US Army Corps
of Engineers ®
Wilmington District

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

Draft Report
August 2024

Executive Summary

This draft integrated general re-evaluation report and environmental assessment documents the findings and conclusions of a General Re-evaluation study of potential changes to the Surf City-North Topsail Beach Coastal Storm Risk Management Project in Onslow and Pender counties, North Carolina. The study is being conducted to identify an implementable Federal project within the Surf City portion of the project and to de-authorize the larger project that included both Surf City and the Town of North Topsail Beach.

To accomplish this purpose, the analysis examined the 2010 Authorized Plan using updated engineering information, project costs, real estate information, and a level 1 economic assessment per the scope supported in a vertical team alignment memorandum dated 4 May 2023. The analysis focuses on changes in sediment volumes, borrow areas and the borrow area use plan to address dredging and placement window alternatives, and to update environmental monitoring/commitments that avoid or minimize environmental impacts. No changes to the physical components of the 2020 Authorized Plan (berm and dune features) were considered in this analysis other than the need to address vulnerabilities within Surf City that would be created by eliminating the North Topsail Beach portion of the project.

The recommended plan is the National Economic Development (NED) and is the plan that maximizes net total benefits across all benefit categories. It is comprised of a sand berm and dune system along approximately 33,300 ft long, or approximately 6 miles of shoreline. The dune would be constructed to an elevation of 14 feet North Atlantic Vertical Datum 1988 (NAVD 88) with a 25 ft wide dune crest, fronted by a 50 ft wide berm at an elevation of 6 feet (NAVD 88). The plan would include a 1000-foot transition berm at the northern end of the project from the town limits of Surf City into the town limits of North Topsail Beach. Other features of the project include dune vegetation and 40 public walkover structures.

The Tentatively Selected Plan increases flexibility and efficiencies for initial construction and periodic nourishments over the 50-year project at Surf City and incorporates measures to reduce impacts to the most vulnerable species within the project area. Initial project construction would occur within a single dredge season lasting approximately 16 months. This change from the 2010 Authorized Plan reduces impacts to the critically endangered North Atlantic Right Whale.

Subsequent nourishment events would occur between November 16 to April 30 during one dredging season and coincide with the current beach placement window. The periodic nourishment intervals would be every six years with a total of seven nourishment events over the 50-year project life (i. e. 2024-2073). Pursuant to 40 CFR 1501, the Bureau of Ocean Energy Management is serving as a cooperating agency for compliance-related activities.

The recommended plan is supported by the Non-Federal Sponsor, the Town of Surf City. The de-authorization of the North Topsail Beach portion of the existing project is supported by the Town of North Topsail Beach.

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List of Acronyms and Abbreviations

AAB	average annual benefits
AAC	average annual cost
AANB	average annual net benefits
AFF	adjusted fill factor
AIWW	Atlantic Intracoastal Waterway
ASA(CW)	Assistant Secretary of the Army for Civil Works
BCR	benefit to cost ratio
BOEM	Bureau of Ocean Energy Management
CBRA	Coastal Barrier Resources Act
CEDAS	Coastal Engineering Design and Analysis System
CEJST	Climate and Economic Justice Screening Tool
CSDR	Coastal Storm Damage Reduction
CSRM	Coastal Storm Risk Management
CPE	Coastal Planning and Engineering of North Carolina, Inc.
DRA 19	Disaster Relief Act of 2019
EA	Environmental Assessment
e.g.	exempli gratia or “For example”
EGM	Economic Guidance Memorandum
EO	Executive Orders
EOP	Environmental Operating Principle
EP	Engineer Pamphlet
EQ	Environmental Quality
ER	Engineer Regulation
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FT	Foot or Feet
Ft/msl	feet per mean sea level
ft/yr	Feet per year
FY	Fiscal Year
i. e.	id est or “that is”
LERRD	Lands, Easements, Rights-Of-Way, Relocations, and Disposal Areas
LPP	Locally Preferred Plan
MCY	Million Cubic Yards
mm	Millimeters
mm/yr	Millimeters per year
NAVD88	North American Vertical Datum of 1988
NC	North Carolina

NED	National Economic Development
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor
NGVD29	National Geodetic Vertical Datum 1929
NM	Nautical Miles
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NTB	North Topsail Beach
O&M	Operations and Maintenance
OMRR&R	Operations, Maintenance, Repair, Rehabilitation and Replacement
OSE	Other Social Effects
P&G	Principles & Guidelines
PED	Pre-construction, Engineering and Design
PGN	Planning Guidance Notebook
PPA	Project Partnership Agreement
RED	Regional Economic Development
RSLC	Relative Sea Level Change
SARBO	South Atlantic Regional Biological Opinion
SCNTB	Surf City-North Topsail Beach
SLC	Sea Level Change
TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform and Development Act of 2014
yd^3	Cubic Yards

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Draft General Re-evaluation Report and Environmental Assessment
Surf City, Onslow and Pender Counties, North Carolina
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1.0 INTRODUCTION*

This report documents the findings and conclusions of a General Re-evaluation study to address potential changes to the Surf City-North Topsail Beach (SCNTB) Coastal Storm Risk Management (CSRM) Project in Onslow and Pender counties, North Carolina. The study is being conducted to identify an implementable Federal project and to de-authorize the portions of the original plan designed to provide protection to the Town of North Topsail Beach (NTB). This report examines the 2010 Authorized Plan using updated engineering analyses, environmental impacts, project costs, real estate information, and benefits analysis per the scope supported in the vertical team alignment memorandum dated 4 May 2023 (**Appendix M**). A new plan is presented for authorization, design and construction. The Town of Surf City, North Carolina is the non-Federal Sponsor (NFS) for the study and project.

1.1 Federal Objective

Per the "Principles and Requirements for Federal Investments in Water Resources" published in March 2013, and the subsequent guidelines published in December 2014, the Federal objective of water and related land resources projects is "…to encourage economic development, and protect the environment by:

(1) seeking to maximize sustainable economic development; and

(2) seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and

(3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems."

Federal investments in water resources strive to maximize public benefits, with appropriate consideration of costs. Public benefits encompass environmental, economic, and social goals, include monetary and nonmonetary effects, and allow for the consideration of both quantified and unquantified measures. Therefore, if the projected benefits of coastal storm risk management measures at Surf City exceed their estimated costs The project does not encourage unwise use of flood-prone areas and avoids or mitigates impacts to environmental resources, then the project is within the government's interest to construct.

1.2 Purpose and Need

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. Surf City's erosion rates since the 2010 Feasibility/EIS have remained consistent with historic

erosion rates (TI Coastal Services 2020), even with changes in the sea level change (SLC) projections over a 50-year period (less than half a foot). If not addressed , Surf City experience a substantial loss of property over the next 50 years.

As pressure continues to mount on a dredge fleet struggling to meet the existing demands of the East and Gulf Coast navigation and coastal storm risk management needs, future risks to project delivery and dredge availability will also increase, particularly for projects that are constrained to narrow construction windows. Currently there are only thirteen hopper dredges available for operation on the East and Gulf Coasts (Maine to Texas) to perform all the required dredging and beach placement projects for USACE projects. This does not consider any privately awarded work for cities, counties, or states during this timeframe. For the project, increasing the timeframes when work occurs substantially lowers risks associated with limited dredge availability.

1.3 Project History

An Integrated Feasibility Report and Environmental Impact Statement for SCNTB CSRM project was completed on 30 December 2010. The 2010 Authorized Plan consisted of a 52,150-foot-long berm and dune system, approximately 9.9 miles of shoreline, extending from the boundary of Topsail Beach and Surf City limits to the southern edge of the Coastal Barrier Resources Act (CBRA) Zone in NTB (**Figure 1)**. The system was to be constructed to an elevation of 14 feet North Atlantic Vertical Datum 1988 (NAVD 88) and a 25-foot-wide crest, fronted by a 50-foot-wide berm at an elevation of 6-foot (NAVD 88) and renourished seven times over 50 years at fixed six-year intervals. Other features of the project included dune vegetation and the construction of 60 dune walkover structures. Sand for the berm and dune construction and renourishment intervals was to be taken from borrow sites identified between one and six miles off the coast of Topsail Island. The plan also included post-construction monitoring over the period of Federal participation (i. e. 50 years) to ensure project performance and adjust the renourishment plan as needed.

The 2010 Authorized Plan reduced risks to residences and commercial properties along the project shoreline, with incidental recreation benefits. A total of 828 permanent easements were required to implement the project: 502 within the Town of Surf City and 326 within the Town of NTB. Adequate parking and public access was also required. Due to the adherence of mitigative measures outlined in **Tables 13** and **14**, the plan would not have adverse environmental effects.

1.4 Project Status

Construction of the SCNTB CSRM project was authorized by Section 7002(3) of the Water Resources Reform and Development Act (WRRDA) of 2014. Project construction was funded by Public Law 116-20, the Additional Supplemental Appropriations Disaster Relief Act, 2019 (DRA 19). Per the Assistant Secretary of the Army for Civil Works (ASA(CW)) *Policy Guidance on Implementation of Additional Supplemental Appropriations for Disaster Relief Act, 2019* memo dated 24

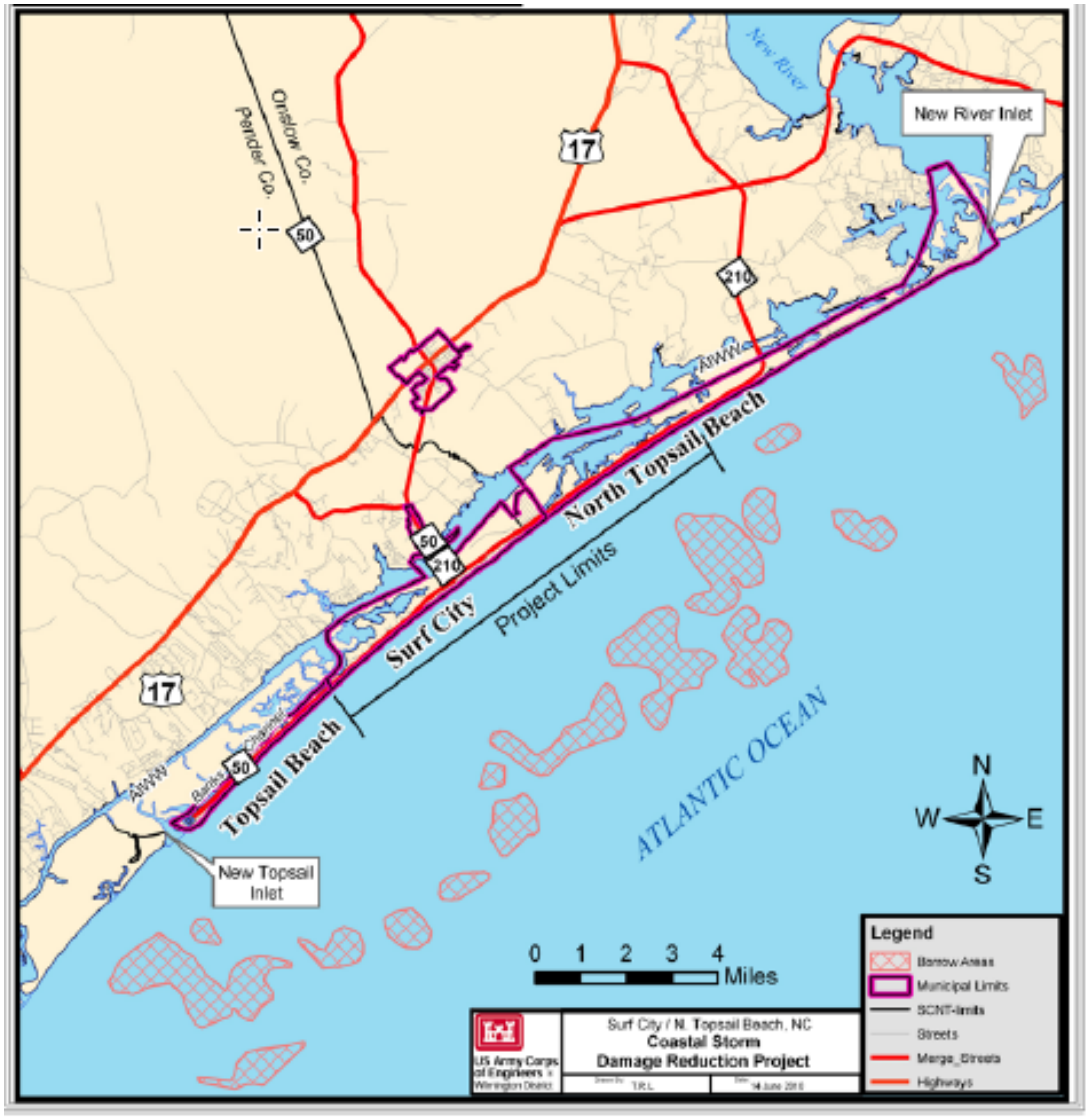

Figure 1. 2010 Authorized Plan for the Surf City/North Topsail Coastal Storm Risk Management Project.

April 2020, paragraph 4(m), the provisions of section 902 of Water Resources Development Act (WRDA) of 1986 did not apply to Public Law 116-20 funding.

The SCNTB CSRM Project completed the Pre-construction, Engineering and Design (PED) phase of the project in 2014 with the Towns of Surf City and NTB as non-Federal Sponsors. However, in July of 2021 the Town of NTB announced its intention to pull out of the construction phase of the project due to financial reasons. It was NTB's understanding that their locally funded beach nourishment project was eligible for Federal Emergency Management Agency (FEMA) reimbursement if damaged by a qualifying coastal storm event. As such, it was NTB's opinion that this reimbursement was more financially advantageous than a cost-shared Federal project and thus a Project Partnership Agreement (PPA) was not executed (**Appendix M**).

The Town of Surf City maintained its support for a Federal project and asked the USACE to examine Coastal Storm risk reduction alternatives within its town limits. As the 2010 Authorized Project was not formulated or designed with separable elements, and construction funding for the project, appropriated by the DRA 19 was constrained to the limits that included the beaches of both towns, a new study and project authorization was required to separate the Surf City portion of the project. A limited feasibility study of the project at a general re-evaluation level was determined to be the appropriate path forward (see **Appendix M**). Upon the receipt of appropriations from DRA 19, the Wilmington District began efforts on the "limited" integrated feasibility and environmental assessment.

The Wilmington District developed a scope for the proposed "limited" feasibility study and presented it to the South Atlantic Division (SAD) within a vertical team alignment memorandum (VTAM) dated 13 January 2023 (see **Appendix M**). The scope included a shorter project length, no consideration of additional management measures resulting in the reformulation of alternatives, no new planning economic model runs (i.e., Beach Fx), a level 1 economic analysis with a recertified cost estimate of the 2010 Authorized Plan, an updated NEPA document, a qualitative risk assessment of the project's performance without the Town of North Topsail Beach, and an updated real estate evaluation. The scope was supported by SAD and a memorandum was forwarded to USACE headquarters on the same day, who in turn supported the scope and forwarded it to the Assistant Secretary of the Army for Civil Works (ASA(CW)) on 4 May 2023 (see **Appendix M**). The ASA(CW) provided approval for the study and funding from DRA 2019 Investigations funding on December 15, 2023.

1.5 Study Area

Topsail Island is a 26-mile-long and 0.5-mile-wide barrier island approximately 40 miles northeast of Wilmington, North Carolina. The island is located within Onslow County to the north and Pender County to the south and contains the communities of North Topsail Beach, Surf City, and Topsail Beach. The New River Inlet borders the island to the northeast, while the New Topsail Inlet borders the island to the southwest. A series of small sounds and channels and a portion of the Atlantic Intracoastal Waterway separate the island from the mainland. Man-made channels with boat docks are present in the northern portion the project providing access to the waterway for residents.

Public access to the beaches is provided through numerous parking areas and dune walkovers. Three fishing piers are present on the island, one in each community: Seaview (NTB), Surf City (Surf City), and Jolly Roger (Topsail Beach). Surf City is home to the Karen Beasley Sea Turtle Rescue and Rehabilitation Center, whose primary mission is the rescue, rehabilitation, and release of sick and injured sea turtles, and public education. Roadway access to the mainland is provided through North Carolina (NC) Highway 50 and then by bridges on NC Highway 50/210 at Surf City and NC Highway 210 at NTB (**Figure 2**).

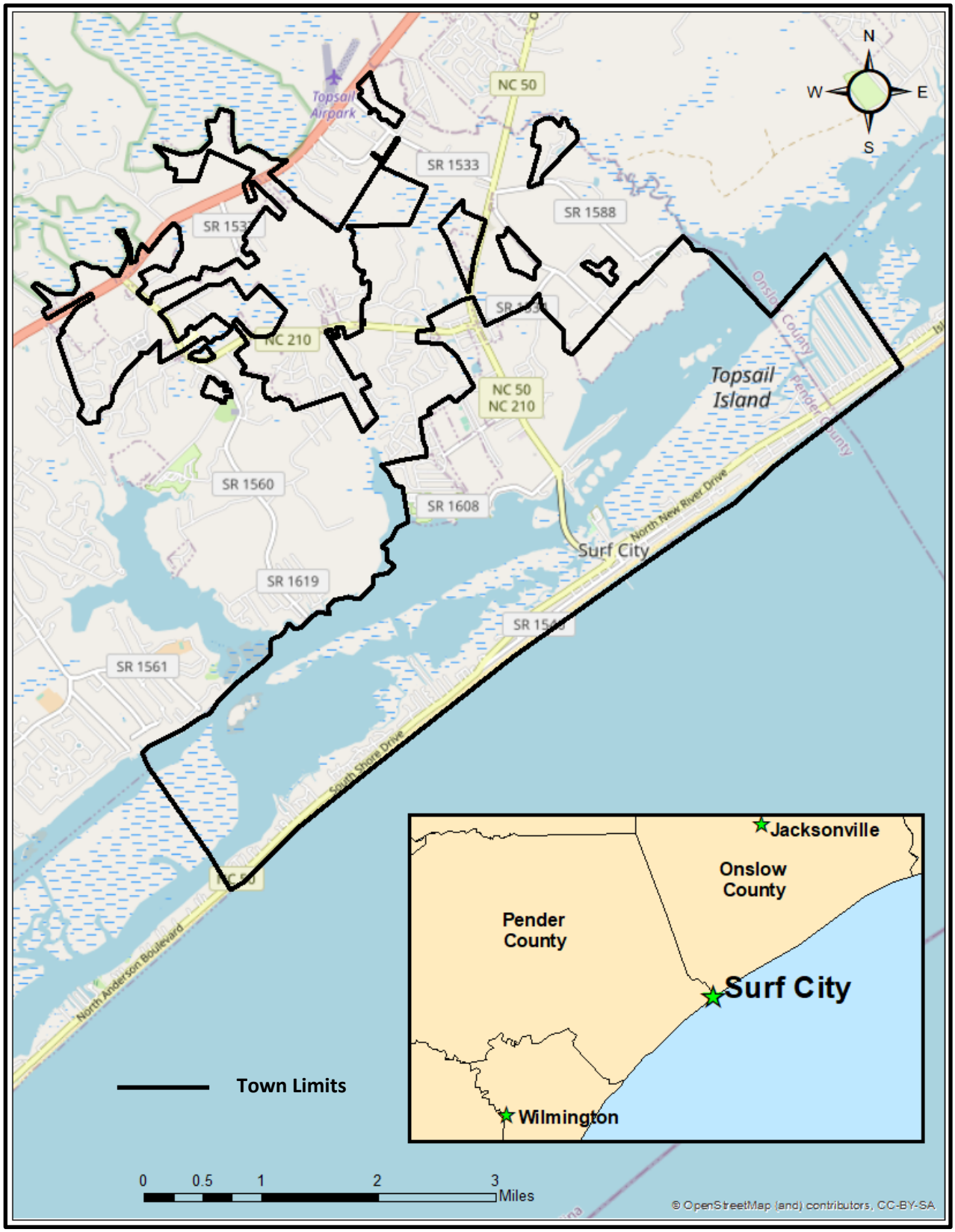

Figure 2. Town Limits of Surf City.*
(* Offshore details provided in Section 2.4 of this report.)

The island maintains a population of 5,380 residents year-round, the largest community being Surf City with a population of 3,911 (U.S. Census Bureau 2020). The year-round population of Surf City has increased approximately 103 percent since the 2010 Feasibility/EIS resulting in tremendous growth in the economy and new development.

This report focuses on the beachfront within the corporate limits of Surf City. The northern limits of the study area are in Onslow County near the road intersection of Island Drive and Scotch Bonnet Drive, while the southern limits are in Pender County near the road intersection of South Shore Drive and Hispaniola Lane. From the shoreline, the study area extends landward approximately 500 feet. Seaward, the study area extends from the shoreline approximately 1 mile. The study area also includes several borrow areas offshore of Topsail Island.

1.6 Other Federal, State and Local Constructed Projects

Two Federal navigation projects are located near the project area. They are listed and briefly described below. The nearest Federal coastal storm risk management project is at Wrightsville Beach, which is 16 miles to the southwest, but beyond the limits of this study.

- Atlantic Intracoastal Waterway (AIWW)—The AIWW provides an important inland navigation route from Norfolk, Virginia, to the St. Johns River, Florida. The 308-mile-long North Carolina portion is the state's only north-south commercial navigation thoroughfare. The project includes a navigation channel with a depth of 12 feet and widths varying from 90 feet in land cuts to 300 feet in open waters; side channels and basins at several locations; and five highway bridges. The Beaufort to Cape Fear River section was authorized by House Document No. 450, 69th Congress, Inland Waterway, Beaufort – Cape Fear River. The main channel of the AIWW in North Carolina was completed in 1940, and it has since been maintained by dredging to remove shoals that develop periodically. Some of the dredged material removed during maintenance activities is beach-quality sand. That material is placed directly on nearby ocean beaches, when practicable; otherwise, it is stockpiled in confined disposal areas near the shoreline of the AIWW. The sand can serve as a viable source of beachfill where it exists in sufficiently large volumes and in proximity to beaches.

- New Topsail Inlet and Connecting Channels—These consist of a channel 8 feet deep and 150 feet wide through New Topsail Inlet, with connecting channels 7 feet deep and 80 feet wide to the AIWW. The connecting channels are through Old Topsail Creek (1.42 miles) and Banks Channel (6.27 miles), both between the AIWW and New Topsail Inlet. Additionally, over the past 25 to 30 years, material resulting from maintenance dredging of New River, the AIWW, and connecting channels have been placed in the vicinity of New River Inlet.

As previously mentioned, the Town of NTB has constructed a non-Federal sand berm and dune system. The Town of Topsail Beach also maintains a non-Federal berm and dune system.

1.7 Report Organization

This report contains elements that are required under "Appendix G: Planning Reports and Programs" of Engineering Regulation 1105-2-100 (Planning Guidance Notebook) dated 30 June 2004.

Chapter 1 provides an overview of the report including its authorization, history, purpose, and need. Chapter 2 presents the existing and future without project conditions, respectively. Chapter 3 presents and evaluates the alternatives developed for the project, while Chapter 4 presents the recommended plan. Chapter 5 discusses the affected human environment and environmental consequences of the recommended plan. Chapter 6 presents the planned implementation of the project from now to construction and view of the NFS. Chapter 7 summarizes compliance with Federal laws and Executive Orders. Chapter 8 summarizes the view of government resource agencies (state and Federal) and the public. Chapters 9 and 10 provide concluding remarks and the District Engineer's recommendation.

2.0 EXISTING AND FUTURE WITHOUT PROJECT CONDITIONS*

2.1 Authorizing Documents and Prior Studies

The USACE prepared several engineering, planning, and environmental reports regarding the Topsail Island area. They addressed coastal storm damage reduction as well as navigational needs. Authorizing documents and technical reports relevant to the present study are briefly described below.

- House Document No. 480, 89th Congress, Topsail Beach and Surf City, North Carolina. This report, approved by Congress in 1966, presents the results of an investigation of Topsail Island conducted during the period 1963 – 1965 as part of a comprehensive study of coastal storm damage reduction needs for the segment of the North Carolina coast extending between Bogue and Moore Inlets. With approval of this report, Congress authorized coastal storm damage reduction projects for the Towns of Topsail Beach and Surf City. Improvements along the northernmost 11.7 miles of Topsail Island, referred to as West Onslow Beach, were determined to be economically infeasible. The improvements authorized by this report were not constructed, and the project was deauthorized August 5, 1977. The reason for this deauthorization was that there was no apparent nonfederal interest in the project following authorization.
- House Document No. 393, 102nd Congress, 2nd Session, West Onslow Beach and New River Inlet, North Carolina. This report (HD 393/102/2) was conducted pursuant to four congressional resolutions adopted between 1970 and 1979. The resolutions addressed beaches, channels, and inlets in the greater vicinity of Topsail Island. Studies for navigation purpose were conducted separately. The recommendation of the Final Feasibility Report and Environmental Impact Statement on Hurricane Protection and Beach Erosion Control was a berm and

dune system at Topsail Beach as described below in Section 1.09, Authorized Project.

- Integrated General Re-Evaluation Report (GRR) and Environmental Impact Statement, West Onslow Beach and New River Inlet (Topsail Beach), North Carolina, February 2009 (USACE 2009). This report proposed a berm and dune system along approximately 5 miles of shoreline in the Town of Topsail Beach. Unfortunately, the NFS did not execute the Project Partnership Agreement (PPA), and the project was not built.

- Integrated Feasibility and Environmental Impact Statement, Coastal Storm Damage Reduction (CSDR), Surf City and North Topsail Beach, North Carolina (USACE 2010). This report identified a 52,150 ft long berm and dune system, approximately 9.9 miles of shoreline, extending from the boundary Topsail Beach and Surf City limits to the southern edge of the Coastal Barrier Resources Act (CBRA) Zone in NTB as the recommended plan and proposed action under NEPA. *(https://www.saw.usace.army.mil/Missions/Coastal-Storm-Risk-Management/Surf-City-and-N-Topsail-Beach/)*

- Supplemental Environmental Assessment (EA) for West Onslow Beach and New River Inlet (Topsail Beach) and Surf City and North Topsail Beach CSDR Projects, July 2013 (USACE 2013a). This environmental document addressed changes that were implemented after the Environmental Impact Statements for both Federal projects. The assessment evaluated the sediment compatibility practice of the agency with North Carolina state requirements. A detailed borrow area utilization plan was developed based on the additional data which provided beach quality material for the 50-year project life. *(https://www.saw.usace.army.mil/Portals/59/docs/coastal_storm_damage_reduction/EA_Topsail%20Beach%20and%20SCNTB%20CSDR_JULY%202013.pdf*

  Both the 2010 and 2013 NEPA documents contain extensive background information pertaining to project-related environmental impacts in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended.

2.2 Hurricane and Coastal Storm Damages

"Coastal storm damage" refers to damages incurred to property and infrastructure from flooding and wave impact during hurricanes and other extratropical events, as well as short-term erosion that occurs during these events. These short-term effects can be exacerbated in areas that are also experiencing long-term erosion. When the island is under storm attack, the full force of the waves is felt along the immediate ocean shoreline; as the waves break and spill over the ocean edge of the island, development in upland areas is subject to the force of the waves.

Topsail Island is a frequent target of hurricanes and tropical storms tracking along the mid-Atlantic coast. According to the National Oceanic and Atmospheric Administration (NOAA)'s Historical Hurricane Tracker approximately 118 coastal storms have passed within a 60 nautical mile radius of Topsail Island since 1851,

including hurricanes, tropical storms, and tropical depressions (NOAA 2023) (**Table 1**). Local effects from these storms can vary depending on their landfall location and strength, but hurricanes Bertha and Fran in 1996, Floyd in 1999, Matthew in 2014 and Florence in 2018 were among the most damaging and costly to affect the island (**Figure 3)**.

Table 1. Historic Storms Near Surf City, North Carolina.

STORM NAME	DATE RANGE	MAXIMUM CATEGORY
FLORENCE 2018	Aug 30, 2018 to Sep 18, 2018	H4
MATTHEW 2016	Sep 28, 2016 to Oct 10, 2016	H5
FLOYD 1999	Sep 07, 1999 to Sep 19, 1999	H4
FRAN 1996	Aug 23, 1996 to Sep 10, 1996	H3
BERTHA 1996	Jul 05, 1996 to Jul 17, 1996	H3

H3= Hurricane Category 3
H4= Hurricane Category 4
H5= Hurricane Category 5

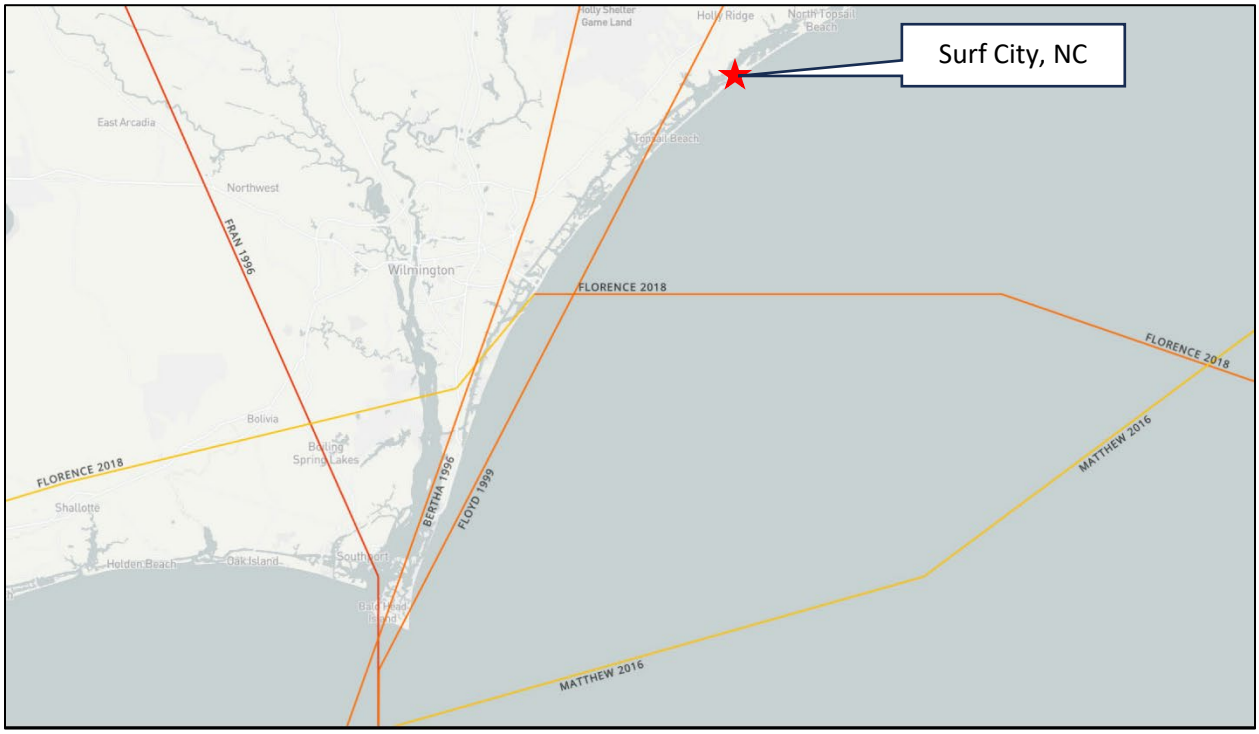

Figure 3. Paths of Selected Hurricanes Near Surf City.

2.3 Relative Sea Level Change

A detailed analysis of climate change and sea level rise is provided in **Appendix P**. The authorized project template presented in the 2010 Feasibility/EIS for the SCNTB CSRM project was designed to be at an elevation of 6 ft NAVD88, with a dune elevation of 14 ft NAVD88 and a dune crest width of 25 ft (**Figure 4**). Sensitivity to sea level change (SLC) at this time was calculated using National Research Council (NRC) curves 1 and 3 and evaluated over the 50-year project life. Conclusions reached during this analysis included:

- The historical rate of relative sea level change (RSLC) for this project was found to be .008 ft/year as observed between 1953 and 1993.
- The low assumption curve represented by NRC curve 1 indicated that over the 50 life of the project an increase in water level of 0.8 ft would be observed (0.016 feet/year or ft/yr).
- The high assumption, NRC curve 3, calculated an overall water level increase of 2.2 ft over the life of the project (0.044 ft/yr).

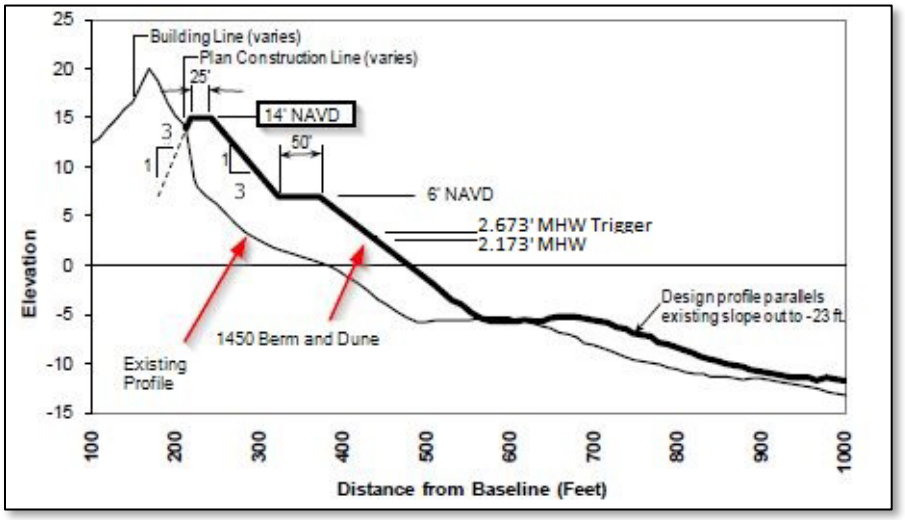

Figure 4. Authorized Project Template.

The historical SLC trends and future RSLC projection rates for the project were re-evaluated using guidance in Engineer Pamphlet (EP) 1100-2-1 “Procedures to Evaluate Sea Level Change: Impacts, Responses and Adaptation” (30Jun2019) and Engineer Regulation (ER) 1100-2-8162 (Dec 2013).

The Sea Level Tracker tool provides an estimate of observed sea level trends and projected RSLC curves (USACE 2023). The future RSLC projections are presented as “Low”, “Intermediate”, and “High” SLC scenarios based on global and local change effects. The historic MSL is represented as either 19-year or 5-year midpoint moving averages. Guidance in using the Sea Level Tracker and technical

background is provided in the “Sea Level Tracker User Guide”, Version 1.0, December 2018.

Table 2 summarizes the results of this analysis. The base year is shown (i.e., 2024) with a 100-year RSLC evaluation window. All estimates are presented in feet per mean sea level (ft/msl).

Table 2. Wilmington, North Carolina (Station #8658120) Relative Sea Level Change.

Project		USACE (ft MSL)			NOAA (ft MSL)			
	Year	Low	Int	High	Low	Int-Low	Int-High	High
Epoch	1992	-0.162	-0.162	-0.162	-0.162	-0.162	-0.162	-0.162
Original Authorization	2014	-0.008	0.036	0.178	-0.008	0.036	0.135	0.249
Start	2024	0.062	0.155	0.451	0.062	0.155	0.362	0.6
	2034	0.132	0.291	0.799	0.132	0.291	0.646	1.052
	2044	0.201	0.446	1.22	0.201	0.446	0.987	1.608
	2054	0.271	0.618	1.716	0.271	0.618	1.385	2.265
	2064	0.341	0.808	2.286	0.341	0.808	1.84	3.025
End	2074	0.41	1.015	2.929	0.411	1.015	2.352	3.888
	2084	0.481	1.24	3.648	0.481	1.24	2.922	4.853
	2094	0.551	1.484	4.44	0.551	1.48	3.548	5.919
	2104	0.621	1.774	5.306	0.621	1.744	4.232	7.089
	2114	0.691	2.203	6.246	0.691	2.023	4.973	8.36
	2124	0.761	2.32	7.261	0.761	2.32	5.771	9.735
2014 to 2024 Increase =		0.07	0.12	0.27	0.07	0.12	0.23	0.35
50-year Increase =		0.35	0.86	2.48	0.35	0.86	1.99	3.29
100-year Increase =		0.70	2.17	6.81	0.70	2.17	5.41	9.14

The updated RSLC projections informed the future risk associated with expected SLC. Trends provided by the Sea-Level Tracker, since the original estimates for the 2010 Feasibility/EIS, indicate that RSLC at the project has decreased in acceleration.

Historical sea level trends were also re-evaluated for the project. For consistency with the 2010 Feasibility/EIS this analysis was based on the NOAA tide gauge located in Wilmington, North Carolina (Station #8658120), within the Cape Fear River and project area. The gauge is compliant and active with a historic record ranging from 1935 to present.

Figure 5 presents the linear relative sea level trend for this gauge. The regionally corrected rate of 0.00699 ft/yd was used as the rate of SLC (Zervas, 2013). Based on monthly mean sea level data, the trend is estimated to be 2.61 mm/yr (0.0085 ft/yr) with a 95% confidence interval of +/- 0.34 mm/yr (0.0011 ft/yr). This is equivalent to an increase of 0.42 ft in sea level for the 50-year period analysis of 2024 to 2073.

Figure 6 summarizes NOAA Gauge number 8658120's predicted SLC trends. Trend lines represent SLC over the 19-Year (Metonic) epoch period and the 5-Year moving average. The light blue-green line represents the 5-year moving average and the heavy dark pink line represents the 19-year moving average. The 19-year average is useful in that this represents the moon's Metonic cycle and the tidal datum epoch. These estimates are referenced to the midpoint of the latest National Tidal Datum epoch, 1992.

The pink line in **Figure 7** is the High SLC prediction, the blue is the Intermediate and the blue-green is the Low-rate prediction. The rates of observed sea level rise can fluctuate over time, but generally the 19-year moving average is increasing to a rate between the High and Intermediate rates. The 5-year moving average appreciably increased after 2013 and trends above the High rate.

Thus, at the current rate of SLC increase, the authorized tolerance in the project elevations could be exceeded in approximately 25 to 30 years following initial construction of the project. Both the intermediate and high sea level rise rates exceed the rate reported in the Authorized Plan and if realized would have an impact on renourishment volumes required and potentially impact the frequency of nourishments. An adaptation strategy that addresses SLC for the project is provided in **Appendix D**.

2.4 Long-Term Erosion

"Long-term erosion" refers to the long-term shore processes that reduce the width of the shoreline. These processes include longshore and cross-shore sediment transport resulting from both tropical and storm-induced wave conditions. Without-project shoreline changes can be assessed by extrapolating historic shoreline erosion/accretion rates out into the future, thereby identifying areas likely to be problematic and prone to storm damage.

Between 1963 and 2002, erosion rates for Topsail Island were relatively low (less than one foot per year) in the southern half of the project but averaged nearly 2 feet per year in the northern half of the project. Major storms in the late 1990s caused substantial erosion and decimated the island's natural dunes, resulting in major property damage.

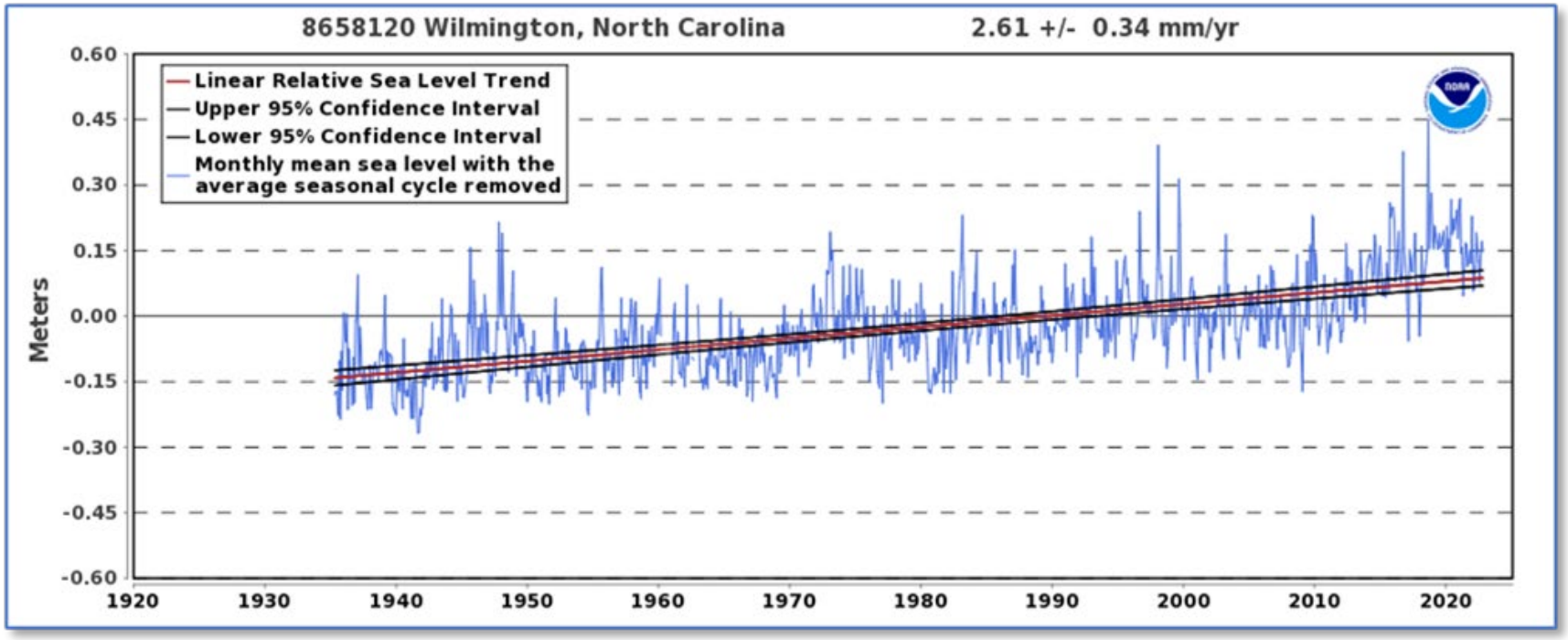

Figure 5. Relative Sea Level Trend, NOAA Gauge 8658120.

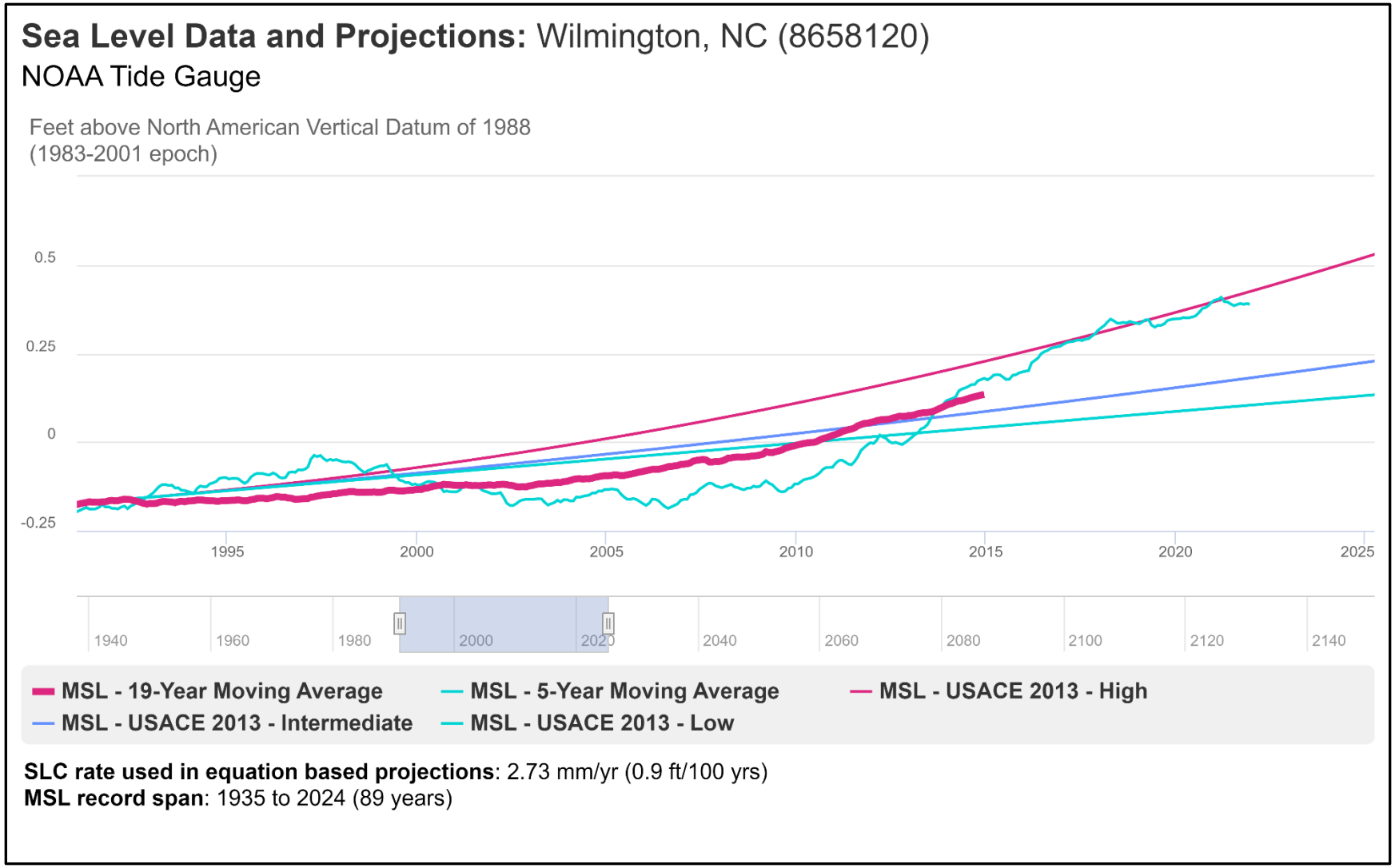

Figure 6. Wilmington Gauge 8658120 - USACE Sea Level Change Trends.

