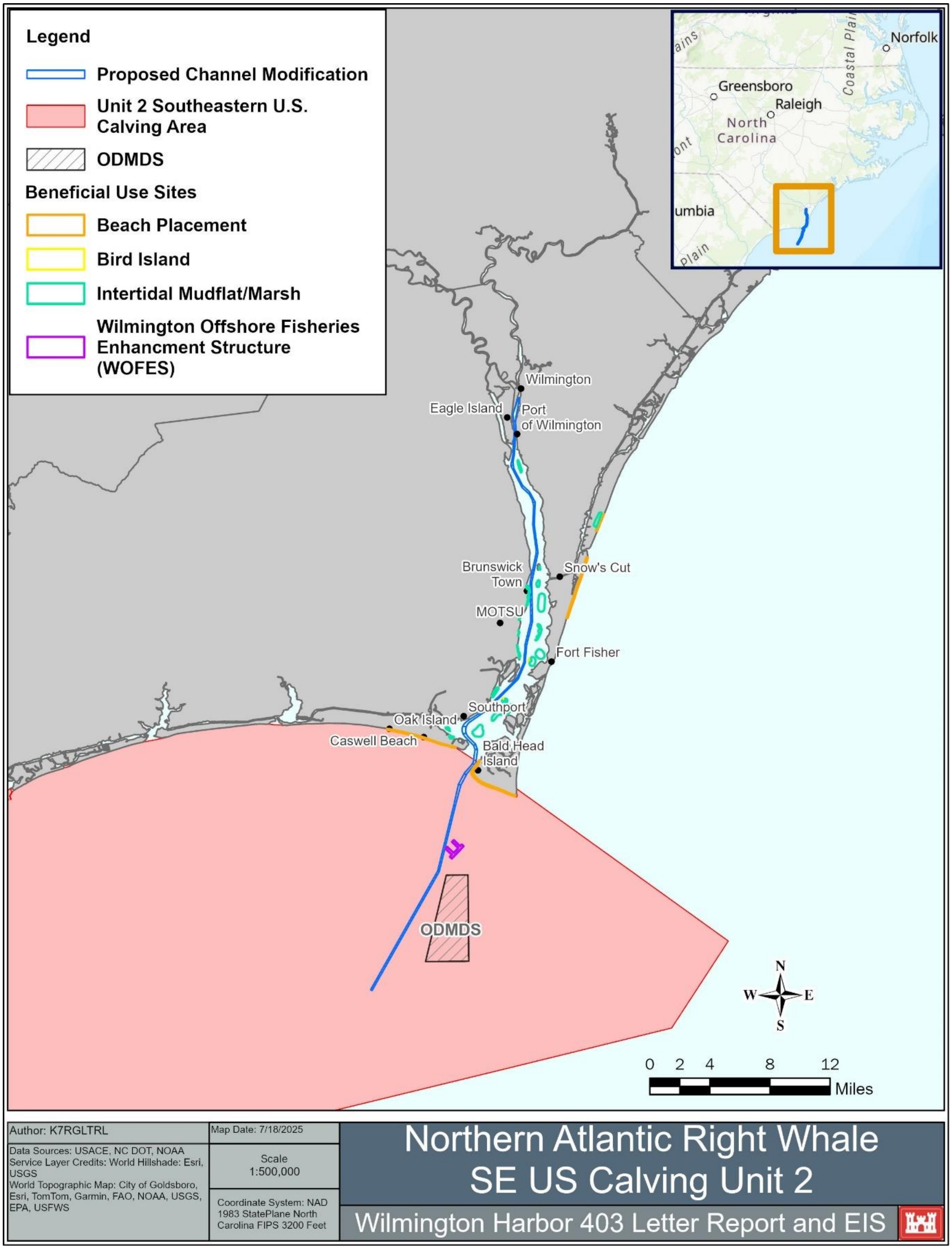

Figure 8. North Atlantic Right Whale Southeastern US Calving Critical Habitat

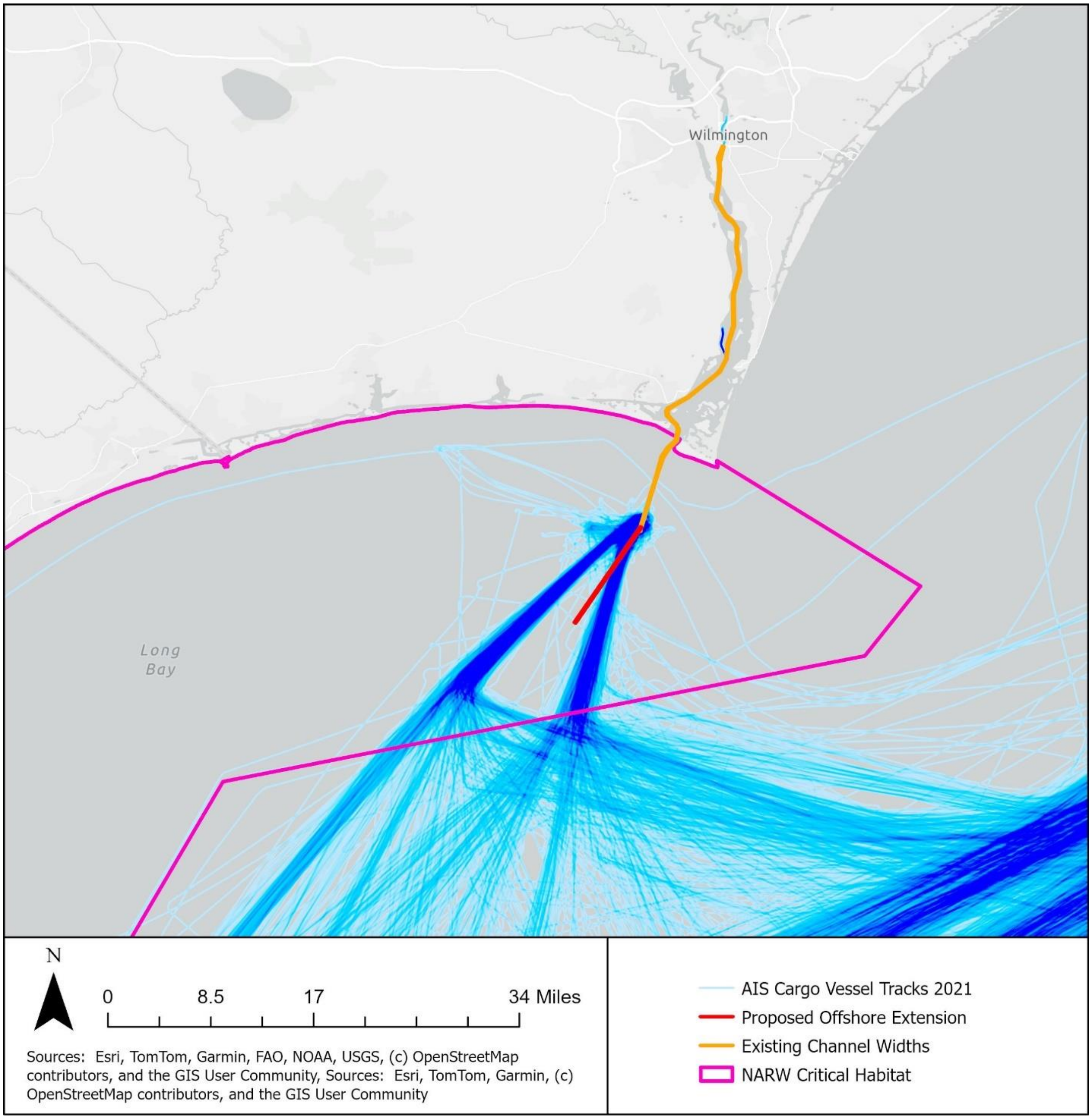

Figure 9. AIS Cargo Vessel Tracks 2021

Figures 10 through 13 below reflect the proposed project overlayed with the automatic identification system (AIS) for cargo vessels for years 2021 to 2024.

