US Army Corps
of Engineers ®
Wilmington District

General Re-evaluation Report and Environmental Assessment
Surf City, Onslow and Pender Counties, North Carolina
Coastal Storm Risk Management Project

Appendix H: Essential Fish Habitat Assessment

Draft

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List of Abbreviations and Acronyms

AUC Area Under the Curve

BMPs Best Management Practices

BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
cm	centimeter(s)
CMECS	Coastal and Marine Ecological Classification Standard
CR	Conservation Recommendations
cy	cubic yards
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
FONSI	Finding of No Significant Impact
FMC	Fisheries Management Council
FMP	Fisheries Management Plan
ft	foot/feet
GC	Geoform Component
GOM	Gulf of Mexico
GPS	global positioning system
HAPC	Habitat Areas of Potential Concern
in	inch(es)
km	kilometer
m	meter(s)
m^3	cubic meters
mm	millimeter(s)
MMP	Marine Minerals Program
MSFCMA	Magnuson-Stevens Fisheries Conservation & Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NVGD	National Geodetic Vertical Datum
PIANC	The World Association for Waterborne Transport Infrastructure

ppt	parts per thousand
TSHD	trailing suction hopper dredges
TSS	total suspended sediments
SARBO	South Atlantic Region Biological Opinion
SC	Substrate Component
SS	suspended sediments
unk	unknown
USACE	U.S. Army Corps of Engineers

1.0 Introduction

The purpose and need of this project is to reduce the impacts and risks associated with erosion, flooding, storm surge and wave attack created by severe coastal storms and sea level rise for the Town of Surf City, North Carolina. In addition, if implemented, the project would enhance the beach strand available for recreation use and provide habitat for a variety of plants and animals.

An *Integrated Feasibility Report and Environmental Impact Statement, Coastal Storm Damage Reduction, Surf City and North Topsail Beach, North Carolina, December 2010* (2010 EIS) was prepared to evaluate coastal storm risk management along Surf City and North Topsail Beach (SCNTB). In addition, a supplemental *Environmental Assessment for West Onslow Beach and New River Inlet (Topsail Beach) and Surf City and North Topsail Beach Coastal Storm Damage Reduction Projects, July 2013* (2013 EA) was prepared to address changes that were implemented after the Environmental Impact Statements (EISs) for both projects were completed.

The Surf City (SC) Coastal Storm Risk Management (CSRM) General Reevaluation Report and Environmental Assessment (GRR/EA) proposes an implementable Federal project for Surf City and proposes to deauthorize the originally authorized project, that include the Town of North Topsail Beach. The GRR/EA addresses changes in sediment volumes, borrow areas and the borrow area use plan, dredging and placement window alternatives, and updates to the environmental monitoring/commitments included in the 2010 Feasibility/EIS. By coordination of this document with the National Marine Fisheries Service (NMFS), consultation is officially initiated and concurrence with the findings is requested. The U.S. Army Corps of Engineers Wilmington District (USACE) is the lead federal agency under the NEPA process and associated environmental compliance activities. Pursuant to 40 CFR 1501, the Bureau of Ocean Energy Management (BOEM) is serving as a cooperating agency as the project proposes to utilize a series of potential borrow areas in federal waters adjacent to the project site. Since BOEM has jurisdiction by law over mineral leasing in the Outer Continental Shelf (OCS) beyond three miles, this 2024 GRR/EA will support BOEM's decision regarding issuance of leases for those portions of the proposed borrow areas outside the three-mile limit. BOEM will also serve as a cooperating agency for consultation requirements related to Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA) (16 USC 1801).

Potential project effects on Essential Fish Habitat (EFH) species and their habitats have been evaluated and were addressed the 2010 EIS. In our letter dated January 13, 2010, the USACE requested consultation under the EFH provisions of the Magnuson-Stevens Act. The NMFS letter dated March 8, 2010, made the following Conservation Recommendations:

1. Before construction begins, the USACE shall provide NMFS with a map and description of the pipeline corridors relative to live/hard bottom habitats. The description shall include measures the USACE would take to ensure minimal impacts would occur to NOAA trust resources.

2. The USACE shall coordinate with NMFS on the final design of the sampling programs for examining impacts to benthic invertebrate communities and sedimentation on live/hard bottom areas; this coordination shall occur well in advance of baseline sampling.

3. The USACE shall reinitiate EFH consultation with the NMFS Habitat Conservation Division should any in-water work be proposed outside the period of November 15 to March 31.

On April 5, 2010, the USACE concurred with the EFH conservation recommendations. EFH impacts were evaluated in the 2013 EA, but an EFH assessment was not conducted.

The project is in Pender and Onslow counties in the town of Surf City, North Carolina. Topsail Island is a 22-mile-long barrier island on North Carolina's south-central coast consisting of three communities, from south to north—Topsail Beach, Surf City, and North Topsail Beach. The footprint of the proposed action includes the sub-aerial beaches of Surf City as well as the marine environment offshore of the barrier island.

See Map 1 for more information on the project area. For this EFH Assessment, Borrow Areas A and N were analyzed as "bookends" to the project area, representing the most inshore, northwest portion (i.e., Borrow Area A) and offshore, southeast portion (i.e., Borrow Area N). The detailed analysis of these two borrow areas has been combined and serves as a proxy for all 13 of the potential borrow areas (A, B, C, D, E, F, G, H, J, L, N, O, and P) in the project area. Throughout this report, then, while one or both borrow areas may be referenced, it is assumed that the conditions would be similar across all borrow areas, unless noted otherwise.

Additional information regarding the proximity of the project to features of interest not covered in this report can be obtained through the BOEM and the National Oceanic and Atmospheric Administration (NOAA) Ocean Reporting Tool (NOAA 2018b).