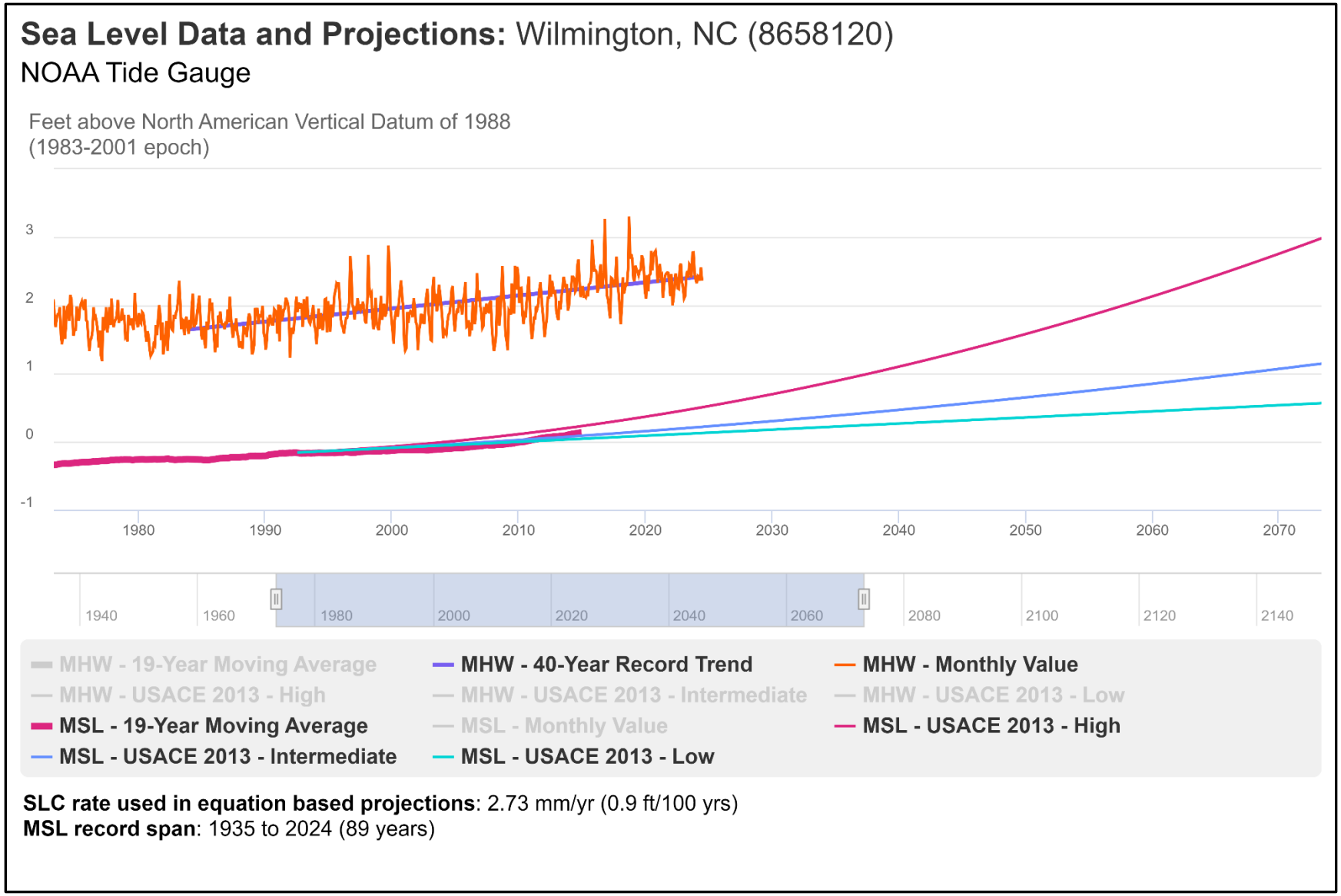

Figure 7. Mean High Water Linear Trends.

Surf City erosion rates since the 2010 Feasibility/EIS have remained consistent with historic FWOP erosion rates (TI Coastal Services 2020), even with changes in the SLC projections over a 50-year period (less than half a foot). This difference does not have an impact on the volume requirements for the project. Volume contingencies related to SLC are reflected in this project.

2.5 Sand Availability

Over the last two decades several geotechnical investigations have been performed offshore of the project to identify beach quality sands. Twenty potential borrow areas were originally identified from these investigations and were designated as borrow areas A–T. Of these, eight have undergone design level study and were found to contain sufficient beach quality sands for beach nourishment needs: Borrow Areas A, G, H, J, L, N, O, and P. The Wilmington District has selected these areas as viable borrow sources capable of providing beach quality material for initial construction and periodic nourishments. In conjunction with approval of this report, additional subsurface investigations will be executed to further delineate beach quality material within these areas to provide additional quantities of beach quality material to meet the 50-year project requirements. Additionally, borrow areas B, C, D, E, and F have been included as potential borrow areas that could supplement sand needs. These borrows were originally part of the Topsail Island and New River Inlet project which has since been implemented by the NFS utilizing other sand resources and, therefore, making these borrows available to the Surf City CSRM project. Note that these volumes represent feasibility level volumes and will require additional study before utilization.

2.5.1 Evaluation of Existing Data

The Wilmington District conducted an evaluation of existing data in 2020 which included a review of the estimated volumes based on the original compatibility analysis and a limited scope bathymetric survey for borrow areas G, H, L, N, O, and P. Reevaluation of the estimated volumes found in **Appendix C** resulted in the development of “High Confidence Volume Estimates” for borrow areas A, G, H, J, L, O, N, and P. These volumes do not represent the total amount of available material, but instead represent the estimated volume of material that could be taken from the borrow area with a high degree of confidence in both the quality and quantity of material. These volumes were established by raising the original dredge cut depths from the 2020 Geotechnical Appendix to an elevation that avoids all instances of cemented sand, rock fragments, and cemented gravel found in the field descriptions of the existing boring logs. Borings within the 2020 dredge box delineations also included a rescreening of the laboratory analysis to exclude those areas containing >10 percent material retained on the composite gravel sieves (#4, #3/8, and #3/4). Estimated volumes were then recalculated utilizing ArcGIS (USACE, 2020). Note that the existing boring logs represent the conditions at the time of sampling.

Volume estimates for borrow areas B, C, and D represent feasibility study estimates based on coarsely spaced core data and do not represent design level volume estimates. Borrow areas E and F include design level spacing of the

cores but were not delineated for dredge cuts as part of the original West Onslow Beach and New River Inlet project. Borrow areas B, C, D, E, and F appear to contain approximately 8 MCY of estimated feasibility level beach quality sands but would require additional geotechnical investigation and evaluation before they could be used to supplement project needs.

The additional bathymetric survey conducted in March 2020 by Geodynamics used Multi-Beam Echosounder (MBES) for borrows G, H, L, N, O, and P to verify existing conditions and determine the magnitude of change using volume analysis with those surveys acquired from 2011-2013 (**Appendix C**). Geodynamics reported good agreement between years. They also noted that even small changes over a large area can result in a substantial volumetric change. Methods employed by Geodynamics resulted in a net volumetric reduction of 3.28% while methods employed by USACE resulted in a net volumetric reduction of 1.38%. This analysis confirmed that the total change in bathymetric conditions since the last survey are not expected to hinder project completion with no impact to the estimated initial construction volume (**Appendix C**).

Table 3 provides the estimated total quantities for the project life borrow areas which include A, B, C, D, E, F, G, H, J, L, N, O, and P. High confidence quantities are provided for Borrow Areas A, G, H, J, L, N, O, and P and include volumes within and beyond 3 nautical miles (NM). Feasibility volumes are provided for Borrow Areas B, C, D, E, and F and include volumes within and beyond 3 NM. Prior to initial construction, additional subsurface investigations will be performed to update these volumes and reflect the most current available volumes to be dredged from the high confidence borrow areas.

2.5.2 Borrow Area Parameters

The offshore borrow areas, shown in **Figure 8,** are located beyond the 31-ft NAVD88 depth contour (depth of closure) to approximately 6 miles offshore. The offshore borrow areas beyond 3NM would be subject to federal mining requirements and coordination with Bureau of Ocean Energy Management (BOEM). Borrow areas have been configured based on previous geotechnical evaluations found in **Appendix C**. Characteristics of each borrow area are shown in **Table 3**. Borrow Area A, located approximately 1.5 miles south of New Topsail Inlet, contains enough high confidence material within 3NM to support initial construction (**Figure 9**). Borrow Areas O and P are estimated to contain enough material within 3 NM to support initial construction, but further geotechnical evaluation is needed to quantify this volume of material beyond the combined high confidence volume of approximately 4.5 MCY (see **Table 3**).

Table 3. Surf City Borrow Area Volumes and Characteristics.

Borrow Area	Surface Elevation (FT. MLLW)[2,3]	Estimated Volume[2] (CY)	High Confidence (HC) Volume[2,4] (CY)	HC Within 3 NM[2,4,5] (CY)	HC Beyond 3 NM[2,4,5] (CY)	Composite Grain Size (phi)[2]	% Passing #200 Sieve[1,2]
A[1]	-39 to -51	13,457,335	10,637,111	9,542,668	1,094,443	2.61	7.50%
B[1]	-42 to -43	820,000	N/A	N/A	N/A	2.17	5.00%
C[1]	-45 to -47	2,750,000	N/A	N/A	N/A	2.32	4.40%
D[1]	-43 to -47	1,860,000	N/A	N/A	N/A	2.13	6.00%
E[1]	-49 to -50	1,390,000	N/A	N/A	N/A	2.15	3.40%
F[1]	-47 to -48	1,290,000	N/A	N/A	N/A	0.8	4.90%
G	-47 to -52	2,642,798	1,106,347	0	1,106,347	2.17	5.40%
H	-47 to -48	1,428,988	268,230	0	268,230	2.48	3.40%
J	-44 to -51	1,641,596	372,319	46,485	325,834	1.92	4.00%
L	-43 to -51	3,616,546	1,423,031	587,305	835,727	1.57	5.00%
N	-45 to -51	2,539,483	1,595,167	0	1,595,167	2.07	2.40%
O	-42 to -48	7,053,742	3,498,525	2,926,335	572,190	2.22	6.70%
P	-40 to -45	3,395,655	1,589,265	1,589,265	0	2.32	8.60%
Totals	**-**	**35,776,143**	**20,489,997**	**14,692,058**	**5,797,939**	**-**	**-**

Notes and Assumptions

1. Some or all laboratory sample analysis performed using the #230 sieve.
2. Reference GRR/EA Appendix C which includes previous studies.
3. Mean Lower Low Water (MLLW)
4. See Section 2.4.1 for definition of High Confidence Volume.
5. 3 Nautical Miles (3NM).

Borrow Area	Surface Elevation (FT. MLLW)[2,3]	Estimated Volume2 (CY)	High Confidence (HC) Volume2,4 (CY)	HC Within 3 NM2,4,5 (CY)	HC Beyond 3 NM2,4,5 (CY)	Composite Grain Size (phi)[2]	% Passing #200 Sieve1,2
A1	-39 to -51	13,457,335	10,637,111	9,542,668	1,094,443	2.61	7.50%
B1	-42 to -43	820,000	N/A	N/A	N/A	2.17	5.00%
C1	-45 to -47	2,750,000	N/A	N/A	N/A	2.32	4.40%
D1	-43 to -47	1,860,000	N/A	N/A	N/A	2.13	6.00%
E1	-49 to -50	1,390,000	N/A	N/A	N/A	2.15	3.40%
F1	-47 to -48	1,290,000	N/A	N/A	N/A	0.8	4.90%
G	-47 to -52	2,642,798	1,106,347	0	1,106,347	2.17	5.40%
H	-47 to -48	1,428,988	268,230	0	268,230	2.48	3.40%

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L	-43 to -51	3,616,546	1,423,031	587,305	835,727	1.57	5.00%
N	-45 to -51	2,539,483	1,595,167	0	1,595,167	2.07	2.40%
O	-42 to -48	7,053,742	3,498,525	2,926,335	572,190	2.22	6.70%
P	-40 to -45	3,395,655	1,589,265	1,589,265	0	2.32	8.60%
Totals	**-**	**35,776,143**	**20,489,997**	**14,692,058**	**5,797,939**	**-**	**-**

Notes and Assumptions

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2. Reference GRR/EA Appendix C which includes previous studies.
3. Mean Lower Low Water (MLLW)
4. See Section 2.4.1 for definition of High Confidence Volume.
5. 3 Nautical Miles (3NM).

Borrow Area	Surface Elevation (FT. MLLW)[2,3]	Estimated Volume[2] (CY)	High Confidence (HC) Volume[2,4] (CY)	HC Within 3 NM[2,4,5] (CY)	HC Beyond 3 NM[2,4,5] (CY)	Composite Grain Size (phi)[2]	% Passing #200 Sieve[1,2]
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F[1]	-47 to -48	1,290,000	N/A	N/A	N/A	0.8	4.90%
G	-47 to -52	2,642,798	1,106,347	0	1,106,347	2.17	5.40%
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O	-42 to -48	7,053,742	3,498,525	2,926,335	572,190	2.22	6.70%
P	-40 to -45	3,395,655	1,589,265	1,589,265	0	2.32	8.60%
Totals	**-**	**35,776,143**	**20,489,997**	**14,692,058**	**5,797,939**	**-**	**-**

Notes and Assumptions

1. Some or all laboratory sample analysis performed using the #230 sieve.
2. Reference GRR/EA Appendix C which includes previous studies.
3. Mean Lower Low Water (MLLW)
4. See Section 2.4.1 for definition of High Confidence Volume.
5. 3 Nautical Miles (3NM).

Borrow Area	Surface Elevation (FT. MLLW)[2,3]	Estimated Volume2 (CY)	High Confidence (HC) Volume2,4 (CY)	HC Within 3 NM2,4,5 (CY)	HC Beyond 3 NM2,4,5 (CY)	Composite Grain Size (phi)[2]	% Passing #200 Sieve1,2
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B1	-42 to -43	820,000	N/A	N/A	N/A	2.17	5.00%
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F1	-47 to -48	1,290,000	N/A	N/A	N/A	0.8	4.90%
G	-47 to -52	2,642,798	1,106,347	0	1,106,347	2.17	5.40%
H	-47 to -48	1,428,988	268,230	0	268,230	2.48	3.40%
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L	-43 to -51	3,616,546	1,423,031	587,305	835,727	1.57	5.00%
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O	-42 to -48	7,053,742	3,498,525	2,926,335	572,190	2.22	6.70%
P	-40 to -45	3,395,655	1,589,265	1,589,265	0	2.32	8.60%
Totals	**-**	**35,776,143**	**20,489,997**	**14,692,058**	**5,797,939**	**-**	**-**

Notes and Assumptions

1. Some or all laboratory sample analysis performed using the #230 sieve.
2. Reference GRR/EA Appendix C which includes previous studies.
3. Mean Lower Low Water (MLLW)
4. See Section 2.4.1 for definition of High Confidence Volume.
5. 3 Nautical Miles (3NM).

Borrow Area	Surface Elevation (FT. MLLW)[2,3]	Estimated Volume[2] (CY)	High Confidence (HC) Volume[2,4] (CY)	HC Within 3 NM[2,4,5] (CY)	HC Beyond 3 NM[2,4,5] (CY)	Composite Grain Size (phi)[2]	% Passing #200 Sieve[1,2]
A[1]	-39 to -51	13,457,335	10,637,111	9,542,668	1,094,443	2.61	7.50%
B[1]	-42 to -43	820,000	N/A	N/A	N/A	2.17	5.00%
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F[1]	-47 to -48	1,290,000	N/A	N/A	N/A	0.8	4.90%
G	-47 to -52	2,642,798	1,106,347	0	1,106,347	2.17	5.40%
H	-47 to -48	1,428,988	268,230	0	268,230	2.48	3.40%
J	-44 to -51	1,641,596	372,319	46,485	325,834	1.92	4.00%

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N	-45 to -51	2,539,483	1,595,167	0	1,595,167	2.07	2.40%
O	-42 to -48	7,053,742	3,498,525	2,926,335	572,190	2.22	6.70%
P	-40 to -45	3,395,655	1,589,265	1,589,265	0	2.32	8.60%
Totals	**-**	**35,776,143**	**20,489,997**	**14,692,058**	**5,797,939**	**-**	**-**

Notes and Assumptions

1. Some or all laboratory sample analysis performed using the #230 sieve.
2. Reference GRR/EA Appendix C which includes previous studies.
3. Mean Lower Low Water (MLLW)
4. See Section 2.4.1 for definition of High Confidence Volume.
5. 3 Nautical Miles (3NM).

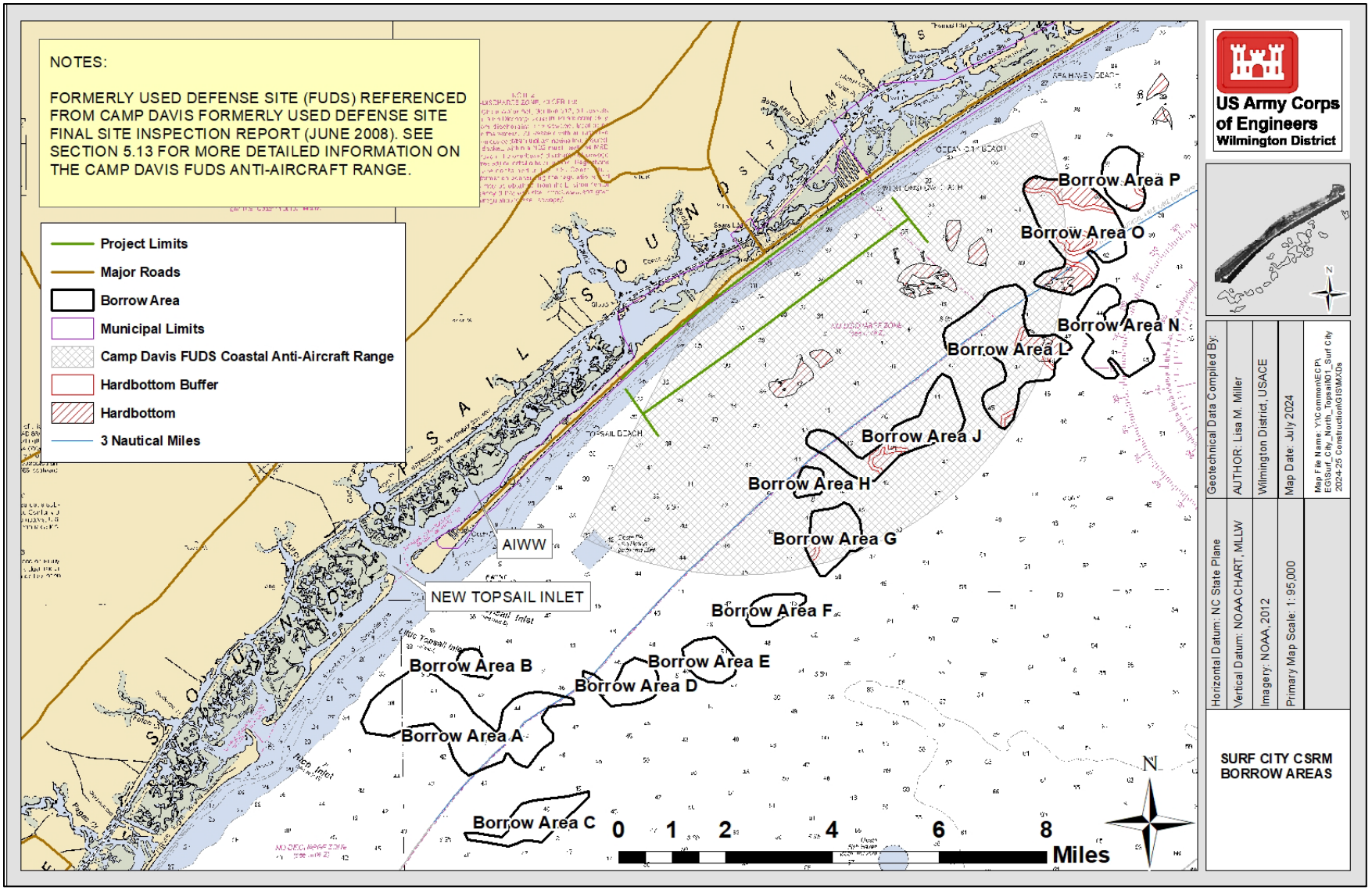
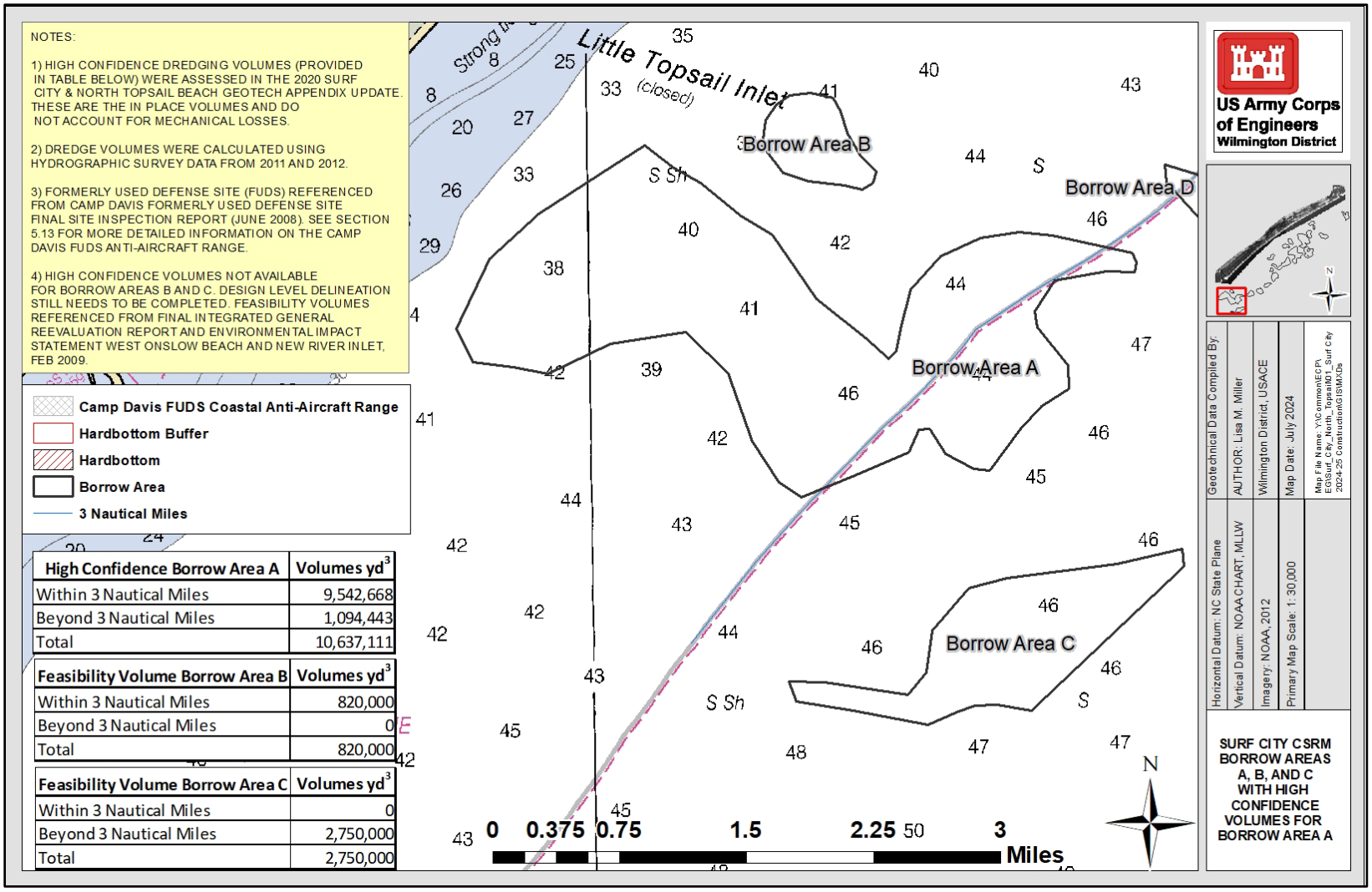


Figure 8. Overview of Borrow Areas for Surf City CSRM.



High Confidence Borrow Area A	Volumes yd^3
Within 3 Nautical Miles	9,542,668
Beyond 3 Nautical Miles	1,094,443
Total	10,637,111

Feasibility Volume Borrow Area B	Volumes yd^3
Within 3 Nautical Miles	820,000
Beyond 3 Nautical Miles	0
Total	820,000

Feasibility Volume Borrow Area C	Volumes yd^3
Within 3 Nautical Miles	0
Beyond 3 Nautical Miles	2,750,000
Total	2,750,000

Figure 9. Estimated volumes within and beyond 3 NM for Borrow Areas A, B, and C with high confidence volumes calculated for borrow area A and feasibility volumes calculated for borrow areas B and C. *(*Dredge box delineations in the attached Geotechnical Appendix and/or volumes are subject to change and should only be regarded as drafts that are currently under development. Feasibility volumes were calculated in 2009 under the West Onslow Beach and New River Inlet project and are subject to additional geotechnical investigation.)

2.5.3 Sediment Compatibility

Previously executed compatibility analyses compared the grain size of the native beach with the material in the proposed borrow areas. Summary sediment compatibility information is provided below for each borrow area. Wilmington District has historically met the intent of the State sediment compatibility standards through diligent best professional judgment practices coupled with detailed sediment compatibility analyses, which evaluate the grain size characteristics of the material within the potential borrow area. To assure that beach placement material consists predominately of sand, the Wilmington District compatibility practice requires that the borrow area contains sediment with an average weighted fine-grained material content of less than (<) 10% passing the #200 sieve. These guidelines have historically been utilized by the Wilmington District to assure compatibility for CSRM projects (i.e., Wrightsville, Carolina, Kure, and Ocean Isle beaches) with much success.

2.5.3.1 Borrow Area A

Compatibility analysis yielded a Mean (Φ) of 2.46 (0.18mm), a composite 8.5% passing the #200 sieve, and a composite 9.4% of visual shell material (Composite Results for 7.5% Fines Content). An additional 20 cores were collected in 2006 by Coastal Planning and Engineering of North Carolina, Inc. (CPE) to locate and evaluate sand for the Interim (Emergency) Beach Nourishment Project for the Town of Topsail Beach. Evaluation of these cores yielded a Mean (Φ) of 2.85 (0.14 mm) with a composite 9.7% passing the #200 sieve and a composite 4.2% of visual shell material (Composite Results for 7.5 % Fines Content). In 2010, 99 cores were collected with 1,000-foot grid spacing during the PED phase of the West Onslow Beach and New River Inlet (Topsail Beach), NC CSDR Project (USACE 2013b). Compatibility analysis reported a Mean (Φ) of 2.56 (0.17 mm) with a composite 7.5% passing the #200 sieve and a composite 6.4% visual shell material (Composite Results for 7.5% Fines Content). Values for compatibility were within USACE technical standards for beach quality sand but fell just outside the values for the state standard of practice.

Initial volume estimates revealed that Borrow Area A could potentially yield approximately 14.4 MCY of beach quality material. Further investigation demonstrated that in some areas the sand thickness is too thin to recover. For example, the area beyond 3 NM often yields less than 4 ft of sand thickness. Based on this shallow dredge depth the estimated volume of beach quality, recoverable sand for Borrow Area A was reduced to 13.5 MCY. Of this amount, 12.7 MCY is within 3NM and 0.8 MCY is located beyond 3NM. Further review of core data resulted in development of a high confidence volume of approximately 10.6 MCY with approximately 9.5 MCY within 3 NM and approximately 1 M yd^3 beyond 3 NM (see **Figure 9 and Table 3**). A variety of methods were used to determine the appropriate Overfill Ratio,

including Dean, AFF, and CEDAS. The final Overfill Ratio range for Borrow Area A is between 1.24 and 1.57.

2.5.3.2 Borrow Area B

Borrow Area B has a Mean (Φ) of 2.17 with a composite 5% passing the #200 sieve, a composite 13% shell material, and an overfill ratio of 1.23. The estimated volume for feasibility level beach quality sand in Borrow Area B is approximately 820,000 CY (see **Figure 9** and **Table 3**). Design level delineation of beach quality material has not been completed for this borrow area, and, therefore, high confidence volumes were not calculated.

2.5.3.3 Borrow Area C

Borrow Area C has a Mean (Φ) of 2.32 with a composite 4.4% passing the #200 sieve, a composite 9% shell material, and an overfill ratio of 1.45. The estimated volume for feasibility level beach quality sand in Borrow Area C is approximately 2.57 MCY (see **Figure 9** and **Table 3**). Design level delineation of beach quality material has not been completed for this borrow area, and, therefore, high confidence volumes were not calculated.

2.5.3.4 Borrow Area D

Borrow Area D has a Mean (Φ) of 2.13 with a composite 6.0% passing the #200 sieve, a composite 6% shell material, and an overfill ratio of 1.22. The estimated volume for feasibility level beach quality sand in Borrow Area D is approximately 1.86 MCY (**Figure 10** and **Table 3**). Design level delineation of beach quality material has not been completed for this borrow area, and, therefore, high confidence volumes were not calculated.

2.5.3.5 Borrow Area E

Borrow Area E has a Mean (Φ) of 2.15 with a composite 3.4% passing the #200 sieve, a composite 5% shell material, and an overfill ratio of 1.04. The estimated volume for feasibility level beach quality sand in Borrow Area E is approximately 1.39 MCY (**Figure 10** and **Table 3**). Design level delineation of beach quality material has not been completed for this borrow area, and, therefore, high confidence volumes were not calculated.

2.5.3.6 Borrow Area F

Borrow Area F has a Mean (Φ) of 0.8 with a composite 4.9% passing the #200 sieve, a composite 7.3% shell material, and an overfill ratio of 1.2. The estimated volume for feasibility level beach quality sand in Borrow Area F is approximately 1.29 MCY (**Figure 10** and **Table 3**). Design level delineation of beach quality material has not been completed for this borrow area, and, therefore, high confidence volumes were not calculated.

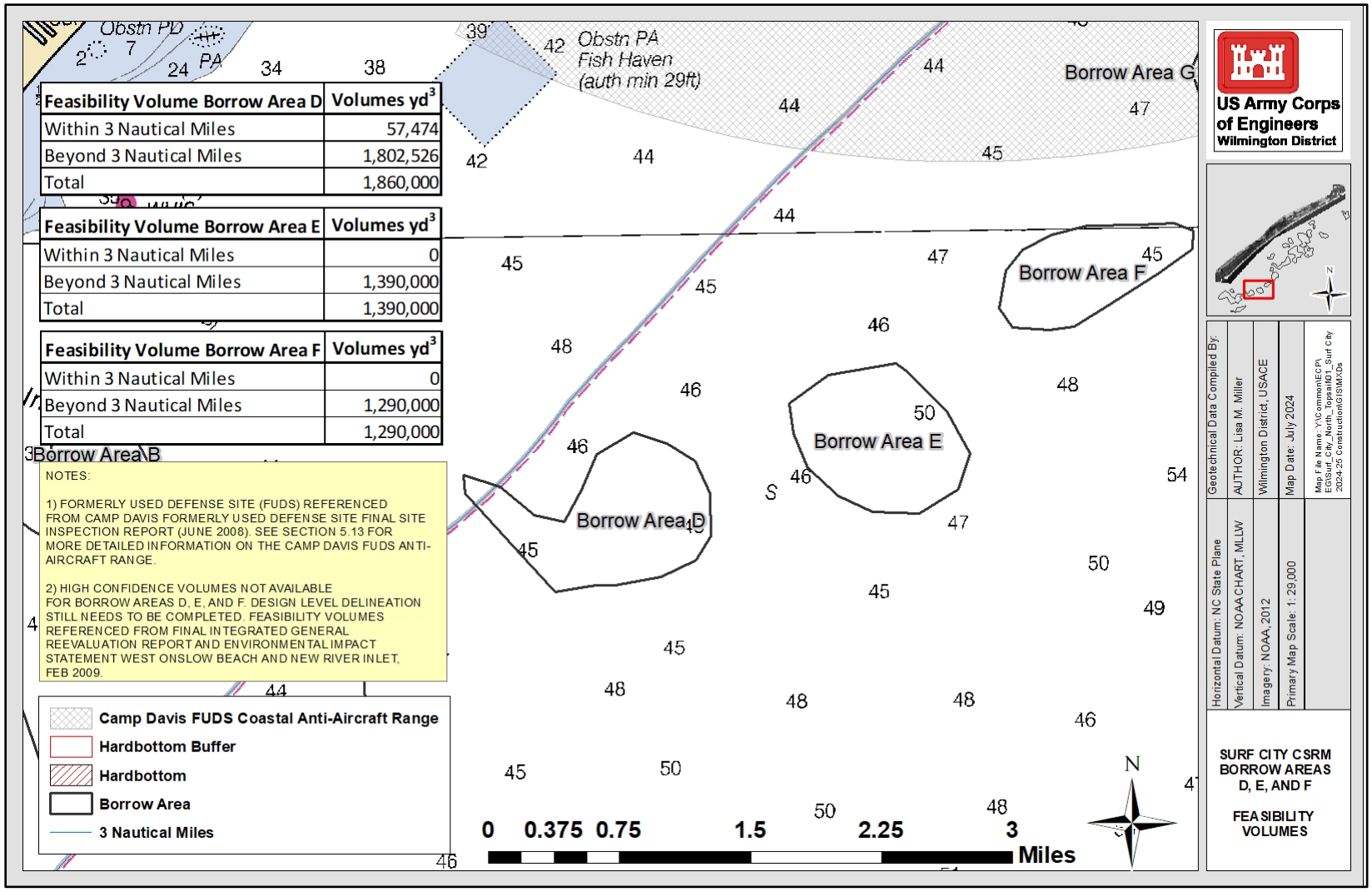


Figure 10. Estimated feasibility volumes within and beyond 3 NM for Borrow Areas D, E, and F. *(*Dredge box delineations in the attached Geotechnical Appendix and/or volumes are subject to change and should only be regarded as drafts that are currently under development. Feasibility volumes were calculated in 2009 under the West Onslow Beach and New River Inlet project and are subject to additional geotechnical investigation.)

2.5.3.7 Borrow Area G

Borrow Area G was found to have a Mean (Φ) of 2.17 with a composite 5.4% passing the #200 sieve, a composite 3.4% visual shell material, and an overfill ratio of 1.08–1.25 (Under 10% Silts). The estimated volume of beach quality, recoverable sand for Borrow Area G is approximately 2.6 MCY and this material lies entirely beyond 3NM. High confidence volumes for Borrow Area G were calculated to approximately 1.1 MCY (**Figure 11** and **Table 3**).

2.5.3.8 Borrow Area H

Borrow Area H was found to have a Mean (Φ) of 2.48 with a composite 3.4% passing the #200 sieve and a composite 2.2% visual shell material. Overfill ratios for Borrow Area H were highly variable due to the statistical sampling method used in laboratory analysis. As a result, mean grain size standard deviation is overly large resulting in overfill ratios that are larger than expected. As a result, an accurate determination of overfill ratios for this borrow area are difficult to achieve. Nevertheless, the estimated volumes for beach quality, recoverable sand in Borrow Area H is approximately 1.4 MCY and lies entirely beyond 3NM. High confidence volumes for Borrow Area H were calculated to approximately 268,230 yd^3 (**Figure 11** and **Table 3**).

2.5.3.9 Borrow Area J

Borrow Area J was found to have a Mean (Φ) of 1.92 with a composite 4.0% passing the #200 sieve, a composite 7.9% visual shell material, and an overfill ratio of 1.06–1.15 (Under 10% Silts). The estimated volume of beach quality, recoverable sand in Borrow Area J is approximately 1.6 MCY with 0.14 MCY located within 3NM and 1.5 MCY located beyond 3NM. High-confidence volumes for Borrow Area J were calculated to approximately 372,319 yd^3 with 46,485 within 3 NM and 325,834 yd^3 beyond 3 NM (**Figure 11** and **Table 3**).

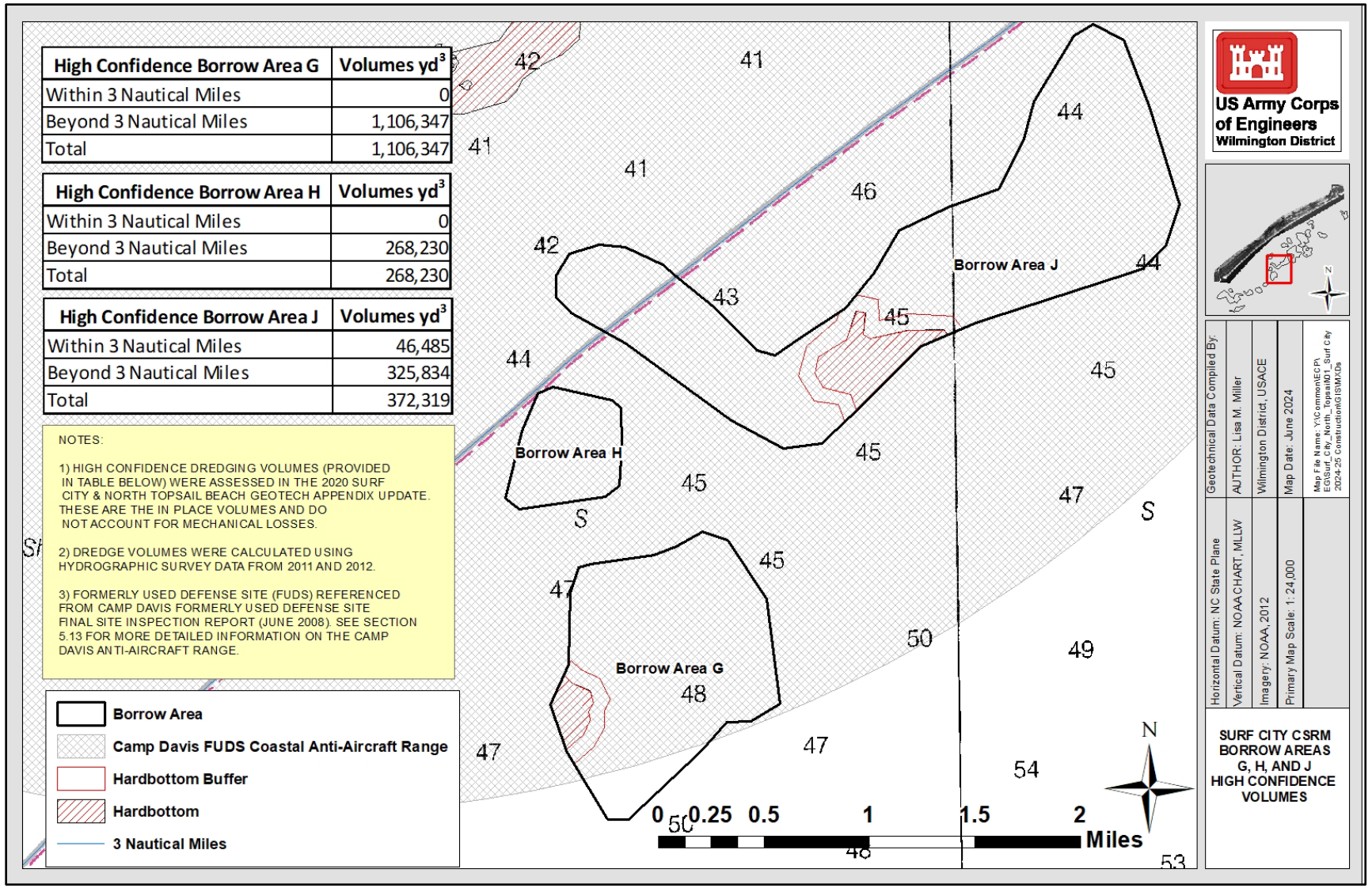


Figure 11. Estimated high confidence volumes within and beyond 3 NM for Borrow Areas G, H, and J. (Dredge box delineations in the attached Geotechnical Appendix and/or volumes are subject to change and should only be regarded as drafts that are currently under development.)

2.5.3.10 Borrow Area L

Borrow Area L was found to have a Mean (Φ) of 1.57 with a composite 5.0% passing the #200 sieve, a composite 11.8% visual shell material, and an overfill ratio of 1.05–1.19. The estimated volume of beach quality, recoverable sand for Borrow Area L is approximately 3.6 MCY with 1.4 M yd^3 located within 3NM and 2.2 MCY located beyond 3NM. High confidence volumes for Borrow Area L were calculated to approximately 1.4 MCY with 587,305 yd^3 within 3 NM and 835,727 yd^3 beyond 3 NM (**Figure 12** and **Table 3**).

2.5.3.11 Borrow Area N

Borrow Area N was found to have a Mean (Φ) of 2.07 with a composite 2.4% passing the #200 sieve, a composite 12.7% visual shell material, and an overfill ratio of 1.03–1.40. The estimated volume of beach quality, recoverable sand for Borrow Area N is approximately 2.5 MCY and it lies entirely beyond 3NM. High confidence volumes were calculated to approximately 1.6 MCY (**Figure 12** and **Table 3**).

2.5.3.12 Borrow Area O

Borrow Area O was found to have a Mean (Φ) of 2.22 with a composite 6.7% passing the #200 sieve, a composite 3.4% visual shell material, and an overfill ratio of 1.10–1.18 (Under 10% Silts). The estimated volume of beach quality, recoverable sand for Borrow Area O is approximately 7.1 MCY with 6.3 MCY located within 3NM and 0.79 MCY located beyond 3NM *()*. High confidence volumes for Borrow Area O were calculated to approximately 3.5 MCY with 2.9 MCY within 3 NM and 572,190 yd^3 beyond 3 NM (**Figure 13**). High confidence volumes for Borrow Area O were calculated to approximately 3.5 MCY with 2.9 MCY within 3 NM and 572,190 yd^3 beyond 3 NM (**Table 3**).

2.5.3.13 Borrow Area P

Borrow Area P was found to have a Mean (Φ) of 2.32 with a composite 8.6% passing the #200 sieve, a composite 3.0% visual shell material, and on overfill ratio of 1.24–1.64. The estimated volume of beach quality, recoverable sand for Borrow Area P is approximately 3.4 MCY and is located entirely within 3NM. High confidence volumes for Borrow Area P were calculated to approximately 1.6 MCY (**Figure 12** and **Table 3**).

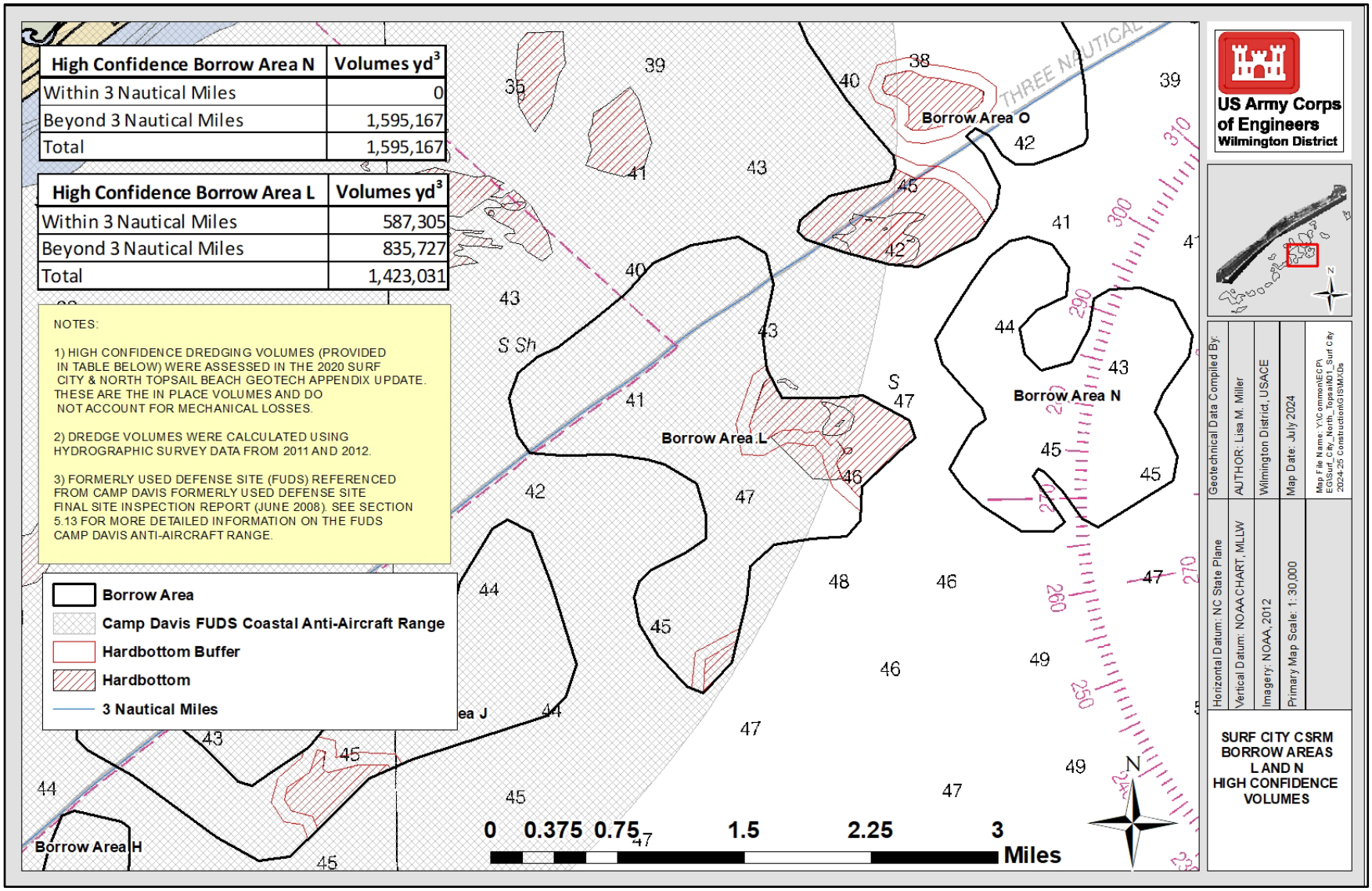


Figure 12. Estimated high confidence volumes within and beyond 3 NM for Borrow Areas L and N. (Dredge box delineations in the attached Geotechnical Appendix and/or volumes are subject to change and should only be regarded as drafts that are currently under development.)