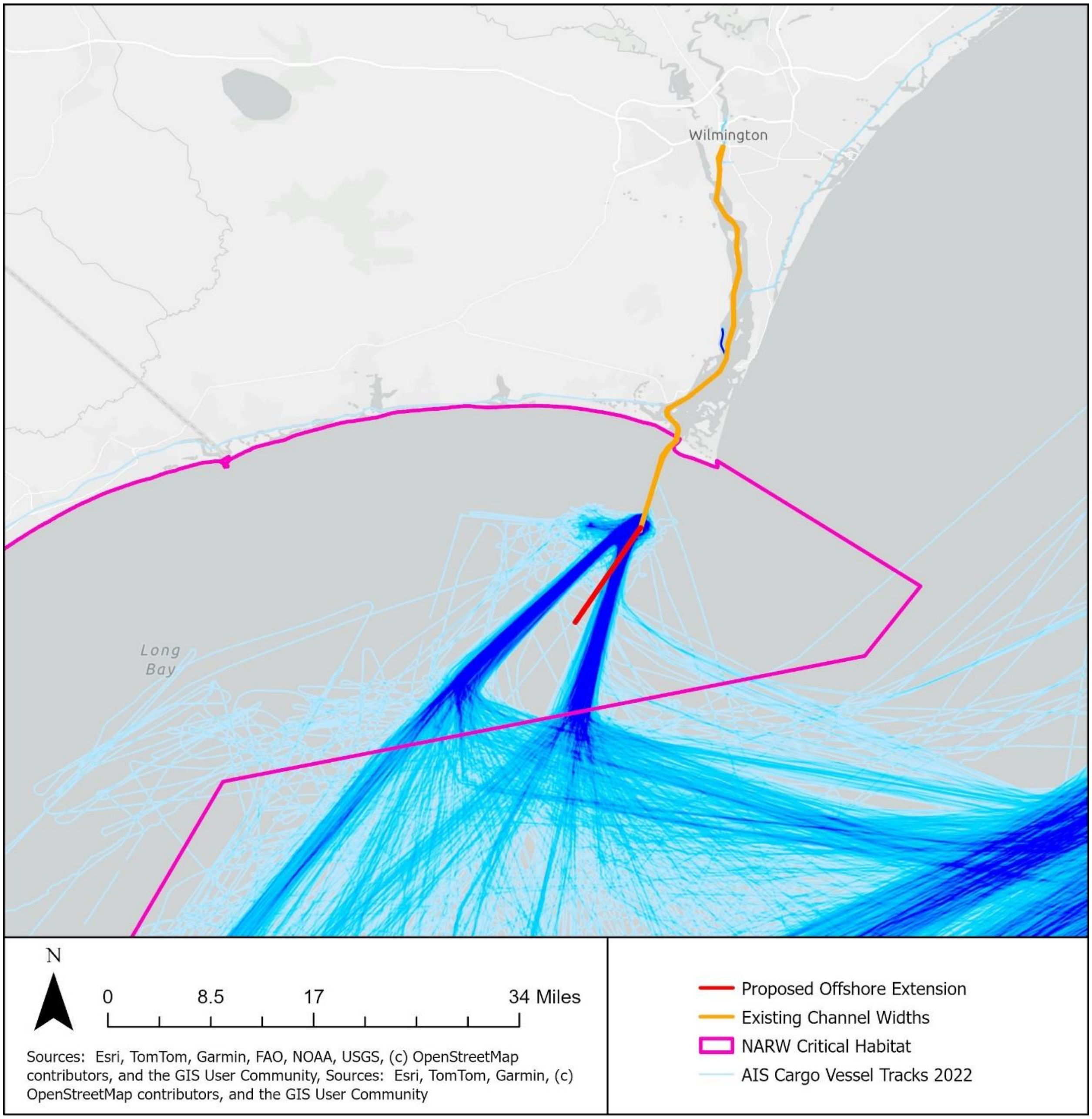

Figure 10. AIS Cargo Vessel Tracks 2022

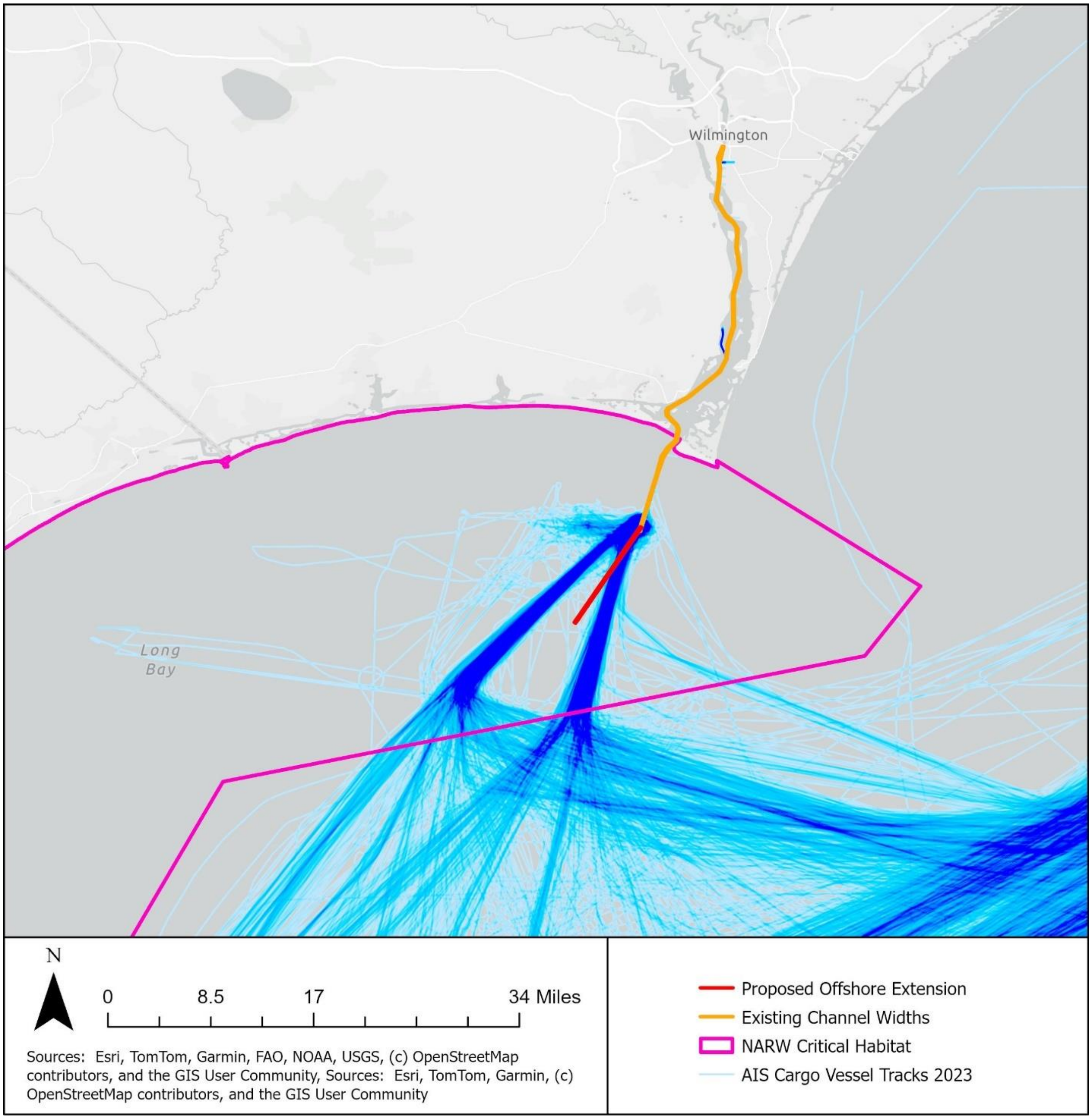

Figure 11. AIS Cargo Vessel Tracks 2023

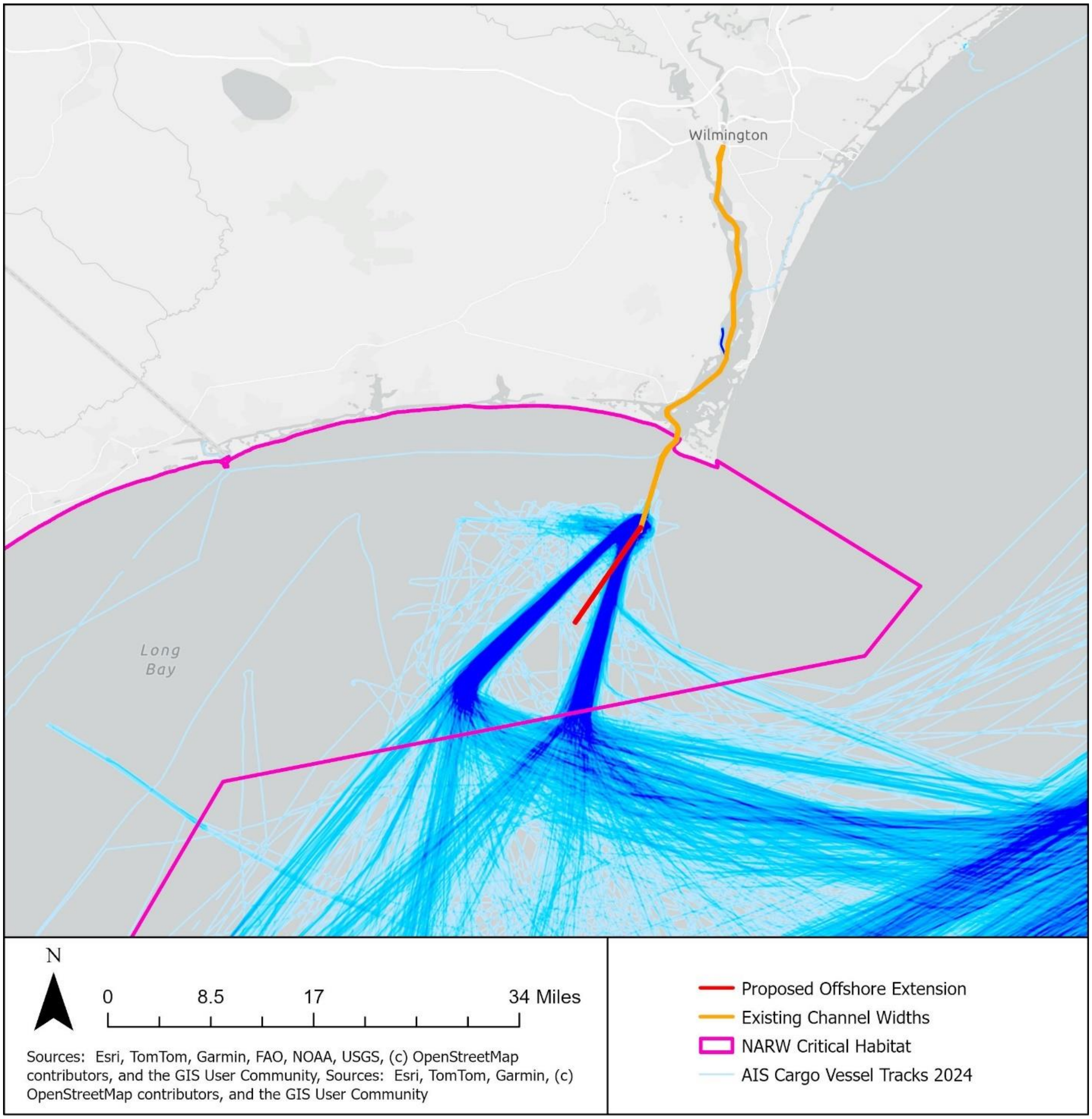

Figure 12. AIS Cargo Vessel Tracks 2024

F.4.4 Sturgeon

F.4.4.1 Atlantic Sturgeon

Status and Distribution

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) was listed under the ESA in 2012 with several DPS segments. These DPS listed the Atlantic sturgeon as endangered for the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs and threatened for the Gulf of Maine DPS (77 FR 5914, 77 FR

5880). The Carolina DPS encompasses subpopulations from the Roanoke, Tar/Pamlico, Cape Fear, Waccamaw, Pee Dee, and Santee-Cooper Rivers in NC and South Carolina. The historical US distribution of the Atlantic Sturgeon includes approximately 38 rivers from the Saint Croix River in Maine to the Saint Johns River in Florida, including spawning populations in at least 35 rivers. The current US distribution includes 35 rivers with spawning known to occur in at least 20 rivers.

Atlantic sturgeon spawn in freshwater but spend most of their adult life in a marine environment. Spawning adults generally migrate upriver in the spring/early summer, although 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 juveniles 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 adult and subadult sturgeon are typically found in shallow (40-70 feet deep) nearshore waters with gravel and sand substrates. Although extensive mixing occurs in coastal waters, Atlantic sturgeons return to their natal river to spawn [Atlantic Sturgeon Status Review Team (ASSRT) 2007].

The Atlantic sturgeon was historically abundant in most NC coastal rivers and estuaries; however, at the time of its listing under the ESA, the Carolina DPS spawning population was estimated at less than 300 individuals (NMFS 2012a). Extant spawning populations in NC are currently known from the Roanoke, Tar-Pamlico, Cape Fear, and potentially the Neuse River systems (ASSRT 2007). Gill net surveys in the Cape Fear River system have captured substantial numbers of Atlantic sturgeon in the Cape Fear River mainstem, Brunswick River, and Northeast Cape Fear River (Moser and Ross 1995, ASSRT 2007). Subadult Atlantic sturgeon in the Cape Fear River system exhibit seasonal movements and distribution patterns; moving upriver during the summer and migrating out of the river to estuarine or ocean waters during the coldest time of the year (Post et al. 2014). High inter-annual return rates of tagged fish demonstrate fidelity to the Cape Fear River system; indicating that the Cape Fear River system may be the natal river system for these individuals (Post et al. 2014). Reports of Atlantic sturgeon above Lock and Dam 1 indicate that some fish are successful at passing Lock and Dam 1, although high resolution telemetry surveys indicate that passage may be occurring via a naturally occurring bypass rather than rock arch ramp constructed in 2013 (Bunch). Although eggs have not been detected, the collective body of evidence suggests that both the Cape Fear River and the Northeast Cape Fear River may be important spawning areas.

Threats

Historical overharvesting contributed to drastic declines in Atlantic sturgeon populations. Commercial exploitation of Atlantic sturgeons continued throughout most of the 20th century (NMFS 1998, ASSRT 2007). Although directed commercial harvest is no longer permitted, by-catch mortality associated with other fisheries remains a major threat. By-catch mortality associated with the shad and shrimp fisheries and water quality degradation in nursery habitats are the primary threats currently facing southeastern sturgeon populations (Collins et al. 2000). Dams that block access to spawning grounds are a major stressor in some southern river systems, including the Cape Fear River. Additional stressors include ship strikes and dredging (ASSRT 2007). A total of 18 Atlantic sturgeons were taken by hopper dredges during federal navigation dredging along the South Atlantic Coast from October 1990 to March 2012 (USACE 2014). Incidental takes occurred at Wilmington Harbor, NC (n=2), Winyah Bay, South Carolina (n=1), Charleston Harbor, South Carolina (n=4), Savannah Harbor, Georgia (n=5) and Brunswick Harbor, Georgia (n=6).

Critical Habitat

Portions of the mainstem Cape Fear River and Northeast Cape Fear River were designated as critical habitat (Carolina Unit 4) for the Carolina DPS in 2017. Carolina Unit 4 encompasses the mainstem Cape Fear River from the estuary mouth (river mile 0; interface with the Atlantic Ocean) up to Lock and Dam 2 (River Mile 71) and the Northeast Cape Fear River from its confluence with the Cape Fear River up to Rones Chapel Road Bridge at Mount Olive, NC (Figure 10). The physical or biological features of Atlantic sturgeon critical habitat that are essential to the conservation of the species include hardbottom substrate in low salinity waters for egg settlement and early life stage development; aquatic habitat encompassing a gradual salinity gradient (0.5-30 ppt) and soft bottom (sand/mud) substrate for juvenile foraging and development; waters of sufficient depth and absent physical barriers to passage to support unimpeded movements of adults, subadults, and juveniles; and water quality conditions (temperature and oxygen) that support spawning, survival, development, and/or recruitment of the various life stages (82 FR 39160).

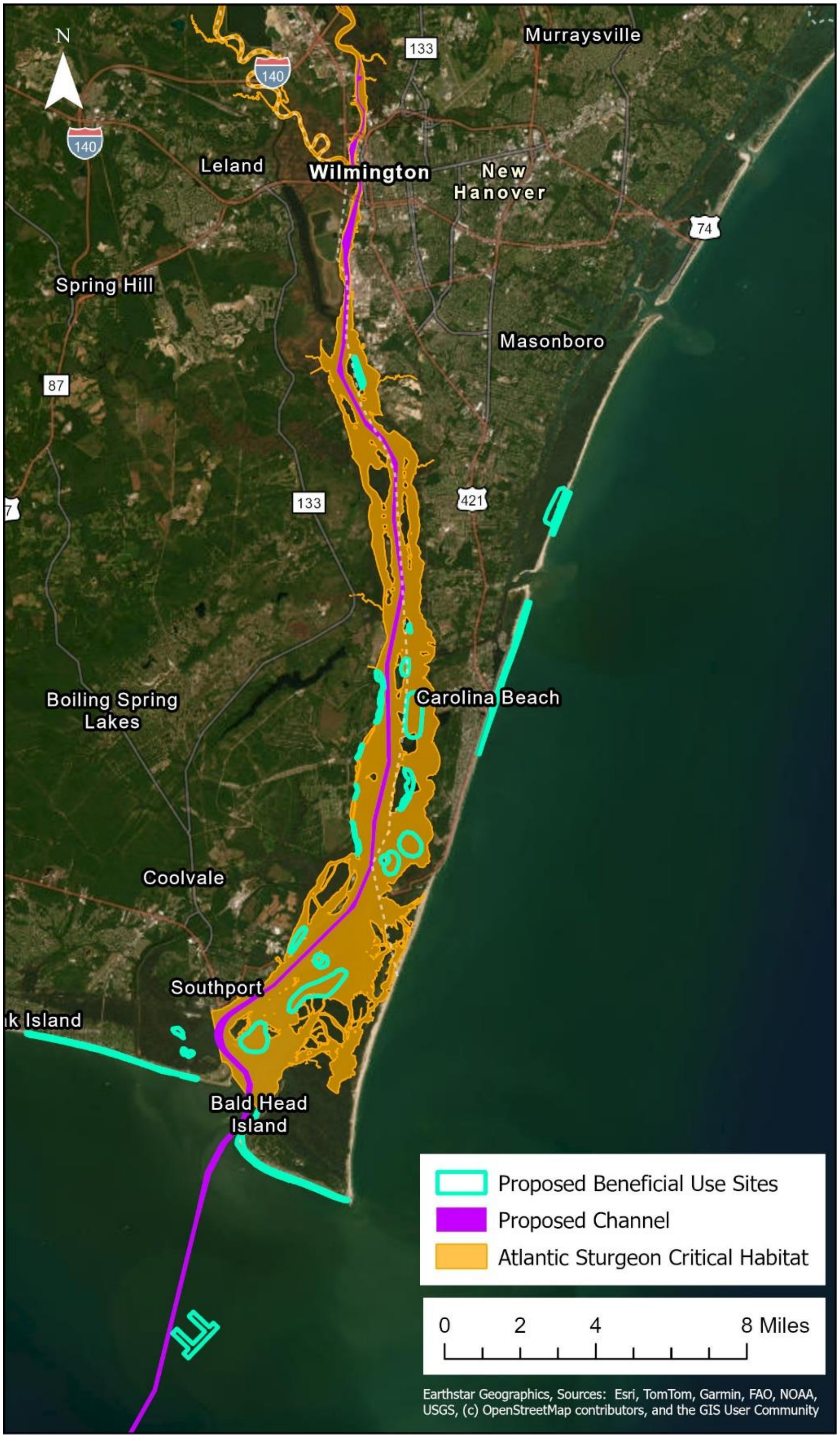

Figure 13. Atlantic Sturgeon Critical Habitat

F.4.4.2 Shortnose Sturgeon

Status and Distribution

The shortnose sturgeon (A. brevirostrum) was listed as endangered throughout its range on 11 March 1967 (32 FR 4001). The species inhabits large Atlantic coast rivers from the St. Johns River in northeastern Florida to the Saint Johns River in New Brunswick, Canada. Adults in southern rivers are estuarine anadromous, foraging at the saltwater-freshwater interface and moving upstream to spawn in the early spring. Shortnose sturgeon spend most of their lives 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 occupy the saltwater-freshwater interface, moving back and forth with the low salinity portion of the salt wedge during summer. Juveniles typically move upstream during the spring and summer and move downstream during the winter, with movements occurring above the saltwater-freshwater interface. In southern rivers, both adults and juveniles are known to congregate in cool, deep thermal refugia during the summer. The shortnose sturgeon is a benthic omnivore that feeds 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).

Shortnose sturgeon are considered extremely rare in North Carolina. Only occasional sightings of shortnose sturgeon are reported in the Cape Fear River and those individuals may be transients from the Winyah Bay system in South Carolina.

Threats

Historical overharvesting contributed to drastic declines in shortnose sturgeon populations. Commercial exploitation of shortnose sturgeons continued into the 1950s (NMFS 1998, ASSRT 2007). Although directed commercial harvest is no longer permitted, by-catch mortality associated with other fisheries remains a major threat. By-catch mortality associated with the shad and shrimp fisheries and water quality degradation in nursery habitats are the primary threats currently facing southeastern sturgeon populations (Collins et al. 2000). Dams that block access to spawning grounds are a major stressor in some southern river systems, including the Cape Fear River. Additional stressors include ship strikes and dredging (ASSRT 2007).

