



**US Army Corps  
of Engineers** ®  
Wilmington District



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**CHANNEL FROM BACK SOUND TO  
LOOKOUT BIGHT  
MAINTENANCE OF  
U.S. ARMY CORPS OF ENGINEERS AND  
U.S. NATIONAL PARK SERVICE  
NAVIGATION CHANNELS  
ENVIRONMENTAL ASSESSMENT**

**September 2023**

**Wilmington District – U.S. Army Corps of Engineers**



**US Army Corps  
of Engineers**®  
Wilmington District



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**Finding of No Significant Impact (FONSI)**  
**Channel from Back Sound to Lookout Bight**  
**Maintenance of U.S. Army Corps of Engineers**  
**and U.S. National Park Service Navigation Channels**  
**Carteret County**  
**North Carolina**

The U.S. Army Corps of Engineers, Wilmington District (USACE), has conducted an environmental analysis in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended. The USACE assessed the effects of the following actions in the Environmental Assessment, Channel from Back Sound to Lookout Bight, Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels, dated July 2023.

As District Commander, it is my duty in the role of responsible Federal official to review and evaluate, in light of public interest, and the stated views of other interested agencies and the concerned public, the environmental effects of this proposed action.

My evaluation and findings are as follows:

**1. PROJECTION DESCRIPTION**

Development of the alternatives for the Channel from Back Sound to Lookout Bight, Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels, addresses the maintenance dredging and associated placement of dredged material, for the existing Back Sound Federal navigation channel, the channel from Barden Inlet to Lookout Bight, and two National Park Service (NPS) boat dock channels, using a contracted hydraulic pipeline dredge and shallow draft Government plant. Maintenance dredging of these channels is required

to maintain safe and reliable navigability for NPS ferry services, residents, visitors, and commercial and recreational fishermen. Alternatives considered include:

Alternative 1 – No Action. The No Action alternative would result in no dredging of the Back Sound to Lookout Bight or NPS navigation channels. These channels have not been adequately maintained for more than 20 years. Absent dredging, the shoaling of the channel would continue to be a hazard to navigation, and the NPS Ferry Service may eventually cease operations to Cape Lookout. Placement areas, specifically Sandbag Island, Morgan Island, and Cape Lookout beaches, would continue to erode over time. The loss of Sandbag Island, which is currently approximately 1.5 acres in size, would result in a loss of nesting bird habitat, and, potentially, the submerged aquatic vegetation beds to the south. As Cape Lookout soundside beaches erode, critical and historic infrastructure could be lost.

Alternative 2 – Maintenance Dredging of Back Sound to Lookout Bight with a navigation corridor for the full project (no fixed channel); NPS channels would follow deep-water (Full Project Corridor alternative). Alternative 2 encompasses a large corridor of approximately 2,236 acres. This alternative allows for dredging of natural deep-water throughout the full project corridor via hydraulic pipeline dredge and/or shallow draft Government plant. Placement options for dredged material would include Sandbag Island bird island, Morgan Island bird island, NPS soundside and oceanside beaches, sidecasting of material, and within deep scour holes.

Alternative 3 (Proposed Action) – Maintenance Dredging of Back Sound to Lookout Bight along fixed alignment for the northern portion and navigation corridor for the southern portion; NPS channels would follow natural deep-water (Partial Project Corridor alternative). Alternative 3 would dredge within a navigation corridor for the Back Sound to Barden Inlet portion of the project (existing navigation channel) and allows for dredging of a natural deep-water corridor from Barden Inlet to Lookout Bight, via hydraulic pipeline dredge and/or shallow draft Government plant. Placement options for dredged material would include Sandbag Island bird island, Morgan Island bird island, NPS soundside and oceanside beaches, sidecasting of material, and within deep scour holes.

The USACE collected information and coordinated with Tribes and Federal, State, and local agencies. The data collection, agency coordination, and findings of the Project Development Team (PDT) resulted in the Proposed Action, which consists of performing maintenance dredging of the fixed channel from Back Sound to Barden Inlet and following natural deep-water within an identified navigation corridor from Barden Inlet to Lookout Bight, as well as the two NPS boat dock channels. Dredged material placement via hydraulic pipeline could occur on Sandbag Island, Morgan Island, or NPS soundside or oceanside beaches, while Government owned shallow draft plant would sidecast material and/or place material within deep scour holes. Initial dredging would occur via hydraulic pipeline and reoccur every 3 to 5 years as needed; Government owned shallow draft plant would occur between contracted pipeline events on an as-needed basis.

The Proposed Action considers the natural ecosystem and habitat that supports the significant resources in the project area. The USACE has considered resource agencies' concerns by reducing dredging and placement of dredged material within the majority of the project area to a time when marine species are less active or not present. The USACE has committed to the protection of sea turtle nesting habitat by restricting dredged material placement on NPS oceanside beaches between November 16 through April 30. Likewise, to protect nesting shorebirds, placement of dredged material on bird islands and NPS soundside beaches would occur from September 1 through March 31. Government owned shallow draft plant dredging would occur from October 1 through March 31 to protect fisheries resources. Submerged aquatic vegetation (SAV) beds are located throughout the project area. To protect these resources, prior to any dredging event, USACE would identify locations of SAV beds using the State's online database and recent aerial imagery. In addition, USACE will maintain a 100 foot buffer from all SAV during placement of dredged material within deep scour holes or sidecasting in the Barden Inlet area during the October 1 – March 31 timeframe. Federally listed species would be protected by following the National Marine Fisheries Service's (NMFS) *2020 South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States* (SARBO), as well as the U.S. Fish and Wildlife Service's (USFWS) *Guidelines for Avoiding Impacts to the West Indian Manatee* (2017) and the *2017 North Carolina Coastal Beach Sand Placement, Statewide Programmatic Beach Placement Biological Opinion* (SPBO). The conservation measures in these BOs would remain in place until all work is complete, all vessels have left the area, and all equipment is removed from beaches and/or bird islands. To protect historic and archaeological resources, a 150 meter no dredging buffer would be established around the wreck of the Olive Thurlow.

## **2. COORDINATION**

A scoping letter describing the Proposed Action and requesting agency participation was circulated via email May 6, 2022, and a scoping meeting was held on June 1, 2022. The USACE coordinated the Proposed Action with Tribes and Federal, state, and local agencies and issued a Public Notice on April 14, 2023, to solicit comments. Agency and public comments were received from: USFWS, NPS, NMFS, Environmental Protection Agency, NC Division of Environmental Quality, NC Wildlife Resources Commission, NC Department of Agriculture, NC Department of Transportation, NC Division of Emergency Management, NC Department of Natural and Cultural Resources, and Carteret County's Shore Protection Office. Documentation of all comments and comment responses is included in this EA/FONSI as Appendix H.

Compliance with Section 7(a)(1) of the Endangered Species Act for the Proposed Action is based on NMFS's 2020 SARBO. Federally protected species under purview of the USFWS have been reviewed and actions approved as followed under the 2017 SPBO and the 2017 Manatee Guidelines. The North Carolina Division of Coastal Management provided their final Federal consistency decision on June 28, 2023

(Appendix I). The USACE Regulatory Division issued a permit on August 28, 2023, for the dredging of NPS channels and placement of material on NPS beaches (Appendix J). In addition, the NC Division of Water Resources (NCDWR) issued the corresponding Water Quality Certificate for these activities on August 15, 2023 (Appendix J). A Special Use Permit has been issued by the NPS, dated July 17, 2023 (Appendix K).

The NCDWR is reviewing a Water Quality Certificate application submitted by USACE for the placement of material on Sandbag Island. No work will begin until all authorizations are received, and all conditions of these authorizations would be adhered to while work is ongoing.

The EA is available on the Wilmington District Website at:

<http://www.saw.usace.army.mil/Missions/Navigation/>

### **3. ENVIRONMENTAL EFFECTS AND IMPACTS**

The Proposed Action will be in compliance with all environmental laws and executive orders, and environmental impacts to protected resources will be minimized to the maximum extent practicable.

### **4. DETERMINATION**

Based on the EA prepared for this project, I have determined that this action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, the action does not require the preparation of a detailed statement under Section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). My determination was made considering the following factors discussed in the EA to which this document is attached:

a. The proposed action may affect, but is not likely to adversely affect, leatherback, loggerhead, Kemp's Ridley, and green sea turtles (swimming) under NMFS purview; West Indian manatee; Atlantic sturgeon; giant manta ray; and roseate tern. The proposed action may affect, and is likely to adversely affect, leatherback, loggerhead, Kemp's Ridley, and green sea turtles (nesting) under USFWS purview; piping plover; red knot; and seabeach amaranth. The proposed action may affect, and is likely to adversely affect, piping plover designated Critical Habitat and red knot Critical Habitat proposed for designation. The potential effects to endangered species and Critical Habitat will not adversely affect any species at the population level.

b. No significant cumulative or secondary impacts would result from implementation of this action.

c. The proposed action would not significantly impact cultural resources.

d. The proposed action would result in no significant impacts to air or water quality.

e. The proposed action would result in no significant adverse impact to fish and wildlife resources.

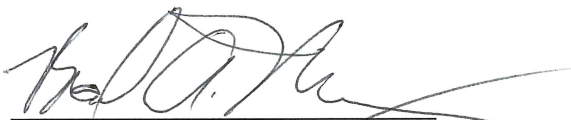
f. The proposed action will not cause any environmental health risks or safety risks that may disproportionately affect children and complies with Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks".

g. The proposed action will not cause any disproportionately high and adverse human health or environmental effects on minority populations and low-income populations and complies with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations".

## 5. FINDINGS AND CONCLUSIONS

The proposed action to maintain the U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels from Back Sound to Lookout Bight would result in no significant environmental impacts.

Date: 12 SEPTEMBER 2023

  
Brad A. Morgan  
Colonel, U.S. Army  
District Commander

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- Appendix A: Geotechnical Assessment
- Appendix B: Sandbag Island Placement Plan
- Appendix C: Clean Water Act Final Section 404(b)(1) Guidelines Analysis
- Appendix D: USFWS IPAC Species List
- Appendix E: National Historic Preservation Act Section 106 Correspondence
- Appendix F: Climate Change and Sea Level Rise Analysis
- Appendix G: EA/FONSI Mailing List
- Appendix H: Public and Agency Comments and Responses
- Appendix I: Coastal Zone Management Act Federal Consistency Correspondence
- Appendix J: USACE Regulatory Division Permit & Water Quality Certificate
- Appendix K: NPS Special Use Permit
- Appendix L: Public & Agency Correspondence

## **1.0 INTRODUCTION.**

The National Environmental Policy Act of 1969 (NEPA), as amended, requires consideration of the environmental impacts for major federal actions. The purpose of this Environmental Assessment (EA) is to ensure the environmental consequences of the proposed action are considered and that environmental and project information is available to the public. This EA is being completed by the U.S. Army Corps of Engineers (USACE) in partnership with the National Park Service (NPS), Cape Lookout National Seashore through a Memorandum of Understanding. The EA will address restoration and maintenance of channels that provide visitor access to the Cape Lookout National Seashore (CALO) and provide access for maintenance of the lighthouse and park grounds. This joint USACE/NPS EA will meet the NEPA requirements for both federal agencies and will cover all actions assessed in the USACE's 1975 Environmental Statement and the NPS's Cape Lookout National Seashore Protection of Lighthouse and Associated Historic Structures EA, dated December 2005. Additionally, the EA will address long-term maintenance of the NPS boat dock channels, dredging using the USACE's shallow-draft fleet and placement of dredged material within the designated areas of impact.

The United States Army Corps of Engineers (USACE) has prepared this EA in accordance with the NEPA, the Council on Environmental Quality regulations (40 Code of Federal Regulations (CFR) parts 1500-1508, 1515-1518), and Engineering Regulation (ER) 200-2-2.

The subject of this EA is the restoration of the USACE federal navigation channel and National Park Service (NPS) boat dock channels within Back Sound to Lookout Bight, Carteret County, North Carolina. The USACE channel historically has included a fixed portion and a portion that follows natural deep water, providing access from the Back Sound through Barden Inlet and Lookout Bight to the Atlantic Ocean (Figure 1). The NPS channels, which connect to the USACE channel, follow a deep water channel for ferry operations that provide visitor access to the Cape Lookout National Seashore (CALO) Lighthouse dock. A second dock that used to service the old U.S. Coast Guard (USCG) Station is no longer used; however, NPS plans to utilize this dock in the future, so this EA also addresses maintenance of a channel that follows deep water to this dock.

The USACE Federal channel has not been maintained in over two decades. Portions of the channel are completely shoaled in, and mariners navigate outside of the north end of the fixed channel, which swings around dangerous shoals (Figure 2). Current depths of the federal channel are 4 feet, allowing only smaller shallow draft boats to navigate the channel. A ferry service from the NPS CALO Headquarters on Harkers Island traverses these waters several times daily during the summer season, navigating by means of homemade buoys that are adjusted as necessary.

The Navigation mission of USACE is to provide safe, reliable, efficient, effective, and environmentally sustainable waterborne transportation systems (i.e., channels, harbors,

and waterways). As part of the navigation mission, the USACE is responsible for maintenance of the federally authorized Channel from Back Sound to Lookout Bight Channel project, allowing mariners to safely access the open ocean and improving access for the recreational and commercial fishing vessels from Harkers Island. Trawlers and other larger vessels have not been able to pass through the Barden Inlet for several years.

This EA explores a reasonable range of alternatives to reestablish safe and navigable channels between Back Sound and Lookout Bight. The No Action alternative of no dredging is compared to the alternatives of restoring the channels to authorized project dimensions. The preferred alternative, which would dredge using Government shallow draft plant and contracted suction cutter hydraulic pipeline dredge, would occur within agency-recommended environmental timeframes, unless emergency actions are needed. This is further explained in Section 4 of this EA.



Figure 1. Project Area Overview

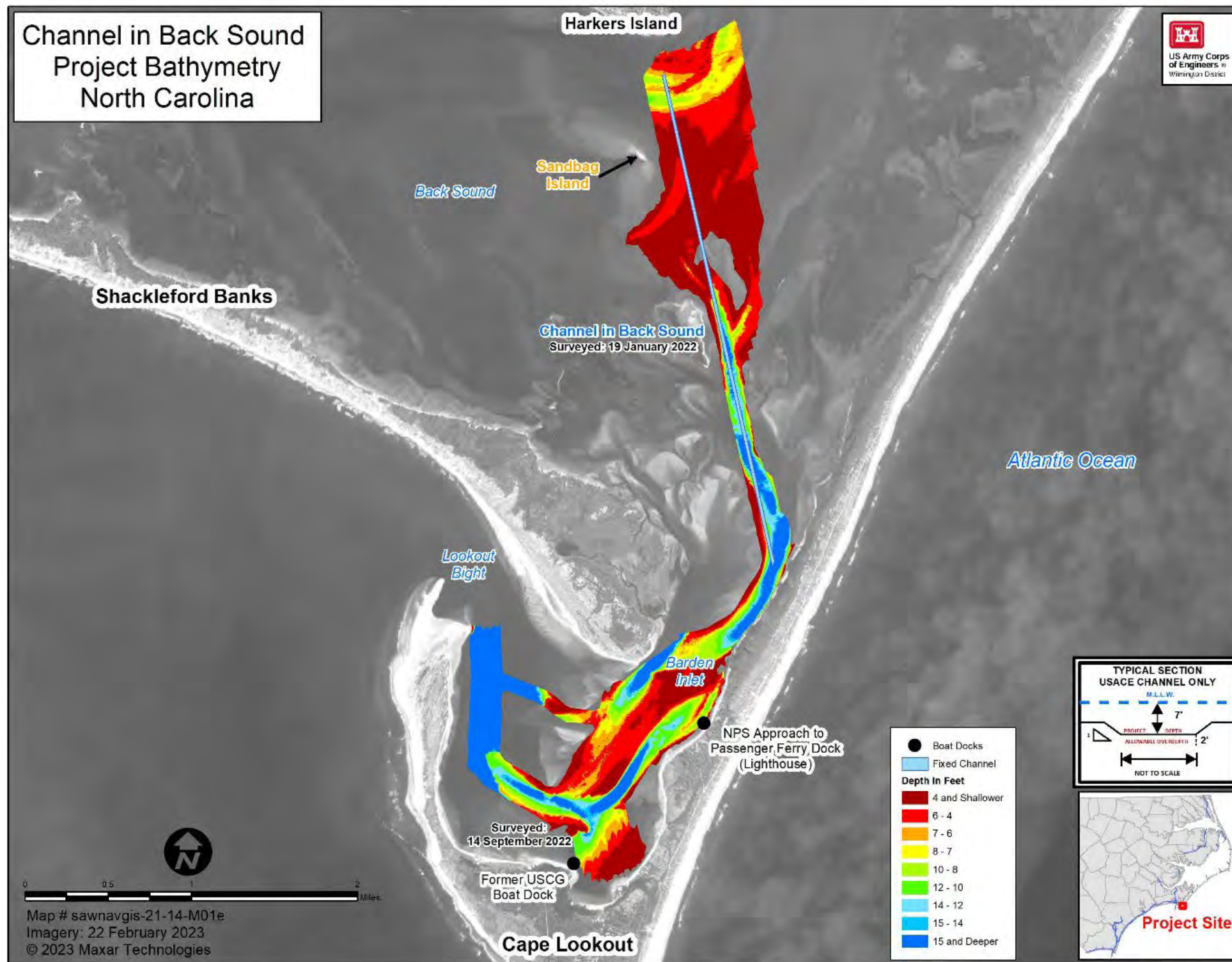


Figure 2. Project Area Bathymetry

## 1.1 Authority.

### 1.1.1 USACE Channel

The Channel from Back Sound to Lookout Bight navigation project was authorized under authority of the River and Harbor Acts of August 26, 1937, and March 2, 1945. The original project provided a channel 5 feet deep and 50 feet wide. A channel 7 feet deep and 100 feet wide was authorized in 1945 by House Document (HD) 746/77/2 and construction was completed in 1956. The channel has been maintained in approximately the same location since it was constructed (1975 FES). The last dredging event via contract occurred in 1997 and the last dredging event via Government Plant (Sidecaster, Merritt) occurred in 1980.

The channel includes two sections, (1) a 100-foot-wide fixed channel with an authorized depth of -7 feet mean lower low water (MLLW), with 2 feet of allowable overdepth, extending from Core Sound, just south of the NPS Visitor Center on Harkers Island, through Back Sound to Barden Inlet, and (2) a 100-foot-wide channel with an authorized depth of -7 feet MLLW, with 2 feet of allowable overdepth that extends from Barden Inlet through Lookout Bight.

### 1.1.2 NPS Channels

The NPS does not have a specific channel authority for dredging to access their boat docks, and there is no record of previous dredging. The dimensions are based on the minimum required to safely accommodate the vessels that use the NPS channels. The proposed dimensions for the channel to the Lighthouse dock would be 40 feet wide by 7 feet deep, with 1-foot overdepth, and the channel to the old USCG Station dock would be 40 feet wide by 4 feet deep, with 2 feet of overdepth.

## 1.2 Background.

### 1.2.1 USACE Channels

Federal funding to maintain the Channel from Back Sound to Lookout Bight project has not been received since the 1990s. The original EA and Finding of No Significant Impact (FONSI) was signed in November 1975 and assessed impacts associated with pipeline dredging the federal channel and placing material onto two bird islands (Morgan Island and Sandbag Island) and on the oceanfront beach of CALO. Sidecasting using the Government-owned dredge MERRITT was also assessed; however, due to resource agency concerns, sidecasting was limited to only within the Barden Inlet area.

The last navigation contract for maintenance dredging of the Back Sound to Lookout Bight channel was in the winter of 1997 by pipeline dredge, which removed 78,350 cubic yards (CYs) of dredged material. The USACE has no records regarding the placement location for this material, however, 1998 aerial imagery shows a considerable increase in the size of Sandbag Island (Figure 3), which was the placement area identified in the 1975 environmental impact statement (EIS). Prior to

that, dredging was completed by pipeline contract in 1992 (no additional information is available) and in 1988 USACE removed 47,078 CYs of material and placed it on Sandbag Island (which included filling and placing the sandbags).

Currently, at low tide, much of the fixed channel bottom is above mean low water. Boat traffic follows a meandering natural channel that has a controlling depth of 2 feet and runs adjacent to the historic fixed channel alignment.

### 1.2.2 NPS Channels

The NPS boat dock channels (including the former USCG dock channel) provide vital navigational linkage to NPS properties along the southern reach of CALO and to the iconic Cape Lookout Lighthouse area, on which residents, visitors, businesses, and NPS staff depend. These channels were maintained in the past, however, there is no record of the last maintenance dredging event or placement location. The channel to the ferry dock experiences the highest boating activity with ferries accessing it multiple times daily. The channel to Les and Sally's boat dock, which provides access to the NPS maintenance area, is used daily by NPS staff, however, this channel is not included in this EA due to the presence of submerged aquatic vegetation (SAV), a protected resource for important fisheries species. To complete urgently-needed dredging proposed for the fall of 2023 – winter of 2024, all environmental compliance requirements must be met expeditiously, including completion of the NEPA process. Maintenance dredging of the Les and Sally's channel would result in unavoidable impacts to SAV; therefore, mitigation would be required. Development of an acceptable SAV mitigation plan could take several months, delaying completion of environmental compliance requirements and risking delay of the upcoming proposed maintenance dredging.

The channel accessing the old USCG dock has not been dredged since the USCG departed in June 1982, however, it tends to follow a natural deep-water route. The existing dock and pier are dilapidated and are not currently in use.

The last NPS project that involved dredging was a shoreline restoration project to protect the important historic structures from erosion. In March 2006, borrow areas within Barden Inlet were dredged and material placed on the soundside beach at Cape Lookout Lighthouse (2005 NPS EA). Only a small portion of the federal channel was dredged, and it was not a project intended to maintain the navigation channel.

### 1.3 Project Area (Dredging and Placement Locations).

The project area encompasses all areas that may be affected by the alternatives considered, including the corridors where dredging may occur and all dredged material placement areas, including sidecast areas, Sandbag Island bird island, Morgan Island bird island, and the soundside and oceanside beaches of CALO (Figure 4, Area of Potential Effect). Details regarding dredging and dredged material placement locations are described in more detail below.



The Federal navigation channels are divided into two sections, the northern section, which has historically been a fixed channel through Back Sound towards Barden Inlet, and the southern section being the corridor encompassing Barden Inlet and Lookout Bight, where channels follow natural deep water. The northern section includes the USACE channel, which connects Harkers Island and Core Sound to Barden Inlet. The southern section contains both NPS and USACE channels, providing access to the CALO shoreline and the open ocean.

Placement locations vary depending on the material composition in the channel and the type of dredge plant used for maintenance. The northern section contains material suitable for beneficial use placement onto Sandbag and Morgan Island bird islands via pipeline dredge and open water sidecasting adjacent to the channel. Material within Barden Inlet and Lookout Bight is beach quality and suitable for soundside (Lighthouse beach) and oceanside beach placement.

A submerged abandoned utility line that once supplied power to the Lighthouse on Cape Lookout, exists within the project area. It has been out of service since 2018 when the solar plant came online. For safety purposes, this utility line is shown on Figure 5 and its location will be provided in Government contracts for future maintenance dredging.

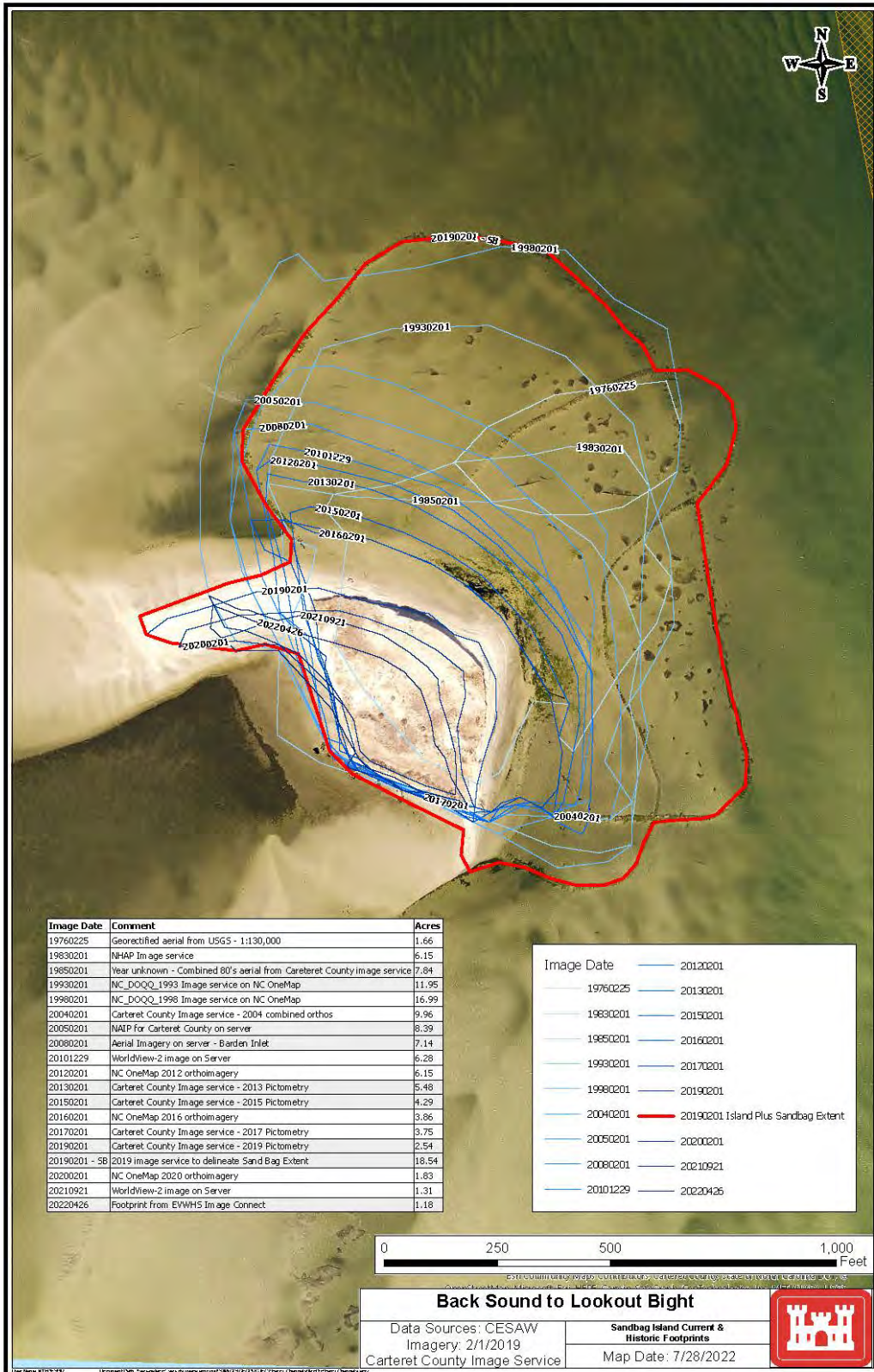


Figure 3. Sandbag Island Dredged Material Placement History

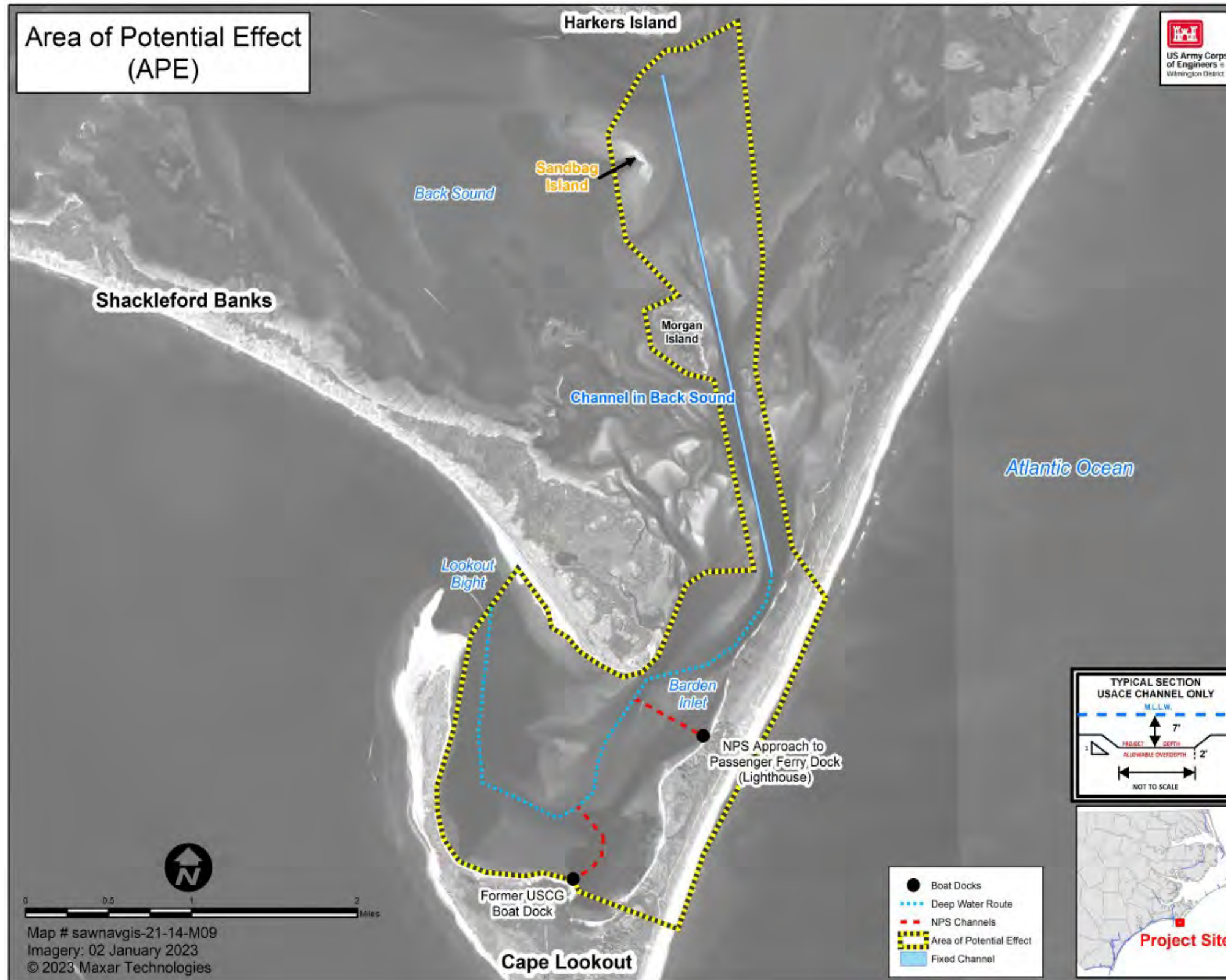


Figure 4. Area of Potential Effect

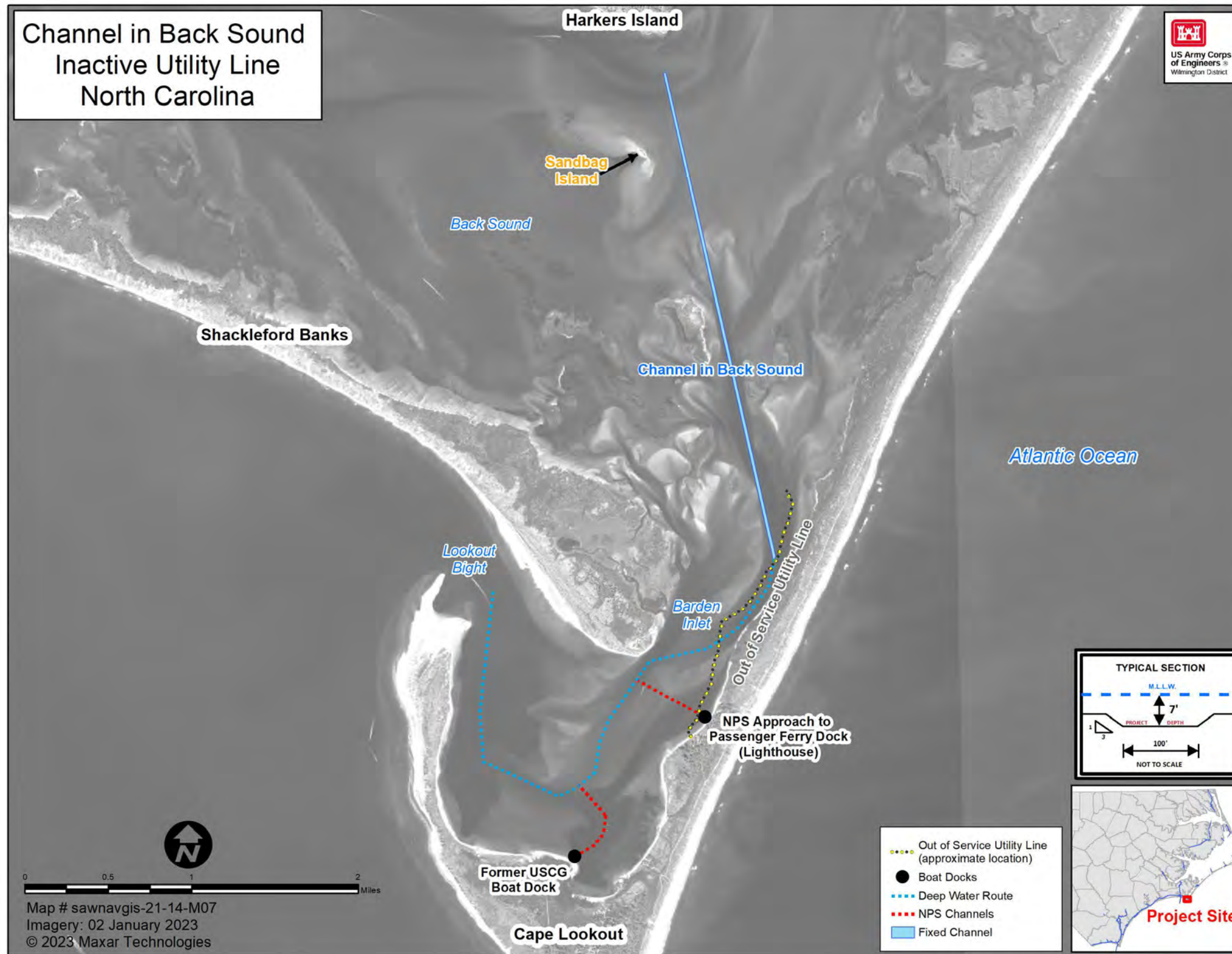


Figure 5. Abandoned Utility Line Location

### 1.3.1 USACE Channel Dredging Action (Back Sound to Lookout Bight)

The northern portion of the proposed project area consists of a linear channel approximately 3 miles long, 100 feet wide, and -7 feet deep MLLW, with 2 feet of allowable overdepth, and 3:1 side slopes. Based on recent and previous sediment analyses (see Appendix A), the material contains less than 10% fine-grained sediments, meaning it is acceptable for bird island, sidecasting and deep-water placement.

The southern portion of the project consists of the route through Barden Inlet and Lookout Bight, where, historically, the exact location of the channel was allowed to shift to take advantage of naturally occurring deep water. The USACE maintained only the area that provided a 100-foot-wide by 7-feet deep channel (plus 2 feet allowable overdepth) along the route that required the least amount of dredging. Natural deep water is more prevalent through Lookout Bight where tidal currents create a more dynamic area of shoaling and erosion, as compared to Back Sound.

### 1.3.2 NPS Channel Dredging Action

There are two NPS boat dock channels proposed to follow deep water to the maximum extent for minimal maintenance. They are Lighthouse Channel and the Old USCG Station Channel and are described below.

1. Lighthouse Channel (40 feet wide by -7 feet MLLW, with 1-foot allowable overdepth) – Ferries from the NPS Visitor Center take visitors to the Cape Lookout National Seashore via the lighthouse channel several times daily between the months of April – October.
2. Old USCG Station Channel (40 feet wide by -4 feet MLLW, with 2 feet allowable overdepth) – The future plan is for NPS to utilize the abandoned USCG Station as a maintenance facility and vehicle storage. The dock is currently in disrepair and would require a complete overhaul. Dredging is not expected to occur here for 3-4 years.

### 1.3.3 Sandbag Island Placement Option

Sandbag Island was created on top of a 1.66-acre island in 1976. Sandbags were placed to contain the material dredged from the historic USACE channel. Figure 3 shows a time lapse of Sandbag Island and the six placement events that occurred between 1976 and 1997. The island was at a maximum size of 16.99 acres in 1988 and appears to have eroded steadily since 1998, after the last placement. At the current size of 1.18 acres, the island has lost 15.81 acres over the last 34 years. Sandbag Island appears to have been most stable between years 2004 – 2016.

#### 1.3.4 Morgan Island Placement Option

Morgan Island is a dredged material placement site, approximately 27 acres in size, including marshlands. The history of the island is not well known. In 1976, it was described in the *Atlas of Colonial Waterbirds of North Carolina Estuaries (1979)* as approximately 15 acres in size with an elevation of approximately 10 feet. The island had a substrate of sand and shell, and approximately two-thirds of the island was diked and included a large area of unvegetated dome. The island received additional dredged material from the Barden Channel maintenance dredging after 1976, but no details are available regarding those placement events. The island's dome is now sparsely vegetated and there is a ring of shrub thicket vegetation with adjacent marshlands and mudflats. There are state-mapped SAV beds to the north, east, and west of the island. Morgan Island is an important bird nesting area within the boundaries of CALO with multiple bird species nesting in the shrub thicket and on the dome area.

The northeast side of Morgan Island is currently experiencing some erosion and loss of bird nesting habitat. The placement of dredged material on Morgan Island would help offset the effects of erosion and rising sea levels, helping preserve bird nesting habitat.

#### 1.3.5 Lighthouse Beach Placement Option (soundside)

Ferries from the NPS visitors center on Harkers Island unload passengers at the ferry landing at Lighthouse beach. The Cape Lookout Lighthouse continues to draw thousands of visitors a year; however, it and its attendant structures are being threatened by beach erosion on the soundside. Lighthouse Beach is a sandy estuarine shoreline approximately 2,600 linear feet that experiences high erosion due to currents and storm events. The high-water line is a stone's throw from the base of the Keeper's Quarters and touches the edge of the foundation of the Summer Kitchen, similar to its location in 2005 prior to NPS implementing a beach nourishment project. Dunes have receded past the edge of Summer Kitchen, which is still in use, but is most vulnerable to storm surge. The historical Coal Shed was removed in 2003 by Hurricane Isabelle and only the foundation remains on the shoreline. In 2006, 74,000 CYs of beach quality material from the Barden Inlet area was placed there; however, that nourishment project is not evident today. Future placement of dredged material from the navigation channels onto Lighthouse Beach would be within the same footprint as the 2006 placement event, in a location that best protects the historic structures. Beach placement events would occur at most, once every 3-5 years.

Placement onto Lighthouse beach would occur in accordance with NPS's December 2005 EA. Oceanside beach placement would occur when there is no need for material on Lighthouse beach; or when quantities exceed the limits of Lighthouse beach.

#### 1.3.6 Cape Lookout Beach Placement Option (oceanside)

Depending on shoaling and erosion rates, future maintenance events using pipeline dredges may require additional placement areas. In this case, NPS has identified areas

along Cape Lookout oceanside beach which would be acceptable for receiving beach quality material (Figure 6). A pipeline would be laid or elevated across the barrier island at the narrowest crossing to reduce the amount of impact to marsh or sensitive upland habitat to the maximum extent practicable. Beach placement events would occur at most, once every 3-5 years.

The beach placement area would depend on the quantity of material available, and the area identified would be approved by NPS. The beach template design would mimic the natural beach as much as possible, typically having a berm elevation of 6 feet and berm width of 175-200 feet, allowing for successful sea turtle nesting.

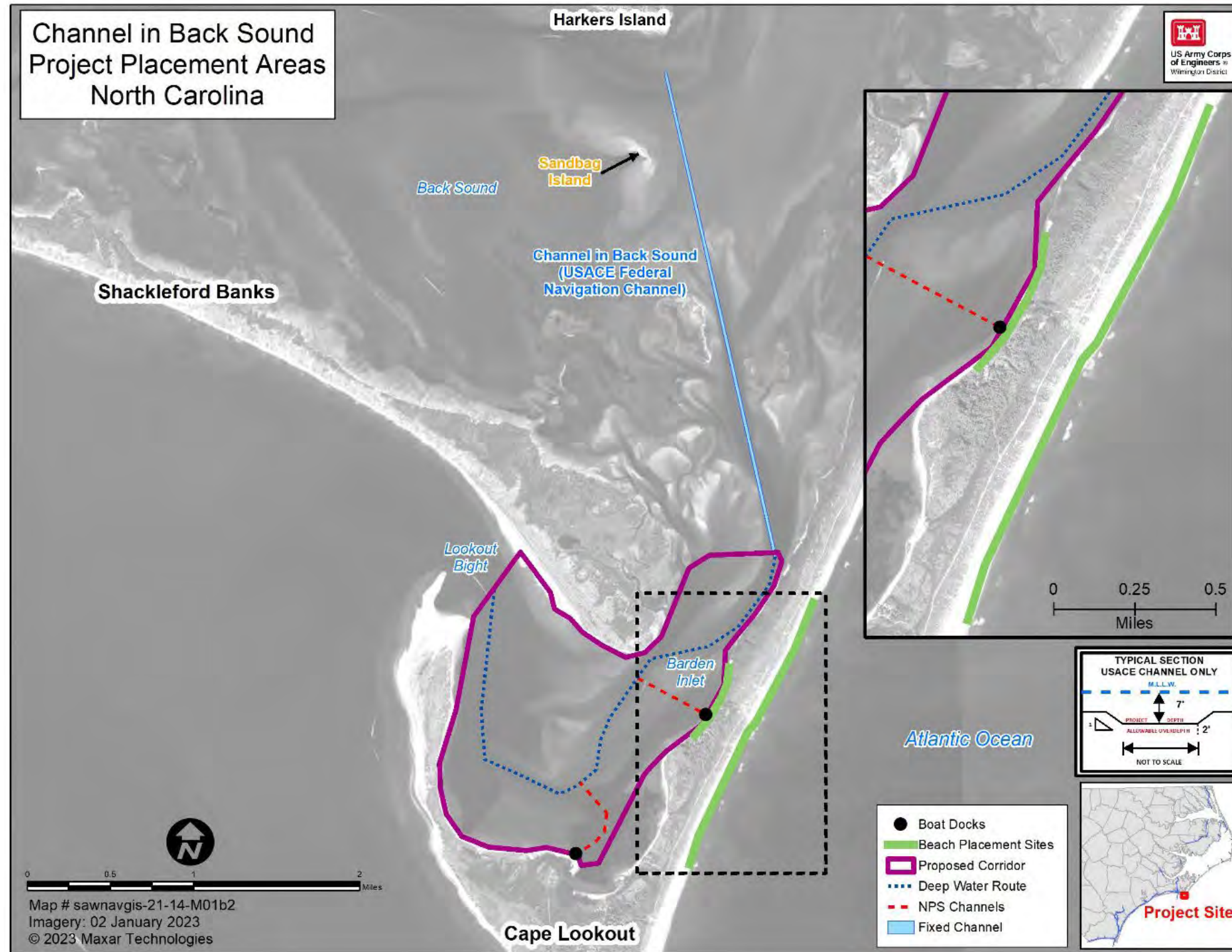


Figure 6. CALO Soundside and Oceanside Beach Placement Areas



### 1.3.7 Open Water and Deep Water Placement Options

Between pipeline dredging events, maintenance of shoals in USACE and NPS channels is expected to occur annually using the Government-owned shallow-draft dredges. Two different types of dredges, special purpose hopper dredge and sidecast (explained further in Sections 4.1.2 and 4.1.3), can be utilized to quickly and efficiently remove shoals within the channels. Both operate in sandy environments only ( $\geq 90\%$  sand) and cast or place material onto sandy bottoms within the project area, keeping sediment within the system.

Open water placement using the sidecast dredge Merritt would take place within 80 feet of the port and starboard sides of the dredge. This would be within the authorized limits of the channels, except when dredging along the channel edges.

Open water placement using the special purpose hopper dredge Murden or Currituck would occur only within waters that are a minimum depth of 14 feet. These deep water locations may shift as shoals move, but would be located within the navigation channel corridor(s) described in Section 4.

## **2.0 PURPOSE AND NEED.**

The purpose of this action is to provide safe and reliable navigation for residents, visitors, and NPS staff to and from Barden Inlet and Cape Lookout National Seashore, while also protecting valuable historic structures from erosion by beneficially using beach suitable dredged material. The northern portion of the channel through Back Sound is almost completely shoaled in and unsafe for navigation. Currently, USACE does not have existing environmental clearances to dredge (with commercial or Government Plant) or to place dredged material in any location (Sandbag Island, Morgan Island, soundside or oceanside beach, or open water) for the Channel from Back Sound to Lookout Bight project. Environmentally, conditions have changed since the 1975 EA, including new federally listed endangered species, water quality regulations, Essential Fish Habitat, identified cultural resources, and shorebird nesting areas; therefore, all applicable environmental requirements, including completion of the NEPA process, must be completed before the Back Sound to Lookout Bight and NPS channels are dredged.

The USACE federal channel (from Back Sound to Lookout Bight) was last dredged in 1997 and has not been maintained since due to a lack of Federal funds. Dates of last maintenance dredging of the NPS channels are not known.

The Island Express Ferry service is a lifeline to this area, connecting the NPS Visitor Center at Harkers Island to Cape Lookout and Shackleford Banks Islands. Harkers Island resident business owners are reliant on tourists to spend money at their lodgings, restaurants, and shops; however, for several years, ferries and mariners have struggled to navigate what's locally known as the "S" curve at the north end of the fixed channel.

Neglect of the channel has caused it to almost completely shoal in, with shoals often exposed at low tide.

A stable and maintainable channel is needed to reduce risks to ferry service operations and mariners. Also, many fishing and trawling boats can no longer pass through Barden Inlet to access the open ocean. The only alternative for them is to travel nearly 9 miles west to Beaufort Inlet, which adds an additional 2 hours round-trip to reach their preferred fishing areas.

Groundings have become commonplace within the Back Sound and Lookout Bight waters. Without proper navigation aids in the “S” curve, boaters unfamiliar with these waters frequently run aground and require assistance. The current routes are not marked with USCG aids, but instead are marked with painted red and green makeshift buoys, rely on regular prop washing to remain open, however unsafe.

Beneficial use of dredged material will help to keep valuable sediments within the system and decrease rates of erosion at Lighthouse beach, which continues to threaten the lighthouse and its attendant structures. Dredged material from USACE and NPS channels can be used to protect and buffer existing shorelines and structures, as well as rebuild upland habitat areas to reduce risks to inshore areas from the effects of storm surge and high tides. CALO lighthouse and its attendant structures are in desperate need of buffering from ongoing erosion, and protection is a top priority of the NPS.

### **3.0 INCORPORATION BY REFERENCE.**

The proposed work would be conducted predominantly by dredging and placement methods previously used by USACE for maintenance dredging of federally authorized channels in the project area. The environmental acceptability of previously used methods has been addressed in previous National Environmental Policy Act (NEPA) documents that were circulated for public and environmental agency review between 1975 and 2005. They include the following:

- a. Maintenance Dredging Channel from Back Sound to Lookout Bight, N.C. Final Environmental Statement. November 1975, U.S. Army Corps of Engineers.

Original NEPA document for the maintenance of USACE channels by use of pipeline dredge (every 2-3 years) with placement onto Morgan Island (one time use only), creation and use of Sandbag Island, and Core Banks oceanside. Sidecast dredging only in a portion from Barden Inlet across the ocean bar to Lookout Bight (1-2 times annually).

- b. Use of Government Plant to Dredge in Federally Authorized Navigation Projects in North Carolina. Environmental Assessment. March 2004, U.S. Army Corps of Engineers. Use of Government Plant to Dredge in Federally Authorized Navigation Projects in North Carolina. Finding of No Significant Impact. September 2004, U.S. Army Corps of Engineers.

Programmatic EA completed for maintenance dredging of USACE channels in North Carolina using sidecast and special purpose hopper dredges. This EA did not include Back Sound to Lookout Bight; however, the EA and FONSI are included by reference to provide detail and background on the mechanics and operations of Government Plant dredges.

c. National Park Service Cape Lookout National Seashore Protection of Lighthouse and Associated Historic Structures Environmental Assessment. December 2005, National Park Service, U.S. Department of the Interior.

NEPA document for placement of material from borrow areas (USACE channel and Barden Inlet) onto CALO beaches experiencing erosion. The NPS action consisted of the placement of approximately 74,000 cubic yards of beach quality material along 2,600 linear feet of the estuarine shoreline of South Core Banks, Cape Lookout National Seashore, in the vicinity of the Cape Lookout Lighthouse and associated historic structures. To provide added protection to the lighthouse and historic structures, a berm approximately 1,260 feet in length was constructed along the southern fill area.

#### **4.0 ALTERNATIVES.**

The USACE and NPS are working collaboratively to restore navigation channels from Back Sound to Lookout Bight and to the adjacent NPS channels. This will ensure safe access to areas that provide natural and historic beauty, as well as provide a safe access to the open ocean for commercial and recreational boaters. The goal is to dredge effectively and economically, while making the best use of dredged material, and avoiding and minimizing impacts to natural and cultural resources to the maximum extent practicable.

As mentioned above, the scope of the project has been reduced to avoid impacting SAV resources near the Les and Sally boat channel and dock. The Les and Sally channel was initially considered for dredging and the adjacent beach for receiving dredged material; however, SAV impacts are unavoidable and timing for the project is critical to restore the Federal navigation channel, therefore it was removed from further analysis in this EA.

##### **4.1 Dredge Types and Placement Options.**

All dredging and placement activities would occur during the proposed timeframes described below and would be based on the type of dredge plant used and the placement location of the material. Below is a description of the dredge types to be used and placement options for maintaining the USACE and NPS channels.

#### 4.1.1 Pipeline Dredging with Bird Island or Beach Placement.

To maintain the USACE and NPS channels, a small contracted hydraulic cutter-suction (pipeline) dredge would be used for initial dredging, then repeated approximately every 3-5 years for 30-45 days per event, depending upon shoaling rates and available funding. These cutter suction dredges typically use pipelines of 12-18 inches and operate 24 hours per day, having the capability to remove larger volumes of material ( $\geq 150,000$  CYs) per contract. Cutterhead suction horsepower (HP) of small non-ocean certified dredges usually ranges between 1,300 – 2,000 HP, whereas larger pipeline dredges (not used for this project) range from 3,000 – 4,500 HP.

These pipeline dredging events would remove the greatest quantity of material, restoring the channels to their full project dimensions. Based on recent bathymetry, dated February 1, 2022, significant shoaling exists in the current channel alignment, including approximately 170,000 – 180,000 CYs of shoaled material in the USACE channels and 10,000 CYs in the NPS Lighthouse channel. These volumes are proposed for dredging in FY23-24. Beneficial use of dredged material may occur in FY23-24 with placement of beach quality sand on Sandbag Island bird nesting island or Lighthouse beach for the purpose of storm surge protection, habitat restoration for nesting shorebirds and sea turtles and protection of historic structures, respectively (Figure 7). Placement onto the oceanside beach will occur when dredged material from Lookout Bight exceeds the capacity of Lighthouse beach. Likewise, placement of dredged material on Morgan Island bird island may occur in the future, depending on erosion rates of the island, amount of material to be dredged, and available funding. Pipeline dredging has been previously authorized with placement onto bird islands, soundside and oceanside beaches. In between contracted pipeline maintenance dredging events, Government owned shallow draft plant would remove any shoals impeding navigation.

Sandbag Island Placement. When a pipeline dredge is used to maintain the Back Sound channel, dredged material is proposed for placement onto Sandbag Island, (Figure 7) which is managed by the NC Wildlife Resources Commission (NCWRC) and has historically provided habitat for various species of colonial waterbirds.

Pipeline dredges place beach quality sand on bird islands using control of effluent technique. Typically, the site is prepared prior to placement with bulldozers to create berms which would influence the direction of the dredged material. Bulldozers are used again after pumping ceases to create the proper slopes and shape the island to accommodate nesting birds in the area. Placement of beach quality sand on Sandbag Island would be done in accordance with the plan laid out in detail in Appendix B. This would occur between September 1 – March 31 for the protection of nesting birds and fledglings, per U.S. Fish and Wildlife Service (USFWS). Initial dredging in FY23-24 is expected to place approximately 160,000 CYs onto Sandbag Island from the Back Sound channel. The initial dredging event would restore Sandbag Island to a size of approximately 5 to 6 acres, with a height of no more than 15 feet.

Over time, USACE is proposing to create a bird island footprint no larger than 25 acres that will not exceed a height of 15 feet (NAVD88), the maximum recommended by NCWRC to reduce risk of predators inhabiting the island. This would be sufficient for future maintenance and provide much-needed nesting habitat for terns, oyster catchers, and pelicans. Placement events would be expected to occur each time a pipeline contract is awarded (every 3-5 years, depending on funding).

Morgan Island Placement. When a pipeline dredge is used to maintain the Back Sound navigation channel, dredged material could be placed on Morgan Island (Figure 7), which is owned by the NPS and is an important nesting area for multiple bird species.

Placement on Morgan Island would be done in a similar manner as most bird islands, via control-of-effluent, as described under the Sandbag Island Placement section above. Placement of beach quality sand on Morgan Island would occur between September 1 and March 31 to protect nesting birds and fledglings. Placement of sand on Morgan Island is not scheduled for the initial dredging event; the island, while experiencing some erosion, does not currently need sand placement. Placement events on Morgan Island could occur when a pipeline contract is awarded (every 3-5 years) and would be dependent on need, amount of material to be dredged, and available funding. Future placement of dredged material on Morgan Island would be coordinated with USFWS, NCWRC, and NPS prior to any placement event.

Lighthouse Beach Placement. Pipeline dredging within Barden Inlet and the Lookout Bight corridor is proposed for placement directly onto Lighthouse beach (Figure 6) for purposes of protecting historic structures and restoring wildlife habitat. Bulldozers onsite would manipulate the material as it discharged from the pipe to maximize settling and stacking. The placement timeframe is driven by the presence of shorebird nesting habitat (September 1 – March 31) to protect nesting birds and fledglings. Lighthouse beach is not known to provide sea turtle nesting habitat (*personal communications with CALO NPS*) since sea turtles primarily nest on oceanside beaches.

A beach template would be designed with a specific elevation and berm width and height in accordance with NPS regulations and would mimic the 2006 NPS nourishment project intended to provide additional protection for the historic structures. For that placement, sand was subdivided into two fundamental zones, with the break between the northern and southern fill areas being the pier used for ferry services and National Park seacraft. The northern fill area was approximately 1,000 linear feet long with an estimated fill width of 50 foot contoured at a grade of +3.5 feet relative to sea level, which is the existing beach elevation. The southern fill area was approximately 1,600 linear feet long with an estimated fill width of 100-foot also contoured at the +3.5-foot elevation. There was also a berm feature for the southern fill area extending 1,250 linear feet, at a +7.5-foot elevation, with a top width of 15 feet.

Initial placement on Lighthouse beach in FY 2023-2024 would include approximately 38,000 CYs from Lookout Bight USACE and NPS channels, covering only a small

portion of what was placed in 2006. However, future pipeline dredge events may result in a larger amount, which would fill the 2006 template.

CALO Oceanside Beach Placement. Oceanside beach placement would occur when dredged quantity amounts exceed the overall placement area of Lighthouse Beach. The identified area where placement could occur is shown in Figures 6 and 7 and actual placement location would be determined by the NPS. Placement onto CALO oceanside beach would occur November 16 – April 30 for protection nesting sea turtles and hatchlings, as required by USFWS in the 2017 NC State Programmatic Biological Opinion. The beach template would be designed by USACE and approved by NPS.

#### 4.1.2 Special Purpose Hopper Dredging with Placement in Deep Scour Holes.

The Wilmington District has two shallow-draft special purpose hopper dredges, the “Murden” and the “Currituck”. Special purpose hopper dredges have not been previously authorized to work in the entire corridor area, therefore no approvals for open water placement currently exist. These vessels typically operate during daylight hours approximately 300 out of 365 days per year, 12 hours per day. Both dredges are capable of dredging at a minimum depth of 5.5 feet of water partially loaded and 8 feet fully loaded, and both have two dragarms with dragheads (2.0 feet by 3.00 feet in size) that pump material at 100-110 HP into a hopper that can overflow to obtain an economic load. Once the hopper is full (~300 to 500 CYs) the dredged material would be placed by opening the split-hull hopper in naturally occurring scour holes, 14 feet deep or greater below mean low water (MLW), within the channel limits in Lookout Bight (Figure 7). These dredges are used to remove small and/or isolated, regularly occurring shoals when contract dredging is not scheduled. Special purpose hopper dredging is proposed to occur during the October 1 – March 31 timeframe as per NMFS and North Carolina Division of Marine Fisheries (NCDMF) recommendations, to minimize impacts to SAV, blue crab spawning and egg/larval stages of fish. In addition, USACE will maintain a 100 foot buffer from all SAV during placement of dredged material within deep scour holes or sidecasting in the Barden Inlet area during the October 1 – March 31 timeframe. Should an unexpected weather event occur that requires dredging outside the October 1 – March 31 timeframe, the USACE would coordinate with resource agencies prior to dredging.

Each hopper dredging event would be expected to last for 1-2 weeks.

Deep water areas may shift over time, therefore fixed deep water placement areas are not proposed. This alternative to nearshore placement avoids the need to traverse Barden Inlet and therefore is a safer option for the dredges and crew; also, deep water placement adjacent to the channel would significantly reduce travel time per load. Deep water placement also would retain these valuable sediments within the system, decreasing rates of erosion and habitat loss.

#### 4.1.3 Sidecast Dredging

The Wilmington District presently has one sidecast dredge, the “Merritt.” The Merritt is capable of dredging in a minimum depth of 4-5 feet of water, has two adjustable dragarms with dragheads (2 feet by 3 feet in size), has a 12-inch discharge pipe that is 80 feet long, and has an available 10-foot pipe extension. The suction pump horsepower is 110 HP. The Merritt casts material approximately 100 feet from the centerline of the vessel (80 feet from starboard or port side) into adjacent open waters where the predominant currents carry the sediments away from the channel. As with the special purpose hopper, the sidecaster operates only during daylight hours (12 hours/day).

Due to its shallow draft capability, the sidecast dredge is often the only method of dredging available for shoal removal. The Merritt is often used for digging pilot channels in order for the special purpose dredges or contract dredge to deepen to project depth. Sidecast dredging takes less time than special purpose dredging, since transit time for dredged material placement is not required. When maintenance dredging is required and other dredge types are not available, USACE proposes to sidecast dredge.

Sidecast dredges have been previously authorized to work only within the Barden Inlet area, therefore no approvals for sidecasting currently exist within the remainder of the project area. USACE proposes to sidecast adjacent to all channels in the project area, only during the timeframe of October 1 – March 31 to minimize impacts to SAV, blue crab spawning and for egg/larval stages of fish, and only as needed during that period. In addition, USACE will maintain a 100 foot buffer from all SAV during placement of dredged material within deep scour holes or sidecasting in the Barden Inlet area during the October 1 – March 31 timeframe. Should an unexpected weather event occur that requires dredging outside the October 1 – March 31 timeframe, the USACE would coordinate with resource agencies prior to dredging. Sidecast dredging is expected to occur annually for a period of 1-2 weeks per event.

#### 4.2 Alternative 1 – No Action.

The No Action alternative would result in no dredging of the Back Sound to Lookout Bight or NPS navigation channels. These channels have not been adequately maintained over the last 20 plus years due to lack of Federal funding. Neglecting to dredge these channels will continue to result in more detrimental effects on the surrounding communities, including Harkers Island and CALO.

It is difficult to assess the future specific effects if dredging does not occur for another 20 plus years; however, the number of boaters running aground due to shoaling is already significant and may increase. Also, in the absence of a safe navigation channel, USCG would likely pull the remaining navigation aids, leaving it to be marked by only private aids. Some of the aids have already been removed due to the shallow conditions. Ferry service to CALO could eventually be forced to discontinue operations, and public visitation would dramatically decline.

It is USACE's responsibility to maintain the Channel from Back Sound to Lookout Bight navigation project, but it is funding dependent. Although taking no action is not a viable option, it is carried forward for comparison purposes in the detailed analysis of the Affected Environment and Environmental Effects in Section 5.

4.3 Alternative 2 – Maintenance Dredging of Back Sound to Lookout Bight with a navigation corridor for the full project (no fixed channel portion); NPS channels would follow natural deep water (Full Project Corridor alternative).

Alternative 2 includes a large corridor (approximately 2,236 acres) that encompasses the entire Back Sound to Lookout Bight project area (Figure 8). The authorized USACE channel dimensions for Back Sound to Lookout Bight (as mentioned above) would be dredged following the deepest natural water within the corridor, and the NPS channels (described above) would connect to the USACE channel and would follow natural deep water to access the docks. The potential to dredge following deep water could occur anywhere within the corridor limits (Figure 8) and all the dredge types and placement options described above in Section 4.1 may be used to maintain the channels within the full corridor.

Sediment samples do not exist throughout the Back Sound corridor (as described in Section 5.1 and Figure 10). Sampling would need to be done to determine sediment grain size prior to dredging. Currently, there is no existing upland placement area for fine-grained material.

Alternative 2, a full project corridor, was not selected as the proposed action because recent and past surveys show very little natural deep water within the larger corridor; therefore, there is no benefit in proposing a full project corridor, which would only be useful if there were enough deep water areas to reduce dredging and in turn, save money and decrease the areas of disturbance.



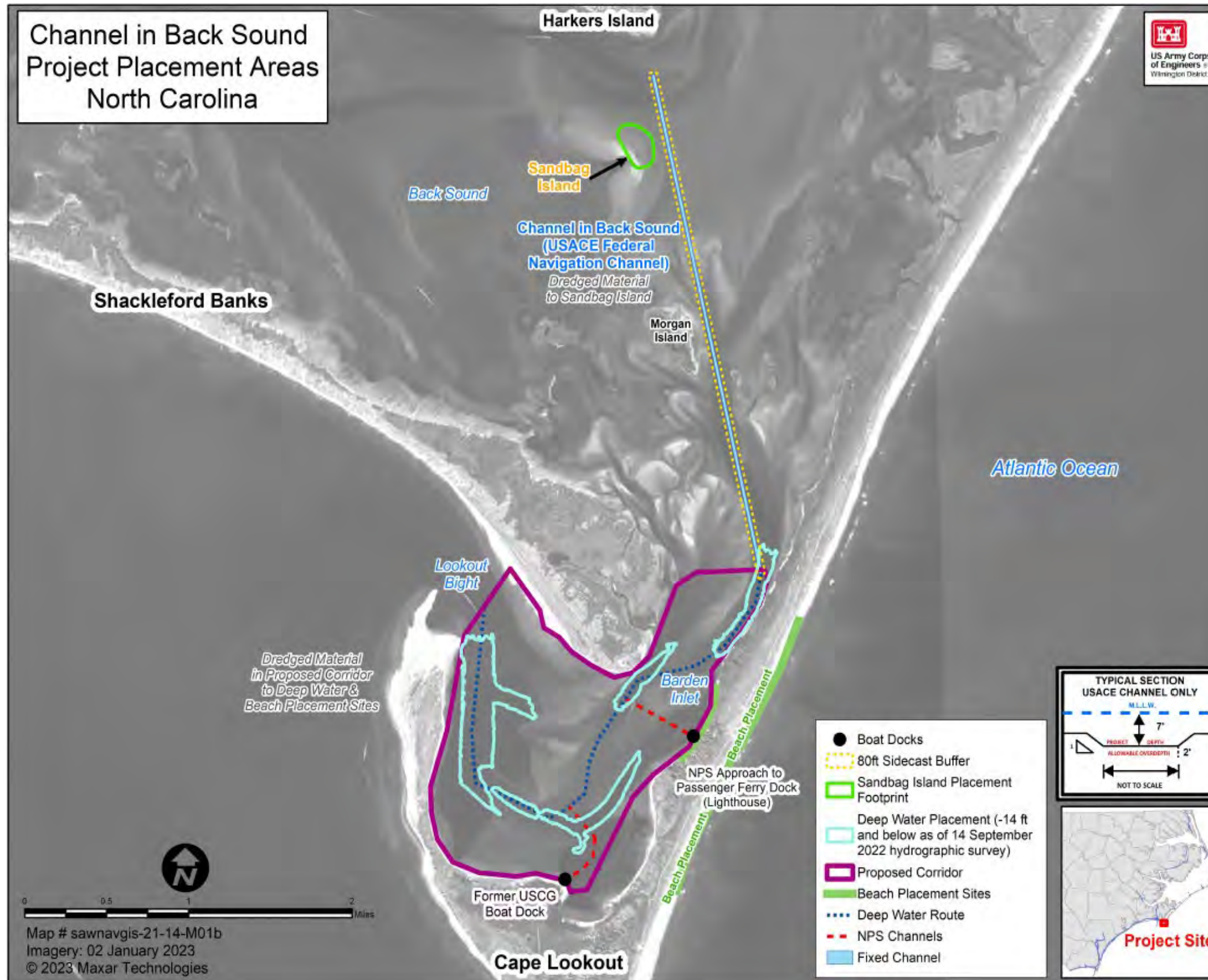


Figure 7. Proposed Dredged Material Placement Areas

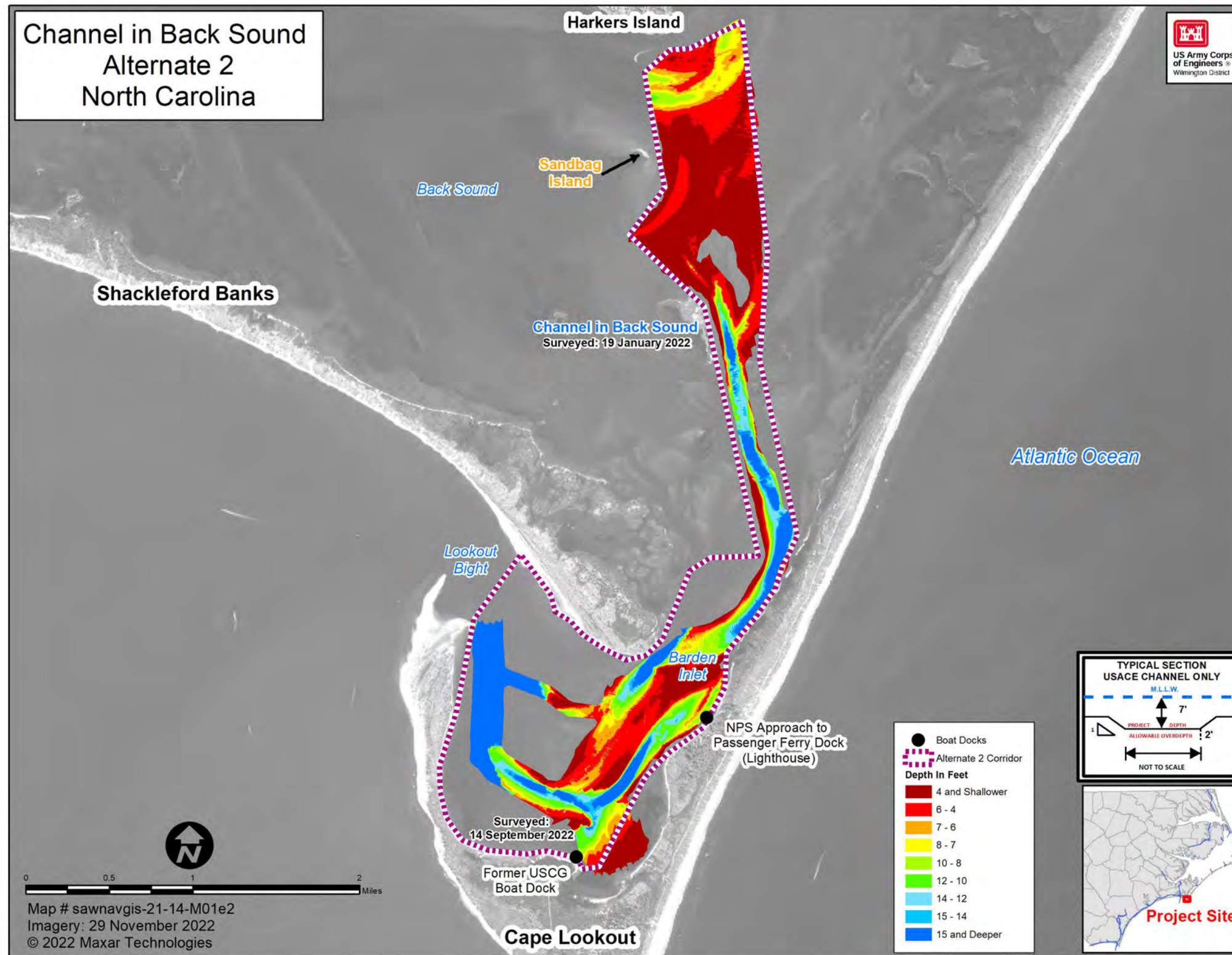


Figure 8. Alternative 2, Full Project Corridor

4.4 Alternative 3 (Preferred Alternative) – Maintenance Dredging of Back Sound to Lookout Bight along fixed alignment for the northern portion and navigation corridor for the southern portion; NPS channels would follow natural deep water (Partial Project Corridor alternative).

Alternative 3 proposes all of the same dredging and placement options as Alternative 2 and as described in Section 4.1; however, Alternative 3 differs from Alternative 2 in that it includes a fixed, linear channel through Back Sound to Barden Inlet, (following the historical route of this portion for the USACE federal navigation channel) instead of a navigation corridor (Figure 9). A corridor for only Barden Inlet and Lookout Bight would be established (approximately 1,359 acres, same as Alternative 2) with the USACE channel following the deepest natural water within the corridor, and the NPS channels would connect to the USACE channel, following natural deep water to access the docks.

A fixed channel through Back Sound is the preferred alternative because it meets the stated purpose and need since there is no deep water in the vicinity of the northern portion. It would be more economical to follow a fixed alignment, particularly once the channel is reestablished with the first pipeline dredging and would also decrease areas of disturbance.

Similar to Alternative 2, establishment of a navigation corridor in Lookout Bight would provide flexibility and cost savings in maintaining the USACE and NPS navigation channels. Maintenance dredging would be limited as much as possible and would only be performed in shoaled areas that require dredging to sustain the authorized channel dimensions.

Authorized USACE and NPS channel dimensions, dredging methodology and placement options would remain the same as Alternative 2. Alternative 3 is the least environmentally damaging practicable alternative (LEDPA).

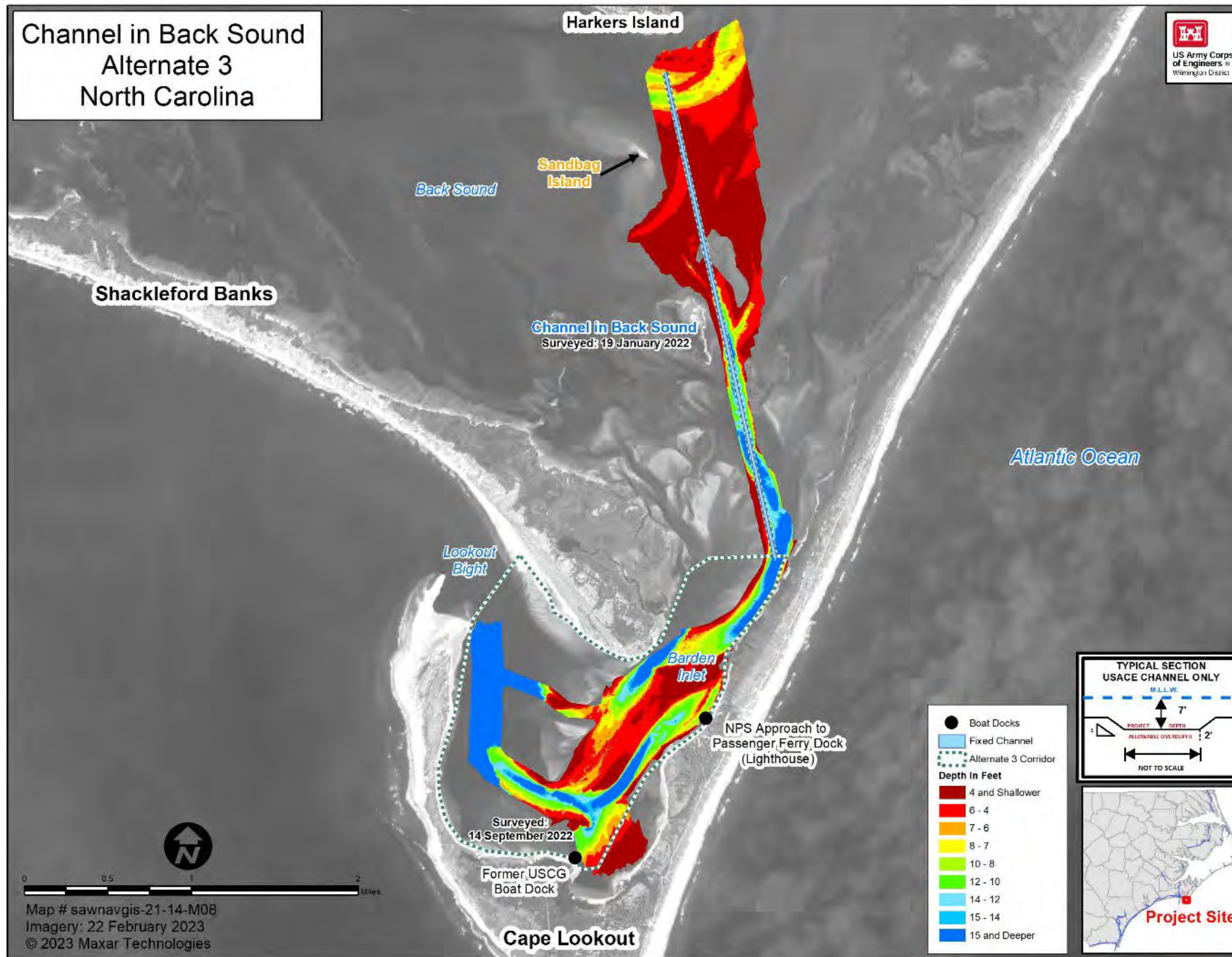


Figure 9. Alternative 3, Partial Project Corridor

## **5.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS**

The affected environment includes all resources that may be affected by dredging and dredged material placement associated with maintenance of the USACE and NPS channels, including areas of Back Sound, Barden Inlet, Lookout Bight, Sandbag Island, Morgan Island, and the CALO soundside and oceanside shorelines. This section also examines and describes the direct and indirect effects on each resource category from implementing the three alternatives described in Section 4.

The impacts of dredging and placement associated with each dredge type (contract pipeline, Government Plant sidecaster and special purpose hopper) will be evaluated in the discussion of effects for each applicable resource, since more than 20 years have passed since dredging occurred in the project area. The area of potential effect (APE) includes the north and south channel corridors, Sandbag Island, Morgan Island, Lighthouse beach, CALO oceanside beach, and deep open/water (Figure 4).

The impacts of these activities will be addressed for the three alternatives described above as 1) No Action; 2) Full Project Corridor Alternative; and 3) Partial Project Corridor Alternative (Preferred). It should be noted that the impact assessments below assume that pipeline dredging would occur during relevant placement periods for nesting sea turtles (November 16 – April 30) and shorebirds (September 1 – March 31) and Government Plant dredging would occur between October 1 and March 31, to the maximum extent practicable.

### **5.1 Sediments**

The Channel from Back Sound to Lookout Bight study area encompasses a ferry route from Harkers Island to the NPS ferry dock adjacent to the Cape Lookout Lighthouse. The ferry route connecting to the NPS ferry dock is shallower than the authorized project depth (-7 feet MLLW with 2 feet of allowable over depth). Geotechnical investigations to characterize the grain size of the shoaled sediments to be dredged were conducted to determine the appropriate dredged material placement options.

Two geotechnical investigations involving the collection of vibracores were performed across the project area (Figure 10), the first was in 2004-2005, and the second was in 2022. The purpose of these investigations was to analyze the subsurface sediments and determine whether the sediments were suitable for beach or bird island placement.

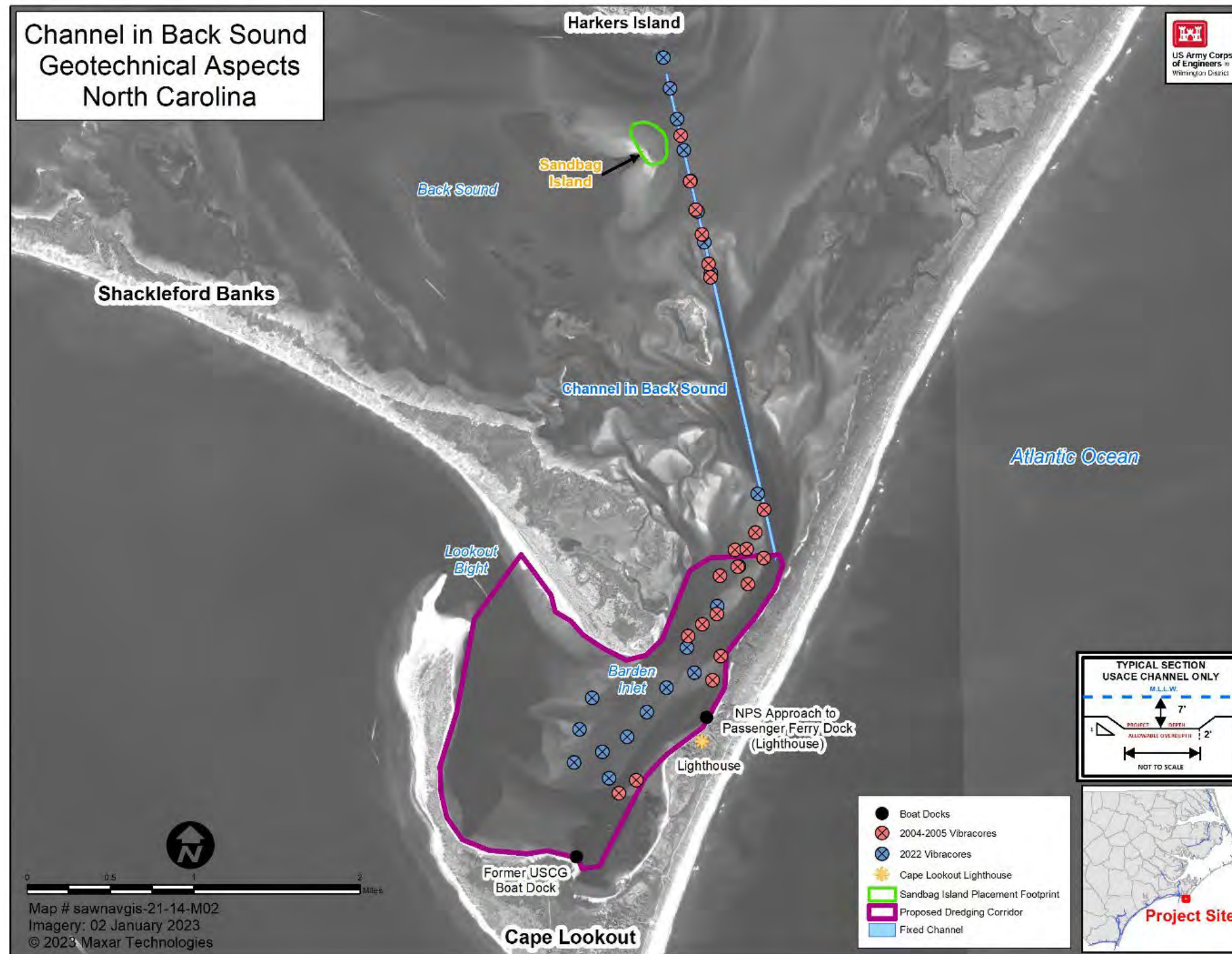


Figure 10. Location of 2004-05 and 2022 USACE Vibracores

Vibracores were strategically placed to target areas of significant shoaling. Areas deeper than -9 feet MLLW were not sampled since dredging would not occur in these locations. If naturally deep-water areas shoal in, additional geotechnical investigations may be conducted if adequate subsurface information is not available within the surrounding area.

In conjunction with the 2004-2005 vibracore investigation, the native grain size was determined for the soundside beach in front of the Cape Lookout Lighthouse. The native grain sizes on Lighthouse beach resemble the material found in the subsurface investigations from 2005 and 2022. On occasion, when Lighthouse beach has reached capacity, placement of dredged material may occur on the oceanside beach where grain size has not been determined; prior to this occurring, grain size of the native beach will need to be determined by NPS for compatibility with the dredged material. Knowing the native grain size helps make the best sedimentological match for the respective beach.

The native grain size of Lighthouse beach was determined by collecting a total of 45 grab samples across 9 profile lines. The grab samples along each profile came from the dune toe, berm, mean high water line, mean sea level line, and mean low water line. Following the collection of these grab samples, a stack of sieves was used to provide grain size distributions, which were then used to determine: mean, percent passing the No. 200 sieve, and standard deviation (sorting; Table 1).

Table 1. The 2004 native grain size assessment of the soundside beach adjacent to Cape Lookout Lighthouse.

<b>Native Grain Size (Soundside Beach)</b>			
Passing No. 200 Sieve	Mean (mm)	Mean (phi <sup>1</sup> )	Std. Dev. (phi)
2.5%	0.45	1.15	0.92

From 2004-2005, twenty vibracores were collected across the study area, specifically, the fixed portion of the USACE Federal navigation channel (northern section) and shoals within the Lookout Bight area (southern section). Sediments within the fixed portion of the USACE channel (CLO-04-V-001 to CLO-04-005) were predominantly comprised of very fine to fine grained sand with clay interbedding. The mean grain size within those vibracores were 0.18 mm (2.46 phi), percent fines (clays and silts) of 3.3%, and standard deviation of 0.71 mm (0.50 phi). Vibracores collected within Lookout Bight (CLO-05-V-001 to CLO-05-V-015) were predominately comprised of fine to medium grained quartz sand. The mean grain size within those vibracores was 0.28 mm (1.86 phi), percent fines (clays and silts) of 1.9%, and standard deviation of 0.64 mm (0.65 phi).

In 2022, a second geotechnical investigation was performed to confirm the subsurface sediments that were found in 2004-2005 in the Back Sound channel and more

<sup>1</sup> A sediment particle size, defined as the logarithmic transformation of the geometric Udden-Wentworth grain size scale. Phi can be converted to mm. When calculating overfill ratios and performing sediment compatibility analysis it is helpful to know this unit of measurement.

extensively in the Lookout Bight area (Figure 10). A total of twenty-one vibracores were collected throughout the study area. As seen in the 2004-2005 geotechnical investigation, sediment characteristics still differed significantly from cores that were collected in the fixed portion of the federal channel (northern section), versus cores collected from the shoaling areas in Lookout Bight (southern section). Vibracores collected in the fixed portion of the Federal navigation channel (CLO-22-V-001 through V-009; northern section) were predominantly comprised of fine-grained quartz sand with clay interbedding. The mean grain size within those vibracores were 0.22 mm (2.40 phi), percent fines (clays and silts) of 4.63%, and standard deviation of 0.66 mm (0.61 phi). Vibracores collected within Lookout Bight were largely comprised of fine to medium-grained quartz sand with notably higher percentages of shell content (Figure 11). The mean grain size within those vibracores was 0.38 mm (1.42 phi), percent fines (clays and silts) of 1.12%, and standard deviation of 0.55 mm (0.85 phi). Table 2 provides a comparison of the grain size statistics from the two geotechnical investigations relative to the native grain size along the soundside beach.

Table 2. Comparison of grain size statistics of the northern vs. southern section of the study area relative to the native grain size of the soundside beach.

<b><u>Location</u></b>	<b><u>Mean (mm)</u></b>	<b><u>Percent Fines (Clays/Silts)</u></b>	<b><u>Sorting (phi)</u></b>	<b><u>Overfill</u></b>
<b>Northern Section</b>	0.22	4.63 %	0.61	>2 (Unstable)
<b>Southern Section</b>	0.38	1.12 %	0.85	1.60
<b>Native Beach</b>	0.45	2.50 %	0.92	N/A

The two geotechnical investigations show similar results and confirm that the material types have remained similar over the last several years. Subsurface sediments within the fixed portion of the Federal navigation channel (northern section) are most suitable for placement on Sandbag Island and/or Morgan Island, and sediments just west of the lighthouse would be suited for placement on the soundside beach. Although the vibracores within the Federal navigation channel indicate greater than 90 percent sand, the mean grain size is much finer than the native soundside beach. Figure 11 shows the northern section grain size curve skewed very far to the right straddling the boundary between fine sand and silt/clays, while the southern section grain size curve closely resembles the native beach grain size curve and is skewed to the boundary near the fine to medium sand.



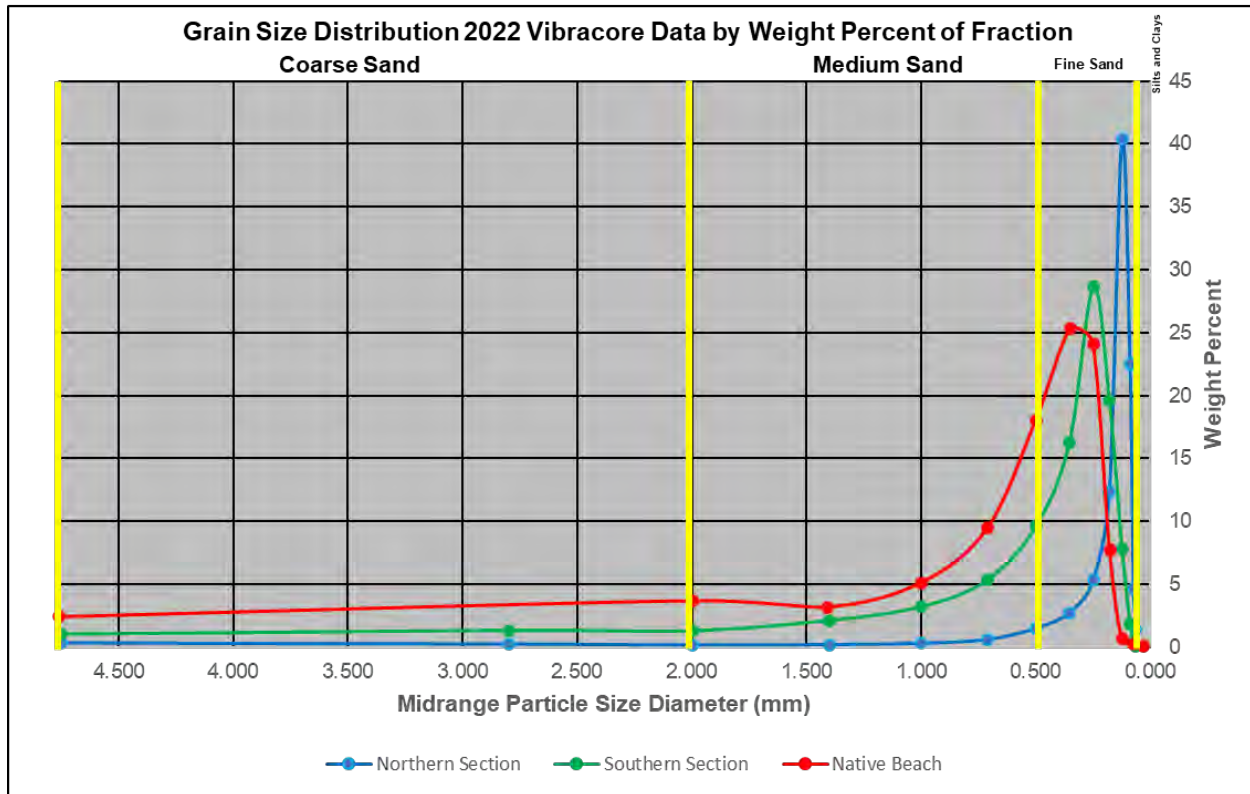


Figure 11. Grain size distribution curves showing the midrange particle diameter (mm) from the 2002 data comparably to each location.

In the southern section, sediments collected from the 2022 vibracores indicate suitable material for soundside beach placement. As with the 2005 vibracore data, subsurface sediments indicate very similar material.

### Environmental Consequences- Sediments.

#### Alternative 1 - No Action:

Under the No Action alternative, USACE would not dredge the USACE or NPS channels, therefore no dredging-related impacts on sediments would occur. Any changes to sediments would be due to natural occurrences from wind, wave, and tidal processes.

#### Alternative 2 – Full Corridor:

Establishing a corridor for the entire project area would allow USACE and NPS channels to follow best, natural deep water may result in the least amount of dredging needed to maintain navigation if there are deep water areas within the corridor. Removing the sediment from a channel following deep water anywhere within the corridor would likely result in a meandering path that extends a longer distance than a linear path. Between dredging events, currents may fill in the previous established channel and create new areas of deeper water, so that dredging in new areas may be

required during the next dredging event. Following dredging events there will be minor impacts to shoaling rates within the dredged areas; it is likely that shoaling rates will increase where dredging occurs. It is anticipated that frequency of dredging will occur on an as needed basis (based on shoaling rates) to maintain a navigable route. Dredged areas where subsurface information is absent would need to be investigated prior to dredging to determine the appropriate placement location for that material.

The northern portion of the project through Back Sound is heavily shoaled in and requires the most amount of dredging to establish full channel dimensions as authorized. Between 1959 and 1997, sediments within the historic fixed channel have been dredged regularly using contracted pipeline dredge. Historically, this channel would shoal in between dredging events, requiring regular maintenance to sustain a navigable route. Maintenance dredging would result in direct sediment removal from the channel, which would be expected to result in minor indirect changes to sediment dynamics within the system since dredged material, placed on either Sandbag or Morgan Island for restoring bird nesting habitat, would remain in the system. Initial dredging within this portion of the project would use a pipeline dredge and be expected to remove approximately 159,707 CYs, with placement of this material on Sandbag Island; the use of Morgan Island as a placement option would be considered for future maintenance dredging events should the island need sand. When dredged by sidecast dredge, material would be cast into adjacent waters, keeping it in the system. Special purpose hopper dredging would relocate sediments to deep waters (scour holes) within Lookout Bight, since very little deep water exists in Back Sound. Sediments in the Back Sound channel were tested in 2004-2005, then again in 2022. If there are significant changes to the location of the channel to follow deep water, new areas of sediment not previously dredged, would need to be dredged. This may require additional subsurface sampling to determine the grain size, which is required to ensure the appropriate placement location is used. There is currently no approved site for placement of fine-grained material.

In the southern section, near Barden Inlet and Lookout Bight, sediments are more dynamic due to the proximity to the Atlantic Ocean. This area's bathymetry contains numerous shoals and naturally occurring deep water due to daily tidal exchange. Although dredged material quantities are less than the northern section, dredging within this area would likely be more frequent due to sediments being more dynamic. Subsurface information indicates extensive presence of beach-quality sediments and previously collected data indicate shoaled sediments follow this trend. Initial dredging within this portion of the project is expected to remove approximately 37,605 CYs of beach quality sand from USACE and NPS channels that would be beneficially used by placing it onto the CALO Lighthouse beach to protect the historic structures threatened by erosion. The soundside beach near CALO Lighthouse has severely eroded to where historic structures are being compromised. Placing material on Lighthouse beach would add much needed protection for these structures. Although maintenance dredging in the southern section would result in direct sediment removal from the channel areas, all placement alternatives would keep the material in the system, resulting in minor indirect changes to sediment dynamics in the vicinity of Barden Inlet and Lookout Bight.

Overall, sediments removed from USACE and NPS channels would not be removed from the system, since placement options would be in close proximity to dredged areas and dredged material would not be placed into confined upland areas. Long-term, maintenance dredging would have minor impacts on sediment dynamics since sediments periodically removed from all channels would not be lost to the system but would be redistributed within the system. This would avoid any possibility of creating a sediment starved environment.

#### Alternative 3 – Partial Corridor (Preferred Alt):

Dredging effects on sediments within USACE and NPS channels related to Alternative 3 are expected to be the same as Alternative 2 in Barden Inlet and Lookout Bight. In Back Sound, however, a fixed, linear channel would be cut through the shoal, in the same location, following the historic route maintained in the past.

Material within the fixed channel has been tested (as described above) and is suitable for placement onto either Sandbag or Morgan Island. Initial dredging within this portion of the project is expected to remove approximately 159,707 CYs, the largest volume of sediment to be dredged for this project, with placement on Sandbag Island; the use of Morgan Island as a placement option may be considered in future maintenance dredging events. Following initial pipeline dredging to full dimensions for all channels, it's expected that maintenance events would result in the need for less dredging, since sediment quantities to be removed would be expected to be less.

## 5.2 Water Resources

### 5.2.1 Hydrology

Water depths in Back Sound are very shallow in most areas of the project, averaging 3 to 4 feet MLLW. Tides are semi-diurnal (two tidal cycles per day), with a mean tidal range (difference between mean high water and mean low water) of 3.11 feet, at nearby NOAA station 8656483, located at the Duke Marine Lab in Beaufort, NC. Mean Sea Level (MSL) is equivalent to -0.37 feet NAVD88 at this location (NOAA, no date). Barden Inlet waters are naturally deep to the west alongside the tip of Shackelford Banks and to the east on the soundside of CALO, north of the Lighthouse (Figure 2). These deep areas are connected by waters 7-8 feet deep, the course currently taken by marine traffic. Shoals 1-2 feet below MLLW surround the inlet, allowing only low tidal flushing within Back Sound.

The estuarine waters of Back Sound and the surrounding area display considerable daily variation in current and salinity conditions due to freshwater inflow, tides, and wind. Regular reversals of flow occur with each tidal cycle. Northeast winds blow steadily in the winter months, creating fetch from Core Sound and can create noticeable differences in tide level.

The Albemarle-Pamlico estuary system has seasonal salinity cycles, with the highest salinity occurring from September to November, the lowest from February to April (NOAA, no date). During periods of high salinity, waters adjacent to the national

seashore Back Sound can have a salinity greater than 25 parts per thousand (ppt) due to the proximity to the inlet and the ocean. During low salinity periods, waters in Back Sound adjacent to the eastern half of Shackleford Banks have an average salinity of 15 to 25 ppt. Annual ocean water temperatures off of the Outer Banks ranges from approximately 50° to 80°F (NOAA, no date).

### **Environmental Consequences - Hydrology.**

#### Alternative 1 - No Action:

Under the No Action alternative, USACE would not dredge the project, therefore there would be no dredging-related impacts on hydrology (changes to salinity, tides, etc.). Any changes to hydrology would be due to natural occurrences.

#### Alternative 2 – Full Corridor:

Dredging the proposed project within the full corridor may increase flow potential through Barden Inlet into Back Sound in areas where sediment is removed. In the northern portion where shoaling is apparent, dredging will result in increases to water depths within the channel, possibly having minor, short-term effects on salinity and flow due to the new channel geometry. In open water areas where sediment is placed, a decrease in water depth would result in a slight increase in water velocities. However, in comparison to the size of the inlet complex, impacts within the area of impact would be minor, temporary, and would not affect the overall hydrology of the area. Dredging within the proposed Lookout Bight corridor, including the NPS channels, would be minimized by allowing natural deep water to dictate where the channels are, therefore allowing flow and salinity levels to resemble their natural state.

Other placement activities, such as placement in deep water holes and on the oceanside beach, can alter hydrologic patterns in some cases. Any decreases in depth due to placement in deep water holes would increase the velocity of flow over these areas and placement on the ocean beach would cause a temporary change in beach slope, which would alter wave dynamics. However, volumes dredged from this channel will be relatively minor, especially compared to volumes moved during a typical beach renourishment event.

#### Alternative 3 – Partial Corridor (Preferred Alt):

The effects on hydrology related to Alternative 3 are expected to be the same as Alternative 2.

#### 5.2.2 Water Quality and Characteristics.

The project area is in North Carolina Division of Water Resources (NCDWR) White Oak River basin and U.S. Geologic Survey (USGS) Hydrologic Unit 03020301.

The Clean Water Act (CWA) of 1972 requires that the surface waters of each state be classified according to designated uses. North Carolina's tidal salt waters are classified with the following categories:

- Class SC: Secondary Recreation (i.e., fishing, boating) and Aquatic Life Propagation
- Class SB: Primary Recreation (swimming) plus SC uses
- Class SA: Commercial Shellfish Harvesting plus SC/SB uses
- HQW: High Quality Waters (all SA waters; excellent quality)
- OWR: Outstanding Resource Waters (all HQWs; outstanding fish habitat/fisheries)

The NCDWR classifies Back Sound at the project site as SA and OWR. The SA waters are protected for commercial shellfish along with all designated SB and SC uses. Class SA commercial shellfish waters in Back Sound are assigned a Shellfish Growing Area Status of "Approved" based on NCDMF Shellfish Sanitation fecal coliform criteria. The OWR waters are a subset of HQW having excellent water quality and of exceptional significance.

Lookout Bight is considered part of the Atlantic Ocean contiguous to the White Oak River Basin. It is classified as SB tidal salt waters protected for all SC uses in addition to primary contact recreation. Primary contact recreational activities include swimming, skin diving, skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis.

If a waterbody does not meet the state designated use standards, it is considered impaired and is placed on the 303(d) list. There are no designated 303(d) waters within the project area.

The potential water quality impacts of dredging and dredged material placement include minor and short-term suspended sediment plumes and the release of soluble trace constituents from the sediment. Suspended sediments also affect turbidity, an optical property of water (measured in nephelometric turbidity units, or NTUs) that affects light penetration into the water column. During dredging, turbidity increases outside the dredging area should be less than 25 NTUs to be considered insignificant. In the case of overflowing Government-owned hopper dredges to obtain economic loading, sediment that is  $\geq 90\%$  sand is not likely to produce significant turbidity or other water quality impacts, since material is expected to dissipate in the water column relatively rapidly (USACE 1997).

Section 401 Water Quality Certifications (WQC) under the Clean Water Act of 1977 (PL 95-217) are issued by NCDWR for projects that result in a regulated discharge of material into waters or wetlands. Pursuant to 33 C.F.R. § 335.7, and meeting the environmental standards established by the Clean Water Act Section 404(b)(1) evaluation process, a draft 404(b)(1) guidelines analysis for dredging USACE channels is included as Appendix C. Discharges associated with dredging are considered

incidental to the dredging operation, and therefore, are not considered as a discharge addressed under the *Section 404(b)(1) Guidelines Analysis*. Section 10/404 authorization for dredging of NPS channels and placement of dredged material will be evaluated by the USACE Regulatory Division, Wilmington Field Office.

### **Environmental Consequences – Water Quality.**

#### Alternative 1 - No Action:

With the No Action alternative, dredging of the project would not occur; therefore, there would be no effects on water quality.

#### Alternative 2 – Full Corridor:

Initial dredging and maintenance dredging of USACE and NPS channels will result in minor and short-term impacts on water quality as these activities increase the suspended sediments in the water column. Sediments within the fixed portion of the USACE channel and Lookout Bight corridor have been sampled and tested and all material to be dredged has less than 10% fine-grained material and therefore is not likely to result in significant turbidity. Placement of material onto Sandbag Island would utilize geo-tubes, turbidity curtains, and the construction of berms to control effluent and reduce turbidity; future placement on Morgan Island would utilize berm construction made of existing island sand to control effluent. Placement onto beaches will utilize longitudinal berm construction to allow material to settle out, resulting in minor and temporary turbidity increases. Effects on water quality from dredging and placement are expected to be minor, temporary, and localized.

Aside from sediment composition, dredging frequency and duration play a role in water quality. Pipeline dredging would happen infrequently, for approximately 30-45 days every 3-5 years. Government plant dredging would happen more frequently on an annual basis, but would be limited to daylight hours only, allowing time for sediments to settle out. Sidecast and special purpose hopper dredging are proposed to occur for 1-2 week periods during the October 1 – March 31 timeframe.

Alternative 2 dredging impacts may occur anywhere within the corridor in the northern and southern portions of the project. Although authorized channel dimensions would be the maximum dimensions maintained, the full corridor alternative encompasses a much larger area of shallow water estuarine habitat (approximately 877 acres) as compared to the fixed channel (approximately 30 acres) for Alternative 3, so the effects of dredging and sidecasting of dredged material may occur over a larger area, with new areas potentially affected with each dredging/placement event.

The required WQC authorizations will be obtained prior to dredged material placement and all conditions of any WQC will be met. For USACE channels, WQC coverage would be required for dredged material placement onto Sandbag and/or Morgan Islands via

control of effluent, previously authorized NPS soundside and oceanside beaches, and open water placement from Government plant sidecasting and special purpose hopper dredging. For NPS channels, the WQC would be required for placement of dredged material onto previously authorized NPS soundside and oceanside beaches, and open water placement from Government plant sidecasting and special purpose hopper dredging.

Section 404 and accompanying WQC authorization will also be required by the NPS for the regulated discharge of dredged material, pursuant to the Clean Water Act, in the form of a Department of the Army (DA) permit. This would be required for impacts related to NPS dredging and dredged material placement. A Section 404(b)(1) Guidelines Analysis for USACE channel maintenance dredged material placement has been completed and is available in Appendix C.

#### Alternative 3 – Partial Corridor:

Impacts related to dredging in the northern section would only occur within the vicinity of the fixed channel alignment, so effects would be limited to the area adjacent to the fixed channel, rather than occurring over the larger estuarine area included in Alternative 2. In the southern section, effects to water quality related to Alternative 3 are expected to be the same as Alternative 2 (minor, short-term impacts).

Clean Water Act, Sections 401 and 404 authorizations for USACE and NPS channel maintenance would be the same as Alternative 2.

#### 5.2.3 Wetlands and Floodplains.

Coastal wetlands in the project vicinity include estuarine emergent wetlands, or tidal salt marshes located along the shorelines and the island fringes in the area. These marshes are comprised mainly of smooth cordgrass (*Spartina alterniflora*) and saltmeadow cordgrass (*Spartina patens*) and are generally more extensive where they are protected from wind and wave action. Intertidal wetlands of the area are very important ecologically due to their high primary productivity, their role as nursery areas for larvae and juvenile stages of many marine species, and their refuge/forage value to wildlife. In addition, they provide esthetically valuable natural areas.

Estuarine emergent wetlands are characterized by erect, rooted, herbaceous plants that are predominantly perennial and represented by salt marsh communities that are dominated by smooth cordgrass (*Spartina alterniflora*) and saltmeadow cordgrass (*Spartina patens*). Emergent wetland areas are located outside the channels to be dredged, so they will not be directly affected by dredging. Placement areas where wetlands may be present in the vicinity would be coordinated with the appropriate resource agencies prior to dredged material placement. There may be fringing wetlands within the pipeline alignment from the dredge to the placement area, and any wetlands would be identified and avoided to the maximum extent practicable. Placement of beach

quality sand within these areas would reduce risks to shorelines from erosion and sea level rise.

### **Environmental Consequences – Wetlands and Floodplains.**

The NPS Procedural Manual PM 77-1, Wetlands Protection, defines unvegetated wetlands to include beaches from MLLW to mean higher high water (MHHW). Typically, NPS-managed beaches receiving dredged material require a Wetlands Statement of Finding (WSOF). Per the NPS (*June 16, 2023, email communication with CALO Superintendent Jeff West*), a WSOF is not required for placement of dredged material on CALO beaches. This is based on NPS internal policy that there is no net loss of waters if the proposed beach slope is similar to the existing beach.

Executive Order 11988 (Floodplain Management) states that federal agencies shall avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative, Federal agencies shall take action to reduce the risk of flood loss, and minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

Under Executive Order 11990 (Protection of Wetlands), Federal policy recognizes that wetlands have unique and significant public values and calls for the protections of wetlands. Policy directives set forth in Executive Order 11990 are, (a) avoid long- and short-term adverse impacts associated with the destruction or modification of wetlands; (b) avoid direct or indirect support of new construction in wetlands; (c) minimize the destruction, loss, or degradation of wetlands; (d) preserve and enhance the natural and beneficial values served by wetlands; and (e) involve the public throughout the wetlands protection decision-making process.

No alternatives considered would adversely affect wetlands or floodplains or alter their function since jurisdictional wetlands pursuant to Section 404 of the Clean Water Act are located outside of all dredging and dredged material placement locations. Work would be in full compliance with Executive Orders 11988 and 11990 following completion of the NEPA process. Likewise, no alternatives considered would result in hydrologic or salinity changes affecting wetlands.

### **5.3 Air Quality**

Cape Lookout National Seashore is subject to Federal and State of North Carolina air regulations. National Ambient Air Quality Standards (NAAQS) have been established by the EPA. No air quality monitoring stations are located within the park boundaries or in the adjacent coastal areas. Therefore, there is no representative quantitative data for the national seashore area. Monitoring in the state occurs principally in the more densely populated areas. Review of monitoring data for inland eastern North Carolina, and the absence of monitors in the coastal area imply that concentrations of the criteria



pollutants in the CALO National Seashore area are well below standards. Areas are classified under the Federal Clean Air Act as either "attainment" or "non-attainment" areas for each criteria pollutant based on whether the NAAQS have been achieved or not. When an area has been designated as "attainment" after having been "non-attainment", it is also classified as a maintenance area.

Section 176(c)(1) of the Clean Air Act (CAA) (42 U.S.C. 7506(c)(1)) requires Federal agencies to assure that their actions conform to applicable implementation plans for achieving and maintaining the NAAQS for criteria pollutants.

The NC Division of Air Quality (NCDAQ) website (<http://deq.state.nc.us>) indicates that Carteret County is in attainment for fine particles, ozone, and sulfur dioxide pursuant to the NAAQS. The Wilmington Regional Office of the NCDAQ has air quality jurisdiction for the project area.

Analysis of greenhouse gas emissions for dredging equipment use, duration, and frequency is included in Section 5.10, Climate Change and Sea Level Change.

### **Environmental Consequences – Air Quality.**

#### Alternative 1 - No Action:

The No Action alternative would result in no dredging and will have no effect on the local or regional air quality.

#### Alternative 2 – Full Corridor:

Dredging the proposed project is not expected to result in adverse effects on air quality within the project area or beyond. Annual dredging volumes have not been determined; however, initial dredging is estimated to take approximately 30-45 days with a pipeline dredge operating 24 hours per day. Maintenance dredging in between regular pipeline events would be expected to be of shorter duration than pipeline events since less material is anticipated. Government plant dredging events would last from 1-2 weeks and only occur during daylight hours, thus avoiding air emissions at night. Dredging and placement operations would result in short-term, localized minor increases in air emissions and would be similar to those impacts occurring during routine maintenance dredging in other nearby locations. Accordingly, there would be no long-term air quality effects and air quality conditions would be similar to existing conditions.

#### Alternative 3 – Partial Corridor (Preferred):

Changes in air quality related to Alternative 3 are expected to be the same as Alternative 2, as dredging durations would not differ substantially.

#### 5.4 Noise.

Noise levels below the water surface within the project area vary throughout the year and often include commercial and recreational boat traffic, in particular daily passenger ferry transport between the months of May and August. Therefore, marine species within the project area are already accustomed to varying levels of motorized noise year-round.

Underwater noise levels associated with dredging and placement activities are expected to comply with Sections 6-28 and 22-33, NC code of ordinances. Dredging operations generally produce low levels of low-frequency sound energy that, although audible over considerable distances from the source, are of short duration (Michel 2013). Sound from a dredge is generated from the drag arm sliding along the bottom, the pumps moving the material, and operation of the ship engine/propeller. The significance of the noise generated by the equipment dissipates with increasing distance from the noise source. The effects of noise from dredging have been determined to have no lethal or injurious effects; behavioral effects on marine species may occur which may disturb feeding, mating, and spawning especially during warmer months.

Noise levels above water would increase during placement activities on either Sandbag or Morgan Island and CALO beaches. Equipment such as bulldozers would be used to move and adjust the pipeline and to push up berms. This may create disturbance to visitors and wildlife that would otherwise not experience anthropogenic noise in such a remote location.

#### **Environmental Consequences - Noise.**

##### Alternative 1 - No Action:

Under the No Action alternative, dredging would not occur, therefore, shoaling would continue and possibly prevent even shallow draft vessels from navigating Back Sound to Barden Inlet. This would reduce noise levels related to ferry boats and other recreational boaters in the area, therefore decreasing underwater noise levels as a result.

##### Alternative 2 – Full Corridor:

While dredging would elevate noise levels somewhat, each pipeline dredging event is expected to be of short duration (30-45 days) and any elevated noise levels would be a disturbance within a very localized area around the dredge and in the placement areas. For maximum efficiency, pipeline operations would occur continuously for 24 hours daily until completion, increasing noise levels anytime from September 1 – March 31 when placing on Sandbag and/or Morgan Island and from November 16 - April 30 on CALO beaches. Birds roosting and foraging within placement areas would be temporarily disturbed during land activity due to increased noise levels, however the length of shoreline affected by noise is small relative to all of the protected shoreline in the area. Visitors to CALO beaches would also be disturbed; however, placement would occur outside of peak tourist season, thereby having less of an effect.

For Government plant dredging, events would last from 1-2 weeks and may occur more than once a year, however only during daylight hours. Sidecast and special purpose hopper dredging is expected to occur between October 1 – March 31, during which underwater noise could occur anytime. As with pipeline dredging, impacts of underwater sound on fish populations are expected to be minor and temporary, because duration of exposure to dredging noise would be short-term and species could easily flee the area. Migrating and spawning fish species are expected to pass the dredge unharmed, as had occurred in the James River, Virginia during a pipeline dredge event while Atlantic sturgeon were migrating. (Balazik, 2020).

Acoustic levels generated by vessels and dredging will not result in injurious or cumulative injurious effects. While the sound generated can result in behavioral effects, the additional traffic from this activity will be limited to specific short term dredging events and is negligible to the continuous vessel traffic in the area.

Sound from dredging within the full corridor is not expected to impact marine mammals in the area, notably whales and dolphins. The critically endangered North Atlantic right whale migrates offshore during the winter months, far enough from the dredging to avoid any behavioral effects.

#### Alternative 3 – Partial Corridor (Preferred):

Changes in noise levels related to Alternative 3 are expected to be the same as Alternative 2, as dredging durations and locations would not differ substantially.

### 5.5 Estuarine Aquatic Organisms.

#### 5.5.1 Nekton.

Nekton collectively refers to aquatic organisms capable of controlling their location through active movement rather than depending upon water currents or gravity for passive movement. Nekton of the nearshore Atlantic Ocean along the northeastern North Carolina coast can be grouped into three categories: estuarine dependent species; permanent resident species; and seasonal migrant species. The most abundant nekton of Back Sound and Lookout Bight waters are the estuarine dependent species that 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*), flounders (*Paralichthys* spp.), mullets (*Mugil* spp.), anchovies (*Anchoa* spp.), blue crab (*Callinectes sapidus*), and penaeid shrimp (*Penaeus* spp.), as well as species that spawn in the estuary, such as red drum (*Sciaenops ocellatus*) and weakfish (*Cynoscion regalis*). Species that are permanent residents of the nearshore marine waters include the black sea bass (*Centropristis striata*), longspine porgy (*Stenotomus caprinus*), Atlantic bumper (*Chloroscombrus chrysurus*), inshore lizardfish (*Synodus foetens*), and searobins (*Prionotus* spp.). Common warm water migrant species include the bluefish (*Pomatomus saltatrix*), Spanish mackerel (*Scomberomorus maculatus*), king mackerel

(*Scomberomorus cavalla*), cobia (*Rachycentron canadum*), and spiny dogfish (*Squalus acanthias*).

Barden Inlet is a passageway for the larvae of many species of commercially and ecologically important fish. Spawning grounds for many marine fishes are believed to occur on the continental shelf with immigration to estuaries, including Back Sound, during the juvenile stage. The shelter provided by the marshes and shallow water habitats within the project area's estuarine waters serves as nursery habitat where young fish undergo rapid growth before returning to the offshore environment.

Marine mammals present in North Carolina's coastal waters include the bottlenose dolphin (*Tursiops truncatus*) and harbor porpoise (*Phocoena phocoena*). These species typically utilize nearshore waters, but only the bottlenose dolphin is present in the inshore areas of Core and Back Sounds. Harbor seals (*Phoca vitulina*) are the only seal expected to occur in NC waters and is a rare winter visitor of Cape Lookout. The federally endangered manatee (*Trichechus manatus*) is also rare, but occasionally finds its way into bays and sounds of the North Carolina coast.

Marine reptiles include four species of federally listed sea turtles that are known to nest on the oceanside beaches of Cape Lookout National Seashore and/or occasionally enter Barden Inlet. These are the green (*Chelonia mydas*), loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), and leatherback (*Dermochelys coriacea*) sea turtles and are discussed more in Section 5.8, Endangered and Threatened Species.

### **Environmental Consequences - Nekton.**

#### Alternative 1 - No Action:

Under the No Action alternative, dredging would not occur, therefore, no impacts would occur to nekton.

#### Alternative 2 – Full Corridor:

Disturbances to nekton, such as entrainment, increases in turbidity, elevated noise, and habitat alteration, would be minor and temporary, affecting a very localized area around the dredging and placement areas, of which nekton can generally avoid.

Entrainment is not expected to occur within the water column since dredge cutterheads and dragheads, when properly operated, are fixed to the sea floor while pumps are engaged. The horsepower of small pipeline and Government plant engines results in a much lower suction power than larger ocean-certified dredges, thus having a low intake velocity and small dredge footprint. Furthermore, pipeline dredges are spudded (anchored) to the seafloor and Government plant vessels travel at a slow speed of 1-4 knots while dredging, allowing mobile species to escape lethal encounters.

Nekton are also expected to avoid sources of increased turbidity and elevated noise which are localized to the dredging and placement areas. This may create a temporary disturbance in certain behaviors but not expected to be injurious. Pipeline dredge events would occur only once every 3-5 years, will be restricted by the sea turtle nesting or bird nesting timeframes, and last a total of 30-45 days. Government plant dredging may occur annually during the months of October 1 – March 31, depending on shoaling, but only last 7-14 days and only during daytime hours.

All dredged material sampled, to date, is  $\geq 90\%$  sand and would be expected to settle through the water column quickly; therefore, dredging and placement events are not expected to adversely impact fish, marine mammals, or marine reptiles in the area.

#### Alternative 3 – Partial Corridor (Preferred):

Effects on nekton resources related to Alternative 3 are expected to be the same as Alternative 2, as dredging durations and locations would not differ substantially and would be limited to the October 1 – March 31 timeframe for Government plant dredging and September 1 – March 31 for pipeline dredging when placing material from Back Sound onto Sandbag and/or Morgan Island and November 16 – April 30 for pipeline dredging when placing material on CALO oceanside beach.

#### 5.5.2 Benthos.

Aquatic organisms that live in close association with the bottom, or substrate, of a body of water, are collectively called benthos. Common benthic organisms associated with soft bottom substrates in the project area would likely include polychaetes, amphipods, decapods, echinoderms, crustaceans, mollusks, flatfish, and some skates and rays. A majority of these species are an important part of the food web that sustains commercial fisheries as well as other invertebrates and bird species. Benthic invertebrates such as shellfish perform important ecological functions in estuaries, such as cleaning sediments, filtering water, and recycling detritus.

#### **Environmental Consequences - Benthos.**

##### Alternative 1 - No Action:

Under the No Action alternative, dredging would not occur, therefore no impacts would occur to benthic resources.

##### Alternative 2 – Full Corridor:

Channel maintenance will be necessary and limited to locations where shoaling occurs. Initial dredging would impact areas of established benthic communities, since maintenance dredging hasn't occurred in 26 years. The areas dredged within the northern and southern corridors could vary according to the deep water channel path. This could potentially allow for more impact area in the northern corridor, since very little deep water exists. Removing sediment from a channel following deep water will likely result in a meandering path that extends a longer distance than a linear path would.

Between dredging events, currents may fill in the previous established channel, resulting in new areas of deeper water, so dredging in new areas may be required during subsequent dredging events. Overall, this would disturb more bottom habitat, affecting the benthic organisms that are well-established in areas not previously dredged.

The 100-foot wide USACE channel would extend approximately 6-7 miles, covering approximately 80 acres of channel bottom. The two, 40-foot wide NPS channels are much smaller, each extending approximately 0.5 mile and covering a total of 5 acres of channel bottom. This is considered the maximum area that could be impacted by dredging; however, only a small percentage would be impacted at any one time (only where shoaling occurs). Areas that remain naturally deep would not be impacted. Overall, initial pipeline dredging likely would result in more impacts on benthos than maintenance of the channels between pipeline dredging events. The biggest impact would occur on the seafloor, resulting in the removal of upper layers of substrate; followed by the burial of benthos on beaches where placement occurs. Placement of large amounts (~300 CY) of material from special purpose hopper dredges may cause smothering of benthos in the open water placement areas. However, removal and burial of benthos and benthic habitat represents a minor resource loss since the channel bottom and dredged material placement areas will become recolonized by benthic organisms within a matter of months. Benthic invertebrates exhibit strong seasonality in reproduction, meaning that the seasonal timing of dredging can influence recovery rates within the limited dredging footprint. In addition, effects to benthos outside the area of dredging and placement is not expected, allowing for the continued presence of these species in the surrounding areas throughout the estuary.

Placement of dredged material onto Sandbag and/or Morgan Island and CALO beaches may have temporary, localized impacts on benthos and benthic habitat. Areas covered up are expected to recover over time, since placement would likely only occur every 3-5 years. Benthos may also be impacted by the placement of dredged material by Government plant. Special purpose hopper placement within Lookout Bight would likely impact benthos in deep water placement areas. Sidecast placement is not expected to smother benthos, as low densities of material are scattered into the water column on an ebb tide while the vessel is in motion. Only a thin veneer of material is expected to accumulate in any one place.

Overall, the affected area would be very small relative to the amount of benthic habitat present on the seafloor throughout Back Sound and Lookout Bight, and the time between dredging events would allow benthic resources to recover; therefore, the ecological significance of benthic losses is considered minor and temporary.

#### Alternative 3 – Partial Corridor (Preferred):

Dredging and placement effects on benthos in Lookout Bight are expected to be the same as Alternative 2; however, effects on benthic resources related to Alternative 3 are expected to impact less acreage than Alternative 2 in the Back Sound area, where the fixed portion of the historically maintained USACE channel would continue to be

maintained in the same location indefinitely. This would result in the same areas being disturbed regularly, reducing the potential area of impact that may occur with Alternative 2. With Alternative 3, regular disturbance of the same areas of benthos would occur, potentially limiting benthic recovery; however, Alternative 3 would not result in disturbance to previously undisturbed habitat.

#### 5.6 Essential Fish Habitat.

The 1996 Congressional amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (Public Law 94-265) set forth new requirements for the National Marine Fisheries Service (NMFS), regional fishery management councils (FMC), and other Federal agencies to identify and protect important marine and anadromous fish habitat. These amendments established procedures for the identification of Essential Fish Habitat (EFH) and a requirement for interagency coordination to further the conservation of federally managed fisheries. The EFH assessment is included in the body of this EA and will be coordinated with NMFS Habitat Conservation Division (HCD) upon its circulation.

The EFH assessment includes fish species managed under MSFCMA that may occur in the vicinity of the project. Categories of EFH and Habitat Areas of Particular Concern (HAPC) for managed species are identified as potentially occurring in southeastern states in the Fishery Management Plan Amendments of the South Atlantic Fishery Management Council.

Tables 3a and 3b show the categories of EFH and HAPC, and species, respectively, located within the project vicinity of Back Sound to Lookout Bight ([www.habitat.noaa.gov/apps/efhmapper](http://www.habitat.noaa.gov/apps/efhmapper)). They include Coastal Migratory Pelagics, Snapper Grouper, Penaeid Shrimp, and Spiny Lobster EFH species of the Mid and South Atlantic. These are described below along with other designated managed fishery habitats within the project area.

Table 3a. Essential Fish Habitat and Habitat Areas of Particular Concern and Potential Impacts (revised from NPS December 2005 EA).

<b>ESSENTIAL FISH HABITAT</b>	<b>Present Near Project Vicinity</b>	<b>Present In Project Area</b>	<b>Effects of Dredging Activities</b>	<b>Effects of Sediment Placement Activities</b>
Estuarine Emergent Wetlands	Yes	No	No	Insignificant
Submerged Aquatic Vegetation	Yes	Yes	Insignificant	Insignificant
Oyster Reefs and Shell Banks	Yes	No	No	No
Intertidal Flats	Yes	No	No	Insignificant
Estuarine Water Column	Yes	Yes	Insignificant	Insignificant
Seagrass	Yes	No	No	No
Mud Bottom	Yes	No	No	No
<b>HABITAT AREAS OF PARTICULAR CONCERN</b>	<b>Present Near Project Vicinity</b>	<b>Present In Project Area</b>	<b>Effects of Dredging Activities</b>	<b>Effects of Sediment Placement Activities</b>
State Primary Nursery Areas	Yes	No	No	No
Submerged Aquatic Vegetation	Yes	Yes	Insignificant	Insignificant



Table 3b. Stages of Mid-Atlantic and Highly Migratory EFH Species that may occur within the Project Area

<b>Species</b>	<b>Adult</b>	<b>Juvenile</b>	<b>Neonatal</b>	<b>Spawning</b>
Atlantic Sharpnose Shark (Atlantic Stock)	x	x	x	
Blacktip Shark (Atlantic Stock)	x	x	x	x
Common Thresher Shark	x	x	x	x
Dusky Shark			x	
Sand Tiger Shark	x	x	x	
Sandbar Shark	x	x		
Scalloped Hammerhead Shark	x	x		
Smoothhound Shark Complex (Atlantic Stock)	x	x	x	x
Spinner Shark	x		x	
Tiger Shark	x	x	x	
Clearnose Skate		x		
Albacore Tuna		x		
Bluefin Tuna	x	x	x	x
Summer Flounder	x	x	x	
Windowpane Flounder		x		
Bluefish	x	x	x	x
Atlantic Butterfish	x	x		
Scup	x	x		

[www.habitat.noaa.gov/apps/efhmapper](http://www.habitat.noaa.gov/apps/efhmapper)

#### 5.6.1 Coastal Migratory Pelagics.

Essential fish habitat for coastal migratory pelagic species includes sandy shoals of capes and offshore bars, high profile rocky bottom, and barrier island oceanside waters from the surf to the shelf break zone. All coastal inlets are state-designated nursery habitats of particular importance to coastal migratory pelagics (for example, in North Carolina, this would include all Primary Nursery Areas (PNA) and all Secondary Nursery Areas). The Gulf Stream is also an essential fish habitat, because it provides a

mechanism to disperse coastal migratory pelagic larvae. For king and Spanish mackerel and cobia, EFH occurs in the South Atlantic and Mid-Atlantic Bights.

#### 5.6.2 Snapper-Grouper.

Essential fish habitat for snapper-grouper species includes coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs, and medium to high profile outcroppings on and around the shelf break zone from shore to at least 600 feet (at least 2,000 feet for wreckfish) where the annual water temperature range is sufficiently warm to maintain adult populations of members of this largely tropical complex. EFH includes the spawning area in the water column above the adult habitat and the additional pelagic environment, including Sargassum, required for larval survival and growth up to and including settlement. In addition, the Gulf Stream is an essential fish habitat, because it provides a mechanism to disperse snapper grouper larvae. For specific life stages of estuarine dependent and nearshore snapper-grouper species, EFH includes areas inshore of the 100-foot contour, such as attached macroalgae; submerged rooted vascular plants (seagrasses); estuarine emergent vegetated wetlands (saltmarshes, brackish marsh); tidal creeks; estuarine scrub/shrub (mangrove fringe); oyster reefs and shell banks; unconsolidated bottom (soft sediments); artificial reefs; and coral reefs and live/hard bottom.

#### 5.6.3 Spiny Lobster.

Essential fish habitat for spiny lobster includes nearshore shelf/oceanic waters; shallow subtidal bottom; seagrass habitat; unconsolidated bottom (soft sediments); coral and live/hard bottom habitat; sponges; algal communities (Laurencia); and mangrove habitat (prop roots). In addition, the Gulf Stream is an essential fish habitat, because it provides a mechanism to disperse spiny lobster larvae. EFH for the spiny lobster fishery in the U.S. Caribbean consists of all waters from mean high water to the outer boundary of the EEZ – habitats used by phyllosome larvae – and seagrass, benthic algae, mangrove, coral, and live/hard bottom substrates from mean high water to 100 fathoms depth.

#### 5.6.4 Coastal Inlet HAPC.

Additionally, HAPC were reviewed using the EFH Mapper to identify their location in the vicinity of the project area. The HAPC are special habitat areas designated by NMFS to further the conservation and enhancement of EFH. The NMFS Mapper shows HAPC present within the inshore areas of Lookout Bight and Back Sound, and outer portions of beach placement areas (EFH Mapper 2022). Areas of HAPC for penaeid shrimp include all coastal inlets, all state-designated nursery habitats of particular importance to shrimp, and state-identified overwintering areas. The project area also contains HAPC for snapper-grouper complex and summer flounder.

#### 5.6.5 Submerged Aquatic Vegetation and Shellfish Beds.

SAV provides food and shelter for multiple species important to the overall system ecology; commercial and recreational fisheries; and other species including shellfish, manatees, and sea turtles. Species highly associated with SAV habitat include bay scallops, shrimp, hard clams, blue crabs, sea trout, gag grouper, and flounder.

SAV is prolific in shallow estuaries of Back Sound and Lookout Bight as shown in NCDEQ's 2019-2020 SAV mapping data (Figure 12). SAV was also identified using aerial imagery of the 2022 growing season (April – October). Although SAV can quickly populate shallow bottom when conditions are conducive, currents, sand movement, and turbid water in the project area can minimize or eliminate the presence of SAV. This is expected in open, unprotected areas and areas following designated and undesignated navigation routes. In November 2022, a ground-truthed survey resulted in no SAV being present within and immediately adjacent to USACE and NPS channels, as well as Sandbag Island. The nearest SAV identified during the November survey was a small “patchy” cluster approximately 250 feet west of the Channel in Back Sound (Figure 12), which could be affected by dredging and dredged material placement (sidecasting). In July 2023, an additional ground-truthed survey resulted in SAV being identified, specifically in twenty-five patchy areas within the overall 25-acre footprint of Sandbag Island, and in several, approximately 400 square-foot patches within a 500 linear foot portion of the USACE channel. SAV is also present to the south and southwest of Sandbag Island. Dredging would avoid known areas of SAV to the maximum extent practicable by identifying the presence of SAV using the State's online database and recent aerial imagery. Government plant dredging and placement activities would occur during the recommended timeframe of October 1 – March 31 to avoid the SAV growing season, thereby making impacts to SAV insignificant. In addition, USACE will maintain a 100 foot buffer from all SAV during placement of dredged material within deep scour holes or sidecasting in the Barden Inlet area during the October 1 – March 31 timeframe.

Oyster beds are present in subtidal and intertidal waters and reefs fringing salt marshes along estuarine shorelines. Sandy, high-energy areas are not conducive for oyster establishment or growth; therefore, shellfish beds are not expected to be present within areas of dredging and placement. There are no NCDMF listed artificial reefs or oyster sanctuaries within the project area.

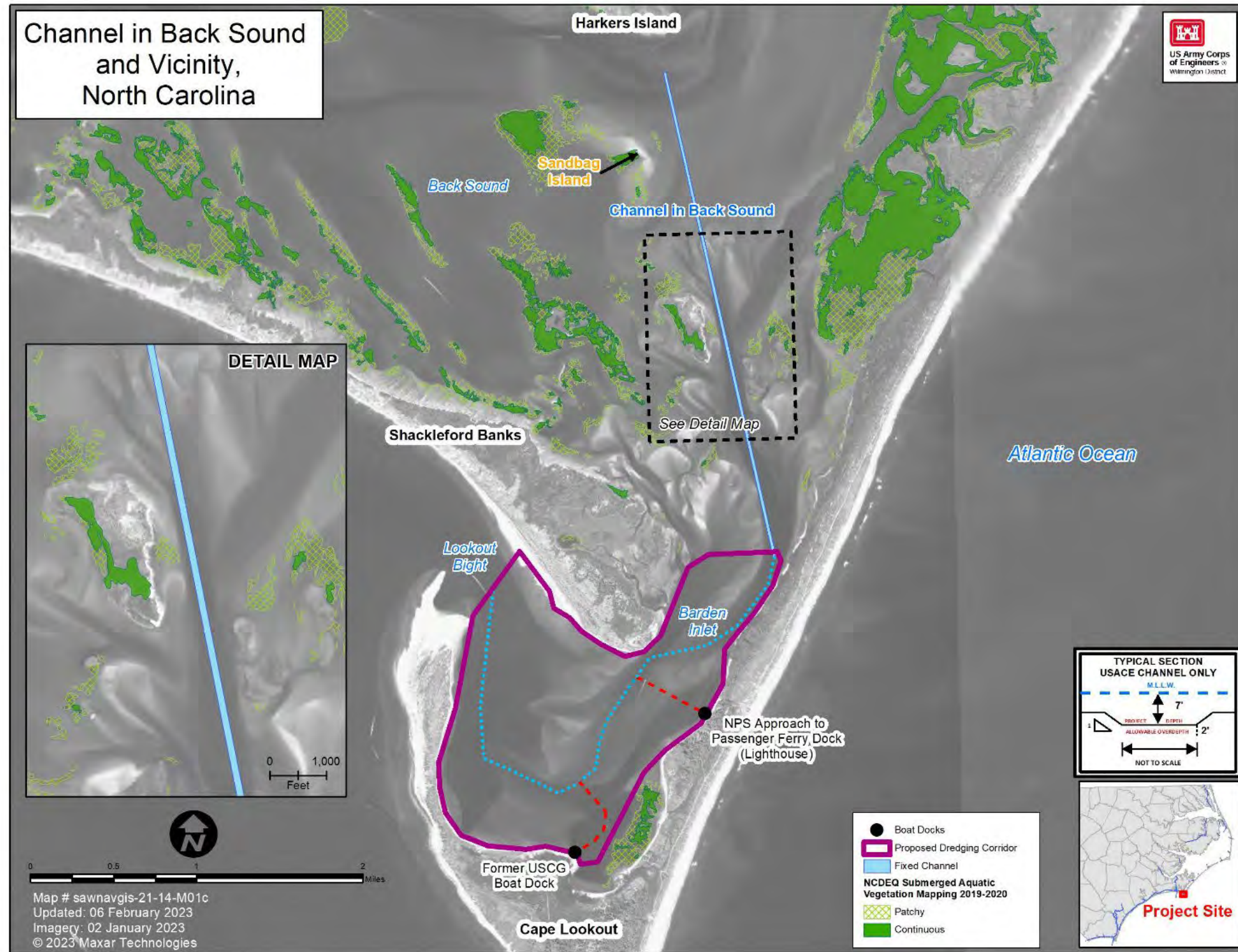
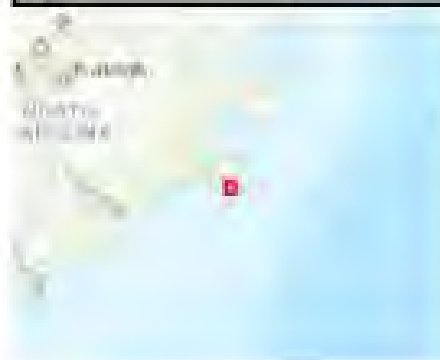
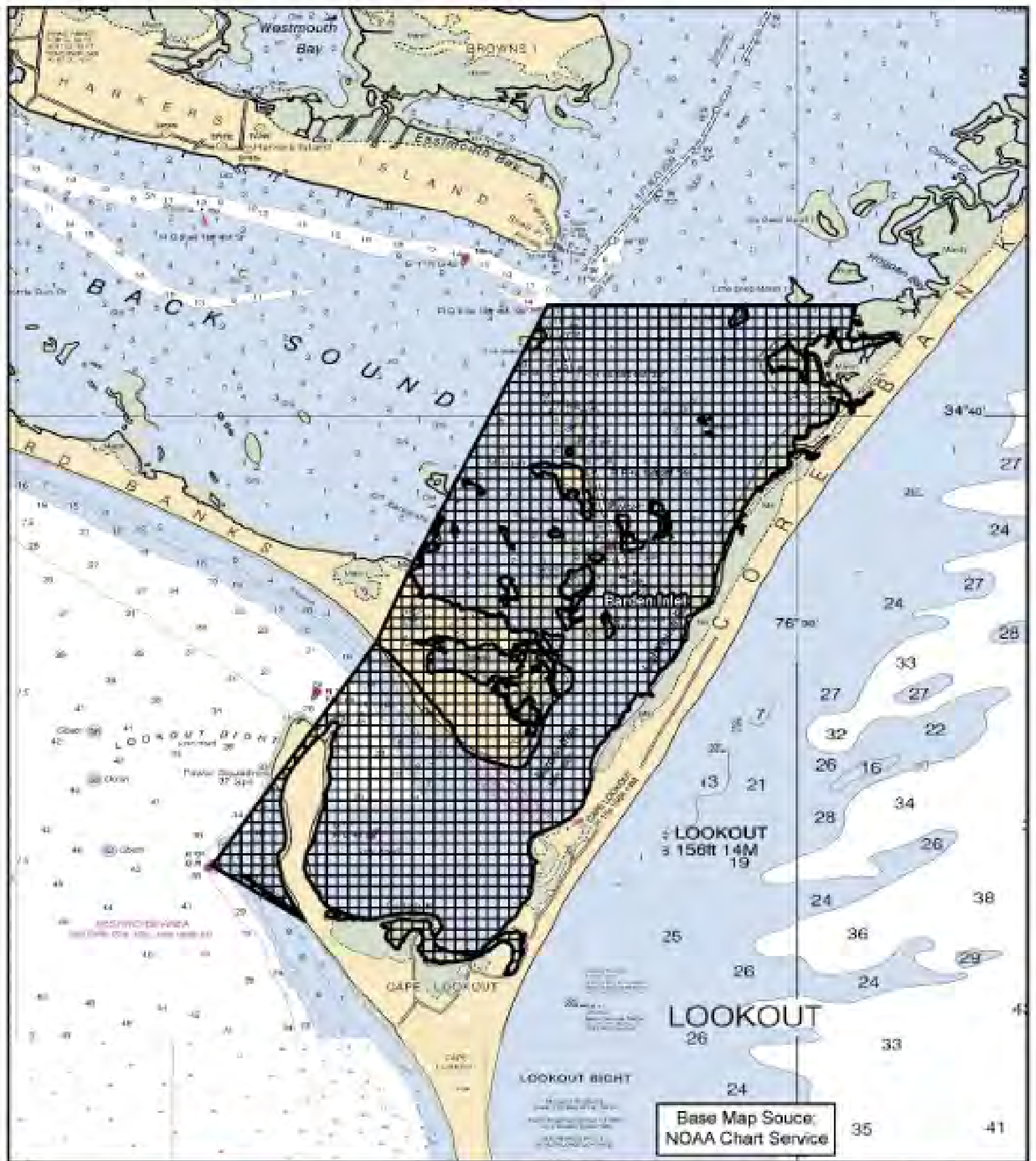


Figure 12. Location of Submerged Aquatic Vegetation (SAV), NCDEQ 2019-2020 SAV Mapper



**Crab Spawning Sanctuaries  
(15A NCAC 03R .0110)  
Barden Inlet**

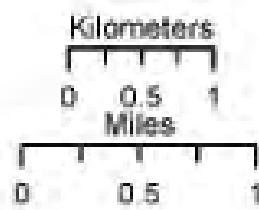


Figure 13. Barden Inlet Crab Spawning Sanctuary (CSS)

#### 5.6.6 Crab Spawning Sanctuary.

The Atlantic blue crab spawns in high salinity, soft-bottom inlet habitat such as that of Barden Inlet and Back Sound. According to An Assessment of Fisheries Species to Inform Time-of-Year Restrictions for North Carolina and South Carolina (Wickliffe, 2019), spawning occurs during the months of April through September, so female blue crabs are present in the inlet during these months. New Crab Spawning Sanctuaries were established in April 2020 under the Blue Crab Fishery Management Plan, Amendment 3. During March 1 – October 31, inlets are now closed to use of trawls, pots, fishing equipment, and mechanical methods for oysters and clams to protect females that congregate in inlet systems to spawn. The spawning season is April – October, therefore, to avoid possible dredging-related effects to spawning blue crabs, no dredging would occur during this time.

Figure 13 shows the designated Barden Inlet Area Crab Spawning Sanctuary (CSS) with its described boundaries detailed in 15A NCAC 03R .0110.

#### 5.6.7 Primary Nursery Areas.

The State of North Carolina defines Primary Nursery Areas (PNAs) as tidal saltwater, which provides essential habitat for the early development of commercially important fish and shellfish (15 NCAC 3B .1405). It is in these estuarine areas that many fish species undergo initial post-larval development. PNAs are designated by the North Carolina Marine Fisheries Commission (NCMFC). The NCMFC does not classify the project area as PNA.

#### 5.6.8 Anadromous Fish Spawning Areas.

Anadromous Fish Spawning Areas (AFSA) are designated and regulated by the NCMFC and NCWRC. Barden Inlet provides anadromous fish access to the Neuse and Pamlico Rivers, however Drum Inlet and Ocracoke Inlet to the north provide much more direct routes. The Neuse and Pamlico Rivers contain spawning areas upstream for species such as Atlantic sturgeon, blueback herring, alewife, hickory shad, and striped bass. It is possible for these species to be present in the project area during migration periods.

### **Environmental Consequences – Essential Fish Habitat.**

#### Alternative 1 - No Action:

Under the No Action alternative, dredging would not occur, therefore no impacts would occur to fisheries or fish habitat.

Conversely, as time passes and the Federal channel continues to be neglected, shoals will shift and shallow habitat areas may expand, increasing the likelihood of SAV, shellfish beds, and other fisheries-related resources encroaching on the Federal

channel. This is evident within the Les and Sally's Bay, where SAV is prolific. The Les and Sally's boat dock channel dredging was removed from this assessment due to unavoidable impacts to SAV.

#### Alternative 2 – Full Corridor:

Dredging operations may impact the estuarine water column in the immediate vicinity of the activity by means of entrainment and turbidity, however, impacts are expected to be minor and short-term. Entrainment occurs at the draghead or cutterhead, which, if buried while operating, should only affect sessile organisms that are on the seafloor in the path of the dredge. Active organisms are expected to swim away from the dredge's sounds and vibrations, avoiding entrainment. Turbidity from the dragheads and propellers impacts only the immediate area of the dredge since sand material would settle quickly (not remain in suspension). Likewise, impacts from pipeline placement onto Sandbag and/or Morgan Island and CALO beaches would occur where material settles out below mean low water (intertidal and shallow water habitat areas).

