US Army Corps of Engineers ®
Wilmington District

ENVIRONMENTAL ASSESSMENT

LITTLE CREEK OYSTER SANCTUARY
NEUSE RIVER, PAMLICO SOUND,
NORTH CAROLINA

Prepared by the North Carolina Division of Marine Fisheries

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EXECUTIVE SUMMARY

Background

In 2000, the Estuary Restoration Act (ERA) was passed to provide federal assistance for estuarine habitat restoration, while objectively encouraging partnerships among public agencies and non-governmental organizations, supporting innovation, and monitoring the success of funded projects (ERA, Title I; Public Law 106-457). In recognition of the need for estuarine habitat restoration in North Carolina, the United States Army Corps of Engineers (USACE) is providing grant funding and oversight to implement the proposed estuarine restoration project in partnership with the North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries (NCDMF). This Environmental Assessment (EA) was written to address the expansion and development of the NCDMF oyster sanctuary network.

Ecosystem Restoration

Recommendations for estuarine habitat restoration contained in this EA focus on *Crassostrea virginica* (henceforth "oyster") restoration. Recognized as an ecosystem engineer and termed a "keystone species," oysters provide valuable support to healthy estuarine ecosystems; however, global, national, and local trends in oyster populations have exhibited substantial decline in the last century (Ault et al. 1994, Beck et al. 2011, Rothschild et al. 1994, zu Ermgassen et al. 2012). In order to improve estuarine ecosystem function, oyster restoration is essential. Among other restoration measures in North Carolina, oyster sanctuaries have been proven to host high density broodstock oyster populations, which subsidize oyster larval production and subsequently enhance ecosystem function (Peters 2014, Peters in review, Puckett and Eggleston 2012). The proposed Little Creek Oyster Sanctuary site, to have a total footprint of 20 acres and contain 10 acres of oyster reef habitat funded by USACE grant, has been identified as exhibiting various degrees of ecosystem degradation and has been acknowledged as a restoration priority by both the NCDMF and academic partners, as well as by the public and interest groups.

National Environmental Policy Act (NEPA)

This EA is written pursuant to, and complies with ER 200-2-2 (33 CFR Part 230): Environmental Quality - Procedures for Implementing the National Environmental Policy Act (NEPA), and 40 CFR Parts 1500 to 1508 the Council on Environmental Quality (CEQ) Regulations for Implementing the National Environmental Policy Act (NEPA). The National Environmental Policy Act of 1969 (NEPA), as amended, requires that environmental consequences of federal actions be evaluated. Further, NEPA stipulates that the details of proposed actions and the potential environmental consequences must be presented to the public and the public must be given the opportunity to provide input before decisions are made and actions taken. NEPA requires consideration of the environmental impacts from a range of reasonable project alternatives, and the consideration of those impacts, in the process of formulating the Selected Plan.

The probable consequences (impacts and effects) of the No Action Alternative and the components of the Little Creek Oyster Sanctuary (proposed action) on significant environmental resources in the lower Neuse River Basin were evaluated and are documented in this EA. The proposed action is not expected to significantly affect the quality of the human environment; therefore, an Environmental Impact Statement (EIS) likely will not be prepared. If this determination remains unchanged following public and agency review of the EA, a Finding of No Significant Impact (FONSI) will be signed and circulated prior to the initiation of the proposed action.

Public Involvement

Throughout the planning process, which included site selection, grant application, and permitting, stakeholders were actively involved. Input was requested and received through a review of Coastal Area Management Act (CAMA) Major Permit #140-09 modification issued to NCDMF November 23, 2011 (Appendix A-1), at a public hearing held by the NCDMF on April 24, 2012, and through additional modification of CAMA Major Permit #140-09 issued on May 5, 2015 (Appendix A-2) . The CAMA Permit review requested comments from State and federal agencies, to identify concerns related to ecosystem restoration through expansion of the North Carolina Oyster Sanctuary network. Additionally, a USACE General Permit #19800291 accounting for actions associated with the proposed project was issued on January 1, 2011 (Appendix A-3) and modified on May 15, 2015 (Appendix A-4). Comments were considered and addressed in the development of the proposed action and project management plan (Appendix E) as well. This EA will be circulated for public and agency review for a 30-day comment period.

1.00 PURPOSE AND NEED

A combination of historical overfishing, habitat destruction, disease, and pollution has led to massive population decline of oysters worldwide (Cooper et al. 2004, Lenihan and Peterson 1998, Pinckney et al. 1998). Globally, an estimated 85 percent of historic oyster reefs have been lost (Beck et al. 2011). Similarly in the United States, present oyster populations have 64% less spatial extent and 88% less total biomass, relative to historical surveys (zu Ermgassen et al. 2012). More locally, population decline has been observed, especially on sub-tidal reefs along the US East Coast (Ault et al. 1994, Hargis and Haven 1988, NCDMF 2001, Rothschild et al. 1994). In 2007, a National Oceanic and Atmospheric Administration biological review team found that current east coast oyster harvest is 2 percent of peak historical volume and suggested that oyster restoration and enhancement efforts are “necessary to sustain populations” (EOBRT 2007).

Oyster harvest in North Carolina has shown a similar trend of decline (Street et al. 2005, Deaton et al. 2010). In the Neuse River Estuary, oyster habitat loss is particularly apparent where viable oyster beds have been “displaced downstream roughly 10-15 miles” since the late 1940s (Jones and Sholar 1981, Steel 1991). Natural expansion of healthy oyster reefs is not expected here because adjacent bottom lacks attachment substrate, and any shell that is sloughed from an existing reef might be subject to deep

water hypoxia and sediment burial, where reef establishment is unlikely (Lenihan 1999, Lenihan and Peterson 1998).

To combat trending population loss in North Carolina, NCDMF constructs and maintains oyster sanctuaries, as one method of habitat restoration. The objective of this program is to establish a self-sustaining network of protected oyster broodstock sanctuaries. These sanctuaries are intended to provide larval subsidies to other reefs throughout Pamlico Sound, including the Neuse River, through larval transport and connectivity.

Healthy oyster reefs are vital to the estuarine ecosystem (NCDMF 2001). A fully developed coastal oyster sanctuary can support high population density, mature size structure, and subsequently high reproductive output relative to non-protected areas (Peters 2014, Peters et al. in review, Puckett and Eggleston 2012). Larval transport through current flow distributes oyster larvae from sanctuaries to historical oyster fishing areas for future harvest (Haase et al. 2012, Puckett et al. 2014). In addition to larval supply, oyster reefs deliver a variety of ecosystem services, such as improving water quality through water filtration, bottom consolidation, benthic-pelagic coupling, shoreline stabilization, and essential fish habitat (Coen et al. 2007, Mackenzie 2007, Mann 2001, Peterson et al. 2003, Pierson and Eggleston 2014, Posey et al. 1999, Soniat et al. 2004).

North Carolina oyster sanctuaries not only serve the ecosystem service and larval subsidy functions described above, but will also benefit recreationally and commercially important finfish species. The oyster is considered an ecosystem engineer because it is one of the only faunal organisms in an estuary that serves as habitat for other species. The complex nature of oyster reefs serves as nursery habitat for numerous marine and estuarine species during key phases of their life cycles (Pierson and Eggleston 2014, Ross and Epperly 1985). Restored nursery habitat will result in healthier fisheries since many of the state's fishery species are estuarine dependent at some point in their life cycles. Further, adult finfish species utilize reef habitats for refuge and feeding, therefore oyster reefs are popular recreational fishing destinations (NCDMF, unpublished data).

As a measure to mitigate oyster population loss in the Pamlico Sound and Neuse River estuaries, the NCDMF Oyster Sanctuary Program, through the USACE, Wilmington District, intends to restore unproductive soft bottom to a protected oyster reef site (Little Creek Oyster Sanctuary). Utilizing conceptual objectives described above, the proposed Little Creek Oyster Sanctuary will provide a source of oyster larvae to support estuary-wide oyster population growth, offer a myriad of ecosystem services, employ innovative reef design techniques, and offer a recreational fishing opportunity for public use.

2.00 ALTERNATIVES CONSIDERED

Alternatives considered included: (1) Restoring existing low output reefs by addition of new cultch; (2) Designating existing high output reefs as sanctuaries; (3) Building new sanctuary reefs; (4) No action.

2.01 Alternative 1

Alternative 1 would consist of adding cultch material to existing reefs. This restoration measure requires initial destruction of existing oyster habitat, which is inconsistent with the South Atlantic Marine Fisheries Commission's (SAMFC) management of Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern, with NCDMF's management of shell bottom/oyster reef critical fish habitat, and published North Carolina Coastal Resources Commission (NCCRC) rules (15A NCAC 07H .0203 and 15A NCAC 07H .0208). Additionally, oyster restoration activities are designed to create additional habitat to offset historic losses. It would be counterproductive to add new material on top of existing shellfish material which would cause mortality of existing beneficial resources. Further, low productivity is likely a function of environmental conditions or harvest pressure; therefore additional cultch may not improve local oyster population. Finally, cultch material required for this type of restoration is not suited to provide high vertical relief, a reef characteristic necessary for reef viability in the Neuse River Estuary. This alternative is not an ecologically or socioeconomically acceptable method of restoration.

2.02 Alternative 2

Alternative 2 would include designating high output oyster reefs as sanctuaries to preclude impacts associated with harvest. Existing state regulation (15A NCAC 03O .0201) only allows "Oyster Sanctuary" designation at previously low value bottoms where new reefs have been constructed. Under this alternative, no new habitat is created; therefore it is not a restoration measure, rather a means of preservation. This alternative can be eliminated as it is not a strong mode of restoration and moreover, is inconsistent with state regulations. In addition, designating existing reefs as sanctuaries will have a negative impact on commercial and recreational harvest interests, as existing harvestable reef area would be reduced.

2.03 Alternative 3

Alternative 3, building new sanctuary reefs, was determined to be the only restoration measure that is technically feasible and environmentally acceptable and meets NCDMF Oyster Sanctuary Program goals.

The proposed Little Creek Oyster Sanctuary would directly restore 10 acres of unproductive soft bottom, by conversion to oyster reef habitat, within a 20-acre permitted footprint. Oyster reefs would be constructed of two limestone mounds, 1,000 Ultra Balls™, and 98 Reef Pyramids. All construction materials would be free from loose dirt and pollutants. These structures would be produced at or delivered to the NCDMF stockpile site in South River, NC along the Neuse River. The stockpile site is approximately 10 nautical miles from the proposed Little Creek Oyster Sanctuary Site (Figure 1). The remaining 10 acres within the 20-acre footprint would be buffer zones and void areas (Figure 2).

Reef Pyramids (Figure 2 and Appendix E) have a 10-foot triangular base, are 8 feet tall, and weigh approximately 6,000 pounds each. They would be delivered to the stockpile

site by truck, ready for deployment. The NCDMF technicians would receive and stage the Reef Pyramids. Duties would include the off-loading and storage of the Reef Pyramids by the barge loading dock.

Ultra Balls™ (Figure 2 and Appendix E) have a base diameter of 5.5 feet and stand 5 feet tall. Each unit weighs approximately 3,500 pounds. Ultra Balls™ are the least expensive structure when comparing surface area to cost (Appendix E). Using local concrete vendors and molds, Ultra Balls™ can be easily produced at the NCDMF stockpile site. NCDMF technicians would assist contractors in setting up the molds and pouring concrete and would be responsible for lifting and moving the Ultra Balls™ from their molds to the barge loading dock.

No fill material would be placed in waters outside of the proposed sanctuary area.

2.04 No Action Alternative

The “No Action” alternative is used as a basis for comparison to the proposed plan (Alternative 3). The No Action plan represents what would occur on the project site if no new sanctuary reefs were built. Under No Action, there would be no re-establishment of oyster reefs in the project area. This would result in no considerable long-term benefits to the environment, perpetuating the status quo of oyster population decline within the estuary.

3.00 PROPOSED ACTION

3.01 Project Location

The proposed project location is in the lower Neuse River in Pamlico Sound, NC, approximately 10 miles east of the town of Oriental and 1.8 miles northwest of Little Creek (35° 02.616’ N 76° 30.889’ W; Figure 1). Oyster habitat suitability is lower in upstream reaches of the Neuse River Estuary Oyster Growing Area (OGA) and higher in downstream reaches, with the highest suitability found near the mouth of the estuary (USACE 2008). However, known reefs are found in both high and low oyster habitat suitability. Within this estuary, more than 50 natural deep water (3 - 6.5 m, ~10.0 - 22.5 ft.) oyster reefs exist, ranging in size from 0.2 - 2.0 ha (~ 0.5 - 5.0 ac; Lenihan 1999). Later surveys done by the USACE in 2008 identified 131 reefs ranging in size from less than 0.25 ha (0.6 ac) to about 6.5 ha (16 ac), and totaling about 99 ha (244 ac; USACE 2008). Further, high-profile oyster reefs are a persistent feature in the Neuse River Estuary, having been recorded on bathymetric charts by the U.S. Coast Guard and Geodetic Survey as far back as 1868 (Lenihan and Peterson 1998). The Little Creek Oyster Sanctuary is centrally located in the OGA which will provide a substantial benefit to the oyster population within the OGA and other parts of the Pamlico Sound Estuary.

The proposed Little Creek Oyster Sanctuary boundaries will designate 20 acres of currently unproductive, unconsolidated estuarine soft bottom on public land as sanctuary area for development, and will feature 10 acres of oyster reef to be constructed using grant funding. The remaining 10 acres will be buffer zones and void areas (Figure 2). The 20-acre sanctuary will be designed in a square shape with the

corners located at 35° 2.694’ N, 76° 30.984’ W (northwest corner); 35° 2.694’ N, 76° 30.794’ W (northeast corner); 35° 2.538’ N, 76° 30.984’ W (southwest corner); and 35° 2.538’ N, 76° 30.794’ W (southeast corner, Figure 2).

3.02 Site Selection

The site selection process for Little Creek Oyster Sanctuary included the following considerations:

Biological and Environmental Suitability

Little Creek Oyster Sanctuary meets the necessary water quality and recruitment base (larval supply) requirements for long-term sustainable subtidal reef growth. NCDMF and partners have recorded water quality conditions including salinity, temperature, and dissolved oxygen from nearby stations. Analysis of these data suggests fluctuating conditions on a monthly basis. Mean monthly dissolved oxygen ranges from ~4.9 mg/L in July to ~10.0 mg/L in February (NCDMF Program 611 unpublished data, Figure 3). This is well within the tolerable range of oxygen concentration for oyster survival (Shumway 1996). Salinity in the mouth of the Neuse River peaks at ~24 psu in June, and is lowest in February (estimated), near 10 psu (NCDMF Program 611 unpublished data, Figure 4). Optimal growth conditions for adult oysters and oyster spat exist at salinities ranging from 14 to 28 psu (Shumway 1996, Quast et al. 1988). In July, water temperatures rise to ~28.5 °C and in February (estimated), temperatures fall to ~6.0 °C (NCDMF Program 611 unpublished data, Figure 5). Population density at the nearby Neuse River Oyster Sanctuary has increased by ~400% between 2007 and 2012, suggesting successful recruitment and high survival (NCDMF Program 611 unpublished data, Figure 6). Further, the mouth of Neuse River has been identified as a recommended sanctuary site based on modeled larval connectivity in Pamlico Sound (Haase et al. 2012, Puckett et al. 2014).

Historic Oyster Habitat and Substrate Suitability

The selected location is in an area that has lost its historic function as oyster habitat, perceivably due to pollution and overharvest (Cooper et al. 2004, Lenihan and Peterson 1998, Pinckney et al. 1998). However, the site is in close proximity to viable subtidal oyster populations. In this area, sonar images (USACE 2006) and ground-truthing using bottom samples have revealed a soft upper layer of mud and silt, 4-6 inches thick, above oyster shell hash. The presence of shell hash indicates that the selected site has historically been productive oyster bottom. Furthermore, from an architectural perspective, this bottom type has proven to be successful in supporting material at 13 other oyster sanctuaries created by NCDMF.

Non-Governmental Organization Recommendations

Placement of an oyster sanctuary within the mouth of the Neuse River fulfills recommendations of the North Carolina Coastal Federation’s Oyster Restoration and Protection Plan for North Carolina: A Blueprint for Action (NCCF 2008). The proposed

location of the Little Creek Oyster Sanctuary is included in the working group's restoration target list as a high priority area.

3.03 Proposed Action

The proposed Little Creek Oyster Sanctuary will have a 20-acre footprint and contain 10 acres of constructed oyster reef. The sanctuary will be identified by wooden three-pile dolphins on all four corners, each displaying sanctuary designation signage. The remaining 10 acres will be buffer zones and void areas (Figure 2). This sanctuary will provide a net increase in the number of oyster larvae for settlement and re-colonization of oyster reefs within the Neuse River Basin. As a sanctuary, this site will be managed by the NCDMF to preclude oyster harvest, but will allow recreational fin-fishing. Construction of this reef expands on successful existing practices already employed in the Neuse River Estuary and the Pamlico Sound. The proposed materials have been proven through extensive field application. The proposed reef architecture has been designed to closely match the form of nearby reference reefs and includes alternate materials in addition to conventional stone design.

Implementation of the proposed project will have four components:

(1) Completion of the NEPA process and receipt of applicable permits and approvals for construction of the Little Creek Oyster Sanctuary.
(2) Construction, purchase, and stockpiling of reef structures.
(3) Construction of the Little Creek Oyster Sanctuary.
(4) Monitoring and evaluation of the Little Creek Oyster Sanctuary.

Task 1: Secure NC Coastal Area Management Act (CAMA) Major Development Permit for the construction of Little Creek Oyster Sanctuary. Prepare and circulate an Environmental Assessment (EA) for public review. Complete the NEPA process by issuance of a Finding of No Significant Impact (FONSI) or Environmental Impact Statement (EIS).

The NCDMF has secured Coastal Area Management Act (CAMA) Major Permit #140-09 through the established permitting process developed with the NC Division of Coastal Management, US Army Corps of Engineers, NOAA, and the NC Division of Water Quality during permitting for other oyster sanctuaries (Appendix A-1, A-2). This permit is for 20 acres at Little Creek, although only 10 acres will be developed through this proposed project. The remaining 10 acres will be buffer zones and void areas (Figure 2).

The NCDMF held a public hearing on April 24, 2012 as required by the permitting process. Information was sought from the public on potential conflicts with other users of the site (fishing, navigation, etc.), environmental benefits, and recreational uses. This EA will be circulated for public review for 30 days public review and all comments will be considered in developing either a FONSI or EIS.

Task 2: Site Marking and Procurement / Staging of Reef Materials

In accordance with U.S. Coast Guard Private Aids to Navigation (PATON) rules and regulations, the sanctuary will be marked with three-pile dolphins and appropriate signage. Reef materials will be produced at or delivered to the existing NCDMF stockpile site in South River, NC (Figure 1) for deployment staging. The stockpile site is approximately 10 nautical miles from the proposed Little Creek Sanctuary site.

Task 3: Construction of Little Creek Oyster Sanctuary

Little Creek Oyster Sanctuary will be constructed to encompass 20 acres of currently unconsolidated soft bottom in the lower Neuse River, NC. As a material buffer, bottom area within 100 ft. inside of sanctuary boundaries will remain undeveloped. The developed area will consist of 100 construction grids, each 75 ft. x 75 ft. The layout will consist of 18 grids with 15 Ultra Balls™ per grid, 18 grids with 150 tons of 4 in. -12 in. processed recycled concrete per grid, 16 grids with five Reef Pyramids per grid, 16 grids with 75 tons of recycled concrete pipe per grid, two grids with 150 tons of basalt rip rap per grid, two grids with 150 tons of granite riprap per grid, two grids with 150 tons of limestone riprap per grid, and two grids with 150 tons of concrete blocks per grid. Twenty-four (24) grids will be left undeveloped to serve as anchor zones for recreational fishing (Figure 2 and Appendix E).