Critical Habitat

There is no critical habitat designated for this species within the proposed project area.

Section F.5 Assessment of Effects

Section 5 identifies the effects that may occur as a result of the activities covered under this assessment in Section F.2, as described and limited by the PDCs from the 2020 SARBO. Each route of effect is described and includes our determination of whether the effect to each identified ESA-listed species and designated critical habitat is: no effect (NE); may affect, not likely to adversely affect (MANLAA); or may affect, likely to adversely affect (MALAA).

Table 8 and Table 9 summarizes our effects determination for each ESA-listed species and critical habitat.

Table 8. Effects Determination

Species	ESA Listing Status	Effects Determination
Sea Turtles		
Green (North Atlantic [NA] DPS)	T	MALAA
Hawksbill	E	MANLAA
Kemp's ridley	E	MALAA
Leatherback	E	MALAA
Loggerhead (Northwest Atlantic [NWA] DPS)	T	MALAA
Fish		
Atlantic sturgeon (SA DPS)	E	MALAA
Shortnose sturgeon	E	MALAA
Elasmobranchs		
Giant manta ray	T	MALAA
Oceanic whitetip shark	T	NE
Whales		
Blue whale	E	NE
Fin whale	E	NE
North Atlantic right whale	E	MANLAA
Sei whale	E	NE
Sperm whale	E	NE

E= endangered; T= threatened
The oceanic white tip, blue whale, fin whale, sei whale, and sperm whale are not addressed in this BA due to a lack of suitable habitat for the species within the proposed project area. Therefore, the USCAE has made a finding of no effect to these species.
The USACE has assessed the critical habitat that overlap with the action area. Determination of the project's potential effects to them as shown in Table 9 below.

Table 9. Critical Habitat Effects Determinations

Species	Critical Habitat	Effect Determination
Loggerhead sea turtle (NWA DPS)	Nearshore Reproductive Habitat (LOGG-N-05)	MANLAA
Atlantic sturgeon	Unit 4. Cape Fear River and Northeast Cape Fear River	MALAA
North Atlantic right whale	Unit 2. Southeastern U.S. Calving Area	NE

This Section analyzes the effects of the proposed action to mobile ESA-listed species, and their associated critical habitat where applicable, that may occur within the action area (sea turtles, fish, elasmobranches, and whales listed in Table 8 above)

The activities analyzed were divided into six general categories (listed below).

1. Construction of the channel modifications, including dredging (including all forms of dredging discussed above and related activities, such as relocation trawling. For the effects analysis below, geotechnical surveys will be considered to have the similar effects as mechanical dredging since this activity removes material by taking samples of sediment, though the effects of a onetime sediment sample are smaller in scope and scale.
2. Long-term impact from channel modification.
3. Placement of dredged materials (including all forms discussed in Section 2.3).
4. Mitigation Impacts- The only impact to ESA listed species from the proposed mitigation construction will be to Atlantic sturgeon.
5. Geophysical surveys authorized by the USACE necessary to complete dredging and material placement projects (discussed in Section 2.1).
6. Maintenance Dredging- will be covered by 2020 SARBO incorporated by reference. BU placement in the river is not covered by the SARBO because of Atlantic sturgeon critical habitat.

In this Section, we also consider how each of the categories 1 through 6 of activities listed above may affect ESA-listed species by analyzing the potential routes of effects expected to occur from those by considering:

1. Species interactions with dredging and material placement equipment during active construction
2. Potential entrainment and impacts caused by capture via relocation and abundance trawling.

3. The potential for effects from degraded water quality
4. Potential for a species to be struck by a vessel.
5. How species interact with the placement of material.
6. Habitat alteration for activities covered under this Assessment.

Each route of effect, proposed conservation recommendations, and effects determination for each species are described below.

F.5.1 Sea Turtles

Five species of sea turtles are potentially affected by the proposed project- green, loggerhead, Kemp's ridley, leatherback, hawksbill.

1. Construction of the channel modifications
    a. Dredging Types
        i. Hydraulic
            1. Cutterhead

Potential effects to sea turtles by cutterhead dredging include physical injury. Information provided by the 2020 SARBO reported that the 1 documented sea turtle interaction with a cutterhead dredge in Texas that could not be definitively linked to injury caused by a cutterhead dredge. According to the 2020 SARBO, NMFS has no other information or reported takes of sea turtles by cutterhead dredging, despite frequent use of cutterhead dredging within the action area. The risk of physical injury or take of sea turtles (green, Kemp's ridley, hawksbill, leatherback, and loggerhead) by cutterhead dredging is an extremely unlikely event because sea turtles will move away from and avoid interaction with cutterhead dredging. Therefore, cutterhead dredging may affect but is not likely to adversely affect sea turtles.

            2. Hopper

Hopper dredges are known to cause mortality to sea turtles (Green, Hawksbill, Kemp's ridley, and Loggerhead) by entrainment and impingement. Species can become entrained in hopper dredges as the draghead moves along the bottom. Entrainment occurs when the species cannot escape from the suction of the dredge and they are sucked into the dredge draghead, pumped through the intake pipe, and then killed as they cycle through the centrifugal pump and into the hopper. Because entrainment is believed to occur primarily while the draghead is operating on the bottom, it is likely that only those species feeding or resting on or near the bottom would be vulnerable to entrainment. They can also be entrained if suction is created in the draghead by current flow while the device is being placed or removed, or if the dredge is operating on an uneven or rocky substrate and rises off the bottom.

An analysis that was reviewed in the 2020 SARBO suggested that the risk of entrainment is highest when the bottom terrain is uneven or when the dredge is conducting “cleanup” operations at the end of a dredge cycle when the bottom is trenched and the dredge is working to level out the bottom. In these instances, it is difficult for the dredge operator to keep the draghead buried in the sand, thus species near the bottom may be more vulnerable to entrainment. Sea turtles or sturgeon resting in deeper waters or holes in the channel may be at an increased risk of take from dredging activities conducted there. Species can also be crushed on the bottom by the moving draghead and not entrained.

As evaluated in the 2020 SARBO, Hopper dredging is likely to adversely affect green, Kemp’s ridley, and loggerhead sea turtles from entrainment or impingement due to hopper dredging. Hopper dredging will not affect leatherback or hawksbill sea turtles. There are no reports of take of leatherback or hawksbill sea turtles from hopper dredging in the action area. Hawksbill sea turtles are generally not vulnerable to entrainment due to their association with reef habitat where hopper dredging will not occur. Leatherback sea turtles are generally not vulnerable to entrainment due to their large size and generally pelagic habits. Based on the lack of reported interactions, and these species expected avoidance of hopper dredging activities, that hopper dredging will have no effect on leatherback or hawksbill sea turtles.

ii. Mechanical

The physical take of sea turtles by mechanical dredging is extremely unlikely to occur. The two reported takes of sea turtles associated with mechanical dredging and placement equipment were found to be the result of unrelated hazards, could not be verified, and were in Cape Canaveral, Florida. Based on the circumstances of the takes discussed above, and the infrequency with which those takes occurred relative to the overall amount of dredging, particularly within the action area, it is extremely unlikely that sea turtles would be injured by mechanical equipment, such as clamshell and bucket dredges used for dredging and material placement. This type of equipment is extremely unlikely to move into a location where sea turtles are positioned and encounter the mobile species without that species detecting its presence. Mobile ESA-listed species, like sea turtles, are expected to be able to avoid interaction with this type of equipment.

Additionally, the general PDCs require that crew members be aware of the species that could occur in the work area and monitor for their presence (2020 SARBO General PDCs Section 2.1 of in 2020 SARBO Appendix B). If ESA-listed species are spotted within the distances provided in the 2020 SARBO PSO PDCs Section 1 of 2020 SARBO Appendix H, activities may not resume until the protected species has departed the project area of its own volition. Therefore, mechanical dredging may affect but is not likely to adversely affect sea turtles.

iii. Blasting

It is not yet known whether blasting will be utilized for the project, but if it is determined to be necessary a confined blast mitigation plan will be created following the process outlined in 403 Letter Report and EIS Appendix L (the Conceptual Blast Mitigation Plan). If sea turtles were located in the upper estuaries of coastal systems during blasting, they could be impacted from blast sounds, pressure waves, or direct injury. Sea turtles have been observed in the Cape Fear River estuary up to river mile 15 but prefer higher salinity waters of the lower estuary (NMFS 1996). During a tracking study of 18 gill-netted green and Kemp's ridley juveniles in the lower Cape Fear River estuary, only one individual (a presumed mortality) moved north of Snow's Cut (river mile 13) (Snoddy and Williard 2010).

Based on the location of the proposed blasting areas between river mile 18 and river mile 22, it is unlikely that the species would be affected by blasting activities. Further, to minimize impacts to mobile aquatic species, blasting operations would implement protective measures as outlined discussed above in Section 2 and in 403 Letter Report and EIS Appendix L. Therefore, we have determined blasting, if used, may affect, but is not likely to adversely affect sea turtles.

iv. Agitation

Sea turtles (green, Kemp's ridley, hawksbill, leatherback, and loggerhead) may be injured or killed if struck by bed-leveling or Water-Injection Dredging (WID) equipment. However, the potential for physical impacts to species from bed-leveling and WID is so low that this route of effect is discountable. Due to uncertainty in the effects to sea turtles from bed-leveling, the USACE's Savannah District performed a study and published a report titled Bed-Leveler Evaluation Report (USACE 2013). The results indicate that bed-leveling did not result in injury or death of sea turtles, likely due to the slow speed of the equipment and the sand wedge created in front of the bed-leveler that prompts sea turtles to move off the channel bottom and away from the bed-leveler. WID, like bed-leveling, uses a slow-moving device and sea turtles are expected to move away from the injection head.

The bed-leveling PDCs in the General PDCs Section 3.4 of 2020 SARBO Appendix B requires that all designs meet the same objective of creating a disturbance ahead of the equipment, which is understood to cause animals to move away from the equipment, and prohibits designs with areas on the bed-leveler that could create a pinch point and trap ESA-listed species. In addition, the bed-leveling PDCs from the 2020 SARBO require that the local sea turtle stranding network be alerted if any dredging is occurring in their area and particularly if bed-leveling is occurring so they can monitor for strandings that may be associated with any new bed-leveling designs. Therefore, with the inclusion of the applicable 2020 SARBO PDCs discussed above, we have determined the agitation dredging by bed-leveling or WID may affect but is not likely to adversely affect sea turtles.

b. Entrainment

i. Lines

The presence of flexible materials in the water, such as buoy lines used to mark pipelines or turbidity curtains and in-water lines could create an entanglement risk to sea turtles; however, entanglement from flexible materials in the water associated with the action alternative is extremely unlikely to occur. The General PDCs in Section 2.2 of 2020 SARBO Appendix B include specific guidance on the use of in-water lines (e.g., rope, chain, and cable, including the lines to secure the turbidity curtains) and require that all line used will be stiff, taut, and non-looping to minimize the risk of entanglement. If flexible lines are used, they must be enclosed in plastic or rubber sleeves/tubes that add rigidity and prevent the line from looping and tangling. It also requires turbidity curtains and in-water equipment to be placed in a manner that does not entrap species within the construction area or block access for them to navigate around the construction area. Therefore, with the inclusion of the applicable 2020 SARBO PDCs this route of effect is discountable, and may affect but is not likely to adversely affect the species.

The lines used in relocation trawling also are known to contain flexible, looping line, especially for what are referred to as the lazy lines attached to the relocation trawling nets. The relocation trawling PDCs in Section 3.5 of 2020 SARBO Appendix B state that lazy lines will be designed according to the design specifications in Appendix I , which provide options to make the lazy line taught to minimize the risk of entanglement with captured species. Relocation trawling is closely monitored by a PSO with limited amounts of time that the lines are in the water, as defined by the PSO PDCs in 2020 SARBO Appendix H and the Relocation trawling PDCs in Section 3.5 of 2020 SARBO Appendix B. The PDCs further reduce the likelihood of entanglement in lines attached to relocation trawling nets. Due to the PDCs identified in the 2020 SARBO and the unlikely event of entanglement in lines this route of effect is discountable, and line used in relocation trawling may affect but are not likely to adversely affect sea turtles.

ii. Relocation trawling

Reports show that predominately loggerhead, Kemp's ridley, and green sea turtles are captured during relocation trawling in the Southeast within the action area (listed from highest to lowest reported captures), though there are also limited reports of leatherback sea turtle captures in the action area (ODESS). Therefore, relocation trawling is likely to adversely affect green, Kemp's ridley, leatherback, and loggerhead sea turtles. There will be no effect to hawksbill sea turtles from relocation trawling due to the hawksbill association with reef habitat.

c. Water Quality During Construction

Changes in water quality resulting from mechanical dredging may affect, but are not likely to adversely affect sea turtles. Mechanical dredging that scoops material and pulls it through the water column is expected to create turbidity plume causing a decrease in the near field DO concentration. Any potential exposure to temporary turbidity and the resulting sedimentation generated by mechanical dredging and material placement will have an insignificant effect on mobile ESA-listed species, particularly outside of riverine environments, as they have unrestricted access to be able to move away from the turbidity generated, and to continue to use similar habitat nearby, if needed.

Open water environments such as estuaries and open ocean areas in the action area are expected to have adequate water flow to ensure good water quality including sufficient DO for mobile species year round. The General PDCs in Section 2.2 of 2020 SARBO Appendix B, require that material and equipment be placed in a manner that will not block the movement of species in the area and therefore these species will be able to move around and avoid localized areas of turbidity in open water environment (e.g., turbidity curtains will not block species from entering or leaving an area). In addition, turbidity is not generally believed to impact sea turtles, as sea turtles breathe air and can therefore both move away from areas of poor water quality and surface to breathe air.

No water quality effects that may adversely affect sea turtles are anticipated from hopper dredging and other equipment. Overflow from hopper dredging or from other equipment such as barges and scows could increase turbidity in the area, and would likely cause a decrease in DO concentrations. Additionally, sea turtles will be able to avoid localized areas of turbidity in open water environments, if needed. Further, any turbidity will be temporary, lasting only for the duration of the proposed project. We therefore do not anticipate any adverse effects to sea turtles from changes in water quality or the associated decrease in DO concentration associated with these activities.

d. Lighting

Some sea turtles may be subject to disorientation from equipment lighting near sea turtle nesting beaches; however, any effects would be insignificant. Female sea turtles approaching the beach to nest could be deterred from nesting by bright lights in the nearshore environment. Hatchlings emerging from their nests could be attracted away from the shortest path to the water and instead crawl or swim toward the bright lights of a nearshore hopper dredge or anchored pumpout barge (instead of crawling or swimming seaward toward the open horizon), thus increasing their exposure time to predation. The General PDCs in Section 2.2 of 2020 SARBO Appendix B state that all lighting near sea turtle nesting beaches will be shielded and minimized to the maximum extent possible consistent with vessel personnel safety and U.S. Coast Guard navigation requirements, to reduce potential disorientation effects, potential reduced or aborted nesting, and potential increased hatchling mortality from increased exposure to predators. Therefore, the effects of lighting may affect but is not likely to adversely affect sea turtles.

e. Construction Vessels

Sea turtles (green, Kemp’s ridley, hawksbill, leatherback, and loggerhead) may be physically injured if struck by transiting vessels working on a project. Sea turtles are susceptible to vessel collisions and propeller strikes because they regularly surface to breathe and may spend a considerable amount of time on or near the surface of the water. However, a sea turtle being struck by a vessel operating for the proposed project is extremely unlikely.