Although dredging and placement activities would avoid known areas of SAV during the growing season to the maximum extent practicable, impacts to the SAV seedbank identified within Sandbag Island and a portion of the USACE Federal navigation channel would occur. Dredging activities would be conducted in the fall/winter of any given year, which is outside of the growing season for SAV and, based on USACE surveys in the area, at a time when SAV would likely not be present. The USACE would avoid and minimize impacts to SAV to the maximum extent practicable by identifying areas of SAV growth using the State's online database and recent aerial imagery prior to dredging and placement of material. SAV was also identified along the south and west sides of Sandbag Island, which would be avoided to the maximum extent practicable using geotubes, turbidity curtains, and berm construction to contain material (Sandbag Island Placement Plan, Appendix B). Likewise, Morgan Island has SAV to the north, east, and west. While this SAV was not ground-truthed, it is noted as patchy and continuous based on available GIS data layers from the state (NCDEQ Online GIS. SAV 2019-2020 Mapping). Any placement of dredged material on Morgan Island in the future would avoid impacts to SAV through the construction of berms/dikes utilizing existing material on the island. Placement of sand on Morgan Island would be coordinated with all applicable resource agencies prior to any work.

Sandbag Island, Morgan Island, and Lighthouse beach have been previously used as placement areas for channel maintenance. Impacts to fish and fish habitat would be minor and temporary since beach quality material settles out quickly, and over time, naturally erodes and shifts underwater from wind and water currents. The process of keeping dredged sediments within the system helps to maintain the EFH estuarine habitat.

As previously stated, patchy and continuous clusters of SAV are present in the Back Sound corridor area (Figure 12) and may be affected by dredging and dredged material

placement (sidecasting). Dredging would avoid known areas of SAV to the maximum extent practicable by identifying areas of SAV growth using the State's online database and recent aerial imagery. Government plant dredging and placement activities would occur during the recommended timeframe of October 1 – March 31 to avoid the SAV growing season, thereby making impacts to SAV insignificant. In addition, USACE will maintain a 100 foot buffer from all SAV during placement of dredged material within deep scour holes or sidecasting in the Barden Inlet area during the October 1 – March 31 timeframe.

Likewise, the Atlantic blue crab spawning season occurs in the spring and summer months, when dredging would not occur. If dredging is required during this timeframe, USACE will coordinate with resource agencies prior to dredging and will avoid impacts to the maximum extent practicable.

#### Alternative 3 – Partial Corridor (Preferred):

Alternative 3 encompasses a much narrower potential project area than Alternative 2, containing much less estuarine habitat. The fixed portion of the USACE channel avoids SAV impacts since the nearest SAV is shown to be approximately 250 feet outside of the channel limits (see Figure 12). Effects on fisheries and habitat related to Alternative 3 are expected to be less than Alternative 2, however not noticeably. Having a fixed, linear channel in the northern portion limits the footprint of dredging to an area that was dredged in the past, therefore avoiding areas not previously dredged and minimizing effects to sensitive habitats.

Overall, the preferred alternative of dredging USACE and NPS channels and associated dredged material placement activities is not expected to adversely affect any type of EFH or EFH-related species present within the project area. Included with this EFH assessment are avoidance and minimization measures listed below that USACE has committed to follow:

- All Government plant dredging would take place between October 1 – March 31.
- USACE will maintain a 100 foot buffer from all SAV during placement of dredged material within deep scour holes or sidecasting in the Barden Inlet area during the October 1 – March 31 timeframe.
- Pipeline dredging and associated beach placement and bird island placement would only occur during the relevant timeframes for the protection of nesting sea turtles (November 16 – April 30) and birds (September 1 – March 31).
- Prior to each dredging event, SAV in the project area would be identified using the State's online SAV database and recent aerial imagery; SAV will be avoided to the maximum extent practicable.



- Placement onto Sandbag or Morgan Island via control-of-effluent would utilize methodologies that will avoid impacts to adjacent SAV beds to the maximum extent practicable.
- All necessary State and Federal authorizations (CZMA consistency, Section 401/404 permits, etc.) will be obtained prior to work commencing and all conditions will be met.
- USACE will abide by the NMFS 2020 SARBO and relevant PDCs.
- Any changes in the proposed plan will be coordinated in advance with resource agencies.

## 5.7 Birds and Bird Nesting Habitat

Cape Lookout National Seashore has nearly 275 species of birds that use the islands for resting, nesting, and feeding, and as wintering or migratory rest stops; the area is designated as a Globally Important Bird Area by the American Bird Conservancy (NPS, Dec 2005). These birds include the American oystercatcher, willet, sanderling, piping plover, royal tern, common nighthawk, great blue heron, red-winged blackbird, eastern meadowlark, and song sparrow. The abundance and variety of birds is due to the national seashore's location on the Atlantic Flyway and to the lack of development and human disturbance.

Colonial nesting waterbirds (gulls, terns, pelicans, and wading birds) are an important part of the project area ecosystem and an attraction for the many tourists that visit it each year. Colonial waterbirds have been documented to nest within the project area, including Sandbag Island, and use the islands or beaches for loafing or roosting during migratory periods or the winter months.

### **Environmental Consequences – Birds and Bird Nesting Habitat.**

#### Alternative 1 - No Action:

Under the No Action alternative, dredging would not occur, therefore no dredged material would be placed on Sandbag Island, which is currently less than two acres in size. The island continues to erode and, in the absence of placement activity, will soon not exist, leaving less habitat for nesting and migrating birds where it is desperately needed. Similarly, Morgan Island, which is also a potential placement site in the future, would continue to erode over time resulting in loss of existing high-quality bird nesting habitat.

#### Alternative 2 – Full Corridor:

Dredging the Federal channel in Back Sound would provide a source of placement material for Sandbag and/or Morgan Islands, neither of which have received material for

over two decades. Initial dredging of the channel would provide over 150,000 CYs of material for Sandbag Island and would increase the footprint of the island to approximately 5 to 6 acres. Over multiple pipeline contracts (10-15 years), USACE proposes to expand the island to a footprint of 25 acres, the maximum size recommended by resource agencies for nesting birds without possible predators inhabiting the island. Placement of dredged material on Morgan Island would occur on an as needed basis in the future should erosion of the island continue. Currently, Morgan Island, while experiencing some erosion along the northeastern shoreline, is relatively stable and contains high-quality bird nesting habitat.

Placement of beach-quality sand onto CALO beaches would also provide additional roosting and foraging habitat for shorebirds.

Alternative 3 – Partial Corridor (Preferred):

Effects on birds and bird habitat related to Alternative 3 are expected to be the same as Alternative 2.

5.8 Endangered and Threatened Species.

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531–1543), provides a program for the conservation of threatened and endangered (T&E) plants and animals and the habitats in which they are found. In accordance with Section 7 (a)(2) of the ESA, USACE has coordinated with the USFWS and NMFS to ensure that effects of the proposed project would not jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat of such species.

Federally listed T&E species (aquatic and terrestrial) with the potential to occur in the vicinity of the project area are listed in Table 4. This list includes species that could be present in the area based upon their historical occurrence or potential geographic range. However, the actual occurrence of a species in the area depends upon the availability of suitable habitat, the season of the year relative to a species' temperature tolerance, migratory habits, and other factors.

*Table 4. Federally Listed Threatened & Endangered Species (aquatic and terrestrial) located in the vicinity of the project area*

<b>Species</b>	<b>Status (T/E)</b>	<b>USFWS/NMFS</b>	<b>Present in the Project Area?</b>
Green sea turtle ( <i>Chelonia mydas</i> )	T	Both	Yes
Loggerhead sea turtle ( <i>Caretta caretta</i> )	T	Both	Yes
Leatherback sea turtle ( <i>Dermochelys coriacea</i> )	E	Both	Rare
Kemp's ridley sea turtle ( <i>Lepidochelys kempii</i> )	E	Both	Yes

Red knot ( <i>Calidris canutus rufa</i> ); Proposed Critical Habitat	T	USFWS	Yes
Piping plover ( <i>Charadrius melodus</i> ); Critical Habitat	T	USFWS	Yes
Eastern Black Rail ( <i>Laterallus jamaicensis</i> )	T	USFWS	No
Roseate tern ( <i>Sterna dougallii dougallii</i> )	E	USFWS	Yes
Red-cockaded Woodpecker ( <i>Picoides borealis</i> )	E	USFWS	No
<b>Species</b>	<b>Status (T/E)</b>	<b>USFWS/NMFS</b>	<b>Present?</b>
West Indian manatee ( <i>Trichechus manatus</i> )	T	USFWS	Rare
Rough-leaved Loosestrife ( <i>Lysimachia asperilaefolia</i> )	E	USFWS	No
Seabeach amaranth ( <i>Amaranthus pumilus</i> )	T	USFWS	Yes
North Atlantic right whale ( <i>Eubalaena glacialis</i> )	E	NMFS	No
Shortnose sturgeon ( <i>Acipenser brevirostrum</i> )	E	NMFS	Rare
Atlantic sturgeon ( <i>Acipenser oxyrinchus oxyrinchus</i> )	E	NMFS	Yes
Giant manta ray ( <i>Manta birostris</i> )	T	NMFS	Yes
Smalltooth sawfish ( <i>Pistis pectinata</i> )	E	NMFS	Rare

### 5.8.1 USFWS.

An updated list of T&E species for the project area within Carteret County, North Carolina was obtained from the USFWS Information, Planning and Conservation System (IPAC) website (<http://ecos.fws.gov/ipac/>) (Appendix D). The list of species is shown in Table 4, which includes T&E species that could be present in the area based on their historical occurrence or potential geographic range. The present species and listed critical habitats under the purview of the USFWS are:

Sea turtles [nesting green, loggerhead, leatherback, and Kemp's ridley]; red knot; piping plover; roseate tern; West Indian manatee; and seabeach amaranth.

The piping plover is also both a Federal and state-listed threatened species. Habitat is concentrated in open beaches and tidal flats, and, at Cape Lookout, all nesting is near both active and inactive inlets. About two-thirds of the nesting piping plovers in North Carolina are found at Cape Lookout National Seashore (NPS, Dec 2005). Designated

critical habitat (DCH) for wintering piping plover is present within the project area on federally managed NPS land on South Core Banks.

The northeast U.S. nesting population of the roseate tern is listed as federally endangered by the USFWS in North Carolina; it is also state listed as endangered. There is no designated critical habitat for the species. Roseate terns in eastern North America nest on sandy barrier islands, on rocky islands, and occasionally on islands or hummocks in saltmarshes. They set their nests among rocks, shells, or vegetation, often in concealed spots such as clumps of seaside goldenrod or beach grass. The northeast population breeds from Long Island Sound north to Nova Scotia. Although identified in the project area at times, the species is considered transient in North Carolina, visiting during the summer.

Currently under USFWS consideration is the proposed DCH for Rufa Red Knot, posted July 15, 2021 (Figure 14). This includes South Core Banks Unit NC-2B and Shackleford Island Unit NC-3.

**Critical Habitat for Rufa Red Knot**  
**NC-2B Core Banks-South Core Banks; Carteret County, North Carolina**

2

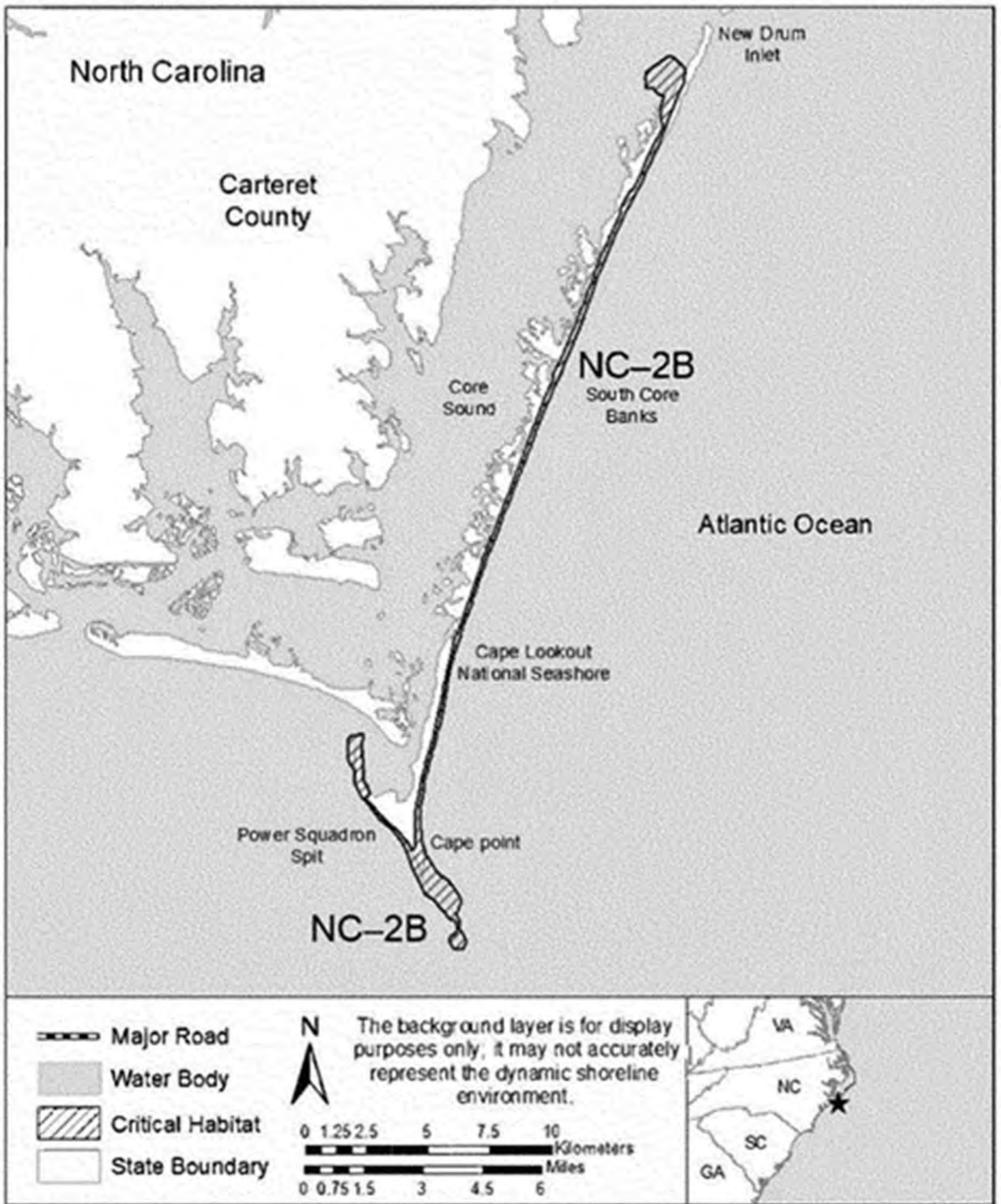


Figure 14. Rufa Red Knot Critical Habitat

Sea turtle nesting may occur on ocean beachfronts of CALO where beach-quality dredged material may be placed; however, placement would occur during November 16 to March 31 to avoid sea turtle nesting season. Likewise, beach placement and control of effluent practices on Sandbag bird island would adhere to the September 1 to March 31 timeframe, thereby protecting nesting piping plovers and visiting red knots and roseate terns. All conditions and conservation recommendations of the USFWS 2017 North Carolina Coastal Beach Sand Placement, Statewide Programmatic Biological Opinion (SPBO) will be abided by; therefore, no impacts to T&E species including seabeach amaranth are anticipated. The eastern black rail and rough-leaved loosestrife are not expected to occur within the project area. The West Indian manatee may be present; however, by following the 2017 USFWS Guidelines for Avoiding Impacts to the West Indian Manatee, no impacts are anticipated.

Formal consultation will not be required with USFWS for this project.

#### 5.8.2 NMFS.

All of the T&E species under the purview of NMFS Protected Resources Division (PRD) listed below may occur in the project area and are covered by the South Atlantic Regional Biological Opinion (SARBO) for Dredging and Material Placement Activities in the Southeast United States, issued by NMFS-PRD on March 27, 2020, as revised on July 30, 2020 (NMFS 2020). The 2020 SARBO can be located at <https://www.fisheries.noaa.gov/content/endangered-species-act-section-7-biological-opinions-southeast>.

Federally protected species in the project area under the purview of NMFS-PRD are the following:

Sea turtles [green, loggerhead, leatherback, and Kemp's ridley]; shortnose sturgeon; Atlantic sturgeon; and giant manta ray.

The project would comply with all relevant SARBO project design criteria (PDC) requirements contained in the Opinion. The PDC requirements include training and education of on-site personnel (vessel captain, crew, etc.) of project requirements, and completing work in a manner that would minimize effects to species, which includes, but is not limited to, the list provided above. All work, including equipment, staging areas, and placement of materials, would be done in a manner that does not block access of ESA-listed species from moving around or past construction. Equipment would be staged, placed, and moved in areas and ways that minimize effects to species and resources in the area, to the maximum extent possible. All work that may generate turbidity would be completed in a way that minimizes the risk of turbidity and sedimentation to the maximum extent practicable. Beach placement would be conducted in a manner that minimizes turbidity in nearshore waters by using methods that promote settlement before water returns to the water body (i.e., shore parallel dikes). Turbidity and marine sedimentation would be further controlled using land-based

erosion and sediment control measures to the maximum extent practicable. Land-based erosion and sediment control measures would (1) be inspected regularly to remove excess material that could be an entanglement risk; (2) be removed promptly upon project completion; and (3) not block entry to or exit from designated critical habitat for ESA-listed species. Lighting associated with beach placement activities would be minimized through reduction, shielding, lowering, and/or use of turtle friendly lights, to the extent practicable without compromising safety, to reduce potential disorientation effects on female sea turtles approaching the nesting beaches and sea turtle hatchlings making their way seaward from their natal beaches. The conservation measures would be reevaluated annually and project changes, including time and/or equipment, may be altered, based on new information and experience.

The focus area for this EA is Channel from Back Sound to Lookout Bight and placement areas to include routes taken to transport dredged material (either by moving dredge or pipeline route). USACE acknowledges the presence of sea turtles within adjacent waters of the Atlantic Ocean, Lookout Bight, and Back Sound year-round. Atlantic sturgeon may also be present throughout the year, feeding along nearshore areas and migrating through Barden Inlet during spawning migrations. Whale species are not expected to be within the project area, as water depths would be too shallow.

### **Environmental Consequences – Threatened and Endangered Species.**

#### Alternative 1 - No Action:

Under the No Action alternative, dredging would not occur, therefore no impacts would occur to threatened and endangered species.

#### Alternative 2 – Full Corridor:

Impacts on T&E species relative to Alternative 2 are expected to be negligible. Maintenance of USACE and NPS channels would adhere to all relevant PDCs of the NMFS 2020 SARBO and the USFWS 2017 SPBO for all dredging and placement activities. Incidental takes, lethal or non-lethal, are not anticipated as risk of entrainment, ship strikes, etc. with pipeline and Government plant dredges are very low.

The placement of beach quality dredged material and the associated construction activities during the November 16 – March 31 timeframe may have minor and temporary impacts on piping plover and red knot foraging, sheltering, and roosting habitat. It may have impacts on the physical and biological features for piping plover and red knot wintering and migration habitat. Bird island placement of dredged material onto Sandbag or Morgan Islands, and NPS beaches is expected to enhance nesting habitat for piping plovers.

Consequently, Alternative 2 dredging may affect, but is not likely to adversely affect, sea turtles, sturgeon, or manta rays under NMFS purview (SARBO, 2020). Dredged material placement activities may affect and will likely adversely affect sea turtles, piping plover, red knot, and seabeach amaranth (SPBO, 2017). It is expected that the proposed

project may affect, but is not likely to adversely affect, the roseate tern, since placement of material will be conducted during the November 16 – March 31 timeframe. Adverse effects to T&E species will be avoided and/or minimized to the maximum extent practicable by implementation of the SARBO PDCs and USFWS 2017 SPBO terms and conditions.

Pipeline and Government plant dredging is not expected to have adverse impacts on listed marine species present (sea turtles, Atlantic sturgeon, giant manta ray) within the Back Sound to Barden Inlet area. According to the 2020 SARBO, the risk to ESA-listed species under NMFS purview from activities covered under this EA including dredging and dredged material placement using the proposed equipment, effects from noise, water quality changes, and blocking migration were determined to be insignificant and would not result in take. These risks to ESA-listed species under USFWS purview are also expected to be low and these species will be able to avoid disturbances without harm.

#### Alternative 3 – Partial Corridor (Preferred):

Effects on T&E species related to Alternative 3 are expected to be the same as Alternative 2.

### 5.9 Cultural, Historic and Archaeological Resources

The environment at Cape Lookout National Seashore has deterred extensive human settlement in the area (NPS 1978). Human occupation of the Outer Banks region initially occurred over 3,000 years ago by a hunting-fishing-gathering people. Earlier peoples may have used the area, but there is a strong likelihood that wave action or other natural processes removed any very early sites long ago, since the dynamic geomorphology of the barrier islands is not considered conducive to the in-situ preservation of archaeological resources (Ehrenhard 1976; NPS 2007).

Little is known about the nomadic hunters on the islands, and specific information about the area up to the time of Colonial English occupation is lacking (Ehrenhard 1976). Shell midden sites on the soundside of Shackleford Banks and in the vicinity of the Harkers Island shell point area of Cape Lookout are the only remains of early human occupation; recent fieldwork has revealed that relatively intact and archeologically significant prehistoric middens may exist, but erosion and inundation threaten these sites, and none have undergone full evaluation for National Register standing. Few sites are known to occur on Core Banks, which has apparently suffered from periodic cycles of island breaching and reformation as inlets opened and closed at various points along the length of the island.

Most of the archaeological sites identified at CALO are historic structures and ruins located in Portsmouth Village and Cape Lookout Village. The majority of these sites date to the late nineteenth and twentieth centuries and are associated with the villages and historic districts which have been recorded on Core Banks.



The Cape Lookout Light Station, situated near the western bank of Barden Inlet, was listed on the National Register in 1973 and contains prehistoric and historic archaeological remains, as well as supporting historic structures; the Light Station also contributes to the National Register listed Cape Lookout Village Historic District. Erosion threatens the Light Station due to the progressive increase and eastward encroachment of a large shoal off the east end of Shackleford Banks. The shoal is constricting the bend in the tidal channel and forcing the channel against the opposite shore, in the immediate vicinity of the Light Station. The expansion of this shoal is naturally occurring as a result of the unrestricted littoral drift influx to Barden Inlet from Shackleford Banks. Historic aerial photography indicates that this eastward shoal encroachment had been occurring long before any dredging in the throat or ocean bar of the inlet.

The Outer Banks are also known as the Graveyard of the Atlantic and shipwreck debris washes onto CALO beaches regularly. The only systematic (i.e., intentional) surveys to identify and record this evidence of CALO's maritime past were conducted by the Surface Interval Diving Company in April 2002 (SIDCO 2002) and SEAC's hurricane damage assessment in 2003 (Schwadron et al. 2003) and focused on Core Banks areas. Shipwrecks and other submerged cultural resources are considered to have high potential within the proposed project area; however, previous disturbances, including dredging, have already affected such resources to a certain unknown degree, although their locations are known. Archaeological field investigations of the eastern end of Shackleford Banks were not able to successfully identify the location of shore whaling stations or camps associated with the 19<sup>th</sup> century community of Diamond City based solely on surface survey, but fieldwork was able to identify features that appear to be associated with the community itself. However, projected locations for historic whaling camps indicate that these sites may actually be situated underwater within the mouth of Barden Inlet (Jateff 2007).

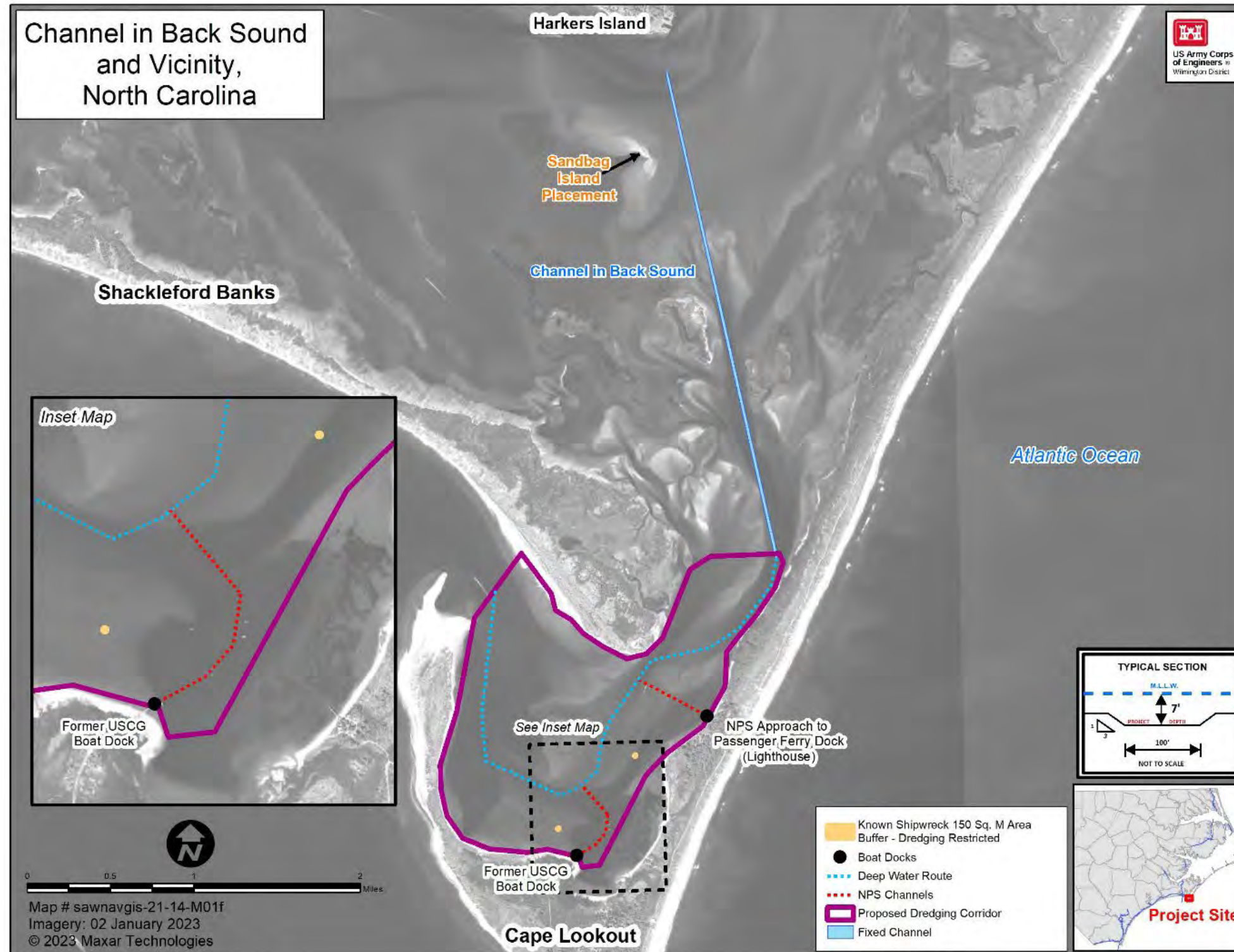


Figure 15. SHPO Identified Submerged Cultural Resources (Shipwrecks)

Shell Point was most recently investigated by McNeil prior to shore stabilization efforts at Harkers Island (NPS 2007). These investigations included shovel testing along the shoreline and artifacts including historic material, pottery, and shell were noted. Test units were also excavated in an area of potentially intact shell deposits along the southern shore, but no such remains were encountered during the excavation. Test units in the harbor area of Harkers Island, approximately 0.25 miles north of the proposed dredging area, recorded prehistoric pottery and flake materials at depths of approximately 50cm below modern disturbances.

Regarding USACE's Federal channels within the proposed project area, including those following natural deep water between Barden Inlet and Lookout Bight, compliance with Section 106 of the National Historic Preservation Act (NHPA) has been previously coordinated and documented in the "Final Environmental Statement, Maintenance Dredging, Channel from Back Sound to Lookout Bight, N.C.", dated November 1975 and filed with the Council on Environmental Quality on March 10, 1976. Similarly, Section 106-related considerations regarding NPS actions in the project area are described in the "Environmental Assessment, National Park Service, Cape Lookout National Seashore, Protection of Lighthouse and Associated Historic Structures", dated December 2005, and in the "Environmental Assessment for National Park Service, Cape Lookout National Seashore, Harkers Island Shore Protection Project", dated August 2006.

Coordination with the North Carolina State Historic Preservation Office (SHPO) has been completed. By letter dated May 9, 2022, USACE informed SHPO of the proposed action and anticipated effects to cultural resources, historic properties, and known shipwrecks. By letter dated June 16, 2022, SHPO provided a response stating, "The Cape Lookout Bight and Back Sound areas contain six recorded submerged archaeological sites, most notably the wreck of the Olive Thurlow (CLS0004), that lie adjacent to the channel. While we find that the Area of Potential Effect (APE) of the proposed maintenance dredging would have no adverse effect on the noted archaeological sites, we ask that an adequate buffer area of 150 square meters be provided surrounding the shipwrecks. The purpose of this buffer is to prevent further deterioration and damage of the archaeological resource, as well as to prevent possible damage to dredge machinery." Correspondence with SHPO is included in Appendix E. As indicated in Figure 15, USACE will implement the requested 150 square meter buffers around known shipwrecks in the proposed project area. Dredging would not occur within buffered areas.

## **Environmental Consequences - Cultural, Historic and Archaeological Resources.**

### Alternative 1 – No Action:

Under the No Action alternative, dredging would not occur, therefore no impacts would occur to cultural resources and historic properties.

### Alternative 2 – Full Corridor:

Under Alternative 2, there would be no adverse effects to known cultural resources and historic properties. Known sites would be avoided and buffered in accordance with SHPO recommendations (Appendix E; Figure 15). Mitigation for disturbance of any unknown sites, should they be directly encountered or indirectly affected during dredging or dredged material placement operations, would follow the CALO inadvertent discovery policy (NPS 2020). Should archeological resources be uncovered during construction, work would be halted in the discovery area and Seashore staff would consult with the North Carolina State Historic Preservation Officer regarding treatment.

### Alternative 3 – Partial Corridor (Preferred):

Effects on cultural resources and historic properties under Alternative 3 are expected to be substantially similar to those described under Alternative 2; however, because Alternative 3 includes a partial corridor rather than the full corridor (larger area), potential adverse effects to unknown sites would be reduced.

The proposed action would have no adverse effect on historic properties or shipwrecks listed, or eligible for listing, on the National Register of Historic Places since identified buffer areas will be avoided during dredging activities. The proposed action is in compliance with Section 106 of the National Historic Preservation Act and the Abandoned Shipwreck Act.

## 5.10 Climate Change and Sea Level Change

### 5.10.1 Climate and Sea Level Change Analysis

According to the complete Climate and Sea Level Change Analysis in Appendix F, temperatures are forecasted to increase in the future with more extreme rain events; however, there is less consensus on future annual precipitation totals. The changing climate is projected to lead to more extreme drought events.

Within the Bogue-Core Sounds watershed, the Climate Hydrology Assessment Tool (CHAT) tool predicts increasing annual maximum temperatures, annual mean temperatures, and annual precipitation in the simulated future period for both emissions scenarios.

An analysis of watershed climate vulnerability using the USACE Climate Change Vulnerability Assessment (VA) Tool shows the area to be relatively less vulnerable for the navigation and flood risk reduction business lines compared to the entire USACE portfolio. The variables used to compute the watershed vulnerability score for the navigation business line include increased low flow reduction, decreased cumulative 90% exceedance flows, increased cumulative flood magnification, and increased sedimentation. The variables used to compute the watershed vulnerability for the flood risk reduction business line include increased cumulative flood magnification, changes

to percentage of urban area in the 500-year floodplain, and increased local flood magnification.

The potential for an increase in extreme drought events coupled with increased extreme rain events could lead to more sedimentation within the Back Sound to Lookout Bight channel, in turn increasing the need for more frequent dredging. The increased frequency of dredge events could lead to the placement sites reaching capacity sooner than they would at current sedimentation rates.

Increasing sea level trends have been observed at the Beaufort Duke Marine Lab station. Over the next 50 years, sea level is expected to rise to 2.67 feet.

#### 5.10.2 Greenhouse Gas (GHG) Emissions Analysis

On January 9, 2023, the Council of Environmental Quality (CEQ) released Executive Order 12866 National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change to disclose possible effects of greenhouse gases (GHGs) from Federal proposed actions and identify alternatives and mitigation measures to avoid or reduce GHG emissions in the NEPA process. In accordance with this EO, USACE has considered: (1) the potential effects of the proposed action on climate change, including by assessing both GHG emissions and reductions from the proposed action; and (2) the effects of climate change on a proposed action and its environmental impacts.

Text below describes the equipment that would be used for the action alternatives, including construction and maintenance, the duration that equipment would be operating and how often during the life of the project. Tools or methodologies for quantifying GHG emissions for dredging and dredged material placement are limited, thus making it difficult to quantifiably compare GHGs across alternatives. For this reason, a predominantly qualitative GHG analysis is provided below.

#### **Environmental Consequences – Climate and Sea Level Change.**

##### Alternative 1 - No Action:

There would be no increase in GHG emissions or effects to climate change or sea level rise resulting from the No Action alternative. Future climate change could potentially lead to more sedimentation within the area exacerbating the shoaling in the channels and reducing the resilience of the area's navigability.

##### Alternative 2 – Full Corridor:

The potential for an increase in extreme drought events coupled with increased extreme rain events could lead to more sedimentation within the Channel from Back Sound to Lookout Bight, increasing the need for more frequent dredging. The increased frequency of dredge events could lead to the placement sites reaching capacity sooner than they would at current sedimentation rates, which could lead to the increased cost

of channel maintenance. Dredging the full corridor would increase the resilience of the area's navigability versus the No Action plan.

GHG emissions are expected from the dredging and placement actions proposed. This is summarized in Table 5, below. A small (18-20 inch) cutter suction pipeline dredge would be used to maintain USACE and NPS channels approximately every 3-5 years, and average of 3 times over the period of 10 years. Each dredge event is estimated to take 30-45 days, working 24 hours per day (approximately 1,000 hours per year). The dredge's horsepower (HP) is approximately 2,000 HP and is tended to by 2 tugboats (each averaging 1,000 HP). A booster barge may or may not be needed, depending on the distance from the dredge to the placement area. A small bulldozer needed to manage material placement averages 100 HP.

Government plant dredges are expected to maintain USACE and NPS channels in between contracted pipeline events, and average of 7 out of 10 years. Maintenance events are estimated to take 7-10 days and would occur twice per year on average (approximately 20 days per year). Operating only during daylight hours, averages out to approximately 240 hours per year. Both the sidecaster and the special purpose hopper dredges utilize propulsion equipment with 450 HP and pumping equipment with 160 HP.

*Table 5. Estimated Hours of GHG emissions over 10-year life of project*

<b>Equipment Type</b>	<b>Engine Size (HP)</b>	<b>Hours of Use Per Year (avg)</b>	<b>Equipment Events Over 10 Years (avg)</b>	<b>Total Hours of Emissions Over 10 Years</b>
18" Pipeline Dredge	2,000	1,000	3	3,000
Tugboat 1	1,000	1,000	3	3,000
Tugboat 2	1,000	1,000	3	3,000
Bulldozer (sm)	100	1,000	3	3,000
Sidecast Dredge	610	240	7	1,680
Special Purpose Hopper Dredge	610	240	7	1,680
<b>Total</b>		<b>4,480</b>		<b>15,360</b>

The Alternative 2 action is expected to represent only a small fraction of global or domestic GHG emissions, and therefore would not increase climate change-related effects.

Alternative 3 – Partial Corridor (Preferred):

The potential for an increase in extreme drought events coupled with increased extreme rain events could leave to more sedimentation within the Back Sound to Lookout Bight channel, leading to the need for more frequent dredging. The more frequent dredge events could lead to the placement sites reaching capacity sooner than they would at current sedimentation rates, which could lead to the increased cost of channel maintenance, but less so than maintaining the full corridor (Alternative 2). Dredging the

partial corridor would increase the resilience of the area's navigability versus the No Action plan.

GHG emissions from 10 years of maintaining the partial corridor (Preferred Alternative) are not expected to be noticeably less than those of Alternative 2. Maintaining a fixed linear channel through Back Sound would be a shorter route to dredge than following naturally deep water, however, shoaling in the fixed channel may be higher, thus balancing out dredging time and frequency between Alternatives 2 and 3.

The Preferred Alternative does not appear to have reasonably foreseeable effects on climate and sea level changes or GHG emissions.

### 5.11 Socioeconomics.

Socioeconomic effects of the project can be felt locally throughout Carteret County, especially Harkers Island, a small community of 1,314 people in 2020 (<https://datausa.io/profile/geo/harkers-island-nc/>) that once thrived from commercial fishing and boat-building. Privately-operated ferries from the NPS Visitor Center provide daily transport for thousands of sightseers, campers, and fishermen to Cape Lookout National Seashore and Shackleford Banks. Additionally, the navigation channel is the only ocean access channel between Beaufort Inlet and Drum Inlet, which provides important economic and recreational benefits to local communities. Continued maintenance of the Channel from Back Sound to Lookout Bight has a significant socioeconomic impact to the NPS, commercial and sport fishermen, recreational navigation, and local residents.

Harkers Island used to be fairly well populated, with its major industry including commercial fishing activities and wooden boat-building enterprises. The population of Harkers Island is currently declining at a rate of -0.71% annually and has decreased by -15.45% since the 2020 census (<https://datausa.io/profile/geo/harkers-island-nc/>). Seasonally, Harkers Island is an important recreational, boating, and sport-fishing center; with tourism being vital to the local economy.

#### 5.11.1 Tourism.

The NPS operates the Cape Lookout National Seashore Visitors Center on Harkers Island and the ferry service from Harkers Island is one of the principal means of tourist access to Cape Lookout and Shackleford Banks. In 2021, the seashore had 562,461 visitors park-wide, an average of 1,540 per day. Island Express Ferry Service carried 110,000 visitors (*personal communications January 23, 2023, Jeff West, NPS Superintendent*). The most popular activity undertaken by park visitors is beach recreation, which includes swimming, picnicking, surf fishing, boating, shell collecting, horse watching, and walking.

The marine environment offers boating and fishing and a multitude of seasonal recreational opportunities for residents and visitors. The few motels, rental homes, restaurants, and other related businesses in the area depend on the navigation of the

channel, mainly between the months of May and August. Despite growth in tourism and the local effort to make the island a top destination for waterfowl enthusiasts, Harkers Island continues to have some of the least developed tourist facilities on the coast of North Carolina. Most visitors come seeking the remote beaches away from the typical beach/hotel/resort experience found along the NC coast.

Shoaling of the channel, and the resulting hazardous navigation, has restricted boating in the area, and thus reduced the visitation and recreation opportunities in the area.

#### 5.11.2 Recreational and Commercial Fishing.

Commercial fishing has always been an important component of the Harkers Island economy. Many island residents are self-employed in the fishing trade. The commercial fishing industry of Harkers Island brings in oysters, clams, shrimp, scallops, crabs, spot, croaker, trout, flounder, bluefish, and mackerel. Big-game fishing operations used to cater to the demand for sport fishing in the area, however shoaling in the channel has made it dangerous for these vessels to access the open ocean.

### **Environmental Consequences – Socioeconomics.**

#### Alternative 1 - No Action:

Maintenance operations are necessary to maintain the navigation channel from Back Sound to Lookout Bight. The loss of the channel by discontinuing dredging would require sport and commercial fishermen to use Beaufort Inlet for access to the ocean. This inlet is located 9.3 miles west of Barden Inlet.

Without maintenance dredging of the Federal channel, access to Cape Lookout National Seashore would be virtually lost. This would significantly restrict boating, and thus reduce the visitation and recreation opportunities in the area. Tourists would not be able to reach the park except by air or via ocean to Lookout Bight.

Continued dynamic coastal processes would continue to erode the Lighthouse beach, resulting in potential loss of the area's exiting aesthetic characteristics, primarily historic structures, and potential loss of existing recreational opportunities.

Shoaling might effectively close this water course, and the Back Sound area would be isolated from the ocean. If this occurred, this would modify existing estuarine ecosystems and be extremely detrimental to the commercially valuable fish and shellfish species in Core Sound, Back Sound, and the Straits.

#### Alternative 2 – Full Corridor:

This alternative would maintain the area's existing commercial and recreational opportunities. Once maintenance dredging is complete, the channel would be open for



safe navigation, allowing ferries to access the National Seashore and Shackelford Banks, and for mariners to access deeper waters for cruising and fishing.

Placement onto Sandbag bird island would improve aesthetics of the island and attract more nesting waterbirds which would appeal to tourists as they pass on the ferry or their personal watercraft. Future placement of dredged material on Morgan Island, if needed, would preserve existing high quality bird nesting habitat and stem erosion of the island, thus improving the aesthetics of the island and the estuary.

Placement onto Lighthouse beach would improve aesthetics of the beach, the Lighthouse, and other historic structures, thereby attracting more visitors. Access to Lighthouse beach by ferry or personal watercraft may be impaired short-term during NPS channel dredging and placement activities.

#### Alternative 3 – Partial Corridor (Preferred):

Socioeconomic impacts related to Alternative 3 are expected to be the same as Alternative 2, benefitting tourism, recreation, and the local economy.

#### 5.12 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires Federal agencies to address environmental justice in relation to proposed actions. Environmental justice is defined by the EPA as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The EPA further defines fair treatment to mean that no group of people should bear a disproportionate share of the negative environmental consequences of industrial, governmental, or commercial operations or policies. Furthermore, Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, requires Federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children as a result of the implementation of Federal policies, programs, activities, and standards.

Data from the EPA's EJSCREEN (<https://www.epa.gov/ejscreen>) mapping tool primarily shows consistency between the demographics of resident populations and the larger Census Block Groups and local municipalities. Of note is statistically significant local presence of low-income populations, a high unemployment rate and residents over 64 years of age. It does not appear that significant minority populations or children under age 5 are present.

None of the alternatives considered will adversely affect environmental justice in minority populations and/or disproportionately affect children and will be in full compliance with Executive Orders 12898 and 13045 following completion of the NEPA process. For reasons stated above, USACE ensures that protected populations are not disproportionately or adversely impacted by the proposed project.

## **Environmental Consequences – Environmental Justice.**

### Alternative 1 - No Action:

The no action alternative may result in adverse effects to socioeconomic resources and thus negatively affect the local residents of Harkers Island and the surrounding area; failure to maintain a navigable channel in the future could result in more frequent navigability difficulties in frequently shoaled areas and less visitors to the area (including CALO), which has a direct effect on the businesses and incomes of local community who depend on tourists and the fishing industry for their livelihoods. More people may become unemployed or move out of the area to find employment. The elderly may be forced to live in poverty. The local tax base may decrease to where infrastructure and services degrade and property values plummet.

### Alternative 2 – Full Corridor:

Alternative 2 would allow the Federal navigation channels and the NPS dock channels to remain safely navigable, which would benefit the local economy by allowing for safe channel use by recreational and commercial vessels, as well as the NPS. Increased use of the channels would draw more visitors to spend money on fuel, food, and lodging, and local fishermen to catch and sell more fish. Dredging would positively benefit the economy and socioeconomics within and beyond the project area, thus providing more jobs for the unemployed, increasing individual incomes and tax base, and improving infrastructure, services, and property values.

### Alternative 3 – Partial Corridor (Preferred Alternative):

Environmental Justice impacts related to Alternative 3 are expected to be the same as Alternative 2, benefitting local unemployment and individual incomes.

## 5.13 Environmental Impact Comparison of Alternatives for USACE and NPS Channels

Table 6. Comparison of Environmental Impacts

<b>Project Area Resource</b>	<b>Alternative 1 No Action/No Dredging</b>	<b>Alternative 2 Dredging within a full project corridor</b>	<b>Alternative 3 (Preferred Alt) Dredging within a fixed channel in Back Sound and a corridor within Barden Inlet and Lookout Bight</b>
Sediments	No effect.	Temporary and minor effects due to movement of shoaled material (dredging and placement). Material would be beneficially used and remain in the system.	Same as Alternative 2.
Hydrology	No effect.	Temporary and minor effects via channel maintenance.	Same as Alternative 2.
Water Quality	No effect.	Temporary and minor effects via turbidity increases at dredging and placement locations.	Same as Alternative 2.
Wetlands & Floodplains	No effect.	No effects.	No effects.
Air Quality	No effect.	Temporary and minor emissions increases during dredging and placement activities.	Same as Alternative 2.
Noise	May reduce boating in area and thus reduce noise levels under water.	Temporary, minor, and localized increases in noise above and below water.	Same as Alternative 2.
Nekton	No effect.	Temporary, minor, and localized effects at dredging and placement locations in terms of turbidity and noise increases and egg/larval entrainment/burial.	Same as Alternative 2.

Table 6. Comparison of Environmental Impacts

Benthos	No effect.	Temporary and minor effects at dredging and placement locations in terms of entrainment/burial. Benthos expected to recover quickly.	Same as Alternative 2 with less dredging impact in fixed channel than Alt 2 corridor.
Fisheries & Fish Habitat	No effect.	Temporary and minor effects at dredging and placement locations in terms of turbidity increases, egg/larval entrainment/burial and removal of bottom habitat.	Same as Alternative 2 with less dredging impact in fixed channel than Alt 2 corridor.

Table 6. Comparison of Environmental Impacts

Project Area Resource	Alternative 1 No Action No Dredging	Alternative 2  Dredging within a full project corridor	Alternative 3 (Preferred Alt) Dredging within a fixed channel in Back Sound and a corridor within Barden Inlet and Lookout Bight
T&E Species (under NMFS purview)	No effect.	May affect, not likely to adversely affect species via increase in turbidity and noise, removal of bottom habitat/benthos.	Same as Alternative 2.
T&E Species (under USFWS purview)	No effect.	May affect, likely to adversely affect species via dredged material placement; MANLAA for manatee under 2017 Guidelines	Same as Alternative 2.
Cultural Resources	No effect.	No effect. Dredging would not occur in identified restricted areas.	Same as Alternative 2.
Climate Change, SLC	No effect.	No significant increases to effects related to climate and sea level change due to infrequency of dredging.	Same as Alternative 2.

Table 6. Comparison of Environmental Impacts

<p>Socioeconomics</p>	<p>May adversely affect NPS ferry service, tourism, and fishing.</p>	<p>Significant improvements to the NPS ferry service, tourism and fishing due to a consistent more reliable channel.</p>	<p>Same as Alternative 2.</p>
<p>Environmental Justice</p>	<p>May adversely affect EJ communities that are ages 64 and older and increase poverty and number of unemployed.</p>	<p>Improvements to EJ communities by decreasing unemployment and increasing the local tax base thus improving infrastructure, services, and property values.</p>	<p>Same as Alternative 2.</p>

## **6.0 CUMULATIVE EFFECTS**

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

This cumulative effects analysis considers the cumulative effects related to direct and indirect effects of dredging in the USACE and NPS channels and placement of dredged material into open waters, on Sandbag and/or Morgan Island, and CALO beaches using contracted pipeline and Government plant dredges. Maintenance, where needed, is expected to occur annually using Government plant and every 3-5 years using a contracted pipeline dredge. Frequency of dredging is an estimation since shoaling rates are unknown and may be determined by the initial dredge event. Also, large storms may move significant quantities of material into the channels in a short period of time.

The action does not include an increase in the footprint of areas to be dredged, as authorized channel dimensions would remain the same as previously maintained. Effects on Sandbag and/or Morgan Island and Lighthouse beach placement areas would also remain the same, as well as sidecasting within the Barden Inlet area. Sidecasting within the Back Sound channel and sidecasting and deep water placement in Lookout Bight would be considered new actions, expected to occur annually between October 1 – March 31 only where shoaling impedes navigation. Placement onto CALO oceanside beach would occur once every 3-5 years only if dredge quantities exceed those needed to renourish Lighthouse beach.

Direct effects (occurring at the same time and place) of dredging would occur within USACE and NPS channel limits, and resources present within these limits that cannot evade the impacts may be impacted by entrainment, changes in water quality, increased noise levels, and changes to habitat, although only minor and temporary. Resources that may be impacted include benthic invertebrates (sessile and mobile), nektonic species that feed and dwell on the seafloor, SAV seedbank, and marine reptiles and mammals such as sea turtles and manatee.

Indirect impacts (occur later in time or are farther removed in distance) of dredging occur outside of the channel limits and, depending on currents, tides, and weather, can have a varying impact on resources within an area approximately one mile from the dredge. Resources include species and habitat in the inlet and estuary environments that can be impacted by changes in water quality and increases in noise levels produced by the dredge. Overall, due to the infrequency and short-term duration of maintenance events, increases in indirect impacts are not expected to result in significant cumulative effects on habitat and species present.

Beneficial direct and indirect impacts to the human environment include improved navigation for ferry services to Shackleford Banks and Lighthouse beach, and safer

recreation for boaters and other activities. Recreational and commercial fishing would also improve in the area, thus having a boost on the local economy.

Other navigation-associated projects exist within the vicinity of the project area and recent past actions include Federal dredging activities in the Morehead City Harbor and the Atlantic Harbor of Refuge. Morehead City Harbor is located approximately 10 miles west of the project area. It is divided into three general areas of channels and basins that require regular maintenance. The Outer Ocean Bar is made up of the entrance channels from the ocean to Beaufort Inlet (approximately 8.25 miles west of project area) and is maintained annually using a hopper dredge with placement to the ODMDS. The Inner Ocean Bar contains the passage through Beaufort Inlet and the channel towards the State Port which is maintained annually either by hopper dredge or pipeline dredge with placement onto Atlantic Beach or within the nearshore. The Inner Harbor contains NC State Ports Authority shipping and fuel berths and federally maintained turning basins. This is typically maintained every 3 years using mechanical dredging and placement to either a confined upland placement area or the ODMDS.

Atlantic Harbor of Refuge is located approximately 17.8 miles to the north-northeast of the project area. Maintenance dredging occurs here approximately every 5 years using a small pipeline dredge with placement of dredged material onto New Dump Island bird nesting habitat.

The cumulative effects analysis below addresses the cumulative effects of No Action as compared to Alternatives 2 and 3.

#### No Action:

The No Action alternative would have no appreciable adverse effects on environmental resources in the project area.

No maintenance dredging of the USACE and NPS channels would continue to have a negative economic impact on the area and on the NPS Cape Lookout National Seashore. A decline in boating activity over the years due to dangerous shoaling has led to a decline in visitors to the area. Additional shoaling from storm events could block the existing channel completely, preventing ferry boats from accessing the Lighthouse dock. Recreational boaters could run aground and become stranded.

#### Alternatives 2 and 3 (full and partial project corridors):

The action alternatives, Alternatives 2 and 3, both include very similar actions and therefore have very similar effects.

The effects of dredging and dredged material placement on federally protected species such as sturgeon and sea turtles are accounted for under NMFS and the 2020 SARBO. Initial and reoccurring dredging for both UASCE and NPS projects is covered under the 2020 SARBO, and it is assumed that with PDCs in place, these species will not be significantly impacted. Based on this, an effects determination of may affect, not likely to



adversely affect, was made. Furthermore, the 2020 SARBO follows adaptive management practices so adjustments may be made in the future.

The effects on protected species under USFWS purview were considered under the 2017 SPBO and include sea turtles (on land), piping plover, and red knot. Placement windows prevent disturbance to species during nesting seasons. Minor and temporary disturbances in placement areas during colder months, where birds are roosting and foraging, will be limited specifically to those discrete locations. This activity may have some impacts on distribution of pre-existing sites that contain the physical and biological features that benefit wintering/migrating piping plover and red knot. In the sand placement areas, piping plover and red knot individuals may be forced to expend valuable energy reserves seeking available habitat elsewhere. For this reason, USACE has determined that the proposed action may affect, and is likely to adversely affect, these species due to alterations of habitat that occur from beach placement activities.

Effects from changes in water quality to other species were evaluated in this EA and are expected to be minor due to the material being sand and falling out quickly, short duration of projects (2-3 months annually) and localized effects (within the dredging footprint and immediate area) leaving the surrounding areas unaffected. Mobile species are expected to avoid adverse interactions with changes in water quality.

Similar to as mentioned above, benthic invertebrate populations impacted within the channels are expected to recover quickly and have a minimal effect on predators that depend on them. Entrainment occurs only within the federal channel and mostly on the channel bottom and is therefore a small area of impact when compared to the greater size of the surrounding habitat.

Alternatives 2 and 3 (full and partial project corridors) would have no appreciable adverse effects on environmental resources in the project area and may provide environmental benefits by contributing sand to bird and turtle nesting habitat, foraging areas for migratory birds, and structure protection to the historic Lighthouse and its attendant features.

Overall, cumulative effects from past, present, and foreseeable future dredging with contracted pipeline and Government plant dredging are expected to be minimal.

## **7.0 STATUS OF ENVIRONMENTAL COMPLIANCE.**

### **7.1 National Environmental Policy Act (NEPA).**

This EA has been prepared in accordance with NEPA, the Council on Environmental Quality regulations (40 Code of Federal Regulations (CFR) parts 1500-1508, 1515-1518) updated in 2020, and Engineer Regulation (ER) 200-2-2. To ensure the EA included an assessment of impacts on all significant resources in the project area, the Wilmington District circulated a scoping letter by email dated May 6, 2022, to state and Federal resource agencies and members of the public for a 30-day comment period. A formal, virtual scoping meeting was conducted on June 1, 2022, and was attended by USEPA, USFWS, NMFS, NPS, DCM, DMF, WRC, and Carteret County representatives. Specific

concerns expressed by the resource agencies included presence of SAV in the channels and placements areas, the need to avoid placement activity on Morgan Island (well-established bird island in Back Sound), and coverage of beach placement under the USFWS 2017 SPBO.

The Draft EA has been released for a 30-day public review and comment. All identified agency and stakeholder concerns have been considered and addressed during the development of the Final EA.

Pursuant to NEPA, a new EA will be prepared if there are significant changes proposed to the project or new circumstances or information relevant to the environmental impacts of the proposed action.

## 7.2 North Carolina Coastal Zone Management Program.

The actions addressed in this EA for the proposed action would take place in the designated coastal zone of the State of North Carolina. Pursuant to the Federal Coastal Zone Management Act (CZMA) of 1972, as amended (P.L. 92-583), Federal activities are required to be consistent, to the maximum extent practicable, with the federally approved coastal management program of the state in which the activities would occur.

With release of the Draft EA, USACE submitted a Federal consistency determination to the NC Division of Coastal Management (NCDCM) in accordance with Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1456(c)(1)(C)). On June 28, 2023, NCDCM issued a Federal consistency concurrence for the Back Sound to Lookout Bight project (Appendix I) with recommendations to utilize biodegradable geo-tubes, if possible, and to closely monitor impacts to SAV and report these impacts should they occur. **This consistency concurrence covers all dredging and placement options included in this EA with the exception of Morgan Island.**

Morgan Island was added to this EA as a future placement option at the request of the NCWRC and NPS following public review of the EA. Due to timing, Morgan Island was **not** included in the USACE federal consistency determination and therefore is not covered in the June 28, 2023, consistency concurrence. A separate Federal consistency concurrence would be required for any placement of material on Morgan Island and would be obtained prior to work being done there.

Section 1102(a) states that “clean, beach quality material from navigation channels within the active nearshore, beach, or inlet shoal systems must not be removed permanently from the active nearshore, beach or inlet shoal system unless no practicable alternative exists. Preferably, this dredged material would be placed on the ocean beach or shallow active nearshore area where environmentally acceptable and compatible with other uses of the beach.” When considering a project’s compliance with Section 1102, NCDCM has stated that the section should be read in concert with NCAC 7H.0208(2)(G), which does provide some flexibility for publicly funded projects, allowing them to be considered by review agencies on a case-by-case basis with respect to

dredged material placement. Placement of dredged material would be done in accordance with this regulation with the majority of the clean, beach quality material (i.e., ≥90% sand) being placed within approved placement areas (Sandbag Island, soundside and oceanside beachfronts or naturally deep scour holes within the federal channel).

#### 7.2.1 Areas of Environmental Concern (AECs).

The proposed action would take place in or near areas designated under the NC Coastal Management Program as AECs (15A NCAC 7H .0100). Specifically, the activities would occur in three AECs, Estuarine Waters, Ocean Hazard, and Public Trust Area. The following determination has been made regarding the consistency of the proposed action with the State's management objective for the AECs that may be affected:

Estuarine Waters: Estuarine Waters are the state's oceans, sounds, tidal rivers, and their tributaries, which stretch across coastal North Carolina and link to the other parts of the estuarine system: public trust areas, coastal wetlands, and coastal shorelines. For regulatory purposes, the inland, or upstream, boundary of estuarine waters is the same line used to separate the jurisdictions of the NCDMF and the NCWRC. However, many of the fish and shellfish that spend part of their lives in estuaries move between the "official" estuarine and inland waters.

The proposed action would not adversely impact estuarine waters, since dredging and placement would be temporary, and subsequent effects would be minor.

Ocean Hazard: The Ocean Hazard System is made up of oceanfront lands and the inlets that connect the ocean to the sounds. Barden Inlet is within the designated Ocean Hazard System.

The proposed action would not adversely affect oceanfront lands or inlets since no new or additional work is proposed within the Ocean Hazard area.

Public Trust Areas: These areas include waters of the Atlantic Ocean and the lands thereunder from the mean high-water mark to the 3-mile limit of state jurisdiction. The proposed action's soundside and oceanside placement areas are within these Public Trust Areas. Acceptable uses include those that are consistent with protection of the public rights for navigation and recreation, as well as conservation and management to safeguard and perpetuate the biological, economic, and aesthetic value of these areas. The activities that comprise the proposed action are not intended to adversely impact public rights for navigation and recreation and are consistent with conservation of the biological, physical, and aesthetic values of public trust areas.

#### 7.2.2 Other State Policies.

The following state policies found in the NC Coastal Management Program document are also applicable to the proposed action in terms of placement of sand.

Shoreline Erosion Response Policies: NC Administrative Code 7M - Section .0200 addresses beneficial use of dredged material as feasible alternatives to the loss or massive relocation of oceanfront development when public beaches and public or private properties are threatened by erosion; when beneficial use is determined to be socially and economically feasible and causes no significant adverse environmental impacts; and the project is consistent with state policies for shoreline erosion response and state use standards for Ocean Hazard and Public Trust Areas AECs.

Policies on Beneficial Use of Materials from the Excavation or Maintenance of Navigation Channels: NC Administrative Code 7M - Section .1101 states that it is the policy of the state that material resulting from the excavation or maintenance of navigation channels be used in a beneficial way wherever practicable. Policy statement .1102(a) indicates that "clean, beach quality material dredged from navigation channels within the active nearshore, beach, or inlet shoal systems must not be removed permanently from the active nearshore, beach, or inlet shoal system unless no practicable alternative exists. Preferably, this dredged material would be placed on the ocean beach or shallow active nearshore area where environmentally acceptable and compatible with other uses of the beach."

### 7.3 Clean Water Act.

Section 401: Pursuant to Section 401 of the Clean Water Act of 1977 (P.L. 95- 217), as amended, a Water Quality Certification (WQC) is required for the preferred alternative for all dredged material placement activities associated with dredging of USACE and NPS channels. Implementation of the proposed project would require separate Individual WQCs, which will be obtained prior to placement of dredged material, and all conditions of the WQCs will be met. For discharges of dredged material, separate WQCs would be required for placement onto Sandbag Island via control of effluent, Morgan Island via control of effluent, NPS soundside and oceanside beaches, and open water placement from Government plant sidcasting and special purpose hopper dredging.

An application requesting a WQC for placement of dredged material on NPS beaches was submitted to NCDWR following the release of the Draft EA. This WQC was issued by NCDWR on August 15, 2023 (Appendix J), and all conditions of the WQC will be met. Similarly, USACE has applied for a WQC to NCDWR for placement of dredged material on Sandbag Island. The WQC is pending; however, all conditions will be met once this WQC is issued. Future placement of dredged material on Morgan Island via control of effluent, sidcasting of dredged material, or placement of dredged material in scour holes would require separate WQCs prior to work being done.

Section 404: Pursuant to Section 404 of the Clean Water Act (33 C.F.R. § 335.7), the impacts associated with the discharge of dredged or fill material into waters of the

United States are discussed in the Section 404(b)(1) (P.L. 95-217) Final Guidelines Analysis in Appendix C. Discharges associated with dredging are considered incidental fallback and therefore, are not considered as a discharge addressed under the *Section 404(b)(1) Guidelines Analysis*. There are no practicable alternatives that would have a less adverse effect on the aquatic environment, therefore, the proposed action is the least environmentally damaging practicable alternative (LEDPA).

A Department of the Army permit application was submitted to the USACE Regulatory Division for NPS channel maintenance and dredged material placement on NPS beaches following the release of the Draft EA. The Regulatory Division issued the permit on August 28, 2023 (Appendix J), and all conditions of the permit will be met. This permit is valid for ten years, with an expiration date of December 31, 2033.

The preferred alternative will comply with Sections 401 and 404 of the Clean Water Act and all conditions of these permits will be met.

#### 7.4 Endangered Species Act.

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531–1543), provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. In accordance with section 7(a)(2) of the ESA, and under the purview of the USFWS and NMFS, USACE will ensure that effects of the proposed project would not jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat of such species.

USACE dredging and placement will operate under the USFWS 2017 NC SPBO for material placement from both the USACE navigation channels and NPS boat dock channels.

The SPBO adopts the Conservation Measures agreed to by USACE for minimizing impacts to federally listed species and lays out the Reasonable and Prudent Measures for beach placement activities for the protection of sea turtles, manatee, piping plover, red knot, and seabeach amaranth. This BO is expected to be updated for Red Knot once a final rule is published that designates Critical Habitat for the species. The USACE will implement all associated terms and conditions for maintenance dredging and placement associated with the SPBO.

All work done for the proposed project will comply with the 2020 SARBO PDCs associated with maintenance dredging and placement using a cutter-section and special purpose hopper dredges (referred to as modified hopper dredging in the 2020 SARBO). No additional risk-minimization measures beyond those considered in this EA are deemed warranted due to the low risk of harm from the dredge equipment proposed, sediments to be dredged, placement areas, and species likely to be present, regardless of time of year when work occurs. This project will be coordinated with NMFS through routine reporting, and monthly calls between agencies (USACE SAD/BOEM/NMFS) are ongoing to discuss the progress of existing projects, completed projects, new work, and

risk to T&E species and the environment associated with all known dredging work covered by the 2020 SARBO.

All work done for the proposed project will comply with the 2020 SARBO <https://www.fisheries.noaa.gov/content/endangered-species-act-section-7-biological-opinions-southeast>.

#### 7.5 Magnuson-Stevens Fishery Conservation and Management Act.

The 1996 Congressional amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (PL 94-265) set forth requirements for NMFS, regional fishery management councils (FMC), and other Federal agencies to identify and protect important marine and anadromous fish habitat. These amendments established procedures for the identification of EFH and a requirement for interagency coordination to further the conservation of federally managed fisheries.

Per the January 22, 2019, and October 2, 2018, EFH Findings between NMFS' Southeast Regional Office and South Atlantic Division, U.S. Army Corps of Engineers and Jacksonville District, respectively, the EFH assessment for the project was integrated within the Draft EA (Section 5.6). USACE EFH coordination with NMFS Habitat Conservation Division (HCD) will be completed prior to completion of the NEPA process.

#### 7.6 Public Laws and Additional Executive Orders.

Table 7 lists the compliance status of all applicable executive orders considered for the proposed Back Sound to Lookout Bight project.

*Table 7. The Relationship of the Preferred Alternative to Federal Laws and Policies*

<b>Title of Public Law</b>	<b>US CODE</b>	<b>*Compliance Status</b>
Abandoned Shipwreck Act of 1987	43 USC 2101	Full Compliance
Anadromous Fish Conservation Act of 1965, As Amended	16 USC 757 et seq.	Full Compliance
Archeological and Historic Preservation Act of 1974, As Amended	16 USC 469	Full Compliance
Archeological Resources Protection Act of 1979, As Amended	16 USC 470	Full Compliance
Clean Air Act of 1972, As Amended	42 USC 7401 et seq.	Full Compliance
Clean Water Act of 1972, As Amended	33 USC 1251 et seq.	In Progress
Coastal Zone Management Act of 1972, As Amended	16 USC 1451 et seq.	In Progress

<b>Title of Public Law</b>	<b>US CODE</b>	<b>*Compliance Status</b>
Endangered Species Act of 1973	16 USC 1531	Full Compliance
Estuary Program Act of 1968	16 USC 1221 et seq.	Full Compliance
Fish and Wildlife Coordination Act of 1958, As Amended	16 USC 661	Full Compliance
Historic and Archeological Data Preservation	16 USC 469	Full Compliance
Historic Sites Act of 1935	16 USC 461	Full Compliance
Magnuson Fishery Conservation and Management Act – Essential Fish Habitat	16 USC 1801	In Progress
National Environmental Policy Act of 1969, As Amended	42 USC 4321 et seq.	Full Compliance
National Historic Preservation Act of 1966, As Amended	16 USC 470	Full Compliance
National Historic Preservation Act Amendments of 1980	16 USC 469a	Full Compliance
Native American Religious Freedom Act of 1978	42 USC 1996	Full Compliance

<b>Executive Orders</b>		<b>*Compliance Status</b>
Protection and Enhancement of Environmental Quality	11514/11991	Full Compliance
Protection and Enhancement of the Cultural Environment	11593	Full Compliance
Floodplain Management	11988	Full Compliance
Protection of Wetlands	11990	Full Compliance
Greenhouse Gas Emissions and Climate Change	12866	Full Compliance
Federal Actions to Address Environmental Justice and Minority and Low-Income Populations	12898	Full Compliance
Invasive Species	13112	Full Compliance

\*Full compliance once the NEPA process is complete.

The Preferred Alternative will not adversely affect natural and cultural resources and will be in full compliance with Executive Orders stated above following completion of the NEPA process.

#### 7.7 National Park Service Special Use Permit.

The placement of dredged material onto Lighthouse Beach (soundside) would provide protection to the historic lighthouse and other adjacent structures. An SUP application was submitted to the NPS on June 30, 2023, for this dredged material placement and the NPS issued an SUP to USACE on July 17, 2023 (Appendix K). The SUP is valid for five years, with an expiration date of August 15, 2028. This SUP authorizes USACE to maintenance dredge the Federal and NPS channels and place dredged material on Lighthouse beach.

The NPS has identified an area of oceanside beach within the Cape Lookout National Seashore as eligible for receiving sand for purposes of habitat restoration and enhancement through the process of obtaining a SUP. The USACE would obtain an SUP from the NPS prior to any placement activity on oceanside beaches.

#### 7.8 Coordination of this Document.

Prior to the release of the Draft EA and following the June 1, 2022, virtual scoping presentation, two meetings were held with state and federal resource agencies to resolve concerns raised during the scoping period. On October 28, 2022, USACE held a virtual meeting to discuss the placement of material onto Sandbag Island, which has SAV present along the west and south sides. The placement plan, attached as Appendix B, reflects changes made to address concerns raised by agencies.

The Preferred Alternative and the environmental impacts of the Preferred Alternative are thoroughly addressed in this EA. The Draft EA was made available to an extensive list of Tribes and local, State, and Federal regulatory agencies, elected officials, and members of the public for a 30-day review and comment period. A list of recipients is included as Appendix G of this document. All comments received during public review were considered during development of the final EA and all comments and responses are included in Appendix H.

This final EA/Finding of No Significant Impact (FONSI) has been made available to the list of recipients in Appendix G and may also be accessed on the Wilmington District Website at: <http://www.saw.usace.army.mil/Missions/Navigation/Dredging/>.

### **8.0 ENVIRONMENTAL COMMITMENTS**

To proceed with the Preferred Alternative of dredging and placement with a partial project corridor, USACE will follow the environmental commitments listed below:

- All Government plant dredging would take place between October 1 – March 31.



- USACE will maintain a 100 foot buffer from all SAV during placement of dredged material within deep scour holes or sidecasting in the Barden Inlet area during the October 1 – March 31 timeframe.
- Beach placement and bird island placement would only occur during the relevant timeframes for the protection of nesting sea turtles (November 16 – April 30) and birds (September 1 – March 31).
- Prior to each dredging event, SAV in the project area would be identified using the State’s online SAV database and recent aerial imagery; SAV will be avoided to the maximum extent practicable.
- Placement onto Sandbag and/or Morgan Island via control-of-effluent would utilize methodologies that will avoid impacts to SAV to the maximum extent practicable.
- On July 17, 2023, a Special Use Permit (SUP) was obtained from the NPS to place dredged material on soundside beaches. A separate SUP would be required prior to commencement of work on oceanfront beaches.
- USACE will establish a 150 square meter buffer around the wreck of the Olive Thurlow (CLS0004) in which no dredging will occur. Should unknown cultural resources or historic properties be directly encountered or indirectly affected during dredging or dredged material placement operations, the CALO inadvertent discovery policy would be followed.
- All necessary State and Federal authorizations (CZMA consistency, Section 401/404 permits, etc.) will be obtained prior to work commencing and all conditions will be met.
- USACE will abide by the USFWS 2017 Statewide Programmatic Beach Placement BO and 2017 Manatee Guidelines.
- USACE will abide by the NMFS 2020 SARBO and relevant PDCs.
- Any changes in the proposed plan will be coordinated in advance with resources agencies.

## **9.0 CONCLUSION**

Based on findings described in this EA, it is in the Federal interest to implement the Preferred Alternative (Alternative 3) of a partial project corridor to maintain the USACE and NPS channels using contracted pipeline dredge every 3-5 years and Government-owned plant as needed. Proposed dredging events would occur within the appropriate environmental timeframes to protect fisheries and shorebird and sea turtle nesting areas. Overall, impacts associated with dredging and dredged material placement would be minor and volumes of material to be dredged would be limited to areas of shoaling. Furthermore, dredged material is beach quality sand and would settle quickly,

resulting in minimal turbidity within the water column. Maintenance dredging may result in minor, short-term and localized impacts to water quality, noise, benthic organisms, important fisheries and protected marine species. Maintenance dredging will have no adverse effects on cultural resources or historic properties.

The Preferred Alternative is the LEDPA and will provide a safer, more navigable channel for ferries and fishermen, while minimizing impacts to the greatest extent practicable.

## **10.0 POINT OF CONTACT.**

Mr. John Policarpo, CESAW-ECP-PE, U.S. Army Engineer District. Telephone (910) 251-4700, email [John.N.Policarpo@usace.army.mil](mailto:John.N.Policarpo@usace.army.mil).

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APPENDIX A  
GEOTECHNICAL ASSESSMENT

CHANNEL BACK SOUND TO LOOKOUT BIGHT  
ENVIRONMENTAL ASSESSMENT

2023



Prepared by:  
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## **1) General**

The Back Sound/Lookout Bight study area lies within a microtidal setting (average tidal range of less than 6 feet) along the North Carolina coastline (NOAA, 2022). The study area encompasses a ferry route from Harkers Island to the National Park Service (NPS) ferry dock adjacent to the Cape Lookout Lighthouse (Figure 1). The ferry route overlaps with the federal navigation channel, which then terminates and follows naturally deep water to access the NPS ferry dock and to exit the Lookout Bight (Barden Inlet).

Presently, the ferry route is within the entire federal navigation channel. The ferry route west of the NPS ferry dock is shallower than the authorized project depth (-7 ft. MLLW with 2 ft. of allowable over depth), in some cases, shoaled areas are exposed during low tides. Dredging and disposal of these shoaled areas is what initiated this geotechnical investigation. The grain size of the shoaled sediment to be dredged must be determined for appropriate placement. The current placement options are 1) an adjacent bird island near the federal navigation channel known as “Sandbag Island”, 2) sound-side beach placement in front of the Cape Lookout Lighthouse and historical structures, and 3) ocean-side placement along Cape Lookout National Seashore.

### **1.1 Historical Significance**

As shipping increased along the Atlantic seaboard after the American Revolution, so did maritime disasters and resultant loss of life. The federal government established lighthouses and light stations as early as the 1790s (NPS, 2012). Specifically, at Cape Lookout, historical structures and sites in this area represent over two centuries of federal efforts to protect maritime commerce (NPS, 2012). This includes the 1812 lighthouse (site), the 1859 lighthouse and light station (current), the 1886 U.S. Life-Saving Station, and the 1917 U.S. Coast Guard Station. The most iconic structure—the 1859 lighthouse—was the first of the four tall tower lighthouses built on the North Carolina coast (NSP, 2012). The lighthouse, with its unique diagonal checkered daymark, was individually listed on the National Register of Historic Places in 1972. The Cape Lookout Lighthouse is an iconic structure that serves as a driver for tourism in the region (NPS, 2004).



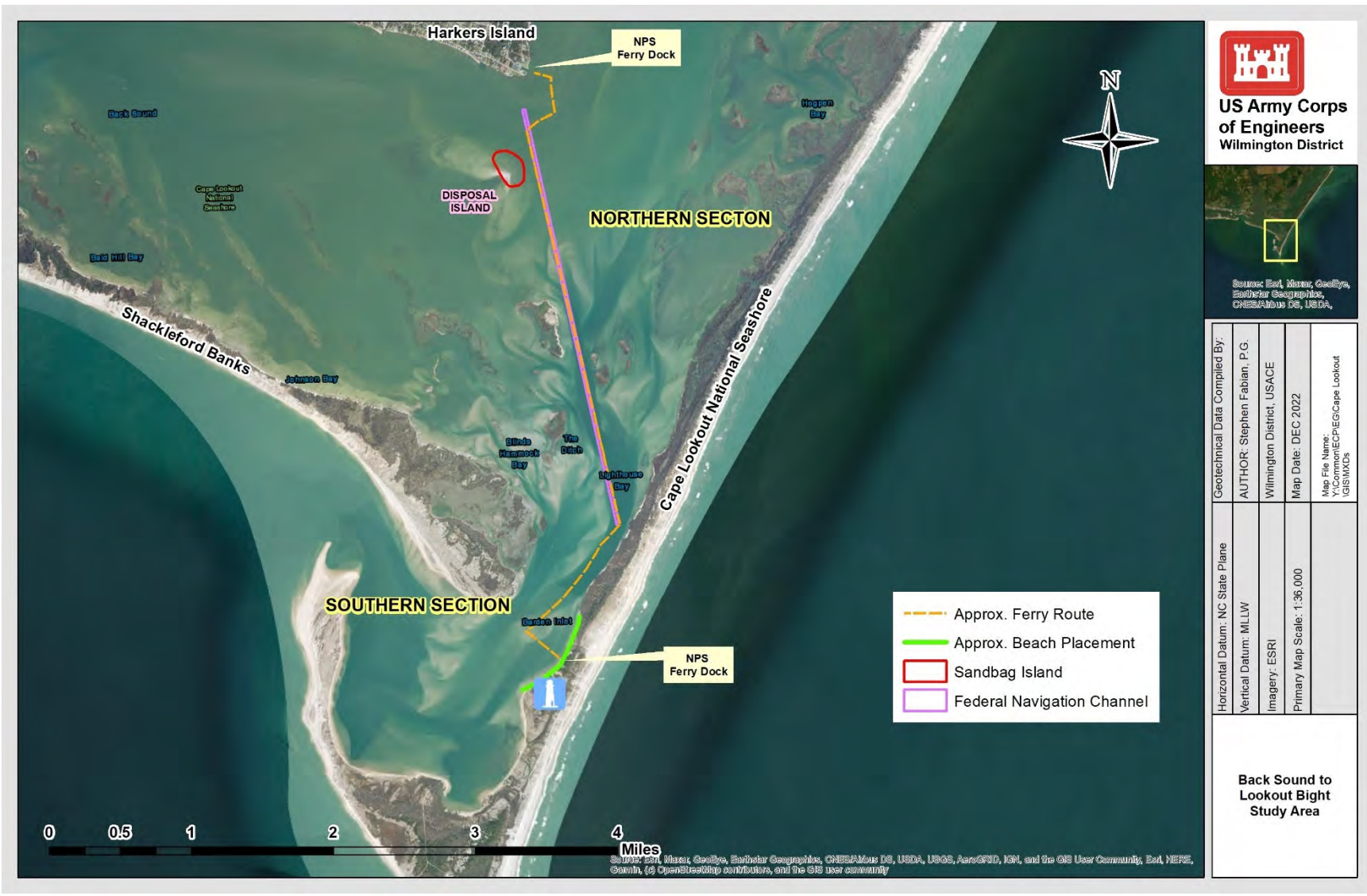


Figure 1. Study area showing ferry route from Harkers Island to the NPS ferry dock. In addition, the figure highlights two possible areas for placement of dredge material; 1) disposal island (Sandbag Island) and, 2) sound-side beach placement.

## **1.2 Buried Cable Route**

The lighthouse's main power source use to supplied by an electrical service cable from Harkers Island to Cape Lookout (Figure 2). The entire cable was mapped in 1993, with subsequent mapping was conducted on a portion of the cable in 2006 prior to a dredging event. The buried cable extends for 5 miles and has powered the Cape Lookout Lighthouse and life-saving station for decades. The survey from 1993 shows the cable running alongside the federal navigation channel and intersecting the southern portion of the federal navigation channel. The cable then follows the sound-side shoreline before terminating at the national historic district, where the lighthouse and lifesaving station are located. However, due to a recent improvement of solar panels that now provide sustainable energy power to the lighthouse the need for the cable is not needed and was abandoned. It is recommended the cable route be mapped prior to any dredging occurring within the study area to prevent damage to any dredging equipment.



Figure 2. Mapped cable routes from Harkers Island to Cape Lookout Lighthouse. The 1993 route covers most of the cable route while the 2006 mapped cable route covers a small portion of the cable's location, which was in the vicinity of where dredging occurred 2006.

## **2) Project History**

In April 1997, the federal navigation channel was dredged to provide easier mariner access from Harkers Island to Cape Lookout. The dredged material was used to create a bird island adjacent to the federal channel, known as “Sandbag Island” (Figure 1 and Figure 3). Prior to dredging and placement of material, a sandbag ring was constructed to prevent sluffing and dispersion of material away from the desired placement area (Figure 3). The sandbag ring is still visible today, but the sediment placed here in 1997 has been removed over time through wind, waves, and tidal processes and now most of the island is submerged. This disposal site has not been used since 1997.

Following numerous coastal storms in the late 1990’s and early 2000’s, the sound-side beach protecting the Cape Lookout Lighthouse and other historical structures had eroded significantly. A geotechnical investigation was performed 2004-2005 to identify beach compatible sediments within the shoaled areas of the ferry channel and federal navigation channel (Figure 4). The geotechnical investigation revealed shoaled sediments just west of the lighthouse were suitable for beach placement, while the sediments within the federal navigation channel were deemed not suitable for beach placement given the large difference in mean grain size relative to the native beach. In 2006, dredging took place west of the lighthouse and replenished the shoreline adjacent to the lighthouse, placing over 70,000 cubic yards (Figure 4) of sand. The federal navigation channel was not dredged. Further discussion on the grain size compatibility from the 2004-2005 project can be found in Section 4.



Figure 3. Sandbag island, a disposal site, was last used in 1997. The island's footprint has changed numerous times due sediments being reworked by wind, tides, and coastal storms. The sandbag ring (dashed red line) used to control the movement of material is still visible today.

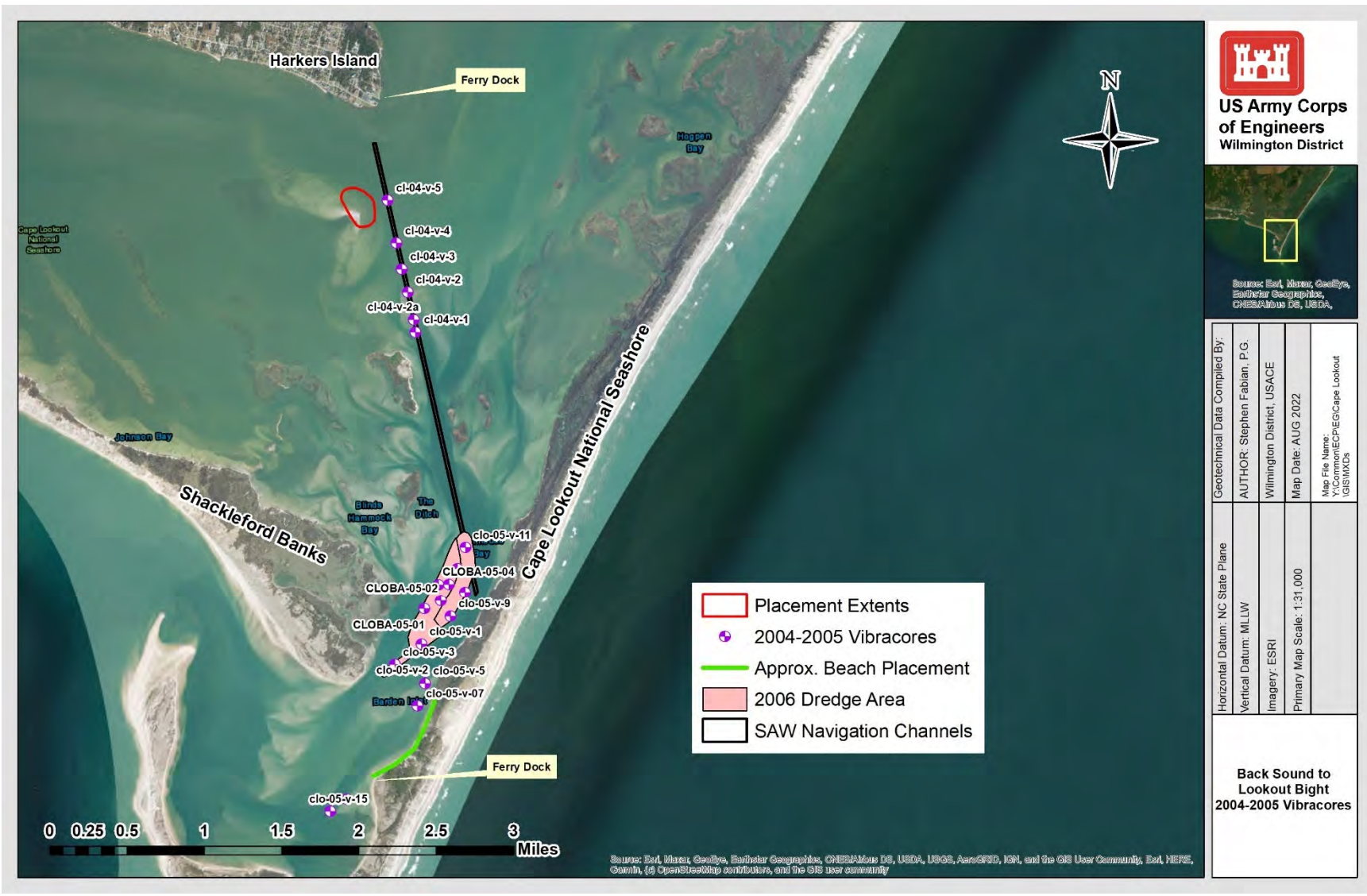


Figure 4. Location of 2004-2005 vibracores and dredging extents of the 2006 beach nourishment project on the sound-side beach adjacent to the Cape Lookout Lighthouse.

Since the 2006 dredging event, no other dredging has occurred in the project area. The shoreline adjacent to the lighthouse has since receded to its approximate original state seen in 2005 and shoaling along the ferry route has made navigation treacherous. In late 2021, the NPS had requested the Wilmington District to assist with identifying the shoaled material through geotechnical sampling and appropriate placement of classified material. This launched a geotechnical investigation in 2022 to identify subsurface sediments in the shoaled material within the federal navigation channel and to the west of the lighthouse. Herein, this appendix provides further discussion on the geotechnical work completed in 2022, classification of sediments, and grain size statistics are presented in the preceding sections.

### **3) Grain Size Compatibility**

Before determining whether dredged material is beach compatible, it is important to understand the differences between field classification and laboratory classification. Field classification of a soil sample consists of visually estimating the grain sizes in hand, in addition to qualitatively recording sample moisture, plasticity, and other attributes such as mineralogy, cementation, or the presence of shells in accordance with D2488-17, Standard Practice for Description and Identification of Soils (Visual Manual Procedures.).

Laboratory classification is performed according to ASTM (American Society for Testing and Materials) Standards, D-421 and D-422, to identify the range of grain sizes and weight percentage of each grain size relative to the entire soil sample. In this process, the sample is physically broken up twice in a mortar using a rubber-tipped pestle, after which the sample is passed through a stack of sieves shaken vertically and horizontally for several minutes to separate the different grain sizes.

While the laboratory data are used for performing compatibility analysis, it would be irresponsible to presumptively value these data over that which is gathered with field classifications. The field classifications more closely represent the condition of the material in-situ, which is the same condition in which the material will ultimately be dredged. While the dredging process disturbs in-situ material, there is no evidence to suggest that dredging would physically alter the soils as much as laboratory preparation. Additionally, field classifications

allow for the identification of friable limestone or other indurated or partially indurated grains, which laboratory analysis might classify as being well or poorly graded sand (SW or SP). Therefore, for the purpose of beach nourishment, materials field classified as cemented or as gravels (GP, GM, or GC) are not being considered.

Beach nourishment success depends on finding a source of sand that is similar in character to the native beach. Three scenarios, described by Dean (1991; 2002), are possible:

- Borrow area sediment is finer than the native beach-resulting in excessive sand migration offshore and flattening of the beach profile.
- Borrow area sediment is coarser than the native beach-resulting in higher “stand-up” of fill material and a steeper beach profile through the surf zone.
- Borrow area sediment matches the native beach-the placed fill material will follow existing surface contours, mimicking the existing profile.

Particle-size analysis was conducted vibracore samples in accordance with ASTM Standard D 6913, “Standard Test Method for Particle-Size Analysis of Soils” using the following U.S. Standard sieve sizes: 1-inch”, 3/8-inch”, No. 4, No. 7, No. 10, No. 14, No. 18, No. 25, No. 35, No. 45, No. 60, No. 80, No. 120, No. 170, No. 200, and No. 230. In addition to the particle-size analysis, all samples were classified using visual engineering soil classification in accordance with ASTM Standard D 2487, “Classification of Soils for Engineering Purposes” (Table 1), as required in Engineering Manual 1110 1 1804.

The first step determining whether dredged material is beach compatible is looking at the USCS visual classification, field notes, and photographs of each vibracore. A portion of material considered to be “suitable” for beach-fill may consist of Poorly Graded Sand (SP), Poorly Graded Sand with Silt (SP-SM), Silty Sand (SM), Poorly Graded Sand with Clay (SP-SC), and Clayey Sand (SC) per the USCS, as long as the portion of material meets the following criteria<sup>1</sup>.

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<sup>1</sup> This criterion is outlined in our plans and specifications for the Wilmington District routine beach nourishment projects.



A portion of material to be considered “unsuitable” for beach fill may consist of SP-SM<sup>2</sup>, SM, SP-SC, or SC not meeting the criteria listed above, as well as, Low Plasticity Silt (ML), High Plasticity Silt (MH), Low Plasticity Clay (CL), and High Plasticity Clay (CH) per the USCS. The next step taken was looking at the percentage of fines (passing the No. 200 sieve<sup>3</sup>) within an entire collected core. Each vibracore consisted of a weighted average of percent fines throughout the entire core. Each weighted average was then color-coded and displayed using ArcMap to depict cluster vibracores containing percent fines less than 10% (Figure 4). In addition, other geotechnical considerations of the borrow material were considered:

- Less than 10 percent, by weight, material retained on the #4 sieve over weighted average;
- Material retained on the 1-inch sieve does not exceed, by percentage or size, which is found on the native beach;
- Contains no construction debris, toxic material, or other foreign matter; and
- Contains no cemented sands or rock fragments.

Vibracores were then further analyzed by calculating grain size statistics such as mean, median, and standard deviation. Each core’s grain size statistics were composited within the suitable portion of the vibracore to determine the grain size compatibility compared to the sound-side native beach, adjacent to the lighthouse. Weighted averages of median, mean, percent fines, standard deviation and lastly overfill ratios were carried out for each vibracore. Once this was done for each vibracore a determination was made for suitable placement of material.

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<sup>2</sup> If SP-SM is identified if the fines content is greater than 12% it was deemed unsuitable for beach placement.

<sup>3</sup> According to the USCS sediments passing the No. 200 sieve are classified as silts and/or clays.

Table 1. USCS definitions (based on ASTM-2487).

Major Division	Group Symbol	Group Name	Criteria	
$F_{200} < 50$ Gravel $R_4/R_{200} > 0.5$  Sands $R_4/R_{200} \leq 0.5$	GP	Poorly graded gravel	$F_{200} < 5$ ; $C_u \geq 4$ , $1 \leq C_z \leq 3$	
	SW	Well-graded sand	$F_{200} < 5$ ; $C_u \geq 6$ , $1 \leq C_z \leq 3$	
	SP	Poorly graded sand	$F_{200} < 5$ , Does not meet the SW criteria of $C_u$ and $C_z$	
	SM	Silty Sand	$F_{200} > 12$ , $PI < 4$	
	SC	Clayey sand	$F_{200} > 12$ , $PI > 7$	
	SW-SM	Well-graded sand with silt	$5 \leq F_{200} \leq 12$ , satisfies $C_u$ and $C_z$ criteria of SW and $PI > 7$	
	SP-SM	Poorly graded sand with silt	$5 \leq F_{200} \leq 12$ , does not satisfy $C_u$ and $C_z$ criteria of SW and $PI < 4$	
	SP-SC	Poorly graded sand with clay	$5 \leq F_{200} \leq 12$ , does not satisfy $C_u$ and $C_z$ criteria of SW and $PI > 7$	
	$F_{200} > 50$ Silts and Clays $LL \geq 50$	MH	Sandy silt	$\geq 30\%$ plus No. 200, % sand $\geq$ % gravel
		CH	Fat clay	$< 30\%$ plus No. 200, $< 15\%$ plus No. 200
Fat clay with sand			$< 30\%$ plus No. 200, 15-29% plus No. 200, % sand $\geq$ % gravel	

Note:  $C_u$  = uniformity coefficient

$C_z$  = coefficient of gradation

LL = liquid limit

PI = plasticity index

$F_{200}$  = percentage finer than the No.200 sieve

$R_4$  = percentage retained on the No.4 sieve

$R_{200}$  = percentage retained on the No.200 sieve

### 3.1 Overfill Ratios

Overfill ratios were determined for each vibrocore collected in the study area. The overfill ratio is defined as the volume of borrow material required to produce a “stable” unit of suitable beach fill material that has the same grain size characteristics as the native beach (James, 1975). For example, an overfill ratio of 1.2 indicates that 1.2 units of borrow material will behave similarly to 1 unit of native beach fill. The overfill ratio accounts for the natural loss due to winnowing of the borrow sediment that is finer than the native beach sediment. Its ultimate purpose is to inform the volume required for beach/dune construction. The overfill ratio is computed by numerically comparing the grain size distribution characteristics of the native beach sand with that of the

borrow area, which includes a final adjustment for the percentage of fines within the borrow area.

Two methods were used to calculate overfill ratios for each borrow area. This process was performed to test the accuracy of each method and determine whether the methods yielded comparable results. The first method was based on USACE's Technical Memorandum No. 60, Techniques for Evaluating Suitability of Borrow Material for Beach Nourishment (James, 1975). This document reviews various methods for determining overfill ratios, such as the Adjusted Fill Factor (AFF) method, which was used in this study. This graphical method was used to develop the overfill ratios for each borrow area. Core composite statistics within the suitable portion of the vibracore such as mean grain size, standard deviation, and percent fines of each core were determined. These calculations were then used to calculate the core composite X values<sup>4</sup>, Y values<sup>5</sup>, and silt correction factor. Once the X and Y values for each core were calculated, the cumulative mean was then used in Figure 5 to determine an "initial overfill ratio"<sup>6</sup>. Using Figure 5, the point on the graph where the X and Y values intersected was the "initial overfill ratio."

The second method for overfill ratio calculations involved the Coastal Engineering Design and Analysis System (CEDAS). The CEDAS method is a computerized program that uses the same variables as the graphical method. The CEDAS software method uses the cumulative borrow means of the mean grain size and standard deviation, native mean grain size and standard deviation, and calculated "in-situ" borrow area volume to output the "initial overfill ratio".

Once the "initial overfill ratio" values for both of the graphical and CEDAS method were determined, one final adjustment was made, the "silt correction factor." This is defined mathematically by  $1/1-(\text{percent silt}^7 / 100)$ . Once the "silt correction factor" was determined, the value was multiplied by the "initial overfill ratio" to obtain a final overfill ratio value for each specific borrow area. Each of the two methods yielded comparable results. Final overfill ratio values between the AFF and CEDAS method had a difference of 0.1 to 0.3.

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<sup>4</sup>  $X = [\text{MEAN (PHI) BORROW} - \text{MEAN (PHI) NATIVE} / \text{STD. DEV. NATIVE (PHI)}$

<sup>5</sup>  $Y = \text{STD. DEV. (PHI) BORROW} / \text{STD. DEV. (PHI) NATIVE}$

<sup>6</sup> The "initial overfill ratio" does not consider the applied silt correction factor.

<sup>7</sup> Percent silt denotes the percent of sediment passing the No. 200 sieve.

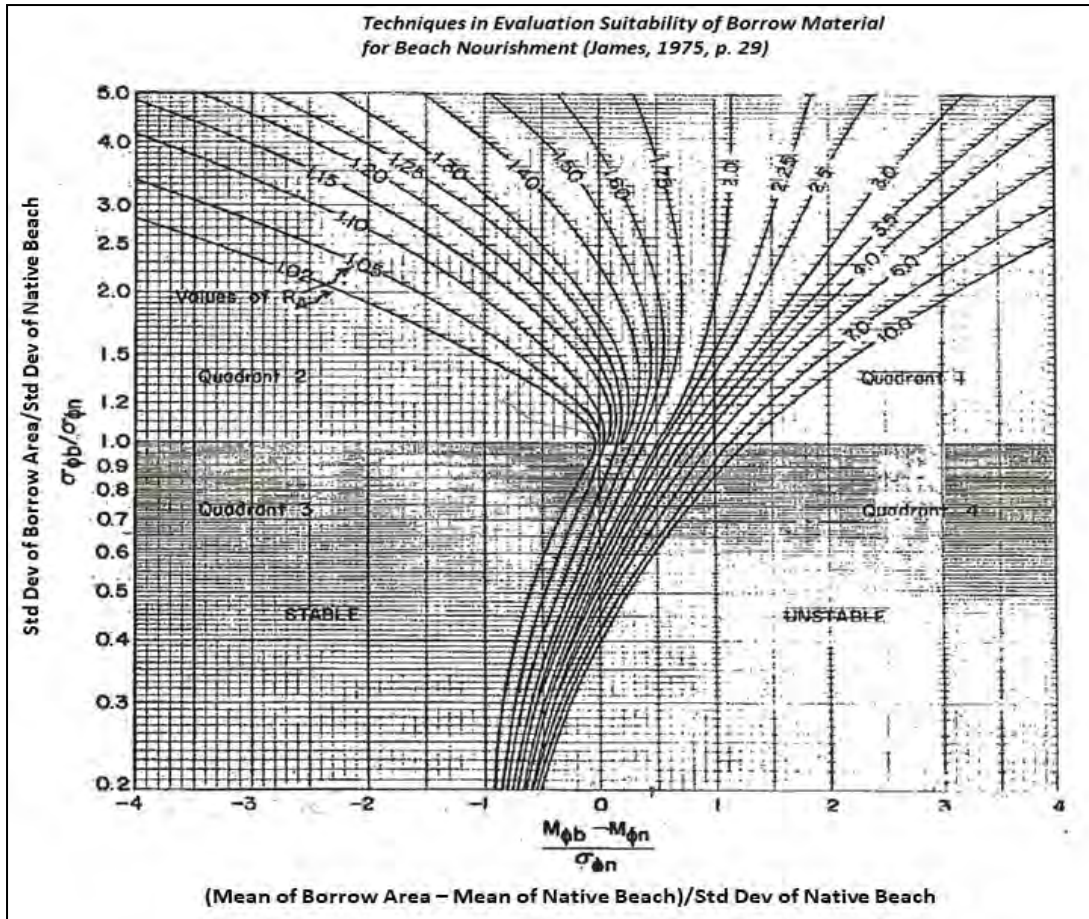


Figure 5. Adjusted Fill Factor Plot. After finding the cumulative mean X and Y values this graph was used to determine the “initial overfill ratio”.

#### 4) Geotechnical Investigations

Two geotechnical investigations involving the collection of vibracores were performed across the study area (Figure 6), the first being in 2004-2005 and the second in 2022. The purpose of these investigations was to analyze the subsurface sediments and determine whether the sediments were suitable for beach or bird island placement. Vibracores were strategically placed to target areas of significant shoaling. Where naturally deep water exists, deeper than -9 ft. MLLW, these areas were not targeted since dredging would not occur in these locations. If naturally deep-water areas do become shoaled-in additional geotechnical investigations may need to occur if sufficient subsurface information is lacking within the surrounding area. Details regarding these investigations are described in the below sections.



Figure 6. Vibracores collected throughout the study area during the 2004-2005 and 2022 drilling efforts.

#### 4.1 Native Grain Size

In conjunction with the 2004-2005 vibracore investigation, the native grain size was determined for the sound-side beach in front of the Cape Lookout Lighthouse. If placement is to occur on the ocean-side beach in front of the lighthouse, determining of the native grain size will need to be performed by the NPS prior to placement. Knowing the native grain size helps quantify the best sedimentological match for the respective beach.

The native grain size of the sound-side beach was determined by collecting a total of 45 grab samples across 9 profile lines. The grab samples along each profile came from the dune toe, berm, mean high water line, mean sea level line, and mean low water line. Following the collection of these grab samples, a stack of sieves was used to provide grain size distributions, which were then used to determine: mean, percent passing the No. 200 sieve, and standard deviation (sorting; Table 1). The median grain size was calculated for the native beach.

Table 2. The 2004 native grain size assessment of the sound-side beach adjacent to Cape Lookout Lighthouse.

<b>Native Grain Size (Sound-Side Beach)</b>			
Passing No. 200 Sieve	Mean (mm)	Mean (phi)	Std. Dev. (phi)
2.5%	0.45	1.15	0.92

#### 4.2 Geotechnical Investigation 2005

From 2004-2005, 20 vibracores were collected across the study area (Figure 4), specifically, the federal navigation channel and the shoals within the Lookout Bight area were investigated. Sediments within the federal navigation channel (CLO-04-V-001 to CLO-04-V-005) were predominantly comprised of very fine to fine grained sand with clay interbedding (northern section; Figure 1). The mean grain size within those vibracores were 0.18 mm (2.46 phi), percent fines (clays and silts) of 3.3%, and standard deviation of 0.71 mm (0.50 phi). Vibracores collected within the Lookout Bight (CLO-05-V-001 to CLO-05-V-015) were predominately comprised of fine to medium grained quartz sand (southern section; Figure 1). The mean grain size within those vibracores were 0.28 mm (1.86 phi), percent fines (clays and silts) of 1.9%, and standard deviation of 0.64 mm (0.65 phi).

### 4.3 Geotechnical Investigation 2022

In 2022, a second geotechnical investigation was performed to confirm the subsurface sediments that were found in 2004 in the Lookout Bight area (Figure 6). A total of 21 vibracores were collected throughout the study area. As seen in the 2004-2005 geotechnical investigation, sediment characteristics still differed significantly from cores that were collected in the federal navigation channel, versus cores collected from the shoaling areas in Lookout Bight. Vibracores collected from the federal navigation channel (CLO-22-V-001 through V-009) were predominantly comprised of fine-grained quartz sand with clay interbedding (northern section; Figure 1). The mean grain size within those vibracores were 0.22 (2.40 phi), percent fines (clays and silts) of 4.63%, and standard deviation of 0.66 mm (0.61 phi). Vibracores collected within Lookout Bight were largely comprised of fine to medium-grained quartz sand with notably higher percentages of shell content (southern section; Figure 1). The mean grain size within those vibracores were 0.38 (1.42 phi), percent fines (clays and silts) of 1.12%, and standard deviation of 0.55 mm (0.85 phi).

### 5) Grain Size Comparisons

Table 3 provides a comparison of the grain size statistics from the two geotechnical investigations relative to the native grain size along the sound-sided beach. The two geotechnical investigations show similar results and confirms that the material types have remained similar over the last several years. The respective figures below (Figure 7 though Figure 11) show the grain size distribution of the northern section, southern section, and native beach and bar graphs comparing individual vibracores with the native grain size for each geotechnical investigation.

Table 3. Comparison of grain size statistics of the northern vs. southern section of the study area relative to the native grain size of the sound-sided beach.

<b><u>Location</u></b>	<b><u>Mean (mm)</u></b>	<b><u>Percent Fines (Clays/Slits)</u></b>	<b><u>Sorting (phi)</u></b>	<b><u>Overfill</u></b>
<b>Northern Section</b>	0.22	4.63 %	0.61	>2 (Unstable)
<b>Southern Section</b>	0.38	1.12 %	0.85	1.60
<b>Native Beach</b>	0.45	2.50 %	0.92	N/A

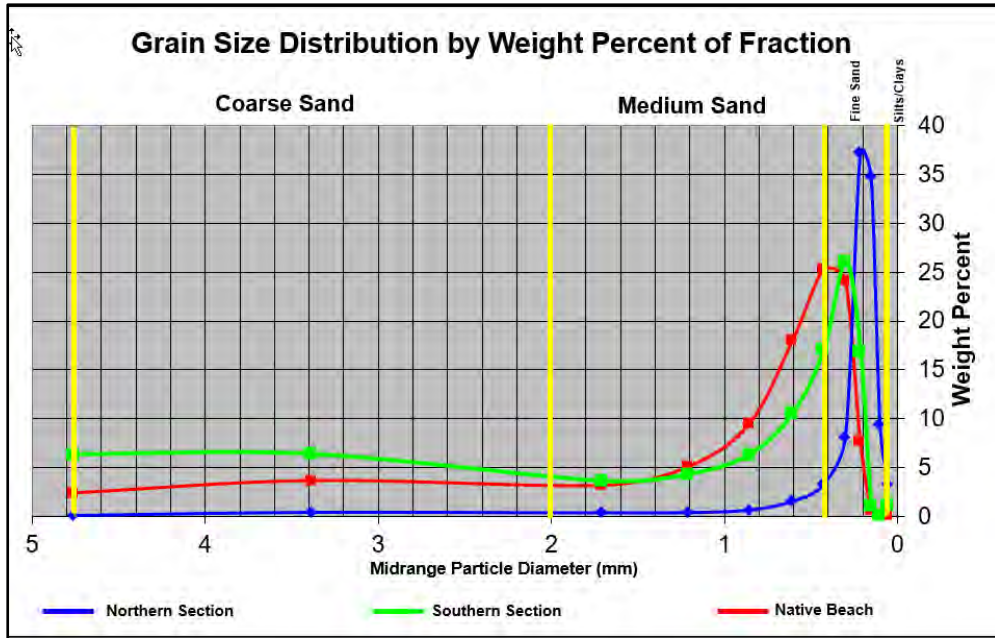


Figure 7. Grain size distribution curves showing the midrange particle diameter (mm) for the collected 2005-2006 vibracore data comparably to each location. The southern section and native beach curve closely resemble one another and straddle the fine to medium sand particle size. The northern section is skewed very far to the right and is close the boundary between fine sand and silt/clays.

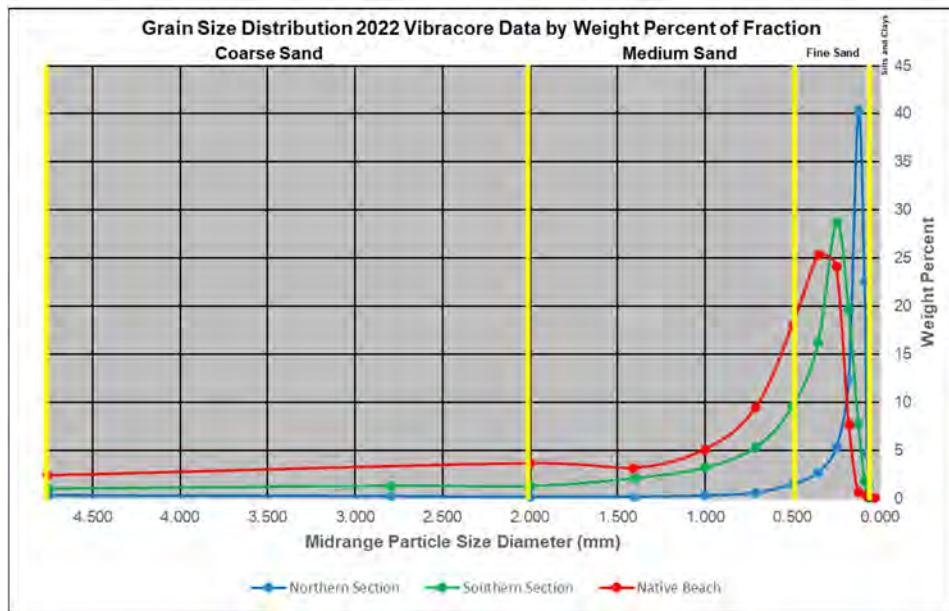


Figure 8. Grain size distribution curves showing the midrange particle diameter (mm) for the collected 2022 vibracore data comparably to each location. Shows similar results to the grain size curves created in 2005-2006.



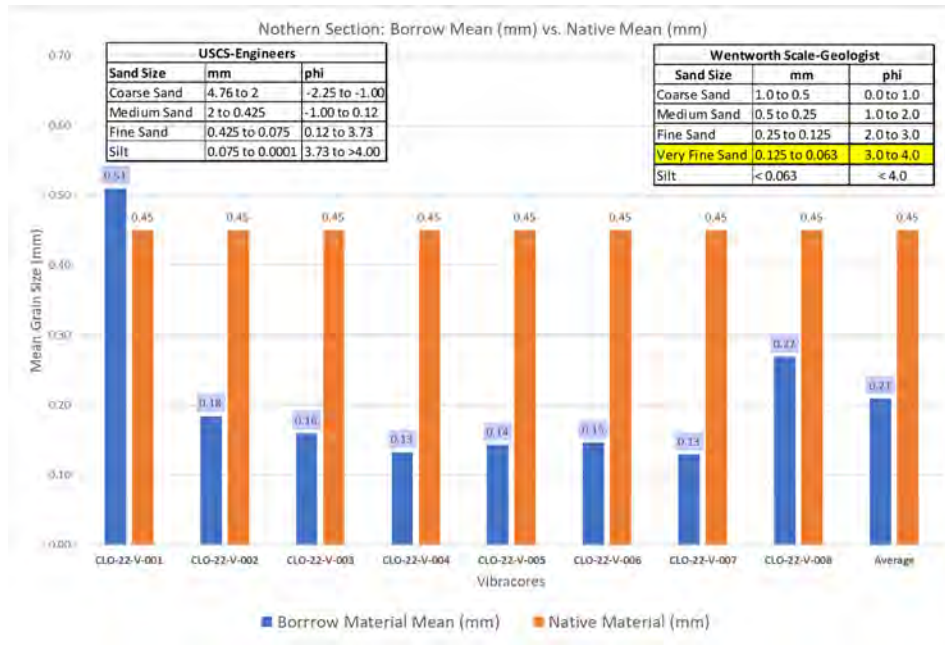


Figure 9. Vibracore data from 2022 collection showing the mean grain size comparison of the northern section vs. the native beach.

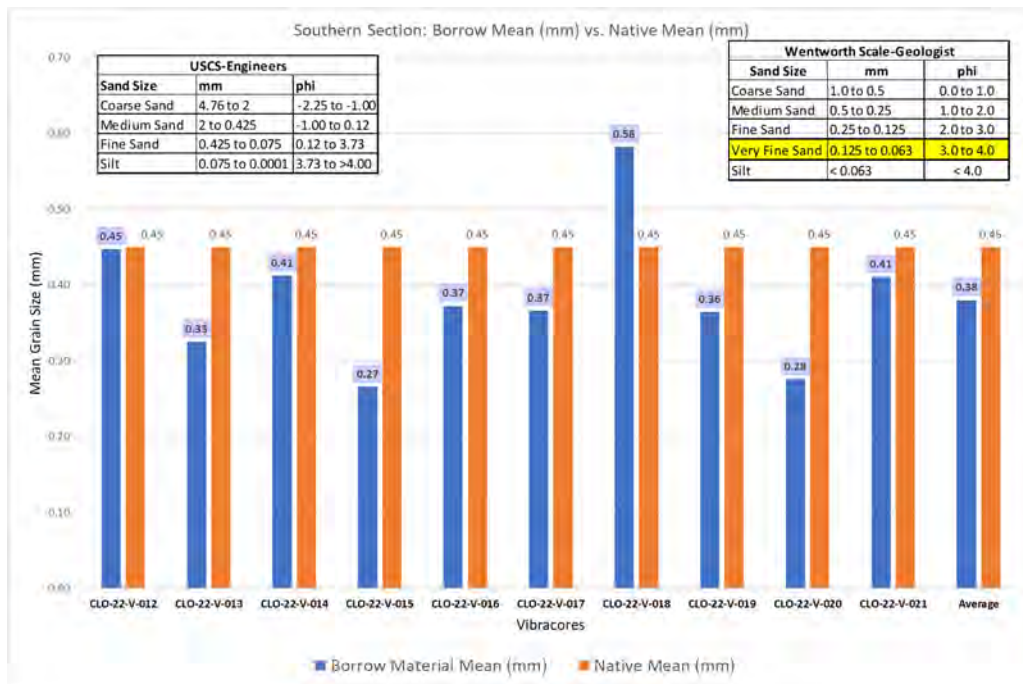


Figure 10. Vibracore data from 2022 collection showing the mean grain size comparison of the southern section vs. the native beach.

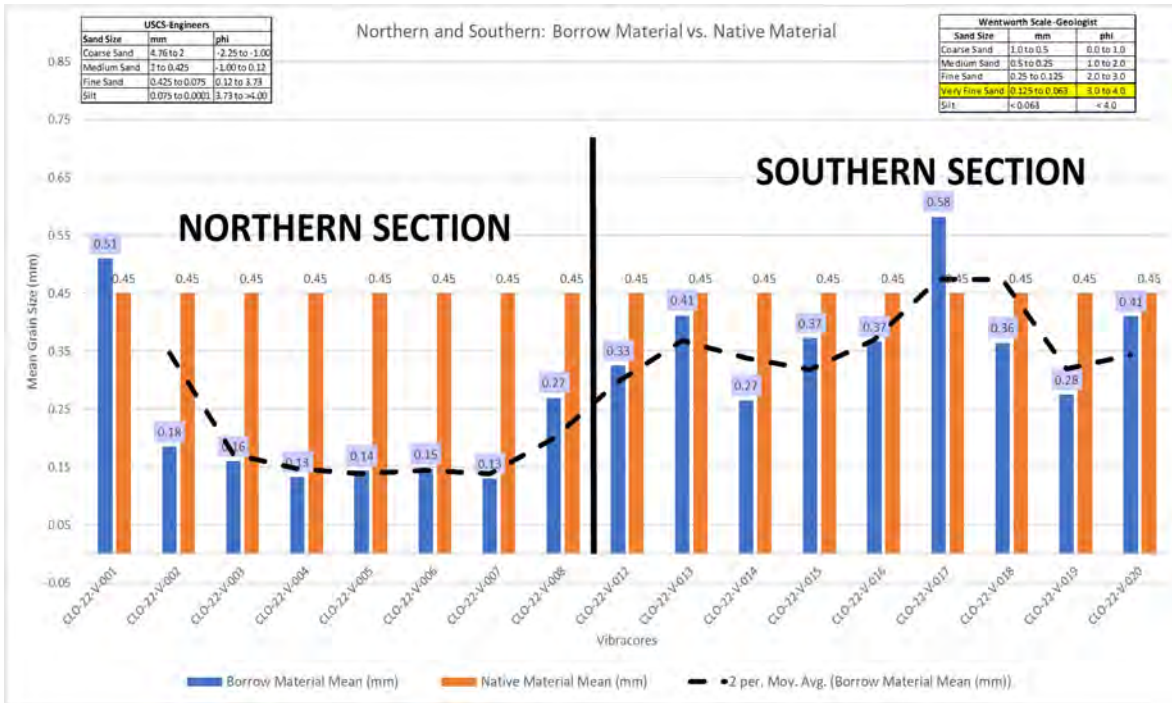


Figure 11. Vibracore data from 2022 collection showing the mean grain size comparison of the northern and southern section vs. the native beach.

## 6) Recommendations

The two geotechnical investigations show similar results and confirm that the material types have remained similar over the last several years. Subsurface sediments within the fixed federal navigation channel (northern section) should be placed on Sandbag Island, and sediments just west of the lighthouse be placed on sound-side beach. Although the vibracores within the federal navigation channel indicate greater than 90 percent sand, the mean grain size is much finer than the native sound-sided beach. Figure 7 and Figure 8 shows the northern section grain size curve skewed very far to the right straddling the boundary between fine sand and silt/clays while the southern section grain size curve closely resembles the native beach grain size curve and is skewed to the boundary near the fine to medium sand.

If dredging occurs over the entire federal navigation channel modifications to the dredging depths are needed to ensure placed material contains greater than 90 percent sand (Figure 12 through Figure 14). Placement on Sandbag Island should be controlled using a combination of geotubes and/or sandbags along with constructed berms/dikes from placed material to prevent sediment from sloughing and dispersing onto nearby submerged aquatic vegetation (SAV).

Placement on the island would be within a 25-acre footprint and would not exceed a height of 15 ft. NAVD88. Also, a portion of the federal navigation channel between vibracores CLO-22-V-005 and CLO-22-V-006 is comprised by a previously mapped submerged feature. This area must be ground-truthed prior to dredging to determine the previously mapped feature. In the southern section, sediments collected within 2022 vibracores indicate suitable material for beach placement (Figure 15 and Figure 16). Similarly, to the 2005 vibracore data, subsurface sediments indicate very similar material. Although, the overfill ratio based on the 2022 data is not ideal for beach placement (1.60) it is the best-fit nourishment alternative that is available.

Lastly, it is recommended that placement monitoring be conducted during any dredging events, specifically on Sandbag Island and the sound-side beach. Placement on Sandbag Island should be monitored to ensure the material is within 90 percent sand or greater and placed material does not impact SAV. In addition, prior to the discharge of any effluent on Sandbag Island, the Contractor shall meet with a representative of the NC Wildlife Resources Commission and representatives of the Contracting Officer to discuss optimal locations for the discharge of effluent. The discharge point shall not be directed at an area of submerged aquatic vegetation (SAV). Impacts to SAV shall be avoided to the greatest extent possible

## **7) Conclusions**

The 2022 geotechnical investigation confirmed that the subsurface sediments within the study area remain relatively the same as the 2004-2005 vibracore effort. The northern section consists of a very fine to fine grained sand (<0.20 mm mean grain size), while the southern section consists of a fine to medium grained sand (>0.30 mm mean grain size) and higher shell content. Although the northern section meets the suitability criteria greater than 90 percent sand, the fine-grained nature of the material does not match well with the native beach. In addition, the dredge distance is greater than 3 miles, which is likely too far for a small dredge plant<sup>8</sup> to efficiently pump the material from the federal navigation channel to the sound-side beach. Therefore, placement on “Sandbag Island” would be most appropriate given the short pumping distance and material being placed here in the past. Lastly, dredging within the Lookout Bight and placing the

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<sup>8</sup> A small dredge plant will likely be used for this work given the shallow depths throughout the project area being 0 to -10 MLLW.

material on the sound-side beach adjacent to the lighthouse is recommended given the material closely resembles the native beach and was done during the last renourishment in 2006 (Figure 14).



Figure 12. Showing dredging limitations within the northern section of the study area. It is recommended all material dredged within the federal navigation channel be placed on the sandbag island (red polygon).

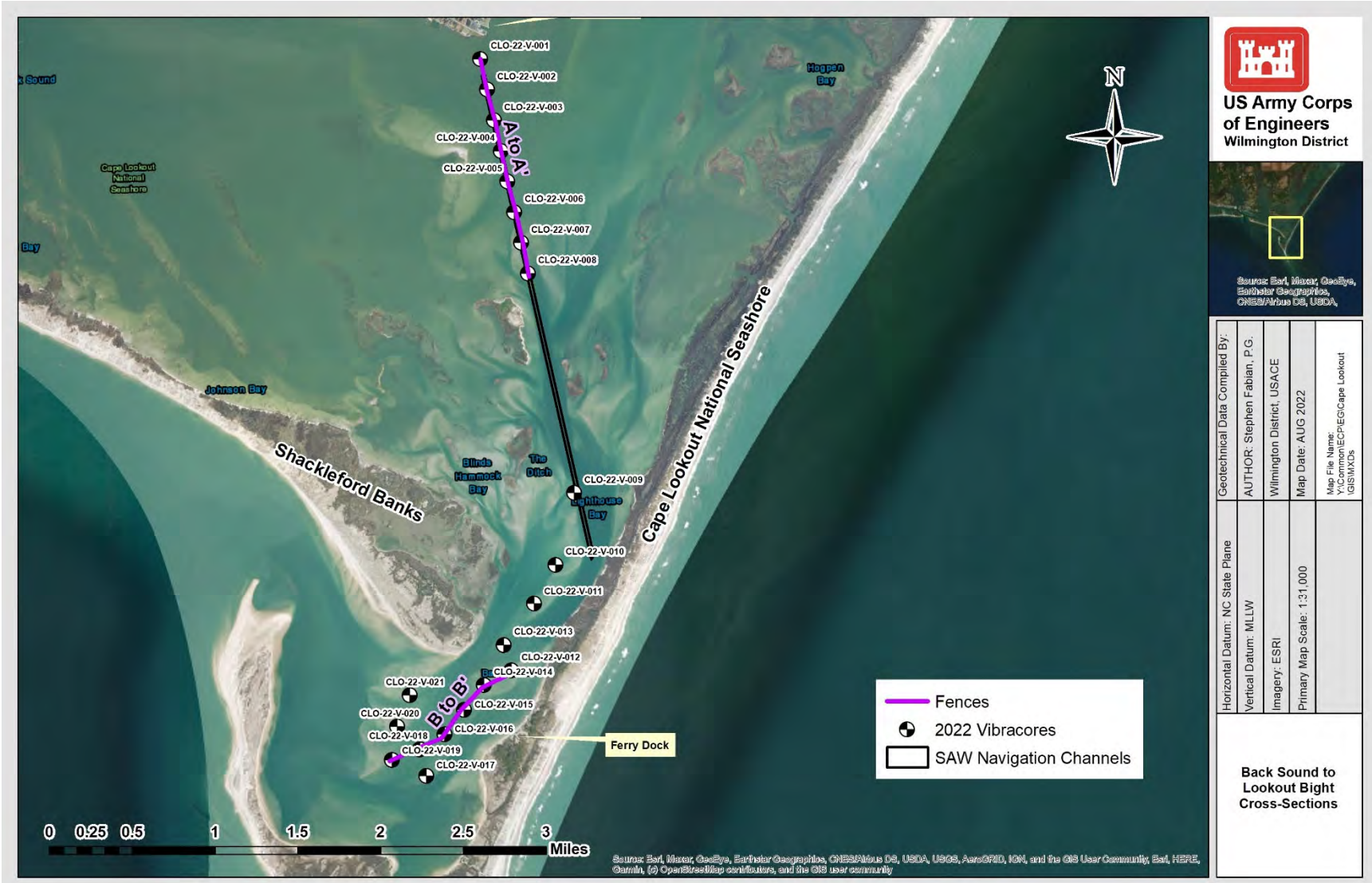


Figure 13. Layout of cross-sections across the study area. Two cross-sections were done, one in the northern section, A to A' and one in the southern section, B to B'.

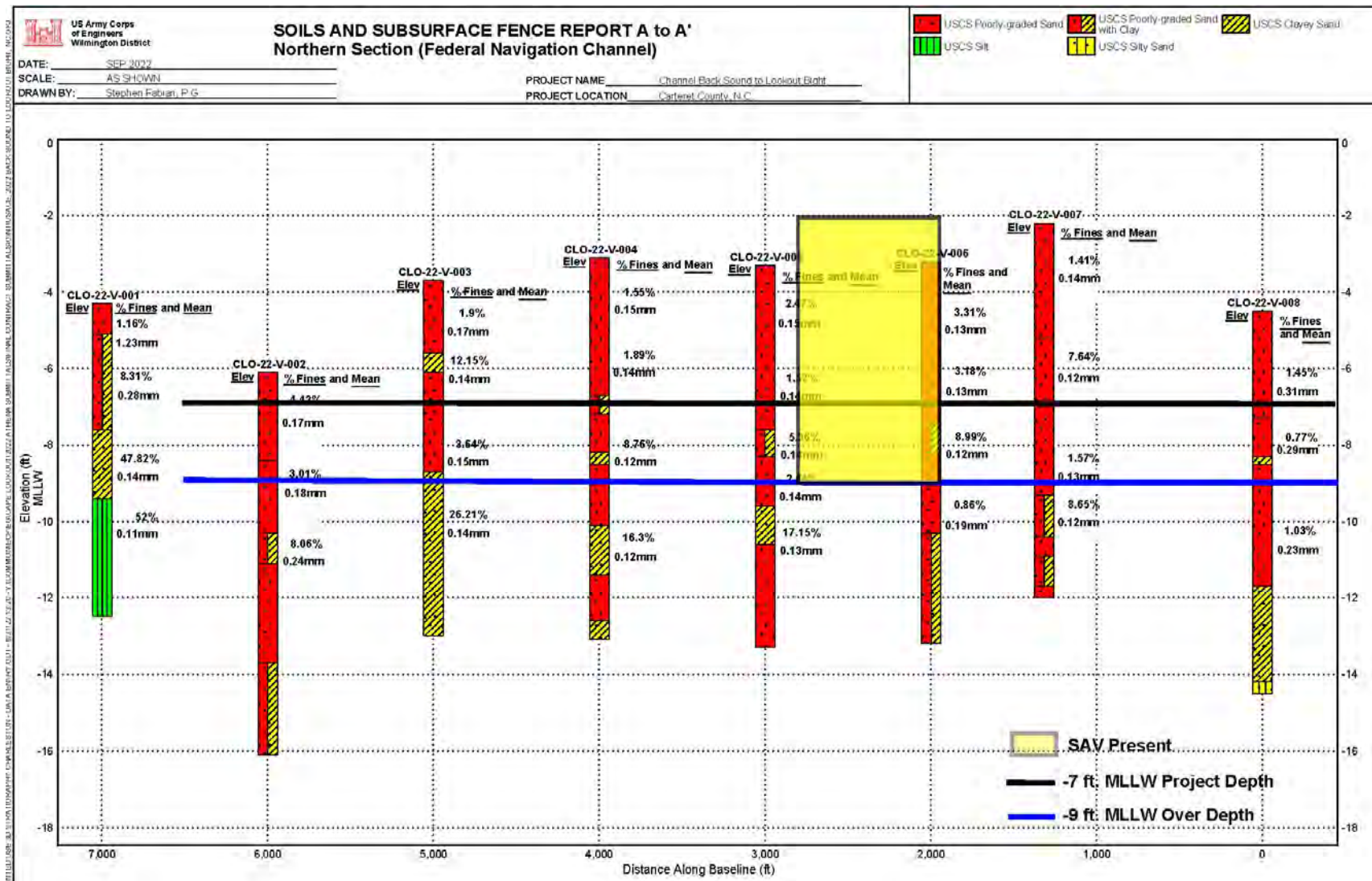


Figure 14. Cross section A to A' showing allowable dredge areas throughout the northern section.



Figure 15. Vibracores collected within the southern section of the study area. It is recommended all dredged material within this area be placed on the sound-side beach in front of the Cape Lookout Lighthouse.



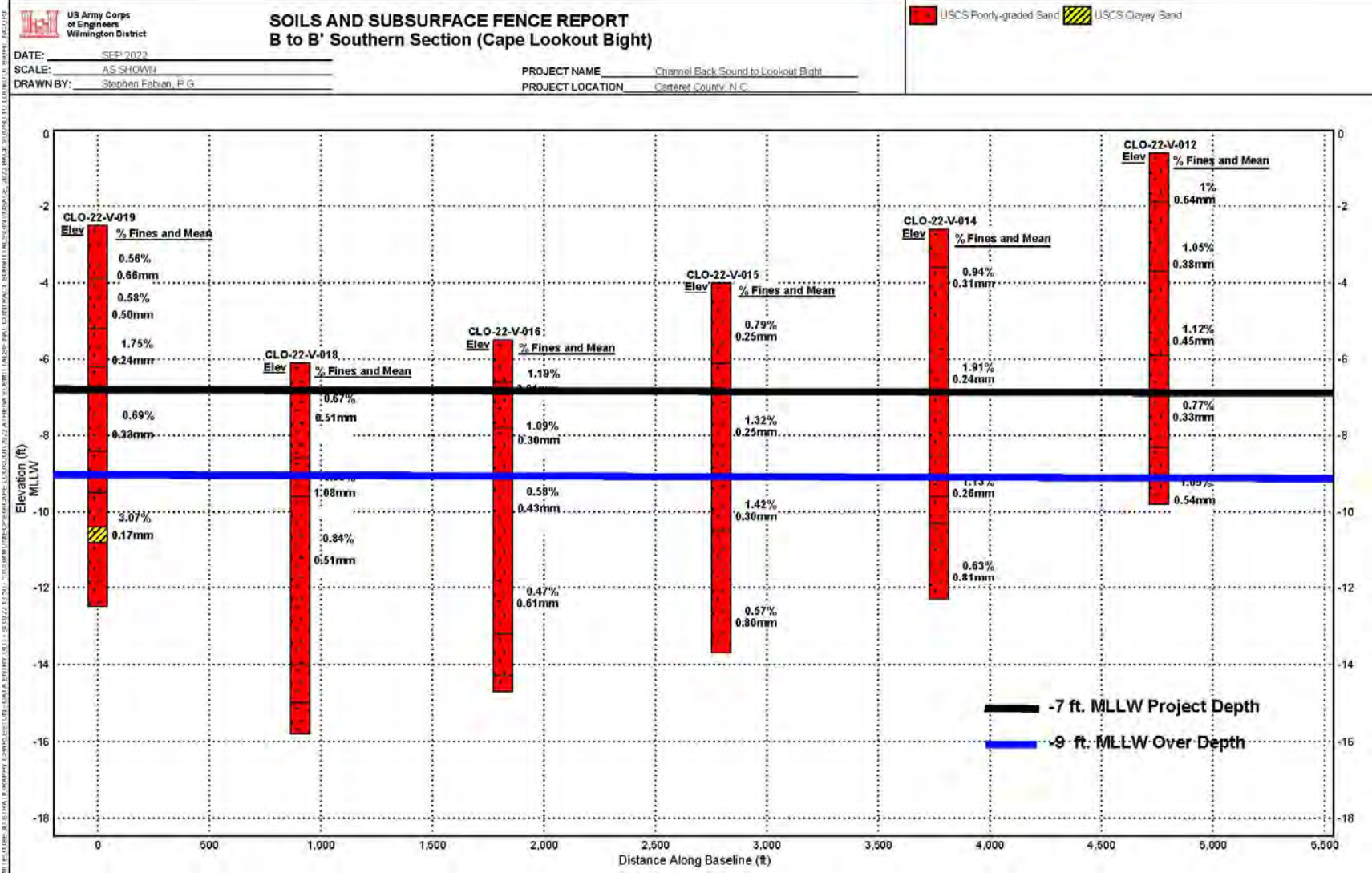
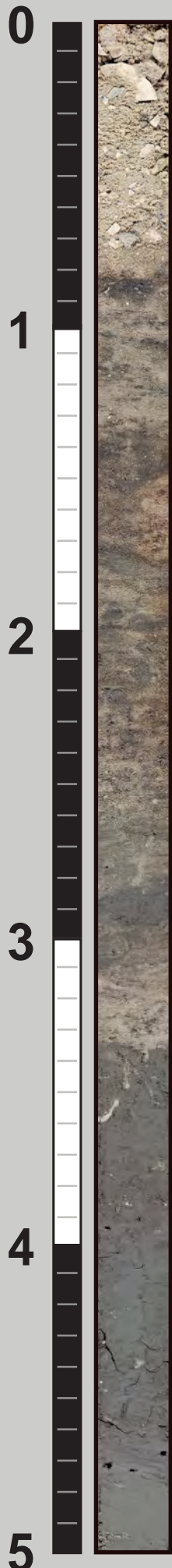


Figure 16. Cross section B to B' showing allowable dredge areas throughout the southern section.

## 8) References

- Dean, R.G., 1991, Equilibrium beach profiles: characteristics and applications, *Journal of Coastal Research*, vol. 7, pp. 53-84.
- Dean, R.G., 2002, *Beach Nourishment: Theory and Practice*, World Scientific Press, New Jersey, 399 p.
- Department of Interior, National Park Service, 2004. Cape Lookout National Seashore, Cape Lookout Life-Saving Station, Historical Structure Report. Historical Architecture, Cultural Resource Division, Southeast Regional Office, National Park Service, p. 1-134.
- Department of Interior, National Park Service, 2012. Foundation Document, Cape Lookout National Seashore, North Carolina. October 2012, p. 1-72. 3
- James, W.R., 1975, Techniques in evaluating suitability of borrow material for beach nourishment: Technical Memorandum no. 60, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA, 82 p.
- National Oceanic Atmospheric Administration (NOAA), 2022.  
<https://tidesandcurrents.noaa.gov/waterlevels.html?id=8656483>
- U.S. Army Corps of Engineers, 1995. *Engineering and Design: Coastal Geology*, Engineering Manual 1110-2-1810, 92 p.

## **Vibracore Data**



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-001**

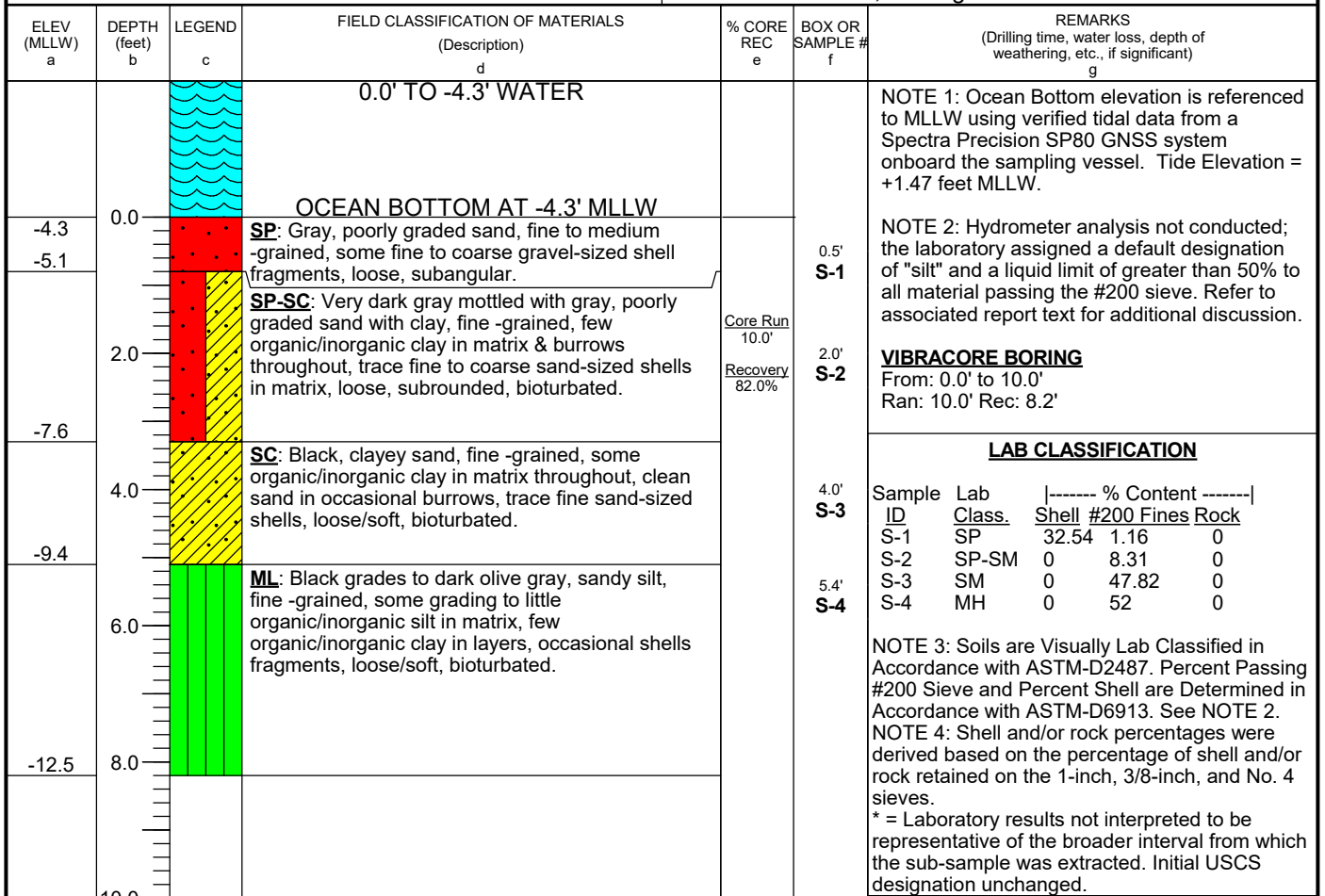
**Top Elev. (ft MLLW): -4.3  
Bottom Elev. (ft MLLW): -12.5**

**Notes:**  
- Photo Mosaic Image  
- Photo Scale in Feet



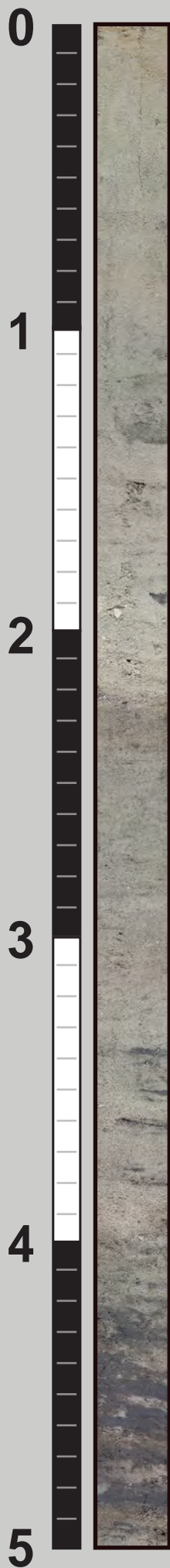
Athena Technologies, Inc.  
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<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-001</b> : N 348622.35 E 2743461.49		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 0810 hrs. : 6/28/22 @ 0825 hrs.	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -4.3' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 82%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-002**

**Top Elev. (ft MLLW): -6.1  
Bottom Elev. (ft MLLW): -16.1**

**Notes:**

- Photo Mosaic Image
- Photo Scale in Feet



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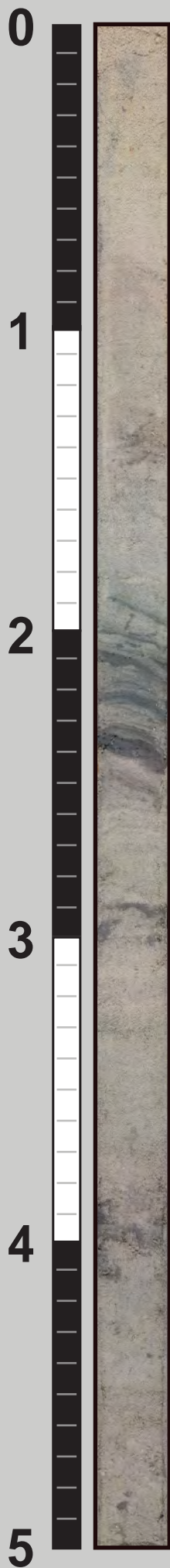
<b>DRILLING LOG</b>		DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane		HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER <b>CLO-22-V-002</b>		LOCATION COORDINATES N 347647.21 E 2743676.97		10. SIZE AND TYPE OF BIT3 Sample Barrel
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0
4. NAME OF DRILLER Palmer McClellan		13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER See Remarks
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL ---	BEARING	15. DATE TIME GROUP : STARTED : COMPLETED OF BORING : 6/28/22 @ 0833 hrs. : 6/28/22 @ 0845 hrs
6. THICKNESS OF OVERBURDEN		16. ELEVATION TOP OF BORING -6.1' MLLW		17. TOTAL CORE RECOVERY FOR BORING 94%
7. DEPTH DRILLED INTO ROCK 0.0'		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist		
8. TOTAL DEPTH OF BORING 10.0'				

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																								
			0.0' TO -6.1' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +1.50 feet MLLW.																								
-6.1	0.0		<b>OCEAN BOTTOM AT -6.1' MLLW</b> <b>SP:</b> Olive gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows, clay rip-up at 1.9', trace medium sand to fine gravel-sized shells below 1.8', loose, subrounded.		1.0' <b>S-1</b>	NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.																								
-8.4	2.0		<b>SP:</b> Olive gray, poorly graded sand, fine -grained, trace inorganic clay in matrix & burrows, organic material/fibers at 3.6', loose, subrounded.	Core Run 14.0' Recovery 94.3%	3.0' <b>S-2</b>	<b>VIBRACORE BORING</b> From: 0.0' to 14.0' Ran: 14.0' Rec: 13.2'																								
-10.3	4.0		<b>SP-SC:</b> Very dark greenish gray mottled with gray, poorly graded sand with clay, fine -grained, few inorganic clay in burrows & layers, loose, subrounded, bioturbated.		4.4' <b>S-3</b>	<b>LAB CLASSIFICATION</b> <table border="1"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>% Fines</th> <th>% Rock</th> </tr> </thead> <tbody> <tr> <td>S-1</td> <td>SP</td> <td>0</td> <td>4.42</td> <td>0</td> <td></td> </tr> <tr> <td>S-2</td> <td>SP</td> <td>0</td> <td>3.01</td> <td>0</td> <td></td> </tr> <tr> <td>S-3</td> <td>SP-SM</td> <td>0.18</td> <td>8.06</td> <td>0</td> <td></td> </tr> </tbody> </table>	Sample ID	Lab Class.	Shell	% #200	% Fines	% Rock	S-1	SP	0	4.42	0		S-2	SP	0	3.01	0		S-3	SP-SM	0.18	8.06	0	
Sample ID	Lab Class.	Shell	% #200	% Fines	% Rock																									
S-1	SP	0	4.42	0																										
S-2	SP	0	3.01	0																										
S-3	SP-SM	0.18	8.06	0																										
-11.1	6.0		<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, trace inorganic clay in burrows & in laminations at 7.2-7.4', trace fine sand to fine gravel-sized shells in matrix & laminations, loose, subrounded.			NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2.																								
-13.7	8.0		<b>SP-SC:</b> Gray and very dark greenish gray, poorly graded sand with clay, fine to medium -grained, few inorganic clay in laminations & layers, trace organic silt in clay intervals below 9.7', loose, subrounded, interbedded.			NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves. * = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.																								
-16.1	10.0		BOTTOM OF BOREHOLE AT 10.0 ft  SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			(10-)Top 10 feet of core retained for processing.																								