From the South River, NC stockpile site, NCDMF technicians will load reef materials onto NCDMF's deployment barge (M/V West Bay, 135 ft. landing craft utility) using dump trucks, a 7.5 ton crane, a telehandler forklift and front-end loaders. Deployment methodology for the limestone, processed recycled concrete, precast concrete pipe, precast concrete blocks, Ultra Balls™ and Reef Pyramids will follow similar procedures to accomplish a checkerboard style deployment design (Figure 2). The precast concrete pipe (75 tons), Ultra Balls™ (15 per grid) and the Reef Pyramids (5 per grid) will be deployed in patch reefs 75 ft. from center to center. Basalt riprap, limestone riprap, granite riprap, 4 in.-12 in. processed recycled concrete, and concrete block mounds will be deployed approximately 75 ft. center to center after the locations have been marked by GPS. After deployment, the NCDMF technicians will record the location, depth of the water column, height of material and environmental parameters (e.g., wind speed, wind direction, air temperature, water temperature, salinity, and dissolved oxygen).

Task 4: Monitoring and Evaluation of the Constructed Reefs

In accordance with condition # 4 of CAMA Permit #140-09, NCDMF will monitor the proposed Little Creek Oyster Sanctuary four times a year for the first two years following project completion and then annually thereafter (Appendix A-1, A-2). The purpose of the monitoring efforts will be to compare any movement of the limestone marl mounds and the concrete block mounds. In the event that concrete blocks are shown to have moved outside the standard of the limestone marl mounds, NCDMF staff will remove all concrete blocks from the bottom.

In addition to the monitoring required by the CAMA Permit, NCDMF's monitoring program evaluates data collected from all NC oyster sanctuaries on an annual basis. Physical data such as location, size, material type, deployment configuration, and

structure dimensions will be measured and recorded, as well as biological data including oyster recruitment, size, and density. Two separate analyses will be conducted to provide guidance for future reef building and habitat restoration. The first analysis will determine the most cost-effective material in terms of cost per unit surface area. This study will highlight specific materials which offer high surface area for oyster settlement at low cost. The second analysis will provide biological perspective on optimal material types. Material types will be rated based on recruitment, survival, and oyster density per unit area. These two analyses will be integrated to help managers make informed cost-benefit decisions on future projects. These data will be maintained in a standardized format in the NCDMF Biological Database. Copies of monitoring reports will be provided to the North Carolina Division of Coastal Management and the United States Army Corps of Engineers.

4.00 ENVIRONMENTAL IMPACTS

4.01 Terrestrial Resources and Land Use

The Neuse River Basin is the third-largest river basin in North Carolina. The basin contains a total area of 6,234 square miles and is one of only four watersheds located entirely within the state. Elevations in the basin range from 905 feet in the western part to sea level where the Neuse River Estuary joins Pamlico Sound. The proposed project area is located in the lower basin, which is in the outer Coastal Plain region, including most of Jones County, part of Craven, Lenoir, and Pamlico counties, and minor parts of Carteret, Duplin, and Onslow counties. This portion of the basin consists of 6.2 percent developed land; 0.1 percent bare earth; rock, sand, or clay, 28.8 percent forested land; 11.3 percent shrub or grassland; 18.5 percent agricultural land; and 35.1 percent wetlands. The open waters of the Neuse River Estuary are used intensively to support recreational and commercial interests (NCDENR 2009).

This proposed project will be submerged within the river, and therefore, will not affect upland areas. Staging area and material stockpiles will be within the existing NCDMF facility currently being used for that purpose. The proposed action is consistent with and will have no adverse impact on current local land use.

The no action alternative would have no impact on terrestrial resources and is also consistent with local land use.

4.02 Local Climate

The following information regarding climate and growing season information for the Neuse River Basin was predominantly obtained from the National Climatic Data Center, NOAA, U.S. Department of Commerce in Asheville, North Carolina.

The basin has a temperate climate with moderate winters and warm, humid summers. Extreme hot and cold temperatures rarely occur. During the summer the average high temperature (Fahrenheit) is in the high to low-90s. In the winter, high temperatures are in the mid-40s. The average annual precipitation over the basin is about 48 in., but there is considerable variation in the mean annual precipitation in different areas of the

basin. Monthly rainfall is fairly consistent throughout the year, but it is greatest near the coast and decreases moving toward the northwest direction. The maximum monthly rainfall averages 6.0 in. and occurs during July; the driest month is November, with an average rainfall of 2.9 in. A study of the rainfall records from the National Climate Center, Asheville, North Carolina, indicates the wettest year of record to be 1975. Early anecdotal evidence suggests, severe flooding might have occurred in the basin during 1865, 1877, and 1901. Droughts occasionally damage crops throughout the basin and cause water shortages. The most recent drought was from 2006 to 2008.

Storm occurrences in the basin are usually of three general types – thundershowers, northeasters, and hurricanes. The most severe floods of record across the basin have been associated with hurricanes. Hurricanes are storms of tropical origin and are most severe near the Atlantic Ocean coastline of the Neuse River Basin. Hurricane season begins June 1 and extends through November 30, potentially generating high winds and prolonged heavy precipitation.

No adverse impact to the existing local climate is anticipated as a result of no action or the proposed action. Likewise, neither the no action alternative nor the proposed action will be impacted by local climate or weather**.**

4.03 Soil

At the proposed Little Creek site, bottom sediment has been characterized through sonar images and diver ground-truthing (NCDMF unpublished data, USACE 2006). Bottom sediment at this location is composed of a soft upper layer of mud and silt 4-6 inches thick, with a firm layer below. The upper layer sediment composition was primarily mud (~76 percent, mineral particles < 0.062 mm to include silts/clays) and sand (~13 percent, mineral particles 0.062 to 2.0 mm). Beneath the soft upper layer is a firmer base of oyster shell hash. This bottom type has proven to be successful in the creation of 13 other oyster sanctuaries constructed by NCDMF. None of these 13 sanctuaries on similar bottom type have caused significant impacts to soils or bathymetry. The area within proposed Little Creek Sanctuary boundaries is 20 acres, of which, upon initial completion, 2.4 acres of soft bottom will be affected (pending CAMA permit modification) and permanently covered with hard reef structures.

No adverse impacts to soil resources are expected from the proposed action or no action. Any changes in topography will be within the natural range of reef heights found in the lower Neuse estuary and would improve conditions for oyster attachment.

The no action alternative would have no impact on soils or topography.

4.04 Estuarine Hydrology

Pamlico Sound is a shallow, bar-built, lagoon estuary, separated from the Atlantic Ocean by the Outer Banks barrier islands. Pamlico Sound is the largest water body in North Carolina, covering an area of approximately 1,318,400 acres (Giese et al. 1979). Located, within Pamlico Sound, Neuse River Estuary extends from Fort Barnwell, NC to Maw Point in Pamlico County, NC. This smaller estuary covers approximately 369,977

acres and ranges in depth from 3 ft. to 17 ft. The 20-acre Little Creek Oyster Sanctuary will cause localized changes in hydrology on and adjacent to the reef, such as increased current flow over structures and small scale current eddies. These small scale changed in current dynamics may be considered ecologically beneficial by offering refuge to finfish and settlement cues to planktonic larvae such as oyster pediveligers (Johansen et al. 2008, Fuchs et al. 2012). No significant adverse impacts to the estuarine hydrology are expected.

The No Action alternative would have no impact on estuarine hydrology.

4.05 Water Quality

Oyster habitat offers a variety of direct and indirect ecosystem services related to water quality. Because non-degraded oyster reefs contain high densities of filter-feeding bivalves, they can modify water quality in shallow waters by their intense filtration. Adult oysters have been reported to filter as much as high as 10 L $h^{-1}g^{-1}$ dry tissue weight (Jordan 1987 as cited in Newell and Langdon 1996). Water-filtering oysters reduce phytoplankton and microbial biomass, as well as suspended solids in the water column, effectively improving water clarity (Cressman et al. 2003, Grizzle et al. 2006, Nelson et al. 2004, Porter et al. 2004, Prins et al. 1997). Oysters concentrate these materials as pseudofeces in the sediments, which stimulates sediment denitrification and produces microphytobenthos (Dame et al. 1989). The decimation of many oyster populations in the eastern U.S. has coincided with increased external nutrient loading in many coastal systems (Paerl et al. 1998). Loss of oyster reefs and subsequent population filtering capacity is exemplified by the case of the Chesapeake Bay. There, in the late 1800's, oysters were abundant enough to filter the entire Bay every 3.3 days. With present day oyster populations, filtering the Bay would take 325 days (Newell 1988). Consequential to reduced filtration, bottom-water hypoxia has increased and food webs are now dominated by phytoplankton, microbes, and pelagic consumers. Dominant pelagic consumers in particular include many nuisance species rather than benthic communities, which support species of commercial and recreational value (Breitburg 1992, Jackson et al. 2001, Lenihan and Peterson 1998, Paerl et al. 1998, Ulanowicz and Tuttle 1992).

In the Neuse River Estuary, deep water hypoxia events frequently affect benthic resources. Hypoxic or anoxic conditions are defined as low oxygen conditions. Those conditions are the combined effect of stratification from a lack of wind mixing and excess nutrients. Hypoxia can occur under natural conditions, but is thought to occur more often in the Neuse River Basin because of increased nutrient loading to the estuary from the larger watershed. High-relief, shell bottom habitat provides an elevated refuge from hypoxia events for estuarine species.

The placement of stone and precast concrete structures for the proposed Little Creek Oyster Sanctuary project will result in temporary, minor turbidity increases during the construction. However, this will remain localized and will not persist. In accordance with condition #12 of the CAMA Permit #140-09 (Appendix A-1, A-2), a level of 50 NTU or less is not considered significant. The proposed action will not contribute to point or

non-point sources of pollutants, and will not have any long-term adverse impacts on water quality in the in the Neuse River Estuary. Establishment of oysters on these constructed reefs will have positive benefits to water quality. The proposed project received General 401 WQ Certification #3642 and was assigned project #11-0952.

The no action alternative would have no impact on water quality in the proposed project area; however, water quality benefits and other ecosystem services offered by the proposed project would be forfeited.

4.06 Wind and Wave Conditions within the Neuse River Estuary

Winds in the Neuse River Basin are primarily from the southwest during spring and summer and from the north-northeast during fall and winter (Giese et al. 1979). Wave conditions are usually driven by prevailing winds in the Neuse River Estuary because the Outer Banks barrier islands (Bodie Island, Hatteras Island, Ocracoke Island, and Portsmouth Island) block, to a large extent, any waves generated in the Atlantic Ocean. Wave energy and duration are dependent on the fetch of water that generates the waves.

The proposed reef structures are expected to withstand the prevailing wave climate at the project site. No adverse impact on existing wind and wave conditions is anticipated from the proposed action or no action alternative.

4.07 Tide Levels and Tidal Currents within the Neuse River Estuary

The Neuse River Estuary is a shallow system with a poor connection to the open ocean. Bodie Island, Hatteras Island, Ocracoke Island, and Portsmouth Island are barrier islands that, to a large extent, block lunar tides from the estuarine portion of the basin. The lunar tidal range in Pamlico Sound near the barrier island inlets is about a meter. However, in the remainder of the estuary, including the Neuse River, tides are driven by prevailing winds and a seiche effect. In this case, northerly winds can cause a high tide and southerly winds can cause a low tide (Giese et al. 1979). Subsequently, relaxed winds or change in wind direction directs major current velocities within the system.

Reef construction would create a hard substrate space with moderate vertical relief within the water column, which may alter currents in immediate vicinity. The combination of increased vertical relief and increased current flow over the reef is expected to have a positive effect on oyster and finfish populations (Bartol et al. 1999, Coen et al. 2007, Lenihan 1999, Lenihan et al. 1996). No significant adverse impacts on tidal levels and tidal currents are expected in the reef vicinity. The proposed action will not impede the flow of waters to or from wetland areas nor the sound or ocean waters.

The no action alternative would have no impact on tide levels and tidal currents within the Neuse River Estuary.

4.08 Estuarine Soft Bottom and Shell Bottom Benthic Resources

This section summarizes these resources according to the Coastal Habitat Protection Plan (CHPP; Deaton et al. 2010, Street et al. 2005) and describes potential impacts resulting from the proposed project. Benthic microalgae are a key part of the food chain in estuarine soft-bottom and shell-bottom habitats. Furthermore, these habitats support a high diversity of benthic invertebrates. Soft bottoms support clams and polychaete worms with larger, mobile invertebrates living on the surface of soft bottoms. Fiddler crabs use intertidal flats and submerged flats, and shallow bottoms support blue crab and other crustaceans and shellfish. Other mobile invertebrates inhabiting soft bottoms include horseshoe crabs, whelks, tulip snails, moon snails, shrimp, and hermit crabs. The site plan will preserve large spans of soft bottom between structures or groupings of structures thereby maintaining the soft bottom communities. Most of the soft bottom species listed above also inhabit shell bottoms; however, shell bottom support additional benthic macroinvertebrates, including mud crabs, pea crab, barnacles, soft-shelled clams, mussels, anemones, hydroids, bryozoans, flatworms, and sponges.

The eastern oyster is considered a keystone estuarine species because it plays an important ecological role, delivering a variety of ecosystem services, such as improving water quality through water filtration, bottom consolidation, benthic-pelagic coupling, shoreline stabilization, and essential fish habitat (Coen et al. 2007, Mackenzie 2007, Mann 2001, Peterson et al. 2003, Pierson and Eggleston 2014, Posey et al. 1999, Soniat et al. 2004). Further, a fully developed coastal oyster reef can support high oyster population density, mature size structure, and subsequently high reproductive output (Peters 2014, Puckett and Eggleston 2012).

Construction of this oyster sanctuary is not expected to cause any considerable adverse impacts to any species. The flora/fauna communities are a function of the frequently disturbed regime and consist of a variety of microscopic plants and soft bottom epifauna/infauna species. Given the nature of environmental and human-induced stressors on these communities, the dominant organisms are opportunistic in nature and thus are adapted to a relatively rapid colonization and recovery. The site plan will preserve large spans of soft bottom habitat between the proposed structures or groupings of structures thereby maintaining the soft bottom communities. The proposed action would increase the oyster population and subsequent shell bottom habitat, therefore helping to improve the overall ecological health of the estuary. Implementation of this proposed project is not expected to cause any significant adverse impacts to any species, but rather facilitate the recovery of Pamlico Sound benthic resources and its beneficiaries.

The no action alternative would have no impact on estuarine soft bottom and shell bottom benthic resources in the proposed project area; however, shell bottom habitat increases the will result from the proposed project would be forfeited.

4.09 Recreational and Commercial Fisheries

Recreational fishing and commercial fishing are important economic activities in the Neuse River Estuary. Important fisheries include flounder, striped bass, red drum, spotted sea trout, blue crabs, and oysters (Deaton et al. 2010, Street et al. 2005).

Harvest of these species is conducted with a variety of gear types, including long-haul seines, shrimp trawls, crab trawls, crab pots, oyster dredges, drift gill nets, baitfish pound nets, eel pots, and hook and line. According to the NCDMF's 2014 Stock Status Report: "Saltwater fish populations in North Carolina are stable and, in many cases, improving but with some species showing declines. Oysters, while remaining listed as *Concern*, have shown signs of improvement with increased landings in the last 10 years and harvest levels have stayed relatively constant in recent years" (NCDMF 2014). In support of recreational and commercial fisheries, no-take oyster sanctuaries have the potential to supply ~65-times more larvae per square meter than non-protected reefs, which contribute to harvested reef persistence (Peters 2014, Peters et al. in review). Furthermore, the creation of long-term sustainable oyster reefs is anticipated to increase and support the abundance of commercially valuable finfish available for harvest. For example, the estimated commercial fish value supported by a hectare of oyster reef is $4,123 annually (Grabowski et al. 2012). A 20-acre sanctuary site in the Neuse River Estuary (Little Creek Oyster Sanctuary), which will include 10 acres of protected oyster reef, could provide an annual commercial fish value of $33,370 and have a larval oyster supply functionally equivalent to 1,300 acres of non-protected oyster reef (adapted from Grabowski et al. 2012, Peters 2014, Peters et al. in review).

Oyster sanctuaries are designated and delineated under North Carolina Marine Fisheries Rule 15A NCAC 03R .0117 and are protected from damaging harvest practices under rule 15A NCAC 03K .0209. Under this rule it is unlawful to use a trawl net, long haul seine, swipe net or mechanical methods for oyster or clam harvest, or to take oysters or clams from designated Oyster Sanctuaries. Since the proposed project area does not contain established shellfish presence (defined as 10 bushels per acre), the preclusion of commercial harvest is not expected to negatively affect commercial harvest activities in Pamlico Sound. This project will create a 10-acre oyster sanctuary intended to support fish and oyster production for the estuary. This obligatory reduction of fishing grounds associated with the proposed action will be minimal compared to the available area in Pamlico Sound and is anticipated to have no significant impact on the local fisheries. In addition, oyster sanctuaries provide recreational fishing opportunities to the general public. For these reasons, no significant adverse impact to recreational and commercial fisheries is anticipated with the creation of Little Creek Oyster Sanctuary.

The no action alternative would have no impact on recreational and commercial fisheries; however, enhanced fishing opportunities offered by the proposed project would be forfeited.

4.10 Estuarine Fish, Essential Fish Habitat, and Habitat Areas of Particular Concern

Oyster reefs provide valuable habitat, supporting a large variety of marine and estuarine fish species by providing refuge and foraging opportunities, among other reasons (Coen et al. 1999, Grabowski et al. 2005, Lenihan et al. 2001, Peterson et al. 2003). Neuse River estuarine fish can be grouped into three categories: estuary-dependent species, permanent resident species, and seasonal migrant species (Deaton et al. 2010, Street

et al. 2005). The most abundant are the estuary-dependent species, which inhabit the estuary as larvae and the ocean as juveniles or adults. This group includes species that spawn offshore, such as the Atlantic croaker (*Micropogon undulatus*), Spot (*Leiostomus xanthurus*), Atlantic menhaden (*Brevoortia tyrannus*), Star drum (*Stellifer lanceolatus*), Southern kingfish (*Menticirrhus americanus*), flounders (*Paralichthys* spp.), mullets (*Mugil* spp.), anchovies (*Anchoa* spp.), Blue crab (*Callinectes sapidus*), and Penaeid shrimp (*Farfantepenaeus* spp.*, Litpenaeus setiferus*), as well as species that spawn in the estuary, such as Red drum (*Sciaenops ocellatus*) and Weakfish (*Cynoscion regalis*). Resident species of soft bottoms include flounders (*Paralichthys* spp.), Sting ray, (*Dasyatis americana*), clearnose skate (*Raja eglantaria*), Naked goby (*Gobisoma bosc*), Striped blenny (*Chasmodes bosquianus*), Feather blenny (*Hypsoblennius hentzi*), Freckled blenny (*Hypsoblennius ionthas*), Skilletfish (*Gobiesox strumosus*), and Oyster toadfish (*Opsanus tau*) (Coen et al. 1999, Lowery and Paynter 2002). Common migrant species include the Bluefish (*Pomatomus saltatrix*), Spanish mackerel (*Scomberomorus maculatus*), King mackerel (*Scomberomorus cavalla*), Cobia (*Rachycentron canadum*), Florida pompano (*Trachinotus carolinus*), and Spiny dogfish (*Squalus acanthias*).

Increased habitat diversity and habitat complexity provided by a new oyster sanctuary will benefit finfish communities within the estuary by providing forage and refuge opportunities. No adverse impacts to essential fish habitat or habitat areas of particular concern are anticipated in association with the proposed action.

The no action alternative would have no impact on estuarine fish, essential fish habitat, or habitat areas of particular concern; however, habitat diversity and habitat complexity provided by the proposed project would be forfeited.

4.11 Plankton

Plankton include drifting organisms (animals, plants, archaea, or bacteria) that inhabit the pelagic zone of oceans, seas, or bodies of freshwater. In the Neuse River Estuary, both phytoplanktonic and zooplanktonic organisms exist. Phytoplanktons are photosynthetic, and include diatoms, desmids, and dinoflagellates. Zooplankton are primary consumers, and consist mainly of small crustaceans, eggs, and larvae of larger animals, such as fish, crustaceans, and annelids (Deaton et al. 2010, Street et al. 2005). Many marine organisms spend a portion of their lives as zooplankton, before maturing and ultimately recruiting to particular habitat. Oyster reefs provide optimal habitat for recruiting mollusks, finfish, aquatic plants, and other biota.