Dredging and relocation trawling will be done by vessels that are slow moving or generally stationary while working, such as barge-mounted equipment, or hopper dredging vessels that are actively dredging or transporting a load of material to a disposal site. Sea turtles avoid interactions with these slow moving vessels and equipment.

Vessels used for these activities are the same vessels used for all dredging and placement projects and, although particular projects may result in localized traffic increases while a project is underway, will not result in an increase in vessel traffic within the overall action area. Therefore, vessels may affect but are not likely to adversely affect sea turtles.

2. Long term impact from channel modification

    i. Changes in Vessel Traffic

As described in Section 2.2 of the DEIS, the projected vessel calls for the Wilmington Harbor are projected to increase 127% by 2085 at current design depths (baseline condition), from 534 annual transits to 1,214. The proposed channel modifications would decrease the total number of vessels projected to call on the port of Wilmington by 265 (22%) by 2085, from 1,214 to 949. Under the proposed action, there would be fewer vessels transiting the FNS than without the project thereby minimally reducing risk from vessel strike. Therefore, long term the project may affect but is not likely to adversely affect sea turtles from the change in vessel use.

    ii. Long Term Water Quality

There will be no long term impacts anticipated to sea turtles due to changes in water quality from dredging activities.

    iii. Habitat Modification

Habitat alteration resulting from the proposed project activities may affect but is not likely to adversely affect sea turtles (green, Kemp's ridley, hawksbill, leatherback, and loggerhead). If any impacts do occur to sea turtle foraging resources in the area, similar habitat will be available in the surrounding areas and that the impact will have an insignificant effect on the ability for sea turtles to forage.

All sea turtles use hardbottom habitats for foraging and refuge, including man-made structures such as the WOFES. The WOFES was created in 1997 from limestone material that was dredged as part of the Wilmington channel deepening. The feature was designed with attributes and features to provide hardbottom habitats and attract fish. The activities associated with the proposed project will have an insignificant effect on a sea turtle's ability to forage or seek refuge in this hardbottom habitat. The General PDCs in Section 2.2 of the 2020 SARBO Appendix B state that all new dredging and placement will avoid areas with significant non-coral hardbottom, defined as an area with a horizontal distance of 150 ft that has an average elevation above the sand of 1.5 ft or greater and has algae growing on it.

Dredging and placement activities may remove or bury areas inhabited by sea turtle prey species, including the crustaceans, fish, jellyfish, shrimp, and mollusks that serve as prey for the various species of sea turtles. These effects are limited in area, temporary, and benthic foraging resources are expected to recolonize these areas. The recovery time of an area varies by the size of the impact, water temperature, and sediment type and can range from 6-8 months in estuarine areas with mud to 2-3 years in areas with sand and local disturbances by waves and currents (Newell et al. 1998). Areas frequently maintained likely lack these resources and may not have ample time between maintenance cycles to recover. However, other areas such as where dredging or material placement occur less frequently are likely to recover and swimming prey such as jellyfish as well as mobile prey like shrimp, may recover more quickly moving from surrounding undisturbed areas. Sea turtles can continue to forage in surrounding areas until the dredge or placement location recolonizes, therefore the effect of any temporary loss of these foraging resources will be insignificant.

Sea turtles may also use channels to thermal regulate by entering deeper channels in the summer to avoid warmer surface waters and entering deeper water in the winter where waters may be warmer than winter surface temperatures. The inability to access these channels during dredging would be temporary and dredging would not occur throughout the entire reach of a channel at the same time, allowing other areas of the channel to remain available to sea turtles to thermal regulate. Therefore, the inability to access a portion of the channel during dredging will have no effect on sea turtles' ability to use the area to thermal regulate.

3. Dredge Material Placement

    a. Placement Types

        i. Sand Placement for Beach Nourishment Beneficial Use (BU)

The potential for interaction from dredge equipment while they are depositing the material is limited to the potential of the species being directly below the material as it is passing through the water column and landing on the sea floor. Sand placement for beach BU may occur during all cycles of the tide, therefore, interaction with dredged material could occur. However, the risk of a mobile species, like sea turtles being caught in the discharge through the water column and buried on the sea floor is so low as to make the route of effect discountable. These mobile species would be able to detect the presence of the material being deposited and avoid being harmed by its placement. In addition, the general PDCs require that crew members be aware of the species that could occur in the work area and to monitor for their presence (2020 SARBO General PDCs Section 2.1 and the PSO PDCs in 2020 SARBO Appendix H). If ESA-listed species are spotted within the distances provided in the PDCs for the different species in the action area, activities may not resume until the protected species has departed the project area of its own volition (PSO PDCs Section 1 in 2020 SARBO Appendix H).

Activities conducted may cause sea turtles to be temporarily unable to use a sand placement BU site for forage and shelter habitat due to avoidance of dredged material placement activities, related noise, and physical exclusion from areas; however, as for other mobile species, any effects would be temporary and insignificant because the

General PDCs (General PDC Section 2.2, 2020 SARBO Appendix B) require that all work, including equipment, staging areas, and placement of materials, will be done in a manner that does not block access of ESA-listed species from moving around or past construction. Therefore, beach nourishment may affect but is not likely to adversely affect sea turtles.

ii. Nearshore Placement for BU

Sea turtles use nearshore environments for important life cycle functions. Female sea turtles migrate to nesting beaches to lay eggs and hatchlings migrate away from these beaches. The placement of materials or presence of equipment in front of (i.e., waterward of) nesting beaches could interfere with or obstruct sea turtles' ability to access or leave the beach; however, this will be an insignificant effect to sea turtles from placement activities restricting access to or from sea turtle nesting beaches. The 2020 SARBO includes PDCs designed to protect sea turtles' access to nesting beaches by ensuring that materials are not piled high in nearshore environments, such that these materials would block sea turtle access to and from nesting beaches (General PDC Section 2.2, 2020 SARBO Appendix B).

Outside of nesting beaches, sea turtles may be temporarily unable to use a project site for forage and shelter habitat due to avoidance of dredging activities, related noise, and physical exclusion from areas; however, as for other mobile species, any effects would be temporary and insignificant. Therefore, nearshore placement may affect but is not likely to adversely affect sea turtles.

iii. ODMDS Placement

The potential for interaction from dredge equipment while they are depositing the material is limited to the potential of the species being directly below the material as it is passing through the water column and landing on the sea floor. The risk of a mobile species, like sea turtles being caught in the discharge through the water column and buried on the sea floor is so low as to make the route of effect discountable. These mobile species would be able to detect the presence of the material being deposited and avoid being harmed by its placement. Placement in an open ocean environment such as an ODMDS would allow room for species to move away from and around the placement. In addition, the general PDCs require that crew members be aware of the species that could occur in the work area and to monitor for their presence (General PDCs Section 2.1 of the 2020 SARBO and the PSO PDCs in 2020 SARBO Appendix H). If ESA-listed species are spotted within the distances provided in the PDCs for the different species in the action area, activities may not resume until the protected species has departed the project area of its own volition (PSO PDCs Section 1 in 2020 SARBO Appendix H). Placement of material at the ODMDS will have no effect on sea turtles.

b. Water Quality During Placement

Turbidity plumes due to placement in the open water areas is limited to an area only a few hundred feet to a few thousand feet and most turbidity settles out quickly once dredging or material placement is complete. In open water environments mobile species will avoid these disturbed areas if needed and turbidity will dissipate relatively quickly. In addition, turbidity is not generally believed to impact sea turtles, as sea turtles breathe air and can therefore both move away from areas of poor water quality and surface to breathe air. Therefore, the temporary changes in water quality may affect but is not likely to adversely affect sea turtles.

c. Lighting

Some sea turtles may be subject to disorientation from equipment lighting near sea turtle nesting beaches; however, any effects would be insignificant. Female sea turtles approaching the beach to nest could be deterred from nesting by bright lights in the nearshore environment. Hatchlings emerging from their nests could be attracted away from the shortest path to the water and instead crawl or swim toward the bright lights of a nearshore hopper dredge or anchored pumpout barge (instead of crawling or swimming seaward toward the open horizon), thus increasing their exposure time to predation. The General PDCs in Section 2.2 of 2020 SARBO Appendix B state that all lighting near sea turtle nesting beaches will be shielded and minimized to the maximum extent possible consistent with vessel personnel safety and U.S. Coast Guard navigation requirements, to reduce potential disorientation effects, potential reduced or aborted nesting, and potential increased hatchling mortality from increased exposure to predators. Therefore, the effects of lighting may affect but is not likely to adversely affect sea turtles.

d. Vessels Used for Placement of Dredged Material/BU Construction

Sea turtles (green, Kemp's ridley, hawksbill, leatherback, and loggerhead) may be physically injured if struck by transiting vessels working on a project. Sea turtles are susceptible to vessel collisions and propeller strikes because they regularly surface to breathe and may spend a considerable amount of time on or near the surface of the water. However, a sea turtle being struck by a vessel operating for the proposed project is extremely unlikely, and therefore this route of effect is discountable.

Placement activities will be done by vessels that are slow moving or generally stationary while working. Sea turtles would avoid interactions with these slow-moving vessels and equipment; therefore, vessels associated with placement activities may affect but are not likely to adversely affect sea turtles.

e. Long term impact form Placement of Dredged Material

i. Vessels for maintenance of nearshore BU.

Activities conducted under this project could affect movement and access to habitat of these mobile species; however, the effect will be insignificant because the General PDCs (General PDC Section 2.2, 2020 SARBO Appendix B) require that all work, including equipment, staging areas, and placement of materials, will be done in a manner that does not block access of ESA-listed species from moving around or past construction. There vessels may affect but are not likely to adversely affect sea turtles due to the General PDCs identified in the 2020 SARBO.

ii. Long Term Water Quality

There will be no long-term impacts anticipated to sea turtles due to changes in water quality from dredging activities.

iii. Habitat Alteration

Impacts from beach BU placement is temporary and limited to during construction. The nearshore BU sites are in locations that sea turtles may forage and could increase foraging opportunities in that habitats will change from subtidal to intertidal. There will be no long-term alterations to habitat part of NMFS purview due to BU dredge material placement activities. Therefore, there will be no long-term alterations to habitat part of NMFS purview due to BU dredge material placement activities.

4. Mitigation Impacts

There will be no effect to sea turtles from mitigation activities. The four mitigation site locations are upstream from sea turtle habitat as shown in Figure 2 above.

5. G&G surveys performed by or authorized by the USACE necessary to complete dredging and material placement projects.

Geotechnical surveying would have similar effects as mechanical dredging in that equipment is placed in the water to collect sediment, but note that taking a single geotechnical sample with typically a 4-inch pipe will be less of a risk than continuing to mechanical dredge an area over a period of time. There are no reports of interactions between ESA-listed species from geotechnical surveys.

The vessels associated with activities that are likely to be moving faster are limited to support vessels like crew boats and survey vessels. All vessel operators and crew are required to monitor for the presence of ESA-listed species and follow guidance on distances to avoid them or shut down operations if they are in close proximity (PSO PDCs Section 1 of 2020 SARBO Appendix H).

Therefore, the physical injury or other take of ESA-listed sea turtle species by geotechnical surveying is extremely unlikely to occur, and therefore geotechnical surveying may affect but is not likely to adversely affect sea turtles.

6. Maintenance Dredging- Effects analysis is covered by 2020 SARBO, incorporated by reference.

F.5.2 Sea Turtle Critical Habitat

1. Nearshore Reproductive Habitat (LOGG-N-05)

The project is located in Loggerhead sea turtle critical habitat. The physical or biological features (PBF) essential for the conservation of the species (“essential features” present in the nearshore reproductive habitat are:

1. Nearshore waters with direct proximity to nesting beaches that support critical aggregations of nesting turtles (e.g., highest density nesting beaches) to 1.6 km (1 mile) offshore

2. Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water

3. Waters with minimal man-made structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents

F.5.2.1 PBF 1

Nearshore reproductive habitat for this project is located within 1 mile from shore in areas with sea turtle nesting beaches in North Carolina. As outlined in the 2020 SARBO PDCs material placement and equipment will be staged in a manner that would not block access of ESA-listed sea turtles, including the access of nesting sea turtles to the beach or of hatchlings returning to the water. This includes the placement of sand in a manner that would not mound or block access to sea turtle nesting beaches, except for the temporary placement of sand berms during beach nourishment projects designed to minimize turbidity during placement of sand. In addition, beach placement will be limited to activities that follow all PDCs in the 2020 SARBO such as those designed to ensure project activities and equipment do not obstruct species movement such as that of sea turtles entering or exiting the beach when nesting or species moving along the shoreline (General PDC Section 2.2 in Appendix B). Therefore, vessels will be located in the nearshore zone as part of the project but will not serve as an obstruction to aggregating turtles and the project may affect but is not likely to adversely affect PBF 1.

F.5.2.2 PBF 2

Dredging, the placement of dredged material, and the transportation of the dredged material may affect, but are not likely to adversely affect PBF 2 (waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward the open water feature of the loggerhead sea turtle critical habitat). The project's effects on this feature will be insignificant.

The General PDCs from the 2020 SARBO describe beach nourishment and provide conditions that limit how and where material is placed and minimize lighting on construction equipment. Based on the PDCs, lighting on construction equipment near nesting beaches will be turtle friendly so as not to disorient hatchlings returning to the ocean. The PDCs also state that material placement and equipment will be staged in a manner that would not block access of ESA-listed species, including the access of nesting sea turtles to the beach or of hatchlings returning to the water. This includes the placement of sand in a manner that would not mound or block access to sea turtle nesting beaches, except for the temporary placement of sand berms during beach nourishment projects designed to minimize turbidity during placement of sand. In addition, beach placement will be limited to activities that follow all PDCs such as those designed to ensure project activities and equipment do not obstruct species movement such as that of sea turtles entering or exiting the beach when nesting or species moving along the shoreline (General PDC Section 2.2 in 2020 SARBO Appendix B).