Drafted By: Adam Freeze  
Date Drafted: 7/6/2022

Reviewed By: Neil Wicker  
Date Checked: 7/7/2022  
VERSION: Final



**US Army Corps of  
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**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-003**

**Top Elev. (ft MLLW): -3.7  
Bottom Elev. (ft MLLW): -13.0**

**Notes:**

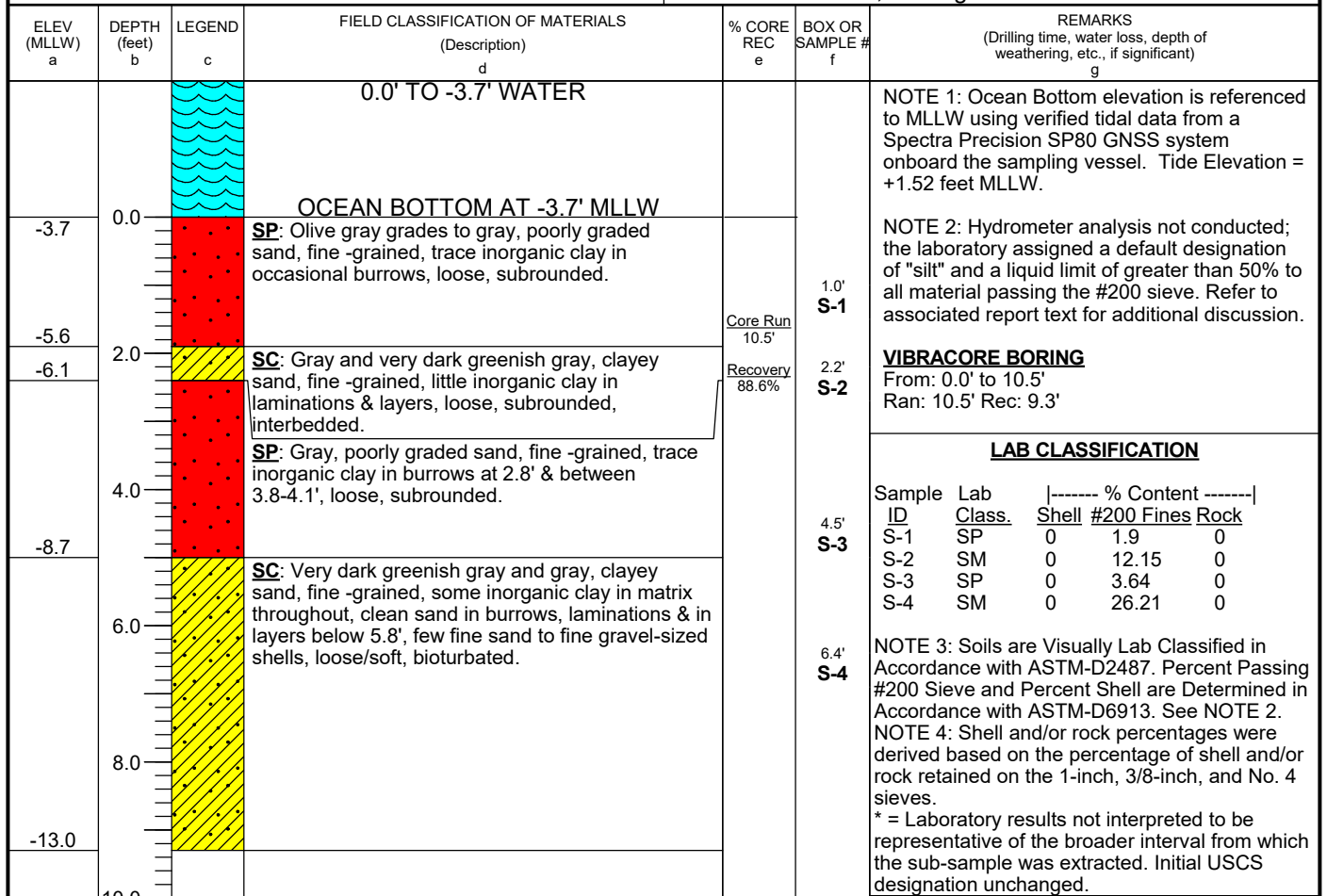
- Photo Mosaic Image
- Photo Scale in Feet



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<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER <b>CLO-22-V-003</b>		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 0853 hrs. : 6/28/22 @ 0905 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -3.7' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 89%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final



**US Army Corps of  
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**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-004**

**Top Elev. (ft MLLW): -3.1  
Bottom Elev. (ft MLLW): -13.1**

**Notes:**

- Photo Mosaic Image
- Photo Scale in Feet



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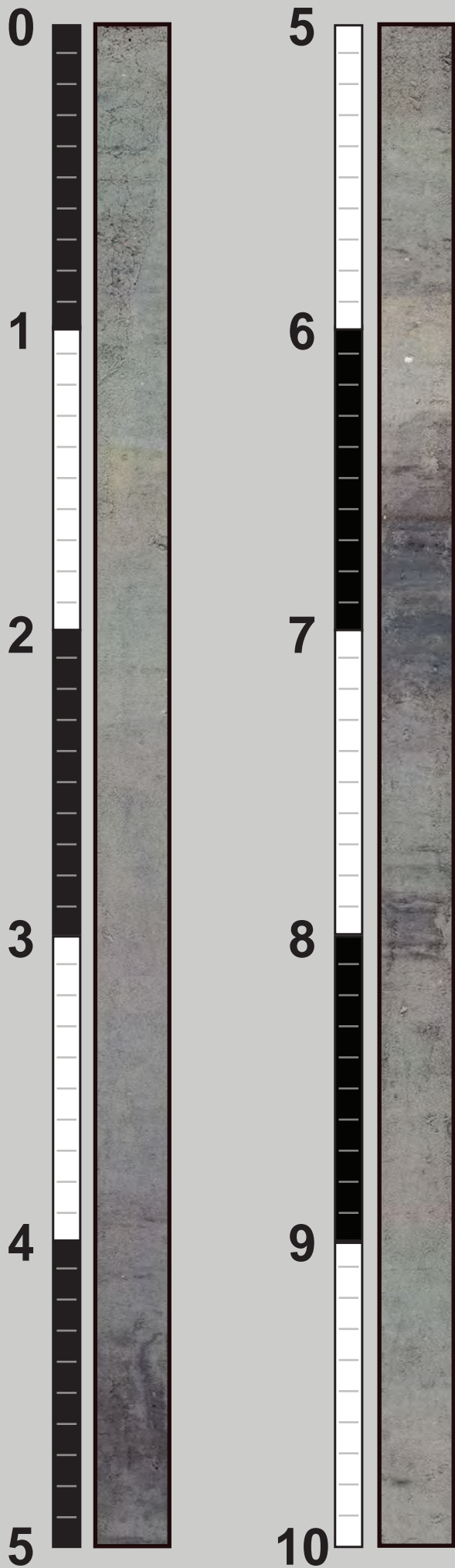
<b>DRILLING LOG</b>		DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
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2. HOLE NUMBER <b>CLO-22-V-004</b>		LOCATION COORDINATES N 345694.08 E 2744112.38		10. SIZE AND TYPE OF BIT3 Sample Barrel
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0
4. NAME OF DRILLER Palmer McClellan		13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER See Remarks
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL ---	BEARING	15. DATE TIME GROUP : STARTED : COMPLETED OF BORING : 6/28/22 @ 0914 hrs. : 6/28/22 @ 0925 hrs.
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8. TOTAL DEPTH OF BORING 10.0'				

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																														
			0.0' TO -3.1' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +1.61 feet MLLW.																														
-3.1	0.0		<b>SP</b> : Gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows below 2.8', loose, subrounded.		1.0' <b>S-1</b>	NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.																														
	2.0			Core Run 12.0'																																
	4.0		<b>SP-SC</b> : Dark gray, poorly graded sand with clay, fine -grained, few inorganic clay in laminations & burrows, loose, subrounded, bioturbated.	Recovery 94.2%	2.5' <b>S-2</b>	<b>VIBRACORE BORING</b> From: 0.0' to 12.0' Ran: 12.0' Rec: 11.3'																														
-6.7						<b>LAB CLASSIFICATION</b>																														
-7.2	4.0		<b>SP</b> : Gray, poorly graded sand, fine -grained, trace inorganic clay in burrows & laminations, trace organic material in clay intervals, loose, subrounded, bioturbated.		4.5' <b>S-3*</b>	<table border="1"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>Fines</th> <th>Rock</th> </tr> </thead> <tbody> <tr> <td>S-1</td> <td>SP</td> <td>0.03</td> <td>1.55</td> <td>0</td> <td></td> </tr> <tr> <td>S-2</td> <td>SP</td> <td>0</td> <td>1.89</td> <td>0</td> <td></td> </tr> <tr> <td>S-3*</td> <td>SP-SM</td> <td>0</td> <td>8.76</td> <td>0</td> <td></td> </tr> <tr> <td>S-4</td> <td>SM</td> <td>0</td> <td>16.3</td> <td>0</td> <td></td> </tr> </tbody> </table>	Sample ID	Lab Class.	Shell	% #200	Fines	Rock	S-1	SP	0.03	1.55	0		S-2	SP	0	1.89	0		S-3*	SP-SM	0	8.76	0		S-4	SM	0	16.3	0	
Sample ID	Lab Class.	Shell	% #200	Fines	Rock																															
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-8.5			<b>SC</b> : Very dark gray, clayey sand, fine -grained, little inorganic clay in matrix, trace fine to coarse sand-sized shells in matrix, loose, subrounded, bioturbated.			NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves.																														
-10.1	6.0				7.2' <b>S-4</b>	* = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.																														
-11.4	8.0		<b>SP</b> : Gray and dark gray, poorly graded sand, fine -grained, trace inorganic clay in burrows, loose, subrounded.																																	
-12.6																																				
-13.1	10.0		<b>SC</b> : Very dark gray mottled with gray, clayey sand, fine -grained, little inorganic clay in matrix, burrows & layers, trace organic silt, loose, subrounded, bioturbated.																																	
			<b>SP</b> : Gray, poorly graded sand, fine -grained, trace inorganic clay in burrows & laminations below 9.1', loose, subrounded.			(10-)Top 10 feet of core retained for processing.																														
			<b>SC</b> : Very dark gray, clayey sand, fine -grained, little inorganic clay, few fine to coarse gravel-sized shells, loose/soft, bioturbated.																																	
			BOTTOM OF BOREHOLE AT 10.0 ft																																	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM																																	



Drafted By: Adam Freeze  
Date Drafted: 7/6/2022

Reviewed By: Neil Wicker  
Date Checked: 7/7/2022  
VERSION: Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-005**

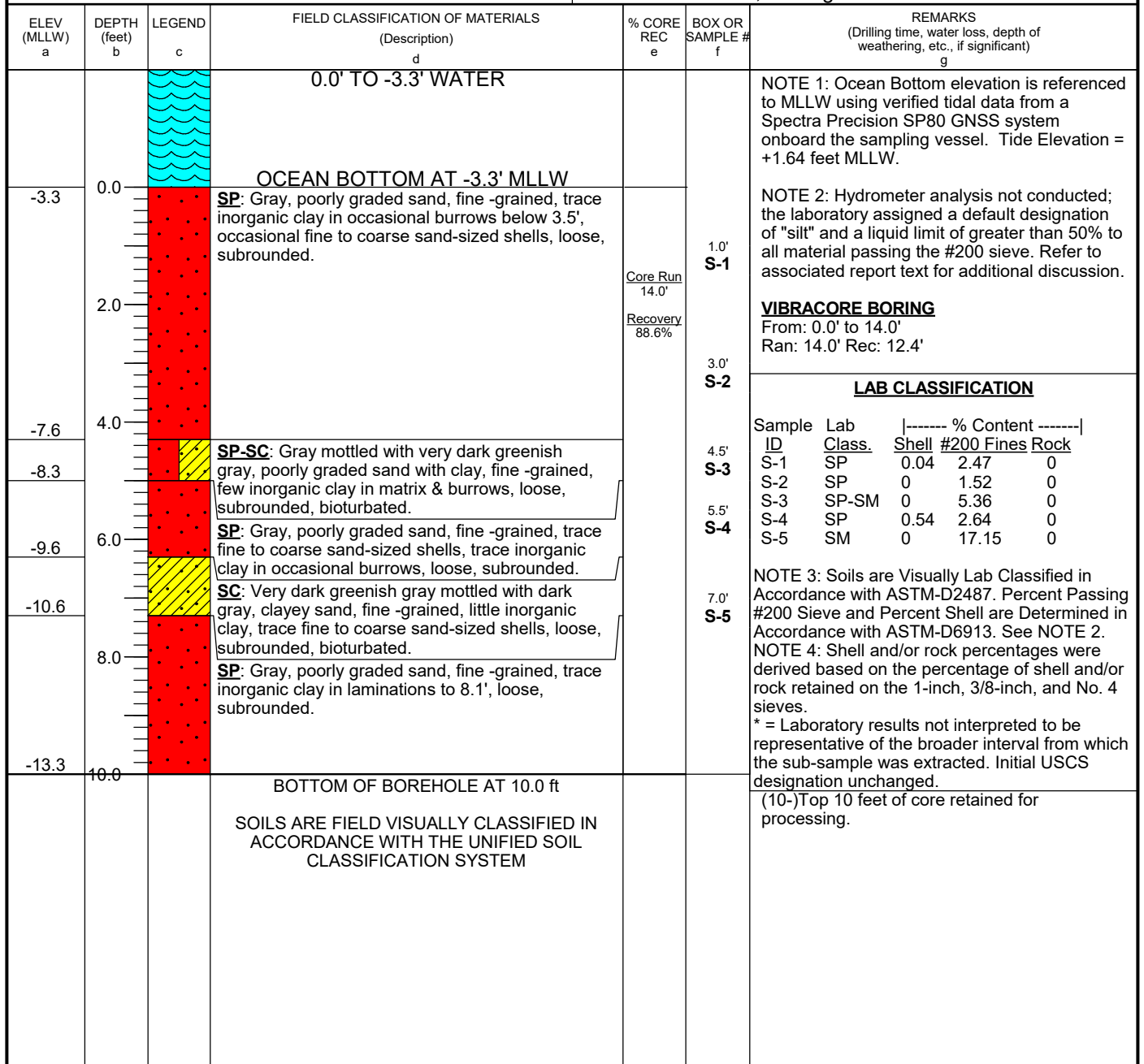
**Top Elev. (ft MLLW): -3.3  
Bottom Elev. (ft MLLW): -13.3**

**Notes:**  
- Photo Mosaic Image  
- Photo Scale in Feet



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<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER <b>CLO-22-V-005</b>		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 0929 hrs. : 6/28/22 @ 0945 hrs.	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -3.3' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 89%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-006**

**Top Elev. (ft MLLW): -3.2  
Bottom Elev. (ft MLLW): -13.2**

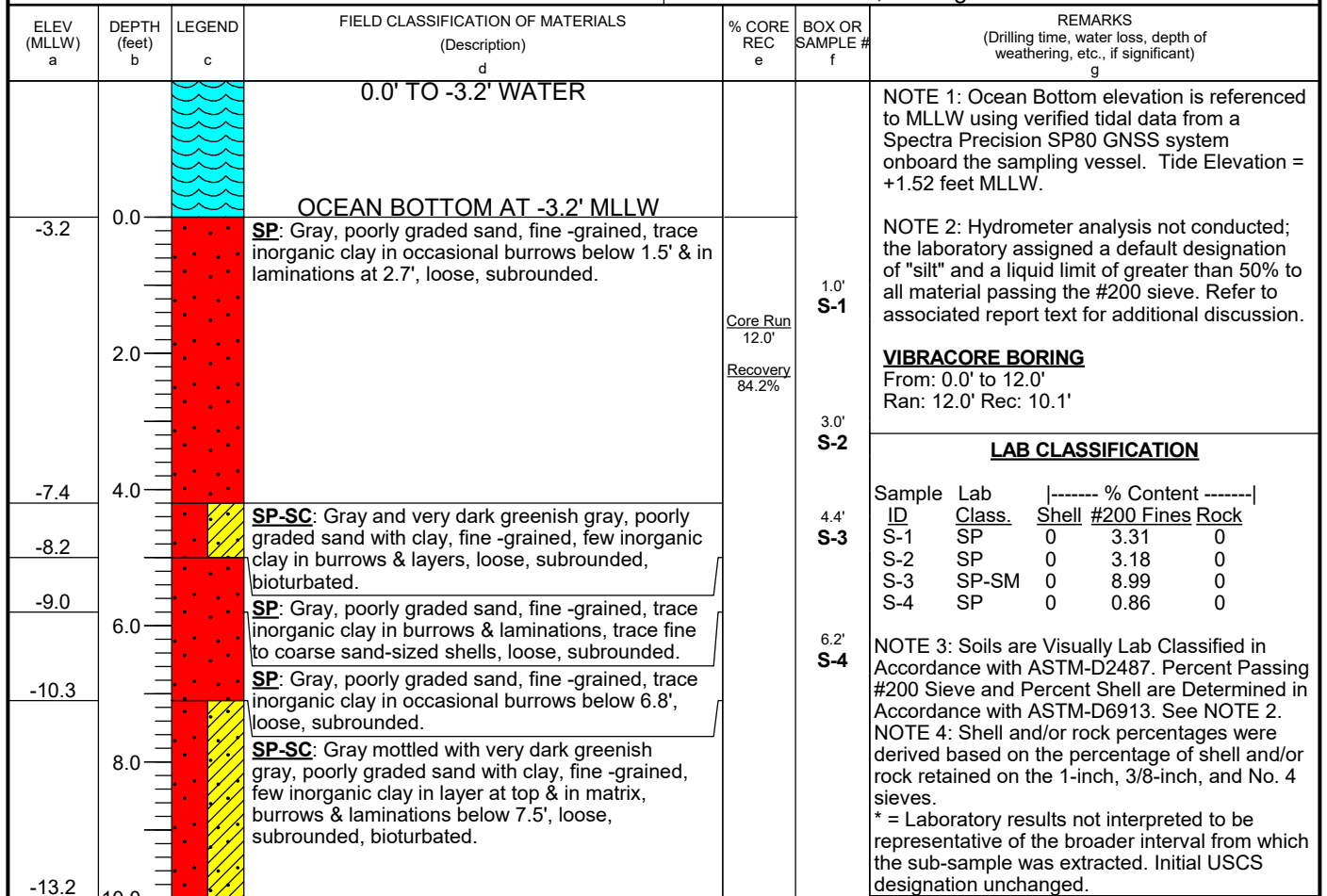
**Notes:**

- Photo Mosaic Image
- Photo Scale in Feet



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<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER <b>CLO-22-V-006</b>		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 0955 hrs. : 6/28/22 @ 1005 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -3.2' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 84%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	



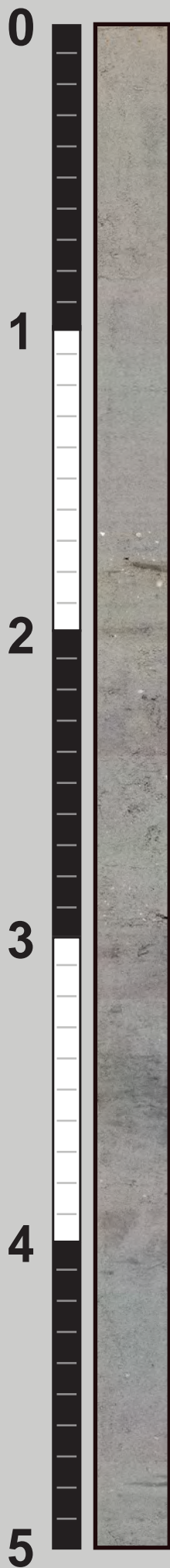
**LAB CLASSIFICATION**

Sample ID	Lab Class.	Shell	% #200	Fines	Rock
S-1	SP	0	3.31	0	
S-2	SP	0	3.18	0	
S-3	SP-SM	0	8.99	0	
S-4	SP	0	0.86	0	



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**2022 Back Sound to Lookout Bight,  
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Contract # W912PM22P0042**

**CLO-22-V-007**

**Top Elev. (ft MLLW): -2.2  
Bottom Elev. (ft MLLW): -12.0**

**Notes:**

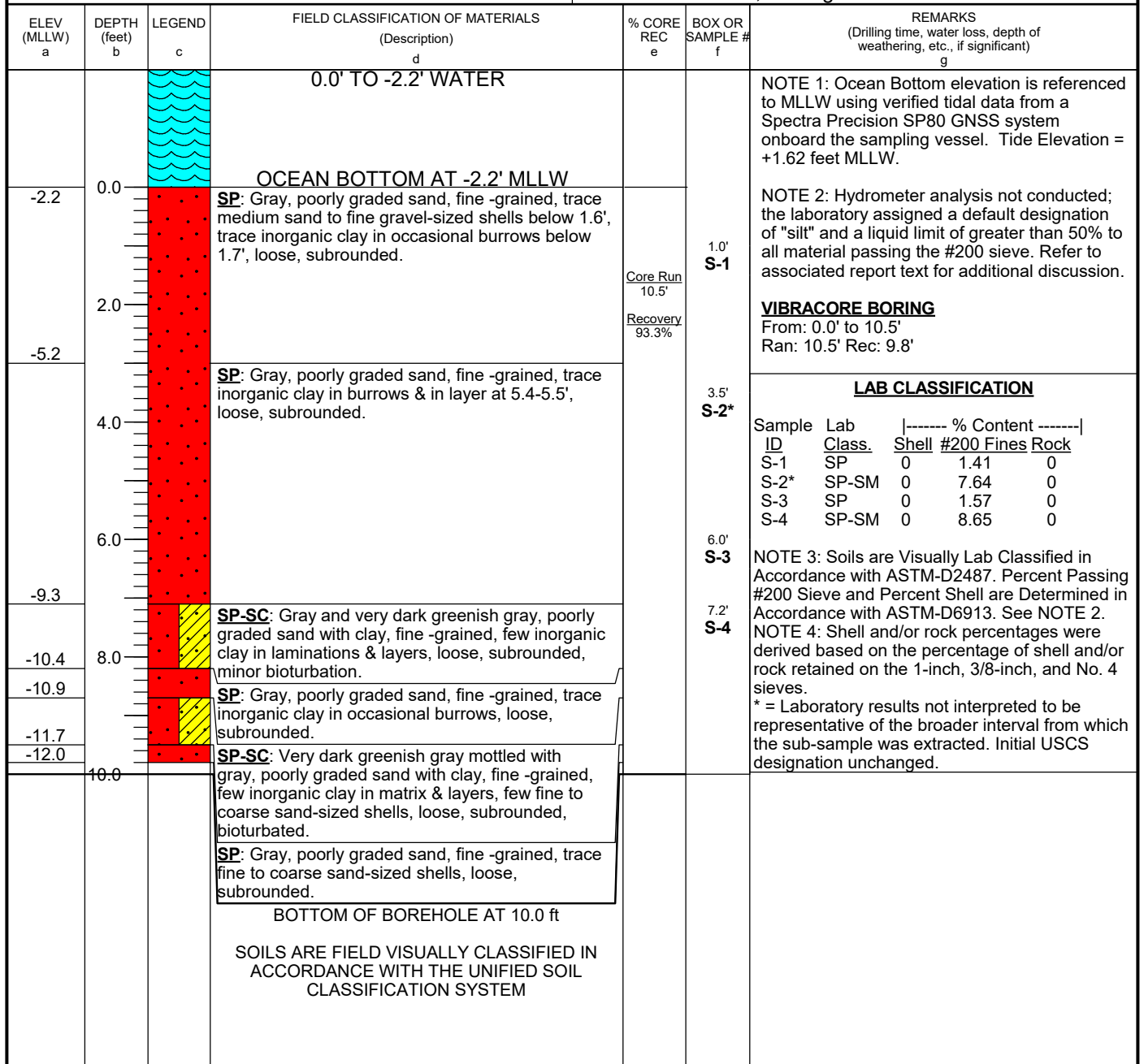
- Photo Mosaic Image
- Photo Scale in Feet



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<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-007</b> : N 343076.5 E 2744693.92		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER : See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP : STARTED : COMPLETED OF BORING : 6/28/22 @ 1012 hrs. : 6/28/22 @ 1030 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -2.2' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 93%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

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**2022 Back Sound to Lookout Bight,  
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Contract # W912PM22P0042**

**CLO-22-V-008**

**Top Elev. (ft MLLW): -4.5  
Bottom Elev. (ft MLLW): -14.5**

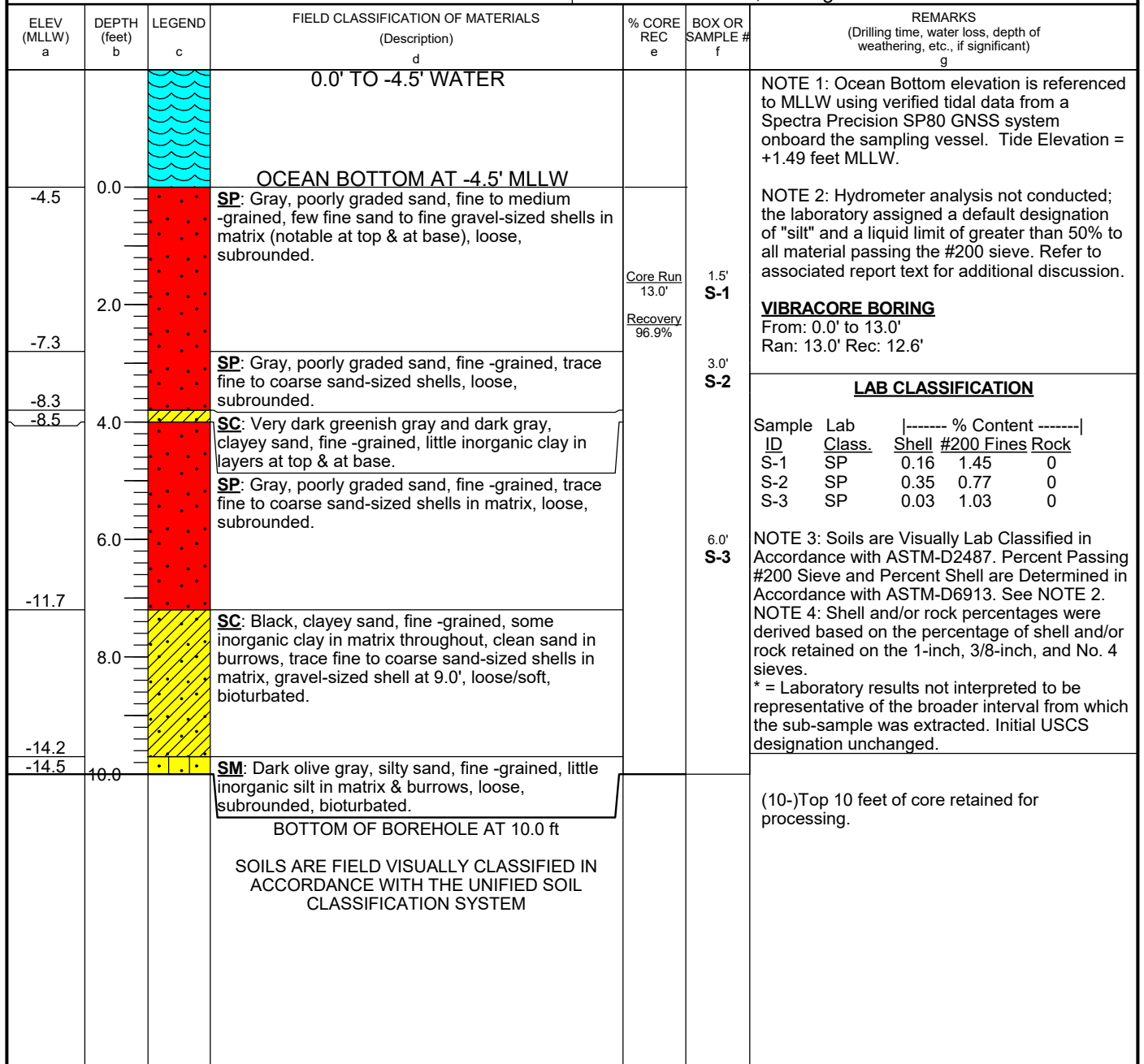
**Notes:**

- Photo Mosaic Image
- Photo Scale in Feet



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<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-008</b> : N 341791.57 E 2744978.55		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER : See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP : STARTED : COMPLETED OF BORING : 6/28/22 @ 1036 hrs. : 6/28/22 @ 1100 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -4.5' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 97%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	



**LAB CLASSIFICATION**

Sample ID	Lab Class.	Shell	% #200	Fines	Rock
S-1	SP	0.16	1.45	0	
S-2	SP	0.35	0.77	0	
S-3	SP	0.03	1.03	0	



**Drafted By:** Adam Freeze  
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Contract # W912PM22P0042**

**CLO-22-V-009**

**Top Elev. (ft MLLW): -0.1  
Bottom Elev. (ft MLLW): -9.2**

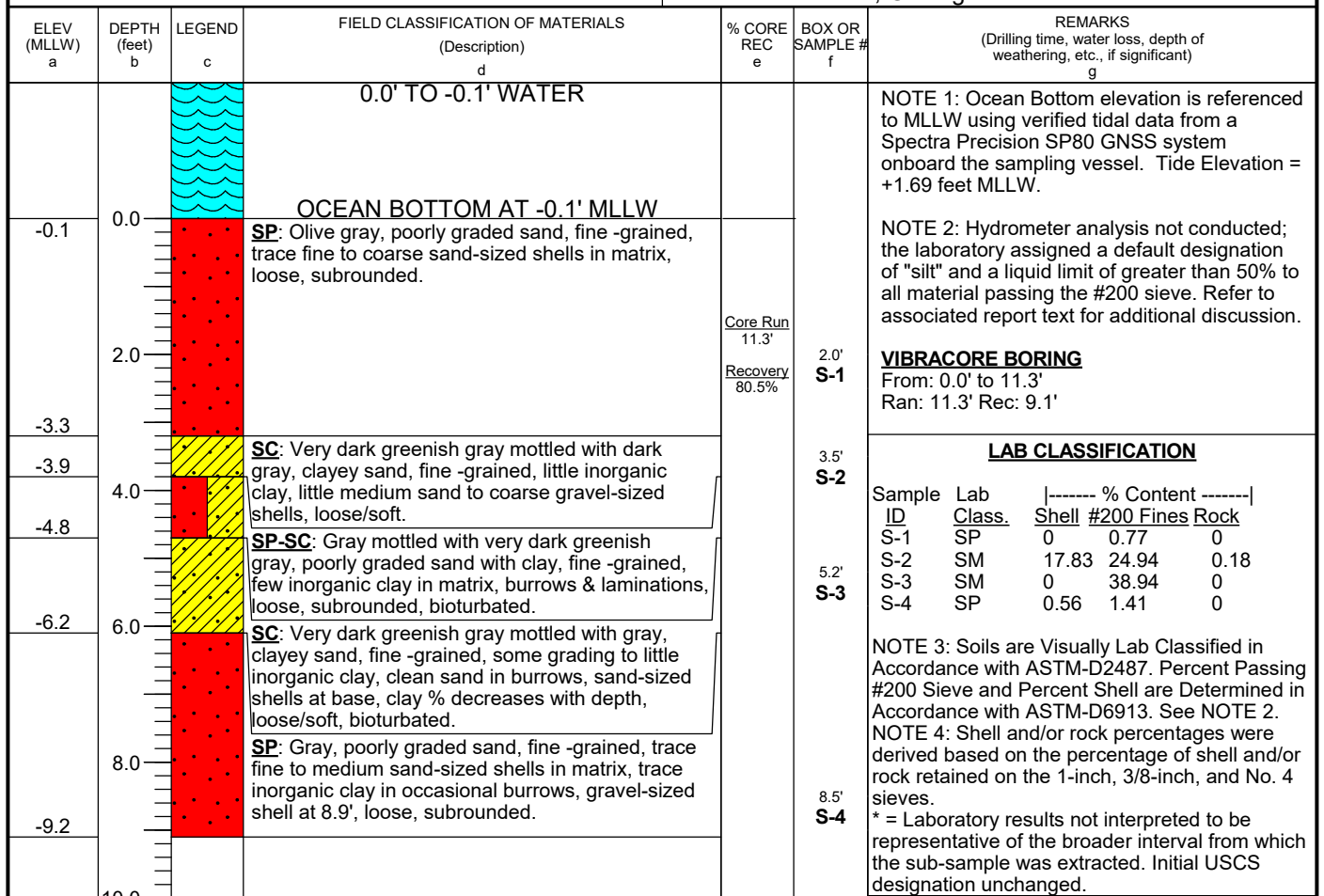
**Notes:**

- Photo Mosaic Image
- Photo Scale in Feet



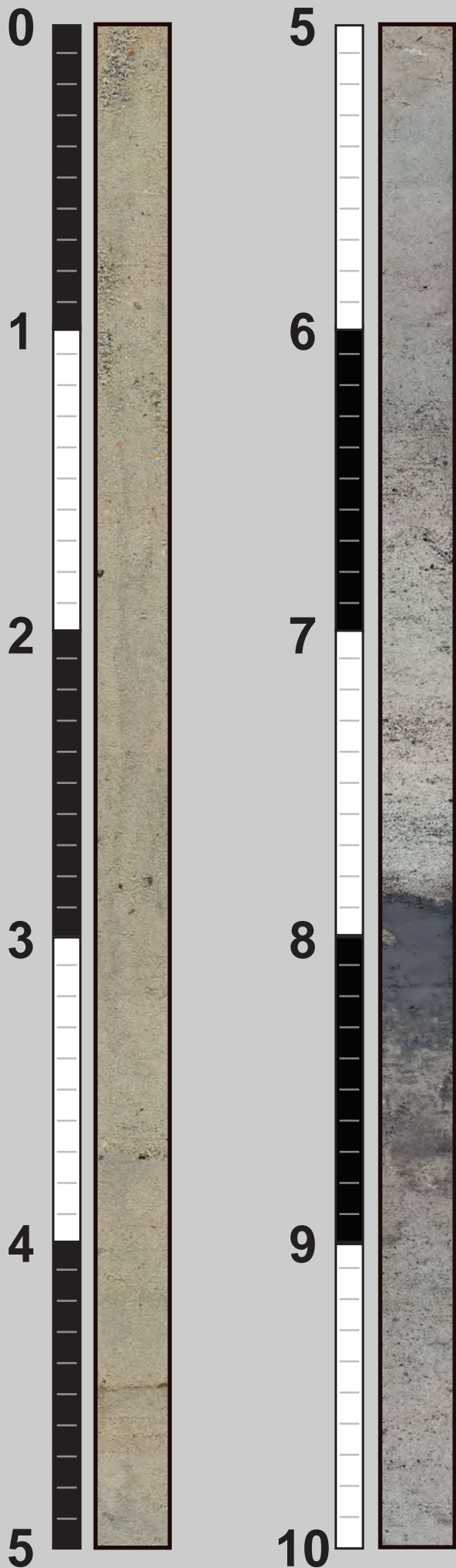
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<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER <b>CLO-22-V-009</b>		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1109 hrs. : 6/28/22 @ 1130 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -0.1' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 81%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	



**Drafted By:** Adam Freeze  
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**2022 Back Sound to Lookout Bight,  
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Contract # W912PM22P0042**

**CLO-22-V-010**

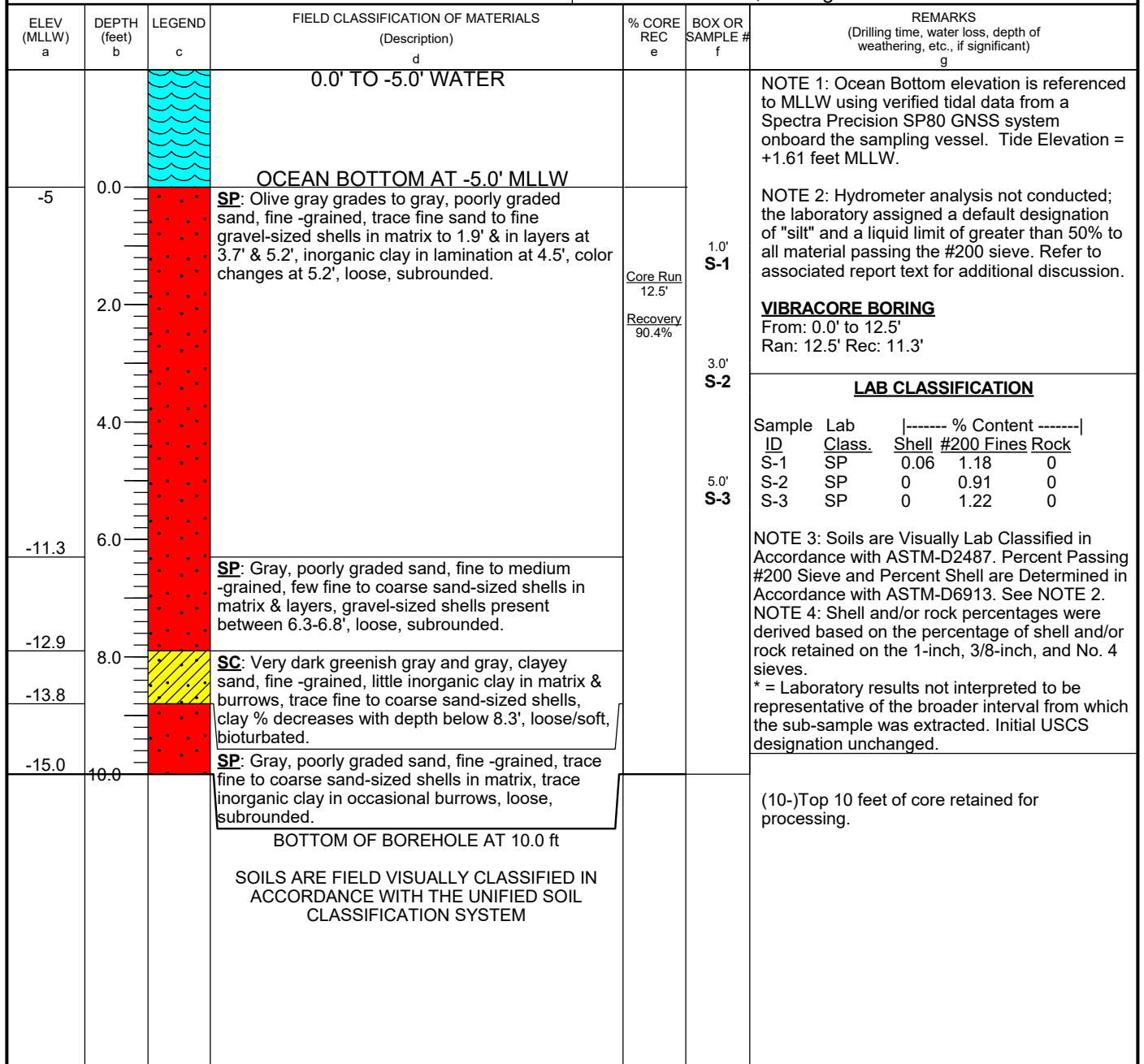
**Top Elev. (ft MLLW): -5.0  
Bottom Elev. (ft MLLW): -15.0**

**Notes:**  
- Photo Mosaic Image  
- Photo Scale in Feet



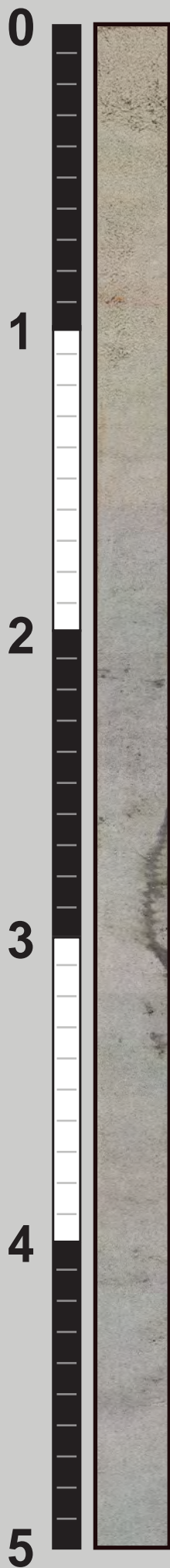
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<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-010</b> : N 332506.87 E 2745856.78		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING : DEG FROM VERTICAL : BEARING <input checked="" type="checkbox"/> VERTICAL : : --- : <input type="checkbox"/> INCLINED : : :		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1142 hrs. : 6/28/22 @ 1215 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -5' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 90%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

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**2022 Back Sound to Lookout Bight,  
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Contract # W912PM22P0042**

**CLO-22-V-011**

**Top Elev. (ft MLLW): -2.1  
Bottom Elev. (ft MLLW): -10.9**

**Notes:**

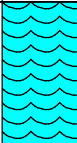
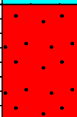
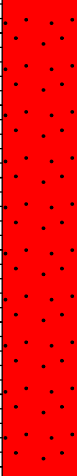
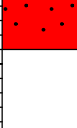
- Photo Mosaic Image
- Photo Scale in Feet



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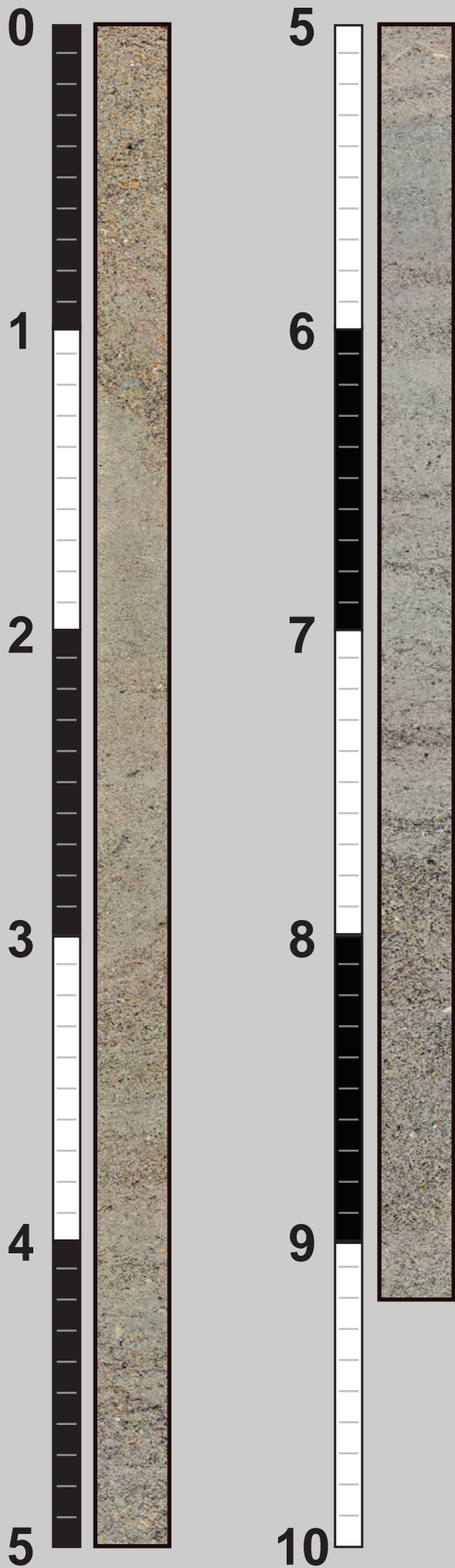
<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-011</b> : N 331246.73 E 2745172.11		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER : See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1226 hrs. : 6/28/22 @ 1250 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -2.1' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 88%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0.0' TO -2.1' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +1.01 feet MLLW.  NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.  <b>VIBRACORE BORING</b> From: 0.0' to 10.0' Ran: 10.0' Rec: 8.8'
-2.1	0.0		<b>SP:</b> Olive gray, poorly graded sand, fine -grained, loose, subrounded.		1.0' <b>S-1</b>	
-3.7	2.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows, clay-lined Callianassa major burrow trace at 2.5-3.1', organic silt in bedding at 5.2-5.3', loose, subrounded.	Core Run 10.0'  Recovery 88.0%	3.0' <b>S-2</b>	
-10.2	8.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, few fine sand to fine gravel-sized shells, loose, subrounded.		6.0' <b>S-3</b>	
-10.9					7.5' <b>S-4</b>	NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2. NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves. * = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.
	10.0		BOTTOM OF BOREHOLE AT 10.0 ft  SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
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**2022 Back Sound to Lookout Bight,  
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Contract # W912PM22P0042**

**CLO-22-V-012**

**Top Elev. (ft MLLW): -0.6  
Bottom Elev. (ft MLLW): -9.8**

**Notes:**  
- Photo Mosaic Image  
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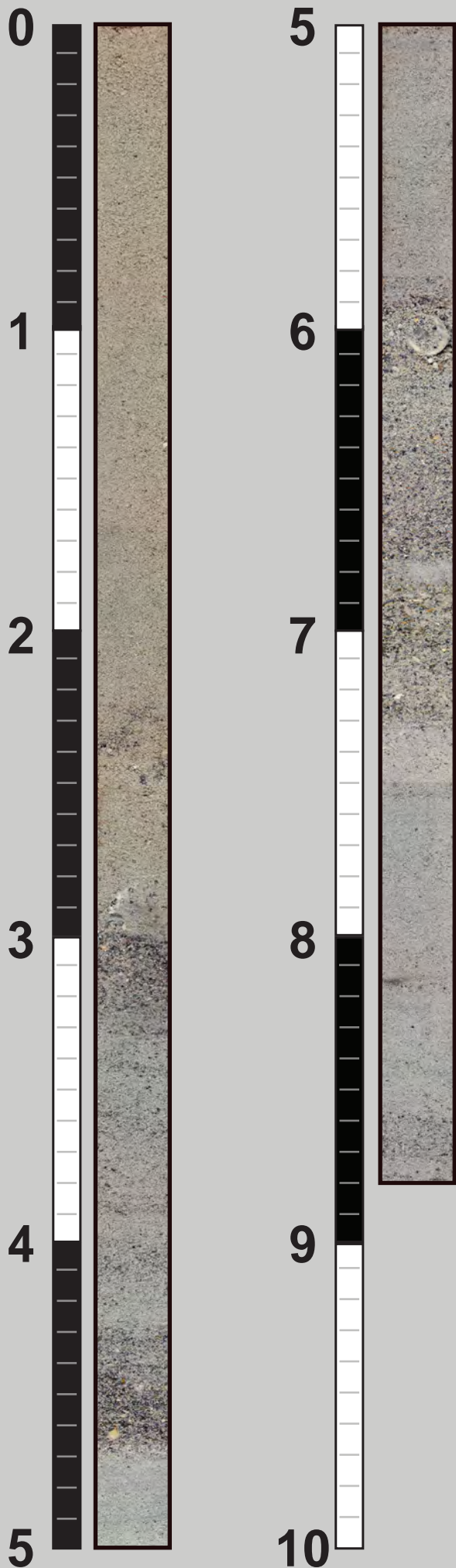
<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-012</b> : N 329132.52 E 2744458.1		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1724 hrs. : 6/28/22 @ 1750 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -0.6' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 92%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																																				
			0.0' TO -0.6' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +2.58 feet MLLW.																																				
			OCEAN BOTTOM AT -0.6' MLLW																																							
-0.6	0.0		<b>SP:</b> Light brownish gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix, loose, subrounded.		0.5' <b>S-1</b>	NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.																																				
-1.9	2.0		<b>SP:</b> Light brownish gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.	Core Run 10.0'	2.0' <b>S-2</b>																																					
-3.7	4.0		<b>SP:</b> Light brownish gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix, coarse gravel-sized shells at base, loose, subrounded.	Recovery 92.0%	4.0' <b>S-3</b>	<b>LAB CLASSIFICATION</b>																																				
-5.9	6.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix & layers, loose, subrounded.		6.0' <b>S-4</b>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>Fines</th> <th>Rock</th> </tr> </thead> <tbody> <tr> <td>S-1</td> <td>SP</td> <td>1.12</td> <td>1</td> <td>0</td> <td></td> </tr> <tr> <td>S-2</td> <td>SP</td> <td>0.57</td> <td>1.05</td> <td>0</td> <td></td> </tr> <tr> <td>S-3</td> <td>SP</td> <td>1.89</td> <td>1.12</td> <td>0</td> <td></td> </tr> <tr> <td>S-4</td> <td>SP</td> <td>0</td> <td>0.77</td> <td>0</td> <td></td> </tr> <tr> <td>S-5</td> <td>SP</td> <td>3.06</td> <td>1.05</td> <td>0</td> <td></td> </tr> </tbody> </table>	Sample ID	Lab Class.	Shell	% #200	Fines	Rock	S-1	SP	1.12	1	0		S-2	SP	0.57	1.05	0		S-3	SP	1.89	1.12	0		S-4	SP	0	0.77	0		S-5	SP	3.06	1.05	0	
Sample ID	Lab Class.	Shell	% #200	Fines	Rock																																					
S-1	SP	1.12	1	0																																						
S-2	SP	0.57	1.05	0																																						
S-3	SP	1.89	1.12	0																																						
S-4	SP	0	0.77	0																																						
S-5	SP	3.06	1.05	0																																						
-8.3	8.0		<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells, occasional gravel-sized shells, loose, subrounded.		8.5' <b>S-5</b>	NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2. NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves. * = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.																																				
-9.8	10.0		BOTTOM OF BOREHOLE AT 10.0 ft																																							
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM																																							



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-013**

**Top Elev. (ft MLLW): -8.0  
Bottom Elev. (ft MLLW): -16.8**

**Notes:**  
- Photo Mosaic Image  
- Photo Scale in Feet



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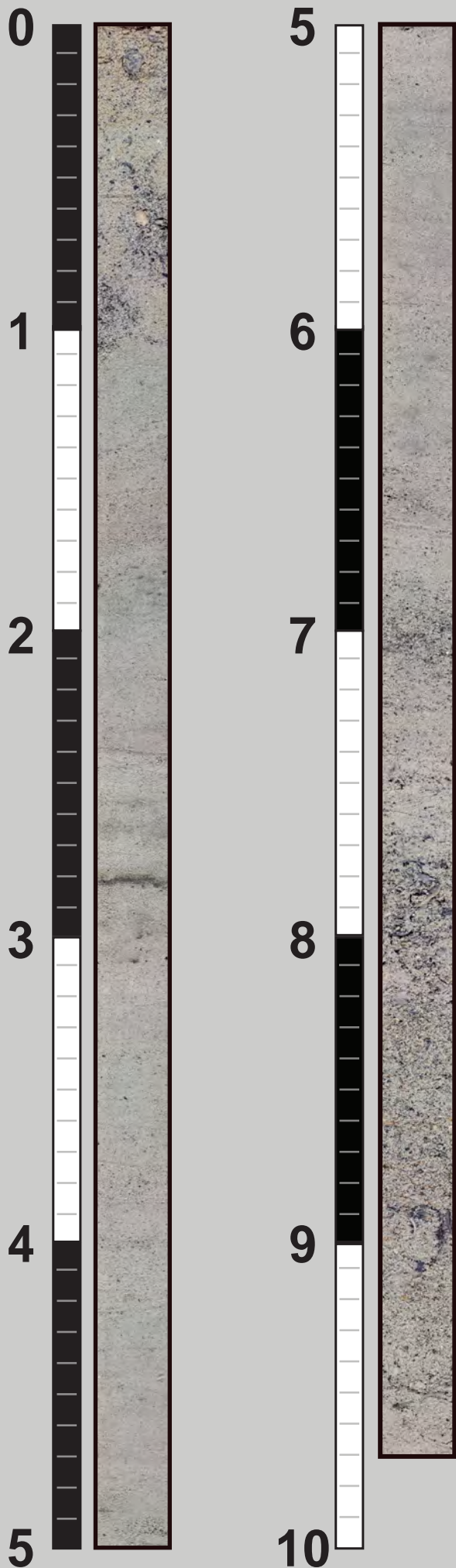
<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-013</b> : N 329931.9 E 2744208.96		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0
4. NAME OF DRILLER Palmer McClellan		13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL : BEARING : --- : ---	14. ELEVATION GROUND WATER : See Remarks
6. THICKNESS OF OVERBURDEN		15. DATE TIME GROUP : STARTED : COMPLETED OF BORING : 6/28/22 @ 1301 hrs. : 6/28/22 @ 1340 hrs	16. ELEVATION TOP OF BORING : -8' MLLW
7. DEPTH DRILLED INTO ROCK 0.0'		17. TOTAL CORE RECOVERY FOR BORING 88%	
8. TOTAL DEPTH OF BORING 10.0'		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																								
			0.0' TO -8.0' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +0.47 feet MLLW.																								
-8	0.0		<b>SP:</b> Light brownish gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, gravel-sized shells at base, loose, subrounded.		0.5' <b>S-1</b>	NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.																								
-10.9	2.0			Core Run 10.0'	2.0' <b>S-2</b>	<b>VIBRACORE BORING</b> From: 0.0' to 10.0' Ran: 10.0' Rec: 8.8'																								
-12.7	4.0		<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells in matrix & in layers at top & at base, loose, subrounded.	Recovery 88.0%	4.0' <b>S-3</b>	<b>LAB CLASSIFICATION</b>																								
-13.9	6.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells in matrix, loose, subrounded.			<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>Fines</th> <th>Rock</th> </tr> </thead> <tbody> <tr> <td>S-1</td> <td>SP</td> <td>0.11</td> <td>0.92</td> <td></td> <td>0</td> </tr> <tr> <td>S-2</td> <td>SP</td> <td>0</td> <td>0.95</td> <td></td> <td>0</td> </tr> <tr> <td>S-3</td> <td>SP</td> <td>0.75</td> <td>0.45</td> <td></td> <td>0</td> </tr> </tbody> </table>	Sample ID	Lab Class.	Shell	% #200	Fines	Rock	S-1	SP	0.11	0.92		0	S-2	SP	0	0.95		0	S-3	SP	0.75	0.45		0
Sample ID	Lab Class.	Shell	% #200	Fines	Rock																									
S-1	SP	0.11	0.92		0																									
S-2	SP	0	0.95		0																									
S-3	SP	0.75	0.45		0																									
-15.3	8.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, trace inorganic silt/clay in burrow at 8.1', loose, subrounded.			NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2. NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves. * = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.																								
-16.8	10.0																													
			BOTTOM OF BOREHOLE AT 10.0 ft																											
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM																											



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-014**

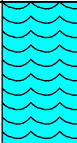
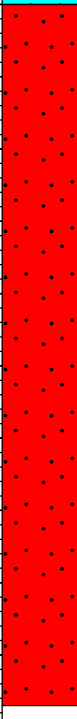
**Top Elev. (ft MLLW): -2.6  
Bottom Elev. (ft MLLW): -12.3**

**Notes:**  
- Photo Mosaic Image  
- Photo Scale in Feet



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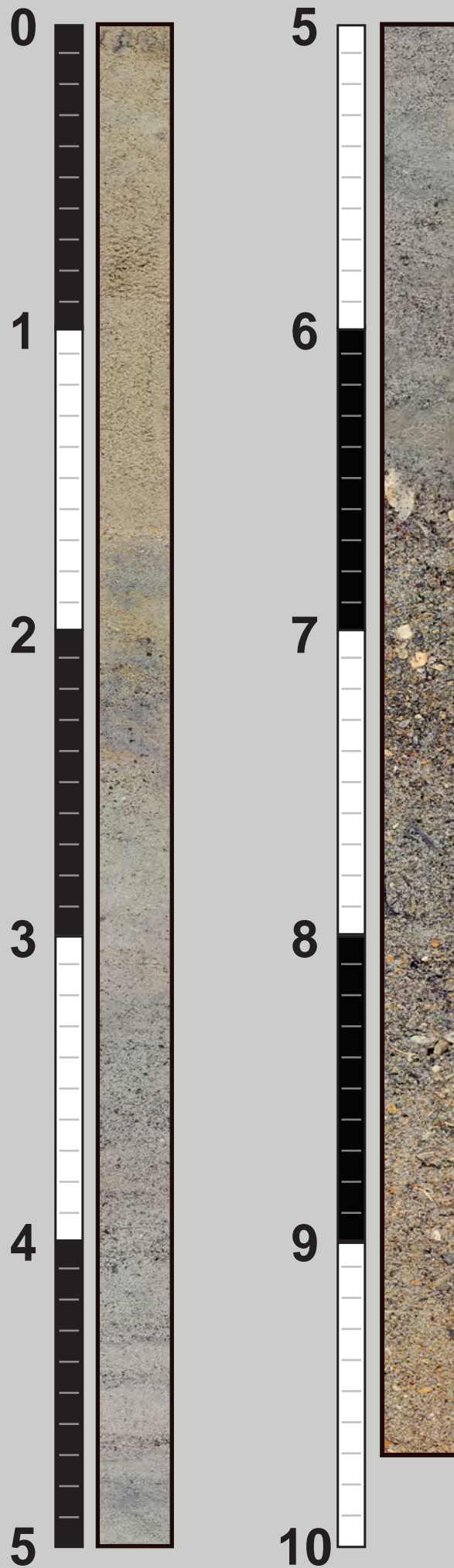
<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER <b>CLO-22-V-014</b>		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1350 hrs. : 6/28/22 @ 1405 hrs.	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -2.6' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 97%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																														
			0.0' TO -2.6' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +0.53 feet MLLW.																														
-2.6	0.0		<b>OCEAN BOTTOM AT -2.6' MLLW</b> SP: Gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix, loose, subrounded.		0.5' <b>S-1</b>	NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.																														
-3.6			SP: Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, inorganic clay in lamination at 2.8', loose, subrounded.	Core Run 10.0'		<b>VIBRACORE BORING</b> From: 0.0' to 10.0' Ran: 10.0' Rec: 9.7'																														
	2.0			Recovery 97.0%	3.0' <b>S-2</b>	<b>LAB CLASSIFICATION</b>																														
	4.0					<table border="1"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>Fines</th> <th>Rock</th> </tr> </thead> <tbody> <tr> <td>S-1</td> <td>SP</td> <td>0.99</td> <td>0.94</td> <td>0.25</td> <td></td> </tr> <tr> <td>S-2</td> <td>SP</td> <td>0</td> <td>1.91</td> <td>0.13</td> <td></td> </tr> <tr> <td>S-3</td> <td>SP</td> <td>1.17</td> <td>1.13</td> <td>0</td> <td></td> </tr> <tr> <td>S-4</td> <td>SP</td> <td>13.86</td> <td>0.63</td> <td>0</td> <td></td> </tr> </tbody> </table>	Sample ID	Lab Class.	Shell	% #200	Fines	Rock	S-1	SP	0.99	0.94	0.25		S-2	SP	0	1.91	0.13		S-3	SP	1.17	1.13	0		S-4	SP	13.86	0.63	0	
Sample ID	Lab Class.	Shell	% #200	Fines	Rock																															
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	6.0				6.0' <b>S-3</b>	NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2.																														
	8.0		SP: Gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells, loose, subrounded.			NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves.																														
	10.0		SP: Gray, poorly graded sand, medium -grained, little fine sand to fine gravel-sized shells, occasional coarse gravel-sized shells, loose, subrounded.		8.2' <b>S-4</b>	* = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.																														
	-12.3																																			
	10.0		BOTTOM OF BOREHOLE AT 10.0 ft																																	
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Drafted By: Adam Freeze  
Date Drafted: 7/6/2022

Reviewed By: Neil Wicker  
Date Checked: 7/7/2022  
VERSION: Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-015**

**Top Elev. (ft MLLW): -4.0  
Bottom Elev. (ft MLLW): -13.7**

**Notes:**

- Photo Mosaic Image
- Photo Scale in Feet



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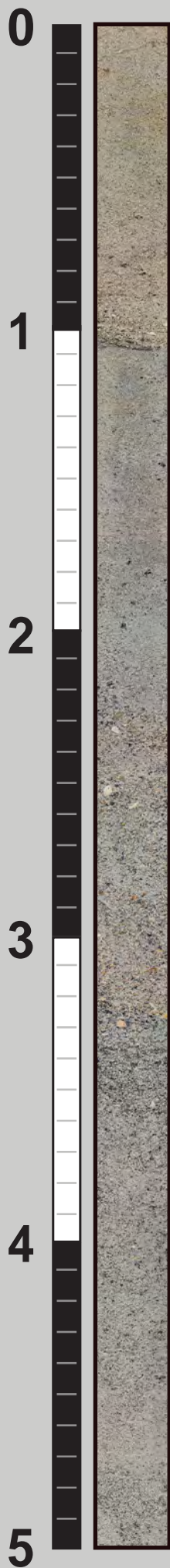
<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-015</b> : N 327884.68 E 2742944.84		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1415 hrs. : 6/28/22 @ 1435 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -4' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 97%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																														
		0.0' TO -4.0' WATER				NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +0.59 feet MLLW.  NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.  <b>VIBRACORE BORING</b> From: 0.0' to 10.0' Ran: 10.0' Rec: 9.7'  <b>LAB CLASSIFICATION</b> <table border="1" style="font-size: small; width: 100%;"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>Fines</th> <th>Rock</th> </tr> </thead> <tbody> <tr><td>S-1</td><td>SP</td><td>0</td><td>0.79</td><td>0</td><td></td></tr> <tr><td>S-2</td><td>SP</td><td>0</td><td>1.32</td><td>0</td><td></td></tr> <tr><td>S-3</td><td>SP</td><td>0</td><td>1.42</td><td>0</td><td></td></tr> <tr><td>S-4</td><td>SP</td><td>3.96</td><td>0.57</td><td>0</td><td></td></tr> </tbody> </table> NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2. NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves. * = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.	Sample ID	Lab Class.	Shell	% #200	Fines	Rock	S-1	SP	0	0.79	0		S-2	SP	0	1.32	0		S-3	SP	0	1.42	0		S-4	SP	3.96	0.57	0	
Sample ID	Lab Class.	Shell	% #200	Fines	Rock																															
S-1	SP	0	0.79	0																																
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S-4	SP	3.96	0.57	0																																
-4	0.0	OCEAN BOTTOM AT -4.0' MLLW	<b>SP:</b> Light brownish gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells in matrix, loose, subrounded.		0.5' <b>S-1</b>																															
-6.1	2.0	SP	<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.	Core Run 10.0' Recovery 97.0%	3.0' <b>S-2</b>																															
-10.5	6.0	SP	<b>SP:</b> Grayish brown grades to pale brown, poorly graded sand, medium -grained, some fine sand to coarse gravel-sized shells in matrix throughout, shell size decreases with depth, loose, subrounded.		5.2' <b>S-3</b>																															
-13.7	8.0	SP			8.0' <b>S-4</b>																															
	10.0		BOTTOM OF BOREHOLE AT 10.0 ft																																	
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**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-016**

**Top Elev. (ft MLLW): -5.5  
Bottom Elev. (ft MLLW): -14.7**

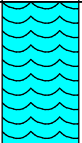
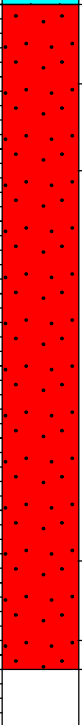
**Notes:**

- Photo Mosaic Image
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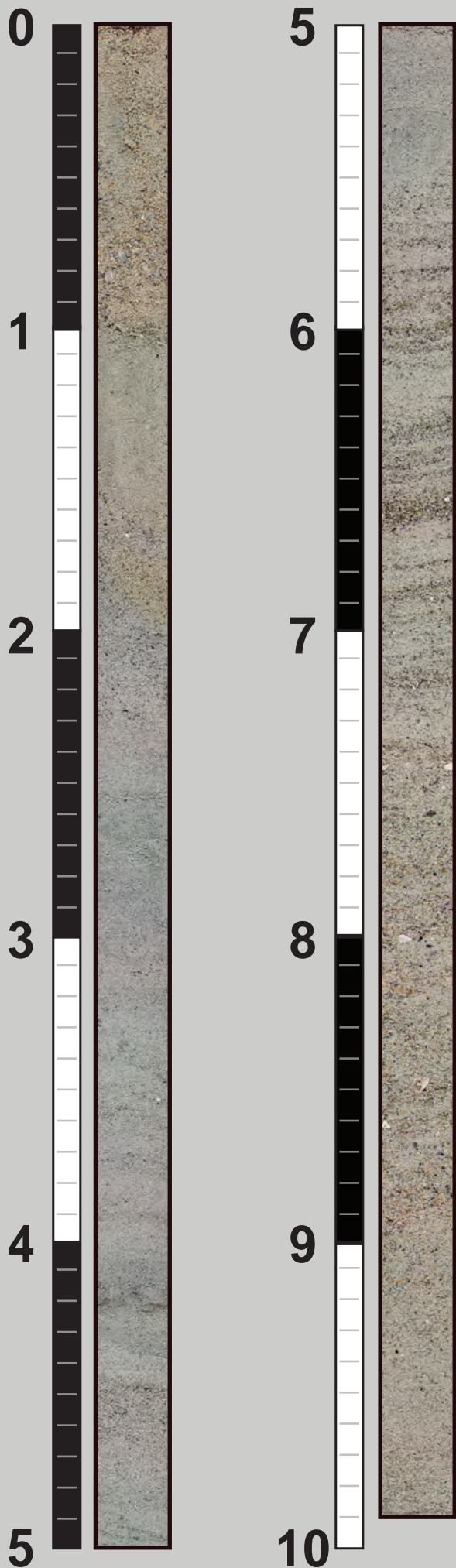
<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : NAD83 VERTICAL : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-016</b> : N 327106.42 E 2742314.74		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER : See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP : STARTED : COMPLETED OF BORING : 6/28/22 @ 1444 hrs. : 6/28/22 @ 1510 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -5.5' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 92%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																														
			0.0' TO -5.5' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +0.99 feet MLLW.																														
-5.5	0.0		<b>OCEAN BOTTOM AT -5.5' MLLW</b> <b>SP:</b> Olive gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells in matrix, inorganic clay in lamination at base, shell size increases at base, loose, subrounded.		0.5' <b>S-1</b>	NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.																														
-6.6			<b>SP:</b> Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.	Core Run 10.0'	2.0' <b>S-2</b>	<b>VIBRACORE BORING</b> From: 0.0' to 10.0' Ran: 10.0' Rec: 9.2'																														
-7.8	2.0		<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix throughout, shell % & size increases with depth, loose, subrounded.	Recovery 92.0%	4.0' <b>S-3</b>	<b>LAB CLASSIFICATION</b> <table border="1"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>Fines</th> <th>Rock</th> </tr> </thead> <tbody> <tr> <td>S-1</td> <td>SP</td> <td>0</td> <td>1.19</td> <td>0</td> <td></td> </tr> <tr> <td>S-2</td> <td>SP</td> <td>0.28</td> <td>1.09</td> <td>0</td> <td></td> </tr> <tr> <td>S-3</td> <td>SP</td> <td>0.33</td> <td>0.58</td> <td>0</td> <td></td> </tr> <tr> <td>S-4</td> <td>SP</td> <td>2.09</td> <td>0.47</td> <td>0</td> <td></td> </tr> </tbody> </table>	Sample ID	Lab Class.	Shell	% #200	Fines	Rock	S-1	SP	0	1.19	0		S-2	SP	0.28	1.09	0		S-3	SP	0.33	0.58	0		S-4	SP	2.09	0.47	0	
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S-3	SP	0.33	0.58	0																																
S-4	SP	2.09	0.47	0																																
-13.2	4.0		<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.		6.0' <b>S-4</b>	NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2. NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves. * = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.																														
-14.3	8.0		<b>SP:</b> Olive gray, poorly graded sand, fine -grained, trace inorganic clay/silt in matrix, trace fine to medium sand-sized shells, loose, subrounded.																																	
-14.7																																				
	10.0		BOTTOM OF BOREHOLE AT 10.0 ft  SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM																																	



Drafted By: Adam Freeze  
Date Drafted: 7/6/2022

Reviewed By: Neil Wicker  
Date Checked: 7/7/2022  
VERSION: Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-017**

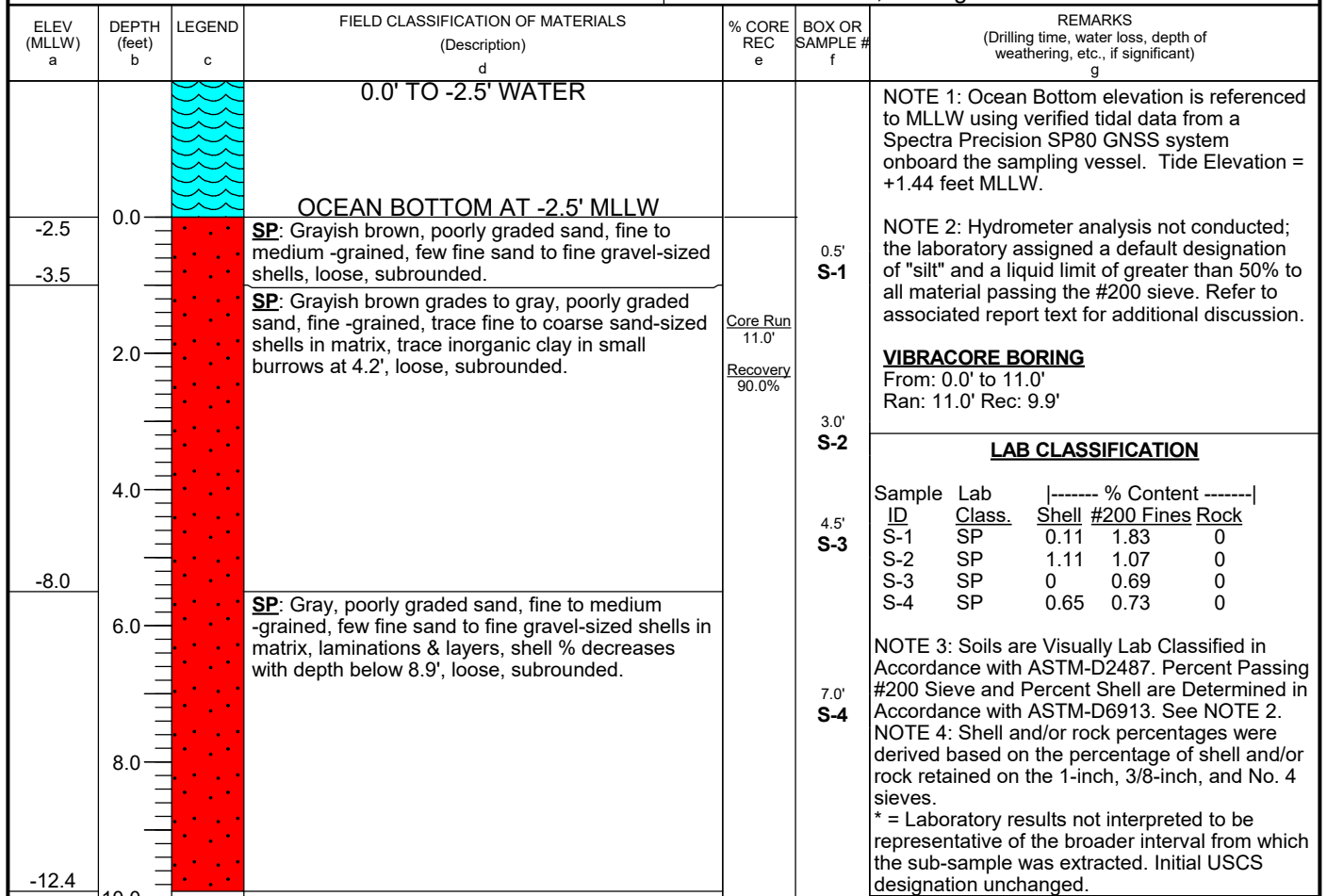
**Top Elev. (ft MLLW): -2.5  
Bottom Elev. (ft MLLW): -12.4**

**Notes:**  
- Photo Mosaic Image  
- Photo Scale in Feet




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1293 Graham Farm Road  
McClellanville, SC 29458  
www.athenatechnologies.com  
(843) 887-3800

<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-017</b> : N 325790.45 E 2741740.47		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1519 hrs. : 6/28/22 @ 1530 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -2.5' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 90%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	



BOTTOM OF BOREHOLE AT 10.0 ft

SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM

 Wilmington District Geotechnical Section	Drafted By: Adam Freeze Date Drafted: 7/6/2022	Reviewed By: Neil Wicker Date Checked: 7/7/2022 VERSION: Final
--	---	--



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-018**

**Top Elev. (ft MLLW): -6.1  
Bottom Elev. (ft MLLW): -15.8**

**Notes:**  
- Photo Mosaic Image  
- Photo Scale in Feet



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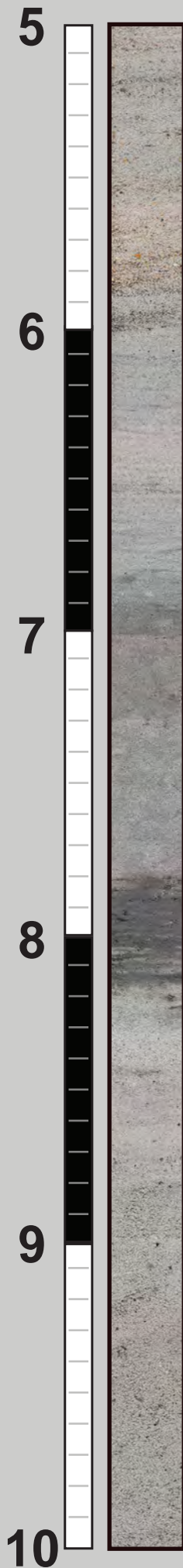
<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER <b>CLO-22-V-018</b>		10. LOCATION COORDINATES N 326626.71 E 2741532.4	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1540 hrs. : 6/28/22 @ 1550 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -6.1' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 97%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																								
			0.0' TO -6.1' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +1.66 feet MLLW.  NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.  <b>VIBRACORE BORING</b> From: 0.0' to 10.0' Ran: 10.0' Rec: 9.7'  <b>LAB CLASSIFICATION</b> <table border="1" style="font-size: small; width: 100%;"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>Fines</th> <th>Rock</th> </tr> </thead> <tbody> <tr> <td>S-1</td> <td>SP</td> <td>2.11</td> <td>0.67</td> <td>0</td> <td></td> </tr> <tr> <td>S-2</td> <td>SP</td> <td>14</td> <td>0.95</td> <td>0</td> <td></td> </tr> <tr> <td>S-3</td> <td>SP</td> <td>1.26</td> <td>0.84</td> <td>0</td> <td></td> </tr> </tbody> </table> NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2. NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves. * = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.	Sample ID	Lab Class.	Shell	% #200	Fines	Rock	S-1	SP	2.11	0.67	0		S-2	SP	14	0.95	0		S-3	SP	1.26	0.84	0	
Sample ID	Lab Class.	Shell	% #200	Fines	Rock																									
S-1	SP	2.11	0.67	0																										
S-2	SP	14	0.95	0																										
S-3	SP	1.26	0.84	0																										
-6.1	0.0		<b>SP:</b> Light brownish gray, poorly graded sand, medium -grained, few fine sand to fine gravel-sized shells in matrix throughout, occasional coarse gravel-sized shells, loose, subrounded.	Core Run 10.0'	1.0' <b>S-1</b>																									
-8.6	2.0		<b>SP:</b> Grayish brown, poorly graded sand, medium -grained, some fine sand to fine gravel-sized shells in matrix, loose, subrounded.	Recovery 97.0%	3.0' <b>S-2</b>																									
-9.6	4.0		<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells in matrix, laminations & layers, occasional fine gravel-sized shells below 7.4', loose, subrounded.		4.5' <b>S-3</b>																									
-14.0	8.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells in matrix, loose, subrounded.																											
-15.0	8.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, few fine to coarse sand-sized shells in matrix, loose, subrounded.																											
-15.8	8.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, few fine to coarse sand-sized shells in matrix, loose, subrounded.																											
	10.0		BOTTOM OF BOREHOLE AT 10.0 ft																											
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM																											



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-019**

**Top Elev. (ft MLLW): -2.5  
Bottom Elev. (ft MLLW): -12.5**

**Notes:**

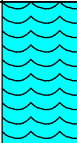
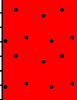

- Photo Mosaic Image
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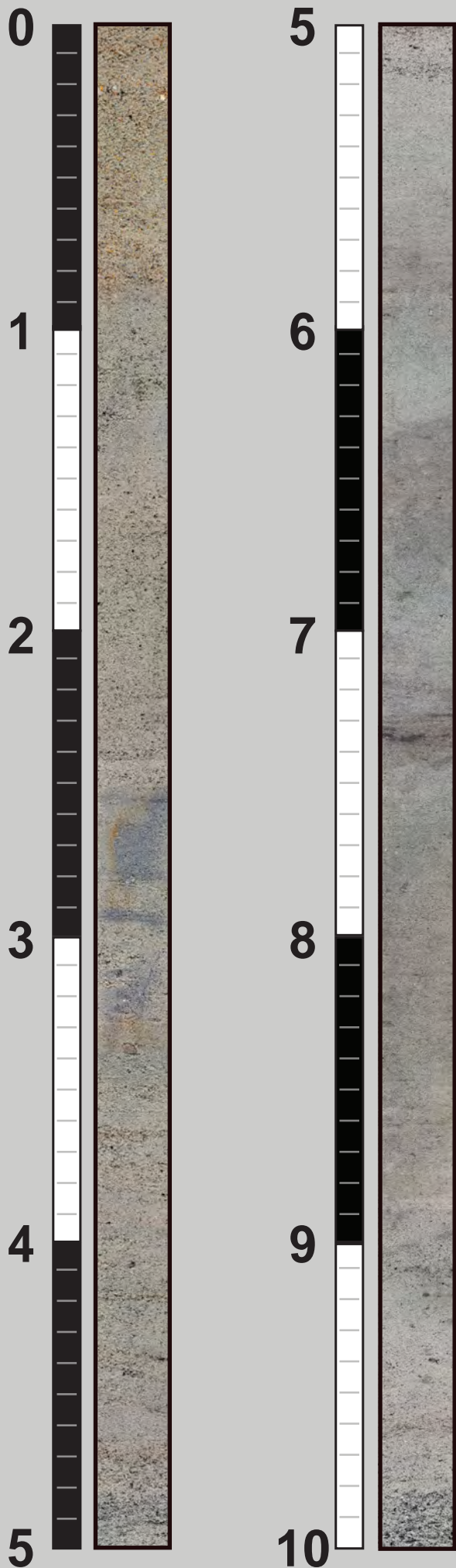
<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER : LOCATION COORDINATES <b>CLO-22-V-019</b> : N 326292.76 E 2740636.8		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED : 1 : 0	
5. DIRECTION OF BORING : DEG FROM VERTICAL : BEARING <input checked="" type="checkbox"/> VERTICAL : : --- : <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1559 hrs. : 6/28/22 @ 1620 hrs	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING -2.5' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 94%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																																				
			0.0' TO -2.5' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +1.85 feet MLLW.																																				
-2.5	0.0		<b>OCEAN BOTTOM AT -2.5' MLLW</b>			NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.																																				
-3.9			<b>SP:</b> Light brownish gray, poorly graded sand, medium -grained, little fine sand to fine gravel-sized shells throughout, loose, subrounded.		1.0' <b>S-1</b>	<b>VIBRACORE BORING</b> From: 0.0' to 11.0' Ran: 11.0' Rec: 10.3'  <b>LAB CLASSIFICATION</b> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>Fines</th> <th>Rock</th> </tr> </thead> <tbody> <tr><td>S-1</td><td>SP</td><td>1.91</td><td>0.56</td><td>0</td><td></td></tr> <tr><td>S-2</td><td>SP</td><td>1.04</td><td>0.58</td><td>0</td><td></td></tr> <tr><td>S-3</td><td>SP</td><td>0.06</td><td>1.75</td><td>0</td><td></td></tr> <tr><td>S-4</td><td>SP</td><td>0.7</td><td>0.69</td><td>0</td><td></td></tr> <tr><td>S-5</td><td>SP</td><td>0</td><td>3.07</td><td>0</td><td></td></tr> </tbody> </table>	Sample ID	Lab Class.	Shell	% #200	Fines	Rock	S-1	SP	1.91	0.56	0		S-2	SP	1.04	0.58	0		S-3	SP	0.06	1.75	0		S-4	SP	0.7	0.69	0		S-5	SP	0	3.07	0	
Sample ID	Lab Class.	Shell	% #200	Fines	Rock																																					
S-1	SP	1.91	0.56	0																																						
S-2	SP	1.04	0.58	0																																						
S-3	SP	0.06	1.75	0																																						
S-4	SP	0.7	0.69	0																																						
S-5	SP	0	3.07	0																																						
-5.2	2.0		<b>SP:</b> Gray grades to grayish brown, poorly graded sand, fine to medium -grained, little fine sand to fine gravel-sized shells in matrix & in layer at 2.2-2.5', loose, subrounded.	Core Run 11.0'	2.0' <b>S-2</b>																																					
-6.2			<b>SP:</b> Dark gray grades to gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.	Recovery 93.6%	3.0' <b>S-3</b>																																					
-8.4	4.0		<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells in laminations & layers, shell % decreases with depth, loose, subrounded.		5.2' <b>S-4</b>																																					
-9.5	6.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, trace fine sand-sized shells in laminations, trace heavy minerals in laminations, loose, subrounded.		7.2' <b>S-5</b>																																					
-10.4			<b>SP:</b> Dark gray, poorly graded sand, fine -grained, trace inorganic clay in matrix & burrows, loose, subrounded, bioturbated.																																							
-10.8	8.0		<b>SC:</b> Very dark greenish gray, clayey sand, fine -grained, little inorganic clay, loose/soft, bioturbated.																																							
-12.5	10.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix, loose, subrounded.																																							
			BOTTOM OF BOREHOLE AT 10.0 ft			NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2. NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves. * = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.																																				
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			(10-)Top 10 feet of core retained for processing.																																				



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final



**US Army Corps of  
Engineers, Wilmington  
District**

**2022 Back Sound to Lookout Bight,  
Subsurface Investigation and  
Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-020**

**Top Elev. (ft MLLW): -0.6  
Bottom Elev. (ft MLLW): -9.4**

**Notes:**  
- Photo Mosaic Image  
- Photo Scale in Feet



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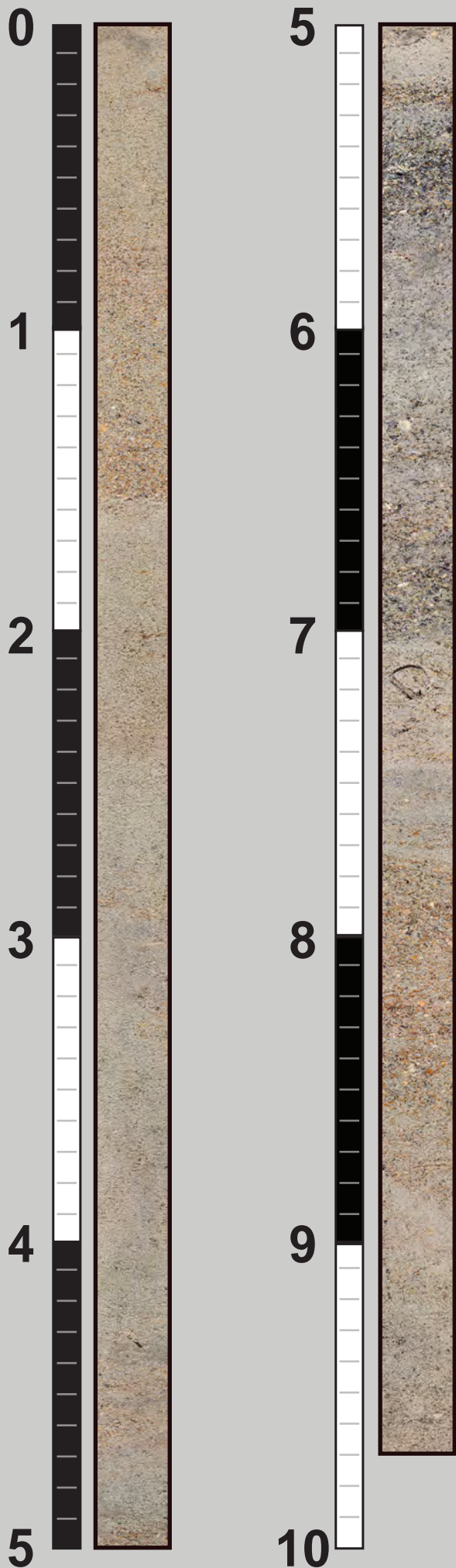
<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER <b>CLO-22-V-020</b>		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1655 hrs. : 6/28/22 @ 1715 hrs.	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING 0.6' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 92%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g																																				
			0.0' TO 0.6' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +2.49 feet MLLW.  NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.																																				
0.6	0.0		<b>OCEAN BOTTOM AT 0.6' MLLW</b>																																							
-0.2			<b>SP:</b> Light brownish gray, poorly graded sand, fine to medium -grained, few fine to medium sand-sized shells, occasional fine gravel-sized shells, loose, subrounded.			<p align="center"><b>VIBRACORE BORING</b></p> <p>From: 0.0' to 12.0' Ran: 12.0' Rec: 11.0'</p> <p align="center"><b>LAB CLASSIFICATION</b></p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Sample ID</th> <th>Lab Class.</th> <th>Shell</th> <th>% #200</th> <th>Fines</th> <th>Rock</th> </tr> </thead> <tbody> <tr><td>S-1</td><td>SP</td><td>0.31</td><td>0.41</td><td></td><td>0</td></tr> <tr><td>S-2</td><td>SP</td><td>0.44</td><td>1.45</td><td></td><td>0</td></tr> <tr><td>S-3</td><td>SP</td><td>0</td><td>1.98</td><td></td><td>0</td></tr> <tr><td>S-4</td><td>SP</td><td>0</td><td>3.31</td><td></td><td>0</td></tr> <tr><td>S-5</td><td>SP</td><td>0.17</td><td>2.27</td><td></td><td>0</td></tr> </tbody> </table> <p>NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2. NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves. * = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.</p>	Sample ID	Lab Class.	Shell	% #200	Fines	Rock	S-1	SP	0.31	0.41		0	S-2	SP	0.44	1.45		0	S-3	SP	0	1.98		0	S-4	SP	0	3.31		0	S-5	SP	0.17	2.27		0
Sample ID	Lab Class.	Shell	% #200	Fines	Rock																																					
S-1	SP	0.31	0.41		0																																					
S-2	SP	0.44	1.45		0																																					
S-3	SP	0	1.98		0																																					
S-4	SP	0	3.31		0																																					
S-5	SP	0.17	2.27		0																																					
	2.0		<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, trace fine to medium sand-sized shells in matrix, fine sand in layers below 2.5', loose, subrounded.	Core Run 12.0'	2.0'																																					
	4.0			Recovery 91.7%	<b>S-1</b>																																					
-4.6			<b>SP:</b> Gray, poorly graded sand, fine -grained, trace inorganic clay in occasional burrows, trace fine sand-sized shells, loose, subrounded.		4.0'																																					
	6.0				<b>S-2</b>																																					
	8.0				6.0'																																					
-8.4			<b>SP:</b> Gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells, trace inorganic clay in occasional burrows, shell % increases at base, loose, subrounded.		8.0'																																					
	10.0				<b>S-3</b>																																					
-9.4					9.0'																																					
			BOTTOM OF BOREHOLE AT 10.0 ft		<b>S-4</b>																																					
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM		<b>S-5</b>																																					
					10.0'																																					
						(10-)Top 10 feet of core retained for processing.																																				



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final



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**2022 Back Sound to Lookout Bight,  
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Geotechnical Laboratory Testing  
Contract # W912PM22P0042**

**CLO-22-V-021**

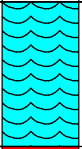
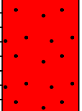
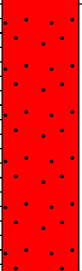
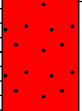
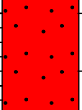
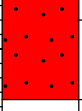
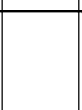
**Top Elev. (ft MLLW): -0.2  
Bottom Elev. (ft MLLW): -9.5**

**Notes:**  
- Photo Mosaic Image  
- Photo Scale in Feet



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<b>DRILLING LOG</b>	DIVISION South Atlantic Division	INSTALLATION Wilmington District	SHEET 1 OF 1 SHEETS
1. PROJECT 2022 Back Sound to Lookout Bight (W912PM22P0042) Carteret County, North Carolina		9. COORDINATE SYSTEM NC State Plane	HORIZONTAL : VERTICAL NAD83 : MLLW
2. HOLE NUMBER <b>CLO-22-V-021</b>		10. SIZE AND TYPE OF BIT3 Sample Barrel	
3. DRILLING AGENCY Athena Technologies		11. MANUFACTURER'S DESIGNATION OF DRILL Athena Technologies Vibracore System	
4. NAME OF DRILLER Palmer McClellan		12. TOTAL SAMPLES DISTURBED : 1 UNDISTURBED : 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN		14. ELEVATION GROUND WATER See Remarks	
7. DEPTH DRILLED INTO ROCK 0.0'		15. DATE TIME GROUP STARTED : COMPLETED OF BORING : 6/28/22 @ 1627 hrs. : 6/28/22 @ 1645 hrs.	
8. TOTAL DEPTH OF BORING 10.0'		16. ELEVATION TOP OF BORING 0.2' MLLW	
		17. TOTAL CORE RECOVERY FOR BORING 97%	
		18. SIGNATURE AND TITLE OF INSPECTOR Adam Freeze, Geologist	

ELEV (MLLW) a	DEPTH (feet) b	LEGEND c	FIELD CLASSIFICATION OF MATERIALS (Description) d	% CORE REC e	BOX OR SAMPLE # f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0.0' TO 0.2' WATER			NOTE 1: Ocean Bottom elevation is referenced to MLLW using verified tidal data from a Spectra Precision SP80 GNSS system onboard the sampling vessel. Tide Elevation = +2.22 feet MLLW.  NOTE 2: Hydrometer analysis not conducted; the laboratory assigned a default designation of "silt" and a liquid limit of greater than 50% to all material passing the #200 sieve. Refer to associated report text for additional discussion.  <b>VIBRACORE BORING</b> From: 0.0' to 10.0' Ran: 10.0' Rec: 9.7'
0.2	0.0		<b>OCEAN BOTTOM AT 0.2' MLLW</b>		1.0' <b>S-1</b>	
-1.4	2.0		<b>SP:</b> Light brownish gray, poorly graded sand, fine to medium -grained, few fine to coarse sand-sized shells in matrix & in layer at base, loose, subrounded.	Core Run 10.0'	3.0' <b>S-2</b>	
-5.1	4.0		<b>SP:</b> Light brownish gray grades to gray, poorly graded sand, fine -grained, trace fine to coarse sand-sized shells in matrix & in layer at base, occasional gravel-sized shells, loose, subrounded.	Recovery 97.0%	6.0' <b>S-3</b>	
-6.8	6.0		<b>SP:</b> Gray, poorly graded sand, medium -grained, little fine sand to fine gravel-sized shells in matrix & in layers at top & at base, loose, subrounded.		8.0' <b>S-4</b>	
-7.6	8.0		<b>SP:</b> Gray, poorly graded sand, fine -grained, trace fine to medium sand-sized shells, gravel-sized shell at top, loose, subrounded.		9.0' <b>S-5</b>	
-8.4	8.0		<b>SP:</b> Light brownish gray, poorly graded sand, fine to medium -grained, few fine sand to fine gravel-sized shells in matrix, loose, subrounded.			
-9.5	9.0		<b>SP:</b> Gray, poorly graded sand, fine to medium -grained, trace fine to coarse sand-sized shells in matrix, occasional gravel-sized shell, loose, subrounded.			
	10.0		BOTTOM OF BOREHOLE AT 10.0 ft			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

**LAB CLASSIFICATION**

Sample ID	Lab Class.	Shell	% #200	Fines	Rock
S-1	SP	0.43	1.5	0	
S-2	SP	0	1.42	0	
S-3	SP	2.54	0.93	0	
S-4	SP	0.96	1.22	0	
S-5	SP	2.54	1.01	0.45	

NOTE 3: Soils are Visually Lab Classified in Accordance with ASTM-D2487. Percent Passing #200 Sieve and Percent Shell are Determined in Accordance with ASTM-D6913. See NOTE 2.  
NOTE 4: Shell and/or rock percentages were derived based on the percentage of shell and/or rock retained on the 1-inch, 3/8-inch, and No. 4 sieves.  
\* = Laboratory results not interpreted to be representative of the broader interval from which the sub-sample was extracted. Initial USCS designation unchanged.



**Drafted By:** Adam Freeze  
**Date Drafted:** 7/6/2022

**Reviewed By:** Neil Wicker  
**Date Checked:** 7/7/2022  
**VERSION:** Final

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT CAPE LOOKOUT NATIONAL SEASHORE				10. SIZE AND TYPE OF BIT 4" DIA VIBRACORE			
2. LOCATION (Coordinates or Station) E 2744960.80 N 341662.97				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLLW			
3. DRILLING AGENCY WILMINGTON DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL SNELL			
4. HOLE NO. CL-04-V-1				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED : 4 UNDISTURBED : 0	
5. NAME OF DRILLER LESTER GAUGHF				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER N/A		16. DATE HOLE : STARTED : 7/12/04 : COMPLETED : 7/12/04	
7. THICKNESS OF OVERBURDEN N/A (3.9' OF WATER)				17. ELEVATION TOP OF HOLE 0.0' MLLW			
8. DEPTH DRILLED INTO ROCK 0.0'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
9. TOTAL DEPTH OF HOLE 23.9'				19. SIGNATURE OF INSPECTOR STACY SMITH & DIANE GREENE			
ELEVATION MLLW a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		0.0' TO 3.9' WATER			Time begin vibracoring: 12:38 hrs. Soils described by Larry Benjamin, Civil Engr Tech.	
	-3.9		RIVER BOTTOM @3.9'		3.9'	NOTE: Scale changed @4.0'.	
	4.0		SP Grayish tan, coarse, poorly graded sand.		1		
	6.0				4.4'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.	
	8.0				8.0'	VIBRACORE BORING From 0.0' To 20.0' Ran 20.0' Rec 12.0'	
	9.9				2	Top of vibracore soil sample is logged as beginning at Ocean Bottom	
	10.0		MH Dark gray elastic silt, 1/2 large shell fragments.		8.5'	When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered	
	12.0				3		
	13.6				10.4'	LAB CLASSIFICATION JAR NUMBER CLASSIFICATION 1 SP 2 SP	
	14.0		SP-SM Gray, fine, poorly graded silty sand.		13.6'		
	16.0				4		
	18.0		ASSUMED NOT RECOVERED		14.1'	NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 20.0'	
	-18.0		CONTINUED ON SHEET 2				
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 0.0' MLLW		Hole No. CL-04-V-1		
PROJECT CAPE LOOKOUT NATIONAL SEASHORE			INSTALLATION WILMINGTON DISTRICT			
SHEET 2 OF 2 SHEETS						
ELEVATION (NGVD) a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	18.0		ASSUMED NOT RECOVERED		DRIVE	
	20.0					
	22.0					
-23.9	23.9		BOTTOM OF HOLE @23.9'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 2 SHEETS
1. PROJECT CAPE LOOKOUT NATIONAL SEASHORE		10. SIZE AND TYPE OF BIT 4" DIA VIBRACORE	
2. LOCATION (Coordinates or Station) E 2744687.17 N 343021.84		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLLW	
3. DRILLING AGENCY WILMINGTON DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL SNELL	
4. HOLE NO. CL-04-V-2		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED : 4 UNDISTURBED : 0
5. NAME OF DRILLER LESTER GAUGHF		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN N/A (4.7' OF WATER)		16. DATE HOLE	STARTED : 7/12/04 COMPLETED : 7/12/04
8. DEPTH DRILLED INTO ROCK 0.0'		17. ELEVATION TOP OF HOLE 0.0' MLLW	
9. TOTAL DEPTH OF HOLE 24.7'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
		19. SIGNATURE OF INSPECTOR STACY SMITH & DIANE GREENE	

ELEVATION MLLW a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		0.0' TO 4.7' WATER			Time begin vibracoring: 1709 hrs. Soils described by Larry Benjamin, Civil Engr Tech.
	4.0					NOTE: Scale changed @4.0'.
	4.7		RI VER BOTTOM @4.7'		4.7'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	6.0		SP Grayish tan, medium poorly graded sand.		1	
	8.0				5.2'	
	10.0				8.7'	VIBRACORE BORING From 0.0' To 20.0' Ran 20.0' Rec 13.6'
	11.7				2	Top of vibracore soil sample is logged as beginning at Ocean Bottom When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered
	12.0		MH Dark gray, elastic silt.		9.2'	
	14.0				11.7'	LAB CLASSIFICATION
	16.0		SP-SM Gray, fine, poorly graded silty sand, T/shell fragments.		12.2'	JAR NUMBER CLASSIFICATION 1 SP 2 SP
	18.0				16.1'	NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 20.0'
			CONTINUED ON SHEET 2		16.6'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			



DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 0.0' MLLW		Hole No. CL-04-V-2		
PROJECT CAPE LOOKOUT NATIONAL SEASHORE			INSTALLATION WILMINGTON DISTRICT		SHEET 2 OF 2 SHEETS	
ELEVATION (NGVD)	DEPTH (feet)	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
18.0	18.0	•••	SP-SM CONT'D ASSUMED NOT RECOVERED	18.3'	DRIVE	
-24.7	24.7		BOTTOM OF HOLE @24.7'  SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

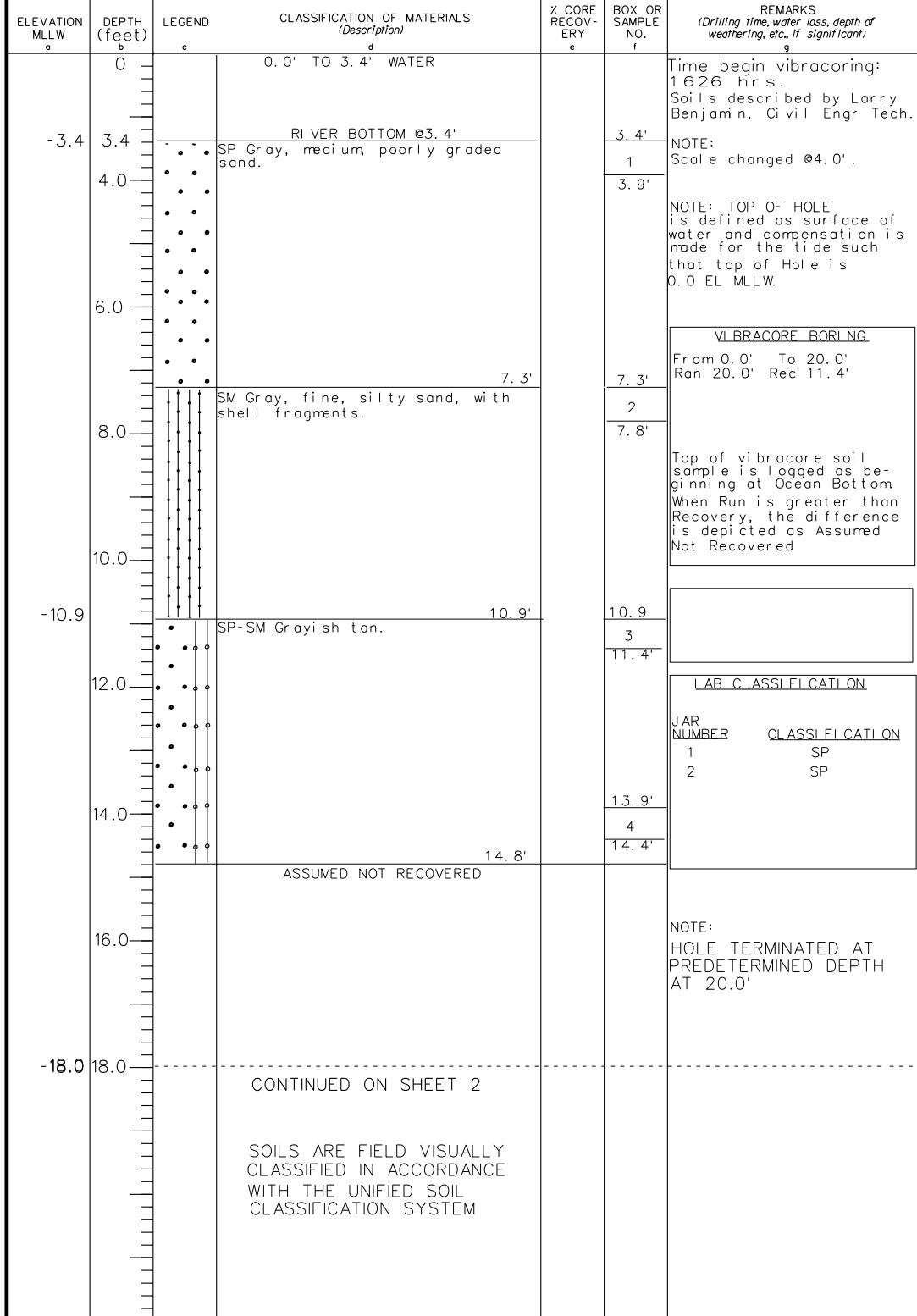
DRILLING LOG		DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 2 SHEETS		
1. PROJECT CAPE LOOKOUT NATIONAL SEASHORE			10. SIZE AND TYPE OF BIT 4" DIA VIBRACORE			
2. LOCATION (Coordinates or Station) E 2744900.8 N 342085.11			11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLLW			
3. DRILLING AGENCY WILMINGTON DISTRICT			12. MANUFACTURER'S DESIGNATION OF DRILL SNELL			
4. HOLE NO. CL-04-V-2A			13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		UNDISTURBED 0	
5. NAME OF DRILLER LESTER GAUGHF			14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.			15. ELEVATION GROUND WATER N/A			
7. THICKNESS OF OVERBURDEN N/A (3.2' OF WATER)			16. DATE HOLE STARTED 7/12/04		COMPLETED 7/12/04	
8. DEPTH DRILLED INTO ROCK 0.0'			17. ELEVATION TOP OF HOLE 0.0' MLLW			
9. TOTAL DEPTH OF HOLE 23.2'			18. TOTAL CORE RECOVERY FOR BORING N/A %			
			19. SIGNATURE OF INSPECTOR STACY SMITH & DIANE GREENE			
ELEVATION MLLW a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		0.0' TO 3.2' WATER			Time begin vibracoring: 1256 hrs.
	3.2		RIVER BOTTOM @3.2'		3.2'	Soils described by Larry Benjamin, Civil Engr Tech.
-3.2	3.2		SP-SM Gray, fine, poorly graded silty sand, T/shell fragments.		1	NOTE: Scale changed @4.0'.
	4.0				3.7'	
	6.0					NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	7.2				7.2'	VIBRACORE BORING From 0.0' To 20.0' Ran 20.0' Rec 9.0'
	8.0		MH Dark gray, elastic silt.		2	
	8.6				7.7'	
	8.6		SP-SM Gray, fine, poorly graded, silty sand, T/shell fragments.		8.6'	Top of vibracore soil sample is logged as be- ginning at Ocean Bottom
	10.0				3	When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered
	12.0				9.1'	
12.2	12.0		ASSUMED NOT RECOVERED			LAB CLASSIFICATION JAR NUMBER CLASSIFICATION 1 SP 2 MH 3 SP-SM
	14.0					
	16.0					NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 20.0'
-18.0	18.0		CONTINUED ON SHEET 2			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 0.0' MLLW		Hole No. CL-04-V-2A		
PROJECT CAPE LOOKOUT NATIONAL SEASHORE			INSTALLATION WILMINGTON DISTRICT			
SHEET 2 OF 2 SHEETS						
ELEVATION (NGVD) a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	18.0		ASSUMED NOT RECOVERED		DRIVE	
	20.0					
	22.0					
-23.2	23.2		BOTTOM OF HOLE @23.2'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT CAPE LOOKOUT NATIONAL SEASHORE				10. SIZE AND TYPE OF BIT 4" DIA VIBRACORE			
2. <b>E 2744490.2 N 343810</b>				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLLW			
3. DRILLING AGENCY WILMINGTON DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL SNELL			
4. HOLE NO. CL-04-V-3				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED : 3 UNDISTURBED : 0	
5. NAME OF DRILLER LESTER GAUGHF				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER N/A		16. DATE HOLE : STARTED : 7/12/04 : COMPLETED : 7/12/04	
7. THICKNESS OF OVERBURDEN N/A (4.4' OF WATER)				17. ELEVATION TOP OF HOLE 0.0' MLLW			
8. DEPTH DRILLED INTO ROCK 0.0'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
9. TOTAL DEPTH OF HOLE 24.4'				19. SIGNATURE OF INSPECTOR STACY SMITH & DIANE GREENE			
ELEVATION MLLW a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		0.0' TO 4.4' WATER			Time begin vibracoring: 1645 hrs. Soils described by Larry Benjamin, Civil Engr Tech.	
	4.0					NOTE: Scale changed @4.0'.	
	-4.4		RIVER BOTTOM @4.4'		4.4'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.	
	4.4		SP-SM Gray, fine, poorly graded sand.		1		
	6.0				4.9'		
	8.0					VIBRACORE BORING From 0.0' To 20.0' Ran 20.0' Rec 9.3'	
	10.0				8.8'	Top of vibracore soil sample is logged as beginning at Ocean Bottom	
	12.0				2	When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered	
	13.0				9.3'		
	-13.7					LAB CLASSIFICATION JAR NUMBER CLASSIFICATION 1 SP 2 SP	
	14.0		ASSUMED NOT RECOVERED		3		
	16.0				13.5'		
	18.0					NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 20.0'	
	-18.0		CONTINUED ON SHEET 2				
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 0.0' MLLW		Hole No. CL-04-V-3		
PROJECT CAPE LOOKOUT NATIONAL SEASHORE			INSTALLATION WILMINGTON DISTRICT			
SHEET 2 OF 2 SHEETS						
ELEVATION (NGVD) a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g h i j k l m n o p q r s t u v w x y z
	18.0		ASSUMED NOT RECOVERED		DRIVE	
	20.0					
	22.0					
	24.0					
-24.4	24.4		BOTTOM OF HOLE @24.4'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 2 SHEETS
1. PROJECT CAPE LOOKOUT NATIONAL SEASHORE			10. SIZE AND TYPE OF BIT 4" DIA VIBRACORE	
2. LOCATION (Coordinates or Station) E 2744310.83 N 344700.48			11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLLW	
3. DRILLING AGENCY WILMINGTON DISTRICT			12. MANUFACTURER'S DESIGNATION OF DRILL SNELL	
4. HOLE NO. CL-04-V-4			13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED : 4 : UNDISTURBED : 0	
5. NAME OF DRILLER LESTER GAUGHF			14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.			15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN N/A (3.4' OF WATER)			16. DATE HOLE : STARTED : 7/12/04 : COMPLETED : 7/12/04	
8. DEPTH DRILLED INTO ROCK 0.0'			17. ELEVATION TOP OF HOLE 0.0' MLLW	
9. TOTAL DEPTH OF HOLE 23.4'			18. TOTAL CORE RECOVERY FOR BORING N/A %	
19. SIGNATURE OF INSPECTOR STACY SMITH & DIANE GREENE				



DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE 0.0' MLLW		Hole No. CL-04-V-4		
PROJECT CAPE LOOKOUT NATIONAL SEASHORE			INSTALLATION WILMINGTON DISTRICT			
SHEET 2 OF 2 SHEETS						
ELEVATION (NGVD) a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g h i j k l m n o p q r s t u v w x y z
	18.0		ASSUMED NOT RECOVERED		DRIVE	
	20.0					
	22.0					
	23.0					
-23.4	23.4		BOTTOM OF HOLE @23.4'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT CAPE LOOKOUT NATIONAL SEASHORE				10. SIZE AND TYPE OF BIT 4" DIA VIBRACORE			
2. <b>E 2744007.0 N 346155</b>				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLLW			
3. DRILLING AGENCY WILMINGTON DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL SNELL			
4. HOLE NO. CL-04-V-5				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED : 4 UNDISTURBED : 0	
5. NAME OF DRILLER LESTER GAUGHF				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.				16. DATE HOLE		STARTED : 7/12/04 COMPLETED : 7/12/04	
7. THICKNESS OF OVERBURDEN N/A (3.8' OF WATER)				17. ELEVATION TOP OF HOLE 0.0' MLLW			
8. DEPTH DRILLED INTO ROCK 0.0'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
9. TOTAL DEPTH OF HOLE 23.8'				19. SIGNATURE OF INSPECTOR STACY SMITH & DIANE GREENE			
ELEVATION MLLW a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc. if significant) g	
	0		0.0' TO 3.8' WATER			Time begin vibracoring: 1359 hrs. Soils described by Larry Benjamin, Civil Engr Tech.	
	-3.8		RI VER BOTTOM @3.8'		3.8'	NOTE: Scale changed @4.0'.	
	4.0		SP-SM Gray, fine, poorly graded sand.		1		
					4.3'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.	
	6.0					VIBRACORE BORING From 0.0' To 20.0' Ran 20.0' Rec 12.1'	
					7.3'		
			SM Gray, fine, silty sand.		2	Top of vibracore soil sample is logged as beginning at Ocean Bottom When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered	
	8.0				7.8'		
						LAB CLASSIFICATION	
	12.0				12.3'	JAR NUMBER CLASSIFICATION	
	-12.3		SP-SM Grayish tan, medium poorly graded, silty sand, 1/shell fragments.		3	1 SP 2 SP-SM	
					12.8'		
	14.0						
					15.4'		
	16.0		ASSUMED NOT RECOVERED		4	NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 20.0'	
					15.9'		
	-18.0		CONTINUED ON SHEET 2				
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				



ELEVATION (NGVD) a	DEPTH (feet) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	18.0		ASSUMED NOT RECOVERED		DRIVE	
	20.0					
	22.0					
	23.0					
-23.8	23.8		BOTTOM OF HOLE @23.8'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT CAPE LOOKOUT LIGHTHOUSE		10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC Coord. E2745157.33 N330992.35 (NAD 83)		11. DATUM FOR ELEVATION SHOWN <i>(B.M. or MSL)</i> MLW	
3. DRILLING AGENCY WILMINGTON DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) : CLO-05-V-1		13. TOTAL NO. OF OVER- : DISTURBED : UNDISTURBED BURDEN SAMPLES TAKEN : 6 : 0	
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN N/A ( 4.7' of Water)		16. DATE HOLE : STARTED : COMPLETED : 01/04/05 : 01/04/05	
8. DEPTH DRILLED INTO ROCK 0.0'		17. ELEVATION TOP OF HOLE 0.0' MLW	
9. TOTAL DEPTH OF HOLE 16.7'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
19. SIGNATURE OF INSPECTOR LARRY BENJAMIN & DIANE GREENE.			

ELEVATION MLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		0.0' TO 4.7' WATER			Time begin vibracoring: 1215 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
-4.7	4.7		TOP OF CHANNEL @ 4.7'		4.7'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	5.0	•••••	SP Tan, coarse, poorly graded sand.		1	
	5.2				5.2'	VIBRACORE BORING From 0.0' to 12.0' Ran 12.0' Rec: 9.8'
	6.5				6.5'	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.
	7.0	•••••			2	
	8.1				7.0'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
	8.1		MH Dark green elastic silt.		8.1'	
	8.7				8.6'	LAB CLASSIFICATION Jar Number Classification 1 SP 2 SP 3 ML 4 SP
	9.0	•••••	SP Grayish tan, coarse, poorly graded sand w/shell fragments.	8.7'	3	
	10.6				8.7'	NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 12.0'
	11.0	•••••	tan, no shell fragments		4	
	11.9				9.2'	
	11.9	•••••	w/shell fragments.		5	
	13.0	•••••			11.0'	
	14.5	•••••			11.5'	
	15.0		ASSUMED NOT RECOVERED		14.0'	
	16.7		BOTTOM OF HOLE AT 16.7'		6	
	16.7		SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM		14.5'	

DIVISION <b>SOUTH ATLANTIC</b>	INSTALLATION <b>WILMINGTON DISTRICT</b>	SHEET 1 OF 1 SHEETS
1. PROJECT <b>CAPE LOOKOUT LIGHTHOUSE</b>	10. SIZE AND TYPE OF BIT <b>4" Dia. Vibracore</b>	
2. LOCATION (Coordinates or Station) <b>NC Coord. E2744698.75 N330669.10 (NAD 83)</b>	11. DATUM FOR ELEVATION SHOWN <b>MLW</b>	
3. DRILLING AGENCY <b>WILMINGTON DISTRICT</b>	12. MANUFACTURER'S DESIGNATION OF DRILL <b>VIBRA CORE SNELL</b>	
4. HOLE NO. (As shown on drawing title and file number) <b>CLO-05-V-2</b>	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	:DISTURBED : 6 :UNDISTURBED : 0
5. NAME OF DRILLER <b>LESTER GAUGHF CRANE OPERATOR</b>	14. TOTAL NUMBER CORE BOXES	<b>N/A</b>
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER	<b>N/A</b>
7. THICKNESS OF OVERBURDEN <b>N/A (5.1' of Water)</b>	16. DATE HOLE	:STARTED : 01/04/05 :COMPLETED : 01/04/05
8. DEPTH DRILLED INTO ROCK <b>0.0'</b>	17. ELEVATION TOP OF HOLE	<b>0.0' MLW</b>
9. TOTAL DEPTH OF HOLE <b>16.1'</b>	18. TOTAL CORE RECOVERY FOR BORING	<b>N/A</b> %
19. SIGNATURE OF INSPECTOR <b>LARRY BENJAMIN &amp; DIANE GREENE</b>		

ELEVATION MLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g								
	0		0.0' TO 5.1' WATER			Time begin vibracoring: 1226 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.								
-5.1	5.0 5.1		TOP OF CHANNEL @ 5.1'		5.1'									
			SP Grayish tan, medium to coarse, poorly graded sand.		1									
	7.0				5.6'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.								
					7.0'									
					2									
			8.0' w/shell fragments		7.5'	<b>VIBRACORE BORING</b> From 0.0' to 11.0' Ran 11.0' Rec: 9.5'								
	9.0				9.0'	Top of vibracore soil sample is logged as beginning at Ocean Bottom.								
					3	When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.								
					9.5'									
	11.0				11.0'									
					4									
					11.5'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.								
	13.0				13.0'									
					5									
					13.5'	<b>LAB CLASSIFICATION</b>								
					14.1'	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Jar Number</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>SP</td> </tr> <tr> <td>2</td> <td>SP</td> </tr> <tr> <td>3</td> <td>SP</td> </tr> </tbody> </table>	Jar Number	Classification	1	SP	2	SP	3	SP
Jar Number	Classification													
1	SP													
2	SP													
3	SP													
-14.6	14.6				6									
	15.0		ASSUMED NOT RECOVERED		14.6'									
-16.1	16.1		BOTTOM OF HOLE AT 16.1'			NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 11.0'								
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM											

DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT CAPE LOOKOUT LIGHTHOUSE		10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC Coord. E2744256.66 N330296.56 (NAD 83)		11. DATUM FOR ELEVATION SHOW <i>(TBM or MSL)</i> MLW	
3. DRILLING AGENCY WILMINGTON DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) : CLO-05-V-3		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED : UNDISTURBED : 5 : 0	
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN N/A (3.0' of Water)		16. DATE HOLE : STARTED : COMPLETED : 01/04/05 : 01/04/05	
8. DEPTH DRILLED INTO ROCK 0.0'		17. ELEVATION TOP OF HOLE 0.0' MLW	
9. TOTAL DEPTH OF HOLE 15.0'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
19. SIGNATURE OF INSPECTOR LARRY BENJAMIN & DIANE GREENE			

ELEVATION MLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g										
	0		0.0' TO 3.0' WATER			Time begin vibracoring: 1308 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.										
-3.0	3.0	•••••	TOP OF CHANNEL @ 3.0' SP Tan, coarse, poorly sand, w/shell fragments.		3.0' 1	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.										
	5.0	•••••			3.5' 2											
	7.0	•••••			5.0' 2	VIBRACORE BORING From 0.0' to 12.0' Ran 12.0' Rec: 9.0'										
	9.0	•••••	9.0' grayish tan w/shell fragments		5.5' 3											
	11.0	•••••			7.0' 3	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.										
	11.5	•••••			7.5' 4											
	13.0				9.0' 4	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.										
	15.0				9.5' 5											
			ASSUMED NOT RECOVERED		11.0' 5	LAB CLASSIFICATION <table border="1"> <thead> <tr> <th>Jar Number</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>SP</td> </tr> <tr> <td>2</td> <td>SP</td> </tr> <tr> <td>3</td> <td>SP</td> </tr> <tr> <td>4</td> <td>SP</td> </tr> </tbody> </table>	Jar Number	Classification	1	SP	2	SP	3	SP	4	SP
Jar Number	Classification															
1	SP															
2	SP															
3	SP															
4	SP															
					11.5'	NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 12.0'										
			BOTTOM OF HOLE AT 15.0'													
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM													

DIVISION <b>SOUTH ATLANTIC</b>	INSTALLATION <b>WILMINGTON DISTRICT</b>	SHEET 1 OF 1 SHEETS
1. PROJECT <b>CAPE LOOKOUT LIGHTHOUSE</b>	10. SIZE AND TYPE OF BIT <b>4" Dia. Vibracore</b>	
2. LOCATION (Coordinates or Station) NC Coord. E2745285.60 N329661.38 (NAD 83)	11. DATUM FOR ELEVATION SHOWN <b>MLW</b>	
3. DRILLING AGENCY <b>WILMINGTON DISTRICT</b>	12. MANUFACTURER'S DESIGNATION OF DRILL <b>VIBRA CORE SNELL</b>	
4. HOLE NO. (As shown on drawing title and file number) : <b>CLO-05-V-5</b>	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : <b>DISTURBED 5 UNDISTURBED 0</b>	
5. NAME OF DRILLER <b>LESTER GAUGHF CRANE OPERATOR</b>	14. TOTAL NUMBER CORE BOXES <b>N/A</b>	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER <b>N/A</b>	
7. THICKNESS OF OVERBURDEN <b>N/A (1.6' of Water)</b>	16. DATE HOLE : <b>STARTED 01/04/05 COMPLETED 01/04/05</b>	
8. DEPTH DRILLED INTO ROCK <b>0.0'</b>	17. ELEVATION TOP OF HOLE <b>0.0' MLW</b>	
9. TOTAL DEPTH OF HOLE <b>15.6'</b>	18. TOTAL CORE RECOVERY FOR BORING <b>N/A</b> %	
19. SIGNATURE OF INSPECTOR <b>LARRY BENJAMIN &amp; DIANE GREENE</b>		

ELEVATION MLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g										
	0		0.0' TO 1.6' WATER			Time begin vibracoring: 1411 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.										
-1.6	1.6		TOP OF CHANNEL @ 1.6'		1.6'											
	2.0	•••••	SP Tan, coarse, poorly graded sand, w/shell fragments.		1	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.										
	4.0	•••••			2.1'											
	4.6	•••••	4.6' w/shell fragments		4.0'											
	6.0	•••••			2											
	8.0	•••••			4.5'											
	9.6				6.0'	<b>VIBRACORE BORING</b> From 0.0' to 14.00' Ran 14.0' Rec: 8.0'  Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.										
	9.6				3											
	8.5				6.5'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.										
	9.1				8.0'											
	9.6				4	<b>LAB CLASSIFICATION</b> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Jar Number</th> <th style="text-align: left;">Classification</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>SP</td> </tr> <tr> <td>2</td> <td>SP</td> </tr> <tr> <td>3</td> <td>SP</td> </tr> <tr> <td>4</td> <td>SP</td> </tr> </tbody> </table>	Jar Number	Classification	1	SP	2	SP	3	SP	4	SP
Jar Number	Classification															
1	SP															
2	SP															
3	SP															
4	SP															
	10.0		ASSUMED NOT RECOVERED		8.5'											
	12.0				9.1'											
	14.0				5											
-15.6	15.6		BOTTOM OF HOLE AT 15.6'		9.6'	NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 14.0'										
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM													

DIVISION <b>SOUTH ATLANTIC</b>	INSTALLATION <b>WILMINGTON DISTRICT</b>	SHEET 1 OF 1 SHEETS
1. PROJECT <b>CAPE LOOKOUT LIGHTHOUSE</b>	10. SIZE AND TYPE OF BIT <b>4" Dia. Vibracore</b>	
2. LOCATION (Coordinates or Station) <b>NC Coord. E2745028.53 N328897.46 (NAD 83)</b>	11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> <b>MLW</b>	
3. DRILLING AGENCY <b>WILMINGTON DISTRICT</b>	12. MANUFACTURER'S DESIGNATION OF DRILL <b>VIBRA CORE SNELL</b>	
4. HOLE NO. (As shown on drawing title and file number) <b>CLO-05-V-07</b>	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED : <b>5</b> : UNDISTURBED : <b>0</b>	
5. NAME OF DRILLER <b>LESTER GAUGHF CRANE OPERATOR</b>	14. TOTAL NUMBER CORE BOXES <b>N/A</b>	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER <b>N/A</b>	
7. THICKNESS OF OVERBURDEN <b>N/A ( 1.3' of Water)</b>	16. DATE HOLE : STARTED : <b>01/04/05</b> : COMPLETED : <b>01/04/05</b>	
8. DEPTH DRILLED INTO ROCK <b>0.0'</b>	17. ELEVATION TOP OF HOLE <b>0.0' MLW</b>	
9. TOTAL DEPTH OF HOLE <b>14.3'</b>	18. TOTAL CORE RECOVERY FOR BORING <b>N/A %</b>	
	19. SIGNATURE OF INSPECTOR <b>LARRY BENJAMIN &amp; DIANE GREENE</b>	

ELEVATION MLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		0.0' TO 1.3' WATER			Time begin vibracoring: 1422 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
-1.3	1.3		TOP OF CHANNEL @ 1.3'		1.3'	
	2.0	••••	SP Grayish tan, coarse, poorly graded sand, T/shell fragments.		1	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	3.3	••••			1.8'	
	4.0	••••			3.3'	
	5.0	••••			2	
	5.5	••••			3.8'	
	6.0	••••			5.0'	VIBRACORE BORING From 0.0' to 13.0' Ran 13.0' Rec: 8.0'
	7.0	••••			3	
	8.0	••••			5.5'	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.
	8.8	••••			7.0'	
	9.3	••••			4	
	10.0		ASSUMED NOT RECOVERED		7.5'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
	12.0				8.8'	
	14.3		BOTTOM OF HOLE AT 14.3'		5	LAB CLASSIFICATION Jar Number      Classification 1                  SP 2                  SP 3                  SP 4                  SP
	15.0				9.3'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			
	-14.3					NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 13.0'

DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT CAPE LOOKOUT LIGHTHOUSE		10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC Coord. E2754827.26 N328433.50 (NAD 83)		11. DATUM FOR ELEVATION SHOWN <sup>BM</sup> or <sup>MSL</sup> MLW	
3. DRILLING AGENCY WILMINGTON DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) : CLO-05-V-8		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 5	
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR		14. TOTAL NUMBER CORE BOXES : N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER : N/A	
7. THICKNESS OF OVERBURDEN N/A ( 2.4' of Water)		16. DATE HOLE : STARTED : 01/04/05 : COMPLETED : 01/04/05	
8. DEPTH DRILLED INTO ROCK 0.0'		17. ELEVATION TOP OF HOLE 0.0' MLW	
9. TOTAL DEPTH OF HOLE 17.9'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
19. SIGNATURE OF INSPECTOR LARRY BENJAMIN & DIANE GREENE			

ELEVATION MLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g										
	0		0.0' TO 2.4' WATER			Time begin vibracoring: 1434 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.										
-2.4	2.4	SP Tan, coarse, poorly graded sand, w/shell fragments.	TOP OF CHANNEL @ 2.4'		1	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.										
	2.9				2.9'											
	4.0				2	VIBRACORE BORING From 0.0' to 15.5' Ran 15.5' Rec: 8.8'										
	4.9				4.9'											
	6.0	6.4' grayish tan			3	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.										
	6.9				6.9'											
	8.0	8.2' tan			4	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.										
	8.6				8.6'											
	10.0				5	LAB CLASSIFICATION <table border="1"> <thead> <tr> <th>Jar Number</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>SP</td> </tr> <tr> <td>2</td> <td>SP</td> </tr> <tr> <td>3</td> <td>SP</td> </tr> <tr> <td>4</td> <td>SP</td> </tr> </tbody> </table>	Jar Number	Classification	1	SP	2	SP	3	SP	4	SP
Jar Number	Classification															
1	SP															
2	SP															
3	SP															
4	SP															
	10.5				10.5'											
-11.2	11.2		ASSUMED NOT RECOVERED			NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 15.5'										
	12.0															
	14.0															
	16.0															
-17.9	17.9		BOTTOM OF HOLE AT 17.9'													
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM													

DIVISION <b>SOUTH ATLANTIC</b>	INSTALLATION <b>WILMINGTON DISTRICT</b>	SHEET 1 OF 1 SHEETS
1. PROJECT <b>CAPE LOOKOUT LIGHTHOUSE</b>	10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC Coord. E2746153.11 N331945.31 (NAD 83)	11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MLW	
3. DRILLING AGENCY WILMINGTON DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) CLO-05-V-9	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED :UNDISTURBED : 5 : 0	
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN N/A ( 0.0' of Water)	16. DATE HOLE :STARTED :COMPLETED :01/04/05 :01/04/05	
8. DEPTH DRILLED INTO ROCK 0.0'	17. ELEVATION TOP OF HOLE 0.0' MLW	
9. TOTAL DEPTH OF HOLE 14.1'	18. TOTAL CORE RECOVERY FOR BORING N/A %	
19. SIGNATURE OF INSPECTOR LARRY BENJAMIN & DIANE GREENE		

ELEVATION MLW	DEPTH feet 0.0'	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g										
	0.0'		SP-SM Grayish tan, fine, poorly silty sand.		1	Time begin vibracoring: 1339 hrs.										
	0.5'				0.5'	Soils described by Larry Benjamin, Civil Engr. Tech.										
	2.0'				3.0'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.										
	4.0'				2											
	4.0'				3.5'	VIBRACORE BORING From 0.0' to 15.0' Ran 15.0' Rec: 11.2'										
	6.0'				3											
	6.0'				5.5'	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.										
	8.0'				4											
	8.0'		7.5' coarse-grain sizes		7.5'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.										
	10.0'				4											
	10.0'				9.8'	LAB CLASSIFICATION <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Jor Number</th> <th style="text-align: left;">Classification</th> </tr> </thead> <tbody> <tr><td>1</td><td>SP</td></tr> <tr><td>2</td><td>SP</td></tr> <tr><td>3</td><td>SP</td></tr> <tr><td>4</td><td>SP</td></tr> </tbody> </table>	Jor Number	Classification	1	SP	2	SP	3	SP	4	SP
Jor Number	Classification															
1	SP															
2	SP															
3	SP															
4	SP															
-11.3	11.3		10.3' ASSUMED NOT RECOVERED		5											
	12.0'				10.3'											
	14.0'					NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 15.0'										
-14.1	14.1		BOTTOM OF HOLE AT 14.1'													
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM													



DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT CAPE LOOKOUT LIGHTHOUSE		10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC Coord. E2746649.66 N332770.64 (NAD 83)		11. DATUM FOR ELEVATION SHOWN <i>BM</i> or <i>MSL</i> MLW	
3. DRILLING AGENCY WILMINGTON DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) : CLO-05-V-10		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED 7 : UNDISTURBED 0	
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN N/A ( 0.5' of Water)		16. DATE HOLE : STARTED 01/04/05 : COMPLETED 01/04/05	
8. DEPTH DRILLED INTO ROCK 0.0'		17. ELEVATION TOP OF HOLE 0.0' MLW	
9. TOTAL DEPTH OF HOLE 15.5'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN & DIANE GREENE	

ELEVATION MLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-0.5	0		0.0' TO 0.5' WATER TOP OF CHANNEL @ 0.5'		0.5'	Time begin vibracoring: 1327 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
	0.5	•••	SP Grayish tan, fine to medium poorly graded sand.		1	
	2.0	•••			2	
	4.0	•••			3	
	5.0		5.0'		4	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	6.0	•••	SP-SM Grayish tan, fine poorly graded silty sand.		5	
	7.7		7.7'		6	VIBRACORE BORING From 0.0' to 15.5' Ran 15.5' Rec: 11.5'
	8.0	•••	SP Grayish tan, coarse, poorly graded sand.		7	
	10.0	•••			8	
	12.0		12.0'		9	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
	14.0		ASSUMED NOT RECOVERED		10	
	15.5		BOTTOM OF HOLE AT 15.5'		11	NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 15.5'
	17.0		SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM		12	

DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT CAPE LOOKOUT LIGHTHOUSE		10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC Coord. E2746664.31 N334306.05 (NAD 83)		11. DATUM FOR ELEVATION SHOWN <i>TBM or MSL</i> MLW	
3. DRILLING AGENCY WILMINGTON DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) : CLO-05-V-11		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 3 : UNDISTURBED : 0	
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN N/A ( 1.3' of Water)		16. DATE HOLE : STARTED : 01/03/05 : COMPLETED : 01/03/05	
8. DEPTH DRILLED INTO ROCK 0.0'		17. ELEVATION TOP OF HOLE 0.0' MLW	
9. TOTAL DEPTH OF HOLE 13.3'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
19. SIGNATURE OF INSPECTOR LARRY BENJAMIN & DIANE GREENE			

ELEVATION MLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g								
	0		0.0' TO 1.3' WATER			Time begin vibracoring: 1300 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.								
-1.3	1.3		TOP OF CHANNEL @ 1.3'		1.3'									
	2.0	•••••	SP Grayish tan, coarse, poorly graded sand.		1									
	4.0	•••••			1.8'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.								
	6.0	•••••			4.0'									
	7.3	•••••			2									
	8.0		ASSUMED NOT RECOVERED		4.5'									
	10.0				6.0'									
	12.0				3	VIBRACORE BORING From 0.0' to 12.0' Ran 12.0' Rec: 5.0'								
	13.3				6.5'									
	13.3		BOTTOM OF HOLE AT 13.3'			Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.								
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: Soils Commercial lab classified in accordance with ASTM D2487.								
						LAB CLASSIFICATION								
						<table border="1"> <thead> <tr> <th>Jar Number</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>SP</td> </tr> <tr> <td>2</td> <td>SP</td> </tr> <tr> <td>3</td> <td>SP</td> </tr> </tbody> </table>	Jar Number	Classification	1	SP	2	SP	3	SP
Jar Number	Classification													
1	SP													
2	SP													
3	SP													
						NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 12.0'								

DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT CAPE LOOKOUT LIGHTHOUSE		10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC Coord. E2742609.46 N325725.17 (NAD 83)		11. DATUM FOR ELEVATION SHOWN <i>(TBM or MSL)</i> <MLW >>	
3. DRILLING AGENCY WILMINGTON DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) : CLO-05-V-14		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED : UNDISTURBED : 5 : :	
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN N/A (0.0' of Water)		16. DATE HOLE : STARTED : COMPLETED : 01/03/05 : 01/03/05	
8. DEPTH DRILLED INTO ROCK 0.0'		17. ELEVATION TOP OF HOLE 0.0' MLW	
9. TOTAL DEPTH OF HOLE 10.4'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
		19. SIGNATURE OF INSPECTOR 0 LARRY BENJAMIN & DIANE GREENE	

ELEVATION MLW	DEPTH feet b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0'				0.0'	
	2.0	•••••	SP Grayish tan, coarse, poorly graded sand, 1/ shell fragments.		1 0.5' 2.0' 2	Time begin vibracoring: 1133 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
	4.0	•••••			2.5' 4.0'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	5.0'				3 4.5' 5.0'	VIBRACORE BORING From 0.0' to 11.0' Ran 11.0' Rec: 8.2'
	6.0	•••••	SM Gray, fine, silty sand.		4 5.5'	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.
-7.6	7.6	•••••			5 7.0'	
	8.0		ASSUMED NOT RECOVERED		7.5'	
	10.0					NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
-10.4	10.4		BOTTOM OF HOLE AT 10.4'			LAB CLASSIFICATION Jar Number Classification 1 SP 2 SP 4 SP 5 SP-SM
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 11.0'

DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT CAPE LOOKOUT LIGHTHOUSE>	10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC Coord. E2742049.69 N325312.46 (NAD 83)	11. DATUM FOR ELEVATION SHOWN <i>BM</i> or <i>MSL</i> MLW	
3. DRILLING AGENCY WILMINGTON DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) CLO-05-V-15	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED : UNDISTURBED : 4 : 0	
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR	14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A	
7. THICKNESS OF OVERBURDEN N/A (2.8' of Water)	16. DATE HOLE : STARTED : COMPLETED : 01/03/05 : 01/03/05	
8. DEPTH DRILLED INTO ROCK 0.0'	17. ELEVATION TOP OF HOLE 0.0' MLW	
9. TOTAL DEPTH OF HOLE 14.8'	18. TOTAL CORE RECOVERY FOR BORING N/A %	
	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN & DIANE GREENE	

ELEVATION MLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		0.0' TO 2.8' WATER			Time begin vibracoring: 1144 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
-2.8	2.8		TOP OF CHANNEL @ 2.8'		2.8'	
	3.0	•••••	SP Tan, coarse, poorly graded sand.		1	
	5.0	•••••			3.3'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	7.0	•••••			4.8'	
	7.8'	•••••			2	
	7.8'	•••••	SP-SM Grayish tan, fine, poorly graded silty sand, w/shell fragments.		5.3'	<u>VIBRACORE BORING</u> From 0.0' to 12.0' Ran 12.0' Rec: 10.0'
	9.0	•••••	SP Tan, coarse, poorly graded sand.		6.8'	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.
	9.0	•••••			3	
	11.0	•••••			7.3'	
	12.8'	•••••			7.8'	
	12.8'	•••••			4	
	13.0		ASSUMED NOT RECOVERED		8.3'	
	13.0				8.8'	
	14.8		BOTTOM OF HOLE AT 14.8'		5	
	14.8		SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM		9.3'	NOTE: Soils Commercial lab classified in accordance with ASTM D2487.
	14.8				10.8'	
	14.8				6	
	14.8				11.3'	
	14.8				7	
	14.8				12.3'	
	14.8				7	
	14.8				12.8'	
	14.8				12.8'	NOTE: HOLE TERMINATED AT VIBRACORE REFUSAL AT 12.0'

# VIBRACORE LOG



SHEET 1 OF 1

CATLIN NO.: 205-064	STATE: NC	COUNTY: Carteret	CITY: Harkers Island/Barden Inlet
PROJECT NAME: Harkers Island Stabilization Borrow Area Investigation		LOGGED BY: Steven Hudson	BORING ID. CLOBA-05-01
NORTHING: 332198	EASTING: 2745258	DRILLER: Tom Landis	ELEV.: -3.1ft.
SYSTEM: NCEP NAD 83 (USft)	BORING LOCATION: Channel in Back Sound - Borrow Area A		DEPTH: 5.0ft.
METHOD: Vibracore	CONDITIONS: Little to no wind w/calm seas. Cold ~45 degrees F.		
START DATE: 12/20/05	FINISH DATE: 12/20/05	TIME: 15:10	SURF. WATER DEPTH: 3.8

DEPTH	ELEV.	ENV. SAMP. ELEV.	ENV. SAMP. ID.	GEOTECH SAMPLE	U S C S	LOG	DEPTH	SEDIMENT DESCRIPTION	ELEVATION
0.0	-3.1						0.0	SEDIMENT SURFACE	-3.1
				01-A	SP	LOG		Light gray, f. SAND. Texturally massive. No bedding or banding.	
2.5	-5.6			01-B	SP		2.5	Olive gray, Same as above.	-5.6
4.6	-7.7						4.6		-7.7
								Boring Terminated at Elevation -8.1 ft (M.L.W.)	

VIBRACORE LOG - 05-034 HARKERS ISLAND G.P.L. CATLIN G.D.T. 12/20/05

<b>COMMENTS:</b> All elevations referenced to Mean Low Water (M.L.W.)	TOTAL LENGTH OF CORE (ft.): 5.0
	TOTAL CORE RECOVERY (ft.): 4.6
	LOSS and/or COMPACTION (ft.): 0.4

# VIBRACORE LOG



SHEET 1 OF 1

CATLIN NO.: 205-064	STATE: NC	COUNTY: Carteret	CITY: Harkers Island/Barden Inlet
PROJECT NAME: Harkers Island Stabilization Borrow Area Investigation		LOGGED BY: Steven Hudson	BORING ID. CLOBA-05-02
DRILLER: Tom Landis		CREW: Ben Ashba	ELEV.: -3.6ft.
NORTHING: 332486	EASTING: 2745819	DEPTH: 5.0ft.	
SYSTEM: NCSP NAD 83 (USft)	BORING LOCATION: Channel in Back Sound - Borrow Area A		DEPTH: 5.0ft.
METHOD: Vibracore	CONDITIONS: Little to no wind w/calm seas. Cold ~45 degrees F.		
START DATE: 12/20/05	FINISH DATE: 12/20/05	TIME: 16:13	SURF. WATER DEPTH: 3.4

DEPTH	ELEV	ENV. SAMP. ELEV.	ENV. SAMP. ID.	GEOTECH SAMPLE	USCS	LOG	DEPTH	SEDIMENT DESCRIPTION	ELEVATION
0.0	-3.6						0.0	SEDIMENT SURFACE	-3.6
				02-A	SP			Light gray, f. SAND. Texturally massive w/trace shell fragments	
2.7	-6.3						2.7		-6.3
				02-B	SP			Olive gray, Same as above w/gradational banding between 2.7ft. and 3.1ft.	
4.7	-8.3						4.7		-8.3
							Boring Terminated at Elevation -8.6 ft (M.L.W.)		