This proposed project would improve available settlement substrate for planktonic larvae, facilitating future community development and subsequent larval productivity, and would have no adverse impact on plankton. The no action alternative would have no impact on plankton.

4.12 Primary Nursery Areas

NCDMF defines Primary Nursery Areas (PNAs) as those areas of the estuarine system where initial post-larval development takes place. Such areas are within the uppermost sections of the estuarine system where populations are uniformly very early juveniles

(Street et al. 2005, Deaton et al. 2010). The estuarine system includes tidal saltwater marsh (including adjacent, shallow, open water areas) that provide essential habitat for the early development of commercially important fish and shellfish, such as ocean spawning estuarine dependent spot, Atlantic croaker, Brown shrimp, and Southern flounder and estuarine spawning, Red drum, Spotted Sea trout and Blue crab. The NCDMF has identified a total of 80,144 acres of PNAs statewide. Approximately 2,835 acres of primary nursery area are in the Neuse River Estuary. Protection of juvenile fish is provided in the areas by prohibiting many commercial fishing activities, including the use of trawls, seines, dredges, or any mechanical methods of harvesting clams or oysters (NCDMF 2008). Additionally, certain development activities are prohibited under the Coastal Area Management Act within PNAs.

The proposed Little Creek Oyster Sanctuary is not located within designated PNAs; therefore no adverse impact is expected. The no action alternative would have no impact on PNAs.

4.13 Threatened and Endangered Species

Endangered and threatened species that may be found temporarily in or around the proposed project area include: Atlantic sturgeon (*Acipenser oxyrhynchus*), Shortnose sturgeon (*Acipenser brevirostrum*), the West Indian manatee (*Trichechus manatus*), Smalltooth Sawfish (*Pristis pectinata*), Loggerhead sea turtle (*Caretta caretta*), Green sea turtle (*Chelonia mydas*), Leatherback sea turtle (*Dermochelys coriacea*), Hawksbill sea turtle (*Eretmochelys imbricate*), and Kemp's Ridley sea turtle (*Lepidochelys kempi*) and Smalltooth sawfish (*Pristis pectinata*).

According to "Endangered Species Act Section 7 Effects Determination Guidance" (National Marine Fisheries Service, 2014; Appendix B), federal actions must make a preliminary effect determination with respect to threatened and endangered species or designated critical habitat in the proposed project area. Pursuant to paragraph 1.a.iii of this guidance, a no effect determination is warranted should a proposed action require a series of exceedingly rare events to occur in a particular sequence, in order to impact individuals of a listed species. A single action could also merit a no effect determination if the route of effect is so unrealistic its occurrence would be implausible. The placement by crane or track hoe of previously described oyster reef construction materials at the proposed project area, and all associated construction activity, would have no effect on threatened and endangered species or designated critical habitat when performed in compliance with conditions described in "Guidelines for Avoiding Impacts to the West Indian Manatee" (USFWS 2003, Appendix C) and "Sea Turtle and Smalltooth Sawfish Construction Conditions" (NMFS 2006, Appendix D).

Shortnose sturgeon *(Acipenser brevirostru*m**)**

Status: Endangered

Shortnose sturgeon ranges exist along the Atlantic seaboard from southern Canada to northeastern Florida (USFWS 1999b.). They feed on invertebrates and stems and leaves of macrophytes. From historical accounts, it appears that this species was once

fairly abundant throughout North Carolina waters; however, many of these early records are unreliable because of confusion between this species and the Atlantic sturgeon (*Acipenser oxyrhynchus*). The proposed action area is in the historic range of the shortnose sturgeon. Currently, reported shortnose sturgeon populations in North Carolina are likely restricted to the Cape Fear River and the western part of Albemarle Sound. Anecdotal information from fishermen suggest that the species may still occur within the Neuse River, Pamlico Sound, and Albemarle Sound (Moser et al. 1998), but despite survey efforts no specimens have been documented in these locations since 1998. The National Marine Fisheries Service has stated in a Biological Opinion issued to the USFWS (Consultation Number F/SER/2010/05390) that based on the low probability of shortnose sturgeon presence in the area of the proposed project, the risk to this species is considered discountable (NMFS 2011). The proposed action and no action alternatives would have no effect on Shortnose sturgeon.

Atlantic sturgeon *(Acipenser oxyrhyncus)*

Status: Endangered

Although specifics vary latitudinally, the general life history pattern of Atlantic sturgeon is that of a long lived, late maturing, estuarine-dependent, anadromous species. The species historic range included major estuarine and riverine systems that spanned from Hamilton Inlet on the coast of Labrador to the Saint Johns River in Florida (Murawski and Pacheco 1977, Smith and Clungston 1997). Atlantic sturgeons are found in the lower Neuse River Estuary (Oakley 2003), but are predominantly found in the Albemarle Sound and Cape Fear River systems.

Population stressors evaluated throughout existing literature indicate that by-catch mortality, water quality, lack of adequate state or federal regulatory mechanisms, and dredging activities were the most significant threat to the viability of Atlantic sturgeon populations. Additionally, some populations were affected by unique stressors, such as habitat impediments (e.g., dams on the Cape Fear and Santee-Cooper rivers) and apparent ship strikes (e.g., Delaware and James rivers). Dams on the Neuse River and its tributaries might also have adversely affected Atlantic sturgeon populations in the Neuse River Basin.

Atlantic sturgeon are occasionally observed within the proposed project area throughout the year; however, there have never been any documented incidents of negative finfish interactions during deployment operations of the NC Oyster Sanctuary and Artificial Reef programs. If present, sturgeons may be indirectly affected on a temporary basis by construction of the sanctuary. Given the mobility of the sturgeons and the extensive areas of soft bottom surrounding the area of disturbance, the proposed action and no action alternatives would have no effect on Atlantic sturgeon.

West Indian manatee (*Trichechus manatus)*

Status: Endangered

The West Indian manatee is an occasional summer resident off the North Carolina coast and has been seen in the Neuse River Basin. The species can be found in shallow (5 ft. to usually <20 ft.), slow-moving rivers, estuaries, saltwater bays, canals, and coastal areas (USFWS 1991). The West Indian manatee is herbivorous and eats aquatic plants such as hydrilla, eelgrass, and water lettuce (USFWS 1999a.). During winter months, the U.S. manatee population confines itself to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia. They are sighted infrequently in southeastern North Carolina, with most records occurring in July, August, and September as they migrate up and down the coast (Clark 1993). The peak warm season (June through October) population of manatees in North Carolina is not thought to exceed a dozen or so individuals. The University of North Carolina at Wilmington have identified 53 known sightings of manatees in North Carolina from 1994-2010, with two sightings occurring within the Neuse River (Cummings et al. 2011).

Due to the shallow water, clear visibility and alert crew, it is highly unlikely that a manatee interaction will occur. There have never been documented incidents of manatee sightings or interactions during deployment operations of the NC Oyster Sanctuary and Artificial Reef programs. Construction activity has a limited area of effect restricted to the immediate area surrounding the deployment vessel to the substrate. The audible sound produced by the activity should discourage interactions with manatees. The U.S. Fish and Wildlife Service's "Guidelines for Avoiding Impacts to the West Indian Manatee" (USFWS 2003, Appendix C) will be followed for all sanctuary construction operations to minimize the risk of adverse impacts to the species. If a manatee is seen within 100 yards of construction activity, all appropriate precautions will be implemented to ensure protection of the species. These precautions will include the immediate shutdown of moving equipment if a manatee comes within 50 feet of the operational area of construction equipment. Activity will not resume until the manatee has departed the project area on its own volition. Support vessels utilized during construction operations will notify construction personnel in the event a manatee is seen within 50 feet of the equipment and will suspend all operations until the manatee has left the immediate area of concern. The proposed action and no action alternatives would have no effect on the West Indian manatee.

Smalltooth sawfish (*Pristis pectinata*)

Status: Endangered

The range of the Federally-listed, endangered Smalltooth sawfish includes all coastal North Carolina waters, including those in the proposed project area. All appropriate precautions will be implemented to ensure protection of this species during project construction to ensure protection of the species. Precautions will include cessation of operation of any moving equipment closer than 50 feet of a Smalltooth sawfish. Operation of any mechanical equipment will cease immediately if a sea turtle or

smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the proposed project area of its own volition (NMFS 2006, Appendix D). The proposed action and no action alternatives would have no effect on Smalltooth sawfish.

Sea turtles

Federally-listed threatened and endangered sea turtles are found within the waters of the Neuse River Estuary. These sea turtles are not known to nest in the area but are found feeding and resting in the adjacent waters of the Neuse River Estuary and Pamlico Sound.

Listed species occasionally observed within the proposed project area are the Loggerhead sea turtle (*Caretta caretta*), Green sea turtle (*Chelonia mydas*), Leatherback sea turtle (*Dermochelys coriacea*), Hawksbill sea turtle (*Eretmochelys imbricate*), and Kemp's Ridley sea turtle (*Lepidochelys kempi*). In 1988, researchers with the NMFS Laboratory in Beaufort, NC began monitoring the distribution of sea turtles in North Carolina estuarine and near-shore waters, employing three complementary methods to assess turtle distributions: aerial surveys, public sightings, and mark-recapture studies (Epperly et al. 1995). This research identified a distinct seasonal pattern of sea turtle distribution in the sounds and near-shore waters of North Carolina. In April, as coastal waters begin to warm, sea turtles enter the NC coastal sounds. During summer months, sea turtles may be found from the Albemarle Sound to the Cape Fear River and as far west as the lower reaches of the Neuse River Estuary including the proposed site for Little Creek Oyster Sanctuary. Once the water temperatures start to cool in August, the females move on in search of food and a place to reside until next nesting season. The proposed project area could serve as feeding and resting grounds for all species of sea turtles.

Leatherback sea turtles tend to be found in pelagic, deep water habitats, and are very rare in the action area, as Pamlico Sound and its tributaries are shallow, inshore water bodies. Leatherbacks are not expected to occur within the area of construction activities. Hawksbill sea turtles have been recorded within Pamlico Sound; however, these are very rare occurrences, with only one or two strandings/sightings in a decade. Pamlico Sound is further north than hawksbills are typically found, and does not provide reef and sponge habitats used by Hawksbills for feeding. The National Marine Fisheries Service has stated in a Biological Opinion issued to the USFWS (Consultation Number F/SER/2010/05390) that Leatherback and Hawksbill sea turtles are very rare in the action area and the chances of these species being affected are discountable (NMFS 2011).

Green, Kemp's Ridley, and Loggerhead sea turtles may be indirectly affected by construction of the sanctuary. Incidental take of these species during deployment operations would be extremely rare. There have never been documented incidents of negative sea turtle interactions during deployment operations of the NC Oyster Sanctuary or Artificial Reef programs. Construction activity has a limited area of effect that is restricted to the immediate vicinity of the deployment vessel. The audible sound

produced by the activity should discourage interactions with sea turtles. The National Oceanic and Atmospheric Administration's "Sea Turtle and Smalltooth Sawfish Construction Conditions" (NMFS 2006, Appendix D) will be followed for all sanctuary construction operations to minimize the risk of adverse impacts to the species. Support vessels utilized during construction operations will notify construction personnel in the event a sea turtle is seen within 50 feet of the equipment and will suspend all operations until the turtle has left the immediate area of concern.

The proposed project would have no effect on any sea turtle species. "Sea Turtle and Smalltooth Sawfish Construction Conditions" (NMFS 2006, Appendix D) will be followed for all sanctuary construction operations. Similarly, the no action alternative would have no effect on threatened or endangered species in the proposed project area.

4.14 Cultural Resources

The National Historic Preservation Act (NHPA) was passed in 1966 to protect, enhance, and preserve any property that possesses significant architectural, archaeological, historical, or cultural characteristics. Section 106 of this act requires the head of any federal agency with jurisdiction over a federally financed action, prior to the expenditure, to take into account the effect of the action on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places. Pursuant to Section 106 and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800, the North Carolina State Historic Preservation Office (SHPO) conducted a review of the proposed project and is not aware of any historic resources which would be affected by the proposed project (ER 11-2086); therefore, the proposed project will not adversely impact any cultural resources.

The no action alternative would have no impact on cultural resources.

4.15 Hazardous and Toxic Waste

The proposed project area is located within open waters of the lower Neuse Estuary where Hazardous and Toxic Waste Sites would not be expected to occur. EPA's Envirofacts Data Warehouse website and was queried to identify the presence of EPA regulated facilities within 5 miles of the proposed project site. The Envirofacts databases contain information on facilities collected from regulatory programs such as RCRA, EPCRA, Superfund, Clean Water Act, and Clean Air Act and information on environmental activities that may affect air, water, and land in the proposed project area. The query returned that no sites were reported in the proposed project area. Further, the EPA, North Carolina Division of Air Quality, and North Carolina Division of Water Resources are actively involved with the CAMA review process and have approved CAMA permit #140-09, finding no adverse impacts of the proposed Little Creek Oyster Sanctuary related to hazardous and toxic waste (Appendix A-1, A-2).

The proposed alternative and no action alternative would have no impact on hazardous and toxic waste in the proposed project area and neither alternative would produce any hazardous or toxic waste.

4.16 Air Quality

Transportation, staging, and deployment of the reef material will require the use of heavy equipment, trucks and barges. The use of motorized machinery will result in a temporary introduction of dust and exhaust into the air during construction and maintenance; however, these changes in air quality would be minimal, localized, and short in duration. The impact is considered negligible. The proposed project is in compliance with National Ambient Air Quality Standards parameters. A State Implementation Plan conformity determination (42 *United States Code* 7506 (c)) would not be required because the proposed project area is in attainment for all criteria pollutants. North Carolina Division of Air Quality has provided approval for CAMA permit number 140-09. No significant adverse impacts on air quality are expected with the Little Creek Oyster Sanctuary.

The no action alternative would have no impact on air quality.

4.17 Noise

Noise levels vary in the lower regions of the Neuse River and are typically dependent on the level of recreational and commercial waterway activities as well as aircraft movement. The highest noise in close vicinity to the proposed project area is generated from aircraft activity in and around the prohibited area 334.420 (BT11 target range). Construction activities associated with the proposed action are expected to be completed by summer 2016; however, due to the possibility of vessel and resource reallocation due to hurricanes and other severe storm events in the project area, a firm completion date is not available. Construction equipment is not expected to cause excessive noise and will be in operation only during daylight hours. Concerning marine mammals, noise levels are expected to be comparable to regular boat traffic in the area, although with higher incidence during construction, and are not expected to exceed hazardous acoustic threshold levels (NOAA 2013). No machinery is expected to be in operation below the water's surface. No significant noise-related adverse impacts are expected.

The no action alternative would have no impact on noise in the proposed project area.

4.18 Wetlands

The proposed oyster sanctuary development area is in open waters of the Neuse River Estuary and staging will occur on high ground at an NCDMF site that is currently used for that purpose. The proposed action will have no impact on wetlands.

The no action alternative would also have no impact on wetlands.

4.19 Navigation

The Neuse River upstream of Pamlico Sound is considered Navigable Waters under Section 10 of the Rivers and Harbor Act. The lower Neuse River Estuary, where the proposed project will be sited, is wide and deep, with most navigable waters assuming

20-26 ft. depth. Water depths along the shoreline are shallower, ranging from 10-15 ft. deep. The lower Neuse River Estuary is a popular, predominately recreational, sailing and boating area, containing both the Neuse River Navigation Channel and the Atlantic Intracoastal Waterway. The proposed Little Creek Oyster Sanctuary will not impede navigation in any established channel or commercial waterway. The proposed project will also conform to minimum vertical clearance requirements, as established by the United States Coast Guard (USCG) and documented in condition #3 of CAMA permit #140-09 (Appendix A-1, A-2). At the proposed project site the water depth is 19 - 22 ft. The constructed reef site will have a minimum navigable clearance of 11 ft. To warn boaters of potential navigational hazards, each sanctuary corner will be marked with a USCG regulation three-pile-dolphin. Each corner dolphin will have two (3 x 3 ft.) signs mounted so that they are facing outside the sanctuary. The signs will serve as both a sanctuary sign and a hazard warning. Each sign will contain the words “Oyster Sanctuary” and possess an orange hazard diamond with the word “Rock” positioned inside the hazard diamond. Collectively, the four corners will make up the sanctuary boundaries.

The project may result in minor impacts to navigation due to decreased depths and installation of marker dolphins in the proposed project area. Regarding depth, navigational hazards will be limited to vessels with a hull draft greater than 11 ft. Navigational hazards will be minimized by site marking in accordance with USCG regulations.

The no action alternative would have no impact on navigation.

4.20 Recreation, Aesthetic and Socioeconomic Resources

The proposed project may have a positive impact to recreational boating and fishing opportunities in the Neuse River Estuary. The Little Creek Oyster Sanctuary will provide a location where anglers and divers can utilize aggregated populations of estuarine species, either in a take (fishing) or no-take (viewing) fashion. Improved recreational opportunities will result in increased economic activity (e.g., expenditures, incomes, jobs) associated with these interests. Each of these purposes may also generate non-market recreational benefits (such as existence values), particularly to non-users of reefs. Such benefits reflect how individuals who may not directly utilize oyster reefs nonetheless value reef existence as being beneficial to the biological habitat of the region. Aesthetic resources will be largely unaffected by the proposed project as the majority of the sanctuary site will be submerged; however, each sanctuary corner will be clearly marked with a USCG regulation three-pile-dolphin having two (3 x 3 ft.) signs, easily visible to boaters in the area.

The proposed Little Creek Oyster Sanctuary will have minor impacts on aesthetic resources in the project area due to marker dolphins and signage; however the proposed project may serve to improve recreational resources and socioeconomics in and near the proposed project area.

The no action alternative would have no impact on recreation, aesthetic and socioeconomic resources.

4.21 Executive Orders

Sections 4.21.1 through 4.21.6 demonstrate the proposed project's compliance with applicable executive orders.

4.21.1 Executive Order 11988 (Flood Plain Management)

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.

The proposed Little Creek Oyster Sanctuary oyster restoration project will be constructed in the Neuse River Estuary and will have no impact on the flood plain. Additionally, materials storage and staging areas are in previously disturbed areas. Therefore, the proposed project will be in compliance with Executive Order 11988.

4.21.2 Executive Order 11990 (Protection of Wetlands)

The purpose of Executive Order 11990 is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands". To meet these objectives, the order requires federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

The proposed Little Creek Oyster Sanctuary oyster restoration project will be constructed in the Neuse River Estuary and will have no impact on wetlands. Additionally, materials storage and staging areas are in previously disturbed areas. Therefore, the proposed project will be in compliance with Executive Order 11990.

4.21.3 Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low Income Communities and Low Income Populations)

Executive Order 12898 states that the federal government would review the effects of its proposed actions on low income communities. 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 proposed action would impact soft bottom in the Neuse River Estuary by conversion to productive oyster reef habitat, and would prohibit navigation for vessels drawing over 11 feet of draft. Material storage and staging will take place in areas previously used for these purposes. The USACE evaluated potential project impacts of Little Creek Oyster Sanctuary and the information demonstrates that the proposed action would not cause disproportionately high and adverse impacts on minority

populations or low-income populations. No impacts to either minority/low-income populations or low-income communities are anticipated as a result of the proposed action; therefore the action would comply with Executive Order 12898.

4.21.4 Executive Order 11593 (Protection and Enhancement of the Cultural Environment)

Executive Order 11593 directs the Federal Government to provide leadership in preserving, restoring and maintaining the historic and cultural environment of the Nation. Federal agencies shall administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations, initiate measures necessary to direct their policies, plans and programs in such a way that federally owned sites, structures, and objects of historical, architectural or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people, and, in consultation with the Advisory Council on Historic Preservation (16 U.S.C. 470i), institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures and objects of historical, architectural or archaeological significance.

Care will be taken during construction to identify potential archaeological concerns, and work would be stopped to evaluate and preserve these areas, as appropriate. However, no short- or long-term adverse effects on the cultural environment from the proposed Little Creek Oyster Sanctuary oyster restoration project, or materials staging, are anticipated; therefore the action would comply with Executive Order 11593.