F.5.2.3 PBF 3

The WOFES is an existing artificial fisheries enhancement site that is built out to less than 50%. The rock material that makes up the WOFES ranges from roughly the size of a basketball, down to the size of a golf ball. The slope of the sides of the WOFES is gradual and averages about 1 foot of vertical rise for every 15 to 20 feet of horizontal width with a minimum of 25 feet below mean low water. There is 8,000,000 cy of capacity available for placement based on the post placement survey from 2013.

There will be no more than minimal additions of man-made structures added within WOFES as part of the project. Therefore, the proposed project will not promote predators, disrupt wave patterns, or create excessive longshore currents and may affect but is not likely to adversely affect PBF 3.

F.5.3 Winter Habitat (LOGG-N-02)

The physical or biological features (PBF) essential for the conservation of the species (“essential features” present in the winter habitat are:

1. Water temperatures above 10°C during the colder months of November through April
2. Continental shelf waters in proximity to the western boundary of the Gulf Stream
3. Water depths between 20-100 m

Winter habitat is restricted to waters off of North Carolina. There will be no effect to PBFs 1, 2, or 3 to the winter habitat due to the proposed project. There will be no dredging, material placement, transportation of material or geophysical surveys within the winter habitat area.

F.5.4 Giant Manta Ray

1. Construction of Channel Modifications
    a. Dredge Types
        ii. Hydraulic
            1. Cutterhead

The risk of a mobile species encountering a cutterhead dredge is extremely low, such that this route of effect is discountable. There are no reported takes of giant manta ray associated with cutterhead dredging in the Southeast. Therefore, there will be no effect to the giant manta ray by physical injury from cutterhead dredging since they are highly mobile and can avoid interactions with both the equipment and the suction created by cutterhead dredging.

2. hopper

There is not a risk of entrainment and impingement from hopper dredging giant manta ray. In the SARBO NMFS stated there have been no known reports of hopper dredging entrainment. They are not expected to be entrained due to their large size and ability to avoid the suction created by a hopper dredge. Therefore, there will be no effect to the species by physical injury from hopper dredging.

iii. Mechanical

Physical injury to the giant manta ray by mechanical dredging, such as clamshell and bucket dredges, is extremely unlikely to occur. There is no information regarding any reported takes caused by mechanical dredging equipment, and it does not change the likelihood of mechanical dredge interactions with giant manta ray. This type of equipment is extremely unlikely to move into a location where a giant manta ray is positioned and encounter a mobile species without that species detecting its presence. Mobile ESA-listed species are expected to be able to avoid interaction with this slow process, even if they remain in the area. In addition, the general PDCs require that crew members be aware of the species that could occur in the work area and monitor for their presence (General PDCs Section 2.1 of in 2020 SARBO Appendix B). If ESA-listed species are spotted within the distances provided in the PSO PDCs Section 1 of 2020 SARBO Appendix H, activities may not resume until the protected species has departed the project area of its own volition. Therefore, we have determined mechanical dredging would have no effect on the giant manta ray.

iv. Blasting

It is not yet known whether blasting will be utilized for the project, but if it is determined to be necessary a confined blast mitigation plan will be created following the process outlined in Appendix L (the Conceptual Blast Mitigation Plan). Though giant manta ray are not known to inhabit the upper estuaries of coastal systems they could be impacted from blast sounds, pressure waves, or direct injury. However, there are no known aggregation sites within the project area. Based on the location of the proposed blasting areas between river mile 18and river mile 22, it is unlikely that the species would be affected by blasting activities. Further, to minimize impacts to mobile aquatic species, blasting operations would implement protective measures as outlined discussed above and in Appendix L. Therefore, we have determined blasting, if used, may affect, but is not likely to adversely affect the giant manta ray.

v. Agitation

Giant manta ray are not expected to be injured by low pressure water used in water-injection dredging (WID) or a slow-moving bed-leveler due to their large size and ability to avoid these dredge equipment types. There will be no effect to giant manta ray from agitation dredging

b. Entrainment (lines/Relocation trawling)-

i. Lines

The project will include the use of flexible materials in the water (i.e., turbidity curtains, in-water lines, mooring lines) which could create an entanglement risk to giant manta rays. However, entanglement from flexible materials in the water associated with the project is extremely unlikely to occur. Per the NMFS Section 7 Framework for the giant manta ray, there are no reports of entanglement in turbidity curtains, non-looping in-water lines, or in-water lines enclosed in plastic or rubber sleeves. Therefore, with the inclusion of the SARBO 2020 General PDCs in Section 2.2 of Appendix B, the project may affect but is not likely to adversely affect the giant manta rays from entanglement in construction material

ii. Relocation Trawling

The project may include the use of relocation trawling to minimize the risk of lethal hopper dredging take. Per the SARBO there are “anecdotal records of giant manta ray captures in relocation trawling associated with dredging in the Gulf of Mexico prior to listing of this species”. As relocation trawling in the action area has been limited. Therefore, we have determined relocation trawling is likely to adversely affect giant manta ray. However, the project will include relocation trawling PDCs include in Section XX as well as the general PDCs included in Section XX to reduce the likelihood of entanglement in lines attached to relocation trawling nets.

c. Water Quality During Construction

Changes in water quality resulting from turbidity from dredging may affect but are not likely to adversely affect the giant manta ray. Any potential exposure to temporary turbidity and the resulting sedimentation generated by dredging will have an insignificant effect on mobile species as they have unrestricted access to be able to move away from the turbidity generated, and to continue to use similar habitat nearby, if needed.

The General PDCs in Section 2.2 of Appendix B of the SARBO, require that material and equipment be placed in a manner that will not block the movement of species in the area and therefore these species will be able to move around and avoid localized areas of turbidity in open water environment (e.g., turbidity curtains will not block species from entering or leaving an area). Additionally, in open water environments mobile species will avoid these disturbed areas if needed and turbidity will dissipate relatively quickly.

d. Lighting

Impacts to the giant manta ray from vessel lighting are not expected. However, General PDCs in Section 2.2 of Appendix B state that all lighting near sea turtle nesting beaches will be shielded and minimized to the maximum extent possible consistent with vessel personnel safety and U.S. Coast Guard navigation requirements. This condition would be used in locations within the action area expected to have the highest probability of giant manta ray interactions (i.e. open water). Though there are no known impacts to the giant manta ray from vessel lights, this PDC would further minimize possible impacts. Therefore, we have determined vessel lighting will have no effect on the species.

e. Construction Vessels

Physical injury to the giant manta ray by vessel strike is extremely unlikely to occur during construction. s ome vessel traffic will occur in inlets where this species may be found in higher concentrations when dredging these channels; however, vessels involved with relocation trawling or transiting for work will be traveling slowly while working in these areas and giant manta rays are mobile species that appear to be able to be responsive to activity in the area and able to move out of the way of at least slow moving equipment. All other, and faster moving, vessel traffic will occur in areas where giant manta rays are expected to be present in much lower concentrations. Due to the expected low concentration of animals in areas where high speed vessel traffic will occur, very limited reports of vessel interactions regionally, and this species' ability to avoid moving vessel traffic outside of confined spaces, we expect that it is extremely unlikely that vessels outside of nearshore inlets and passes will encounter giant manta rays. Therefore, we have determined vessel interactions during construction will have no effect on the species.

2. Long term impact from channel modification

a. Changes in Vessel Traffic

Vessel traffic, both recreational and commercial, has been documented to adversely affect protected species such as the giant manta ray. If the giant manta ray is struck by vessels, it could result in injury or mortality to the individual (Pate and Marshall 2020; McGregor et al 2019). They spend considerable time basking, traveling, and feeding in surface waters, where they are susceptible to vessel strikes. In addition, they are at greater risk of vessel strike if they occur near areas of high human use (e.g., inlets, coastal areas, beaches) such as the action area. As described in detail in the above Section 5.2, the proposed channel modifications would decrease the total number of vessels projected to call on the port of Wilmington. Therefore, long term there would be no effect to mobile species due to the change in vessel use.

b. Long Term Water quality

There are no long term impacts to water quality expected to impact the giant manta ray. DEIS Section 3.4 and Appendix B-IX, Section 5 outline that the change in DO is negligible. The giant manta ray is expected to occur in the action area in more open water habitats and at the mouth of the Cape Fear River, with naturally higher DO concentrations. Additionally, as previously discussed, the species is mobile and likely would move to areas with preferred water quality. Therefore, we have determined there would be no effect to the giant manta ray from changes in water quality after channel deepening is completed.

c. Habitat Alteration

The giant manta ray is a migratory species and appear to exhibit a high degree of plasticity in terms of their use of depths within their habitat. The project will not alter the availability of zooplankton in the water column used by this species for foraging. Some of the activities such as channel maintenance dredging will occur in areas used by this species; however, they are not expected to alter the habitat in a way that would affect this migratory species that uses a wide range of habitat types. Therefore, there will be no effect to the giant manta ray from habitat alteration resulting channel construction.

3. Dredge Material Placement

a. Placement Types

Species interaction with the placement of material. This Assessment covers placement of material by multiple types of equipment, including side-cast, split/hull hopper placement, and pipeline placement described in Section 2 of this Assessment. Generally, all of these methods are used to deposit material through the water column to the sea floor or to place it on land for upland disposal or beach nourishment. Placement may occur in a number of areas discussed in Section 2.4 of this Assessment, including sand placement on beaches, nearshore placement, beneficial use placement, ODMDS, and upland placement. The potential for interaction from these types of equipment while they are depositing the material is limited to the potential of the species being directly below the material as it is passing through the water column and landing on the sea floor.

Risk of a mobile species being caught in the discharge through the water column and buried on the sea floor is so low as to make the route of effect discountable. These mobile species would be able to detect the presence of the material being deposited and avoid being harmed by its placement. Placement in an open ocean environment such as an ODMDS would allow room for species to move away from and around the placement. In addition, the general PDCs require that crew members be aware of the species that could occur in the work area and to monitor for their presence (General PDCs Section 2.1 and the PSO PDCs in Appendix H). If ESA- listed species are spotted within the distances provided in the PDCs for the different species in the action area, activities may not resume until the protected species has departed the project area of its own volition (PSO PDCs Section 1 in Appendix H).

Blocked Access by construction or material placement- Mobile ESA-listed species may be temporarily unable to use a project site for forage and shelter habitat due to avoidance of dredging activities, related noise, and physical exclusion from areas; however, species will avoid these areas, and any effects would be temporary and insignificant for Nassau grouper, elasmobranchs and whales. All activities covered under this Assessment are limited to confined areas where similar type of habitat is nearby which would support the same activities. Thus, any animals disrupted by the activities covered under this Assessment would be expected to continue to conduct the same activities in the surrounding areas not disrupted by activities covered under this Assessment. Species may also be deterred from entering an area by increased noise, which is discussed separately in Section 3.1.8 of this Assessment.

Activities conducted under this Assessment could affect movement and access to habitat of these mobile species; however, the effect will be insignificant because the General PDCs (General PDC Section 2.2, Appendix B) require that all work, including equipment, staging areas, and placement of materials, will be done in a manner that does not block access of ESA-listed species from moving around or past construction. Of the mobile species considered in this Assessment, only Nassau grouper, sea turtles, and sturgeon use nearshore environments for important life cycle functions. However, material placement will not impact nearshore Nassau grouper habitat, as the General PDCs in Section 2.2 of Appendix B limit work on or near hardbottom, reef, and seagrass habitats. The potential for impacts to nesting turtles and sturgeon, from blocked access are discussed specifically, below.

i. Sand Placement for beach nourishment

It is expected that giant manta ray present in the vicinity of active beach nourishment would move to seek out available habitat nearby. Additionally, the PDCs require that activities cease if a ESA listed species is observed; therefore, the beach nourishment component of the project will have no effect on the species.

ii. Nearshore placement for beneficial use

As described above for beach nourishment, giant manta ray in the vicinity of active dredge material placement for beneficial use inshore would likely move to seek out available habitat nearby. Therefore, the nearshore placement for beneficial use component of the project will have no effect on the species.

iii. Placement at ODMDS

The potential for interaction from dredging equipment while disposing of dredged material within the ODMDS is limited to giant manta ray being directly below the material as it is passing through the water column to the sea floor.

The risk of a mobile species, like the giant manta ray, being caught being caught in the discharge through the water column and buried on the sea floor is so low as to make the route of effect discountable. The giant manta ray would be able to detect the presence of the material being deposited and avoid being harmed by its placement. Placement in an open ocean environment such as an ODMDS would allow room for species to move away from and around the placement. In addition, the general PDCs require that crew members be aware of the species that could occur in the work area and to monitor for their presence (General PDCs Section 2.1 and the PSO PDCs in Appendix H). If giant manta ray are spotted within the action area, activities may not resume until the protected species has departed the project area of its own volition (PSO PDCs Section 1 in Appendix H).

b. Water Quality During Placement

Turbidity plumes due to placement in the open water areas are limited to an area only a few hundred feet to a few thousand feet and most turbidity settles out quickly once dredging or material placement is complete. Additionally, the giant manta ray are not expected to impacted by localized turbidity as a result of placement of material at the ODMDS as they can move away from areas of poor water quality. Additionally, in open water environments mobile species will avoid these disturbed areas if needed and turbidity will dissipate relatively quickly.

c. Lighting

Impacts to giant manta ray from vessel lighting are not expected. However, General PDCs in Section 2.2 of the SARBO Appendix B state, “all lighting near sea turtle nesting beaches will be shielded and minimized to the maximum extent possible consistent with vessel personnel safety and U.S. Coast Guard navigation requirements.” This condition would be used in locations within the action area expected to have the highest probability of giant manta ray interactions (i.e. open water). Therefore, we have determined vessel lighting will have no effect on the species.

d. Vessels Used for Placement of Dredged Material/BU Construction

The impact of vessels transporting dredged material for beneficial use or placement at the ODMDS would primarily be attributed to vessel strikes as discussed above. As provided for in the PDCs of the 2020 SARBO, all vessel operations will follow the requirements set forth in the 2020 SARBO.

e. Long term impact from Placement of Dredged Material

i. Vessels for maintenance of nearshore BU.

The projected vessel calls for the Wilmington Harbor are expected to increase 127% by 2085 at current design depths. The proposed channel modifications would decrease the total number of vessels projected to call on the port of Wilmington by 265 (22%) by 2085. Therefore, long term change in vessel use for maintenance of nearshore BU may affect but is not likely to adversely affect the giant manta ray.

ii. Water quality

There will be no effect to the giant manta ray due to the long-term effects in water quality from beneficial use activities.

iii. Habitat Alteration

The giant manta ray is a migratory species and appear to exhibit a high degree of plasticity in terms of their use of depths within their habitat. The project will not alter the availability of zooplankton in the water column used by this species for foraging. Some of the activities such as channel maintenance dredging and beach nourishment will occur in areas used by this species; however, they are not expected to alter the habitat in a way that would affect this migratory species that uses a wide range of habitat types described above. If this species were present near an active project site, we assume that this mobile species would move and seek out similar available habitat nearby There will be no effect to the giant manta ray from habitat alteration resulting channel construction.