VIBRACORE LOG - 034 HARKERS ISLAND G.P.I. CATLIN G.S.I. 12/20/05

<b>COMMENTS:</b> All elevations referenced to Mean Low Water (M.L.W.)	TOTAL LENGTH OF CORE (ft.): 5.0 TOTAL CORE RECOVERY (ft.): 4.7 LOSS and/or COMPACTION (ft.): 0.3
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# VIBRACORE LOG

**CATLIN**

ENGINEERS and SCIENTISTS

WILMINGTON, NORTH CAROLINA

SHEET 1 OF 1

CATLIN NO.: 205-064	STATE: NC	COUNTY: Carteret	CITY: Harkers Island/Barden Inlet
PROJECT NAME: Harkers Island Stabilization Borrow Area Investigation		LOGGED BY: Steven Hudson	BORING ID. CLOBA-05-03
NORTHING: 333033	EASTING: 2745738	DRILLER: Tom Landis	ELEV.: -0.6ft.
SYSTEM: NCSP NAD 83 (USft)		CREW: Ben Ashba	DEPTH: 5.4ft.
METHOD: Vibrocore		BORING LOCATION: Channel in Back Sound - Borrow Area A	
CONDITIONS: Wind 10-20 mph w/seas @ -1-2ft. Cold ~45 degrees F.			
START DATE: 12/21/05	FINISH DATE: 12/21/05	TIME: 09:45	SURF. WATER DEPTH: 3.1

DEPTH	ELEV	ENV. SAMP. ELEV.	ENV. SAMP. ID.	GEOTECH SAMPLE	U S C S	L O G	DEPTH	SEDIMENT DESCRIPTION	ELEVATION
0.0	-0.6						0.0	SEDIMENT SURFACE	-0.6
				03-A	SP			Light gray, f. to SAND. Texturally massive w/trace shell fragments (~1/8" diameter).	
2.4	-3.0						2.4		-3.0
				03-B	SP			Olive gray, f. SAND w/trace silt.	
5.4	-6.0						5.4	Boring Terminated at Elevation -6.0 ft (M.L.W.)	-6.0

VIBRACORE LOG - 6-05-1 HARKERS ISLAND CPT - CATLIN G01 - 12/20/05

**COMMENTS:**

All elevations referenced to Mean Low Water (M.L.W.)

TOTAL LENGTH OF CORE (ft.): 5.4  
 TOTAL CORE RECOVERY (ft.): 5.4  
 LOSS and/or COMPACTION (ft.): 0.0

# VIBRACORE LOG

**CATLIN**

ENGINEERS and SCIENTISTS

WILMINGTON, NORTH CAROLINA

SHEET 1 OF 1

CATLIN NO.: 205-064	STATE: NC	COUNTY: Carteret	CITY: Harkers Island/Barden Inlet
PROJECT NAME: Harkers Island Stabilization Borrow Area Investigation		LOGGED BY: Steven Hudson	BORING ID. CLOBA-05-04
NORTHING: 333047	EASTING: 2746104	DRILLER: Tom Landis	ELEV.: -0.1ft.
SYSTEM: NCSP NAD 83 (USft)		CREW: Ben Ashba	DEPTH: 5.0ft.
METHOD: Vibracore		CONDITIONS: Wind 10-20 mph w/seas @ ~1-2ft. Cold ~45 degrees F.	
START DATE: 12/21/05	FINISH DATE: 12/21/05	TIME: 11:20	SURF. WATER DEPTH: 2.4

DEPTH	ELEV	ENV. SAMP. ELEV.	ENV. SAMP. ID.	GEOTECH SAMPLE	U S C S	LOG	DEPTH	SEDIMENT DESCRIPTION	ELEVATION
0.0	-0.1						0.0	SEDIMENT SURFACE	-0.1
				04-A	SP			Light gray, f. SAND. Texturally massive. Trace shell fragments.	
2.4	-2.5			04-B	SP		2.4	Olive gray, f. SAND w/trace silt.	-2.5
3.3	-3.4			04-C	SP		3.3	Olive gray, f. SAND w/trace silt and few shell fragments.	-3.4
4.5	-4.6						4.5		-4.6
							Boring Terminated at Elevation -5.1 ft (M.L.W.)		

VIBRACORE LOG - 05-04 HARKERS ISLAND BEL CATLIN GDT - 12/20/05

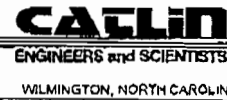
**COMMENTS:**

All elevations referenced to Mean Low Water (M.L.W.)

TOTAL LENGTH OF CORE (ft.): 5.0  
 TOTAL CORE RECOVERY (ft.): 4.5  
 LOSS and/or COMPACTION (ft.): 0.5



# VIBRACORE LOG



SHEET 1 OF 1

CATLIN NO.: 205-064	STATE: NC	COUNTY: Carteret	CITY: Harkers Island/Barden Inlet
PROJECT NAME: Harkers Island Stabilization Borrow Area Investigation		LOGGED BY: Steven Hudson	BORING ID. CLOBA-05-05
DRILLER: Tom Landis			
NORTHING: 333582	EASTING: 2746388	CREW: Ben Ashba	ELEV.: -0.4ft.
SYSTEM: NCSP NAD 83 (USft)	BORING LOCATION: Channel in Back Sound - Borrow Area A		DEPTH: 4.9ft.
METHOD: Vibracore	CONDITIONS: Wind 10-20 mph w/seas @ ~1-2ft. Cold ~45 degrees F.		
START DATE: 12/21/05	FINISH DATE: 12/21/05	TIME: 12:03	SURF. WATER DEPTH: 2.6

DEPTH	ELEV	ENV. SAMP. ELEV.	ENV. SAMP. ID.	GEOTECH SAMPLE	USCS	LOG	DEPTH	SEDIMENT DESCRIPTION	ELEVATION
0.0	-0.4						0.0	SEDIMENT SURFACE	-0.4
				05-A	SP			Light gray, f. SAND. Trace shell fragments along isolated horizons up to 1" in thickness. Slight gray banding.	
3.2	-3.6			05-B	SP		3.2	Olive gray, f. SAND w/few shell fragments.	-3.6
4.6	-5.0						4.6		-5.0
							Boring Terminated at Elevation -5.3 ft (M.L.W.)		

<b>COMMENTS:</b> All elevations referenced to Mean Low Water (M.L.W.)	TOTAL LENGTH OF CORE (ft.): 4.9
	TOTAL CORE RECOVERY (ft.): 4.6
	LOSS and/or COMPACTION (ft.): 0.3

VIBRACORE LOG - 05-05- HARKERS ISLAND.GPJ - CATLIN.GDT - 12/23/05

## **Grain Tables and Curves Data**

**Granulometric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-001 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,461</b>	Northing (ft): <b>348,622</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-4.8 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 2.5Y-5/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>211.34</b>	Wash Weight (g): <b>209.12</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.17</b> <b>#230 - 1.06</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	49.16	23.26	49.16	76.74
#4	-2.25	4.76	19.60	9.27	68.76	67.47
#7	-1.50	2.83	10.84	5.13	79.60	62.34
#10	-1.00	2.00	3.85	1.82	83.45	60.52
#14	-0.50	1.41	2.77	1.31	86.22	59.21
#18	0.00	1.00	3.02	1.43	89.24	57.78
#25	0.50	0.71	5.78	2.73	95.02	55.05
#35	1.00	0.50	12.94	6.12	107.96	48.93
#45	1.50	0.35	20.73	9.81	128.69	39.12
#60	2.00	0.25	29.58	14.00	158.27	25.12
#80	2.50	0.18	33.39	15.80	191.66	9.32
#120	3.00	0.13	14.76	6.98	206.42	2.34
#170	3.50	0.09	1.93	0.91	208.35	1.43
#200	3.75	0.07	0.54	0.26	208.89	1.17
#230	4.00	0.06	0.23	0.11	209.12	1.06

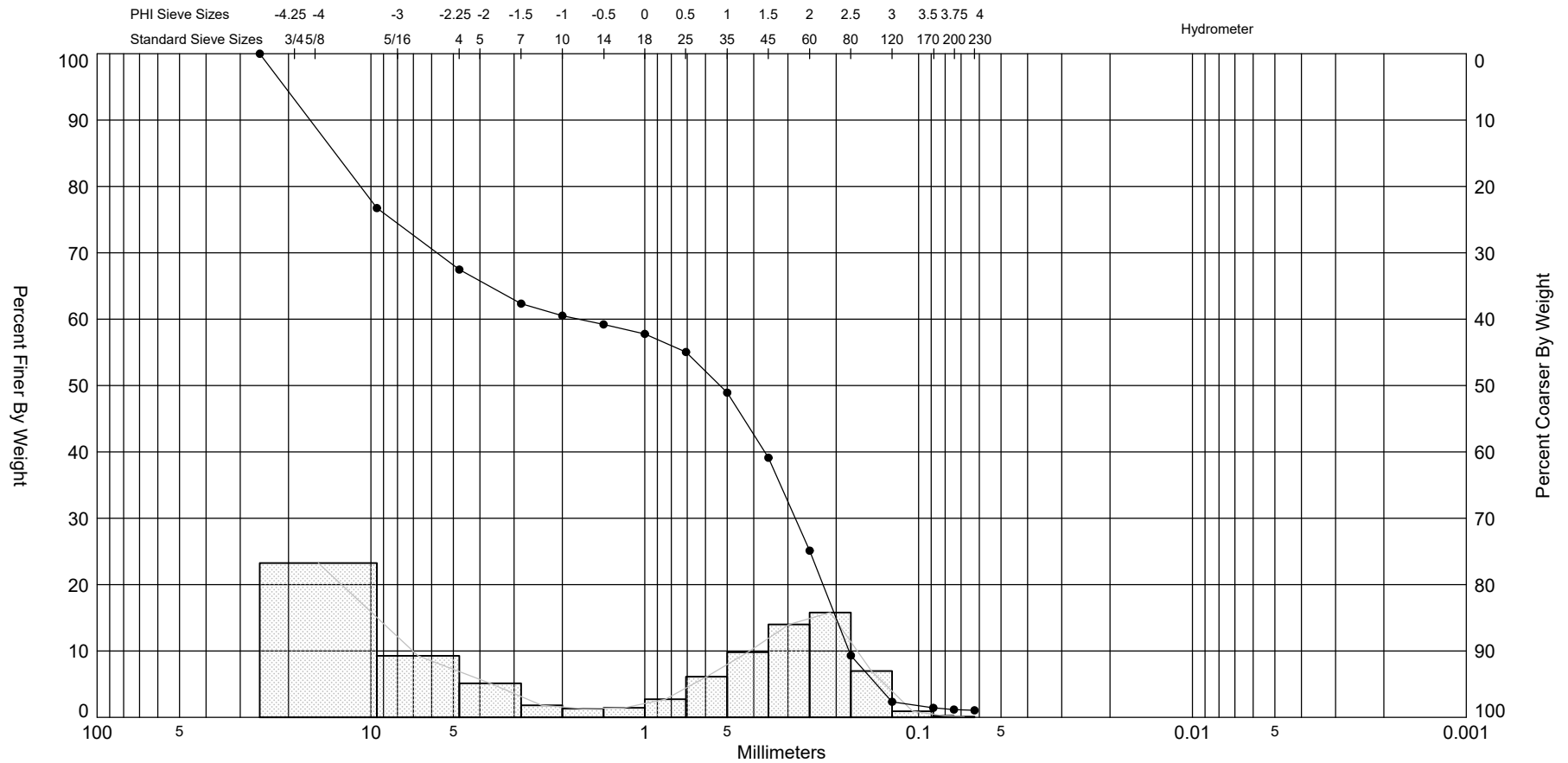
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.81	2.29	2.00	0.91	-3.06	-3.69	-4.36


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-0.3	1.23	2.58	-0.36	1.46

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-001 #S-1	—●—	-4.8	SP	#200 - 1.17 #230 - 1.06			0.91	-0.3	-0.36	1.46	2.58	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,743,461
												Northing (Y, ft):	348,622
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-001 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,461</b>	Northing (ft): <b>348,622</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-6.3 MLLW</b>
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USCS: <b>SP-SM</b>	Munsell: <b>Moist - 2.5Y-4/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>176.43</b>	Wash Weight (g): <b>162.32</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 8.31</b> <b>#230 - 8.00</b>	Organics (%):	Carbonates (%):	Shells (%):
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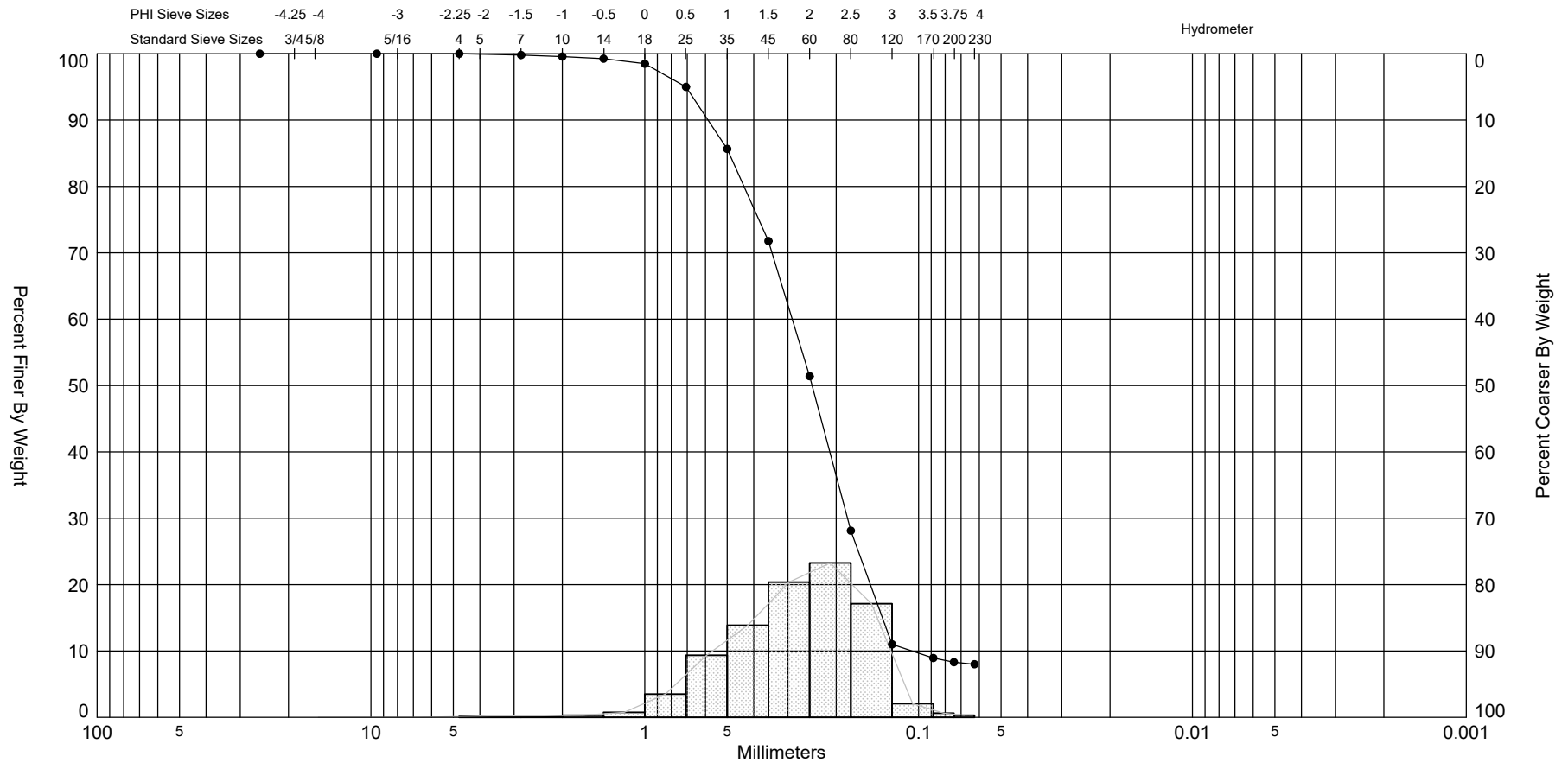
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.35	0.20	0.35	99.80
#10	-1.00	2.00	0.40	0.23	0.75	99.57
#14	-0.50	1.41	0.56	0.32	1.31	99.25
#18	0.00	1.00	1.34	0.76	2.65	98.49
#25	0.50	0.71	6.15	3.49	8.80	95.00
#35	1.00	0.50	16.49	9.35	25.29	85.65
#45	1.50	0.35	24.49	13.88	49.78	71.77
#60	2.00	0.25	35.94	20.37	85.72	51.40
#80	2.50	0.18	41.06	23.27	126.78	28.13
#120	3.00	0.13	30.23	17.13	157.01	11.00
#170	3.50	0.09	3.64	2.06	160.65	8.94
#200	3.75	0.07	1.12	0.63	161.77	8.31
#230	4.00	0.06	0.55	0.31	162.32	8.00

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	2.85	2.59	2.03	1.38	1.06	0.50


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.84	0.28	0.81	-0.65	3.91

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-001 #S-2	—●—	-6.3	SP-SM	#200 - 8.31 #230 - 8.00			2.03	1.84	-0.65	3.91	0.81	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,743,461
												Northing (Y, ft):	348,622
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-001 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,461</b>	Northing (ft): <b>348,622</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.3 MLLW</b>
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USCS: <b>SM</b>	Munsell: <b>Moist - 2.5Y-2.5/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>128.03</b>	Wash Weight (g): <b>70.91</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 47.84</b> <b>#230 - 44.64</b>	Organics (%):	Carbonates (%):	Shells (%):
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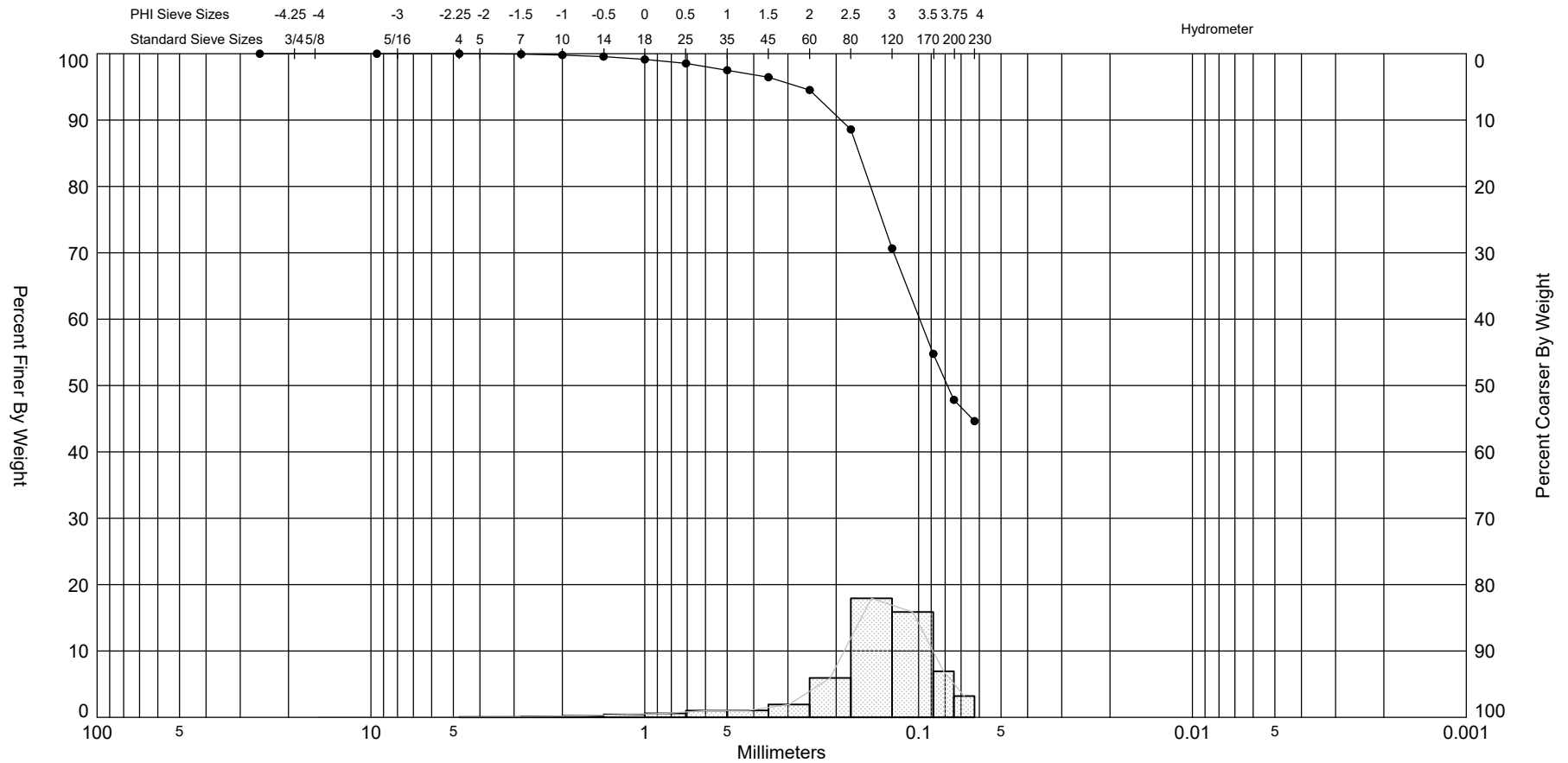
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.09	0.07	0.09	99.93
#10	-1.00	2.00	0.17	0.13	0.26	99.80
#14	-0.50	1.41	0.30	0.23	0.56	99.57
#18	0.00	1.00	0.55	0.43	1.11	99.14
#25	0.50	0.71	0.77	0.60	1.88	98.54
#35	1.00	0.50	1.32	1.03	3.20	97.51
#45	1.50	0.35	1.35	1.05	4.55	96.46
#60	2.00	0.25	2.47	1.93	7.02	94.53
#80	2.50	0.18	7.61	5.94	14.63	88.59
#120	3.00	0.13	22.96	17.93	37.59	70.66
#170	3.50	0.09	20.33	15.88	57.92	54.78
#200	3.75	0.07	8.89	6.94	66.81	47.84
#230	4.00	0.06	4.10	3.20	70.91	44.64

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
			3.67	2.88	2.63	1.88


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.83	0.14	0.82	-1.95	8.58

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-001 #S-3	●—	-8.3	SM	#200 - 47.84 #230 - 44.64			3.67	2.83	-1.95	8.58	0.82	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,743,461
												Northing (Y, ft):	348,622
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-001 #S-4

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,461</b>	Northing (ft): <b>348,622</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.7 MLLW</b>
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USCS: <b>MH</b>	Munsell: <b>Moist - 2.5Y-4/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>137.84</b>	Wash Weight (g): <b>73.68</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 51.99</b> <b>#230 - 46.54</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.05	0.04	0.05	99.96
#10	-1.00	2.00	0.13	0.09	0.18	99.87
#14	-0.50	1.41	0.36	0.26	0.54	99.61
#18	0.00	1.00	0.41	0.30	0.95	99.31
#25	0.50	0.71	0.54	0.39	1.49	98.92
#35	1.00	0.50	0.61	0.44	2.10	98.48
#45	1.50	0.35	0.53	0.38	2.63	98.10
#60	2.00	0.25	0.98	0.71	3.61	97.39
#80	2.50	0.18	3.36	2.44	6.97	94.95
#120	3.00	0.13	13.86	10.06	20.83	84.89
#170	3.50	0.09	29.19	21.18	50.02	63.71
#200	3.75	0.07	16.15	11.72	66.17	51.99
#230	4.00	0.06	7.51	5.45	73.68	46.54

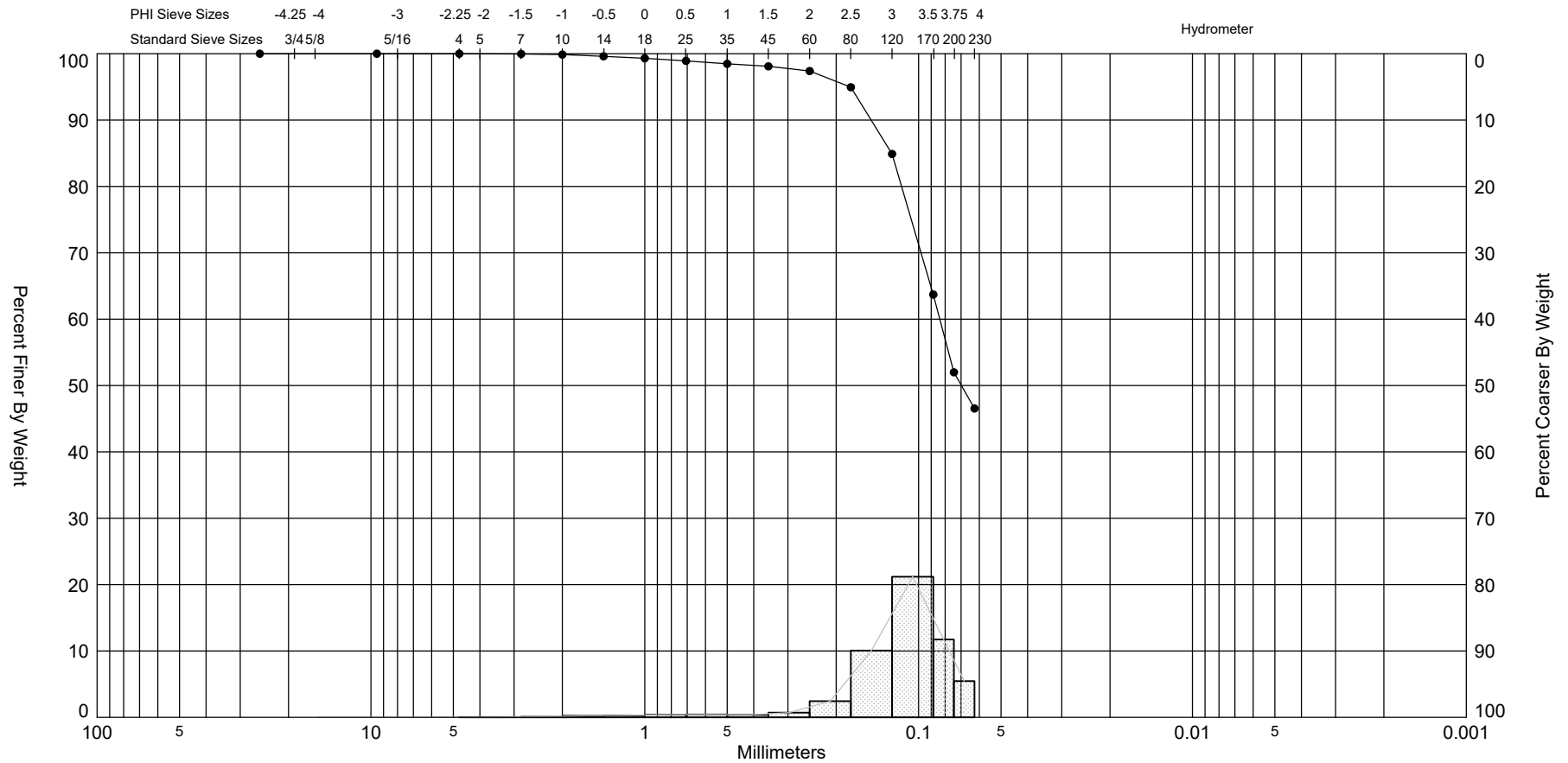
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
			3.84	3.23	3.02	2.49


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	3.13	0.11	0.72	-2.82	14.11

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-001 #S-4	—●—	-9.7	MH	#200 - 51.99 #230 - 46.54			3.84	3.13	-2.82	14.11	0.72	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,743,461
												Northing (Y, ft):	348,622
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-002 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,677</b>	Northing (ft): <b>347,647</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-5/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>141.76</b>	Wash Weight (g): <b>136.68</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 4.42</b> <b>#230 - 3.58</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.00	0.00	0.00	100.00
#14	-0.50	1.41	0.11	0.08	0.11	99.92
#18	0.00	1.00	0.17	0.12	0.28	99.80
#25	0.50	0.71	0.17	0.12	0.45	99.68
#35	1.00	0.50	0.33	0.23	0.78	99.45
#45	1.50	0.35	0.74	0.52	1.52	98.93
#60	2.00	0.25	5.17	3.65	6.69	95.28
#80	2.50	0.18	62.98	44.43	69.67	50.85
#120	3.00	0.13	49.80	35.13	119.47	15.72
#170	3.50	0.09	13.19	9.30	132.66	6.42
#200	3.75	0.07	2.83	2.00	135.49	4.42
#230	4.00	0.06	1.19	0.84	136.68	3.58

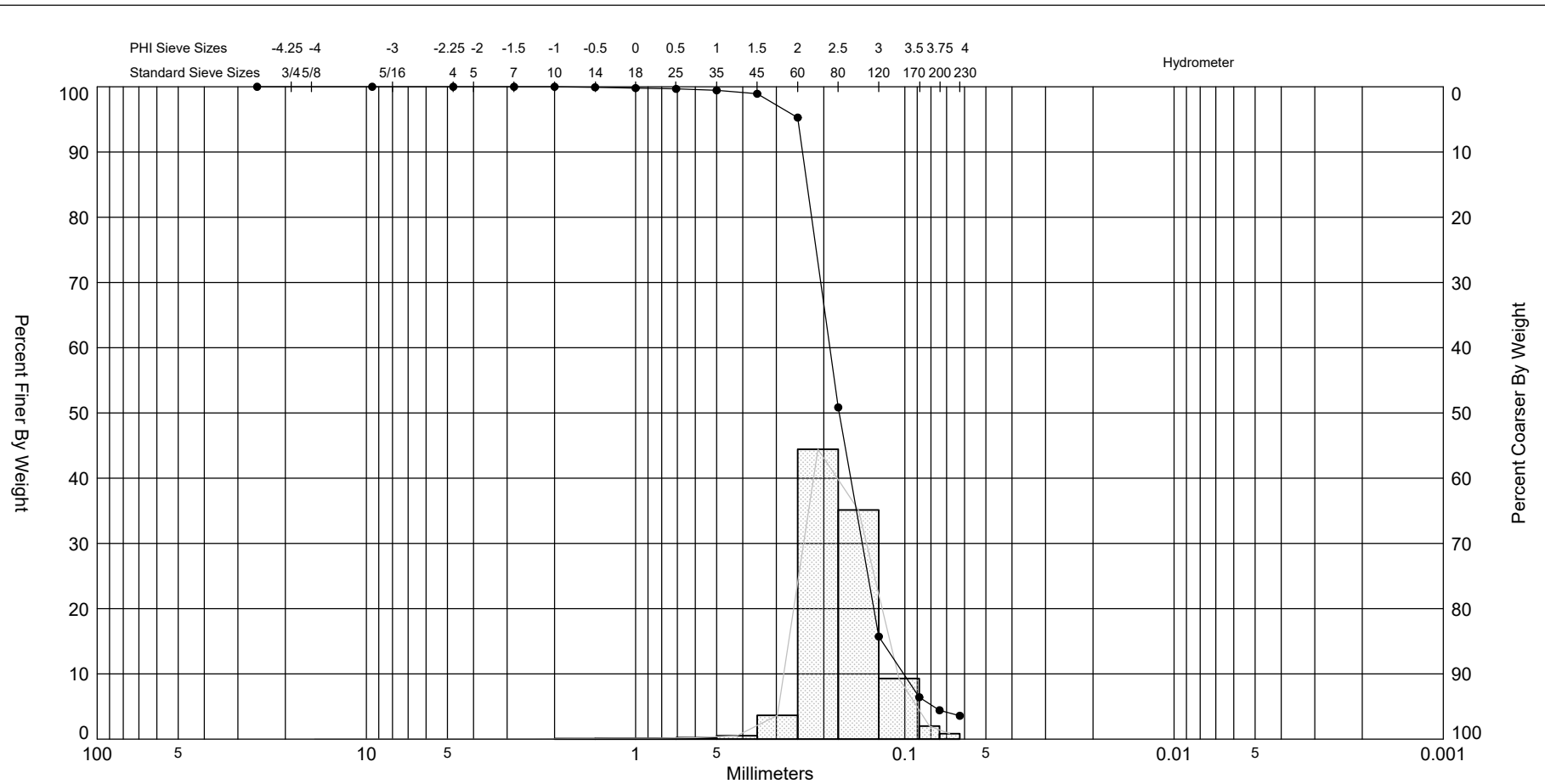
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.68	3.00	2.87	2.51	2.23	2.13	2.00


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.54	0.17	0.46	-0.4	7.87

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-002 #S-1	●—	-7.1	SP	#200 - 4.42 #230 - 3.58			2.51	2.54	-0.4	7.87	0.46	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,743,677
												Northing (Y, ft):	347,647
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-002 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,677</b>	Northing (ft): <b>347,647</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-4/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>141.81</b>	Wash Weight (g): <b>138.19</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 3.03</b> <b>#230 - 2.57</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.02	0.01	0.02	99.99
#14	-0.50	1.41	0.04	0.03	0.06	99.96
#18	0.00	1.00	0.13	0.09	0.19	99.87
#25	0.50	0.71	1.08	0.76	1.27	99.11
#35	1.00	0.50	4.06	2.86	5.33	96.25
#45	1.50	0.35	6.15	4.34	11.48	91.91
#60	2.00	0.25	8.77	6.18	20.25	85.73
#80	2.50	0.18	38.88	27.42	59.13	58.31
#120	3.00	0.13	58.97	41.58	118.10	16.73
#170	3.50	0.09	16.91	11.92	135.01	4.81
#200	3.75	0.07	2.53	1.78	137.54	3.03
#230	4.00	0.06	0.65	0.46	138.19	2.57

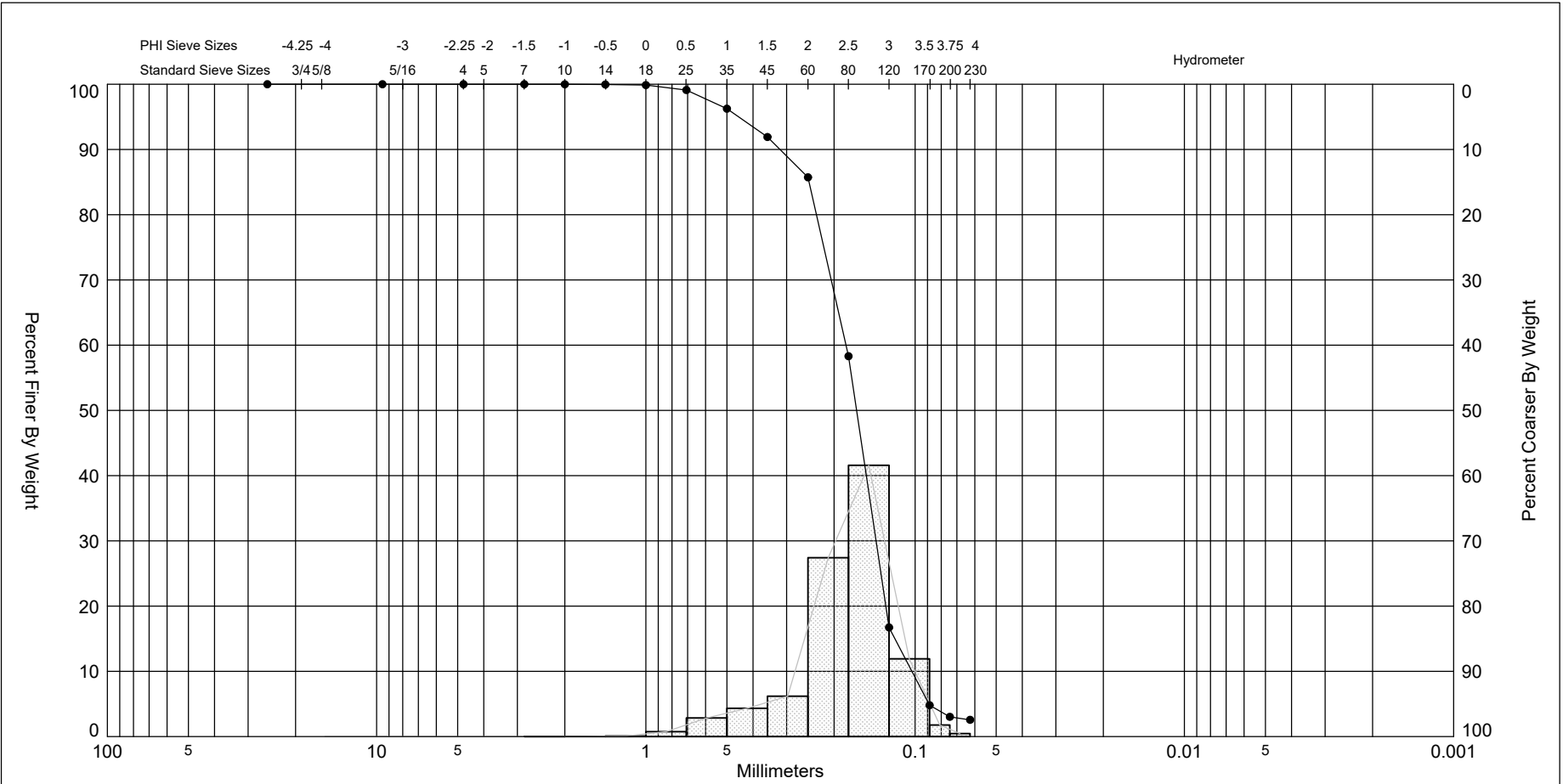
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.49	3.03	2.90	2.60	2.20	2.03	1.14

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.48	0.18	0.63	-1.14	5.1

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-002 #S-2	●—	-9.1	SP	#200 - 3.03 #230 - 2.57			2.6	2.48	-1.14	5.1	0.63	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL  
 Depths and elevations based on measured values

Analysis Date:	07-29-22
Analyzed By:	CRM
Easting (X, ft):	2,743,677
Northing (Y, ft):	347,647
Horizontal System:	NAD 1983
Vertical System:	MLLW



Athena Technologies, Inc.  
 1293 Graham Farm Road  
 McClellanville, SC 29458  
 Office: 843-887-3800

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-002 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,677</b>	Northing (ft): <b>347,647</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-10.5 MLLW</b>
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USCS: <b>SP-SM</b>	Munsell: <b>Moist - 2.5Y-5/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>142.76</b>	Wash Weight (g): <b>132.47</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 8.04</b> <b>#230 - 7.19</b>	Organics (%):	Carbonates (%):	Shells (%):
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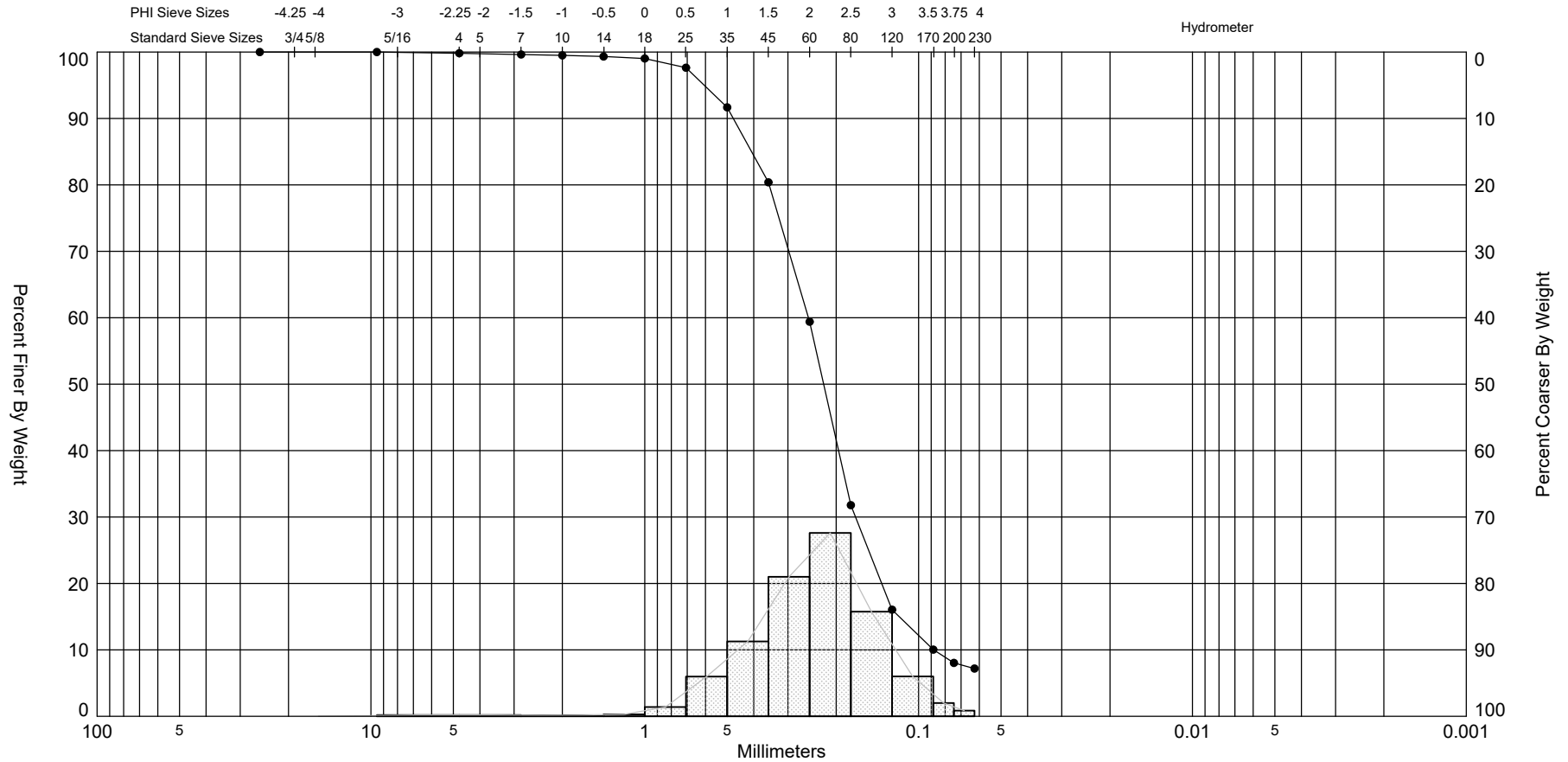
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.26	0.18	0.26	99.82
#7	-1.50	2.83	0.27	0.19	0.53	99.63
#10	-1.00	2.00	0.18	0.13	0.71	99.50
#14	-0.50	1.41	0.24	0.17	0.95	99.33
#18	0.00	1.00	0.43	0.30	1.38	99.03
#25	0.50	0.71	1.98	1.39	3.36	97.64
#35	1.00	0.50	8.52	5.97	11.88	91.67
#45	1.50	0.35	16.10	11.28	27.98	80.39
#60	2.00	0.25	29.96	20.99	57.94	59.40
#80	2.50	0.18	39.42	27.61	97.36	31.79
#120	3.00	0.13	22.47	15.74	119.83	16.05
#170	3.50	0.09	8.58	6.01	128.41	10.04
#200	3.75	0.07	2.85	2.00	131.26	8.04
#230	4.00	0.06	1.21	0.85	132.47	7.19

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.00	2.72	2.17	1.63	1.34	0.72


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.05	0.24	0.81	-0.85	6.35

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-002 #S-3	—●—	-10.5	SP-SM	#200 - 8.04 #230 - 7.19			2.17	2.05	-0.85	6.35	0.81	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,743,677
												Northing (Y, ft):	347,647
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-003 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,892</b>	Northing (ft): <b>346,671</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-4.7 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>144.34</b>	Wash Weight (g): <b>142.03</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.89</b> <b>#230 - 1.59</b>	Organics (%):	Carbonates (%):	Shells (%):
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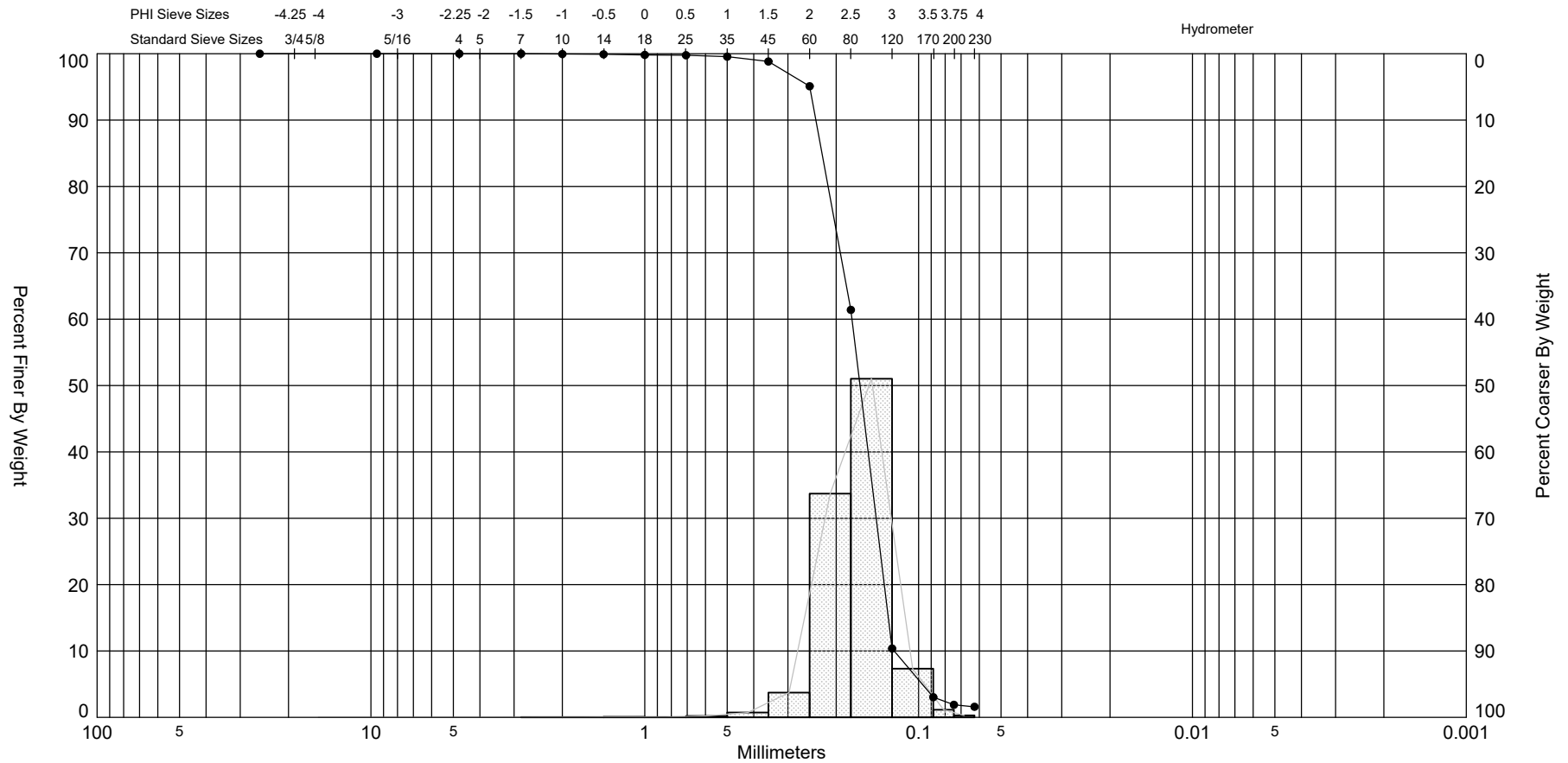
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.07	0.05	0.07	99.95
#14	-0.50	1.41	0.06	0.04	0.13	99.91
#18	0.00	1.00	0.13	0.09	0.26	99.82
#25	0.50	0.71	0.07	0.05	0.33	99.77
#35	1.00	0.50	0.31	0.21	0.64	99.56
#45	1.50	0.35	1.05	0.73	1.69	98.83
#60	2.00	0.25	5.38	3.73	7.07	95.10
#80	2.50	0.18	48.64	33.70	55.71	61.40
#120	3.00	0.13	73.65	51.03	129.36	10.37
#170	3.50	0.09	10.58	7.33	139.94	3.04
#200	3.75	0.07	1.66	1.15	141.60	1.89
#230	4.00	0.06	0.43	0.30	142.03	1.59

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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.37	2.94	2.86	2.61	2.30	2.16	2.00
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.57	0.17	0.41	-1.18	11.34	

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-003 #S-1	—●—	-4.7	SP	#200 - 1.89 #230 - 1.59			2.61	2.57	-1.18	11.34	0.41	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,743,892
												Northing (Y, ft):	346,671
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-003 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,892</b>	Northing (ft): <b>346,671</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.9 MLLW</b>
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USCS: <b>SM</b>	Munsell: <b>Moist - 2.5Y-4/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>131.54</b>	Wash Weight (g): <b>118.48</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 12.15</b> <b>#230 - 9.93</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.21	0.16	0.21	99.84
#14	-0.50	1.41	0.40	0.30	0.61	99.54
#18	0.00	1.00	0.55	0.42	1.16	99.12
#25	0.50	0.71	0.60	0.46	1.76	98.66
#35	1.00	0.50	0.86	0.65	2.62	98.01
#45	1.50	0.35	0.87	0.66	3.49	97.35
#60	2.00	0.25	1.78	1.35	5.27	96.00
#80	2.50	0.18	11.72	8.91	16.99	87.09
#120	3.00	0.13	57.37	43.61	74.36	43.48
#170	3.50	0.09	33.51	25.48	107.87	18.00
#200	3.75	0.07	7.69	5.85	115.56	12.15
#230	4.00	0.06	2.92	2.22	118.48	9.93

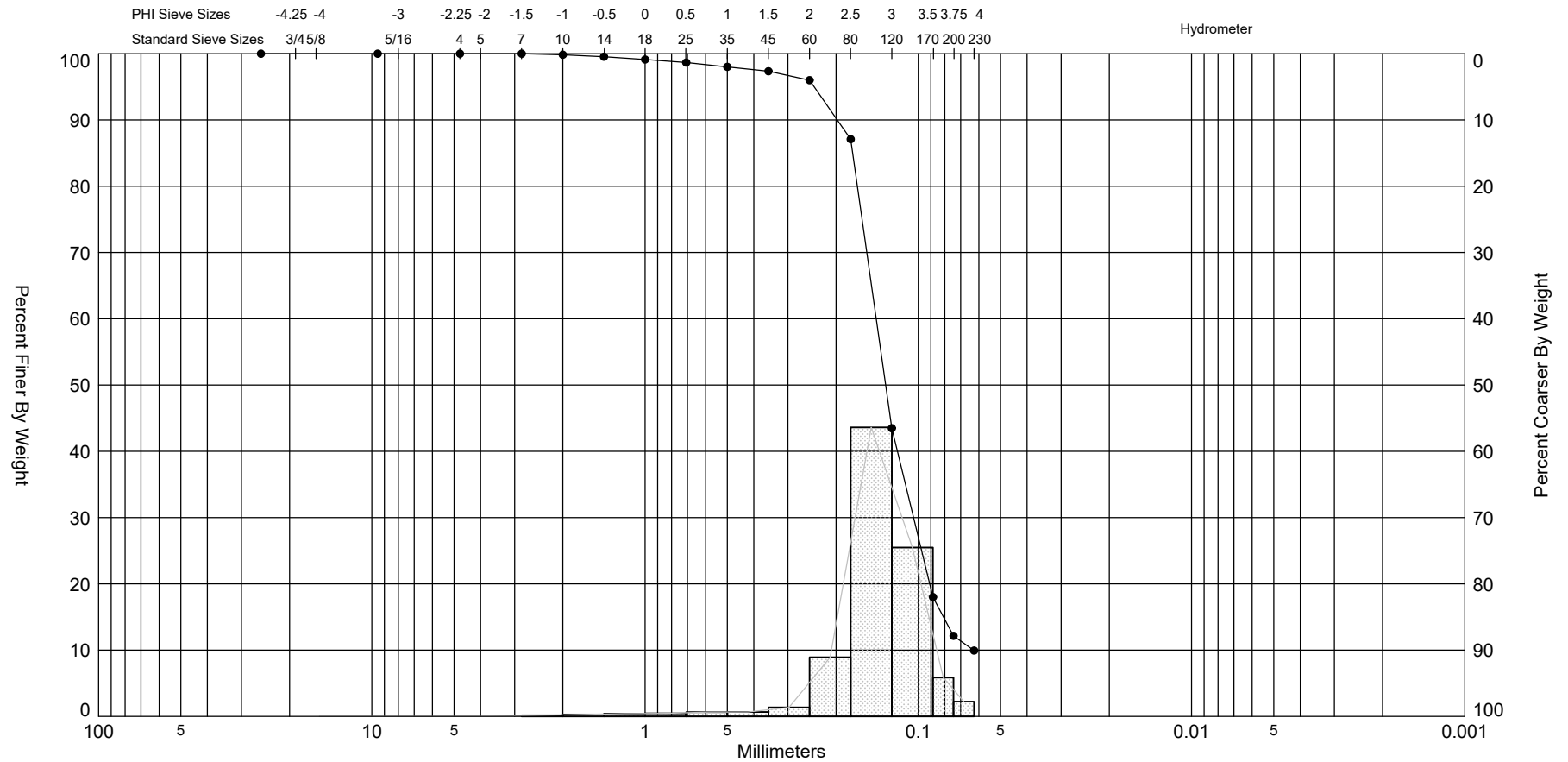
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.59	3.36	2.93	2.64	2.54	2.06


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.84	0.14	0.61	-2.47	14.38

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-003 #S-2	●—	-5.9	SM	#200 - 12.15 #230 - 9.93			2.93	2.84	-2.47	14.38	0.61	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,743,892
												Northing (Y, ft):	346,671
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-003 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,892</b>	Northing (ft): <b>346,671</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.2 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-5/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>153.79</b>	Wash Weight (g): <b>149.45</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 3.64</b> <b>#230 - 2.82</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.04	0.03	0.04	99.97
#10	-1.00	2.00	0.14	0.09	0.18	99.88
#14	-0.50	1.41	0.16	0.10	0.34	99.78
#18	0.00	1.00	0.29	0.19	0.63	99.59
#25	0.50	0.71	0.30	0.20	0.93	99.39
#35	1.00	0.50	0.31	0.20	1.24	99.19
#45	1.50	0.35	0.35	0.23	1.59	98.96
#60	2.00	0.25	1.60	1.04	3.19	97.92
#80	2.50	0.18	30.65	19.93	33.84	77.99
#120	3.00	0.13	85.82	55.80	119.66	22.19
#170	3.50	0.09	23.91	15.55	143.57	6.64
#200	3.75	0.07	4.62	3.00	148.19	3.64
#230	4.00	0.06	1.26	0.82	149.45	2.82

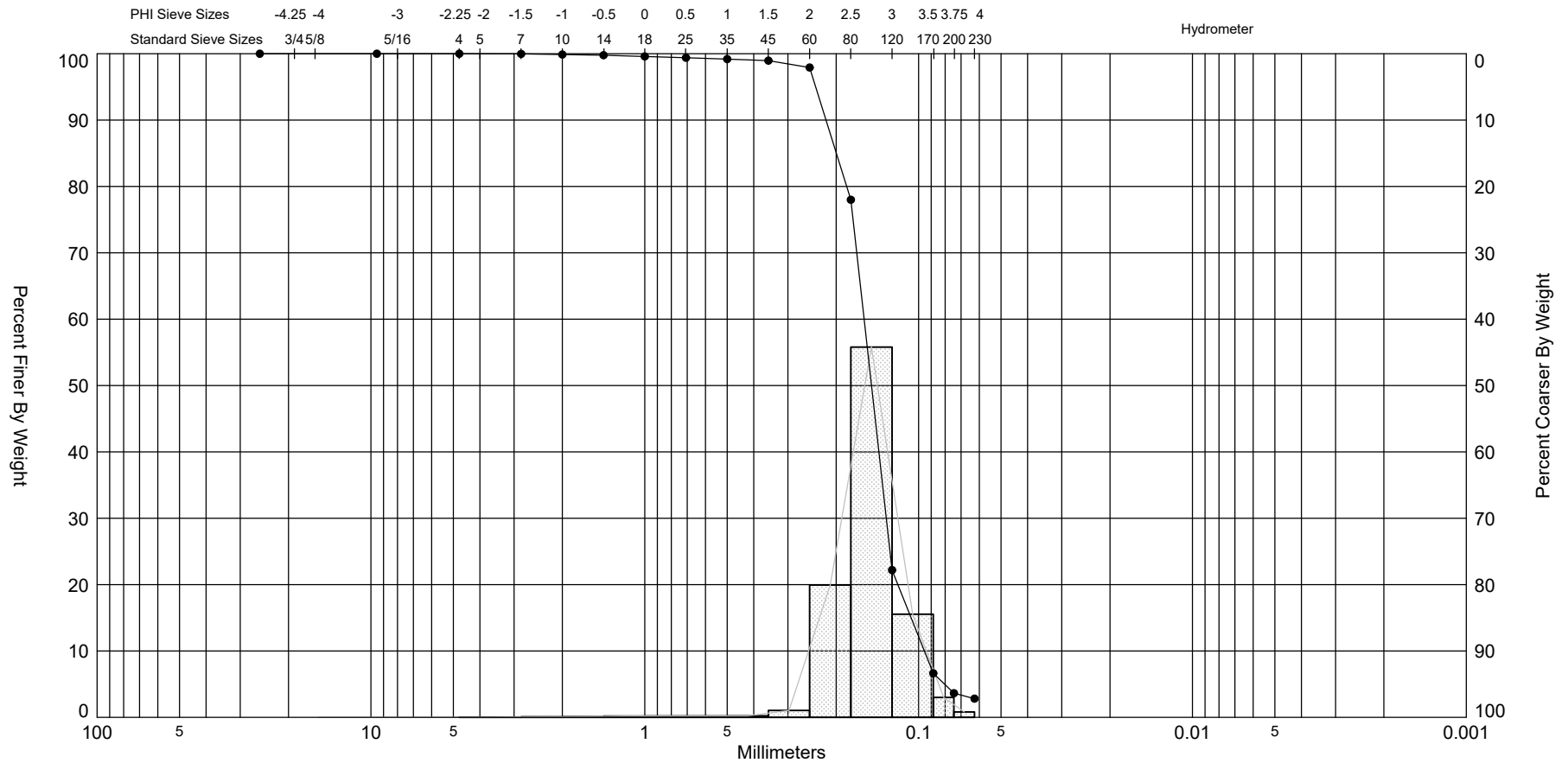
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.64	3.20	2.97	2.75	2.53	2.35	2.07


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.73	0.15	0.46	-2.12	18.67

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-003 #S-3	—●—	-8.2	SP	#200 - 3.64 #230 - 2.82			2.75	2.73	-2.12	18.67	0.46	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,743,892
												Northing (Y, ft):	346,671
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-003 #S-4

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,743,892</b>	Northing (ft): <b>346,671</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-10.1 MLLW</b>
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USCS: <b>SM</b>	Munsell: <b>Moist - 5Y-4/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>136.21</b>	Wash Weight (g): <b>106.69</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 26.23</b> <b>#230 - 21.69</b>	Organics (%):	Carbonates (%):	Shells (%):
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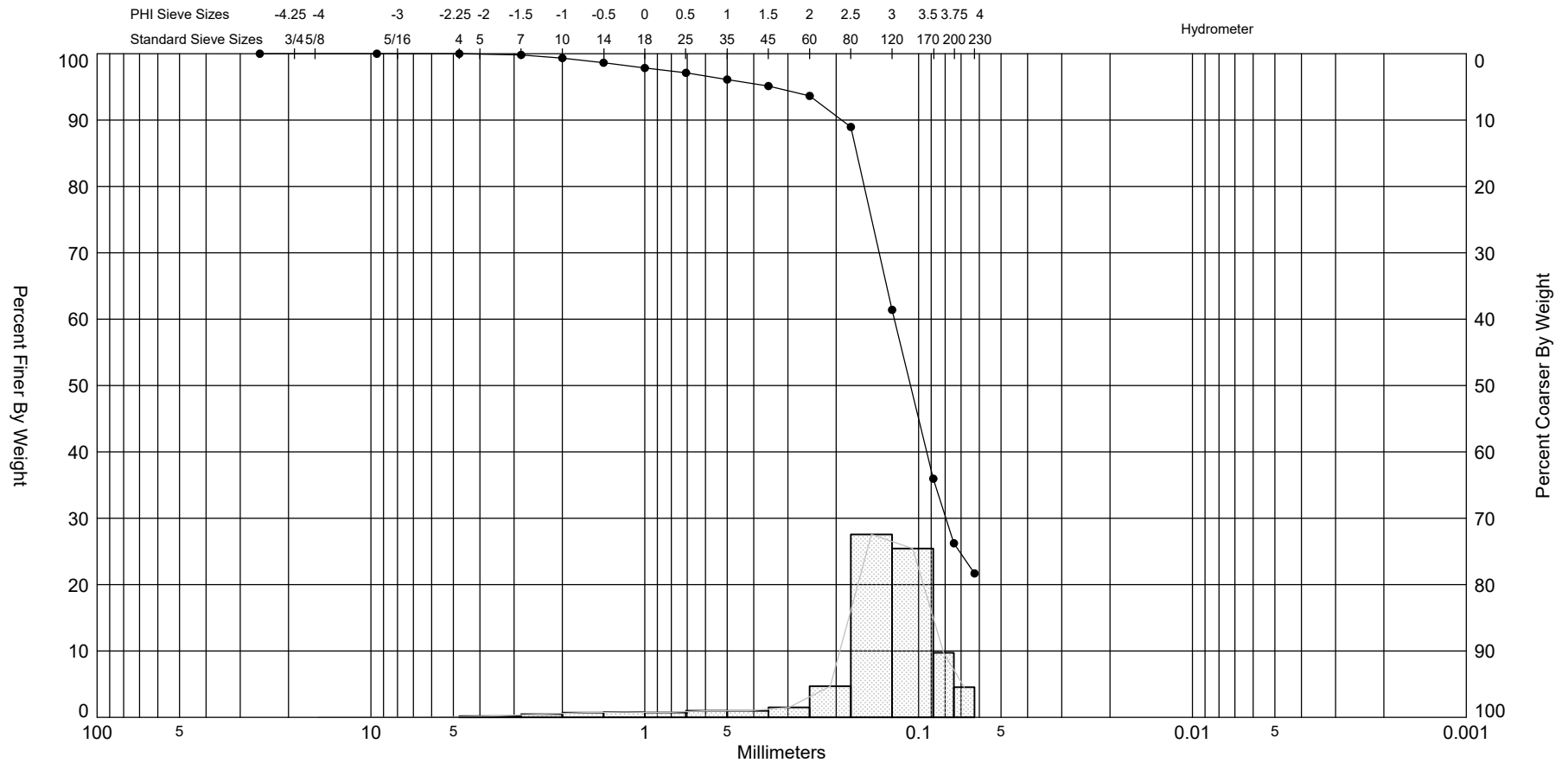
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.25	0.18	0.25	99.82
#10	-1.00	2.00	0.66	0.48	0.91	99.34
#14	-0.50	1.41	0.95	0.70	1.86	98.64
#18	0.00	1.00	1.08	0.79	2.94	97.85
#25	0.50	0.71	1.00	0.73	3.94	97.12
#35	1.00	0.50	1.38	1.01	5.32	96.11
#45	1.50	0.35	1.33	0.98	6.65	95.13
#60	2.00	0.25	2.03	1.49	8.68	93.64
#80	2.50	0.18	6.38	4.68	15.06	88.96
#120	3.00	0.13	37.54	27.56	52.60	61.40
#170	3.50	0.09	34.65	25.44	87.25	35.96
#200	3.75	0.07	13.26	9.73	100.51	26.23
#230	4.00	0.06	6.18	4.54	106.69	21.69

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
		3.82	3.22	2.75	2.59	1.54


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.87	0.14	0.87	-2.55	11.2

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-003 #S-4	●—	-10.1	SM	#200 - 26.23 #230 - 21.69			3.22	2.87	-2.55	11.2	0.87	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,743,892
												Northing (Y, ft):	346,671
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-004 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,112</b>	Northing (ft): <b>345,694</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-4.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>153.00</b>	Wash Weight (g): <b>151.18</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.54</b> <b>#230 - 1.18</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.04	0.03	0.04	99.97
#7	-1.50	2.83	0.00	0.00	0.04	99.97
#10	-1.00	2.00	0.00	0.00	0.04	99.97
#14	-0.50	1.41	0.03	0.02	0.07	99.95
#18	0.00	1.00	0.01	0.01	0.08	99.94
#25	0.50	0.71	0.10	0.07	0.18	99.87
#35	1.00	0.50	0.23	0.15	0.41	99.72
#45	1.50	0.35	0.53	0.35	0.94	99.37
#60	2.00	0.25	1.00	0.65	1.94	98.72
#80	2.50	0.18	16.65	10.88	18.59	87.84
#120	3.00	0.13	106.44	69.57	125.03	18.27
#170	3.50	0.09	23.07	15.08	148.10	3.19
#200	3.75	0.07	2.53	1.65	150.63	1.54
#230	4.00	0.06	0.55	0.36	151.18	1.18

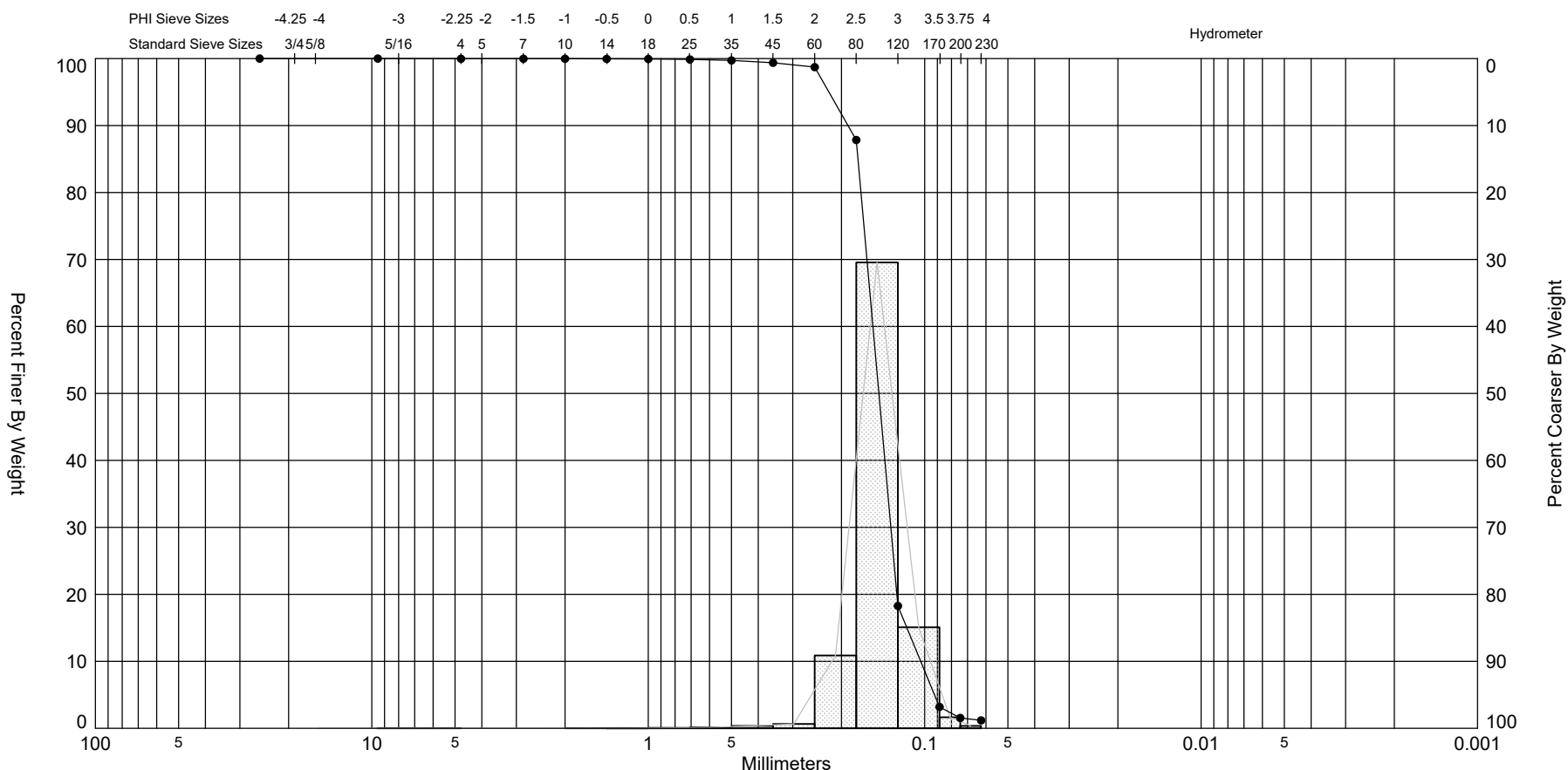
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.44	3.08	2.95	2.77	2.59	2.53	2.17


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.77	0.15	0.34	-1.99	27.84

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-004 #S-1	●—	-4.1	SP	#200 - 1.54 #230 - 1.18			2.77	2.77	-1.99	27.84	0.34	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,744,112
												Northing (Y, ft):	345,694
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-004 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,112</b>	Northing (ft): <b>345,694</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.6 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-5/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>148.30</b>	Wash Weight (g): <b>146.20</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.89</b> <b>#230 - 1.42</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.01	0.01	0.01	99.99
#14	-0.50	1.41	0.02	0.01	0.03	99.98
#18	0.00	1.00	0.08	0.05	0.11	99.93
#25	0.50	0.71	0.07	0.05	0.18	99.88
#35	1.00	0.50	0.09	0.06	0.27	99.82
#45	1.50	0.35	0.20	0.13	0.47	99.69
#60	2.00	0.25	0.43	0.29	0.90	99.40
#80	2.50	0.18	6.57	4.43	7.47	94.97
#120	3.00	0.13	97.96	66.06	105.43	28.91
#170	3.50	0.09	36.16	24.38	141.59	4.53
#200	3.75	0.07	3.91	2.64	145.50	1.89
#230	4.00	0.06	0.70	0.47	146.20	1.42

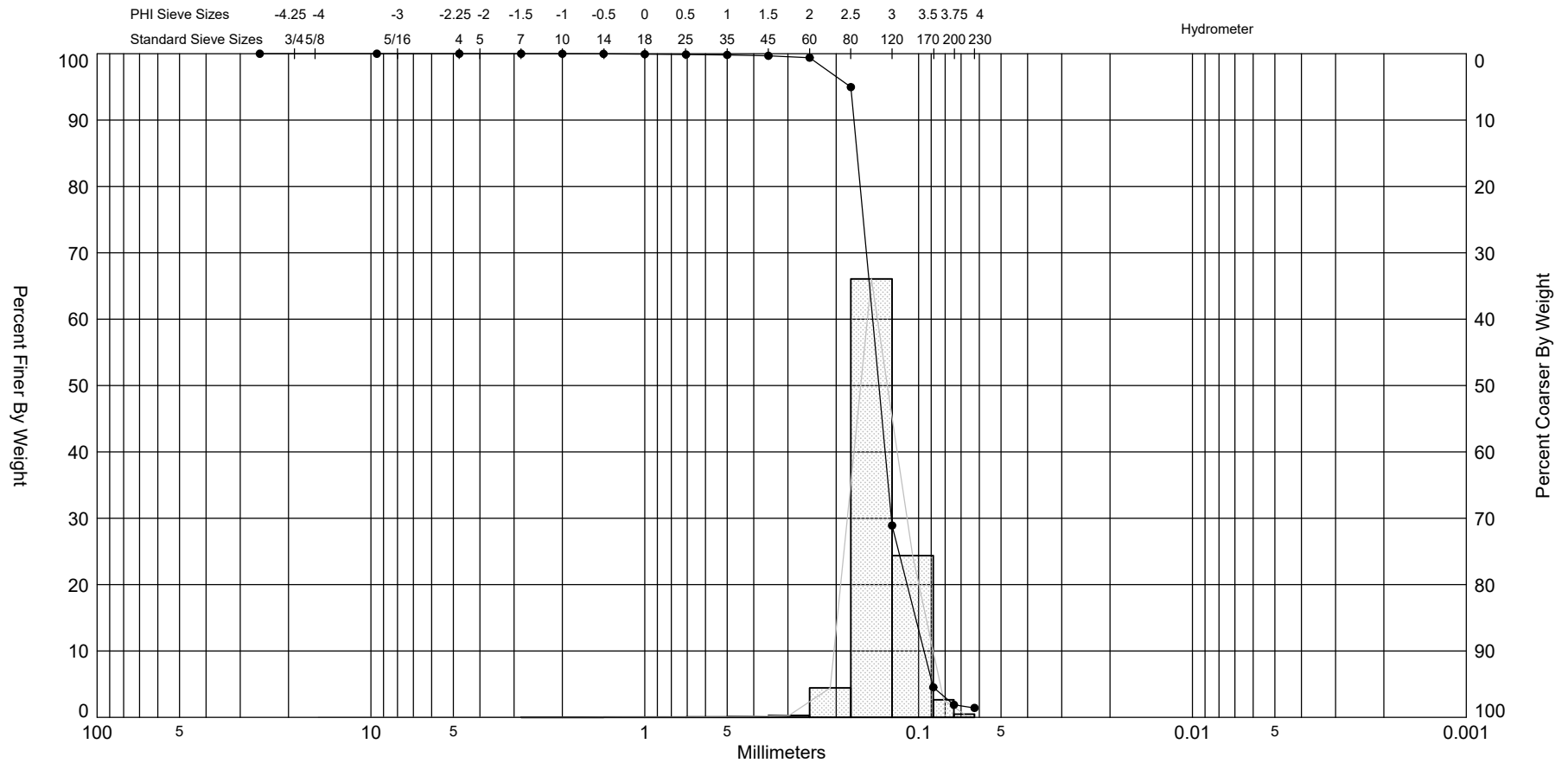
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.49	3.26	3.08	2.84	2.65	2.58	2.50


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.87	0.14	0.32	-1.02	15.58

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-004 #S-2	●—	-5.6	SP	#200 - 1.89 #230 - 1.42			2.84	2.87	-1.02	15.58	0.32	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,744,112
												Northing (Y, ft):	345,694
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-004 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,112</b>	Northing (ft): <b>345,694</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.6 MLLW</b>
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USCS: <b>SP-SM</b>	Munsell: <b>Moist - 5Y-5/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>141.13</b>	Wash Weight (g): <b>133.28</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 8.78</b> <b>#230 - 5.58</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.00	0.00	0.00	100.00
#14	-0.50	1.41	0.02	0.01	0.02	99.99
#18	0.00	1.00	0.06	0.04	0.08	99.95
#25	0.50	0.71	0.07	0.05	0.15	99.90
#35	1.00	0.50	0.13	0.09	0.28	99.81
#45	1.50	0.35	0.57	0.40	0.85	99.41
#60	2.00	0.25	1.53	1.08	2.38	98.33
#80	2.50	0.18	1.90	1.35	4.28	96.98
#120	3.00	0.13	47.37	33.56	51.65	63.42
#170	3.50	0.09	59.19	41.94	110.84	21.48
#200	3.75	0.07	17.93	12.70	128.77	8.78
#230	4.00	0.06	4.51	3.20	133.28	5.58

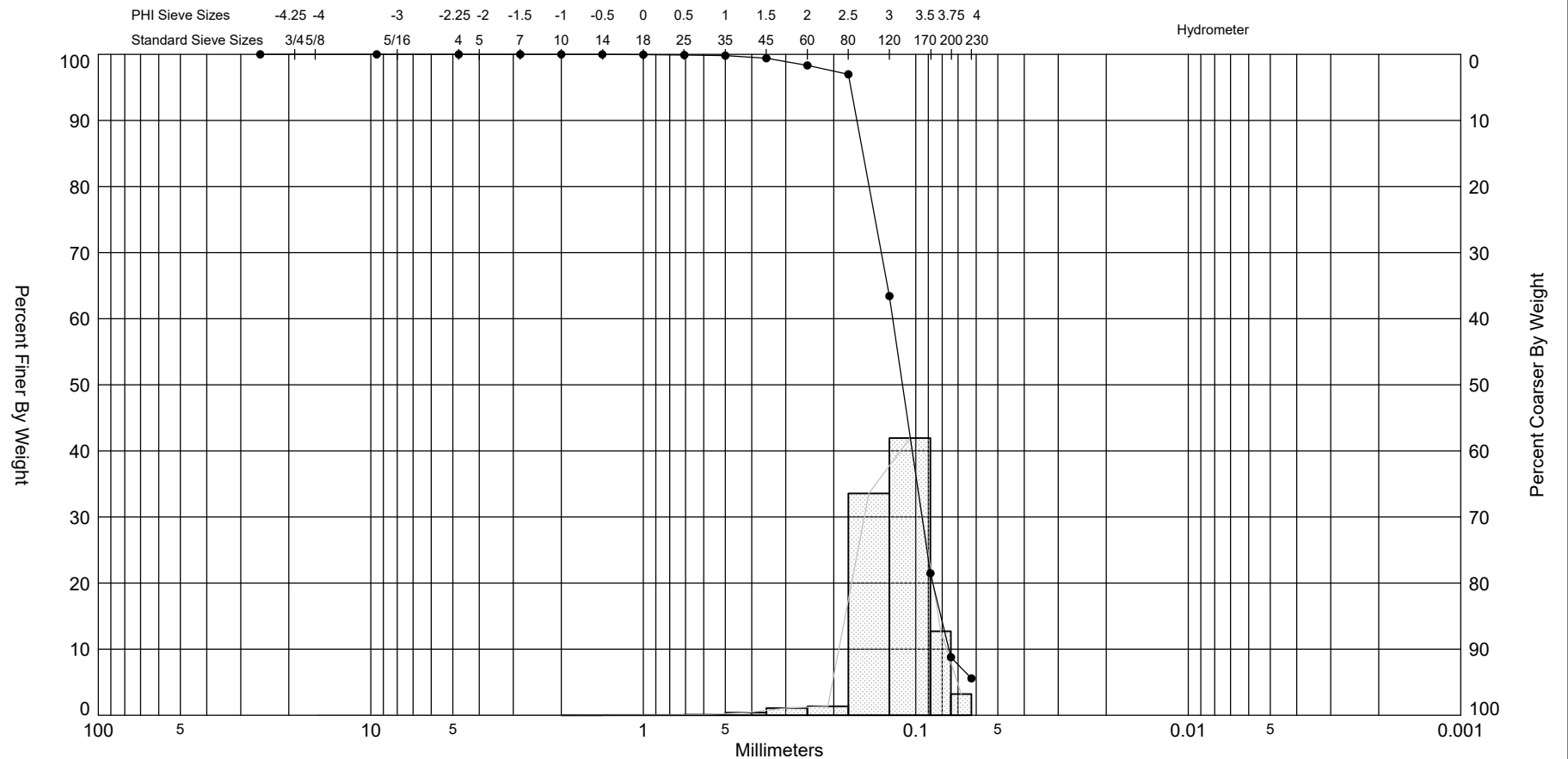
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.61	3.46	3.16	2.83	2.69	2.53

Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	3.1	0.12	0.42	-1.27	9.17

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay	
Coarse	Fine	Coarse	Medium	Fine		

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
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CLO-22-V-004 #S-3	●—	-7.6	SP-SM	#200 - 8.78 #230 - 5.58			3.16	3.1	-1.27	9.17	0.42	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
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Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
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Depths and elevations based on measured values												Analyzed By:	CRM
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	<p>Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Easting (X, ft):</td><td>2,744,112</td></tr> <tr><td>Northing (Y, ft):</td><td>345,694</td></tr> <tr><td>Horizontal System:</td><td>NAD 1983</td></tr> <tr><td>Vertical System:</td><td>MLLW</td></tr> </table>	Easting (X, ft):	2,744,112	Northing (Y, ft):	345,694	Horizontal System:	NAD 1983	Vertical System:	MLLW	
Easting (X, ft):	2,744,112										
Northing (Y, ft):	345,694										
Horizontal System:	NAD 1983										
Vertical System:	MLLW										

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-004 #S-4

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,112</b>	Northing (ft): <b>345,694</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-10.3 MLLW</b>
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USCS: <b>SM</b>	Munsell: <b>Moist - 5Y-5/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>149.43</b>	Wash Weight (g): <b>132.29</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 16.30</b> <b>#230 - 11.47</b>	Organics (%):	Carbonates (%):	Shells (%):
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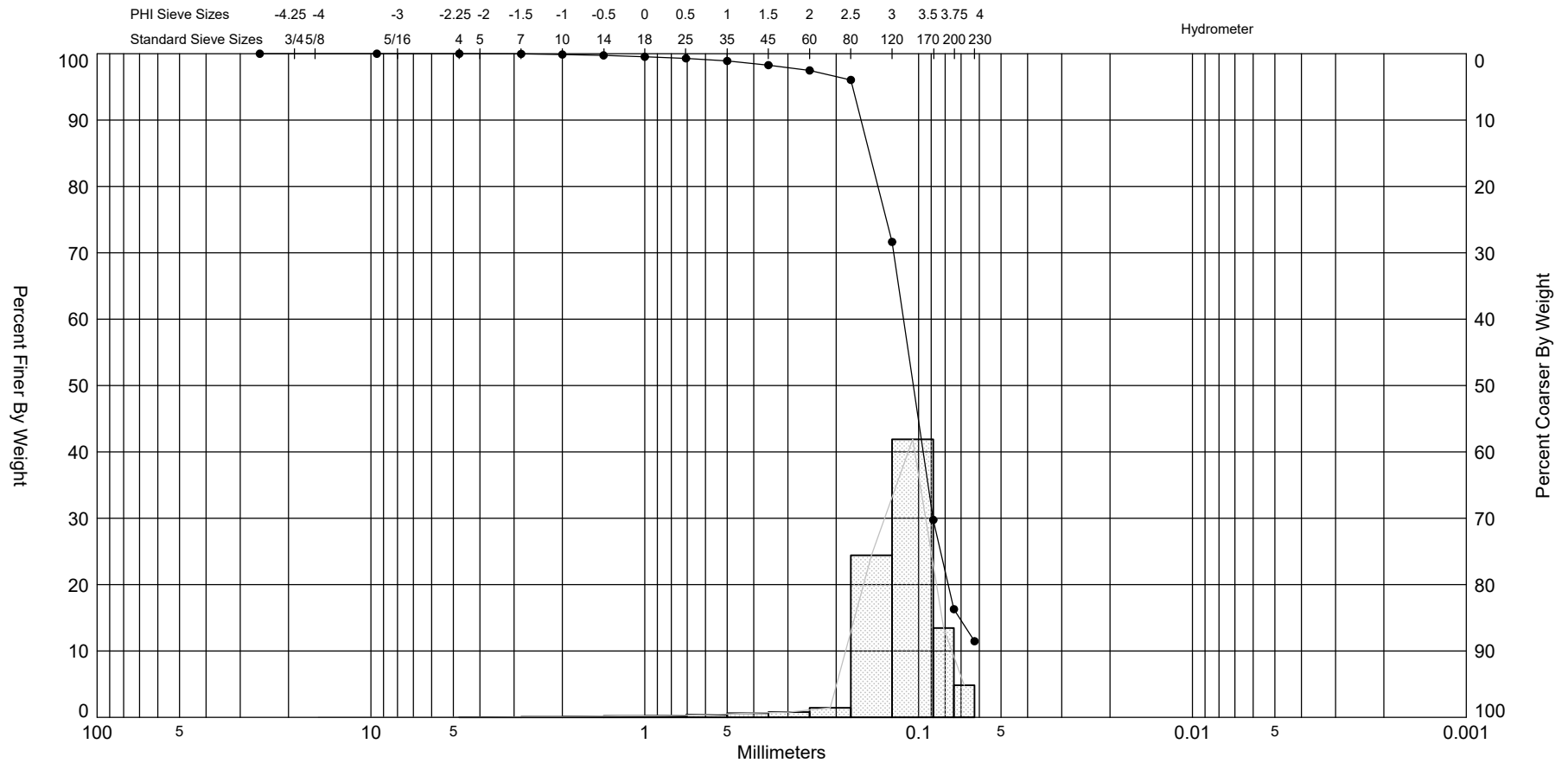
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.05	0.03	0.05	99.97
#10	-1.00	2.00	0.13	0.09	0.18	99.88
#14	-0.50	1.41	0.19	0.13	0.37	99.75
#18	0.00	1.00	0.32	0.21	0.69	99.54
#25	0.50	0.71	0.36	0.24	1.05	99.30
#35	1.00	0.50	0.59	0.39	1.64	98.91
#45	1.50	0.35	0.94	0.63	2.58	98.28
#60	2.00	0.25	1.19	0.80	3.77	97.48
#80	2.50	0.18	2.13	1.43	5.90	96.05
#120	3.00	0.13	36.48	24.41	42.38	71.64
#170	3.50	0.09	62.59	41.89	104.97	29.75
#200	3.75	0.07	20.10	13.45	125.07	16.30
#230	4.00	0.06	7.22	4.83	132.29	11.47

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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.77	3.59	3.26	2.93	2.75	2.52
Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
	3.12	0.12	0.54	-3	19.79	

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-004 #S-4	●—	-10.3	SM	#200 - 16.30 #230 - 11.47			3.26	3.12	-3	19.79	0.54	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,112
												Northing (Y, ft):	345,694
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-005 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,329</b>	Northing (ft): <b>344,720</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-4.3 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-5/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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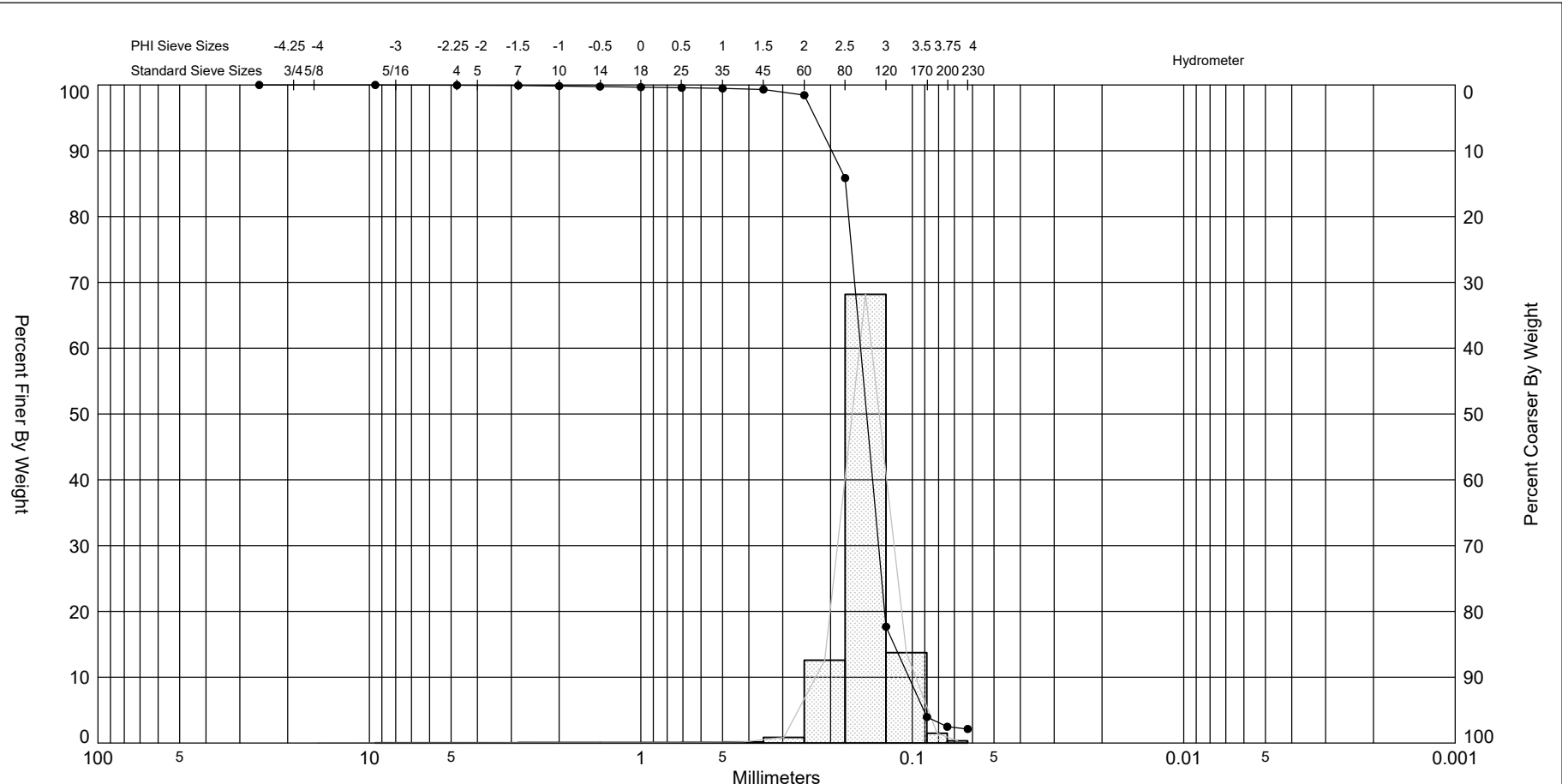
Dry Weight (g): <b>151.53</b>	Wash Weight (g): <b>148.30</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 2.47</b> <b>#230 - 2.13</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.06	0.04	0.06	99.96
#7	-1.50	2.83	0.06	0.04	0.12	99.92
#10	-1.00	2.00	0.12	0.08	0.24	99.84
#14	-0.50	1.41	0.12	0.08	0.36	99.76
#18	0.00	1.00	0.14	0.09	0.50	99.67
#25	0.50	0.71	0.13	0.09	0.63	99.58
#35	1.00	0.50	0.16	0.11	0.79	99.47
#45	1.50	0.35	0.24	0.16	1.03	99.31
#60	2.00	0.25	1.31	0.86	2.34	98.45
#80	2.50	0.18	19.08	12.59	21.42	85.86
#120	3.00	0.13	103.32	68.18	124.74	17.68
#170	3.50	0.09	20.81	13.73	145.55	3.95
#200	3.75	0.07	2.24	1.48	147.79	2.47
#230	4.00	0.06	0.51	0.34	148.30	2.13

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.46	3.06	2.95	2.76	2.58	2.51	2.14

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.74	0.15	0.4	-3.78	42.44

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-005 #S-1	—●—	-4.3	SP	#200 - 2.47 #230 - 2.13			2.76	2.74	-3.78	42.44	0.4	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)

Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Easting (X, ft):	2,744,329
Northing (Y, ft):	344,720
Horizontal System:	NAD 1983
Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-005 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,329</b>	Northing (ft): <b>344,720</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-6.3 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-5/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>146.21</b>	Wash Weight (g): <b>144.55</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.52</b> <b>#230 - 1.14</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.04	0.03	0.04	99.97
#14	-0.50	1.41	0.01	0.01	0.05	99.96
#18	0.00	1.00	0.08	0.05	0.13	99.91
#25	0.50	0.71	0.11	0.08	0.24	99.83
#35	1.00	0.50	0.08	0.05	0.32	99.78
#45	1.50	0.35	0.09	0.06	0.41	99.72
#60	2.00	0.25	0.44	0.30	0.85	99.42
#80	2.50	0.18	10.21	6.98	11.06	92.44
#120	3.00	0.13	93.59	64.01	104.65	28.43
#170	3.50	0.09	36.77	25.15	141.42	3.28
#200	3.75	0.07	2.57	1.76	143.99	1.52
#230	4.00	0.06	0.56	0.38	144.55	1.14

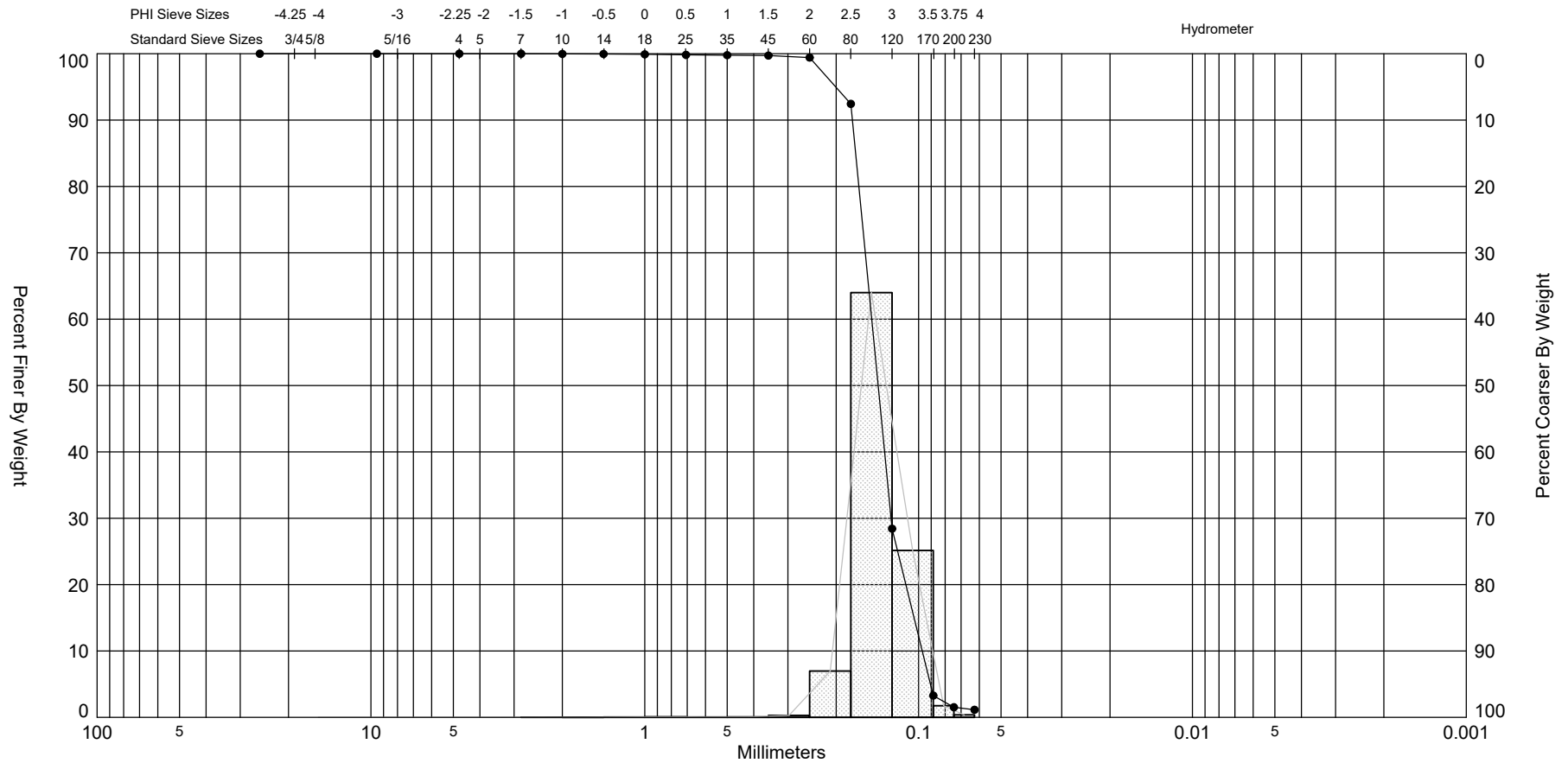
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.47	3.25	3.07	2.83	2.64	2.57	2.32


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.85	0.14	0.33	-1.4	17.98

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-005 #S-2	—●—	-6.3	SP	#200 - 1.52 #230 - 1.14			2.83	2.85	-1.4	17.98	0.33	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,329
												Northing (Y, ft):	344,720
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-005 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,329</b>	Northing (ft): <b>344,720</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.8 MLLW</b>
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USCS: <b>SP-SM</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>142.90</b>	Wash Weight (g): <b>136.82</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 5.37</b> <b>#230 - 4.26</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.04	0.03	0.04	99.97
#10	-1.00	2.00	0.21	0.15	0.25	99.82
#14	-0.50	1.41	0.37	0.26	0.62	99.56
#18	0.00	1.00	0.56	0.39	1.18	99.17
#25	0.50	0.71	0.55	0.38	1.73	98.79
#35	1.00	0.50	0.65	0.45	2.38	98.34
#45	1.50	0.35	0.68	0.48	3.06	97.86
#60	2.00	0.25	1.42	0.99	4.48	96.87
#80	2.50	0.18	5.92	4.14	10.40	92.73
#120	3.00	0.13	78.24	54.75	88.64	37.98
#170	3.50	0.09	40.20	28.13	128.84	9.85
#200	3.75	0.07	6.40	4.48	135.24	5.37
#230	4.00	0.06	1.58	1.11	136.82	4.26

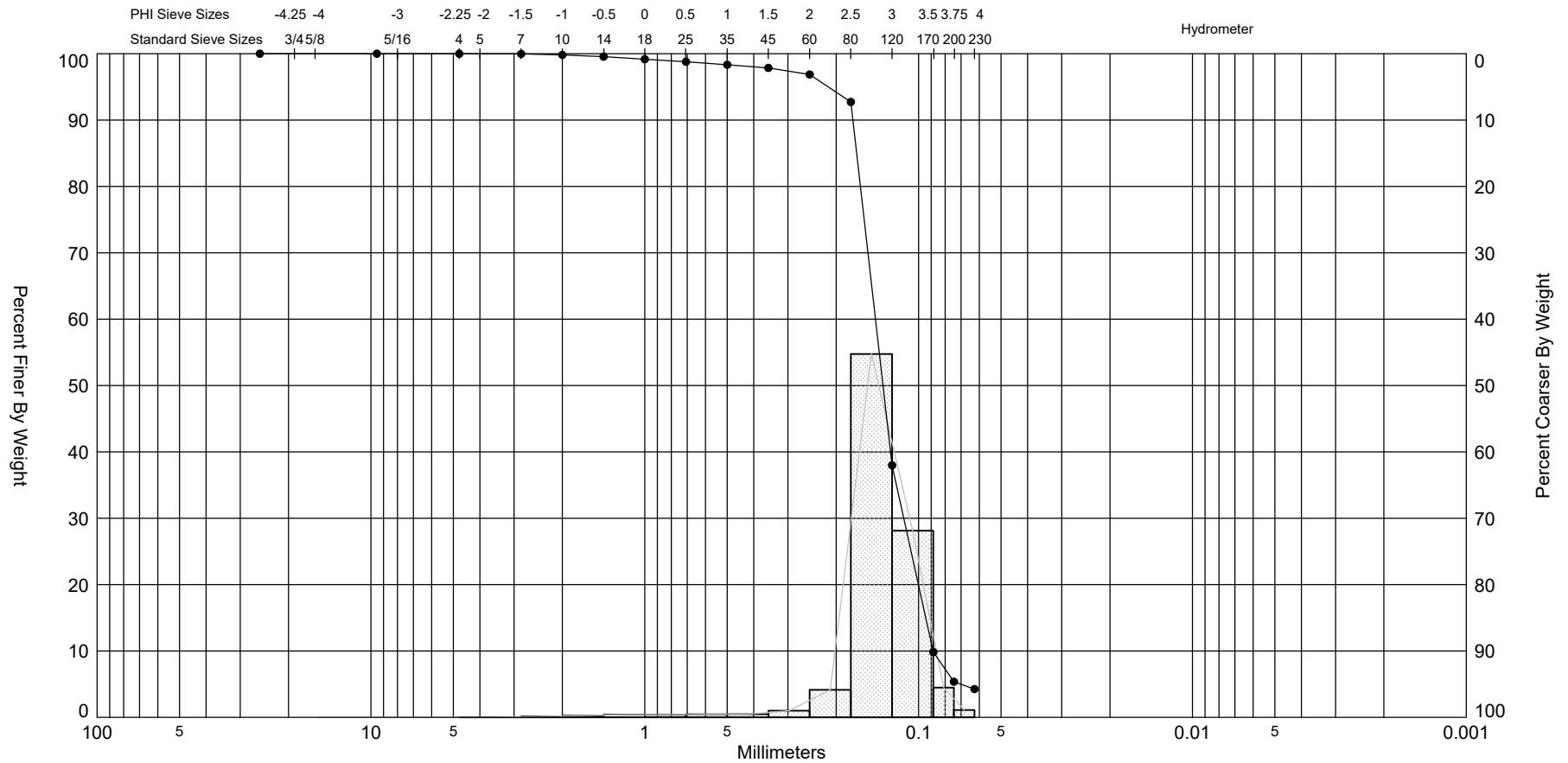
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.83	3.39	3.23	2.89	2.66	2.58	2.23


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.86	0.14	0.54	-3.24	21.67

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-005 #S-3	—●—	-7.8	SP-SM	#200 - 5.37 #230 - 4.26			2.89	2.86	-3.24	21.67	0.54	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,744,329
												Northing (Y, ft):	344,720
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-005 #S-4

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,329</b>	Northing (ft): <b>344,720</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.8 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>157.24</b>	Wash Weight (g): <b>154.27</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 2.64</b> <b>#230 - 1.89</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.85	0.54	0.85	99.46
#4	-2.25	4.76	0.00	0.00	0.85	99.46
#7	-1.50	2.83	0.00	0.00	0.85	99.46
#10	-1.00	2.00	0.14	0.09	0.99	99.37
#14	-0.50	1.41	0.14	0.09	1.13	99.28
#18	0.00	1.00	0.27	0.17	1.40	99.11
#25	0.50	0.71	0.32	0.20	1.72	98.91
#35	1.00	0.50	0.46	0.29	2.18	98.62
#45	1.50	0.35	0.41	0.26	2.59	98.36
#60	2.00	0.25	1.16	0.74	3.75	97.62
#80	2.50	0.18	12.55	7.98	16.30	89.64
#120	3.00	0.13	91.32	58.08	107.62	31.56
#170	3.50	0.09	40.57	25.80	148.19	5.76
#200	3.75	0.07	4.90	3.12	153.09	2.64
#230	4.00	0.06	1.18	0.75	154.27	1.89

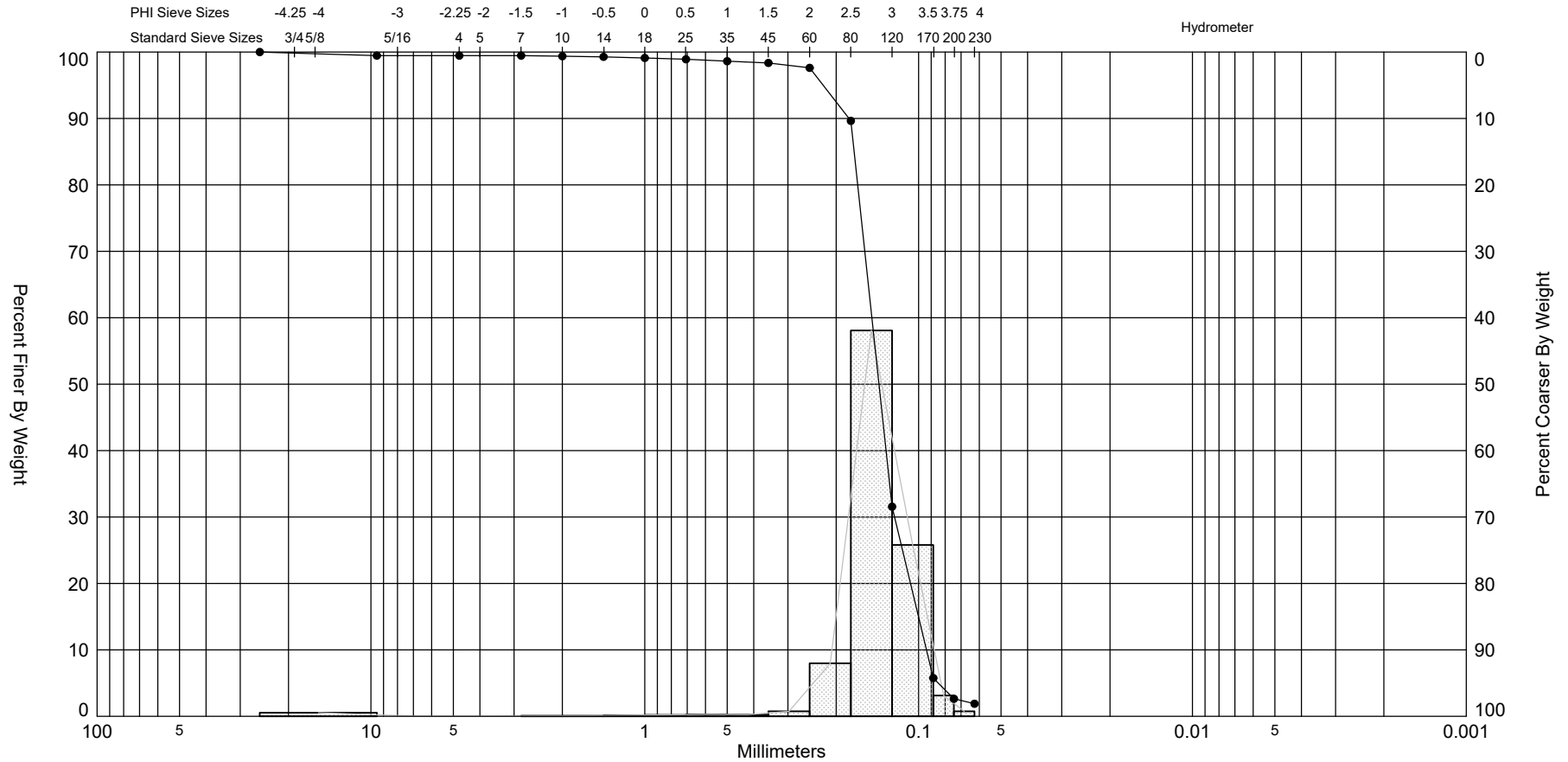
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.56	3.30	3.13	2.84	2.63	2.55	2.16


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.81	0.14	0.67	-6.41	62.13

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-005 #S-4	—●—	-8.8	SP	#200 - 2.64 #230 - 1.89			2.84	2.81	-6.41	62.13	0.67	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,329
												Northing (Y, ft):	344,720
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-005 #S-5

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,329</b>	Northing (ft): <b>344,720</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-10.3 MLLW</b>
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USCS: <b>SM</b>	Munsell: <b>Moist - 5Y-4/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>103.44</b>	Wash Weight (g): <b>88.93</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 17.16</b> <b>#230 - 14.04</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.06	0.06	0.06	99.94
#10	-1.00	2.00	0.12	0.12	0.18	99.82
#14	-0.50	1.41	0.32	0.31	0.50	99.51
#18	0.00	1.00	0.48	0.46	0.98	99.05
#25	0.50	0.71	0.48	0.46	1.46	98.59
#35	1.00	0.50	0.49	0.47	1.95	98.12
#45	1.50	0.35	0.52	0.50	2.47	97.62
#60	2.00	0.25	1.00	0.97	3.47	96.65
#80	2.50	0.18	3.14	3.04	6.61	93.61
#120	3.00	0.13	37.49	36.24	44.10	57.37
#170	3.50	0.09	33.03	31.93	77.13	25.44
#200	3.75	0.07	8.57	8.28	85.70	17.16
#230	4.00	0.06	3.23	3.12	88.93	14.04

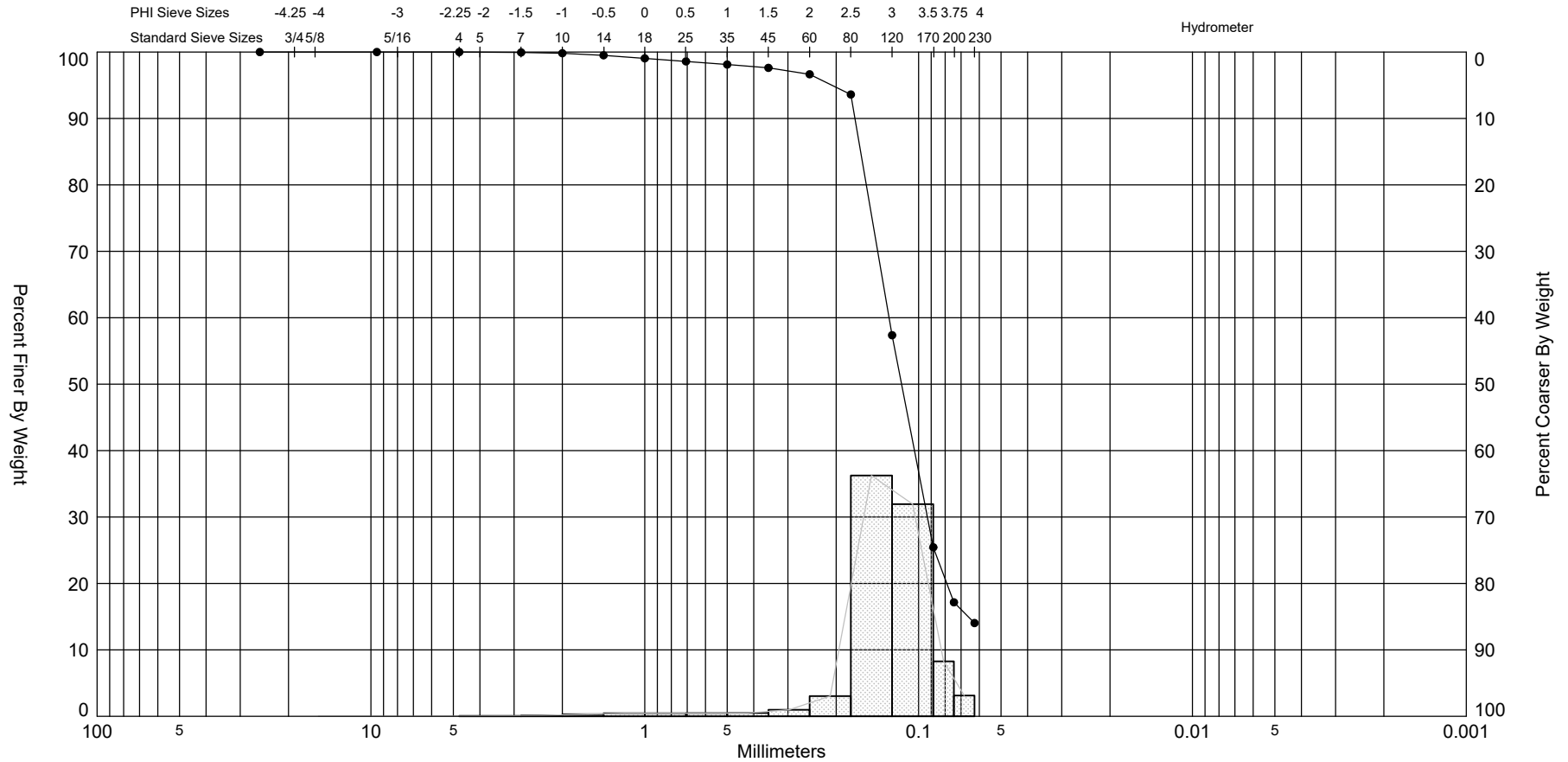
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.84	3.51	3.12	2.76	2.63	2.27


Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	2.96	0.13	0.62	-2.96	17.52

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-005 #S-5	—●—	-10.3	SM	#200 - 17.16 #230 - 14.04			3.12	2.96	-2.96	17.52	0.62	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,329
												Northing (Y, ft):	344,720
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-006 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,546</b>	Northing (ft): <b>343,742</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-4.2 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>99.60</b>	Wash Weight (g): <b>97.40</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 3.32</b> <b>#230 - 2.22</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.00	0.00	0.00	100.00
#14	-0.50	1.41	0.02	0.02	0.02	99.98
#18	0.00	1.00	0.02	0.02	0.04	99.96
#25	0.50	0.71	0.03	0.03	0.07	99.93
#35	1.00	0.50	0.07	0.07	0.14	99.86
#45	1.50	0.35	0.06	0.06	0.20	99.80
#60	2.00	0.25	0.45	0.45	0.65	99.35
#80	2.50	0.18	5.88	5.90	6.53	93.45
#120	3.00	0.13	56.66	56.89	63.19	36.56
#170	3.50	0.09	28.34	28.45	91.53	8.11
#200	3.75	0.07	4.77	4.79	96.30	3.32
#230	4.00	0.06	1.10	1.10	97.40	2.22

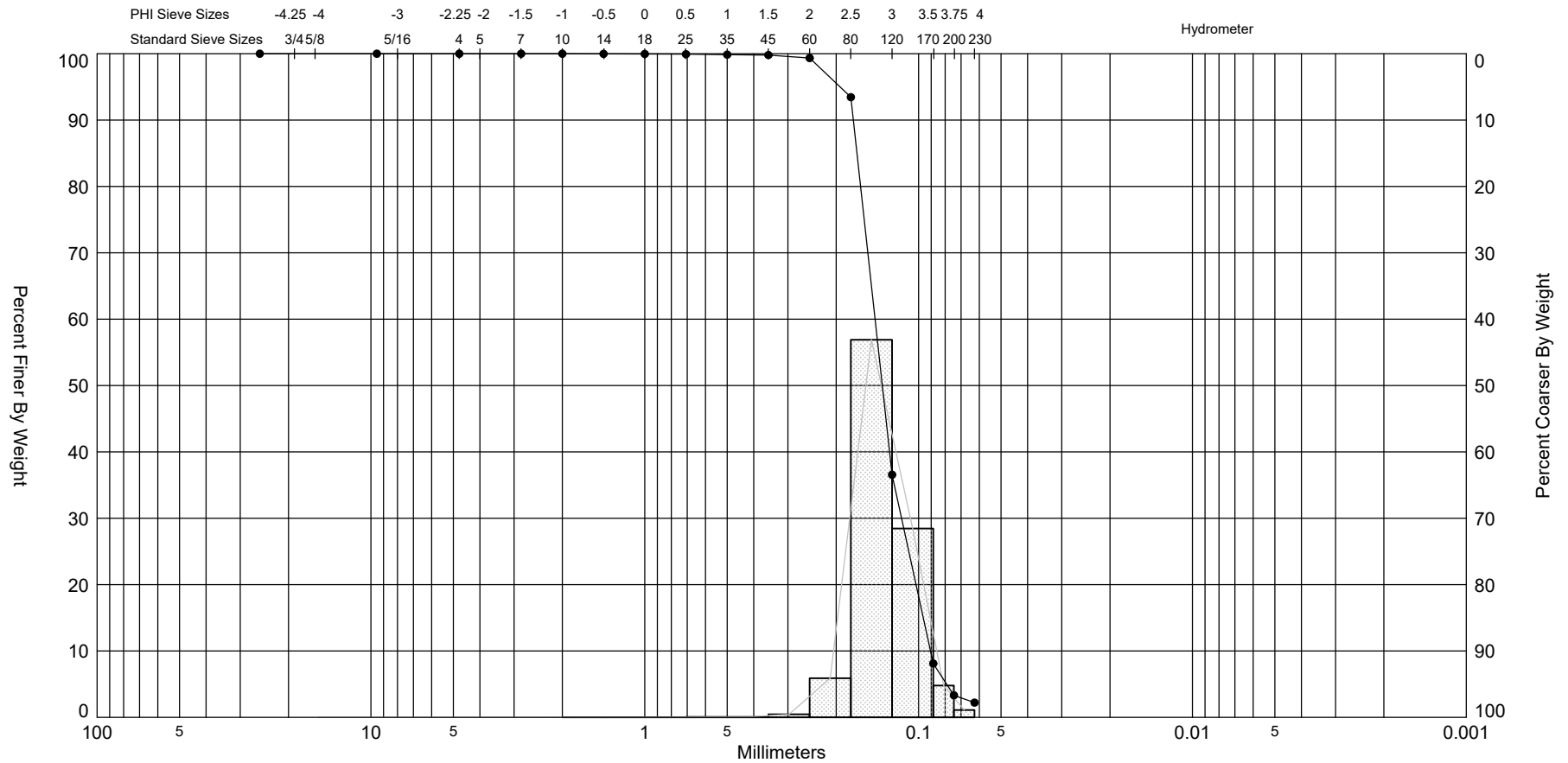
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.66	3.36	3.20	2.88	2.66	2.58	2.37


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.91	0.13	0.36	-0.45	8.46

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-006 #S-1	●—	-4.2	SP	#200 - 3.32 #230 - 2.22			2.88	2.91	-0.45	8.46	0.36	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,744,546
												Northing (Y, ft):	343,742
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-006 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,546</b>	Northing (ft): <b>343,742</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-6.2 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>100.65</b>	Wash Weight (g): <b>98.42</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 3.18</b> <b>#230 - 2.22</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.01	0.01	0.01	99.99
#14	-0.50	1.41	0.01	0.01	0.02	99.98
#18	0.00	1.00	0.03	0.03	0.05	99.95
#25	0.50	0.71	0.02	0.02	0.07	99.93
#35	1.00	0.50	0.03	0.03	0.10	99.90
#45	1.50	0.35	0.15	0.15	0.25	99.75
#60	2.00	0.25	0.34	0.34	0.59	99.41
#80	2.50	0.18	2.38	2.36	2.97	97.05
#120	3.00	0.13	54.04	53.69	57.01	43.36
#170	3.50	0.09	36.74	36.50	93.75	6.86
#200	3.75	0.07	3.70	3.68	97.45	3.18
#230	4.00	0.06	0.97	0.96	98.42	2.22

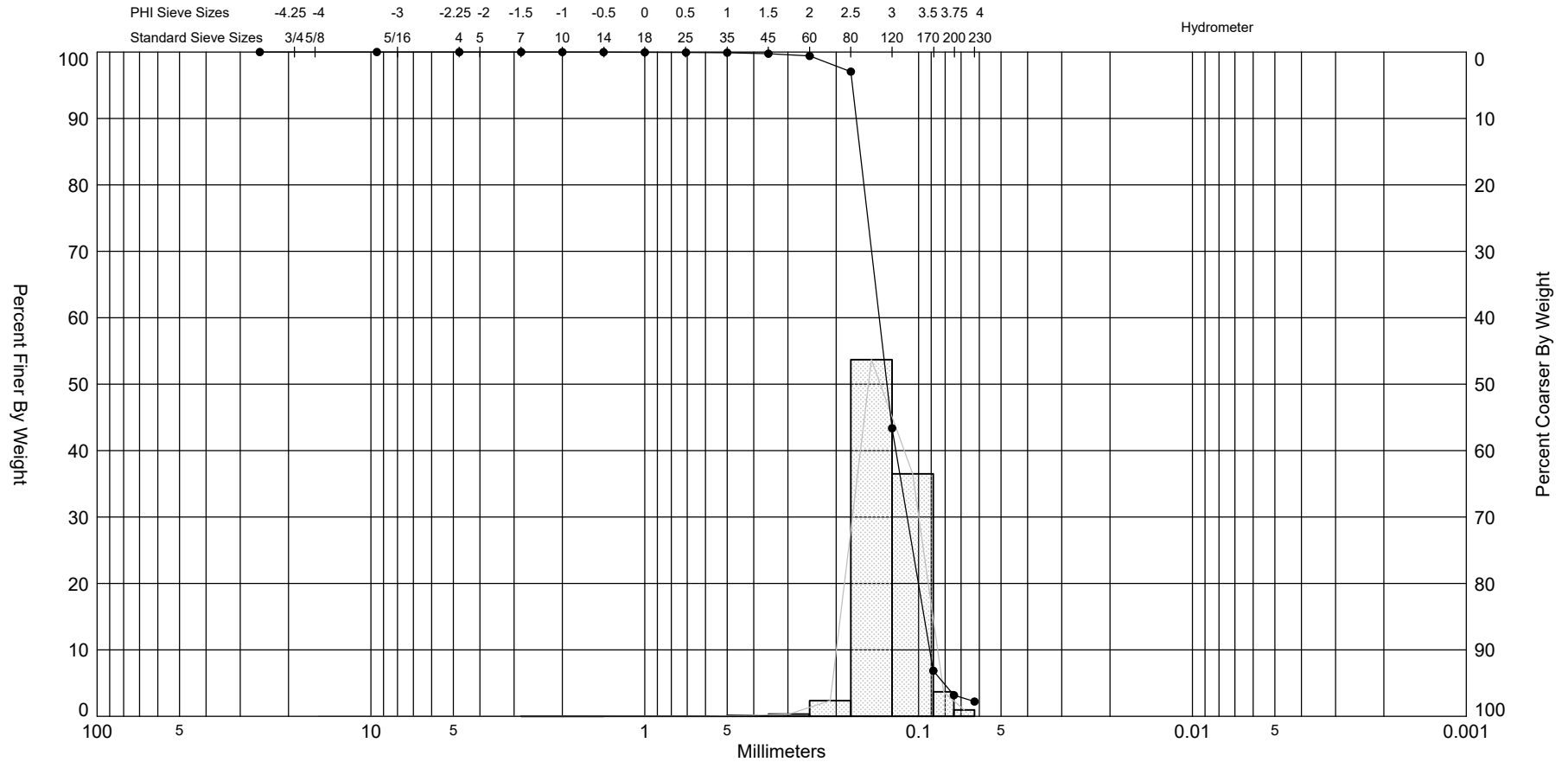
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.63	3.37	3.25	2.94	2.71	2.62	2.52


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.96	0.13	0.33	-0.8	11.77

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-006 #S-2	—●—	-6.2	SP	#200 - 3.18 #230 - 2.22			2.94	2.96	-0.8	11.77	0.33	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,546
												Northing (Y, ft):	343,742
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-006 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,546</b>	Northing (ft): <b>343,742</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.6 MLLW</b>
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USCS: <b>SP-SM</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>98.96</b>	Wash Weight (g): <b>93.05</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 9.00</b> <b>#230 - 5.98</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.00	0.00	0.00	100.00
#14	-0.50	1.41	0.13	0.13	0.13	99.87
#18	0.00	1.00	0.05	0.05	0.18	99.82
#25	0.50	0.71	0.12	0.12	0.30	99.70
#35	1.00	0.50	0.15	0.15	0.45	99.55
#45	1.50	0.35	0.53	0.54	0.98	99.01
#60	2.00	0.25	0.71	0.72	1.69	98.29
#80	2.50	0.18	1.05	1.06	2.74	97.23
#120	3.00	0.13	30.63	30.95	33.37	66.28
#170	3.50	0.09	45.12	45.59	78.49	20.69
#200	3.75	0.07	11.57	11.69	90.06	9.00
#230	4.00	0.06	2.99	3.02	93.05	5.98

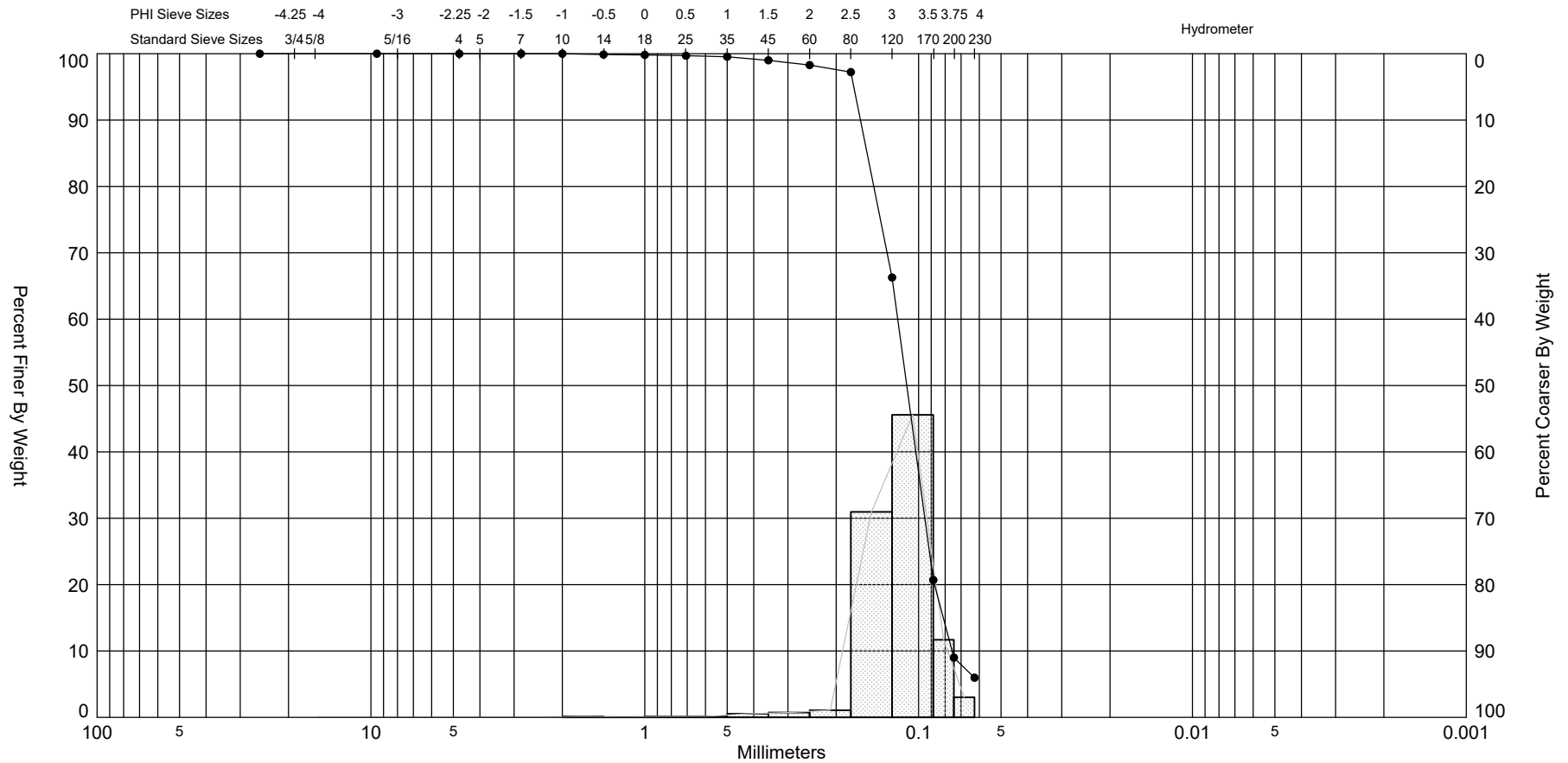
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.60	3.45	3.18	2.86	2.71	2.54


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	3.1	0.12	0.44	-2.29	17.14

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-006 #S-3	—●—	-7.6	SP-SM	#200 - 9.00 #230 - 5.98			3.18	3.1	-2.29	17.14	0.44	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,744,546
												Northing (Y, ft):	343,742
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-006 #S-4

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,546</b>	Northing (ft): <b>343,742</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.4 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>137.12</b>	Wash Weight (g): <b>136.01</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.85</b> <b>#230 - 0.80</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.05	0.04	0.05	99.96
#10	-1.00	2.00	0.04	0.03	0.09	99.93
#14	-0.50	1.41	0.06	0.04	0.15	99.89
#18	0.00	1.00	0.09	0.07	0.24	99.82
#25	0.50	0.71	0.09	0.07	0.33	99.75
#35	1.00	0.50	0.26	0.19	0.59	99.56
#45	1.50	0.35	0.85	0.62	1.44	98.94
#60	2.00	0.25	9.09	6.63	10.53	92.31
#80	2.50	0.18	67.41	49.16	77.94	43.15
#120	3.00	0.13	53.66	39.13	131.60	4.02
#170	3.50	0.09	4.00	2.92	135.60	1.10
#200	3.75	0.07	0.34	0.25	135.94	0.85
#230	4.00	0.06	0.07	0.05	136.01	0.80

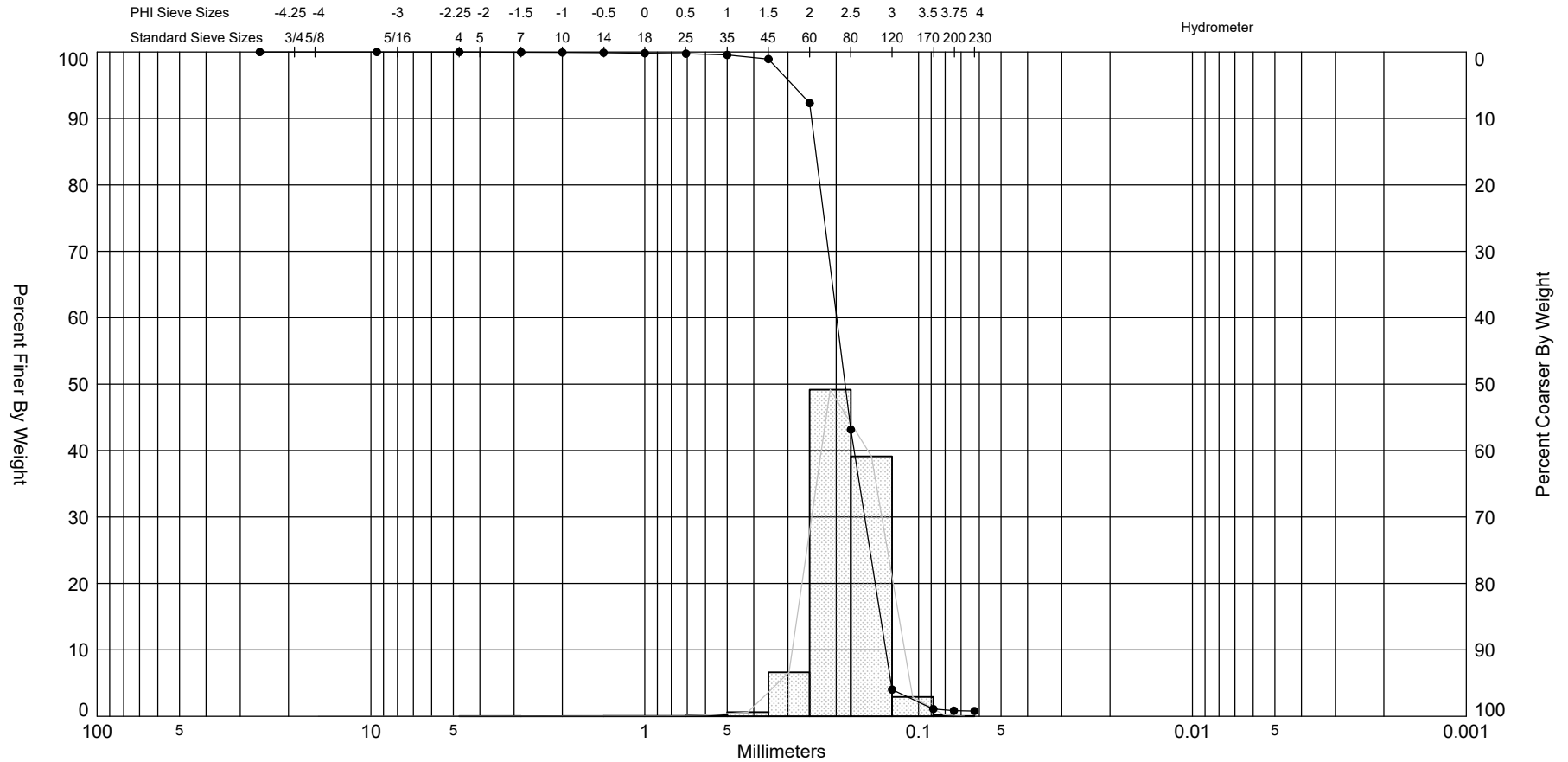
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.99	2.85	2.73	2.43	2.18	2.08	1.80


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.43	0.19	0.39	-1.51	15.39

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-006 #S-4	●—	-9.4	SP	#200 - 0.85 #230 - 0.80			2.43	2.43	-1.51	15.39	0.39	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,546
												Northing (Y, ft):	343,742
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-007 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,694</b>	Northing (ft): <b>343,077</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-3.2 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>144.63</b>	Wash Weight (g): <b>143.12</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.41</b> <b>#230 - 1.04</b>	Organics (%):	Carbonates (%):	Shells (%):
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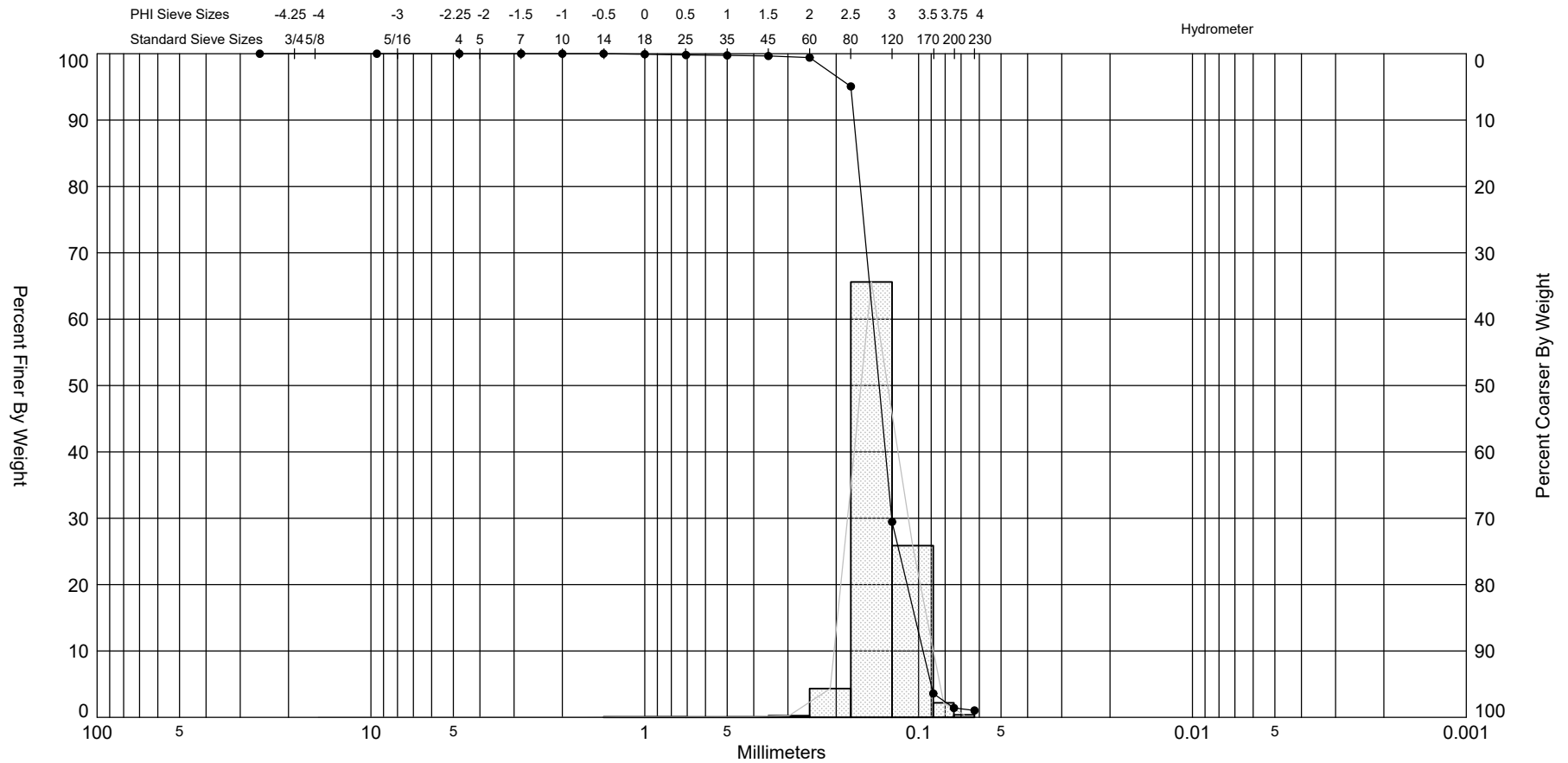
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.00	0.00	0.00	100.00
#14	-0.50	1.41	0.00	0.00	0.00	100.00
#18	0.00	1.00	0.12	0.08	0.12	99.92
#25	0.50	0.71	0.16	0.11	0.28	99.81
#35	1.00	0.50	0.09	0.06	0.37	99.75
#45	1.50	0.35	0.13	0.09	0.50	99.66
#60	2.00	0.25	0.36	0.25	0.86	99.41
#80	2.50	0.18	6.28	4.34	7.14	95.07
#120	3.00	0.13	94.89	65.61	102.03	29.46
#170	3.50	0.09	37.41	25.87	139.44	3.59
#200	3.75	0.07	3.15	2.18	142.59	1.41
#230	4.00	0.06	0.53	0.37	143.12	1.04

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.47	3.26	3.09	2.84	2.65	2.58	2.50


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.87	0.14	0.32	-1.29	16.29

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-007 #S-1	—●—	-3.2	SP	#200 - 1.41 #230 - 1.04			2.84	2.87	-1.29	16.29	0.32	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,744,694
												Northing (Y, ft):	343,077
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-007 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,694</b>	Northing (ft): <b>343,077</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.7 MLLW</b>
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USCS: <b>SP-SM</b>	Munsell: <b>Moist - 5Y-5/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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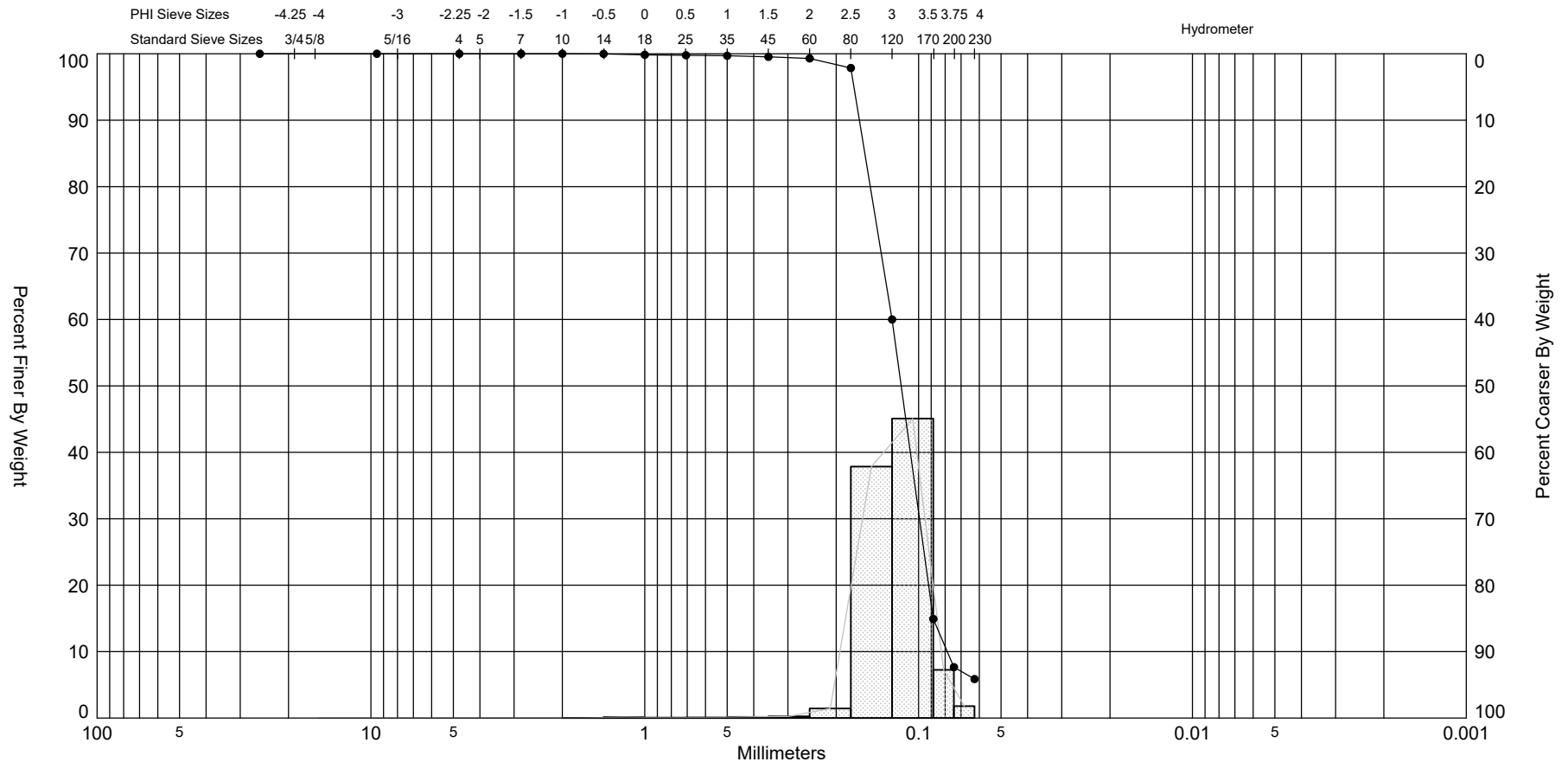
Dry Weight (g): <b>110.80</b>	Wash Weight (g): <b>104.31</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 7.66</b> <b>#230 - 5.87</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.00	0.00	0.00	100.00
#14	-0.50	1.41	0.02	0.02	0.02	99.98
#18	0.00	1.00	0.16	0.14	0.18	99.84
#25	0.50	0.71	0.07	0.06	0.25	99.78
#35	1.00	0.50	0.09	0.08	0.34	99.70
#45	1.50	0.35	0.18	0.16	0.52	99.54
#60	2.00	0.25	0.27	0.24	0.79	99.30
#80	2.50	0.18	1.60	1.44	2.39	97.86
#120	3.00	0.13	41.95	37.86	44.34	60.00
#170	3.50	0.09	49.95	45.08	94.29	14.92
#200	3.75	0.07	8.04	7.26	102.33	7.66
#230	4.00	0.06	1.98	1.79	104.31	5.87