4.21.5 Executive Order 13045 (Protection of Children from Environmental Health Risks)

Executive Order 13045 states that Federal agencies shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

There are no schools, playgrounds, parks, or public access areas near or adjacent to the proposed project area or stockpile site; therefore the action would comply with Executive Order 13045.

4.21.6 Executive Order 13186 (Protection of Migratory Birds)

Executive Order 13186 directs Federal agencies taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement Memorandums of Understanding (MOU) with the USFWS that shall promote the conservation of migratory bird populations.

There are no anticipated long-term adverse effects on migratory birds from the proposed Little Creek Oyster Sanctuary oyster restoration project; therefore the action would comply with Executive Order 13186.

5.00 CUMULATIVE IMPACTS

The Federal Executive Branch's Council on Environmental Quality defines *cumulative impact* as "the impact on the environment [that] results from the incremental impact of an 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" (40 CFR 1508.7, NEPA 1969).

Due to a combination of inland development, changing environmental conditions, and historic harvest pressure, NC oyster numbers have declined over the past century. In a proven successful effort to restore oyster populations and enhance both shellfish and finfish fisheries, the NCDMF has been constructing artificial reefs in Pamlico Sound as part of their Oyster Sanctuary Program for the past 15 years. Thirteen protected sites have been constructed to date, all located in Pamlico Sound (Figure 1), and are of varying sizes and material compositions. Future sites are expected to be constructed as funding and resources permit.

Similar to other NCDMF oyster sanctuary sites, the proposed Little Creek Oyster Sanctuary will be monitored four times a year for the first two years following project completion and then annually thereafter. Physical data such as location, size, material type, deployment configuration, and structure dimensions will be measured and recorded, as well as biological data including oyster recruitment, size, and density. Based on monitoring data, construction methodologies have been constantly evolving in order to best ensure success and health of the Oyster Sanctuary Program as a whole. Most current methodologies will be employed for construction of the proposed project.

The proposed oyster sanctuary is found to have no adverse impact on environmental resources of the lower Neuse River Basin and in some instances, will provide environmental benefits. This proposed action will be managed as part of the NCDMF Oyster Sanctuary Program. The cumulative impact of adding a sanctuary to Neuse River/Pamlico Sound is a contribution to an existing network of sanctuaries. Sanctuaries added to this network will provide support for larval connectivity between existing sites and improve self-sustainability of the network as a protected broodstock reserve.

6.00 FINDING OF NO SIGNIFICANT IMPACT

The proposed action is not expected to significantly affect the quality of the human environment; therefore an Environmental Impact Statement likely will not be prepared. If this determination remains unchanged following public and agency review of the EA, a Finding of No Significant Impact (FONSI) will be signed and circulated prior to the initiation of the proposed action.

7.00 COORDINATION

The Little Creek Oyster Sanctuary (proposed action) has received a Major CAMA Permit through the NC Division of Coastal Management (permit number 140-09) for;

- Major development in an area of environmental concern pursuant to NCGS 113A-118

- Excavation and/or filling pursuant to NCGS 113A-229

Pursuant to Section 401 of the Clean Water Act, the NC Division of Water Resources has determined that the project is in compliance with North Carolina's Water Quality Certification Program and issued WQ Certification #3642 on 11/14/2011 and assigned the project #11-0952.

A project scoping meeting was held on September 7, 2011. The following state and federal agencies were present and provided input:

- N.C. Division of Water Quality

- N.C. Division of Marine Fisheries

- N.C. Division of Coastal Management

- N.C. Wildlife Resources Commission

- U.S. Army Corps of Engineers

- National Oceanic and Atmospheric Administration (NOAA)

A public hearing was held on April 24, 2012 by the N.C. Division of Marine Fisheries at the Central District Office in Morehead City, NC. Attendance was low, and only positive comments concerning the proposed project were received.

8.00 PREPARERS

This Environmental Assessment was prepared by the NCDMF for the U.S. Army Corps of Engineers, Wilmington District, Wilmington, North Carolina. Preparers included Craig Hardy (now retired), Pelle Holmlund, Michael Jordan, Jason Peters, Kelly Price, Curt Weychert, and Garry Wright, of the N.C. Division of Marine Fisheries, and Justin Bashaw and Chuck Wilson (now retired) of the U.S. Army Corps of Engineers.

9.00 POINT OF CONTACT

Written comments regarding this EA should be sent to Mr. Justin Bashaw, CESAW-ECP-PE, U.S. Army Corps of Engineers, Wilmington District, 69 Darlington Avenue, Wilmington, North Carolina 28403 or submitted by email to justin.p.bashaw@usace.army.mil.

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11.00 FIGURES

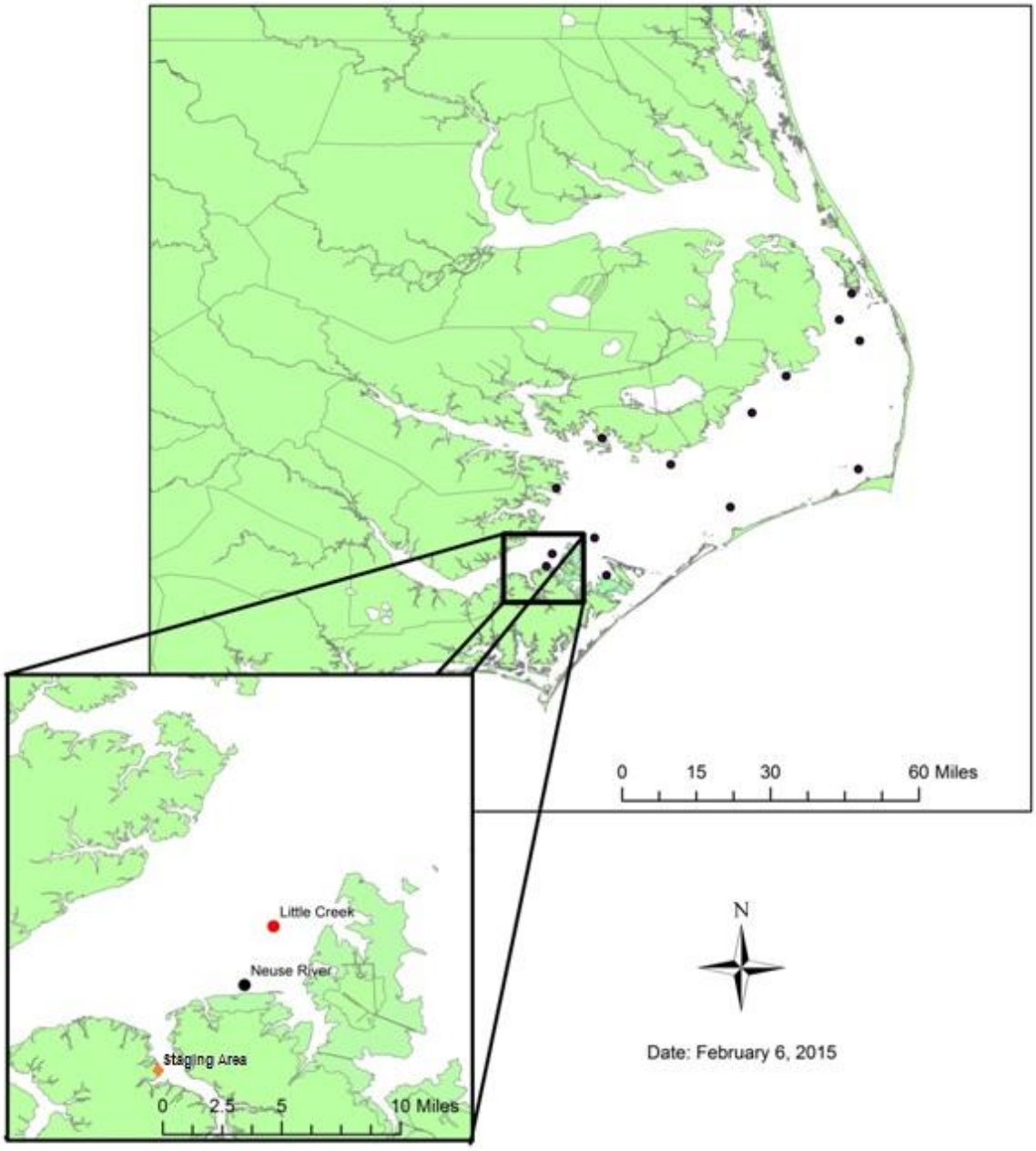

Figure 1. Proposed Little Creek Oyster Sanctuary Reference Map. All existing sanctuaries are denoted by black circles. Proposed Little Creek Sanctuary is denoted by a red circle. South River staging area is denoted by an orange diamond. Little Creek Sanctuary will be located north-northwest of the existing Neuse River Sanctuary in the Lower Neuse River Estuary, North Carolina, USA.

Proposed Little Creek Oyster Sanctuary

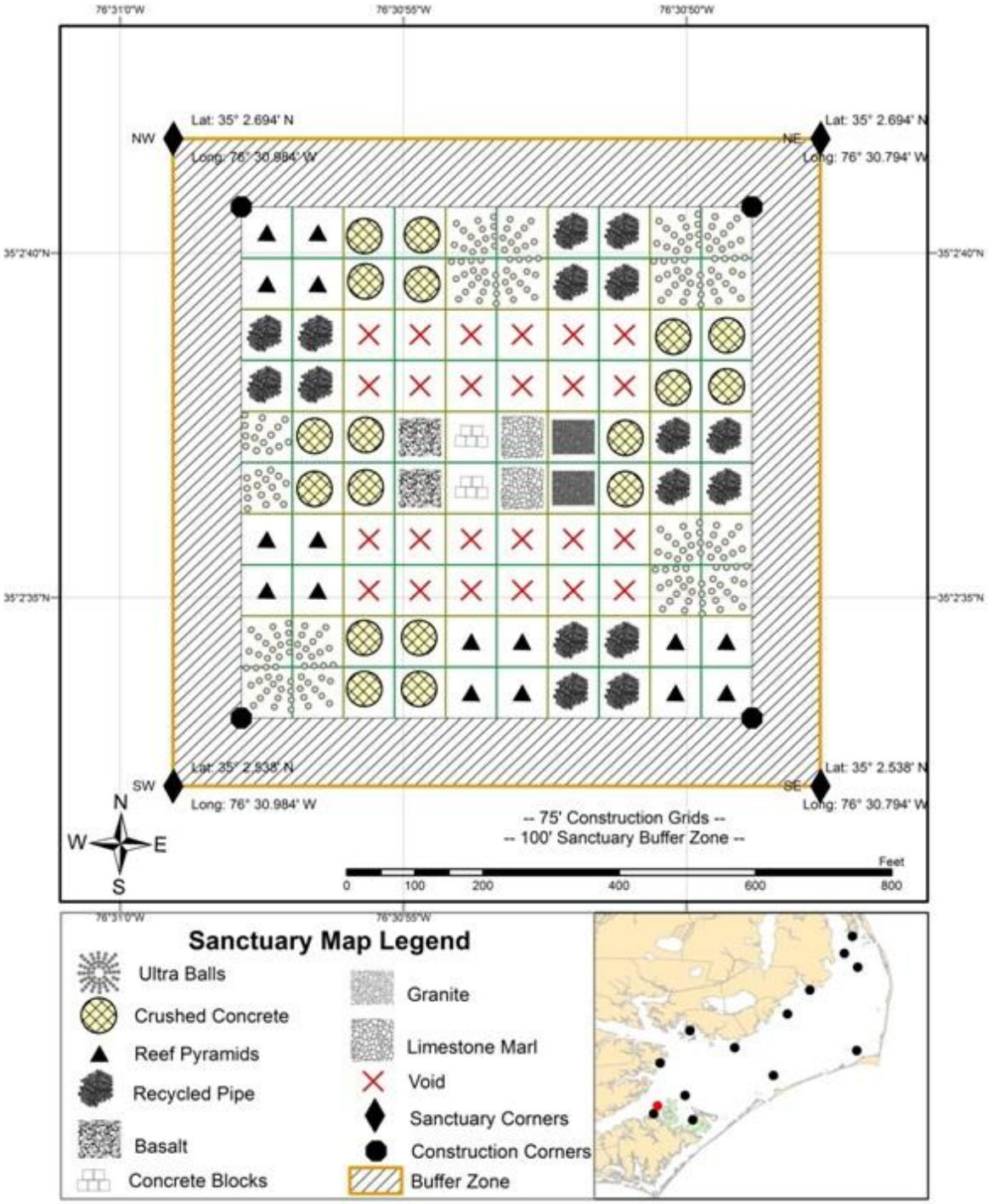

Figure 2. Proposed Little Creek Site Map. Material types and distribution depicted by symbology. Reference map is inset, with the proposed Little Creek Sanctuary location highlighted in red.

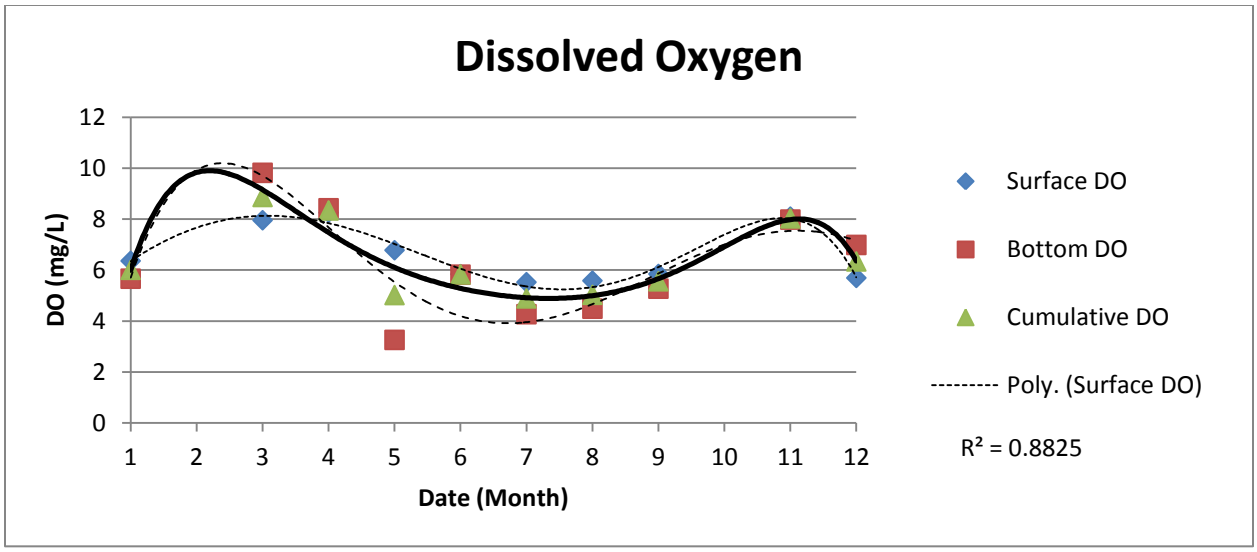

Figure 3. Dissolved Oxygen Concentration at Neuse River Oyster Sanctuary. Values are reported as mean monthly dissolved oxygen (mg/L) for the sampling years 2007-2012 and gleaned from NCDMF program 611 biological documentation (unpublished data). Trend lines are drawn representing polynomial best fit for surface dissolved oxygen (DO, dotted line), bottom DO (dashed line), and cumulative DO (solid line). Cumulative DO was calculated by averaging all surface and bottom values for a given month. Data for February and October were unavailable.

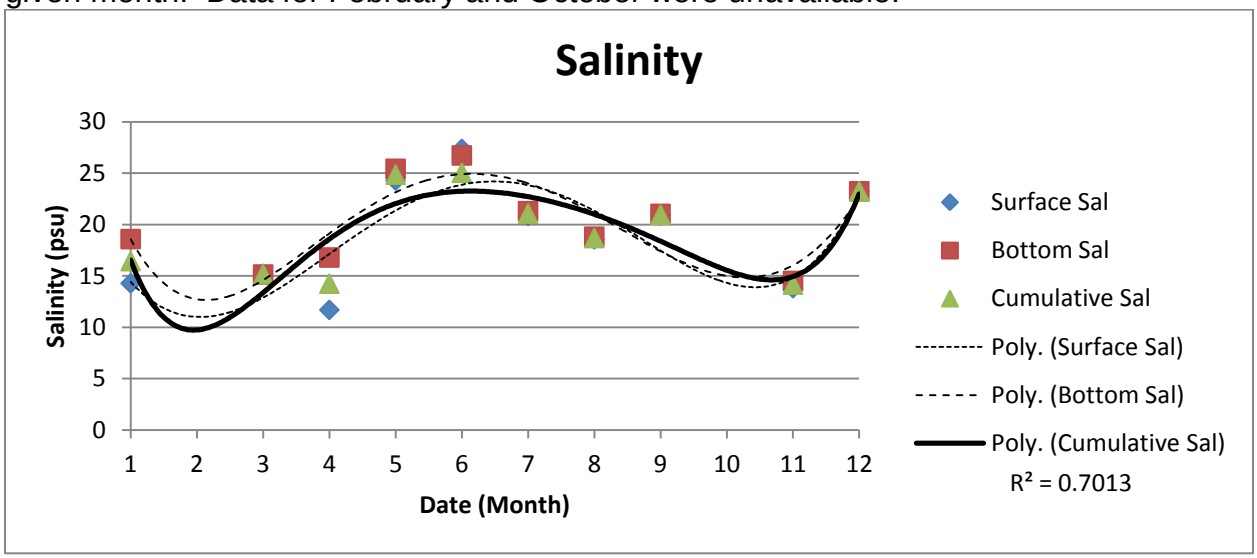

Figure 4. Salinity at Neuse River Oyster Sanctuary. Values are reported as mean monthly salinity (psu) for the sampling years 2007-2012 and gleaned from NCDMF program 611 biological documentation (unpublished data). Trend lines are drawn representing polynomial best fit for surface salinity (dotted line), bottom salinity (dashed line), and cumulative salinity (solid line). Cumulative salinity was calculated by averaging all surface and bottom values for a given month. Data for February and October were unavailable.

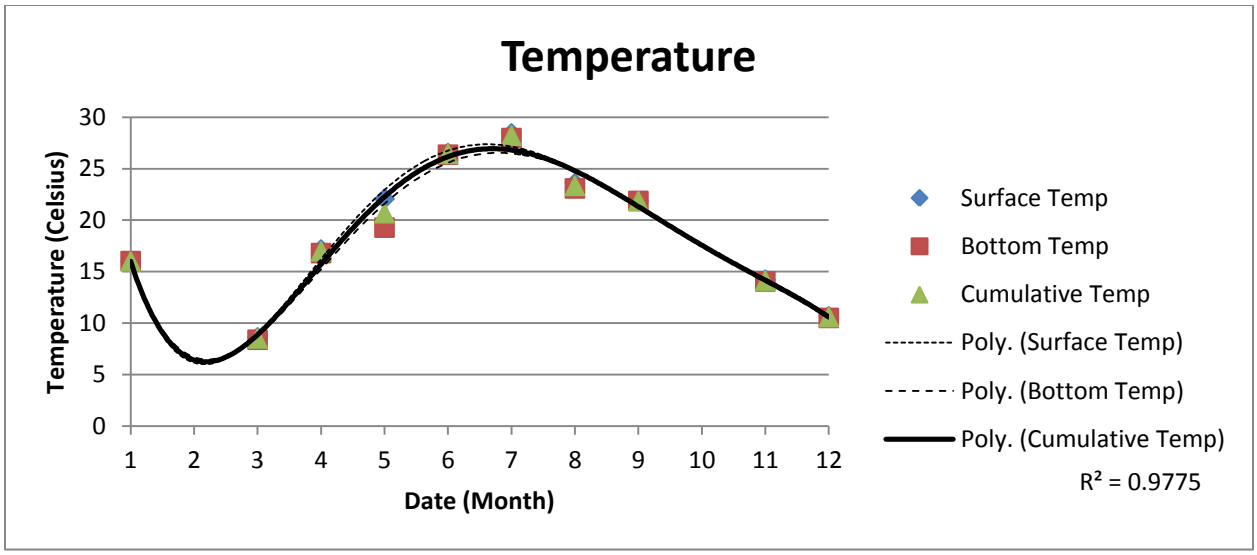

Figure 5. Temperature at Neuse River Oyster Sanctuary. Values are reported as mean monthly temperature (Celsius) for the sampling years 2007-2012 and gleaned from NCDMF program 611 biological documentation (unpublished data). Trend lines are drawn representing polynomial best fit for surface temperature (dotted line), bottom temperature (dashed line), and cumulative temperature (solid line). Cumulative salinity was calculated by averaging all surface and bottom values for a given month. Data for February and October were unavailable.