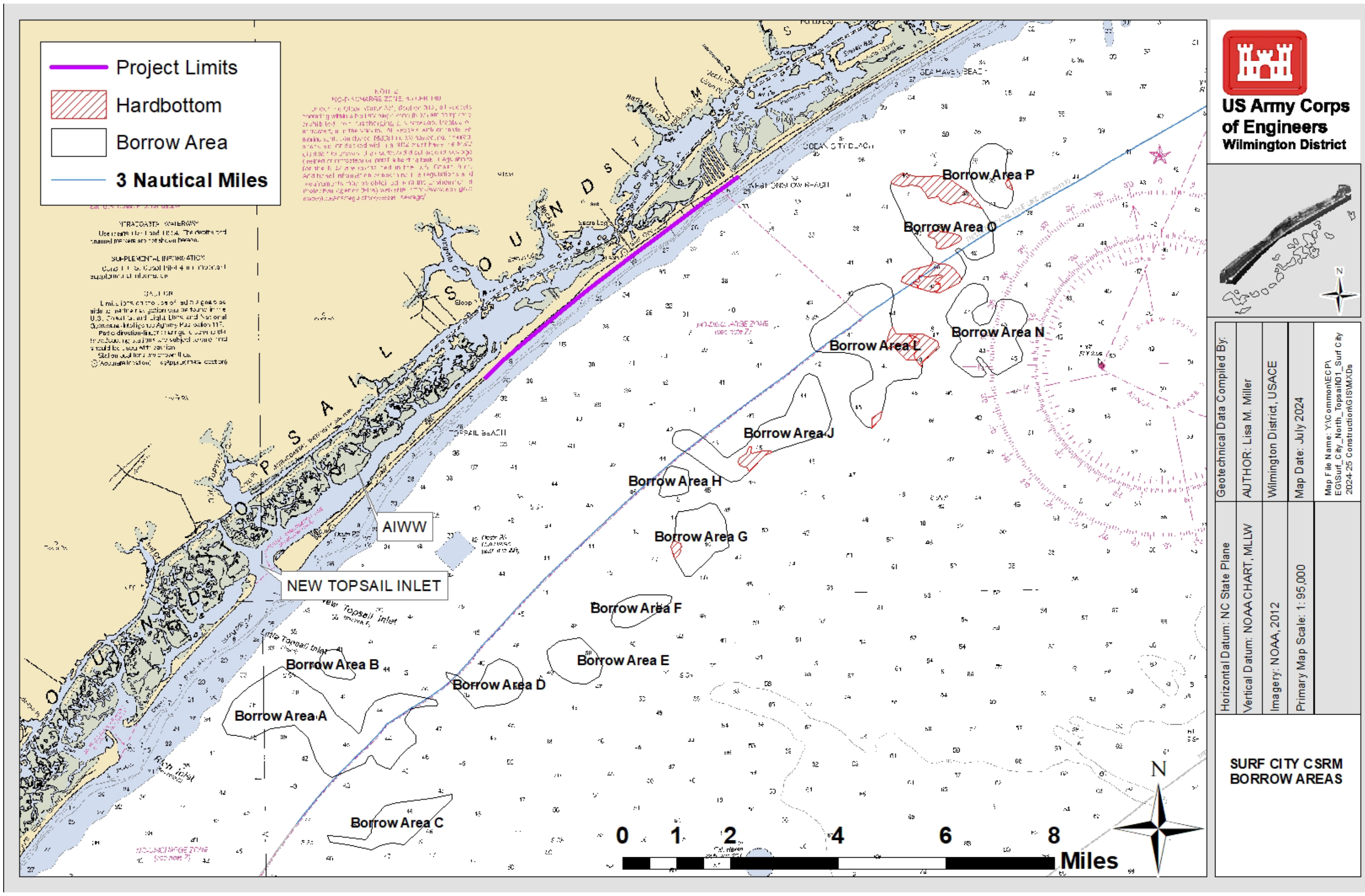

Figure 1.Project Area

2.0 Purpose

Provisions of the Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA) (16 USC 1801) require that EFH areas be identified for each species managed under a fishery management plan, and that all Federal agencies consult with the National Marine Fisheries Service (NMFS) on all Federal actions that may adversely affect EFH. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." This EFH assessment is being prepared pursuant to Section 305(b)(2) of the MSFCMA and includes the following required parts: 1) identification of species of concern; 2) a description of the proposed action; 3) an analysis of the effects of the proposed action; 4) proposed mitigation; and 5) the Federal agency's views regarding the effects of the proposed action. The purpose of this consultation process is to address specific federal actions that may adversely affect EFH, but do not have the potential to cause substantial adverse impact.

3.0 Proposed Action

The Surf City Coastal Storm Risk Management project would consist of a sand dune constructed to an elevation of 15 feet above the National Geodetic Vertical Datum (NGVD) 29 fronted by a 50-foot-wide beach berm constructed to an elevation of 7 feet above NGVD 29. The berm and dune project will extend along a reach of 52,150 feet. The proposed action is to perform initial construction (only) any time of year. Two hopper dredges are assumed to be used for the initial construction and one hopper dredge is assumed for nourishments. Dredging depths and the two-foot dredging buffer will be the same as discussed in the 2010 EIS, but production rates may change due to protective screening measures for Munitions and Explosives of Concern. The total required sediment volume for initial construction and nourishment events throughout the 50-year project life will be approximately 21.9 million cubic yards. The scope of the proposed action includes initial construction (~6.4 million cubic yards (MCY)) and the seven nourishment events (~13.9 MCY) totaling approximately 21.9 MCY for the life of the 50-year project. Initial construction would result in one disturbance event, lasting approximately 16 months, from dredges and all other required equipment in the water and on the beach. Eliminating the environmental window for initial construction will avoid at least two winter seasons of dredging along with reducing the number of disturbance events to one as compared to the four disturbance events under Alternative 2a, Authorized Plan for Surf City with Environmental Windows. The periodic nourishment interval for the project remains at six years with a total of seven nourishment events. Nourishment would occur between November 16 to April 30, which is the current beach placement window and nourishment events would be accomplished in one dredging season. The identified borrow areas offshore of Topsail Island have sufficient beach quality sediment to support initial construction and each nourishment event (6-year renourishment interval) for the 50-year life of the project. Pipeline routes and hopper pump-out locations have not yet been identified; however, once they are identified, USACE will implement the following strategy to avoid effects to hardbottom:

1. The construction contractor in coordination with the USACE will survey potential pipeline and pumpout locations for hardbottom (and cultural resources).

2. All information associated with the surveys, data analysis, identification and mapping of pipeline corridors and pumpout locations and subsequent measures developed to avoid resource impacts would be coordinated with the resource agencies before construction. The USACE will place buffers of 500 meters (1,640 ft.) for high- and moderate-relief hardbottom and 122 meters (400 ft.) for low relief hardbottom.

The Coastal and Marine Ecological Classification Standard (CMECS) provides a national framework for organizing information about coasts and oceans and their living systems. The six elements of the standard represent the different aspects of the seascape (water column, geoform, substrate, biotic communities, biogeographic setting, and aquatic setting), starting with the broadest systems (marine, estuarine, and lacustrine) and narrowing to the most detailed physical and biological features associated with a specific habitat type (biotic community). Descriptive information such as salinity, turbidity, rugosity (small-scale variations of amplitude in the height of a surface), and percent cover are included in CMECS as modifiers. Endorsed by the Federal Geographic Data Committee, federally funded projects working with environmental data in marine settings use CMECS as their primary classification system or include CMECS attributes for their data.

Borrow Area A ranges in depth from 11.0m (36.08ft) to approximately 15.0m (49.2ft). Borrow Area N ranges in depth from 13.0m (42.64ft) to approximately 15.0m (49.2ft). The resources' Geoform Component (GC) and Substrate Component (SC) under CMECS are unknown. For additional CMECS variables that define Borrow Area A please see **Table 1.** Borrow Area N has similar attributes, which is also expected for all borrow areas within the project area.

The suite of borrow areas identified for this project have not been dredged previously; however, other borrow sources, such as existing navigation channels, have been used for placement of beach quality sand on Topsail Island.

While hard bottoms are most abundant in southern portions of North Carolina, they occur along the entire NC coast. Based on multiple surveys conducted offshore of Topsail Island, hard bottom communities are primarily located offshore of Surf City and North Topsail Beaches. According to Cleary (2003), the environment offshore of the project area is characterized by an undulating, relatively flat, hard bottom platform punctuated by scattered, low-relief, hard bottom scarps (moldic limestone and siltstone) and sediment-filled depressions. Side scan sonar and diver ground truth data were used to identify and delineate low, moderate, and high relief hard bottom features within the proposed borrow areas. Mitigative buffers were established in the EIS to avoid direct and indirect impacts to these resources and include a 500-meter, hard bottom buffer around high- and moderate-relief hard bottom and a 122-m (400-ft.) buffer around low-relief hard bottom. Detailed hard bottom discussions for the Surf City project are included within the referenced EIS and Section 5 of the 2024 GRR/EA .

Threatened and endangered species could be present within the project areas, and they include: sea turtles [green (*Chelonia mydas*), loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), and Kemp's ridley (*Lepidochelys kempii*); North Atlantic right whale (*Eubalaena glacialis*); shortnose sturgeon (*Acipenser brevirostrum*); Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*); and West Indian manatee (*Trichechus manatus*). Further discussion of Threatened and Endangered species can be found in Section 5 of the 2024 GRR/EA.

Table 1. Classification and values associated with the proposed Borrow Area A (modified from CMECS).

Attribute	Value	Unit
Magnitude of Bottom Current - January	0.01	m/s
Magnitude of Bottom Current - February	0.01	m/s
Magnitude of Bottom Current - March	0.01	m/s
Magnitude of Bottom Current - April	0.02	m/s
Magnitude of Bottom Current - May	0.04	m/s
Magnitude of Bottom Current - June	0.04	m/s
Magnitude of Bottom Current - July	0.05	m/s
Magnitude of Bottom Current - August	0.04	m/s
Magnitude of Bottom Current - September	0.04	m/s
Magnitude of Bottom Current - October	0.03	m/s
Magnitude of Bottom Current - November	0.02	m/s
Magnitude of Bottom Current - December	0.01	m/s
Rugosity	1.0	
Slope Range	0.0 - 0.41	Degrees
Orientation	281.1	Degrees
Bathymetric Position Index (BPI) (a measure of where a referenced location is relative to the locations surrounding it)	0.95	
Dissolved Oxygen Minimum	4.61	mg/L
Temperature Range	11.77 - 27.36	Degrees C

4.0 Identification of Managed Species

Table 2.Essential Fish Habitat species and life stages that overlap the proposed borrow area with "high" impact potential. (Information in this table was gathered from official EFH documentation when available or other well recognized studies of sand affinity (noted in the shoalMATE study report). X's indicate that the proposed area matches the habitat criteria for the species/life stage combination to determine the possibility that a species/life stage with an overlapping EFH polygon may utilize the proposed area. The use of "unk" indicates that the habitat parameter was not defined for that species/lifestage combination in the documentation and is treated as a match to indicate that particular care should be taken in researching the impacts on these species. An "X" in the Water Column Zone field indicates the species is known to be demersal for some portion of that lifestage (as opposed to pelagic). The impact potential is a qualitative assessment based on the combination of results for the four parameters in this table. Species/life stages with "medium" or "low" potential impact from dredging are listed in Appendix A.)