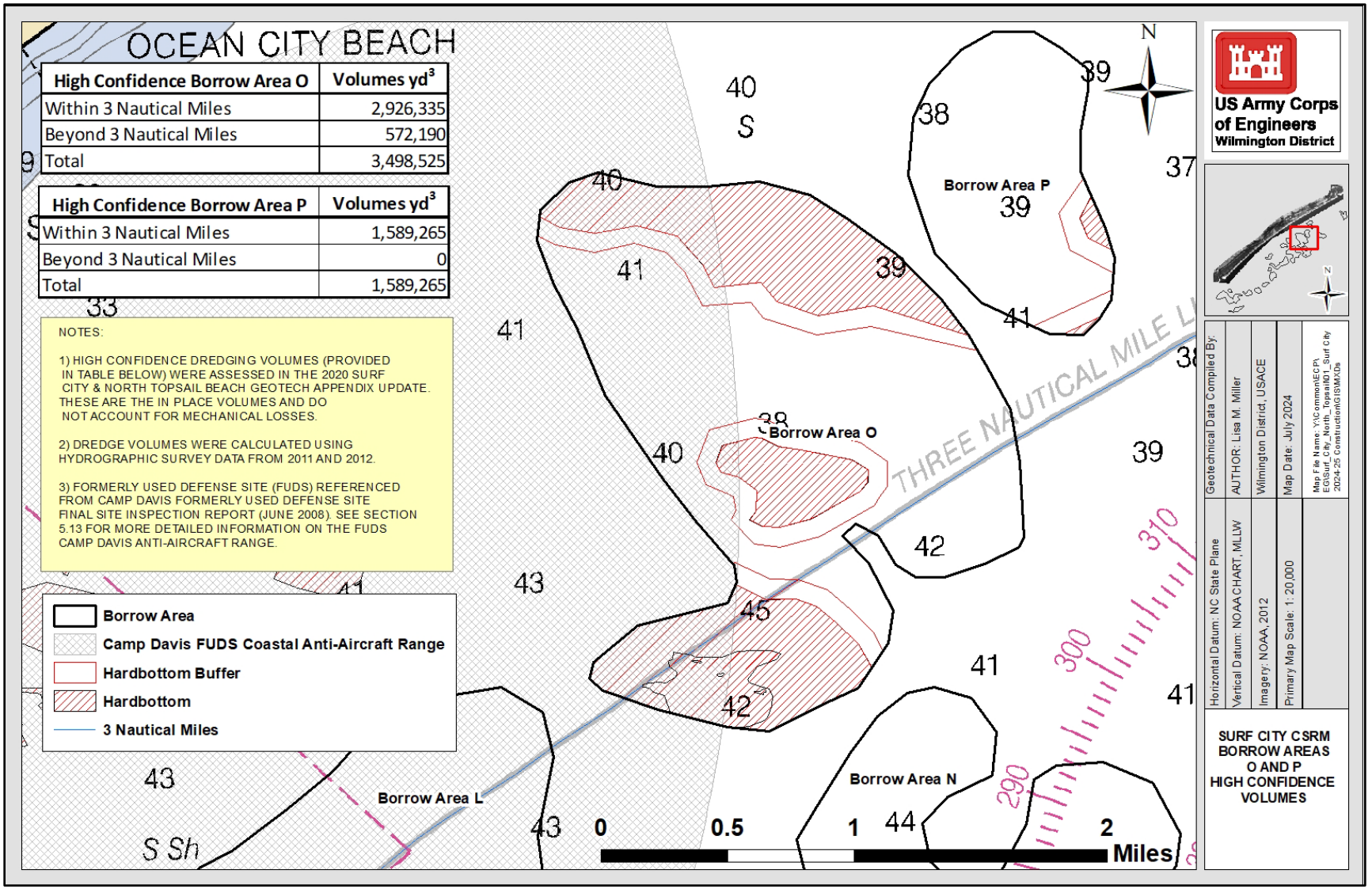


Figure 13. Estimated high confidence volumes within and beyond 3 NM for Borrow Areas O and P. (Dredge box delineations in the attached Geotechnical Appendix and/or volumes are subject to change and should only be regarded as drafts that are currently under development.)

2.6 Loss of Sea Turtle Nesting Habitat

A shoreface composed of beach, berm, and dune components can provide valuable nesting habitat for sea turtles. The loggerhead and green sea turtles, which are Federally-listed threatened and endangered species, have been documented to nest on Topsail Island. However, long-term shoreline erosion coupled with historical short-term hurricane events, have led to losses from the shoreface. The berm and dune system is also being squeezed between the ocean and adjacent human development, increasing potential impacts to nesting sea turtle habitat.

Turtle monitoring efforts from 1990 to 2008 show declines over the previous year in nesting numbers following hurricanes in the 1990s: 91 to 53 from 1992 to 1993 (Hurricane Emily), 102 to 61 from 1996-97 (Hurricanes Bertha and Fran) and 152 to 87 from 1999 to 2000 (Hurricane Floyd). Also, a comparison between the average number of annual turtle nests between 1990–1999 and 2000–2008 indicates a decline from 88 to 65 nests per year. In some cases, nests laid in high-erosion areas where available nesting habitat is lost need to be relocated to avoid tidal inundation (Jean Beasley, personal communication, 2004).

Without beach renourishment activities, the number of nest relocations would be expected to increase. Persistent erosion along the Towns of Surf City and NTB could lead to site-specific loss of nesting habitat. Additionally, as short-term erosional processes scour the existing shoreface and the nesting beach environment slowly erodes away, large scarps may form at the toe of the primary dune, thus preventing a turtle from encountering suitable nesting habitat above the mean high tide line. Re-establishing a berm and dune system with a gradual slope can enhance nesting success of sea turtles by providing suitable nest sites without escarpment obstacles and away from tidal inundation.

2.7 Munitions and Explosions of Concern

The study area is within the limits of a U.S. Army training facility known as Camp David. Established in 1941, Camp Davis was as an Anti-Aircraft Training Center at Holly Ridge, North Carolina with several ranges and supporting facilities on the Topsail Island and the mainland. The Coastal Gunnery Range Emplacement Area was situated on Topsail Island near the Surf City bridge and the Coastal Gunnery Potential Range Impact Area was offshore of the island. No records or documentation have been identified as to the exact types of ordnance used at this time, although it is presumed that mostly practice rounds were used ranging in size from 37 mm (1.46 inches) to 155 mm (6.10 inches).

After World War II, Camp Davis was assumed by the Navy for its secret guided missile testing program, code named Operation Bumblebee. During the 18 months that Operation Bumblebee was active on Topsail Island, an estimated 200 experimental rockets, each measuring 6 inches in diameter and between 3 and 13 ft. in length, were fabricated at the Assembly Building, dispatched to the launch site, and fired along a northeasterly angular deflection of 15 degrees to the shoreline for a maximum clear distance of 40 miles. A detailed discussion of munitions and

explosives of concern (MEC) within the study area and their impacts to the project is presented in *Section 5.13* of this report.

2.8 Socio-Economic Conditions

2.8.1 Population

The resident, year-round population of Surf City is approximately 5,380 persons. During the summer months this population swells to several thousand people due to seasonal visitation. In all, the town has grown approximately 103 percent since 2010.

The percentage of low-income communities (25%) and minority populations (9%) are well below the state average (34% and 37%, respectively) and the national average (31% and 39%, respectively). Approximately 33 percent of population is 65 years or older.

Other relevant facts regarding the Surf City from the U.S. Census Bureau (US Census Bureau 2023) include:

- There are an estimated 1,369 households.
- The median age of residents is 39.9 years.
- Approximately 47 percent of the population have a bachelor's degree or higher.
- Approximately 9.5 percent of the population are without health care coverage.
- Approximately 7.7 percent of the population speak a language other than English at home.

One historic minority community is located north of Surf City and project within the North Topsail Beach town limits, known as Ocean City Beach (**Figure 14)**. During the 1950's, it was vacation destination for African Americans in the southeastern United States when access to public recreational swimming and fishing was either nonexistent or substandard. The community was created and promoted to Black professionals by Wade Chestnut, a white attorney from Wilmington, and a designated group of "directors from key metropolitan areas to include Raleigh, Durham, Greensboro, Winston-Salem, Wilmington, High Point, Fayetteville, and Charlotte." Lots were sold for $500 or $1000 on the oceanfront for commercial and residential use. The first homes were built in 1949, followed by a restaurant in 1953 within the "Operation Bumblebee Towers" (see *Sections 2.7 and 5.13*), and then the Wade Chestnut Memorial Chapel in 1957. Streets in the community bear the names of community family members and famous Black Americans. The community remains as a vacation destination for travelers around the world and is currently part of the North Carolina Civil Rights Trail. The community hosts the

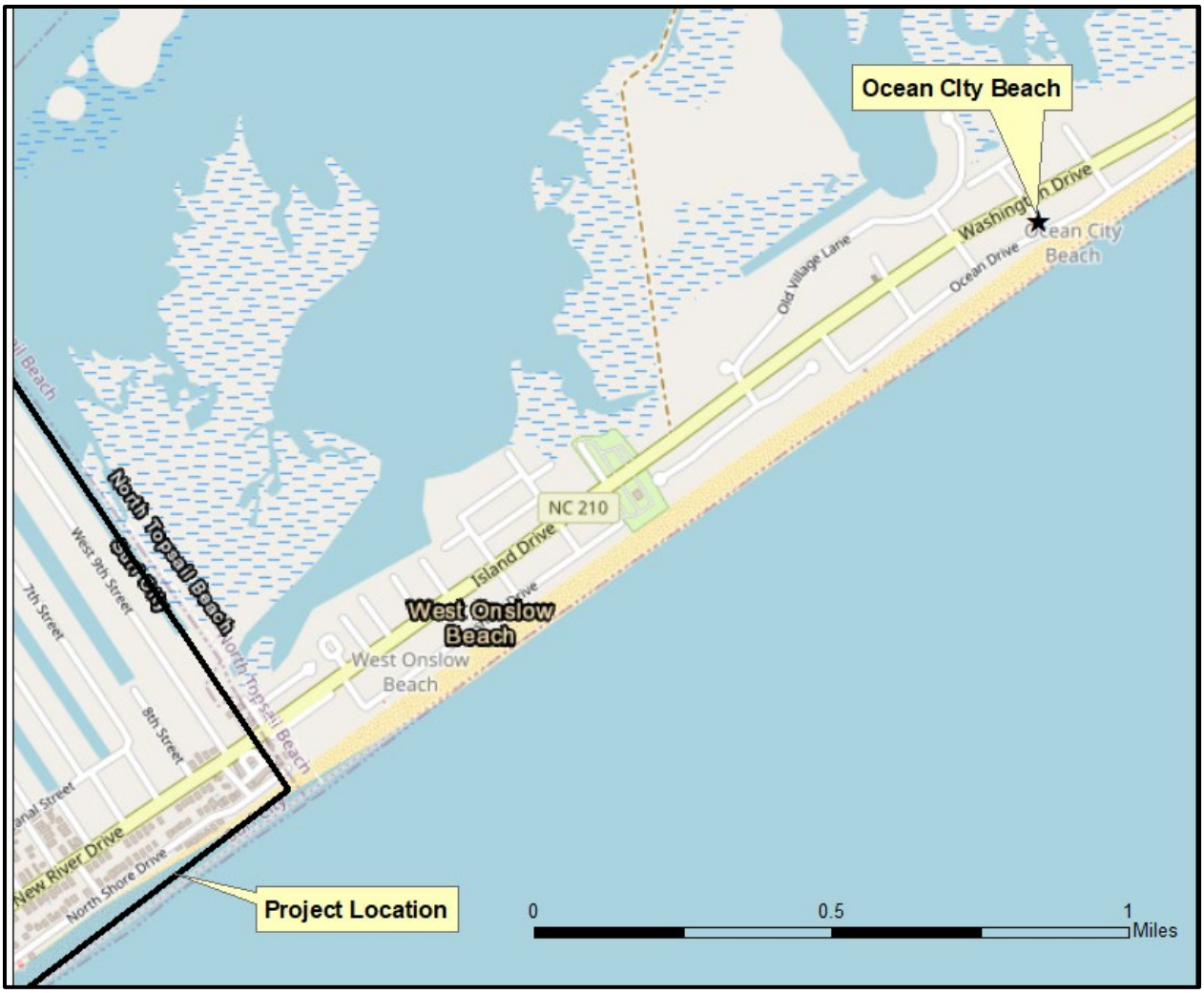


Figure 14. Location of Ocean City Beach in proximity to the project.

Ocean City Jazz Festival every summer (see https://oceancitync.com/ for additional information).

2.8.2 Economy

Industries that support the Surf City economy include tourism, construction, retail services, health care and social services. Professional, scientific, and technical services and public administration are also employers. The current unemployment rate is 4.6 percent (US Census Bureau 2023). Surf City hosts special events throughout the year that are significant draws for the region including the Surf City Exposition (March), the Surf City Bridge Jam (May), and an Independence Day celebration (July). It is anticipated that their economy continue to grow in the future.

2.8.3 Income

The median annual household income for Surf City is $77,202, above the state of North Carolina at $61,972. The median annual income for families is $92,500. (US Census Bureau 2023). When compared to the 2010 median annual

household income, Surf City residents have experienced a 22 percent growth in median annual household income. It is anticipated that incomes continue to grow for the town.

2.8.4 Land-use

Land use at Surf City generally consists of medium-density detached homes, multi-unit apartments, and condominiums. Newly constructed and rebuilt structures on the island have raised first floors in response to previous coastal storm events and local building codes. While there are a few structures built at grade, almost every building in the town is raised to at least 8 feet. Commercial use of the island of the town centers around the intersection of NC Highways 210 and 50 (i. e. S. Shore Drive), and N. Topsail Drive. While a few vacant lots exist on the island, it is assumed that they be built upon within the period of analysis for this report, since the infrastructure (water, electric, sewer, etc.) already exists in these areas. The first few rows of structures abutting the oceanside of the island are relatively dense and are unlikely to experience further new development.

2.8.5 Aesthetics and Recreational Activities

Surf City's aesthetics are defined by its coastal beach setting. All reaches of the project are available for a multitude of recreational activities including fishing, harvesting oysters, swimming, surfing, snorkeling, scuba diving, kayaking, boating, hiking, and dining. Sound Side Park and the Kenneth D. Batts Family Park provide playgrounds and picnic tables on the island for the public. Two campgrounds on the island provide recreational vehicle camping. Ocean piers and charter boats that use the nearshore waters also contribute to the local economy.

The primary concern for aesthetics and recreation on the island is that long term shore erosion continue to narrow the amount of beach available for recreational use. As the available width decreases, some of those recreational opportunities are reduced and eventually lost altogether. Maintaining or expanding the current beach width would increase recreational usage.

2.8.6 Public Parking and Access

Surf City has 40 public beach access points within the project limits. These access points generally consist of small parking areas and wooden walkways to the beach. Since all right-of-way areas in the town are considered eligible for vehicle parking except for areas with designated restrictions (e.g., driveways, fire hydrants, intersection, physical barriers), additional spaces can range from off-street parallel, angled, and perpendicular to designated lots of varying size. A total of 886 parking spaces are available to the public and within a quarter mile of these access points. Their location and number of spaces for the project is shown **Figure 15** The parking and access availability for the project currently meets all applicable requirements for a Federally cost-shared project.

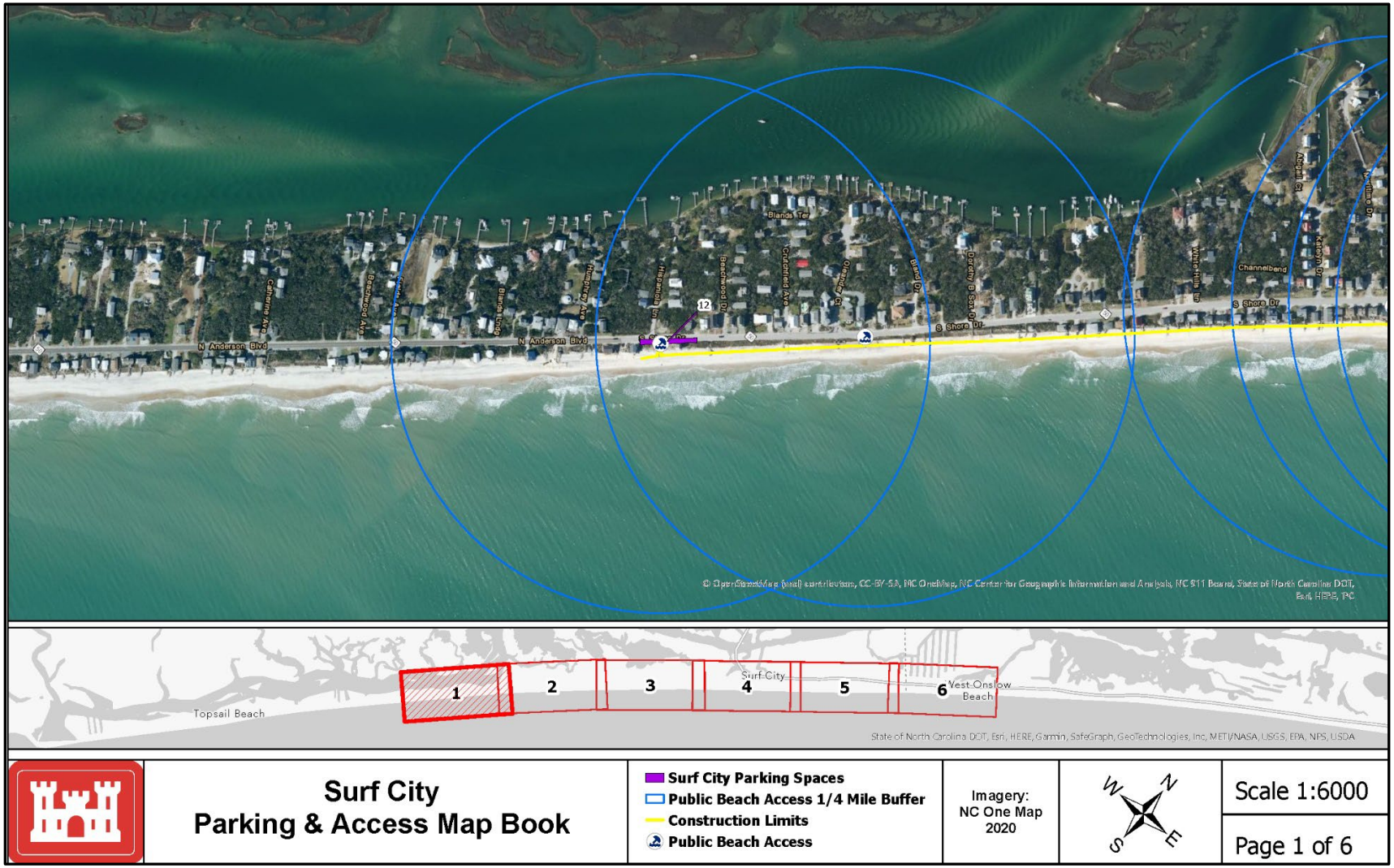


Figure 15. Public Beach Access Point and Parking at Surf City.

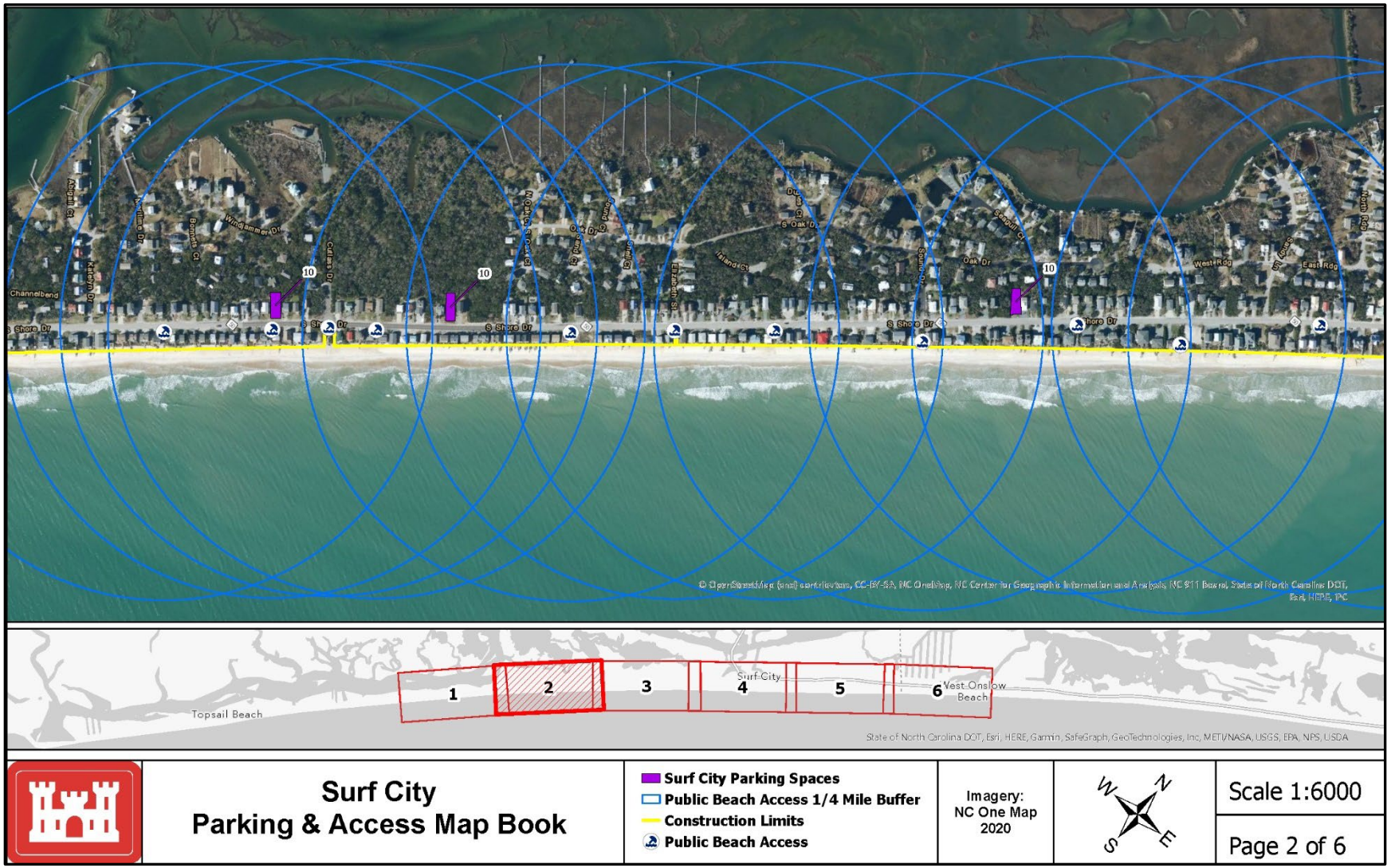


Figure 15. Public Beach Access Point and Parking at Surf City, continued.

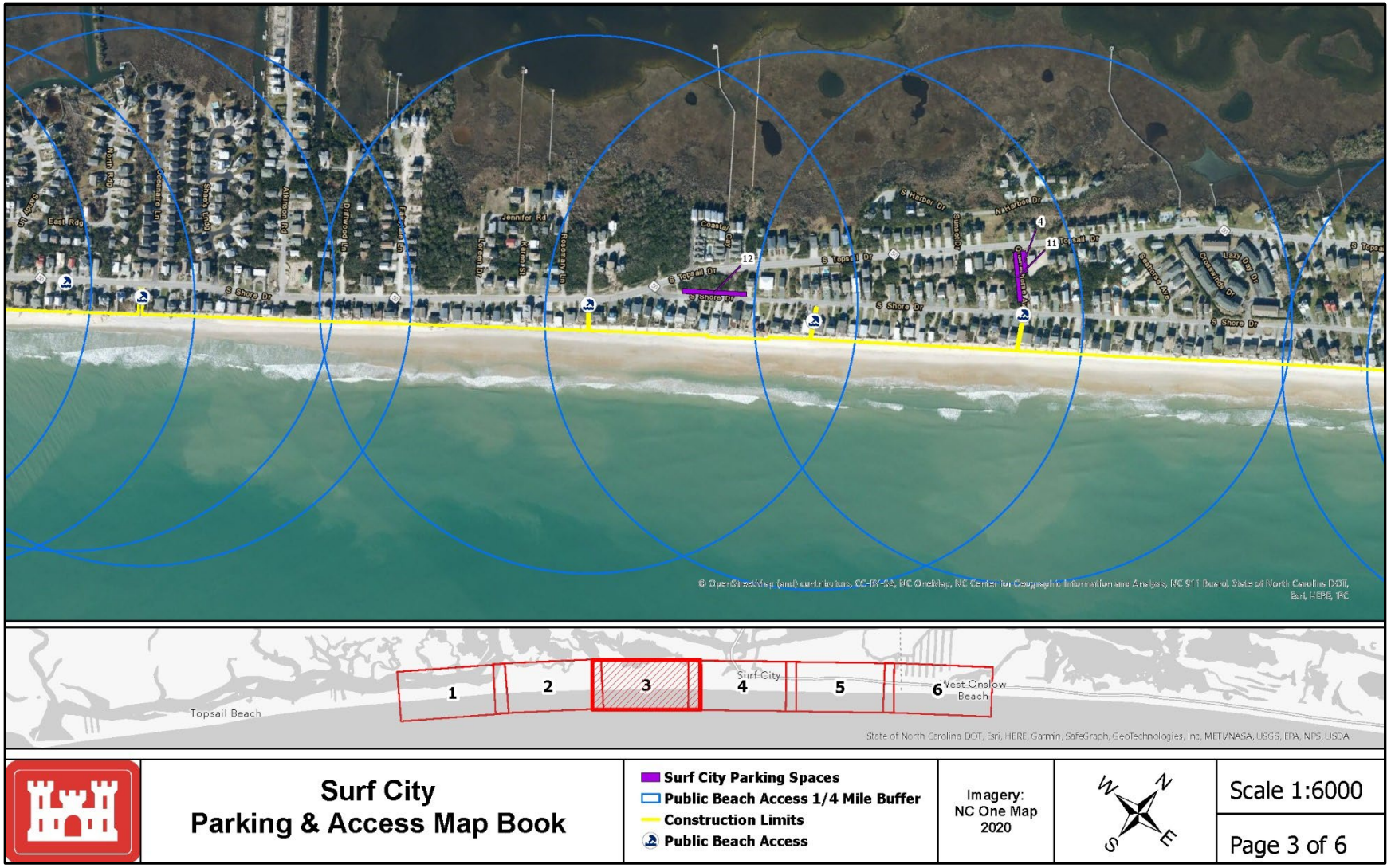


Figure 15. Public Beach Access Point and Parking at Surf City, continued.

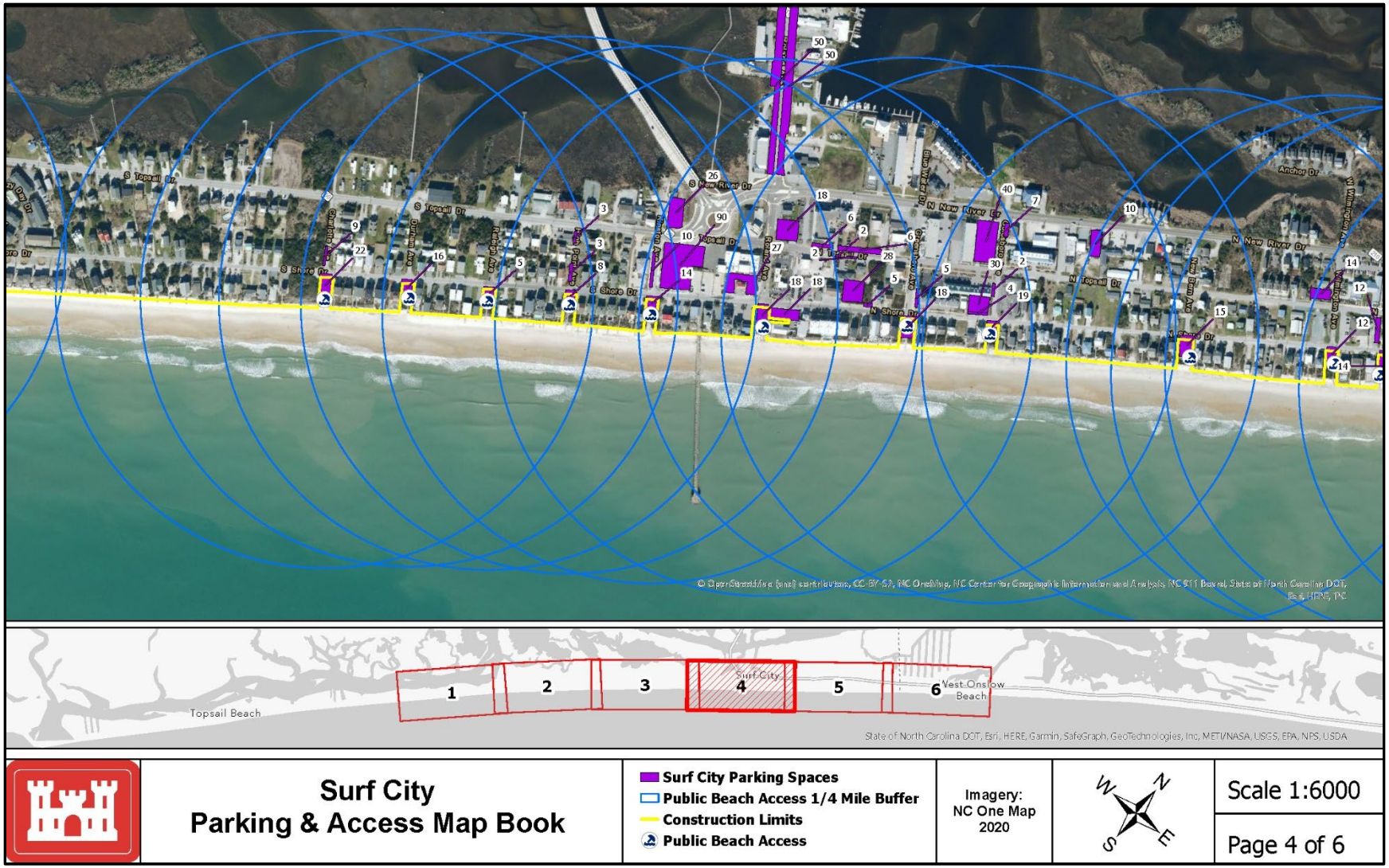


Figure 15. Public Beach Access Point and Parking at Surf City, continued.

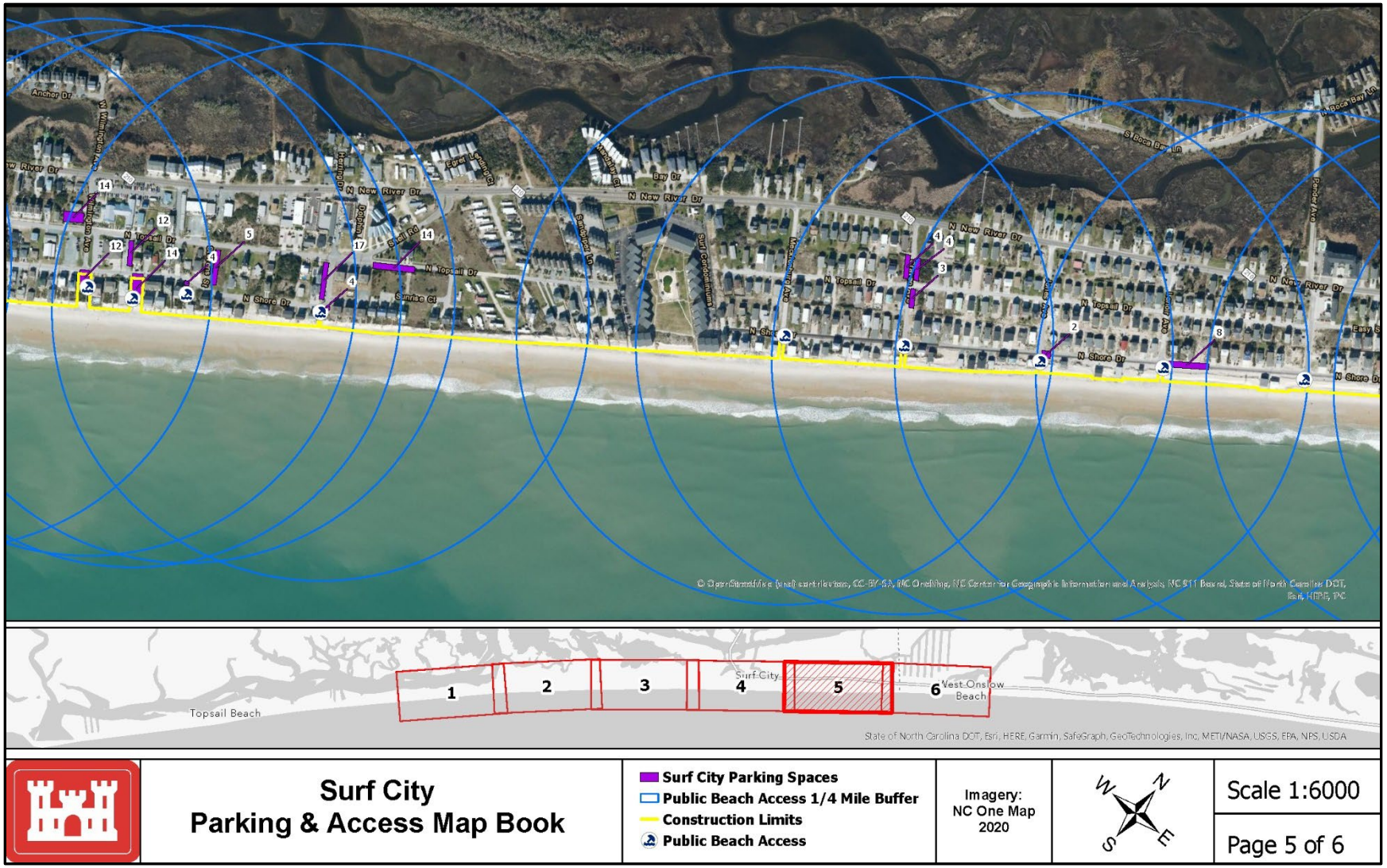


Figure 15. Public Beach Access Point and Parking at Surf City, continued.

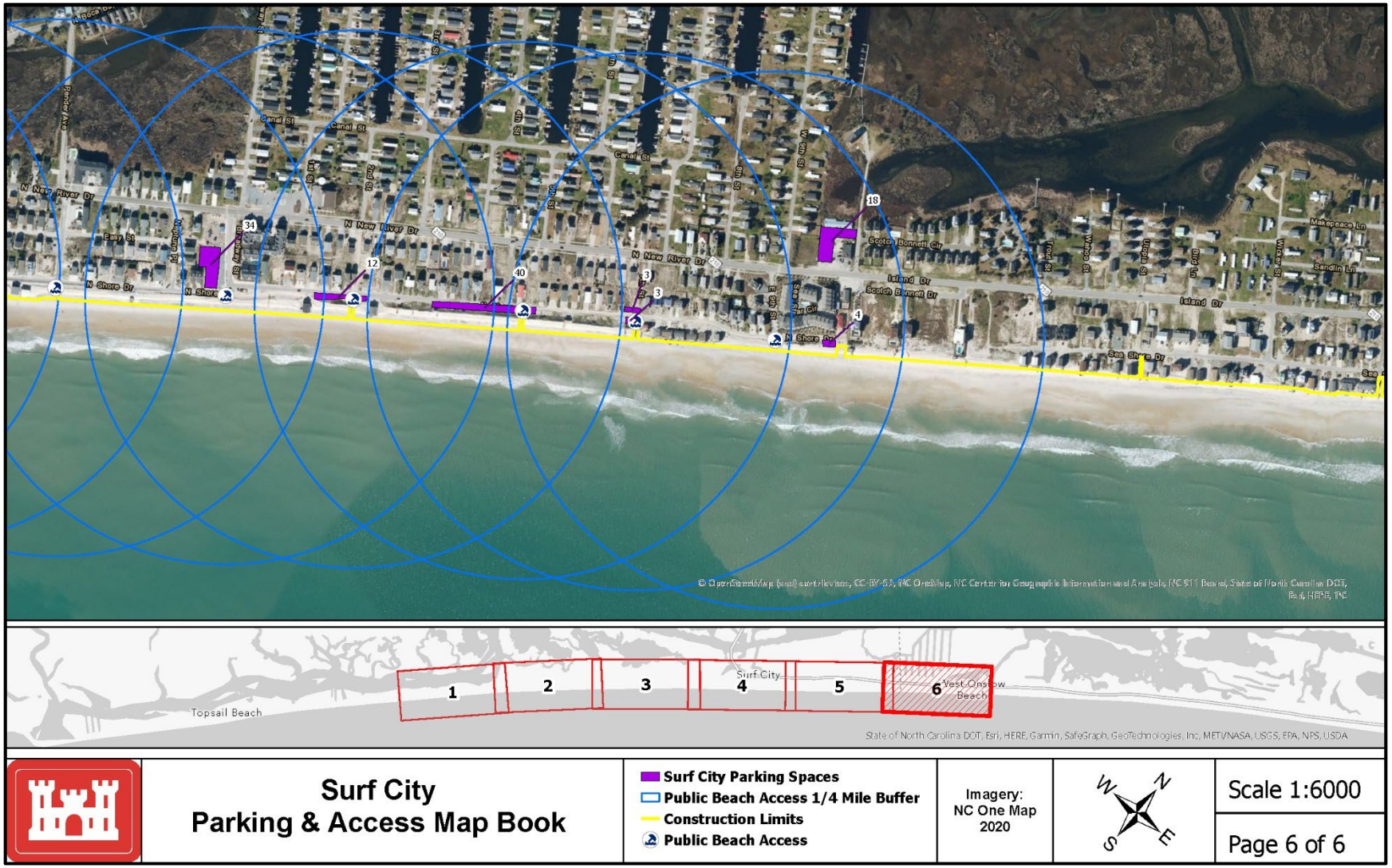


Figure 15. Public Beach Access Point and Parking at Surf City, continued.

3.0 ALTERNATIVES DEVELOPMENT AND EVALUATION*

Alternatives were developed to address the water resource problems and meet the objectives while avoiding constraints and taking advantage of opportunities. The evaluation was conducted in accordance with the USACE Planning Guidance Notebook (ER 1105-2-100) emanating from the Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Planning Act (Public Law 89-80) and EO 11747, which was approved by the U.S. Water Resources Council in 1982, and by the President in 1983.The formulation of alternatives was limited by the scope requirements within the 13 January 2023 VTAM discussed in *Section 1.4* of this report.

Based on guidance and policy, the USACE has a well-defined six-step process to identify and respond to problems and opportunities associated with federal water resources planning objectives, and specific state and local concerns:

1) Identify problems and opportunities
2) Inventory and forecast conditions
3) Formulate alternative plans
4) Evaluate alternative plans
5) Compare alternative plans
6) Select Recommended Plan.

The results of these analyses identified an economically viable and environmentally acceptable recommended plan, as well as a comprehensive benefits plan.

3.1 Problem Statement

The Town of Surf City is currently vulnerable to the impacts of erosion, flooding, storm surge and wave attack created by severe coastal storms and sea level rise. These impacts disrupt the economic, environmental, and social characteristics of the community, and place the town's residents and property at risk for future loss.

3.2 Technical Criteria

Alternative plans were developed by applying technical agency criteria and guidance. They included:

Engineering Criteria:

- The plan must represent a sound, acceptable, and safe solution that incorporates the most current engineering principles and practices.

Economic Criteria:

- The plan must contribute benefits to the National Economic Development account that exceed its costs.
- Recreational benefits may not be more than 50 percent of the total benefits required for economic justification.

- Plan implementation may not preclude development of more economical means for accomplishing the same purpose.

Environmental Criteria:

- The plan must fully comply with all laws, regulations, policies, executive orders.
- The plan will balance economic benefits and environmental impacts and sustainability considerations.
- The plan must be consistent with the USACE's Environmental Operating Principles (EOPs).
- Implementation of the environmental commitments as outlined in **Tables 13** and **14** mitigates the potential environmental impacts of the project and supports signing of a Finding of No Significant Impact (FONSI).
    - *Other Criteria:*
- The plan must address the identified concerns of the NFS and public.
- The plan must be implementable with respect to financial and institutional capabilities.

3.3 Objectives and Constraints

Objectives are statements that describe the results desired by solving the problems and taking advantage of the opportunities identified. The primary objective for this project is to identify a plan that reduces coastal storm damage to structures and infrastructure for the Town of Surf City, North Carolina from coastal storms and sea level rise over a 50-year period. Additional objectives for the project include:

- Reduce life, health, and safety risks for residents and visitors.
- Maintain social cohesiveness for the community.
- Limit disruptions to regional economic opportunities while maintaining economic vitality.
- Maintaining community and emergency services during and after a major coastal storm event.
- Maintain or increase habitat for threatened or endangered species, terrestrial and marine resources, and migratory birds.

Unlike Opportunities that represent desired positive future conditions in the community, constraints represent restrictions that must not be violated. Universal constraints like complying with applicable law and policy are a given for all USACE projects. Constraints identified for this study include:

- Avoiding impacts to threatened and endangered species, such as Sea Turtles and the North Right Whale

3.4 Opportunities

Given these conditions, opportunities identified for the project include:

- Improved recreational access within the project.
- Improved of coastal storm risk resiliency for the Town of Surf City and its citizens.
- Reduced business disruption from natural disasters.
- Improving suitable and critical habitat for threatened or endangered species, terrestrial and marine resources, migratory birds, and cultural resources.
- Building community and social cohesion.

3.5 Focused Alternatives Array

Alternatives for this report were based primarily on the need to reduce the length of the authorized project, the application of technical criteria presented in *Section 3.2*, communications with the NFS and government resource agencies, requirements under state and Federal laws, and the approved VTAM dated 13 January 2023 (see **Appendix M**).

Four action alternatives were initially formulated for the project defined primarily by the length of the proposed project and the inclusion or exclusion of environmental windows during initial construction and/or nourishment events. They included:

- A Surf City only project with existing environmental windows (December 1 and March 31) during both initial construction and nourishment events.
- A Surf City only project with extended environmental windows (November 16-April 30) during both initial construction and nourishment events.
- A Surf City only project with no environmental window during initial construction and extended environmental windows (November 16-April 30) during nourishment events.
- A Surf City only project with no environmental windows during both initial construction and nourishment events.

Internal analysis determined that the addition of no environmental windows to nourishment events would add no benefit to the project, as they can be accomplished by a single event within an expanded environmental window. Thus, it was screened from the array, and the remaining alternatives were carried forward for additional analysis.

All action alternatives would use identified and previously surveyed borrow areas. Dredging would occur within the footprint of identified borrow areas and the placement of the beach quality dredged material would be within limits of the Surf City.

The approximate length of the project would be reduced by approximately 36%, or approximately 3.9 fewer miles (9.9 miles to 6.0 miles, or 52,210 feet to 33,300 feet) with the exclusion of the Town of NTB . Both initial construction and subsequent nourishment events are expected to progress at about a mile per month or about 200 feet per day.

3.5.1 Alternative 1: No Action.

Under this alternative, no Federal project would be constructed at Surf City within the period of analysis. While a local project could still be constructed by the NFS, this alternative would only be recommended if none of the others produce positive net benefits or result in unacceptable adverse environmental impacts that cannot be mitigated.

3.5.2 Alternative 2a: Surf City only with Environmental Windows.

Alternative 2a is the 2010 Authorized Plan excluding the Town of NTB. It consists of a dune constructed to an elevation of 14 feet North Atlantic Vertical Datum 1988 (NAVD 88) and a 25 ft wide dune crest, fronted by a 50 ft wide berm at an elevation of 6 feet (NAVD 88). However, the length of the project would be restricted to town limits of Surf City approximately 33,300 ft or 6 miles. The alternative would also include a 1000 ft transition berm in northern end of the project from the town limits of Surf City into the town limits of NTB (**Figure 16**). A detailed analysis of this transition is presented in **Appendix B**. Because no changes have been made affecting the transition at the southwestern end of the project (the border between Surf City and Topsail Beach), the transition within the 2010 Authorized Plan would be adopted at that reach. Other features of the alternative would include dune vegetation and 40 public walkover structures.

Hopper dredges will be used in this analysis based on their higher efficiency and environmental considerations. All dredging activities would be performed within existing environmental windows between December 1 and March 31. The initial construction activities would span four dredging seasons and require four disturbance events from all equipment in the water and on the beach. The system would be renourished seven times over the 50-year project life span at fixed six-year intervals. Sand for the construction and renourishment intervals would be taken from identified borrow sites off the coast of Topsail Island. A summary of the volumes needed for this alternative is presented in **Table 4**. These volumes represent quantities to be removed from the borrow areas, which include +8.7% dredging loss and +15% overfill ratio. Lastly, issues related to SLC would be addressed through an Adaptation Strategy presented in **Appendix D**.

The rough order of magnitude (ROM) cost of initial construction for this alternative is $220,239,000 while the ROM cost for renourishments over the 50-year lifespan of the project is $317,426,000. Thus, the total project cost of Alternative 2a is **$537,665,000**.