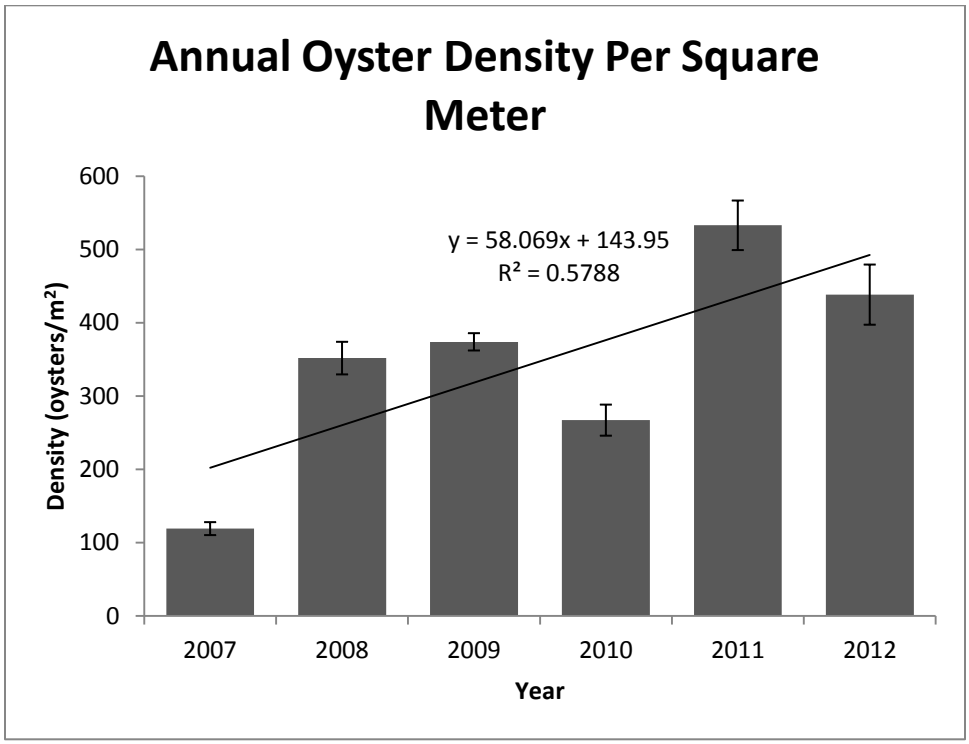

Figure 6. Annual Oyster Density at Neuse River Oyster Sanctuary. Values are reported from NCDMF Program 611 biological documentation (unpublished data) for the sampling years 2007-2012. Trend in total population density at this sanctuary indicates a 400% increase over six years.

12.00 APPENDICIES

Appendix A-1

Permit Class
MODIFICATION/MAJOR

Permit Number
140-09

STATE OF NORTH CAROLINA
Department of Environment and Natural Resources
and
Coastal Resources Commission

Permit

for

_X_ Major Development in an Area of Environmental Concern pursuant to NCGS 113A-118

_X_ Excavation and/or filling pursuant to NCGS 113-229

Issued to **NC Division of Marine Fisheries, PO Box 769, Morehead City, NC 28557**.

Authorizing development in Carteret County 1.8 miles northwest of Little Creek in the lower Neuse River, in the Pamlico Sound complex, as requested in the permittee's application dated 10/18/11, including the attached workplan drawings (10 total), all dated 10/17/11.

This permit, issued on November 23, 2011, is subject to compliance with the application (where consistent with the permit), all applicable regulations, special conditions and notes set forth below. Any violation of these terms may be subject to fines, imprisonment or civil action; or may cause the permit to be null and void.

Authorized Development

1) Unless specifically altered herein, this Major Modification authorizes the addition of an 11th site, at the Little Creek site in the Neuse River in Carteret County, to the 10 permitted Oyster Sanctuaries in the Pamlico Sound Complex, as depicted in the attached permit application and workplan drawings.

(See Attached Sheets for Additional Conditions)

This permit action may be appealed by the permittee or other qualified persons within twenty (20) days of the issuing date. An appeal requires resolution prior to work initiation or continuance as the case may be.

This permit must be accessible on-site to Department personnel when the project is inspected for compliance.

Any maintenance work or project modification not covered hereunder requires further Division approval.

All work must cease when the permit expires on

February 7, 2015

In issuing this permit, the State of North Carolina agrees that your project is consistent with the North Carolina Coastal Management Program.

Signed by the authority of the Secretary of DENR and the Chairman of the Coastal Resources Commission.

David W. Moye
for M. Ted Tyndall, Assistant Director
Division of Coastal Management

This permit and its conditions are hereby accepted.

H. Craig Hart
Signature of Permittee

ADDITIONAL CONDITIONS

Little Creek Oyster Sanctuary

2) In accordance with commitments made by the permittee, reef construction within the Little Creek site shall be accomplished using Class B limestone marl riprap stone, Ultra Balls, Florida Reef pyramids, concrete pipe material, and concrete blocks. All material shall be free from loose dirt or any pollutant.

3) In accordance with commitments made by the permittee, a minimum navigation clearance of 11 feet as measured from the top of the Little Creek Sanctuary structure to the normal water level shall be maintained for all new mound construction.

4) In accordance with commitments made by the permittee, NCDMF proposes to monitor the Little Creek site 4 times a year for the first 2 years and then annually thereafter and compare the limestone marl mounds to the concrete block mound to see if any movement has occurred. In the event that the concrete blocks are shown to have moved outside the standard of the limestone marl mounds, the NCDMF has agreed to remove all the concrete blocks from the bottom. NCDMF shall provide copies of the monitoring reports to the Division of Coastal Management as well as to the US Army Corps of Engineers.

5) No fill material shall be placed at any time in any waters outside of the alignment of the fill areas indicated on the attached workplan drawing(s).

6) This permit does not authorize the excavation or filling of any vegetated wetlands, even temporarily.

U.S. Army Corps of Engineers Requirements

NOTE: The U.S. Army Corps of Engineers has assigned the proposed project ORM ID No. SAW-2011-02018.

7) Except as specified in the plans attached to this permit, no excavation, fill or mechanized land-clearing activities shall take place at any time in the construction or maintenance of this project, in such a manner as to impair normal flows and circulation patterns within waters or wetlands or to reduce the reach of waters or wetlands.

8) Except as authorized by this permit or any USACE approved modification to this permit, no excavation, fill or mechanized land-clearing activities shall take place at any time in the construction or maintenance of this project, within waters or wetlands. This permit does not authorize temporary placement or double handling of excavated or fill material within waters or wetlands outside the permitted area. This prohibition applies to all borrow and fill activities connected with this project.

9) The permittee must install and maintain, at his expense, any signal lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, on authorized facilities. For further information, the permittee should contact the U.S. Coast Guard Marine Safety Office at (910) 772-2191.

ADDITIONAL CONDITIONS

10) The permittee shall advise the Corps in writing at least two weeks prior to beginning the work authorized by this permit and again upon completion of the work authorized by this permit.

11) The permittee shall require its contractors and/or agents to comply with the terms and conditions of this permit in the construction and maintenance of this project, and shall provide each of its contractors and/or agents associated with the construction or maintenance of this project with a copy of this permit. A copy of this permit, including all conditions, shall be available at the project site during construction and maintenance of this project.

12) The activity will be conducted in such a manner as to prevent a significant increase in turbidity outside the area of construction or construction-related discharge. Increases such that the turbidity in the waterbody is 50 NTU or less are not considered significant.

13) Violations of these conditions or violations of Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act must be reported in writing to the Wilmington District U.S. Army Corps of Engineers within 24 hours of the permittee's discovery of the violation.

General

14) This permit shall not be assigned, transferred, sold, or otherwise disposed of to a third party without the written approval of the Division of Coastal Management.

15) The permittee understands and agrees that, if future operations by the United States requires the removal, relocation, or other alteration of the structures or work authorized by this permit, or if in the opinion of the Secretary of the Army or his authorized representative, said structures or work shall cause unreasonable obstruction to free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove relocate or alter the structural work or obstructions caused thereby, without expense to the United States or the state of North Carolina. No claim shall be made against the United States or the state of North Carolina on account of any such removal or alteration.

16) This Major Modification shall be attached to the original of Permit No. 140-09, which was issued on 11/3/09, as well as the Letter of Refinement dated 8/11/11, and copies of all documents shall be readily available on site when a Division representative inspects the project for compliance.

17) All conditions and stipulations of the active permit remain in force under this Major Modification unless specifically altered herein.

NOTE: This permit does not eliminate the need to obtain any additional state, federal or local permits, approvals or authorizations that may be required.

NOTE: Future development at any of the permitted Oyster Sanctuary sites may require a modification of this permit. Contact a representative of the Division of Coastal Management at (252) 808-2808 prior to the commencement of any such activity for this determination.

ADDITIONAL CONDITIONS

NOTE: The N.C. Division of Water Quality has determined the project is in compliance with North Carolina's Water Quality Certification Program and has issued General 401 WQ Certification #3642 on 11/14/2011 and it was assigned project #11-0952.

Appendix B-2

Permit Class
MODIFICATION/MINOR

Permit Number
140-09

STATE OF NORTH CAROLINA
Department of Environment and Natural Resources
and
Coastal Resources Commission

Permit

for

X Major Development in an Area of Environmental Concern pursuant to NCGS 113A-118

X Excavation and/or filling pursuant to NCGS 113-229

Issued to **NC Division of Marine Fisheries, PO Box 769, Morehead City, NC 28557**

Authorizing development in Dare, Hyde, Pamlico, and Carteret Counties on the Pamlico Sound, Croatan Sound, and the Neuse River, as requested in the permittee's letter dated received on 2/19/15, including the attached workplan drawing (2), both dated received in MHC on 2/19/15

This permit, issued on May 5, 2015, is subject to compliance with the application (where consistent with the permit), all applicable regulations, special conditions and notes set forth below. Any violation of these terms may be subject to fines, imprisonment or civil action; or may cause the permit to be null and void.

1) Unless specifically altered herein, this minor modification authorizes the increased tonnage and footprint with associated additional materials of basalt rock, granite rock, and processed recycled concrete to the previously authorized Oyster Sanctuaries, all as depicted in the attached narrative and workplan drawings.

2) This minor modification shall be attached to the original Permit No. 140-09, which was issued on 11/3/09 as well as all subsequent renewals, modifications, letters of refinement, and copies of all documents shall be readily available on site when Division personnel inspect the project for compliance.

3) All conditions and stipulations of the active permit remain in force under this minor modification unless specifically altered herein.

NOTE: A minor modification application processing fee of $100 was received by DCM for this project.

This permit action may be appealed by the permittee or other qualified persons within twenty (20) days of the issuing date.

This permit must be accessible on-site to Department personnel when the project is inspected for compliance.

Any maintenance work or project modification not covered hereunder requires further Division approval.

All work must cease when the permit expires on

December 31, 2017

In issuing this permit, the State of North Carolina agrees that your project is consistent with the North Carolina Coastal Management Program.

Signed by the authority of the Secretary of DENR and the Chairman of the Coastal Resources Commission.

Doug V Huggett
for Braxton C. Davis, Director
Division of Coastal Management

This permit and its conditions are hereby accepted.

Signature of Permittee

The North Carolina Division of Marine Fisheries is requesting a minor modification to a DCM CAMA Major Permit Modification #140-09, which authorized the construction of Little Creek Oyster Sanctuary. This major permit modification was issued on November 23, 2011, expiring on February 7th, 2015, signed by David W. Moye for M. Ted Tyndall, and issued to North Carolina Division of Marine Fisheries.

The original permit authorized five different types of material, totaling 2,897.5 tons, to be placed on sandy mud bottom (Table 1.). The proposed update to this major permit modification contains three additional types of material, increasing tonnage, and creating a larger impacted footprint (Table 2.). Additional materials include basalt rock, granite rock, and processed recycled concrete. These materials are being added to the project to evaluate the suitability of alternative substrates for oyster spat settlement.

Figure 1 illustrates a conceptual plan of material locations and arrangements and includes the site boundaries and grid locations, which are geographically accurate. However, it is important to note that the materials are not drawn to scale in the illustration.

Each individual grid is 75 feet wide and 75 feet long and the tonnage for each material type is presented (Table 3.). It is important to note the impacted footprint has increased due to changes in the deployment design and a buffer area increase of 100%. These modifications will reduce the overall construction area by 3.2 acres and ensure that all material is set within permitted boundaries. For comparison the original construction map is depicted in Figure 2.

Table 1. Original permitted specifications on the DCM-MP2

Material Type	Tonnage	Footprint (acres)
Ultra Balls	2058	0.1241
Florida Reefs	269.5	0.1125
Limestone Mounds	300	0.13
Block Mounds	120	0.083
Pipe Field	150	0.05
Totals	**2897.5**	**0.4996**

Table 2. Proposed construction material to be used.

Material Type	Tonnage	Footprint (acres)
Ultra Balls	540	0.1469
Florida Reefs	240	0.08
Limestone Mounds	300	0.13
Block Mounds	300	0.13
Pipe Field	1,200	0.487
Basalt	300	0.13
Granite	300	0.13
Processed Recycled Concrete	2,700	1.17
Totals	**5,880**	**2.404**

Table 3. Breakdown of proposed construction materials and tonnage per grid.

Material Type	Tonnage/Grid	Number of Grids in project
Ultra Balls	30	18
Florida Reefs	15	16
Limestone Mounds	150	2
Block Mounds	150	2
Pipe Field	75	16
Basalt	150	2
Granite	150	2
Processed Recycled Concrete	150	18

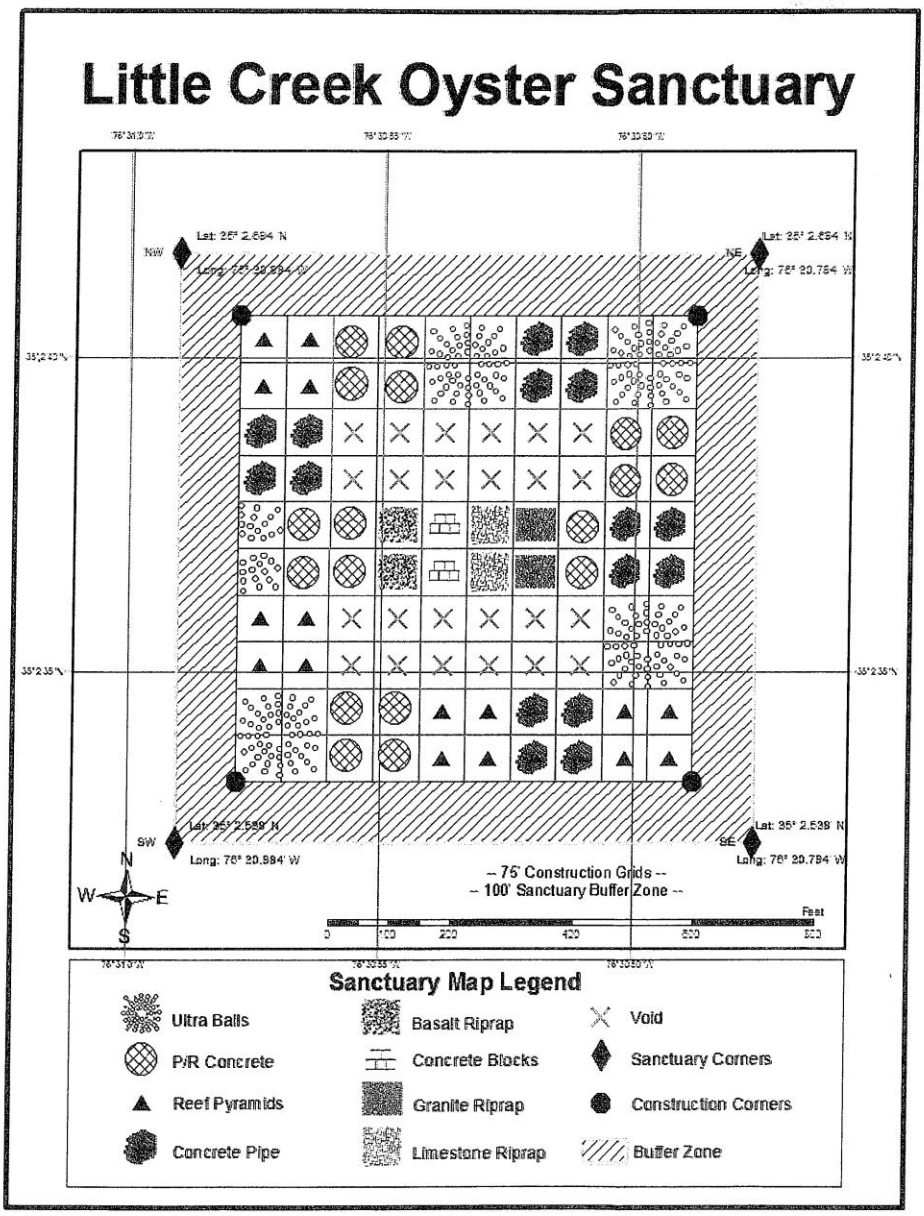

Figure 1. Deployment Map of Little Creek Oyster Sanctuary

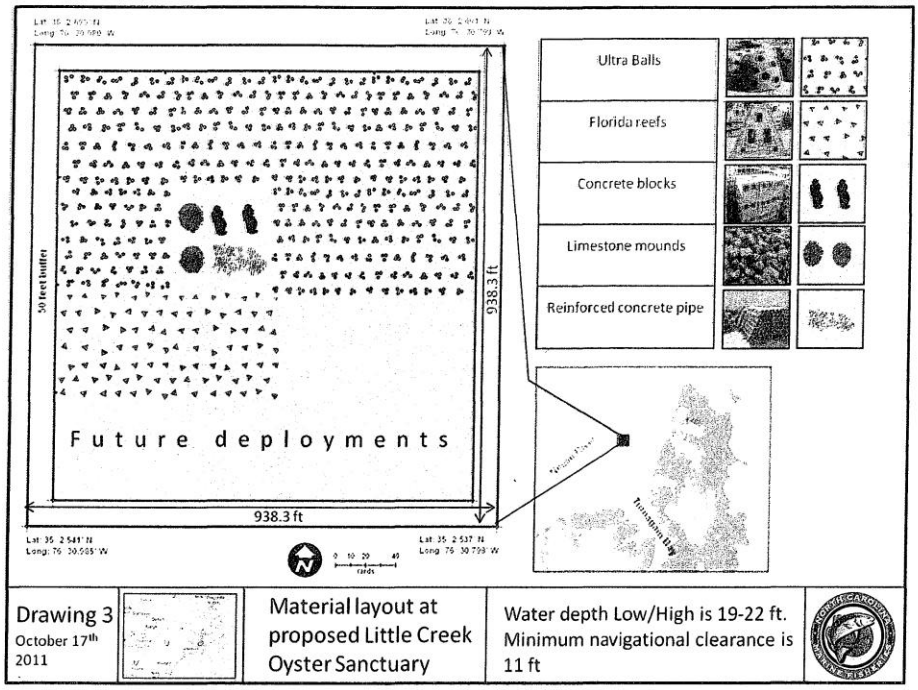

Figure 2. Original Little Creek Oyster Sanctuary construction map

Appendix C-3

DEPARTMENT OF THE ARMY
Wilmington District, Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403-1343
http://www.saw.usace.army.mil/WETLANDS/index.html

General Permit No. **198000291**
Name of Permittee: **General Public**
Effective Date: **January 1, 2011**
Expiration Date: **December 31, 2016**

DEPARTMENT OF THE ARMY
GENERAL PERMIT

A general permit to do work in or affecting navigable waters of the United States and waters of the United States, upon recommendation of the Chief of Engineers, pursuant to Section 10 of the Rivers and Harbors Act of March 3, 1899 (U.S.C. 403), and Section 404 of the Clean Water Act (33 U.S.C. 1344), is hereby issued by authority of the Secretary of the Army by

District Engineer
U.S. Army Engineer District, Wilmington
Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403-1343

TO AUTHORIZE THOSE CONSTRUCTION ACTIVITIES IN THE 20 COASTAL COUNTIES RECEIVING PRIOR APPROVAL FROM THE STATE OF NORTH CAROLINA IN THE FORM OF A COASTAL AREA MANAGEMENT ACT (CAMA) PERMIT, AND/OR A STATE DREDGE AND FILL PERMIT, AND IF REQUIRED, A WATER QUALITY CERTIFICATION, THAT ARE OTHERWISE NOT ELIGIBLE FOR FEDERAL AUTHORIZATION IN THE FORM OF A NATIONWIDE PERMIT OR ANOTHER REGIONAL GENERAL PERMIT.