Dredging or placing material alters existing habitat within the project footprint, which may affect ESA-listed species that use that habitat. Based on the activities covered and the PDCs that limit them, habitat alteration is not likely to adversely affect or will have no effect on ESA- listed species, as discussed by species below (however, muck dredging is addressed first, for all species, as we expect no effects to listed species from this activity).

Habitat alteration resulting from projects covered under this Assessment are expected to be confined to the dredge or placement area or areas where materials and equipment are placed during construction. Species using these areas will still be able to forage or seek refuge in nearby areas outside of active project sites.

The disposal options outlined above are not expected to negatively impact giant manta ray habitat. In-water material disposal at the ODMDS will only result in a minor decrease in the overall project depth at this location and will be discountable.

During feeding, giant manta rays may be found aggregating in shallow waters at depths less than 10 m. However, tagging studies have also shown that the species conducts dives of up to 200 -450 m and is capable of diving to depths exceeding 1,000 m.[31] None of the activities covered under this Assessment will alter the availability of zooplankton in the water column used by this species for foraging. Some of the activities such as channel maintenance dredging and beach nourishment will occur in areas used by this species; however, they are not expected to alter the habitat in a way that would affect this migratory species that uses a wide range of habitat types described above. If this species were present near an active project site, we assume that this mobile species would move and seek out similar available habitat nearby

4. Mitigation Impacts-

The location of the proposed mitigation measures, detailed in Appendix M: Mitigation Plan, are not within giant manta ray habitat. Therefore, the mitigation impacts would have no effect on the giant manta ray. it is unlikely that giant manta rays would be affected by the mitigation activities.

5. G&G surveys performed by or authorized by the USACE necessary to complete dredging and material placement projects.

Geotechnical surveys are conducted in generally the same way as mechanical dredges, as described above, where equipment is lowered to take a core sediment sample; however, geotechnical surveys are a onetime sample collected from typically a 4-inch pipe and are therefore smaller in scope and scale than mechanical dredging.

Geotechnical surveying would have similar effects as mechanical dredging in that equipment is placed in the water to collect sediment, but note that taking a single geotechnical sample with typically a 4-inch pipe will be less of a risk than continuing to mechanical dredge an area over a period of time. We have no reports of interactions between ESA-listed species from geotechnical surveys. We also have no reason to expect that geotechnical surveys would impact water quality. Therefore, we similarly believe physical injury or other take of ESA-listed species by geotechnical surveying is extremely unlikely to occur, and therefore would have no effect on the giant manta ray.

6. Maintenance Dredging- Effects analysis is covered by 2020 SARBO, incorporated by reference.

F.5.5 North Atlantic Right Whale

1. Construction of the Channel Modification

    a. Dredge Types

        i. Hydraulic

            1. Cutterhead

The risk of a mobile species encountering a cutterhead dredge is extremely low, such that this route of effect is discountable. There are no reported takes associated with cutterhead dredging and the NARW. Cutterhead dredging may affect but is not likely to adversely affect the NARW by physical injury since they are highly mobile and can avoid interactions with both the equipment and the suction created by cutterhead dredging.

            2. Hopper

There is not a risk of entrainment and impingement from hopper dredging to NARW. There have been no known reports of hopper dredging entrainment of NARWs. Whales are not expected to be entrained due to their large size and ability to avoid the suction created by a hopper dredge. In addition, the PDCs require that all work cease if whales are spotted in the area. Mobile ESA-listed species are expected to be able to avoid interaction with this slow process, even if they remain in the area. In addition, the general PDCs require that crew members be aware of the species that could occur in the work area and monitor for their presence (General PDCs of the 2020 SARBO). If ESA-listed species are spotted within the distances provided in the Protected Species Observer PDCs (PSO PDCs in 2020 SARBO Appendix H), activities may not resume until the protected species has departed the project area of its own volition. Therefore, hopper dredging may affect but is not likely to adversely affect NARW.

        ii. Mechanical

Physical injury to the NARW by mechanical dredging, such as clamshell and bucket dredges, is extremely unlikely to occur. There is no information regarding any reported takes caused by mechanical dredging equipment and it does not change the low likelihood of mechanical dredge interactions with whales. Mechanical equipment is generally stationary working from land or a large barge and uses the bucket to remove material. This type of equipment is extremely unlikely to move into a location where NARWs are positioned, and it is unlikely that the equipment will encounter a NARW, a mobile species, without that species detecting its presence. Mobile ESA-listed species are expected to be able to avoid interaction with this slow process, even if they remain in the area. In addition, the general PDCs require that crew members be aware of the species that could occur in the work area and monitor for their presence (General PDCs of the 2020 SARBO). If ESA-listed species are spotted within the distances provided in the Protected Species Observer PDCs (PSO PDCs in 2020 SARBO Appendix H), activities may not resume until the protected species has departed the project area of its own volition. Therefore, mechanical dredging may affect but is not likely to adversely affect the NARWs.

iii. Blasting

Based on the location of the proposed blasting areas between river mile 18 and river mile 22, the NARW would not be affected by blasting activities. However, as previously described, blasting operations would implement protective measures for aquatic species. It is not yet known whether blasting will be utilized for the project, but if it is determined to be necessary a confined blast mitigation plan will be created following the process outlined in Appendix L: Conceptual Blast Mitigation Plan. Therefore, there would be no effect to NARW from blasting.

iv. Agitation

There will be no effect to the NARW from agitation dredging. NARWs are not expected to be injured by low pressure water used in water-injection dredging or a slow moving bed-leveler due to their large size and ability to avoid these dredge equipment types. In addition, whales are not likely to occur in the generally shallower, nearshore areas where agitation dredging will occur.

b. Entrainment

i. Lines

The presence of flexible materials in the water, such as buoy lines used to mark pipelines or turbidity curtains and in-water lines could create an entanglement risk to the NARW; however, entanglement from flexible materials in the water associated with activities in this projects is extremely unlikely. The general PDCs discussed in the 2020 SARBO Appendix B include specific guidance on the use of in-water lines and require that all lines used will be stiff, taut, and non-looping to minimize the risk of entanglement.

ii. Relocation trawling

There are no recorded captures of NARW from relocation trawling or any other interactions between NARW and relocation trawling. There will be no effect to these species from relocation trawling beyond the potential for vessel strikes or entanglement with other loose lines in the water which is discussed below.

c. Water Quality During Construction

Changes in water quality resulting from turbidity from dredging may affect but are not likely to adversely affect NARWs. Any potential exposure to temporary turbidity and the resulting sedimentation generated by dredging will have an insignificant effect on mobile NARWs as they have unrestricted access to be able to move away from the turbidity generated, and to continue to use similar habitat nearby, if needed.

Additionally, whales are not expected to impacted by localized turbidity as a result of dredging activities, as whales breathe air and can therefore both move away from areas of poor water quality and surface to breathe air. Additionally, in open water environments mobile species will avoid these disturbed areas if needed and turbidity will dissipate relatively quickly.

d. Lighting

Impacts to whales from vessel lighting are not expected. However, General PDCs in Section 2.2 of the 2020 SARBO Appendix B state, “all lighting near sea turtle nesting beaches will be shielded and minimized to the maximum extent possible consistent with vessel personnel safety and U.S. Coast Guard navigation requirements.” This condition would be used in locations within the action area expected to have the highest probability of whale interactions (i.e. open water). Though there are no known impacts to the NARW from vessel lights, this PDC would further minimize possible impacts. Therefore, we have determined vessel lighting will have no effect on the species.

e. Construction Vessels

North Atlantic right whales are known to be susceptible to vessel strike collisions that can lead to death; however, a vessel strike is extremely unlikely and that this route of effect will be discountable based on the PDCs identified in the 2020 SARBO.

There are numerous reports of vessels strikes on North Atlantic right whales for vessels between 33-65 ft in length (33 ft being the smallest reported lethal strike and 65 ft being the size in which speed restrictions are required under the rule for vessels traveling in designated areas in the United States (73 FR 60173, Publication Date October 10, 2008). However, the risk of a vessel strike occurring during the proposed action is very low, since we are only aware of 2 reported interactions with vessels related to dredging, worldwide with North Atlantic or the closely related South Atlantic right whales despite decades of dredging both within the action area and globally.

NMFS, USACE, and BOEM developed a North Atlantic Right Whale Conservation Plan detailing conservation measures for the species. Specifically, the Plan provides funding for aerial surveys with the portions of the action area where NARW may be present. The

Plan also details how notification of the presence of these whales will be communicated. Reports of North Atlantic right whale presence from both the aerial surveys and reports from crew work in the action area will then be broadcast to other commercial mariners in the area triggering speed restrictions for vessels within a specified distance of the whale sighting and will be sent as an alert to commercial vessels in the area to be on the lookout for their presence. If a NARW is identified, whether by shipboard observation or aerial survey, all vessels within 38 nautical miles (nmi) and over 33 ft in length that are associated with the project will be required to slow to 10 knots, when working when and where North Atlantic right whales may be present in the action area.

Because there are so few North Atlantic right whales, and much of the vessel traffic associated with the proposed action will take place outside of areas and times when North Atlantic right whales may be present, the likelihood of collisions is already very rare. The implementation of the protective measures in the PDCs further reduces the possibility of a vessel strike (2020 SARBO Appendix F). When the rarity of occurrence is combined with the requirements of the North Atlantic Right Whale Conservation Plan, vessel strikes are extremely unlikely to occur.

Therefore, with the PDCs identified in the 2020 SARBO, vessels may affect but are not likely to adversely affect NARWs.

2. Long-term impact from channel modification

a. Changes in Vessel Traffic

As described in detail in the above Section 5.2, the proposed channel modifications would decrease the total number of vessels projected to call on the port of Wilmington. Therefore, long term the project may affect but is not likely to adversely affect the NARW due to the change in vessel use.

b. Water quality

There will be no long-term effects anticipated to NARWs due to changes in water quality from dredging activities.

c. Habitat Alteration

There will be no effect to NARWs from habitat alteration resulting from activities within the proposed action. NARWs are pelagic species that do not forage on benthic resources and therefore will not be affected by changes in sediment from dredging or material placement. NARWs use the action area for calving and move north to forage. While in the action area, NARW mothers do not forage while nursing their calves. The activities considered for the proposed action will not alter the depth of waters used by whales. If whales are present near an active project site, we assume that this mobile species would move and seek out similar available habitat nearby. Additionally, the PDCs require that activities cease if a whale is observed; therefore, the proposed action will not interfere with NARWs use of the action area, including calving (2020 SARBO Appendix F).

3. Dredge Material Placement

a. Sand Placement Types

i. Sand Placement for beach nourishment

If whales are present near an active project site, this mobile species would move and seek out similar available habitat nearby. Additionally, the PDCs require that activities cease if a whale is observed; therefore, the proposed action will not interfere with NARWs use of the action area, including calving. Therefore, sand placement for beach nourishment will have no effect on NARWs.

ii. Nearshore placement for beneficial use

If whales are present near an active project site, this mobile species would move and seek out similar available habitat nearby. Additionally, the PDCs require that activities cease if a whale is observed; therefore, the proposed action will not interfere with NARWs use of the action area, including calving. Therefore, nearshore placement for beneficial use will have no effect on NARWs.

iii. Placement at ODMDS

The potential for interaction from dredging equipment while they are depositing the material is limited to the potential of NARWs being directly below the material as it is passing through the water column and landing on the sea floor.

The risk of a mobile species, like the NARW, being caught in the discharge through the water column and buried on the sea floor is so low as to make the route of effect discountable. The NARW would be able to detect the presence of the material being deposited and avoid being harmed by its placement. Placement in an open ocean environment such as an ODMDS would allow room for species to move away from and around the placement. In addition, the general PDCs require that crew members be aware of the species that could occur in the work area and to monitor for their presence (2020 SARBO General PDCs Section 2.1 and the PSO PDCs in 2020 SARBO Appendix H) If NARWs are spotted within the action area, activities may not resume until the protected species has departed the project area of its own volition (PSO PDCs Section 1 in 2020 SARBO Appendix H). Therefore, the project may affect but is not likely to adversely affect NARWs from placement at the ODMDS.

b. Water Quality During Placement

Turbidity plumes due to placement in the open water areas is limited to an area only a few hundred feet to a few thousand feet and most turbidity settles out quickly once dredging or material placement is complete. Additionally, whales are not expected to impacted by localized turbidity as a result of dredging activities, as whales breathe air and can therefore both move away from areas of poor water quality and surface to breathe air. Additionally, in open water environments NARW may avoid these disturbed areas if needed and turbidity will dissipate relatively quickly. Therefore, there the project may affect but is not likely to adversely affect the NARW from temporary changes in water quality.

c. Lighting

Impacts to whales from vessel lighting are not expected. However, General PDCs in Section 2.2 of the SARBO Appendix B state, “all lighting near sea turtle nesting beaches will be shielded and minimized to the maximum extent possible consistent with vessel personnel safety and U.S. Coast Guard navigation requirements.” This condition would be used in locations within the action area expected to have the highest probability of whale interactions (i.e. open water). Though there are no known impacts to the NARW from vessel lights, this PDC would further minimize possible impacts. Therefore, we have determined vessel lighting will have no effect on the species.

d. Vessels Used for Placement of Dredged Material/BU Construction

The impact of vessels transporting dredge material for beneficial use or placement at the ODMDS would primarily be attributed to vessel strikes. As provided for in the PDCs of the 2020 SARBO, all vessel operations will follow the requirements set forth in the 2020 SARBO.

e. Long term impact from Placement of Dredged Material

i. Vessels for maintenance of nearshore BU would be covered under the SARBO.

ii. Water quality

There will be no long-term effects to the NARW due to changes in water quality from beneficial use activities.

iii. Habitat Alteration

In-water material placement will only result in a minor decrease in the overall depth in an area that is expected to be undetectable to NARWs using this habitat. Therefore, habitat alteration from beneficial use of dredged material may affect but is not likely to adversely affect the NARW.

4. Mitigation Impacts- NARW habitat is not present within the location of the proposed mitigation measures.

5. G&G surveys performed by or authorized by the USACE necessary to complete dredging and material placement projects.

Geotechnical surveys would have similar effects to the NARW as mechanical dredging in that equipment is placed in the water to collect sediment. There are no reports of interactions between NARWs from geotechnical surveys. Therefore, the physical injury or other take of NARWs by geotechnical surveying is extremely unlikely to occur, and therefore this route of effect is discountable. Additionally, the sound generated during geotechnical surveys will not result in injury to NARWs.