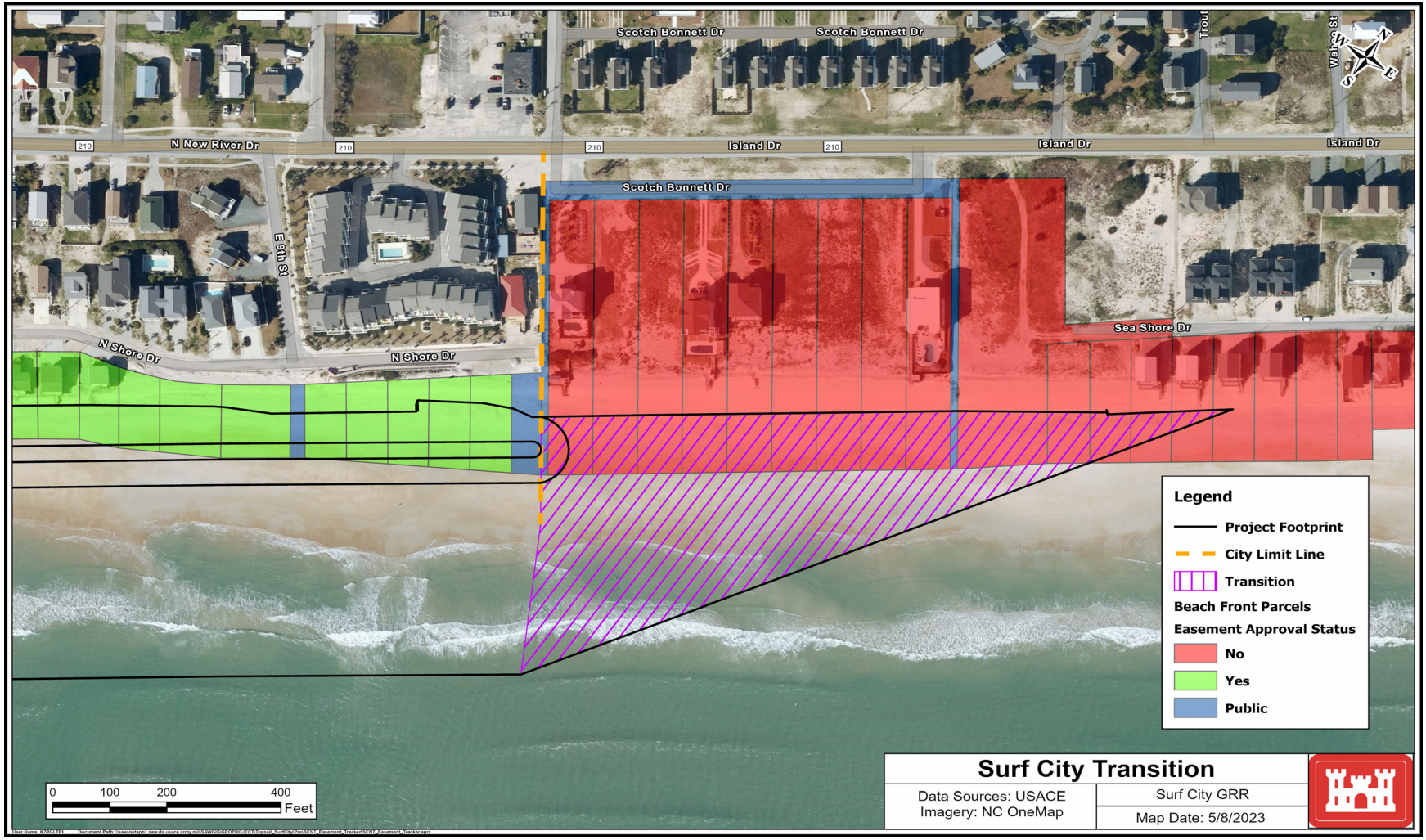


Figure 16. Proposed Transition into North Topsail Beach.

Table 4. Sand Quantities for All Action Alternatives.

Initial Construction	6,400,000 CY
Initial Borrow Area Requirements	8,000,000 CY
Total Renourishments on Beach	11,046,000 CY
Total Borrow Area for Renourishments	13,808,100 CY
Average (7 renourishments)	1,578,000 CY
Average Borrow (7 renourishments)	1,972,586 CY
Total Placed on Beach	17,086,000 CY
Total Removed from Borrow Sites	21,808,100 CY

3.5.3 Alternative 2b: Surf City Only with Expanded Environmental Windows.

Alternative 2b is a refinement of 2a. It is the same length, dimension and scope as 2a, but the environmental windows for initial construction and nourishment events of 2b would be expanded to coincide with the USFWS August 28, 2017 North Carolina Coastal Beach Sand Placement statewide programmatic biological opinion from December 1-March 31 (120 days) to November 16-April 30 (166 days). The initial construction activities would span three dredging seasons and require three disturbance events from all equipment in the water and on the beach. A summary of the volumes needed for this alternative is presented in **Table 4**. Lastly, issues related to SLC would be addressed through an Adaption Strategy presented in **Appendix D**.

The ROM cost of initial construction for this refinement is $210,796,000, while the ROM cost for renourishments over the 50-year lifespan of the project is $317,426,000. Thus, the total project cost of Alternative 2b is **$528,222,000**.

3.5.4 Alternative 2c: Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action).

Alternative 2c is a further refinement of 2a and 2b. The length, design and scope of plan would remain the same but dredging activities during initial construction would be performed without environmental windows. Impacts to threatened and endangered species by these activities would be addressed through assessments required under the South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States (SARBO) (NOAA 2020). Only one disturbance event, both in the water and on the beach, would be required with this refinement lasting approximately 16 months. Nourishment events would occur within expanded environmental windows between November 16 to April 30, coinciding with the current beach placement window. A summary of the volumes needed for this alternative is presented in **Table 4**. Lastly, issues related to SLC would be addressed through an Adaption Strategy presented in **Appendix D**.

The ROM cost of initial construction for this refinement is $186,637,000 while the cost for renourishments over the 50-year lifespan of the project is $317,426,000. Thus, the total project cost of Alternative 2c is **$504,063,000**.

3.6 Evaluation of Alternatives

After the focused array of alternatives was developed, a forecast of the with-project conditions expected under each alternative plan was examined. They were then compared to the without project conditions using an established set of evaluation criteria, namely contributions to the study planning objectives and Federal objective, and to the four evaluation criteria within the Principles & Guidelines (P&G) (i. e. completeness, effectiveness, efficiency, and acceptability). The purpose of this evaluation is to characterize and quantify the benefits and adverse effects of each alternative.

3.6.1 Study Objectives

Each alternative was evaluated based on the study objectives in *Section 3.3* (**Table 5**). In short, the No Action Alternative (#1) did not meet the stated objectives of the study, while the remaining alternatives did meet the objectives. Moreover, Alternatives 2a, 2b and 2c met the objectives equally with no discernable difference between them.

3.6.2 Cost and Benefits Analysis

Increases in the net value of the national output of goods and services, expressed in monetary units, through the reduction in wave, erosion and inundation damages were measured through the variables required under the National Economic Development (NED) account. These variables included project cost, average annual cost (AAC), average annual benefits (AAB), average annual net benefits (AANB), benefit to cost ratio (BCR) and residual risk.

Results were costed at the FY2025 Price Level and discounted at the FY2024 Federal Discount Rate of 2.75% in accordance with Economic Guidance Memorandum (EGM) 23-01 *Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2024*. They were then reported at the FY2010 Price Level to compare versus benefits quantified in the 2010 modeling effort used for this report (**Table 6**).

A thorough evaluation was conducted to compare the quantified variables associated with the different alternatives considered for Surf City, NC. The analysis revealed that Alternative 2c demonstrated the highest level of net NED benefits. While Alternative 2b achieved a BCR above 1.0, it did not maximize the net NED benefits. Notably, the NED plan for Surf City, NC exhibits a substantial AANB of $16,284,000, accompanied by a BCR of 2.8.

Table 5. Evaluation of the Alternatives Array to the Study Objectives.

Surf City, North Carolina Coastal Storm Risk Management General Re-Evaluation Report Alternatives Array Evaluation				
Objectives	**Alternative 1: No Action**	**Alternative 2a**	**Alternative 2b**	**Alternative 2c**
1 - Reduce coastal storm damages to structures and infrastructure.	Does Not Meet Objective	Meets Objective	Meets Objective	Meets Objective
2 - Reduce risks to life, health and safety for residents and visitors.	Does Not Meet Objective	Meets Objective	Meets Objective	Meets Objective
3 - Maintain social cohesion for community.	Does Not Meet Objective	Meets Objective	Meets Objective	Meets Objective
4 - Limit disruptions to regional economic opportunities	Does Not Meet Objective	Meets Objective	Meets Objective	Meets Objective
5 - Maintain community and emergency services during and after a major coastal storm event.	Does Not Meet Objective	Meets Objective	Meets Objective	Meets Objective
6 - Maintain or increase habitat for threatened or endangered species, terrestrial and marine resources, and migratory birds.	Does Not Meet Objective	Meets Objective	Meets Objective	Meets Objective

Table 6. Benefits And Costs for the Alternatives Array.

Alternative	Total Project Cost (2024)	Average Annual Benefits (AAB)	Average Annual Cost (AAC)	Benefit-To-Cost Ratio (BCR)	BCR Without Recreation	Average Annual Net Benefits (AANB)	Residual Risk
Alternative 1: No Action	**$0**	**$0**	**$0**	**N/A**	**N/A**	**$0**	**100.00%**
Alternative 2a: Surf City only with Environmental Windows	**$537,666,000**	**$25,206,000**	**$9,755,000**	**2.6**	**1.1**	**$15,451,000**	**11.00%**
Alternative 2b: Surf City Only with Expanded Environmental Windows	**$528,223,000**	**$25,206,000**	**$9,521,000**	**2.6**	**1.1**	**$15,685,000**	**11.00%**
Alternative 2c: Surf City only with No Environmental Window for Initial Construction and Expanded Environmental Window for Nourishment Events	**$504,064,000**	**$25,206,000**	**$8,922,000**	**2.8**	**1.2**	**$16,284,000**	**11.00%**

3.6.3 Principles and Guidelines Criteria

Each alternative was then evaluated to the four general criteria described in the "Principles and Requirements for Federal Investments in Water Resources" published in March 2013, and the subsequent guidelines published in December 2014. They included:

- *Completeness*: This criterion is the extent that a plan provides and accounts for all investments and actions required to ensure the planned output is achieved. These criteria may require that an alternative consider the relationship of the plan to other public and private plans if those plans affect the outcome of the project. Completeness also includes consideration of real estate issues, operations and maintenance (O&M), monitoring, and sponsorship factors.
- *Effectiveness:* This criterion is defined as the degree to which the plan would achieve the planning objectives. The plan must make a significant contribution to the problems being addressed or opportunities being realized.
- *Efficiency*: The project must be a cost-effective means of addressing the problem or opportunity. The plan outputs cannot be produced more cost-effectively by another institution or agency.
- *Acceptability*: A plan must be acceptable to Federal, state, and local government in terms of applicable laws, regulation, and public policy. The project should have evidence of broad- based public support and be acceptable to the non-Federal cost sharing partner.

Table 7 provides the results of this assessment. It was determined that Alternative 1, the "no action" alternative, met none of the P&G criteria. Alternative 2c was determined to be more "efficient" than Alternatives 2a and 2b, given its lower cost and higher net economic benefits. Alternatives 2a, 2b and 2c satisfied the acceptability, completeness, and effectiveness criteria equally.

3.6.4 Comprehensive Benefits Analysis

On January 5, 2021, a policy directive from the Commanding General for the USACE required consideration of the benefits gained across the four P&G evaluation accounts and within agency decision documents for water resource studies, leading to the identification of a "Comprehensive Benefits Plan".

Table 7. Evaluation of Alternatives Array to the Four P&G Criteria.

Surf City, North Carolina Coastal Storm Risk Management General Re-Evaluation Report Alternatives Array Evaluation				
Criteria:	**Alternative 1: No Action**	**Alternative 2a**	**Alternative 2b**	**Alternative 2c**
Acceptability:	Does Not Meet Criterion	Meets Criterion	Meets Criterion	Meets Criterion
Completeness:	Does Not Meet Criterion	Meets Criterion	Meets Criterion	Meets Criterion
Effectiveness:	Does Not Meet Criterion	Meets Criterion	Meets Criterion	Meets Criterion
Efficiency:	Does Not Meet Criterion	Meets Criterion, but not the strongest	Meets Criterion, but not the strongest	Meets Criterion

While the primary purpose of this report was to identify the NED plan, this report also identified the economic, environmental, and social factors that are vital to Surf City and their residents. These factors were evaluated as to their contribution to the remaining P&G evaluation accounts: Regional Economic Development (RED), Environmental Quality (EQ), and Other Social Effects (OSE). These factors, as defined by the P&G, include:

- The RED account addresses economic benefits important to the region. Items in this account relate to economic activities such as employment and income.
- The EQ account assesses the favorable or unfavorable changes in the ecological, aesthetic and cultural or natural resources by the project. This review is typically conducted with the participation of agencies, local governments, and stakeholders through an on-going and engaging series of scoping meetings, public input meetings, agency and stakeholder meetings, and State and Agency reviews. Items in this account include threatened and endangered species and their critical habitat, terrestrial and marine species, migratory birds, and historic properties considered eligible for, or listed on, the National Register of Historic Places.
- *Other Social Effects (OSE) account.* OSE considers the benefits of alternative plans to social and community attributes. Factors within this account can include the improvement of life, health and safety, community and social cohesion, access to public facilities and services, and improvement to disadvantaged and socially vulnerable populations.

Each factor was evaluated qualitatively using existing and developed information (quantitative and qualitative), NFS input, and professional judgement. A focus was made on how well the alternatives would reduce the impacts of erosion, flooding, storm surge and wave attack created by severe coastal storms and sea level rise across the each economic, environmental, and social factors.

3.6.4.1 Regional Economic Development (RED)

The RED account registers changes in the distribution of regional economic activity that result from each alternative plan. Two economic factors are used in this evaluation: regional income and regional employment.

The regional economic effects are measured in terms of output, jobs, labor income, and gross regional product (value added), as summarized in the **Appendix G**. Primarily considered transfers from the nation, thus not NED, these benefits are comparable across the alternatives array. The no action alternative assumes no RED benefits and thus no change. For this study, Alternative 2a, 2b and 2c have the same per dollar impact on RED and thus should be considered the same.

In the local impact area, the Civil Works expenditures of $276 million support a total of 3,756 full-time equivalent jobs, $234 million in labor income, $264 million in gross regional product, and $447 million in economic output. On a

broader scale, these expenditures have a nationwide impact and change to regional community (**Table 8**). They support 5,097 full-time equivalent jobs, $358 million in labor income, $456 million in gross regional product, and $772 million in economic output across the nation. The job support and economic impacts would largely be experienced during the renourishment events. Although temporary in nature, expenditures contribute to job creation, increased labor income, and enhanced regional and national economic output.

Based on this analysis, there is no meaningful difference between the alternatives in terms of income and employment. The regional economic benefit of all alternatives, except for the no action alternative, in terms dollars is moderate.

Table 8. RED Account, Comprehensive Benefits Analysis.

Surf City, North Carolina Coastal Storm Risk Management General Re-Evaluation Report Alternatives Array Evaluation				
RED Factors	**Alternative 1: No Action**	**Alternative 2a**	**Alternative 2b**	**Alternative 2c**
Wages	No change in benefits	Moderate Additional Benefits	Moderate Additional Benefits	Moderate Additional Benefits
Employment	No change in benefits	Moderate Additional Benefits	Moderate Additional Benefits	Moderate Additional Benefits

3.6.4.2 Environmental Quality (EQ)

Beneficial effects in the EQ account are generally favorable for environmental and cultural resources. They include the benefits gained or loss to habitat for threatened and endangered species, marine and terrestrial species and migratory birds, and the preservation of historic properties determined eligible for listing to the NRHP.

A full description and analysis of environmental and cultural resources impacts under NEPA is presented in *Section 5.0* of this document The no action alternative assumes no EQ benefits for the project. In addition, none of the alternatives effect historic properties listed on, or eligible for the NRHP, and would have no change. Thus, the remaining environmental factors – threatened and endangered species, terrestrial and marine resources, and migratory bird – were used to evaluate the EQ account (**Table 9**).

While the no action alternative results in zero EQ benefits, alternatives that include beach renourishment increase the amount of habitat available for Loggerhead, Green, and Kemp Ridley Sea Turtles. The Karen Beasley Sea

Table 9. EQ Account, Comprehensive Benefits Analysis.

Surf City, North Carolina Coastal Storm Risk Management General Re-Evaluation Report Alternatives Array Evaluation				
EQ Factors	**Alternative 1: No Action**	**Alternative 2a**	**Alternative 2b**	**Alternative 2c**
Threatened or endangered species	No Change In Benefits	Minor Additional Benefits	Minor Additional Benefits	Moderate Additional Benefits
Terrestrial and marine resources	No Change In Benefits	Minor Additional Benefits	Minor Additional Benefits	Moderate Additional Benefits
Migratory birds	No Change In Benefits	Minor Additional Benefits	Minor Additional Benefits	Moderate Additional Benefits
NRHP historic properties (listed and determined eligible)	No Change In Benefits	No Change In Benefits	No Change In Benefits	No Change In Benefits

Turtle Rescue and Rehabilitation Center and the Topsail Turtle Project Nesting Program are in Surf City. In 2023, there were 23 sea turtle nests within the Surf City town limits.

Each of the alternatives provide greater habitat for terrestrial species on the project. The most discerning category for this account, in terms of benefits gained or loss, was the frequency and duration of disturbances during initial construction and nourishments to marine species (i. e. Loggerhead, Green and Leatherback Sea Turtles, West Indian manatee and North Atlantic Right Whale), foraging birds (i. e. Piping plover, Red knot), fish (i. e. Atlantic and shortnose sturgeon) and plants (i. e. seabeach amaranth) listed as T&E species. Based on professional opinions and consultations with resource agencies, the projected environmental benefits were anticipated to be greater for Alternative 2c than Alternatives 2a and 2b. Nourishing the beach at Surf City would increase available habitat. Thus, Alternative 2c was determined to provide greater benefits to the project when compared to the other alternatives.

3.6.4.3 Other Social Effects (OSE)

The OSE account examines the social fabric of a community and identifies issues and concerns that are important to it residents before and after a coastal storm. As with most CSRM projects, the alternatives were evaluated for their improvement to life, health and safety through risk reduction. Other social factors examined during this study included continued access to public facilities and services, maintaining social cohesion, and potential improvement for disadvantaged and socially vulnerable populations. These factors were evaluated qualitatively using demographic information and professional judgement. The no action alternative assumes no OSE benefits and thus no change would occur.

Based on this assessment, there was no discernible difference between the alternatives in terms of the social benefits gained (**Table 10)**. All the alternatives reduce the stress related to life, health and safety concerns caused by severe coastal storms, though evacuation would still be required for a storm landfall. They may also facilitate the maintenance of public facilities and services. The reduced displacement of residents and visitors would help maintain better social cohesion for the community.

While no disadvantaged and socially vulnerable populations were identified within the permanent population of Surf City, it was estimated that a slight improvement would occur for those populations in the surrounding area and out-of-town visitors for Alternative 2a, 2b, and 2c, including the residents for Ocean City Beach (see *Section 2.6.2*).

The improvement for the residents of Ocean City is of particular importance to the OSE account for this project. Although Ocean City falls outside of the

Table 10. OSE Account, Comprehensive Benefits Analysis.

Surf City, North Carolina Coastal Storm Risk Management General Re-Evaluation Report Alternatives Array Evaluation				
OSE Factors	**Alternative 1: No Action**	**Alternative 2a**	**Alternative 2b**	**Alternative 2c**
Improve life, health and safety	No change in benefits	Major Additional Benefits	Major Additional Benefits	Major Additional Benefits
Maintain access to public facilities and services	No change in benefits	Moderate Additional Benefits	Moderate Additional Benefits	Moderate Additional Benefits
Maintain social cohesion	No change in benefits	Moderate Additional Benefits	Moderate Additional Benefits	Moderate Additional Benefits
Improve conditions for disadvantaged and socially vulnerable populations	No change in benefits	Minor Additional Benefits	Minor Additional Benefits	Minor Additional Benefits

Project Area, some residents of Ocean City may find gainful employment in Surf City during the peak of the tourist season each summer.

3.7 Plan Selection

3.7.1 National Economic Development Plan

This analysis identified Alternative 2c as the plan that reasonably maximizes NED benefits when compared to other alternatives considered. Therefore, it is the NED plan for this project.

Through an evaluation of quantified measures, Alternative 2c consistently demonstrated the highest level of net benefits across Surf City, NC. This alternative effectively balances the costs and benefits associated with the project, resulting in a favorable BCR of 2.8 and a substantial AANB of $16,284,000. By prioritizing the optimization of net benefits, Alternative 2c aligns with the principles and guidelines outlined by the USACE, making it the preferred choice for maximizing the economic development and overall positive impacts in Surf City.

3.7.2 Comprehensive Benefits Plan

In compliance with the ASA(CW) Policy Directive *Comprehensive Documentation of Benefits in Decision Document* signed 5 January 2021, the final array of alternatives must include a “Comprehensive Benefits” Plan that maximizes total economic, environmental, and social benefits across all four P&G evaluation accounts. This plan has been identified as Alternative 2c, given its value of national outputs of goods and services and overall beneficial effects to the

environment, regional economic development, and the social fabric of the community.

3.7.3 Locally Preferred Plan

No locally preferred plan was identified by the NFS.

4.0 THE RECOMMENDED PLAN*

4.1 Description

Based on the above assessment, Alternative 2c is the recommended plan (**Figure 17)**. It is a berm and dune system measuring approximately 33,300 foot long, or approximately 6 miles of shoreline, with a dune constructed to an elevation of 14 feet North Atlantic Vertical Datum 1988 (NAVD 88) and fronted by a 6-foot (NAVD 88) (50 ft wide) beach berm restricted by the Town limits of Surf City (**Appendix A)**.

The alternative would include a 1000 ft transition berm in northern end of the project that would go into the town limits of NTB (see **Figure 15**). Other features of the alternative would include dune vegetation and 40 public walkover structures.

Initial construction would be implemented with no environmental window. Only one disturbance event from dredges and other equipment, both in the water and on the beach and lasting approximately 16 months, would be required. Nourishment events would be accomplished within the current beach placement window of November 16 to April 30. The periodic nourishment intervals would be every six years, resulting in a total of seven nourishment events over the 50-year project life (i. e. 2024-2073) with the quantities listed in **Table 4**. The total ROM project costs of the recommended plan is **$504,063,000** (**FY24 price levels**) (**Appendix F**).

4.2 Justice40 initiative

The recommended plan was evaluated for consideration as a Federal investment under the Justice40 initiative, per the 20 July 2021 and 27 January 2023 Presidential Memoranda, Interim Implementation Guidance for the Justice40 Initiative and Addendum to the Interim Implementation Guidance for the Justice40 Initiative, M-21-28, on using the Climate and Economic Justice Screening Tool (CEJST), respectively. According to CEJST, Surf City possesses no land tracts with Environment Justice communities that could directly benefit from the construction of a Federal project. The African American community of Ocean City Beach is located outside of the project limits and may have an indirect benefit through a stable and secure Surf City. However, the project, as formulated, does not qualify as a Federal investment under the Justice40 initiative (Council on Environmental Quality 2023).

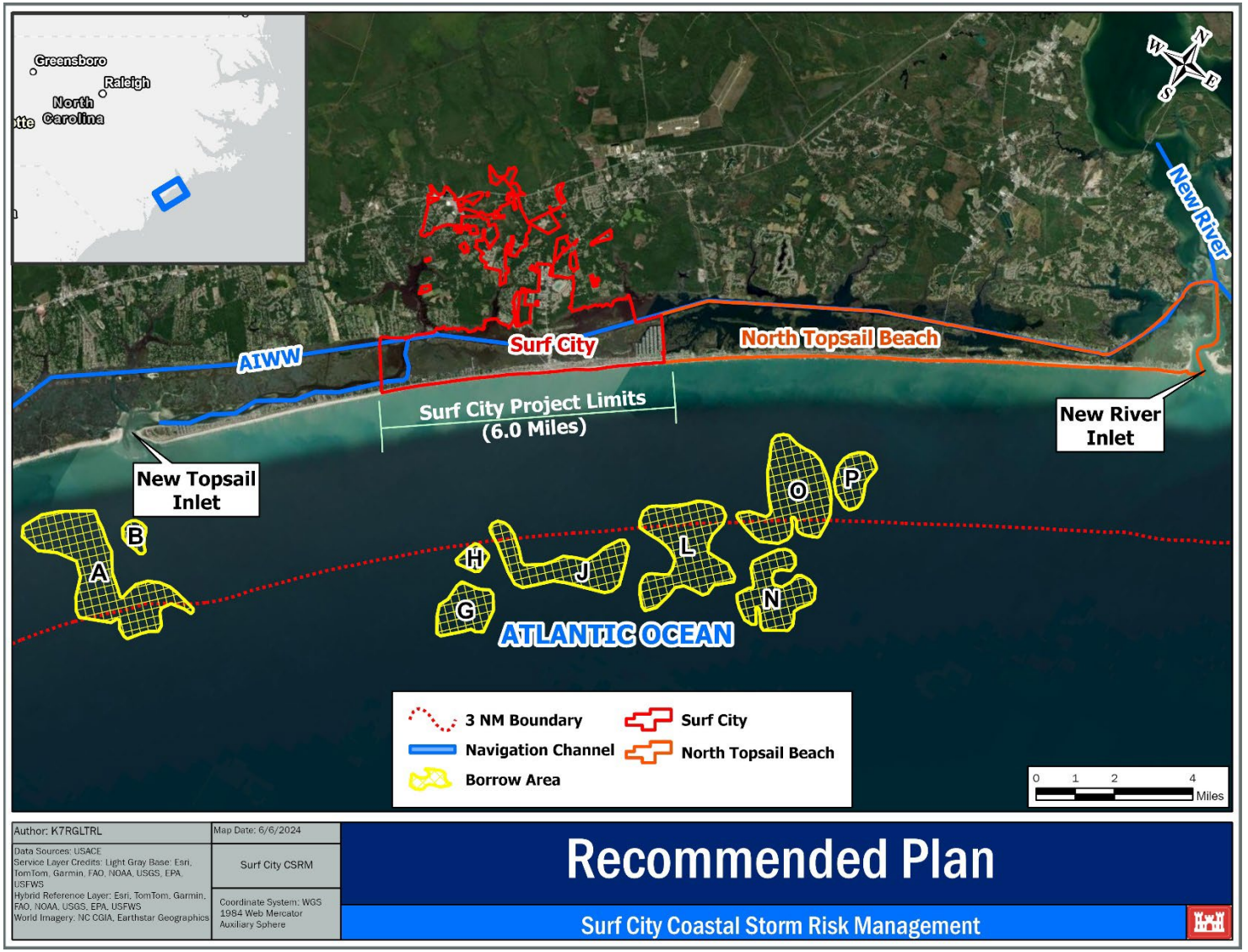


Figure 17. Recommended Plan.

4.3 Risk and Uncertainty

Uncertainties related to sea level change present a medium risk to the performance of the project over its 50-year lifespan. USACE would communicate this risk to the NFS and develop an adaptation strategy for inclusion in this report (see **Appendix D**).

Uncertainties related to the availability of a contractor with adequate equipment (i. e. hopper dredges to construct and nourish the project over a 50-year lifespan presents a medium risk that could impact the scope, schedule, and budget. USACE would work closely with the District contracting office to identify an adequate contractor to support the project

The potential to encounter rock and/or cemented sands within designated, offshore borrow sites presents a medium technical risk that could slow the construction of the project. Both risks could increase the cost of the project. The District has collected an additional 110 vibracores located in those borrow areas within three nautical miles and plans to collect an additional 105 vibracores in those borrow areas beyond three nautical miles to further delineate the presence and/or extent of rock and cemented sands. A more detailed delineation of dredge cuts would then be developed which would attempt to avoid these materials without impacting sand availability. Should rock or cemented sands be encountered and should they be found to be unavoidable, USACE would minimize the impact of rocks and cemented sand by using screening measures. USACE would work closely with the District contracting office to ensure that both a ¾-inch and 1.25-inch screening device is available. The Contractor shall deploy screening devices at the discretion and advisement of the Contracting Officer.

It should be stated that the recommended plan does not prevent damages from flooding along the AIWW. Therefore, any ground-level floors of structures, ground-level floor contents, vehicles, landscaping, and property stored outdoors on the ground in Surf City would still be subject to flows through back bay channels and considered a residual risk of the project.

5.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES*

This section describes the affected environment and environmental consequences that may result through the implementation of the alternatives described in *Section 3.5*.

The remainder of this section documents new information obtained since completion of past NEPA documents for the SCNTB CSRM project, addresses changes to the project, including the exclusion of North Topsail Beach, changes in sediment volumes, borrow areas and the borrow area use plan, dredging and placement window alternatives, and updates the environmental monitoring/commitments from the 2010 Feasibility/EIS.

Only those resources impacted by these changes are addressed in this section. They include geology and sediments, beach and dune, water quality, surf zone and nearshore ocean fishes, nekton, larval entrainment, benthic resources, Essential Fish

Habitat (EFH) and hardbottoms, birds, cultural resources, noise, threatened and endangered species, recreation, aesthetic and fishing resources, sea level rise, air quality, environmental justice and hazardous, toxic and radioactive wastes. Currently, there is no anticipated change in impacts associated with wetlands and floodplains, inlets, flats and sounds, maritime scrub thicket, wave conditions, shoreline and sand transport, hydrology, groundwater, air and water pollution, man-made and natural resources, community cohesion and the availability of public facilities and services from those analyzed in the 2010 Feasibility/EIS.

While the project has not identified the type of dredge to be used for initial construction and subsequent beach placement events, this assessment focuses on the impacts associated with hopper dredges on the marine environment, since it is most likely that two hopper dredges would be utilized for its construction and nourishments. While there is no environmental window for pipeline dredging, the window for beach placement (for any type of dredge) to minimize impacts to sea turtle nesting habitat is November 16 to April 30.

Prior to project construction and nourishments, cultural resources and hardbottom investigations between the offshore borrow sites and the shoreline may be required to ensure pipeline routes and pump-out stations to avoid important resources.

As previously stated, the approximate length of the project (9.9 miles to 6.0 miles) or (52,210 feet to 33,320 feet) is reduced by approximately 33%, or approximately 3.9 fewer miles without the Town of NTB.

The authorized project described in the 2010 Feasibility/EIS requires an estimated 11.9 million cubic yards (MCY) of sand for initial construction and a total of 32.3 MCY for the 50-year project life. These calculations were refined during the PED phase of the project, and based on this information the Surf City portion of the project is estimated to require approximately 8.0 MCY (-33%) for initial construction and 13.8 MCY (-32%) for the combined nourishments for a total of 21.8 MCY (-33%) over the life of the 50-year project (**Table 11**).

Table 11. Approximate Quantity of Beach Quality Sand Required.

	Initial Construction	Nourishments	50-Year Project Life
Surf City and North Topsail Beach (MCY)	11.9	20.4	32.3
Surf City Only (MCY)	8.0	13.8	21.8
Change (MCY)	-3.9	-6.6	-10.5
Change %	-33%	-32%	-33%

Changes to the quantities noted above reduces the time needed to complete the initial construction and subsequent nourishment events for the 50-year project life cycle: approximately t5.3 months for the initial construction and 1.8 months for the subsequent nourishment events (**Table 12**).

Table 12. Approximate Initial Construction and Nourishment Durations and Number of Seasons to Complete.

	Initial Construction		Nourishments	
Alternative	Surf City and North Topsail Beach	Surf City Only	Surf City and North Topsail Beach	Surf City Only
1. No Action	n/a	n/a	n/a	n/a
2a: Authorized Plan for Surf City with Environmental Windows	21.3 months/6 seasons	16 months/4 seasons	7.3 months/2 seasons	5.5 months/2 season
2b: Authorized Plan for Surf City with Expanded Environmental Windows.	n/a	16 months/3 seasons	n/a	5.5 months /1 season
2c: Authorized Plan for Surf City With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action)	n/a	16 months/1 season	n/a	5.5 months /1 season

Alternatives 2b and 2c allow for the elimination and/or expansion of environmental windows for the initial construction and subsequent nourishments events. The expanded environmental window for Alternative 2b would allow initial construction to be completed in 3 seasons (3 dredging/placement events) as compared to the 6 seasons presented in the 2010 Feasibility/EIS. With Alternative 2c, there would be no environmental window for initial construction, which would result in only one disturbance event of approximately 16 continuous months.

All action alternatives involve the use of identified and previously surveyed borrow areas. It is anticipated that dredging would occur within the footprint of identified borrow areas and the placement of these materials would be within limits of the previously authorized Surf City project footprint, as described in *Section 4.0*.

Tables 13 and **14** present the environmental commitments from the 2010 Feasibility/EIS with updates and additions. The commitments include avoidance and minimization measures and monitoring to obtain information on certain species and habitat-specific impacts. Some commitments may be modified pending new information acquired through the NEPA process or from resource agency coordination associated with other environmental compliance requirements, including, but not limited to, a Biological Opinion issued by the U. S. Fish and Wildlife Service for initial construction of the project.

In addition, the project would comply with requirements of the SARBO (NOAA 2020). The current version is available for reference on the NMFS website at:

https://www.fisheries.noaa.gov/content/endangered-species-act-section-7-biological-opinions-southeast.

The 2020 SARBO allows options of equipment choice to complete proposed actions. Allowing the use of relocation trawling (discussed in Section 6.1.4, of the SARBO) is intended to reduce the lethal take expected from hopper dredging. Take is defined under the Endangered Species Act means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Seasonal variation and water temperature also play an important role in the potential density of species in an area and the potential of entrainment.

Table 13. The 2010 Feasibility/EIS Environmental Commitments With Updates.

	2010 Environmental Commitment	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 would use the Wilmington District compatibility practice for beach placement material, as outlined in the 2013 EA, that meets these criteria: Less than 10 percent, by weight, material passes #200 sieve over weighted average. Less than 10 percent, by weight, material retained on the #4 sieve over weighted average. Material retained on the 3/4-inch sieve does not exceed, by percentage or size that found on the native beach. Contains no construction debris, toxic material, or other foreign matter. • 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	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

	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.	would notify the NCDCM and other resource agencies of such a contingency measure.
4	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).
5	All staging areas, pipeline routes, and associated construction activities would avoid high value piping plover and shorebird habitat, located within the vicinity of New River Inlet, to the maximum extent practicable.	No change. Would be implemented as described.
6	The Corps would implement precautionary measures for avoiding impacts to manatees during construction activities as detailed in the *Guidelines for Avoiding Impacts to the West Indian Manatee in North Carolina Waters* established by the USFWS.	No change. Would be implemented as described.
7	Endangered species observers would be on board all hopper dredges and would record all large whale sightings and note any potential behavioral effects. The USACE and the contractor would keep the date, time, and approximate location of all marine mammal sightings. They would take care not to closely approach (within 300 feet) any whales, manatees, or other marine mammals during dredging operations or transport of dredged material. An observer would serve as a lookout to alert the dredge	Changed to adhere to updated Project Design Criteria (PDC)s outlined in the 2020 SARBO.

	operator or vessel pilot or occurrence of such animals. If any marine mammals are observed during other dredging operations, including vessel movements and transit to the dredged material disposal site, collisions would be avoided either through reduced vessel speed, course alteration, or both.	
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	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. Would be implemented as described.

10	The Corps would avoid the sea turtle nesting season during initial construction and each nourishment interval. If, because of unforeseen circumstances, construction extends into the nesting season, the Corps would implement a sea turtle nest monitoring and avoidance/relocation plan through coordination with USFWS and NCWRC.	The proposed action is to accomplish initial construction any time of year (no environmental window) and to accomplish all nourishments within the beach placement window of November 16 to April 30. A new USFWS BO is pending. Re-initiation of consultation of this project is currently underway. The project would adhere to all Terms and Conditions of the BO when completed. USACE would implement a sea turtle nest monitoring plan as noted for any work within the sea turtle nesting season.
11	Sea turtle nesting monitoring activities in beach nourishment areas would be required to assess post-nourishment nesting activity. That would include daily surveys beginning at sunrise from May 1 until September 15. Information on false crawl location, nest location, and hatching success of all nests would be recorded and provided to NCWRC.	Likely no change. Would be implemented as required by the USFWS BO issued for this project.
12	The beach would be monitored for escarpment formation by the contractor before completion of beach construction activities associated with initial construction and each nourishment interval. Additionally, the local sponsor would monitor the beach for escarpment formation before each turtle nesting season every year between nourishment events. Escarpments that exceed 18 inches in height for a 100 ft distance would be leveled by the contractor or the local sponsor accordingly. If it is determined that escarpment leveling is required during the nesting or	Likely no change. Would be implemented as required by the USFWS BO issued for this project.

	hatching season, leveling actions should be directed by the USFWS.	
13	Only beach-compatible sediment would be placed on the beach as a component of the project. The USACE 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. Would be implemented as required by the USFWS BO issued for this project.
14	Local lighting ordinances would be encouraged to the maximum extent practicable to reduce lighting impacts to nesting females and hatchlings. The local sponsors would be encouraged to work with the USFWS, local monitoring groups, and other concerned organizations to develop the best plan for Surf City.	No change. Would be implemented as described.
15	Throughout the duration of each nourishment event, both initial construction and periodic nourishment, the contractor would be required to monitor for the presence of stranded sea turtles, live or dead. If a stranded sea turtle is identified, the contractor would immediately notify the NCWRC of the stranding and implement the appropriate measures, as directed by the NCWRC. Construction activities would be modified appropriately as not to interfere with stranded animals, live or dead.	No change. Would be implemented as described.

16	To better understand the threshold of sediment color change and resultant heat conduction from nourishment on temperature-dependent sex determination of sea turtles, the USACE would monitor nest temperatures in the project area during the nesting season following initial construction. That data would be compared to non-nourished native sediment temperatures to support development of management criteria for sediment color guidelines.	Coordination with the USFWS, NCDCM and NCWRC has resulted in this commitment being dropped.
17	To assess the abundance of sea turtles, and potential risk of hopper dredge take within the proposed borrow areas for the project, the USACE would participate in the NCWRC's current satellite telemetry efforts to track the distribution and habitat usage of sea turtles in North Carolina offshore waters.	Coordination with the USFWS, NCDCM and NCWRC has resulted in this commitment being dropped.
18	Monitoring for seabeach amaranth on Surf City would be implemented in the growing season following initial construction to assess the post-nourishment presence of plants. The survey would be broken down into survey reaches for each town in accordance with the designated Corps sea beach amaranth survey reaches from 1991 to 2008 to maintain consistent data and survey techniques over time, and results would be provided to USFWS.	A new USFWS BO is pending. Re-initiation of consultation of this project is currently underway. The project would adhere to all Terms and Conditions of the BO when completed.

19	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 impacts to surf zone fishes and benthic invertebrates to the maximum extent practicable, but initial construction is proposed to occur any time of year to reduce the number of disturbance events.
20	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 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**.
21	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.

22	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. Would 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 Corps of Engineers-dredging industry partnership for automated dredging monitoring of Corps dredging projects.
23	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. Would be implemented as described.
24	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. Would be implemented as described.

25	Project monitoring of sedimentation effects from dredging activities in the proposed 122- m (400-feet) 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 within the 122-m (400-feet) buffer and move to another area 500-m (1,640-feet) from the identified hardbottom sites.	The USACE has coordinated with the NMFS to obtain input to develop a plan to monitor sedimentation effects from dredging activities (sediment resuspension and potential deposition on hardbottom habitat) within the 122-m (400-foot) hardbottom buffer as outlined in **Appendix L**.
26	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. Would be implemented as described.
27	Before initiating any land-disturbing activities, the USACE would obtain the approval of the North Carolina Division of Land Resources of an erosion and sedimentation control plan. The USACE would comply with the requirements of the approved erosion and sedimentation control plan. A copy of the plan approval would be forwarded to NCDCM.	No change. Would be implemented as described.

28	Before construction, the USACE would obtain a Section 401 Water Quality Certification from the NCDWQ for the proposed project. The Corps would comply with the requirements of the Section 401 Water Quality Certification. A copy of the certification would be forwarded to NCDCM.	No change. Will be implemented as described.
29	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. Would be implemented as described.
30	Land-based equipment necessary for beach nourishment work would be brought to the site through existing accesses. If the work results in any damage to existing accesses, the accesses would be restored to pre- project conditions immediately on project completion.	No change. Would be implemented as described.
31	Dune disturbance would be kept to a minimum. Any alteration of existing dunes would be coordinated with NCDCM and the appropriate property owner(s). All disturbed areas would be restored to original contours and configuration with reference to the surveyed normal high-water line and would be revegetated immediately after project completion in that area.	No change. Would be implemented as described.

32	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. Would be implemented as described.
33	Before construction the existing MHW line would be surveyed, and a copy provided to the NCDCM. If construction is not initiated within 60 days or there is a major shoreline change before beginning beach nourishment (or both), a new survey would be conducted.	No change. Would be implemented as described.
34	Before initiating any beach nourishment activity, the USACE would coordinate with NCDCM to determine the static vegetation line to be used as the reference point for measuring future oceanfront setbacks. That static vegetation line would then be marked, and a survey depicting the static vegetation line would be submitted to NCDCM before any beach nourishment activities.	No change. Would be implemented as described.
35	After the post-construction beach profile surveys are completed, the USACE would coordinate with the North Carolina Floodplain Mapping Program to support revisions to the Digital Flood Insurance Rate Maps (DFIRMs). As part of such coordination, the Corps would provide a Letter of Map Revision.	No change. Would be implemented as described.

36	No sand would be placed on any sandbags that have been determined by NCDCM to be subject to removal under 15A NCAC 07H.0308(a)(2). To ensure compliance with that condition, NCDCM would be contacted before project initiation so that NCDCM staff may meet on-site with the USACE or the contractor or both.	No change. Would be implemented as described.
37	To mitigate the very remote chance of encountering ordnance, the beach would be inspected daily, and any ordnance discovered would be handled in accordance with the Military Munitions Rule, Title 40 of the *Code of Federal Regulations* (CFR) Parts 260-270. The Marine Corps Base Explosive Ordnance Disposal Team would be available (on call) during the dredging process. Additionally, the contract specifications for the proposed project would direct the contractor to immediately stop dredging or disposal. Additional measures would then be implemented, as necessary, including inspection of dredged material on the beach and installing outflow screens on the dredge pipeline. Any unexploded ordnance found on the beach would be promptly removed.	No change. Would be implemented as described.

38	To assure the risk of potential impacts to cultural resources within inshore areas subject to pump-out activities are avoided, specific pump-out locations would identify, survey, and investigate for cultural resources in conjunction with hardbottom surveys before beginning nourishment activities.	No change. Would be implemented as described.
39	If, during dredging activities, any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered in the inflow screening of the dredge or in the beach placement area, all activities that could damage or alter such resources would be suspended. If such a discovery or find is made, the USACE Contracting Officer would be immediately notified so that the appropriate authorities, including the BOEM, may be notified in accordance with USACE policy and 30 CFR 250.194(c) and a determination made as to their significance and what, if any, special disposition of the finds should be made.	No change. Would be implemented as described.

Table 14. 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	During placement, material between the toe of the dune and the mean high-water line may be tilled, if required, to minimize compaction.
3	As part of the borrow area use plan, the contractor 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 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 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”) would be a contractual option that 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 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 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 would be kept regarding when the debris containers are emptied. A map showing areas dredged and relative amounts of debris would be developed and distributed to the Service, NCDCM and other agencies weekly.
7	When a container of screened material is full, pumping should cease until an empty replacement container can be installed. Containers should not be allowed to overflow.
8	During sea turtle nesting season, beach raking of areas where construction is complete must be conducted only during daylight hours, after the daily survey for sea turtle nests has been completed. Any nests identified must be marked for avoidance and avoided during all beach raking activities.
9	As part of the North Carolina Sea Turtle Protection Project, and with the help of Federal and local agencies and volunteer groups, annual surveys of sea turtle activity have and continue to occur along Surf City. These surveys would likely continue, with or without a project in place.
10	The design of a restored or constructed dune would include as steep a waterward slope as possible. The restored/constructed dune would tie into the pre-existing dune without loss of elevation, to avoid development of a “trough” between the existing dune and the constructed dune.
11	To prevent back slope or troughs that hinder turtles, all nourishment events would tie into the existing profile in a manner that does not create backslope or troughs.

5.1 Geology and Sediments

16 borrow areas with the potential to provide beach quality sand were identified (Borrows A, B, C, D, E, F, G, H, J, L, N, O, P, Q, S and T) offshore of Topsail Island. The water depths in the borrow areas range from between –35 feet to –50 feet Mean Lower Low Water. Sediment sampling within these borrow areas was conducted in 2011 and 2013 during the PED phase of work for the SCNTB project. In 2011, Phase I surveying of Borrow Areas G, H, J, L, O, and P, collected 210 vibracores at a 1,000-foot grid-spacing, conducted laboratory analysis, and analyzed geophysical data, including hydrographic, multi-beam backscatter, and compressed high intensity radar pulse (CHIRP) surveys. In 2013, Phase II sampling focused on Borrow Areas E, F, N, R, and S, collecting an additional 88 vibracores and geophysical data, including hydrographic, multi-beam backscatter, and CHIRP surveys. A list of available reports detailing PED sediment sampling and survey results is provided below:

- High-resolution geophysical surveys of Borrow Areas G, H, J, L, O, and P Offshore Topsail Beach, North Carolina: November 2011-January 2012. January 2012, Geodynamics.
- Multibeam & Geophysical Surveys of Designated Borrow Areas (E, F, N, R, S) Topsail, North Carolina: September 2013. February 2014, Geodynamics.
- Vibracore Sampling and Soils Lab Testing of Offshore Borrow Sources, Surf City and North Topsail Beach, North Carolina. 02 July 2013. Athena Technologies.
- Site Conditions and Laboratory Report, Vibracore Sampling and Soils Lab Testing of Offshore Borrow Sources, Surf City and North Topsail Beach, North Carolina. July 2013. Athena Technologies
- USACE Wilmington District. 2013. Geotechnical Appendix – West Onslow Beach and New River Inlet (Topsail Beach), NC, Coastal Storm Damage Reduction Project (see **Appendix C).**
- USACE Wilmington District. 2020. Geotechnical Appendix for the Design Documentation Report –Surf City & North Topsail Beach, NC, Coastal Storm Damage Reduction Project (**Appendix C**).