Operating Procedures

a. Applications for joint state and federal authorization under this programmatic general permit will be accepted through the North Carolina Division of Coastal Management (NCDCM). Receipt of a complete application by the NCDCM will initiate the State's field review that will include a site visit and preparation of a Field Investigation Report and a state Bio-Report. The NCDCM will forward a copy of the complete application, its Field Investigation Report and its Bio-Report, to the appropriate Corps of Engineers field office, thereby initiating federal review of the project. The Corps, upon receipt of an application, will immediately assign an action identification number, acknowledge receipt thereof, and examine the application to assure that it can be processed pursuant to this programmatic general permit.

The applicant and the NCDCM will be furnished written notification of the Corps' determination. Notification to the applicant will include a brief description of the administrative process.

b. For those proposals that may result in a discharge into waters of the United States, including wetlands, the North Carolina Division of Water Quality (NCDWQ) and the applicant will be informed regarding the applicant's need to obtain a Water Quality Certification in accordance with section 401 of the Clean Water Act.

c. If, at any time, the Corps determines that a proposed activity is eligible for authorization under another regional general permit (RGP) or a nationwide permit (NWP), this procedure may be terminated and the activity authorized pursuant to the terms and conditions of the appropriate RGP or NWP.

d. The permit review process conducted by the NCDCM is a public process involving publication of public notices in local newspapers, public hearings, and various public appeal procedures. The Corps may issue a separate public notice for a specific proposal if it is deemed necessary for compliance with appropriate laws, regulation and guidance.

e. This general permit does not, in any way, alter established procedures or responsibilities, as required by federal laws, memoranda of agreements (MOA's) or administrative regulations, with respect to the Corps' coordination with appropriate review agencies. The applicant will continue to have the opportunity to rebut any objections to a proposal.

f. The Corps will provide copies of the application and plans, the NCDCM's Field Investigation Report, and the state Bio-Report, to the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS) the U.S. Environmental Protection Agency (EPA), and any other federal agency that the Corps determines to be a necessary review agency (collectively, the "Federal Agencies"). Receipt of this material will initiate the Federal Agencies' review. The Federal Agencies will be allowed sufficient time, normally thirty (30) days, to provide the Corps with their comments and recommendations, including any proposed permit special conditions and recommendations of denial. The Corps may grant extensions of time for Federal Agency review if justified by unusual circumstances. If an extension is granted that would substantially delay an NCDCM decision, the application may be removed from this general permit process.

g. The Corps will receive and review all Federal Agency comments as well as any applicant rebuttal. Provided all Federal Agencies and the Corps are in agreement, the Corps will prepare a coordinated federal position incorporating all Federal Agency comments, including proposed permit special conditions and any recommendations for denial. The Corps will typically furnish this coordinated federal position to the NCDCM within 45 days of its receipt of the complete application, and copies of the Field Investigation Report and Bio-Report.

h. If the Corps does not concur with a Federal Agency's comments or recommendations, the Corps will contact the Federal Agency and advise it of the Corps' position.

Attempts to resolve the issue may include initiating the referral procedures outlined by current memoranda of agreement (MOA's) between the Department of the Army and the agency. No coordinated federal position will be furnished to the NCDCM until and unless the Corps receives written agreement from the Federal Agency that all issues have been resolved to the satisfaction of that agency.

i. If any of the recommendations and/or conditions included in the coordinated federal position are unacceptable to the NCDCM, the NCDCM will contact the Corps within ten (10) days of receipt of the coordinated federal position and attempt to resolve the conflict. If resolution of the conflict involves changes to the conditions or recommendations provided by the Federal Agencies, the provisions of paragraphs g. and h. (above) will apply. If the conflict is resolved to the satisfaction of the Corps and any affected Federal Agency, the NCDCM permit will be issued and the authority of this general permit will apply.

j. If a Federal Agency conflict is not resolved within the time necessary for a decision by the NCDCM, the NCDCM may proceed, independently, to conclude the state action without inclusion of the federal position. In such case, the applicant and the NCDCM will be notified immediately, in writing, that the state permit does not satisfy the federal permit requirements and that the proposal in question may not proceed without federal authorization.

k. If the coordinated federal position is not in conflict with state agencies' positions, law, regulation, or policy, and is acceptable to the NCDCM, a state permit will be developed by the NCDCM fully incorporating the state and federal positions. The NCDCM will furnish copies of the final permit to the applicant and the Corps. The NCDWQ will furnish a copy of the Section 401 Water Quality Certification, if required, to the applicant and the Corps. The Corps will not confirm the authorization of a proposed project under this General Permit until the issuance of the NCDCM permit and, if required, the Section 401 Water Quality Certification.

l. If the NCDCM permit or Section 401 Water Quality Certification is denied, the applicant will be informed that federal authorization is denied without prejudice.

m. No work may proceed under this general permit until the District Engineer or his representative provides written verification that the procedures and conditions of the general permit have been satisfied.

n. The NCDCM and the Corps will monitor all permitted work and periodically inspect projects for compliance with permit conditions and applicable state and federal regulations. If any violation of the NCDCM permit is discovered which would also constitute a violation of the federal position, both the NCDCM and the Corps, in accordance with their respective regulations and policies, may take enforcement action.

o. This general permit will not be used to authorize an activity when the District Engineer determines that the proposed activity would significantly affect the quality of the human environment and therefore require preparation of an Environmental Impact Statement (EIS).

General Conditions

a. Except as authorized by this general permit or any USACE approved modification to this general permit, no excavation, fill or mechanized land-clearing activities shall take place, at any time in the construction or maintenance of this project, within waters or wetlands. This permit does not authorize temporary placement or double handling of excavated or fill material within waters or wetlands outside the permitted area. This prohibition applies to all borrow and fill activities connected with this project.

b. Authorization under this general permit does not obviate the need to obtain other federal, state, or local authorizations.

c. All work authorized by this general permit must comply with the terms and conditions of the applicable Clean Water Act Section 401 Water Quality Certification for this general permit issued by the North Carolina Division of Water Quality.

d. The permittee shall employ all sedimentation and erosion control measures necessary to prevent an increase in sedimentation or turbidity within waters and wetlands outside the permit area. This shall include, but is not limited to, the immediate installation of silt fencing or similar appropriate devices around all areas subject to soil disturbance or the movement of earthen fill, and the immediate stabilization of all disturbed areas. Additionally, the project must remain in full compliance with all aspects of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statutes Chapter 113A Article 4).

e. The activities authorized by this general permit must not interfere with the public's right to free navigation on all navigable waters of the United States. No attempt will be made by the permittee to prevent the full and free use by the public of all navigable waters at or adjacent to the authorized work for a reason other than safety.

f. The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

g. The permittee, upon receipt of a notice of revocation of this permit or upon its expiration before completion of the work will, without expense to the United States and in such time and manner as the Secretary of the Army or his authorized representative may direct, restore the affected water of the United States to its former conditions.

h. The permittee will allow the Wilmington District Engineer or his representative to inspect the authorized activity at any time deemed necessary to assure that the activity is being performed or maintained in strict accordance with the Special and General Conditions of this permit.

i. This general permit does not grant any property rights or exclusive privileges.

j. This permit does not authorize any injury to the property or rights of others.

k. This general permit does not authorize the interference with any existing or proposed federal project.

l. In issuing this permit, the Federal Government does not assume any liability for the following:

(1) Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

(2) Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

(3) Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

(4) Design or construction deficiencies associated with the permitted work

(5) Damage claims associated with any future modification, suspension, or revocation of this permit.

m. Authorization provided by this general permit may be modified, suspended or revoked in whole or in part if the Wilmington District Engineer, acting for the Secretary of the Army, determines that such action would be in the best public interest. The term of this general permit shall be five (5) years unless subject to modification, suspension or revocation. Any modification, suspension or revocation of this authorization will not be the basis for any claim for damages against the United States Government.

n. This general permit does not authorize any activity which the District Engineer determines, after any necessary investigations, would adversely affect:

(1) Rivers named in Section 3 of the Wild and Scenic Rivers Act (15 U.S.C. 1273), those proposed for inclusion as provided by Sections 4 and 5 of the Act and wild, scenic and recreational rivers established by state and local entities.

(2) Historic, cultural or archeological sites listed in or eligible for inclusion in the National Register of Historic Places as defined in the National Historic Preservation Act of 1966 and its codified regulations, the National Historic Preservation Amendment Acts of 1980 and 1992, the Abandoned Shipwreck Act of 1987 and the Native American Graves Protection and Repatriation Act.

(3) Sites included in or determined eligible for listing in the National Registry of Natural Landmarks.

o. This general permit does not authorize any activity which will adversely affect any threatened or endangered species or a species proposed for such designation, or their designated critical habitat as identified under the Federal Endangered Species Act (16 U.S.C. 1531). Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the Corps field offices or at the following internet address: http://www.ncnhp.org/Pages/heritagedata.html. or http://nc-es.fws.gov/es/es.html. Permittees should notify the Corps if any listed species or designated critical habitat might be affected by the proposed project and may not begin work until notified by the Corps that the requirements of the Endangered Species Act have been satisfied and that the activity is authorized.

p. Permittees are advised that development activities in or near a floodway may be subject to the National Flood Insurance Program that prohibits any development, including fill, within a floodway that results in any increase in base flood elevations. This general permit does not authorize any activity prohibited by the National Flood Insurance Program.

q. The permittee must install and maintain, at his expense, any signal lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, on authorized facilities. For further information, the permittee should contact the U.S. Coast Guard Marine Safety Office at (910) 772-2191.

r. At his sole discretion, any time during the processing cycle, the Wilmington District Engineer may determine that this general permit will not be applicable to a specific proposal. In such case, the procedures for processing an individual permit in accordance with 33 CFR 325 will be available.

s. Activities which have commenced (i.e., are under construction) or are under contract to commence in reliance upon this general permit will remain authorized provided the activity is completed within twelve months of the date of the general permit's expiration, modification, or revocation. Activities completed under the authorization of this general permit which were in effect at the time the activity was completed continue to be authorized by the general permit

BY AUTHORITY OF THE SECRETARY OF THE ARMY:

Jefferson M. Ryscavage
Colonel, U.S. Army
District Engineer

Appendix D-4

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

RECEIVED
MAY 20 2015
Habitat & Enhancement

May 15, 2015

Regulatory Division

Action ID No. SAW-2011-02018 and State Permit No. 140-09

Mr. Curtis Weychert
NC Division of Marine Fisheries
3441 Arandell Street
Morehead City, North Carolina 28557

Dear Mr. Weychert:

Through coordination with the North Carolina Division of Coastal Management, we have learned of your request to modify the work associated with your Department of the Army (DA) permit previously issued on December 23, 2011, which authorized to add an 11th site to the authorized Oyster Sanctuary at the Little Creek Site located in the Neuse River, in Carteret County, North Carolina.

Your proposal to utilize different materials continues to be consistent with the provisions and objectives of general permit No. 19800291 (copy enclosed). The permit is hereby modified. It is understood that all other conditions of your permit remain applicable including the previously authorized Special Conditions below. The expiration date of your DA permit is December 31, 2016.

Special Conditions
SAW-2011-02018

1. All work authorized by this permit must be performed in strict compliance with the attached plans, which are a part of this permit. Any modification to these plans must be approved by the US Army Corps of Engineers (USACE) prior to implementation.

2. The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the U.S. Army Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal, relocation, or alteration. The permittee shall notify NOAA/NATIONAL OCEAN SERVICE Chief Source Data Unit N CS261, 1315 E West HWY- RM 7316, Silver Spring, MD 20910-3282 at least two weeks prior to beginning work and upon completion of work.

3. Except as specified in the plans attached to this permit, no excavation, fill or mechanized land-clearing activities shall take place at any time in the construction or maintenance of this project, in such a manner as to impair normal flows and circulation patterns within waters or wetlands or to reduce the reach of waters or wetlands.

4. The docks and piers extending over wetlands will be elevated sufficiently (a minimum of 3 feet) above the wetland substrate to prevent total shading of vegetation, substrate, or other elements of the aquatic environment.

5. Except as authorized by this permit or any USACE approved modification to this permit, no excavation, fill or mechanized land-clearing activities shall take place at any time in the construction or maintenance of this project, within waters or wetlands. This permit does not authorize temporary placement or double handling of excavated or fill material within waters or wetlands outside the permitted area. This prohibition applies to all borrow and fill activities connected with this project.

6. Unless otherwise authorized by this permit, all fill material placed in waters or wetlands shall be generated from an upland source and will be clean and free of any pollutants except in trace quantities. Metal products, organic materials (including debris from land clearing activities), or unsightly debris will not be used.

7. All mechanized equipment will be regularly inspected and maintained to prevent contamination of waters and wetlands from fuels, lubricants, hydraulic fluids, or other toxic materials. In the event of a spill of petroleum products or any other hazardous waste, the permittee shall immediately report it to the N.C. Division of Water Quality at (919) 733-5083, Ext. 526 or (800) 662-7956 and provisions of the North Carolina Oil Pollution and Hazardous Substances Control Act will be followed.

8. The authorized structure and associated activity must not interfere with the public's right to free navigation on all navigable waters of the United States. No attempt will be made by the permittee to prevent the full and free use by the public of all navigable waters at or adjacent to the authorized work for reason other than safety.

9. The permittee must install and maintain, at his expense, any signal lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, on authorized facilities. For further information, the permittee should contact the U.S. Coast Guard Marine Safety Office at (910) 772-2191.

10. If the permittee discovers any previously unknown historic or archeological remains while accomplishing the authorized work, he will immediately notify the Wilmington District Engineer who will initiate the required coordination procedures.

11. The permittee shall advise the Corps in writing at least two weeks prior to beginning the work authorized by this permit and again upon completion of the work authorized by this permit.

12. Approval of the structure was based on determinations that there would be no obstruction to navigation. Under conditions existing in the Atlantic Intracoastal Waterway (AIWW), a possibility exists that the structure may be damaged by wave wash from passing vessels. Unreasonable slowing down of vessel traffic cannot be required because it would tend to nullify the navigational benefits on which the AIWW was justified. Issuance of this permit should not be construed, as relieving the permittee of taking proper steps to insure the structure and moored boats will not be damaged by wave wash normally to be expected in the AIWW.

13. The permittee shall require its contractors and/or agents to comply with the terms and conditions of this permit in the construction and maintenance of this project, and shall provide each of its contractors and/or agents associated with the construction or maintenance of this project with a copy of this permit. A copy of this permit, including all conditions, shall be available at the project site during construction and maintenance of this project.

14. The permittee shall employ all sedimentation and erosion control measures necessary to prevent an increase in sedimentation or turbidity within waters and wetlands outside the permit area. This shall include, but is not limited to, the immediate installation of silt fencing or similar appropriate devices around all areas subject to soil disturbance or the movement of earthen fill, and the immediate stabilization of all disturbed areas. Additionally, the project must remain in full compliance with all aspects of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statutes Chapter 113A Article 4).

15. The activity will be conducted in such a manner as to prevent a significant increase in turbidity outside the area of construction or construction-related discharge. Increases such that the turbidity in the waterbody is 50 NTU's or less in all rivers not designated as trout waters by the North Carolina Division of Environmental Management (NCDEM), 25 NTU's or less in all saltwater classes and in all lakes and reservoirs, and 10 NTU's or less in trout waters, are not considered significant.

16. The permittee, upon receipt of a notice of revocation of this permit or upon its expiration before completion of the work will, without expense to the United States and in such time and manner as the Secretary of the Army or his authorized representative may direct, restore the water or wetland to its pre-project condition.

17. Violations of these conditions or violations of Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act must be reported in writing to the Wilmington District U.S. Army Corps of Engineers within 24 hours of the permittee's discovery of the violation.

18. The permittee shall provide the Corps of Engineers a copy of any report that may be prepared by the North Carolina Division of Marine Fisheries (NCDMF) documenting the conditions or performance of the constructed Oyster Sanctuary.

If you have any questions or comments you may reach me at telephone (910) 251-4170.

Sincerely,

Tyler Crumbley, Project Manager
Wilmington Regulatory Field Office

Enclosure

GP 291 conditions

Copies Furnished (without enclosure):

Mr. Daniel Govoni
Division of Coastal Management
North Carolina Department of
Environment and natural Resources
400 Commerce Avenue
Morehead City, North Carolina 28557

Mrs. Joanne Steenhuis
Division of Water Resources
North Carolina Department of
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127 Cardinal Drive
Wilmington, North Carolina 28405

Appendix B

Endangered Species Act Section 7 Effects Determination Guidance
National Marine Fisheries Service
Southeast Regional Office, Protected Resources Division
March 2014

The purpose of this document is to provide general guidance on considerations for making effects determinations for Endangered Species Act (ESA) Section 7 consultations.

Effect Determination Definitions

In order to fulfill their ESA Section 7 duties for an action they propose to implement, fund or authorize, federal action agencies must make one of the following preliminary determinations with respect to threatened or endangered species[1] or designated critical habitat:

1. **No effect;**
2. **May affect, but is not likely to adversely affect; or**
3. **May affect, and is likely to adversely affect**

These effects determinations must be based on all direct and indirect effects of the agency action, as well as the effects of activities that are interrelated to or interdependent with the federal agency's proposed action.

1) "**No effect**" means ESA-listed species or critical habitat will not be affected, directly or indirectly. Generally, this means no ESA-listed species or critical habitat will be exposed to any potentially harmful/beneficial elements of the action

   a) Some examples of when a "no effect" conclusion would be reached are:

      i) The species doesn't occur at all in the action area, meaning not just the immediate project area but it will also be absent from all areas where the project will have direct or indirect environmental effects.

      ii) The species occurs in the action area seasonally, and the project will be timed to avoid their presence. For example, a project in the South Atlantic that will be completed in the summertime and has no lasting environmental effects will not affect right whales, which would only potentially occur there from November – April.

      iii) The species occurs in the action area and may be present at the time of the project, but there are no plausible (i.e., no credible) routes of effects (beneficial or adverse) to the species. A route of effect could be implausible if it would require a series of exceedingly rare events to occur in a particular sequence, in order to impact individuals of a listed species or habitats. A single event could also be in this category if the route of effect is so unrealistic its occurrence would be implausible.

[1] These determinations are at the individual scale, not the population or species scales.

b) For critical habitat, some examples of reasons to reach a "no effect" conclusion would be:

i) The project and its direct and indirect environmental effects don't occur in any designated critical habitat area.

ii) The project occurs inside designated critical habitat, but no "essential features" of critical habitat are present or will be affected.

(1) *Important exception*: "Essential features" do not necessarily have to be present at the time of the project to be affected. Some essential features are seasonal or temporary (e.g., mobile prey) or are the product of certain natural processes. An action that would interrupt the natural development or occurrence of the essential feature is still adversely affecting that feature, even if the feature is not present. An example might be a fish that requires spawning habitat of a certain water depth and a project with water control features that is preventing those depths from periodically occurring, as they would from natural water level variations.