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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.49	3.39	3.11	2.80	2.68	2.54
Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
	3.06	0.12	0.38	-1.84	16.82	

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-007 #S-2	—●—	-5.7	SP-SM	#200 - 7.66 #230 - 5.87			3.11	3.06	-1.84	16.82	0.38	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,694
												Northing (Y, ft):	343,077
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-007 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,694</b>	Northing (ft): <b>343,077</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.2 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>114.16</b>	Wash Weight (g): <b>112.72</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.57</b> <b>#230 - 1.26</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.00	0.00	0.00	100.00
#14	-0.50	1.41	0.00	0.00	0.00	100.00
#18	0.00	1.00	0.01	0.01	0.01	99.99
#25	0.50	0.71	0.03	0.03	0.04	99.96
#35	1.00	0.50	0.03	0.03	0.07	99.93
#45	1.50	0.35	0.05	0.04	0.12	99.89
#60	2.00	0.25	0.20	0.18	0.32	99.71
#80	2.50	0.18	4.00	3.50	4.32	96.21
#120	3.00	0.13	72.85	63.81	77.17	32.40
#170	3.50	0.09	32.90	28.82	110.07	3.58
#200	3.75	0.07	2.30	2.01	112.37	1.57
#230	4.00	0.06	0.35	0.31	112.72	1.26

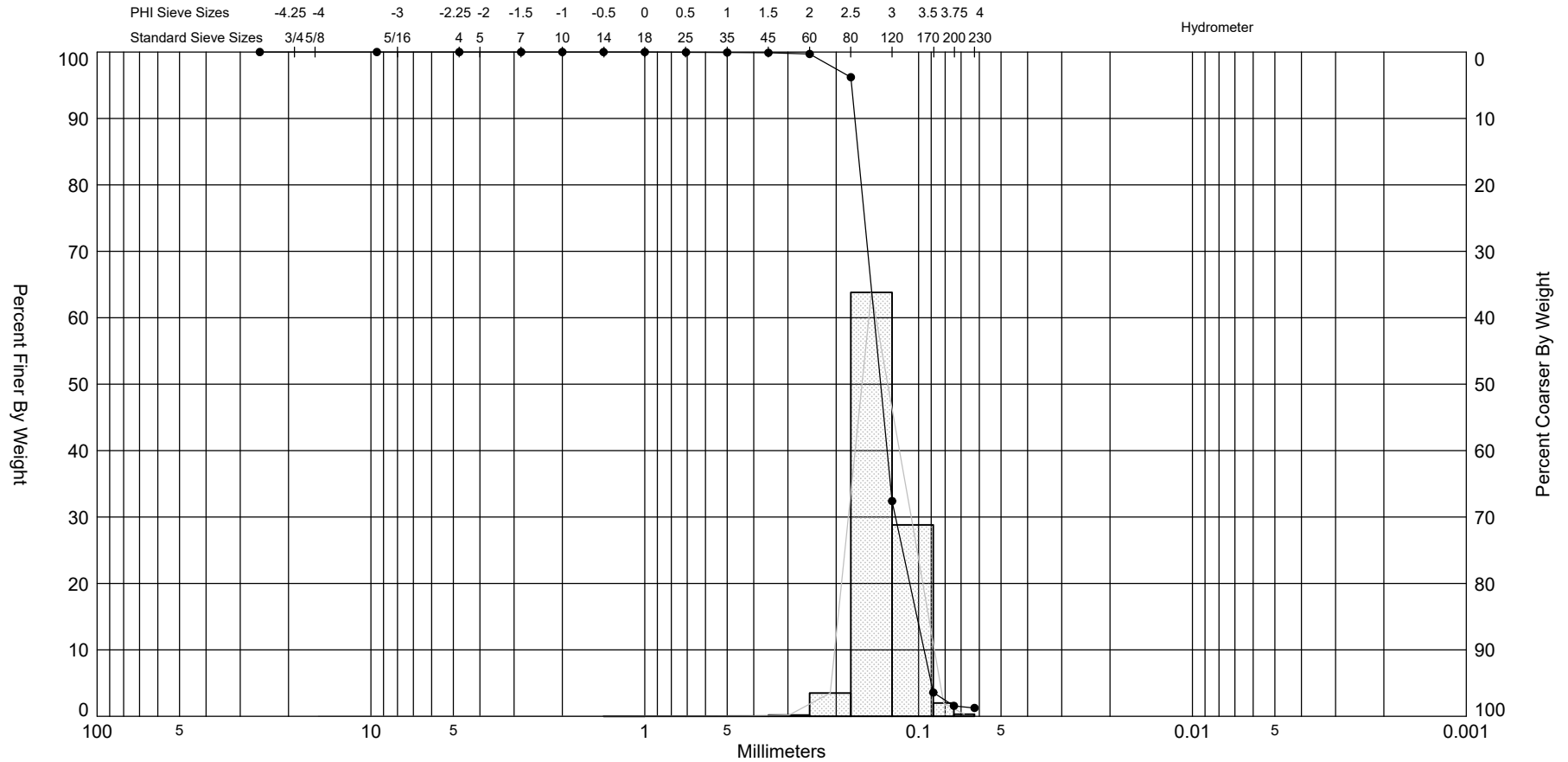
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.48	3.28	3.13	2.86	2.67	2.60	2.51


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.9	0.13	0.29	-0.11	7.14

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-007 #S-3	—●—	-8.2	SP	#200 - 1.57 #230 - 1.26			2.86	2.9	-0.11	7.14	0.29	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,694
												Northing (Y, ft):	343,077
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



**Granulometric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-007 #S-4

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,694</b>	Northing (ft): <b>343,077</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.4 MLLW</b>
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USCS: <b>SP-SM</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>126.74</b>	Wash Weight (g): <b>118.01</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 8.66</b> <b>#230 - 6.90</b>	Organics (%):	Carbonates (%):	Shells (%):
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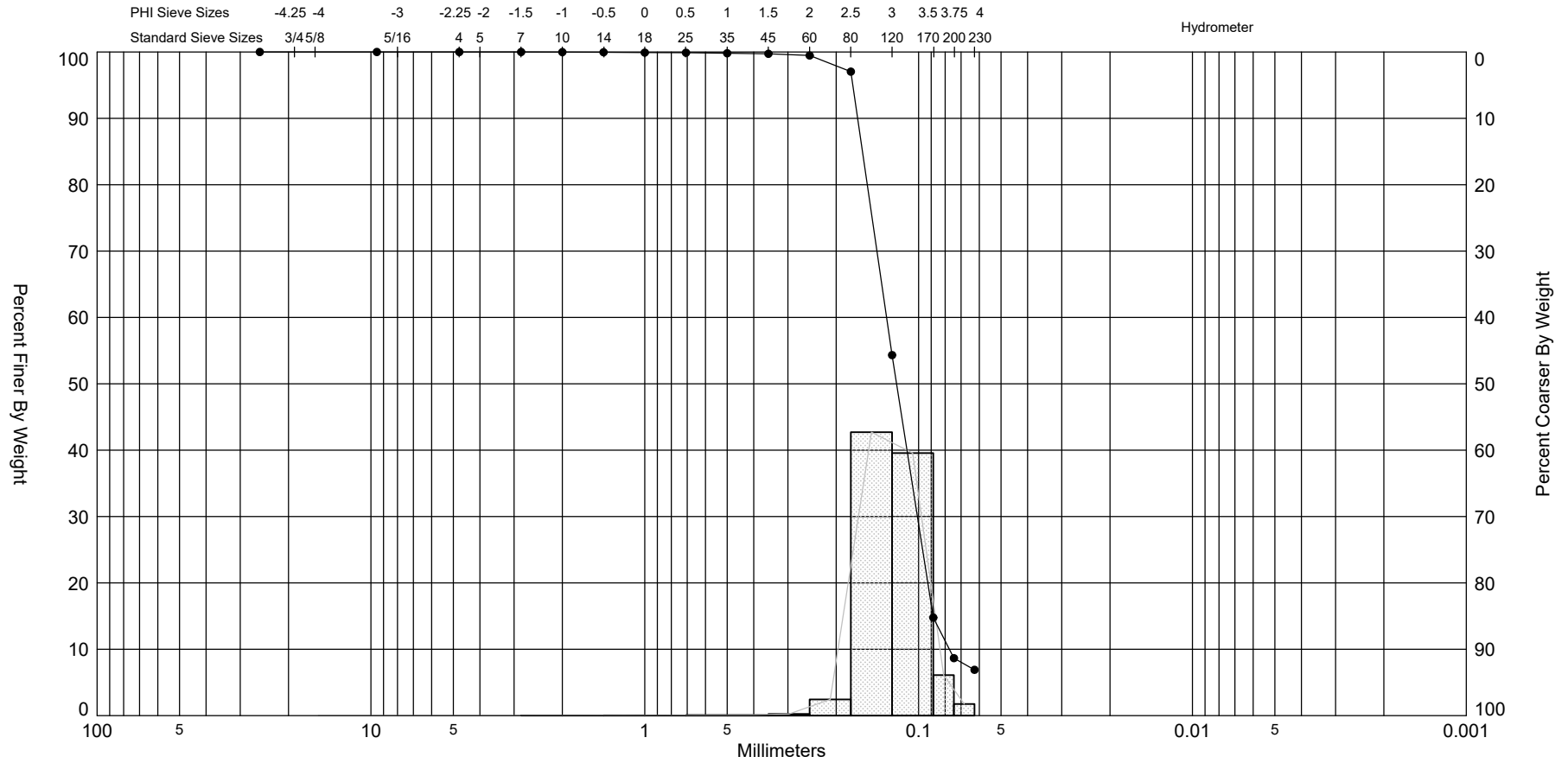
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.03	0.02	0.03	99.98
#14	-0.50	1.41	0.03	0.02	0.06	99.96
#18	0.00	1.00	0.06	0.05	0.12	99.91
#25	0.50	0.71	0.03	0.02	0.15	99.89
#35	1.00	0.50	0.10	0.08	0.25	99.81
#45	1.50	0.35	0.10	0.08	0.35	99.73
#60	2.00	0.25	0.33	0.26	0.68	99.47
#80	2.50	0.18	3.08	2.43	3.76	97.04
#120	3.00	0.13	54.13	42.71	57.89	54.33
#170	3.50	0.09	50.14	39.56	108.03	14.77
#200	3.75	0.07	7.75	6.11	115.78	8.66
#230	4.00	0.06	2.23	1.76	118.01	6.90

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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.48	3.37	3.05	2.76	2.65	2.52

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	3.02	0.12	0.37	-1.3	14.96

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-007 #S-4	●—	-9.4	SP-SM	#200 - 8.66 #230 - 6.90			3.05	3.02	-1.3	14.96	0.37	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL											Analysis Date:	07-29-22	
Depths and elevations based on measured values											Analyzed By:	CRM	
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800				Easting (X, ft):	2,744,694	
											Northing (Y, ft):	343,077	
											Horizontal System:	NAD 1983	
											Vertical System:	MLLW	

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-008 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,979</b>	Northing (ft): <b>341,792</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-6.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>140.22</b>	Wash Weight (g): <b>138.20</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.46</b> <b>#230 - 1.45</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.23	0.16	0.23	99.84
#7	-1.50	2.83	0.43	0.31	0.66	99.53
#10	-1.00	2.00	1.00	0.71	1.66	98.82
#14	-0.50	1.41	1.34	0.96	3.00	97.86
#18	0.00	1.00	2.21	1.58	5.21	96.28
#25	0.50	0.71	4.31	3.07	9.52	93.21
#35	1.00	0.50	9.44	6.73	18.96	86.48
#45	1.50	0.35	18.99	13.54	37.95	72.94
#60	2.00	0.25	48.45	34.55	86.40	38.39
#80	2.50	0.18	39.09	27.88	125.49	10.51
#120	3.00	0.13	10.86	7.74	136.35	2.77
#170	3.50	0.09	1.66	1.18	138.01	1.59
#200	3.75	0.07	0.18	0.13	138.19	1.46
#230	4.00	0.06	0.01	0.01	138.20	1.45

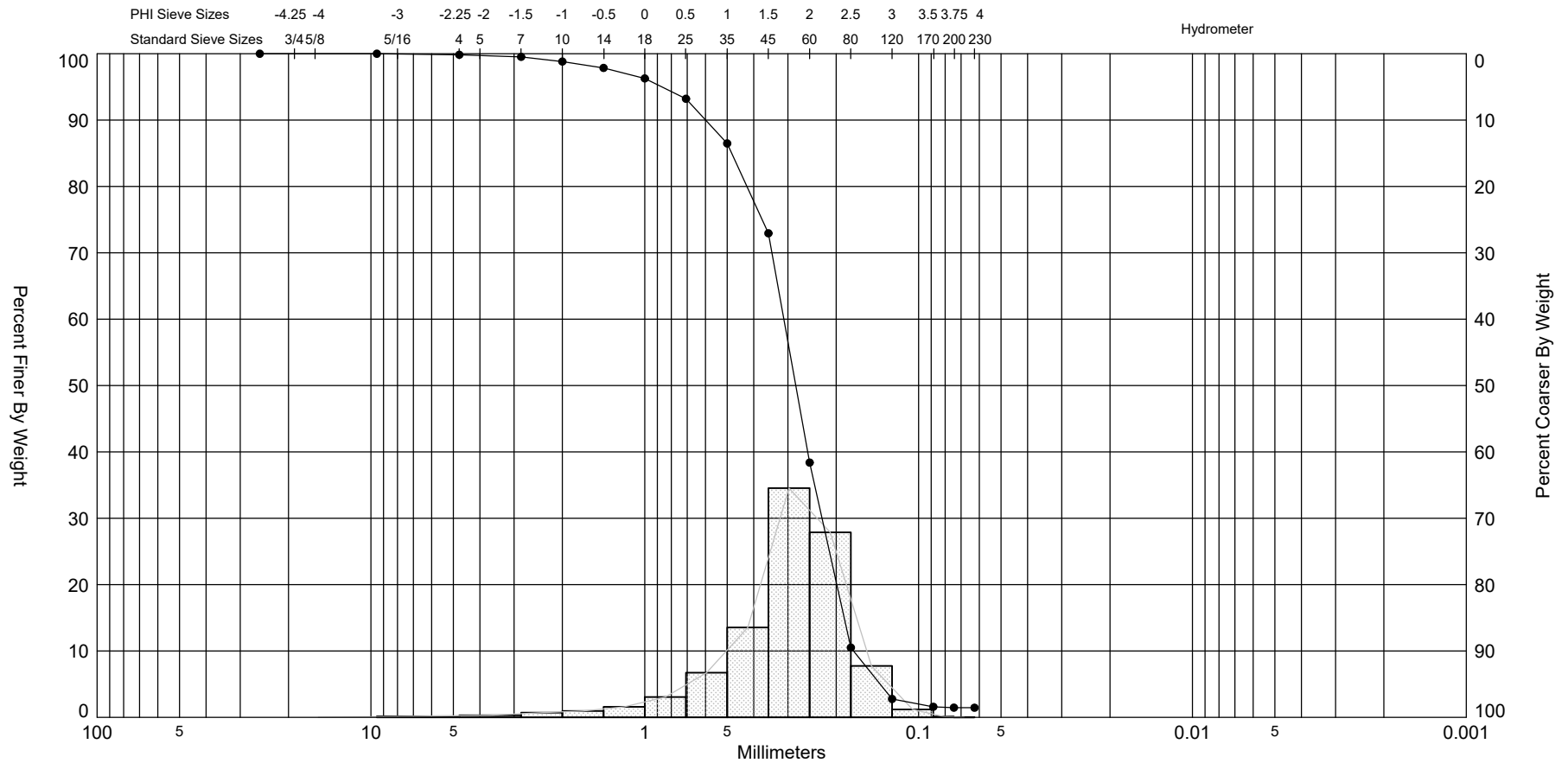
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.86	2.40	2.24	1.83	1.42	1.09	0.21


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.71	0.31	0.79	-1.5	7.17

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-008 #S-1	●—	-6.0	SP	#200 - 1.46 #230 - 1.45			1.83	1.71	-1.5	7.17	0.79	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,979
												Northing (Y, ft):	341,792
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-008 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,979</b>	Northing (ft): <b>341,792</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>138.41</b>	Wash Weight (g): <b>137.37</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.76</b> <b>#230 - 0.75</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.49	0.35	0.49	99.65
#7	-1.50	2.83	0.70	0.51	1.19	99.14
#10	-1.00	2.00	0.80	0.58	1.99	98.56
#14	-0.50	1.41	0.90	0.65	2.89	97.91
#18	0.00	1.00	1.67	1.21	4.56	96.70
#25	0.50	0.71	3.22	2.33	7.78	94.37
#35	1.00	0.50	10.25	7.41	18.03	86.96
#45	1.50	0.35	25.52	18.44	43.55	68.52
#60	2.00	0.25	36.42	26.31	79.97	42.21
#80	2.50	0.18	32.33	23.36	112.30	18.85
#120	3.00	0.13	21.93	15.84	134.23	3.01
#170	3.50	0.09	2.91	2.10	137.14	0.91
#200	3.75	0.07	0.21	0.15	137.35	0.76
#230	4.00	0.06	0.02	0.01	137.37	0.75

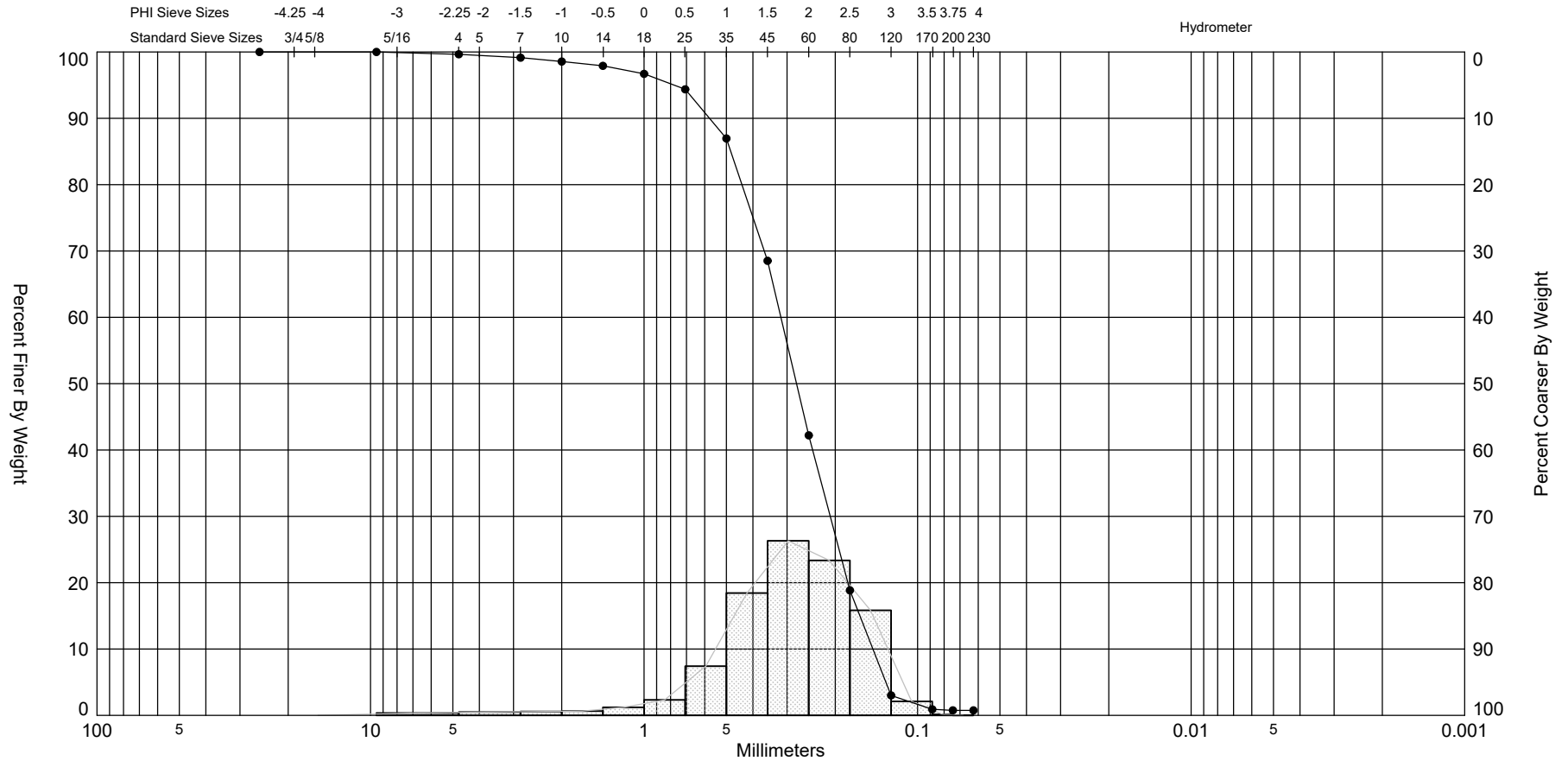
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.94	2.59	2.37	1.85	1.32	1.08	0.36


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.77	0.29	0.85	-1.4	7.25

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-008 #S-2	●—	-7.5	SP	#200 - 0.76 #230 - 0.75			1.85	1.77	-1.4	7.25	0.85	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,744,979
												Northing (Y, ft):	341,792
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-008 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,744,979</b>	Northing (ft): <b>341,792</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-10.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>138.96</b>	Wash Weight (g): <b>137.68</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.02</b> <b>#230 - 0.91</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.04	0.03	0.04	99.97
#7	-1.50	2.83	0.47	0.34	0.51	99.63
#10	-1.00	2.00	0.69	0.50	1.20	99.13
#14	-0.50	1.41	0.83	0.60	2.03	98.53
#18	0.00	1.00	0.91	0.65	2.94	97.88
#25	0.50	0.71	1.43	1.03	4.37	96.85
#35	1.00	0.50	3.41	2.45	7.78	94.40
#45	1.50	0.35	7.04	5.07	14.82	89.33
#60	2.00	0.25	26.16	18.83	40.98	70.50
#80	2.50	0.18	57.93	41.69	98.91	28.81
#120	3.00	0.13	32.96	23.72	131.87	5.09
#170	3.50	0.09	5.16	3.71	137.03	1.38
#200	3.75	0.07	0.50	0.36	137.53	1.02
#230	4.00	0.06	0.15	0.11	137.68	0.91

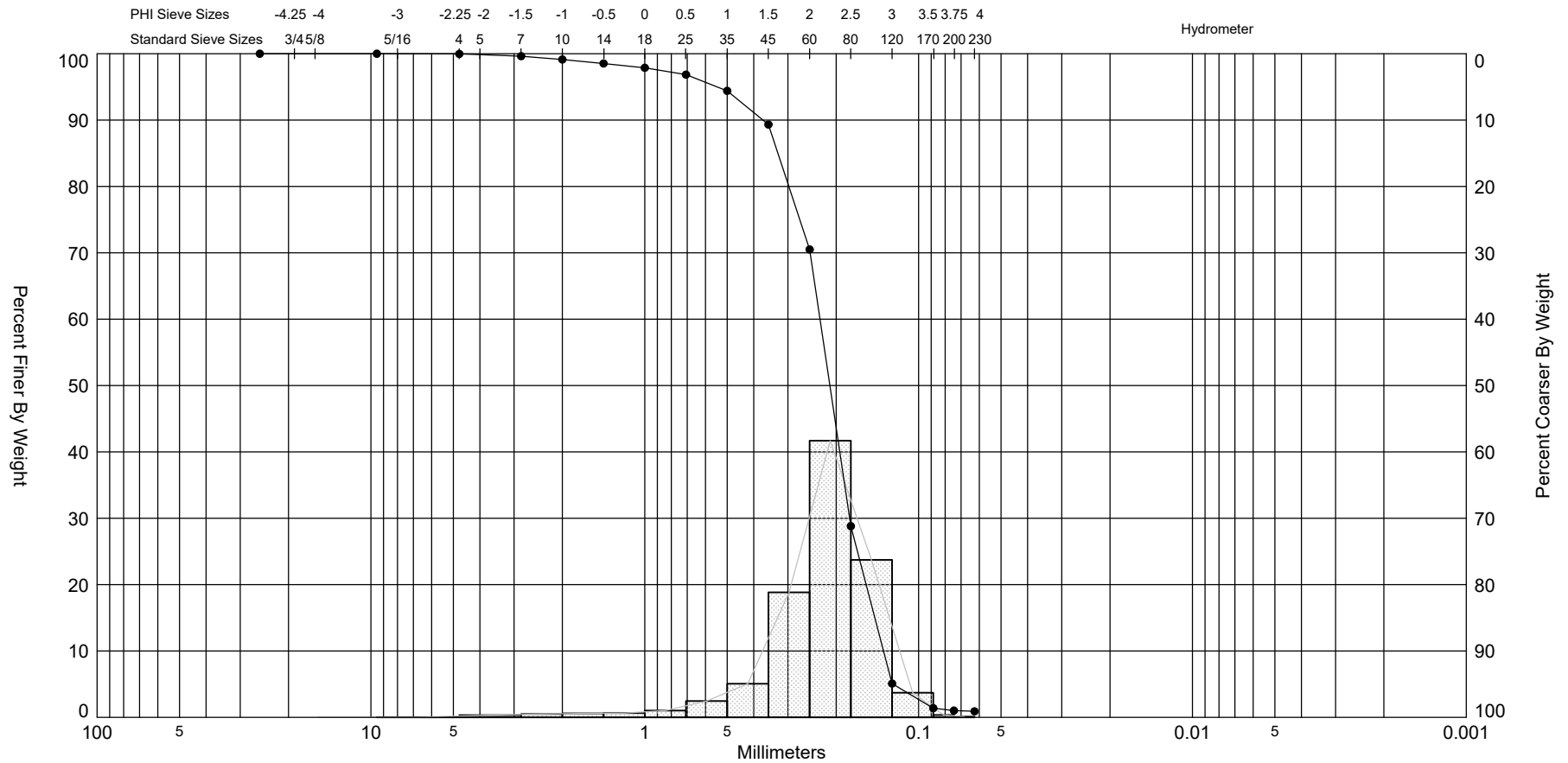
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.01	2.77	2.58	2.25	1.88	1.64	0.88


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.14	0.23	0.72	-2.04	10.37

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-008 #S-3	●—	-10.5	SP	#200 - 1.02 #230 - 0.91			2.25	2.14	-2.04	10.37	0.72	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,979
												Northing (Y, ft):	341,792
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-009 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,746,455</b>	Northing (ft): <b>334,798</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-2.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>141.47</b>	Wash Weight (g): <b>140.42</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.78</b> <b>#230 - 0.75</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.08	0.06	0.08	99.94
#10	-1.00	2.00	0.14	0.10	0.22	99.84
#14	-0.50	1.41	0.55	0.39	0.77	99.45
#18	0.00	1.00	1.02	0.72	1.79	98.73
#25	0.50	0.71	2.89	2.04	4.68	96.69
#35	1.00	0.50	8.66	6.12	13.34	90.57
#45	1.50	0.35	18.51	13.08	31.85	77.49
#60	2.00	0.25	41.61	29.41	73.46	48.08
#80	2.50	0.18	48.35	34.18	121.81	13.90
#120	3.00	0.13	17.18	12.14	138.99	1.76
#170	3.50	0.09	1.39	0.98	140.38	0.78
#200	3.75	0.07	0.00	0.00	140.38	0.78
#230	4.00	0.06	0.04	0.03	140.42	0.75

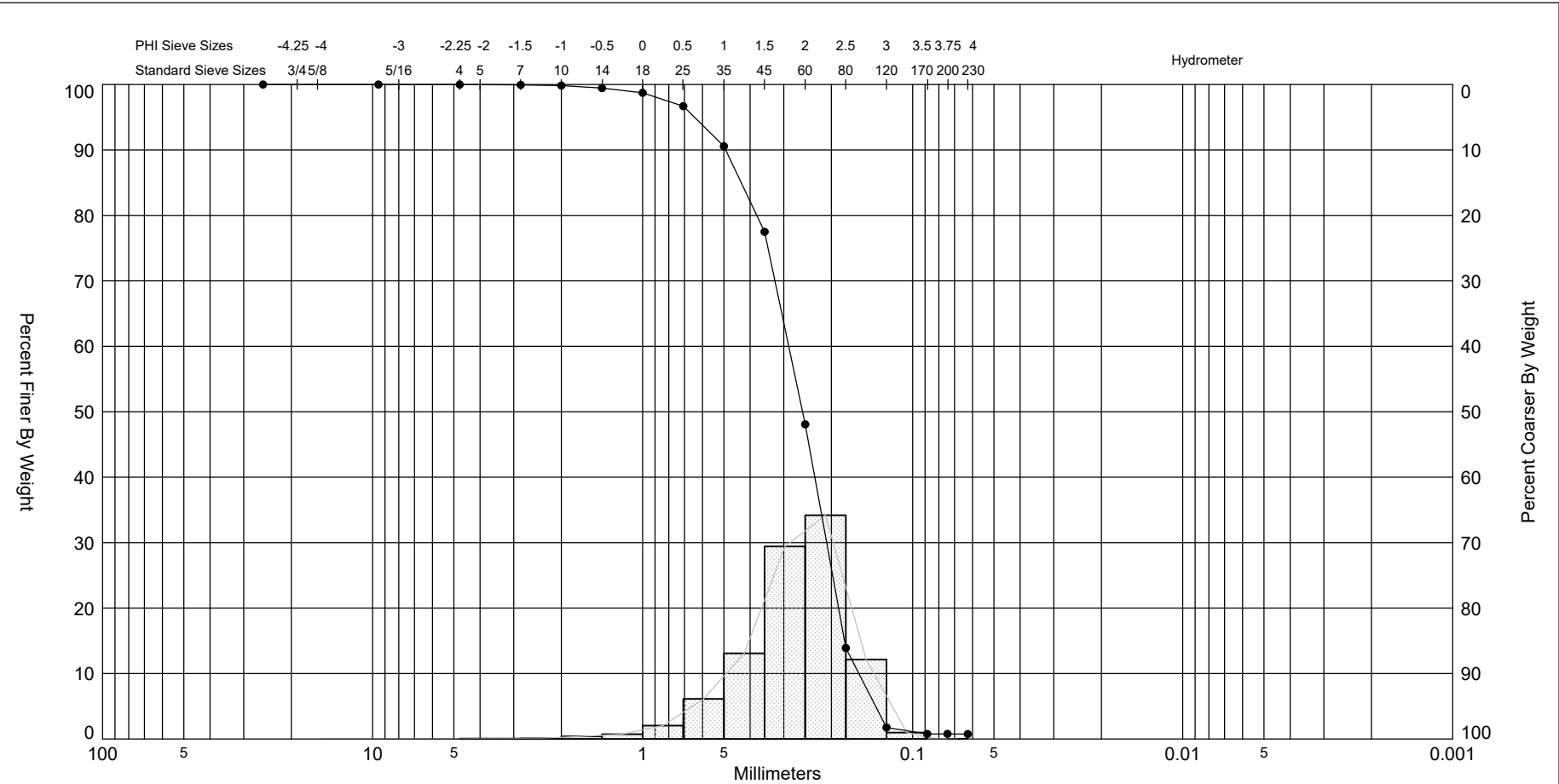
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.87	2.47	2.34	1.97	1.54	1.25	0.64


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.87	0.27	0.65	-0.99	5.02

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-009 #S-1	●—	-2.1	SP	#200 - 0.75 #230 - 0.75			1.97	1.87	-0.99	5.02	0.65	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Eastings (X, ft):	2,746,455
												Northing (Y, ft):	334,798
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-009 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,746,455</b>	Northing (ft): <b>334,798</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-3.6 MLLW</b>
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USCS: <b>SM</b>	Munsell: <b>Moist - 5Y-4/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>168.17</b>	Wash Weight (g): <b>128.07</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 24.93</b> <b>#230 - 23.83</b>	Organics (%):	Carbonates (%):	Shells (%):
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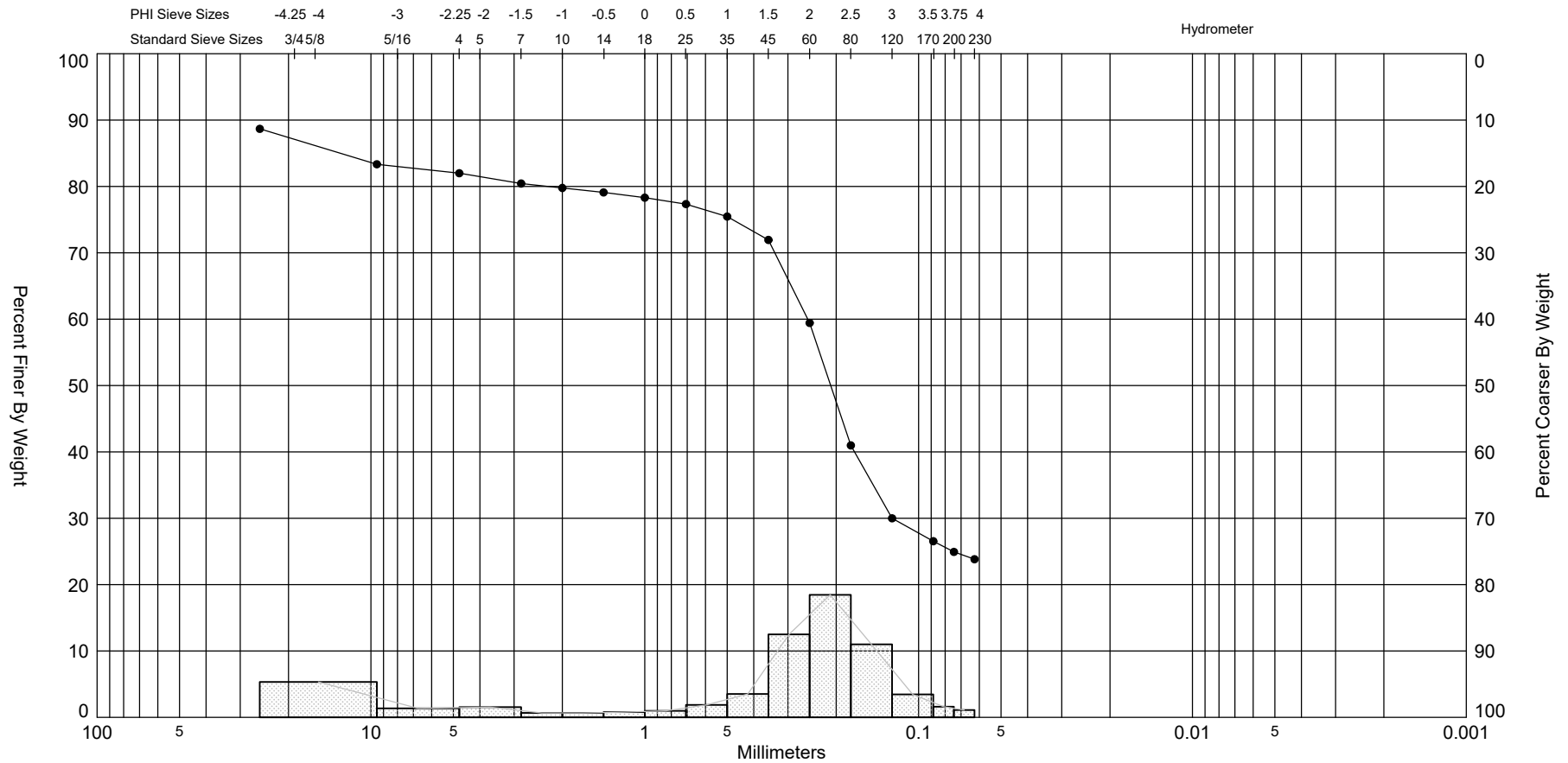
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	19.03	11.32	19.03	88.68
3/8	-3.25	9.51	8.98	5.34	28.01	83.34
#4	-2.25	4.76	2.27	1.35	30.28	81.99
#7	-1.50	2.83	2.60	1.55	32.88	80.44
#10	-1.00	2.00	1.13	0.67	34.01	79.77
#14	-0.50	1.41	1.12	0.67	35.13	79.10
#18	0.00	1.00	1.33	0.79	36.46	78.31
#25	0.50	0.71	1.63	0.97	38.09	77.34
#35	1.00	0.50	3.16	1.88	41.25	75.46
#45	1.50	0.35	5.92	3.52	47.17	71.94
#60	2.00	0.25	21.03	12.51	68.20	59.43
#80	2.50	0.18	31.03	18.45	99.23	40.98
#120	3.00	0.13	18.48	10.99	117.71	29.99
#170	3.50	0.09	5.81	3.45	123.52	26.54
#200	3.75	0.07	2.70	1.61	126.22	24.93
#230	4.00	0.06	1.85	1.10	128.07	23.83

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
		3.74	2.26	1.07	-3.43	


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.4	0.76	2.09	-0.06	2.25

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-009 #S-2	—●—	-3.6	SM	#200 - 24.93 #230 - 23.83			2.26	0.4	-0.06	2.25	2.09	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,746,455
												Northing (Y, ft):	334,798
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-009 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,746,455</b>	Northing (ft): <b>334,798</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.3 MLLW</b>
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USCS: <b>SM</b>	Munsell: <b>Moist - 5Y-5/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>144.07</b>	Wash Weight (g): <b>90.27</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 38.96</b> <b>#230 - 37.36</b>	Organics (%):	Carbonates (%):	Shells (%):
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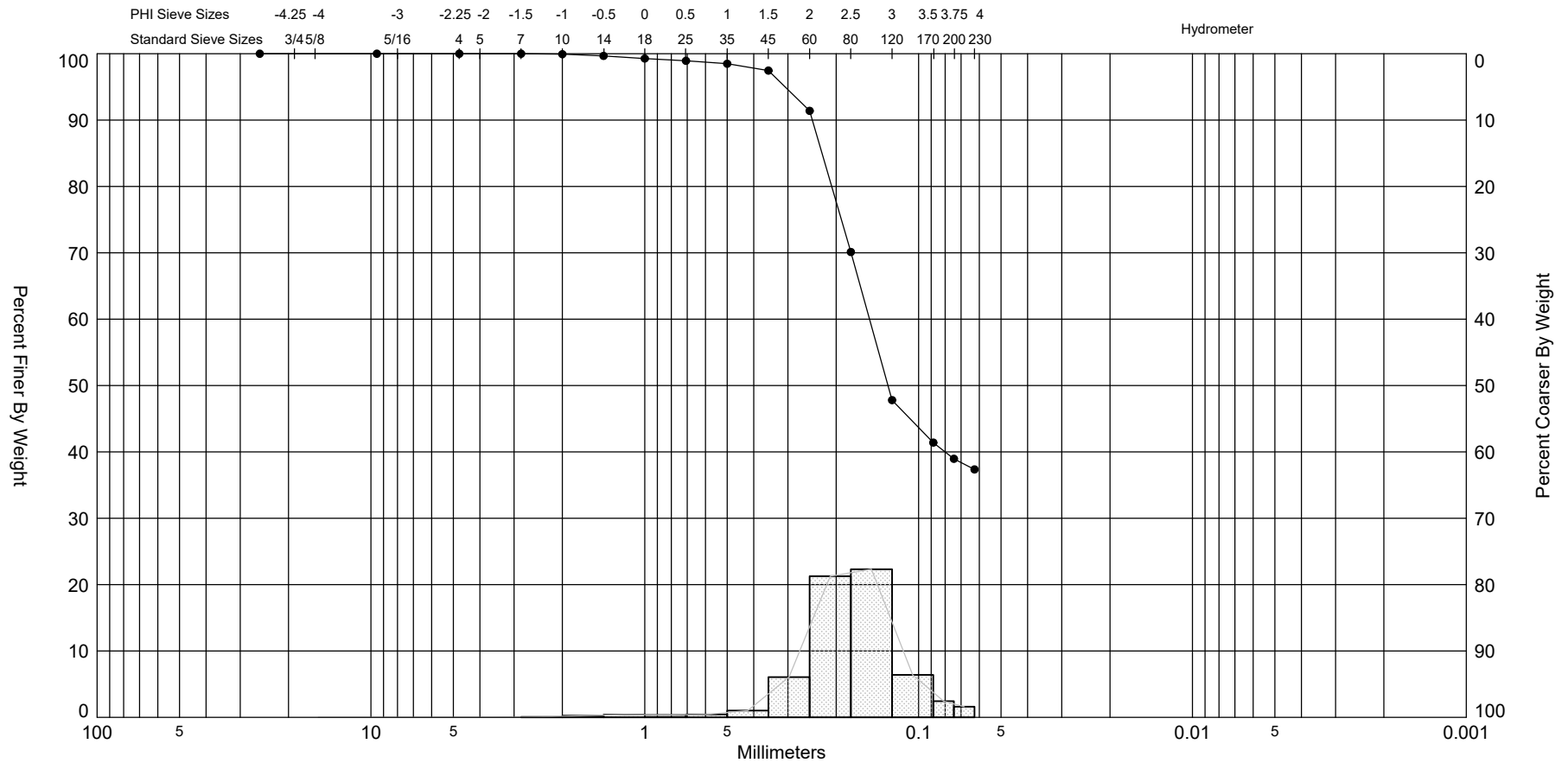
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.10	0.07	0.10	99.93
#14	-0.50	1.41	0.38	0.26	0.48	99.67
#18	0.00	1.00	0.56	0.39	1.04	99.28
#25	0.50	0.71	0.51	0.35	1.55	98.93
#35	1.00	0.50	0.64	0.44	2.19	98.49
#45	1.50	0.35	1.49	1.03	3.68	97.46
#60	2.00	0.25	8.75	6.07	12.43	91.39
#80	2.50	0.18	30.65	21.27	43.08	70.12
#120	3.00	0.13	32.15	22.32	75.23	47.80
#170	3.50	0.09	9.22	6.40	84.45	41.40
#200	3.75	0.07	3.52	2.44	87.97	38.96
#230	4.00	0.06	2.30	1.60	90.27	37.36

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
			2.95	2.39	2.17	1.70


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.51	0.18	0.66	-1.22	8.01

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-009 #S-3	●—	-5.3	SM	#200 - 38.96 #230 - 37.36			2.95	2.51	-1.22	8.01	0.66	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Eastings (X, ft):	2,746,455
												Northing (Y, ft):	334,798
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-009 #S-4

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,746,455</b>	Northing (ft): <b>334,798</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.6 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>134.55</b>	Wash Weight (g): <b>132.75</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.43</b> <b>#230 - 1.36</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.58	0.43	0.58	99.57
#4	-2.25	4.76	0.18	0.13	0.76	99.44
#7	-1.50	2.83	0.61	0.45	1.37	98.99
#10	-1.00	2.00	0.58	0.43	1.95	98.56
#14	-0.50	1.41	0.73	0.54	2.68	98.02
#18	0.00	1.00	1.26	0.94	3.94	97.08
#25	0.50	0.71	2.06	1.53	6.00	95.55
#35	1.00	0.50	3.74	2.78	9.74	92.77
#45	1.50	0.35	5.40	4.01	15.14	88.76
#60	2.00	0.25	17.84	13.26	32.98	75.50
#80	2.50	0.18	58.83	43.72	91.81	31.78
#120	3.00	0.13	36.73	27.30	128.54	4.48
#170	3.50	0.09	3.85	2.86	132.39	1.62
#200	3.75	0.07	0.26	0.19	132.65	1.43
#230	4.00	0.06	0.10	0.07	132.75	1.36

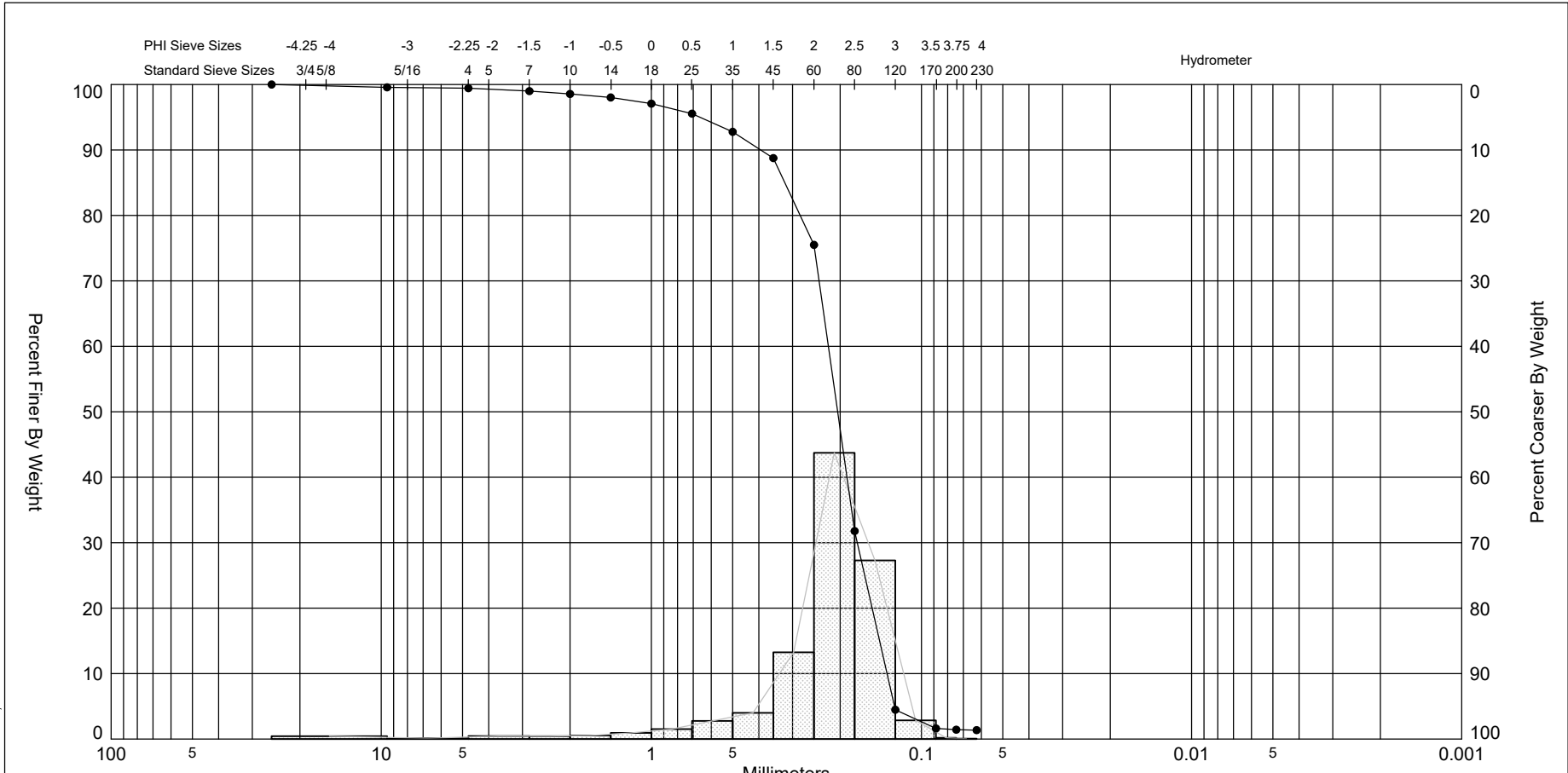
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.99	2.79	2.62	2.29	2.01	1.68	0.60


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.13	0.23	0.86	-3.14	17.99

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-009 #S-4	●—	-8.6	SP	#200 - 1.43 #230 - 1.36			2.29	2.13	-3.14	17.99	0.86	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,746,455
												Northing (Y, ft):	334,798
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



**Granulometric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-010 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,745,857</b>	Northing (ft): <b>332,507</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-6.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>123.31</b>	Wash Weight (g): <b>121.87</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.19</b> <b>#230 - 1.17</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.07	0.06	0.07	99.94
#7	-1.50	2.83	0.33	0.27	0.40	99.67
#10	-1.00	2.00	0.21	0.17	0.61	99.50
#14	-0.50	1.41	0.22	0.18	0.83	99.32
#18	0.00	1.00	0.40	0.32	1.23	99.00
#25	0.50	0.71	0.66	0.54	1.89	98.46
#35	1.00	0.50	1.48	1.20	3.37	97.26
#45	1.50	0.35	4.60	3.73	7.97	93.53
#60	2.00	0.25	32.64	26.47	40.61	67.06
#80	2.50	0.18	64.83	52.57	105.44	14.49
#120	3.00	0.13	15.37	12.46	120.81	2.03
#170	3.50	0.09	0.94	0.76	121.75	1.27
#200	3.75	0.07	0.10	0.08	121.85	1.19
#230	4.00	0.06	0.02	0.02	121.87	1.17

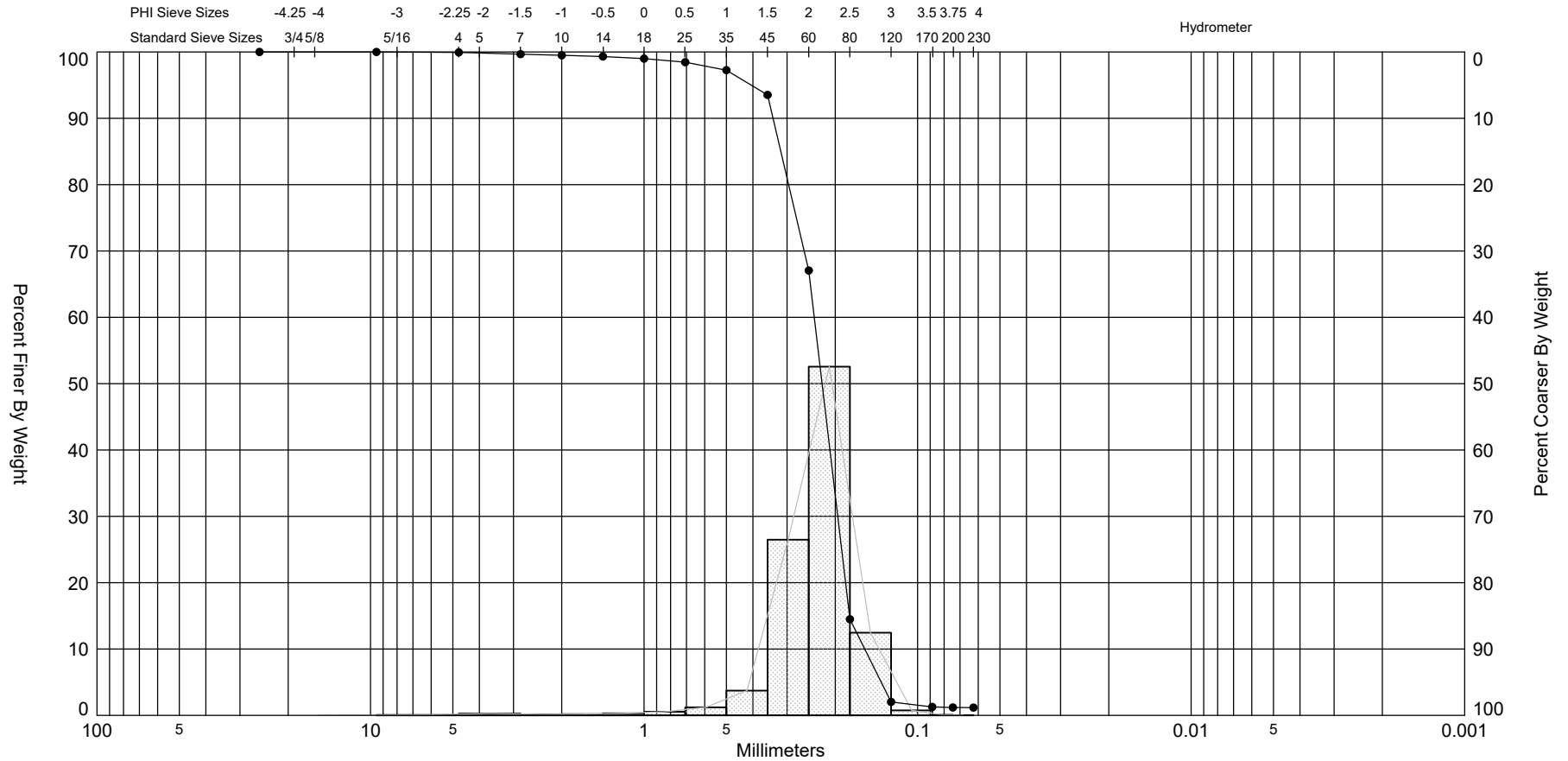
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.88	2.49	2.40	2.16	1.85	1.68	1.30


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.09	0.23	0.54	-2.74	19.18

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-010 #S-1	●—	-6.0	SP	#200 - 1.19 #230 - 1.17			2.16	2.09	-2.74	19.18	0.54	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							<b>Athena Technologies, Inc.</b> 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,745,857
												Northing (Y, ft):	332,507
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-010 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,745,857</b>	Northing (ft): <b>332,507</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>143.84</b>	Wash Weight (g): <b>142.57</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.89</b> <b>#230 - 0.86</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.57	0.40	0.57	99.60
#10	-1.00	2.00	0.17	0.12	0.74	99.48
#14	-0.50	1.41	0.18	0.13	0.92	99.35
#18	0.00	1.00	0.24	0.17	1.16	99.18
#25	0.50	0.71	0.34	0.24	1.50	98.94
#35	1.00	0.50	0.85	0.59	2.35	98.35
#45	1.50	0.35	2.92	2.03	5.27	96.32
#60	2.00	0.25	31.65	22.00	36.92	74.32
#80	2.50	0.18	82.07	57.06	118.99	17.26
#120	3.00	0.13	22.12	15.38	141.11	1.88
#170	3.50	0.09	1.35	0.94	142.46	0.94
#200	3.75	0.07	0.07	0.05	142.53	0.89
#230	4.00	0.06	0.04	0.03	142.57	0.86

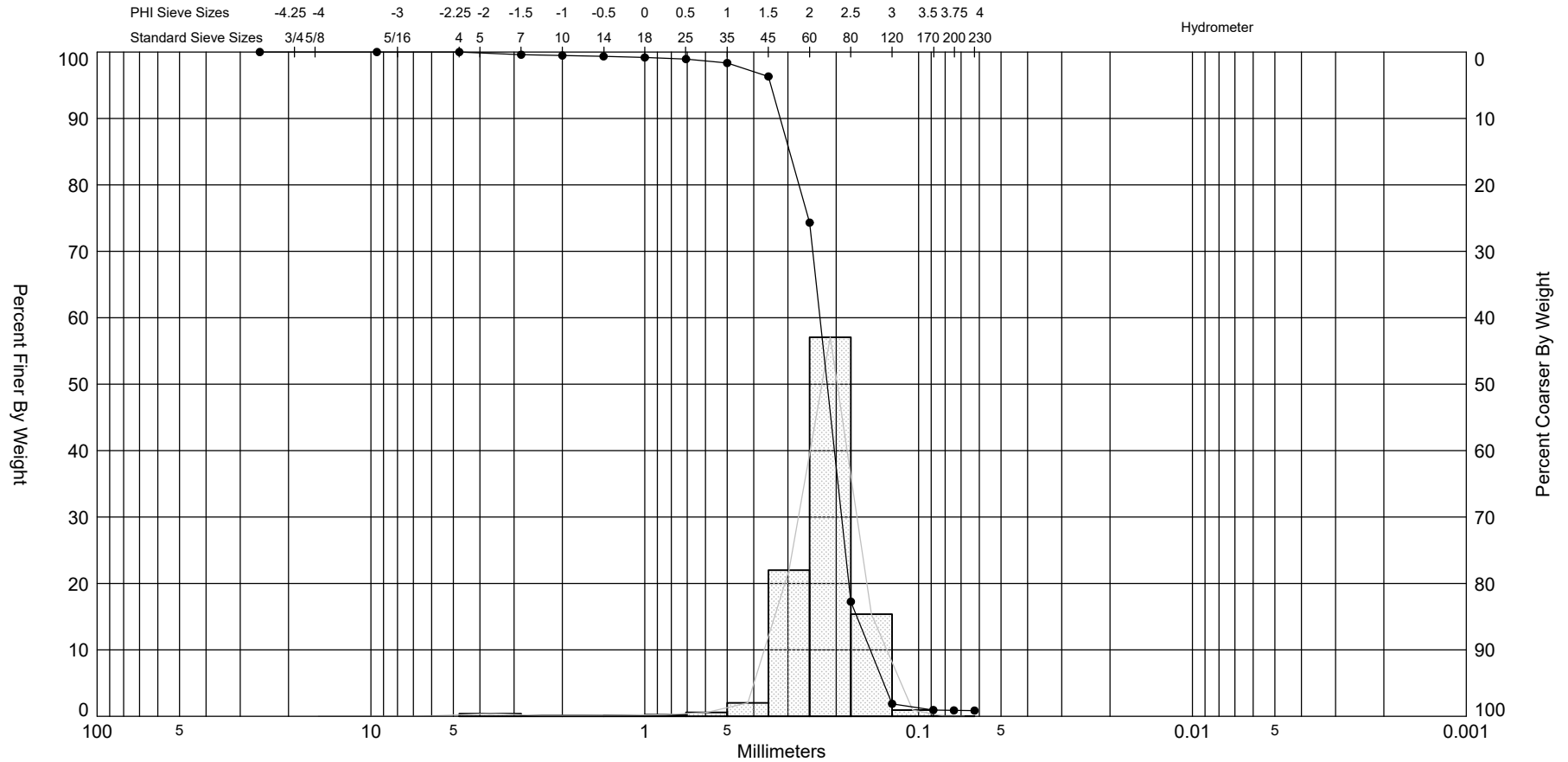
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.90	2.54	2.43	2.21	1.98	1.78	1.53


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.16	0.22	0.5	-3.15	24.57

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-010 #S-2	—●—	-8.0	SP	#200 - 0.89 #230 - 0.86			2.21	2.16	-3.15	24.57	0.5	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,745,857
												Northing (Y, ft):	332,507
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-010 #S-3

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,745,857</b>	Northing (ft): <b>332,507</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-10.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>90.96</b>	Wash Weight (g): <b>89.88</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.22</b> <b>#230 - 1.19</b>	Organics (%):	Carbonates (%):	Shells (%):
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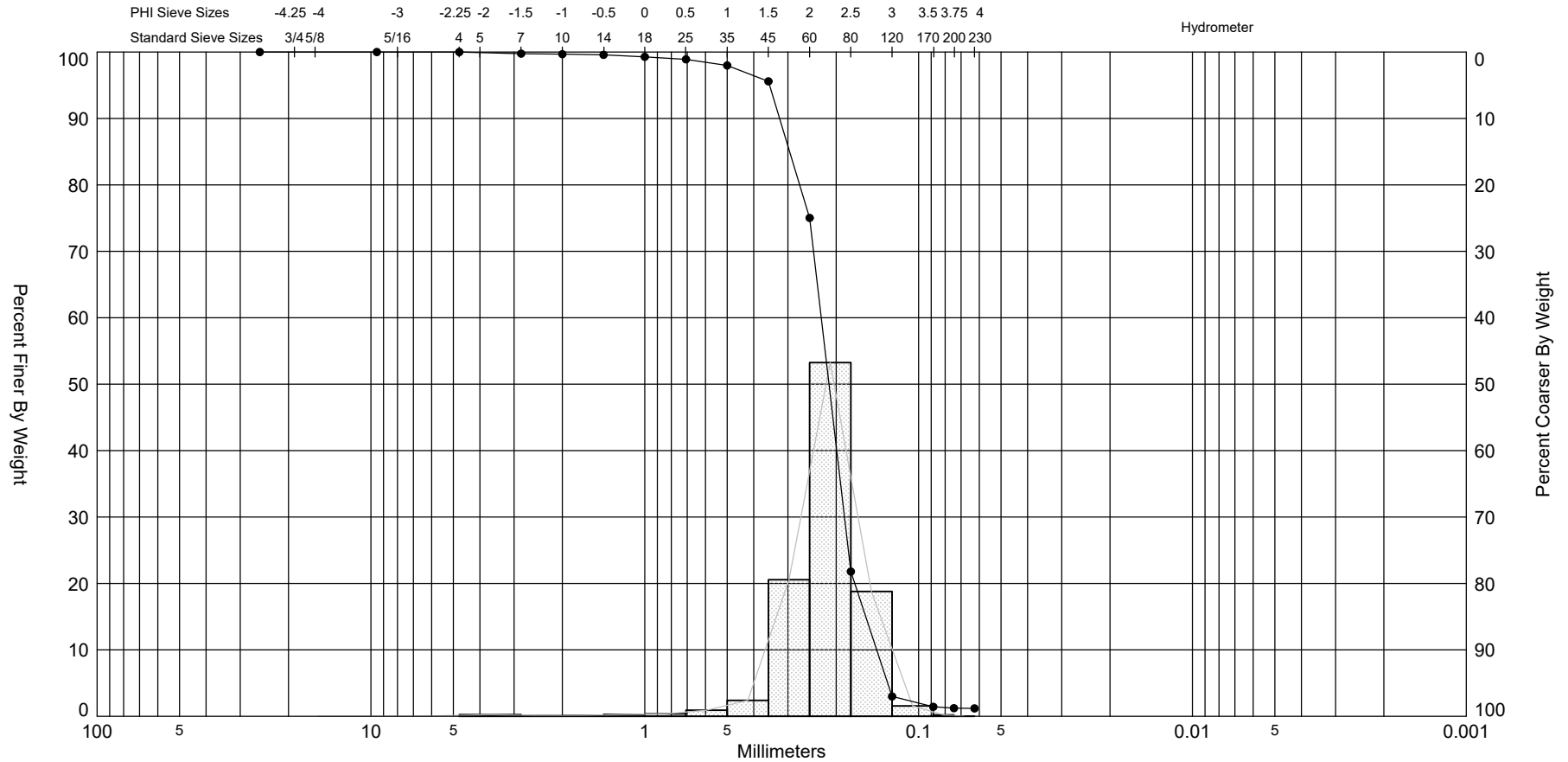
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.22	0.24	0.22	99.76
#10	-1.00	2.00	0.07	0.08	0.29	99.68
#14	-0.50	1.41	0.09	0.10	0.38	99.58
#18	0.00	1.00	0.27	0.30	0.65	99.28
#25	0.50	0.71	0.35	0.38	1.00	98.90
#35	1.00	0.50	0.84	0.92	1.84	97.98
#45	1.50	0.35	2.17	2.39	4.01	95.59
#60	2.00	0.25	18.70	20.56	22.71	75.03
#80	2.50	0.18	48.43	53.24	71.14	21.79
#120	3.00	0.13	17.10	18.80	88.24	2.99
#170	3.50	0.09	1.42	1.56	89.66	1.43
#200	3.75	0.07	0.19	0.21	89.85	1.22
#230	4.00	0.06	0.03	0.03	89.88	1.19

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.95	2.65	2.47	2.24	2.00	1.78	1.51


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.19	0.22	0.51	-2.31	17.21

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-010 #S-3	—●—	-10.0	SP	#200 - 1.22 #230 - 1.19			2.24	2.19	-2.31	17.21	0.51	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,745,857
												Northing (Y, ft):	332,507
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-011 #S-1

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,745,172</b>	Northing (ft): <b>331,247</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-3.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>115.53</b>	Wash Weight (g): <b>114.55</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.89</b> <b>#230 - 0.86</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.14	0.12	0.14	99.88
#10	-1.00	2.00	0.04	0.03	0.18	99.85
#14	-0.50	1.41	0.08	0.07	0.26	99.78
#18	0.00	1.00	0.06	0.05	0.32	99.73
#25	0.50	0.71	0.05	0.04	0.37	99.69
#35	1.00	0.50	0.13	0.11	0.50	99.58
#45	1.50	0.35	0.29	0.25	0.79	99.33
#60	2.00	0.25	7.97	6.90	8.76	92.43
#80	2.50	0.18	68.29	59.11	77.05	33.32
#120	3.00	0.13	34.77	30.10	111.82	3.22
#170	3.50	0.09	2.53	2.19	114.35	1.03
#200	3.75	0.07	0.16	0.14	114.51	0.89
#230	4.00	0.06	0.04	0.03	114.55	0.86

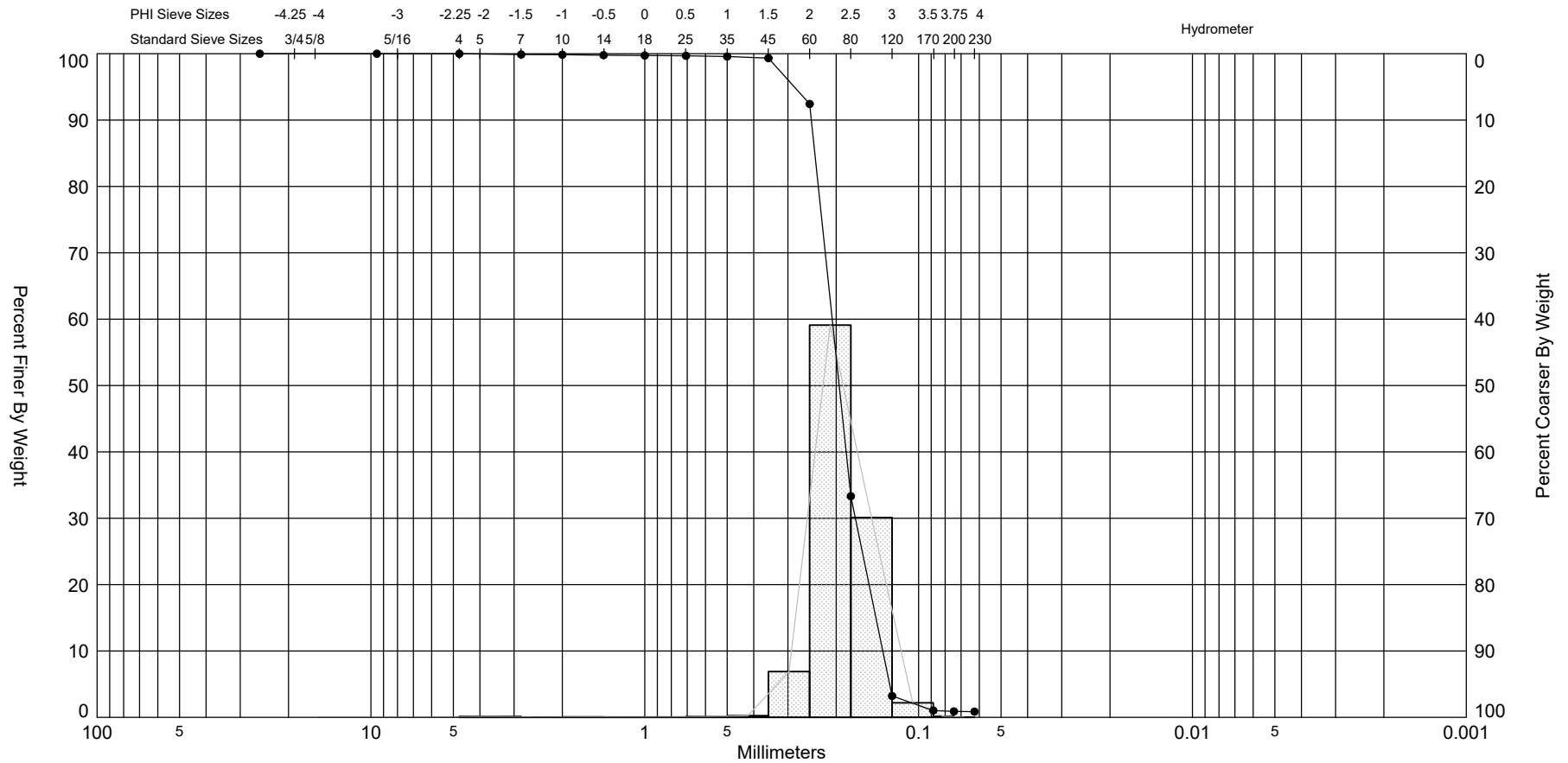
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.97	2.79	2.64	2.36	2.15	2.07	1.81


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.38	0.19	0.38	-2.52	29.16

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-011 #S-1	—●—	-3.1	SP	#200 - 0.89 #230 - 0.86			2.36	2.38	-2.52	29.16	0.38	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,745,172
												Northing (Y, ft):	331,247
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-011 #S-2

Analysis Date: 07-29-22

Analyzed By: CRM

Easting (ft): <b>2,745,172</b>	Northing (ft): <b>331,247</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>162.39</b>	Wash Weight (g): <b>157.90</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 2.93</b> <b>#230 - 2.76</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.07	0.04	0.07	99.96
#10	-1.00	2.00	0.18	0.11	0.25	99.85
#14	-0.50	1.41	0.14	0.09	0.39	99.76
#18	0.00	1.00	0.27	0.17	0.66	99.59
#25	0.50	0.71	0.35	0.22	1.01	99.37
#35	1.00	0.50	0.55	0.34	1.56	99.03
#45	1.50	0.35	0.90	0.55	2.46	98.48
#60	2.00	0.25	15.29	9.42	17.75	89.06
#80	2.50	0.18	78.99	48.64	96.74	40.42
#120	3.00	0.13	54.05	33.28	150.79	7.14
#170	3.50	0.09	5.91	3.64	156.70	3.50
#200	3.75	0.07	0.93	0.57	157.63	2.93
#230	4.00	0.06	0.27	0.17	157.90	2.76

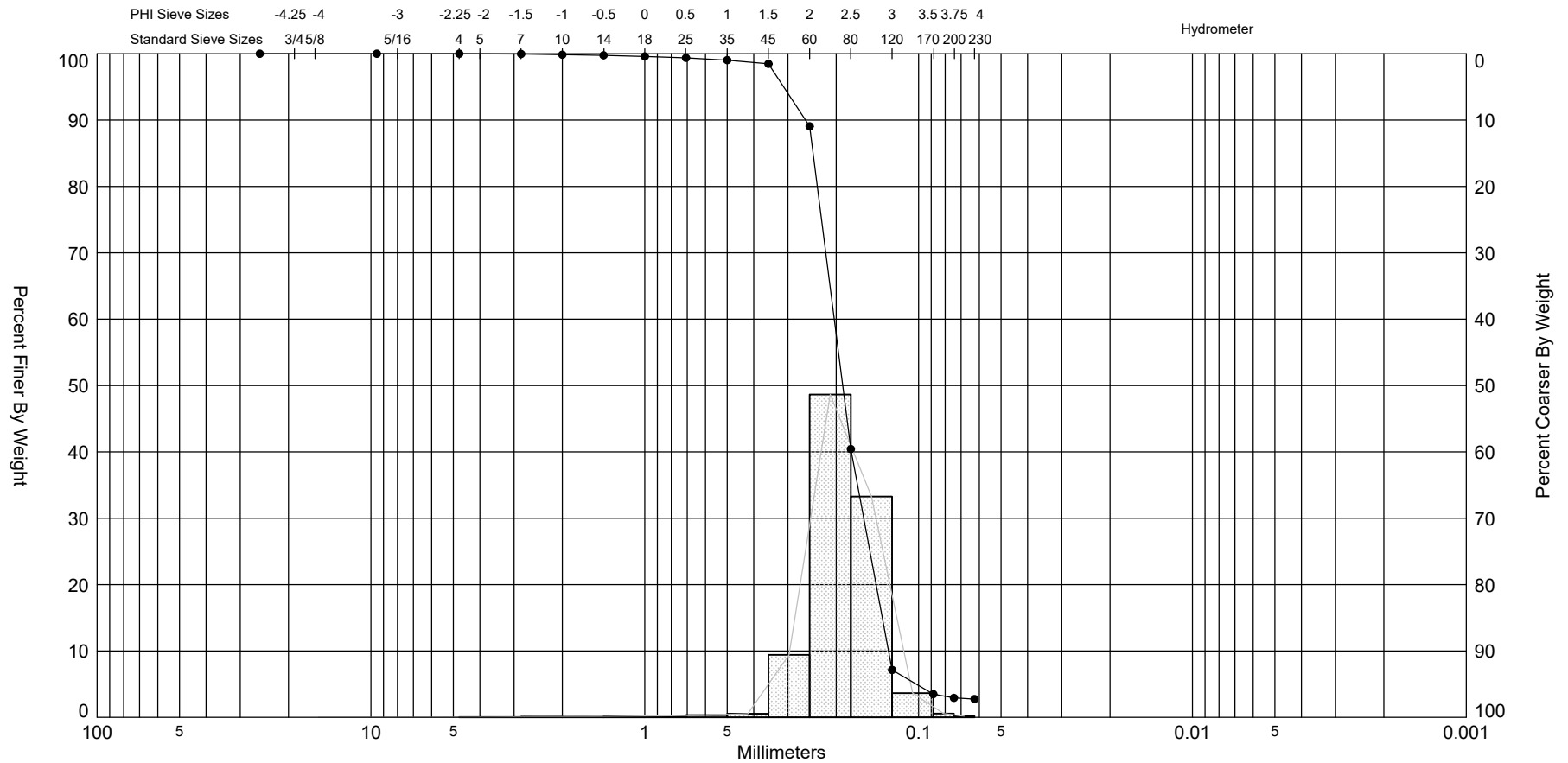
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.29	2.87	2.73	2.40	2.14	2.05	1.68


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.39	0.19	0.45	-1.79	15.8

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-011 #S-2	—●—	-5.1	SP	#200 - 2.93 #230 - 2.76			2.4	2.39	-1.79	15.8	0.45	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	07-29-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,745,172
												Northing (Y, ft):	331,247
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-011 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,745,172</b>	Northing (ft): <b>331,247</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>150.41</b>	Wash Weight (g): <b>148.35</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.69</b> <b>#230 - 1.36</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.03	0.02	0.03	99.98
#14	-0.50	1.41	0.04	0.03	0.07	99.95
#18	0.00	1.00	0.10	0.07	0.17	99.88
#25	0.50	0.71	0.10	0.07	0.27	99.81
#35	1.00	0.50	0.14	0.09	0.41	99.72
#45	1.50	0.35	0.26	0.17	0.67	99.55
#60	2.00	0.25	3.46	2.30	4.13	97.25
#80	2.50	0.18	42.19	28.05	46.32	69.20
#120	3.00	0.13	74.01	49.21	120.33	19.99
#170	3.50	0.09	24.47	16.27	144.80	3.72
#200	3.75	0.07	3.05	2.03	147.85	1.69
#230	4.00	0.06	0.50	0.33	148.35	1.36

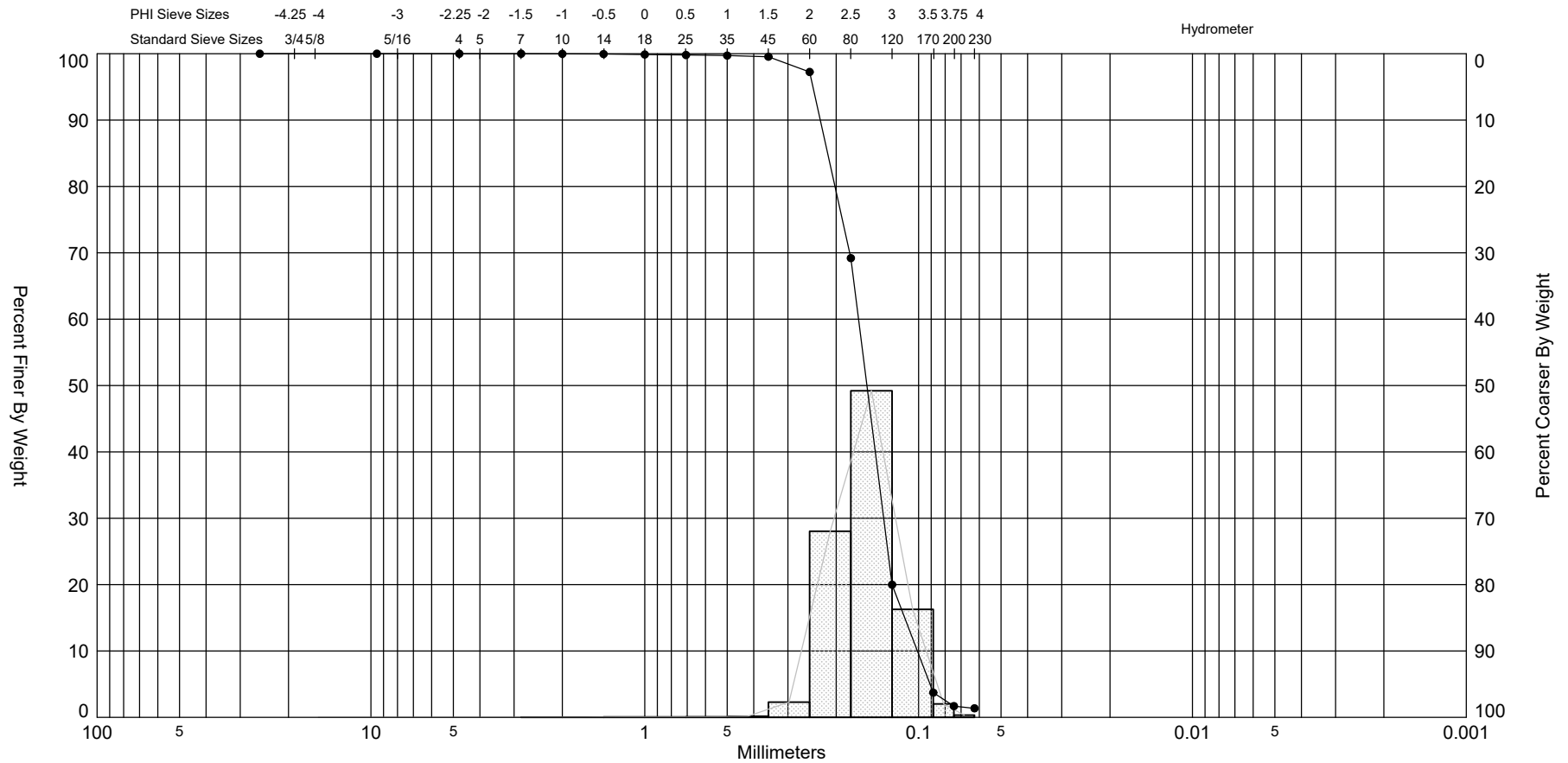
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.46	3.12	2.95	2.70	2.40	2.24	2.04


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.68	0.16	0.42	-0.66	8.05

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-011 #S-3	—●—	-8.1	SP	#200 - 1.69 #230 - 1.36			2.7	2.68	-0.66	8.05	0.42	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Eastings (X, ft):	2,745,172
												Northing (Y, ft):	331,247
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

## Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-011 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,745,172</b>	Northing (ft): <b>331,247</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.6 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>134.70</b>	Wash Weight (g): <b>133.74</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.75</b> <b>#230 - 0.71</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.12	0.09	0.12	99.91
#10	-1.00	2.00	0.14	0.10	0.26	99.81
#14	-0.50	1.41	0.15	0.11	0.41	99.70
#18	0.00	1.00	0.15	0.11	0.56	99.59
#25	0.50	0.71	0.16	0.12	0.72	99.47
#35	1.00	0.50	0.58	0.43	1.30	99.04
#45	1.50	0.35	3.26	2.42	4.56	96.62
#60	2.00	0.25	40.66	30.19	45.22	66.43
#80	2.50	0.18	61.35	45.55	106.57	20.88
#120	3.00	0.13	25.17	18.69	131.74	2.19
#170	3.50	0.09	1.77	1.31	133.51	0.88
#200	3.75	0.07	0.17	0.13	133.68	0.75
#230	4.00	0.06	0.06	0.04	133.74	0.71

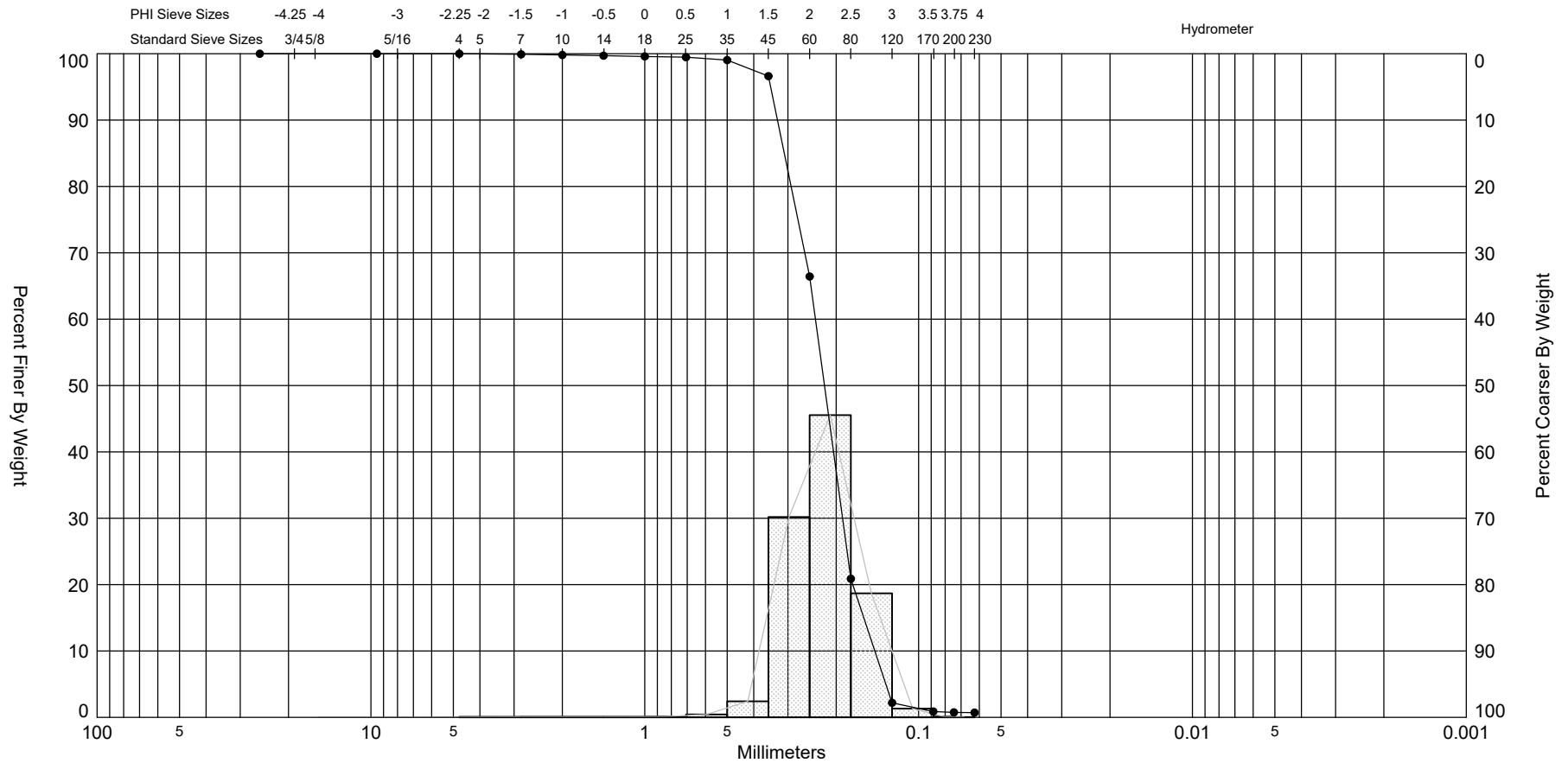
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.92	2.63	2.45	2.18	1.86	1.71	1.53


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.16	0.22	0.46	-1.41	13.02

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-011 #S-4	—●—	-9.6	SP	#200 - 0.75 #230 - 0.71			2.18	2.16	-1.41	13.02	0.46	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,745,172
												Northing (Y, ft):	331,247
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granulometric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-012 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,744,458</b>	Northing (ft): <b>329,133</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-1.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>121.54</b>	Wash Weight (g): <b>120.38</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.00</b> <b>#230 - 0.96</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	1.36	1.12	1.36	98.88
#7	-1.50	2.83	3.10	2.55	4.46	96.33
#10	-1.00	2.00	3.81	3.13	8.27	93.20
#14	-0.50	1.41	6.63	5.45	14.90	87.75
#18	0.00	1.00	11.57	9.52	26.47	78.23
#25	0.50	0.71	20.12	16.55	46.59	61.68
#35	1.00	0.50	26.79	22.04	73.38	39.64
#45	1.50	0.35	23.71	19.51	97.09	20.13
#60	2.00	0.25	17.97	14.79	115.06	5.34
#80	2.50	0.18	4.23	3.48	119.29	1.86
#120	3.00	0.13	0.91	0.75	120.20	1.11
#170	3.50	0.09	0.12	0.10	120.32	1.01
#200	3.75	0.07	0.01	0.01	120.33	1.00
#230	4.00	0.06	0.05	0.04	120.38	0.96

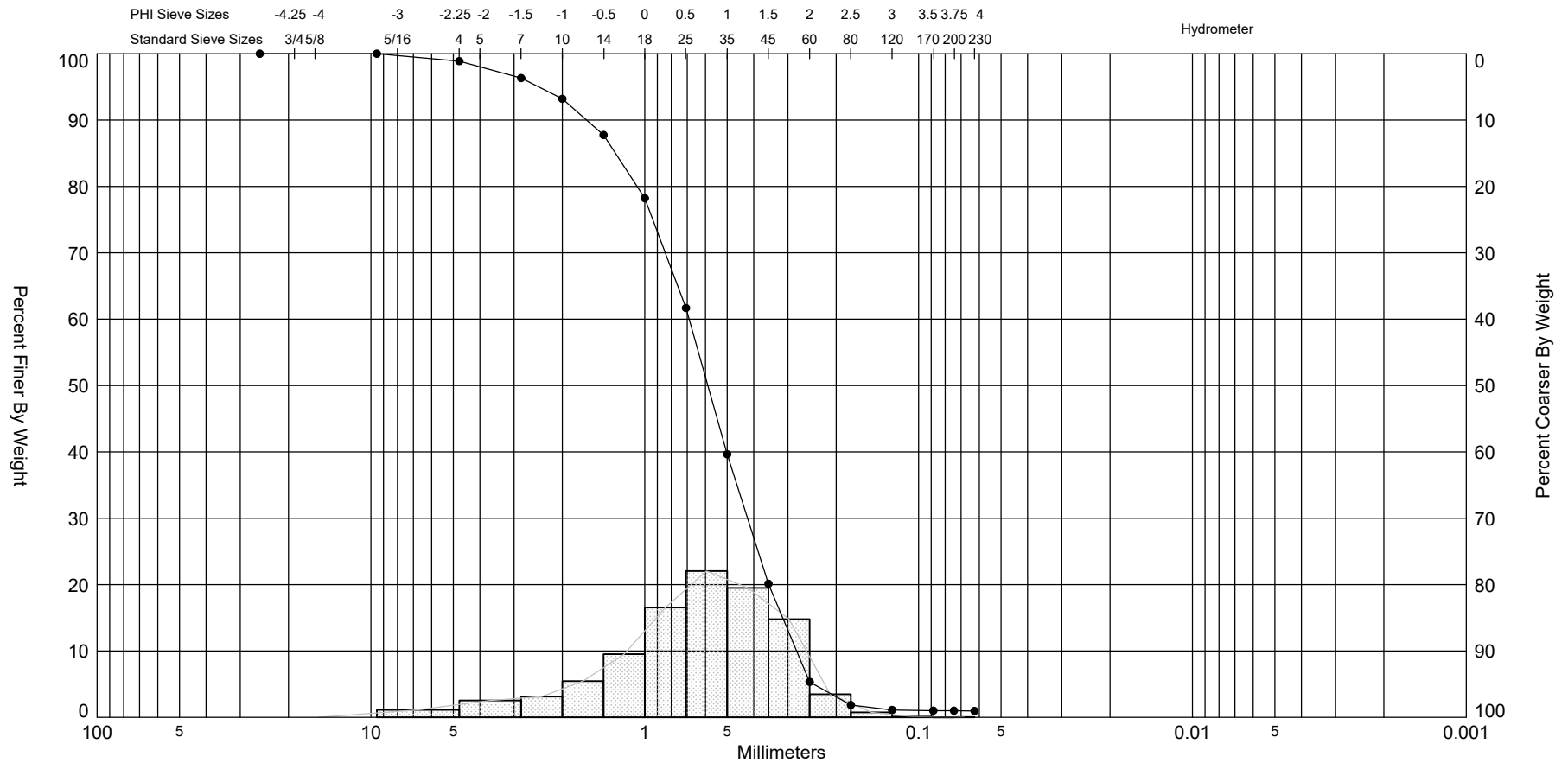
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.05	1.64	1.38	0.76	0.10	-0.30	-1.29


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.64	0.64	1.01	-0.77	3.85

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-012 #S-1	—●—	-1.1	SP	#200 - 1.00 #230 - 0.96			0.76	0.64	-0.77	3.85	1.01	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,458
												Northing (Y, ft):	329,133
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



**Granulometric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-012 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,744,458</b>	Northing (ft): <b>329,133</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-2.6 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>144.52</b>	Wash Weight (g): <b>143.00</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.05</b> <b>#230 - 1.05</b>	Organics (%):	Carbonates (%):	Shells (%):
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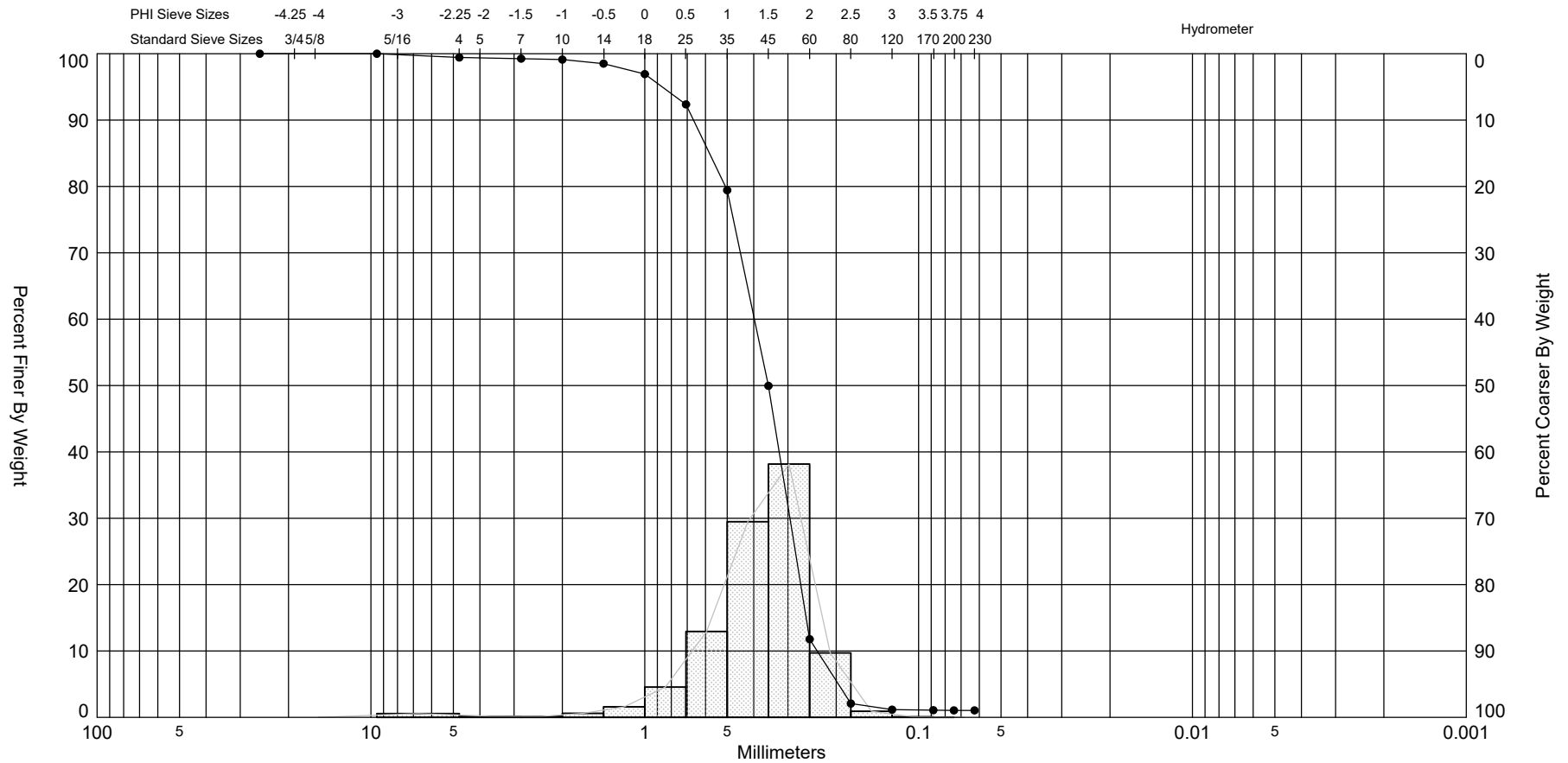
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.83	0.57	0.83	99.43
#7	-1.50	2.83	0.24	0.17	1.07	99.26
#10	-1.00	2.00	0.20	0.14	1.27	99.12
#14	-0.50	1.41	0.88	0.61	2.15	98.51
#18	0.00	1.00	2.29	1.58	4.44	96.93
#25	0.50	0.71	6.61	4.57	11.05	92.36
#35	1.00	0.50	18.69	12.93	29.74	79.43
#45	1.50	0.35	42.60	29.48	72.34	49.95
#60	2.00	0.25	55.16	38.17	127.50	11.78
#80	2.50	0.18	14.02	9.70	141.52	2.08
#120	3.00	0.13	1.33	0.92	142.85	1.16
#170	3.50	0.09	0.11	0.08	142.96	1.08
#200	3.75	0.07	0.04	0.03	143.00	1.05
#230	4.00	0.06	0.00	0.00	143.00	1.05

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.35	1.94	1.83	1.50	1.08	0.82	0.21


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.38	0.38	0.68	-1.92	11.21

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-012 #S-2	●—	-2.6	SP	#200 - 1.05 #230 - 1.05			1.5	1.38	-1.92	11.21	0.68	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,458
												Northing (Y, ft):	329,133
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-012 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,744,458</b>	Northing (ft): <b>329,133</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-4.6 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>112.26</b>	Wash Weight (g): <b>111.00</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.14</b> <b>#230 - 1.14</b>	Organics (%):	Carbonates (%):	Shells (%):
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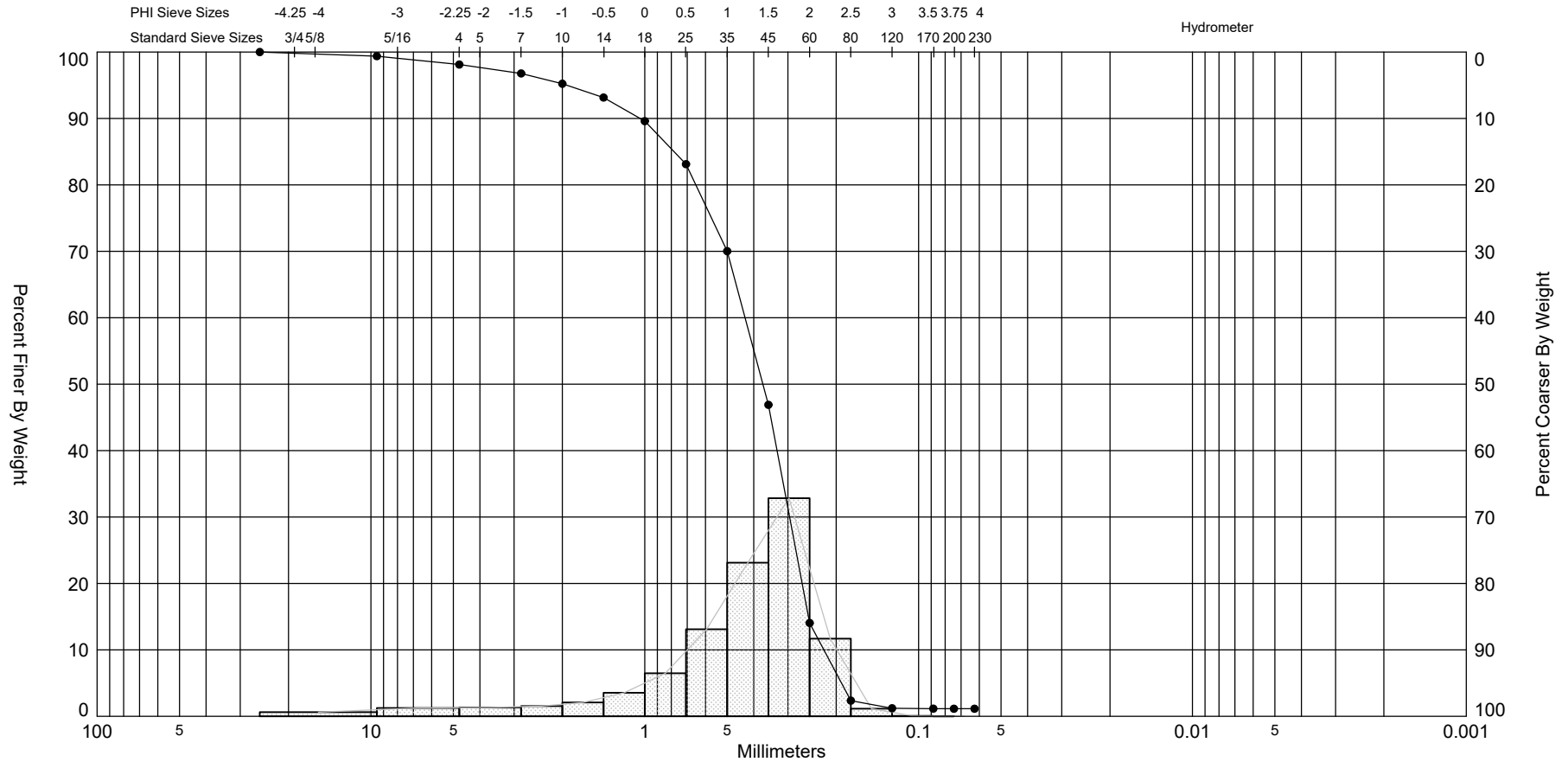
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.70	0.62	0.70	99.38
#4	-2.25	4.76	1.42	1.26	2.12	98.12
#7	-1.50	2.83	1.50	1.34	3.62	96.78
#10	-1.00	2.00	1.74	1.55	5.36	95.23
#14	-0.50	1.41	2.34	2.08	7.70	93.15
#18	0.00	1.00	3.99	3.55	11.69	89.60
#25	0.50	0.71	7.27	6.48	18.96	83.12
#35	1.00	0.50	14.71	13.10	33.67	70.02
#45	1.50	0.35	25.97	23.13	59.64	46.89
#60	2.00	0.25	36.87	32.84	96.51	14.05
#80	2.50	0.18	13.12	11.69	109.63	2.36
#120	3.00	0.13	1.29	1.15	110.92	1.21
#170	3.50	0.09	0.07	0.06	110.99	1.15
#200	3.75	0.07	0.01	0.01	111.00	1.14
#230	4.00	0.06	0.00	0.00	111.00	1.14

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.39	1.97	1.83	1.43	0.81	0.43	-0.94


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.16	0.45	1.04	-1.96	8.19

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-012 #S-3	—●—	-4.6	SP	#200 - 1.14 #230 - 1.14			1.43	1.16	-1.96	8.19	1.04	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,458
												Northing (Y, ft):	329,133
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-012 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,744,458</b>	Northing (ft): <b>329,133</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-6.6 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>109.42</b>	Wash Weight (g): <b>108.61</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.76</b> <b>#230 - 0.73</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.58	0.53	0.58	99.47
#10	-1.00	2.00	0.50	0.46	1.08	99.01
#14	-0.50	1.41	0.96	0.88	2.04	98.13
#18	0.00	1.00	1.73	1.58	3.77	96.55
#25	0.50	0.71	4.32	3.95	8.09	92.60
#35	1.00	0.50	9.74	8.90	17.83	83.70
#45	1.50	0.35	20.23	18.49	38.06	65.21
#60	2.00	0.25	38.12	34.84	76.18	30.37
#80	2.50	0.18	27.02	24.69	103.20	5.68
#120	3.00	0.13	5.09	4.65	108.29	1.03
#170	3.50	0.09	0.27	0.25	108.56	0.78
#200	3.75	0.07	0.02	0.02	108.58	0.76
#230	4.00	0.06	0.03	0.03	108.61	0.73

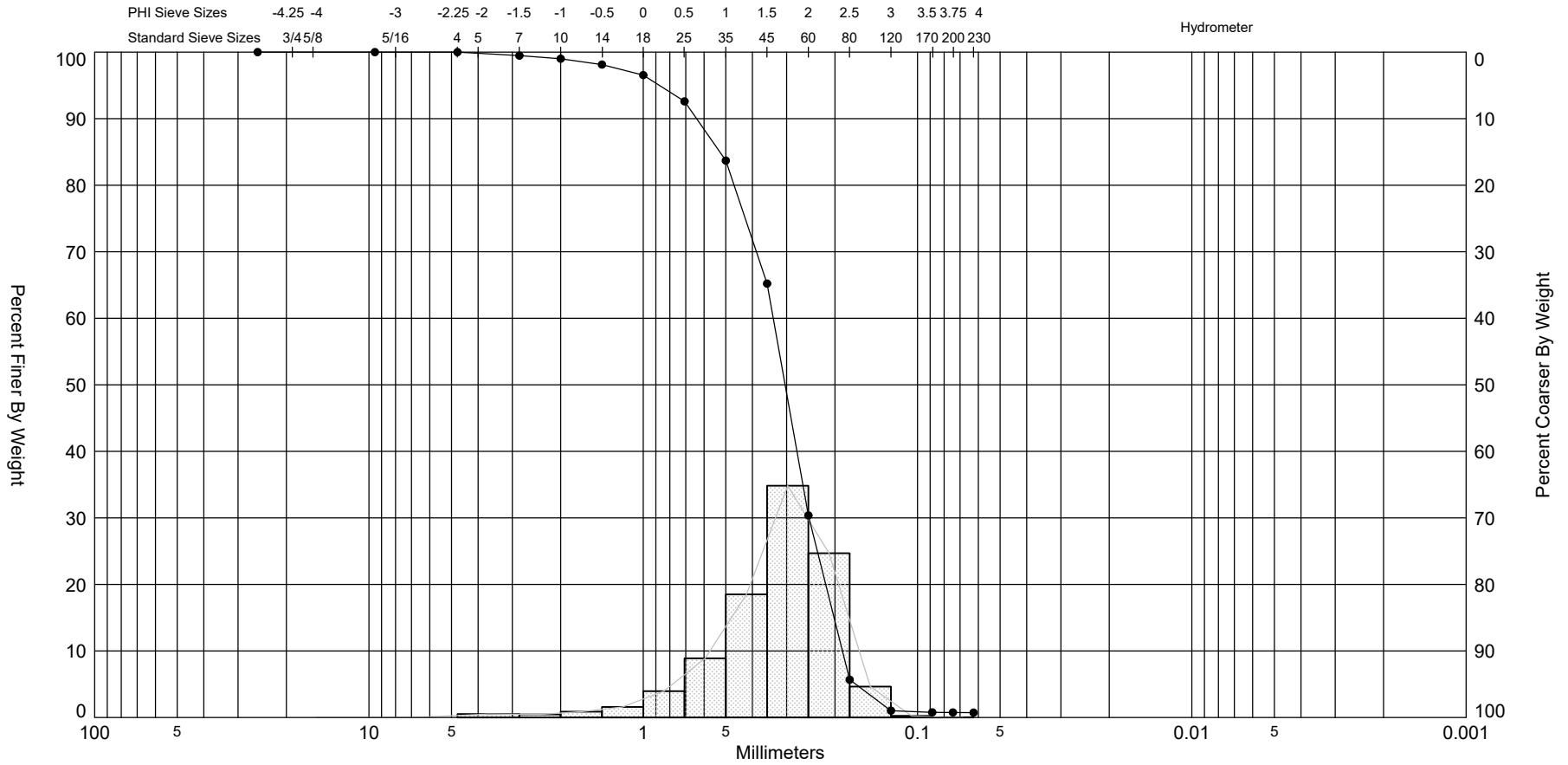
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.57	2.29	2.11	1.72	1.24	0.98	0.20


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.6	0.33	0.74	-1.34	6.19

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-012 #S-4	—●—	-6.6	SP	#200 - 0.76 #230 - 0.73			1.72	1.6	-1.34	6.19	0.74	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,744,458
												Northing (Y, ft):	329,133
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-012 #S-5

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,744,458</b>	Northing (ft): <b>329,133</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>115.10</b>	Wash Weight (g): <b>113.98</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.04</b> <b>#230 - 0.96</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	1.01	0.88	1.01	99.12
#4	-2.25	4.76	2.51	2.18	3.52	96.94
#7	-1.50	2.83	2.92	2.54	6.44	94.40
#10	-1.00	2.00	3.37	2.93	9.81	91.47
#14	-0.50	1.41	5.99	5.20	15.80	86.27
#18	0.00	1.00	8.54	7.42	24.34	78.85
#25	0.50	0.71	11.10	9.64	35.44	69.21
#35	1.00	0.50	14.50	12.60	49.94	56.61
#45	1.50	0.35	17.39	15.11	67.33	41.50
#60	2.00	0.25	29.38	25.53	96.71	15.97
#80	2.50	0.18	14.79	12.85	111.50	3.12
#120	3.00	0.13	2.18	1.89	113.68	1.23
#170	3.50	0.09	0.18	0.16	113.86	1.07
#200	3.75	0.07	0.03	0.03	113.89	1.04
#230	4.00	0.06	0.09	0.08	113.98	0.96

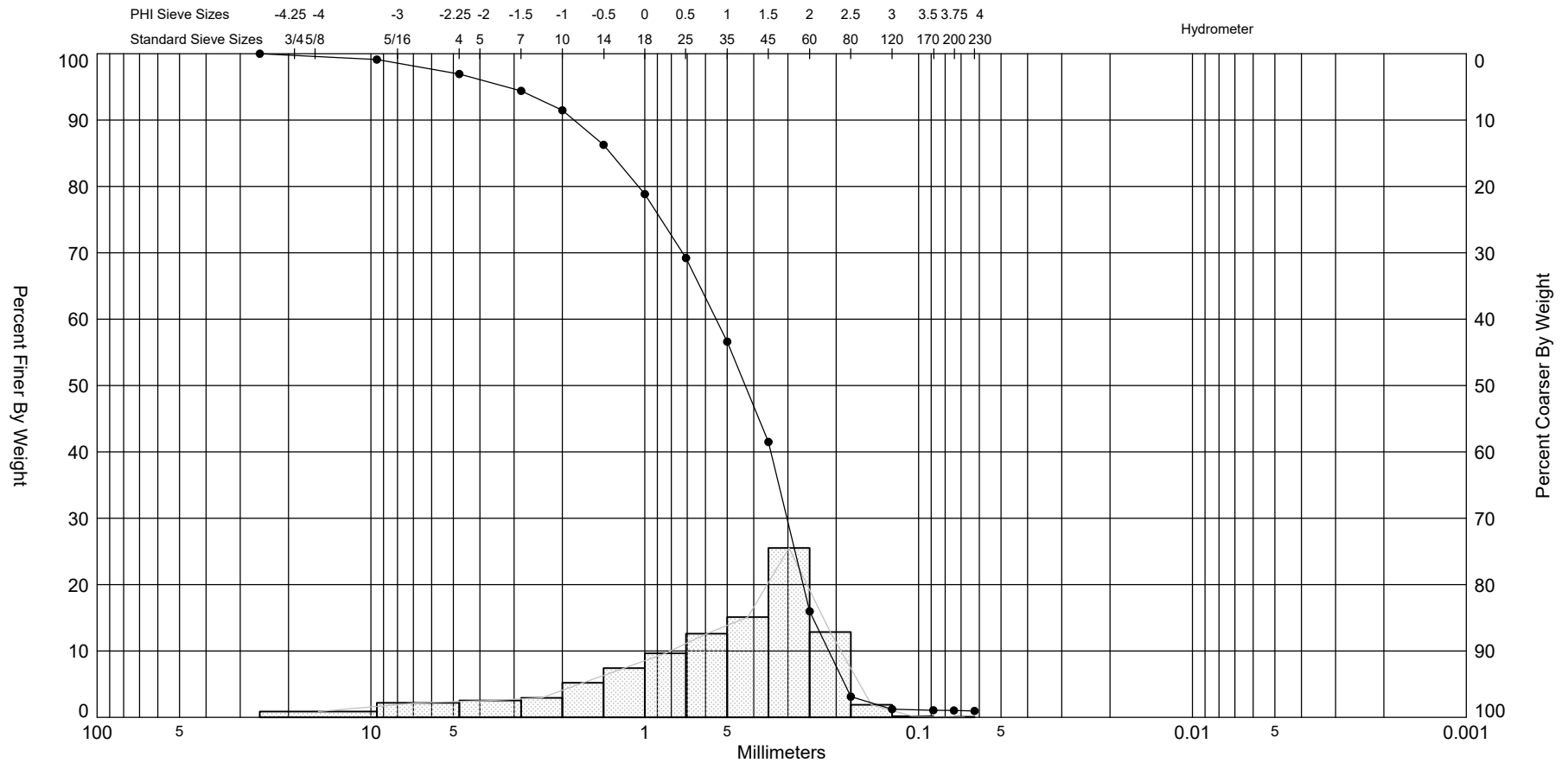
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.43	2.00	1.82	1.22	0.20	-0.35	-1.68


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.88	0.54	1.28	-1.2	4.5

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-012 #S-5	—●—	-9.1	SP	#200 - 1.04 #230 - 0.96			1.22	0.88	-1.2	4.5	1.28	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,458
												Northing (Y, ft):	329,133
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-013 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,744,209</b>	Northing (ft): <b>329,932</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>148.42</b>	Wash Weight (g): <b>147.08</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.92</b> <b>#230 - 0.90</b>	Organics (%):	Carbonates (%):	Shells (%):
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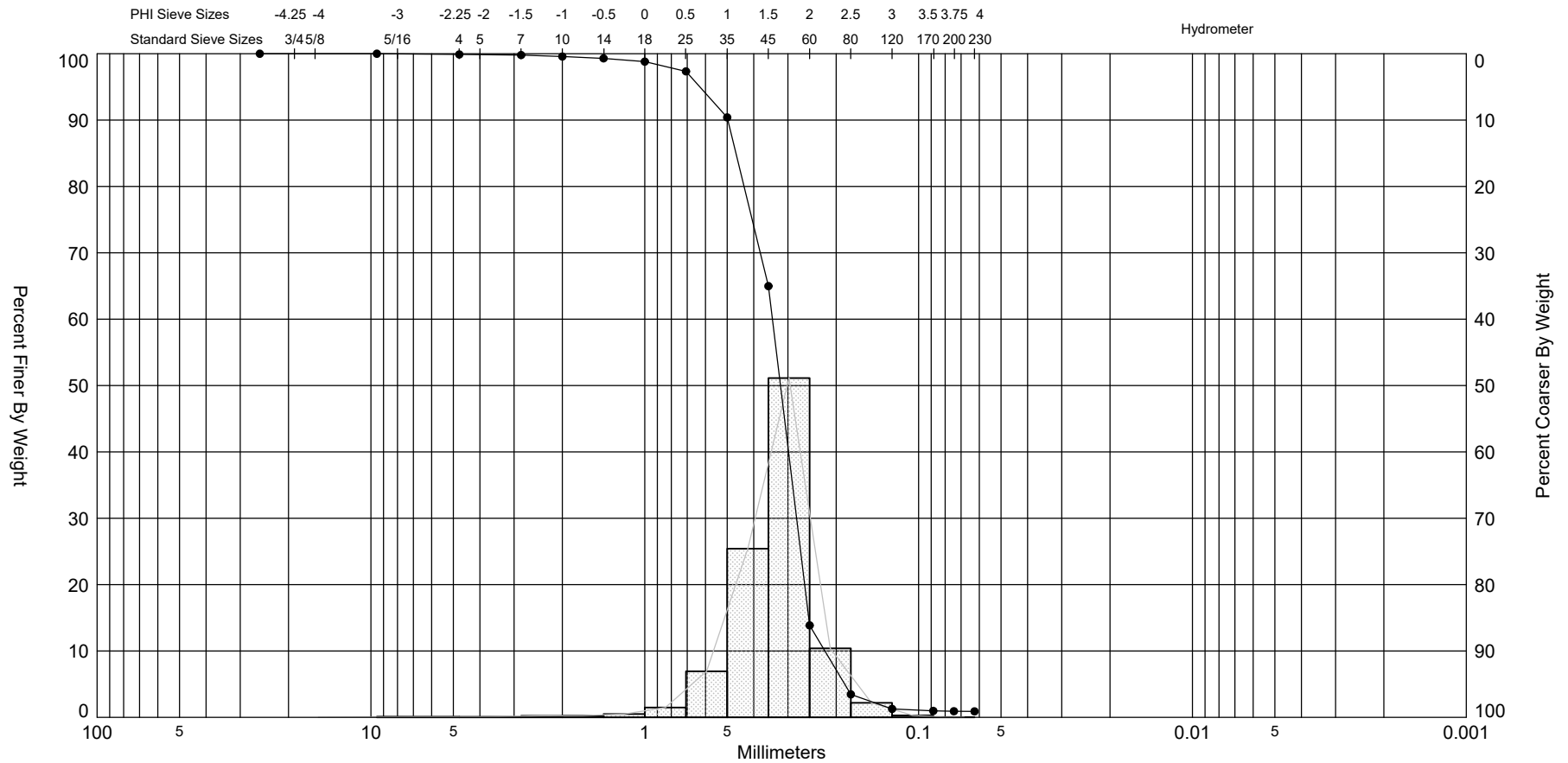
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.16	0.11	0.16	99.89
#7	-1.50	2.83	0.14	0.09	0.30	99.80
#10	-1.00	2.00	0.33	0.22	0.63	99.58
#14	-0.50	1.41	0.42	0.28	1.05	99.30
#18	0.00	1.00	0.72	0.49	1.77	98.81
#25	0.50	0.71	2.18	1.47	3.95	97.34
#35	1.00	0.50	10.30	6.94	14.25	90.40
#45	1.50	0.35	37.73	25.42	51.98	64.98
#60	2.00	0.25	75.87	51.12	127.85	13.86
#80	2.50	0.18	15.43	10.40	143.28	3.46
#120	3.00	0.13	3.25	2.19	146.53	1.27
#170	3.50	0.09	0.45	0.30	146.98	0.97
#200	3.75	0.07	0.07	0.05	147.05	0.92
#230	4.00	0.06	0.03	0.02	147.08	0.90

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.43	1.98	1.89	1.65	1.30	1.13	0.67


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.58	0.33	0.54	-1.53	11.86

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-013 #S-1	●—	-8.5	SP	#200 - 0.92 #230 - 0.90			1.65	1.58	-1.53	11.86	0.54	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,209
												Northing (Y, ft):	329,932
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granulometric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-013 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,744,209</b>	Northing (ft): <b>329,932</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-10.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>134.28</b>	Wash Weight (g): <b>133.04</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.94</b> <b>#230 - 0.92</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.02	0.01	0.02	99.99
#10	-1.00	2.00	0.08	0.06	0.10	99.93
#14	-0.50	1.41	0.14	0.10	0.24	99.83
#18	0.00	1.00	0.25	0.19	0.49	99.64
#25	0.50	0.71	1.03	0.77	1.52	98.87
#35	1.00	0.50	6.44	4.80	7.96	94.07
#45	1.50	0.35	30.08	22.40	38.04	71.67
#60	2.00	0.25	75.71	56.38	113.75	15.29
#80	2.50	0.18	16.51	12.30	130.26	2.99
#120	3.00	0.13	2.55	1.90	132.81	1.09
#170	3.50	0.09	0.19	0.14	133.00	0.95
#200	3.75	0.07	0.01	0.01	133.01	0.94
#230	4.00	0.06	0.03	0.02	133.04	0.92

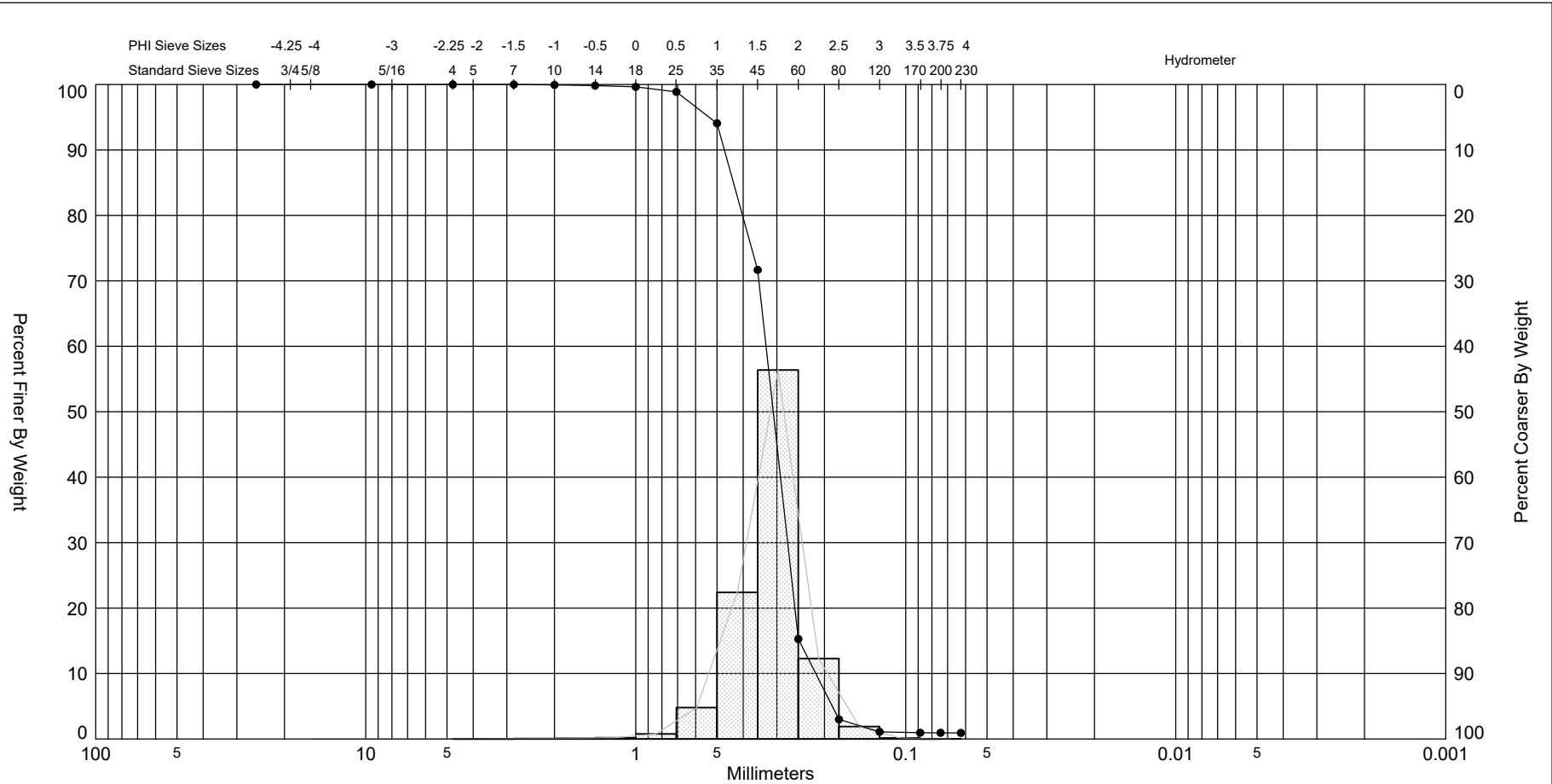
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.42	1.99	1.91	1.69	1.43	1.22	0.90


Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
	1.65	0.32	0.43	-0.72	7.09

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-013 #S-2	●—	-10.0	SP	#200 - 0.94 #230 - 0.92			1.69	1.65	-0.72	7.09	0.43	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,744,209
												Northing (Y, ft):	329,932
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-013 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,744,209</b>	Northing (ft): <b>329,932</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-12.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>133.93</b>	Wash Weight (g): <b>133.36</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.44</b> <b>#230 - 0.42</b>	Organics (%):	Carbonates (%):	Shells (%):
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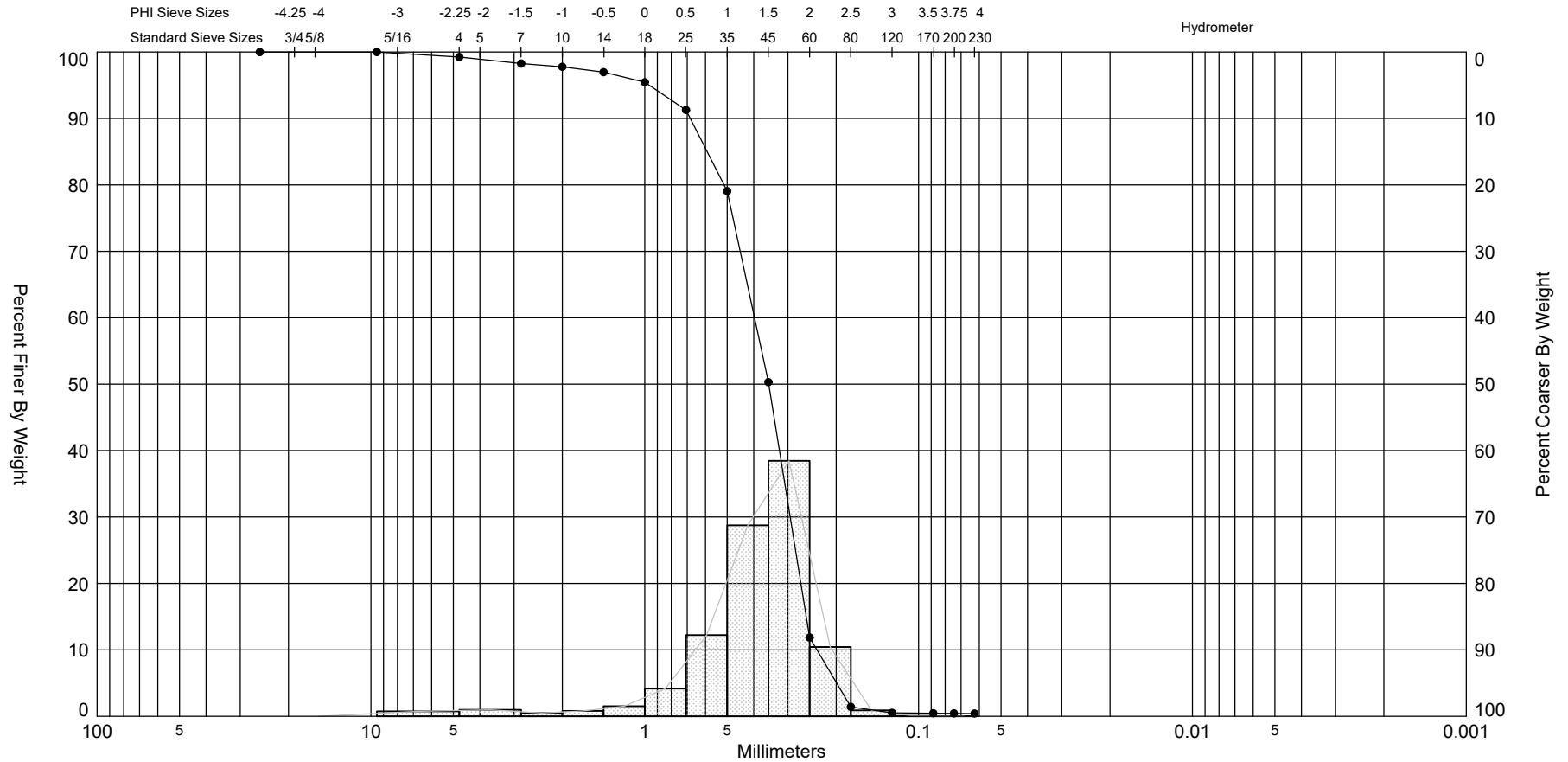
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	1.01	0.75	1.01	99.25
#7	-1.50	2.83	1.31	0.98	2.32	98.27
#10	-1.00	2.00	0.66	0.49	2.98	97.78
#14	-0.50	1.41	1.08	0.81	4.06	96.97
#18	0.00	1.00	2.03	1.52	6.09	95.45
#25	0.50	0.71	5.59	4.17	11.68	91.28
#35	1.00	0.50	16.36	12.22	28.04	79.06
#45	1.50	0.35	38.50	28.75	66.54	50.31
#60	2.00	0.25	51.49	38.45	118.03	11.86
#80	2.50	0.18	13.98	10.44	132.01	1.42
#120	3.00	0.13	1.21	0.90	133.22	0.52
#170	3.50	0.09	0.08	0.06	133.30	0.46
#200	3.75	0.07	0.03	0.02	133.33	0.44
#230	4.00	0.06	0.03	0.02	133.36	0.42

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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.33	1.95	1.83	1.50	1.07	0.80	0.05

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.35	0.39	0.78	-2.17	10.65

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-013 #S-3	●—	-12.0	SP	#200 - 0.44 #230 - 0.42			1.5	1.35	-2.17	10.65	0.78	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,744,209
												Northing (Y, ft):	329,932
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-014 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,743,568</b>	Northing (ft): <b>328,665</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-3.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>86.19</b>	Wash Weight (g): <b>85.45</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.95</b> <b>#230 - 0.87</b>	Organics (%):	Carbonates (%):	Shells (%):
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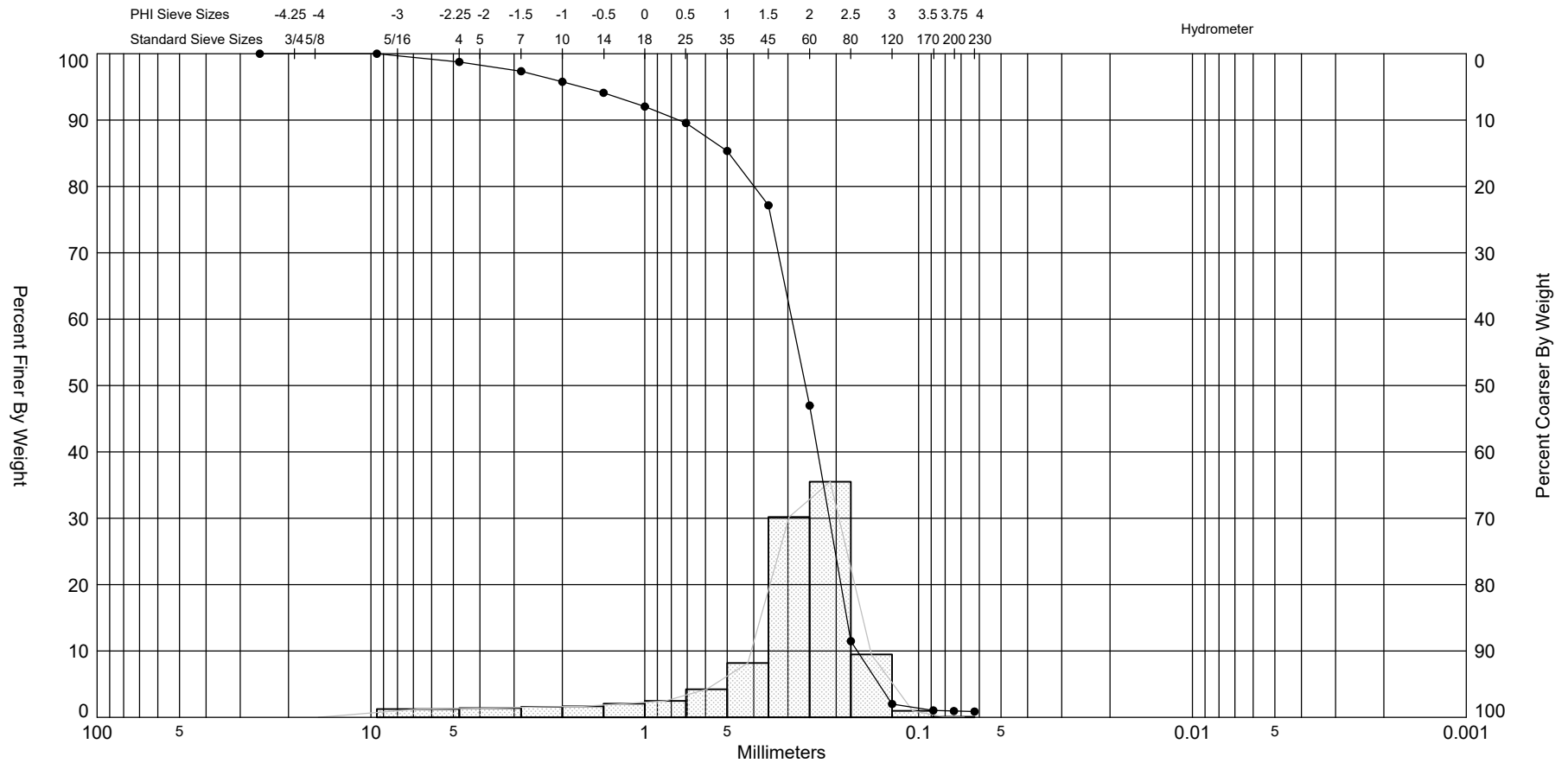
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	1.07	1.24	1.07	98.76
#7	-1.50	2.83	1.21	1.40	2.28	97.36
#10	-1.00	2.00	1.37	1.59	3.65	95.77
#14	-0.50	1.41	1.43	1.66	5.08	94.11
#18	0.00	1.00	1.78	2.07	6.86	92.04
#25	0.50	0.71	2.14	2.48	9.00	89.56
#35	1.00	0.50	3.64	4.22	12.64	85.34
#45	1.50	0.35	7.05	8.18	19.69	77.16
#60	2.00	0.25	26.01	30.18	45.70	46.98
#80	2.50	0.18	30.60	35.50	76.30	11.48
#120	3.00	0.13	8.16	9.47	84.46	2.01
#170	3.50	0.09	0.84	0.97	85.30	1.04
#200	3.75	0.07	0.08	0.09	85.38	0.95
#230	4.00	0.06	0.07	0.08	85.45	0.87

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.84	2.44	2.31	1.95	1.54	1.08	-0.77


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.68	0.31	1.05	-2.08	7.88

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-014 #S-1	—●—	-3.1	SP	#200 - 0.95 #230 - 0.87			1.95	1.68	-2.08	7.88	1.05	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,743,568
												Northing (Y, ft):	328,665
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-014 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,743,568</b>	Northing (ft): <b>328,665</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.6 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>115.78</b>	Wash Weight (g): <b>113.68</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.89</b> <b>#230 - 1.79</b>	Organics (%):	Carbonates (%):	Shells (%):
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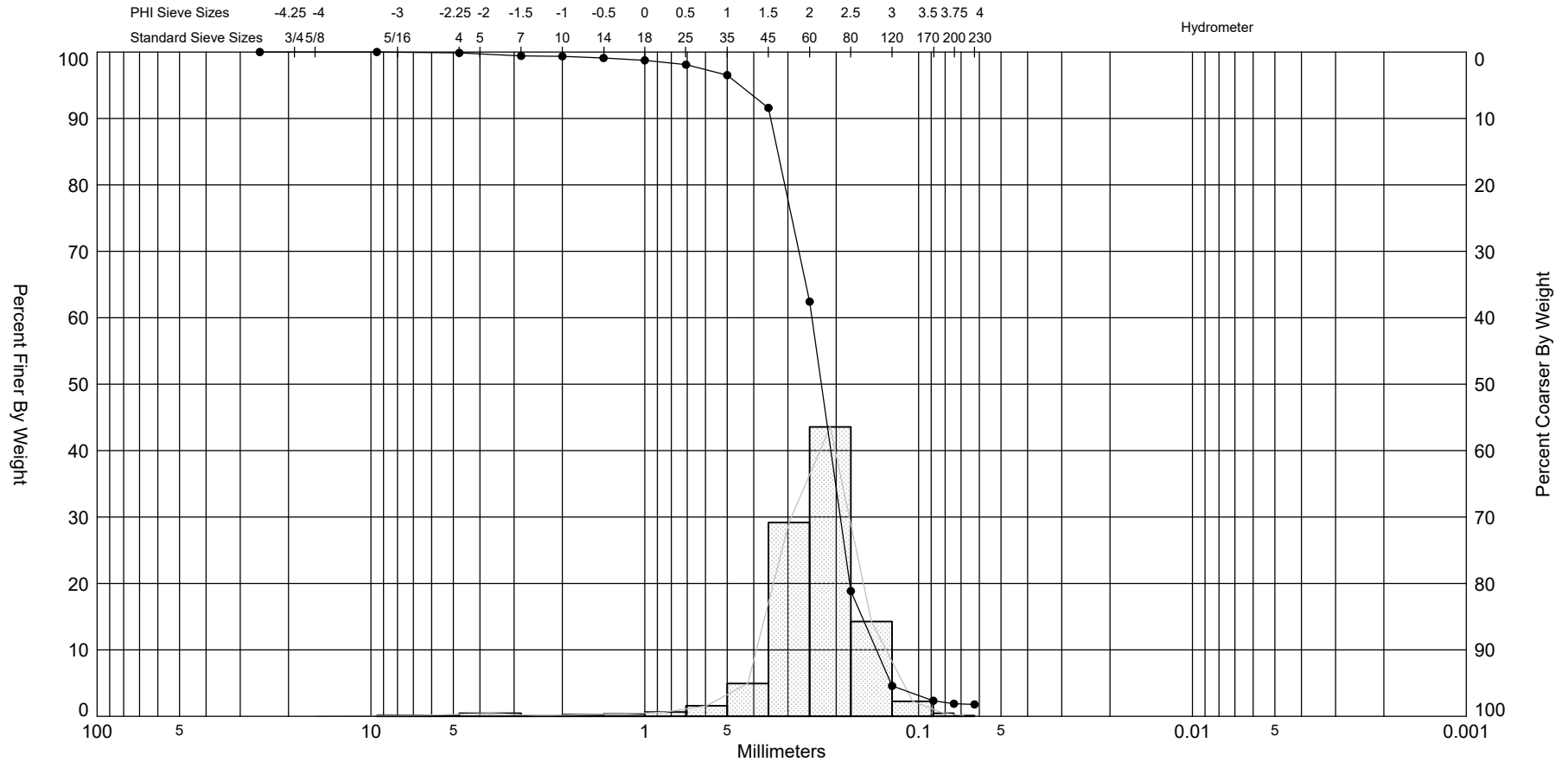
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.15	0.13	0.15	99.87
#7	-1.50	2.83	0.52	0.45	0.67	99.42
#10	-1.00	2.00	0.07	0.06	0.74	99.36
#14	-0.50	1.41	0.30	0.26	1.04	99.10
#18	0.00	1.00	0.40	0.35	1.44	98.75
#25	0.50	0.71	0.75	0.65	2.19	98.10
#35	1.00	0.50	1.83	1.58	4.02	96.52
#45	1.50	0.35	5.71	4.93	9.73	91.59
#60	2.00	0.25	33.77	29.17	43.50	62.42
#80	2.50	0.18	50.44	43.57	93.94	18.85
#120	3.00	0.13	16.52	14.27	110.46	4.58
#170	3.50	0.09	2.59	2.24	113.05	2.34
#200	3.75	0.07	0.52	0.45	113.57	1.89
#230	4.00	0.06	0.11	0.10	113.68	1.79

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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.99	2.60	2.43	2.14	1.78	1.63	1.15