The total footprint for the 16 borrow areas as described in the 2010 Feasibility/EIS was 12,307 acres. PED level data collection and analysis resulted in the selection of eight borrow areas for the Surf City and North Topsail Beach Coastal Storm Risk Management Project: A, G, H, J, L, N, O, and P (**Figure 18**). Further exclusions including areas of hardbottom and the established Low-Relief Hardbottom Buffers were included for the above listed borrow areas leaving a total area of disturbance of 7,756 acres (**Table 15**). An additional 1,907 acres of disturbance is included for

borrow areas B, C, D, E, and F for a total disturbance acreage of 9,663 acres, including low relief hardbottom buffers. Mitigative buffers were established in the 2010 EIS to avoid direct and indirect impacts to hardbottom and include a 500-meter buffer around high- and moderate-relief hardbottom and a 122-meter (400-foot) buffer around low-relief hardbottom. Refined borrow area volume calculations and utilization plans resulted in identification of maximum dredging depth boundaries. The maximum depths that would be dredged within each borrow area would be no deeper than as described in the 2010 Feasibility/EIS. The 2010 Feasibility/EIS showed the anticipated maximum dredging depths and subsequent post-dredge surface elevations for borrow areas based on vibracore data. The thickness range of beach quality material was 2 to 14.8 feet, with the average being 3.5 to 6.4 feet and the post-dredging surface elevation was –40.5 to –60.8 feet.

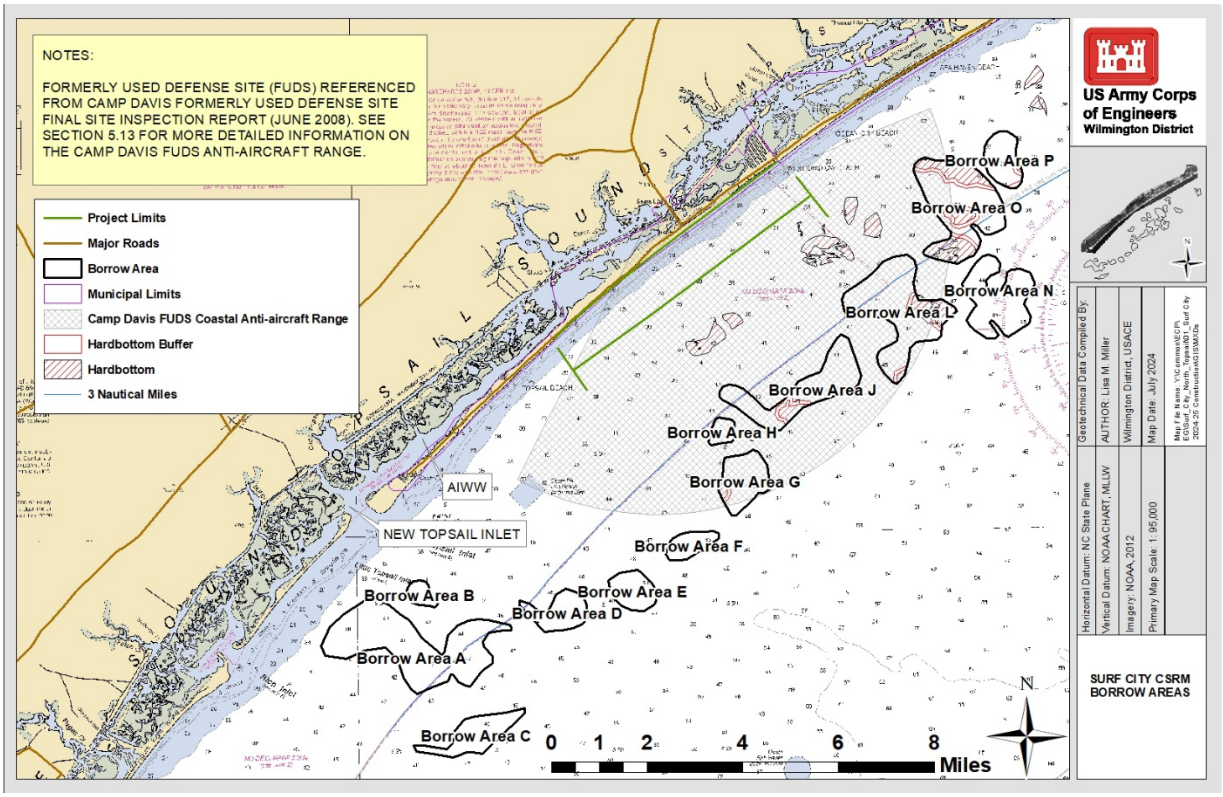


Figure 18. Borrow Areas for the Surf City CSRM Project.

Table 15. Disturbance Acreages for the Surf City CSMR Project.

Borrow Area	Total Acres[1] Excluding Hardbottom and Buffers[3]	Total Acres[1] - Within 3NM[4] Excluding Hardbottom and Buffers	Total Acres[1] - Beyond 3NM[4] Excluding Hardbottom and Buffers
A	2,297	1,879	418
B	158	158	0
C	597	0	597
D	464	12	452
E	406	0	406
F	282	0	282
G	576	0	576
H	158	0	158
J	1,033	93	940
L	1,382	458	924
N	1,061	0	1,061
O[5]	838	677	162
P	410	410	0
Totals	**9,663**	**3,687**	**5,976**

Notes and Assumptions

1. Acres calculated in ArcMap using "Calculate Geometry" with NAD83 State Plane Datum or referenced from West Onslow Beach and New River Inlet (Topsail Beach) NC Final Integrated General Reevaluation Report and Environmental Impact Statement, 2009.

2. Hardbottom delineations referenced from "Surf City and North Topsail Beach CSDR Project Integrated FEIS, 2005, Appendix U".

3. Low-Relief Buffers referenced from "Surf City and North Topsail Beach CSDR Project 2005 Integrated FEIS" which denotes a low relief buffer used for all borrow areas with a total width of 400 ft.

4. 3 Nautical Miles (NM)

5. 82.6706 acres of hardbottom excluded from center of Borrow Area O.

The volume of beach quality sand needed was reduced with the removal of the North Topsail portion of the project. Additionally, updated shoreline surveys and erosion calculations resulted in further refinement of the sediment volumes required for initial construction. These borrow areas were found to contain approximately 35.8 million cubic yards of beach quality sand providing sufficient sand for the dredging and placement of the estimated 50-year project need of approximately 21.8 million

cubic yards, a decrease of 10.5 MCY over the 2010 Feasibility/EIS estimate (**Table 16**). The 50-year project need includes the following:

Table 16.Summary of Volumes from 2010 Feasibility/EIS, 2013 EA and 2024 Estimated Project Volumes.

Year	2010 Feasibility/EIS Estimated Volume yd^{3*}	2013 EA Estimated Volume yd^{3*}	2024 Estimated Volume yd^{3*}
0	11,860,000	13,600,000	8,000,000
6	1,982,000	1,982,000	2,000,000
12	2,640,000	2,640,000	2,000,000
18	2,640,000	2,640,000	2,000,000
24	2,640,000	2,640,000	2,000,000
30	2,640,000	2,640,000	2,000,000
36	2,640,000	2,640,000	2,000,000
42	2,640,000	3,523,000	2,000,000
48	2,640,000	0	0
Total:	**32,300,000**	**32,300,000**	**22,000,000**

(*) - Volumes represent quantities to be removed from the borrow areas, which include +8.7% dredging loss and +15% overfill ratio.

~8.0 MCY for the initial construction and ~13.8 MCY for the seven nourishment events occurring over the life of the project, each one approximately every six years.

This EA addresses initial construction and the seven nourishment events occurring over the life of the project, each one approximately every six years totaling approximately 21.8 MCY for the life of the 50-year project.

Because all proposed offshore borrow areas are beyond the –35-foot contour and the proposed depth of closure for this project is –23 feet, infilling of the borrow areas because of longshore sediment transport processes is expected to be minimal. However, considering the shallow dredged volumes of material to be removed from the borrow areas, some infilling of sediments could still occur from other storm- and current-driven processes. Although some infilling of the borrow areas is anticipated from sedimentation and side sloughing, as well as wind- and tidal-driven currents, the bathymetric feature of the post-dredging borrow area would be expected to persist.

As part of the borrow area use plan, the contractor would 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.

Only beach quality material (defined as an average weighted fine-grained sediment content of less than 10% passing the #200 sieve) as outlined in the 2013 EA would be used. Beach quality material within the borrow areas generally ranges from Unified Soil Classification System classifications of SM (silty sand) to SP (poorly graded sand). Should rock or cemented sands be encountered and should they be found to be unavoidable, USACE would minimize the impact of rocks and cemented sand by using screening measures. USACE would work closely with the District contracting office to ensure that both a ¾-inch and 1.25-inch screening device is available. The Contractor shall deploy screening devices at the discretion and advisement of the Contracting Officer.

The No Action alternative is not expected to result in any significant adverse geologic impacts. For the other three alternatives evaluated, the removal and placement of beach quality dredged sediments are not expected to produce any significant adverse geologic impacts. Sediment impacts from dredging and placement would be the same for all three alternatives for the 50-year life of the project since the sediment quality and volumes removed would not vary between alternatives. Sediments within the borrow areas are continually subject to movement facilitated by strong currents. Redistribution of sediments is, therefore, a natural and continuous phenomenon.

Further Geotechnical information can be found in *Section 2.4*. Borrow area volumes are based on maximum dredging depth boundaries (or dredge cuts) within each borrow area (**Appendix C**). These boundaries are routed to avoid/buffer hardbottom habitat and are still under development for the dredging contracts. Dredging boundary configuration and volumetric estimates may change based on changing field conditions or collection of new data.

5.2 Beach and Dune

The area where beach placement would occur at Surf City is considered the beach community and encompasses a total of 445 acres, a decrease of approximately 36% as compared to the 2010 Authorized Plan that included North Topsail Beach. Approximately 33,300 feet of beach berm and dune would be constructed, a decrease from the 52,210 feet outlined in the 2010 Authorized Plan. Constructed dunes would be waterward of the first line of stable vegetation, would tie into existing dunes where practical, and be revegetated with native dune grasses to minimize effects. That would result in a seaward movement of the shoreline. However, short-term transient effects could occur to mammalian species using the dune and fore-dune habitat, but those species are mobile and would be expected to move to other,

undisturbed areas of habitat during construction and periodic nourishment events. During initial construction and nourishments, the active construction zone of the beach placement would cover approximately 1,000 feet of the beach of the 6-mile-long project. Progress along the beach for both initial construction and nourishment events would be expected to move along the beach at a relatively slow rate (i.e., about a mile per month or about 200 feet per day). Revegetation of dune areas would be expected to increase the amount and quality of habitat available to mammal and avian species dependent on those areas.

Project construction would result in disturbance and removal of some of the existing vegetation along the seaward side of the existing dune. However, construction would be followed by measures designed to stabilize the constructed dunes. Dune stabilization would be accomplished by planting vegetation on the dune during the optimum planting seasons and after the berm and dune construction. Planting stocks would consist of sea oats (Uniola paniculata), American beachgrass (Ammophila breviligulata), panic grass (Panicum amarum), and seaside little bluestem (Littoralis variety). The vegetative cover would extend from the landward toe of the dune to the seaward intersection with the storm berm for the length of the dune. Sea oats would be the predominant plant with American beach grass and panic grass as a supplemental plant. Seaside little bluestem would be planted on the backside of the dune away from the most extreme environment. Planting would be accomplished during the season best suited for the plant.

Periodic nourishment of the project would involve placing material along the berm. Therefore, minimal impacts to dune vegetation would be expected from implementing the project. Nourishment operation at Surf City would be expected to directly affect ghost crabs through burial (USACE, 2004b; Lindquist and Manning, 2001; Peterson et al., 2000; Reilly and Bellis 1983). Because ghost crabs are vulnerable to changes in sand compaction, short-term effects could occur from changes in sediment compaction and grain size. It is expected that ghost crab populations would recover within one-year post-construction (USACE, 2004b; Lindquist and Manning, 2001; Peterson et al., 2000; Reilly and Bellis 1983). The beach community is comprised of a dry berm zone located beyond the high tide line, an intertidal zone that is alternately covered and exposed by tidal action, and a subtidal zone that occurs below the low tide line and extends seaward, merging with the ocean surf. In general, beaches are gently sloping communities that serve as transitional areas between open water and upland terrestrial communities. These communities experience almost continuous changes as they are exposed to erosion and deposition by winds, waves and currents. Sediments are unstable and vegetation is absent. Wave action, longshore currents, shifting sands, tidal rise and fall, heavy predation, and extreme temperature and salinity fluctuations combine to create a rigorous environment for macroinvertebrates.

Terrestrial areas that may be influenced by the proposed action include a 6-mile area that includes all of Surf City. Terrestrial habitat types within the areas include sandy or sparsely vegetated beaches and vegetated dune communities. The first line of stable vegetation is outside or landward of the proposed project limits. Utility corridors may have herbaceous or shrub cover. Barren areas are also widespread because of the disturbed nature of the utility corridors. Mammals occurring in this environment are opossums, cottontails, red foxes, gray foxes, raccoons, feral house cats, shrews, moles, voles, and house mice.

Among North Carolina's upland habitats, the beach and dune community could be considered depauperate in both plants and animals. The beach environment is severe because of constant exposure to salt spray, shifting sands, wind, and sterile soils with low water retention capacity. Common vegetation of the upper beach includes beach spurge (Euphorbia polygonifolia), sea rocket (Cakile edentula) and pennywort (Hydrocotyle bonariensis). The dunes are more heavily vegetated, and common species are American beach grass (Ammophila breviligulata), panic grass (Panicum amarum), sea oats (Uniola paniculata), broom straw (Andropogon virginicus), seashore elder (Iva imbricata), and salt meadow hay (Spartina patens) (Nash and Rogers, 2003). Important macroinvertebrates of the beach/dune community are the mole crab (E. talpoida), coquina clams (D. variabilis) and ghost crabs (O. quadrata).

Ghost crabs occupy the upper zone of the beach environment and function as an important predator in the beach community. Up to 60 percent of their diet consists of mole crabs; up to 25 percent consists of coquina clams (Wolcott, 1978). During the sea turtle nesting season, ghost crabs are also known to prey on incubating sea turtle eggs and newly hatched sea turtle hatchlings. O. quadrata is the only ghost crab occurring in the southeastern United States and, though little is known regarding its life history aspects, their various reproductive and larval components most likely reflect that of other decapods. Although timing of recruitment is poorly understood, it most likely occurs between late spring and early fall (Hackney et al., 1996).

Alternative 1– No Action: Long term erosion is expected to reduce sandy or sparsely vegetated beach and vegetated dune communities, reducing the plant and animal community habitat.

Alternative 2a – Surf City only with Environmental Windows. Project construction and nourishment activities associated with use of hopper dredging equipment would be constrained to the December 1 to March 31 hopper dredging window. The periodic nourishment intervals would remain at six years with a total of seven nourishment events occurring over the life of the project.

Compared to the 2010 Authorized Plan, this alternative would result in a decrease of approximately 5.3 months during initial construction and 1.8 months during

nourishments. The number of disturbance events for initial constructions would be four, as opposed to six for the 2010 Authorized Plan. Nourishments would still take two seasons to complete. The upper beach and dune vegetation would be impacted short term during construction or nourishment activities, but overall impacts would be minor and temporary due to post construction revegetation. Short-term transient effects could occur to mammalian species using the dune and fore-dune habitat, but those species are mobile and would be expected to move to other, undisturbed areas of habitat during construction and periodic nourishment events. Only a portion of the beach and borrow areas would be impacted as the sediment is dredged and placed, allowing for recovery of ghost crab feeding habitat. It is expected that ghost crab populations would recover within one-year post-construction and no significant long-term impacts to the ghost crab population would be expected. Overall, impacts to the beach and dune would be minor, temporary and localized.

Alternative 2b – Surf City Only with Expanded Environmental Windows. Shortening the project length by approximately four miles and reducing the amount of beach quality sand dredged and placed for initial construction has resulted in an approximate 5.3 month decrease in the total time of work. Also, with expanded environmental windows for initial construction (November 16 through April 30), work would span over three seasons, one fewer than Alternative 2a. Nourishment events would also see expanded environmental windows and would be completed in one dredging season, unlike two seasons for Alternative 2a.

During nourishments, the expansion of the environmental window (November 16 to April 30) and placement, would avoid the times of highest biological activity. During periodic nourishments, if the dune is under the design template height or if the dredging contractor damages the dune, dune stabilization would be accomplished by planting vegetation on the dune during the optimum planting season following nourishment in accordance with the USFWS Dune Planting Guidelines for North Carolina Beaches November 20, 2019 (**Appendix N**). Expanding the windows to allow dredging and placement from November 16 to April 30 would increase the potential of short-term impacts to plants and animals that utilize this habitat. Due to the mobile nature of the mammalian species, dune stabilization procedures and short recovery time for ghost crabs, this alternative would have no significant impact to the beach and dune terrestrial environment. Impacts to the beach and dune would be like Alternative 2a., but with potential to work when times of higher biological activity. Overall, these alternative impacts would be minor, temporary and localized.

Alternative 2c – Surf City Only with no Environmental Window for Initial Construction and an Expanded Environmental Window for Nourishment Events (Proposed Action). Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months, resulting in only one disturbance event as opposed

to the Alternative 2b, which would require three disturbance events over three seasons. Only a portion of the beach and borrow areas would be impacted as the sediment is dredged and placed. As beach sections are completed, they would not be disturbed again until nourishment. Overall, these alternative impacts would be minor, temporary and localized.

5.3 Water Quality

All surface waters in North Carolina are assigned a primary classification by the North Carolina Division of Water Resources (NCDWR) (15A NC Administrative Code 02B .0301 to .0317). Waters in the vicinity of Topsail Island fall into three classifications:

1. SA- tidal salt waters that are used for commercial shell fishing or marketing purposes and are also protected for all Class SC and Class SB uses.
2. SB- tidal salt waters protected for all SC uses in addition to primary recreation such as swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis.
3. SC- all tidal salt waters protected for secondary recreation such as fishing, boating, and other activities involving minimal skin contact; fish and noncommercial shellfish consumption; aquatic life propagation and survival; and wildlife uses.

Waters of the Atlantic Ocean between Drum Inlet and Baldhead Island are classified as SB and are suitable for primary recreation, including frequent or organized swimming and all SC uses. Stormwater controls are required under the federal Coastal Zone Management Act (CZMA), and there are no categorical restrictions on discharges. All other surface waters in the vicinity, including the New River, Atlantic Intracoastal Waterway (AIWW), Topsail Sound, and Banks Channel, meet the SA classification. All SA waters are High Quality Waters (HQW) by definition, and stormwater controls are required, and domestic discharges are prohibited by the NCDWR. HQW are a supplemental classification intended to protect waters which are rated excellent based on biological and physical/chemical characteristics through NCDWR monitoring or special studies, primary nursery areas designated by the NC Marine Fisheries Commission, and other functional nursery areas designated by the NC Marine Fisheries Commission.

Waters of the AIWW from Daybeacon # 17 (between Chadwick Bay and Alligator Bay landward of the northern portions of North Topsail Beach) to Morris Landing (south of Spicer Bay landward of the southern portion of North Topsail Beach) and waters of Topsail Sound southward from approximately New Topsail Inlet to Middle Sound are classified as SA Outstanding Resource Waters (ORW). The ORW designation is a supplemental classification intended to protect unique and special waters having excellent water quality and an exceptional state or national ecological

or recreational significance. No new or expanded wastewater discharges are allowed in these waters.

Waters of that classification must have one of the following outstanding resource values:

- Outstanding fish habitat or fisheries
- Unusually high level of water-based recreation
- Some special designation such as North Carolina or National Wild/Scenic/Natural/Recreational River, National Wildlife Refuge
- Important component of state or national park or forest
- Special ecological or scientific significance (rare or endangered species habitat, research, or educational areas)

The potential water quality impacts of dredging and placement have been addressed in the documents incorporated by reference in Section 1.6; however previous NEPA documents prepared by the Wilmington District have not addressed water quality impacts related to hopper dredging in the spring and summer months. Overall, the dredging and placement of beach quality sand from the proposed project would not have any significant impacts on water quality as discussed in detail below.

During initial construction and nourishments, the active construction zone of the beach placement would cover approximately 1,000 feet of the beach of the 6-mile-long project. Progress along the beach for both initial construction and nourishment events would be expected to move along the beach at a relatively slow rate (i.e., about a mile per month or about 200 feet per day). Sand dikes would be used during beach placement to reduce turbidity. Sand dikes are constructed with earth-moving equipment and run parallel with the existing beach. Typically, a sand dike is constructed from the existing beach sand and runs several hundred feet in front of the sand discharge location. The sand dike allows a space where the discharged slurry would have space to allow settling of heavy and finer particles, allowing the water discharging into the open waters to be less sediment-laden than without the sand dike.

Dredging and placement of beach quality material increases the suspended sediments in the water column (total suspended solids) which can affect species or habitat by burying it as the sediment settles, or sediments can be harmful to fish gills. If the sediment in the water column is nutrient rich or contains oxygen depleting chemicals, it can deplete oxygen in the surrounding water, potentially leading to anoxic or hypoxic conditions that are harmful to species that are not air breathing, like sea turtles and marine mammals. Suspended sediments also affect turbidity, an optical property of water (measured in nephelometric turbidity units, or NTUs) that affects light penetration into the water column. During dredging, turbidity increases outside the dredging area should be less than 25 NTUs, which is considered insignificant. In the case of overflowing hopper dredges or scows to obtain economic loading, sediment that is ≥90% sand is not likely to produce

significant turbidity or other water quality impacts (USACE 1997). The material to be removed from the borrow areas would be comprised of ≥90% sand. Sandy material is heavier than fine silt or clay, so it falls out of suspension more quickly, resulting in less turbid waters. Based on past research, dredging and placing beach quality material have proven to have little to no effect on water quality since material would dissipate from the water column relatively rapidly.

USACE Wilmington District and the US Army Engineer Research and Development Center (ERDC) conducted a study monitoring water quality level (suspended sediment, turbidity and DO) during trailing-suction- hopper dredge operations at Beaufort Inlet, NC (July 2020) and the Cape Fear Inlet, NC (June 2021) (Balazik 2022a, Balazik 2022b). Both ERDC and the NC Department of Environment Quality (NCDEQ) conducted water quality sampling. The report concluded the dredging did increase turbidity values around 2 NTU up to 11 NTU but those peak values only lasted a few minutes and therefore was considered insignificant to water quality (Balazik 2022a). Because the sediment from the proposed borrow area would likely be coarser than Beaufort or Cape Fear Inlet, turbidity values are not expected to reach the same levels. It is expected turbidity would also be insignificant for the proposed action. More information regarding suspended sediments and turbidity can be found in the Essential Fish Habitat Evaluation (see **Appendix H**).

The 2010 Authorized Plan showed the anticipated maximum dredging depths and subsequent post-dredge surface elevations for borrow areas based on vibracore data. The thickness range of beach quality material was 2 to 14.8 feet, with the average being 3.5 to 6.4 feet and the post-dredging surface elevation was –40.5 to –60.8 feet. The maximum dredge depths did not change, and therefore the post-dredge surface elevation for this project would be the same as stated in the 2010 Authorized Plan. But there would be slightly different cut depressions due to the change in pre-dredging surface elevations as shown from the 2020 bathymetric surveys. The estimated changes in bathymetry for each borrow area due to the PED-level data collection and analysis resulted in -3.6 to +2.04 feet range of pre-dredging surface elevation with the difference averaging between -0.25 to +0.39 feet. The changes in bathymetry and post-dredge elevations since evaluated in the 2010 Feasibility /EIS would not result in the project having any significant anoxic pockets due to excessive dredge depth.

Pursuant to Section 401 of the Clean Water Act of 1977 (P.L. 95- 217), as amended, a Water Quality Certification (WQC) is required for this proposed project and will be obtained before any work is started. All conditions of the water quality certification would be implemented to minimize adverse impacts to water quality. As part of the NCDCM consistency conditions of the 2010 Feasibility/EIS, the USACE, in conjunction with ERDC, would conduct monitoring of sedimentation effects from dredging activities within the 122-m (400-foot) hardbottom buffer. Various water quality monitoring equipment would be used to determine the sediment resuspension in the area and potential deposition on hard-bottom habitat. Handheld

water quality units would be used to take point samples around the dredge to track any potential dredge plumes. Continuous water quality monitoring sondes would be placed at stations along the edges of hard-bottom habitats. A sondes particle analyzer would be used to monitor turbidity, total suspended solids and dissolved oxygen. Stations would likely move depending on where the dredge is digging and water currents. Underwater cameras may also be used to monitor for any sediment deposition on hard-bottom habitat.

Pursuant to Section 404 of the Clean Water Act, the impacts associated with the discharge of fill material into waters of the United States are discussed in the Section 404(b)(1) (P.L. 95-217) Guidelines Analysis in **Appendix I**. Discharges associated with dredging in the offshore borrow areas are considered incidental to the dredging operation, and therefore, are not being considered as being a discharge addressed under the Section 404(b)(1) Guidelines Analysis.

Alternative 1 (No Action). This alternative would have no effect to water quality.

Alternative 2a – Surf City Only with Environmental Windows. Shortening the project length by approximately four miles and reducing the amount of beach quality sand dredged and placed for initial construction has resulted in an approximate 5.3 month decrease in the total time of work (from 16 months). Initial construction would span over four seasons, two more than the 2010 Authorized Plan that included North Topsail Beach. Nourishment events would still be completed in two dredging seasons. All work would be required to occur from December 1 to March 31, initial construction would span four dredging seasons, requiring four disturbance events to construct the project. A total of seven nourishment events would occur over the life of the project, with one approximately every six years. Dredging and placement activities that occur from December 1 to March 31 would be during times of low biological activity when water temperatures are cooler. Dissolved Oxygen levels may decline naturally in the summer months in rivers in the southeast; however, Wilmington and Morehead City water quality historic records do not indicate a significant drop in dissolved oxygen during summer months. The water quality studies completed in 2020 (Balazik 2020a, Balazik 2020b) support that changes in water quality from dredging in these areas during summer months is localized and temporary. The borrow areas are in open ocean areas and therefore are expected to have adequate water flow to ensure good water quality including sufficient DO year-round. The changes in DO concentrations caused by dredging are confined to areas relatively close to where the equipment operates and DO concentrations return to background levels within hours, therefore changes in DO due to this alternative are not expected to be significant. Although there would be slightly different cut depressions compared to the 2010 Feasibility/EIS due to the change in pre-dredging surface elevations, deep depressions due to this alternative are not anticipated.

Some infilling of the borrow area after dredging would be expected from side sloughing of native bottom sediments, which consist of predominately sandy material with a small amount of fine or organic material. Significant increases in turbidity are not expected to occur outside the immediate construction/maintenance area (turbidity increases of 25 or less are not considered significant). Turbid waters (increased turbidity relative to background levels but not necessarily above 25 NTUs) would hug the shore and be transported with waves either northeast or southwest depending on wind conditions. Because of the low percentage of silt and clay in the borrow areas (less than 10 percent), turbidity impacts would not be expected to be greater than the natural increase in turbidity and suspended material that occurs during storm events. Any increases in turbidity in the borrow areas during project construction and maintenance would be expected to be temporary and limited to the area surrounding the dredging. Turbidity levels would be expected to return to background levels in the surf zone when dredging ends.

Overall, the decrease of project length, time to construct and quantities to dredge and place reduce the overall impact of this alternative as compared to the 2010 Authorized Plan but would still result in temporary and minor effects on water quality due to turbidity increases in the nearshore and in the offshore borrow areas.

Alternative 2b – Surf City Only with Expanded Environmental Windows. Shortening the project length by approximately four miles and reducing the amount of beach quality sand dredged and placed for initial construction has resulted in an approximate 5.3 month decrease in the total time of work. Also, with expanded environmental windows for initial construction, work would span over three seasons, one fewer than Alternative 2a. Nourishment events would still be completed in two dredging seasons.

Expanding the dredging window for initial construction and nourishment events to November 16 to April 30 would not limit work to the winter months only, allowing dredging to occur when water temperatures are warmer and biological activity is higher. Dissolved Oxygen levels may decline naturally in the summer months in rivers in the southeast; however, Wilmington and Morehead City historic records do not indicate a significant drop in dissolved oxygen during summer months. The water quality studies completed in 2022 (Balazik 2022a, Balazik 2022b) support that changes in water quality from dredging in these areas during summer months is localized and temporary. The borrow areas are in open ocean areas and therefore are expected to have adequate water flow to ensure good water quality including sufficient DO year-round. The changes in DO concentrations caused by dredging are confined to areas relatively close to where the equipment operates and DO concentrations return to background levels within hours. Although there would be slightly different cut depressions compared to the 2010 Feasibility/EIS due to the change in pre-dredging surface

elevations, deep depressions due to this alternative are not anticipated. Dredging associated with this alternative could reduce the DO concentrations during each dredging event over three seasons totaling approximately 16 months for initial construction. Nourishment events are expected once every six years totaling approximately 5.5 months per season. However, it is anticipated those effects would be temporary, and therefore insignificant.

Increased turbidity, especially where fine-grained material is present, may influence the egg, larvae and early juvenile critical life stages of important fisheries that exist within the ocean; however, borrow sites have been evaluated to identify beach quality material for placement on the beach, so very little dredging of fine-grained material is anticipated. **Table 17** summarizes the presence of fisheries species during the April to November timeframe according to the *Assessment of Fisheries Species to Inform Time of Year Restrictions for North and South Carolina* published by the National Oceanic and Atmospheric Administration-National Centers for Coastal Ocean Science (NOAA NCCOS) in 2019 (hereon referred to as Wickliffe et al. 2019).

For initial construction, the proposed expanded environmental window would result in a potential increase in the duration of disturbance from 4 months to 5.5 over three dredging seasons and three disturbance events. Some infilling of the borrow area after dredging would be expected from side sloughing of native bottom sediments, which consist of predominately sandy material with a small amount of fine or organic material. Significant increases in turbidity are not expected to occur outside the immediate construction/maintenance area (turbidity increases of 25 or less are not considered significant). Turbid waters (increased turbidity relative to background levels but not necessarily above 25 NTUs) would hug the shore and be transported with waves either northeast or southwest depending on wind conditions. Because of the low percentage of silt and clay in the borrow areas (less than 10 percent), turbidity impacts would not be expected to be greater than the natural increase in turbidity and suspended material that occurs during storm events. Any increases in turbidity in the borrow areas during project construction and maintenance would be expected to be temporary and limited to the area surrounding the dredging. Turbidity levels would be expected to return to background levels in the surf zone when dredging ends.

Several important fishery species may be present due to warmer water temperatures in the fall and spring; however, it’s expected that mobile species would leave areas of disturbance, returning soon after turbidity dissipates.

With implementation of this alternative, the anticipated volumes of fine-grained sediments within the identified borrow areas and associated dredging and dredged material placement anticipated from work in the project area, would result in temporary and minor impacts to water quality. Living marine resources

dependent upon good water quality should not experience significant long-term adverse impacts due to water quality changes from dredging or material placement in the nearshore placement areas. Therefore, this alternative would have no significant negative effect on water quality.

Table 17. Presence of Important Fisheries Species (Eggs, Larvae and Early Juveniles) from April – November.

	April	*May*	*June*	*July*	*August*	*September*	*October*	*November*
River	Atlantic Sturgeon, American Shad, River Herring	Atlantic sturgeon, American Shad, River Herring	Atlantic sturgeon, American Shad, River Herring	River Herring	Atlantic sturgeon, River Herring	Atlantic sturgeon	Atlantic sturgeon	Atlantic sturgeon
Inlet	White Shrimp, Blue Crab, Gag Grouper, Summer Flounder	White Shrimp, Pink Shrimp, Blue Crab	White Shrimp, Pink Shrimp, Blue Crab	Pink Shrimp, Blue Crab	Blue Crab	Blue Crab	Blue Crab	Southern Flounder
Estuary	White Shrimp	White Shrimp, Gag Grouper	White Shrimp, Gag Grouper	White Shrimp	Red Drum	Red Drum	Red Drum	N/A
Ocean	Pink Shrimp, Blue Crab, Gag Grouper, Summer Flounder	Pink Shrimp, Blue Crab, Gag Grouper	Pink Shrimp, Blue Crab	Pink Shrimp, Blue Crab	Blue Crab	Blue Crab	Brown Shrimp, Summer Flounder	Brown Shrimp, Summer & Southern Flounder
Total	**8 species**	**8 species**	**7 species**	**4 species**	**4 species**	**3 species**	**5 species**	**4 species**

- **Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action).** Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months, resulting in only one disturbance event as opposed to Alternative 2b that utilizes three disturbance events over three seasons. Increased turbidity would occur during this time as well; however,

sediments are anticipated to be comprised of ≥90% sand and therefore not likely to produce significant turbidity or other water quality impacts. Suspended sediments in the water column (total suspended solids) can affect species or habitat by burying it as the sediment settles, or sediments can be harmful to fish gills. If the sediment in the water column is nutrient rich or contains oxygen depleting chemical, it can deplete oxygen in the surrounding water potentially leading to anoxic or hypoxic conditions that are harmful to species that are not air breathing like sea turtles and marine mammals. Species that cannot move to avoid the effects would be temporarily impacted. Sedimentation effects on hardbottoms and proposed monitoring are discussed in detail in *Section 5.4.5 Essential Fish Habitat*.

Twice as many important fisheries species are present during the spring months of April – June as compared to July – November. Due to the increased number of species present from April to June, reduction in water quality may have an increased adverse effect as compared to Alternative 2a and 2b. However, the area of disturbance, or the active construction zone of the beach nourishment is expecting to cover approximately 1,000 feet of the 6-mile-long project as compared to areas of non-disturbance, impacts are not expected to be significant. During any given dredging and placement activity, it's expected that mobile species, such as the North Atlantic Right Whale, would leave areas of disturbance, returning soon after turbidity dissipates.

Overall water quality impacts of the proposed action would be of longer continuous duration and may occur during higher biological activity, but the total frequency of disturbances over the duration of project construction as compared to Alternatives 2a and 2b would be fewer. The proposed action would result in one disturbance event over 16 continuous months of construction while Alternative 2b would have three disturbance events over three seasons. Impacts to water quality during periodic nourishment events, which are anticipated to take about 5.5 months days every six years, would be of much shorter duration than impacts resulting from initial construction and would occur between November 16 and April 30 of any given year. The proposed action would result in short-term, and minor increases in turbidity in the immediate vicinity of dredging and placement; however, living marine resources dependent on good water quality should not experience significant adverse impacts.

5.4 Marine Environment

5.4.1 Surf Zone and Nearshore Ocean Fishes

The Southeast Area Monitoring and Assessment Program-South Atlantic (SEAMAP-SA) has conducted annual nearshore (depths 15-60 feet) trawl surveys for demersal fishes in Onslow Bay since 1986. Catches have been consistently dominated by sciaenid fish that utilize estuaries during part of their life cycle (SEAMAP-SA 2001). Overall patterns of demersal fish abundance are strongly influenced by the high abundance of spot and Atlantic croaker. These two species have been consistently dominant, accounting for more than 36% of the total catch between 1990 and 1999. Other abundant demersal fishes in this

region include the Atlantic bumper (Chloroscombrus chrysurus), scup, pinfish, star drum (Stellifer lanceolatus), banded drum (Larimus fasciatus), gray trout (Cynoscion regalis), silver seatrout (C. nothus), southern kingfish, and inshore lizardfish (SEAMAP-SA 2001).

Peterson and Wells (2000) documented seasonal variations (November, February, and May) in demersal fish communities at inshore (approximately one mile) and offshore (approximately five miles) soft bottom sites off the southern NC coast. In November, catches at the offshore sites were dominated by spot (>50% of total catch), pinfish, pigfish, and croaker; while the inshore sites were dominated by croaker, silver perch (Bidyanus bidyanus), Atlantic silversides, pinfish, and striped mullet (Mugil cephalus). In February, total catches at the offshore and inshore sites were reduced by 96% and 59%, respectively. Pinfish, Atlantic menhaden, and silversides collectively accounted for 96.4% of the total combined inshore/offshore catch in February. The combined inshore/offshore totals for spot and croaker were reduced by 98.9% and 99.8%, respectively, and catches of all other taxa decreased sharply, except for silversides and pinfish at the inshore sites. During the May sampling period, large numbers of Atlantic silversides and Atlantic threadfin herring (Opisthonema oglinum) increased the total inshore catch. Peterson and Wells (2000) also analyzed the stomach contents of demersal fishes that were caught during the November sampling period and found that croakers and pinfish were primarily consuming polychaete worms, bivalves, grass shrimp, and pinnotherid crabs. Silver perch, pigfish, and spot consumed polychaetes, grass shrimp, and other small bottom-dwelling crustaceans. Gray trout consumed grass shrimp, penaeid shrimp, and portunid crabs, whereas kingfishes primarily consumed pinnotherid crabs, portunid crabs, and large polychaete worms.

When North Topsail Beach dropped out of the project, the project length was shortened by approximately four miles which reduced the amount of beach quality sand dredged and placed and a decrease of approximately 5.3 months of total time of work (from 21.3 months to 16 months). Nourishment events would also see a decrease of approximately 1.8 months (from 7.3 months to 5.5 months).

Waters within nearshore areas are more dynamic and susceptible to higher turbidity, especially during storms. Species that depend on these areas are commonly more tolerant of elevated turbidity levels. Any fine-grained material can remain in suspension during hopper dredging and overflow, potentially clogging gills of fish present within the water column. The material to be removed from the borrow areas would be comprised of ≥90% sand and expected to contain very little fines. Depending on sea conditions, turbidity can be detected as far as two miles, possibly due to the elevated concentration of low-

density organic matter from fragmented benthos discharged during sorting (Newell et al. 2003).

The primary organisms subject to entrainment by hopper dredges are bottom-oriented fishes and shellfishes (flounder, crabs, skates and stingrays). Organisms resting, feeding, or inhabiting the bottom would be closer to the suction field of the draghead and, therefore, at higher risk. Both demersal and pelagic fish eggs and larvae are susceptible to entrainment, as well as other slow-moving organisms found in nearshore habitats. However, a dredge operating in an open ocean environment would pump a very small amount of water in proportion to the surrounding water volume. Fish may be captured if relocation trawling is implemented, but the amount is expected to be minor.

Dredging and placement of beach fill may create impacts in the marine water column in the immediate vicinity of the activity, potentially affecting the surf zone and nearshore ocean fishes. These impacts may include minor and short-term suspended sediment plumes and related turbidity.

Alternative 1 (No Action). This alternative would have no effect on surf zone and nearshore ocean fishes.

Alternative 2a – Surf City Only With Environmental Windows. Under Alternative 2a, dredging and placement occur during the winter months (December through March) due to the window restrictions included in the 2010 Feasibility/EIS. Initial construction would span four dredging seasons, requiring four disturbance events due to dredges and all other required equipment in the water and on the beach. A total of seven nourishment events occurring over the life of the project, each one approximately every six years. Dredging and placement activities that occur from December 1 to March 31 would be during times of low biological activity. During the December through March timeframe, the marine environment within the surf zone and nearshore areas of Surf City contain critical life stages of brown shrimp, summer and southern flounder, and gag grouper; important ocean-dwelling fishery species (**Table 18**). Disposal and subsequent turbidity increases may have short-term effects on surf zone and nearshore fishes and prey availability. However, the opportunistic behavior of the organisms within the dynamic surf zone environment enables them to adapt to short-term disturbances. Effects on surf zone and nearshore fishes are not expected to be significant because construction-related activities in

Table 18. Summary of the Most Sensitive Life Stages (Eggs, Larvae and Early Juveniles) for Each of the Fisheries Species in the Ocean Throughout the Year.

Fishery Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Brown Shrimp	■									■	■	■
Pink Shrimp				■	■	■	■					
Blue Crab				■	■	■	■	■	■			
Gag Grouper			■	■	■							
Summer Flounder	■	■	■	■						■	■	■
Southern Flounder	■	■									■	■

*Green boxes represent abundant eggs and/or larvae present (Wickliffe et al. 2019).

the offshore borrow areas and on beaches proposed for nourishment would be localized. A study of nearshore borrow areas after dredging offshore of South Carolina revealed no long-term effects on fishery and planktonic organisms, because of the dredging (Van Dolah et al., 1992). Reducing the overall time to construct the project and to do the periodic nourishments has decreased the duration of impacts for this alternative as compared to the 2010 Feasibility/EIS. Because of the adaptive ability of representative organisms in the area and the avoidance of peak recruitment and abundance time frames with a December 1 to March 31 construction timeframe, such effects would be expected to be temporary and minor.

Alternative 2b – Surf City Only With Expanded Environmental Windows. For initial construction and nourishment events, the proposed expanded environmental window would result in an increase in the duration of disturbance from 4 months to 5.5 months. Initial project construction would be completed over three seasons, requiring three disturbance events as compared to four dredging seasons and four disturbance events under Alternative 2a. Expanding the dredging window for initial construction and nourishment events would allow dredging to occur when water temperatures are warmer and biological activity is higher but would not result in any significant impacts to the surf zone and nearshore marine habitat beyond those described above. Dredging and placement would disturb the same areas disturbed in Alternative 2a; no additional dredging or beach placement would occur.

Critical life stages of the species identified in Alternative 2a (brown shrimp, gag grouper, summer and southern flounder) with the addition of pink shrimp and blue crab, may be present within and around the borrow areas during dredging and at risk of being affected by turbidity, entrainment by the dredge, or relocation trawling (see **Table 18**); however, impacts would not be significant due to the abundance of habitat in the ocean as compared to the footprint of the identified borrow sites and the areas disturbed by placement.

Alternative 2c – Surf City only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and would be ongoing, without interruption, for up to 16 months resulting in only one disturbance event as opposed to Alternative 2b that utilizes three disturbance events over three seasons. Impacts of the proposed action would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbance over the duration of project construction as compared to Alternative 2b would be less.

Potential impacts to fisheries in the surf zone and nearshore areas would be predominantly due to entrainment from the dredge or relocation trawling and turbidity. Entrainment impacts in the identified borrow areas are expected to be

insignificant for this proposed project. A very small percentage of demersal and pelagic fishes are subject to entrainment, so dredging is not expected to significantly affect the local or regional populations. Dredging in the months that are outside the beach placement window of November 16 through April 30 would have the most effect on the pink shrimp, blue crab and gag grouper that are spawning or in critical early life stages May through October (see **Table 18**). Bottom dwellers and feeders within the borrow and placement areas would be more abundant during the warmer months of the year, increasing their risks to the effects of dredging and dredged material placement. During initial construction and nourishments, the active construction zone of the beach placement would cover approximately 1,000 feet of the beach of the 6-mile-long project. Progress along the beach for both initial construction and nourishment events would be expected to move along the beach at a relatively slow rate (i.e., about a mile per month or about 200 feet per day). Such a rate of progress is slow enough that surf-feeding fishes could move to other areas not affected by the nourishment operation. As the dredging operation passes by a section of beach, that area would be available for recolonization by invertebrates. Even though new species may be present in higher abundance and in varying life stages as compared to alternative 2b and 2c, the impacts would still be short term and recoverable based on continued implementation of the 2010 environmental commitments and any new commitments established as a component of this analysis. Overall, these impacts would be minor when considering the abundance of habitat in the ocean as compared to the footprint of the identified borrow sites and the areas disturbed by placement.

5.4.2 Nekton

Oceanic nekton are active swimmers, not at the mercy of the currents, and are distributed in the relatively shallow oceanic zone. They are composed of three phyla-chordates, mollusks, and arthropods, with chordates (i.e., fish species) forming the largest portion. Any entrainment of adult fish, and other motile animals in the vicinity of the borrow areas during dredging would be expected to be minor because of their ability to actively avoid the disturbed areas. Fish species are expected to leave the area temporarily during the dredging operations and return when dredging ceases (Pullen and Naqvi, 1983). Larvae and early juvenile stages of many species pose a greater concern than adults because their powers of mobility are either absent or poorly developed, leaving them subject to transport by tides and currents. That physical limitation makes them potentially more susceptible to entrainment by an operating dredge. Benthic-oriented organisms close to the dredge draghead could be captured by the effects of its suction field and entrained in the flow of dredged sediment and water. As a worst-case, it could be assumed that entrained animals experience 100 percent mortality, although some small number might survive. Nekton may be captured if relocation trawling is implemented, but the amount is expected to be minor. Susceptibility to this effect depends on avoidance reactions of the organism, the efficiency of its swimming ability, its proximity to the draghead, the pumping rate of the dredge, and possibly other factors.

The biological effect of hydraulic entrainment has been a subject of numerous studies conducted nationwide to assess its effect on early life stages of marine resources, including larval oysters (Carriker et al., 1986), post-larval brown shrimp (Van Dolah et al., 1994), striped bass eggs and larvae (Burton et al., 1992), juvenile salmonid fishes (Buell, 1992), and Dungeness crabs (Armstrong et al., 1982). The studies indicate that the primary organisms subject to entrainment by hydraulic dredges are bottom-oriented fishes and shellfishes. The significance of entrainment effects depends on the species present; the number of organisms entrained; the relationship of the number entrained to local, regional, and total population numbers; and the natural mortality rate for the various life stages of a species. Assessing the significance of entrainment is difficult, but most studies indicate that the significance of impact is low.