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
				Borrow Areas A and N			
Atlantic Butterfish	Juveniles	All	X	X	X	X	High
	Spawning Adults	All	X	unk	X	unk	High
Atlantic Sharpnose Shark	Adults	All	unk	unk	X	X	High
	Juveniles	All	X	unk	X	X	High
	Mating/Birthing	Spring, Summer, Fall	unk	unk	X	unk	High
	Neonate/YOY	All	X	unk	X	X	High
Bank Sea Bass	Adults	All	unk	X	X	unk	High
	Spawning Adults	Fall, Winter, Spring	unk	unk	X	unk	High
Bar Jack	Adults	All	unk	unk	X	X	High
	Juveniles	All	unk	unk	X	X	High
	Spawning Adults	All	unk	unk	X	unk	High
Black Sea Bass	Adults	All	unk	unk	X	X	High

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
	Spawning Adults	Spring, Summer, Fall	unk	unk	X	unk	High
Blacknose Shark	Juveniles; Adults	All	X	X	X	X	High
Blacktip Shark	Neonate/YOY	All	unk	unk	X	X	High
Bluefish	Adults	All	unk	unk	X	unk	High
	Eggs	Spring, Summer	X	unk	X	unk	High
	Juveniles	All	unk	unk	X	unk	High
	Larvae	Spring, Summer, Fall	X	unk	X	unk	High
Clearnose Skate	Adults	All	X	X	X	X	High
	Juveniles	All	X	X	X	X	High
Gag	Juveniles	All	unk	unk	X	unk	High
	Spawning Adults	Winter, Spring	unk	unk	X	unk	High
Golden Tilefish	Spawning Adults	Spring, Summer, Fall	unk	X	X	unk	High
Goliath Grouper	Spawning Adults	Summer, Fall	unk	unk	X	unk	High
Gray Snapper	Adults	All	unk	unk	X	X	High
	Spawning Adults	Summer, Fall	unk	unk	X	unk	High
Gray Triggerfish	Juveniles	All	unk	unk	X	unk	High
	Adults	All	unk	unk	X	X	High
	Spawning Adults	Spring, Summer	unk	unk	X	unk	High
Jolthead porgy	Adults	All	unk	unk	X	X	High
Margate	Spawning Adults	All	unk	unk	X	unk	High
Red Porgy	Adults	All	unk	unk	X	X	High
	Spawning Adults	Fall, Winter, Spring	unk	unk	X	unk	High
Rock Sea Bass	Adults	All	unk	unk	X	unk	High
Sand Tiger Shark	Adults	All	X	unk	X	X	High

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
	Neonate/YOY; Juveniles	All	X	unk	X	X	High
Sand Tilefish	Adults	All	unk	X	X	X	High
Sandbar Shark	Juveniles	All	X	X	X	X	High
	Neonate/YOY	Spring, Summer, Fall	X	X	X	X	High
	Spawning Adults	Spring, Summer	X	unk	X	unk	High
Saucereye porgy	Larvae; Juveniles	All	unk	unk	X	unk	High
Scalloped Hammerhead Shark	Juveniles; Adults	All	unk	unk	X	unk	High
Scup	Spawning Adults	Summer	unk	unk	X	unk	High
Spinner Shark	Adults	All	unk	unk	X	X	High
	Juveniles	All	X	unk	X	X	High
	Neonate/YOY	All	X	unk	X	unk	High
	Spawning Adults	Spring, Summer	unk	unk	X	unk	High
Summer Flounder	Adults	All	unk	X	X	X	High
	Juveniles	All	X	X	X	X	High
Tiger Shark	Juveniles; Adults	All	unk	X	X	unk	High
	Neonate; YOY	All	unk	X	X	unk	High
Tomtate	Adults	All	unk	unk	X	X	High
	Spawning Adults	Spring, Summer	unk	unk	X	unk	High
Windowpane Flounder	Adults	All	X	unk	X	X	High
	Juveniles	All	X	unk	X	X	High
	Spawning Adults	Fall, Winter, Spring	X	unk	X	unk	High
Borrow Area A Only							
Blacktip Shark	Juveniles; Adults	All	X	unk	X	X	High

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Sailfish	Adults	All	unk	unk	X	X	High
	Juveniles	All	unk	unk	X	unk	High
Borrow Area N Only							
Longfin Inshore Squid	Eggs	All	X	X	X	X	High

5.0 Evaluation of Impacts on EFH Species

Fish species' presence within waters of the project impact area is highly variable, both spatially and temporally. Presence can vary for highly migratory species, among life stages, and seasonally.

The short-term impacts of dredging on fish include entrainment, physiological or behavioral changes due to human-made sounds, loss of prey/food web effects, loss of bottom substrate, and effects due to suspended and resuspended sediment plumes, sedimentation of the seafloor, and the potential release of contaminants (Kim et al. 2008; Suedel et al. 2008; Wenger et al. 2017). Hopper and cutterhead dredges use hydraulic suction fields to obtain and transport unconsolidated sediments from aquatic ecosystems. These actions may result in the *entrainment* of fish and shellfish, as defined as the direct uptake of organisms due to the hydraulic suction field generated by a draghead or cutterhead dredge (Reine et al. 1998).

Sounds from dredging operations are produced from vessels in transit to/from the dredging location, supporting vessels, and the dredging operation itself (see Reine et al. 2014a; Reine et al. 2014b; Robinson et al. 2012; Pickens and Taylor 2020). Underwater sounds emitted from dredging operations are of the amplitude to affect the behavior of fish at a considerable distance from the dredge operation (~400-1,200 m). However, the maximum sound levels emitted by dredge activities are restricted to approximately 0-300 m from the source of the vessel. These sounds are not at a level that would result in mortality or severe injury. At the closest proximities, effects may include permanent or temporary hearing impairment. Expected behavioral changes where sound is above ambient conditions may include avoidance, masking of conspecific communication, masking of predator or prey detection, or other behavioral changes. Avoidance could have severe consequences if the particular area is critical for spawning, habitat is limited in the near vicinity, migratory corridors are blocked, or the area is important for other life history requirements (Pickens and Taylor 2020).

Regarding suspended sediments, the rotation of the cutterhead itself (for cutterhead dredges) produces substantial sediment resuspension in the lower part of the water column; plume concentrations at the surface of the water column may be half of the concentration at the bottom (Havis 1988). Overflow from hopper dredges can be extremely turbid in close proximity to the dredge, as fine-grained total suspended sediments (TSS) may reach >750 mg/L (Havis 1988). Additionally, undesirable fine sediments may be discarded in the sorting and screening process (Michel et al. 2013; Sutton et al. 2009). Havis (1988) compared trailing suction hopper dredges (TSHD) and cutterhead dredges, and showed TSS concentrations were much greater for TSHD (with overflow allowed), particularly at greater depths. Potential responses of fish to suspended solids (SS) are avoidance, changes in foraging and predation rates, physiological stress, reduced growth, physical damage, and mortality of adults, juveniles, larvae, or eggs (Kjelland et al. 2015; Wilber and Clarke 2001). Fish eggs and larvae are particularly susceptible to sedimentation and SS; this may be because of their lack of mobility, relatively high oxygen demand, and/or anatomy (Appleby and Scarratt 1989; Wilber and Clarke 2001). The reaction distance of adult fish in response to planktonic prey are directly and negatively related to turbidity (Utne-Palm 2002; Wilber and Clarke 2001). Negative impacts to fish habitat may also include sedimentation of hard bottom or damage/mortality of corals from sedimentation or SS (Erftemeijer et al. 2012; Linderman and Snyder 1999; Pickens and Taylor 2020).

Long-term impacts to fish from offshore dredging operations include loss of physical habitat and suspended/resuspended sediment plumes. Although most studies measure turbidity over hours to a few days following dredging, Fisher (2015) showed turbidity fluxes over 1 ½ years after dredging; turbidity fluxes were not observed >2 km from the initial dredge site. Overall, the pattern has emerged that extremely high turbidity occurs for a relatively short duration (10-15 minutes) during and immediately following dredging. The area most affected by high TSS and sedimentation is generally 300-600 m from the dredge site, but some effects are expected to 3 km. Under certain oceanographic conditions, sediments plumes may extend up to 20 km from the dredge site. Recommendations for best practices for dredging near corals, and coral reefs, are further provided by The World Association for Waterborne Transport Infrastructure (PIANC) (2010). All species listed in **Table 2** may be more vulnerable to long-term impacts due to dredging operations.

Some species/life stages classified as 'medium' or 'low' in the 'Impact Potential' column in Appendix A may lack a depth of information regarding the environmental conditions at which they have been observed and/or they lack information on their temporal presence within the proposed borrow area as specified in Fisheries Management Plans. Further review of the existing body of scientific literature may reveal information that can be used to fill in these knowledge gaps. Another important note regarding this report is that distribution and/or abundance information specifically for important forage species for EFH species was not considered but may exist as part of species models or as part of the data that was used in the creation of EFH GIS shapes.