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.07	0.24	0.62	-2.31	15.96

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-014 #S-2	●—	-5.6	SP	#200 - 1.89 #230 - 1.79			2.14	2.07	-2.31	15.96	0.62	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						<b>Athena Technologies, Inc.</b> 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,743,568
												Northing (Y, ft):	328,665
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-014 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,743,568</b>	Northing (ft): <b>328,665</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.6 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>119.00</b>	Wash Weight (g): <b>117.70</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.13</b> <b>#230 - 1.09</b>	Organics (%):	Carbonates (%):	Shells (%):
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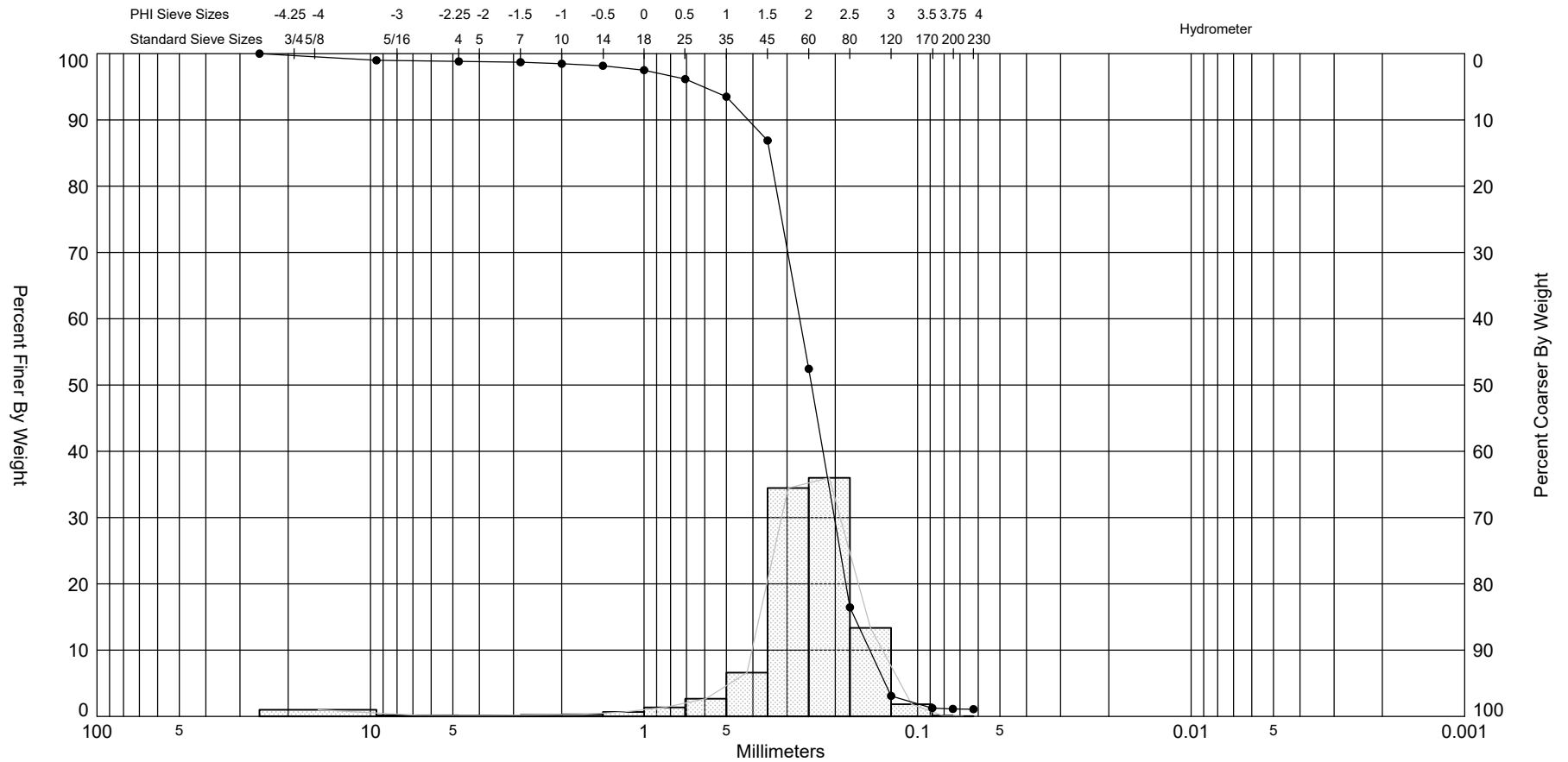
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	1.20	1.01	1.20	98.99
#4	-2.25	4.76	0.19	0.16	1.39	98.83
#7	-1.50	2.83	0.14	0.12	1.53	98.71
#10	-1.00	2.00	0.27	0.23	1.80	98.48
#14	-0.50	1.41	0.37	0.31	2.17	98.17
#18	0.00	1.00	0.79	0.66	2.96	97.51
#25	0.50	0.71	1.61	1.35	4.57	96.16
#35	1.00	0.50	3.17	2.66	7.74	93.50
#45	1.50	0.35	7.86	6.61	15.60	86.89
#60	2.00	0.25	40.99	34.45	56.59	52.44
#80	2.50	0.18	42.83	35.99	99.42	16.45
#120	3.00	0.13	15.90	13.36	115.32	3.09
#170	3.50	0.09	2.18	1.83	117.50	1.26
#200	3.75	0.07	0.15	0.13	117.65	1.13
#230	4.00	0.06	0.05	0.04	117.70	1.09

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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.93	2.52	2.38	2.03	1.67	1.54	0.72

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.92	0.26	0.88	-3.7	23.84

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-014 #S-3	●—	-8.6	SP	#200 - 1.13 #230 - 1.09			2.03	1.92	-3.7	23.84	0.88	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,743,568
												Northing (Y, ft):	328,665
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-014 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,743,568</b>	Northing (ft): <b>328,665</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-10.8 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>153.63</b>	Wash Weight (g): <b>152.69</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.62</b> <b>#230 - 0.60</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	14.28	9.30	14.28	90.70
#4	-2.25	4.76	7.01	4.56	21.29	86.14
#7	-1.50	2.83	5.96	3.88	27.25	82.26
#10	-1.00	2.00	4.07	2.65	31.32	79.61
#14	-0.50	1.41	6.32	4.11	37.64	75.50
#18	0.00	1.00	8.29	5.40	45.93	70.10
#25	0.50	0.71	12.07	7.86	58.00	62.24
#35	1.00	0.50	17.31	11.27	75.31	50.97
#45	1.50	0.35	27.44	17.86	102.75	33.11
#60	2.00	0.25	34.88	22.70	137.63	10.41
#80	2.50	0.18	13.12	8.54	150.75	1.87
#120	3.00	0.13	1.72	1.12	152.47	0.75
#170	3.50	0.09	0.15	0.10	152.62	0.65
#200	3.75	0.07	0.04	0.03	152.66	0.62
#230	4.00	0.06	0.03	0.02	152.69	0.60

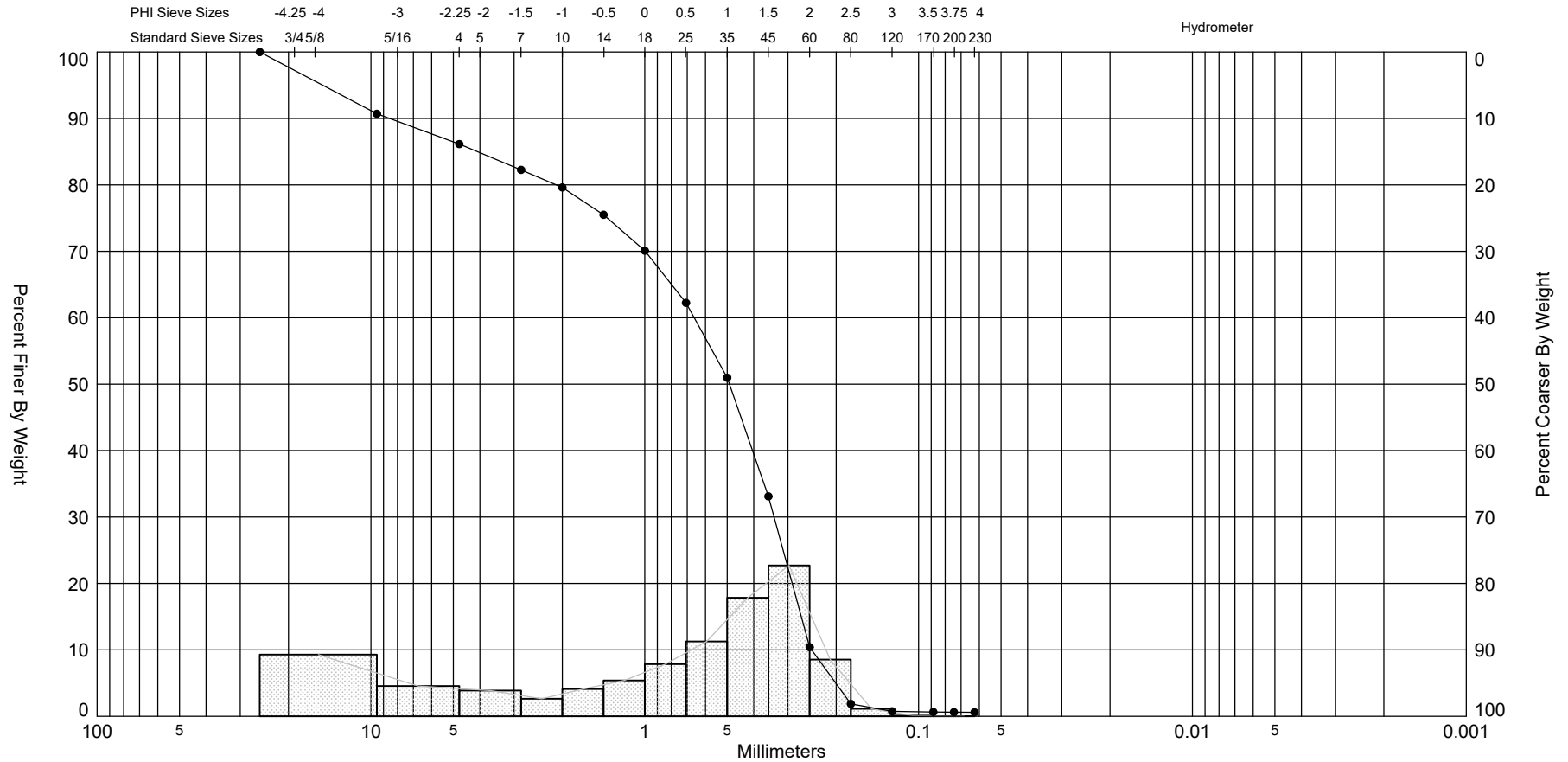
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.32	1.88	1.68	1.03	-0.45	-1.84	-3.91


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.31	0.81	1.87	-1.14	3.18

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-014 #S-4	—●—	-10.8	SP	#200 - 0.62 #230 - 0.60			1.03	0.31	-1.14	3.18	1.87	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,743,568
												Northing (Y, ft):	328,665
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-015 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,742,945</b>	Northing (ft): <b>327,885</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-4.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>116.60</b>	Wash Weight (g): <b>115.70</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.79</b> <b>#230 - 0.77</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.09	0.08	0.09	99.92
#14	-0.50	1.41	0.23	0.20	0.32	99.72
#18	0.00	1.00	0.40	0.34	0.72	99.38
#25	0.50	0.71	0.70	0.60	1.42	98.78
#35	1.00	0.50	1.83	1.57	3.25	97.21
#45	1.50	0.35	7.93	6.80	11.18	90.41
#60	2.00	0.25	42.66	36.59	53.84	53.82
#80	2.50	0.18	48.37	41.48	102.21	12.34
#120	3.00	0.13	12.20	10.46	114.41	1.88
#170	3.50	0.09	1.14	0.98	115.55	0.90
#200	3.75	0.07	0.13	0.11	115.68	0.79
#230	4.00	0.06	0.02	0.02	115.70	0.77

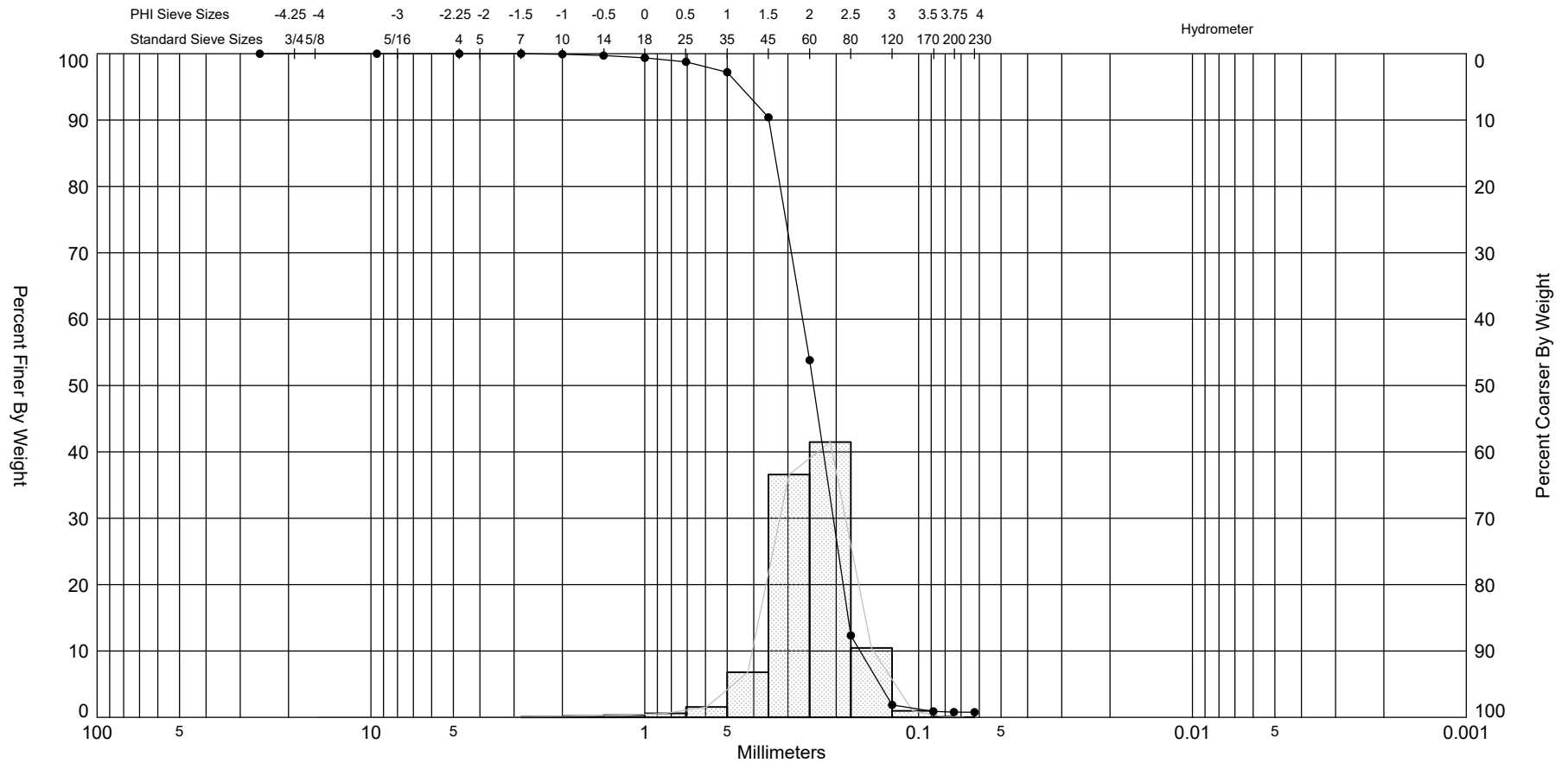
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.85	2.46	2.35	2.05	1.71	1.59	1.16


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.01	0.25	0.5	-1.08	7.7

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-015 #S-1	●—	-4.5	SP	#200 - 0.79 #230 - 0.77			2.05	2.01	-1.08	7.7	0.5	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,742,945
												Northing (Y, ft):	327,885
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-015 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,742,945</b>	Northing (ft): <b>327,885</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>142.65</b>	Wash Weight (g): <b>140.85</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.33</b> <b>#230 - 1.27</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.12	0.08	0.12	99.92
#10	-1.00	2.00	0.17	0.12	0.29	99.80
#14	-0.50	1.41	0.36	0.25	0.65	99.55
#18	0.00	1.00	0.69	0.48	1.34	99.07
#25	0.50	0.71	1.48	1.04	2.82	98.03
#35	1.00	0.50	4.00	2.80	6.82	95.23
#45	1.50	0.35	10.99	7.70	17.81	87.53
#60	2.00	0.25	45.75	32.07	63.56	55.46
#80	2.50	0.18	60.05	42.10	123.61	13.36
#120	3.00	0.13	15.35	10.76	138.96	2.60
#170	3.50	0.09	1.62	1.14	140.58	1.46
#200	3.75	0.07	0.19	0.13	140.77	1.33
#230	4.00	0.06	0.08	0.06	140.85	1.27

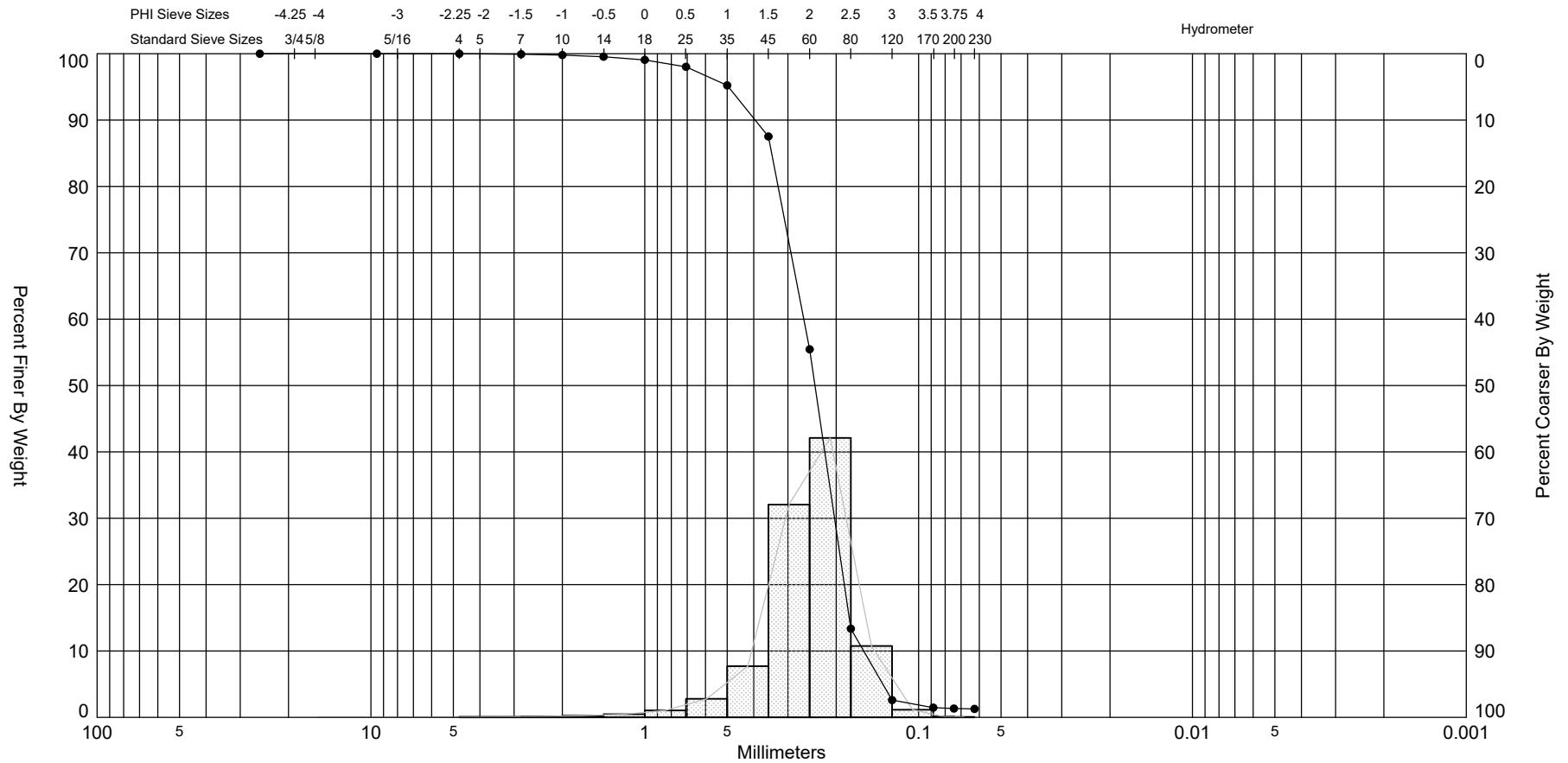
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.89	2.47	2.36	2.06	1.70	1.56	1.01


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.99	0.25	0.57	-1.38	8.3

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-015 #S-2	●—	-7.0	SP	#200 - 1.33 #230 - 1.27			2.06	1.99	-1.38	8.3	0.57	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,742,945
												Northing (Y, ft):	327,885
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-015 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,742,945</b>	Northing (ft): <b>327,885</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.2 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>100.82</b>	Wash Weight (g): <b>99.45</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.41</b> <b>#230 - 1.35</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.09	0.09	0.09	99.91
#10	-1.00	2.00	0.26	0.26	0.35	99.65
#14	-0.50	1.41	0.31	0.31	0.66	99.34
#18	0.00	1.00	0.69	0.68	1.35	98.66
#25	0.50	0.71	1.47	1.46	2.82	97.20
#35	1.00	0.50	5.32	5.28	8.14	91.92
#45	1.50	0.35	17.91	17.76	26.05	74.16
#60	2.00	0.25	46.85	46.47	72.90	27.69
#80	2.50	0.18	20.23	20.07	93.13	7.62
#120	3.00	0.13	4.98	4.94	98.11	2.68
#170	3.50	0.09	1.11	1.10	99.22	1.58
#200	3.75	0.07	0.17	0.17	99.39	1.41
#230	4.00	0.06	0.06	0.06	99.45	1.35

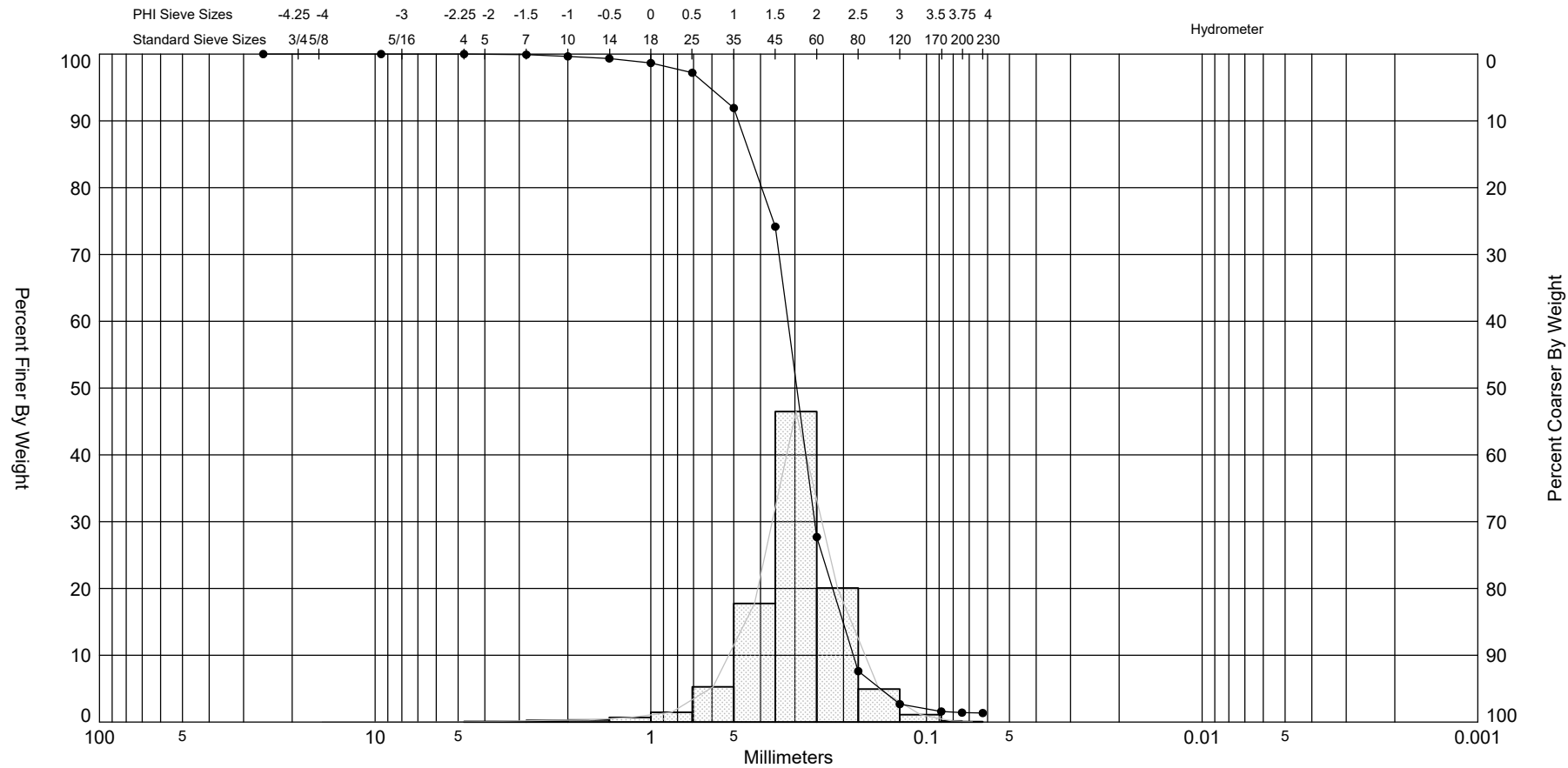
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.77	2.29	2.07	1.76	1.48	1.22	0.71


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.72	0.30	0.59	-0.91	7.18

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-015 #S-3	—●—	-9.2	SP	#200 - 1.41 #230 - 1.35			1.76	1.72	-0.91	7.18	0.59	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,742,945
												Northing (Y, ft):	327,885
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-015 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,742,945</b>	Northing (ft): <b>327,885</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-12.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>151.97</b>	Wash Weight (g): <b>151.12</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.57</b> <b>#230 - 0.56</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	6.02	3.96	6.02	96.04
#7	-1.50	2.83	8.41	5.53	14.43	90.51
#10	-1.00	2.00	7.26	4.78	21.69	85.73
#14	-0.50	1.41	11.70	7.70	33.39	78.03
#18	0.00	1.00	16.19	10.65	49.58	67.38
#25	0.50	0.71	22.10	14.54	71.68	52.84
#35	1.00	0.50	28.54	18.78	100.22	34.06
#45	1.50	0.35	30.02	19.75	130.24	14.31
#60	2.00	0.25	16.61	10.93	146.85	3.38
#80	2.50	0.18	3.38	2.22	150.23	1.16
#120	3.00	0.13	0.71	0.47	150.94	0.69
#170	3.50	0.09	0.13	0.09	151.07	0.60
#200	3.75	0.07	0.04	0.03	151.11	0.57
#230	4.00	0.06	0.01	0.01	151.12	0.56

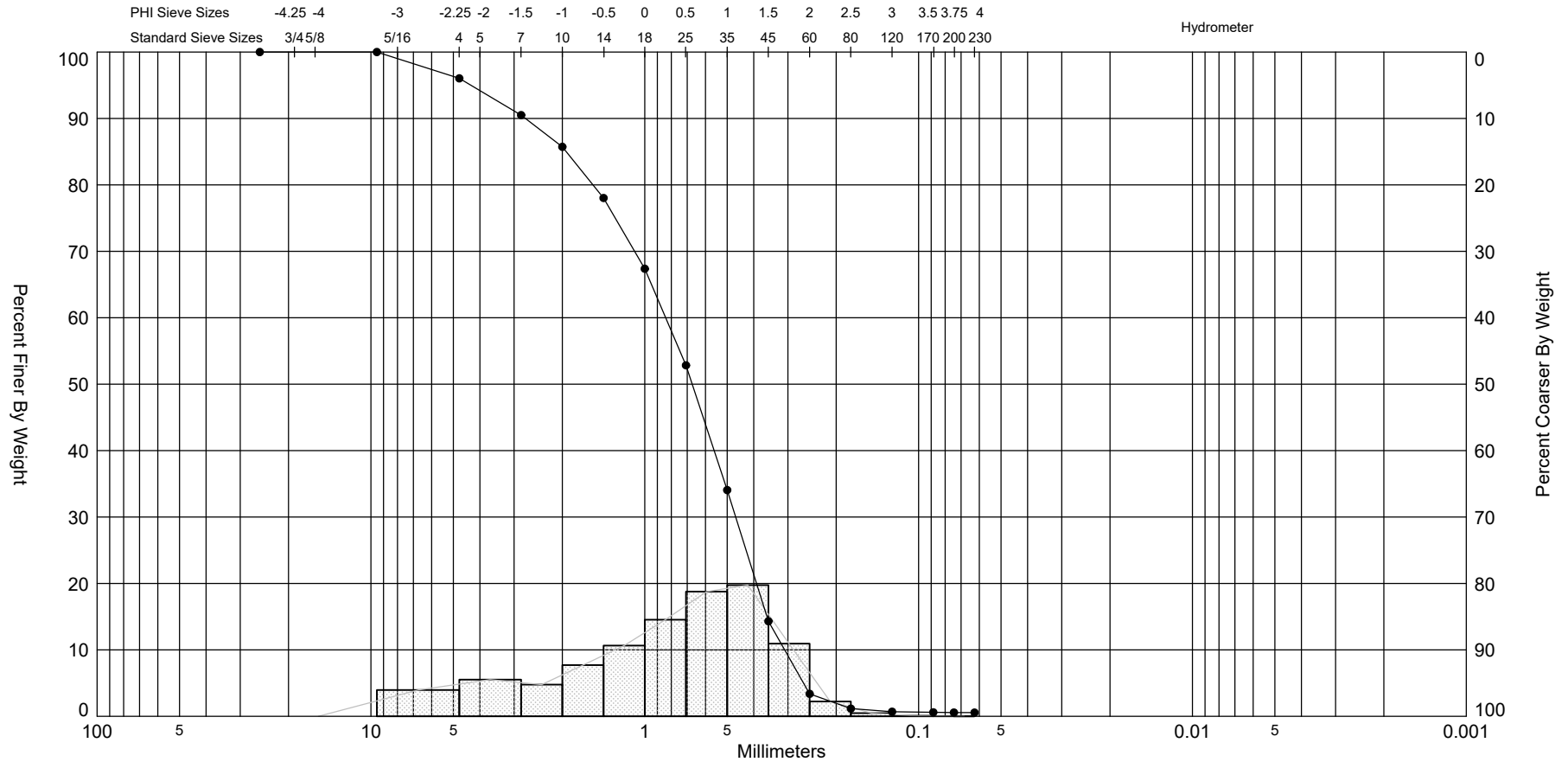
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.93	1.46	1.23	0.58	-0.36	-0.89	-2.11


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.33	0.80	1.2	-0.76	3.12

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-015 #S-4	—●—	-12.0	SP	#200 - 0.57 #230 - 0.56			0.58	0.33	-0.76	3.12	1.2	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,742,945
												Northing (Y, ft):	327,885
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-016 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,742,315</b>	Northing (ft): <b>327,106</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-6.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>123.47</b>	Wash Weight (g): <b>122.03</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.19</b> <b>#230 - 1.17</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.00	0.00	0.00	100.00
#14	-0.50	1.41	0.16	0.13	0.16	99.87
#18	0.00	1.00	0.56	0.45	0.72	99.42
#25	0.50	0.71	2.40	1.94	3.12	97.48
#35	1.00	0.50	10.27	8.32	13.39	89.16
#45	1.50	0.35	24.17	19.58	37.56	69.58
#60	2.00	0.25	54.88	44.45	92.44	25.13
#80	2.50	0.18	24.77	20.06	117.21	5.07
#120	3.00	0.13	4.36	3.53	121.57	1.54
#170	3.50	0.09	0.39	0.32	121.96	1.22
#200	3.75	0.07	0.04	0.03	122.00	1.19
#230	4.00	0.06	0.03	0.02	122.03	1.17

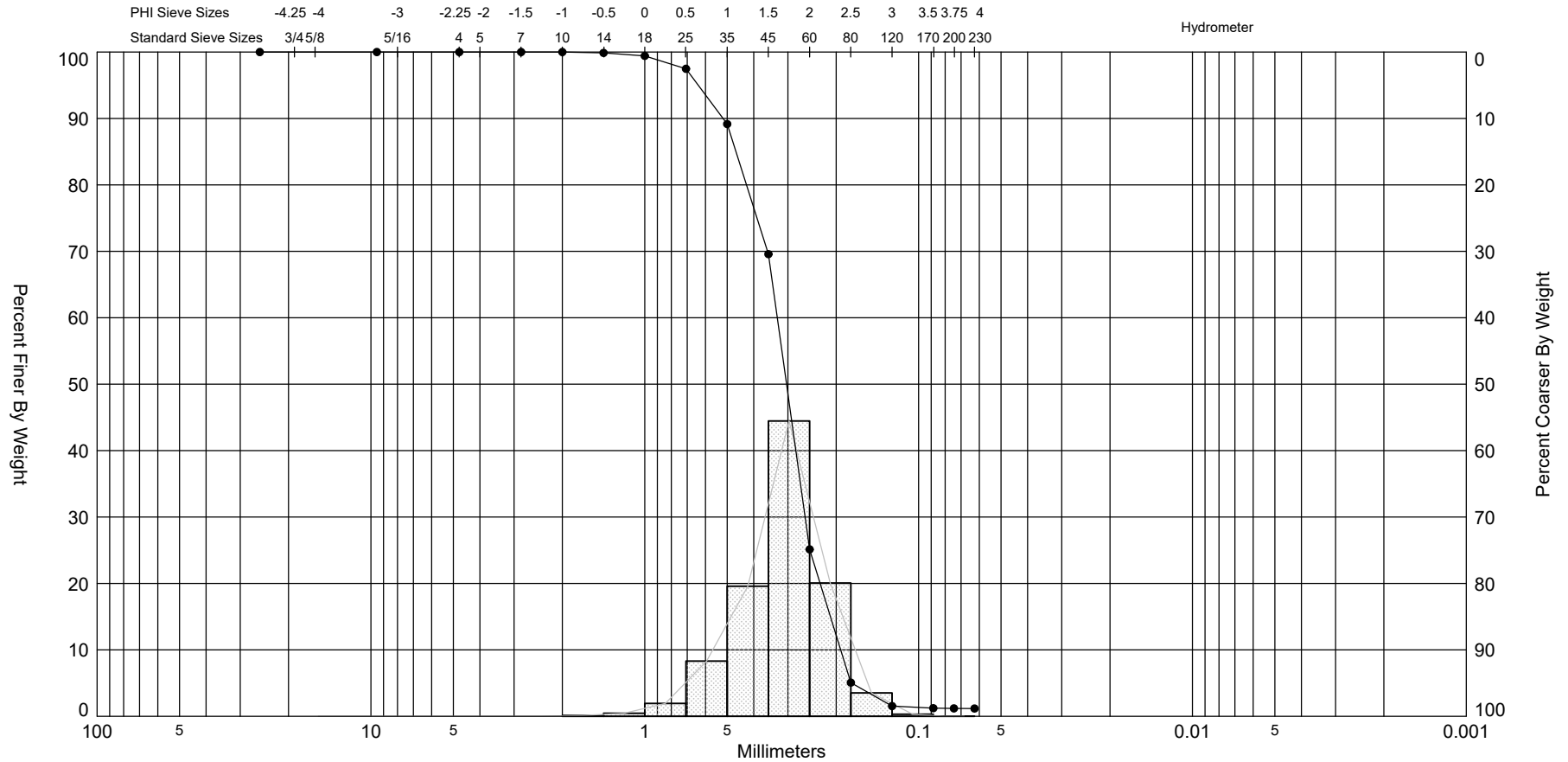
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.51	2.23	2.00	1.72	1.36	1.13	0.65


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.67	0.31	0.54	-0.52	4.12

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-016 #S-1	—●—	-6.0	SP	#200 - 1.19 #230 - 1.17			1.72	1.67	-0.52	4.12	0.54	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,742,315
												Northing (Y, ft):	327,106
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-016 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,742,315</b>	Northing (ft): <b>327,106</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>139.72</b>	Wash Weight (g): <b>138.25</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.08</b> <b>#230 - 1.04</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.39	0.28	0.39	99.72
#7	-1.50	2.83	0.72	0.52	1.11	99.20
#10	-1.00	2.00	0.89	0.64	2.00	98.56
#14	-0.50	1.41	1.11	0.79	3.11	97.77
#18	0.00	1.00	1.53	1.10	4.64	96.67
#25	0.50	0.71	3.00	2.15	7.64	94.52
#35	1.00	0.50	6.91	4.95	14.55	89.57
#45	1.50	0.35	16.25	11.63	30.80	77.94
#60	2.00	0.25	53.42	38.23	84.22	39.71
#80	2.50	0.18	44.28	31.69	128.50	8.02
#120	3.00	0.13	8.19	5.86	136.69	2.16
#170	3.50	0.09	1.30	0.93	137.99	1.23
#200	3.75	0.07	0.21	0.15	138.20	1.08
#230	4.00	0.06	0.05	0.04	138.25	1.04

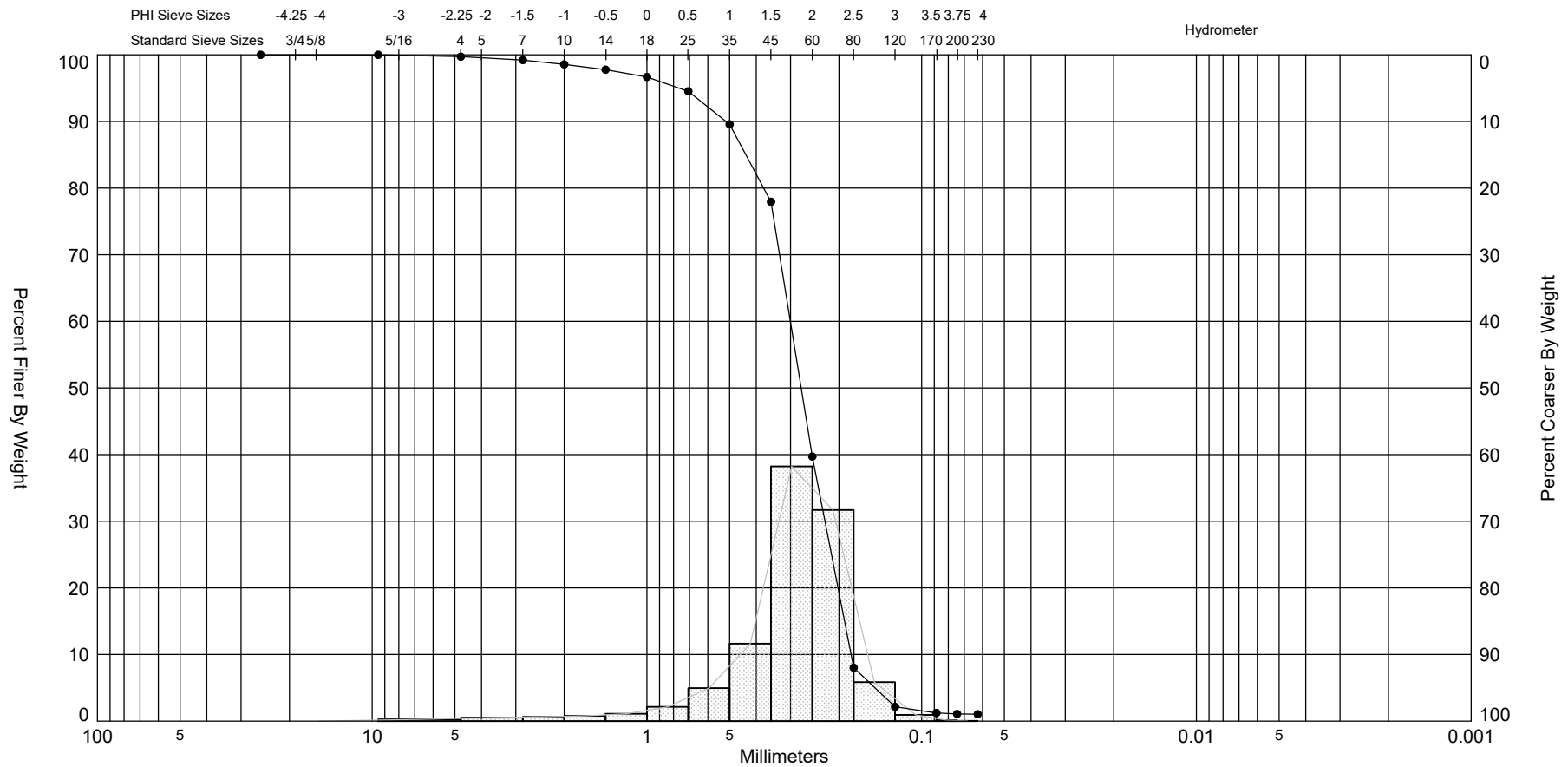
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.76	2.37	2.23	1.87	1.54	1.24	0.39


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.75	0.30	0.76	-2.05	10.33

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-016 #S-2	—●—	-7.5	SP	#200 - 1.08 #230 - 1.04			1.87	1.75	-2.05	10.33	0.76	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800				Easting (X, ft):	2,742,315		
										Northing (Y, ft):	327,106		
										Horizontal System:	NAD 1983		
										Vertical System:	MLLW		

**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-016 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,742,315</b>	Northing (ft): <b>327,106</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>153.41</b>	Wash Weight (g): <b>152.52</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.60</b> <b>#230 - 0.60</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.51	0.33	0.51	99.67
#7	-1.50	2.83	1.40	0.91	1.91	98.76
#10	-1.00	2.00	1.21	0.79	3.12	97.97
#14	-0.50	1.41	2.90	1.89	6.02	96.08
#18	0.00	1.00	5.39	3.51	11.41	92.57
#25	0.50	0.71	12.07	7.87	23.48	84.70
#35	1.00	0.50	25.67	16.73	49.15	67.97
#45	1.50	0.35	40.96	26.70	90.11	41.27
#60	2.00	0.25	44.50	29.01	134.61	12.26
#80	2.50	0.18	15.24	9.93	149.85	2.33
#120	3.00	0.13	2.46	1.60	152.31	0.73
#170	3.50	0.09	0.19	0.12	152.50	0.61
#200	3.75	0.07	0.02	0.01	152.52	0.60
#230	4.00	0.06	0.00	0.00	152.52	0.60

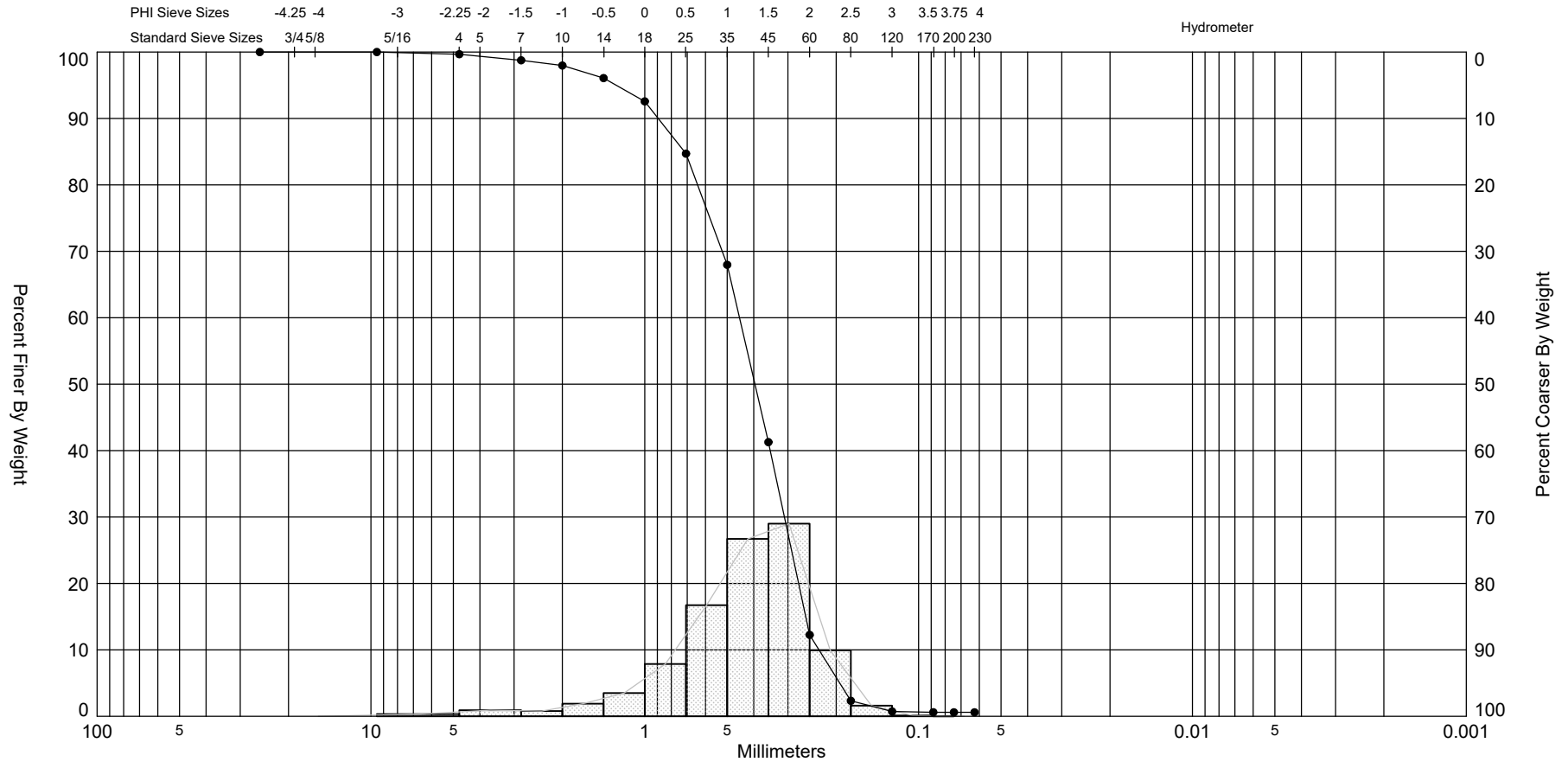
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.37	1.94	1.78	1.34	0.79	0.52	-0.35


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.21	0.43	0.83	-1.24	5.82

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-016 #S-3	—●—	-9.5	SP	#200 - 0.60 #230 - 0.60			1.34	1.21	-1.24	5.82	0.83	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							<b>Athena Technologies, Inc.</b> 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,742,315
												Northing (Y, ft):	327,106
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granulometric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-016 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,742,315</b>	Northing (ft): <b>327,106</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-11.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>176.01</b>	Wash Weight (g): <b>175.21</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.48</b> <b>#230 - 0.47</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	3.68	2.09	3.68	97.91
#7	-1.50	2.83	5.72	3.25	9.40	94.66
#10	-1.00	2.00	5.98	3.40	15.38	91.26
#14	-0.50	1.41	10.48	5.95	25.86	85.31
#18	0.00	1.00	14.12	8.02	39.98	77.29
#25	0.50	0.71	19.62	11.15	59.60	66.14
#35	1.00	0.50	29.33	16.66	88.93	49.48
#45	1.50	0.35	40.26	22.87	129.19	26.61
#60	2.00	0.25	36.54	20.76	165.73	5.85
#80	2.50	0.18	8.11	4.61	173.84	1.24
#120	3.00	0.13	1.24	0.70	175.08	0.54
#170	3.50	0.09	0.11	0.06	175.19	0.48
#200	3.75	0.07	0.00	0.00	175.19	0.48
#230	4.00	0.06	0.02	0.01	175.21	0.47

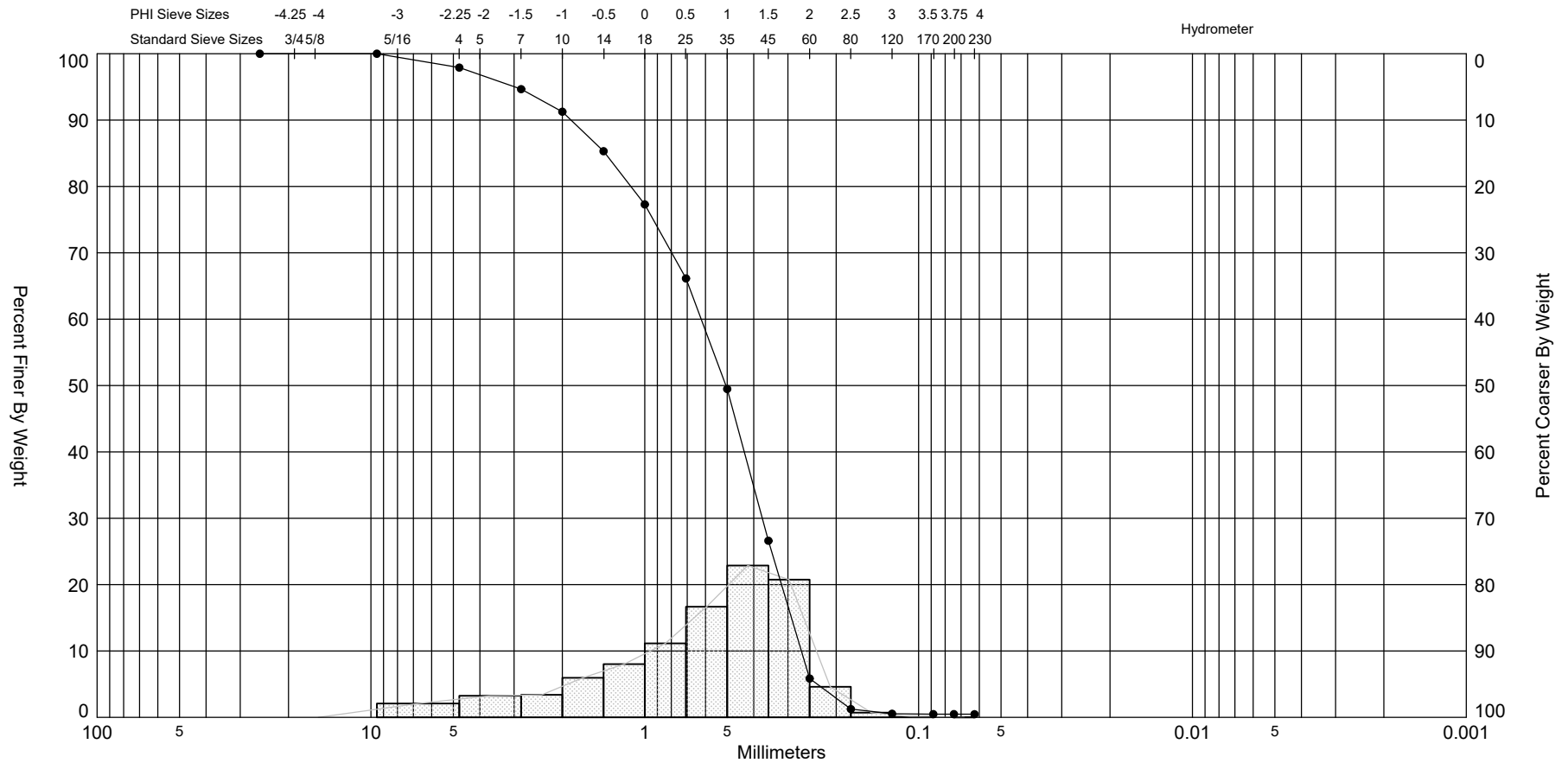
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.09	1.76	1.54	0.98	0.10	-0.42	-1.58


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.71	0.61	1.12	-1	3.74

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-016 #S-4	—●—	-11.5	SP	#200 - 0.48 #230 - 0.47			0.98	0.71	-1	3.74	1.12	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,742,315
												Northing (Y, ft):	327,106
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-017 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,740</b>	Northing (ft): <b>325,790</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-3.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>106.76</b>	Wash Weight (g): <b>105.21</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.83</b> <b>#230 - 1.46</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.12	0.11	0.12	99.89
#7	-1.50	2.83	0.07	0.07	0.19	99.82
#10	-1.00	2.00	0.08	0.07	0.27	99.75
#14	-0.50	1.41	0.09	0.08	0.36	99.67
#18	0.00	1.00	0.33	0.31	0.69	99.36
#25	0.50	0.71	0.71	0.67	1.40	98.69
#35	1.00	0.50	1.79	1.68	3.19	97.01
#45	1.50	0.35	5.62	5.26	8.81	91.75
#60	2.00	0.25	25.95	24.31	34.76	67.44
#80	2.50	0.18	39.44	36.94	74.20	30.50
#120	3.00	0.13	21.96	20.57	96.16	9.93
#170	3.50	0.09	7.38	6.91	103.54	3.02
#200	3.75	0.07	1.27	1.19	104.81	1.83
#230	4.00	0.06	0.40	0.37	105.21	1.46

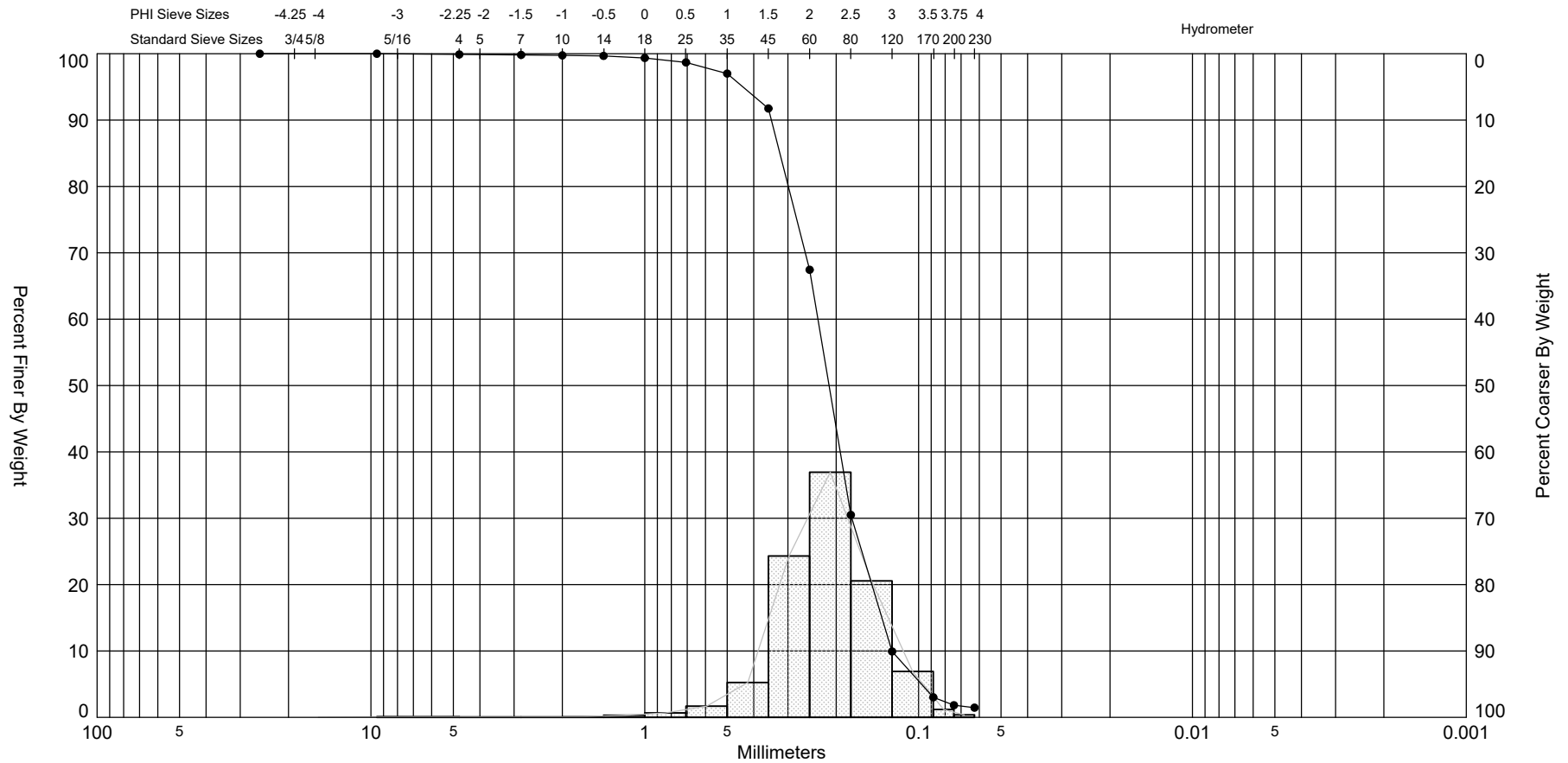
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.36	2.85	2.63	2.24	1.84	1.66	1.19


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.21	0.22	0.64	-1.13	9.36

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-017 #S-1	●—	-3.0	SP	#200 - 1.83 #230 - 1.46			2.24	2.21	-1.13	9.36	0.64	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,741,740
												Northing (Y, ft):	325,790
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-017 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,740</b>	Northing (ft): <b>325,790</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>109.73</b>	Wash Weight (g): <b>108.68</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.06</b> <b>#230 - 0.95</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	1.22	1.11	1.22	98.89
#7	-1.50	2.83	1.08	0.98	2.30	97.91
#10	-1.00	2.00	1.13	1.03	3.43	96.88
#14	-0.50	1.41	2.25	2.05	5.68	94.83
#18	0.00	1.00	3.64	3.32	9.32	91.51
#25	0.50	0.71	6.44	5.87	15.76	85.64
#35	1.00	0.50	12.21	11.13	27.97	74.51
#45	1.50	0.35	20.87	19.02	48.84	55.49
#60	2.00	0.25	26.62	24.26	75.46	31.23
#80	2.50	0.18	13.97	12.73	89.43	18.50
#120	3.00	0.13	13.80	12.58	103.23	5.92
#170	3.50	0.09	4.67	4.26	107.90	1.66
#200	3.75	0.07	0.66	0.60	108.56	1.06
#230	4.00	0.06	0.12	0.11	108.68	0.95

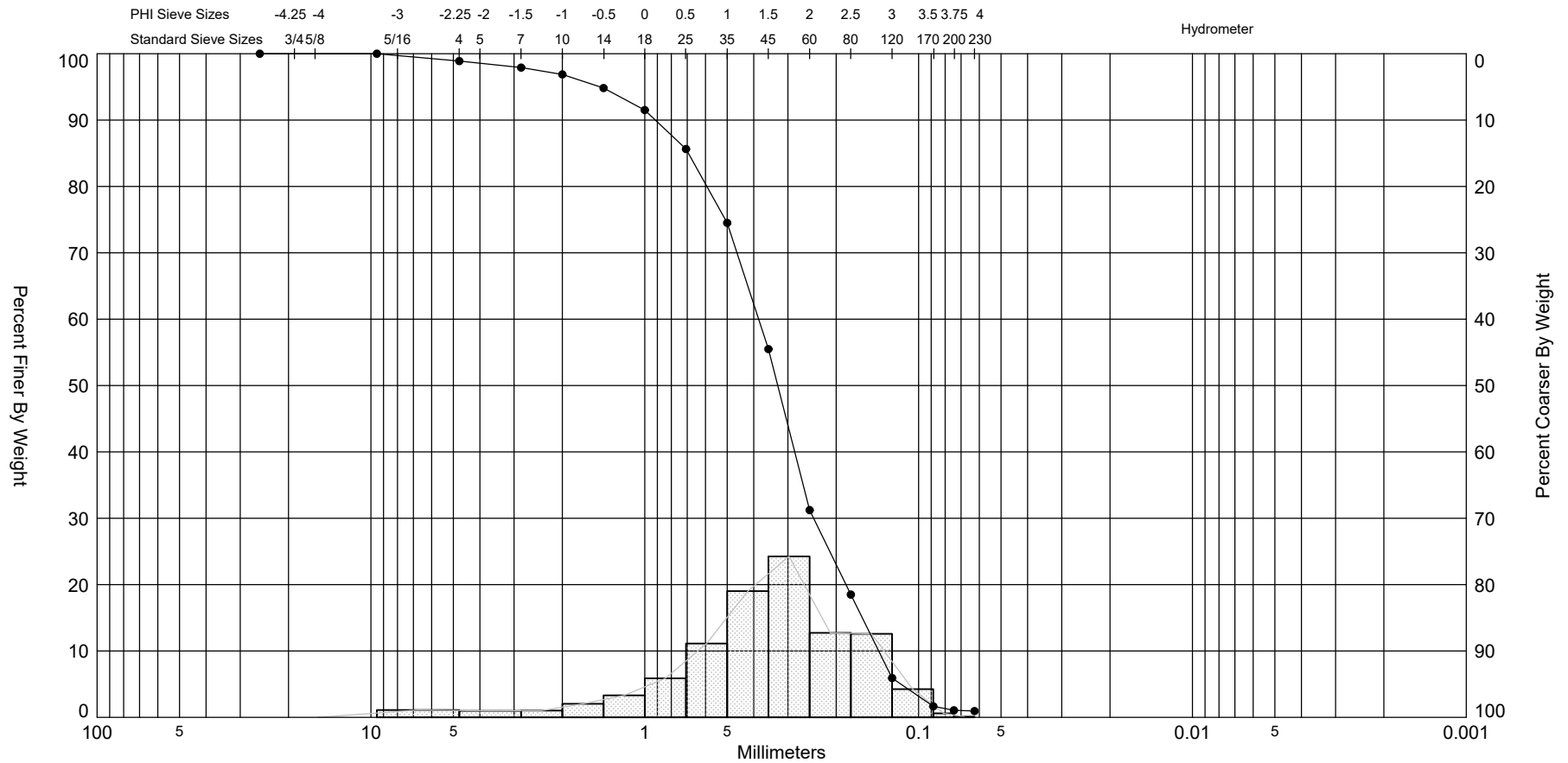
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.11	2.60	2.24	1.61	0.98	0.57	-0.54


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.49	0.36	1.1	-1.02	4.97

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-017 #S-2	—●—	-5.5	SP	#200 - 1.06 #230 - 0.95			1.61	1.49	-1.02	4.97	1.1	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,741,740
												Northing (Y, ft):	325,790
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-017 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,740</b>	Northing (ft): <b>325,790</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.0 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>111.56</b>	Wash Weight (g): <b>110.83</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.69</b> <b>#230 - 0.65</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.05	0.04	0.05	99.96
#10	-1.00	2.00	0.10	0.09	0.15	99.87
#14	-0.50	1.41	0.36	0.32	0.51	99.55
#18	0.00	1.00	0.84	0.75	1.35	98.80
#25	0.50	0.71	2.57	2.30	3.92	96.50
#35	1.00	0.50	8.13	7.29	12.05	89.21
#45	1.50	0.35	15.57	13.96	27.62	75.25
#60	2.00	0.25	36.99	33.16	64.61	42.09
#80	2.50	0.18	38.50	34.51	103.11	7.58
#120	3.00	0.13	6.86	6.15	109.97	1.43
#170	3.50	0.09	0.70	0.63	110.67	0.80
#200	3.75	0.07	0.12	0.11	110.79	0.69
#230	4.00	0.06	0.04	0.04	110.83	0.65

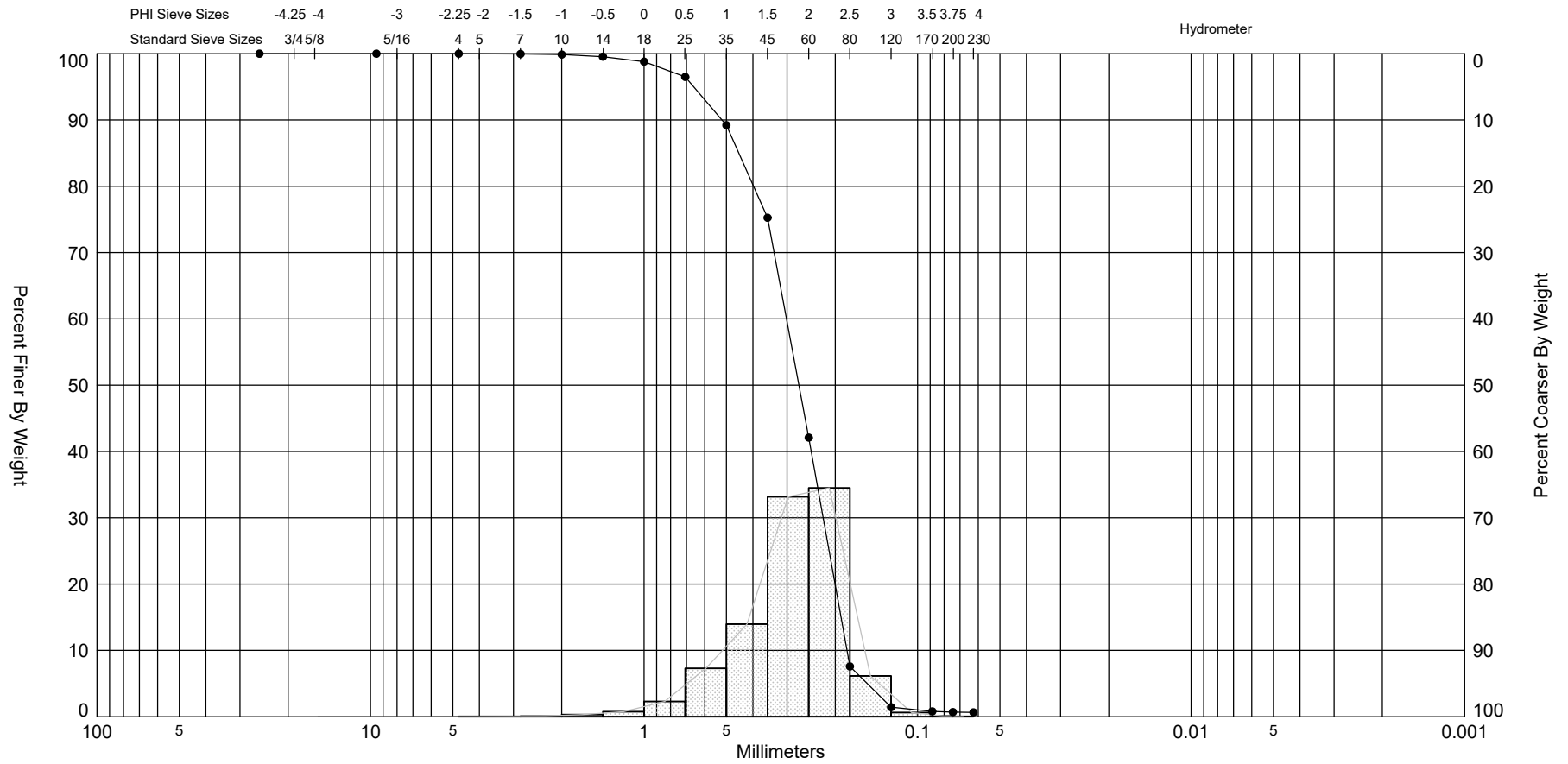
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.71	2.38	2.25	1.88	1.50	1.19	0.60


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.79	0.29	0.63	-0.97	5.02

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay	
Coarse	Fine	Coarse	Medium	Fine		

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-017 #S-3	●—	-7.0	SP	#200 - 0.69 #230 - 0.65			1.88	1.79	-0.97	5.02	0.63	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						<b>Athena Technologies, Inc.</b> 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,741,740
												Northing (Y, ft):	325,790
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-017 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,740</b>	Northing (ft): <b>325,790</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>147.51</b>	Wash Weight (g): <b>146.44</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.75</b> <b>#230 - 0.74</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.96	0.65	0.96	99.35
#7	-1.50	2.83	1.32	0.89	2.28	98.46
#10	-1.00	2.00	1.58	1.07	3.86	97.39
#14	-0.50	1.41	2.82	1.91	6.68	95.48
#18	0.00	1.00	5.45	3.69	12.13	91.79
#25	0.50	0.71	11.88	8.05	24.01	83.74
#35	1.00	0.50	23.36	15.84	47.37	67.90
#45	1.50	0.35	34.07	23.10	81.44	44.80
#60	2.00	0.25	43.33	29.37	124.77	15.43
#80	2.50	0.18	17.87	12.11	142.64	3.32
#120	3.00	0.13	3.26	2.21	145.90	1.11
#170	3.50	0.09	0.47	0.32	146.37	0.79
#200	3.75	0.07	0.06	0.04	146.43	0.75
#230	4.00	0.06	0.01	0.01	146.44	0.74

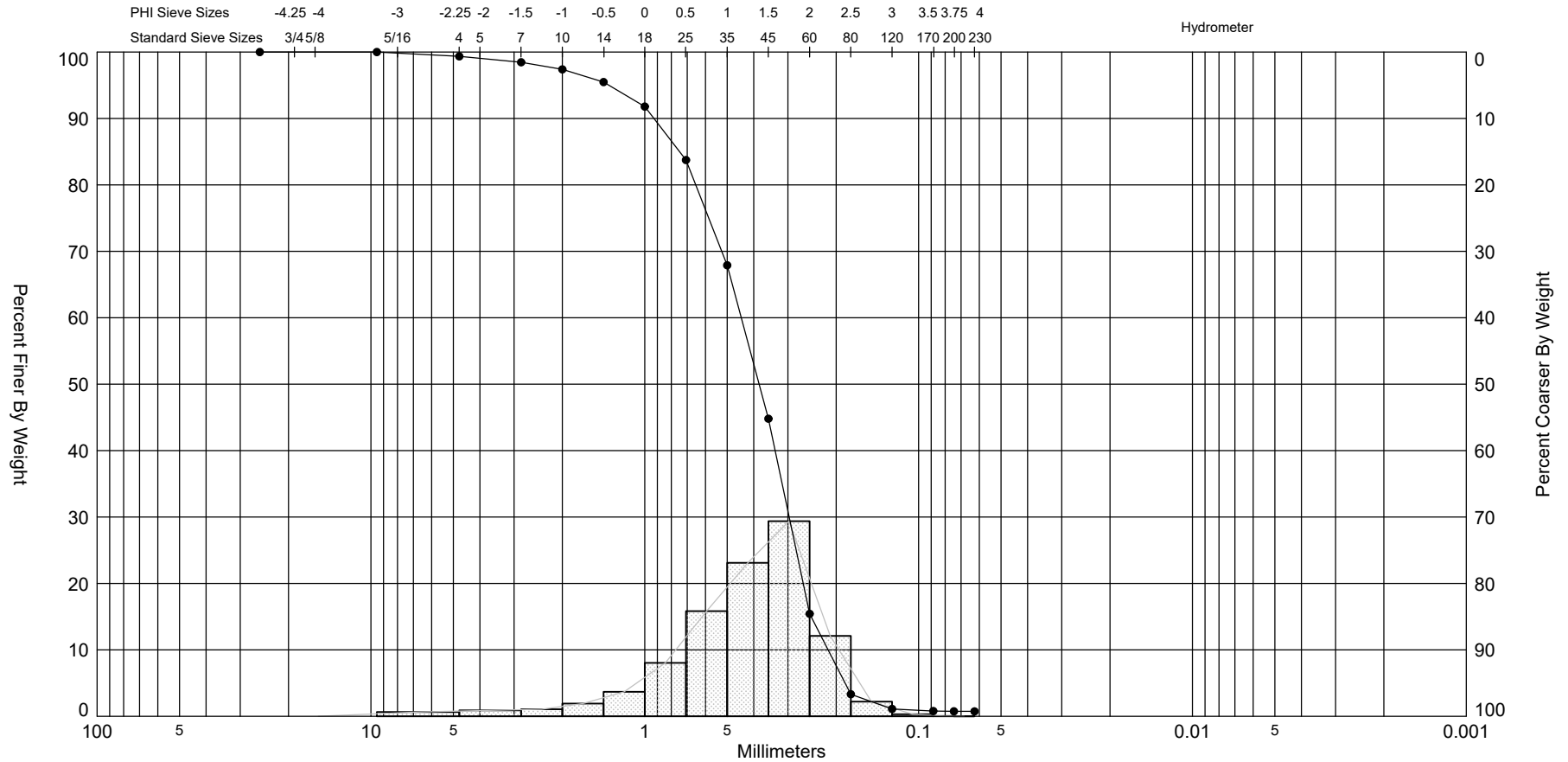
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.43	1.99	1.84	1.39	0.78	0.48	-0.43


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.22	0.43	0.9	-1.27	5.85

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-017 #S-4	—●—	-9.5	SP	#200 - 0.75 #230 - 0.74			1.39	1.22	-1.27	5.85	0.9	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,741,740
												Northing (Y, ft):	325,790
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-018 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,532</b>	Northing (ft): <b>326,627</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>111.14</b>	Wash Weight (g): <b>110.42</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.66</b> <b>#230 - 0.64</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.96	0.86	0.96	99.14
#4	-2.25	4.76	1.39	1.25	2.35	97.89
#7	-1.50	2.83	2.26	2.03	4.61	95.86
#10	-1.00	2.00	2.73	2.46	7.34	93.40
#14	-0.50	1.41	4.38	3.94	11.72	89.46
#18	0.00	1.00	6.54	5.88	18.26	83.58
#25	0.50	0.71	10.30	9.27	28.56	74.31
#35	1.00	0.50	16.70	15.03	45.26	59.28
#45	1.50	0.35	25.19	22.67	70.45	36.61
#60	2.00	0.25	26.51	23.85	96.96	12.76
#80	2.50	0.18	9.30	8.37	106.26	4.39
#120	3.00	0.13	3.49	3.14	109.75	1.25
#170	3.50	0.09	0.54	0.49	110.29	0.76
#200	3.75	0.07	0.11	0.10	110.40	0.66
#230	4.00	0.06	0.02	0.02	110.42	0.64

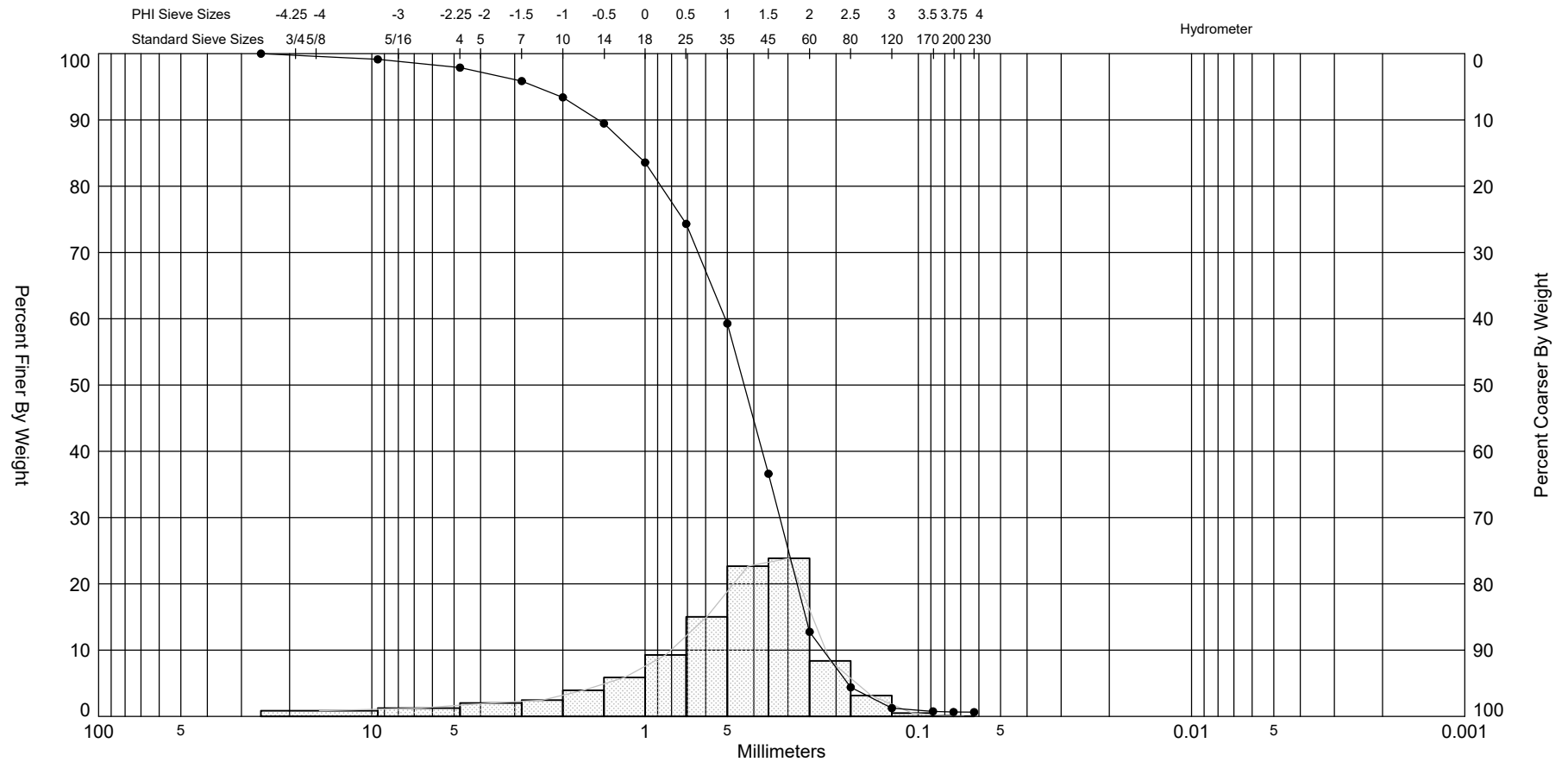
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.46	1.93	1.74	1.20	0.46	-0.04	-1.33


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.96	0.51	1.17	-1.35	5.7

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-018 #S-1	—●—	-7.1	SP	#200 - 0.66 #230 - 0.64			1.2	0.96	-1.35	5.7	1.17	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,741,532
												Northing (Y, ft):	326,627
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-018 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,532</b>	Northing (ft): <b>326,627</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.1 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>127.96</b>	Wash Weight (g): <b>126.77</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.94</b> <b>#230 - 0.92</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	6.69	5.23	6.69	94.77
#4	-2.25	4.76	11.23	8.78	17.92	85.99
#7	-1.50	2.83	11.71	9.15	29.63	76.84
#10	-1.00	2.00	9.58	7.49	39.21	69.35
#14	-0.50	1.41	11.73	9.17	50.94	60.18
#18	0.00	1.00	11.95	9.34	62.89	50.84
#25	0.50	0.71	11.32	8.85	74.21	41.99
#35	1.00	0.50	9.96	7.78	84.17	34.21
#45	1.50	0.35	9.56	7.47	93.73	26.74
#60	2.00	0.25	17.00	13.29	110.73	13.45
#80	2.50	0.18	13.17	10.29	123.90	3.16
#120	3.00	0.13	2.51	1.96	126.41	1.20
#170	3.50	0.09	0.31	0.24	126.72	0.96
#200	3.75	0.07	0.02	0.02	126.74	0.94
#230	4.00	0.06	0.03	0.02	126.77	0.92

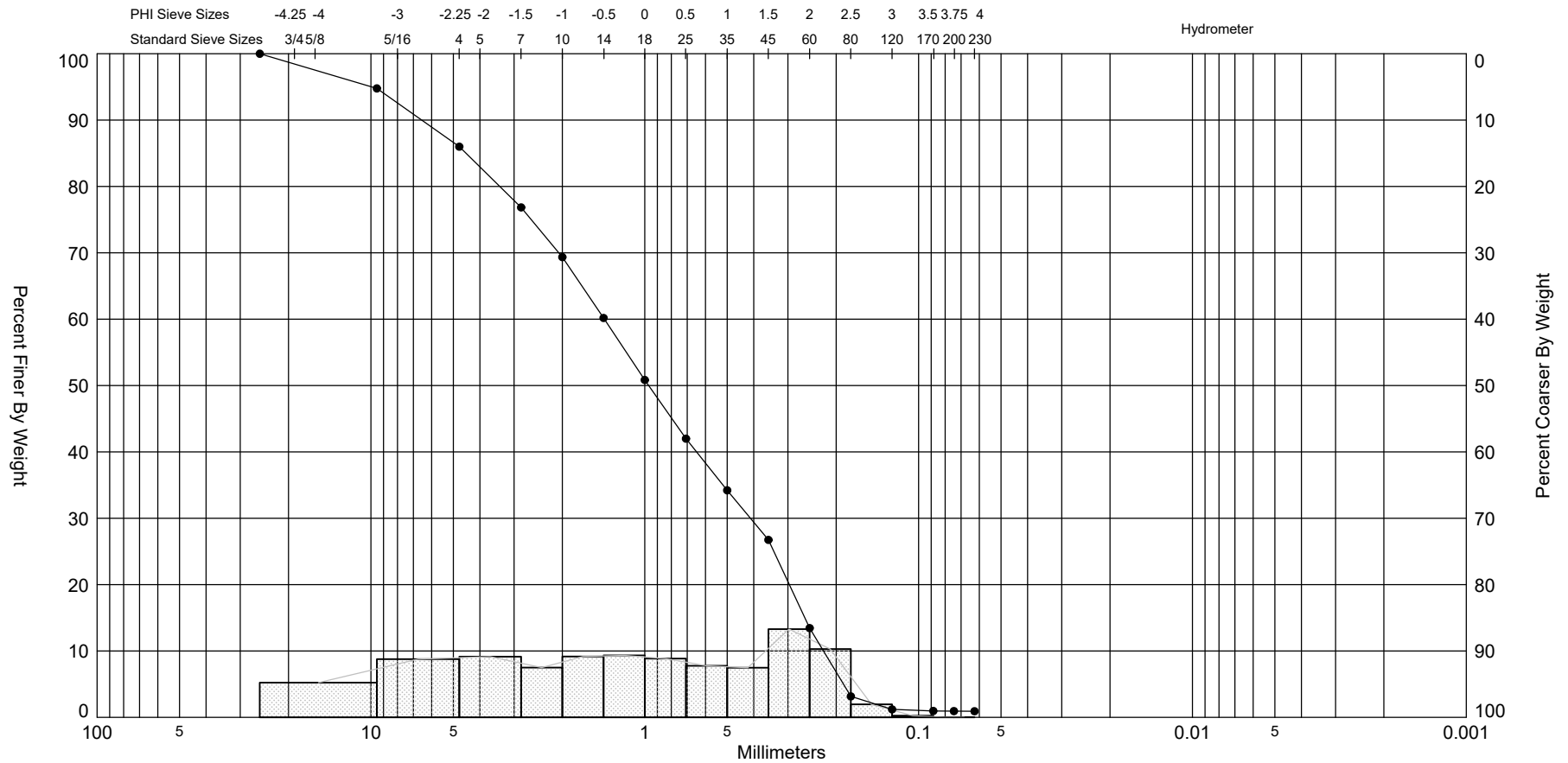
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.41	1.90	1.57	0.05	-1.38	-2.09	-3.31


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-0.11	1.08	1.81	-0.39	2.23

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-018 #S-2	—●—	-9.1	SP	#200 - 0.94 #230 - 0.92			0.05	-0.11	-0.39	2.23	1.81	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,741,532
												Northing (Y, ft):	326,627
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-018 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,532</b>	Northing (ft): <b>326,627</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-10.6 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>157.06</b>	Wash Weight (g): <b>155.79</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.84</b> <b>#230 - 0.81</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	1.98	1.26	1.98	98.74
#7	-1.50	2.83	2.10	1.34	4.08	97.40
#10	-1.00	2.00	2.39	1.52	6.47	95.88
#14	-0.50	1.41	4.06	2.58	10.53	93.30
#18	0.00	1.00	7.00	4.46	17.53	88.84
#25	0.50	0.71	16.45	10.47	33.98	78.37
#35	1.00	0.50	32.86	20.92	66.84	57.45
#45	1.50	0.35	41.90	26.68	108.74	30.77
#60	2.00	0.25	36.71	23.37	145.45	7.40
#80	2.50	0.18	8.76	5.58	154.21	1.82
#120	3.00	0.13	1.38	0.88	155.59	0.94
#170	3.50	0.09	0.12	0.08	155.71	0.86
#200	3.75	0.07	0.03	0.02	155.74	0.84
#230	4.00	0.06	0.05	0.03	155.79	0.81

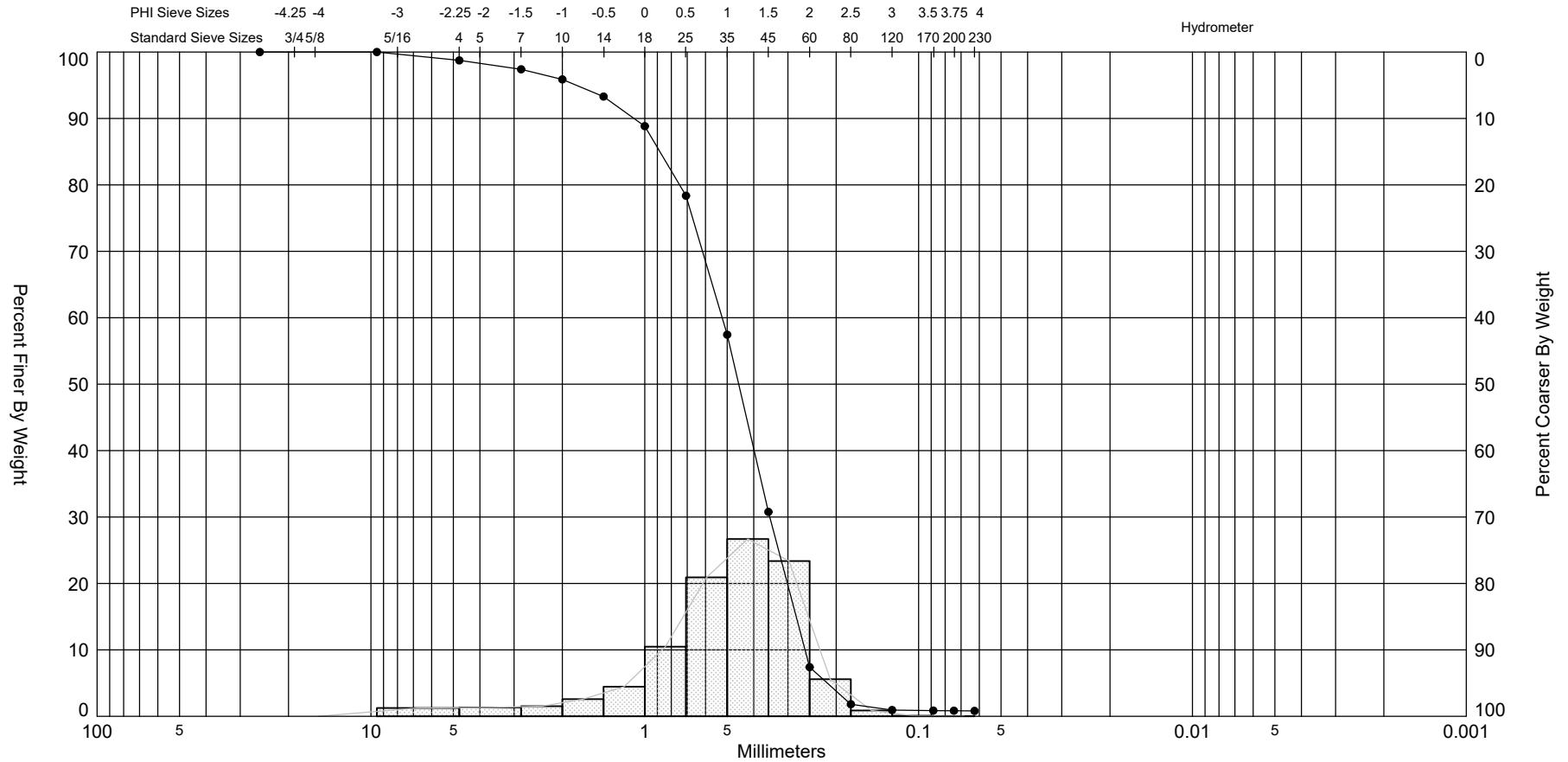
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.22	1.82	1.62	1.14	0.58	0.23	-0.83


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.98	0.51	0.93	-1.38	6.01

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-018 #S-3	●—	-10.6	SP	#200 - 0.84 #230 - 0.81			1.14	0.98	-1.38	6.01	0.93	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,741,532
												Northing (Y, ft):	326,627
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-019 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,637</b>	Northing (ft): <b>326,293</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-3.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>150.19</b>	Wash Weight (g): <b>149.36</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.55</b> <b>#230 - 0.54</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	2.87	1.91	2.87	98.09
#7	-1.50	2.83	6.21	4.13	9.08	93.96
#10	-1.00	2.00	6.47	4.31	15.55	89.65
#14	-0.50	1.41	10.59	7.05	26.14	82.60
#18	0.00	1.00	13.98	9.31	40.12	73.29
#25	0.50	0.71	18.41	12.26	58.53	61.03
#35	1.00	0.50	24.79	16.51	83.32	44.52
#45	1.50	0.35	29.45	19.61	112.77	24.91
#60	2.00	0.25	26.48	17.63	139.25	7.28
#80	2.50	0.18	8.33	5.55	147.58	1.73
#120	3.00	0.13	1.56	1.04	149.14	0.69
#170	3.50	0.09	0.21	0.14	149.35	0.55
#200	3.75	0.07	0.00	0.00	149.35	0.55
#230	4.00	0.06	0.01	0.01	149.36	0.54

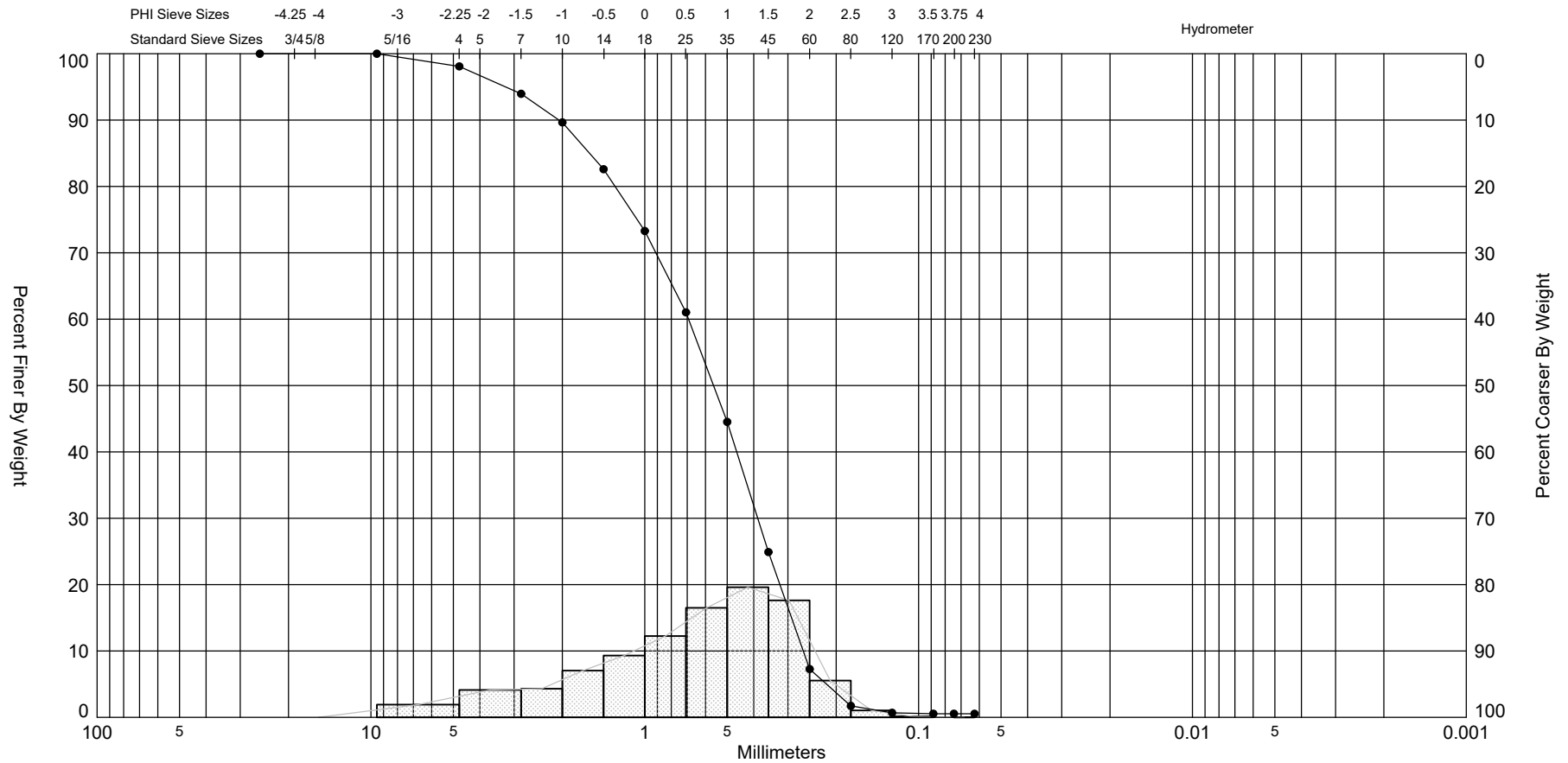
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.21	1.75	1.50	0.83	-0.09	-0.60	-1.69


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.61	0.66	1.17	-0.75	3.17

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-019 #S-1	—●—	-3.5	SP	#200 - 0.55 #230 - 0.54			0.83	0.61	-0.75	3.17	1.17	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,740,637
												Northing (Y, ft):	326,293
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-019 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,637</b>	Northing (ft): <b>326,293</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-4.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>111.76</b>	Wash Weight (g): <b>111.12</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.57</b> <b>#230 - 0.56</b>	Organics (%):	Carbonates (%):	Shells (%):
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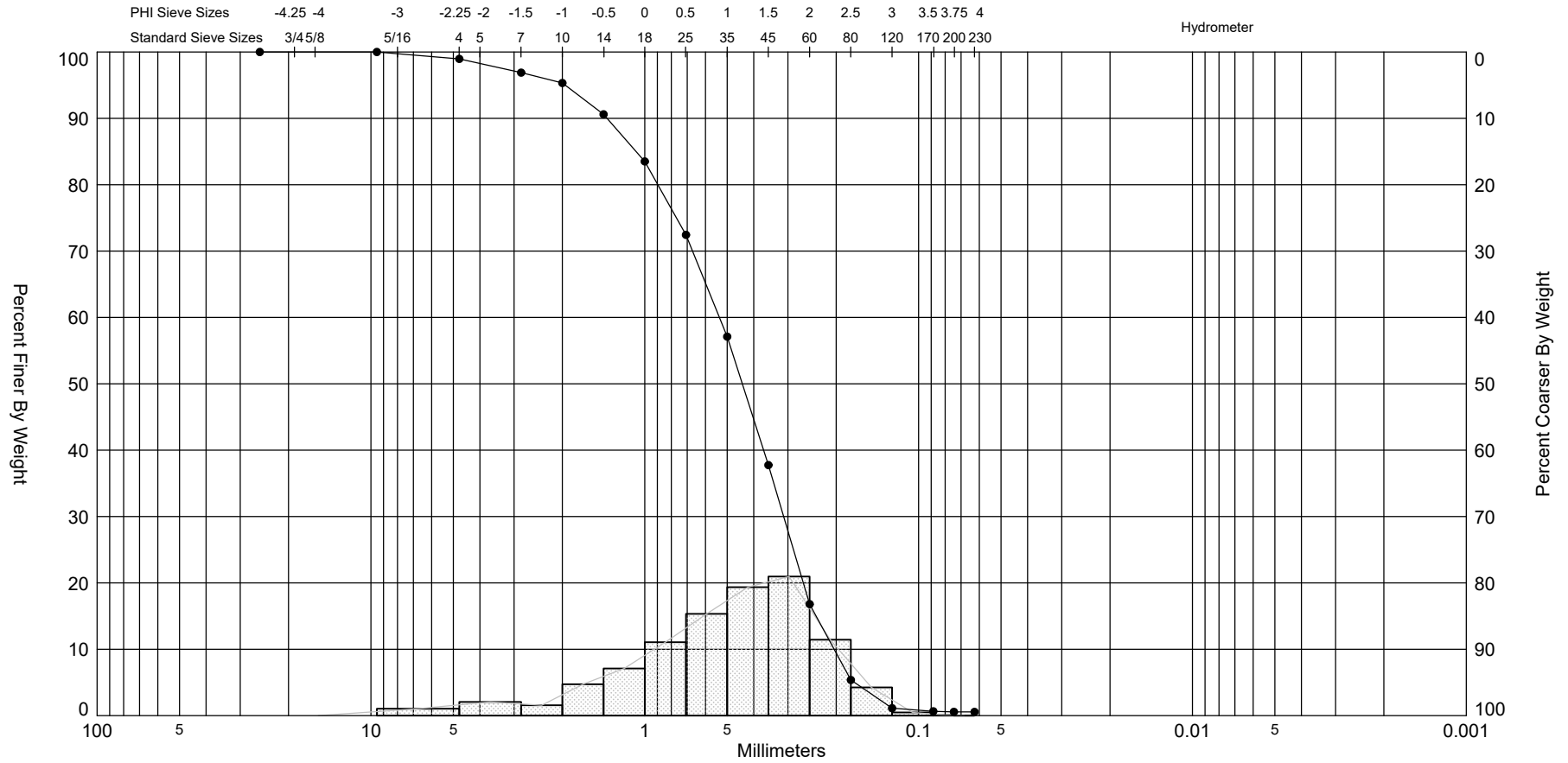
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	1.16	1.04	1.16	98.96
#7	-1.50	2.83	2.31	2.07	3.47	96.89
#10	-1.00	2.00	1.74	1.56	5.21	95.33
#14	-0.50	1.41	5.28	4.72	10.49	90.61
#18	0.00	1.00	7.94	7.10	18.43	83.51
#25	0.50	0.71	12.37	11.07	30.80	72.44
#35	1.00	0.50	17.13	15.33	47.93	57.11
#45	1.50	0.35	21.64	19.36	69.57	37.75
#60	2.00	0.25	23.41	20.95	92.98	16.80
#80	2.50	0.18	12.77	11.43	105.75	5.37
#120	3.00	0.13	4.75	4.25	110.50	1.12
#170	3.50	0.09	0.52	0.47	111.02	0.65
#200	3.75	0.07	0.09	0.08	111.11	0.57
#230	4.00	0.06	0.01	0.01	111.12	0.56

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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.54	2.03	1.80	1.18	0.38	-0.03	-0.97

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.01	0.50	1.09	-0.83	3.83

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-019 #S-2	●—	-4.5	SP	#200 - 0.57 #230 - 0.56			1.18	1.01	-0.83	3.83	1.09	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,740,637
												Northing (Y, ft):	326,293
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-019 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,637</b>	Northing (ft): <b>326,293</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.5 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>114.67</b>	Wash Weight (g): <b>112.79</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.74</b> <b>#230 - 1.63</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.07	0.06	0.07	99.94
#7	-1.50	2.83	0.31	0.27	0.38	99.67
#10	-1.00	2.00	0.66	0.58	1.04	99.09
#14	-0.50	1.41	1.09	0.95	2.13	98.14
#18	0.00	1.00	2.03	1.77	4.16	96.37
#25	0.50	0.71	3.44	3.00	7.60	93.37
#35	1.00	0.50	6.69	5.83	14.29	87.54
#45	1.50	0.35	11.83	10.32	26.12	77.22
#60	2.00	0.25	18.98	16.55	45.10	60.67
#80	2.50	0.18	25.12	21.91	70.22	38.76
#120	3.00	0.13	33.71	29.40	103.93	9.36
#170	3.50	0.09	7.77	6.78	111.70	2.58
#200	3.75	0.07	0.96	0.84	112.66	1.74
#230	4.00	0.06	0.13	0.11	112.79	1.63

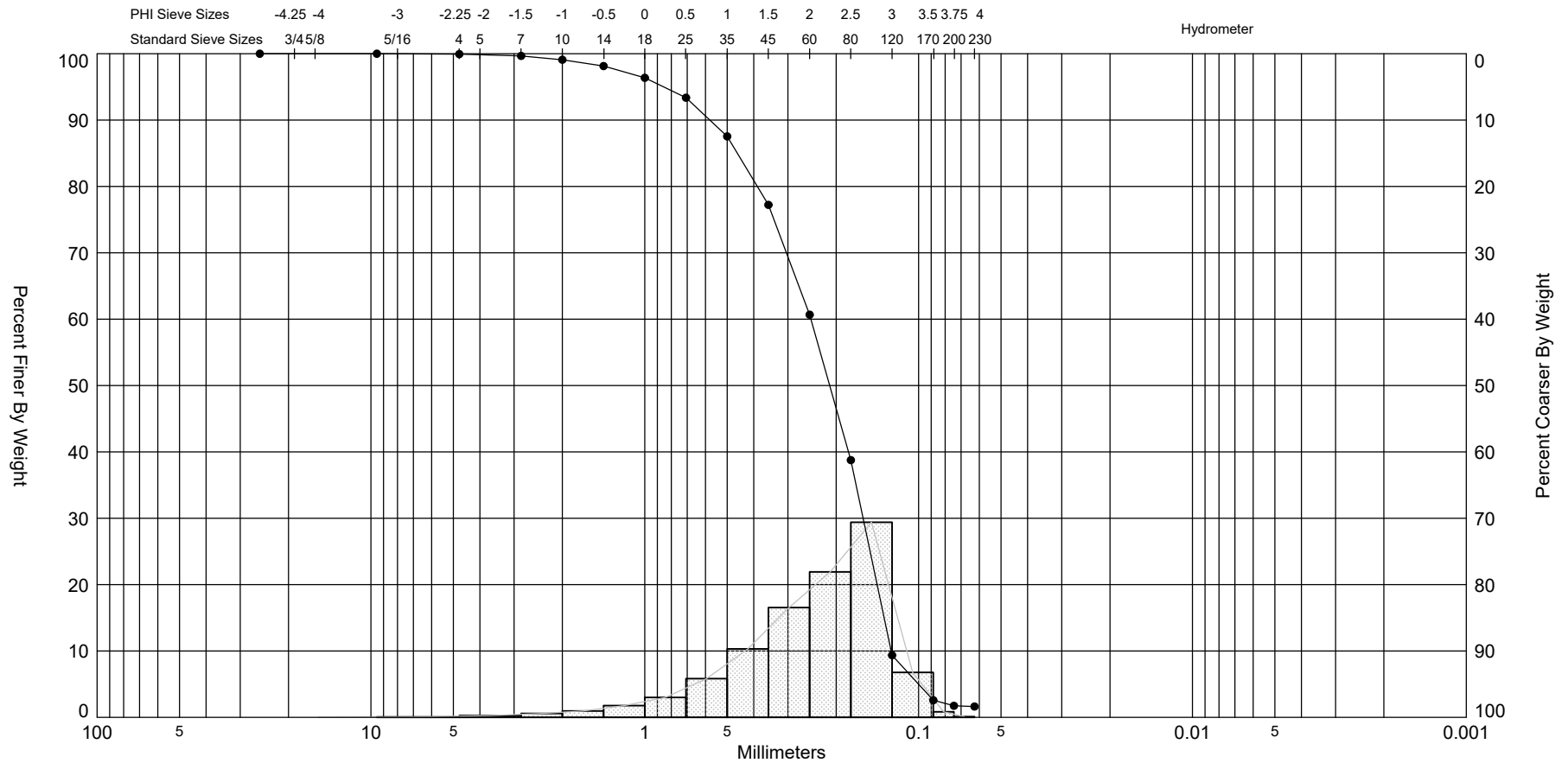
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.32	2.89	2.73	2.24	1.57	1.17	0.23


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.03	0.24	0.92	-1.19	4.86

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-019 #S-3	—●—	-5.5	SP	#200 - 1.74 #230 - 1.63			2.24	2.03	-1.19	4.86	0.92	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,740,637
												Northing (Y, ft):	326,293
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-019 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,637</b>	Northing (ft): <b>326,293</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.7 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>103.57</b>	Wash Weight (g): <b>102.87</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.69</b> <b>#230 - 0.68</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.44	0.42	0.44	99.58
#4	-2.25	4.76	0.28	0.27	0.72	99.31
#7	-1.50	2.83	0.64	0.62	1.36	98.69
#10	-1.00	2.00	0.56	0.54	1.92	98.15
#14	-0.50	1.41	0.76	0.73	2.68	97.42
#18	0.00	1.00	1.40	1.35	4.08	96.07
#25	0.50	0.71	2.56	2.47	6.64	93.60
#35	1.00	0.50	5.87	5.67	12.51	87.93
#45	1.50	0.35	17.55	16.95	30.06	70.98
#60	2.00	0.25	45.75	44.17	75.81	26.81
#80	2.50	0.18	22.10	21.34	97.91	5.47
#120	3.00	0.13	4.31	4.16	102.22	1.31
#170	3.50	0.09	0.57	0.55	102.79	0.76
#200	3.75	0.07	0.07	0.07	102.86	0.69
#230	4.00	0.06	0.01	0.01	102.87	0.68

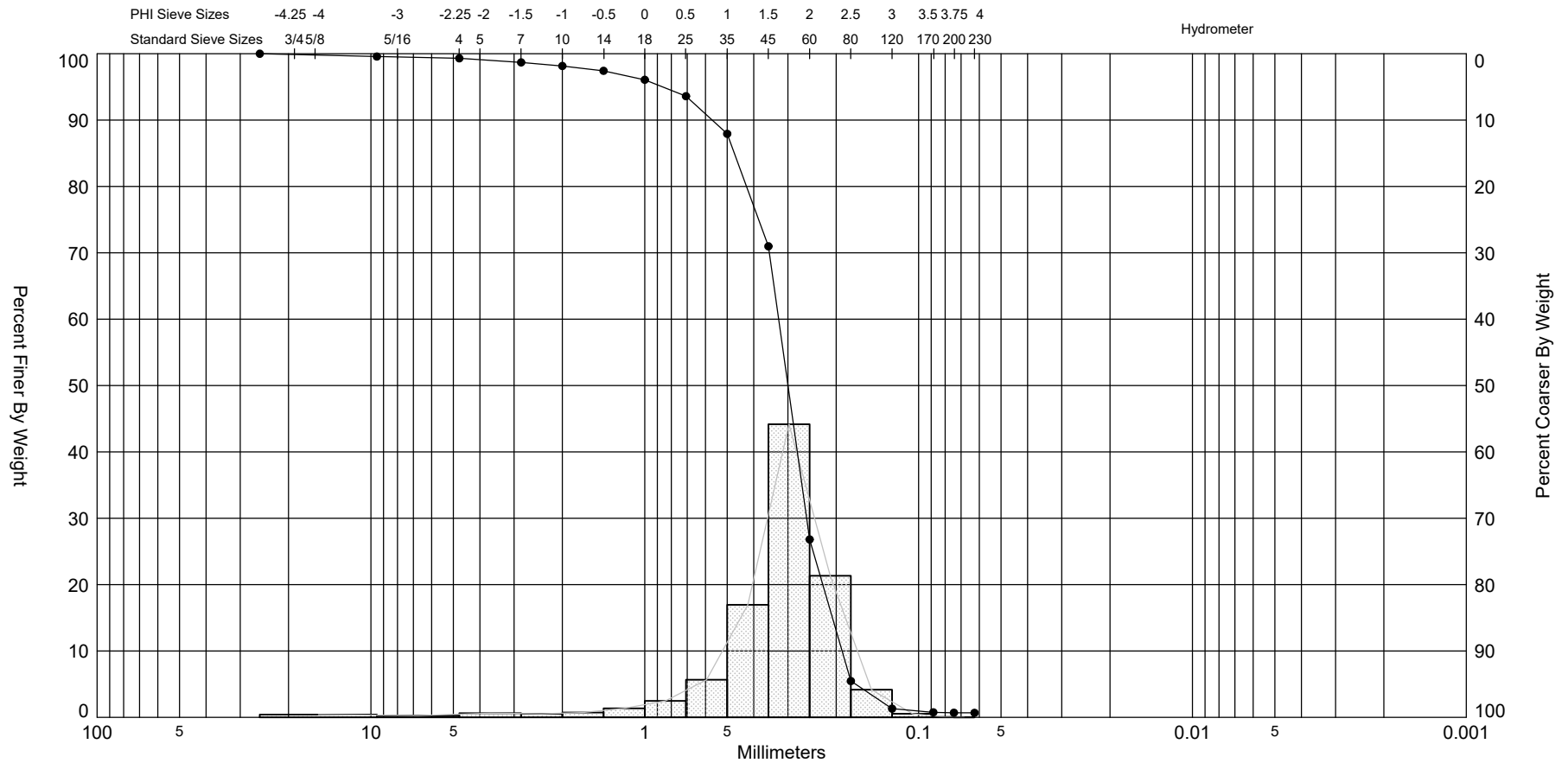
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.56	2.25	2.04	1.74	1.38	1.12	0.22


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.61	0.33	0.82	-2.71	15.58

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-019 #S-4	●—	-7.7	SP	#200 - 0.69 #230 - 0.68			1.74	1.61	-2.71	15.58	0.82	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,740,637
												Northing (Y, ft):	326,293
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-019 #S-5

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,637</b>	Northing (ft): <b>326,293</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-9.7 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>117.30</b>	Wash Weight (g): <b>114.47</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 3.05</b> <b>#230 - 2.39</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.03	0.03	0.03	99.97
#10	-1.00	2.00	0.05	0.04	0.08	99.93
#14	-0.50	1.41	0.03	0.03	0.11	99.90
#18	0.00	1.00	0.09	0.08	0.20	99.82
#25	0.50	0.71	0.22	0.19	0.42	99.63
#35	1.00	0.50	0.70	0.60	1.12	99.03
#45	1.50	0.35	2.19	1.87	3.31	97.16
#60	2.00	0.25	9.12	7.77	12.43	89.39
#80	2.50	0.18	34.10	29.07	46.53	60.32
#120	3.00	0.13	45.86	39.10	92.39	21.22
#170	3.50	0.09	17.86	15.23	110.25	5.99
#200	3.75	0.07	3.45	2.94	113.70	3.05
#230	4.00	0.06	0.77	0.66	114.47	2.39

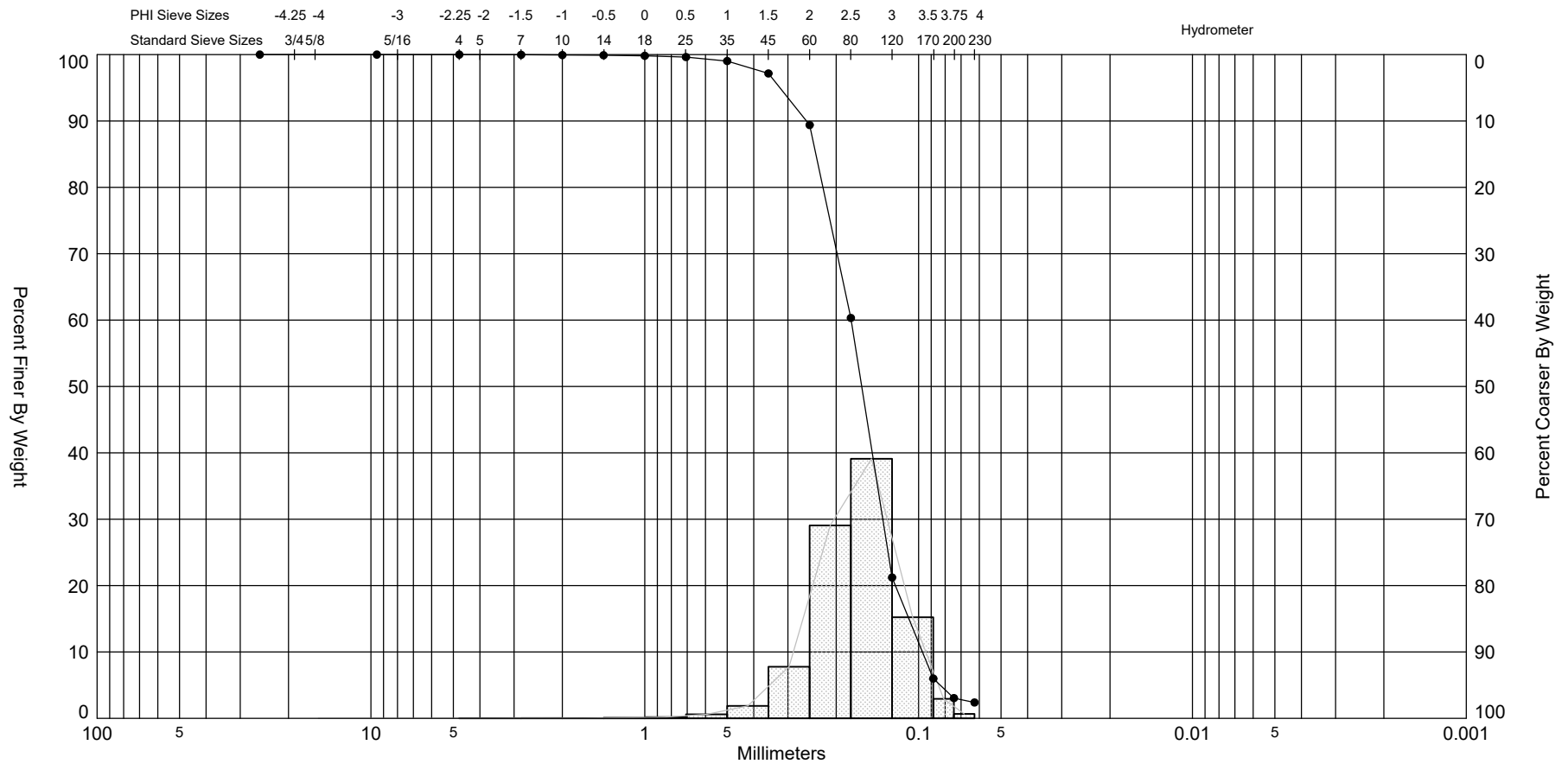
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.58	3.17	2.95	2.63	2.25	2.09	1.64


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.58	0.17	0.55	-0.87	6.65

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-019 #S-5	—●—	-9.7	SP	#200 - 3.05 #230 - 2.39			2.63	2.58	-0.87	6.65	0.55	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,740,637
												Northing (Y, ft):	326,293
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-020 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,813</b>	Northing (ft): <b>327,342</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-1.4 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>126.54</b>	Wash Weight (g): <b>126.02</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.41</b> <b>#230 - 0.41</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.39	0.31	0.39	99.69
#7	-1.50	2.83	0.78	0.62	1.17	99.07
#10	-1.00	2.00	0.81	0.64	1.98	98.43
#14	-0.50	1.41	1.27	1.00	3.25	97.43
#18	0.00	1.00	2.32	1.83	5.57	95.60
#25	0.50	0.71	5.74	4.54	11.31	91.06
#35	1.00	0.50	14.10	11.14	25.41	79.92
#45	1.50	0.35	31.04	24.53	56.45	55.39
#60	2.00	0.25	50.04	39.54	106.49	15.85
#80	2.50	0.18	17.21	13.60	123.70	2.25
#120	3.00	0.13	1.95	1.54	125.65	0.71
#170	3.50	0.09	0.26	0.21	125.91	0.50
#200	3.75	0.07	0.11	0.09	126.02	0.41
#230	4.00	0.06	0.00	0.00	126.02	0.41

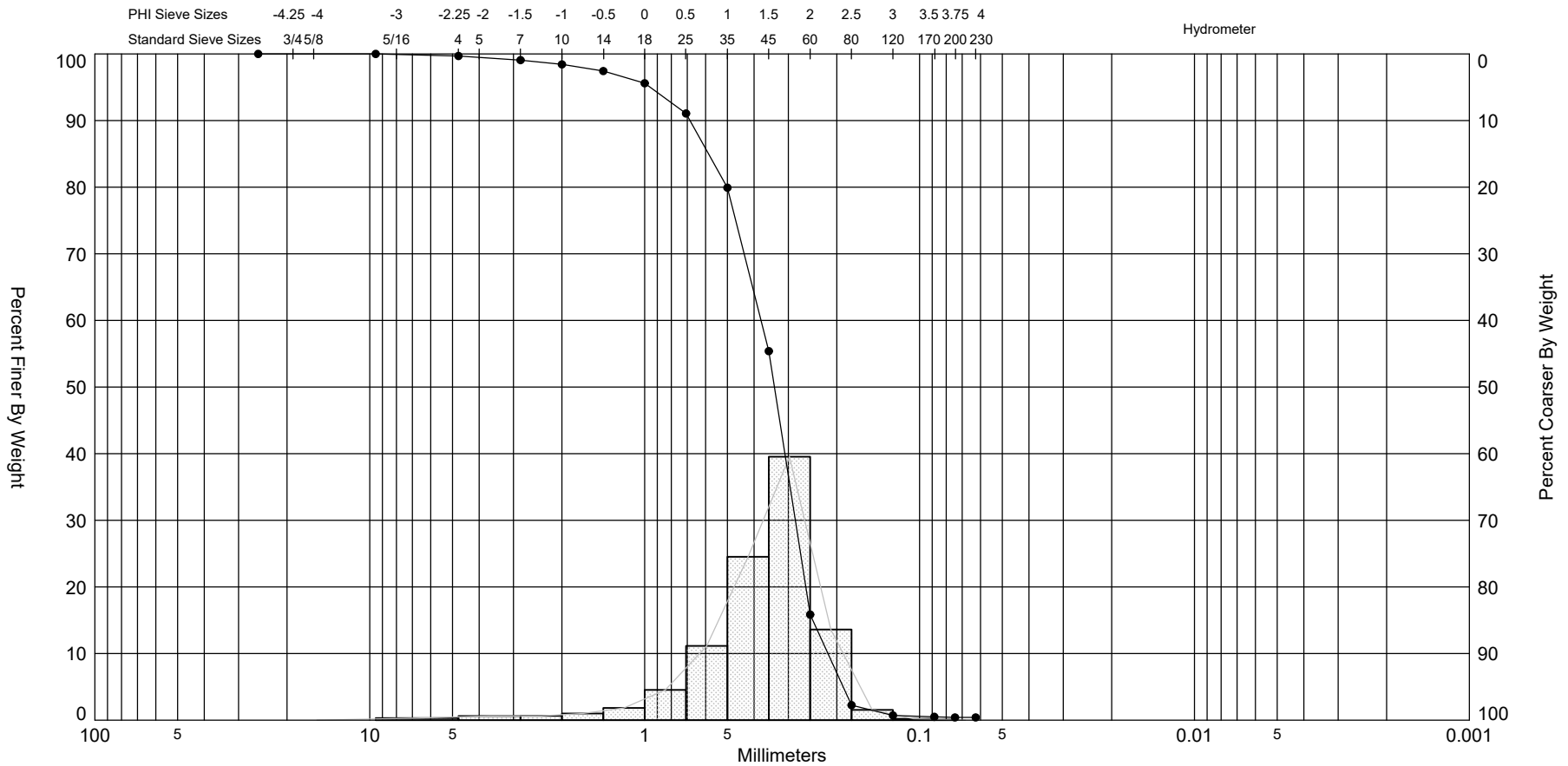
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.40	2.00	1.88	1.57	1.10	0.82	0.07


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.42	0.37	0.75	-1.69	8.32

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-020 #S-1	●—	-1.4	SP	#200 - 0.41 #230 - 0.41			1.57	1.42	-1.69	8.32	0.75	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL											Analysis Date:	08-01-22	
Depths and elevations based on measured values											Analyzed By:	CRM	
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800				Easting (X, ft):	2,740,813	
											Northing (Y, ft):	327,342	
											Horizontal System:	NAD 1983	
											Vertical System:	MLLW	



# Granularmetric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-020 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,813</b>	Northing (ft): <b>327,342</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-3.4 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>97.63</b>	Wash Weight (g): <b>96.21</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.46</b> <b>#230 - 1.46</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.43	0.44	0.43	99.56
#7	-1.50	2.83	0.59	0.60	1.02	98.96
#10	-1.00	2.00	0.57	0.58	1.59	98.38
#14	-0.50	1.41	0.72	0.74	2.31	97.64
#18	0.00	1.00	1.55	1.59	3.86	96.05
#25	0.50	0.71	3.60	3.69	7.46	92.36
#35	1.00	0.50	10.66	10.92	18.12	81.44
#45	1.50	0.35	18.07	18.51	36.19	62.93
#60	2.00	0.25	30.22	30.95	66.41	31.98
#80	2.50	0.18	21.74	22.27	88.15	9.71
#120	3.00	0.13	7.49	7.67	95.64	2.04
#170	3.50	0.09	0.53	0.54	96.17	1.50
#200	3.75	0.07	0.04	0.04	96.21	1.46
#230	4.00	0.06	0.00	0.00	96.21	1.46

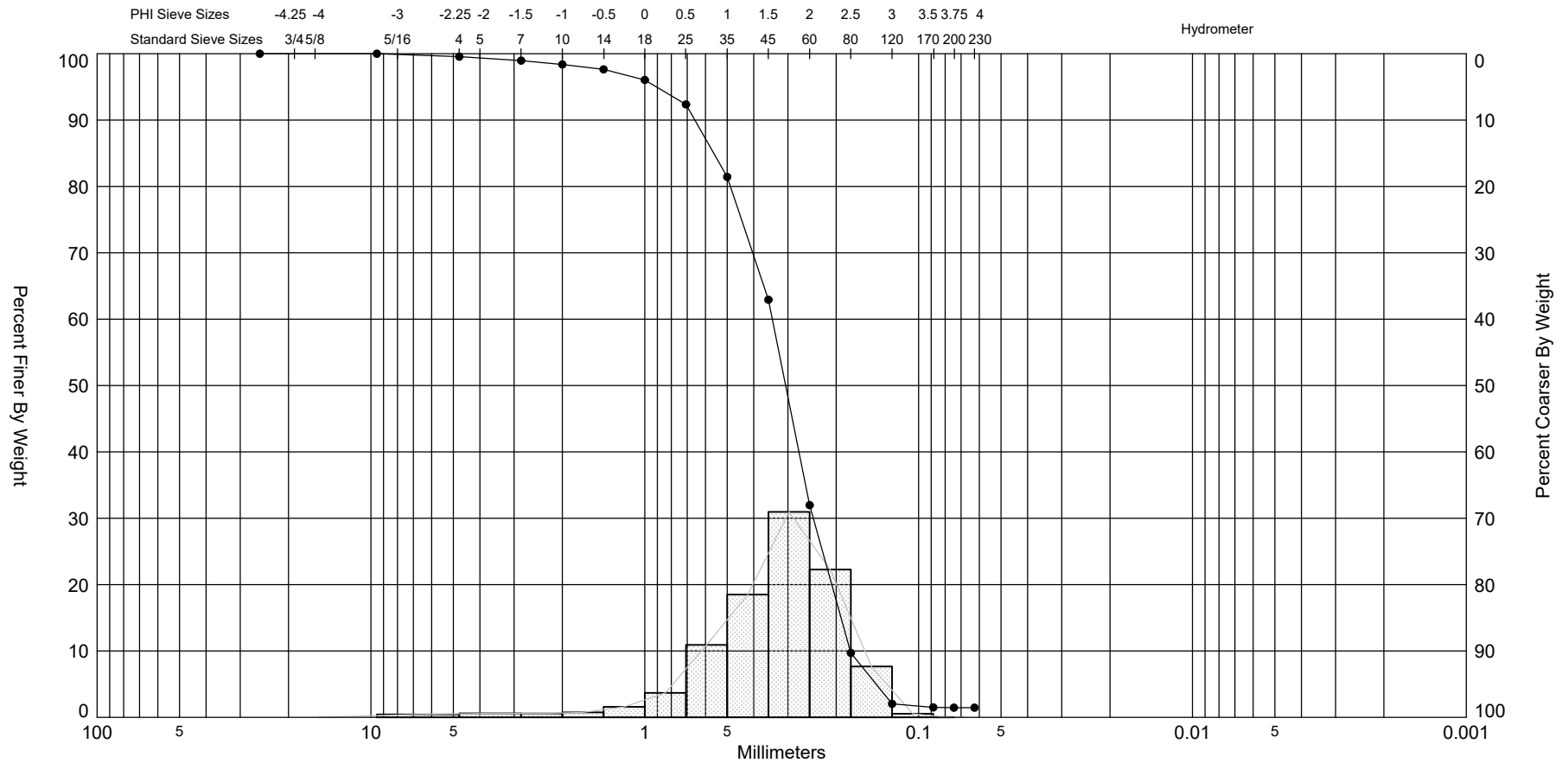
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.81	2.36	2.16	1.71	1.17	0.88	0.14


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.58	0.33	0.83	-1.5	7.5

GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-020 #S-2	●—	-3.4	SP	#200 - 1.46 #230 - 1.46			1.71	1.58	-1.5	7.5	0.83	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Eastings (X, ft):	2,740,813
												Northing (Y, ft):	327,342
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-020 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,813</b>	Northing (ft): <b>327,342</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.4 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>81.77</b>	Wash Weight (g): <b>80.31</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.99</b> <b>#230 - 1.79</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.00	0.00	0.00	100.00
#14	-0.50	1.41	0.02	0.02	0.02	99.98
#18	0.00	1.00	0.07	0.09	0.09	99.89
#25	0.50	0.71	0.06	0.07	0.15	99.82
#35	1.00	0.50	0.26	0.32	0.41	99.50
#45	1.50	0.35	0.91	1.11	1.32	98.39
#60	2.00	0.25	8.89	10.87	10.21	87.52
#80	2.50	0.18	29.60	36.20	39.81	51.32
#120	3.00	0.13	29.31	35.84	69.12	15.48
#170	3.50	0.09	9.76	11.94	78.88	3.54
#200	3.75	0.07	1.27	1.55	80.15	1.99
#230	4.00	0.06	0.16	0.20	80.31	1.79

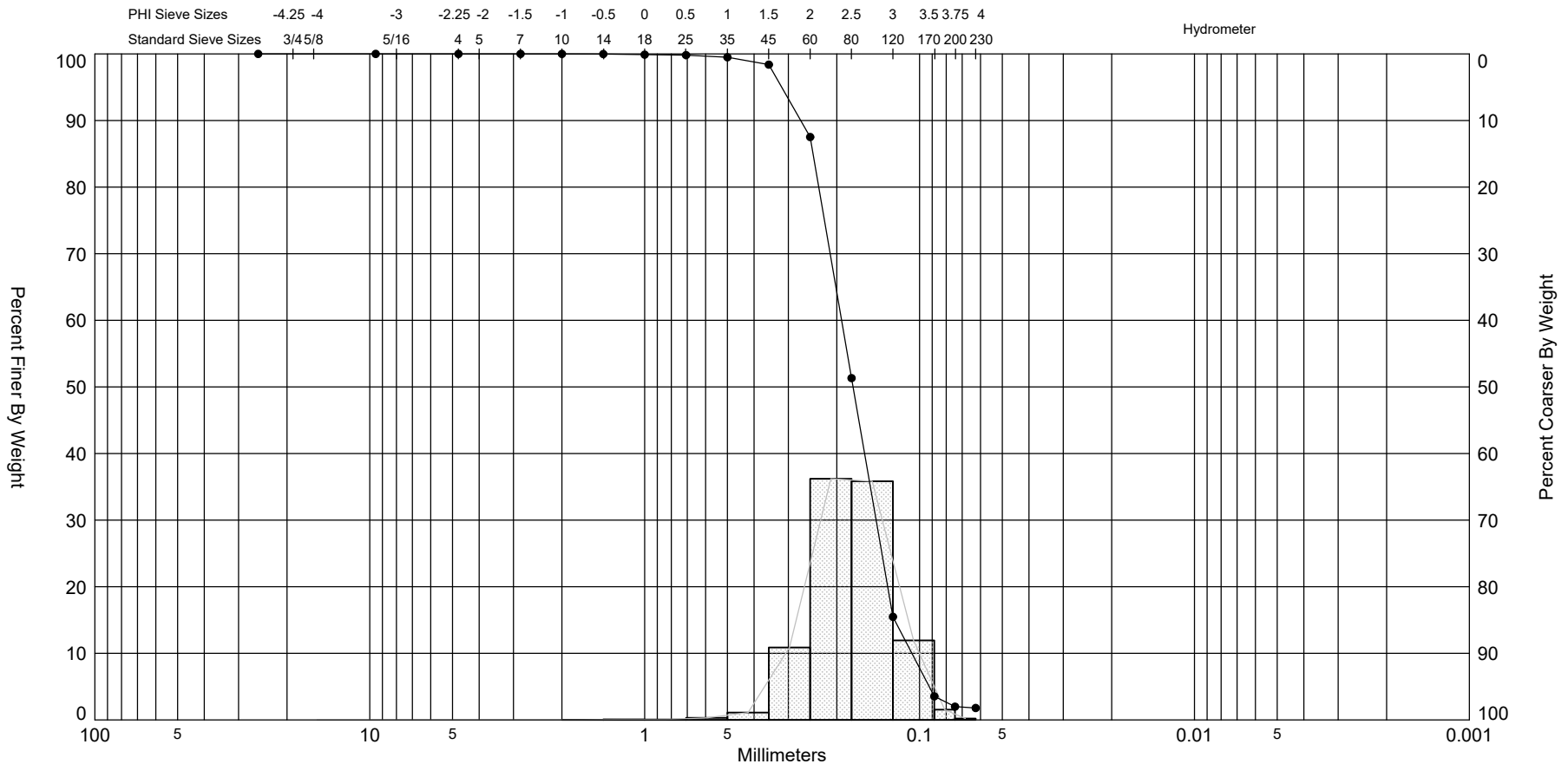
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.44	2.99	2.87	2.52	2.17	2.05	1.66


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.5	0.18	0.49	-0.38	4.55

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-020 #S-3	—●—	-5.4	SP	#200 - 1.99 #230 - 1.79			2.52	2.5	-0.38	4.55	0.49	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,740,813
												Northing (Y, ft):	327,342
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-020 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,813</b>	Northing (ft): <b>327,342</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.4 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>122.78</b>	Wash Weight (g): <b>119.44</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 3.30</b> <b>#230 - 2.71</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.00	0.00	0.00	100.00
#10	-1.00	2.00	0.03	0.02	0.03	99.98
#14	-0.50	1.41	0.07	0.06	0.10	99.92
#18	0.00	1.00	0.26	0.21	0.36	99.71
#25	0.50	0.71	0.49	0.40	0.85	99.31
#35	1.00	0.50	1.20	0.98	2.05	98.33
#45	1.50	0.35	3.32	2.70	5.37	95.63
#60	2.00	0.25	20.28	16.52	25.65	79.11
#80	2.50	0.18	37.85	30.83	63.50	48.28
#120	3.00	0.13	38.22	31.13	101.72	17.15
#170	3.50	0.09	13.70	11.16	115.42	5.99
#200	3.75	0.07	3.30	2.69	118.72	3.30
#230	4.00	0.06	0.72	0.59	119.44	2.71

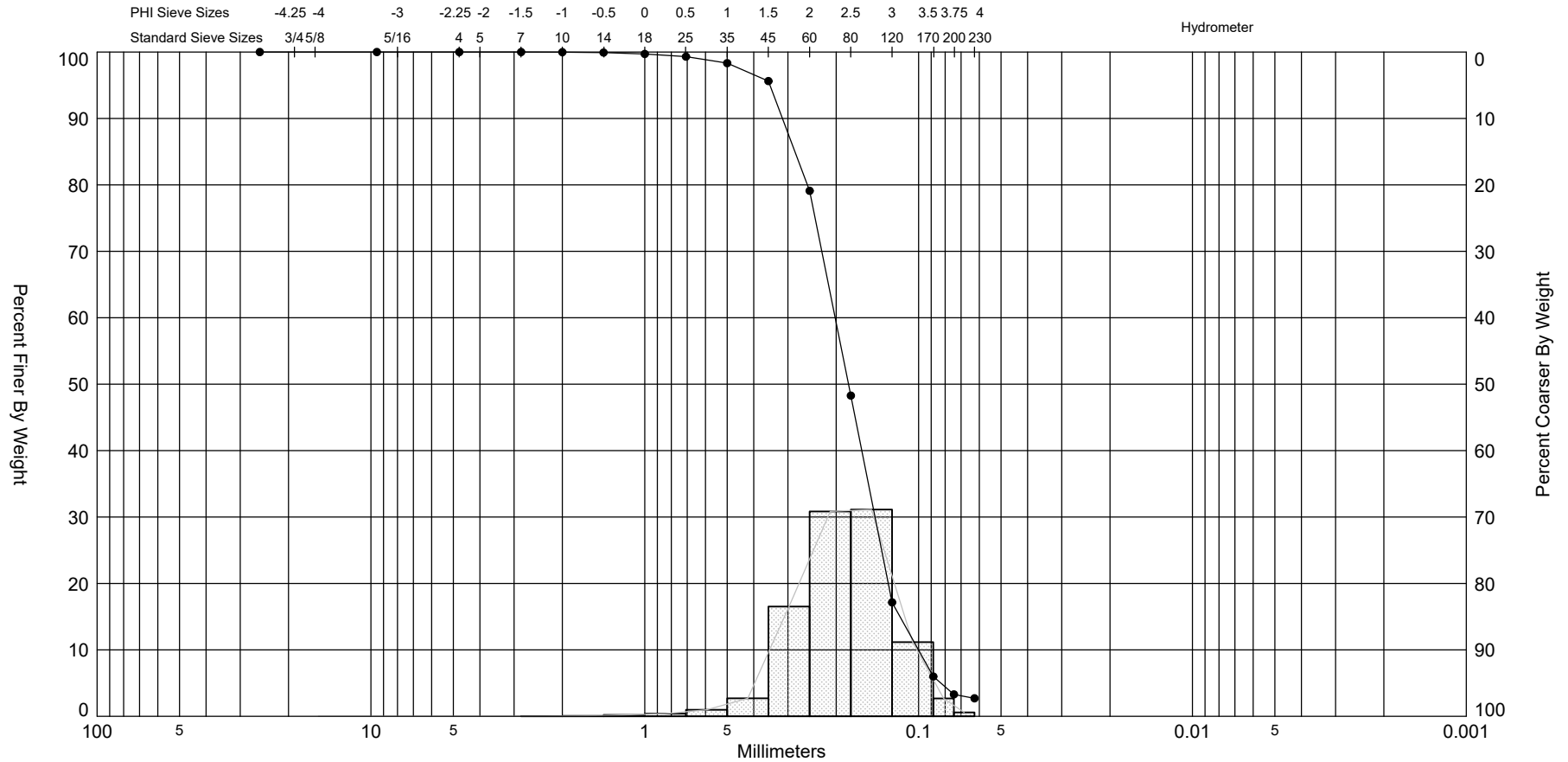
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.59	3.05	2.87	2.47	2.07	1.85	1.52


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.43	0.19	0.6	-0.57	4.71

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-020 #S-4	—●—	-7.4	SP	#200 - 3.30 #230 - 2.71			2.47	2.43	-0.57	4.71	0.6	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,740,813
												Northing (Y, ft):	327,342
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-020 #S-5

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,740,813</b>	Northing (ft): <b>327,342</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.4 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>90.24</b>	Wash Weight (g): <b>88.50</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 2.24</b> <b>#230 - 1.90</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.15	0.17	0.15	99.83
#7	-1.50	2.83	0.05	0.06	0.20	99.77
#10	-1.00	2.00	0.05	0.06	0.25	99.71
#14	-0.50	1.41	0.09	0.10	0.34	99.61
#18	0.00	1.00	0.24	0.27	0.58	99.34
#25	0.50	0.71	0.55	0.61	1.13	98.73
#35	1.00	0.50	1.33	1.47	2.46	97.26
#45	1.50	0.35	3.56	3.95	6.02	93.31
#60	2.00	0.25	22.75	25.21	28.77	68.10
#80	2.50	0.18	34.26	37.97	63.03	30.13
#120	3.00	0.13	19.56	21.68	82.59	8.45
#170	3.50	0.09	4.31	4.78	86.90	3.67
#200	3.75	0.07	1.29	1.43	88.19	2.24
#230	4.00	0.06	0.31	0.34	88.50	1.90

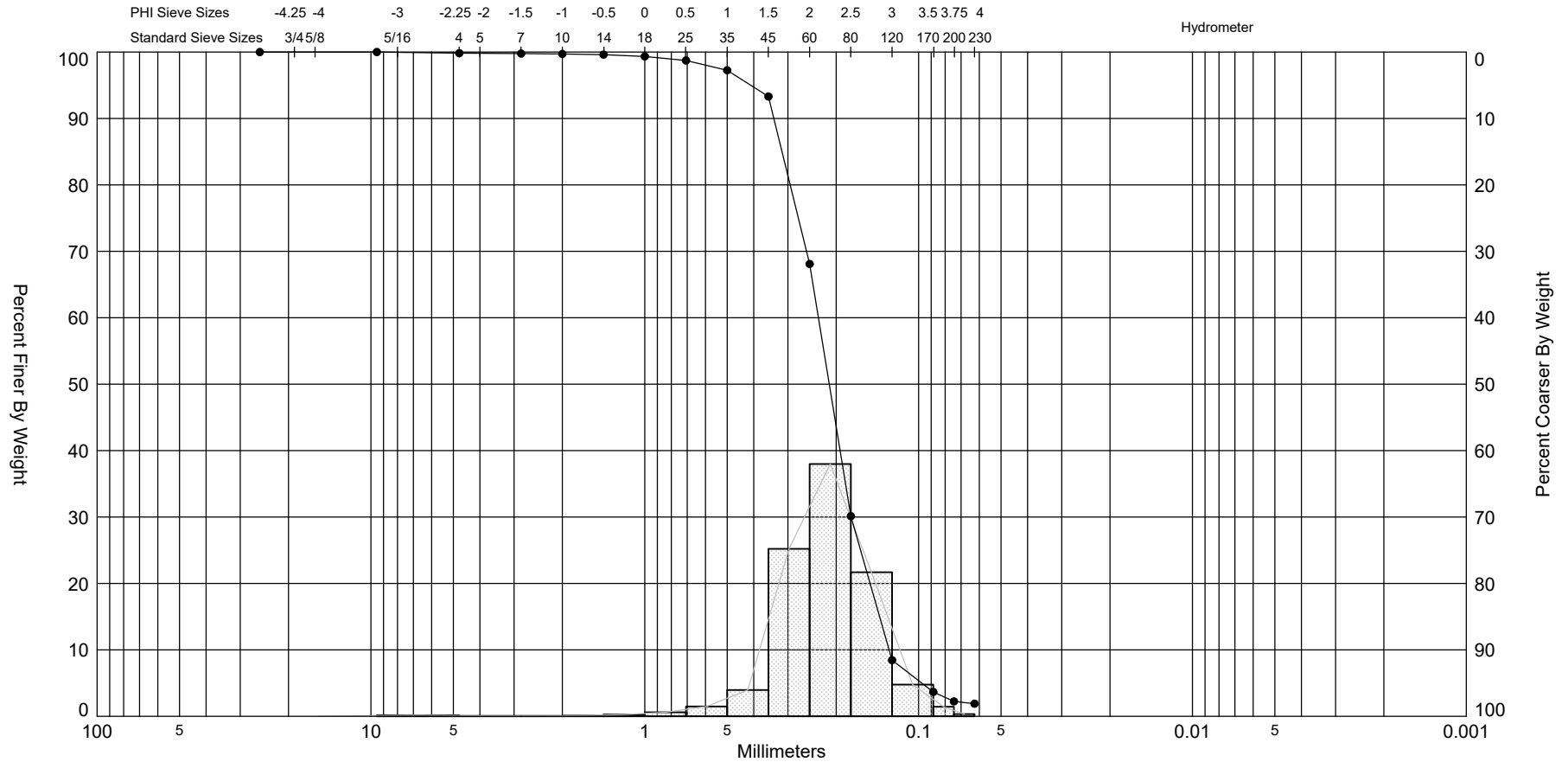
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.36	2.83	2.62	2.24	1.86	1.68	1.29