Dredging and placement of beach fill may create impacts to nekton. These impacts may include minor and short-term suspended sediment plumes and related turbidity.

Alternative 1 (No Action). This alternative would have no effect on nekton.

Alternative 2a – Surf City Only With Environmental Windows. Under Alternative 2a, dredging and placement would occur during the winter months (December through March) due to the window restrictions in the 2010 Feasibility/EIS. Initial construction would span four dredging seasons, requiring four disturbance events due to dredges and all other required equipment in the water and on the beach. A total of seven nourishment events, one approximately every six years, would occur during the 50-year project life. Dredging and placement activities that occur from December 1 to March 31 would be during times of low biological activity. Although entrainment of benthic-oriented organisms would be expected from the proposed dredging activities, a dredge operating in the open ocean would pump such a small amount of water in proportion to the surrounding water volume that any entrainment effects associated with dredging of borrow material for the project are not expected to adversely affect species at the population level. Nekton may be captured if relocation trawling is implemented, but the amount is expected to be minor.

Alternative 2b – Surf City Only With Expanded Environmental Windows. For initial construction and nourishment events, the proposed expanded environmental window of November 16 to April 30 would result in an increase in the duration of disturbance from 4 months to 5.5 months. Initial project construction would be completed over three seasons, requiring three disturbance events as compared to four dredging seasons and four disturbance events under Alternative 2a. Expanding the dredging window for initial construction and nourishment events would allow dredging to occur when water temperatures are warmer and biological activity is higher but would not result in any significant impacts to nekton beyond those described above.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Except for initial construction, impacts of this

alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months resulting in only one disturbance event as opposed to Alternative 2b that utilizes three disturbance events over three seasons. Impacts of the proposed action would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2b would be less. Overall, this alternative would result in no significant effects on nekton.

5.4.3 Larval Entrainment

New Topsail and New River Inlets are important passageways for the larvae of many species of commercially or ecologically important fish. Spawning grounds for many marine fishes are believed to occur on the continental shelf with immigration to estuaries during the juvenile stage. The shelter provided by the marsh and creek systems in the sound serves as nursery habitat where young fish undergo rapid growth before returning to the offshore environment.

Those free-floating planktonic larvae lack efficient swimming abilities and are, therefore, susceptible to entrainment by an operating hydraulic or hopper dredge as they immigrate from offshore to inshore waters. However, all the proposed borrow areas are between 1 and 5 miles offshore, and none of the borrow areas are in the vicinity of the New River Inlet or New Topsail Inlet complexes. Therefore, though concentrations of larvae would likely be present within offshore borrow areas, dredging activities would not occur in the highest concentration inlet bottleneck areas.

As described in Section 8.01.4 of the 2010 Feasibility/EIS, under the worst-case scenario with the highest concentrations of larvae possible based on spatial and temporal distribution patterns, the maximum percentage entrained barely exceeds 0.1 percent per day. Although any larvae entrained (calculations indicate 914 to 1.8 million depending on the initial concentration in the tidal prism) would likely be killed, the effect at the population level would be expected to be insignificant (Settle 2002). Based on those calculations indicating an *insignificant* larval entrainment impact, at the population level, from hydraulic dredging activities within a representative high concentration *inlet bottleneck* at Beaufort Inlet, North Carolina, the risk of larval entrainment from dredging activities in the offshore borrow areas associated with this project would likely be even less and would not be expected to adversely affect marine fish larvae.

Alternative 1 (No Action). This alternative would have no effect on larvae of commercially or ecologically important fish.

Alternative 2a – Surf City Only With Environmental Windows. Initial construction would span four dredging seasons, requiring four disturbance events due to dredges and all other required equipment in the water and on the beach. A total of seven nourishment events occurring over the life of the project,

each one approximately every six years. Dredging and placement activities that occur from December 1 to March 31 would be during times of low biological activity and during critical larval life stages of brown shrimp, summer flounder, southern flounder, and gag grouper (see **Table 18**). Although entrainment of larvae would be expected from the proposed dredging activities, a hydraulic dredge operating in the open ocean would pump such a small amount of water in proportion to the surrounding water volume that any entrainment effects associated with dredging of borrow material for the project would not be expected to adversely affect species at the population level.

Alternative 2b – Surf City Only With Expanded Environmental Windows. For initial construction and nourishment events, an expanded environmental window would result in an increase in the duration of disturbance from 4 months to 5.5 months. Initial project construction would be completed over three seasons, requiring three disturbance events as compared to four dredging seasons and four disturbance events under Alternative 2a. Expanding the dredging window for initial construction and nourishment events to coincide with the beach placement window of November 16 through April 30 would allow dredging to occur when water temperatures are warmer and biological activity is higher. Critical life stages of the species identified in Alternative 1 (brown shrimp, gag grouper, summer and southern flounder) with the addition of pink shrimp and blue crab, may be present within and around the borrow areas during dredging and at risk of being affected by turbidity and entrainment by the dredge (see **Table 23**); however, impacts would not be significant due to the vastness of habitat in the ocean as compared to the dredging footprint.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months resulting in only one disturbance event as opposed to Alternative 2b that utilizes three disturbance events over three seasons. Dredging in the months that are outside the beach placement window of November 16 through April 30 would have the most effect on the pink shrimp, blue crab and gag grouper that are in critical early larval life stages May through October (see **Table 18**). However, impacts would not be significant due to the vastness of habitat in the ocean as compared to the dredging footprint. Impacts of the proposed action would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2b would be fewer. Overall, this alternative would have no significant effects on commercially or ecologically important fish larvae entrainment.

5.4.4 Benthic Resources

Aquatic organisms that live in close association with the bottom, or substrate, of a body of water, are collectively called the benthos. Benthic communities provide a link between planktonic and benthic production and commercially important fish species (Posey 1991). The primary organisms subject to entrainment by hopper dredges are bottom-oriented fishes and shellfishes (flounder, crabs, skates and stingrays). Organisms resting, feeding, or inhabiting the channel bottom would be closer to the suction field of the draghead and, therefore, at higher risk.

Benthic communities of the project area exhibit a wide range of organism composition and density, and community structure may vary considerably depending on substrate type, salinity regime, proximity to structural habitat, and the like. Benthic substrate type and structural habitat within the project area range between fine- to coarse-grained sand and shell hash. Specifically, the nearshore soft bottom environment just offshore of the beach face consists of transitioning regions of shell hash and sand.

The area where beach nourishment placement would occur at Surf City is considered the beach community and encompasses a total of 445 acres, a decrease of approximately 36% as compared to the 2010 Authorized Plan. The beach community is comprised of a dry berm zone located beyond the high tide line, an intertidal zone that is alternately covered and exposed by tidal action, and a subtidal zone that occurs below the low tide line and extends seaward, merging with the ocean surf. In general, beaches are gently sloping communities that serve as transitional areas between open water and upland terrestrial communities. These communities experience almost continuous changes as they are exposed to erosion and deposition by winds, waves and currents. Sediments are unstable and vegetation is absent. Wave action, longshore currents, shifting sands, tidal rise and fall, heavy predation, and extreme temperature and salinity fluctuations combine to create a rigorous environment for macroinvertebrates.

Macroinvertebrates are the predominant faunal organisms inhabiting the beach region and most live beneath the sand surface where salinities and temperatures are most constant. Relatively few species inhabit sandy beaches, but those present frequently occur in large numbers. Consequently, high-energy beaches are far from being biological deserts, and together with the associated fauna they act as extensive food-filtering systems. Typical beach inhabitants are beach fleas (Orchestia sp.) and ghost crabs (Ocypode quadrata) in the beach berm. Coquinas (Donax variabilis), mole crabs (Emerita talpoida) and various burrowing worms inhabit the beach intertidal zone and blue crabs (Callinectes sapidus), horseshoe crabs (Limulus polyphemus), sand dollars (Echinarachnius parma) and numerous clams and gastropod mollusks inhabit the beach subtidal areas. Beach intertidal macrofauna are also a seasonally important food source for numerous shorebird species.

The surf zone of the beach shoreface is extremely dynamic and is characterized as the area from mean low tide landward to the high tide mark. The area serves as habitat for invertebrate communities adapted to the high-energy, sandy-beach

environment. Important invertebrates of the surf zone and beach community include the mole crab (*Emerita talpoida*), coquina clams (*Donax variabilis*), polychaete worms, amphipods, and ghost crabs (*Ocypode quadrata*). Mole crabs and coquinas represent the largest component of the total macrofaunal biomass of North Carolina intertidal beaches, and they are consumed in large numbers by important fish species such as flounders, pompanos, silversides, mullets, and kingfish (Reilly and Bellis 1978). Beach intertidal macrofauna are also a seasonally important food source for numerous shorebird species**.**

During initial construction and nourishments, the active construction zone of the beach placement would cover approximately 1,000 feet of the beach of the 6-mile-long project. Progress along the beach for both initial construction and nourishment events would be expected to move along the beach at a relatively slow rate (i.e., about a mile per month or about 200 feet per day). Such a rate of progress is slow enough that surf-feeding fishes and shorebirds can move to other areas that are not affected by the nourishment operation. As the dredging operation passes by a section of beach, that area is soon available for recolonization by invertebrates.

Offshore sand bottom communities along the North Carolina coast are relatively diverse habitats containing over 100 polychaete taxa. Tube dwellers and permanent burrow dwellers are important benthic prey for fish and epibenthic invertebrates. These species are also most susceptible to sediment deposition, turbidity, erosion, or changes in sediment structure associated with sand mining activities, compared to other more mobile polychaetes. Because periodic storms can affect benthic communities along the Atlantic coast to a depth of about 115 feet (35 meters), the soft bottom community tends to be dominated by opportunistic taxa that are adapted to recover relatively quickly from disturbance. Many faunal species documented on the ebb tide delta are important food sources for demersal predatory fishes and mobile crustaceans, including spot, croaker, weakfish, red drum, and penaeid shrimp. These fish species congregate in and around inlets during various times of the year, presumably to enhance successful prey acquisition and reproduction (Deaton et al. 2010).

Impacts on the sea floor from dredging results in the removal of upper layers of substrate. One hundred percent (100%) mortality of benthos existing within the dredging and placement footprint can be assumed, and this reduction of food availability for bottom feeding fish and invertebrates can impact fish productivity. As part of the borrow area use plan, the contractor would recover the maximum amount of beach nourishment material within one portion of a borrow area 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. Since dredging would deplete the sand within the work area before moving to the next area, removal of benthos and benthic habitat by dredging activities represents a one-time temporary resource loss since the borrow areas would become recolonized by benthic organisms within a matter of months.

As evaluated in *Section 5.1* Geology and Sediments, above, the estimated changes in bathymetry for each borrow area due to the PED-level data collection and analysis resulted in -3.6 to +2.04 feet range of pre-dredging surface elevation. Overall, the post-dredging borrow area depressions would be to those described in the 2010 Feasibility/EIS. Because all proposed offshore borrow areas are beyond the –35-foot contour and the proposed depth of closure for this project is –23 feet, significant infilling of the borrow areas because of longshore sediment transport processes would not be expected to occur. However, considering the shallow dredged volumes of material to be removed from the borrow areas, some infilling of sediments could still occur from other storm- and current-driven processes. Although, some infilling of the borrow areas is anticipated from sedimentation and side sloughing, as well as wind- and tidal-driven currents, the bathymetric feature of the post-dredging borrow area would be expected to persist.

As part of the environmental commitments made during coordination of the 2010 Feasibility/EIS, the USACE, in conjunction with the ERDC, would conduct benthic monitoring. Benthic samples would be taken with a standard ponar grab sampler. To get representative pre-project data, ponar grabs would be taken within each borrow area. An additional 10 samples would be taken outside of the proposed borrow areas to act as reference locations. Invertebrate organisms would be removed and identified and wet-weight biomass would be calculated. Sediment parameters, such as grain size and distribution along with total organic content would be determined. Benthic samples would be collected before initial dredging begins and again every four months after dredging to monitor any potential effects the dredging may have on the infauna and epifauna in the dredged areas.

The ecological significance of temporary benthic losses is considered minor since the affected area is very small relative to the amount of benthic habitat present on the ocean bottom. The total combined acreage (ac) for borrow areas A, B, C, D, E, F, G, H, J, L, N, O, P, Q, S and T as outlined in the 2010 Feasibility/EIS was 12,313 acres. The total combined acreage for borrow areas A, B, C, D, E, F, G, H, J, L, N, O, and P is 9,663 acres. As noted in *Section 5.1 above*, **Table 15** provides information on the maximum area of disturbance of each borrow area. Further delineation of dredge cut boxes is ongoing with additional geotechnical investigations underway. Disturbance acreages are based on the full footprint of the borrow area, excluding hardbottom and low relief hardbottom buffers, and would likely be reduced significantly with the delineation of dredge cut boxes.

Alternative 1 (No Action). This alternative would have no effect on benthos.

Alternative 2a – Surf City Only With Environmental Windows. Initial construction would span four dredging seasons, requiring four disturbance events due to dredges and all other required equipment in the water and on the beach. A total of seven nourishment events occurring over the life of the project, each one approximately every six years. Dredging and placement activities that

occur from December 1 to March 31 would be during times of low biological activity.

Beach placement would cover a maximum of 445 acres on Surf City, resulting in negative effects on intertidal macrofauna through direct burial or increased turbidity in the surf zone; such effects would be expected to be localized, short-term, and reversible. As soon as beach sections are completed, benthic recovery would begin and therefore the entire 445 acres would not be buried all at once. Any reduction in the numbers or biomass (or both) of intertidal macrofauna present immediately after beach placement may have localized limiting effects on surf-feeding fishes and shorebirds because of a reduced food supply. In such instances, those animals may be temporarily displaced to other locations, but would be expected to return within 1–2 years following placement, enough time to fully recover before the next expected six-year nourishment.

Dredging from the offshore borrow areas would have a short-term impact to benthic organisms within those borrow areas since the contractor would recover the maximum amount of beach nourishment material within one portion of a borrow area before relocating to another area. However, recolonization by opportunistic species would be expected to begin soon after the dredging activity stops. Because of the opportunistic nature of the species that inhabit the soft-bottom benthic habitats, and fact that borrow areas likely would only be utilized one-time, benthic recovery could begin as soon a borrow material is removed. Full recovery would be expected to occur within 1–2 years and be permanent. Demersal fish may incur a slight risk due to entrainment by dredging activities.

Only a portion of the beach and borrow areas would be impacted as the sediment is dredged and placed. As beach sections are completed, they would not be disturbed again until nourishment, approximately every 6 years. The dredged areas within the borrow areas likely would be utilized only once and therefore may not be disturbed again for the life of the project.

Alternative 2b – Surf City Only With Expanded Environmental Windows. For initial construction and nourishment events, the proposed expanded environmental window would result in an increase in the duration of disturbance from 4 months to 5.5 months. Initial project construction would be completed over three dredging seasons, requiring three disturbance events as compared to four dredging seasons and four disturbance events under Alternative 2a. Dredging and placement would disturb the same areas as those disturbed by Alternative 2a; no additional dredging or beach placement would occur. Expanding the dredging window for initial construction and nourishment events to coincide with the beach placement window of November 16 through April 30 would allow dredging to occur when water temperatures are warmer and biological activity is higher, but beach placement areas would be expected to fully recover between nourishment cycles. Therefore, expanded dredging windows would be expected to result in minor impacts to benthic invertebrates; no significant impacts to benthos would occur.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months, resulting in only one disturbance event as opposed to the Alternative 2b, which would require three disturbance events over three seasons. Only a portion of the beach and borrow areas would be impacted as the sediment is dredged and placed. As beach sections are completed, they would not be disturbed again until nourishment. The dredged areas of the borrow areas likely would be utilized only once and therefore may not be disturbed again for the life of the project. Impacts of the proposed action would be of longer continuous duration and may result in greater impacts to benthos due to high biological activity but are still temporary and insignificant. As part of the project, benthic monitoring would be conducted as outlined in **Appendix L**. Overall, this alternative would have no significant effects on benthos.

5.4.5 Essential Fish Habitat

Provisions of the Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA) (16 USC 1801) require that Essential Fish Habitat (EFH) areas be identified for each species managed under a fishery management plan, and that all Federal agencies consult with the NMFS on all Federal actions that may adversely affect EFH. The USACE is the lead federal agency and BOEM serves as a cooperating agency for consultation requirements related to MSFCMA. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." The EFH assessment was 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 EFH consultation process is to address specific federal actions that may adversely affect EFH, but do not have the potential to cause substantial adverse impact.

The EFH Assessment (**Appendix H**), was prepared by the USACE, Wilmington District, in conjunction with the BOEM, utilizing the SHOALmate tool, to evaluate the impacts of expanding the environmental window for construction and periodic nourishment events and to address changes that have occurred since completion of the 2010 Feasibility/EIS and 2013 EA/Finding of No Significant Impact (FONSI). 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 the EFH analysis.

Pelagic Sargassum is positively buoyant and, depending on the prevailing surface currents, would remain on the continental shelf for extended periods or be cast ashore. Therefore, pelagic Sargassum species could be transported inshore from the Gulfstream and drift through the vicinity of the dredge plant operation. Because it occurs in the upper few feet of the water column, it is not subject to effects from dredging or sediment disposal activities associated with the proposed action (SAFMC 1998); thus, effects from the dredging and placement operations would not be expected to be significant.

Dredging and beach fill placement conducted during project construction and periodic nourishment could create effects in the marine water column in the immediate vicinity of the activity. Such effects could include minor and short-term suspended sediment plumes and related turbidity, and the release of soluble trace constituents from the sediment. Overall water quality impacts of the proposed action would be expected to be short-term and minor. The various life stages of fish species associated with marine and estuarine resources dependent on good water quality would not be expected to experience significant adverse effects from water quality changes.

An extensive geophysical investigation was conducted and outlined in the 2010 EIS to identify hardbottom presence and delineate hardbottom that was identified in and near several borrow areas. Hard-bottom buffers of 500 meters (1,640 ft.) were established for high- and moderate-relief hardbottom and 122 meters (400 ft.) were established for low relief hardbottom. The USACE, proposed such buffers, and several state and federal resource agencies concurred. Short-term impacts to hardbottom habitat communities from offshore dredging operations due to suspended/resuspended sediment plumes.

The project has not yet identified the nearshore pipeline routes or hopper and pump-out locations. However, once they are identified, USACE would implement the following strategy to avoid effects to hardbottom:

1. The construction contractor in coordination with the USACE would survey pipeline and pump-out locations for hardbottom.
2. The USACE would then coordinate with agencies on the routes selected. The USACE will place buffers of 500 meters (1,640 ft.) for high- and moderate-relief and 122 meters (400 ft.) for low relief hardbottom.
3. No pipeline would be placed, and no hopper or pump-out station will be established until consulting parties are afforded an opportunity to comment on the report of investigations and determination of effect.

Based on the available information pertaining to the dredged sediments, hopper dredge overflow activities, and associated potential turbidity plumes, and implementing a 122-meter (400-foot) buffer, no significant effects would be expected from the sedimentation and turbidity associated with the proposed dredging activities. Project monitoring of sedimentation effects from dredging

activities in the proposed 122-m (400-foot) 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. The USACE 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. 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 within the 122-m (400-foot) buffer and move to another area 500-m (1,640-feet) from the identified hard-bottom sites. The potential impacts to the hardbottom communities would not be expected to exceed the natural sedimentation and turbidity conditions of the project area. The Corps will 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 will occur well in advance of baseline sampling.

Multiple simultaneous dredging and placement of beach fill work may create impacts to EFH. These impacts may include minor and short-term suspended sediment plumes and related turbidity. However, the high quality of the sediment selected for beach fill and the small amount of beach affected at any point in time would not suggest that this activity poses a significant threat.

Alternative 1 (No Action). This alternative would have no effect on EFH.

Alternative 2a – Surf City Only With Environmental Windows. Alternative 2a may have short term localized adverse effects on EFH for Federally managed species within the dredged footprints and beach nourishment areas in the surf zone. 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.

Alternative 2b – Surf City Only With Expanded Environmental Windows. For initial construction and nourishment events, the proposed expanded environmental window would result in an increase in the duration of disturbance from 4 months to 5.5 months. Initial project construction would be completed over three seasons, requiring three disturbance events as compared to four dredging seasons and four disturbance events under the no action plan. Expanding the dredging window for initial construction and nourishment events to coincide with the beach placement window of November 16 through April 30 would allow dredging to occur when water temperatures are warmer and biological activity is higher but would not result in any significant impacts to EFH beyond those described above.

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. Critical life stages of the species identified in Alternative 2a (brown shrimp, gag grouper, summer and southern flounder) with the addition of pink shrimp and blue crab, may be present within and around the borrow areas during dredging and at risk of being affected by turbidity and entrainment by the dredge. This alternative would expand the windows, increasing the likelihood of impacting a broader range of EFH species or habitat than Alternative 2a due to work occurring during warmer times of the year. However, this alternative is not anticipated to significantly impact EFH species or habitat that may be in the project area.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months resulting in only one disturbance event as opposed to the Alternative 2b plan that requires three disturbance events over three seasons. Dredging in the months outside the beach placement window of November 16 through April 30 would have the most effect on the pink shrimp, blue crab and gag grouper that are spawning or in critical early life stages May through October (Wickliffe et al. 2019). Impacts of the proposed action would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2b would be less. Monitoring of sedimentation and turbidity to assess impacts to benthos and hardbottoms, as noted above, be implemented as part of the project (**Appendix L**). Information gained will inform the risk-based analysis approach where dredging timeframes and equipment types will be evaluated based on the available scientific data and experience. Overall, this alternative will have no significant effects on EFH.

5.5 Birds

Birds that are common to the nearshore ocean within the project area are loons, grebes, gannets, cormorants, scoters, red-breasted mergansers, gulls, and terns. The habitat and food source of such seabirds is the marine environment, whether coastal, offshore or pelagic. The beaches and inlets of the project vicinity are heavily used by migrating shorebirds. However, dense development and high public use of project area ocean front beaches may reduce their value to shorebirds. The identified project limits avoid important shorebird habitat in the New River and New Topsail Inlet complexes. Although the project area is heavily developed and sustains heavy recreational use, migratory shorebirds could still use the project area for foraging and roosting habitat.

Although it is possible that shorebird nesting could occur in the project area during the spring and summer months (April 1–August 31), most of the bird species have been displaced by development pressures and heavy recreational use along the beach; thus, traditional nesting areas on the project beach have been lost. Many of the bird species have retreated to the relatively undisturbed dredged material placement islands that border the navigation channels in the area. Nonetheless, it is possible that shorebird species would still attempt to nest in the project area.

Alternative 1 (No Action) - This alternative would have no effect on birds.

Alternative 2a – Surf City Only With Environmental Windows. Initial construction would span four dredging seasons, requiring four disturbance events due to dredges and all other required equipment in the water and on the beach. A total of seven nourishment events occurring over the life of the project, each one approximately every six years. Dredging and placement activities occur from December 1 to March 31, during times of low biological activity.

Beach nourishment activities could temporarily affect the roosting and intertidal macro-fauna foraging habitat; however, recovery often occurs within one year when nourishment material is beach quality. Although temporary impacts to the shorebird prey base could occur in the affected areas, the staggering of the initial construction effort would allow for availability of adjacent unaffected foraging habitat. Because (1) areas of diminished prey base are temporary and isolated, (2) recovery occurs within one year when material is beach quality, and (3) adjacent unaffected foraging and roosting habitat would be available throughout the project, it would not be expected that foraging and roosting habitat would be significantly affected by implementing this alternative.

Alternative 2b – Surf City Only With Expanded Environmental Windows. For initial construction and nourishment events, the proposed expanded environmental window would result in an increase in the duration of disturbance from 4 months to 5.5 months. Initial project construction would be completed over three seasons, requiring three disturbance events as compared to four dredging seasons and four disturbance events under Alternative 2a. Expanding the windows to allow dredging and placement from November 16 to April 30 would increase the potential of short-term impacts to nesting (April 1 through August 31), foraging and roosting shorebirds in the month of April. Due to the development pressures and heavy recreational use and the availability of nearby nesting, foraging and roosting habitat, these impacts would not be significant.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement

may occur any time of year and could be ongoing, without interruption, for up to 16 months resulting in only one disturbance event as opposed to Alternative 2b that utilizes three disturbance events over three seasons. Placement of material in the summer months would increase the potential of short-term impacts to nesting (April 1 through August 31), foraging and roosting shorebirds. During initial construction and nourishments, the active construction zone of the beach placement would cover approximately 1,000 feet of the beach of the 6-mile-long project. Progress along the beach for both initial construction and nourishment events would be expected to move along the beach at a relatively slow rate (i.e., about a mile per month or about 200 feet per day). Such a rate of progress is slow enough that shorebirds can move to other areas not affected by the nourishment operation. As the dredging operation passes by a section of beach, that area soon becomes available for recolonization by invertebrates. The heavy recreational use of the beaches during the summer months would reduce the availability of nesting, foraging and roosting habitat and therefore the impacts of nourishment would not be significant. Impacts of the proposed action be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2b would be less. Overall, this alternative would result in no significant effects to birds.

5.6 Cultural Resources

As documented in the December 2010 Feasibility Report/EIS, no historic properties listed on, or eligible for listing on, the National Register of Historic Places (NRHP) were identified within the borrow locations and beach. This determination was based on the results of surveys conducted within the proposed sand borrow locations. Surveys were coordinated the North Carolina State Historic Preservation Office (NC SHPO), who concurred with the findings in letter dated March 1, 2005. The letter and the final survey report were included in the 2010 Feasibility Report/EIS.

Since the 2010 Feasibility Report/EIS, the USACE has revisited existing geotechnical- and cultural resources-related data regarding potential effects to ancient landforms underlying the proposed sand borrow areas. Additional information regarding potential effects to ancient landforms is available in **Appendix Q.**

Consultation under Section 106 of the National Historic Preservation Act (NHPA) was re-initiated on June 15, 2020. The NC SHPO confirmed that no known historic properties have been recorded within the proposed sand borrow locations. Additional Section 106 consultation and investigations will be needed to address potential sea floor disturbance associated with specific nearshore pipeline routes and hopper pump-out locations These investigations may include use of a shallow seismic profiler, side scan sonar, fathometer, marine survey magnetometer, sub-bottom profiler, and electronic positioning system to characterize benthic and sub-bottom features. The USACE's dredging Contractor will be responsible for identifying and surveying pipeline routes and hopper pump-out locations. The survey

methodology will be coordinated with the North Carolina Office of State Archaeology (OSA) and State Historic Preservation Office (SHPO). Survey results meeting requirements of 36 CFR 800.11 and a determination of effect on these elements will be coordinated with the OSA, SHPO, tribes, and other consulting parties with interest in the project. Additionally, pursuant to 15A NCAC 07H, survey results would be coordinated with the North Carolina Division of Coastal Management regarding cultural resources . Any historic property identified within pipeline routes or hopper pump-out areas would be protected by applying a buffer around the area where work that would affect the resource would be precluded. If necessary, nearshore pipeline routes and hopper pump-out locations would be relocated to ensure no effect to historic properties. No construction activities would occur within nearshore pipeline routes or hopper pump-out locations until effects to NRHP-eligible historic properties are resolved and consultation under Section 106 of the NHPA is concluded.

The implementation of this strategy will avoid effects to historic properties determined eligible for listing to the National Register of Historic Places and across the action alternatives . Upon its completion, USACE and Proposed Undertaking will be in full compliance with Section 106 of the NHPA .

Alternative 1 (No Action) - This alternative would have no effect to historic properties eligible for listing to the NRHP.

Alternative 2a – Surf City Only With Environmental Windows. This alternative would have no effect to historic properties eligible for listing to the NRHP.

Alternative 2b – Surf City Only With Expanded Environmental Windows. This alternative would have no effect to historic properties eligible for listing to the NRHP.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). This alternative would have no effect to historic properties eligible for listing to the NRHP.

5.7 Noise

Noise is a prominent feature in the study area because of the sound of the breakers and at times, tourists and traffic. The sounds of breakers are tranquil and add to the pleasure experienced by visitors. No large manufacturing, industrial, or mining-type of operations are located on Topsail Island. No airports or other area establishments or entities create unbearable noise levels on the community. Any beach or open-water coastal environment has several underwater ambient noise sources such as commercial and recreational vessel traffic, dredges, natural sounds (e.g., storms, biological), and so on.

Noise in the outside environment associated dredging and beach placement activities would be expected to minimally exceed normal ambient noise in the project area; however, construction noise would be attenuated by background sounds from wind and surf. Beach placement noise would be the result of heavy equipment used

in sand shaping such as deposition noise—noise associated with the placement of the material within the barge or hopper and transport noise—noise associated with transport of material up the suction pipe. During initial construction and nourishments, the active construction zone of the beach placement would cover approximately 1,000 feet of the beach of the 6-mile-long project. Progress along the beach for both initial construction and nourishment events would be expected to move along the beach at a relatively slow rate (i.e., about a mile per month or about 200 feet per day).

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). Specifically, noise associated with dredging could occur from (1) ship/machinery noise—noise associated with onboard machinery and propeller and thruster noise, (2) pump noise—noise associated with pump driving the suction through the pipe, (3) collection noise—noise associated with the operation and collection of material on the sea floor, (4) deposition noise—noise associated with the placement of the material within the barge or hopper, (5) transport noise—noise associated with transport of material up the suction pipe.

A limited number of studies have indicated that dredge noise occurs in the low frequency range (< 1200 Hz), which is within the audible range of listed species of whales and sea turtles, as well as many species of fish (Reine et al 2013.) 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 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).

Dredging operations generally produce low levels of low-frequency sound energy that, although audible over considerable distances from the source, are of short duration (Michel 2013). The significance of the noise generated by the equipment dissipates with increasing distance from the noise source. Major effects on fish populations are more likely when fish are exposed continuously to an intense sound source at levels well above ambient noise (Michel 2013). A literature review found that the sounds generated by dredging are low frequencies under 1,000 Hz (Reine et al. 2014; Reine and Dickerson 2014). Based on this information, sound generated by equipment operated would not result in a peak pressure injury since all

sound source levels measured at 1 m from the source are under the threshold of 206 dB peak for sea turtles and fish. Consequently, the impacts of underwater sound on fish populations are expected to be temporary and localized.

Marine mammals are known to have the most sensitivity to underwater noise since they utilize sound for detecting prey, navigating, and communicating. According to Clarke et al. (2002), based on (1) the predicted noise effect thresholds noted by Richardson et al. (1995), (2) the background noise that already exists in the marine environment, and (3) the ability of marine mammals to move away from the immediate noise source, noise generated by dredge activities would not be expected to affect the migration, nursing/breeding, feeding/sheltering or communication of large whales.

Furthermore, Protected Species Observers (PSOs) are required to be onboard hopper dredges year-round to record all whale and manatee sightings and note any potential behavioral impacts. Care must be taken not to closely approach (within 300 feet) any whales, manatees, or other marine mammals during dredging operations or transportation of dredged material. See *Section 5.10* for more information regarding North Atlantic right whale protections.

The current SARBO made the following determination of impacts due to dredging and placement noise to ESA listed species:

> *"While we acknowledge that the noise generated by vessel traffic is of concern, we expect that any behavioral effects from noise exposure from activities contemplated in this Opinion will be insignificant and that mobile species would be able to avoid areas of behavioral sound disturbances while work is occurring and return once it is complete. We also considered if the sound generated would affect important biological functions including feeding, sheltering, and reproduction and determined that the PDCs (Project Design Criteria) in this Opinion limit activities that would result in adverse effects to these functions. We believe that the behavioral effects will be insignificant and will not alter any important biological functions since these species are mobile and can move away from these sound sources and continue to use similar habitat in surrounding areas.*
>
> *Although noise generated from dredging equipment is within the hearing range of sea turtles, some fish species, and marine mammals, effects would be minor. Increased noise levels would be relatively short-term (longer for construction than nourishments) and temporary. Mobile species could easily flee from the area."*

Alternative 1 (No Action). This alternative would have no effect on noise.

Alternative 2a – Surf City Only With Environmental Windows. Initial construction would span four dredging seasons, requiring four disturbance events

due to dredges and all other required equipment in the water and on the beach. A total of seven nourishment events occurring over the life of the project, each one approximately every six years. Dredging and placement activities that occur from December 1 to March 31 would be during times of low biological activity and when fewer people visit and use the beach.

Alternative 2b – Surf City Only With Expanded Environmental Windows. For initial construction and nourishment events, the proposed expanded environmental window would result in an increase in the duration of disturbance from 4 months to 5.5 months. Initial project construction would be completed over three seasons, requiring three disturbance events as compared to four dredging seasons and four disturbance events under Alternative 2a. Expanding the dredging window for initial construction and nourishment events to coincide with the beach placement window of November 16 through April 30 would allow dredging to occur when water temperatures are warmer, biological activity is higher and more people visit and use the beach. The amounts and levels of dredging and beach placement-related noise are expected to be like Alternative 2a, however the time of year in which the noise occurs can have a varying effect due to the increased presence and numbers of species in the project area during the spring and fall months. This is especially true for sea turtles, anadromous fish and marine mammals. Since this window expansion is still outside the period of peak biological activity and peak tourist season, the overall noise impacts from hopper dredging and beach placement during this timeframe are expected to be minor.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months, resulting in only one disturbance event as opposed to Alternative 2b that utilizes three disturbance events over three seasons. Impacts of the proposed action would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2b would be less.

More marine species of importance may be affected during the spring and summer months, except for the NARW. Hopper dredging in the spring and summer may be beneficial to the NARW, since this whale is only present in the action area during the winter months (refer to *Section 5.9* for more details on the NARW). Noise levels would be increased during the duration of construction and during each nourishment event. Species present in the project area may be affected by the increased noise; however, mobile species could easily leave the area. Noise impacts to tourists during high tourist season would be short-term as construction moves along the beach. Noise impacts would be temporary and short-term, and therefore not significant.

5.8 Recreation, Aesthetic Resources and Fishing

The Towns of Surf City and North Topsail Beach are urbanized beach communities characterized by paved streets, bridges, parking lots, hotels, single-family dwellings, hotels, and low-rise condominiums. Land use is primarily recreational and residential with few commercial properties. A scenic setting is provided by waters of the Atlantic Ocean, New River Inlet, the AIWW and Stump Sound, and the numerous vessels common to those waters. The marine environment provides opportunities for boating and fishing, as well as an escape from the faster pace of land-based activities. Beaches generally offer extensive recreational opportunities for activities such as swimming, sunbathing, walking, surfing, bird watching, and fishing. In addition, one ocean fishing pier is in the project area and is considered important recreational facilities at Topsail Island.

Alternative 1 (No Action). The No Action alternative would not prevent the continued deterioration of the beach and berm width resulting in a negative impact to the aesthetic view and a reduction of sunbathing and other recreational activities along the beach front. This alternative would have no effect on fishing.

Alternative 2a – Surf City Only With Environmental Windows. Initial construction would span four dredging seasons, requiring four disturbance events due to dredges and all other required equipment in the water and on the beach. A total of seven nourishment events occurring over the life of the project, each one approximately every six years. Dredging and placement activities that occur from December 1 to March 31, which would avoid the peak summer tourist season. The ocean, in the vicinity of the project area, would be affected to a minor extent in that dredges, barges, and other watercraft associated with the work would be on-site for the duration of the initial construction and periodic nourishments every 6 years. However, this is judged to be an insignificant effect since commercial and recreational vessels would be able to maneuver around these working dredges and other equipment. Placement of beach fill would result in temporary use of a dredge pipeline, bulldozers, and other equipment on the beach. These objects would detract from the normal appearance of the beach, as well as create elevated levels of noise, vibration, lighting, etc. within the active project area. During initial construction and nourishment, the active construction zone of the beach placement would cover approximately 1,000 feet of the beach per dredge (two dredges) for a total of 2,000 feet of the 9.9-mile-long project. Progress along the beach for both initial construction and nourishment events would be expected to move along the beach at a relatively slow rate (i.e., about a mile per month or about 200 feet per day). Also, recreational activities on beaches may experience some interruption or interference during work periods, but the degenerated, eroded conditions of the beaches already present recreational constraints.

Alternative 2a could cause a temporary reduction of aesthetic appeal and interference with recreational activities during project construction and nourishments (every 6 years). However, because work would be conducted in relatively small

areas at a time, recreational and aesthetic impacts would be localized. Effects on shore fishing would be limited to the area where material is being placed on the beach. Such localized temporary impact can easily be avoided by anglers in the area. Nearshore fishing boats could operate around the dredging equipment in the area. The beach nourishment plan would not be expected to affect inside fishing or the operation of commercial fishing boats operating in or going through New Topsail Inlet or New River Inlet. Unless there is extreme weather, the ocean-going dredge would operate continuously. Therefore, the economic impact of commercial and recreational fishing would not be expected to change with the project construction or nourishments. Overall, short-term minor adverse and long-term beneficial effects would be expected on aesthetic, recreational and fishing resources.

Alternative 2b – Surf City Only With Expanded Environmental Windows. For initial construction and nourishment events, the proposed expanded environmental window would result in an increase in the duration of disturbance from 4 months to 5.5 months. Initial project construction would be completed over three seasons, requiring three disturbance events as compared to four dredging seasons and four disturbance events under Alternative 2a. Dredging and placement impacts of this alternative would be like Alternative 2a. However, this alternative would allow for the dredging and placement from November 16 to April 30 instead of December 1 to March 31, increasing the possibility of recreation, aesthetic and fishing impacts due to work occurring during periods of time when more people may be using the beach. Overall, short-term minor adverse and long-term beneficial effects would be expected on recreation, aesthetic and fishing resources along with long-term improvement of appearance and enhanced recreational experience.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months resulting in only one disturbance event as opposed to Alternative 2b that utilizes three disturbance events over three seasons. Impacts of the proposed action would be of longer continuous duration and occur during peak tourist season, but the frequency of disturbances over the duration of project construction as compared to Alternative 2b would be less. Also, because work would be conducted in relatively small areas at a time, recreational and aesthetic impacts would be localized. Overall, short-term minor adverse and long-term beneficial effects would be expected on aesthetic, recreational and fishing resources and therefore impacts would not be significant.

5.9 Air Quality and Greenhouse Gases

According to the North Carolina Division of Air Quality, high levels of ozone have been linked to heart and lung conditions, including asthma, particularly in young children, older adults and other sensitive groups. North Carolina has a State

Implementation Plan approved or promulgated under Section 110 of the federal Clean Air Act. A conformity determination is not required for this project because it is in an attainment area, which means overall air quality has been determined to follow the National Ambient Air Quality Standards, under the federal Clean Air Act, including Pender and Onslow Counties.

Greenhouse Gases Emissions

An important component of air quality evaluation is estimating future greenhouse gas (GHG) emissions based on the initial construction period(s) and seven subsequent nourishment events 50 years post-initial construction. Elevated GHG levels are of particular concern. Such gases absorb infrared radiation, thereby trapping heat and making the planet warmer. The most important greenhouse gases directly emitted by human activity include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and several other fluorine-containing halogenated substances. Although CO_2, CH_4, and N_2O occur naturally in the atmosphere, human activities have changed their atmospheric concentrations. From the pre-industrial era (i.e., ending about 1750) to 2017, concentrations of these greenhouse gases have increased globally by 45, 164, and 22 percent, respectively (EPA Draft Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2017).

Gases in the atmosphere can contribute to climate change both directly and indirectly. Direct effects occur when the gas itself absorbs radiation. Indirect *radiative forcing* occurs when chemical transformations produce other greenhouse gases, when a gas influences the atmospheric lifetimes of other gases, and/or when a gas affects atmospheric processes that alter the *radiative balance* of the earth.

In 2017, total gross U.S. greenhouse gas emissions were 6,472.3 million metric tons for carbon dioxide. Total U.S. emissions have increased by 1.6 percent from 1990 to 2017, and emissions decreased from 2016 to 2017 by 0.3 percent (EPA Draft Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2017).

The initial construction phase is being evaluated for GHG emissions. This phase is identified as the effort made to reconstruct/re-create the berm and dune system (i.e., beach front toe of dune downslope to a specific elevation within the surf zone). Also being evaluated is the subsequent maintenance efforts, which are also known as the proposed nourishment events. The proposed nourishment events are expected to be no more than seven events during the 50-year post-initial construction maintenance period. Nourishment events require less construction time because it is expected that the dune will remain intact between nourishment events, thereby only requiring berm replacement.

The primary difference among the alternatives is the use of three different environmental/construction windows and when the windows are applied, which is substantially different for each alternative. However, the total initial construction time is estimated to be the same 16-month period for each alternative, no matter the

number of construction seasons needed. To clarify, Alternatives 2a and 2b's initial construction would occur over multiple seasons based on their different environmental construction windows, while Alternative 2c would have a continuous initial construction period of 16 months.

Three construction alternatives (2a, 2b and 2c) have been quantitatively evaluated to better compare potential greenhouse gas emissions among the alternatives. This evaluation considers the initial construction phase and the maintenance phase (i.e., nourishment events). A predictive model was used to estimate the total greenhouse gas emissions.

Each nourishment event is expected to last for no more than 165 days, which means individual nourishment events can be completed in a single environmental/construction season/window for each alternative. Consequently, the fundamental difference in greenhouse gas emissions among the three alternatives is determined by the initial construction phase and the need for additional mobilization and demobilization efforts. This is based on the number of construction/environmental seasons/windows needed to complete initial construction.

GHG emissions result from diesel fuel combustion, which produces emissions of CO_2, CH_4, and N_2O. GHGs (i.e., CO_2, CH_4, and N_2O), are typically presented in *CO_2 equivalent*, or *CO_2e*, which is based on each gas's specific Global Warming Potential (GWP). Each GHG type has a different heat trapping capability. A GWP multiplier factor is applied to the total final GHG emission for each gas type, then totaled to acquire a single value, expressed as CO_2e, for each alternative.

The corresponding GWP has been calculated to reflect how long the gas remains in the atmosphere and how strongly it absorbs energy compared to CO_2. Gases with a higher GWP absorb more energy, per unit weight, than gases with a lower GWP. The total weight of each chemical compound is represented in *metric tons* and for the total CO_2 equivalent per alternative.

Appendix O contains all GHG emissions calculations and a description of the calculation assumptions. **Table 19** provides a summary of the Carbon Dioxide equivalency (CO_2e) emissions by alternative. All alternatives produce the same amount of CO_2e emissions for the nourishment events because there is no difference between the alternatives in how vessels and equipment will be used, and for how long. Conversely, initial construction CO_2e emissions are different between each alternative. This is exclusively due to each alternative requiring different numbers of initial construction periods, which demonstrates a direct relationship between the number of initial construction periods with the total CO_2e emissions for each alternative.

Table 19 shows that Alternative 2a (56,320.69 metric tons CO_2e) would produce the most emissions, then 2b (56,246.62 metric tons CO_2e); with Alternative 2c

Table 19. Total Carbon Dioxide Equivalency (Co_2e) Emissions During Project Life by Build Alternative[1] (Metric Tons).

Alternative Name	Initial Construction		Nourishment Events3		Total CO_2e Emissions By Alternative
	Dredging and Placement of Material[2]	Mobilization and Demobilization	Maintenance Events Total[2]	Mobilization and Demobilization	
2a	35,849.700	3,555.342	10,693.803	6,221.849	56,320.69
2b	36,664.466	2,666.507	10,693.803	6,221.849	56,246.62
2c	35,553.422	888.836	10,693.803	6,221.849	53,357.91

[1]Dredging and Placement + Initial Construction Mobilization/Demobilization + Nourishment Maintenance Event + Nourishment Mobilization/Demobilization Event = Total
[2]Includes initial berm and dune construction
[3]Nourishment/Maintenance includes seven events conducted during project lifetime (50 years)
[4]Reconstruction of berm only

(53,357.91 metric tons CO_2e) producing the least amount of carbon dioxide equivalency emissions over the 50-year project life. In percentages, Alternative 2b produces 0.13 percent less emissions than Alternative 2a. Alternative 2c produces 5.26 percent less emissions (by weight) than 2a and 5.13 percent than Alternative 2b. Therefore, Alternative 2c would be preferred. However, from a percentage perspective, all three alternatives would produce similar CO_2e emission loads during the project life. The three alternatives are so close that a preferred alternative based on greenhouse gas emissions is negligible. Although Alternative 2c produces the least amount of emissions, choosing a different alternative would not substantial/y influence the selected preferred alternative.

Alternative 1 (No Action): This alternative would have no effect on air quality as no GHG would be produced.

Alternative 2a – Surf City Only With Environmental Windows. Initial construction would span four construction/environmental seasons/windows, requiring four disturbance events from vessels, heavy equipment and other GHG producing equipment. This alternative would take the longest period to perform initial construction, which includes four separate construction seasons/windows. These four seasons/windows would require all in-water construction activities to be contained within the environmental protection window (December 1 through March 31). In other words, with a four-month construction period each year, the estimated 16-month total construction time would require four years, to complete. This schedule requires that there are mobilization and demobilization periods before and after each environmental window, resulting in four separate mobilization and demobilization events for this alternative.

The USACE presumes that the construction contractor would take up to 12 days for each mobilization and demobilization effort. Heavy equipment needed for each construction alternative includes dredgers, barges to transport the pipeline to the nourishment areas, bulldozer for dune construction, tugboats and pilot boats to assist the barge and dredgers. The tugboats would also be used to assist moving the barge and dredgers, and the bulldozer would be responsible for pipeline set-up and sand leveling and contouring.

This alternative would require the longest construction duration because it must adhere to the shortest of the three environmental construction windows (December 1 to March 31, or, 120 days). The 16-month initial construction period would occur over a four-year period. However, the seven future nourishment events would use an extended construction/environmental window of 165 days (November 16 to April 30).