5.1. EFH Species with High Potential for Impacts

The species listed in **Table 2** are those that have an affinity for sand/sediment resources, overlap depth, temporal, and temperature ranges in the project area, and have demersal habits, indicating potential use of the proposed borrow areas. Some species are lumped into groups for EFH purposes and therefore will have identical EFH descriptions. Three species (gag grouper, summer flounder and the scalloped hammerhead shark) will be evaluated and used as a broad assessment of impacts to EFH species with high potential for impacts.

5.1.1. Gag Grouper

Wickliffe et al. 2014, states the Gag is a large (up to 47.2 in total length), 85.9 lbs max weight) epinepheline serranid economically important in recreational (Huntsman 1976) and commercial (Rohde and Francesconi 1992) fisheries in the Carolinas (Ross and Moser 1995, Heemstra et al. 2002, Adamski et al. 2012, Murdy and Musick 2013). Gag have an estuarine dependent life cycle and are one of the most abundant Groupers in the southeast, ranging from Massachusetts into the Gulf of Mexico, (Briggs 1958, Smith 1971, Hardy 1978, Ross and Moser 1995, NOAA 2014, Sedberry and Reichert 2015, NCDENR 2018).

Gag spawn during late winter to early spring (January to May), peaking in March and April in the Carolinas (McGovern et al. 1998, Sedberry et al. 2006, Sedberry and

Reichert 2015). Gag larvae develop for approximately 43 days (Keener et al. 1988, McGovern et al. 1998), after which they recruit to estuaries during flood tides (MARMAP 1998). Early juveniles ingress into South Carolina estuaries from April through June, peaking in April (Sedberry and Reichert 2015) and early May (Powles 1977, Collins et al. 1987, Keener et al. 1988, MARMAP 1998). The earliest collections of young juveniles in North Carolina were in May and June (Ross and Moser 1995). Additionally, larval and early juvenile Gag abundance was reported highest from June through September sampling period in North Carolina estuarine waters, with highest from late April to mid-May with peak ingress around new moons (Adamski et al. 2012, unpub. Bridgenet data). Juvenile Gag were caught from June through September sampling period in North Carolina estuarine waters, with highest catch per unit effort from July through August (Adamski et al. 2011).

Larval and juvenile transport from offshore spawning locations, away from adult populations, to estuarine nursery areas is a critical component of Gag life history. The interactions between spawning locations, physical processes, salinity, temperature, chemical cues, and habitat preferences are critical in determining larval settlement in estuaries (Peterson et al. 2000, Brown 2002). Both natural and maintained inlets in North Carolina and South Carolina are important habitat related to the migration dynamics of Gag and other estuarine dependent species of snapper and grouper (Peters et al. 1995, Peters and Settle 1994, Tzeng et al. 2003). Juvenile Gag live in estuarine waters during their first summer, typically residing in habitats high in salinity with natural and artificial structure. Juveniles prefer oyster reefs and shell rubble, seagrass beds, dredged canals, pilings, rock jetties, and artifical reefs (Keener et al. 1988, Ross and Moser 1995, Mullaney and Gale 1996, Koenig and Coleman 1998). In North Carolina, Gag have been observed to move from seagrass beds to these complex substrates within estuaries between late June and July (Ross and Moser 1995, Adamski 2009). Massive emigration from estuaries to nearshore ocean hard bottom habitats occurs in the fall (October) with the concurrent drop in water temperature (Ross and Moser 1995). Adult Gag can be found at depths of 15 to 107 m (49 to 351 ft) along the continental shelf once they leave the estuaries (Moser and Taylor 1995, Heemstra et al. 2002, SCDNR MARMAP unpublished data). In offshore waters, Gag occupy natural and artificial reefs, including wrecks, hard bottom, shelf-edge scarps, ledges, sponge/coral habitats, and various other habitats providing vertical relief from the bottom (Mullaney 1994, Koenig and Coleman 1998, Sadovy de Mitcheson and Colin 2011).

5.1.2. Summer Flounder

Summer Flounder (*Paralichthys dentatus*) are found in inshore and offshore waters ranging from Nova Scotia, Canada to the east coast of Florida (Ginsburg 1952, Bigelow and Schroeder 1953, Anderson and Gehringer 1965, Gutherz 1967, Gilbert 1986, Scott and Scott 1988, Grimes et al. 1989, Klein-MacPhee 2002, Sackett et al. 2007, Able et al. 2010, Able and Fahay 2010). In the United States, Summer Flounder are most abundant along the continental shelf and adjoining estuaries from Cape Cod, Massachusetts to Cape Fear, North Carolina (Hildebrand and Schroeder 1928, Wilk et al. 1980, Grosslein and Azarovitz 1982, Able and Kaiser 1994, Able and Fahay 1998, ASMFC 2015). Juveniles and adults have seasonal inshore/offshore migrations, with movements into shallow estuaries or coastal areas in the spring, estuarine residence through the summer, and movement out of estuaries (emigration) and nearshore habitats in late summer and fall, overwintering on the edge of the continental shelf. Summer Flounder are one of the most sought after commercial and recreational fishes along the Atlantic coast.

Summer Flounder are batch spawners, spawning more than once in a spawning season in response to environmental conditions. They spawn as they move from bays and estuarine grounds to the coasts and open ocean along the continental shelf (Packer et al. 1999, Able et al. 2010). Summer Flounder spawn throughout the fall and winter as fish emigrate offshore or onto their wintering grounds (Packer et al. 1999). Offshore migration is correlated to cooling temperatures and decreasing photoperiod in the fall (Packer et al. 1999).

Summer Flounder eggs (1 mm, or 0.04 in, in diameter) are transparent, pelagic, and buoyant and have been found at depths of 30 to70 m (98 to 230 ft) in the fall, as deep as 110 m (360 ft) in the winter, and between 10 and 30 m (33 to 98 ft) in the spring (Henderson-Arzapalo et al. 1988, Powell and Henley 1995, Packer et al. 1999). Rate of Summer Flounder egg development is positively correlated with temperature, with increasing developmental rate occurring with increasing temperatures (Packer et al. 1999). Peak abundances for eggs in the fall occur at temperatures around 14 to 17 °C (57 to 63 °F) (Reid et al. 1999). Watanabe et al. (1999) experimentally showed higher temperatures and salinity increased the rate of embryonic development through hatching, but at high temperature and low salinity, inhibition of hatching and growth of embryos occurred. Conversely, a low temperature of 16 °C (61 °F) at low salinities enhanced larval survival indicating a low temperature–low salinity synergistic effect. Watanabe et al. (1999) therefore posits moderate to high survival under all salinities at 16 °C reflects an adaptability of the yolk sac larvae to inshore movement during the pelagic larval phase. Eggs hatch between 72 and 75 hours post fertilization (Smith and Fahay 1970) with unpigmented eyes and no fin buds or mouth parts, surviving off the yolk-sac during initial development (Smith and Fahay 1970). After about two to three days, the yolk-sac is exhausted, and larvae have formed critical organs allowing them to begin consuming small planktonic food (Bisbal and Bengtson 1995).

Larvae begin swimming upright and stay in this orientation until ingress into estuarine nursery grounds occurs during nighttime flood tides (late-stage larvae, Burke et al. 1998). Metamorphosis from larvae to juvenile generally takes between 30 to 70 days post hatch. Once metamorphosis occurs, individuals leave the water column, settle to the bottom and generally bury themselves in sediment to complete development to the juvenile stage (Keefe and Able 1993, 1994). Ingress patterns in Beaufort Inlet, North Carolina indicate larvae occurred from December through the end of the sampling period in May, but larvae were most abundant from February through April (Able et al. 2010). In February, most were transforming larvae, but by March a portion were completely settled juveniles (11 to 21 mm [0.3 to 0.8 in] SL) (Packer et al. 1999). In South Carolina, peak larval densities occurred in North Inlet estuary in February and March (Burns 1974), in the Port Royal Sound from January through March (Bearden and Farmer 1972), in the Charleston Harbor from January to April (Wenner et al. 1990), and in the Chainey Creek area around the same time period (Wenner et al. 1986). Notably, some Summer Flounder emigrate early in the summer or temporarily emigrate out of estuaries (Sackett et al. 2007, Capossela 2010). These early migrations are likely not related to offshore spawning, but rather these individuals may occupy habitats on the inner continental shelf or move among coastal estuarine systems (Capossela 2010).