6. Maintenance Dredging- will be covered by 2020 SARBO incorporated by reference.

NARW Critical Habitat (Unit 2: off the coast of North Carolina, South Carolina, Georgia, and Florida)

The project is located in NARW critical habitat. The PBFs essential for the conservation of the species present in the Southeastern Calving Area, which provides calving area functions, includes:

1. Sea surface conditions associated with Force 4 or less on the Beaufort Scale
2. Sea surface temperatures of 7°C to 17°C
3. Water depths of 6 to 28 m, where these features simultaneously co-occur over contiguous areas of at least 231 nmi² of ocean waters during the months of November through April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves.

There will be no effect to PBF 1, 2, or 3 of the North Atlantic right whale critical habitat from any of the activities analyzed for this project. The features of North Atlantic right whale critical habitat were designated to provide calving areas, which include specific sea surface conditions, sea surface temperatures, and water depth needed to be available for calving, nursing, and rearing North Atlantic right whale calves. Maintenance dredging, transportation of dredged materials, material placement, or dredging surveys will have no effect on the sea state or temperature and will not change the availability of waters 20-92 ft deep, as defined to be the depth needed in the critical habitat.

F.5.6 Sturgeon

1. Construction of the channel modifications
    a. Dredging types
        i. Hydraulic-
            1. Cutterhead

Cutterhead dredges are a suction type dredge that operate when the cutterhead is generally embedded in sediment. Smaller sturgeon who are not strong enough to outswim the suction zone or larger individuals who are biologically motivated to remain in place may not swim away from equipment and could be injured.

However, as of the 2020 SARBO, there was no record of reported of takes of sturgeon associated with cutterhead dredging in open water environments. Therefore, there will be no effect to sturgeon in open water areas (outside the mouth of the river) within the project by physical injury from cutterhead dredging since they are highly mobile and can avoid interactions with both the equipment and the suction created by cutterhead dredging.

The 2020 SARBO states, “The risk of an individual sturgeon being entrained in a cutterhead dredge is difficult to calculate. While a large area overall will be dredged, the dredge operates in an extremely small area at any given time (i.e., the river bottom in the immediate vicinity of the intake). To be entrained, an individual would need to be in the immediate area where the dredge is operating (i.e., within 1m of the dredge head). It is likely that nearly all shortnose and Atlantic sturgeon in the action area will never encounter the dredge as they would not occur within 1 m of the dredge.”

To minimize this risk to sturgeon during times when water quality is poor and sturgeon are stressed, the SARBO Sturgeon PDCs prohibit dredging in known sturgeon seasonal aggregation areas and require monitoring of cutterhead dredging outside of aggregation areas in the sections of sturgeon rivers identified as having poor water quality such as the Cape Fear River (identified as the letters “B” in Table 56 in the 2020 SARBO Sturgeon PDCs in Appendix E). Therefore, take of Atlantic and shortnose sturgeon may occur during the proposed project.

2. Hopper

Hopper dredges are known to cause mortality to sturgeon by entrainment and impingement. Species can become entrained in hopper dredges as the draghead moves along the bottom. Entrainment occurs when the species cannot escape from the suction of the dredge and they are sucked into the dredge draghead, pumped through the intake pipe, and then killed as they cycle through the centrifugal pump and into the hopper. Because entrainment is believed to occur primarily while the draghead is operating on the bottom, it is likely that only those species feeding or resting on or near the bottom would be vulnerable to entrainment. They can also be entrained if suction is created in the draghead by current flow while the device is being placed or removed, or if the dredge is operating on an uneven or rocky substrate and rises off the bottom.

An analysis that was reviewed in the 2020 SARBO suggested that the risk of entrainment is highest when the bottom terrain is uneven or when the dredge is conducting “cleanup” operations at the end of a dredge cycle when the bottom is trenched and the dredge is working to level out the bottom. In these instances, it is difficult for the dredge operator to keep the draghead buried in the sand, thus species near the bottom may be more vulnerable to entrainment. Sea turtles or sturgeon resting in deeper waters or holes in the channel may be at an increased risk of take from dredging activities conducted there. Species can also be crushed on the bottom by the moving draghead and not entrained. Therefore, hopper dredging is likely to adversely affect the species.

ii. Mechanical

Mechanical dredging that scoops material and pulls it through the water column is expected to create turbidity plume causing a decrease in the near field DO concentration. Any potential exposure to temporary turbidity and the resulting sedimentation generated by mechanical dredging and material placement covered under this Assessment will have an insignificant effect on mobile ESA-listed species, particularly outside of riverine environments, as they have unrestricted access to be able to move away from the turbidity generated, and to continue to use similar habitat nearby, if needed. As discussed above, a notable exception may be sturgeon in rivers, they may not be able to or may not elect to avoid these areas. Open water environments such as estuaries and open ocean areas in the action area are expected to have adequate water flow to ensure good water quality including sufficient DO for mobile species year-round. The General PDCs in Section 2.2 of Appendix B, require that material and equipment be placed in a manner that will not block the movement of species in the area and therefore these species will be able to move around and avoid localized areas of turbidity in open water environment (e.g., turbidity curtains will not block species from entering or leaving an area).

Sturgeon in open water areas: Studies of the effects of turbid water on fishes suggest that concentrations of suspended solids can reach thousands of milligrams per liter (mg/L) before an acute toxic reaction is expected (Burton 1993). Any turbidity exceeding those thresholds under this Assessment would be localized to the project location.

Sturgeon will be able to avoid localized areas of turbidity in open water environments, if needed. Additionally, we expect any turbidity will be temporary, lasting only for the duration of the proposed project. We therefore expect that these fishes in open water environments will not be exposed to harmful levels of turbidity.

Sturgeon in riverine environments: As noted in Section 3.1.1.2 of the 2020 SARBO, during periods of stressful water quality (primarily summer months) even small decreases in DO can harm sturgeon. The PDCs establish a 3,000 ft buffer zones around the known seasonal aggregations areas identified in the Sturgeon PDCs in Appendix E to protect sturgeon from stressful decreases in DO. This distance is the furthest downstream Burton (Burton 1993) measured total suspended solid concentrations from dredge sites in the Delaware River. Buffer zones of this size are sufficiently large to ensure the turbidity, and resultant changes in DO concentrations, we anticipate would be cause by any form of mechanical dredging will have dissipated before reaching sturgeon within the aggregations. Thus, we anticipate any adverse effects would be insignificant.

Therefore, mechanical dredging may affect but is not likely to adversely affect sturgeon.

iii. Blasting

The blasting of hard rock would only be carried out if necessary to support the construction of the proposed action. If it is determined that blasting is needed, Atlantic sturgeon may be impacted by intense underwater noise and shock waves. Blasting may result in injurious effects may include a temporary or permanent change in hearing (threshold shift), lung or gastrointestinal tract injury (from pressure waves), or direct injury or mortality. Behavioral responses to blasting are less understood but may include changes in swim speed or direction, foraging, resting, social state, distribution, or stress level.

If confined underwater blasting is required, operations would adhere to an August 1 – January 31 environmental timeframe. The proposed window would avoid potential aggregation areas during the Atlantic sturgeon spawning migration that occurs during the spring when environmental conditions could result in additional stress to sturgeon.

If blasting is required, acoustic ranges to sturgeon auditory and non-auditory impact thresholds would be calculated and included in a Comprehensive Plan to predict the extent to which underwater noise from the potential blasting may impact sturgeon. These ranges represent the distance from explosive activity within which species could experience injurious or behavioral effects. The ranges correlate to in-water impact zones, and these zones can inform viable mitigation technologies and monitoring strategies. Impact zones would be estimated by applying a combination of empirical - and physics-based computational models. Modeling of acoustic fields produced by explosive force should include shock pulse pressure, impulse, and sound exposure level modeling. Acoustic thresholds for marine mammals, sea turtles, and fish are available from the Navy (2024), NMFS (2024), and ANSI-Accredited Standards Committee (Popper et al. 2014). To assess the potential level of impact from blasting and inform the development of specific mitigation measures, a thorough impact analysis during the development of the Comprehensive Plan during pre-construction phase would be developed, which would include an assessment of explosive underwater noise. More information on potential BMPs, monitoring, and mitigation measures including pre- and post- blasting clearance, confinement, visual monitoring, and noise attenuation measures is available in Appendix L: Conceptual Blast Mitigation Plan.

Following minimization, avoidance, and mitigation elements described in the Conceptual Blast Mitigation Plan, and further coordination of mitigation efforts if blasting is required, is expected to significantly reduce potential impacts from blasting to Atlantic sturgeon. However, blasting is still likely to result in moderate risk for Atlantic sturgeon considering the location of the potential blasting near the fresh-saltwater interface, which is valuable habitat for juvenile Atlantic sturgeon. Therefore, the USACE has determined that the blasting may affect, is likely to adversely affect sturgeon in the project area.

iv. Agitation

Open Water Sturgeon- Atlantic and shortnose sturgeon may be injured or killed if struck by bed-leveling or WID equipment. However, the potential for physical impacts to species from bed-leveling and WID is discountable due to the slow speed of the equipment and the sand wedge created in front of the bed-leveler that prompts sturgeon to move off the channel bottom and away from the bed-leveler. Both Atlantic sturgeon and shortnose sturgeon are expected to be capable of swimming speeds greater than those at which bed-leveling and WID equipment is towed (1-2 knots).

The bed-leveling PDCs in the SARBO General PDCs Section 3.4 of Appendix B requires that all designs meet the same objective of creating a disturbance ahead of the equipment, which is understood to cause animals to move away from the equipment, and prohibits designs with areas on the bed-leveler that could create a pinch point and trap ESA- listed species.

F.5.7 Sturgeon in Rivers

In addition to the potential for physical injury discussed above, sturgeon in rivers are particularly susceptible to changes in water quality. Bed-leveling is frequently used in sturgeon rivers to move sediment from an area where it is accumulating, such as a berth, back into the river to be washed out of the area by the river water movement and often by the tide in areas of the river closer to the ocean.

During periods of stressful water quality (primarily summer months) even small decreases in DO can harm sturgeon, which is why buffer zones were established around the known seasonal aggregations areas identified in the Sturgeon PDCs in Appendix E. These are expected to ensure the turbidity, and resultant changes in DO concentrations, associated with any form of agitation dredging will have dissipated before reaching any sturgeon within the aggregations. Therefore, agitation dredging within sturgeon rivers may affect, but is not likely to adversely affect the species.

b. Entrainment

i. Lines

The project will include the use of flexible materials in the water (i.e., turbidity curtains, in-water lines, mooring lines) which could create an entanglement risk to sturgeon. However, per the SARBO, entanglement from flexible materials in the water associated with the project is extremely unlikely to occur. Therefore, with the inclusion of the SARBO 2020 General PDCs in Section 2.2 of Appendix B, there will be no effect to the sturgeon from entanglement in construction material.

ii. Relocation Trawling

Atlantic sturgeon have been captured in relocation trawling in the South Atlantic portion of the action area, and we expect that shortnose sturgeon, given their life history similarities, may also be captured in relocation trawling. Therefore, relocation trawling is likely to adversely affect Atlantic and shortnose sturgeon. However, the project will include relocation trawling PDCs include in the SARBO 2020 Appendix I as well as the SARBO 2020 General PDCs in Section 2.2 of Appendix B to reduce the likelihood of entanglement in lines attached to relocation trawling nets.

c. Water quality during construction

The SARBO, "relies on scientific literature, and information provided by the NOAA Greater Atlantic Region regarding the expected effects for turbidity and total suspended solids (Section 7 Effects Analysis: Turbidity in the Greater Atlantic Region | NOAA Fisheries), including information on newer technologies such as water injection dredging and bed-leveling, for distances that suspended solids may extend from a dredging project are based. NOAA Greater Atlantic Region's turbidity analysis is appropriate to consider for the action area because the mechanisms by which turbidity is created (i.e., dredging), the physics of turbidity (i.e., how it moves through water), and its routes of effect to species (e.g., potential abrasion) are the same across the regions."

In the 2020 SARBO the Cape Fear River and Northeast Cape Fear River were designated as "A" or "B" rivers throughout the year as outlined in Appendix E of the 2020 SARBO (incorporated by reference). When the requirements associated with each of these categories and the other SARBO 2020 PDCs in Appendix E are properly implemented dredging in/around seasonal aggregations may affect, but is not likely to adversely affect the sturgeon as a result of water quality changes.

Cutterhead dredging removes sediment by suction and, as required by the PDCs, is not operated until the dredging cutterhead is embedded in the sediment. Cutterhead dredging may cause localized turbidity; however, we expect that in open water environments mobile species will avoid these disturbed areas if needed and turbidity will dissipate relatively quickly. Therefore, for the same reasons discussed in above for mechanical dredging, we expect any effects to sturgeon in open water areas as a result of changes in water quality from cutterhead dredging to be insignificant.

Regarding effects to sturgeon in riverine environments, while cutterhead dredges they may create a small turbidity plume localized around the dredging head, this plume is expected to be localized and changes in DO would also be expected to be minimal. Because of the very small area where cutterhead dredging is removing sediment once embedded in the sediment, turbidity generated and the area of lower DO is localized and returns to normal quickly in riverine environments due to the water flow and is expected to have an insignificant effect to sturgeon in rivers, outside of seasonal aggregation areas, even during times of poor water quality. For animals inside the seasonal aggregation areas, the buffer zones established in the Sturgeon PDCs are sufficiently large to ensure the turbidity, and resultant changes in DO concentrations, caused by cutterhead dredging will have dissipated before reaching sturgeon within the aggregations.

Thus, cutterhead dredging may affect, but is not likely to adversely sturgeon as a result of water quality changes during construction.

Overflow from hopper dredging or from other equipment such as barges and scows could increase turbidity in the area, and would likely cause a decrease in DO concentrations. However, hopper dredging would be limited by the PDCs to times of year in sturgeon rivers when water quality is not seasonally degraded in (e.g., winter). Additionally, sturgeon are able to avoid localized areas of turbidity in open water environments, if needed. Further, any turbidity will be temporary, lasting only for the duration of the proposed project. We therefore do not anticipate any adverse effects to sturgeon or sea turtles from changes in water quality or the associated decrease in DO concentration associated with these activities. Therefore, hopper dredging may affect, but is not likely to adversely sturgeon as a result of water quality changes during construction.

Agitation dredging in open water environments would have no effect on sturgeon as they are a mobile species will avoid these disturbed areas if needed and turbidity will dissipate relatively quickly.

During periods of stressful water quality (primarily summer months) even small decreases in DO can harm sturgeon, which is why buffer zones were established around the known seasonal aggregations areas identified in the Sturgeon PDCs in Appendix E. These are expected to ensure the turbidity, and resultant changes in DO concentrations, associated with any form of agitation dredging will have dissipated before reaching any sturgeon within the aggregations. Therefore, agitation dredging within sturgeon rivers may affect, but is not likely to adversely affect the species.