Therefore, from a GHG emissions perspective, this alternative is the least favorable choice of the three construction alternatives but, the impacts to air quality and greenhouse gases would be minor, temporary and of relatively short duration and the project would follow section 176 (c) of the Clean Air Act, as amended.

Alternative 2b – Surf City Only With Expanded Environmental Windows. Although like Alternative 2a, the most important difference between these alternatives is that Alternative 2b would use an expanded environmental window. Instead of December 1 to March 31, the window would be November 16 to April 30, in which all initial construction and future nourishment events would occur. With this approach the number of annual construction periods would be fewer, from four for Alternative 2a, to three. This would also reduce the number of mobilization and demobilization efforts compared to Alternative 2a, resulting in Alternative 2b producing less greenhouse gas emissions compared to Alternative 2a. Impacts of this alternative would be like Alternative 2a, but with a slight increase of potential impacts of initial construction during warmer months. Overall, impacts to greenhouse gases and air quality would be minor, temporary and relatively short in duration. This alternative would follow section 176 (c) of the Clean Air Act, as amended.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Under this alternative there would be one mobilization and demobilization event and the initial construction period would be 16 continuous months. This means no environmental construction windows would apply. All the same activities would occur that have been described for Alternatives 2a and 2b. However, Alternative 2c would require only one mobilization and demobilization event for the initial construction. This alternative has the potential to produce the least amount of greenhouse gas compared to the two other construction alternatives. Alternative 2c, the Proposed Action, would be the construction alternative that minimizes greenhouse gas emissions more than the other ones. Overall, impacts to greenhouse gases and air quality would be minor, temporary and relatively short in duration. This alternative would follow section 176 (c) of the Clean Air Act, as amended.

5.10 Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531–1543), provides a program for the conservation of threatened and endangered (T&E) plants and animals and the habitats in which they are found. During the 2010 Feasibility/EIS, a biological opinion was obtained from the U.S. Fish and Wildlife Service (USFWS) for beach placement of sand. In accordance with Section 7 (a)(2) of the ESA, the USACE has been in consultation with the USFWS to ensure that effects of the proposed action would not jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat of such species. To jeopardize the continued existence of is defined as “to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02). The USACE in conjunction with the BOEM has reinitiated coordination with the USFWS for the initial construction of the proposed action and pursuant to Section 7 of the ESA a Biological Assessment is included in

Appendix K. Re-initiation of Section 7 coordination would be conducted by the USACE for each future nourishment event. Updated lists of T&E species within Pender and Onslow County, North Carolina were obtained from the Information, Planning and Conservation System website (http://ecos.fws.gov/ipac/) (**Appendix J**). These are shown in **Table 20**, which includes T&E species that could be present in the area based on their historical occurrence or potential geographic range.

Threatened and endangered species under the purview of the USFWS that could be present within the project areas include: Northern Long-eared Bat (Myotis septentrionalis); Tricolored Bat (Perimyotis subflavus); West Indian manatee (Trichechus manatus); Eastern Black Rail (Laterallus jamaicensis ssp. Jamaicensis); Red-cockaded Woodpecker (Picoides borealis); red knot (Calidris canutus rufa); piping plover (Charadrius melodus); Roseate Tern (Sterna dougallii dougallii); American Alligator (Alligator mississippiensis); sea turtles [green (Chelonia mydas), loggerhead (Caretta caretta), leatherback (Dermochelys coriacea), and Kemp's ridley (Lepidochelys kempii)]; Long-eared Bat; Tricolored Bat; Eastern Black Rail; Red-cockaded Woodpecker; American Alligator; Monarch Butterfly; Cooley's Meadowrue; Pondberry and Rough-leaved Loosestrife are all terrestrial, freshwater, marsh, woodland, or savanna species. Since this habitat type is not present in the areas to be affected by the proposed action, these species are unlikely to occur. More information regarding USFWS species covered under Section 7 consultation can be found in **Appendix K**.

Topsail Island is considered one of the major rookeries for the declining Northern loggerhead population, thus, restoration of this important nesting habitat on Topsail Island is critical. Topsail Island contains 26 miles of Loggerhead terrestrial critical habitat (Unit LOGG-T-NC-07), which encompasses the entire length of the island (**Figure 19**). It is the longest area of designated terrestrial critical habitat (out of

Table 20. Effects Determination for T&E Species That May Be Present in the Project Area.

Category	Listed Species within the Project Area	Status	Effects Determination for the Proposed Action	
			Beach Placement Activities (USFWS)	In-Water Activities (NMFS)
Mammals	West Indian Manatee/ *Trichechus manatus*	Threatened	MANLAA	MANLAA
	Blue Whale/ *Balaenoptera musculus*	Endangered	No Effect	MANLAA
	Sei Whale/ *Balaenoptera borealis*	Endangered	No Effect	MANLAA
	Sperm whale/ *Physeter macrocephalus*	Endangered	No Effect	MANLAA
	Finback whale/ *Balaenoptera physalus*	Endangered	No Effect	MANLAA
	Humpback whale/ *Megaptera novaeangliae*	Endangered	No Effect	MANLAA
	North Atlantic Right Whale/ *Eubalaena glacialis*	Endangered	No Effect	MANLAA
	Northern Long-eared Bat/ Myotis septentrionalis	Endangered	No Effect	No Effect
	Tricolored Bat/ Perimyotis subflavus	Proposed Threatened	No Effect	No Effect
Birds	Piping Plover/ *Charadrius melodus*	Threatened	MANLAA	No Effect
	Red Knot/ *Calidris canutus rufa*	Threatened	MANLAA	No Effect
	Eastern Black Rail/ *Laterallus jamaicensis ssp. jamaicensis*	Proposed Threatened	No Effect	No Effect
	Roseate Tern/ Sterna dougallii	Endangered	No Effect	No Effect
	Red-cockaded Woodpecker/ *Picoides borealis*	Endangered	No Effect	No Effect
Reptiles	American Alligator/ *Alligator mississippiensis*	Similarity of Appearance Threatened	No Effect	No Effect
	Green Sea Turtle/ *Chelonia mydas*	Threatened	MALAA	MALAA
	Hawksbill Sea Turtle/ *Eretmochelys imbricata*	Endangered	MALAA	MALAA
	Kemp's Ridley Sea Turtle/ *Lepidochelys kempii*	Endangered	MALAA	MALAA
	Leatherback Sea Turtle/ *Dermochelys coriacea*	Endangered	MALAA	MALAA
	Loggerhead Sea Turtle/ *Caretta*	Threatened	MALAA	MALAA
Fish	Atlantic Sturgeon/ *Acipenser oxyrinchus*	Endangered	No Effect	MALAA
	Shortnose Sturgeon/ *Acipenser brevirostrum*	Endangered	No Effect	MANLAA
	Smalltooth sawfish/ *Pristis pectinata*	Endangered	No Effect	MANLAA
Flowering Plants	Seabeach Amaranth/ *Amaranthus pumilus*	Threatened	MANLAA	No Effect
	Cooley's Meadowrue/ Thalictrum cooleyi	Endangered	No Effect	No Effect
		Endangered	No Effect	No Effect
	Pondberry/ Lindera melissifolia	Endangered	No Effect	No Effect
	Rough-leaved Loosestrife/ Lysimachia asperulaefolia	Endangered	No Effect	No Effect
Critical Habitats	Loggerhead Sea Turtle		NLAM	NLAM

MANLAA = May Affect, But Not Likely to Adversely Affect
MALAA = May Affect, Likely to Adversely Affect
NLAM = Not Likely to Adversely Modify

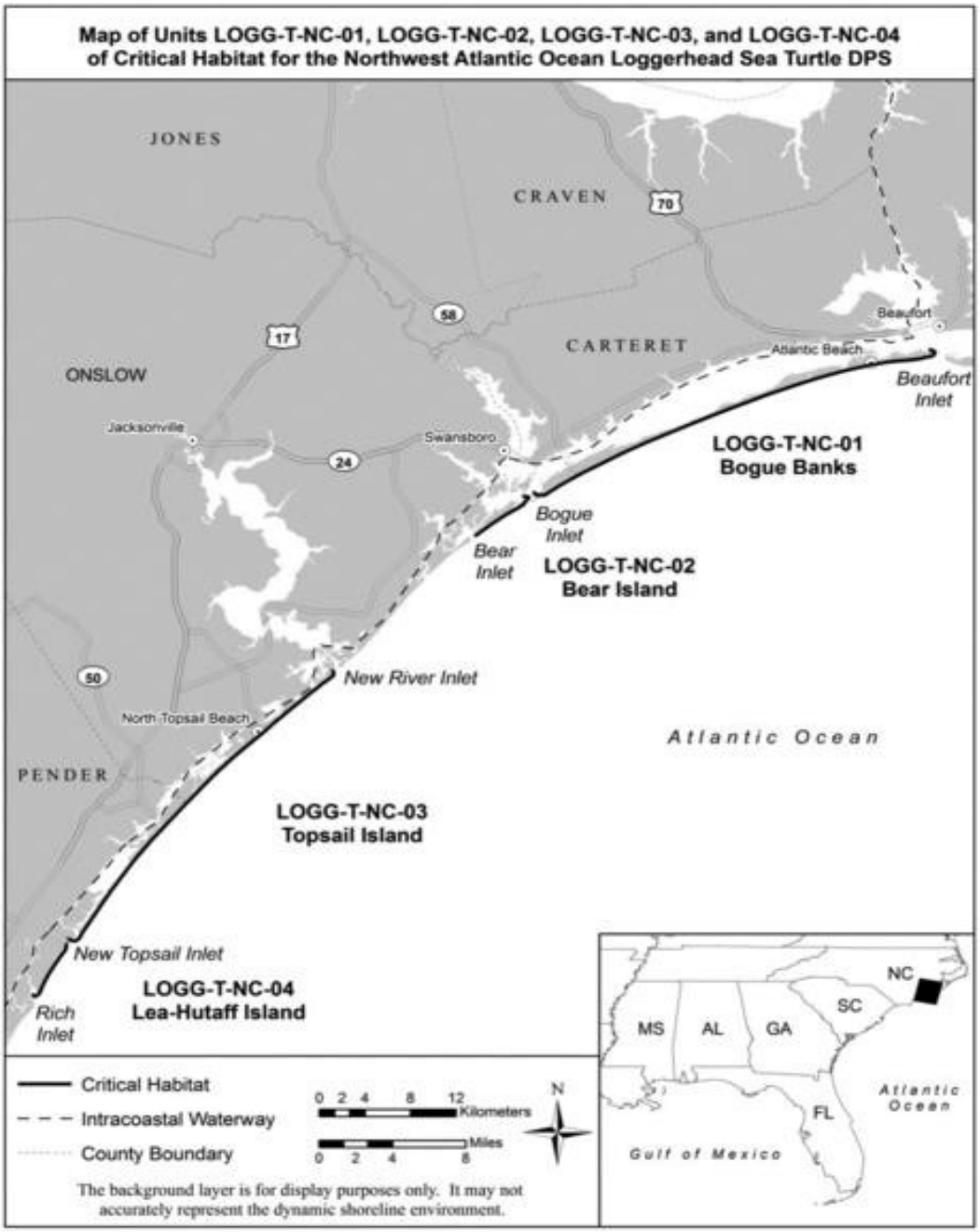


Figure 19.USFWS Loggerhead Terrestrial Critical Habitat (Unit LOGG-T-NC-07).

eight units) in NC. Approximately 6 miles of critical habitat on Topsail Island are contained within the Surf City project area.

The 2010 Feasibility/EIS recognized that the 1997 SARBO was under revision and the USACE would abide by the revised biological opinion, when issued. Thus, a supersede request would be provided to the NMFS per the current SARBO to satisfy Section 7 consultation requirements of the ESA, because even though this project is

not specifically identified as covered, the effects would be substantially like the effects already considered and using the same dredges already covered.

The actions considered in the SARBO are those actions NMFS believes are likely to result in a taking and they are primarily actions that have been occurring in the action area for many decades and are expected to continue to occur. The SARBO considers the cumulative effects of the continued maintenance of these activities that were previously considered under multiple Opinions, and includes, via the Project Design Criteria (PDCs), minimization measures that are expected to reduce both the likelihood and impact of take from the proposed action. The PDCs define the proposed action and provide the limitations of how, where, and when activities must be completed to be covered under the SARBO. The PDCs were developed by the SARBO Team, with the intent of avoiding or minimizing effects to ESA-listed species and designated critical habitat. All applicable PDCs would be incorporated into projects covered under this Opinion

The Dredge Project Scheduling Project Adaptive Management Process (see Section 2.9.2.2 of the *2020 SARBO*) considers the steps outlined below. Each step outlines the general process used to evaluate potential impacts from projects and how minimization measures would be selected to reduce lethal take.

Assessment Step 1: Determine the list of upcoming projects expected and pre-construction project assessment. Each fiscal year, the USACE and/or BOEM would compile a list of projects proposed for the next year and beyond (e.g., projects proposed for the next 1-5 years), including relevant minimization measures based on the pre-construction project assessment results. The final project timing and assessment would be developed and maintained by the USACE and/or BOEM. Timing of upcoming projects would minimize the potential of impacts to ESA-listed species by considering the impacts to ESA-listed species posed by projects based on project-specific timing, location, and equipment used, as appropriate. This assessment would involve considering the presence of ESA-listed species at project locations/times, known equipment interactions with species expected to be present, and the history of interactions at a particular project site. These suggested minimization measures consider when, where, and what equipment could be used to reduce take-based species use of an area. This information combined with experience by the USACE and BOEM of problems encountered working in the same or similar areas would continue to be incorporated into the pre-construction project assessment. NMFS has provided an initial list of specific suggested items to consider when determining how to reduce take from an upcoming project; however, the project-specific considerations used are expected to evolve for each equipment type and project area, as USACE and BOEM continue to engage in projects in the action area.

Individual projects that were not reviewed during the annual review (e.g., USACE Regulatory projects that are proposed after the annual review and would be

implemented before the next annual review) would be reviewed using the same approach and discussion with NMFS. Before permitting any activities analyzed under the 2020 SARBO, conformance with the PDCs in the 2020 SARBO must be confirmed.

Assessment Step 2: Post-take Project Assessment. This process would be completed by USACE and/or BOEM after any take occurs to determine what factors lead to the adverse effect and if additional measures can be used to prevent it from occurring again.

Assessment Step 3: Post-Project Review and Reporting. This process would be used to document what happened during the project and any lessons learned that can be applied to future projects to reduce the potential of incidental take.

Assessment Step 4: Annual Review and Reporting. This process would be used to document what happened during the year and any lessons learned that can be applied to future projects to reduce the potential of incidental take.

The 2020 SARBO can be found on the NOAA's website at the following link (NOAA 2020): https://www.fisheries.noaa.gov/content/endangered-species-act-section-7-biological-opinions-southeast

The Surf City CSRM project would comply with all relevant SARBO project design criteria (PDC) requirements. PDC requirements include training and education of on-site personnel (vessel captain, crew, etc.) of project requirements, and completing work in a manner that would minimize effects to species. All work, including equipment, staging areas, and placement of materials, would be done in a manner that does not block access of ESA-listed species from moving around or past construction. Equipment would be staged, placed, and moved in areas and ways that minimize effects to species and resources in the area, to the maximum extent possible. All work that may generate turbidity would be completed in a way that minimizes the potential impacts of turbidity and sedimentation to the maximum extent practicable. Beach placement would be conducted in a manner that minimizes turbidity in nearshore waters by using methods that promote settlement before water returns to the water body (i.e., shore parallel dikes). Turbidity and marine sedimentation would be further controlled using land-based erosion and sediment control measures to the maximum extent practicable. Land-based erosion and sediment control measures would (1) be inspected regularly to remove excess material that could be an entanglement risk, (2) be removed promptly upon project completion, (3) and would not block entry to or exit from designated critical habitat for ESA-listed species. Lighting associated with beach placement activities would be minimized through reduction, shielding, lowering, and/or use of turtle friendly lights, to the extent practicable without compromising safety, to reduce potential disorientation effects on female sea turtles approaching the nesting beaches and sea turtle hatchlings making their way seaward from their natal beaches.

Threatened and endangered (T&E) species under the purview of the NMFS that could be present within the project areas 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*) and Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) (see **Table 20**).

Regarding T&E species under NMFS, for all three action alternatives evaluated, construction and maintenance of the SC CSRM project would be covered by the SARBO issued by the NMFS on March 20, 2020 (NMFS 2020). The SARBO covers dredging activities within navigation channels and borrow areas in the Southeastern United States from the North Carolina/Virginia border south to the Florida Keys and the islands of Puerto Rico and the US Virgin Islands.

The NMFS identified physical biological features (PBFs) of habitat essential for the conservation of the loggerhead sea turtle, the Primary Constituent Elements (PCEs) that support the PBFs, and the specific areas identified using these PBFs and PCEs. A description of the means used to identify PBFs, PCEs and specific areas can be found in the proposed rule 78 FR 18000, March 25, 2013.

Of the five categories of habitat identified in Loggerhead critical habitat, only Nearshore Reproductive Habitat occurs in the project area (**Figure 20**). Nearshore Reproductive Habitat is described as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment. Nearshore Reproductive Habitat is also described as the portion that are used by nesting females to transit between beach and open water during the nesting season.

The endangered North Atlantic right whale has been a particular focus of conservation efforts in the Southeastern United States, where the species has its only known calving habitat. North Atlantic right whales have been listed as endangered under the Endangered Species Act since 1970. Today researchers estimate there are about 360 North Atlantic right whales with fewer than 70 breeding females left. Only 69 births have been observed from 2017 to 2023, less than one-third the previous average annual birth rate for right whales. This, together with an unprecedented 123 deaths, serious or sublethal injuries/illnesses since 2017, accelerates the downward trend that began around 2010, with deaths outpacing births in this population (https://www.fisheries.noaa.gov/species/north-atlantic-right-whale).

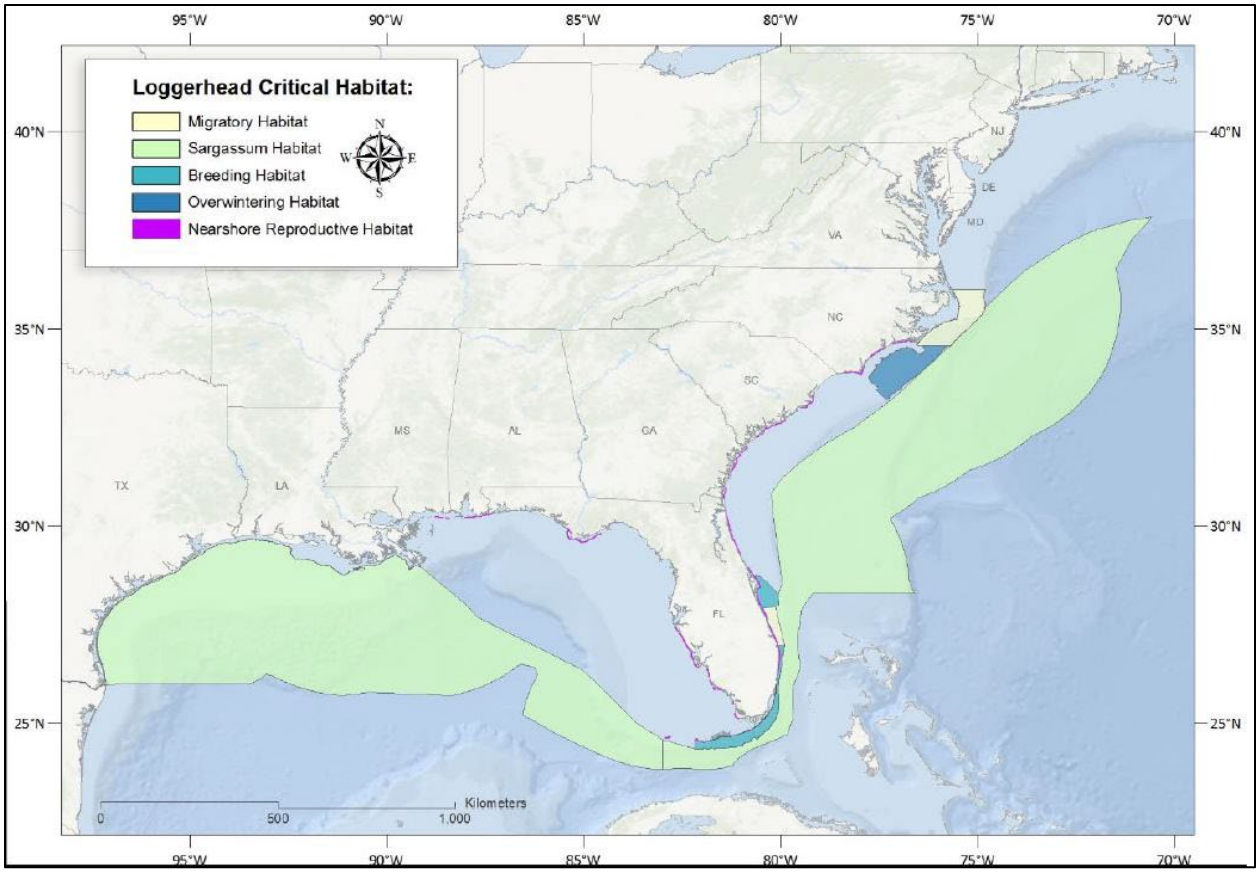


Figure 20.NMFS Loggerhead Critical Habitat.

North Atlantic right whales primarily occur in Atlantic coastal waters or close to the continental shelf, although movements over deep waters are known. Right whales migrate seasonally and may travel alone or in small groups. In the spring, summer, and into fall, many of these whales can be found in waters off New England and further north into Canadian waters, where they feed and mate. Each fall, some right whales travel more than 1,000 miles from these feeding grounds to the shallow, coastal waters of South Carolina, Georgia, and northeastern Florida. These waters in the southern United States are the only known calving area for the species and is the area where females regularly give birth during winter. While this is the typical pattern, migration patterns vary for some of these whales.

NOAA Fisheries has designated two critical habitat areas to provide important feeding, nursery, and calving habitat (located approximately 50 miles south of the project area) for the North Atlantic population of right whales (**Figure 21**):

- Off the coast of New England (foraging area)
- Off the southeast U.S. coast from Cape Fear, North Carolina, to below Cape Canaveral, Florida (calving area). The calving area is approximately 50 miles south of the project area.

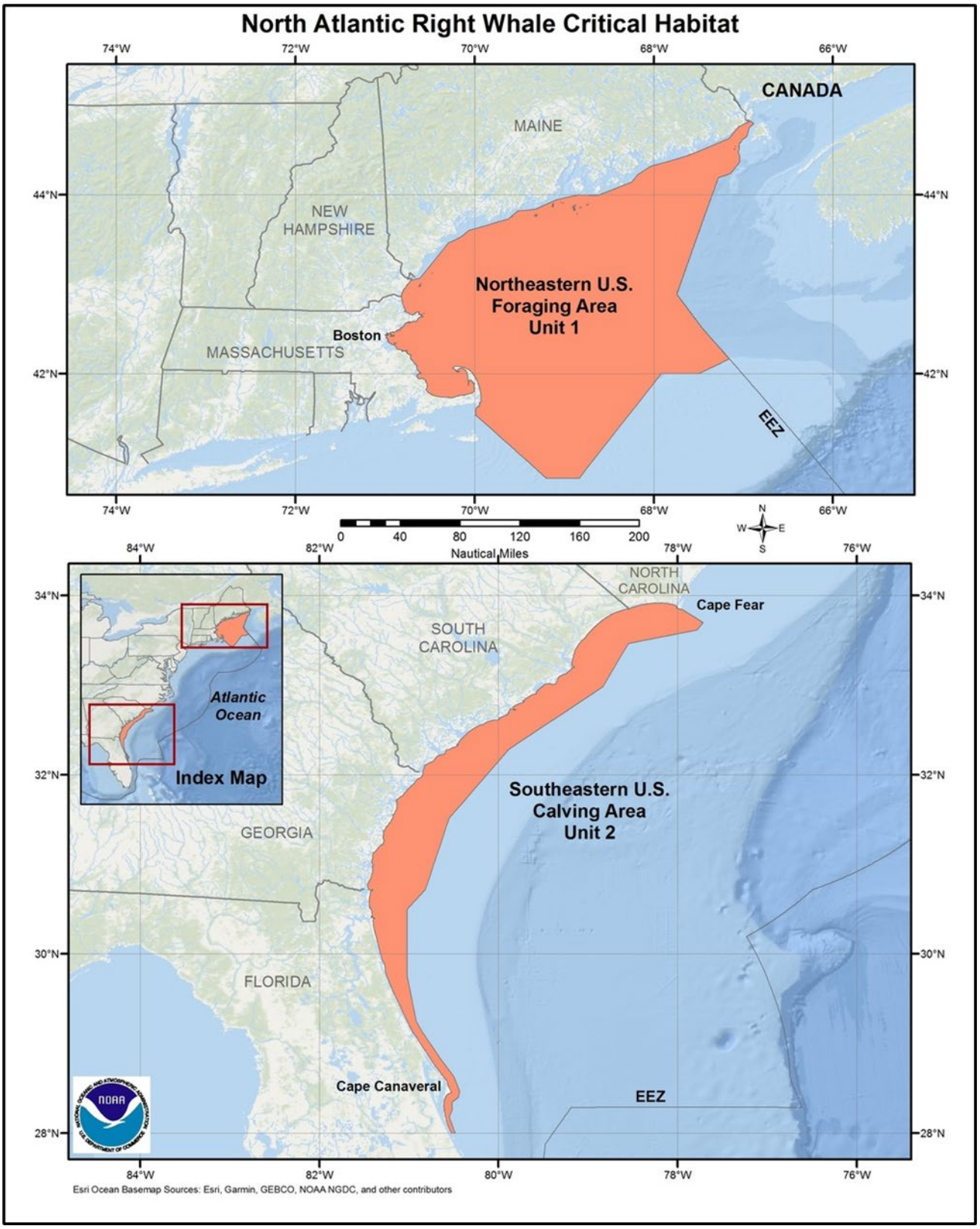


Figure 21. NARW Critical Habitat Foraging and Calving Areas.

One tradeoff considered is the implication of winter dredging windows on the potential increased vessel strike impacts to critically endangered North Atlantic Right Whales. The North Atlantic right whale Conservation Plan outlines management measures that the USACE South Atlantic Division (SAD) and BOEM would implement within its area of responsibility to create an ESA Section 7(a)(1) conservation program for North Atlantic right whales. The USACE SAD developed this program through consultation with the NMFS Southeast Regional Office. The North Atlantic Right Whale Conservation Plan complies with USACE Environmental Operating Principles, Civil Works Ecosystem Restoration Policy (ER 1165-2-501), and supports the conservation intent of the Marine Mammal Protection Act (16 U.S. Code Chapter 31). As part of the 2020 SARBO, the NARW conservation plan requires collection of additional data on the presence of the NARW off North Carolina and South Carolina waters and encourages the timing of projects to minimize the potential interaction with these critically endangered whales (e.g., ship strikes) during winter migration and calving periods when they are most vulnerable to ship strike.

The USACE and the BOEM would implement the North Atlantic right whale Conservation Plan within an Atlantic coastal action area extending from the Virginia/North Carolina border south to Cape Canaveral, Florida, during the North Atlantic right whale migration and calving season from November 1 through April 30.

This plan includes systems to detect the presence of whales, alert vessels operating in the area, and avoidance and minimization measures for projects covered under the 2020 SARBO that reduce the potential of a vessel strike if a whale is detected in the area. Implementation of these management measures would minimize the potential of North Atlantic right whale/dredge vessel interactions and would contribute to North Atlantic right whale recovery. The aerial survey team, North Carolina Early Warning System (NCWS), is managed by the Clearwater Marine Aquarium Research Institute, and funded by the USCE to monitor the calving season, prevent vessel collision, and document reproductive rates. **Table 21** shows the number of various whales sighted in North Carolina from November 15, 2023, through March 23, 2024.

Some of the potential effects of the action alternatives include entrainment of sea turtles and Atlantic sturgeon, localized increases in turbidity and possible vessel strikes with larger swimming mammals, such as whales or manatees. These impacts are largely avoidable by adhering to PDCs applicable to hopper dredging and the threatened and endangered species found within the project area as outlined in the 2020 SARBO and by following the USFWS *Guidelines for Avoiding Impacts to the West Indian Manatee.*

While interactions with ESA-listed species have been reported in the past during dredging and placement projects, and are expected to continue in the future, previous Section 7 consultation on these activities have concluded that none of

these activities were likely to jeopardize the continued existence of any ESA-listed species. SARBO considered the effects of take to the species based on the number of take estimated over any consecutive 3-year period for species with take estimated to occur annually (NOAA 2020). For example, the lethal take of 214 and nonlethal take (examples, include false crawls and nest relocation) of 5,270 loggerhead sea turtles plus the loss of 65 egg clutches associated with activities covered under the SARBO over any consecutive 3-year period is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of loggerhead sea turtles in the wild. The project may have impacts to species, but the SARBO states the proposed actions covered under the Opinion are not reasonably expected to cause an appreciable reduction in the likelihood of survival or recovery of the green, Kemp's ridley, leatherback or loggerhead sea turtles, Atlantic or shortnose sturgeon or the smalltooth sawfish. Therefore, it is not likely to jeopardize these species. For more information regarding ESA species please see the Biological Assessment in **Appendix K.**

Table 21.Survey Effort for the NCWS Surveys Conducted 15 November 2023 – 23 March 2024 (Meghan Bradley, Clearwater Marine Aquarium Research Institute).

Sightings (total)		**Hours Flown**	
Right Whales	67	**November**	49.9
Mom and Calf Pairs of NARW	4	**December**	87.9
Humpback Whales	82	**January**	48.2
Fin Whales	6	**February**	70.2
Minke Whales	2	**March**	59.2
Sperm Whales	2	**April**	
Leatherback Turtles	37		
Manta Rays	23	**Total**	**315.4**

Alternative 1 (No Action). This alternative would have no effect on threatened and endangered species.

Alternative 2a – Surf City Only With Environmental Windows. Initial construction would span four dredging seasons, requiring four disturbance events due to dredges and all other required equipment in the water and on the beach. A total of seven nourishment events occurring over the life of the project, each one approximately every six years.

Alternative 2a would minimize potential impacts to threatened and endangered species under the purview of NMFS and USFWS by following established operational protocols for dredging and beach placement and by adhering to the hopper dredging window of December 1 to March 31. However, dredging within the offshore borrow areas during the winter months may increase the potential impacts associated with ship strike injury to the critically endangered NARW. This alternative is covered by the USFWS North Carolina Coastal Beach Sand Placement Statewide Programmatic Biological Opinion Service Log Number 04EN2000-2017-F-0126, August 18, 2017. Impacts to sea turtle and bird nesting would be avoided because all work would occur outside their respective nesting seasons. Overall, impacts are largely avoidable by adhering to PDCs applicable to hopper dredging and the threatened and endangered species found within the project area as outlined in the 2020 SARBO and by following the USFWS *Guidelines for Avoiding Impacts to the West Indian Manatee.* Therefore, this alternative would not have significant impacts to the species at a population scale.

Alternative 2b – Surf City Only With Expanded Environmental Windows. For initial construction and nourishment events, the proposed expanded environmental window would result in an increase in the duration of disturbance from 4 months to 5.5 months. Initial project construction would be completed over three seasons, requiring three disturbance events as compared to four dredging seasons and four disturbance events under Alternative 2a. Expanding the dredging window for initial construction and nourishment events to coincide with the beach placement window of November 16 through April 30 would allow dredging to occur when water temperatures are warmer and biological activity is higher, therefore this alternative would likely have similar impacts to T&E species and designated critical habitat as Alternative 2a. Dredging and placement would disturb approximately 6 miles of shoreline.

This alternative is covered by the USFWS North Carolina Coastal Beach Sand Placement Statewide Programmatic Biological Opinion, Service Log Number 04EN2000-2017-F-0126, August 18, 2017. This alternative would avoid impacts on the beach during the sea turtle nesting season of May 1 to November 15 and the shorebird nesting season of April 1 to August 31; however, this alternative may result in added potential of ship strike injury to the endangered NARW.

The North Atlantic Right Whale (*Eubalaena glacialis*) would potentially have some benefit from a change with the extended window which may result in less work during the winter than would occur with Alternative 2a. Overall, impacts are largely avoidable by adhering to PDCs applicable to hopper dredging and the threatened and endangered species found within the project area as outlined in the 2020 SARBO and by following the USFWS *Guidelines for Avoiding Impacts to the West Indian Manatee.* Therefore, this alternative would not have significant impacts to the species at a population scale.

Alternative 2c – Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). Except for initial construction, impacts of this alternative would be like Alternative 2b. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months resulting in only one disturbance event as opposed to Alternative 2b that utilizes three disturbance events over three seasons. Impacts of the proposed action would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2b would be fewer.

Pursuant to Section 7 of the ESA of 1973 (P.L. 93-205), as amended, a biological assessment evaluating the potential effects of the proposed action on T&E species has been prepared (see **Appendix K**) and is being coordinated with the USFWS. Hopper dredging operations for the project would also work in accordance with the *2020 SARBO* or any superseding document that is prepared by NMFS. All compliance obligations under Section 7 would be satisfied before the proposed action is implemented. See **Table 20** for effects determinations for T&E species.

For species under the purview of the USFWS, the Eastern Black Rail*;* Red-cockaded Woodpecker*;* American Alligator*;* Northern Long-eared Bat; Tricolored Bat; Monarch Butterfly; Cooley's Meadowrue; Pondberry and Rough-leaved Loosestrife are all terrestrial, freshwater, marsh, woodland, or savanna species. Since this habitat type is not present in the areas to be affected by the proposed action, these species are unlikely to occur and therefore the project would have no effect.

Over the expected 16-month timeline for initial construction, only a portion of the beach would be impacted as the material is placed, allowing for recolonization of benthics for bird foraging as sections are completed. Nourishment events would occur approximately every six years, allowing for recolonization before the first nourishment cycle and between nourishments.

The placement of beach quality sand on the beach and the associated construction activities may temporarily impact foraging, sheltering, and roosting habitat and may impact the constituent elements for piping plover wintering habitat. However, beach placement and subsequent nourishments would mean more viable future habitat for these birds. The long-term effects of the project may restore lost roosting and nesting habitat through the addition of beach fill; however, short-term impacts to foraging, sheltering, roosting habitat may occur during project construction. Therefore, it has been determined that the project may affect, but is not likely to adversely affect the piping plover.

The placement of beach quality sand on the beach and the associated construction activities may also temporarily impact foraging, sheltering, and roosting habitat of the red knot. Again, beach placement and subsequent nourishments would mean more

viable future habitat for these birds. The long-term effects of the project may restore lost roosting and nesting habitat through the addition of beach fill; however, any beach construction action that occurs during the month of May and into June would have negative impacts on the quality and/or availability of foraging and roosting habitats. July-August numbers decline as final populations depart for their winter habitat. Considering that beach placement activities likely would occur during peak red knot migration (May-June), the placement of dredged material on the beach may affect but is not likely to adversely affect red knot.

Beach placement may result in deep burial of seabeach amaranth (*Amaranthus pumilus*) seeds during placement and may slow germination and population recovery temporarily. However, beach placement and subsequent nourishments would mean more viable future habitat for these plants. Therefore, the proposed action may affect, but is not likely to adversely affect the seabeach amaranth.

The loggerhead, green, Kemp's ridley, hawksbill, and leatherback sea turtles have been known or potentially nest within the limits of the project beach placement area. Therefore, species specific impacts may occur from the beach placements. The proposed project could potentially affect sea turtles both directly and indirectly in the following ways: (1) The pipeline route running parallel to the shoreline may impede nesting sea turtles from accessing suitable nesting sites, (2) The operation of heavy equipment on the beach may impact nesting females and incubating nests, (3) Associated lighting impacts from the nighttime operations and the increased beach profile elevation may deter nesting females from coming ashore and may disorient emerging hatchlings, (4) Burial of existing nests may occur if missed by monitoring efforts, (5) Escarpment formations could result in impediments to nesting females as well as potential losses to the beach equilibration process, (6) Relocation efforts could reduce nest success rates, and (7) Sediment density (compaction), shear resistance (hardness), sediment moisture content, beach slope, sediment color, sediment grain size, sediment grain shape, and sediment grain mineral content may be altered, potentially affecting the nesting and incubating environment. Though alterations in beach substrate properties may occur with the input of sediment types from other sources, re-establishment of a berm and dune system with a gradual slope would enhance nesting success of sea turtles by expanding the available nesting habitat beyond erosion and inundation prone areas.

During initial construction, monitoring for sea turtle nesting activity would be implemented throughout the construction area including the disposal area and beachfront pipeline routes, in accordance with guidelines provided by the NCWRC and USFWS, so that nests laid in a potential construction zone can be bypassed and/or relocated outside of the construction zone prior to project commencement. A Sea Turtle Monitoring and Nest Relocation Plan would be developed and implemented by the contractor to minimize impacts for the duration of the project (until all equipment is removed from the beach). Despite implementing the

conservation measures to the maximum extent practicable (i.e., beach quality sand and nest monitoring), the chance of impacting turtles and their incubating environment still exists. The project, which would be done in coordination with the USFWS, does not reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species and therefore does not jeopardize any threatened or endangered species. As a result, it has been determined that the proposed action may affect and is likely to adversely affect the loggerhead, green, Kemp's ridley, hawksbill, and leatherback sea turtles when under the jurisdiction of the USFWS.

The proposed project could potentially affect critical sea turtle habitat by altering sediment density (compaction), shear resistance (hardness), sediment moisture content, beach slope, sediment color, sediment grain size, sediment grain shape, and sediment grain mineral content, potentially affecting the nesting and incubating environment. However, due to the long-term benefits to sea turtle nesting habitat from the maintenance of the beach, this alternative is not likely to adversely modify the Recovery Unit LOGG-N-3 loggerhead critical habitat.

To avoid negative effects to the West Indian manatee, hopper dredges within the project areas would be required to follow the *USFWS Guidelines for Avoiding Impacts to the West Indian Manatee*, which is applicable for projects in North Carolina waters. Since the habitat and food supply of the manatee would not be significantly impacted, overall occurrence of manatees in the project vicinity is infrequent, all hopper dredging would occur in the offshore environment, and precautionary measures for avoiding impacts to manatees, as established by USFWS, would be implemented for transiting vessels associated with the project, the proposed action may affect by is not likely to adversely affect the manatee.

Regarding T & E species under the jurisdiction of NMFS, although, initial construction dredging and beach placement may take place any time of the year, and nourishments would occur in the timeframe between November 16 to April 30, the hopper dredges would follow project design criteria set forth in the 2020 SARBO to protect NMFS-protected T&E species (sea turtles, Atlantic and shortnose sturgeon, and NARW) and monitor for incidences of take of these species. See **Table 20** for effects determinations for T&E species.

Of the six species of whales listed in **Table 21**, only the NARW and humpback whale would normally be expected to occur in the project area. The proposed action would include the ability to perform initial construction (dredging and beach placement) any time of year. Conditions outlined in the 2020 SARBO to reduce the potential for accidental collision (i.e., contractor pre-project briefings, large whale observers, slow down and course alteration procedures) would be implemented as a component of the project. Therefore, the proposed project may affect, but is not likely to adversely affect the humpback whale, blue whale, finback whale, sei whale, and sperm whale.

The 2020 SARBO contains multiple avoidance measures as part of the NARW conservation plan. One of these measures is the Dredge Project Scheduling Project Based Adaptive Management Process (see Section 2.9.2.2 of the *2020 SARBO*). It states:

> *Hopper dredging and projects requiring survey vessels over 33-ft in length be scheduled, to the maximum extent practicable, outside of North Atlantic right whale migration and calving season to avoid impacts to North Atlantic right whales, including reproducing females and newborn calves. Other information that will be considered includes where material is to be placed and whether the timing of the placement would be high risk for other listed species (e.g. sea turtles).*

Other conservation measures agreed upon by USACE and NMFS and included in the NARW conservation plan, include the presence of trained Protected Species Observers onboard vessels, speed restrictions (<10 knots), and established right whale early warning system participation that includes aerial survey species tracking. Project Design Criteria, which are the specific criteria, including the technical and engineering specifications, indicating how an individual project must be sited, constructed, or otherwise carried out both to be covered under the SARBO and to avoid or minimize adverse effects to ESA-listed species or designated critical habitat. A full list of SARBO Project Design Criteria can be found in the NOAA's website at the following link: https://www.fisheries.noaa.gov/content/endangered-species-act-section-7-biological-opinions-southeast.

The NARW has occasionally been spotted from aerial surveys off Topsail Island during winter therefore, any work that occurs during the summer months (May-November) would reduce the potential of injuries occurring from ship strikes to the NARW. Implementation of the North Atlantic Right Whale Conservation Plan and the SARBO avoidance and minimization measures would minimize the potential of vessel interactions to the humpback and NARW and contribute to NARW recovery. If hopper dredging were to occur more frequently during the summer months (May-November) there would be less likelihood of injuries occurring from vessel strikes to the NARW. Therefore, dredging activities associated with the proposed action may affect but are not likely to adversely affect the humpback or NARW. The project which would be coordinated with the NMFS through the Supersede process, would not reduce appreciably the likelihood of both the survival and recovery of the NARW in the wild by reducing the reproduction, numbers, or distribution of that species and therefore would not jeopardize NARW.

The proposed hopper dredging activities for initial construction, as well as each nourishment interval, may occur in areas used by migrating turtles. Hopper dredges pose potential impacts to benthic oriented sea turtles through physical injury or death by entrainment. Under the proposed action, initial construction hopper dredging activities may be in operation any time of year. To avoid or minimize

adverse effects to ESA-listed species or designated critical habitat, the project would adhere to the SARBO Project Design Criteria. Therefore, the proposed hopper dredging activities may affect and likely to adversely affect loggerhead, leatherback, green, hawksbill, and Kemp's ridley sea turtles. Although there is potential of lethal and non-lethal take of sea turtles associated with hopper dredging and relocation trawling, there would not be a significant impact to the species at a population scale. The project would not reduce appreciably the likelihood of both the survival and recovery of sea turtles in the wild by reducing the reproduction, numbers, or distribution of that species and therefore does not jeopardize sea turtles. Overall, impacts are largely avoidable by adhering to PDCs applicable to hopper dredging and the threatened and endangered species found within the project area as outlined in the 2020 SARBO and by following the USFWS *Guidelines for Avoiding Impacts to the West Indian Manatee.* Therefore, this alternative would not have significant impacts to the species at a population scale.

Nearshore reproductive habitat is located within 1 mile from shore in areas with sea turtle nesting beaches and is found within the action area from North Carolina to south Florida. The current SARBO states, "We believe that dredging or the placement of materials and the transportation of materials may affect but is not likely to adversely affect the waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water feature of loggerhead sea turtle critical habitat. We believe the effects to this feature would be insignificant." All borrow areas are outside the 1-mile limit from shore and would not directly impact nearshore reproductive habitat. Therefore, the project would not be likely to adversely modify the nearshore reproductive habitat.

5.11 Climate Change and Sea Level Rise

A detailed analysis of climate change and sea level rise is provided in **Appendix P**. Temperatures are forecasted to increase in the future with more extreme rain events; however, there is less consensus on future annual precipitation totals. The changing climate is projected to lead to more extreme drought events. There is also potential for larger, more powerful tropical storms in the project area. These larger storms could lead to the need for a larger placement template or more frequent placement to provide the expected level of protection.

Within the project watershed, the CHAT tool predicts increasing annual maximum temperatures, annual mean temperatures, and annual precipitation in the simulated future period for both emissions scenarios (RCP 4.5 and 8.5).

An analysis of watershed climate vulnerability using the USACE VA Tool shows the area to be relatively less vulnerable for the emergency management, recreation, and flood rise reduction business lines compared to the entire USACE portfolio.

The potential for an increase in extreme drought events coupled with increased extreme rain events could lead to increased erosion in the project area. Increased

erosion in the area could lead to more frequent nourishment intervals to provide the expected level of protection.

Increasing sea level trends have been observed at the Wilmington NC gauge. Over the next 50 years the sea level is expected to rise to 2.929 feet in this area. Increasing sea levels have the potential to require a larger placement template on the beach to provide the expected level of protection.

Alternative 1 (No Action): Under this alternative the Town of Surf City would experience an increase of adverse climate projections leading to a loss of resilience and protection for the community.

Alternative 2a, 2b, and 2c: Under this alternative the increased coastal protection provided by the berm and dune system would increase the Town of Surf City's resilience for future adverse climate impacts including increased tropical storm activity and SLC.

5.12 Environmental Justice and Socioeconomics

Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, states that the Federal government will review the impacts of its proposed actions on low-income communities and minority populations. Federal agencies are "to the greatest extent practicable and permitted by law" identify and address "as appropriate, disproportionately high and adverse human health and environmental effects of its programs, policies and activities on minority populations and low-income populations in the United States."

The USEPA's environmental justice mapping and screening tool, EJ Screen, was utilized to provide demographic socioeconomic information with environmental data for the study area, narrowed specifically to the Topsail Island portion of the Town of Surf City.

These results indicate that the percentage of low-income communities (25%) and minority populations (9%) are well below the state average (34% and 37%, respectively) and the national average (31% and 39%, respectively). The greatest environmental and health risks to these populations come from climate change (specifically sea level rise), toxic releases into air, wastewater discharge and underground storage tanks.

Alternative 1 (No Action): Under this alternative the Town of Surf City would address identified coastal storm risks to low-income communities and minority populations through local and state programs, as well as through the Federal Emergency Management Agency's disaster response program. These actions could include the development of a local beach nourishment program, buy-outs, and/or relocations. The No Action alternative would not address the risks to property, economic growth, community resources, and social cohesion for low-income communities and minority populations within the island portion of Surf City.

Alternative 2a – Surf City With Environmental Windows. These alternative addresses identified coastal storm risks to low-income communities and minority populations through a Federal project involving sand berm and dune system within the island portion of Surf City. The alternative is the same as Alternatives 2b and 2c and reduces damages to standing structures (i. e. residential, public, commercial) and critical infrastructure, as well as supports economic growth, maintains community resources, and improves social cohesion.