Juveniles are distributed in bays, sounds, and many estuaries throughout the species range during spring, summer, and fall (Deubler 1958, Poole 1966, Miller and Jorgenson 1969, Powell and Schwartz 1977, Fogarty 1981, Able and Kaiser 1994, Rountree and Able 1997, Walsh et al. 1999). Patterns of juvenile estuarine use vary by latitude (Packer et al. 1999). Juveniles in southern waters generally overwinter in bays and sounds (Able and Kaiser 1994). In North Carolina sounds, juveniles often remain for 18 to 20 months (Powell and Schwartz 1977). Juveniles located offshore return to coasts and bays in the spring and generally stay the entire summer (Packer et al. 1999). Once estuarine residency is established, individuals will only make minor movements as they become sedentary until fall migration (Desfosse 1995, Capossela 2010). Estuarine waters west and northwest of Cape Hatteras, North Carolina (Monaghan 1996) and in high salinity bays and tidal creeks of Core Sound (Noble and Monroe 1991), serve as significant nursery areas for juvenile Summer Flounder. Powell and Schwartz (1977) found that juveniles were most abundant in the relatively high salinities of the eastern and central parts of Pamlico Sound, all of Croatan Sound, and around inlets (Packer et al. 1999). Age-0 juveniles in the Pamlico Sound and Croatan Sound areas disappeared from the catch in late summer, suggesting that these fish are leaving estuarine habitats at that time (Powell and Schwartz 1977). Juveniles located from Cape Hatteras northward enter the north-south, inshore-offshore movement of the Bight once exiting the estuaries (Monaghan 1996). In contrast, those juveniles south of Cape Hatteras in the South Atlantic Bight, do not exhibit the same inshore-offshore, north-south migratory movement; juveniles > 11.8 in total length are rarely found in North Carolina estuaries, but larger fish are found around the inlets and along coastal beaches (Packer et al. 1999).

5.1.3. Scalloped hammerhead shark

Miller et al. (2014) describe the scalloped hammerhead shark as a circumglobal species that lives in coastal warm temperate and tropical seas. It occurs over continental and insular shelves, as well as adjacent deep waters. Scalloped hammerhead sharks are highly mobile and partly migratory, making migrations along continental margins as well as between oceanic islands in tropical waters.

Scalloped hammerhead sharks are highly mobile and partly migratory and are likely the most abundant of the hammerhead species (Maguire et al. 2006). These sharks have been observed making migrations along continental margins as well as between oceanic islands in tropical waters (Kohler and Turner 2001, Duncan and Holland 2006, Bessudo et al. 2011, Diemer et al. 2011, Prus 2013).

Both juveniles and adult scalloped hammerhead sharks occur as solitary individuals, pairs, or in schools. Neonate and juvenile aggregations are more common in nearshore nursery habitats, such as Kāne'ohe Bayin Oahu, Hawaii, coastal waters off Oaxaca, Mexico, Guam's inner Apra Harbor, coastal areas in the Republic of Transkei, and coastal intertidal habitats in Cleveland Bay, Australia (Duncan and Holland 2006, Bejarano-Álvarez et al. 2011, Diemer et al. 2011, Tobin et al. 2013). It has been suggested that neonates and juveniles inhabit these nursery areas for up to or more than a year as they provide valuable refuges from predation (Duncan and Holland 2006, Tobin et al. 2013). In Mauritanian waters, Zeeberg et al. (2006) noted an increase in abundance of hammerhead bycatch in pelagic trawlers during the summer months, with bycatch probability decreasing significantly during the winter and spring, as trade wind-induced upwellings caused sea surface temperatures to drop from summer maximums of 30°C to 18°C.

5.1.4. Impact determination to EFH Species with High Potential Impacts

Entrainment studies indicate that dredging elicits an avoidance response by demersal and pelagic species and that most juvenile and adult fishes are successful at avoiding entrainment (Larson and Moehl 1990, McGraw and Armstrong 1990). Based on these studies, it is anticipated that most juvenile and adult Gag, summer flounder and scalloped hammerhead shark would be successful at avoiding entrainment in the dredge intake pipe. Dredging at the offshore borrow sites would entrain the planktonic eggs and larvae of Gag and summer flounder that occur in the vicinity of the dredge pipe suction field. According to Van Dolah et al. (1992), estimated rates of larval entrainment at an offshore borrow site in South Carolina were negligible in relation to the fecundity rates and natural larval mortality rates of marine species. As a result of the dredging and placement outside of the 2010 EIS window of December 1 to March 31, the proposed action may result in short-term localized adverse effects. Due to the ability of juvenile and adult fish to move away from the dredge and the negligible rates of larval entrainment, the impacts of the proposed action would not be significant.

5.2. EFH Species with Medium Potential for Impacts

The species listed in Appendix A with a value of Medium in the 'Impact Potential' column have EFH GIS shapes which spatially overlap the project boundaries, have an observed affinity for sand/sediment resources (Rutecki, et al. 2014), and have observed depth, temporal, and temperature ranges which also overlap the project area. However, these species and life stages are observed to be within the water column, somewhere between a few feet above the seafloor and the surface. Due to their presence in the water column instead of bottom habitats, these species and life stages may experience fewer dredge-related impacts than demersal species.

5.3. EFH Species with Low Potential for Impacts

The species and life stages listed in Appendix A with a value of Low in the 'Impact Potential' column have EFH GIS shapes which spatially overlap the project boundaries, however, data from fishery management plans and scientific research (Rutecki, et al. 2014) indicate that it is unlikely that those species and life stages will be found within the project area. This determination was made due to one or more of the following factors: they have not been observed to have affinity for using sand/sediment resources (Rutecki, et al. 2014), they have not been observed within the depth range of the project, they have not been observed within the project area during the season and/or month of the project, or they have not been observed within the anticipated water temperature range of the project. Because these important characteristics do not overlap, these species have the lowest potential of those categorized to be impacted during dredging.

Another group of species with a value of ‘Low’ in the 'Impact Potential' column of Appendix A are those that are lacking information in fishery management plan documentation with regards to observed depth ranges, seasonality, temperature ranges, or whether the species or life stage is found in the water column or on, near, or within the seafloor substrate. A review of the existing body of scientific literature may reveal more data than what exists in the fishery management plans reviewed in preparation of this document.

5.4. Predicted Relative Abundance or Probability of Presence of Selected Species

Species distribution models are state-of-the-art statistical models that predict the distribution of species based on species-habitat relationships (Guisan and Zimmermann 2000; Robinson et al. 2011). Distribution models were developed based on fishery-independent survey data from 2004-2017 combined with remote sensing data on oceanographic conditions, substrate, geography, and the surrounding ecosystems of wetlands and estuaries (see Pickens and Taylor 2020 for detailed methods and specific results). Predictive models were assessed with independent validation data, and species distribution models predicted the probability of presence with an accuracy of >70% (range: 73-88% accuracy) as measured by Area Under the Curve (AUC) statistics; these measures show good predictive ability (Manel et al. 2001). We selected species to model based on potential use of sand shoals, socio-economic value, data availability, representation of fish guilds (e.g., demersal species, apex predators). Species modeled include red snapper (adults), black sea bass (juveniles and adults), tiger shark (juveniles and adults), sandbar shark (juveniles and adults), and blacknose shark (juveniles and adults). All models represent spring, summer, and fall seasons. Probability of presence on Borrow Areas A and N are shown in **Tables 3** and **4**. Variables in the models, and their relative influence, are shown in Appendix B.

Table 3. Probability of presence for selected EFH species in Borrow Area A and the surrounding marine environment. All items reported are mean values.

Species	Age group(s)	Season	Within Shoal/ Borrow Area	Within 20km	Within Species' Geographic Range within the Region
Blacknose shark	Juveniles and Adults	All	0.25	0.11	0.12
Black sea bass	Juveniles and Adults	All	0.93	0.69	0.6
Red snapper	Adults (years 2+)	All	0	0	0.2
Sandbar shark	Juveniles and Adults	All	0.01	0.01	0.22
Tiger shark	Juveniles and Adults	All	0.53	0.47	0.6

Table 4. Probability of presence for selected EFH species in Borrow Area N and the surrounding marine environment. All items reported are mean values.

Species	Age group(s)	Season	Within Shoal/ Borrow Area	Within 20km	Within Species' Geographic Range within the Region
Blacknose shark	Juveniles and Adults	All	0.35	0.16	0.12
Black sea bass	Juveniles and Adults	All	0.75	0.69	0.6
Red snapper	Adults (years 2+)	All	0	0	0.2
Sandbar shark	Juveniles and Adults	All	0.01	0.01	0.22
Tiger shark	Juveniles and Adults	All	0.51	0.47	0.6

5.5. Habitat Areas of Particular Concern (HAPC)

Habitat Areas of Potential Concern (HAPC) are subsets of EFH that have been identified for special consideration during planning due to the rarity of the environment, stressors from development, importance to federally managed species, or vulnerability to anthropogenic degradation (BOEM; NOAA 2018a). HAPCs that overlap the proposed area are listed in **Table 5** and have been considered within this assessment.