If confined underwater blasting is required, operations would adhere to an August 1 – January 31 environmental timeframe. The proposed window would avoid potential aggregation areas during the Atlantic sturgeon spawning migration that occurs during the spring when environmental conditions could result in additional stress to sturgeon. It is expected that during construction there would be changes in turbidity localized to the blast radius that would dissipate with river water movement. Therefore, confined underwater blasting may affect, but is not likely to adversely affect sturgeon in relation to changes in water quality

d. Lighting during construction

Impacts to sturgeon from vessel lighting are not expected. However, the SARBO 2020 General PDCs in Section 2.2 of Appendix B state that all lighting near sea turtle nesting beaches will be shielded and minimized to the maximum extent possible consistent with vessel personnel safety and U.S. Coast Guard navigation requirements. Though there are no known impacts to sturgeon from vessel lights, this PDC would further minimize possible impacts. Therefore, we have determined vessel lighting will have no effect on the species.

e. Construction Vessels

Physical injury to sturgeon due to vessel strike is extremely unlikely to occur during construction. The rivers in the Southeast tend to be wider than those in the Northeast where vessel strikes occurred and likely provide more room for sturgeon to escape a strike. Sturgeon in the Southeast also generally appear to aggregate in areas outside of heavily trafficked shipping channels; however, vessels involved with relocation trawling or transiting for work will be traveling slowly while working in these areas and giant manta rays are mobile species that appear to be able to be responsive to activity in the area and able to move out of the way of at least slow moving equipment. Therefore, we have determined vessel interactions during construction will have no effect on the species

2. Long-term impact from channel modification

    a. Changes in Vessel Traffic

Sturgeon are susceptible to vessel strike if a deep draft vessel encounters the animals at the sea floor or if the sturgeon moves up into the water column or is sucked in to the propeller. However, this is extremely unlikely to occur. As described in detail in the above Section 5.2, the proposed channel modifications would decrease the total number of vessels projected to call on the port of Wilmington without the project. Further minimizing vessel interactions long term. Therefore, long term changes in vessel traffic may affect but are not likely to adversely affect the species due to the change in vessel use.

    b. Long Term Water quality

There are no long term impacts to water quality expected to impact sturgeon. DEIS Section 3.4 and Appendix B-IX, Section 5 outline that the change in DO is negligible. Therefore, the USACE has determined there will be no effect to sturgeon from long term water quality impacts associated with the channel modification.

    c. Habitat Alteration

Modifications to the FNS including deepening and widening will result in long term changes to hydrodynamics and water quality, including increased salinity upriver. To assess the impacts of these long term changes to sturgeon habitat, Habitat Suitability Index (HSI) modeling was completed using an HSI model that was created with input from local and regional sturgeon subject matter experts. More information on HSI modeling and results is available in Appendix H: Aquatic Habitat Suitability.

Results indicate that the proposed action would result in negligible impacts to adult, juvenile, and young of year Atlantic sturgeon habitat in current sea level conditions, while habitat for spawning and early life stage habitat would be decreased (~2.6%) due to salinity migration. In future sea level conditions, the project would have a negligible impact on adult and juvenile habitat. However, a considerable amount (2.2-4.6%, depending on flow conditions) of spawning/early life stage and young of year habitat would be lost due primarily to salinity migration upriver.

As mitigation for the loss of spawning/early life stage and young-of-year habitat in current and future conditions, fish passage structures are included as part of the proposed action. These proposed measures include creation of a bypass at Lock and Dam 1 utilizing an existing canal with anecdotal and acoustic evidence of successful but limited passage and construction of a rock ramp at Lock and Dam 2. These measures have the potential to negatively impact the species during construction but provide significant long-term benefits to the species and DPS. More information on the mitigation measures including conceptual designs is available in Appendix M: Mitigation Plan.

Construction of the fish passage structures should restore access to historic spawning grounds for sturgeon in the Cape Fear River as mitigation for minor losses in spawning and early life stage habitat due to the proposed action. Success criteria and adaptive management measures have been identified in Appendix M to ensure success of the fish passage structures.

Both Shortnose and Atlantic sturgeon are bottom suctorial feeders and feed primarily on small macroinvertebrates or other benthic organisms such as crustaceans, worms, and mollusks. Because substrate type strongly affects composition of benthic prey, both juvenile and adult shortnose sturgeon primarily forage over sandy-mud bottoms, which are good producers of benthic invertebrates (Carlson and Simpson 1987, Kynard 1997). The proposed project will temporarily affect benthic food supplies but these organisms have been shown to recolonize quickly. The recovery time of an area varies by the size of the impact, water temperature, and sediment type and can range from 6-8 months in estuarine areas with mud to 2-3 years in areas with sand and local disturbances by waves and currents (Newell et al. 1998). There is also abundant adjacent habitat for sturgeon to utilize for foraging and the adjacent habitat will aid in the recolonization of benthic resources.

The wetland restoration aspect of the mitigation plan is expected to provide high value habitat for prey species (mollusks, fish, crustaceans) and improve nearby foraging opportunities for Atlantic sturgeon.

3. Dredge Material Placement

   a. Placement Types

      i. Sand Placement for Beneficial Use (BU)

Sturgeon are opportunistic feeders. Unlike rivers where foraging habitat is relatively confined and discrete, when sturgeon are in larger estuarine and marine systems they are able to forage over large areas. We anticipate they will be able to locate prey beyond the immediate areas where work will occur. Sturgeon are not expected to forage in areas where beach nourishment or nearshore placement associated with beach nourishment occur due to the shallow depths and high energy areas associated with coastal beaches. Therefore, we have determined sand placement for beneficial use no effect on sturgeon.

ii. Nearshore Placement for BU

Sturgeon may forage in the nearshore placement locations. Placement of dredged material in these areas may impact foraging resources, but this is expected to be temporary since benthic invertebrate populations in dredged areas are expected to recover. Therefore, we have determined that nearshore placement for BU may affect but is not likely to adversely affect sturgeon.

iii. ODMDS Placement

Sturgeon my forage in ODMDS placement sites. Dredge spoil placement in these areas may affect foraging resources availability, but this is expected to be temporary since benthic invertebrate populations in dredged areas are expected to recover. Therefore, we have determined that ODMDS placement may affect but is not likely to adversely affect sturgeon.

b. Water Quality During Placement

Turbidity plumes due to placement in the open water areas is limited to an area only a few hundred feet to a few thousand feet and most turbidity settles out quickly once dredging or material placement is complete. In open water environments mobile species will avoid these disturbed areas if needed and turbidity will dissipate relatively quickly. Therefore, the temporary changes in water quality may affect but is not likely to adversely affect sturgeon.

c. Lighting

Impacts to sturgeon from vessel lighting are not expected. However, the SARBO 2020 General PDCs in Section 2.2 of Appendix B state that all lighting near sea turtle nesting beaches will be shielded and minimized to the maximum extent possible consistent with vessel personnel safety and U.S. Coast Guard navigation requirements. Though there are no known impacts to sturgeon from vessel lights, this PDC would further minimize possible impacts. Therefore, we have determined vessel lighting will have no effect on the species.

d. Vessels Used for Placement of Dredged Material/BU Construction

Construction Vessels Physical injury to sturgeon due to vessel strike is extremely unlikely to occur during construction. The rivers in the Southeast tend to be wider than those in the Northeast where vessel strikes occurred and likely provide more room for sturgeon to escape a strike. Sturgeon in the Southeast also generally appear to aggregate in areas outside of heavily trafficked shipping channels; however, vessels involved with relocation trawling or transiting for work will be traveling slowly while working in these areas and giant manta rays are mobile species that appear to be able to be responsive to activity in the area and able to move out of the way of at least slow moving equipment. Therefore, we have determined vessel interactions during construction will have no effect on the species

e. Long term impact from BU

iv. Changes in Vessel traffic from the BU

The impact of vessels transporting dredge material for beneficial use or placement at the ODMDS would primarily be attributed to vessel strikes. As provided for in the PDCs of the 2020 SARBO, all vessel operations will follow the requirements set forth in the 2020 SARBO.

v. Water quality

Open water- Turbidity plumes due to placement in the open water areas is limited to an area only a few hundred feet to a few thousand feet and most turbidity settles out quickly once dredging or material placement is complete. Additionally, whales are not expected to impacted by localized turbidity as a result of dredging activities, as whales breathe air and can therefore both move away from areas of poor water quality and surface to breathe air. Additionally, in open water environments mobile species will avoid these disturbed areas if needed and turbidity will dissipate relatively quickly.

River System- There are no long term impacts to water quality expected to impact sturgeon from BU. It is expected that BU locations would stabilize and long term not increase sedimentation over baseline. Therefore, the USACE has determined there will be no effect to sturgeon from long term water quality impacts associated with BU.

vi. Habitat Alteration

The BU aspect of the project is expected to increase high value habitat for prey species (mollusks, fish, crustaceans) and improve nearby foraging opportunities for Atlantic sturgeon. Therefore, we have determined the habitat modification will have no effect on sturgeon

4. Mitigation Impacts

Construction of the fish passage structures will require deepening and reinforcement of an existing stream near Lock and Dam 1 and placement of rock material in-channel just below Lock and Dam 2. These construction activities will occur within Atlantic sturgeon critical habitat to improve conditions conducive to fish passage. These impacts will be temporary, and construction will occur during an environmental timeframe of August 1 - January 31 to avoid the spring spawning migration to minimize the potential risk of direct negative effects to sturgeon. The spawning migration typically occurs during high flows that would not be conducive to construction. Construction would be coordinated with water managers to avoid negative impacts from environmental flow (eFlow) releases.

The mitigation plan also includes wetland restoration, and the relevant project action includes mechanical removal of the invasive common reed, Phragmites australis, near the Brunswick River. Construction activities will be limited to areas currently vegetated and located above MLLW. Sturgeon are unlikely to be present in supratidal or shallow wetland habitats, and are unlikely to be impacted by wetland restoration activities

5. G&G surveys performed by or authorized by the USACE necessary to complete dredging and material placement projects.

As described in detail above in Section 5.1.5, physical injury or other take of ESA-listed species from geotechnical surveys is extremely unlikely to occur and therefore may affect but, is not likely to adversely affect sturgeon.

6. Maintenance Dredging- will be covered under the 2020 SARBO, incorporated by reference. However, maintenance of the BU placement sites in the Cape Fear River is not covered by the SARBO due to sturgeon critical habitat designation.

Atlantic Sturgeon Critical Habitat

1. Atlantic Sturgeon Unit 4. Cape Fear River and Northeast Cape Fear River

The project is located in Atlantic sturgeon critical habitat. The physical features essential for the conservation of Atlantic sturgeon belonging to the Carolina DPSs are those habitat components that support successful reproduction and recruitment. These are:

(1) Hardbottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0-0.5 parts per thousand range) for settlement of fertilized eggs and refuge, growth, and development of early life stages;

(2) Aquatic habitat inclusive of waters with a gradual downstream salinity gradient of 0.5 up to as high as 30 parts per thousand and soft substrate (e.g., sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development;

(3) Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support:

(i) Unimpeded movement of adults to and from spawning sites;

(ii) Seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary; and

(iii) Staging, resting, or holding of subadults or spawning condition adults. Water depths in main river channels must also be deep enough (at least 1.2 m) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river;

(4) Water quality conditions, especially in the bottom meter of the water column, with temperature and oxygen values that support:

(i) Spawning;

(ii) Annual and inter-annual adult, subadult, larval, and juvenile survival; and

(iii) Larval, juvenile, and subadult growth, development, and recruitment. Appropriate temperature and oxygen values will vary interdependently, and depending on salinity in a particular habitat. For example, 6.0 mg/L DO or greater likely supports juvenile rearing habitat, whereas DO less than 5.0 mg/L for longer than 30 days is less likely to support rearing when water temperature is greater than 25°C. In temperatures greater than 26°C, DO greater than 4.3 mg/L is needed to protect survival and growth. Temperatures of 13 to 26 °C likely support spawning habitat.

F.5.7.1 PBF1

Hard bottom substrates required for spawning and early life stage Atlantic sturgeon are located far above the proposed action area will not be impacted by the project. USACE has determined that the project will have **"no effect"** to PBF1.

F.5.7.2 PBF2

Salinity in the mid estuary is expected to increase slightly with a localized migration upriver. This may increase the area of available foraging habitat below spawning areas for certain life stages. Substrates are anticipated to remain soft or quickly fill in with soft materials where blasting is required. USACE has determined that the project "**may affect, but not likely to adversely affect**" PBF2.

F.5.7.3 PBF3

The project actions will not create physical barriers between the river mouth and spawning sites. Impacts from dredging such as turbidity and noise will be minor, temporary, and avoidable to adult sturgeon undergoing spawning migrations. Fish passage mitigation measures are expected to beneficially affect Atlantic sturgeon access to spawning sites. USACE has determined that the project "**may affect, but not likely to adversely affect** " PBF3.

F.5.7.4 PBF4

The water quality of the main stem of the Cape Fear River will be able to continue to support spawning, annual and inter-annual adult, subadult, larval, and juvenile survival, and larval, juvenile, and subadult growth, development, and recruitment. The project includes fill impacts for BU within sturgeon critical habitat that will result in the loss of approximately 1175 subtidal acres by converting it to 1170 acres of intertidal habitat and 6 acres of supratidal (above MHHW) habitat. This could temporarily affect water quality (PBF 4) during initial construction and O&M events. Therefore, USACE has determined that the project "**may affect, but not likely to adversely affect**" PBF4.

Section F.6 Summary of Effects

Table 10. Proposed Species Effects Determinations

ESA-listed Species	ESA Listing Status	Effects Determination
Sea Turtles		
Green (North Atlantic [NA] DPS)	T	MALAA
Hawksbill	E	MANLAA
Kemp's ridley	E	MALAA
Leatherback	E	MALAA
Loggerhead (Northwest Atlantic [NWA] DPS)	T	MALAA
Fish		
Atlantic sturgeon (SA DPS)	E	MALAA
Shortnose sturgeon	E	MALAA
Elasmobranchs		
Giant manta ray	T	MALAA
Oceanic whitetip shark	T	NE
Whales		
Blue whale	E	NE
Fin whale	E	NE
North Atlantic right whale	E	MANLAA
Sei whale	E	NE
Sperm whale	E	NE

Table 11. Critical Habitat Effects Determinations

Species	Critical Habitat	Effect Determination
Loggerhead sea turtle (NWA DPS)	Nearshore Reproductive Habitat (LOGG-N-05)	MANLAA
Loggerhead sea turtle (NWA DPS)	Winter Habitat (LOGG-N-02)	NE
Atlantic sturgeon	Unit 4. Cape Fear River and Northeast Cape Fear River	MALAA
North Atlantic right whale	Unit 2. Southeastern U.S. Calving Area	NE

Section F.7 References

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