(2) While this example considers effects to the essential features of CH, effects to habitat in general could also result in harm to the species, if the habitat impacts result in actual injury or death of individuals of a listed species.

iii) The project occurs inside designated critical habitat, and the essential features are present, but the project presents no plausible route of effect (beneficial or adverse) to the features. For example, the essential feature of *unobstructed migratory pathways for sturgeon through a waterbody* would not be affected by a proposed seawall replacement project that is parallel to the shoreline. Or, the essential feature of *settlement substr*ate for corals would not be affected by a project that only involves surface activities with no plausible routes of effects to the sea floor.

(1) *Important exception*: An adverse effect to (or prevention of) the conservation function the features provide to the species is an adverse effect on the critical habitat, even if the feature itself is not directly affected. For example, a project that creates a barrier that prevents species from accessing areas of critical habitat containing the features may eliminate the conservation value of those features to the species by preventing access.

The National Marine Fisheries Service (NMFS) is required to make its own determinations relative to the potential effects of all aspects of a proposed federal action subject to consultation, including aspects that are believed to have no effect. However, NMFS does not provide concurrence on an action agency's no effect determination. It is prudent to document in project records the rationale behind your 'no effect' decisions as it will act as the official ESA consultation Agency's no-effect determination.

"**May affect, but not likely to adversely affect**" means that all effects are *beneficial*, *insignificant*, or *discountable*. These conclusions are not made on the "net" effects of the action. Any adverse impact to an individual animal of an ESA-listed species, whether interim or short-term, regardless of any beneficial conservation measures or mitigation activities, requires ESA Section 7 consultation.

a) *Beneficial* effects have an immediate positive effect without any adverse effects to the species or habitat. Beneficial effects are usually discussed when the project has a clear link to the listed species or its specific habitat needs and consultation is required because the species may be affected.

   i) Example: Removing a man-made barrier that once blocked upstream spawning habitat, during a time of year when no ESA-listed species are likely to be present.

b) *Discountable* effects are those that are extremely unlikely to occur. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action and that would be an adverse effect if it did impact a listed species), but it is very unlikely to occur.

   i) Example: The risk of a slow-moving vessel, such as sailboats, striking a sea turtle is extremely unlikely to occur.

      (1) One thing to keep in mind with discountable is that the chance of adverse effects increases with the frequency and duration of the action. Discountable may be the proper determination if the action is one-time or infrequent; it may not be if the action is frequent, or continuous.

         (a) Example: If a military exercise with in-water explosions is repeated many times a year, the probability of an individual animal being injured will increase correspondingly. For this reason the action agency must not separate what is truly a single program or action into a series of individual actions for the purposes of consultation.

      (2) Whether an effect is discountable is primarily a question of risk. Including well-thought-out risk management measures to avoid injuring listed species can be an effective way to ensure that an effect is discountable.

c) *Insignificant* effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect. That means the ESA-listed species may be expected to be affected, but not harmed or harassed.

   i) Example: A sea turtle avoids an area because of construction, and thereby avoids being injured directly by project equipment. However, you have still predicted that sea turtles will be affected, by evidence of their avoidance. If the effect of the avoidance does not rise to the level of disturbance, and has no realistic potential to lead to harm or harassment of the animal, the effect is insignificant.

d) For critical habitat, you need to first assess the potential effects to each of the essential features and determine whether the effects are beneficial, discountable, or insignificant. In the context of critical habitat, "take" is not an issue so we define insignificant effects slightly differently. Insignificant effects are when there is an actual possibility of an effect to the essential feature and the effect is temporary, minor, or both, so that there is

no discernible impact on the conservation function of that essential feature in that designated critical habitat unit.

i) Example: The water and sediment quality essential feature of Gulf sturgeon critical habitat may be affected by a pile-installation project that temporarily increases turbidity. However, we would anticipate those effects to be temporary and minimal because suspended particles will settle out within a short time frame without measurable effects on water quality.

Action agencies must request and receive written concurrence from NMFS on a "not likely to adversely affect" determination. The request for concurrence should clearly identify the different potential effects that the project may pose to listed species or critical habitat. For each potentially adverse effect, you should explain why the effect is either discountable or insignificant. If there are no plausible routes of effect to listed species or critical habitat, "no effect" may be the proper conclusion.

2) **"May affect, and is likely to adversely affect"** means that one or more individuals of an ESA-listed species or one or more essential features of critical habitats are likely to be exposed to the actions and are likely to result in "take" or adverse effects, respectively (the definition of take is discussed below).

If you conclude that a listed species or its critical habitat is likely to be adversely affected, formal consultation will be required. NMFS issues a biological opinion at the conclusion of formal consultation. If we conclude in the opinion that the project is not likely to jeopardize the continued existence of any listed species or destroy or adversely modify critical habitat, we will include terms and conditions to minimize and monitor impacts to listed species. If we conclude in the opinion that the project is likely to jeopardize the continued existence of any listed species or destroy or adversely modify critical habitat, the project may not go forward unless we provide a "reasonable and prudent alternative" that would avoid jeopardy and destruction or adverse modification. (Note: "Adversely affect" and "destroy or adversely modify" critical habitat are two separate and very different standards, but they are sometimes confused because they sound similar.)

The Definition of Take

Take is defined as to harass, harm, pursue, hunt, shoot, wound, trap, capture, collect or attempt to engage in any such conduct. "Harm" includes any act that actually kills or injures fish or wildlife. This includes habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, spawning, rearing, migrating, feeding, or sheltering. The U.S. Fish and Wildlife Service defines "harass" as "an intentional or negligent act which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns…."

In general, "take" is a violation of the ESA, even when it's unintentional. The Section 7 consultation process provides a way to exempt federal activities from the ESA's take prohibitions, if the take is incidental to an otherwise lawful activity and it doesn't jeopardize the species.

Questions to Ask when Beginning Your Effects Analysis

To determine the effect of your project on an ESA-listed species and/or its critical habitat, think through and document the following steps:

1. **What is the action area (the area where effects from the project can be found)?**

The action area is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." This area will experience measurable or detectable changes in land, air, and water, or other measurable factors that result from the full scope of the proposed action and all interrelated or interdependent actions.

- Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. An example of this would be if a request is made for consultation for the construction of a new marina. New vessel traffic originating from the marina is interrelated to the proposed marina development and must be considered as part of the action.

- Interdependent actions are those that have no independent utility apart from the action under consideration. An example of this would be constructing the pilings for a dock or bridge and then coming back for another consultation for the decking for the bridge or dock.

To determine the action area, we recommend that you first break the action down into its components including pre-construction preparation (e.g., vegetation clearing, construction actions such as the installation of cofferdams, placement of pipelines, intake structures, turbidity areas, dredging, dredge spoil storage areas, borrow areas, operations, maintenance, pile driving, etc.), and post-construction site cleanup. Determine the stressors that are expected to result from each project component. For example, sound levels from machinery or pile driving may be detectable hundreds of feet, thousands of feet, or even miles away. Calculate these distances when delineating the extent of your action area.

Remember, in addition to direct project effects, you must consider effects that may occur later in time and the effects of an interdependent/interrelated activity, regardless of whether they are under your agency's legal control or jurisdiction. Depending on the agency action at issue, fishing activities from a fishing pier, or marina usage/vessel operations after construction of a new or expanded marina, or changes in water quality/quantity after constructing an in-stream culvert, can be either indirect effects or interdependent/interrelated effects to the federal agency's proposed action.

2. **Once you have determined the action area, identify which species or critical habitats are found in the action area.**

Refer to the general species lists for ESA-listed species and critical habitat under NMFS purview: http://sero.nmfs.noaa.gov/pr/esa/specieslst.htm

Is the action area is located behind some kind of barrier that could be man-made or ecologically based (e.g., bridge, dam, salinity) that would prevent the species from being there? Are the

species likely to be absent at the time of the action? For example, your project is located in a bay that is used by Gulf sturgeon for feeding but the project will be completed during the summer when sturgeon have migrated up river. In this case you should also consider whether the project results in impacts to the habitat that could affect the species from using this area in the future.

3. **After identifying which ESA-listed species or critical habitat may be present in or near the action area, determine how they may be affected by the project.**

To conduct the analysis of your project's effects, consider these sorts of questions when determining potential routes of effects to ESA-listed species or habitat:

- What are the specific stressors (e.g., construction, dredging, blasting, vessel traffic, fishing activities, pile driving, noise, changes in water flow) that might impact each species or critical habitat?
- Are critical habitat essential features found in the action area?
- What are the life history patterns/behavior of the ESA-listed species that could be affected in relationship to the location of your project and timing of work associated with your project?
- Where, when, how frequently, for how long, and at what intensity will the stressors occur, and how will it impact the species or critical habitat?
- Will the project effects be permanent?
- Is there a way to minimize/avoid exposure? For example, can the work be carried out at low tide, behind a construction barrier, or when the species is not seasonally present? Can noise impacts be minimized/avoided by use of sound dampening equipment?
- Will the habitat in the action area or affected outside the action area still be beneficial to the species or converted to another type of habitat as a result of the project? For example, will mangroves (a habitat feature important to sawfish) be removed and replaced with a seawall?

Once you've thought through these questions, you should be able to make the appropriate effects determination and transmit your rationale to NMFS.

If you have any questions, please contact the Protected Resources Division at 727-824-5312 and ask for the Interagency Cooperation Branch Chief or Section 7 Coordinator.

Appendix C

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

GUIDELINES FOR AVOIDING IMPACTS TO THE WEST INDIAN MANATEE
Precautionary Measures for Construction Activities in North Carolina Waters

The West Indian manatee (*Trichechus manatus*), also known as the Florida manatee, is a Federally-listed endangered aquatic mammal protected under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) and the Marine Mammal Protection Act of 1972, as amended (16 U.S.C 1461 *et seq.*). The manatee is also listed as endangered under the North Carolina Endangered Species Act of 1987 (Article 25 of Chapter 113 of the General Statutes). The U.S. Fish and Wildlife Service (Service) is the lead Federal agency responsible for the protection and recovery of the West Indian manatee under the provisions of the Endangered Species Act.

Adult manatees average 10 feet long and weigh about 2,200 pounds, although some individuals have been recorded at lengths greater than 13 feet and weighing as much as 3,500 pounds. Manatees are commonly found in fresh, brackish, or marine water habitats, including shallow coastal bays, lagoons, estuaries, and inland rivers of varying salinity extremes. Manatees spend much of their time underwater or partly submerged, making them difficult to detect even in shallow water. While the manatee's principal stronghold in the United States is Florida, the species is considered a seasonal inhabitant of North Carolina with most occurrences reported from June through October.

To protect manatees in North Carolina, the Service's Raleigh Field Office has prepared precautionary measures for general construction activities in waters used by the species. Implementation of these measure will allow in-water projects which do not require blasting to proceed without adverse impacts to manatees. In addition, inclusion of these guidelines as conservation measures in a Biological Assessment or Biological Evaluation, or as part of the determination of impacts on the manatee in an environmental document prepared pursuant to the National Environmental Policy Act, will expedite the Service's review of the document for the fulfillment of requirements under Section 7 of the Endangered Species Act. These measures include:

1. The project manager and/or contractor will inform all personnel associated with the project that manatees may be present in the project area, and the need to avoid any harm to these endangered mammals. The project manager will ensure that all construction personnel know the general appearance of the species and their habit of moving about completely or partially submerged in shallow water. All construction personnel will be informed that they are responsible for observing water-related activities for the presence of manatees.

2. The project manager and/or the contractor will advise all construction personnel that

there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act and the Endangered Species Act.

3. If a manatee is seen within 100 yards of the active construction and/or dredging operation or vessel movement, all appropriate precautions will be implemented to ensure protection of the manatee. These precautions will include the immediate shutdown of moving equipment if a manatee comes within 50 feet of the operational area of the equipment. Activities will not resume until the manatee has departed the project area on its own volition (i.e., it may not be herded or harassed from the area).

4. Any collision with and/or injury to a manatee will be reported immediately. The report must be made to the U.S. Fish and Wildlife Service (ph. 919.856.4520 ext. 16), the National Marine Fisheries Service (ph. 252.728.8762), and the North Carolina Wildlife Resources Commission (ph. 252.448.1546).

5. A sign will be posted in all vessels associated with the project where it is clearly visible to the vessel operator. The sign should state:

> CAUTION: The endangered manatee may occur in these waters during the warmer months, primarily from June through October. Idle speed is required if operating this vessel in shallow water during these months. All equipment must be shut down if a manatee comes within 50 feet of the vessel or operating equipment. A collision with and/or injury to the manatee must be reported immediately to the U.S. Fish and Wildlife Service (919-856-4520 ext. 16), the National Marine Fisheries Service (252.728.8762), and the North Carolina Wildlife Resources Commission (252.448.1546).

6. The contractor will maintain a log detailing sightings, collisions, and/or injuries to manatees during project activities. Upon completion of the action, the project manager will prepare a report which summarizes all information on manatees encountered and submit the report to the Service's Raleigh Field Office.

7. All vessels associated with the construction project will operate at "no wake/idle" speeds at all times while in water where the draft of the vessel provides less than a four foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

8. If siltation barriers must be placed in shallow water, these barriers will be: (a) made of material in which manatees cannot become entangled; (b) secured in a manner that they cannot break free and entangle manatees; and, (c) regularly monitored to ensure that manatees have not become entangled. Barriers will be placed in a manner to allow manatees entry to or exit from essential habitat.

Prepared by (rev. 06/2003):
U.S. Fish and Wildlife Service
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726
919/856-4520

Figure 1. The whole body of the West Indian manatee may be visible in clear water; but in the dark and muddy waters of coastal North Carolina, one normally sees only a small part of the head when the manatee raises its nose to breathe.

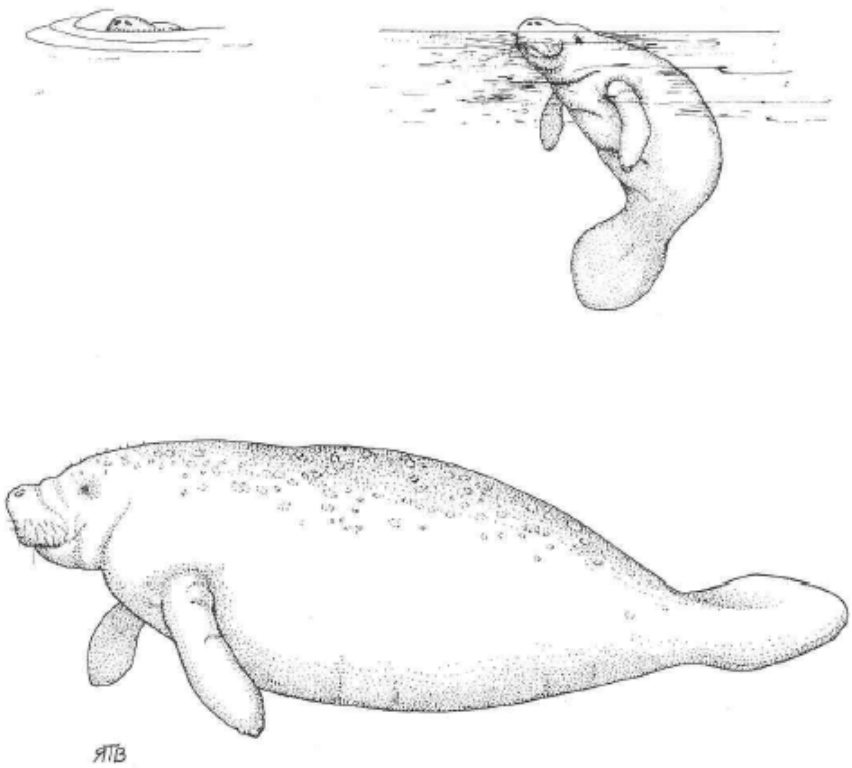

Illustration used with the permission of the North Carolina State Museum of Natural Sciences. Source: Clark, M. K. 1987. Endangered, Threatened, and Rare Fauna of North Carolina: Part I. A re-evaluation of the mammals. Occasional Papers of the North Carolina Biological Survey 1987-3. North Carolina State Museum of Natural Sciences. Raleigh, NC. pp. 52.

Appendix D

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

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

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

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006
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Appendix E

PROJECT MANAGEMENT PLAN
ESTUARY RESTORATION ACT
LITTLE CREEK OYSTER SANCTUARY

1. **PROJECT NAME AND STATE:** Little Creek Oyster Sanctuary Project, North Carolina.

2. **LOCATION:** The lower Neuse River in Pamlico Sound, NC. Approximately 10 miles east of the town of Oriental and 1.8 miles north west of Little Creek. (N35° 02.616' W76° 30.889', Public Land)

3. **AUTHORIZATION:** The Estuary Restoration Act of 2000, Title I of Public Law 106-457.

4. **CONGRESSIONAL INTEREST:** NC-03

5. **SPONSOR:** North Carolina Department of Environment & Natural Resources, Division of Marine Fisheries

6. **SUMMARIZED FINANCIAL DATA:**

	FY 2013 Estimate
Federal Cost (65% of total costs)	$586,182.00
Estimated Non-Federal Sponsor Cost (35% of total costs)	$317,331.00
Total Estimated Project Cost	$903,513.00

7. **DESCRIPTION**: This project will directly restore 10 acres of unproductive soft bottom to a protected oyster reef site within the estuary of the Neuse River, Pamlico Sound. This 10-acre site will, for North Carolina, incorporate a new reef building technique that could significantly reduce costs and increase the surface area available for oyster recruitment and growth. The site will help to sustain countless additional reefs that are part of the state's sustainable oyster fisheries management program by incorporating structures that will discourage harvest while providing high relief for sanctuary from anoxic/hypoxic events common to the estuary. Establishing this reef will also help to foster formation and expansion of naturally occurring oyster reefs by protecting the oysters that recruit to the site allowing development of a naturally selected brood stock that will increase larval production. Direct and indirect ecosystem services such as increased filtering capacity, benthic-pelagic coupling, nutrient dynamics and sediment stabilization, are expected benefits from this reef. The project will enhance the productivity of the state's primary and secondary fish nursery areas and will benefit recreationally and commercially important finfish species, such as gag, black sea bass, sheepshead, and flounder. This will result in healthier fisheries since many of the state's fishery species are estuarine dependent at some point in their life cycles.

   This project will provide jobs to reef unit builders, concrete suppliers, transportation workers, equipment operators, NCDMF employees and ultimately fishermen that benefit from the increased nursery function for estuarine and marine species and the increased spawning stock capacity provided by the oyster sanctuaries. Mobilization of existing NCDMF vessels and deployment equipment to transport the constructed reef structures in the most cost effective and environmentally responsible manner provides benefits to the coastal environment and increases the efficiency of the project.

   Finally, monitoring of this reef site will play an important role in guiding future investments and efforts in North Carolina's oyster restoration.

1. **Project Areas and Project Components:**

NCDMF ERA Project Area - Little Creek Oyster Sanctuary:

Figure 1: Project Area

Project Area Description:

Within the last century, the oyster population in Pamlico Sound is estimated to have declined by over 90 percent. Restoration efforts that can increase the oyster population help to improve the overall ecological health of our estuary. Implementation of this project is not expected to cause any significant adverse impacts to any species but will facilitate the recovery of Pamlico Sound and its beneficiaries. The project area consists predominantly of subtidal soft bottom habitat in depths ranging from 19-22 ft. The subtidal bottoms are subjected to vigorous trawling and fishing activities. The flora/fauna communities are a function of the frequently disturbed regime and consist of a variety of microscopic plants and soft bottom epifauna/infauna species. The selected site has historically been a productive oyster bottom. It has lost most of that oyster productivity foremost due to bottom disturbing activities such as trawling and dredging.

Project Components:

By providing a substrate on which platonic larvae may settle, we are primarily targeting the Eastern Oyster (*Crassostrea virginica*). The restored oyster habitat is vital to the health of the Pamlico Sound estuary, effectively filtering nutrients, algae, bacteria, fine sediments and toxins from the water and improving water quality. Oyster reefs provide important forage, refuge and nursery habitat for many species of invertebrates, such as shrimp, crabs, clams, snails and worms, and many species of fish, such as gag, black sea bass, sheepshead, flounder, and red drum.