Table 5. List of HAPCs that overlap the project area.

Site Name	Link
Coastal Inlets	http://ocean.floridamarine.org/efh_coral/pdfs/Comp_Amend/EFHAmendSect4.0.pdf#page=7

5.6. Forage Species for EFH Species

Certain forage species may be important indicators for the presence of EFH species; however, these forage species may not be listed as EFH. For further information on forage species for EFH, see Duval et al. 2016, Okey et al. 2014., CSA International, Inc. et al. 2009, Houde et al. 2014, and Ward Slacum et al. 2011., and South Atlantic Fishery Management Council 2018.

6.0 Proposed Mitigation

Measures to minimize or avoid effects on EFH and managed species will be implemented based on consultation with federal agencies. Overarching measures to mitigate impacts are as follows: 1) implementation of best management and engineering practices; and 2) completion of hydrographic surveys pre- and post- dredging. The following Best Management Practices (BMPs) will be utilized for this project to the maximum extent practicable:

6.1. Best Management Practices

1. Activities will be consistent with those evaluated in all applicable National Environmental Policy Act documents and project permits.

2. The project will comply with all applicable environmental laws.

3. The dredge and any bottom-disturbing equipment will have an onboard global positioning system (GPS). All appropriate Dredging Quality Management and Automatic Identification System (if applicable) data will be submitted to BOEM.

4. As part of the borrow area use plan, the contractor will recover the maximum amount of beach nourishment material within one portion of a borrow area using a two-foot buffer (i.e. leaving approximately 2 feet of sand on the bottom) before relocating to another portion of the same borrow area or to a separate borrow area. Maximum recovery of material shall be determined by dredging equipment efficiencies, entrainment of unsuitable nourishment material, or the maximum dredging depth determined by the government. Overall, the post-dredging

borrow area depressions would be slightly deeper on average but similar to the 2010 EIS and will avoid creating deep depressions or pits.

5. Dredge operators (and any other contractor[s]) will prepare and implement a Marine Pollution Control and Contingency Plan.

6. Pre- and post-dredging bathymetric surveys of the Borrow Areas will be submitted to BOEM.

6.2. Mitigation Measures

Except where noted in Table 13 and 14 of the 2024 GRR/EA and **Tables 6** and **7** below, the proposed action will adhere to the same commitments included in the 2010 EIS. **Table 6** shows the environmental commitments from the 2010 EIS that are applicable to EFH and the current status. The commitments include avoidance and minimization measures and monitoring to obtain information on certain species or habitat-specific impacts and should be considered preliminary. Some commitments may be modified pending new information acquired through the review process for 2024 GRR/EA.

Beach placement will be conducted in accordance with the Division of Coastal Management's Consistency Concurrence and the Terms and Conditions of the US Fish and Wildlife's Biological Opinion when received. In addition, dredging will be conducted in accordance with the *2020 South Atlantic Region Biological Opinion for Dredging and Material Placement Activities in the Southeast United States, March 27, 2020* (SARBO) and all applicable project design criteria of the SARBO will be implemented. Previous EFH Consultation (2010) Conservation Recommendations (CRs) and other impact minimization measures have been integrated into the current project plan. These include, but are not limited to:

Table 6. The 2010 Feasibility/EIS Environmental Commitments with Updates.

	2010 EFH Environmental Commitments Built into Project	**Status**
1.	Only beach quality sediment (i.e., in accordance with North Carolina Sediment Criteria Rule Language) would be placed on the beach as a component of this project.	The project ~~will~~would use the Wilmington District compatibility practice for beach placement material, as outlined in the 2013 EA, that meets these criteria: 1. Less than 10 percent, by weight, material passes #200 sieve over weighted average. 2. Less than 10 percent, by weight, material retained on the #4 sieve over weighted average. 3. Material retained on the 3/4-inch sieve does not exceed, by percentage or size

		that found on the native beach. 4. Contains no construction debris, toxic material, or other foreign matter. 5. Contains no clasts or lithified rock.
2.	During the PED phase of this project, additional borings or geophysical surveys or both would be performed to better delineate the borrow area boundaries and material types.	Subsurface investigations described in the 2010 FEIS were completed in 2013 to better delineate the borrow area boundaries and material types. Additional borings are being collected to further delineate dredge cut boundaries.
3.	If the dredging operations encounter sand deemed non-compatible with native grain size or sorting characteristics of the native beach, the Wilmington District would make the decision on a suitable contingency measure that may include moving the dredge to another site in the borrow area or to another borrow area and would notify the NCDCM and other resource agencies of such a contingency measure	If the dredging operations encounter sand that does not meet the sediment requirements described above, the Wilmington District would make the decision on a suitable contingency measure that may include moving the dredge to another site in the borrow area or to another borrow area. The USACE would notify the NCDCM and other resource agencies of such a contingency measure.
4.	To determine the potential taking of whales, turtles, and other species by hopper dredges, NMFS-certified observers would be on board during all hopper dredging activities. Recording and reporting procedures would be followed in accordance with the conditions of the current NMFS RBO.	No change. ~~Will~~Would be implemented as described.
5.	Only beach-compatible sediment would be placed on the beach as a component of the project. The USACE ~~will~~would, in coordination with the NCWRC and USFWS, evaluate post-nourishment beach compaction (hardness)would using qualitative assessment techniques to assure that impacts to nesting and incubating sea turtles are minimized and, if necessary, identify appropriate mitigation responses.	Likely no change. ~~Will~~Would be implemented as required by the USFWS BO ~~that will be~~ issued for this project.
6.	To prevent leakage, dredge pipes would be routinely inspected. If leakage is found and repairs cannot be made immediately, pumping of material must stop until such leaks are fixed.	No change. ~~Will~~Would be implemented as described.
7.	The USACE would adhere to appropriate environmental windows to the maximum extent practicable.	The proposed action is to eliminate the beach placement window for initial construction, but to abide by

		the beach placement window for nourishments (November 16 to April 30).
8.	The USACE would strictly adhere to all conditions outlined in the most current NMFS Regional Biological Opinion (RBO) for dredging of channels and borrow areas in the southeastern United States. Furthermore, as a component of this project, hopper dredging activities for both initial construction and each nourishment interval would adhere, to the maximum extent practicable, to a dredging window of December 1 to March 31. Turtle-deflecting dragheads, inflow or overflow screening, or both would be used, and NMFS-certified turtle and whale observers would also be implemented.	The 2020 SARBO supersedes previous RBO. The proposed action is to eliminate the environmental window for initial construction and to accomplish all nourishments during the beach placement window of November 16 to April 30. No other changes are proposed.
9.	The anticipated construction timeframe for initial and periodic nourishment events would avoid peak recruitment and time for surf zone fishes and benthic invertebrates.	The proposed action would minimize surf zone fishes and benthic invertebrates impacts to the maximum extent practicable; but initial construction is proposed to occur any time of year to reduce the number of disturbance events.
10.	Before initiating any land disturbing activities related to the initial construction period, the USACE would develop Monitoring Plan, in coordination with the resource agencies, to assess project impacts on fisheries and fish prey habitat that outlines: (1) the methodologies for evaluating for hardbottom and intertidal beach habitat impacts, (2) the criteria for determining whether significant, adverse impacts to these habitats have occurred, (3) implementation of the monitoring plan. Though unlikely, based on the avoidance measures incorporated in the study design, should the Monitoring Plan document indicate that a significant adverse impact to habitat has occurred, a Mitigation Plan would be developed outlining the appropriate actions that would be implemented in cooperation with state and federal agencies to rectify the adverse impacts to a level of insignificance.	The USACE has coordinated with the NMFS and developed a plan to monitor for any potential effects the dredging may have on the benthic infauna and epifauna in the borrow areas as outlined in Appendix L of the GRR/EA.
11.	To provide sufficient compatible sand resources for the 50-year project while minimizing impacts to hard bottom resources, a 122 m (400 ft.) dredging buffer around the low relief hard bottom (< 0.5 m [1.6 ft.]) in the offshore borrow sites would be implemented.	In effect.
12.	Project monitoring of sedimentation effects from dredging activities in the proposed 122-m (400-ft.) buffer would be implemented when appropriate. Sediment monitoring at select offshore transects, including controls, would occur before, during, and, if necessary, after construction and would include installing sediment traps (collectors) and in-situ sediment depth measurements. If sediment accumulation at the compliance transects is > 10% of the sediment accumulated on average per day at the three control sites, the USACE would direct the contractor to stop dredging operations	The USACE has coordinated with the NMFS and developed a plan to monitor sedimentation effects from dredging activities within the 122-m (400-foot) hardbottom buffer to determine the sediment resuspension in the area and potential deposition on hardbottom habitat as