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.21	0.22	0.62	-1.42	12.05

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-020 #S-5	●—	-8.4	SP	#200 - 2.24 #230 - 1.90			2.24	2.21	-1.42	12.05	0.62	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,740,813
												Northing (Y, ft):	327,342
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



**Granulometric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-021 #S-1

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,212</b>	Northing (ft): <b>328,338</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-0.8 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>108.23</b>	Wash Weight (g): <b>106.64</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.48</b> <b>#230 - 1.45</b>	Organics (%):	Carbonates (%):	Shells (%):
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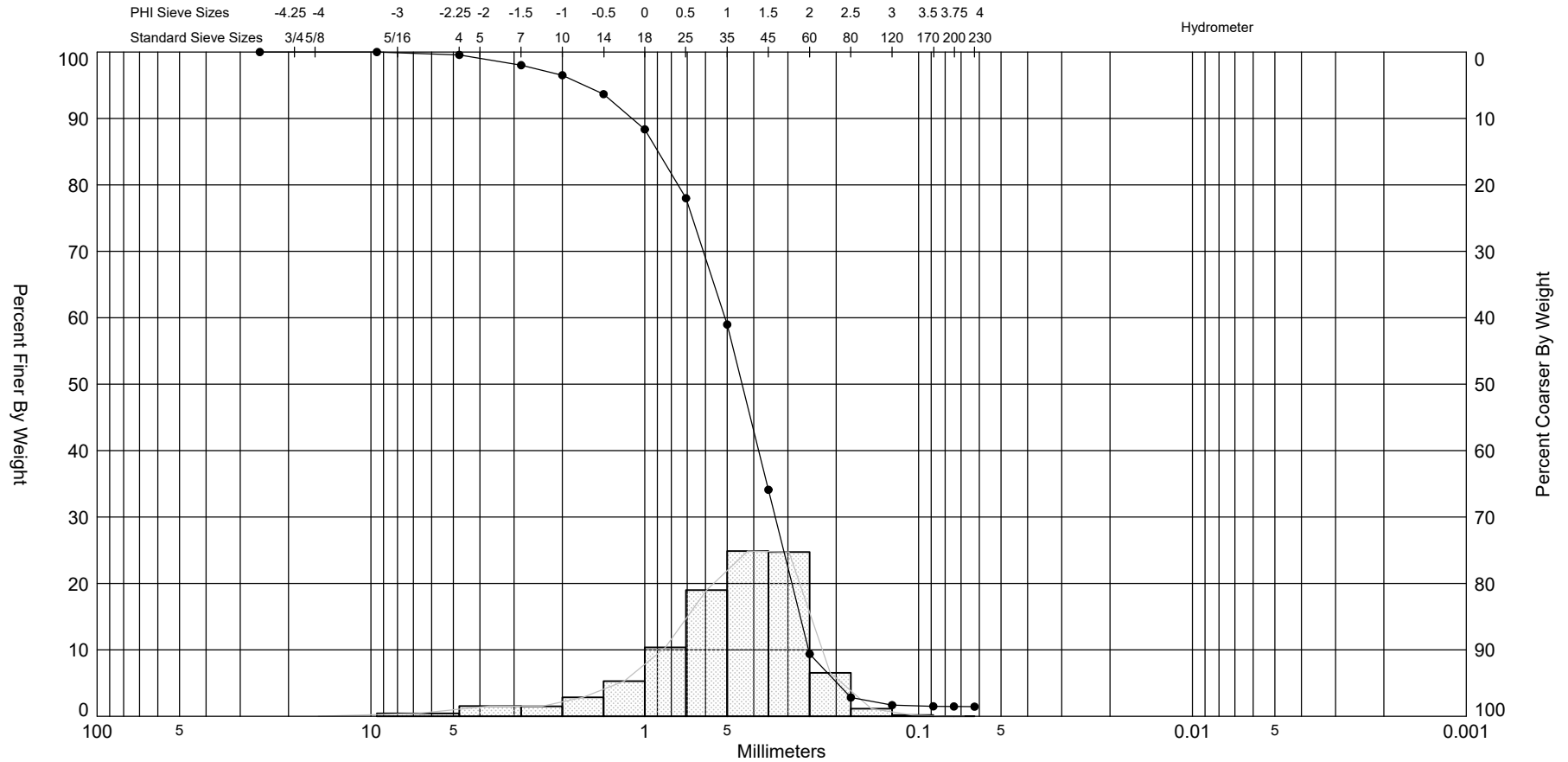
Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.46	0.43	0.46	99.57
#7	-1.50	2.83	1.68	1.55	2.14	98.02
#10	-1.00	2.00	1.63	1.51	3.77	96.51
#14	-0.50	1.41	3.08	2.85	6.85	93.66
#18	0.00	1.00	5.74	5.30	12.59	88.36
#25	0.50	0.71	11.22	10.37	23.81	77.99
#35	1.00	0.50	20.57	19.01	44.38	58.98
#45	1.50	0.35	26.93	24.88	71.31	34.10
#60	2.00	0.25	26.75	24.72	98.06	9.38
#80	2.50	0.18	7.09	6.55	105.15	2.83
#120	3.00	0.13	1.24	1.15	106.39	1.68
#170	3.50	0.09	0.20	0.18	106.59	1.50
#200	3.75	0.07	0.02	0.02	106.61	1.48
#230	4.00	0.06	0.03	0.03	106.64	1.45

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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.33	1.87	1.68	1.18	0.58	0.21	-0.74

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.02	0.49	0.91	-1.07	4.81

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-021 #S-1	●—	-0.8	SP	#200 - 1.48 #230 - 1.45			1.18	1.02	-1.07	4.81	0.91	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
							Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800					Easting (X, ft):	2,741,212
												Northing (Y, ft):	328,338
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-021 #S-2

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,212</b>	Northing (ft): <b>328,338</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-2.8 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/2</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>121.98</b>	Wash Weight (g): <b>120.28</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.41</b> <b>#230 - 1.39</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	0.00	0.00	0.00	100.00
#7	-1.50	2.83	0.16	0.13	0.16	99.87
#10	-1.00	2.00	0.19	0.16	0.35	99.71
#14	-0.50	1.41	0.54	0.44	0.89	99.27
#18	0.00	1.00	0.88	0.72	1.77	98.55
#25	0.50	0.71	1.82	1.49	3.59	97.06
#35	1.00	0.50	4.34	3.56	7.93	93.50
#45	1.50	0.35	13.12	10.76	21.05	82.74
#60	2.00	0.25	52.06	42.68	73.11	40.06
#80	2.50	0.18	40.15	32.92	113.26	7.14
#120	3.00	0.13	6.55	5.37	119.81	1.77
#170	3.50	0.09	0.39	0.32	120.20	1.45
#200	3.75	0.07	0.05	0.04	120.25	1.41
#230	4.00	0.06	0.03	0.02	120.28	1.39

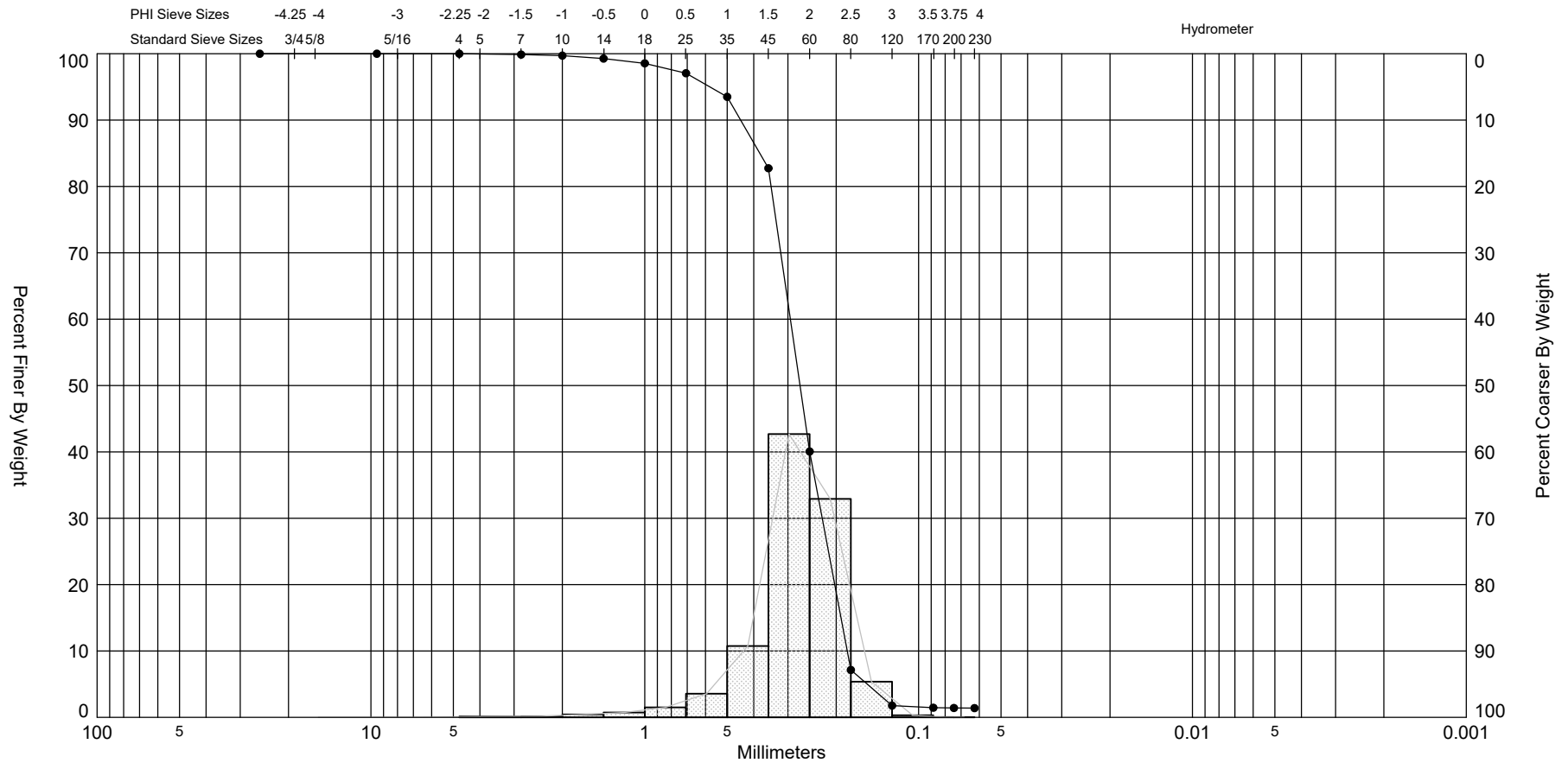
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.70	2.37	2.23	1.88	1.59	1.44	0.79


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.83	0.28	0.57	-1.6	8.87

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-021 #S-2	●—	-2.8	SP	#200 - 1.41 #230 - 1.39			1.88	1.83	-1.6	8.87	0.57	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,741,212
												Northing (Y, ft):	328,338
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

**Granulometric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-021 #S-3

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,212</b>	Northing (ft): <b>328,338</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-5.8 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-6/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>79.80</b>	Wash Weight (g): <b>79.10</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 0.93</b> <b>#230 - 0.88</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	2.03	2.54	2.03	97.46
#7	-1.50	2.83	1.83	2.29	3.86	95.17
#10	-1.00	2.00	2.01	2.52	5.87	92.65
#14	-0.50	1.41	2.74	3.43	8.61	89.22
#18	0.00	1.00	3.95	4.95	12.56	84.27
#25	0.50	0.71	6.11	7.66	18.67	76.61
#35	1.00	0.50	9.64	12.08	28.31	64.53
#45	1.50	0.35	13.92	17.44	42.23	47.09
#60	2.00	0.25	21.34	26.74	63.57	20.35
#80	2.50	0.18	12.20	15.29	75.77	5.06
#120	3.00	0.13	2.84	3.56	78.61	1.50
#170	3.50	0.09	0.34	0.43	78.95	1.07
#200	3.75	0.07	0.11	0.14	79.06	0.93
#230	4.00	0.06	0.04	0.05	79.10	0.88

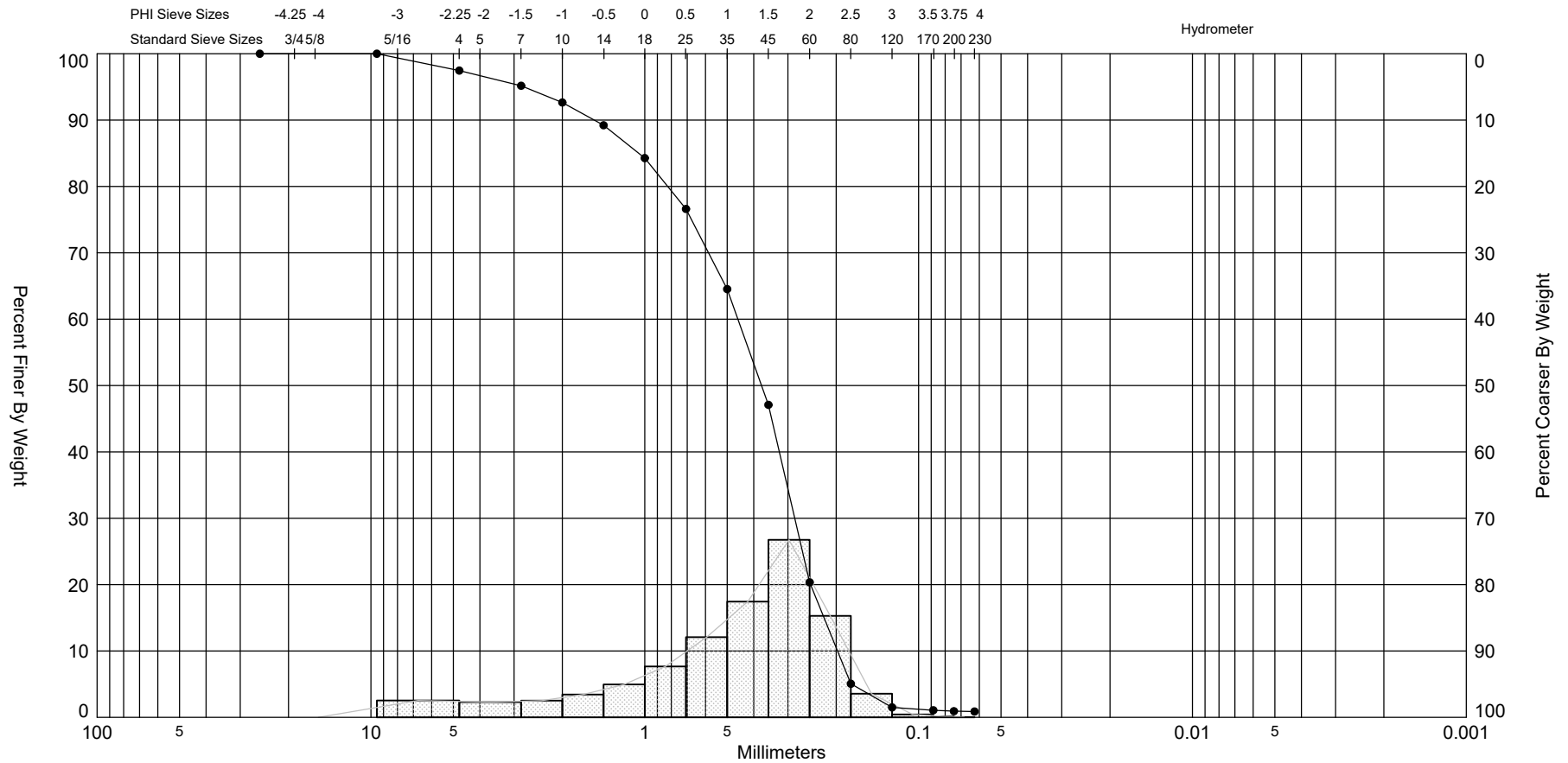
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.51	2.14	1.91	1.42	0.57	0.02	-1.47


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.09	0.47	1.21	-1.24	4.46

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-021 #S-3	●—	-5.8	SP	#200 - 0.93 #230 - 0.88			1.42	1.09	-1.24	4.46	1.21	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,741,212
												Northing (Y, ft):	328,338
												Horizontal System:	NAD 1983
												Vertical System:	MLLW

# Granulometric Report

Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-021 #S-4

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,212</b>	Northing (ft): <b>328,338</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-7.8 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>118.87</b>	Wash Weight (g): <b>117.45</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.21</b> <b>#230 - 1.18</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	1.14	0.96	1.14	99.04
#7	-1.50	2.83	2.00	1.68	3.14	97.36
#10	-1.00	2.00	2.22	1.87	5.36	95.49
#14	-0.50	1.41	4.63	3.90	9.99	91.59
#18	0.00	1.00	7.29	6.13	17.28	85.46
#25	0.50	0.71	11.86	9.98	29.14	75.48
#35	1.00	0.50	14.61	12.29	43.75	63.19
#45	1.50	0.35	18.84	15.85	62.59	47.34
#60	2.00	0.25	30.34	25.52	92.93	21.82
#80	2.50	0.18	20.32	17.09	113.25	4.73
#120	3.00	0.13	3.80	3.20	117.05	1.53
#170	3.50	0.09	0.34	0.29	117.39	1.24
#200	3.75	0.07	0.03	0.03	117.42	1.21
#230	4.00	0.06	0.03	0.03	117.45	1.18

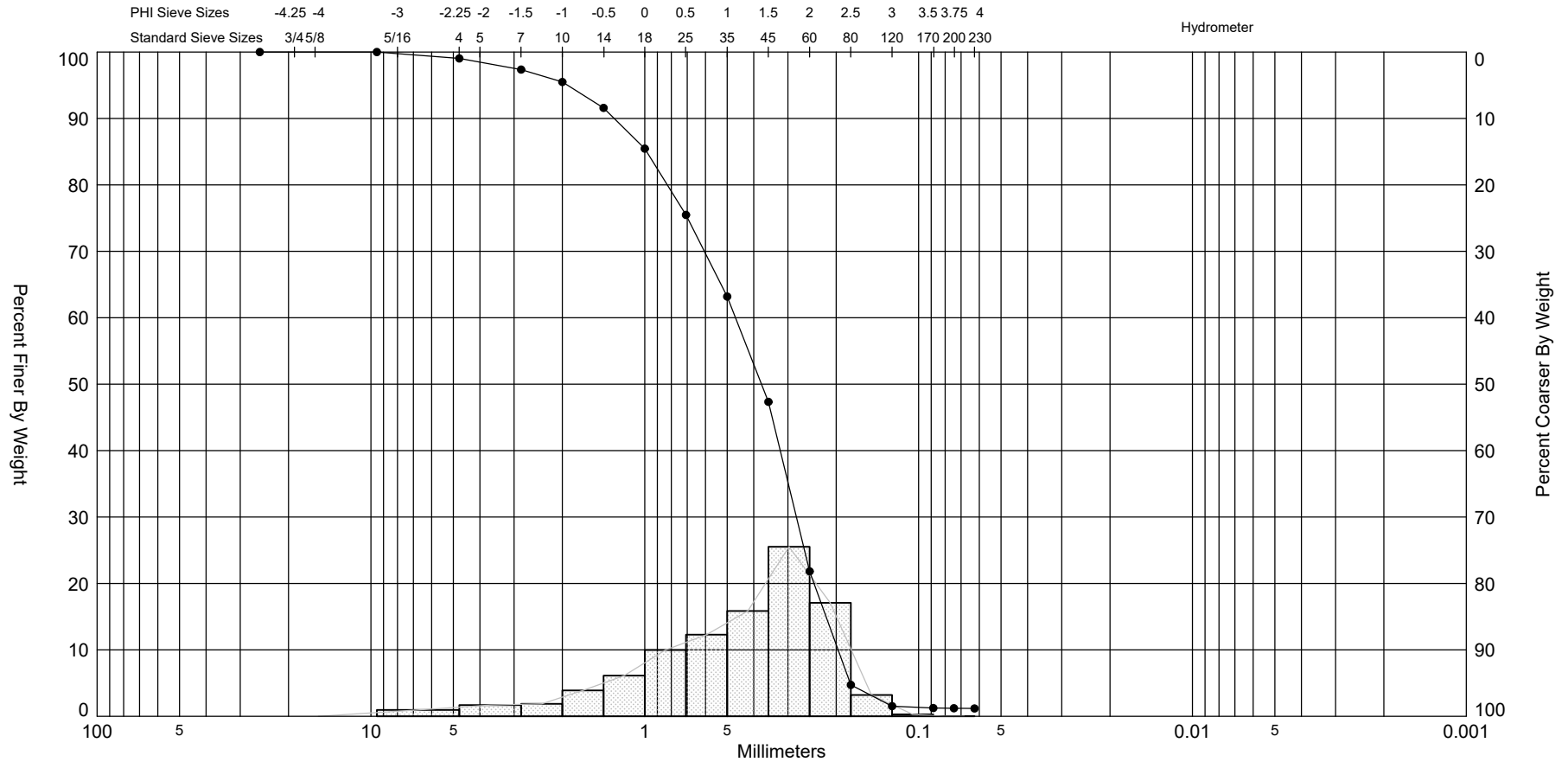
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.49	2.17	1.94	1.42	0.52	0.07	-0.94


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.13	0.46	1.09	-1.03	4.02

GRANULOMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-021 #S-4	—●—	-7.8	SP	#200 - 1.21 #230 - 1.18			1.42	1.13	-1.03	4.02	1.09	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,741,212
												Northing (Y, ft):	328,338
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



**Granularmetric Report**  
Depths and elevations based on measured values



Athena Technologies, Inc.  
1293 Graham Farm Road  
McClellanville, SC 29458  
Office: 843-887-3800

Project Name: 2022 Back Sound to Lookout Bight (W912PM22P0042)

Sample Name: CLO-22-V-021 #S-5

Analysis Date: 08-01-22

Analyzed By: CRM

Easting (ft): <b>2,741,212</b>	Northing (ft): <b>328,338</b>	Coordinate System: <b>NC State Plane, Zone 3200</b>	Elevation (ft): <b>-8.8 MLLW</b>
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USCS: <b>SP</b>	Munsell: <b>Moist - 5Y-7/1</b>	Comments: <b>Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL</b>
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Dry Weight (g): <b>114.19</b>	Wash Weight (g): <b>113.08</b>	Pan Retained (g):	Sieve Loss (%):	Fines (%): <b>#200 - 1.00</b> <b>#230 - 0.96</b>	Organics (%):	Carbonates (%):	Shells (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	% Passing Sieve
1	-4.67	25.46	0.00	0.00	0.00	100.00
3/8	-3.25	9.51	0.00	0.00	0.00	100.00
#4	-2.25	4.76	3.41	2.99	3.41	97.01
#7	-1.50	2.83	2.43	2.13	5.84	94.88
#10	-1.00	2.00	2.73	2.39	8.57	92.49
#14	-0.50	1.41	4.43	3.88	13.00	88.61
#18	0.00	1.00	7.58	6.64	20.58	81.97
#25	0.50	0.71	12.50	10.95	33.08	71.02
#35	1.00	0.50	23.36	20.46	56.44	50.56
#45	1.50	0.35	26.25	22.99	82.69	27.57
#60	2.00	0.25	19.77	17.31	102.46	10.26
#80	2.50	0.18	9.15	8.01	111.61	2.25
#120	3.00	0.13	1.25	1.09	112.86	1.16
#170	3.50	0.09	0.15	0.13	113.01	1.03
#200	3.75	0.07	0.03	0.03	113.04	1.00
#230	4.00	0.06	0.04	0.04	113.08	0.96

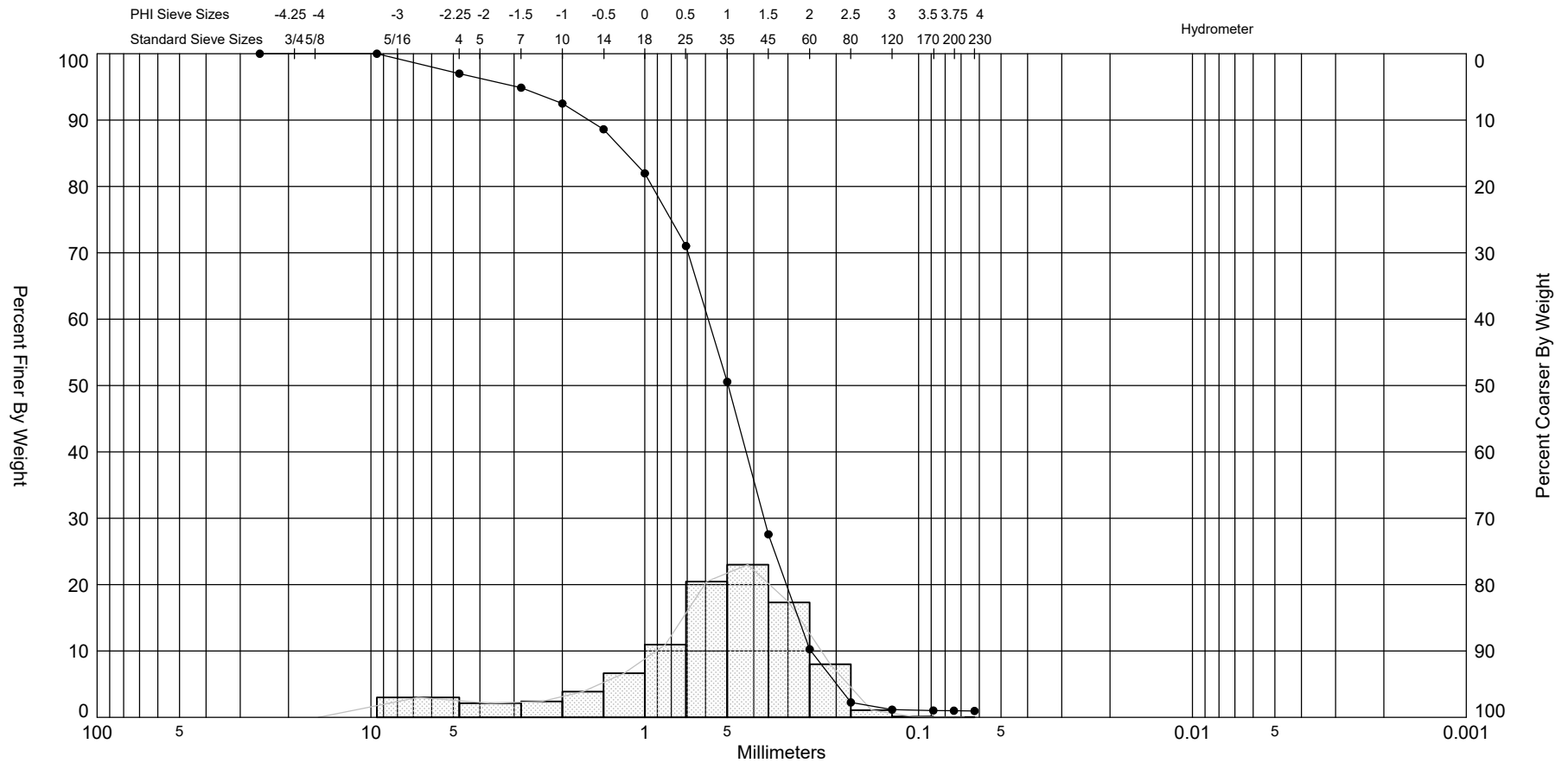
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Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.33	1.83	1.57	1.01	0.32	-0.15	-1.54


Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.8	0.57	1.13	-1.17	4.6

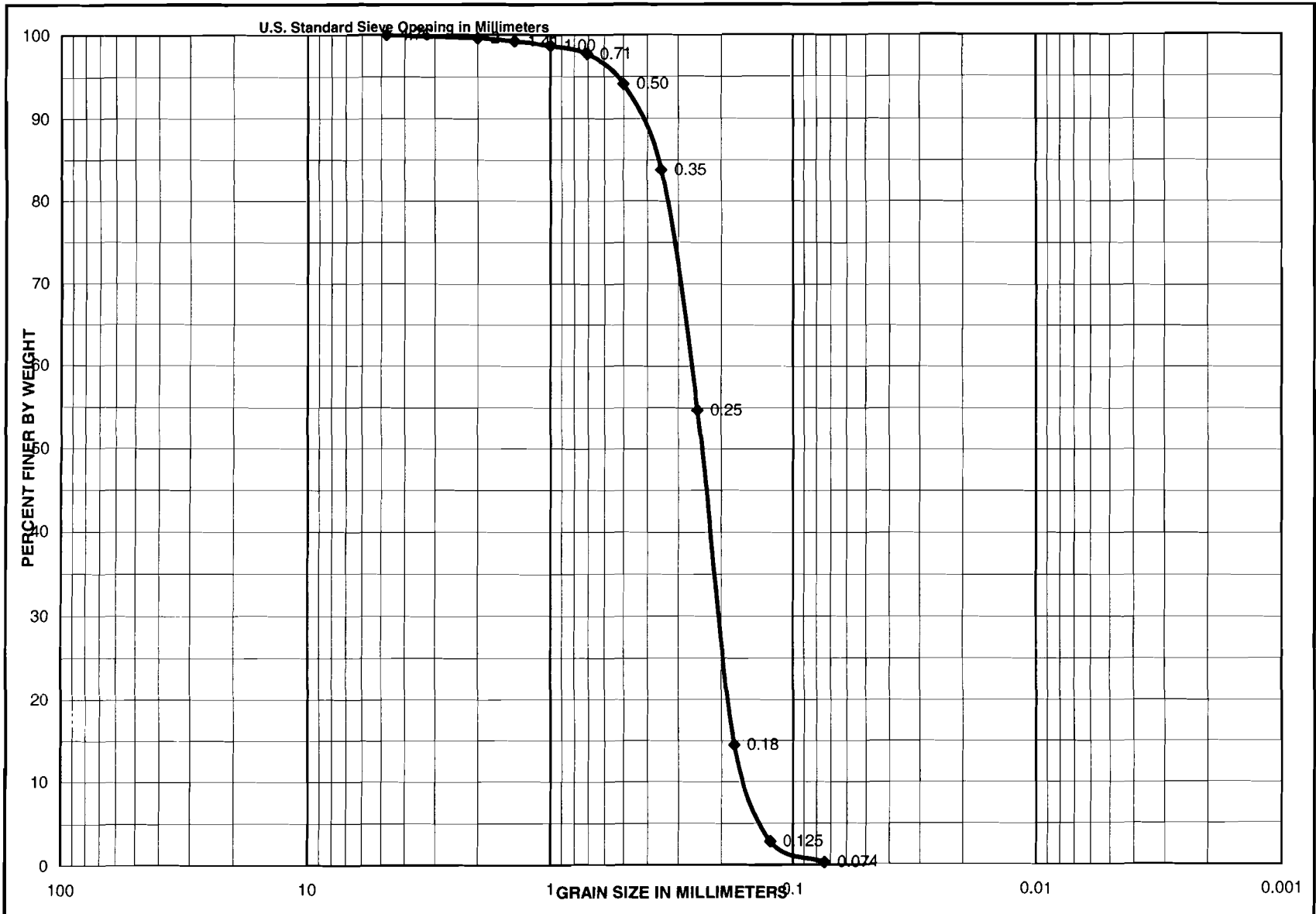
GRANULARMETRIC REPORT USACE, 2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT, 8/12/22

SIEVE ANALYSIS USACE\_2022 BACK SOUND TO LOOKOUT BIGHT, NC - ROSS GRAIN SIZE.GPJ FL DEP ROSS.GDT\_8/12/22

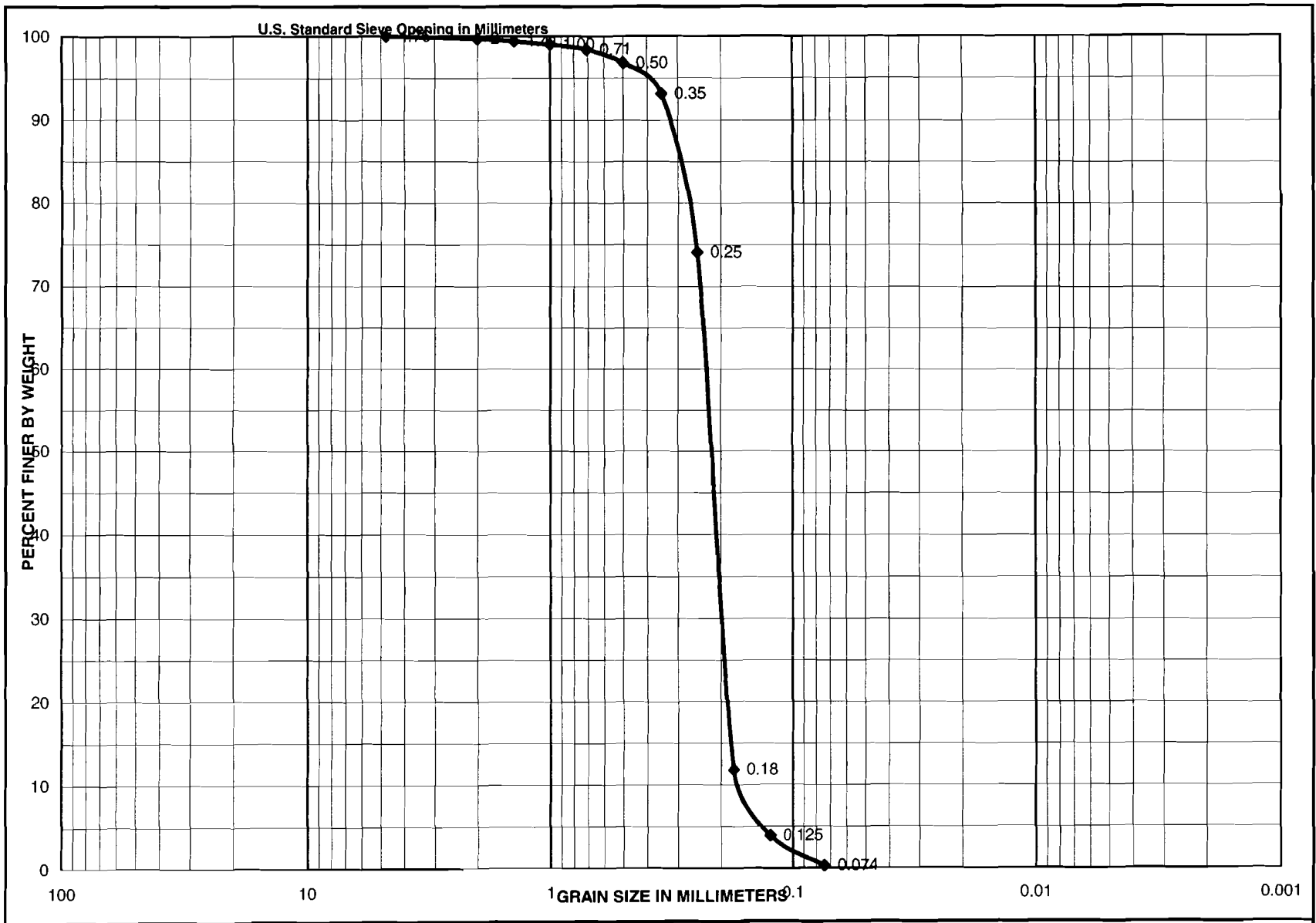


Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

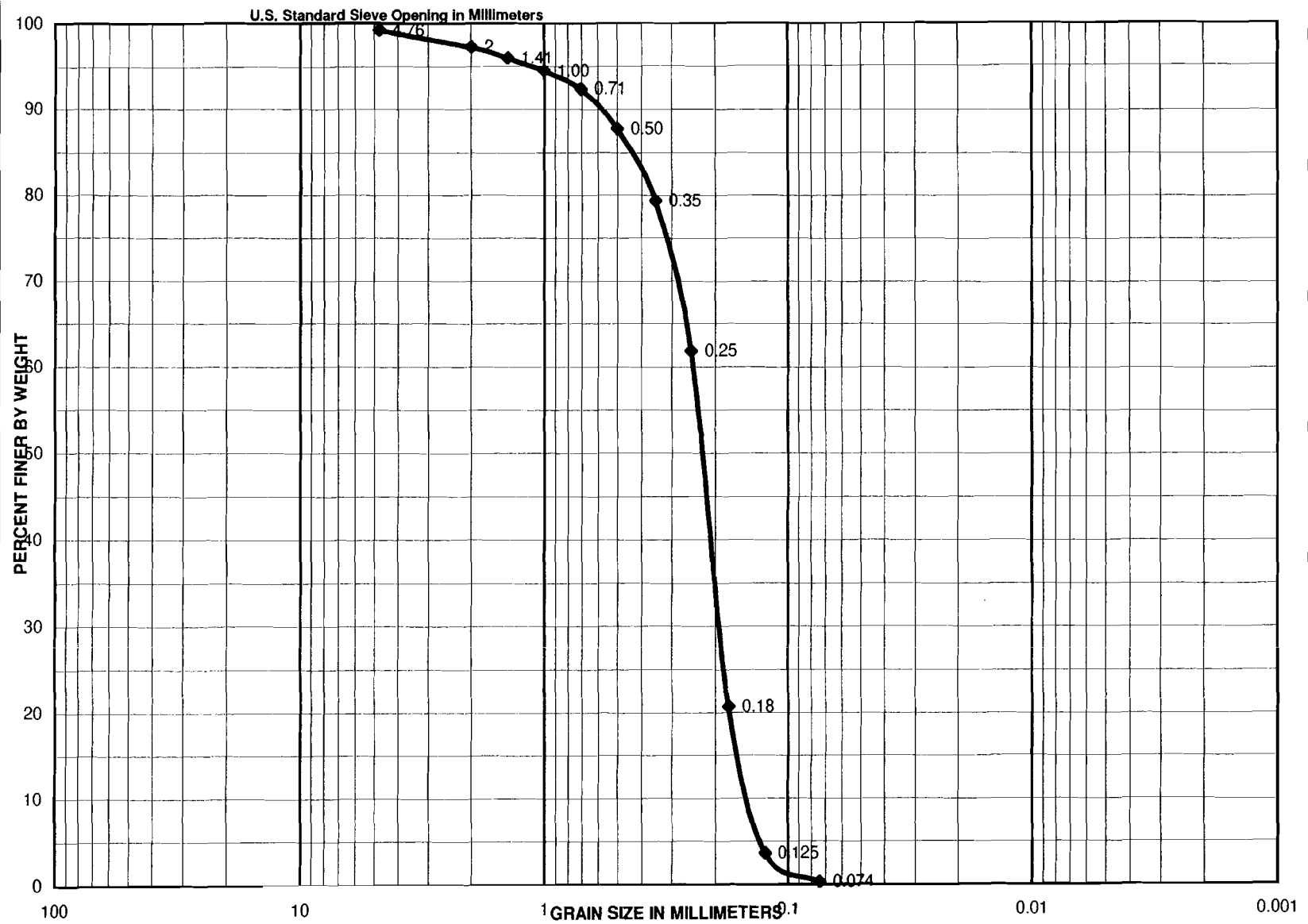
Sample	Symbol	Elev. (ft)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CLO-22-V-021 #S-5	●—	-8.8	SP	#200 - 1.00 #230 - 0.96			1.01	0.8	-1.17	4.6	1.13	Project Name:	2022 Back Sound to Lookout Bight (W912PM22P0042)
Comments: Analysis conducted by Terracon Consultants, Inc. of Jacksonville, FL												Analysis Date:	08-01-22
Depths and elevations based on measured values												Analyzed By:	CRM
						Athena Technologies, Inc. 1293 Graham Farm Road McClellanville, SC 29458 Office: 843-887-3800						Easting (X, ft):	2,741,212
												Northing (Y, ft):	328,338
												Horizontal System:	NAD 1983
												Vertical System:	MLLW



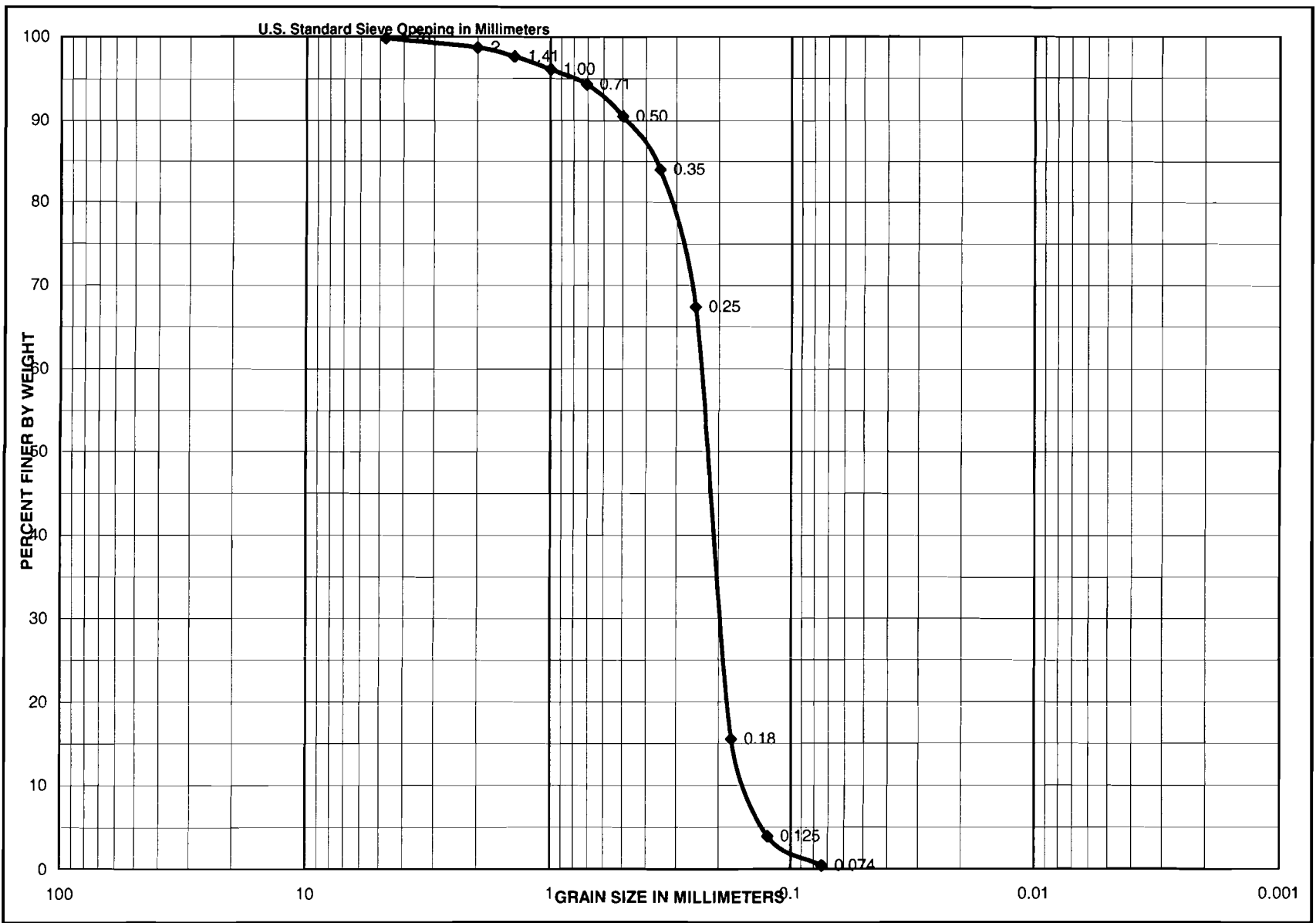
<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
1	3.9-4.4	Olive gray poorly graded sand with trace shells, SP	<b>Area</b> Cape Lookout
		2.35% Shells	<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-1
			<b>Date</b> 7/29/2004



<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
2	8.0-8.5	Olive gray poorly graded sand with trace shells, SP	<b>Area</b> Cape Lookout
		1.63% Shells	<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-1
			<b>Date</b> 7/29/2004



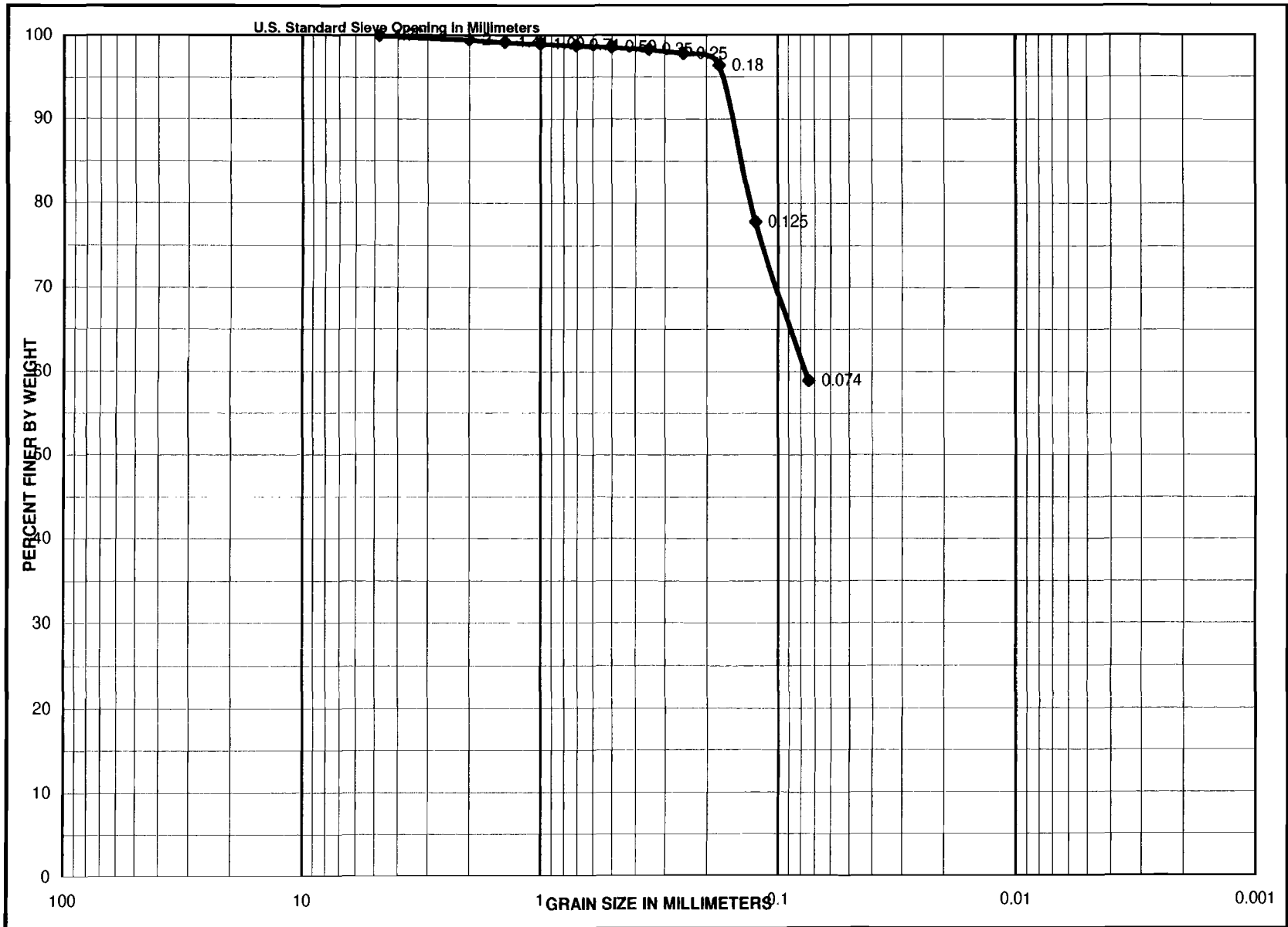
<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
1	4.7-5.2	Dark gray poorly graded sand with few shells, SP	<b>Area</b> Cape Lookout
		7.70% Shells	<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-2
			<b>Date</b> 7/29/2004



<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
2	8.7-9.2	Olive gray poorly graded sand with few shells, SP	<b>Area</b> Cape Lookout
		5.71% Shells	<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-2
			<b>Date</b> 7/29/2004



<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
1	3.2-3.7	Dark gray poorly graded sand with trace shells, SP	<b>Area</b> Cape Lookout
		0.18% Shells	<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-2A
			<b>Date</b> 7/29/2004



<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
2	7.2-7.7	Dark gray sandy elastic silt with trace shells, MH	<b>Area</b> Cape Lookout
		1.53 % Shells	<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-2A
			<b>Date</b> 7/29/2004

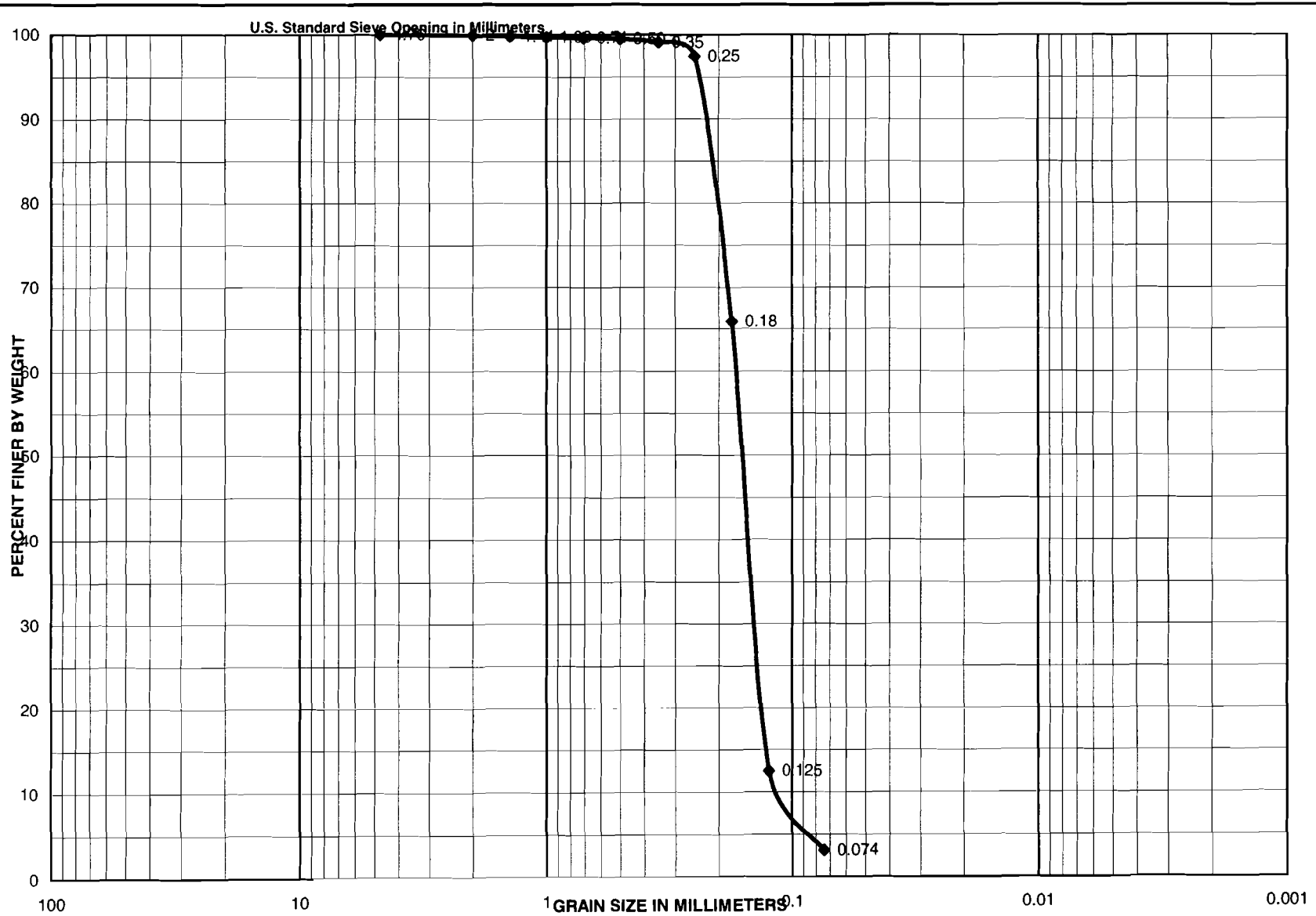




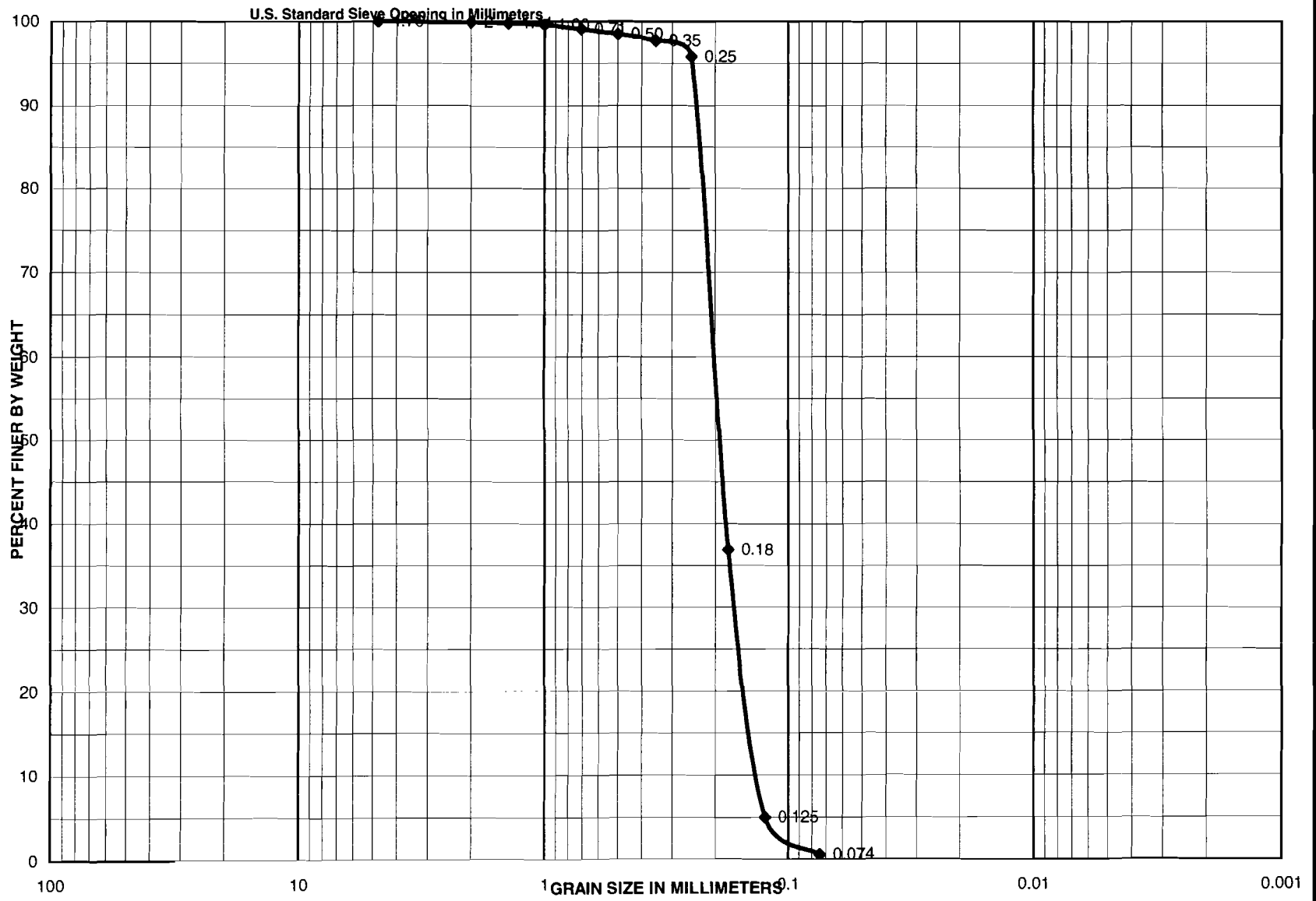
<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
3	8.6-9.1	Dark gray poorly graded sand with silt and trace shells, SP-SM 0.43% Shells	<b>Area</b> Cape Lookout
			<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-2A
			<b>Date</b> 7/29/2004



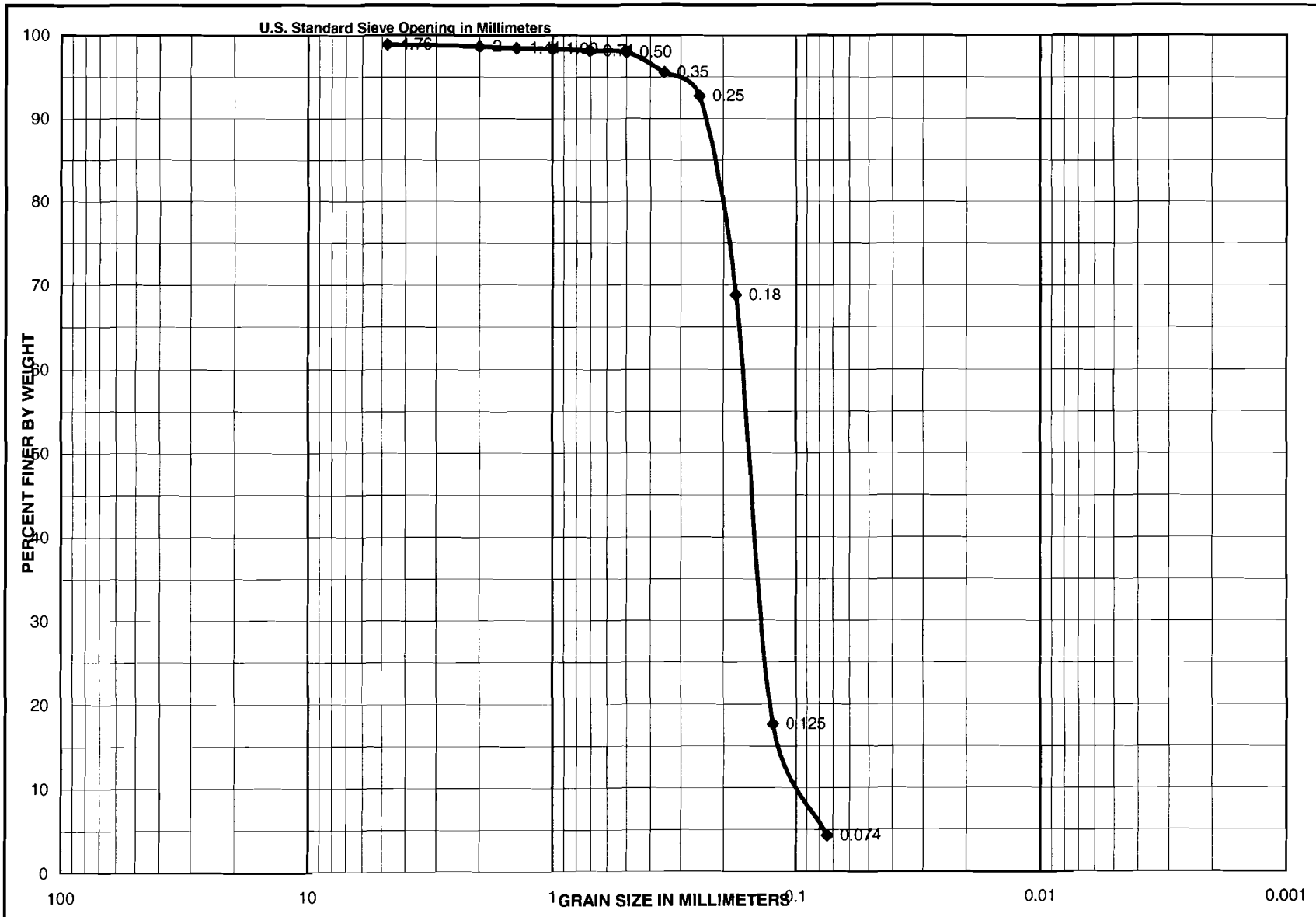
Sample No.	Depth (ft)	Classification	Project
1	4.4-4.9	Dark gray poorly graded sand with trace shells, SP	USACOE Various Sites
		1.04% Shells	Area Cape Lookout
			CATLIN Geotechnical Laboratory
			Boring No. CL-04-V-3
			Date 7/29/2004



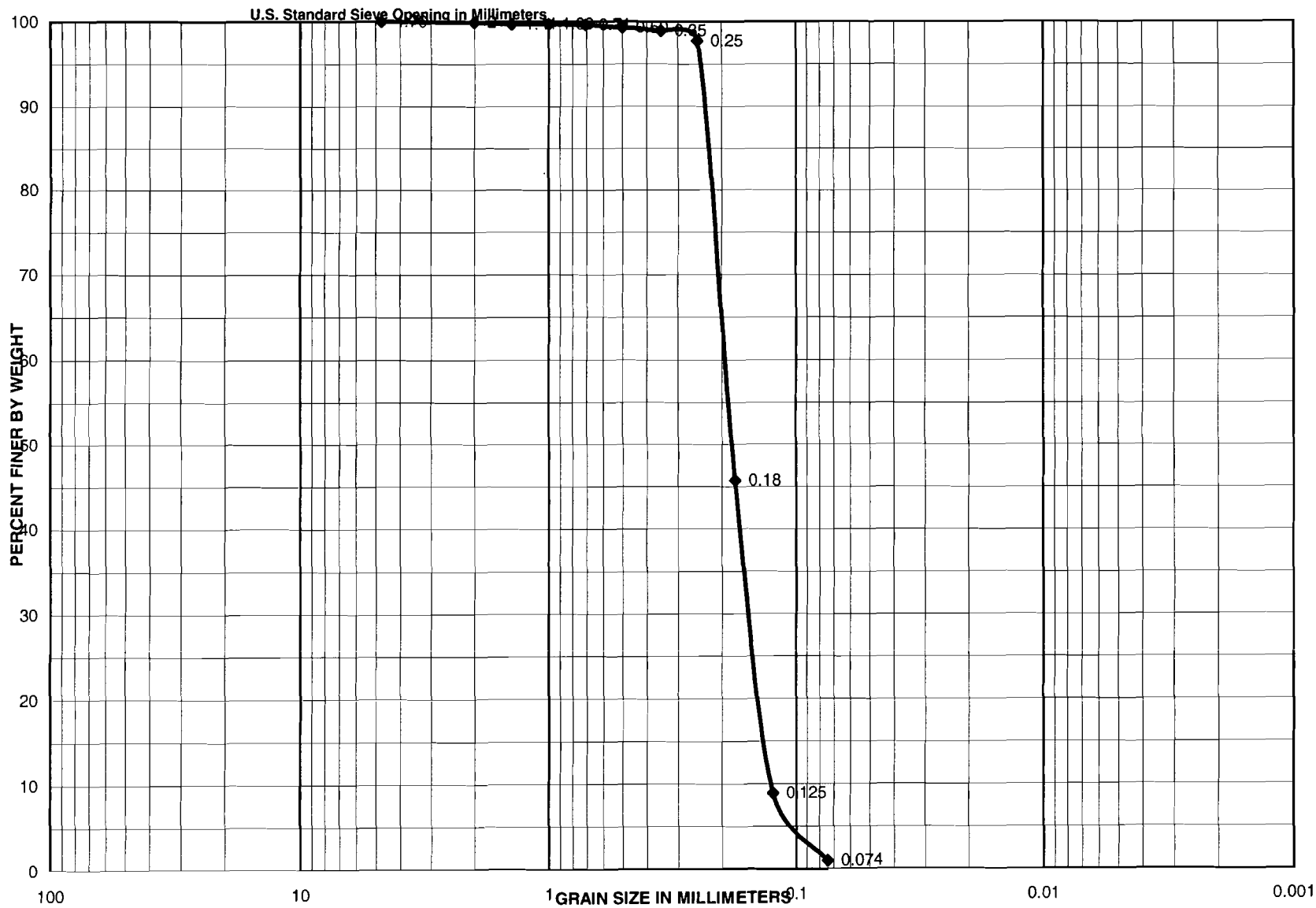
<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
2	8.8-9.3	Dark gray poorly graded sand with trace shells, SP	<b>Area</b> Cape Lookout
		0.11% Shells	<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-3
			<b>Date</b> 7/29/2004



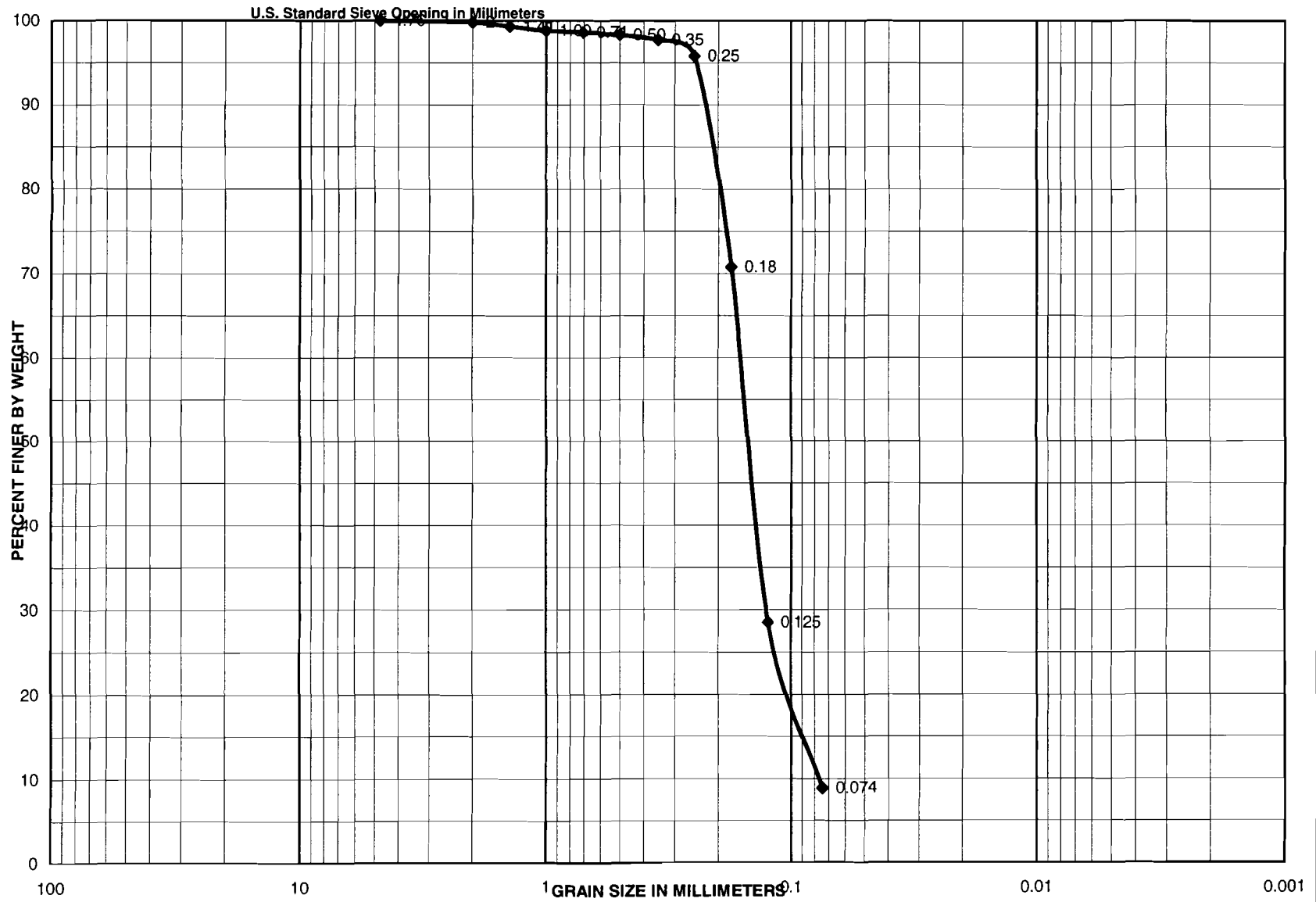
Sample No.	Depth (ft)	Classification	Project
1	3.4-3.9	Dark gray poorly graded sand, SP	USACOE Various Sites
		0.0% Shells	Area
			Cape Lookout
			CATLIN Geotechnical Laboratory
			Boring No.
			CL-04-V-4
			Date
			7/29/2004



<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
2	7.3-7.8	Olive gray poorly graded sand with trace shells, SP	<b>Area</b> Cape Lookout
		1.61% Shells	<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-4
			<b>Date</b> 7/29/2004



<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
1	3.8-4.3	Dark gray poorly graded sand with trace shells, SP	<b>Area</b> Cape Lookout
		0.08% Shells	<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-5
			<b>Date</b> 7/29/2004



<b>Sample No.</b>	<b>Depth (ft)</b>	<b>Classification</b>	<b>Project</b> USACOE Various Sites
2	7.3-7.8	Olive gray poorly graded sand with silt and trace shells, SP-SM 0.19% Shells	<b>Area</b> Cape Lookout
			<b>CATLIN Geotechnical Laboratory</b>
			<b>Boring No.</b> CL-04-V-5
			<b>Date</b> 7/29/2004



# WOLF TECHNOLOGIES, INC.

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Jacksonville, Florida 32246  
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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	4.7-5.2
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-1		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)		

Tare Weight, (g):	50.41	
Dry Wt. Before Washing (g):	157.54	(with tare)
Dry Weight After Washing (g):	156.22	(with tare)

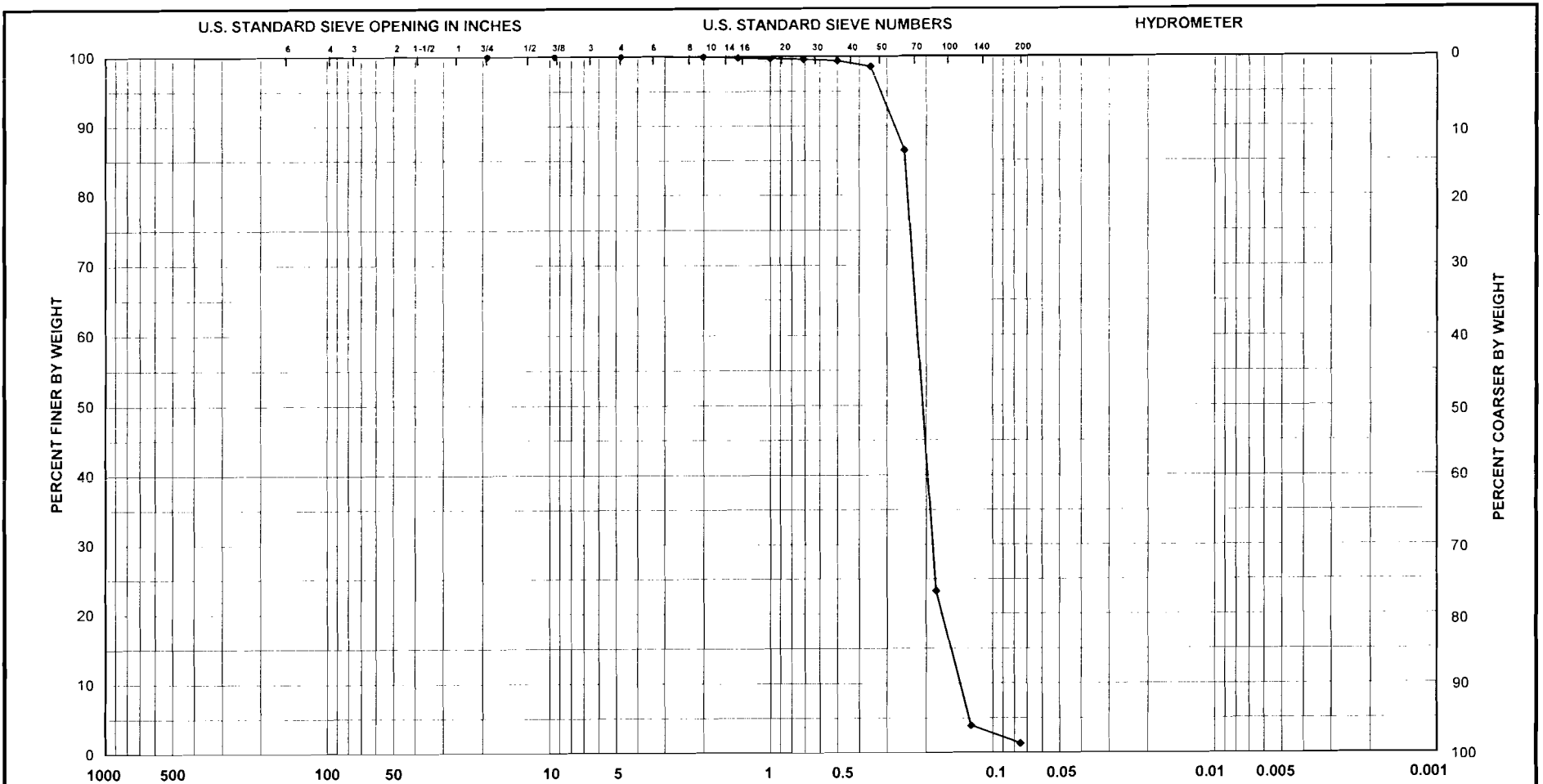
Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.05	99.95	100	0.05
#14	1.400	0.13	99.83	70	0.09
#18	1.000	0.16	99.68	70	0.11
#25	0.710	0.12	99.57	45	0.05
#35	0.500	0.20	99.38	25	0.05
#45	0.355	0.91	98.53	15	0.14
#60	0.250	12.97	86.43	5	0.65
#80	0.180	67.71	23.22	3	2.03
#120	0.125	20.73	3.87	1	0.21
#200	0.075	2.71	1.34	1	0.03

Total Shell Content: 

2
---

 %





COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-1	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)	2						Cape Lookout
									Station V-1
									Boring No. 1
									Date 2/4/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

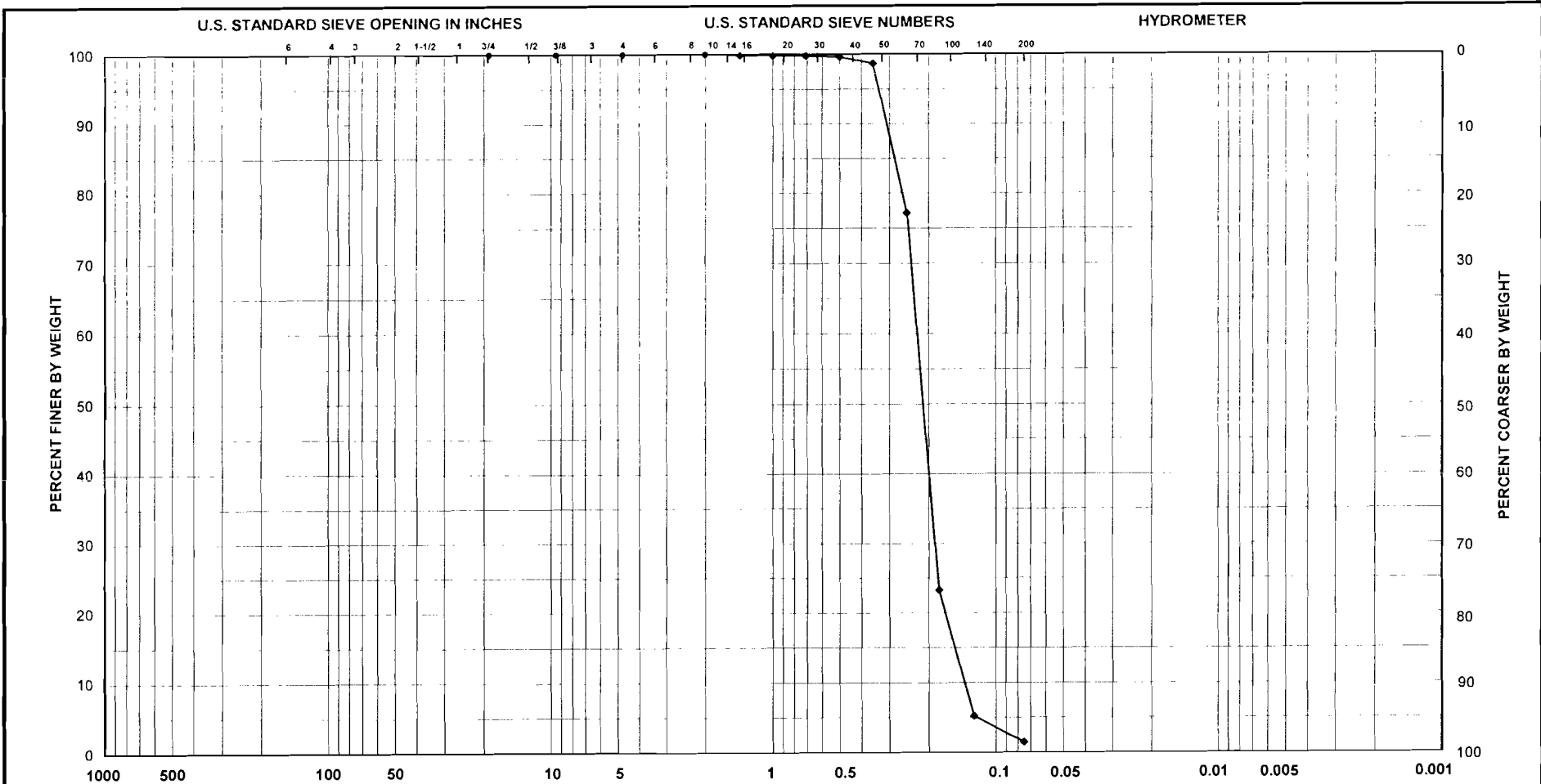
### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	6.5-7.0
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-1		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)		

Tare Weight, (g):	50.32	
Dry Wt. Before Washing (g):	147.37	(with tare)
Dry Weight After Washing (g):	146.19	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.00	100.00	0	0.00
#14	1.400	0.13	99.87	100	0.13
#18	1.000	0.08	99.78	100	0.08
#25	0.710	0.02	99.76	40	0.01
#35	0.500	0.13	99.63	35	0.05
#45	0.355	0.95	98.65	15	0.14
#60	0.250	20.88	77.14	5	1.04
#80	0.180	52.29	23.26	1	0.52
#120	0.125	17.52	5.20	1	0.18
#200	0.075	3.64	1.45	1	0.04

Total Shell Content: 1 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-1	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)	1						Cape Lookout
									Station V-1
									Boring No. 2
									Date 2/4/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	8.1-8.6
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-1		
Sample No.:	3		
Description:	SILT, inorganic-L, little fine-grained quartz sand, trace carbonate, very dark gray (ML)		

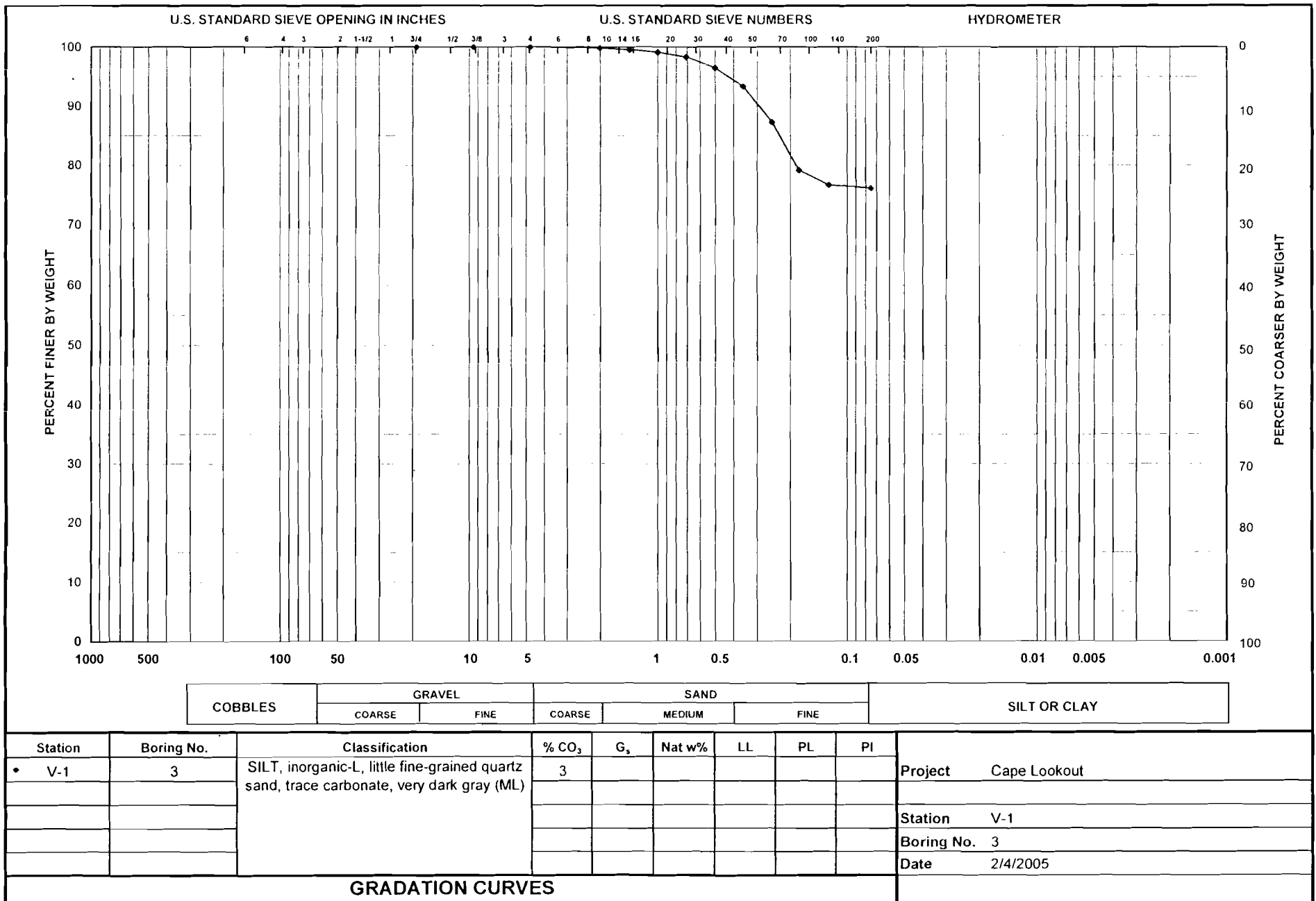
Tare Weight, (g):	50.37	
Dry Wt. Before Washing (g):	108.42	(with tare)
Dry Weight After Washing (g):	63.85	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.10	99.83	60	0.06
#14	1.400	0.16	99.55	90	0.14
#18	1.000	0.26	99.10	80	0.21
#25	0.710	0.47	98.29	70	0.33
#35	0.500	1.04	96.50	35	0.36
#45	0.355	1.85	93.32	20	0.37
#60	0.250	3.52	87.25	5	0.18
#80	0.180	4.72	79.12	1	0.05
#120	0.125	1.40	76.71	1	0.01
#200	0.075	0.34	76.12	1	0.00

Total Shell Content: 

3
---

 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>2</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-1	3	SILT, inorganic-L, little fine-grained quartz sand, trace carbonate, very dark gray (ML)	3						Cape Lookout
									Station V-1
									Boring No. 3
									Date 2/4/2005
<b>GRADATION CURVES</b>									



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

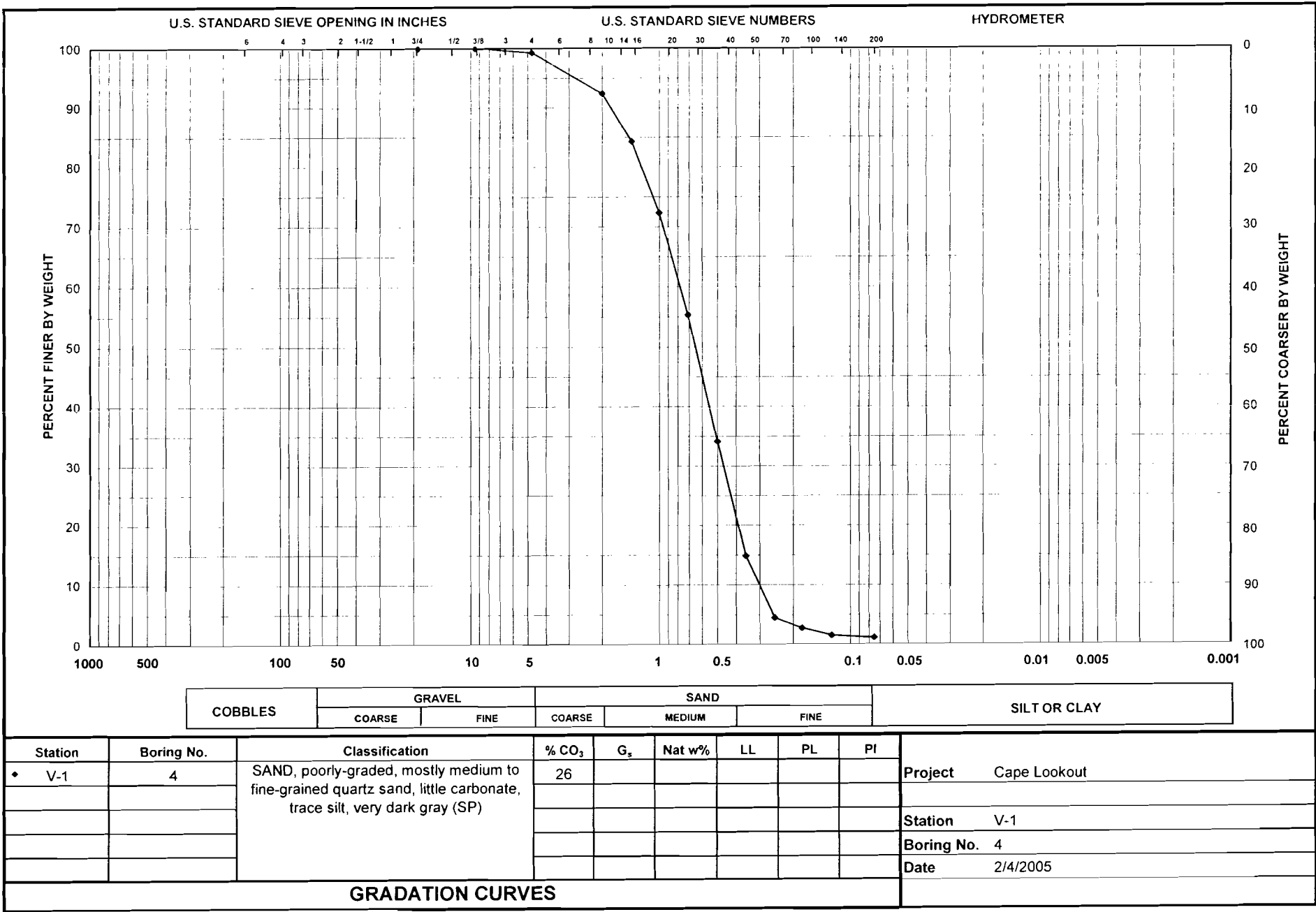
Project:	Cape Lookout	Depth:	8.7-9.2
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-1		
Sample No.:	4		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, very dark gray (SP)		

Tare Weight, (g):	50.58	
Dry Wt. Before Washing (g):	148.02	(with tare)
Dry Weight After Washing (g):	147.16	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.70	99.28	80	0.56
#10	2.000	6.74	92.36	90	6.07
#14	1.400	7.91	84.25	85	6.72
#18	1.000	11.62	72.32	60	6.97
#25	0.710	16.57	55.32	45	7.46
#35	0.500	20.64	34.13	30	6.19
#45	0.355	18.79	14.85	20	3.76
#60	0.250	10.10	4.48	10	1.01
#80	0.180	1.68	2.76	3	0.05
#120	0.125	1.19	1.54	3	0.04
#200	0.075	0.35	1.18	1	0.00

Total Shell Content: 

26	%
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**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	5.1-5.6
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-2		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)		

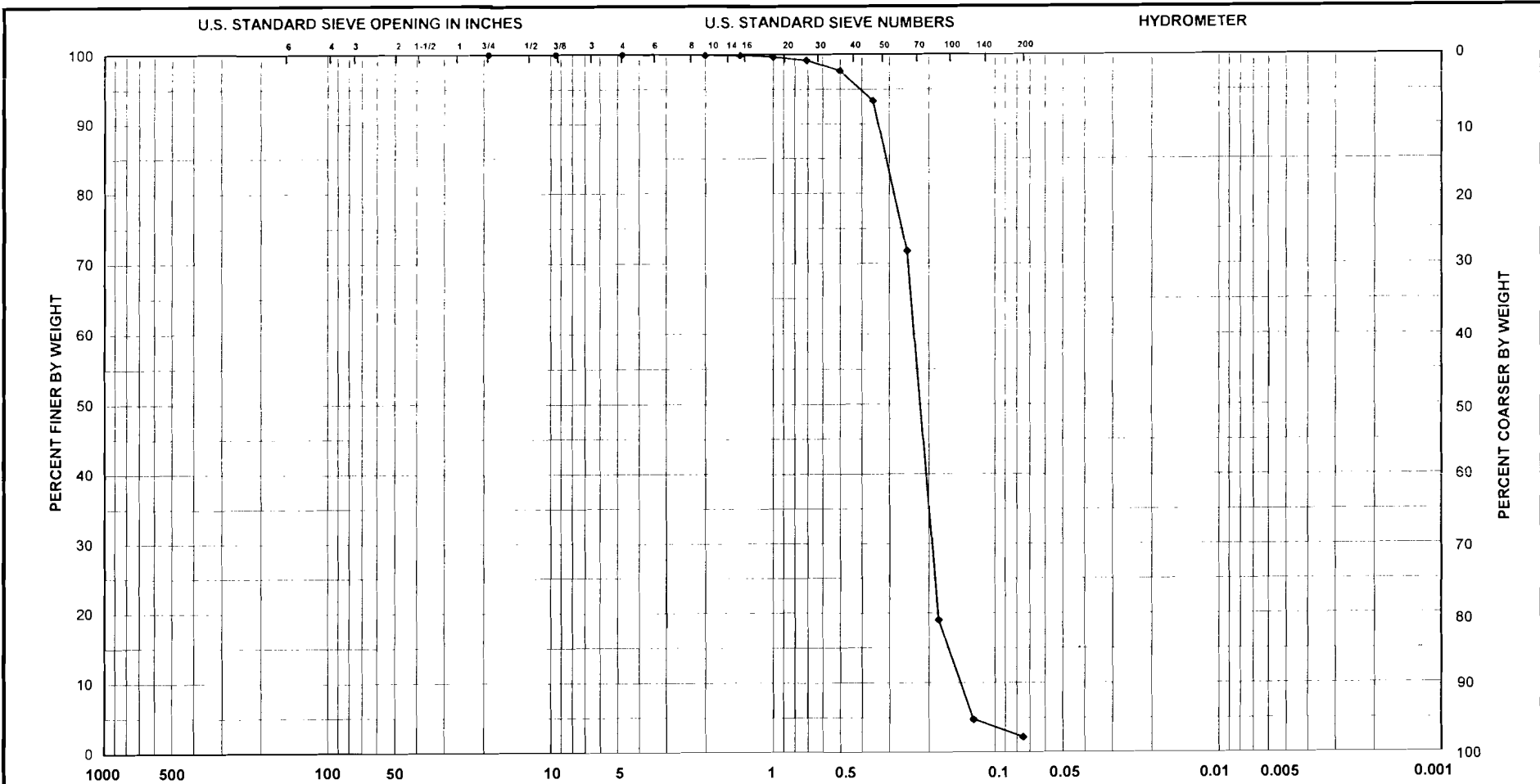
Tare Weight, (g):	50.09	
Dry Wt. Before Washing (g):	155.20	(with tare)
Dry Weight After Washing (g):	154.01	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.08	99.92	100	0.08
#14	1.400	0.09	99.84	90	0.08
#18	1.000	0.24	99.61	70	0.17
#25	0.710	0.51	99.12	40	0.20
#35	0.500	1.60	97.60	25	0.40
#45	0.355	4.52	93.30	15	0.68
#60	0.250	22.65	71.75	5	1.13
#80	0.180	55.52	18.93	1	0.56
#120	0.125	14.94	4.72	1	0.15
#200	0.075	2.62	2.23	1	0.03

Total Shell Content: 

2	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-2	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)	2						Cape Lookout
									Station V-2
									Boring No. 1
									Date 2/4/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

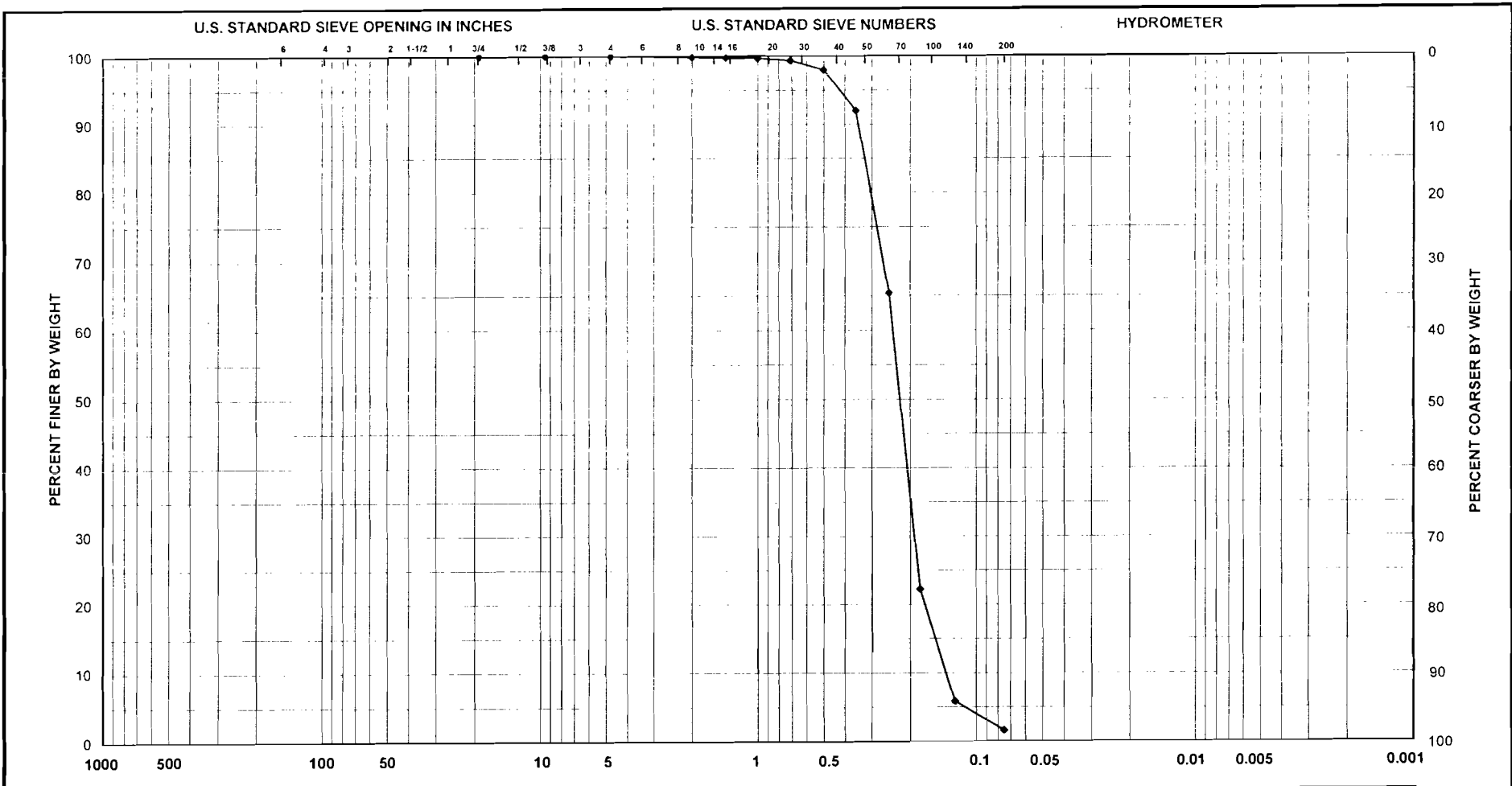
Project:	Cape Lookout	Depth:	7.0-7.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-2		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)		

Tare Weight, (g):	49.95	
Dry Wt. Before Washing (g):	154.55	(with tare)
Dry Weight After Washing (g):	153.23	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.15	99.86	90	0.14
#14	1.400	0.09	99.77	70	0.06
#18	1.000	0.13	99.65	65	0.08
#25	0.710	0.34	99.32	50	0.17
#35	0.500	1.40	97.98	30	0.42
#45	0.355	6.31	91.95	20	1.26
#60	0.250	27.80	65.37	5	1.39
#80	0.180	45.12	22.24	1	0.45
#120	0.125	17.17	5.82	1	0.17
#200	0.075	4.41	1.61	1	0.04

Total Shell Content: 

3	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project	
V-2	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)	3						Cape Lookout	
									Station	V-2
									Boring No.	2
									Date	2/4/2005

**GRADATION CURVES**



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Jacksonville, Florida 32246  
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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

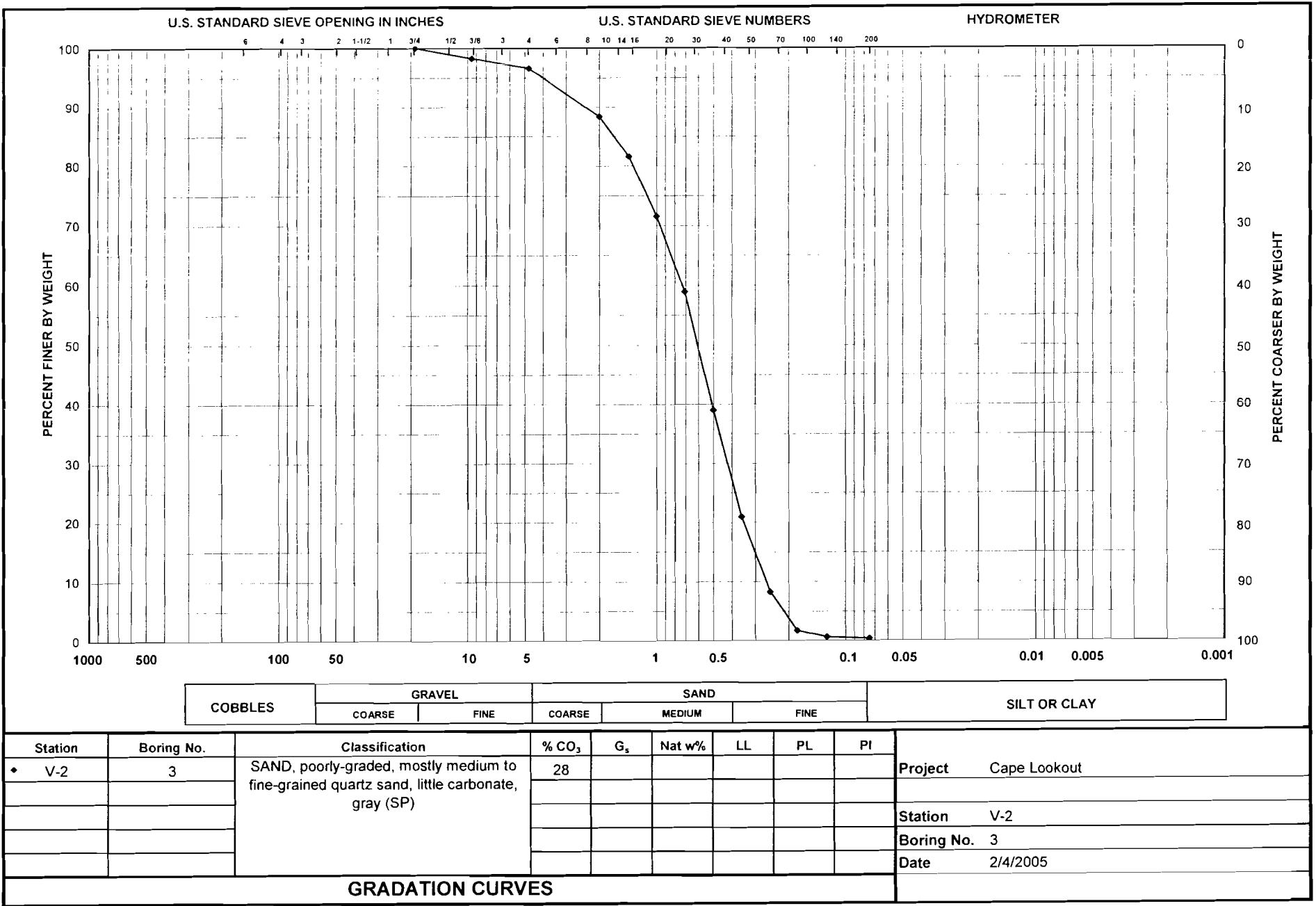
Project:	Cape Lookout	Depth:	9.0-9.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-2		
Sample No.:	3		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, gray (SP)		

Tare Weight, (g):	50.48	
Dry Wt. Before Washing (g):	177.90	(with tare)
Dry Weight After Washing (g):	177.23	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	2.21	98.27	100	2.21
#4	4.750	2.13	96.59	100	2.13
#10	2.000	10.54	88.32	100	10.54
#14	1.400	8.61	81.56	80	6.89
#18	1.000	12.77	71.54	60	7.66
#25	0.710	16.12	58.89	45	7.25
#35	0.500	25.32	39.02	30	7.60
#45	0.355	23.06	20.92	15	3.46
#60	0.250	16.14	8.26	5	0.81
#80	0.180	8.26	1.77	3	0.25
#120	0.125	1.41	0.67	1	0.01
#200	0.075	0.26	0.46	1	0.00

Total Shell Content: 

28	%
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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

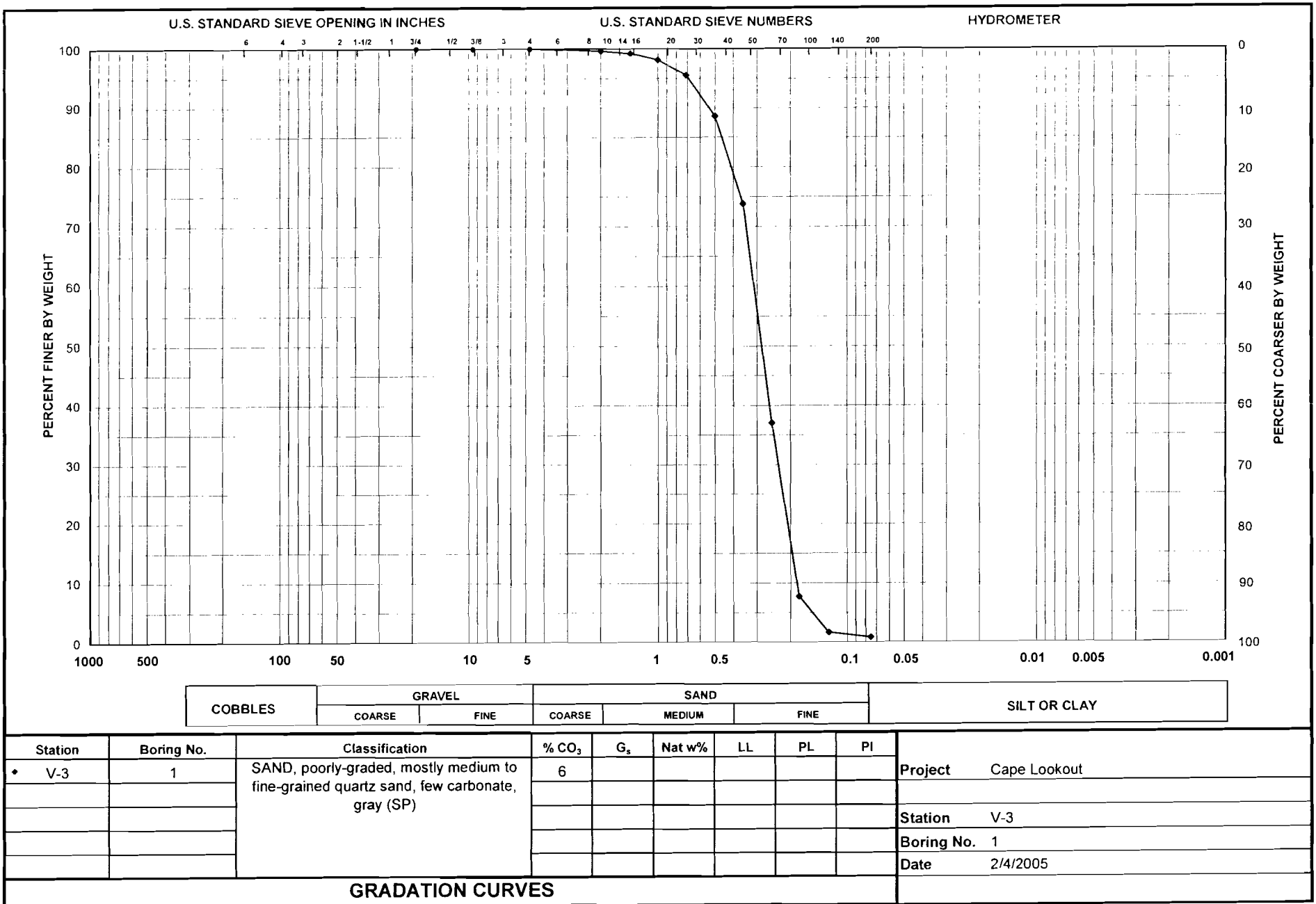
Project:	Cape Lookout	Depth:	3.0-3.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-3		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, gray (SP)		

Tare Weight, (g):	50.31	
Dry Wt. Before Washing (g):	150.37	(with tare)
Dry Weight After Washing (g):	149.56	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.37	99.63	100	0.37
#14	1.400	0.44	99.19	95	0.42
#18	1.000	1.07	98.12	90	0.96
#25	0.710	2.66	95.46	40	1.06
#35	0.500	6.90	88.57	25	1.73
#45	0.355	14.79	73.79	15	2.22
#60	0.250	36.80	37.01	5	1.84
#80	0.180	29.36	7.67	1	0.29
#120	0.125	6.01	1.66	1	0.06
#200	0.075	0.80	0.86	1	0.01

Total Shell Content: 

6	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>2</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-3	1	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, gray (SP)	6						Cape Lookout
									Station V-3
									Boring No. 1
									Date 2/4/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	5.0-5.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-3		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)		

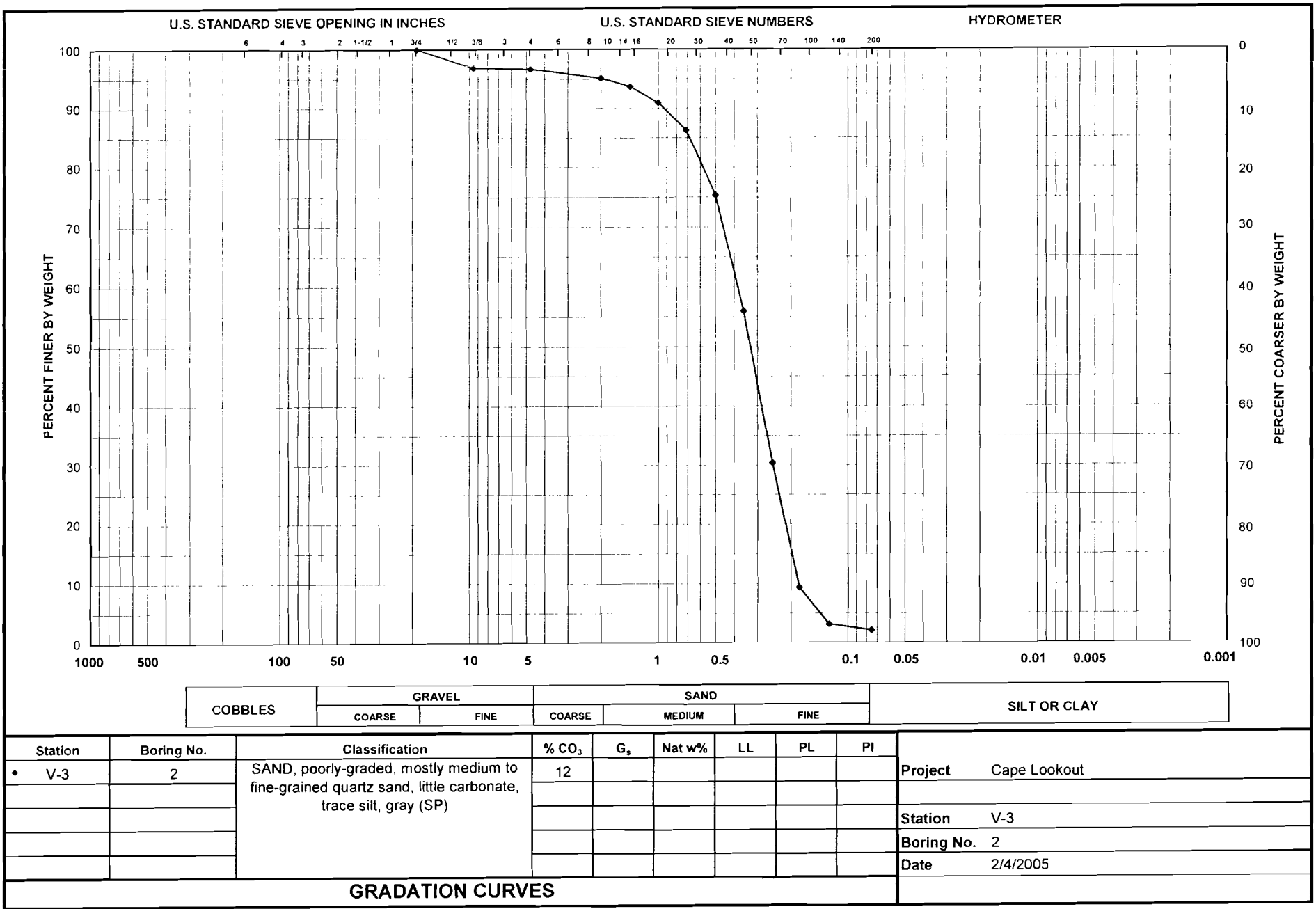
Tare Weight, (g):	50.46	
Dry Wt. Before Washing (g):	147.95	(with tare)
Dry Weight After Washing (g):	146.97	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	3.09	96.83	100	3.09
#4	4.750	0.14	96.69	100	0.14
#10	2.000	1.54	95.11	100	1.54
#14	1.400	1.43	93.64	90	1.29
#18	1.000	2.65	90.92	75	1.99
#25	0.710	4.56	86.24	45	2.05
#35	0.500	10.65	75.32	30	3.20
#45	0.355	18.91	55.92	10	1.89
#60	0.250	24.89	30.39	5	1.24
#80	0.180	20.55	9.31	3	0.62
#120	0.125	6.05	3.11	1	0.06
#200	0.075	0.94	2.14	1	0.01

Total Shell Content: 

12	%
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Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project	
									COBBLES	GRAVEL
V-3	2	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)	12						Cape Lookout	
									Station	V-3
									Boring No.	2
									Date	2/4/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

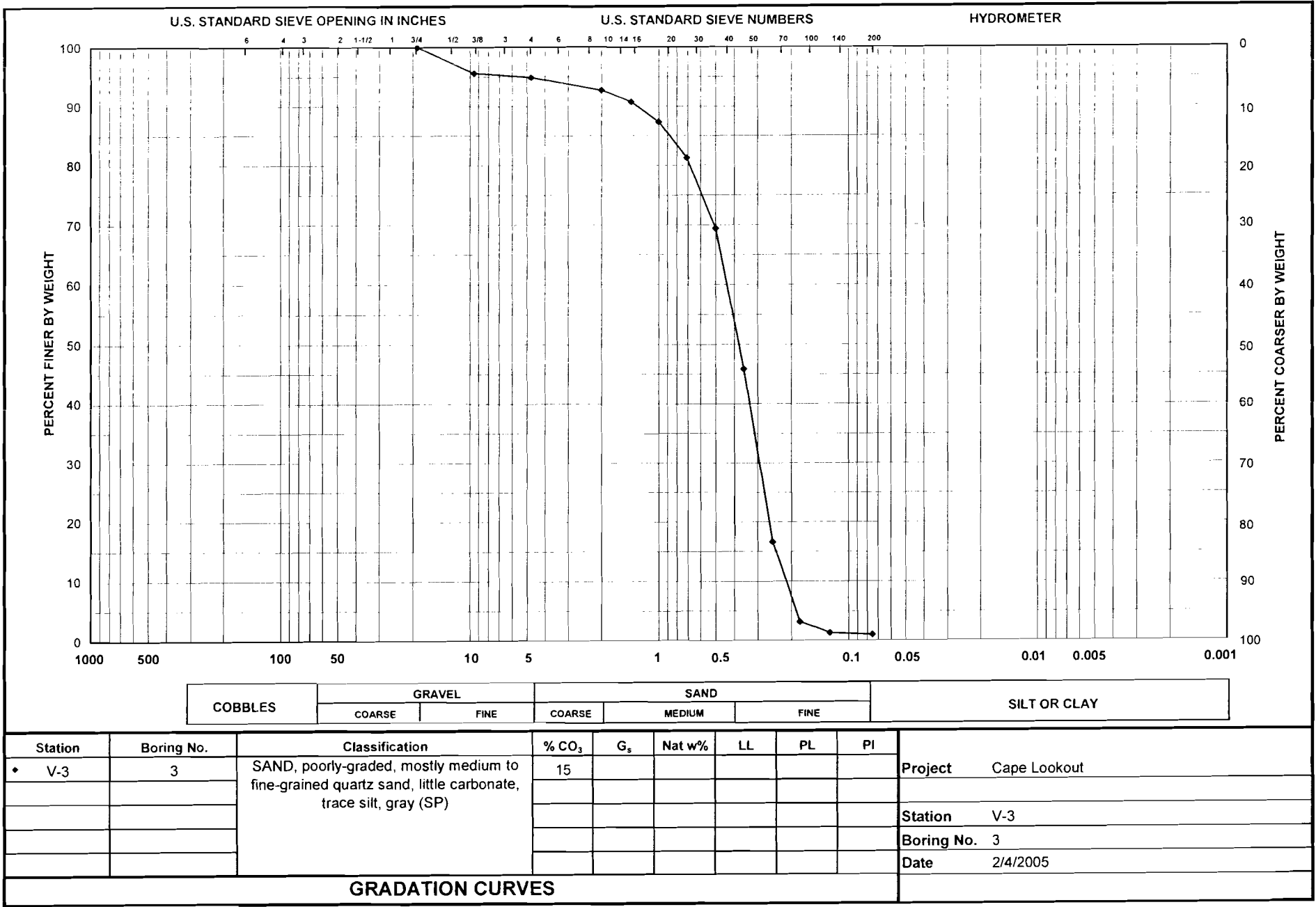
Project:	Cape Lookout	Depth:	7.0-7.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-3		
Sample No.:	3		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)		

Tare Weight, (g):	50.00	
Dry Wt. Before Washing (g):	160.50	(with tare)
Dry Weight After Washing (g):	159.64	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	4.92	95.55	100	4.92
#4	4.750	0.74	94.88	100	0.74
#10	2.000	2.40	92.71	100	2.40
#14	1.400	2.23	90.69	90	2.01
#18	1.000	3.72	87.32	60	2.23
#25	0.710	6.72	81.24	40	2.69
#35	0.500	13.14	69.35	30	3.94
#45	0.355	25.97	45.85	15	3.90
#60	0.250	32.30	16.62	3	0.97
#80	0.180	14.82	3.20	1	0.15
#120	0.125	2.09	1.31	1	0.02
#200	0.075	0.28	1.06	1	0.00

Total Shell Content: 

15	%
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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	9.0-9.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-3		
Sample No.:	4		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, dark gray (SP)		

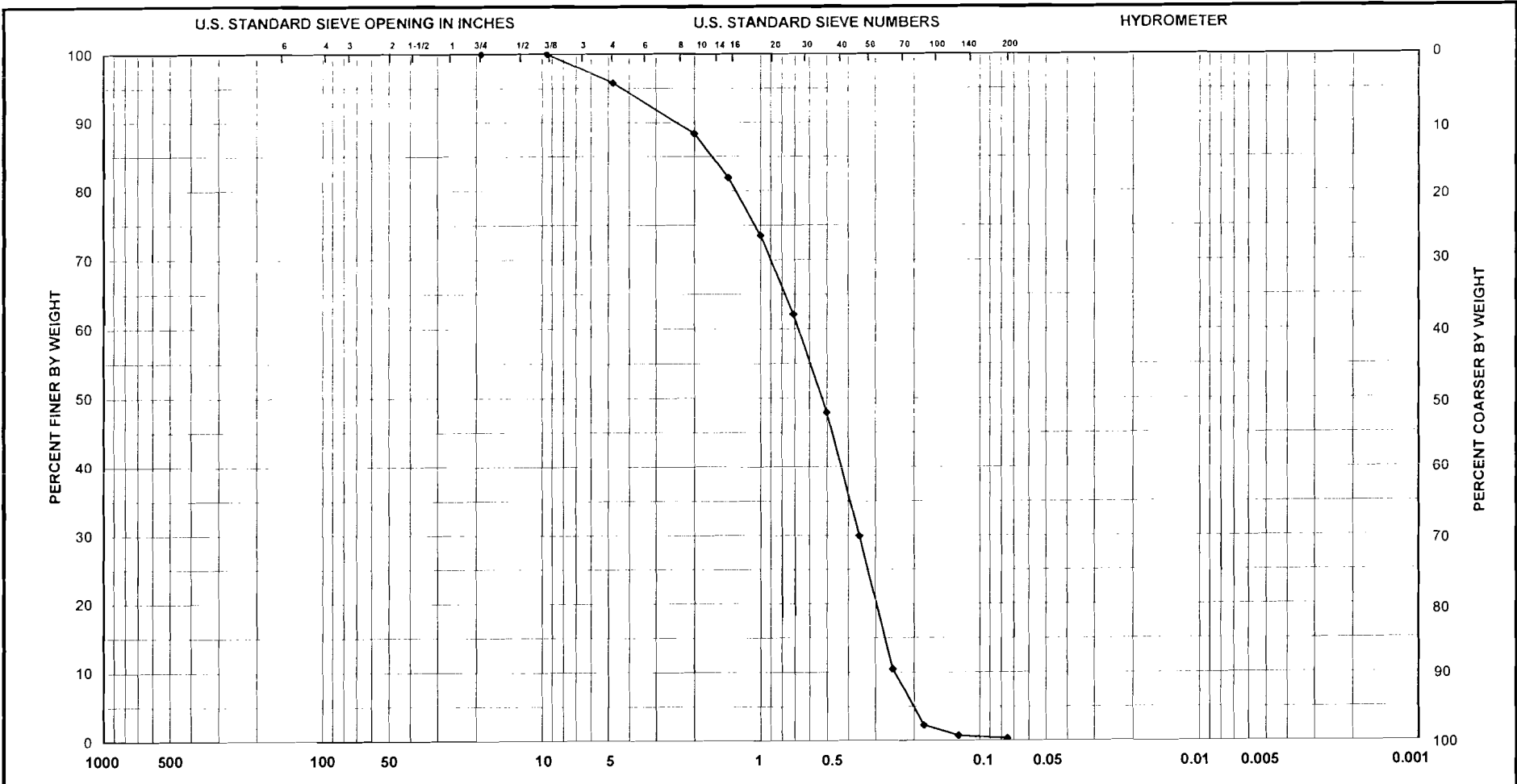
Tare Weight, (g):	50.63	
Dry Wt. Before Washing (g):	147.88	(with tare)
Dry Weight After Washing (g):	147.00	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	4.10	95.78	100	4.10
#10	2.000	7.27	88.31	95	6.91
#14	1.400	6.25	81.88	85	5.31
#18	1.000	8.21	73.44	70	5.75
#25	0.710	11.05	62.08	45	4.97
#35	0.500	13.82	47.87	20	2.76
#45	0.355	17.52	29.85	15	2.63
#60	0.250	18.90	10.42	5	0.95
#80	0.180	7.95	2.24	3	0.24
#120	0.125	1.42	0.78	1	0.01
#200	0.075	0.39	0.38	1	0.00

Total Shell Content: 

23
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 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project	
V-3	4	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, dark gray (SP)	23						Cape Lookout	
									Station	V-3
									Boring No.	4
									Date	2/4/2005
<b>GRADATION CURVES</b>										



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

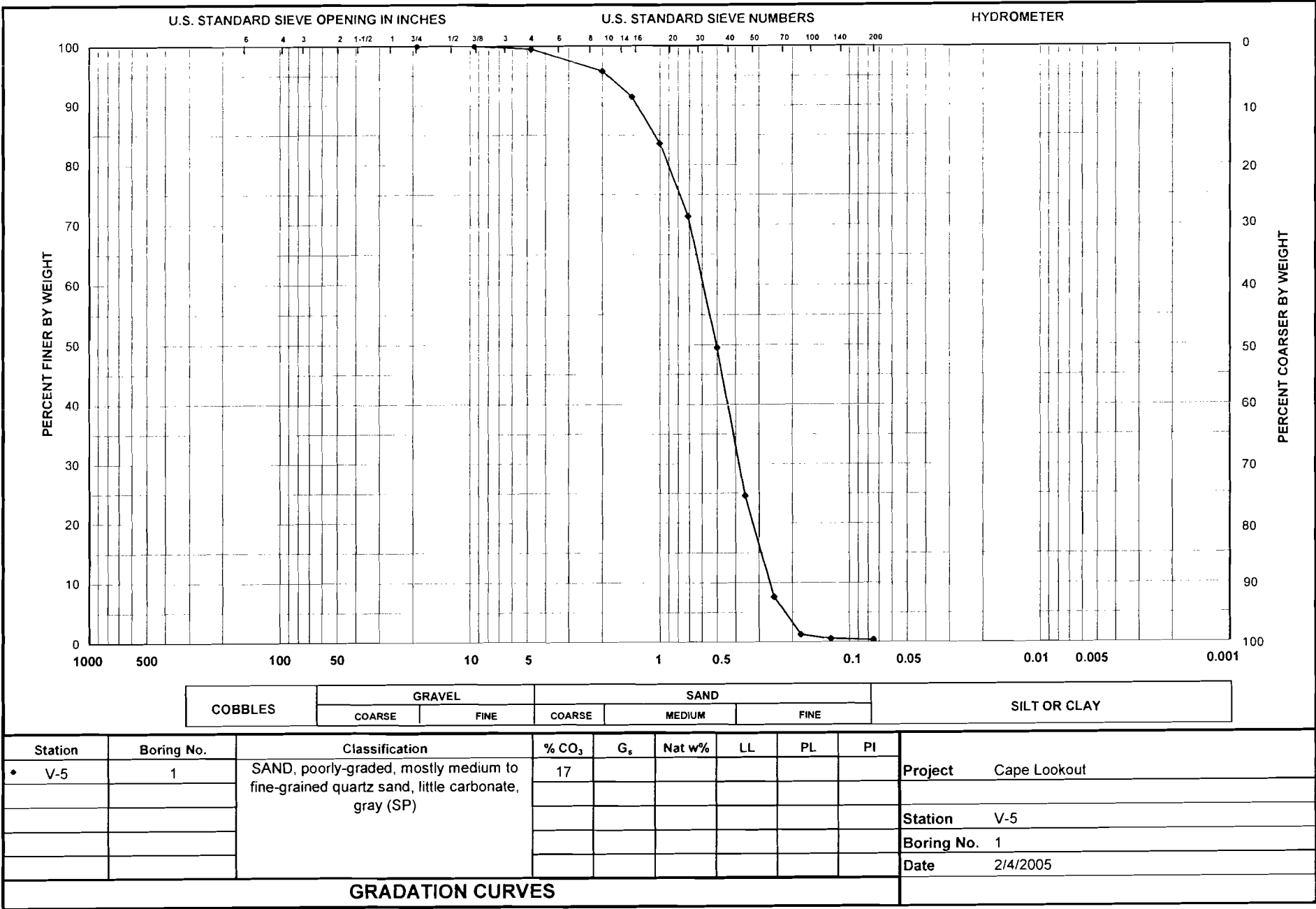
Project:	Cape Lookout	Depth:	1.6-2.1
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-5		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, gray (SP)		

Tare Weight, (g):	49.48	
Dry Wt. Before Washing (g):	161.12	(with tare)
Dry Weight After Washing (g):	160.51	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.56	99.50	100	0.56
#10	2.000	4.17	95.76	100	4.17
#14	1.400	4.86	91.41	90	4.37
#18	1.000	8.78	83.55	60	5.27
#25	0.710	13.62	71.35	35	4.77
#35	0.500	24.43	49.46	20	4.89
#45	0.355	27.82	24.54	10	2.78
#60	0.250	18.92	7.60	5	0.95
#80	0.180	7.02	1.31	1	0.07
#120	0.125	0.79	0.60	1	0.01
#200	0.075	0.15	0.47	1	0.00

Total Shell Content: 

17	%
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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	4.0-4.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-5		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, gray (SP)		

Tare Weight, (g):	48.65	
Dry Wt. Before Washing (g):	146.29	(with tare)
Dry Weight After Washing (g):	145.63	(with tare)

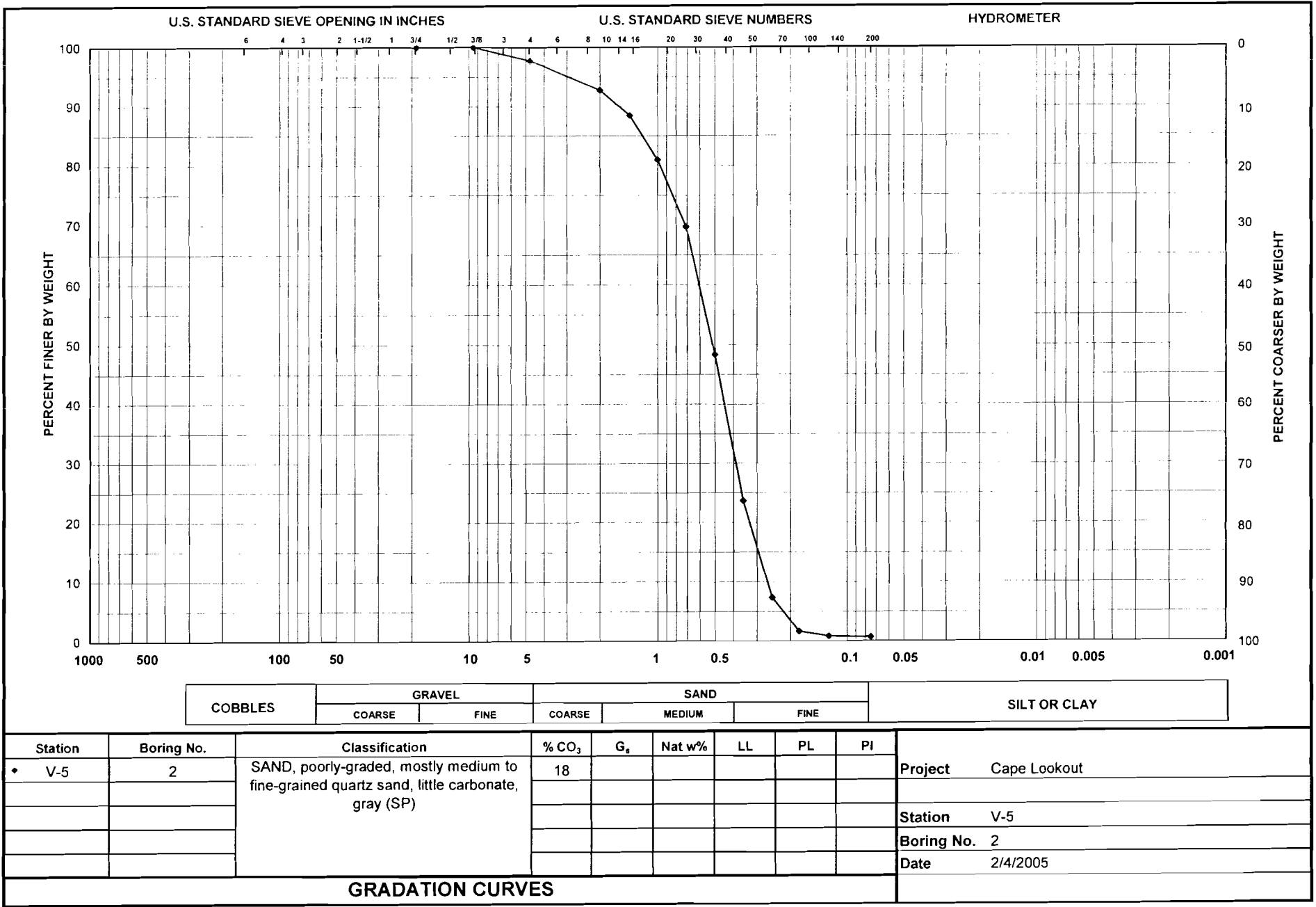
Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	2.20	97.75	100	2.20
#10	2.000	4.91	92.72	100	4.91
#14	1.400	4.22	88.40	85	3.59
#18	1.000	7.31	80.91	65	4.75
#25	0.710	10.95	69.69	35	3.83
#35	0.500	20.88	48.31	20	4.18
#45	0.355	24.07	23.66	10	2.41
#60	0.250	15.93	7.34	5	0.80
#80	0.180	5.54	1.67	3	0.17
#120	0.125	0.80	0.85	1	0.01
#200	0.075	0.09	0.76	1	0.00

Total Shell Content: 

18
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 %







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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

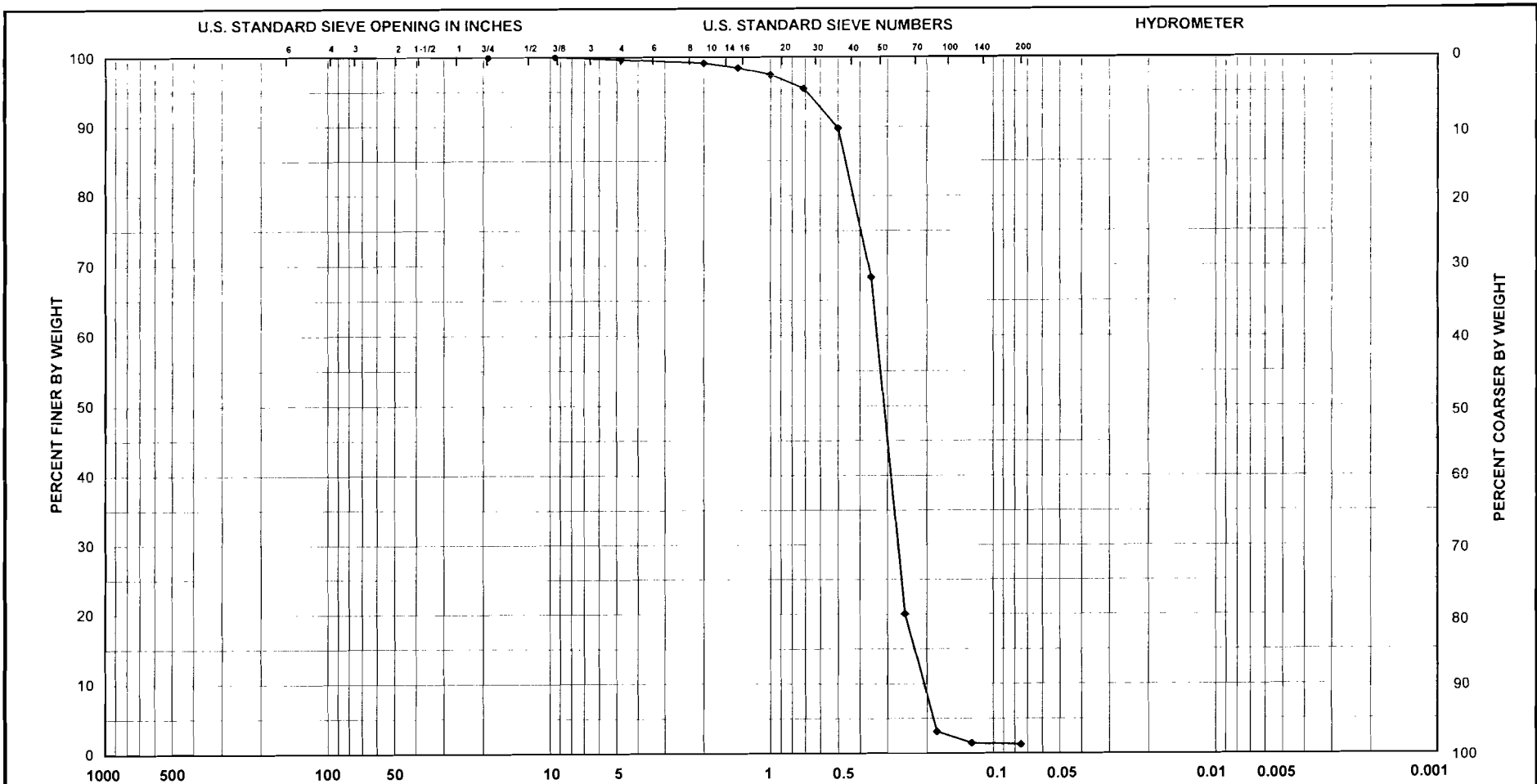
Project:	Cape Lookout	Depth:	6.0-6.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-5		
Sample No.:	3		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, trace silt, gray (SP)		

Tare Weight, (g):	50.48	
Dry Wt. Before Washing (g):	145.69	(with tare)
Dry Weight After Washing (g):	144.88	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.36	99.62	100	0.36
#10	2.000	0.47	99.13	90	0.42
#14	1.400	0.66	98.44	85	0.56
#18	1.000	0.95	97.44	70	0.67
#25	0.710	1.89	95.45	40	0.76
#35	0.500	5.50	89.68	30	1.65
#45	0.355	20.33	68.32	15	3.05
#60	0.250	45.96	20.05	5	2.30
#80	0.180	16.13	3.11	3	0.48
#120	0.125	1.52	1.51	1	0.02
#200	0.075	0.22	1.28	1	0.00

Total Shell Content: 

7	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-5	3	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, trace silt, gray (SP)	7						Cape Lookout
									Station V-5
									Boring No. 3
									Date 2/4/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	8.0-8.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-5		
Sample No.:	4		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, gray (SP)		

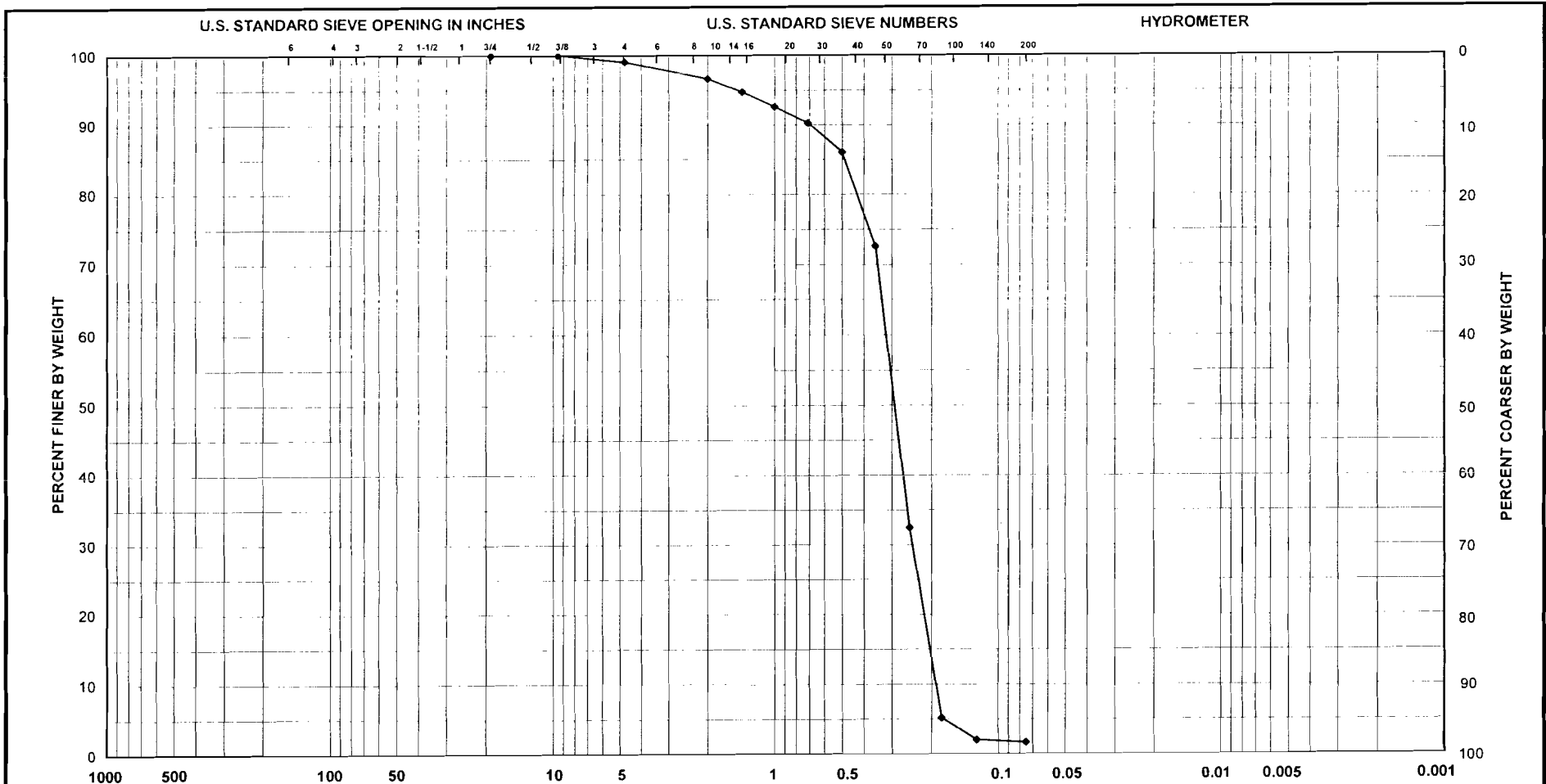
Tare Weight, (g):	49.61	
Dry Wt. Before Washing (g):	166.69	(with tare)
Dry Weight After Washing (g):	165.52	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	1.10	99.06	100	1.10
#10	2.000	2.83	96.64	90	2.55
#14	1.400	2.30	94.68	65	1.50
#18	1.000	2.46	92.58	60	1.48
#25	0.710	2.79	90.19	40	1.12
#35	0.500	4.90	86.01	30	1.47
#45	0.355	15.78	72.53	20	3.16
#60	0.250	46.94	32.44	5	2.35
#80	0.180	31.90	5.19	3	0.96
#120	0.125	3.70	2.03	1	0.04
#200	0.075	0.40	1.69	1	0.00

Total Shell Content: 

9
---

 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
• V-5	4	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, gray (SP)	9						Cape Lookout
									Station V-5
									Boring No. 4
									Date 2/4/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