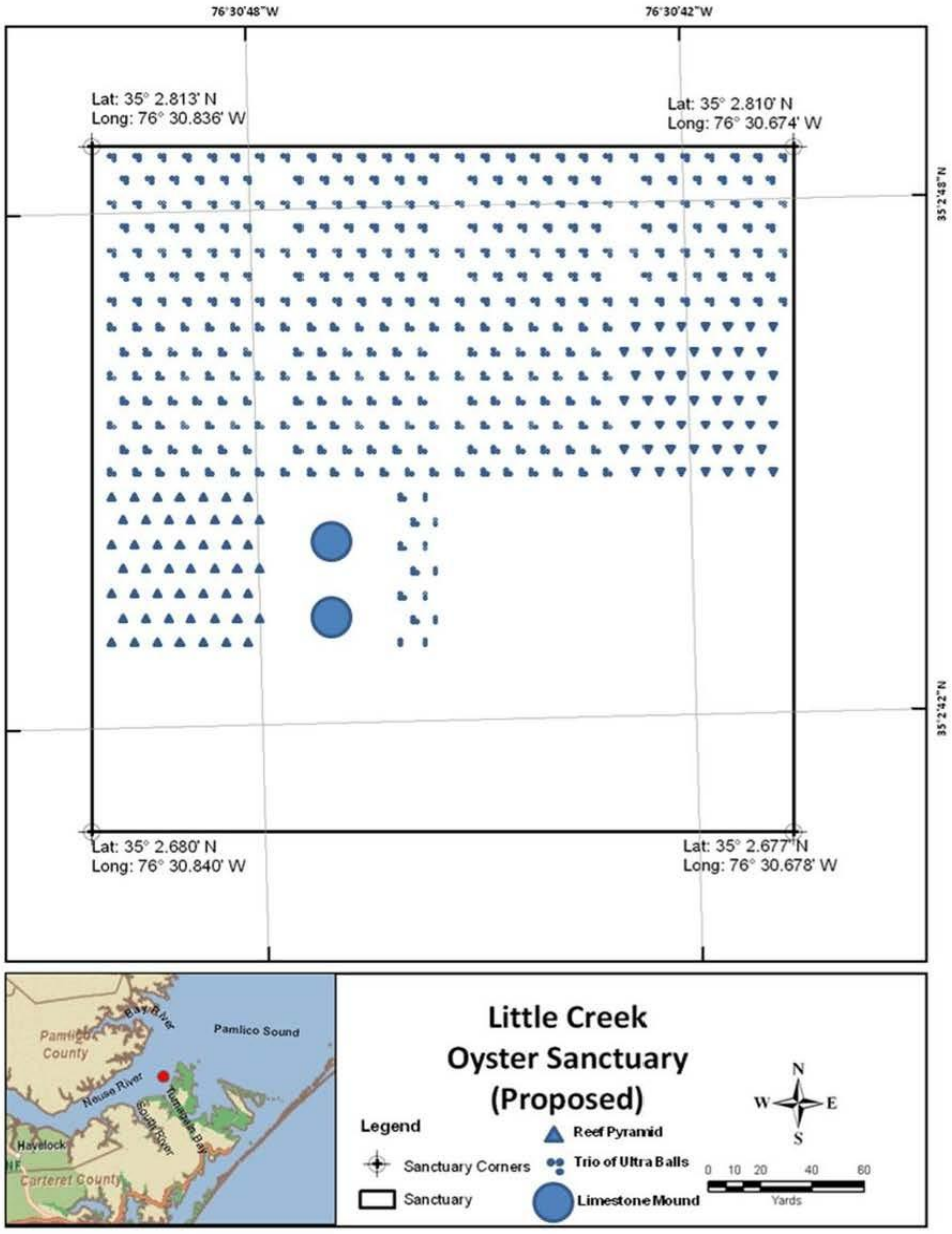

Figure 2. Project layout for Little Creek Oyster Sanctuary

2. Project Activities:

The following tasks are necessary for this project. The process has been developed by the N.C. Division of Marine Fisheries (DMF) through the last 15 years of oyster sanctuary siting, permitting, and development.

Objectives

1. Create or purchase limestone marl, 1,000 Ultra Balls and 98 Reef Pyramids and deploy the materials at the 10-acre Little Creek Oyster Sanctuary in the Neuse River/Pamlico Sound by December 2015.

2. Monitor NC Oyster Sanctuaries (including Little Creek) annually for five years to evaluate the biological value and cost-effectiveness of the Little Creek Oyster Sanctuary compared to traditional limestone reefs in the NC Oyster Sanctuary network.

Approach

The project will have four components:

1. Permitting the Little Creek Oyster Sanctuary based on site selection data, public input, and site plan.
2. Construction, purchase, and stockpiling of reef structures.
3. Construction of the Little Creek Oyster Sanctuary.
4. Monitoring and evaluation of the Little Creek Oyster Sanctuary and others in the NC Oyster Sanctuary system.

Task 1: Secure NC Coastal Area Management Act (CAMA) Major Development permit for the construction of Little Creek Oyster Sanctuary.

The NCDMF secured a Coastal Area Management Act (CAMA) Major Permit on November 23, 2011 through the established permitting process developed with the NC Division of Coastal Management, U.S. Army Corps of Engineers, NOAA, and the NC Division of Water Quality during permitting for other oyster sanctuaries. The permit (#140-09) was obtained for development of 15 acres at Little Creek, although only 10 acres will be developed through this project.

The NCDMF held a public hearing on April 24, 2012 to seek information from the public on potential conflicts with other users of the site (fishing, navigation, etc.), environmental benefits, and recreational uses.

Task 2: Construction and staging of reef structures

The Little Creek Oyster Sanctuary will be constructed of two limestone mounds, 1,000 Ultra Balls and 98 Reef Pyramids. These structures will be produced at or delivered to the DMF stockpile site in South River, NC along the Neuse River. The stockpile site is approximately 10 nautical miles from the proposed Little Creek reef site.

Reef Pyramids (Figure 9) have a 10 foot triangular base, are 8 feet tall and weigh approximately 6,000 lbs each. They will be delivered to the stockpile site by truck ready for deployments. DMF technicians will receive and stage the Reef Pyramids. Duties will include the off-loading and storage of the Reef Pyramids by the barge loading dock.

Ultra Balls (Figure 10) have a base diameter of 5.5 feet and stand 5 feet tall. Each unit weighs approximately 3,500 lbs. They are the least expensive structure when comparing surface area to cost (Table 2). Using local concrete venders and molds, they will be easily produced at the DMF stockpile site. DMF technicians will support and oversee contractors in the production of the Ultra Balls. Contractors are expected to produce about 30 Ultra Balls per week (total completion time is estimated at 33 weeks). DMF technicians will assist contractors in setting up the molds and pouring concrete and will be responsible for lifting and moving the Ultra Balls from their molds to the barge loading dock.

All handling of reef structures requires mobile rough terrain loading equipment. DMF has an all- terrain 7.5 ton crane bought specifically to do these tasks, and large front-end loaders and forklifts to safely handle the reef structures. DMF technicians will assist in the construction of 1,000 Ultra Balls, provide logistical support and stage materials for vessel loading. The DMF technicians will also be tasked with maintaining quality control and compliance with environmental and fiscal accounting standards.

Task 3: Construction of Little Creek Oyster Sanctuary

NCDMF technicians will load an estimated 1,098 reef structures from the dock in South River onto NCDMF's deployment barge M/V West Bay (135ft LCU, landing craft utility) (Figure 11) by using a 7.5 ton crane and front-end loader. It is estimated that the M/V West Bay will hold 50 Ultra Balls or 54 Reef Pyramids or 150 tons of limestone rip rap per load in addition to the offloading equipment (front end loader, crane or skid steer). The M/V West Bay is operated by a crew of four NCDMF employees. Deployment methodology for the limestone, Ultra Balls and Reef Pyramids will follow similar procedures to accomplish a checkerboard style deployment design (Appendix B). A trio of Ultra Balls and the Reef Pyramids will be deployed approximately 30 feet from center to center. Limestone mounds will be deployed approximately 75 ft center to center.

Figure 3. M/V West Bay during deployment operations at a Pamlico Sound Oyster Sanctuary

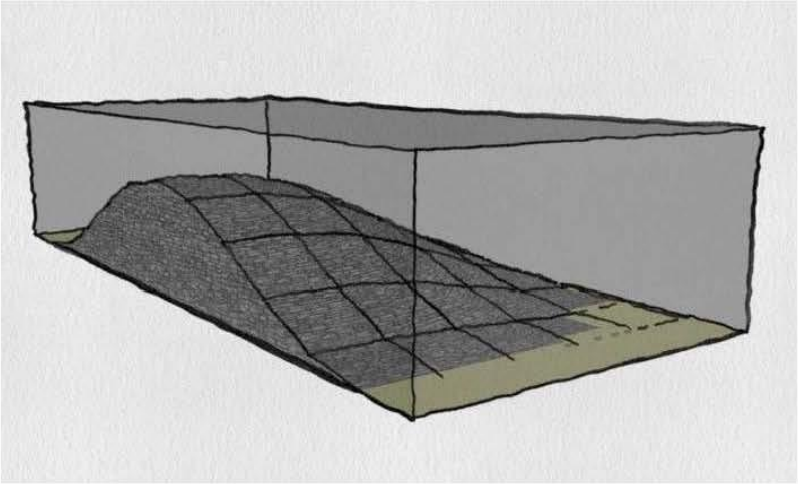

Figure 4. Cross-section of a 150-ton limestone mound. The inside the mound does not get exposed to the surrounding water and is not accessible for oyster growth. The base diameter is approximately 12 meters and the height approximately 3 meters.

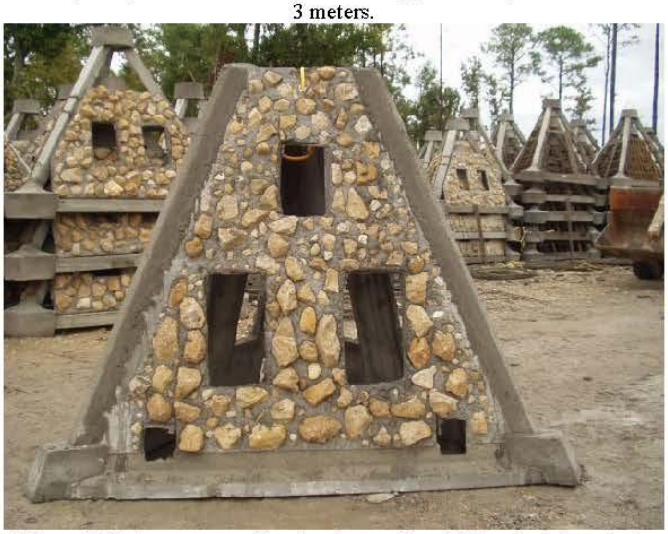

Figure 5. Typical Reef Pyramid design – a cave-like structure, with a 3.65 meter triangular base and a height of 2.44 meters.

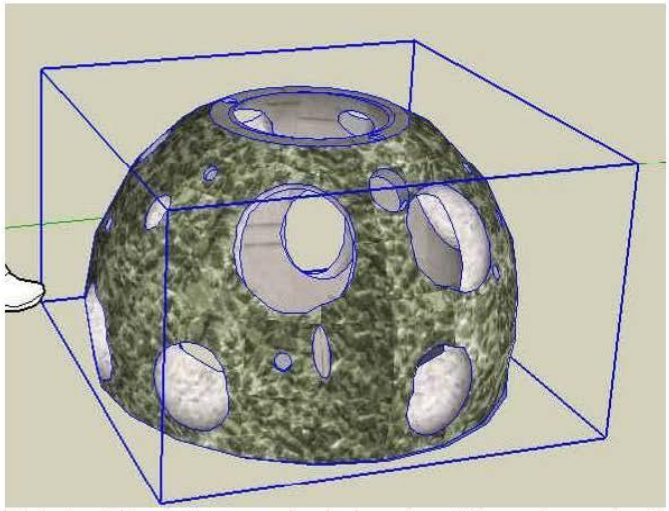

Figure 6. Typical Ultra Ball design. It is a hollow concrete structure shaped like a sphere and perforated by a series of holes. The base diameter is 1.6 meters and height 1.3 meters.

The reef structure locations are predetermined for placement using WAAS GPS coordinates within Oyster Sanctuary boundaries. Before deployment, a support vessel operated by DMF technicians will be sent to the sanctuary site to mark the locations for mound or unit deployments with "highflyer buoys". A highflyer is an orange foam buoy that has a pole and counterweight so that the pole sticks up 10' feet above the water. The end of the pole has an orange marker (paint, flag, etc) so that the captain of the deployment vessel can more readily see and find the pole when maneuvering the ship onto station. The highflyer uses large disposable chain links and ¼ inch cotton line as an anchor. This way if the structure has been placed onto its location the highflyer can be retrieved simply by cutting or breaking the line and leaving the disposable chain links underneath the structure. After several highflyers are in place a second pass is made by the support vessel, as close to the highflyers as possible, to confirm that the GPS coordinate locations are correct within .001 minute tolerance.
After the locations have been marked, NCDMF technicians will record the depth of the water column and environmental parameters (i.e. wind speed, direction, air temp, water temp, salinity, and dissolved oxygen).

Deployments of the reef materials will occur over 20 weeks from May to September 2013. The deployment vessel will come alongside the highflyers, close enough to allow the equipment to set the reef structures directly by the highflyers. When the deployment vessel has finished with a mound construction/unit deployment the support vessel can safely retrieve the highflyer as previously mentioned and the final height of the structure is measured using a graduated sounding pole.

Task 4: Monitoring and evaluation of the constructed reefs

The Little Creek Oyster Sanctuary will be monitored annually each fall for five years post-construction. Data will be collected and maintained in a standardized format in NCDMF Biological Database. NCDMF's monitoring program evaluates data from all NC oyster sanctuaries on an annual basis. The monitoring will be conducted by 2-3 scuba divers. Monitoring will be conducted over 15 days in Year 2 post-construction and over 10 days in subsequent years. Physical data such as location, size, material type, deployment configuration and structure dimensions will be measured and recorded, as well as biological data including oyster recruitment, size, and density (Figure 12). Spat set (recruitment) and reef development will be closely monitored and evaluated in comparison to our existing and parallel

constructed limestone reefs. Two separate analyses will be conducted to determine which artificial structure is the most cost effective for oyster restoration. The first will determine the most economical method to provide the most surface for settling oyster larvae. The second will include data from oyster monitoring to quantify which artificial reef is the most cost effective in producing the most oysters per square meter, or in other words, which has the lowest per oyster cost. For more details see the full Monitoring Plan.

3. Project Methodology

Patch Oyster Reef Habitat Creation:
This project will directly restore 10 acres of unproductive soft bottom to a protected oyster reef site within the estuary of the Neuse River, Pamlico Sound. This 10-acre site will, for North Carolina, incorporate a new reef building technique that could significantly reduce costs and increase the surface area available for oyster recruitment and growth. The site will help to sustain countless additional reefs that are part of the state's sustainable oyster fisheries management program by incorporating structures that will discourage harvest while providing high relief for sanctuary from anoxic/hypoxic events common to the estuary. Establishing this reef will also help to foster formation and expansion of naturally occurring oyster reefs by protecting the oysters that recruit to the site allowing development of a naturally selected brood stock that will increase larval production. Direct and indirect ecosystem services such as increased filtering capacity, benthic-pelagic coupling, nutrient dynamics and sediment stabilization, are expected benefits from this reef. The project will enhance the productivity of the state's primary and secondary fish nursery areas and will benefit recreationally and commercially important finfish species, such as gag, black sea bass, sheepshead, and flounder. This will result in healthier fisheries since many of the state's fishery species are estuarine dependent at some point in their life cycles.

This project will provide jobs to reef unit builders, concrete suppliers, transportation workers, equipment operators, NCDMF employees and ultimately fishermen that benefit from the increased nursery function for estuarine and marine species and the increased spawning stock capacity provided by the oyster sanctuaries. Mobilization of existing NCDMF vessels and deployment equipment to transport the constructed reef structures in the most cost effective and environmentally responsible manner provides benefits to the coastal environment and increases the efficiency of the project.

Finally, monitoring of this reef site will play an important role in guiding future investments and efforts in North Carolina's oyster restoration.

Permits and Approvals:
The NCDMF has secured a NC Coastal Area Management Act (CAMA) Major Development Permit that is reviewed by federal and state regulatory agencies including U.S. Army Corps of Engineers, NOAA, NC Division of Coastal Management, NC Division of Water Quality, and the U.S. Coast Guard. A public hearing will be held to gain public input on the project.

4. Project Scope:

The project scope consists of the creation of a total of 10 acres of oyster habitat in the lower Neuse River Basin, North Carolina. All permitting, design, and engineering work will occur/have occurred prior to initiation of implementation activities at each of these sites.

5. **Schedule:**

October 2011 – April 2012: Secure project permits and hold public hearing (complete)

October 2014 – August 2015: Prepare purchasing contracts for purchase, delivery, and construction of reef materials. Acquire and/or construct reef materials and store at DMF's stockpile at South River.

November 2014 – August 2015: Mark the Little Creek Oyster Sanctuary site according to the PATON permit.

August 2015 – February 2016: 20 weeks of deployments of reef materials at Little Creek Oyster Sanctuary.

September 2016 – November 2016: Conduct quantitative reef assessments at Little Creek Oyster Sanctuary.

Fall 2017, 2018, 2019, 2020: Conduct quantitative reef assessments at Little Creek Oyster Sanctuary and all NC oyster sanctuaries.

Once the Cooperative Agreement is executed, NCDMF will submit a quarterly project report and invoice covering the project activities and expenses occurring in the previous three months. The report and invoice will be submitted by the 30th day of the month following the close of the quarter.

Payments will be made to NCDMF within 30 days of receipt and review by USACE of each quarterly report and invoice. Payments will be made by Electronic Funds Transfer (EFT).

Notwithstanding any other provision of this PMP and detailed project schedule, in no circumstance shall any construction activity begin within the project area, prior to written notification from the USACE that NEPA compliance has been achieved and necessary permits obtained for the project area, and no reimbursement will be made for any construction activity performed prior to such USACE notification. For the purpose of this paragraph, the phrase "construction activities" includes, but is not limited to, construction of oyster reefs, loading of materials onto barges and deployment to the project area, and post construction monitoring. Work accomplished prior to execution of the cooperative agreement may not be considered as part of the non-Federal share of the project costs. A site visit to all sites is planned prior to construction to ensure new construction (post-CA execution) is being performed.

6. **BUDGET:**

See attached spreadsheet for full project budget showing line items, quantities, rates and non-federal cost shares. Approximately $40,000 is available for the Corps administrative component of the project. Changes to the budget and/or schedule, if any will be added to this PMP by amendment and the revised budget(s) will be attached. The remainder of the project budget ($546,182 Federal and $317,331 non-Federal) is allocated to construction and related costs.

Little Creek Oyster Sanctuary – Project Budget

	Federal Share	State Share	Total
Personnel	$92,130	$80,277	$172,407
Fringe	$0	$29,995	$29,995
Travel	$0	$0	$0
Equipment	$0	$165,538	$165,538
Supplies	$5,402	$0	$5,403
Contractual	$284,200	$0	$284,200
Other	$164,450	$28,356	$192,806
Total Direct	$546,182	$304,166	$850,348
Indirect	$40,000	$13,165	$53,165
TOTAL	**$586,182**	**$317,331**	**$903,513**

7. **ENVIRONMENTAL COMPLIANCE:**

NCDMF, the non-Federal sponsor, will be responsible for complying with the N.E.P.A. and securing any necessary regulatory permits for the project activities.

Due to this ERA award being funded through the U.S. Army Corps of Engineers, the Corps determined that a Corps programmatic Environmental Assessment for the project would be needed, and that the NCDMF as the non-federal sponsor would be responsible for drafting the EA. NCDMF will prepare an Environmental Assessment (EA) for the project activities. The EA will be submitted to the USACE for review and public comment. USACE will then follow and complete the NEPA process. NCDMF hasreceived all applicable state and federal permits for the project activities.

The following requisite environmental permits have been obtained for all project activities:

- Coastal Area Management Act Permit - NC Division of Coastal Management
- NC Division of Water Quality General 401 Water Quality Certification
- Department of the Army General Permits and Consistency Determination