	within the 122-m (400-ft.) buffer and move to another area 500-m (1,640-ft.) from the identified hardbottom sites.	outlined in Appendix L of the GRR/EA .
13.	Initial construction would be completed over the course of four construction stages, each stage entailing a full constructed template.	The proposed action is to construct the project in one 16-month long phase, avoiding multiple disturbance events.
14.	To (1) ensure that required buffer distances are adhered to, (2) avoid physical impacts to hardbottom resources, and (3) monitor the potential for leakage of sediment, the USACE would require all dredges to implement the Silent Inspector automated dredge plant monitoring system.	No change. Will be implemented as described. The Silent Inspector automated dredge plant monitoring system has been replaced with the National Dredging Quality Management (DQM) Program which is a USACE-dredging industry partnership for automated dredging monitoring of Corps dredging projects.
15.	Before construction, the USACE will obtain a Section 401 Water Quality Certification from the NCDWQ for the proposed project. The Corps will comply with the requirements of the Section 401 Water Quality Certification. A copy of the certification would be forwarded to NCDCM.	The proposed action is covered under the North Carolina Division of Water Resources January 4, 2022, Water Quality General Certification (WQC) No. 4500: General Certification for Projects Eligible for U.S. Army Corps of Engineers Regional General Permit 198000048.
16.	All vessels will preferentially follow deep-water routes (e.g., marked channels) to avoid potential groundings or damaging bottom resources whenever possible and practicable.	In effect.
17.	If pipelines are used, they will be placed in areas away from bottom resources and of sufficient size or weight to prevent movement or anchored to prevent movement or the pipeline will be floated over sensitive areas.	In effect.
18.	Considering the ephemeral nature of the low- relief, hardbottom features in the nearshore environment and the potential for low-lying outcrops to occur in the pipeline corridor distance requirements and associated dredge and pipeline anchor points, the USACE intends to survey all areas associated with potential pump-out and pipeline corridor requirements before construction to avoid potential impacts to hardbottom features. All information associated with the surveys, data analysis, identification and mapping of pipeline corridors, appropriate buffers, and such, and subsequent measures developed to avoid resource impacts would be coordinated with the resource agencies before construction.	No change. Will be implemented as described.

19.	The District shall coordinate with NMFS on the final design of the sampling programs for examining impacts to benthic invertebrate communities and sedimentation on live/hardbottom areas; this coordination shall occur well in advance of baseline sampling.	In effect.
20.	The District shall reinitiate EFH consultation with the NMFS Habitat Conservation Division should any in-water work be proposed for a renourishment outside the period of November 15 to April 30.	In effect.
21.	If a physical impact by the hopper dredge drag heads to previously unexposed hard- bottom occurs, the incident would be thoroughly documented and coordinated with the appropriate state and federal resource agencies. Based on the outcome of such coordination, appropriate action would be taken to investigate and mitigate potential effects.	No change. Will be implemented as described.
22.	The USACE would contact the North Carolina Shellfish Sanitation and Recreational Water Quality Section before start of work, so the project area may be posted as required.	No change. Will be implemented as described.
23.	Temporary dikes would be used to retain and direct flow of material parallel to the shoreline to minimize surf zone turbidities. The temporary dikes would be removed and the beach graded in accordance with approved profiles on completion of pumping activities in that section of beach.	No change. Will be implemented as described.

Table 7. Additional Environmental Commitments.

1.	Depending on regional incidental sea turtle take numbers at the time of operations and the potential of project specific take, relocation trawling may be required as a component of offshore borrow hopper dredging operations.
2.	The contractor ~~will~~would be required to maintain a minimum of one dredge diligently working until the nourishment is completed.
3.	As part of the borrow area use plan, the contractor ~~will~~would recover the maximum amount of beach quality sand within one portion of the borrow area using a two-foot buffer (i.e., leaving approximately two feet of beach quality sand on the bottom) before relocating to another area within the borrow area. The contractor ~~will~~would be allowed to disturb this two-foot buffer to comply with SARBO PDCs to minimize entrainment impacts but is not allowed to dredge material from the 2 foot-buffer. Maximum recovery of material shall be determined by dredging equipment efficiencies, entrainment of unsuitable material, or the maximum dredging depth determined by the government, whichever depth is less.
4.	If the dredge encounters a pocket of material that contains incompatible material such as rock or clay balls, the contractor ~~will~~would stop dredging in that area and move the dredge within the approved borrow area. Mechanical raking of the beachfill area during/after beachfill placement (i.e., Using a front-end loader, bobcat type, or similar mechanical equipment outfitted with a specialized bucket containing a rake and screen with screen opening size no larger than 2"X2") ~~will~~would be a contractual option that ~~will~~would be exercised if needed. Screening at the draghead or on the beach may also be a contractual option if needed.
5.	All locations identified as acceptable alternatives for beach access for pipeline, pipe staging areas, location of pipeline routes, and offshore anchoring ~~will~~would be surveyed by the dredging company contracted to complete the project and coordinated with the OSA/SHPO prior to implementation of the proposed action.

6.	The dredge ~~will~~would avoid areas of known debris in the borrow area and cease operations and move away from an area if large amounts of debris are found. Records ~~will~~would be kept regarding when the debris containers are emptied. A map showing areas dredged and relative amounts of debris ~~will~~would be developed and distributed to the Service, NCDCM and other agencies weekly.
7.	All work that may generate turbidity will be completed in a way that minimizes the risk of turbidity and sedimentation reaching non-mobile ESA-listed species to the maximum extent practicable. This may include selecting equipment types that minimize turbidity and positioning equipment away or downstream of non-mobile species.

7.0 Conclusion and Agency Review

The severity of the impact to EFH and supported species is dictated by: 1) the spatial extent of the impact and 2) the chronic or long-term nature of the impact. A review of international literature has shown heightened levels of turbidity regularly occur within 3 km (or 1.86 miles) of dredging sites; turbidity, as a direct result of dredging, often settles within minutes to hours, but long-term monitoring of dredged sites has also shown resuspension of sediments occurs up to 1 ½ years after the dredging event (Pickens and Taylor 2020). Mortality of fish from turbidity is unlikely, but avoidance of the area by fish is a strong possibility (Pickens and Taylor 2020). Underwater sounds and fish entrainment are more local effects that occur over short time periods during the dredging event itself.

The ar eas that have been designated as EFH in the project area have been given this classification because they are believed to be “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 U. S. C. 1802). HAPC, a separate designation within EFH, is based on one or more of the following considerations: 1) the importance of the ecological function, 2) extent to which the habitat is sensitive to human-induced degradation, 3) whether and to what extent development activities are stressing the habitat type, or 4) rarity of habitat type [50 CFR 600.815(a)(8)].

As discussed and evaluated in this assessment, offshore dredging, dredge transit, and placement along the shoreline are not expected to impact “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” to any appreciable extent over a significantly large area or over any significant period of time. Impacts would be limited and short-term. From a finfish perspective, demersal species, early life stages (i.e., eggs, larvae), dormant life stages, spawning individuals, and habitats that are important for species’ migration are predicted to most impacted (Pickens and Taylor 2020). Other pelagic species and life stages are predicted to be minimally impacted. Given the relatively small size of the impacted area relative to the large geographic ranges of transitory fishes, the proposed activities are likely to have only minor impacts on the populations of finfish evaluated in this analysis.

Accordingly, it has been determined that the project may have adverse effects on EFH for Federally managed species, but adverse effects on EFH species, due to construction, will largely be temporary and localized within the dredged footprints and beach nourishment areas in the surf zone. In conclusion, the project is not anticipated to significantly impact EFH species or habitat that may be in the project area.

8.0 References

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Appendix A: Medium and Low Impact Potential EFH

Table A-1. Fishes with EFH with expected medium to low impact potential.