Alternative 2b – Surf City with Expanded Environmental Windows. These alternative addresses identified coastal storm risks to low-income communities and minority populations in the same manner as Alternative 2a: through a Federal project involving a sand berm and dune system within the island portion of Surf City.

Alternative 2c – Surf City With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). This alternative is the proposed action and addresses identified coastal storm risks to low-income communities and minority populations in the same manner as Alternatives 2a and 2B: through a Federal project involving a sand berm and dune system within the island portion of Surf City.

No impacts are anticipated to low-income communities and minority populations within the island portion of Surf City. Therefore, the proposed action complies with EO 12898.

5.13 Munitions And Explosives of Concern

The potential for encountering MECs within the proposed action exists and is discussed in the 2010 Feasibility/EIS. As previously stated, the study area is within the limits of a U.S. Army training facility known as Camp Davis. The following description is taken from the Defense Environmental Restoration Program For Formerly Used Defense Sites (DERP-FUDS), Ordnance And Explosive Waste, Archives Search Report, Findings For The Former Camp Davis, Holly Ridge, North Carolina, Project Number 104nc001702 published in May 1994.

> *In 1941 Camp Davis was established as an Anti-Aircraft Training Center at Holly Ridge, North Carolina. Acquisition of land for Camp Davis took place from 1941 to 1943. Approximately 46,682 acres were acquired by lease from numerous individuals, corporations, and governmental agencies by the War Department for a World War II Army Air Corps training facility. The Training Center was later used as a convalescent hospital and rehabilitation center and became home to various military units. Coast Artillery Anti-Aircraft Regiments were the dominant groups, moving thousands of recruits through basic training and anti-aircraft weaponry. Although the main part of Camp Davis was on the mainland, northwest of Topsail Island, the Coastal Gunnery Range Emplacement Area was on Topsail Island near the Surf City bridge and the Coastal Gunnery Potential Range Impact Area was offshore of Topsail Island* (see **Figure 8**).

The Gunnery Emplacement area was 4.5 miles southeast of the main portion of the former Camp Davis. The site was known as the Sears Landing and occupied a narrow strip of land between the inland waterway and the ocean. As a gun emplacement, the ordnance used on-site would have been fired or returned to the point of issue; therefore, the possibility of ordnance residue is extremely remote. The inspection team did not observe any Ordnance or Explosive Wastes (OEW) in the area, and there are no reports of OEW within the gun emplacement area.

The Coastal Gunnery Range Impact Area, which was offshore of Topsail Island, was viewed by inspectors from the beach (no offshore survey was conducted). The AA coastal gunnery range impact area has potential ordnance contamination because of its use when it was active; however, no evidence of residual OEW contamination has been found or documented since the anti-aircraft gunnery range was closed. No records or documentation were located as to the exact types of ordnance used, although it is presumed that mostly practice rounds were used because gunners fired at a target that was pulled/towed behind an aircraft. Practice round sizes would have varied but are presumed to consist of: 37 mm (1.46 inches), 40 mm (1.57 inches), 3-inch, 90 mm (3.54 inches), 105 mm (4.13 inches), and 155 mm (6.10 inches).

After World War II, Camp Davis was assumed by the Navy for its secret guided missile testing program, code named Operation Bumblebee. Topsail Island was the third of three widespread test sites established along the Atlantic seaboard in the closing years of World War II and the first permanent ground for missile testing. The Topsail Island site, placed in operation in March 1947, incorporated rigid structures that were designed and built for specific uses related to the assembly, firing, monitoring and perfecting of experimental ramjet missiles. The Navy used only a small portion of Camp Davis for testing rocket motor propulsion systems. An arsenal center for assembling and storing rockets was built on the sound-side of the island, and launching pads were constructed on the oceanfront. Concrete observation towers were built throughout the island to monitor the experimental launchings, and many of the military structures remain today. During the 18 months that Operation Bumblebee was active at Topsail Island, an estimated 200 experimental rockets, each measuring 6 inches in diameter and between 3 and 13 ft. in length, were fabricated at the Assembly Building, dispatched to the launch site, and fired along a northeasterly angular deflection of 15 degrees to the shoreline for a maximum clear distance of 40 miles. Despite the initial success of the U.S. Naval Ordnance Testing facility at Topsail Island, its location did not fulfill completely the needs of a permanent base because weather conditions and increased sea traffic interfered with testing, and

Navy abandoned the facility and moved its equipment to other sites (http://www.cr.nps.gov/nr/travel/aviation/usn.htm).

Although, more than 200 rocket launchings took place on the island between 1946 and 1948, no OEW was associated with the testing procedures, and all leased land was returned to the original landowners. Most of the former Camp Davis lands are being used for state wildlife game lands (Holly Shelter) and for producing forestry products.

Impacts from HTRWs within the proposed action, and documented within the 2010 Feasibility/EIS, concluded that "[t]he probability of the areas being contaminated by pollutants is low; however, the beach front (potential nourishment area) and the potential borrow areas are in areas that were affected by the operations of Camp Davis and the Navy's Operation Bumblebee."

It was added that ". . . a very remote possibility exists that OEW (or MECs) could be present in the material to be dredged from offshore borrow areas. However, the only ordnance that would be expected to be encountered would be spent shells from anti-aircraft target practice. The missiles that were tested during Operation Bumblebee contained no OEW and were fired approximately 40 miles offshore, well beyond the project area, and the likelihood of encountering them in an offshore borrow area would be remote."

A final Site Inspection (SI) report dated June 2008 was prepared for the Camp Davis FUDS property to determine the presence/absence of MEC contamination associated with Department of Defense (DoD) use of the property. Several munitions response sites (MRS) were identified in the SI report, with only one MRS potentially impacting the offshore borrow sources for the project. This MRS was identified as MRS2 (Coastal Anti-aircraft Range) with the firing point located at Surf City and the range fan extending outward into the Atlantic Ocean (see **Figure 8**). No historic reports of MEC associated with this range were identified. The SI report states that High Explosives may have been used at the Coastal Anti-aircraft range, but not considered likely. The report recommended no action for the Coastal Anti-Aircraft Range as no MECs were found at the MRS since site closure and an incomplete exposure pathway.

Given the risk and uncertainty associated with MECs and the project area, USACE would develop a probability assessment in cooperation with Environmental and Munitions Center of Expertise in Huntsville, Alabama and/or its Military Munitions Design Centers (MMDC) and per ER 1110-1-8183. The assessment would determine the nature and extent of MECs within offshore borrow areas and present recommendations to reduce risks to the public.

It is not expected that any HTRW sites would be encountered during construction or periodic nourishment. However, if any hazardous and toxic waste sites are identified, response plans and remedial actions would be the responsibility of the NFS.

Based on this information and the above assumptions, USACE has determined following:

Alternative 1 (No Action) - This alternative would have no impact from MECs.

Alternative 2a – Surf City Only With Environmental Windows. This alternative may encounter MECs, but with the risk reduction measures outlined above, would not expect to be significant.

Alternative 2b – Surf City Only With Expanded Environmental Windows. This alternative may encounter MECs, but with the risk reduction measures outlined above, would not expect to be significant.

Alternative 2c – Surf City With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action). This alternative may encounter MECs, but with the risk reduction measures outlined above, would not expect to be significant.

5.14 Environmental Impact Comparison of Alternatives and Summary

Table 22 compares the environmental impacts by alternative.

5.15 Cumulative Impacts

The CEQ regulations (40 CPR 1508.7) require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions."

This analysis considers the cumulative effects related to direct and indirect effects of dredging of offshore material and placement on Surf City with no environmental windows for initial construction and expanded environmental windows for nourishment events.

Table 22. Summary and Comparison of Impacts.

	Alternative 1: No Action	Alternative 2a: Surf City Only With Environmental Windows	Alternative 2b: Surf City Only With Expanded Environmental Windows.	Alternative 2c: Surf City Only With No Environmental Windows for Initial Construction and Expanded Environmental Windows for Nourishment Events (Proposed Action).
Geology and Sediments	No effect.	Post-dredging borrow area depressions would be slightly deeper on average but like the 2010 Feasibility/EIS. Deep depressions are not anticipated.	Post-dredging borrow area depressions would be slightly deeper on average but like the 2010 Feasibility/EIS. Deep depressions are not anticipated.	Post-dredging borrow area depressions would be slightly deeper on average but like the 2010 Feasibility/EIS. Deep depressions are not anticipated.
Water Quality	No effect.	Temporary and minor effects to turbidity and DO Dec 1-Mar 31 for (construction) and every 6 years (nourishments) thereafter. No significant long-term negative effects.	Minor, localized, temporary increase in turbidity and DO for construction and nourishments (Nov 16 and April 30). No significant long-term negative effects.	Impacts would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2 would be fewer. Initial construction impacts would have minor and temporary increase in turbidity and DO during times of high biological activity (April – July). No significant long-term negative effect. Nourishment event impacts would be like Alternative 2.
Surf Zone and Nearshore Ocean Fishes	No effect.	Critical life stages of brown shrimp, summer and southern flounder, and gag grouper may be present within and around the borrow areas during dredging and at risk of turbidity and entrainment by the dredge. Temporary and minor impacts from placement. Overall, the impacts from dredging and placement would be insignificant.	Critical life stages of pink and brown shrimp, blue crab, summer and southern flounder, and gag grouper may be present within and around the borrow areas during dredging and at risk of turbidity and entrainment by the dredge. Temporary and minor impacts from placement.	Impacts would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2 would be fewer. During initial construction, bottom dwellers and feeders within borrow sites and placement areas would be more abundant during the warmer months of the year, increasing their risks to the effects of dredging and dredged material placement. Critical life stages of pink and brown shrimp, blue crab, summer and southern flounder, and gag grouper may be present within and around the borrow areas during

			Overall, the impacts from dredging and placement would be insignificant.	dredging and at risk of turbidity and entrainment by the dredge. Overall, these impacts would be minor and therefore insignificant. Nourishment impacts would be the same as Alternative 2.
Nekton	No effect.	Entrainment of benthic oriented organisms would be expected but not adverse effects to species at the population level.	Increased impacts from dredging during higher biological activity but are not significant.	Impacts would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2 would be fewer. Other impacts are the same as Alternative 2. Nourishment impacts would be the same as Alternative 2. Overall Impacts are not significant.
Larval Entrainment	No effect.	Some entrainments of larvae, but no adverse effects to species at the population level.	Increased impacts from dredging during higher biological activity but are not significant.	Impacts would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2 would be fewer. Other impacts are the same as Alternative 2. Nourishment impacts would be the same as Alternative 2. Overall Impacts are not significant.
Benthic Resources	No effect.	Impacts due to direct burial or increased turbidity in the surf zone would be expected to be localized, short-term, and reversible. Deep depressions are not anticipated. Short-term impact to benthic organisms from dredging. A total reduction from 12,307 acers (2010 Feasibility/EIS) to 9,663 acres.	Increased impacts to benthics during months of April and November but are not significant. Minor impact to benthic macro-invertebrate community from direct burial and turbidity associated with beach placement.	Impacts would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2would be fewer. Other impacts are the same as Alternative 2. Overall, these impacts would be temporary and insignificant. Nourishment impacts would be the same as Alternative 2.

			Short-term and localized impact to macroinvertebrate community associated with dredging. A total dredging footprint impact reduction from 12,307 acres (2010 Feasibility/EIS) to 9,663 acres.	
EFH and Hardbottoms	No effect.	Short-term and minor impacts due to entrainment, human-made sound, loss of prey/food web, loss of bottom substrate and sedimentation potential release of contaminants and suspended/resuspended sediment plumes. Avoidance of turbidity and entrainment effects from April to November. Minor impacts due to implementation of the 400- or 500-foot buffer in hardbottom areas and Monitoring of sedimentation and turbidity to assess impacts to benthos and hardbottoms. Overall, impacts would be temporary and localized but not significant. Would not have significant impacts to the species at a population scale.	Increased impacts during months of April and November but are not significant. However, this alternative is not anticipated to significantly impact EFH species or habitat that may be in the project area. Would not have significant impacts to the species at a population scale.	Impacts would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2 would be fewer. Other impacts are the same as Alternative 2. This alternative is not anticipated to significantly impact EFH species or habitat that may be in the project area. Nourishment impacts would be the same as Alternative 2. No significant negative effects. Would not have significant impacts to the species at a population scale.
Birds	Long-term loss of habitat areas as beach erodes.	Beach nourishment activities could temporarily affect the roosting and intertidal macro-fauna foraging habitat. Overall impacts would be insignificant.	Increased potential of short-term impacts to nesting (April 1 through August 31), foraging and roosting shorebirds in the month of	Impacts would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2 would be fewer.

			April. Long-term enhancement of beach habitat areas with nourishment. Overall impacts would be insignificant.	During initial construction, increased potential of short-term impacts to nesting (April 1 through August 31), foraging and roosting shorebirds. Nourishment impacts would be the same as Alternative 2.
Cultural Resources	No effect.	No effect for proposed sand borrow location. Additional consultation under Section 106 of NHPA may be needed for nearshore pipeline routes and hopper pump-out locations, once known.	No effect for proposed sand borrow location. Additional consultation under Section 106 of NHPA may be needed for nearshore pipeline routes and hopper pump-out locations, once known.	No effect for proposed sand borrow location. Additional consultation under Section 106 of NHPA may be needed for nearshore pipeline routes and hopper pump-out locations, once known.
Noise	No effect.	Minor, temporary increase in noise during construction and nourishments, but would occur during times of low biological activity and when fewer people visit and use the beach. No significant increases in noise.	Minor, temporary increase in noise during November 16-April 30, when water temperatures are warmer, biological activity is higher and more people visit and use the beach. No significant increases in noise.	Impacts would be of longer continuous duration and occur during peak tourist season when water temperatures are warmer and biological activity is higher but the frequency of disturbances over the duration of project construction as compared to Alternative 2 would be fewer. For initial construction, minor, temporary increase in noise during times of higher biological activity for most species). Reduced impact of noise to NARW during summer. Impacts are temporary and short-term, and therefore not significant. Nourishment impacts would be like Alternative 2.
Recreation, Aesthetic and Fishing Resources	Long-term negative impact to the aesthetic view and a reduction of sunbathing and other	Work during winter avoids of peak tourist season. Temporary reduction of aesthetic appeal and interference with recreational and fishing activities. Overall, short-term minor adverse	Expanded windows increase work during warmer weather which increases the possibility of recreation, aesthetic and fishing impacts. Overall, short-term minor adverse and long-term	Impacts would be of longer continuous duration and occur during peak tourist season when water temperatures are warmer and biological activity is higher but the frequency of disturbances over the duration of project construction as compared to Alternative 2 would be fewer. Nourishment impacts would be like Alternative 2.

	recreational activities along the beach front. No effect on fishing.	and long-term minor beneficial effects.	beneficial effects would be expected on recreation, aesthetic and fishing resources along with long-term improvement of appearance and enhanced recreational experience.	Overall, short-term minor adverse and long-term beneficial effects on recreation, aesthetics and fishing.
Air Quality and Greenhouse Gases	No effect	Minor, temporary and short-term increase of emissions	Impacts of this alternative would be like Alternative 2a, but with a slight increase of potential impacts of initial construction during warmer months	Initial construction would result in one disturbance event, lasting approximately 13 continuous months, from the dredge and all other required equipment in the water and on the beach. Impacts of this alternative would be like Alternative 2b, but with a slight increase of impacts of initial construction during warmer months
Threatened and Endangered Species	Long-term loss of bird, turtle and seabeach amaranth habitat areas as beach erodes.	Minimizes potential impacts due to December 1 to March 31 work window. Increased potential impacts associated with ship strike injury to the critically endangered NARW due to multiple disturbance events during winter.	Increased potential impacts to the manatee, piping plover, red knot, green, hawksbill, Kemp's leatherback and loggerhead sea turtle, Atlantic sturgeon and seabeach amaranth due to expansion of the dredging and placement window of November 16 through April 30.	Impacts would be of longer continuous duration and may occur during higher biological activity, but the frequency of disturbances over the duration of project construction as compared to Alternative 2 would be fewer. For initial construction, MALAA the loggerhead, green, hawksbill, leatherback and Kemp's Ridley sea turtles, MANLAA determination for all other affected species; no effect to Loggerhead CH. Less likelihood of injuries occurring from vessel strikes to NARW when work occurs in summer. Nourishment impacts would be like Alternative 2.

Environmental Justice and Socioeconomics	The No Action alternative would not address the risks to property, economic growth, community resources, and social cohesion for low-income communities and minority populations.	This alternative would reduce damages to standing structures (i. e. residential, public, commercial) and critical infrastructure to maintain economic growth, community resources, and social cohesion for low- income communities and minority populations.	This alternative would reduce damages to standing structures (i. e. residential, public, commercial) and critical infrastructure to maintain economic growth, community resources, and social cohesion for low-income communities and minority populations.	This alternative would reduce damages to standing structures (i. e. residential, public, commercial) and critical infrastructure to maintain economic growth, community resources, and social cohesion for low- income communities and minority populations.
HTRW	The No Action alternative would not address the Impacts of HTRWs	Implementing the measures to address potential MECs, this alternative would avoid impacts from HTRWs.	Implementing the measures to address potential MECs, this alternative would avoid impacts from HTRWs.	Implementing the measures to address potential MECs, this alternative would avoid impacts from HTRWs.

Direct effects (occurring at the same time and place) of hopper dredging occur within offshore borrow areas and along the beach of Surf City, and resources present within these limits are impacted by entrainment, direct contact with vessels, changes in water quality and increased noise levels. Resources impacted include benthic invertebrates (sessile and mobile), nektonic species that feed and dwell on the seafloor, and marine reptiles and mammals such as sea turtles, manatee and whales.

Indirect impacts (occur later in time or are farther removed in distance) the project occur outside of the dredging limits and, depending on currents, tides and weather, can have a varying impact on resources within a 1–2-mile distance from the dredge. Resources include species and habitat in the adjacent ocean, and beach front environments that can be impacted by changes in water quality and increases in noise levels produced by the hopper dredge. Overall, increases in indirect impacts are not expected to result in significant cumulative effects on habitat and species present.

The Wilmington District's coastal storm risk management program has nourished Ocean Isle Beach, Carolina Beach, Kure Beach and Wrightsville Beach for the past 50 years. All these projects have similar impacts to water quality, noise levels, benthic organisms, important fisheries and federally protected marine reptiles and mammals.

Since this time, dredges have grown in demand and become more highly efficient, innovative and cost-effective while also responding to concerns regarding environmental impacts. In 2006, USACE implemented the Silent Inspector (SI) program on a national basis to monitor hopper dredging by collecting digital data from the dredge and compiling it into a central database. SI evolved into the Dredging Quality Management Program (DQM) that provides near real-time data for all USACE dredging projects. Today, DQM allows for better understanding and oversight of hopper dredge operations, thus reducing risks to protected resources.

Unavoidable impacts from hopper dredging occur due to increased turbidity, noise levels and entrainment. Benthic organisms in the path of the dredge would be entrained and die; however, communities are expected to recover rapidly and therefore these localized effects of removing sediment within the dredge footprint or minor sedimentation in surrounding areas would only have short-term impacts on the ecosystem and benthic resources would recover quickly. Under the no action alternative, critical life stages of important fisheries most at risk of dredging are summer and southern flounder and brown shrimp that occur in the inlets and ocean; and Atlantic and shortnose sturgeon, American shad and river herring that occur in the Cape Fear River (NOAA Report, 2019). Populations of these species have been damaged over time mainly due to fishing practices, and hopper dredging is not

known to have a decline on the populations of these species. The effects to Atlantic and shortnose sturgeon are analyzed in the 2020 SARBO.

Historically, hopper dredging had a window put in place primarily to protect sea turtles. Although effective at reducing takes, hopper dredging during the December 1 – March 31 window may occasionally entrain sea turtles resting on the bottom or affected by cold stunning, despite the protection measures in place. The 2020 SARBO shifts from historic winter dredging as the primary method to reduce take to an adaptive management assessment approach that considers timing and equipment choices to reduce effects to all species in these areas. The 2020 SARBO also includes the use of relocation trawling as an option to minimize take, which were not available under the 1997 SARBO. Relocation trawling is an option to relocate sea turtles (except leatherback sea turtles) and sturgeon out of the project area. Using the adaptive management assessment approach with these available options allows USACE to work in times outside the historic dredging window and still minimize the risk of sea turtle takes. NMFS increased the numbers of allowable takes for sea turtle species in the 2020 SARBO to cover the larger area covered under the Opinion from North Carolina to the U.S. Caribbean and to account for changes in sea turtle populations.

The critically endangered North Atlantic Right Whale (NARW) is also under protection by NMFS and the 2020 SARBO and may be present in the harbors during the December 1 – March 31 window. NARW and their calves are at great risk of vessel strikes. USACE developed a conservation plan included in the 2020 SARBO as Appendix F to minimize this risk. This conservation plan includes USACE funding additional aerial survey teams to monitor for the presence of NARW in North Carolina, South Carolina, and Georgia. It also states that USACE hopper dredging and projects requiring survey vessels over 33-ft in length would be scheduled, to the maximum extent practicable, outside of NARW migration and calving season to avoid impacts, especially to reproducing females and newborn calves. Protected Species Observers on hopper dredges and relocation trawling vessels monitor for the presence of marine mammals and vessels slow when NARW are in the area according to the conservation plan. To date, there are no recorded NARW takes (ship strikes) from hopper dredging in the project area.

In the past 5 years, more non-federal hopper dredging projects have occurred along the NC coast. From 2017-2019, Dare County utilized hopper dredges to nourish beaches in the Towns of Duck, Kitty Hawk, Southern Shores, Kill Devil Hills, Nags Head and Buxton. Dredging and placement for all these projects occurred during the summer months, since offshore conditions are unsafe for the dredge and crew to work in the wintertime. Other shoreline protection projects that utilize hopper dredges include Topsail Beach and Bogue Banks. These projects operate under their own USFWS and NMFS Biological Opinions. Work is expected to reoccur

approximately every five years under the USFWS Opinion and the 2020 SARBO since it replaced the previous individual NMFS consultations.

The future may see an increase in demand for hopper dredging, as more and more federal and non-federal beach projects get underway, not considered as part of this EA. Continuing to hopper dredge during the December 1 – March 31 window would have minor effects on the benthos, fish and threatened and endangered species present during this time. Turbidity rates and noise levels would not increase, and the footprint of disturbance would continue to occur in the same previously disturbed areas. In combination with past, present and foreseeable future hopper dredging of federal and non-federal projects along the entire North Carolina coast, impacts to benthic organisms, fisheries and marine reptiles and mammals would be minimal. Therefore, cumulative effects from of the no action alternative on marine species are expected to be negligible.

5.16 Conclusions

This EA evaluated the changes including removal of North Topsail Beach from the project, as well as changes in sediment volumes, borrow areas and the borrow area use plan, to address dredging and placement window alternatives and to update environmental monitoring/commitments to avoid or minimize impacts. The proposed action incorporates the environmental commitments described in *Section 2.5*, as well as the requirements of the current SARBO and any other revised requirements that may come from the forthcoming USFWS BO or during the NEPA process. Based on findings described in this EA, it is in the federal interest to implement the proposed action to eliminate environmental windows for initial construction only, with an expanded environmental window for nourishment events to the current beach placement window of November 16 to April 30. During initial construction, dredging and beach placement may occur any time of year and could be ongoing, without interruption, for up to 16 months utilizing only one disturbance event. Impacts of the proposed action may result in minor and short-term impacts to beach and dune, water quality, surf zone and nearshore ocean fishes, nekton, larval entrainment, benthic resources, EFH, birds, noise, air quality, threatened and endangered species, recreation, aesthetic and fishing resources. The proposed action would have no effect on cultural resources. Overall, no significant impacts are expected. The overall benefit of the proposed action is to document new information obtained since completion of past NEPA documents for the SCNTB CSRM project, to discuss changes to the project, including removal of North Topsail Beach from the project, as well as changes in sediment volumes, borrow areas and the borrow area use plan, to address dredging and placement window alternatives and to update environmental monitoring/commitments to avoid or minimize impacts.

Monitoring, assessing and evaluating data during and after dredging would be important on reducing impacts to the environment. USACE would use the current SARBO project assessment framework to evaluate potential impacts to all species

and habitat in the area by considering the possible routes of effects based on project location, timing, equipment, and minimization measures available. The assessment would consider the potential impacts and benefits at a local, regional, and national level and prioritize protection of the most vulnerable species based on population status and the best-available information.

Though time and space crowded perturbations are expected in the reasonably foreseeable future, assuming each project adheres to project related impact avoidance measures, it is likely that adjacent unimpacted and/or recovered portions of beach would be available to support dependent species and facilitate recovery of individual project sites to pre-project conditions. When combined with the impacts of other foreseeable projects in the south Atlantic, potential impacts to borrow sites or to beaches on which the material is placed would be minimal.

The proposed action would not significantly impact the quality of the human environment. If this opinion is upheld following circulation and review of this EA, a FONSI be signed and circulated.

6.0 PLAN IMPLEMENTATION

6.1 Project Schedule

Table 23. Project Schedule.

Activity	Date
Execution of the Project Partnership Agreement	November 2025
Certification of Real Estate	January 2026
Issue Solicitation	May 2026
Award Contract	June 2026
Begin Construction	September 2026
Complete Construction	October 2027

6.2 Division of Plan Responsibilities

6.2.1 General

Federal policy requires that costs for water resources projects be assigned to the various purposes served by the project. These costs are then apportioned between the federal government and the NFS according to percentages specified in Section 103 of the WRDA of 1986 (Public Law 99-662). For projects that provide damage reduction to publicly owned shores, the purposes are usually (1) Coastal Storm Risk Management and (2) separable recreation. For the Surf City project, there is no separable recreation component.

6.2.2 Cost-Sharing

Cost sharing for initial construction of the recommended plan would be consistent with that specified in Section 103(c)(5) of WRDA 1986 as amended by WRDA 1996 (generally 65 percent federal and 35 percent non-federal). Cost-sharing for the selected plan is shown in **Table 24** at FY24 price levels.

Table 24. Project Cost Share.

Initial Project Construction Costs					
Project purpose	Project First Costs	Apportionment %		Apportionment $	
		Non-Federal	Federal	Non-Federal	Federal
Coastal Storm Risk Management	$186,637,000	35%	65%	$65,322,950	$121,314,050
LERRD Credit	$1,022,125	100%	0%	$1,022,125	$0
Cash Portion	$185,614,875			$64,300,825	$121,314,050
Total Renourishment Costs					
Project purpose	Total Cost (7 renourishments)	Apportionment %		Apportionment $	
		Non-Federal	Federal	Non-Federal	Federal
Coastal Storm Risk Management	$ 317,426,000	50%	50%	$ 158,713,000	$ 158,713,000
Annual Costs					
	Cost per year	Apportionment %		Apportionment $	
		Non-Federal	Federal	Non-Federal	Federal
Beach Fill Monitoring	$25,000	100%	0%	$25,000	$0
General Repair, Maintenance, Inspection	$75,000	100%	0%	$75,000	$0
Total Annual Costs	$100,000			$100,000	$0

Non-federal interests are required to provide all lands, easements, right-of-way, and dredged material disposal areas and perform all necessary relocations necessary for the project (**Appendix E**). The value of the non-federal portion of the lands, easements, rights-of way, relocations, and disposal areas (LERRD) is $1,022,125 and is included in the non-federal share of initial project construction costs. The remainder of the non-federal share of initial project construction costs consists of approximately $64,300,825 cash contribution.

Cost sharing for periodic nourishment (i. e. continued construction) would be consistent with Section 215 of WRDA 1999, which requires that such costs be shared 50 percent federal and 50 percent non-federal.

Annual Operations, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) costs, such as inspection costs and dune vegetation maintenance costs, are 100 % non-federal responsibility. The federal government is responsible for preparing and providing an OMRR&R manual to the sponsor.

As noted previously, current federal policy requires that, unless there are other, overriding considerations, the plan that produces the maximum net benefits, the NED Plan, would be the plan recommended for implementation. However, the NFS can request recommendation of a Locally Preferred Plan (LPP) that differs from the NED Plan if they are willing to pay 100% of the cost differential between the two plans. In this case, the NFS has not elected to pursue an LPP, therefore the recommended plan is the NED plan.

The sponsor has obtained the required public access sites and public parking to meet the definition of a public shoreline in accordance with Engineering Regulation (ER) 1165-2-130. Cost sharing would not be impacted by public access sites or public parking availability.

Actual cost-sharing percentages for the project would ultimately be based on a detailed assessment prior to initiation of construction, of the following factors:

1. Adequacy of public access and public parking throughout the constructed project reach (factor met).
2. Economic justification of the individual project reaches (factor met), and.
3. Presence of undeveloped lots.

All these requirements may affect the cost-sharing percentages of federal and NFSs. This issue is also re-visited prior to each re-nourishment, and cost-sharing may be adjusted accordingly. Continued maintenance (i. e. access for the public by both access corridors and public parking) is an especially important factor in ensuring funding of the project. The NFS is fully aware of all the factors potentially affecting cost-sharing and has wholly committed to meeting those requirements.

Cost allocation for undeveloped lots would be 100% non-Federal. The presented cost-sharing percentages assume 100% development along the entire project shoreline. The number of undeveloped first row lots would be reassessed before the signing of the PPA, and the cost-sharing would be recalculated at that time to reflect any remaining undeveloped lots.

6.2.3 Project Partnership Agreement

A Project Partnership Agreement (PPA) would establish the responsibilities for project execution between the federal government and the NFS as required by Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 USC 1962d-5b), and Section 103 of the WRDA of 1986, Public Law 99-662, as amended (33 USC 2213), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the NFS has entered into a written agreement to furnish its required cooperation for the project or separable element. The terms of local cooperation to be required in the PPA are described below. A Letter of Intent acknowledging this process and stating their intent to support project implementation would be obtained from the Town of Surf City and included in the final report.

Federal commitments regarding a construction schedule or specific provisions of the PPA cannot be made to the NFS on any aspect of the recommended plan or separable element until the following are true:

1. The recommended plan is authorized.
2. Construction funds are appropriated, apportioned by the Office of Management and Budget, and their allocation is approved by the ASA(CW). These funds may be appropriated, apportioned, and allocated for construction of the authorized project under DRA 19.
3. The draft PPA has been reviewed and approved by the ASA(CW).

6.3 View of the Non-Federal Sponsor

The Town of Surf City fully supports the recommended plan. A letter of support from them will be included in the final report.

The Town of NTB decided not to participate in the project. Multiple letters were sent to the town detailing the implications of not participating in the project. Acknowledgement of those letters and the town's understanding will be included in the final report.

7.0 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS*

Table 25 presents the status of compliance with relevant Federal laws. Additional comments are provided below.

Table 25. The Proposed Action and Compliance with Federal Laws and Policies.

Title of Public Law	US CODE	*Compliance Status
Anadromous Fish Conservation Act of 1965, As Amended	16 USC 757 et seq.	Full Compliance
Clean Air Act of 1972, As Amended	42 USC 7401 et seq.	Full Compliance
Clean Water Act of 1972, As Amended	33 USC 1251 et seq.	Full Compliance
Coastal Zone Management Act of 1972, As Amended	16 USC 1451 et seq.	Full Compliance
Endangered Species Act of 1973	16 USC 1531	In Progress
Estuary Protection Act of 1968	16 USC 1221 et seq.	Full Compliance
Farmland Protection Policy Act	7 USC 4201 et seq.	Full Compliance
Fish and Wildlife Coordination Act of 1958, As Amended	16 USC 661	Full Compliance
Magnuson Fishery Conservation and Management Act – Essential Fish Habitat	16 USC 1801	Full Compliance
National Environmental Policy Act of 1969, As Amended	42 USC 4321 et seq.	In Progress
National Historic Preservation Act of 1966, As Amended	16 USC 470	In Progress
Protection and Enhancement of Environmental Quality	E.O. 11514/11991	Full Compliance
Protection and Enhancement of the Cultural Environment	E.O. 11593	Full Compliance
Floodplain Management	E.O. 11988	Full Compliance
Protection of Wetlands	E.O. 11990	Full Compliance
Federal Actions to Address Environmental Justice and Minority and Low-Income Populations	E.O. 12898	Full Compliance
Implementation of the North American Free Trade Agreement	E.O.12889	Full Compliance
Invasive Species	13112	Full Compliance

*Full compliance upon completion of the NEPA process.

7.1 National Environmental Policy Act (Public Law 91–190)

This EA was prepared in accordance with the NEPA, the Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations parts 1500- 1508,1515-1518), and Engineer Regulation 200-2-2.

During the NEPA scoping process, comments were received from NC Division of Marine Fisheries, NC Wildlife Resources Commission, NC Audubon Society, US Fish and Wildlife Service, NC Division of Coastal Management, and the NC Division of Water Resources. Concerns voiced were predominantly related to the potential for effects on hardbottom habitats, non-beach quality material being placed on the beach, impacts to threatened and endangered birds and sea turtles, and impacts from both private and Federal projects. Comments also resulted in a request from the USFWS to enact formal consultation by means of submitting a Biological Assessment, and a request from the North Carolina Division of Coastal Management to provide a Coastal Area Management Act consistency determination. All identified agency and stakeholder concerns were considered during the development of the EA.

The BOEM (previously the Minerals Management Service) was a cooperating agency for the 2010 EIS, and has continued in this role for the EA. The USACE maintain its role as the lead federal agency for NEPA, Section 7 of the Endangered Species Act (50 CFR 402), Section 106 of the National Historic Preservation Act (36 CFR 800), Federal Consistency with Approved Coastal Management Programs (15 CFR 930), and Section 305 of the Magnusson-Stevens Conservation and Management Act (50 CFR 600).

7.2 Outer Continental Shelf Sand Resources

The Bureau of Ocean Energy Management is authorized under Section 8 of the Outer Continental Shelf Lands Act (Public Law 103-426) to negotiate on a non-competitive basis, the rights to Outer Continental Shelf (OCS) sand resources for shore protection projects. BOEM's proposed connected action is to issue a negotiated agreement authorizing use of sand resources located in federal waters.

On May 8, 2024, the USACE requested to enter a non-competitive negotiated Three Party Agreement with the BOEM and the Town of Surf City, regarding the use of sand from existing OCS borrow areas for initial construction for the Surf City CSRM Project.

7.3 Endangered Species Act (Public Law 93–205)

Pursuant to Section 7 of the ESA of 1973 (P.L. 93-205), as amended, a biological assessment evaluating the potential effects of the initial construction of the proposed action on T&E species under the purview of the USFWS has been prepared (**Appendix K**) and is being coordinated with the USFWS. Re-initiation of Section 7 consultation would be conducted by the USACE for each future nourishment event.

Dredging operations for the project would be done in accordance with the *2020 National Marine Fisheries Service South Atlantic Regional Biological Opinion Dredging and Material Placement Activities in the Southeastern United States* or any superseding document that is prepared by NMFS. A supersede request will be provided to the NMFS to request approval to rely on the SARBO to satisfy ESA Section 7 consultation requirements. Even though the Surf City CSRM is not specifically identified in the SARBO, the effects would be substantially like the effects already considered. All compliance obligations under Section 7 would be met.

7.4 Magnuson Fishery Conservation and Management Act of 1976 (Public Law 94-265)

Potential project effects on EFH species and their habitats have been evaluated and are addressed in *Section 5.4.5* of this document and **Appendix H**. It has been determined that the proposed action would not have a significant adverse effect on such resources. By coordination of this document with the NMFS, consultation is officially initiated and concurrence with the USACE findings is requested. Compliance obligations related to EFH provisions of the 1996 congressional amendments to the MSFCMA (P.L. 94-265) would be fulfilled before initiation of the proposed action.

7.5 North Carolina Coastal Management Program

The proposed action would be conducted in the designated coastal zone of the State of North Carolina. Pursuant to the federal CZMA of 1972, as amended (PL 92-583), federal activities are required to be consistent, to the maximum extent practicable, with the federally approved coastal management program of the state in which their activities will occur. Concurrent with public review of this EA, the USACE will submit a separate consistency determination to the N.C. Division of Coastal Management in accordance with Section 307 (c) (l) of the Federal Coastal Zone Management Act of 1972, as amended.

7.6 Clean Water Act of 1972 (Public Law 92-500)

Pursuant to Section 401 of the Act, as amended, a Water Quality Certification (WQC) is required for this proposed project. A WQC will be obtained before any work is started. All conditions of the water quality certification would be implemented to minimize adverse impacts to water quality.

Pursuant to Section 404 of the Act, the impacts associated with the discharge of fill material into waters of the United States are discussed in the Section 404(b)(1) Guidelines Analysis in **Appendix I**. Discharges associated with dredging in the offshore borrow areas are considered incidental to the dredging operation, and therefore, are not being considered as being a discharge addressed under the Section 404(b)(1) Guidelines Analysis.

7.7 National Historic Preservation Act of 1966 (Public Law 89-665)

Based on consultation to date and available information provided by consulting parties, USACE has determined that the proposed action and recommended plan would have no effect to historic properties eligible for listing to the National Register for Historic Place.

USACE would implement the actions outlined Section 5.6 for the identification and evaluation of historic properties with the routes of the proposed pipeline and pump-out locations.

8.0 SUMMARY OF AGENCY AND PUBLIC INVOLVEMENT*

To ensure this document included an assessment of impacts on all significant resources in the project area, the Wilmington District circulated a scoping letter by email dated May 26, 2020, to state and federal resource agencies for a 30-day comment period. A formal scoping meeting was conducted virtually on June 15, 2020. All agency and stakeholder concerns were considered during the development of the EA.

The draft EA is being circulated for a 30-day review and comment period to a comprehensive list of Federal, State and local agencies, as well as pertinent government officials, tribes, interested stakeholders and individuals. All comments received during public review will be considered and specifically addressed in the final EA.

9.0 CONCLUSIONS

9.1 Summary

This report examined the current risks associated with hurricanes and severe coastal storms for the Town of Surf City, North Carolina and identified a plan that would reduce these risks for a 50-year period. This plan was evaluated using engineering, economic, environmental, and social criteria, existing laws, policy, and guidance, and the interests of the NFS and public. The conclusions of this study are as follows:

- The Surf City shoreline is susceptible to major damage and erosion from hurricanes and severe coastal storms.

- The recommended plan is a berm and dune system measuring approximately 33,300 ft long, or approximately 6 miles of shoreline, with a dune constructed to an elevation of 14 feet (NAVD 88) and fronted by a 6-foot (NAVD 88) (50 ft wide) beach berm restricted by the town limits of Surf City. The alternative would include a 1000 ft transition berm in northern end of the project from the town limits of Surf City into the town limits of NTB. Other features of the alternative would include dune vegetation and 40 public walkover structures.

- The proposed plan is to complete initial construction any time of year. Initial construction would result in one disturbance event, lasting approximately 16 months, from the dredges and all other required equipment in the water and on

the beach. Nourishment events would occur during the beach placement window of November 16 to April 30, during one dredging season. The periodic nourishment intervals would be every six years with a total of seven nourishment events over the 50-year project life (i. e. 2024-2073).

- The total project cost of the recommended plan is **$504,064,000**(FY24 price levels).

- The plan is feasible based on engineering and economic criteria and would not result in a significant impact or adverse effect under existing cultural resource (i. e. National Historic Preservation Act) and environmental laws (NEPA, Clean Water Act, Endangered Species Act, etc.).

- Issues related to SLC for this alternative would be addressed through an Adaption Strategy presented in **Appendix D**.

- Surf City possesses no Environmental Justice communities eligible for consideration under the Justice40 initiative.

- The selected plan is supported by the Town of Surf City, who has the capability to provide the necessary non-Federal requirements identified and described in *Section 6.2* of this report, Division of Plan Responsibilities.

- Remaining risks associated with project include back bay flooding along the AIWW, the need for beach quality sand over the 50-year project life, the potential impacts of SLC to the project, use of anytime dredging as part of the project, selection of a construction contractor with adequate equipment to build the project, and the presence of rock and cemented sands within offshore borrow sites.

9.2 Additional Recommendations

For life and safety risks to be effectively reduced, the Town of Surf City has implemented certain measures to assure residents and visitors of the appropriate actions when responding to a severe coastal storm event. These recommendations were mentioned in the 2010 Feasibility/EIS but are being reiterated here due to their importance:

1. **Public Education.** Education and information is vital for life safety during a severe coastal storm event. Even one death prevented is sufficient to improve engagement with the public on the hazards associated with coastal flooding, storm surge and wind during these events. Information should include the magnitude of the threat, the urgency to heed calls for evacuation when necessary, and information from which individuals can make choices on their safety. Public education should be done in advance of the hurricane season and in a variety of formats to reach the widest audience (i. e. broadcast media, newspapers, in-person meeting, public spaces, internet, etc.).

2. **Evacuation Planning**. Evacuation planning is also essential for ensuring the safety of residents and visitors to coastal North Carolina. Years of studies on evacuation routes and populations along the coastline have provided tremendous value in aiding community readiness in the face of approaching coastal storm events. It is recommended that an update to evacuation route signage and online tools for mobile devices be integrated as part of this project for use by individuals and families in their preparation efforts.

3. **Hurricane and Storm Warning.** The residents and visitors of coastal North Carolina live in, or visit, a high-hazard area. Although certain times of the year pose less of a risk for life safety than others, each year's hurricane season provides a strong possibility of impact somewhere along the coast. All need to be made aware of the threat as assessed and characterized by experts at FEMA and the National Weather Service. The following supportive activities are critical to an adequate warning process:

    a. Ongoing efforts to upgrade the existing system of NOAA buoys, transmission capabilities, and advanced warning measures that provide data on the location and nature of weather conditions.

    b. Public appreciation for the need to be aware at all times of, and the need to listen to weather reports and advice given on various media. Television weather reports, radio, and the Internet all provide excellent, up-to-date information on weather conditions, and the development of threatening situations.

    c. Efforts directed at the interpretation of that data and its dissemination to the media and public, through the National Weather Service.

    d. The importance of heeding the advice of experts. One should know what needs to be done when a storm is approaching. Family members should conduct evacuation drills, keep needed phone numbers and travel supplies on hand, and be prepared to leave on short notice. One should be aware of evacuation routes, keep a full tank of gas during the hurricane season and have a plan for where one should go, how to maintain contact with other family members, and where one will relocate temporarily, particularly if the event turns out to be longer than expected.

10.0 DISTRICT ENGINEER'S RECOMMENDATION

Based on the above analysis and conclusion, I support the Tentatively Selected Plan described herein. The cost of initial construction is estimated to be $186,637,000 (FY24 price levels) cost-shared at 35 percent and 65 percent between the NFS and Federal government, respectively. The cost of renourishment events is estimated to be $317,426,000 (FY24 price levels) cost-shared at 50/50 percent between the NFS and Federal government. The NFS has stated that they have the necessary funds to provide their share of the project's initial construction and periodic renourishment costs. The recommendation of this plan for Surf City includes a concurrent recommendation to deauthorize the 2010 Authorized Plan that includes the Towns of both Surf City and North Topsail Beach.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for implementation funding. However, prior to transmittal to the Congress, the sponsor, the states, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Brad A. Morgan
COL, EN
Commanding

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Borrow Area	Total Acres[1] Excluding Hardbottom and Buffers[3]	Total Acres[1] - Within 3NM[4] Excluding Hardbottom and Buffers	Total Acres[1] - Beyond 3NM[4] Excluding Hardbottom and Buffers
A	2,297	1,879	418
B	158	158	0
C	597	0	597
D	464	12	452
E	406	0	406
F	282	0	282
G	576	0	576
H	158	0	158
J	1,033	93	940
L	1,382	458	924
N	1,061	0	1,061
O[5]	838	677	162
P	410	410	0
Totals	**9,663**	**3,687**	**5,976**
Notes and Assumptions			

1. Acres calculated in ArcMap using "Calculate Geometry" with NAD83 State Plane Datum or referenced from West Onslow Beach and New River Inlet (Topsail Beach) NC Final Integrated General Reevaluation Report and Environmental Impact Statement, 2009.

2. Hardbottom delineations referenced from "Surf City and North Topsail Beach CSDR Project Integrated FEIS, 2005, Appendix U".

3. Low-Relief Buffers referenced from "Surf City and North Topsail Beach CSDR Project 2005 Integrated FEIS" which denotes a low relief buffer used for all borrow areas with a total width of 400 ft.

4. 3 Nautical Miles (NM)

5. 82.6706 acres of hardbottom excluded from center of Borrow Area O.

Borrow Area	Total Acres1 Excluding Hardbottom and Buffers3	Total Acres1 - Within 3NM4 Excluding Hardbottom and Buffers	Total Acres1 - Beyond 3NM4 Excluding Hardbottom and Buffers	
A	2,297	1,879	418	2,297
B	158	158	0	7,756
C	597	0	597	
D	464	12	452	
E	406	0	406	
F	282	0	282	
G	576	0	576	
H	158	0	158	
J	1,033	93	940	
L	1,382	458	924	1,382
N	1,061	0	1,061	
O5	838	677	162	839
P	410	410	0	
Totals	**9,663**	**3,687**	**5,976**	9,663

Notes and Assumptions

1. Acres calculated in ArcMap using "Calculate Geometry" with NAD83 State Plane Datum or referenced from West Onslow Beach and New River Inlet (Topsail Beach) NC Final Integrated General Reevaluation Report and Environmental Impact Statement, 2009.

2. Hardbottom delineations referenced from "Surf City and North Topsail Beach CSDR Project Integrated FEIS, 2005, Appendix U".

3. Low-Relief Buffers referenced from "Surf City and North Topsail Beach CSDR Project 2005 Integrated FEIS" which denotes a low relief buffer used for all borrow areas with a total width of 400 ft.

4. 3 Nautical Miles (NM)

5. 82.6706 acres of hardbottom excluded from center of Borrow Area O.