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Borrow Areas A and N							
Atlantic Butterfish	Adults	All	X		X	X	Medium
Atlantic Butterfish	Eggs	All	X		X	X	Medium
Atlantic Butterfish	Larvae	All	X		X	X	Medium
Banded Rudderfish	Juveniles	All	unk		X	unk	Medium
Windowpane Flounder	Eggs	Fall, Winter, Spring	X		X	X	Medium
Windowpane Flounder	Larvae	All	X		X	X	Medium
Borrow Area A Only							
Sailfish	Eggs; Larvae; Spawning Adults	Spring, Summer, Fall	unk		X	unk	Medium
Borrow Areas A and N							
Almaco Jack	Adults	All	unk			X	Low
Atlantic Spadefish	Adults	All	unk	unk		X	Low
Atlantic Spadefish	Spawning Adults	Spring, Summer, Fall	unk	unk		unk	Low
Black Grouper	Adults	All	unk	unk		X	Low
Black Grouper	Juveniles	All	unk	unk		unk	Low
Black Grouper	Spawning Adults	All	unk	unk		unk	Low
Blackfin Snapper	Adults	All	unk	X	X		Low
Blackfin Snapper	Juveniles	All	unk	unk			Low
Blueline Tilefish	Adults	All	X	unk			Low
Blueline Tilefish	Spawning Adults	All	unk	unk			Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Coney	Adults	All	unk	unk		X	Low
Cottonwick	Adults	All	unk	unk		X	Low
Cubera Snapper	Adults	All	unk	unk			Low
Cubera Snapper	Juveniles	All	unk	unk		unk	Low
Cubera Snapper	Spawning Adults	Summer, Fall	unk	unk		unk	Low
Gag	Adults	All	unk	unk	X		Low
Golden Tilefish	Adults	All	X	X	X		Low
Golden Tilefish	Eggs	Spring, Summer, Fall	X		X		Low
Golden Tilefish	Juveniles	Winter, Spring	X	X	X		Low
Golden Tilefish	Juveniles	Summer, Fall		X	X		Low
Golden Tilefish	Larvae	Winter, Spring	X		X		Low
Golden Tilefish	Larvae	Summer, Fall			X		Low
Goliath Grouper	Adults	All	unk	unk		X	Low
Graysby	Adults	All	unk	unk		X	Low
Graysby	Spawning Adults	Summer	unk	unk		unk	Low
Greater Amberjack	Adults	All	unk				Low
Greater Amberjack	Juveniles	All	unk			unk	Low
Greater Amberjack	Spawning Adults	Winter, Spring, Summer	unk	unk		unk	Low
Hogfish	Adults	All	unk	unk		X	Low
Hogfish	Spawning Adults	Fall, Winter, Spring	unk	unk			Low
Knobbed porgy	Adults	All	unk	X		X	Low
Knobbed porgy	Spawning Adults	Spring, Summer	unk	unk		unk	Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Lane Snapper	Adults	All	unk	unk		X	Low
Lane Snapper	Larvae; Juveniles	All	unk	unk		unk	Low
Lane Snapper	Spawning Adults	All	unk	unk		unk	Low
Lesser Amberjack	Adults	All	unk				Low
Longspine porgy	Adults	All	unk	unk		X	Low
Margate	Adults	All	unk	unk	X		Low
Misty Grouper	Adults	All	unk	X			Low
Misty Grouper	Juveniles	All	unk	unk			Low
Mutton Snapper	Adults	All	unk	unk			Low
Mutton Snapper	Juveniles	All	unk	unk		unk	Low
Nassau Grouper	Adults	All	unk	unk		X	Low
Nassau Grouper	Juveniles	All	unk	unk		unk	Low
Ocean Triggerfish	Adults	All	unk	unk		X	Low
Queen Snapper	Adults	All	unk	X			Low
Queen Snapper	Spawning Adults	Spring	unk	unk		unk	Low
Red Grouper	Adults	All	unk	unk		X	Low
Red Grouper	Spawning Adults	Winter, Spring, Summer	unk	unk			Low
Red Hind	Adults	All	unk	unk		X	Low
Red Hind	Spawning Adults	Summer	unk	unk		unk	Low
Red Porgy	Juveniles	All	unk	unk	X		Low
Red Snapper	Adults	All	unk	unk		X	Low
Red Snapper	Juveniles	All	unk	unk		unk	Low
Red Snapper	Spawning Adults	All	unk	unk		unk	Low
Rock Hind	Adults	All	unk	X		X	Low
Rock Hind	Spawning Adults	Spring, Summer	unk	unk		unk	Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Sailor's choice	Adults	All	unk	unk		unk	Low
Sailor's choice	Larvae; Juveniles	All	unk	unk		X	Low
Sand Tiger Shark	Birthing	Spring	unk	unk		unk	Low
Sandbar Shark	Adults	All	unk	unk	X		Low
Saucereye porgy	Adults	All	unk	unk		X	Low
Scalloped Hammerhead Shark	Neonate/YOY	All	X	X	X		Low
Scamp	Adults	All	unk	unk			Low
Scamp	Spawning Adults	All	unk	unk		unk	Low
Silk Snapper	Adults	All	unk	unk			Low
Silk Snapper	Juveniles	All	unk	unk		unk	Low
Silk Snapper	Spawning Adults	Summer	unk	unk		unk	Low
Smoothhound Shark Complex (Atlantic Stock)	All	All	X	X	X		Low
Smoothhound Shark Complex (Atlantic Stock)	Mating	Spring, Summer, Fall	unk	unk			Low
Snowy Grouper	Adults	All	unk	unk			Low
Snowy Grouper	Juveniles	All	unk	unk		unk	Low
Snowy Grouper	Spawning Adults	Spring, Summer, Fall	unk	unk		unk	Low
Speckled Hind	Adults	All	unk	unk			Low
Speckled Hind	Spawning Adults	Spring, Summer, Fall	unk	unk		unk	Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Spiny Lobster	Adults	All	unk	X		unk	Low
Spiny Lobster	Juveniles	All	unk	X		unk	Low
Spiny Lobster	Puerulus	All	unk	X		unk	Low
Spiny Lobster	Spawning Adults	Spring, Summer, Fall	unk	X		unk	Low
Summer Flounder	Eggs	Fall, Winter, Spring	unk	unk	X		Low
Summer Flounder	Larvae	Fall, Winter, Spring	unk	unk	X		Low
Vermilion Snapper	Adults	All	unk	X			Low
Vermilion Snapper	Spawning Adults	Spring, Summer, Fall	unk	unk		unk	Low
Warsaw Grouper	Adults	All	unk	unk			Low
Warsaw Grouper	Spawning Adults	Spring	unk	unk		unk	Low
White Grunt	Adults	All	unk	unk		unk	Low
White Grunt	Spawning Adults	Spring, Summer, Fall	unk	unk		unk	Low
Whitebone porgy	Adults	All	unk	unk		X	Low
Whitebone porgy	Spawning Adults	Spring, Summer	unk	unk		unk	Low
Windowpane Flounder	Eggs	Summer			X	X	Low
Windowpane Flounder	Spawning Adults	Summer		unk	X	unk	Low
Wreckfish	Adults	All	unk	X			Low
Wreckfish	Spawning Adults	Winter, Spring	unk	unk		unk	Low
Yellowedge Grouper	Adults	All	unk	X			Low
Yellowedge Grouper	Spawning Adults	Spring, Summer, Fall	unk	unk		unk	Low

	Life Stage	Season	Temp	Water Column Zone	Sand Affinity	Depth Range	Impact Potential
Yellowfin Grouper	Adults	All	unk	unk		unk	Low
Yellowmouth Grouper	Adults	All	unk	unk		X	Low
Yellowmouth Grouper	Spawning Adults	All	unk	unk		unk	Low
Yellowtail Snapper	Adults	All	unk			X	Low
Yellowtail Snapper	Juveniles	All	unk	unk		unk	Low
Yellowtail Snapper	Spawning Adults	Spring, Summer	unk	unk		unk	Low
Borrow Area N Only							
Blacktip Shark	Juveniles; Adults	All	X	unk	X		Low
Longfin Inshore Squid	Pre-recruits	All	X			X	Low
Longfin Inshore Squid	Recruits	All	X			X	Low
Longfin Inshore Squid	Spawning Adults	All	unk	X		X	Low

Appendix B: South Atlantic Predictive Models

Species	Variables in Predictive Models	Relative Influence (%)
Blacknose Shark		
	Velocity of west to east currents	40
	Concentration of chlorophyll in the surface waters during summer (mg m^{-3})	39
	km^2 of estuarine waters within 160 km of location	21
Sandbar Shark		
	Depth	55
	Bottom temperature in Fall	45
Tiger Shark		
	km^2 of estuarine wetlands within 160 km of location	40
	Time that the survey was conducted (00:00)	31
	Depth	29
Red Snapper		
	km^2 of estuarine wetlands within 160 km of location	34
	Depth	24
	Distance to shoreline (km)	22
	Velocity of west to east currents	20
Black Sea Bass		
	Concentration of chlorophyll in the surface waters during summer (mg m^{-3})	33
	Distance to shoreline (km)	25
	km^2 of estuarine waters within 160 km of location	22
	Distance to shoreline	20