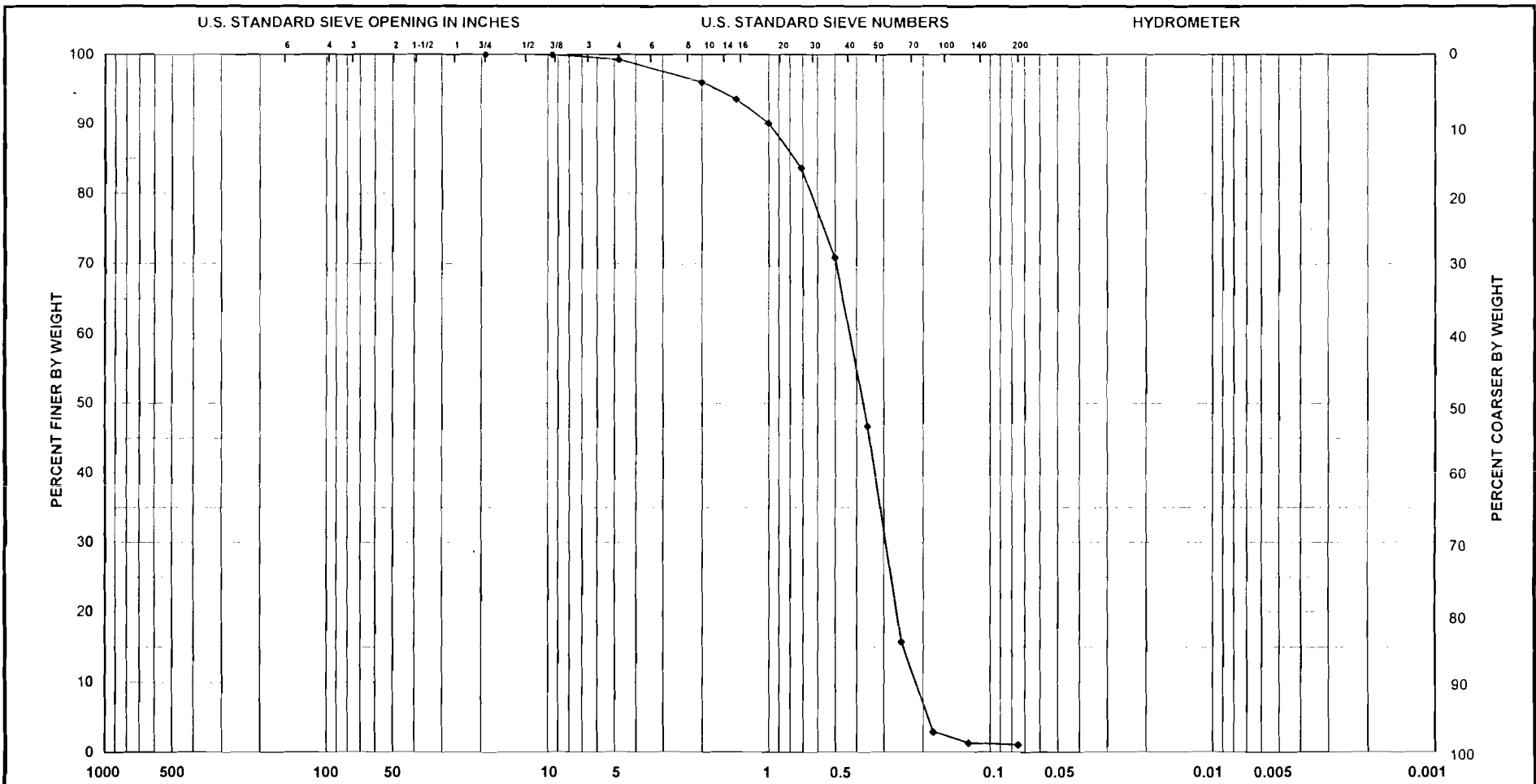
### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	1.3-1.8
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-7		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)		

Tare Weight, (g):	50.52	
Dry Wt. Before Washing (g):	161.76	(with tare)
Dry Weight After Washing (g):	160.97	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.78	99.30	100	0.78
#10	2.000	3.63	96.04	85	3.09
#14	1.400	2.71	93.60	80	2.17
#18	1.000	3.88	90.11	60	2.33
#25	0.710	7.19	83.65	35	2.52
#35	0.500	14.23	70.86	30	4.27
#45	0.355	26.86	46.71	15	4.03
#60	0.250	34.45	15.74	5	1.72
#80	0.180	14.24	2.94	1	0.14
#120	0.125	1.77	1.35	1	0.02
#200	0.075	0.28	1.10	1	0.00

Total Shell Content: 13 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
• V-7	1	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)	13						Cape Lookout
									Station V-7
									Boring No. 1
									Date 2/4/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	3.3-3.8
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-7		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, dark gray (SP)		

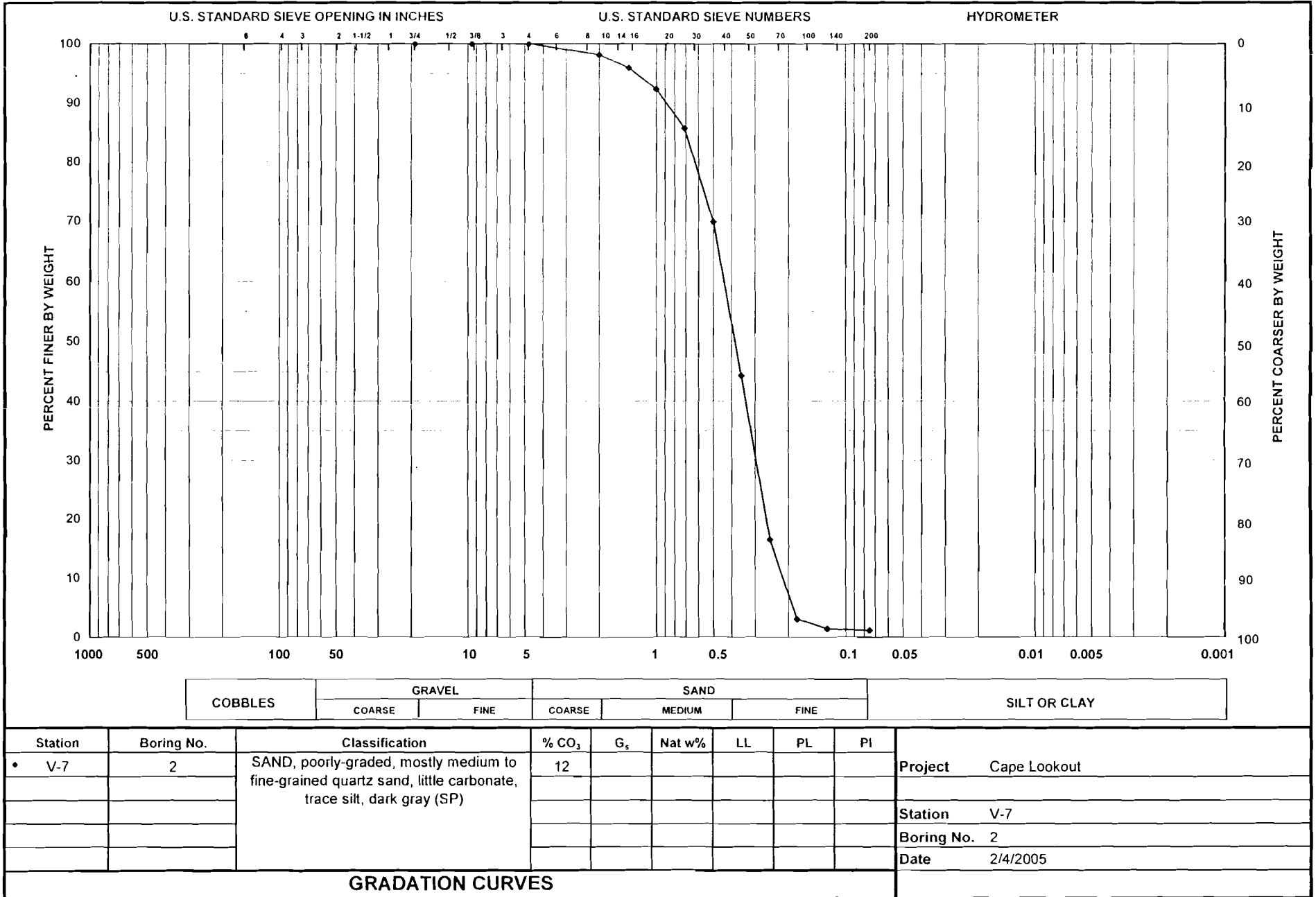
Tare Weight, (g):	49.70	
Dry Wt. Before Washing (g):	152.46	(with tare)
Dry Weight After Washing (g):	151.71	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	1.88	98.17	90	1.69
#14	1.400	2.26	95.97	80	1.81
#18	1.000	3.77	92.30	65	2.45
#25	0.710	6.82	85.67	35	2.39
#35	0.500	16.24	69.86	30	4.87
#45	0.355	26.28	44.29	15	3.94
#60	0.250	28.54	16.51	5	1.43
#80	0.180	13.88	3.01	1	0.14
#120	0.125	1.65	1.40	1	0.02
#200	0.075	0.26	1.15	1	0.00

Total Shell Content: 

12	%
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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

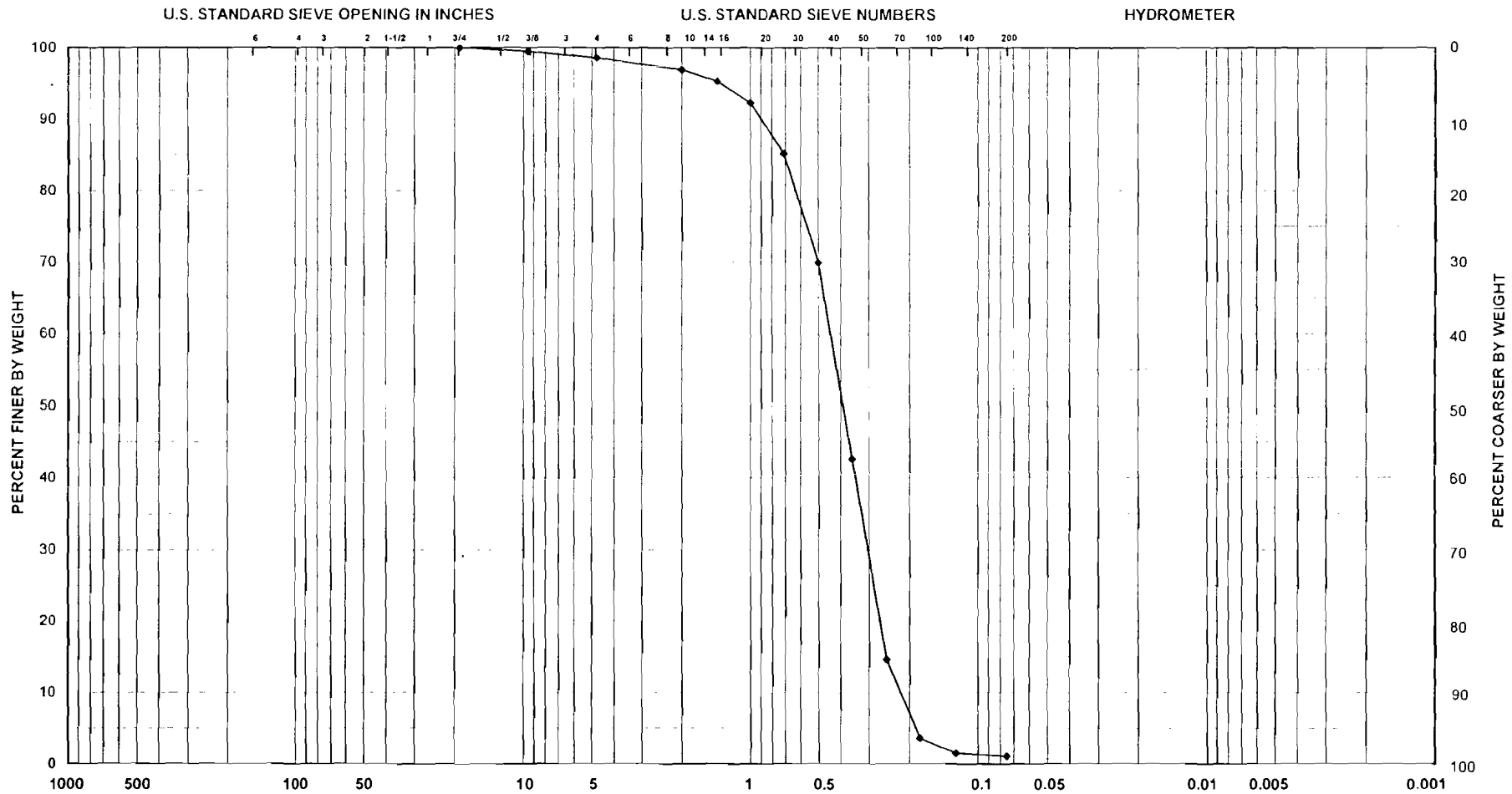
Project:	Cape Lookout	Depth:	5.0-5.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-7		
Sample No.:	3		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, dark gray (SP)		

Tare Weight, (g):	49.96	
Dry Wt. Before Washing (g):	162.48	(with tare)
Dry Weight After Washing (g):	161.54	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.58	99.48	100	0.58
#4	4.750	1.00	98.60	100	1.00
#10	2.000	1.79	97.00	90	1.61
#14	1.400	1.83	95.38	80	1.46
#18	1.000	3.49	92.28	60	2.09
#25	0.710	8.02	85.15	40	3.21
#35	0.500	17.16	69.90	30	5.15
#45	0.355	30.72	42.60	15	4.61
#60	0.250	31.56	14.55	5	1.58
#80	0.180	12.27	3.64	1	0.12
#120	0.125	2.40	1.51	1	0.02
#200	0.075	0.47	1.09	1	0.00

Total Shell Content: 

13	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-7	3	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, dark gray (SP)	13						Cape Lookout
									Station V-7
									Boring No. 3
									Date 2/4/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

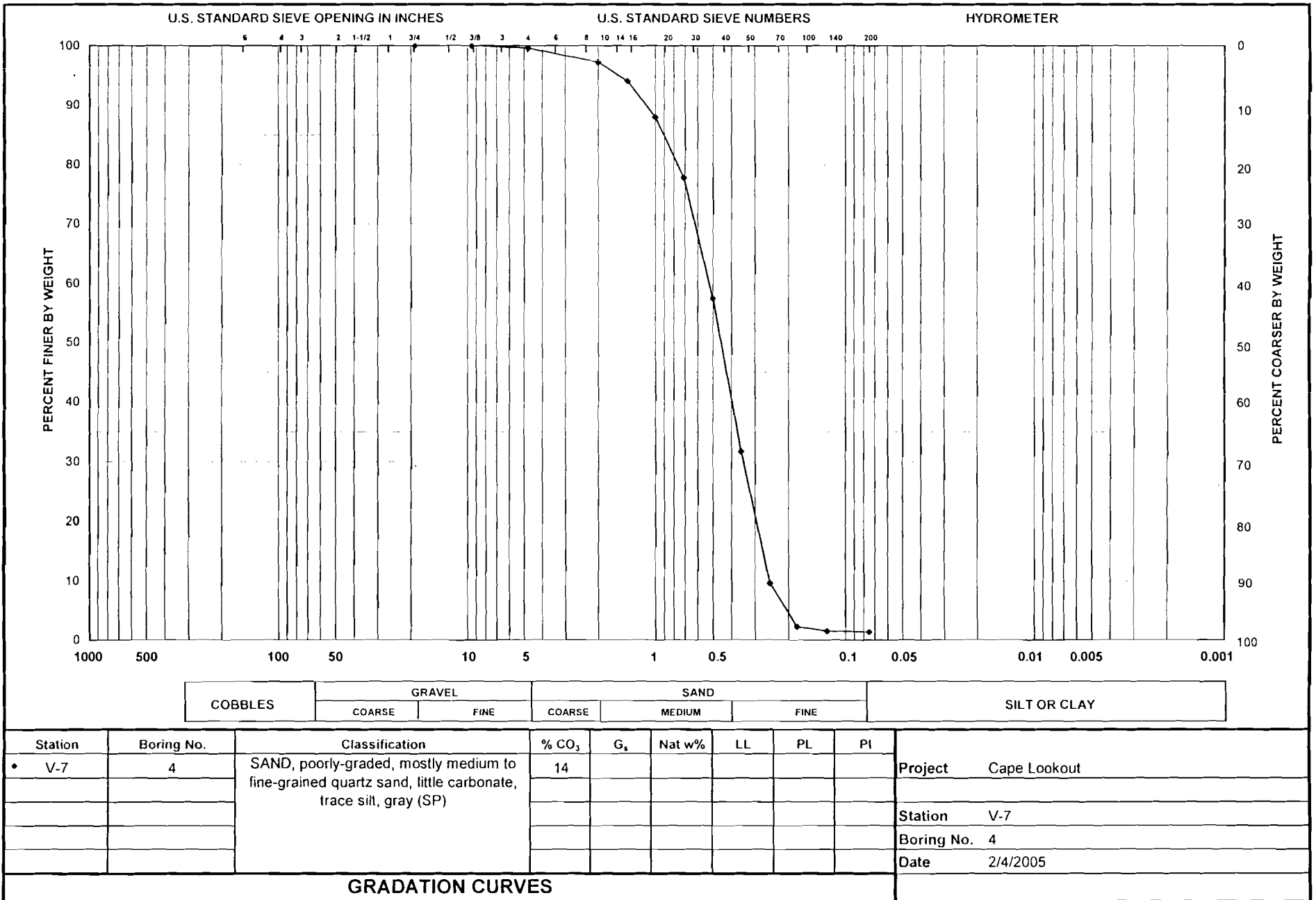
Project:	Cape Lookout	Depth:	7.0-7.5
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-7		
Sample No.:	4		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)		

Tare Weight, (g):	50.18	
Dry Wt. Before Washing (g):	156.63	(with tare)
Dry Weight After Washing (g):	155.67	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.45	99.58	100	0.45
#10	2.000	2.48	97.25	100	2.48
#14	1.400	3.36	94.09	90	3.02
#18	1.000	6.49	87.99	50	3.25
#25	0.710	10.82	77.83	35	3.79
#35	0.500	21.66	57.48	25	5.42
#45	0.355	27.44	31.71	10	2.74
#60	0.250	23.48	9.65	5	1.17
#80	0.180	7.83	2.29	3	0.23
#120	0.125	0.81	1.53	1	0.01
#200	0.075	0.16	1.38	1	0.00

Total Shell Content: 

14	%
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## VISUAL SHELL CONTENT

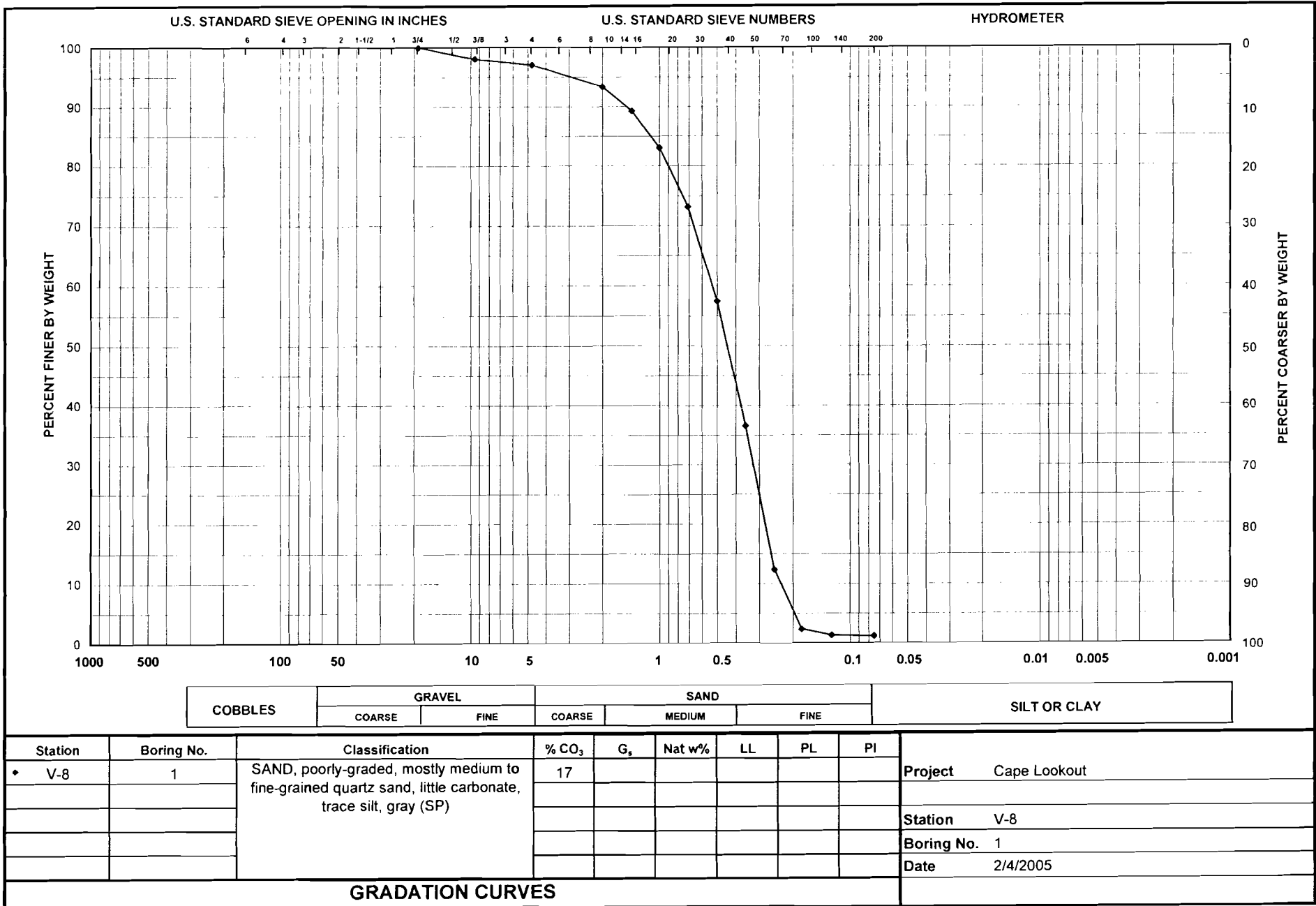
### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	2.4-2.9
Project No.:	2086-01-60	Date:	2/4/2005
Boring No.:	V-8		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, gray (SP)		

Tare Weight, (g):	50.33	
Dry Wt. Before Washing (g):	150.44	(with tare)
Dry Weight After Washing (g):	149.78	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	2.00	98.00	100	2.00
#4	4.750	0.99	97.01	100	0.99
#10	2.000	3.70	93.32	90	3.33
#14	1.400	4.09	89.23	75	3.07
#18	1.000	6.23	83.01	60	3.74
#25	0.710	9.89	73.13	40	3.96
#35	0.500	15.74	57.41	25	3.94
#45	0.355	20.88	36.55	15	3.13
#60	0.250	24.27	12.31	5	1.21
#80	0.180	9.95	2.37	1	0.10
#120	0.125	1.01	1.36	1	0.01
#200	0.075	0.12	1.24	1	0.00

Total Shell Content: 17 %



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	4.4-4.9
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-8		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)		

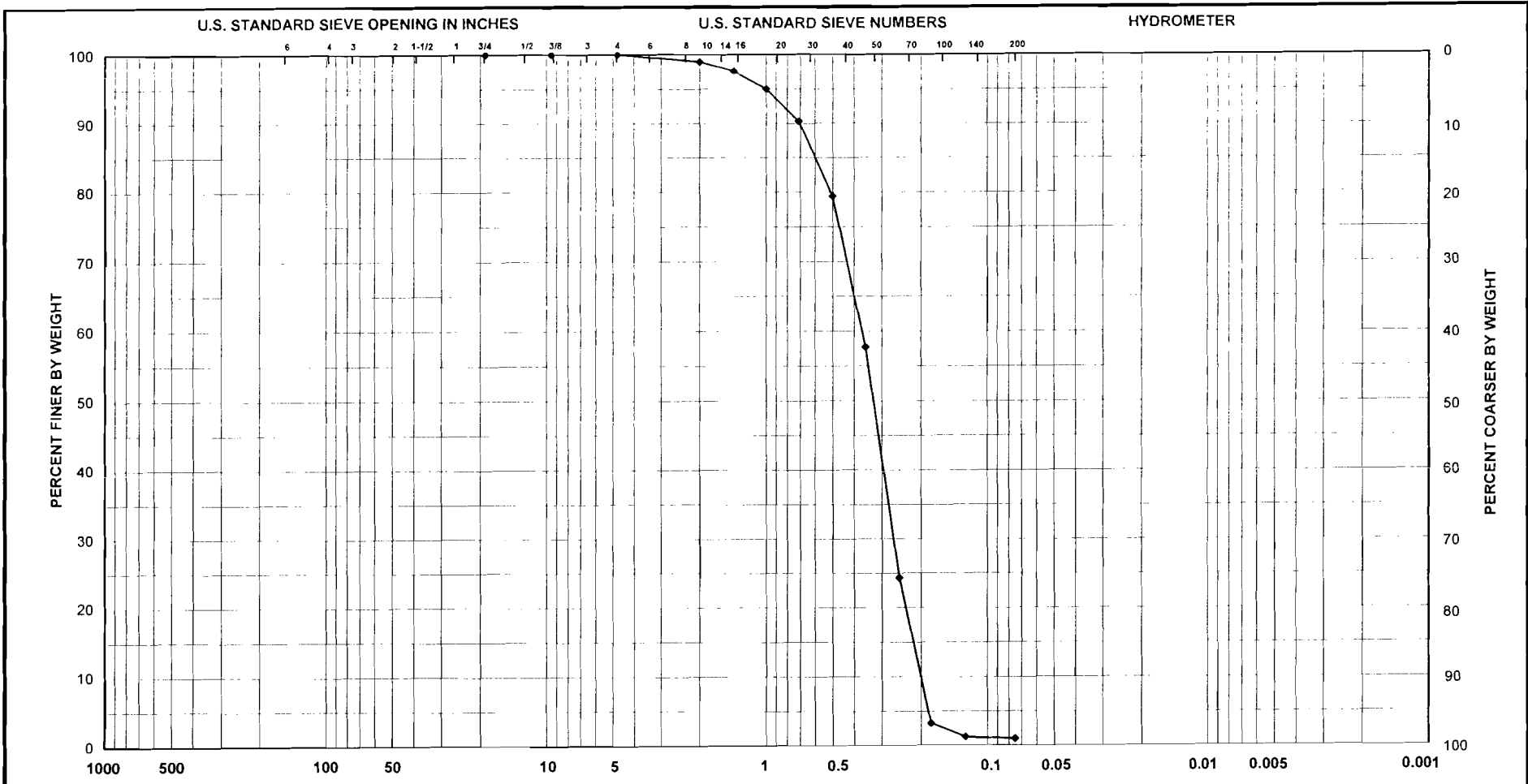
Tare Weight, (g):	50.38	
Dry Wt. Before Washing (g):	145.16	(with tare)
Dry Weight After Washing (g):	144.30	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	1.00	98.94	100	1.00
#14	1.400	1.30	97.57	90	1.17
#18	1.000	2.45	94.99	75	1.84
#25	0.710	4.51	90.23	45	2.03
#35	0.500	10.29	79.37	25	2.57
#45	0.355	20.58	57.66	15	3.09
#60	0.250	31.64	24.28	5	1.58
#80	0.180	19.91	3.27	3	0.60
#120	0.125	1.85	1.32	1	0.02
#200	0.075	0.29	1.01	1	0.00

Total Shell Content: 

10	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-8	2	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)	10						Cape Lookout
									Station V-8
									Boring No. 2
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

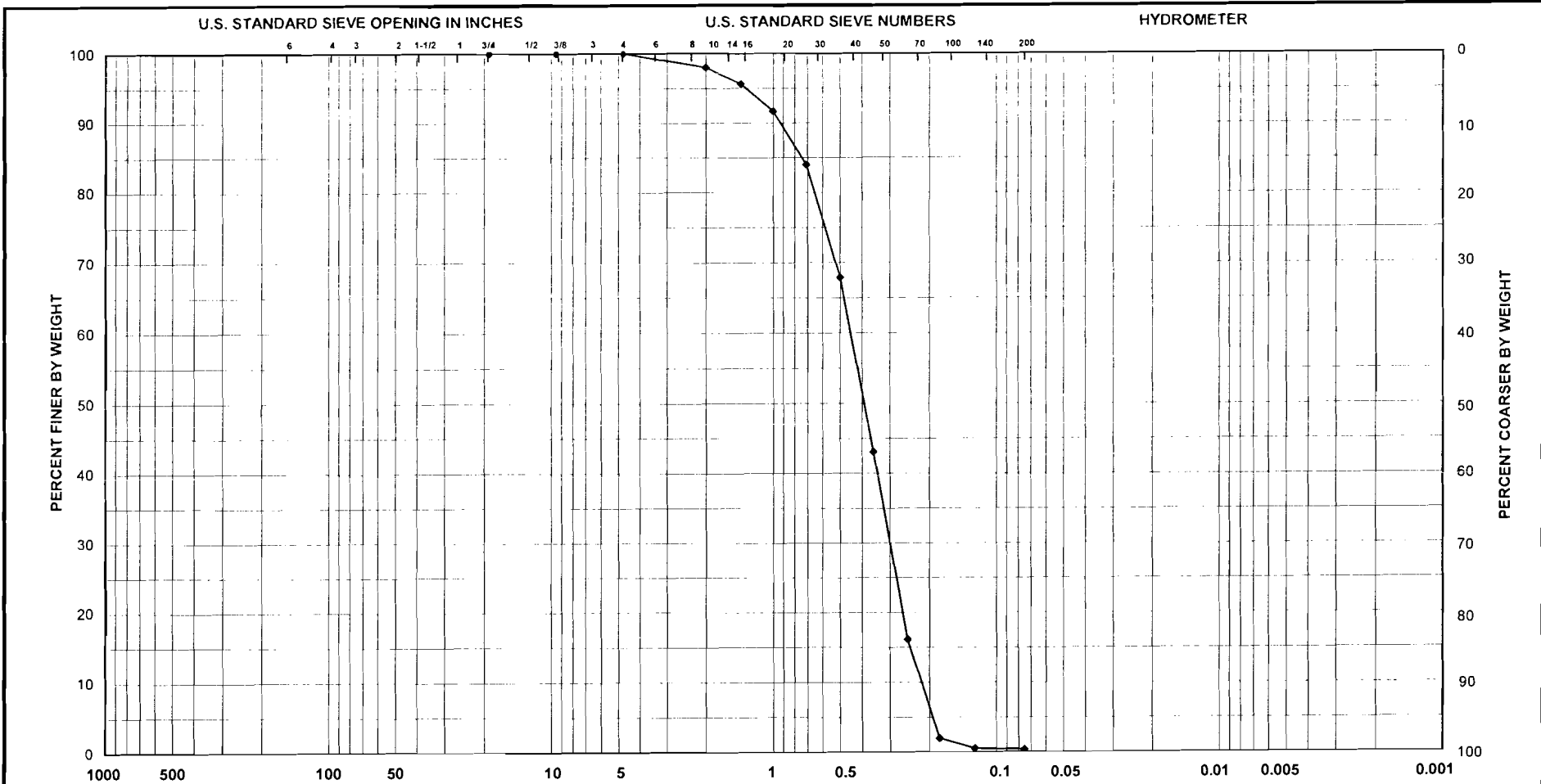
Project:	Cape Lookout	Depth:	6.4-6.9
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-8		
Sample No.:	3		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, gray (SP)		

Tare Weight, (g):	49.56	
Dry Wt. Before Washing (g):	139.68	(with tare)
Dry Weight After Washing (g):	139.04	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	1.81	97.99	100	1.81
#14	1.400	2.16	95.59	95	2.05
#18	1.000	3.52	91.69	65	2.29
#25	0.710	6.96	83.97	35	2.44
#35	0.500	14.52	67.85	20	2.90
#45	0.355	22.36	43.04	10	2.24
#60	0.250	24.25	16.13	3	0.73
#80	0.180	12.77	1.96	1	0.13
#120	0.125	1.25	0.58	1	0.01
#200	0.075	0.13	0.43	1	0.00

Total Shell Content: 

10	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-8	3	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, gray (SP)	10						Cape Lookout
									Station V-8
									Boring No. 3
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

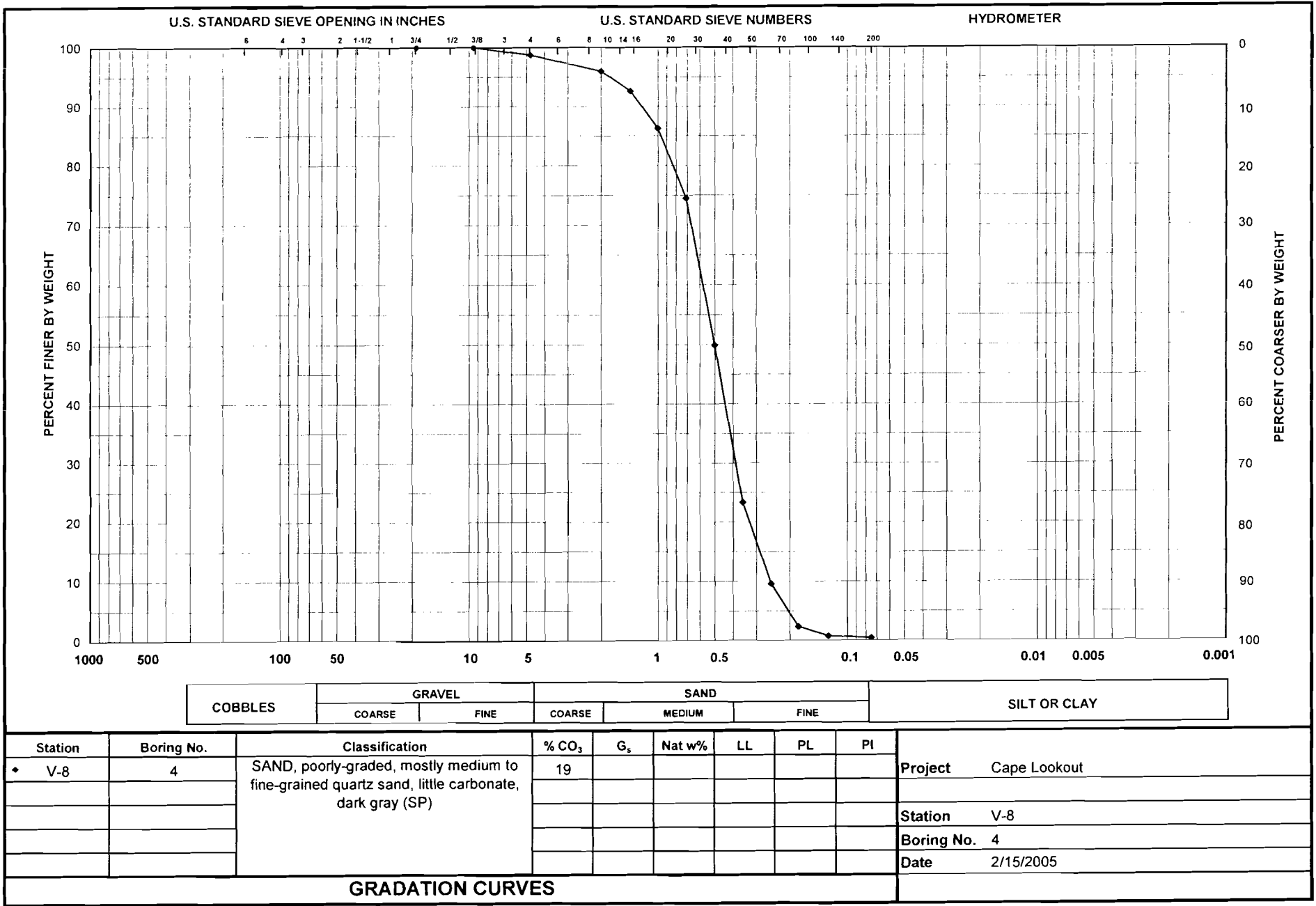
Project:	Cape Lookout	Depth:	8.2-8.6
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-8		
Sample No.:	4		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, dark gray (SP)		

Tare Weight, (g):	49.53	
Dry Wt. Before Washing (g):	147.57	(with tare)
Dry Weight After Washing (g):	146.75	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	1.26	98.71	100	1.26
#10	2.000	2.68	95.98	100	2.68
#14	1.400	3.34	92.57	80	2.67
#18	1.000	6.20	86.25	70	4.34
#25	0.710	11.56	74.46	45	5.20
#35	0.500	24.15	49.83	30	7.25
#45	0.355	25.98	23.33	15	3.90
#60	0.250	13.51	9.55	5	0.68
#80	0.180	7.06	2.35	3	0.21
#120	0.125	1.52	0.80	1	0.02
#200	0.075	0.31	0.48	1	0.00

Total Shell Content: 

19	%
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## VISUAL SHELL CONTENT

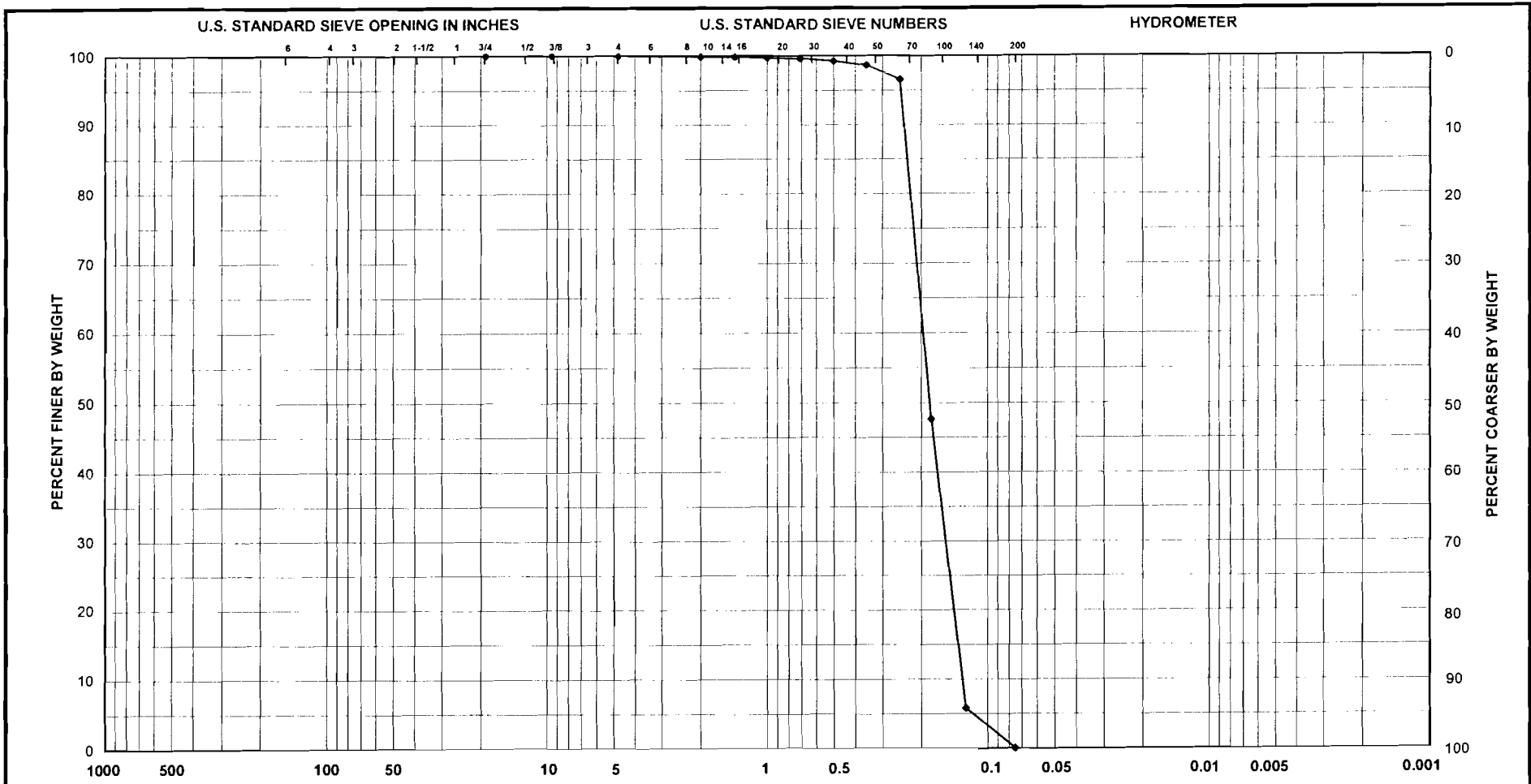
### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	0.0-0.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-9		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, dark gray (SP)		

Tare Weight, (g):	50.12	
Dry Wt. Before Washing (g):	114.26	(with tare)
Dry Weight After Washing (g):	113.54	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.08	99.88	100	0.08
#14	1.400	0.04	99.81	70	0.03
#18	1.000	0.08	99.69	60	0.05
#25	0.710	0.07	99.58	30	0.02
#35	0.500	0.22	99.24	15	0.03
#45	0.355	0.41	98.60	3	0.01
#60	0.250	1.30	96.57	3	0.04
#80	0.180	31.42	47.58	1	0.31
#120	0.125	26.80	5.80	1	0.27
#200	0.075	3.66	0.09	1	0.04

Total Shell Content: 1 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>2</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-9	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, dark gray (SP)	1						Cape Lookout
									Station V-9
									Boring No. 1
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

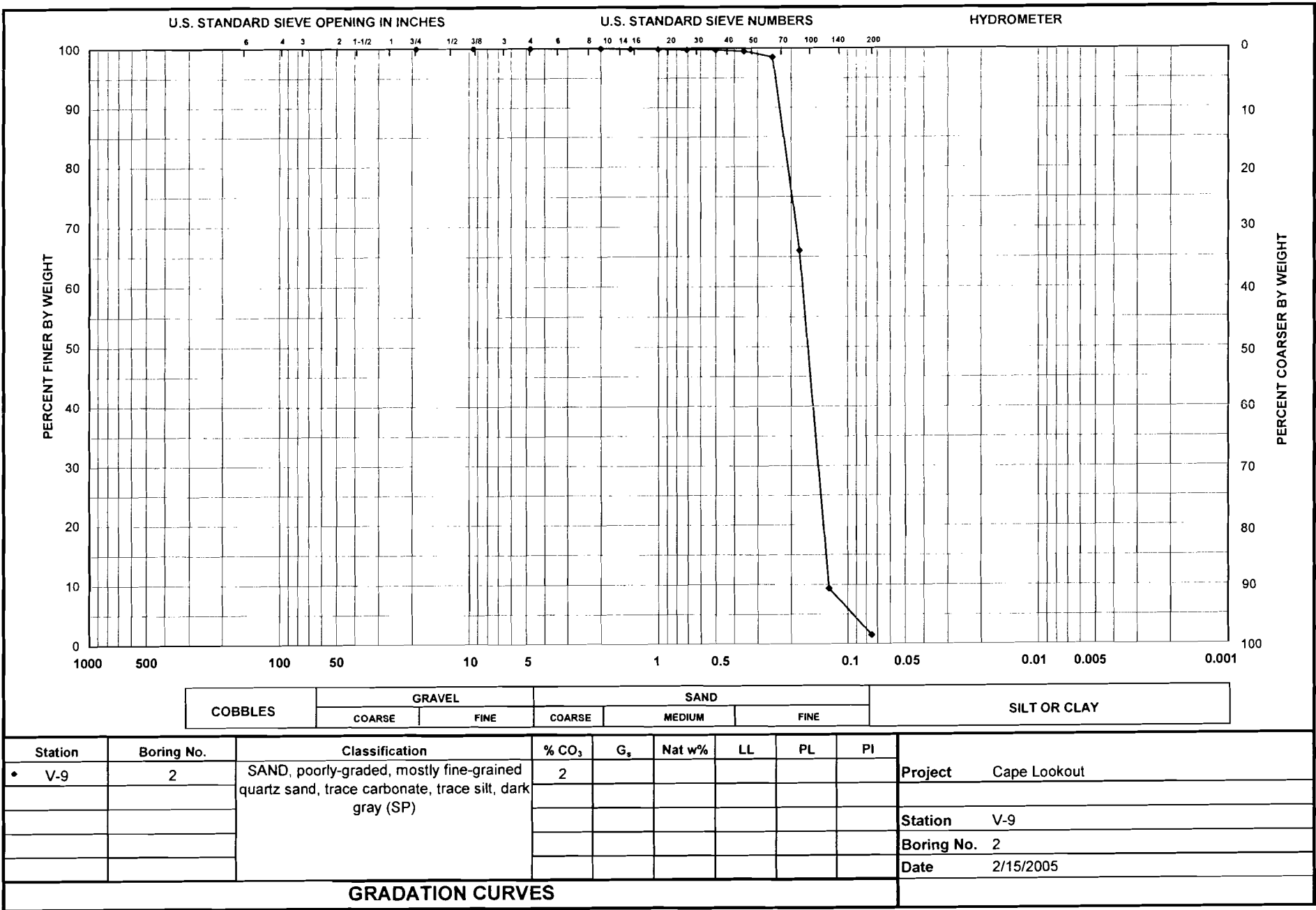
Project:	Cape Lookout	Depth:	3.0-3.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-9		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)		

Tare Weight, (g):	50.41	
Dry Wt. Before Washing (g):	153.63	(with tare)
Dry Weight After Washing (g):	152.24	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.03	99.97	0	0.00
#14	1.400	0.09	99.88	0	0.00
#18	1.000	0.09	99.80	10	0.01
#25	0.710	0.05	99.75	5	0.00
#35	0.500	0.06	99.69	3	0.00
#45	0.355	0.21	99.49	30	0.06
#60	0.250	1.05	98.47	25	0.26
#80	0.180	33.57	65.95	5	1.68
#120	0.125	58.47	9.30	1	0.58
#200	0.075	8.01	1.54	1	0.08

Total Shell Content: 2 %





COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-9	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)	2						Cape Lookout
									Station V-9
									Boring No. 2
									Date 2/15/2005
<b>GRADATION CURVES</b>									



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	5.0-5.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-9		
Sample No.:	3		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)		

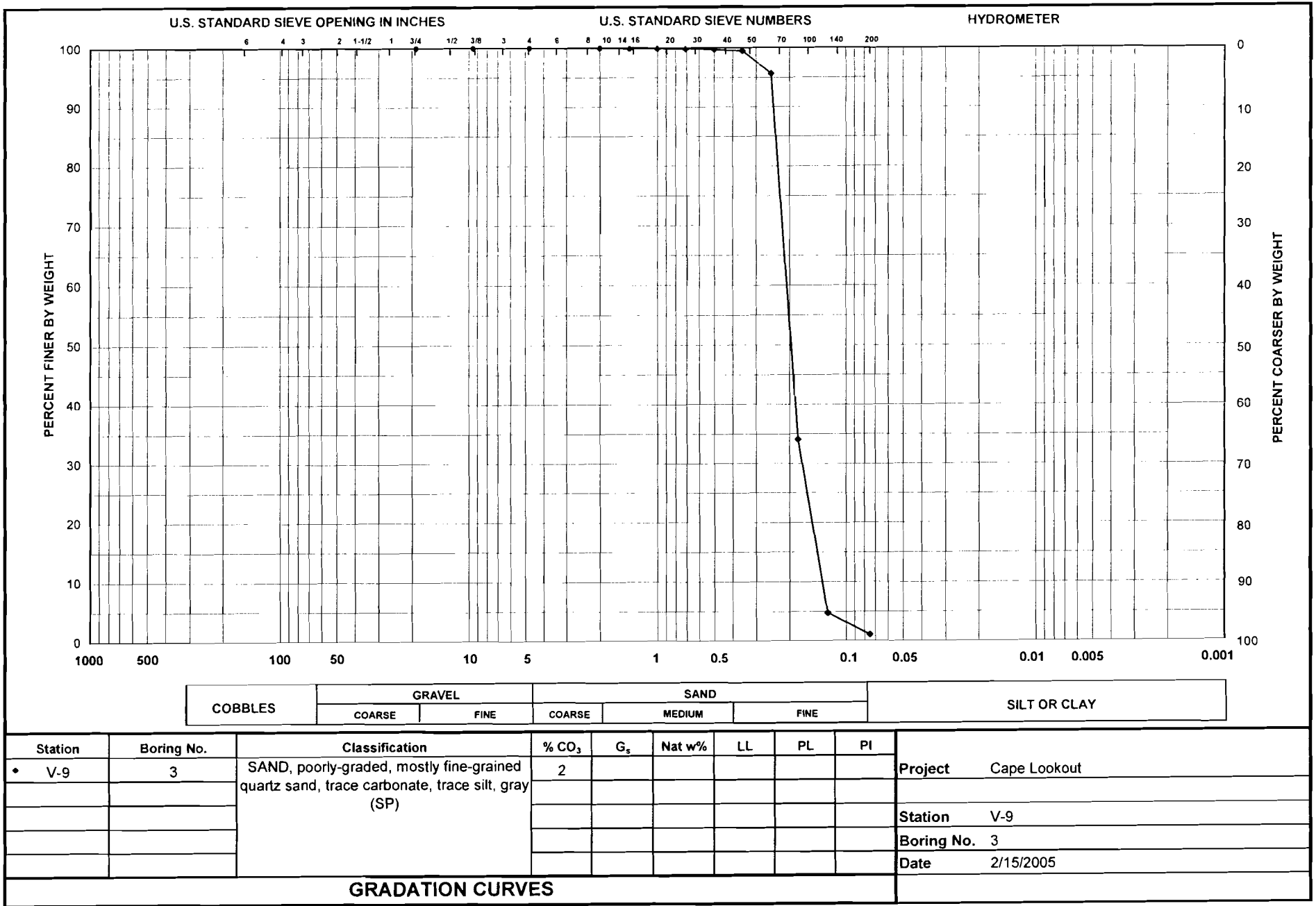
Tare Weight, (g):	49.84	
Dry Wt. Before Washing (g):	140.78	(with tare)
Dry Weight After Washing (g):	139.68	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.05	99.95	0	0.00
#14	1.400	0.06	99.88	0	0.00
#18	1.000	0.03	99.85	0	0.00
#25	0.710	0.02	99.82	10	0.00
#35	0.500	0.11	99.70	35	0.04
#45	0.355	0.21	99.47	30	0.06
#60	0.250	3.49	95.63	10	0.35
#80	0.180	56.00	34.06	3	1.68
#120	0.125	26.64	4.76	1	0.27
#200	0.075	3.29	1.14	1	0.03

Total Shell Content: 

2
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 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-9	3	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)	2						Cape Lookout
									Station V-9
									Boring No. 3
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	7.5-8.0
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-9		
Sample No.:	4		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)		

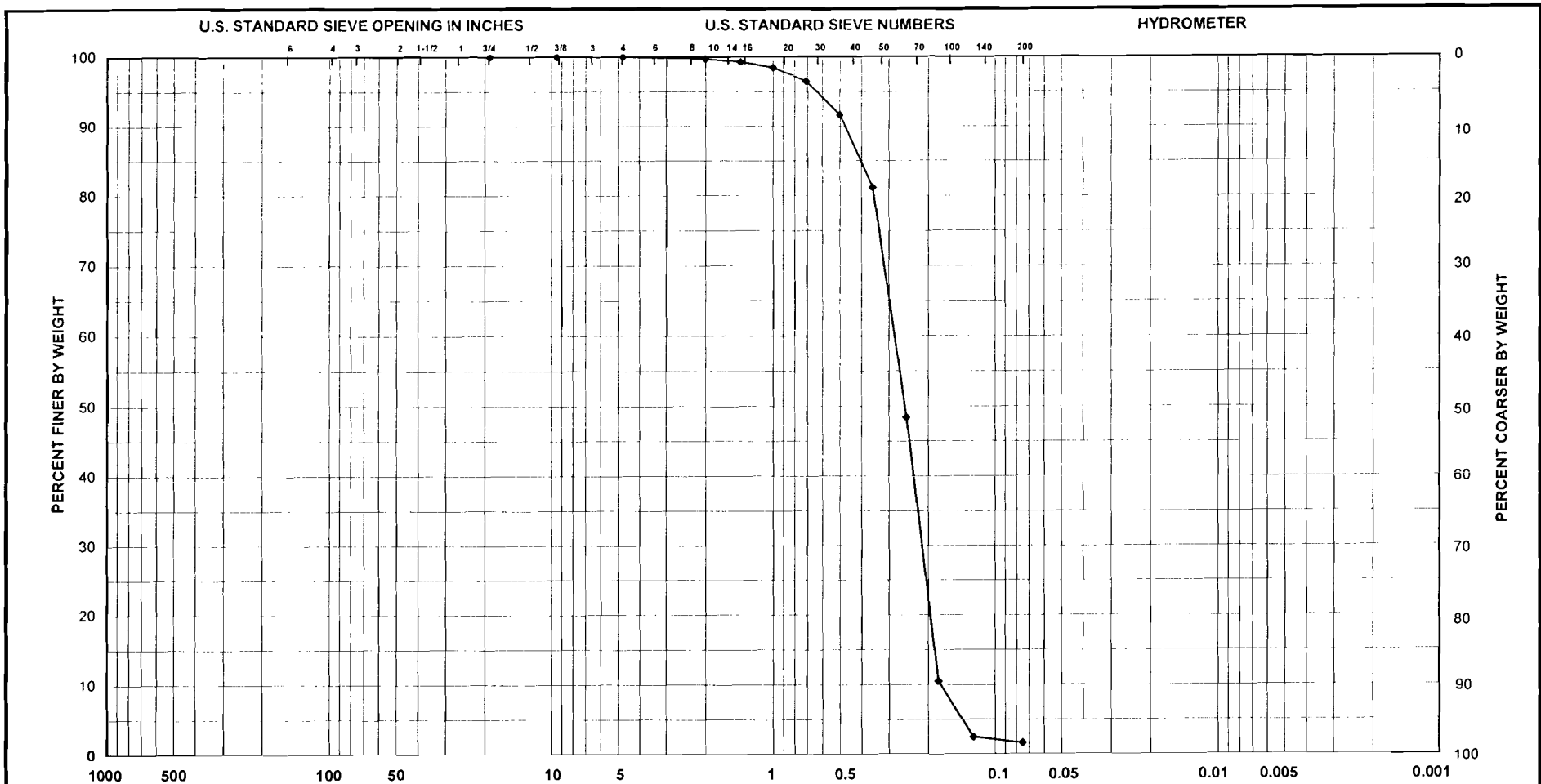
Tare Weight, (g):	50.07	
Dry Wt. Before Washing (g):	126.95	(with tare)
Dry Weight After Washing (g):	126.00	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.24	99.69	70	0.17
#14	1.400	0.35	99.23	70	0.25
#18	1.000	0.64	98.40	70	0.45
#25	0.710	1.50	96.45	40	0.60
#35	0.500	3.74	91.58	25	0.94
#45	0.355	8.05	81.11	15	1.21
#60	0.250	25.16	48.39	3	0.75
#80	0.180	29.22	10.38	1	0.29
#120	0.125	6.07	2.48	1	0.06
#200	0.075	0.64	1.65	1	0.01

Total Shell Content: 

4
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 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-9	4	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, gray (SP)	4						Cape Lookout
									Station V-9
									Boring No. 4
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

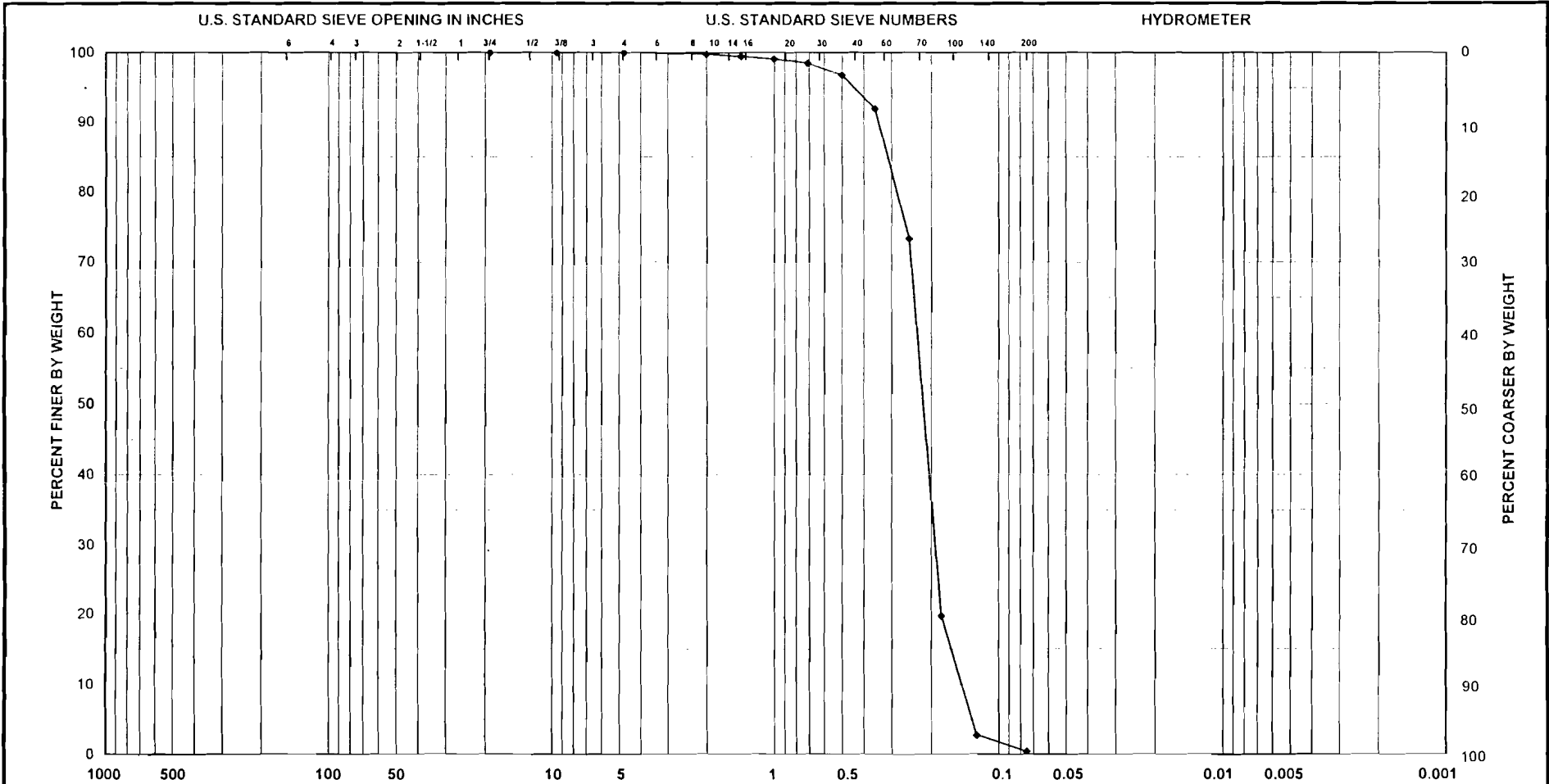
Project:	Cape Lookout	Depth:	0.5-1.0
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-10		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)		

Tare Weight, (g):	49.96	
Dry Wt. Before Washing (g):	132.18	(with tare)
Dry Weight After Washing (g):	131.48	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.18	99.78	100	0.18
#14	1.400	0.27	99.45	80	0.22
#18	1.000	0.29	99.10	60	0.17
#25	0.710	0.49	98.50	25	0.12
#35	0.500	1.41	96.79	20	0.28
#45	0.355	4.03	91.89	10	0.40
#60	0.250	15.24	73.35	3	0.46
#80	0.180	44.16	19.64	1	0.44
#120	0.125	13.90	2.74	1	0.14
#200	0.075	1.89	0.44	1	0.02

Total Shell Content: 

2	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>2</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
• V-10	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)	2						Cape Lookout
									Station V-10
									Boring No. 1
									Date 2/15/2005

**GRADATION CURVES**



# WOLF TECHNOLOGIES, INC.

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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

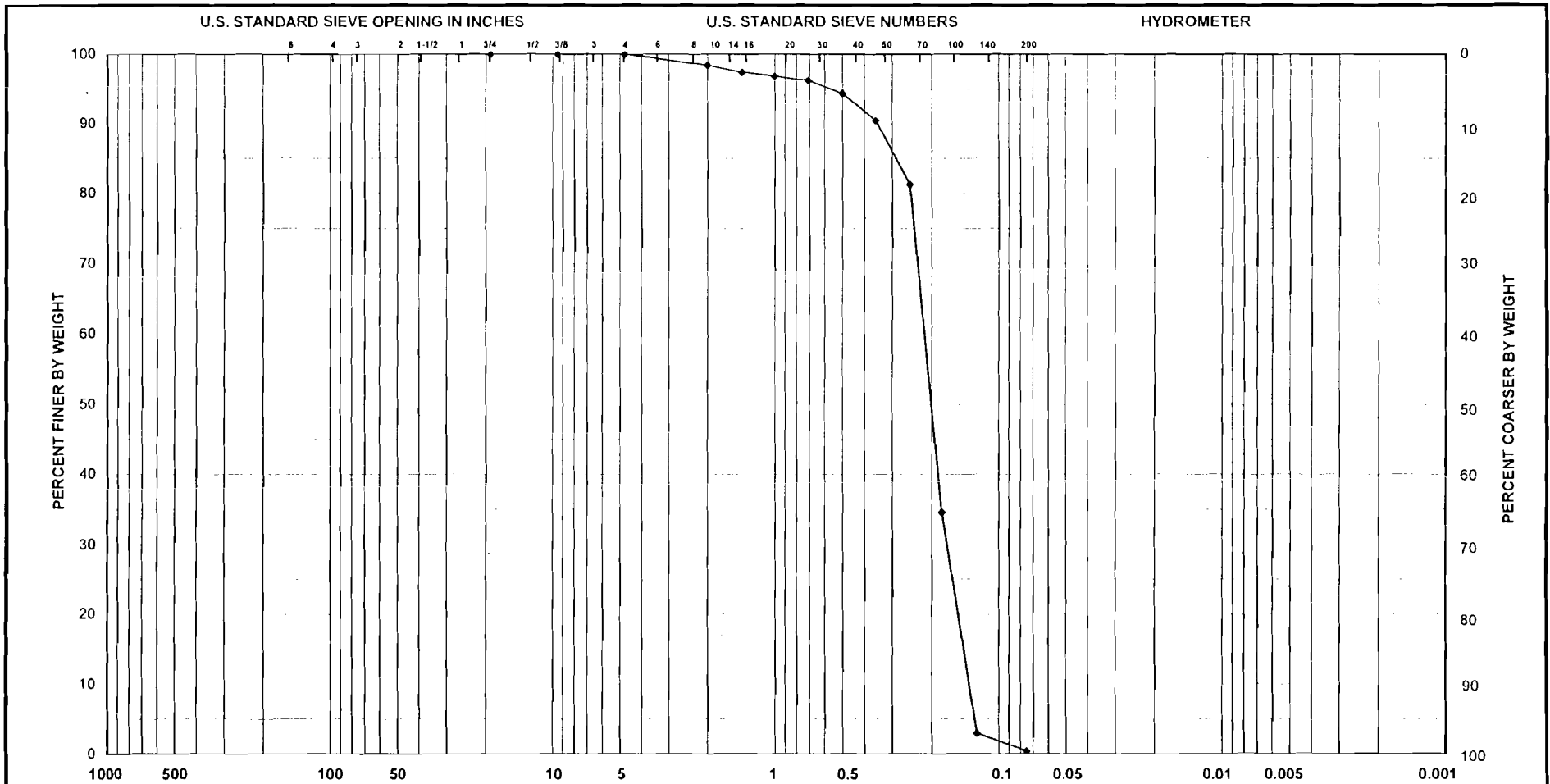
Project:	Cape Lookout	Depth:	2.0-2.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-10		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)		

Tare Weight, (g):	49.73	
Dry Wt. Before Washing (g):	118.73	(with tare)
Dry Weight After Washing (g):	117.97	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	1.10	98.41	95	1.05
#14	1.400	0.68	97.42	60	0.41
#18	1.000	0.39	96.86	65	0.25
#25	0.710	0.44	96.22	40	0.18
#35	0.500	1.25	94.41	35	0.44
#45	0.355	2.73	90.45	15	0.41
#60	0.250	6.35	81.25	10	0.64
#80	0.180	32.23	34.54	3	0.97
#120	0.125	21.77	2.99	1	0.22
#200	0.075	1.76	0.43	1	0.02

Total Shell Content: 4 %





COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-10	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)	4						Cape Lookout
									Station V-10
									Boring No. 2
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	5.0-5.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-10		
Sample No.:	4		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)		

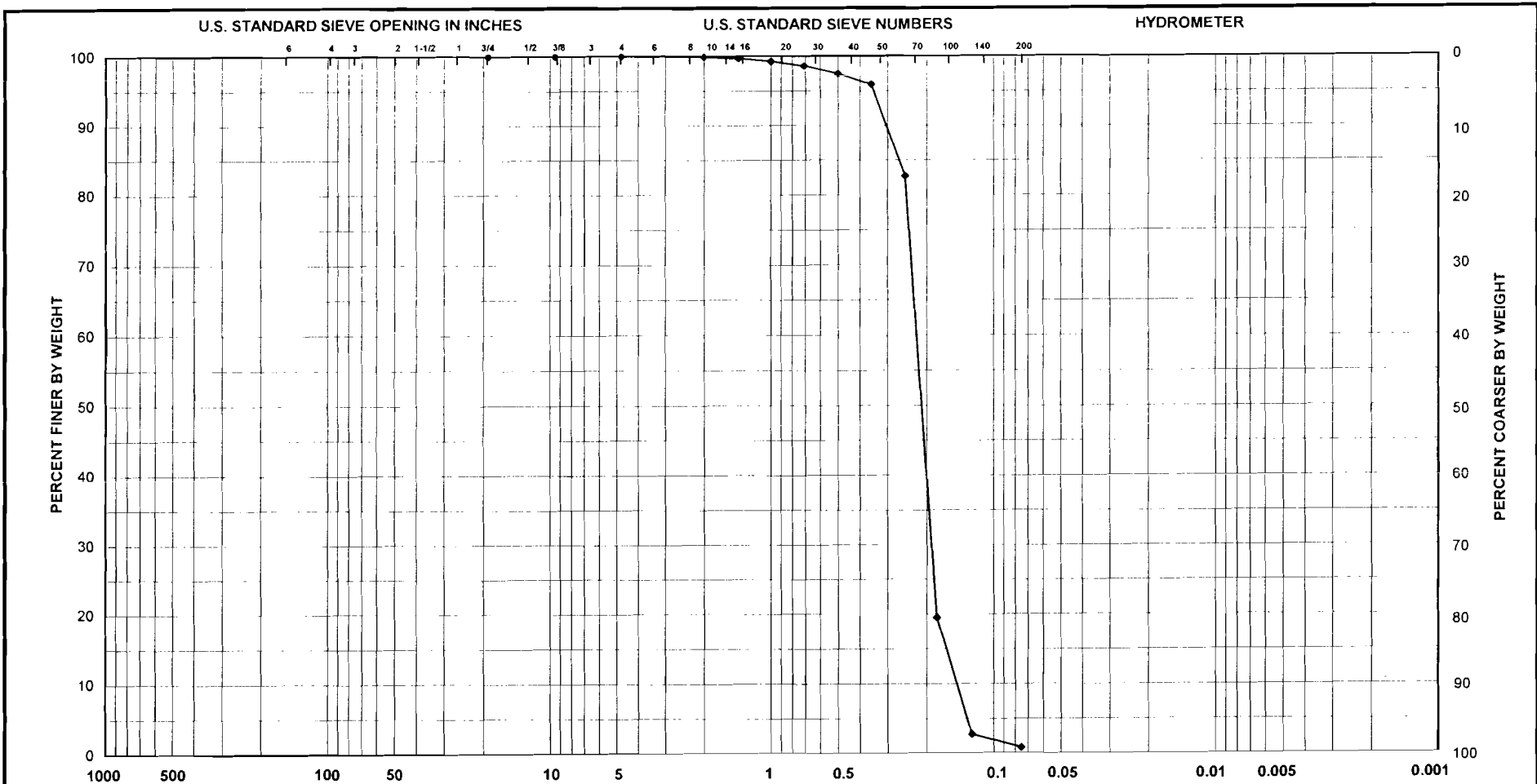
Tare Weight, (g):	50.03	
Dry Wt. Before Washing (g):	135.45	(with tare)
Dry Weight After Washing (g):	134.55	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.10	99.88	60	0.06
#14	1.400	0.20	99.65	40	0.08
#18	1.000	0.35	99.24	45	0.16
#25	0.710	0.57	98.57	30	0.17
#35	0.500	0.92	97.49	30	0.28
#45	0.355	1.36	95.90	25	0.34
#60	0.250	11.30	82.67	5	0.57
#80	0.180	54.03	19.42	1	0.54
#120	0.125	14.23	2.76	1	0.14
#200	0.075	1.63	0.85	1	0.02

Total Shell Content: 

2
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 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-10	4	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)	2						Cape Lookout
									Station V-10
									Boring No. 4
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

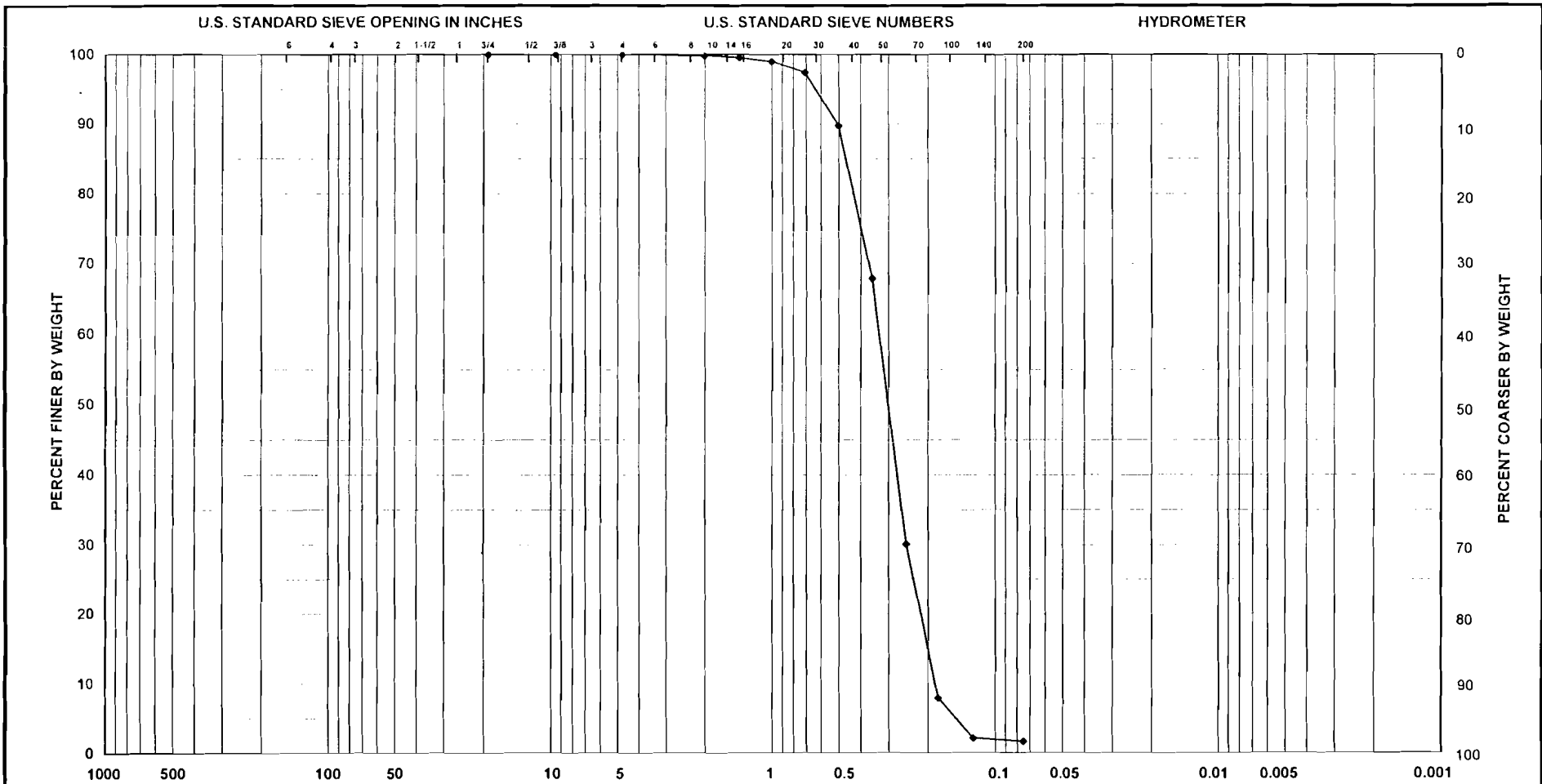
Project:	Cape Lookout	Depth:	7.7-8.2
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-10		
Sample No.:	5		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)		

Tare Weight, (g):	50.26	
Dry Wt. Before Washing (g):	144.69	(with tare)
Dry Weight After Washing (g):	143.64	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.18	99.81	90	0.16
#14	1.400	0.25	99.54	85	0.21
#18	1.000	0.53	98.98	80	0.42
#25	0.710	1.45	97.45	65	0.94
#35	0.500	7.30	89.72	40	2.92
#45	0.355	20.64	67.86	20	4.13
#60	0.250	35.67	30.09	3	1.07
#80	0.180	20.95	7.90	1	0.21
#120	0.125	5.42	2.16	1	0.05
#200	0.075	0.47	1.66	1	0.00

Total Shell Content: 

7	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-10	5	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)	7						Cape Lookout
									Station V-10
									Boring No. 5
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

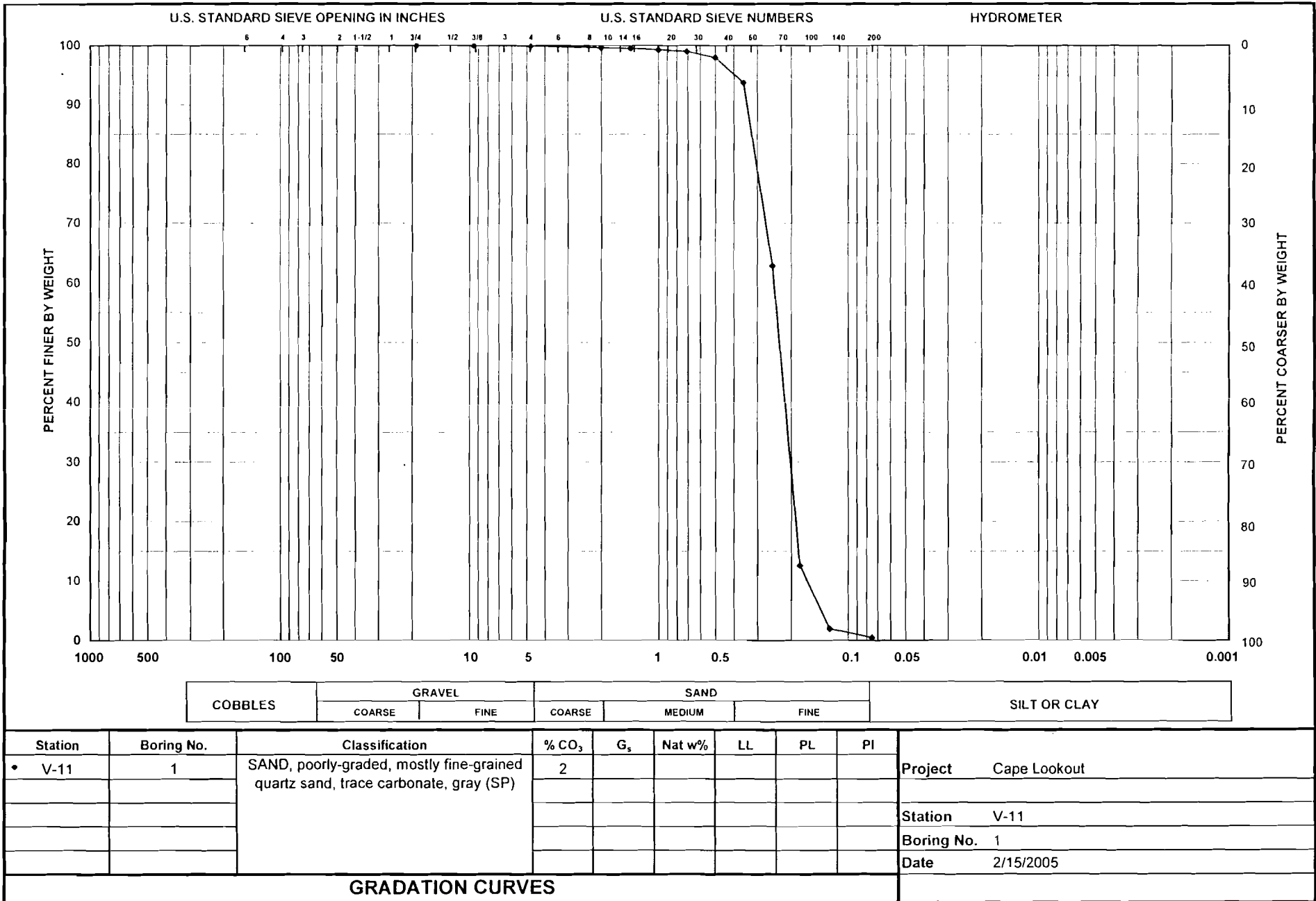
Project:	Cape Lookout	Depth:	1.3-1.8
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-11		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, gray (SP)		

Tare Weight, (g):	50.25	
Dry Wt. Before Washing (g):	143.05	(with tare)
Dry Weight After Washing (g):	142.25	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.11	99.88	100	0.11
#10	2.000	0.24	99.62	100	0.24
#14	1.400	0.08	99.54	90	0.07
#18	1.000	0.19	99.33	70	0.13
#25	0.710	0.30	99.01	50	0.15
#35	0.500	0.93	98.01	25	0.23
#45	0.355	3.92	93.78	10	0.39
#60	0.250	28.68	62.88	3	0.86
#80	0.180	46.68	12.58	1	0.47
#120	0.125	9.85	1.96	1	0.10
#200	0.075	1.37	0.48	1	0.01

Total Shell Content: 

2	%
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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	4.0-4.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-11		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)		

Tare Weight, (g):	48.56	
Dry Wt. Before Washing (g):	165.10	(with tare)
Dry Weight After Washing (g):	164.02	(with tare)

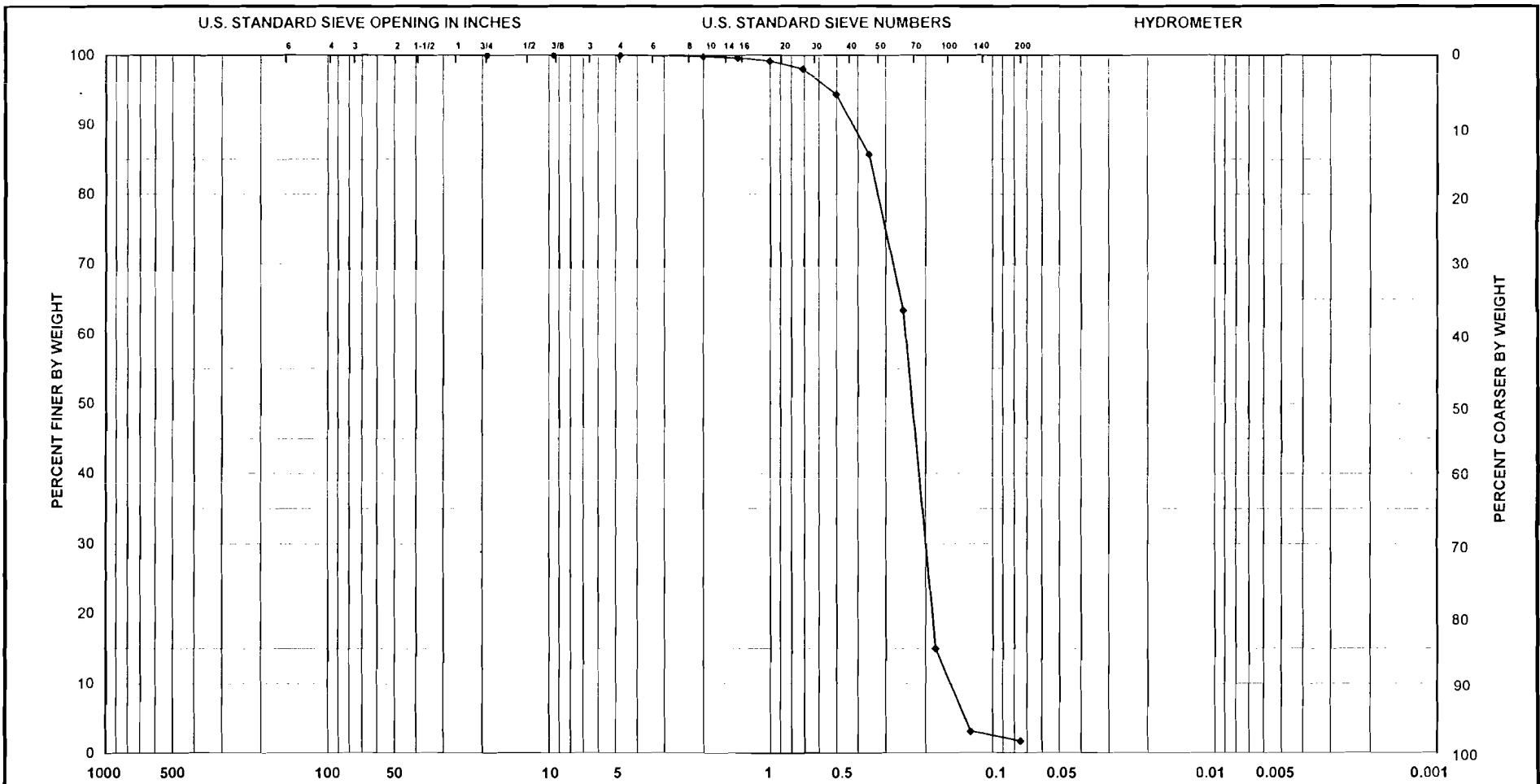
Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.20	99.83	100	0.20
#14	1.400	0.29	99.58	85	0.25
#18	1.000	0.53	99.12	60	0.32
#25	0.710	1.25	98.05	40	0.50
#35	0.500	4.25	94.41	25	1.06
#45	0.355	10.16	85.69	10	1.02
#60	0.250	25.98	63.39	3	0.78
#80	0.180	56.40	15.00	1	0.56
#120	0.125	13.85	3.11	1	0.14
#200	0.075	1.63	1.72	1	0.02

Total Shell Content: 

3
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 %





COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-11	2	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)	3						Cape Lookout
									Station V-11
									Boring No. 2
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

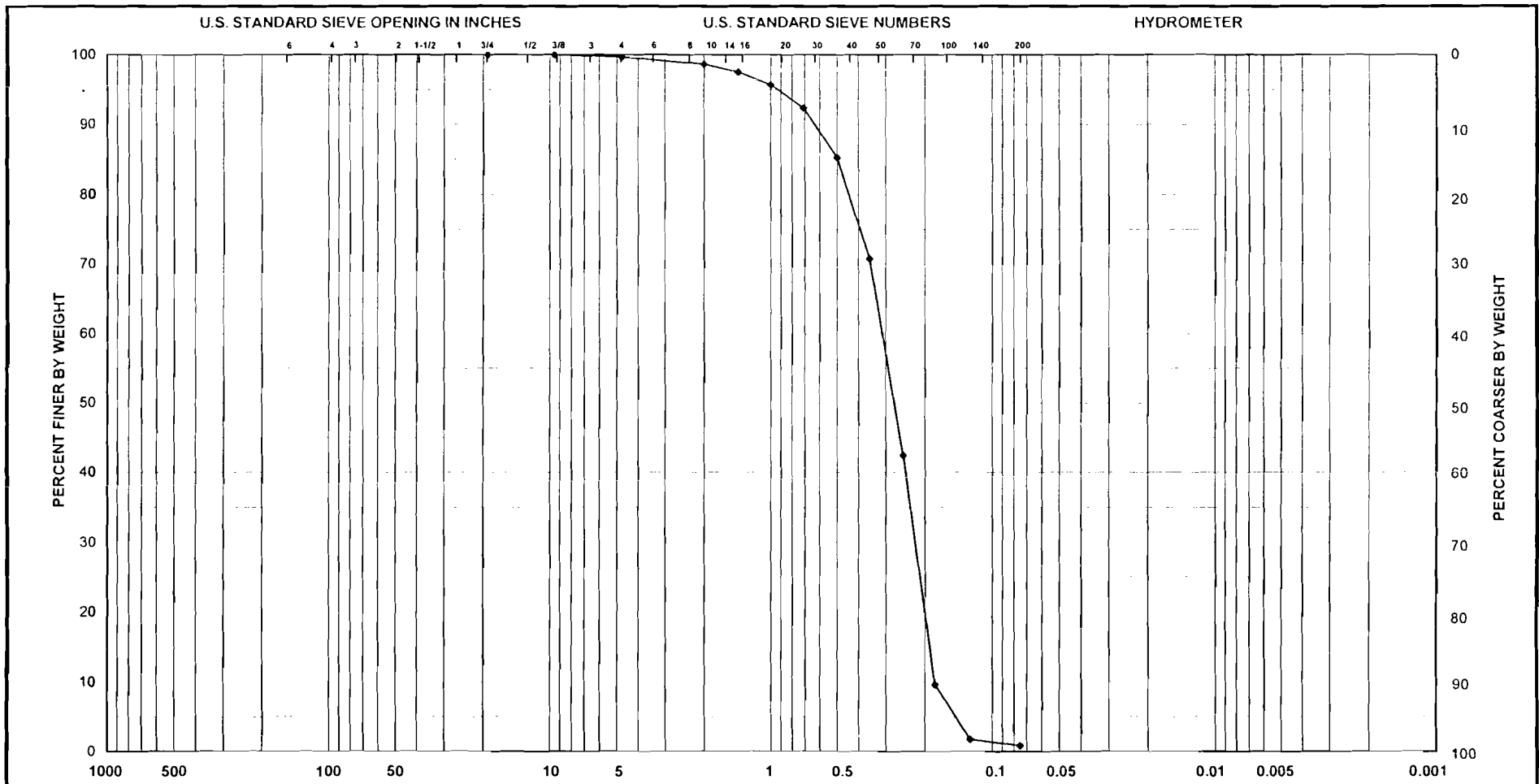
Project:	Cape Lookout	Depth:	6.0-6.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-11		
Sample No.:	3		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, dark gray (SP)		

Tare Weight, (g):	50.31	
Dry Wt. Before Washing (g):	147.12	(with tare)
Dry Weight After Washing (g):	146.28	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.32	99.67	100	0.32
#10	2.000	0.98	98.66	95	0.93
#14	1.400	1.10	97.52	80	0.88
#18	1.000	1.76	95.70	80	1.41
#25	0.710	3.26	92.34	40	1.30
#35	0.500	6.86	85.25	30	2.06
#45	0.355	14.04	70.75	15	2.11
#60	0.250	27.42	42.42	5	1.37
#80	0.180	31.79	9.59	3	0.95
#120	0.125	7.60	1.74	1	0.08
#200	0.075	0.89	0.82	1	0.01

Total Shell Content: 

8	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-11	3	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, dark gray (SP)	8						Cape Lookout
									Station V-11
									Boring No. 3
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

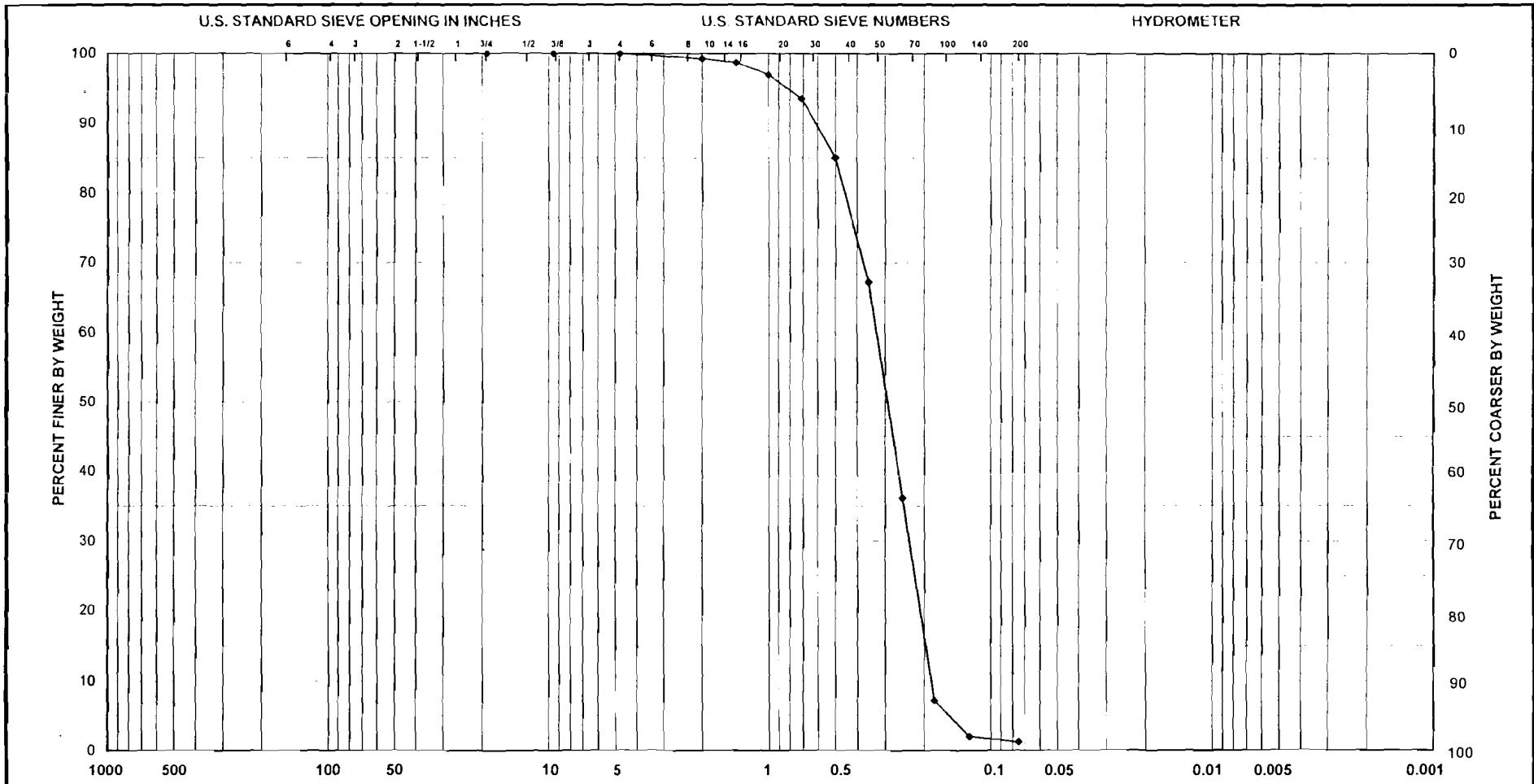
### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	0.0-0.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-14		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)		

Tare Weight, (g):	50.28	
Dry Wt. Before Washing (g):	145.19	(with tare)
Dry Weight After Washing (g):	144.31	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.67	99.29	90	0.60
#14	1.400	0.55	98.71	100	0.55
#18	1.000	1.66	96.97	60	1.00
#25	0.710	3.23	93.56	35	1.13
#35	0.500	8.08	85.05	20	1.62
#45	0.355	16.94	67.20	10	1.69
#60	0.250	29.55	36.07	3	0.89
#80	0.180	27.45	7.14	1	0.27
#120	0.125	4.92	1.96	1	0.05
#200	0.075	0.69	1.23	1	0.01

Total Shell Content: 5 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>2</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-14	1	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)	5						Cape Lockout
									Station V-14
									Boring No. 1
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	2.0-2.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-14		
Sample No.:	2		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)		

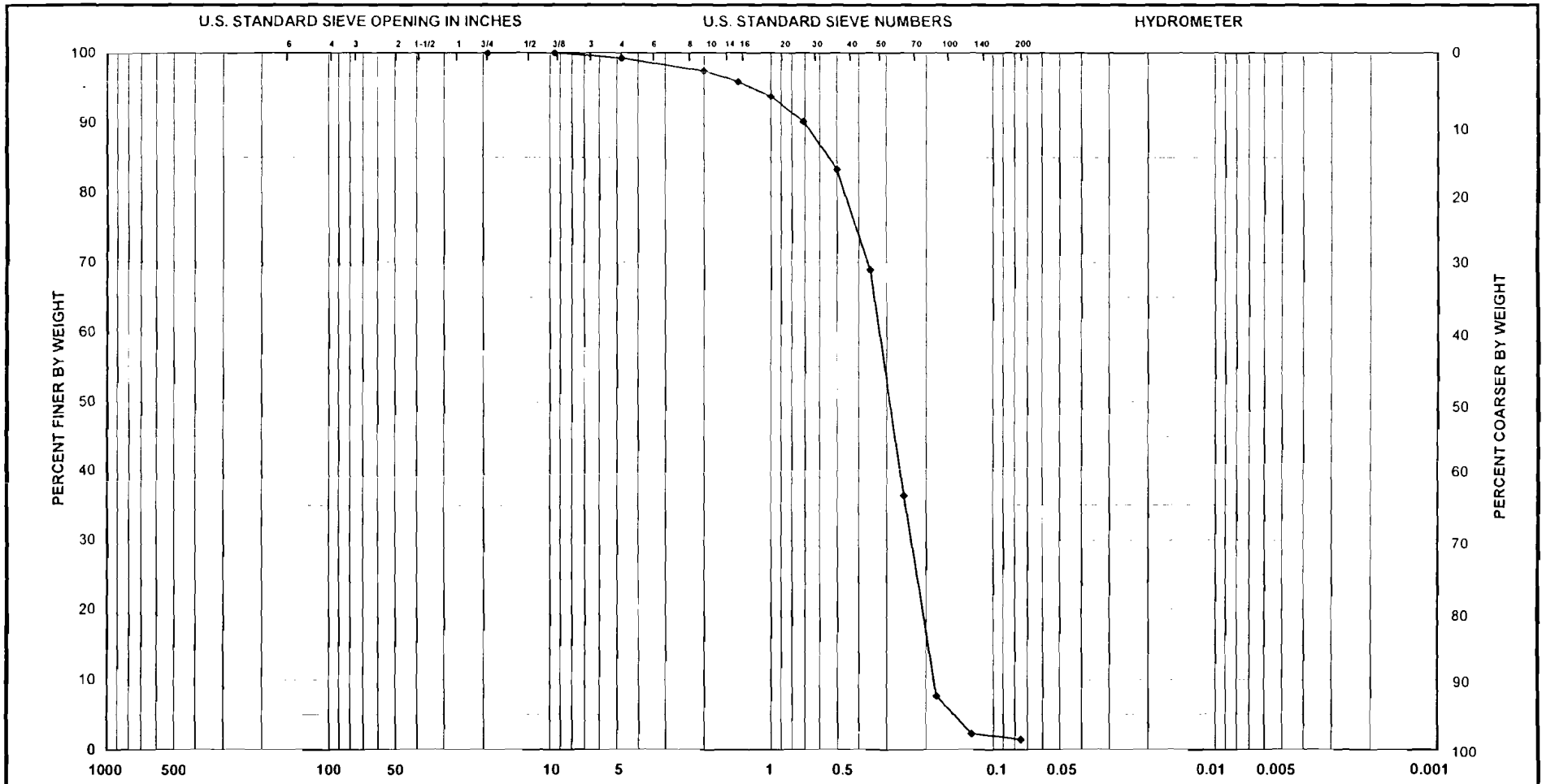
Tare Weight, (g):	50.08	
Dry Wt. Before Washing (g):	143.65	(with tare)
Dry Weight After Washing (g):	142.84	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.70	99.25	100	0.70
#10	2.000	1.69	97.45	85	1.44
#14	1.400	1.43	95.92	70	1.00
#18	1.000	1.98	93.80	55	1.09
#25	0.710	3.40	90.17	40	1.36
#35	0.500	6.44	83.29	30	1.93
#45	0.355	13.44	68.92	10	1.34
#60	0.250	30.44	36.39	3	0.91
#80	0.180	26.87	7.67	1	0.27
#120	0.125	5.08	2.24	1	0.05
#200	0.075	0.75	1.44	1	0.01

Total Shell Content: 

7
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 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-14	2	SAND, poorly-graded, mostly medium to fine-grained quartz sand, few carbonate, trace silt, dark gray (SP)	7						Cape Lookout
									Station V-14
									Boring No. 2
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	5.0-5.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-14		
Sample No.:	4		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, very dark gray (SP)		

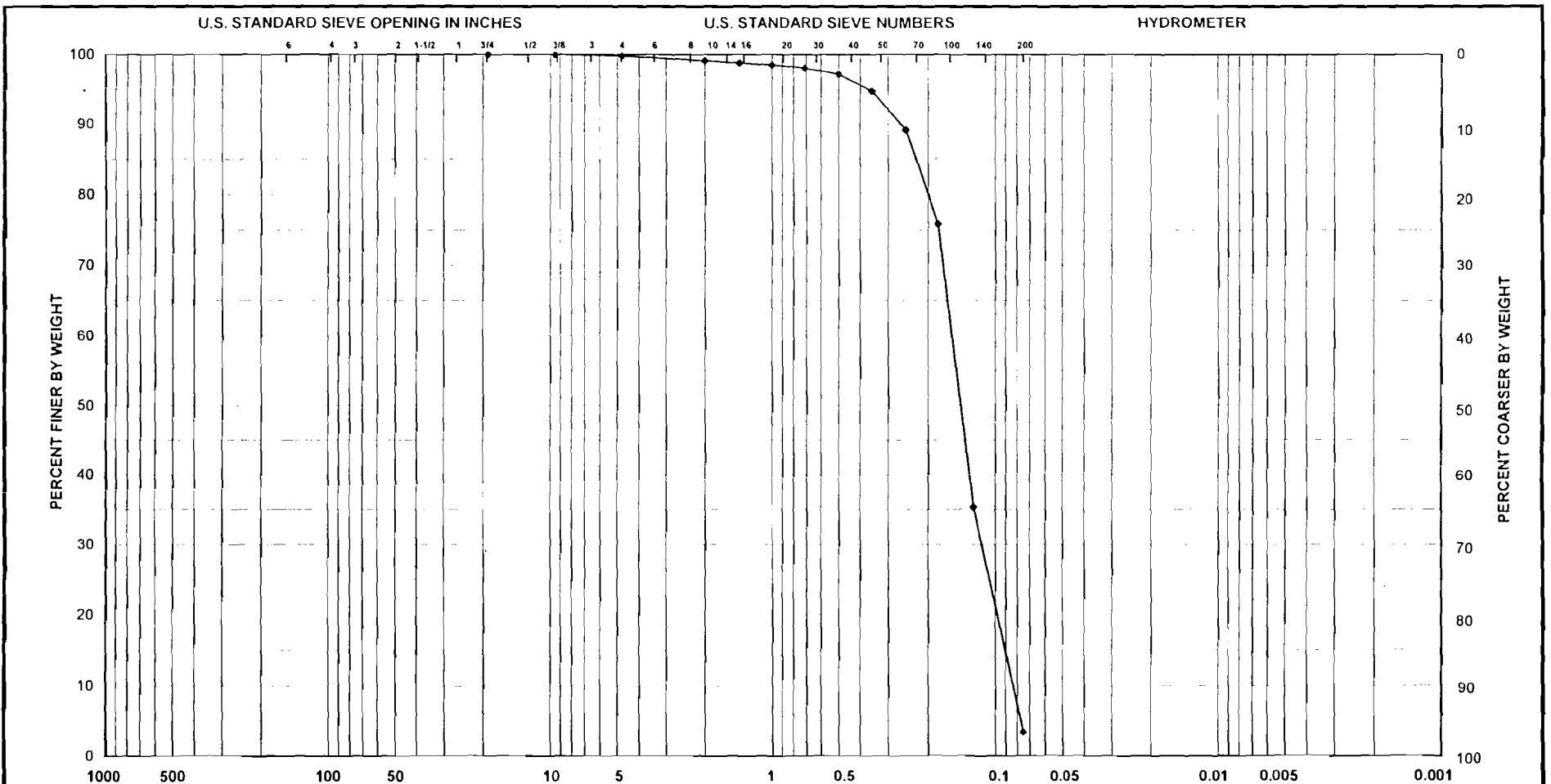
Tare Weight, (g):	50.42	
Dry Wt. Before Washing (g):	124.32	(with tare)
Dry Weight After Washing (g):	122.34	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.18	99.76	100	0.18
#10	2.000	0.47	99.12	100	0.47
#14	1.400	0.23	98.81	85	0.20
#18	1.000	0.24	98.48	70	0.17
#25	0.710	0.31	98.06	60	0.19
#35	0.500	0.65	97.19	30	0.20
#45	0.355	1.77	94.79	30	0.53
#60	0.250	4.17	89.15	15	0.63
#80	0.180	9.79	75.90	5	0.49
#120	0.125	29.98	35.33	1	0.30
#200	0.075	23.60	3.40	1	0.24

Total Shell Content: 

3	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-14	4	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, very dark gray (SP)	3						Cape Lookout
									Station V-14
									Boring No. 4
									Date 2/15/2005

**GRADATION CURVES**



# WOLF TECHNOLOGIES, INC.

3047-4 St. Johns Bluff Road S.  
Jacksonville, Florida 32246  
(904) 997-1400 (Tel) · (904) 997-9150 (Fax)

## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

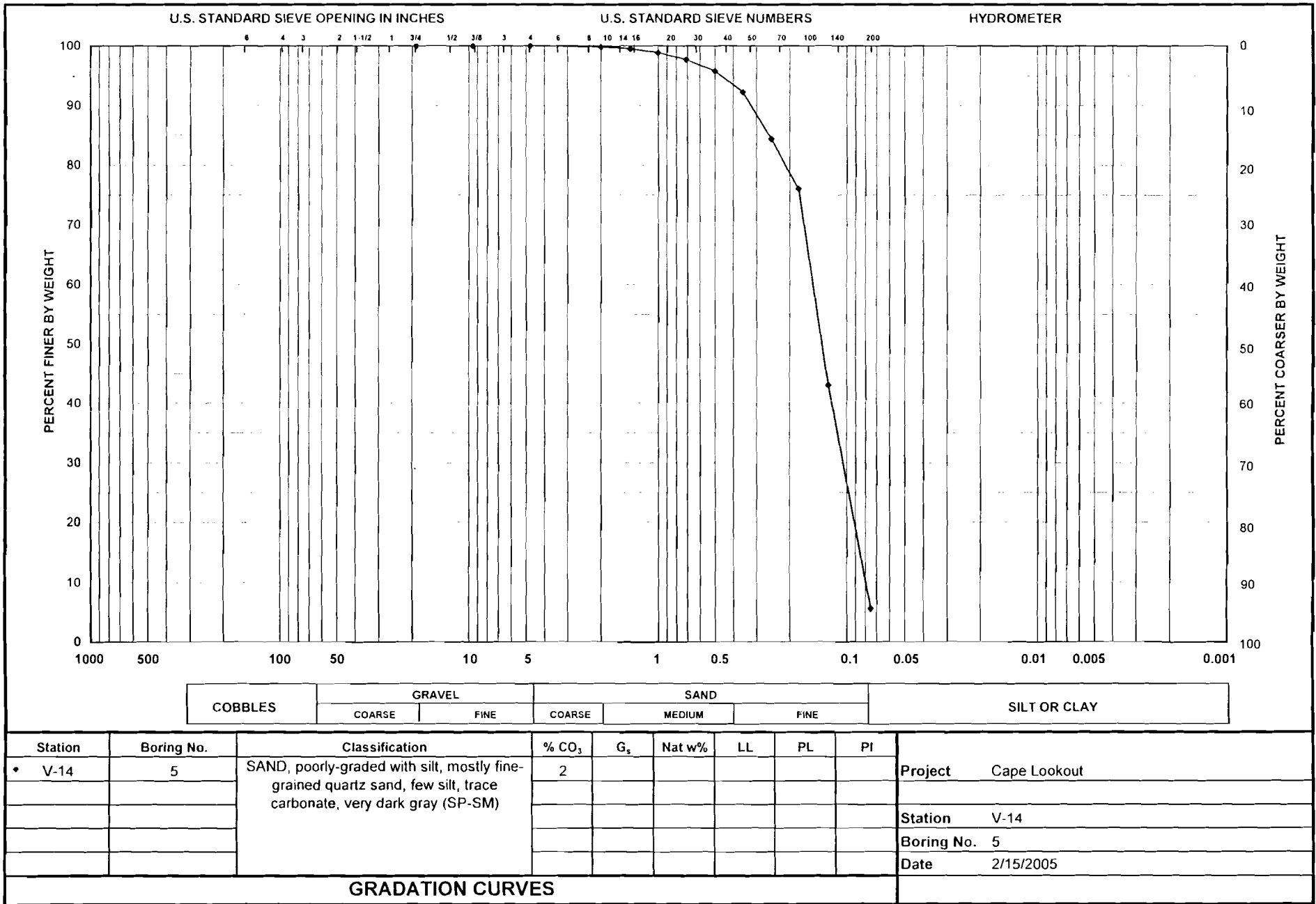
Project:	Cape Lookout	Depth:	7.0-7.5
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-14		
Sample No.:	5		
Description:	SAND, poorly-graded with silt, mostly fine-grained quartz sand, few silt, trace carbonate, very dark gray (SP-SM)		

Tare Weight, (g):	50.37	
Dry Wt. Before Washing (g):	135.35	(with tare)
Dry Weight After Washing (g):	131.79	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.14	99.84	100	0.14
#14	1.400	0.28	99.51	70	0.20
#18	1.000	0.54	98.87	55	0.30
#25	0.710	0.99	97.71	30	0.30
#35	0.500	1.64	95.78	20	0.33
#45	0.355	3.01	92.23	15	0.45
#60	0.250	6.72	84.33	5	0.34
#80	0.180	7.04	76.04	3	0.21
#120	0.125	28.01	43.08	1	0.28
#200	0.075	31.85	5.60	1	0.32

Total Shell Content: 

2	%
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Jacksonville, Florida 32246  
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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	2.8-3.3
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-15		
Sample No.:	1		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)		

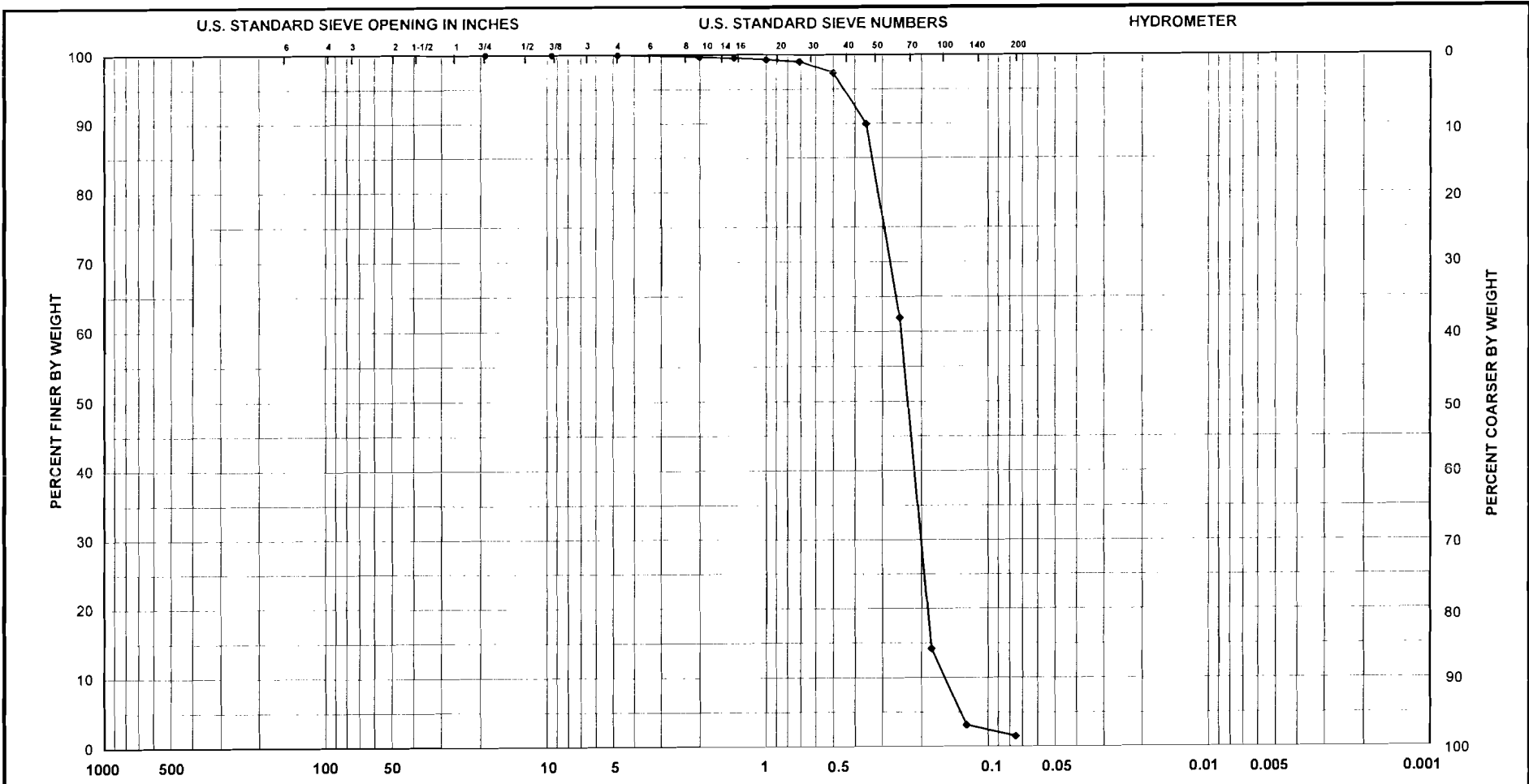
Tare Weight, (g):	49.76	
Dry Wt. Before Washing (g):	139.35	(with tare)
Dry Weight After Washing (g):	138.46	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.26	99.71	90	0.23
#14	1.400	0.17	99.52	80	0.14
#18	1.000	0.20	99.30	70	0.14
#25	0.710	0.28	98.98	55	0.15
#35	0.500	1.45	97.37	30	0.44
#45	0.355	6.69	89.90	15	1.00
#60	0.250	25.08	61.90	3	0.75
#80	0.180	42.79	14.14	1	0.43
#120	0.125	9.87	3.13	1	0.10
#200	0.075	1.43	1.53	1	0.01

Total Shell Content: 

2
---

 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>2</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-15	1	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)	2						Cape Lookout
									Station V-15
									Boring No. 1
									Date 2/15/2005

**GRADATION CURVES**



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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

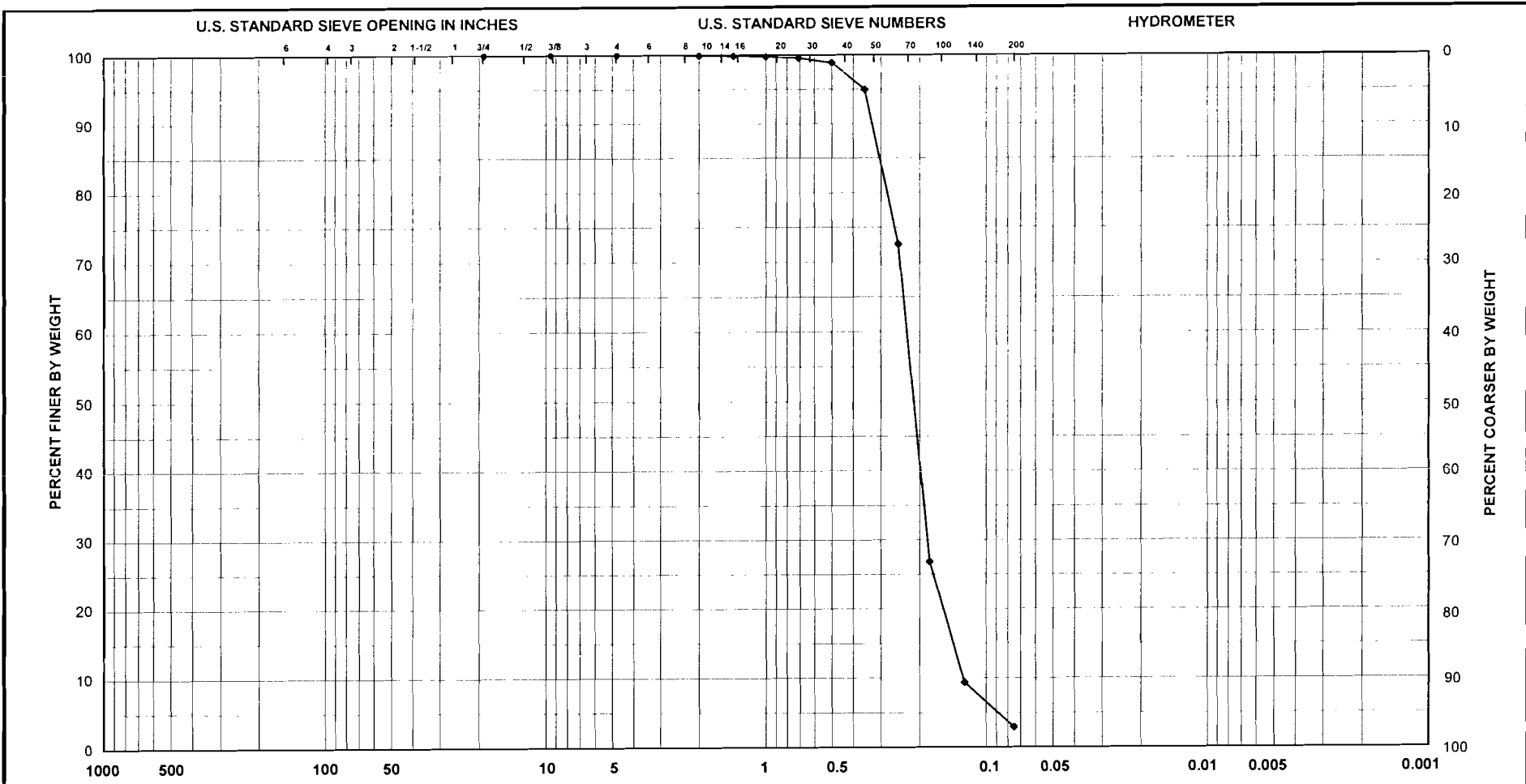
Project:	Cape Lookout	Depth:	6.8-7.3
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-15		
Sample No.:	3		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)		

Tare Weight, (g):	50.30	
Dry Wt. Before Washing (g):	157.34	(with tare)
Dry Weight After Washing (g):	154.93	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#10	2.000	0.10	99.91	100	0.10
#14	1.400	0.05	99.86	80	0.04
#18	1.000	0.12	99.75	70	0.08
#25	0.710	0.20	99.56	60	0.12
#35	0.500	0.72	98.89	40	0.29
#45	0.355	4.21	94.96	25	1.05
#60	0.250	23.99	72.54	5	1.20
#80	0.180	48.94	26.82	1	0.49
#120	0.125	18.77	9.29	1	0.19
#200	0.075	6.83	2.91	1	0.07

Total Shell Content: 

2	%
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>2</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-15	3	SAND, poorly-graded, mostly fine-grained quartz sand, trace carbonate, trace silt, dark gray (SP)	2						Cape Lookout
									Station V-15
									Boring No. 3
									Date 2/15/2005

**GRADATION CURVES**



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Jacksonville, Florida 32246  
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## VISUAL SHELL CONTENT

### GRAIN SIZE AND VISUAL SHELL CONTENT

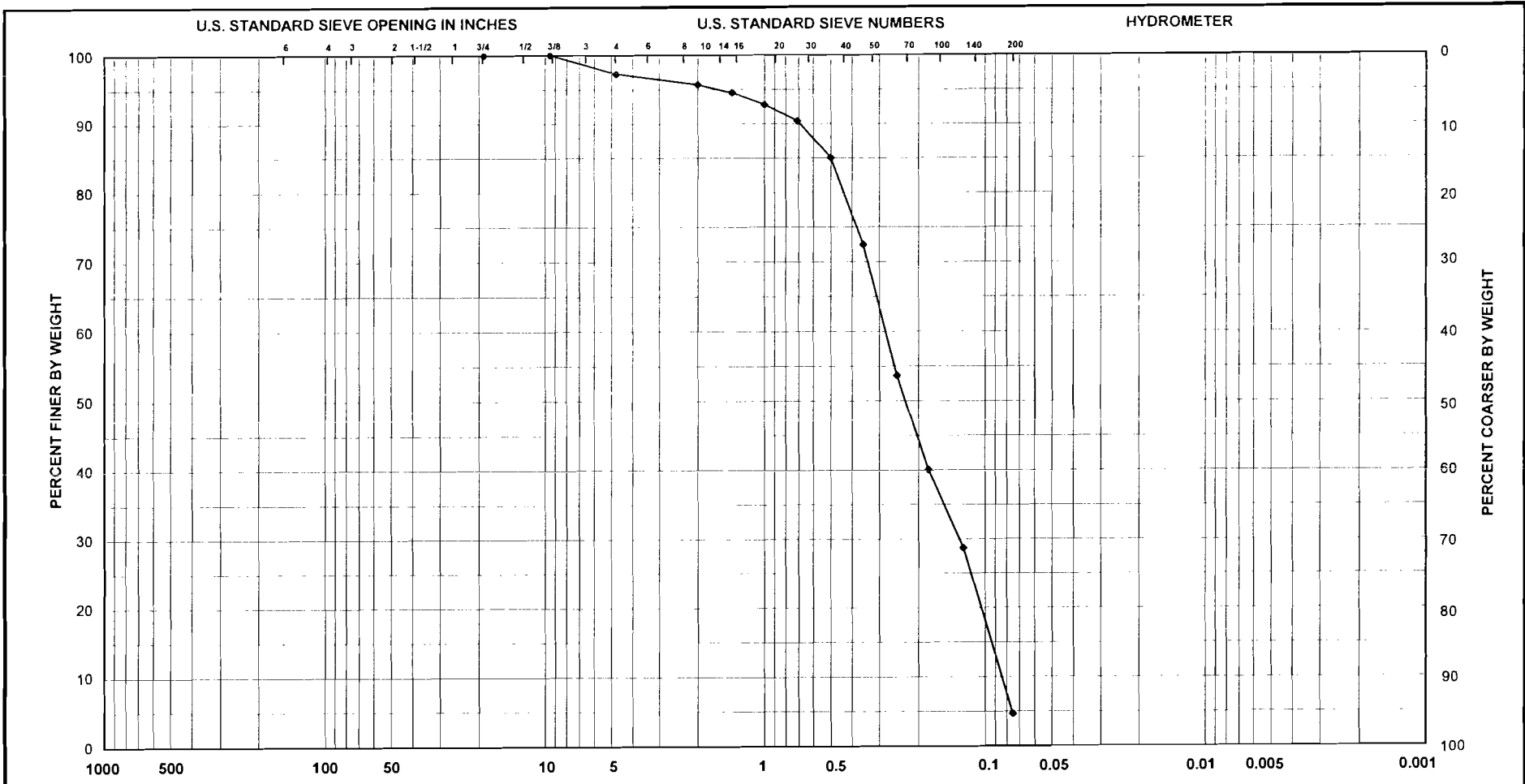
Project:	Cape Lookout	Depth:	7.8-8.3
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-15		
Sample No.:	4		
Description:	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, trace silt, very dark gray (SP)		

Tare Weight, (g):	49.53	
Dry Wt. Before Washing (g):	139.08	(with tare)
Dry Weight After Washing (g):	136.29	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	2.47	97.24	100	2.47
#10	2.000	1.36	95.72	85	1.16
#14	1.400	1.12	94.47	85	0.95
#18	1.000	1.54	92.75	75	1.16
#25	0.710	2.12	90.39	60	1.27
#35	0.500	4.83	84.99	40	1.93
#45	0.355	11.26	72.42	20	2.25
#60	0.250	16.81	53.65	3	0.50
#80	0.180	12.19	40.03	1	0.12
#120	0.125	10.17	28.68	1	0.10
#200	0.075	21.53	4.63	1	0.22

Total Shell Content: 9 %





COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project	
V-15	4	SAND, poorly-graded, mostly fine-grained quartz sand, few carbonate, trace silt, very dark gray (SP)	9						Cape Lookout	
									Station	V-15
									Boring No.	4
									Date	2/15/2005
<b>GRADATION CURVES</b>										



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## VISUAL SHELL CONTENT

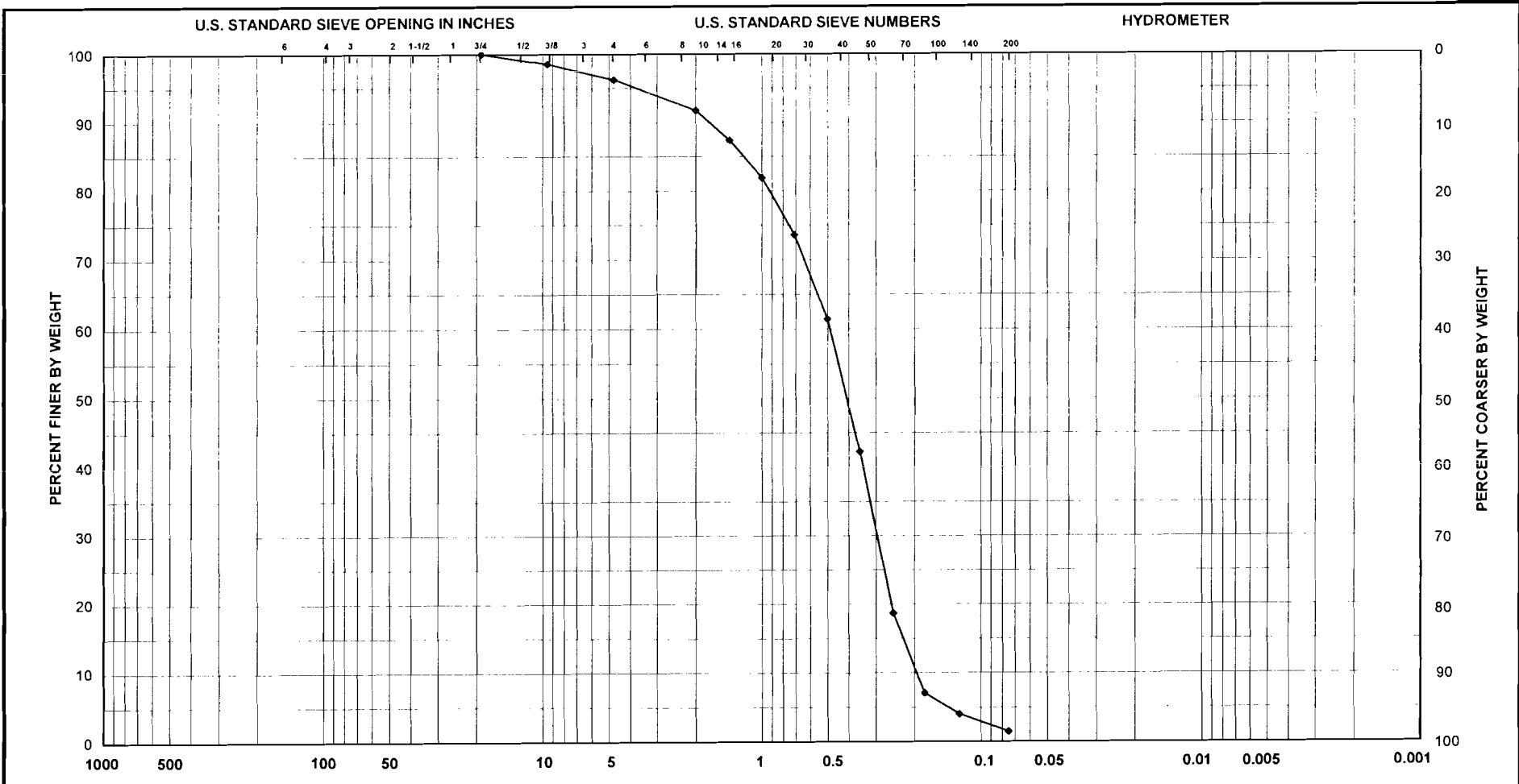
### GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	Cape Lookout	Depth:	8.8-9.3
Project No.:	2086-01-60	Date:	2/15/2005
Boring No.:	V-15		
Sample No.:	5		
Description:	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, brownish gray (SP)		

Tare Weight, (g):	50.57	
Dry Wt. Before Washing (g):	153.40	(with tare)
Dry Weight After Washing (g):	152.14	(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	1.50	98.54	100	1.50
#4	4.750	2.37	96.24	100	2.37
#10	2.000	4.62	91.74	95	4.39
#14	1.400	4.53	87.34	75	3.40
#18	1.000	5.61	81.88	65	3.65
#25	0.710	8.51	73.61	35	2.98
#35	0.500	12.54	61.41	30	3.76
#45	0.355	19.68	42.27	10	1.97
#60	0.250	24.27	18.67	3	0.73
#80	0.180	11.94	7.06	1	0.12
#120	0.125	3.17	3.98	1	0.03
#200	0.075	2.57	1.48	1	0.03

Total Shell Content: 16 %



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Station	Boring No.	Classification	% CO <sub>3</sub>	G <sub>s</sub>	Nat w%	LL	PL	PI	Project
V-15	5	SAND, poorly-graded, mostly medium to fine-grained quartz sand, little carbonate, trace silt, brownish gray (SP)	16						Cape Lookout
									Station V-15
									Boring No. 5
									Date 2/15/2005

**GRADATION CURVES**

**TABLE 1  
SUMMARY OF LABORATORY TESTING RESULTS  
FOR GRAIN SIZE ANALYSIS**

**USACOE - CAPE LOOKOUT  
CATLIN PROJECT NO. 205-094**

*1.30-1.40 PHE FINE (uses)  
SAND on  
MAX-FINE SAND (what would)  
2.05-2.5 PHE*

BORING NUMBER	SAMPLE #	DEPTH	% SHELL	#4	#10	#15	#18	#25	#35	#45	#60	#80	#120	#200
CLOBA-05-01	01-A	0.0-2.5	0.0	99.9	99.6	99.3	98.9	97.7	94.3	84.3	52.8	11.6	1.9	0.9
CLOBA-05-01	01-B	2.5-4.6	1.57	100.0	99.8	99.5	99.1	98.4	95.9	84.5	46.5	11.5	2.8	2.0
CLOBA-05-02	02-A	0.0-2.7	1.40	99.7	99.5	99.4	99.1	98.6	97.1	91.7	71.2	18.2	2.4	0.8
CLOBA-05-02	02-B	2.7-4.7	3.03	100.0	99.7	99.3	98.5	97.0	92.8	83.0	59.5	17.6	3.2	1.7
CLOBA-05-03	03-A	0.0-2.4	0.60	100.0	99.9	99.7	99.4	99.4	97.4	92.5	75.9	22.6	5.6	2.3
CLOBA-05-03	03-B	2.4-5.4	0.52	100.0	99.9	99.9	99.8	99.5	98.6	95.7	84.6	33.5	4.7	4.7
CLOBA-05-04	04-A	0.0-2.4	1.89	99.9	99.8	99.5	99.1	98.1	95.5	88.8	68.9	19.6	3.5	1.3
CLOBA-05-04	04-B	2.4-3.3	0.44	100.0	100.0	99.9	99.8	99.6	98.8	97.2	91.5	28.0	4.6	1.8
CLOBA-05-04	04-C	3.3-4.5	5.90	99.4	98.5	97.7	96.6	94.1	87.6	75.1	53.6	17.3	2.3	0.9
CLOBA-05-05	05-A	0.0-3.2	2.42	99.3	98.8	98.6	98.2	97.6	94.5	77.6	33.9	6.1	2.1	1.7
CLOBA-05-05	05-B	3.2-4.6	6.16	99.7	98.6	97.6	96.2	93.8	88.6	77.4	51.7	15.0	2.7	1.7

*MISS SANDS HELD UP IN HOLE.*

Dec-30-05 10:58am From-CATLIN ENGINEERS AND SCIENTISTS +9104527863 T-745 P.07/07 F-389

## **Appendix B**

# **Channels from Back Sound to Lookout Bight Maintenance Dredging Project Proposed Plan for Sandbag Island Placement Area**

Project Background: The proposed area being considered for dredged material placement from maintenance of the Back Sound Federal navigation channel is a previously authorized bird nesting island managed by the State of North Carolina, locally known as Sandbag Island. At present, the island is less than 1.5 acres in size and was last used for dredged material placement in 1997, when it was built to its maximum size of 18 acres. The island has eroded considerably over the last 25 years and is subject to seasonal heavy winds from the northeast and boat wakes from the nearby navigation channel.

Dredged material from the Back Sound Federal navigation channel contains very fine-grained sand, with the average grain size ranging from 0.13-0.18 mm (just above the grain size of silt, which is 0.075 mm). Behaviors of fine-grained sand make it challenging to contain and stack up, requiring a suite of methods to build the island with a minimal footprint. Past methods of successful placement include control-of-effluent measures that used sandbags to contain the material released from the dredge pipe, allowing material to build above mean high water (MHW) level. Once the material stacked high enough for ground moving equipment to safely maneuver, berms were constructed to manipulate material, controlling the direction of flow.

Control-of-effluent measures have been used on various placement areas that serve as bird nesting habitat managed by the State. This proposed plan for reestablishing Sandbag Island is to provide a placement area for the material removed from the navigation channel over the lifetime of the project. The USACE estimates the need for a 25-acre island that would receive material approximately every 3-5 years depending on funding and need; however, the initial dredging event would build the island to an approximate size of 5 to 6 acres. Final elevations of the island would not exceed 15 feet (NAVD88).

The backside of Sandbag Island (southwest side, Figure 1) contains a dense bed of

submerged aquatic vegetation (SAV). The USACE will attempt to avoid impacts to SAV during island construction to the maximum extent practicable. Efforts using geo-tubes, berm construction, and turbidity curtains will be made to direct effluent away from the direction of SAV and build the island to the north and east.

#### Alternatives Considered:

1. Sandbags: Sandbags are created by filling bags onsite using dredged material and are generally inexpensive to construct. These were previously used during the 1997 construction to assist in controlling the effluent. A sandbag barrier would be constructed to the size needed to contain the quantity of material and built to an elevation to withstand overwash.

Remnant sandbags are visible from two previous construction events (Figure 1). These sandbags are not effective today for island construction and removal would require an extensive effort. Likewise, new sandbags would be difficult to remove once buried with new material. Regular placement activities (every 3-5 years) could attempt to cover over any exposed sandbags to ensure they do not pose a threat to wildlife.

2. Geo-tubes: Geo-tubes are created by filling geosynthetic tubes onsite using dredged material. They are large, single structures as opposed to numerous individual sandbags and thus more effective in controlling effluent and providing a barrier between the placement limits and SAV. They are more resistant to incoming tides and wind-driven waves, requiring less maintenance than sandbags. Costs can range from \$200-\$300 a foot, which could add substantial construction costs overall (\$300,000 - \$500,000). The USACE has limited knowledge and experience using geo-tubes for coastal projects.

3. Berm Construction: Berm construction is the least expensive containment method and the most environmentally friendly method since they are moveable and do not pose a threat to wildlife. However, existing material on the island is insufficient to construct berms needed to control effluent successfully. Also, due to the fine to very fine-grained nature of the dredge material, using berms alone will be difficult to contain the placement material. Berms can be easily eroded during incoming tides and can require persistent maintenance during dredging.

4. Turbidity Curtains: Turbidity curtains are effective in trapping sediments suspended in water (clays, silts, and very fine to fine grained sand). Installation and removal are relatively straight forward, and costs are generally inexpensive, approximately \$16 to \$20 per foot. However, use of turbidity curtains is constrained by shallow water depths; water depth must be greater than 3 feet for turbidity curtains to be installed. The project area is very shallow, less than 2 feet NAVD88, therefore these curtains may not be effective. Until new survey information is obtained placement of turbidity curtains remains unknown.

#### Sandbag Island Conceptual Design:

In FY23-24, USACE proposes to place approximately 150,000 to 160,000 cubic yards (CY) of dredged material onto Sandbag Island using a cutter suction pipeline dredge. The placed dredged material will be managed by means of control-of-effluent using a combination of geo-tubes, berm construction, and turbidity curtains. The use of sandbags, as discussed above, was not carried forward as a methodology as the sandbags tend to leave gaps in which fledgling birds can get trapped and die; therefore, the NC Wildlife Resources Commission (NCWRC) does not prefer their use as a structural method. There is no other placement area available for this material that is economically justified and environmentally acceptable.

The conceptual design requires topographic and bathymetric surveys to refine the proposed design.

Prior to placing material on the island, filling and placement of geo-tubes around the perimeter of Sandbag Island would occur to establish a barrier between the placement area and SAV (Figure 1). The total length of geo-tubes would be approximately 7,500 feet. The height and location of the geo-tubes would be determined at a later date once a survey of the island is complete. If surrounding waters are 3 feet or greater in depth, turbidity curtains would be installed to prevent the fine-grained sandy dredged material from migrating over the SAV. Using the dredged material in the Federal navigation channel, the dredge pipe would be directly connected to the geo-tubes to fill them to their maximum capacity. Once the geo-tubes are filled and placed, the center of the island would then be reworked through earth moving equipment. The dredge pipe would then be oriented toward the north or south (away from SAV) and initial placement would begin in the center of the island. As the dredged material piles up in the center of the island, between the geo-tubes, the placed material will be reworked again and pushed away from the center of the island toward the north and south building out berms to further contain the placed material. Placing material in this manner would require around the clock attention to ensure the center of the island does not overflow with material and to ensure berms constructed from placed material are not breached. Depending on the orientation of the pipe, the effluent would be controlled to ensure water velocities are slow enough to allow dredged material to settle out while water continues to flow away from the placed area.

#### Avoidance and Minimization Measures:

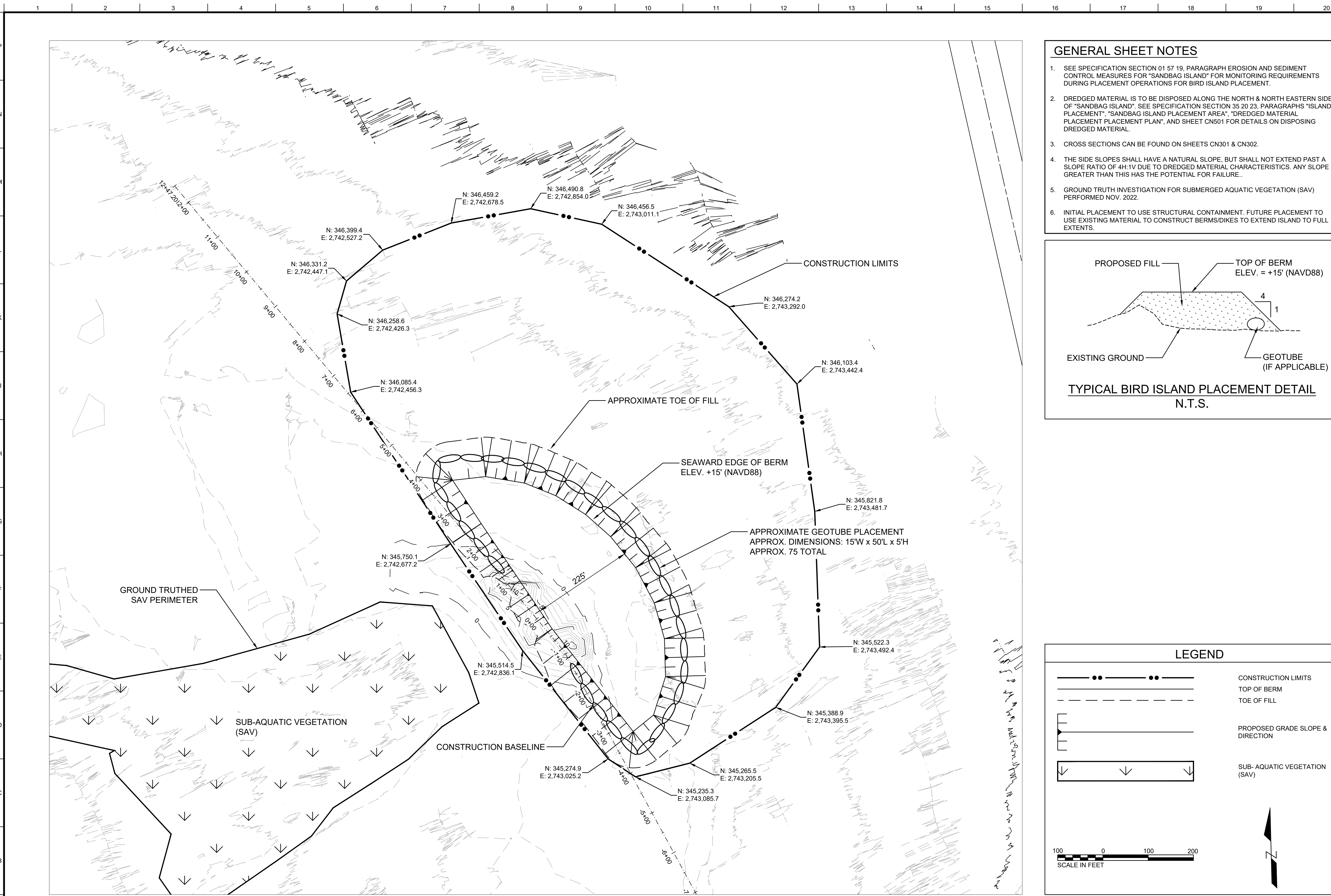
- The existing island and proposed placement area will be surveyed to determine the existing topography and capacity for dredged material. Surrounding waters are very shallow (1-2 feet).
- At early stages of island construction, geo-tubes will be used to contain the dredged material.
- The discharge end of the pipe will be kept below the water level to decrease sediment runoff/suspended sediments and help material to stay within the desired

area.

- Once there is enough material on the island, berms will be constructed to help reduce suspended sediments in the surrounding waters and control and direct material away from SAV.
- Turbidity curtains will be used if water depths are adequate (3 feet or greater).
- There will be continuous bulldozing/manipulation of material to construct the island. Once placement begins, there should be no planned breaks during pumping until placement of all material is complete (personal communication with Erica Janocha, USACE, Savannah District, October 11, 2022).
- To reduce future erosion, marsh grass (*Spartina spp.*) sprigs may be planted along the eastern perimeter of the island. Prior to any planting, coordination with NCWRC and NPS will take place to ensure proper plant species, design, and density to avoid effects to bird usage.
- Work will be conducted during fall/winter (September – March) to minimize impacts on nesting birds and their young.

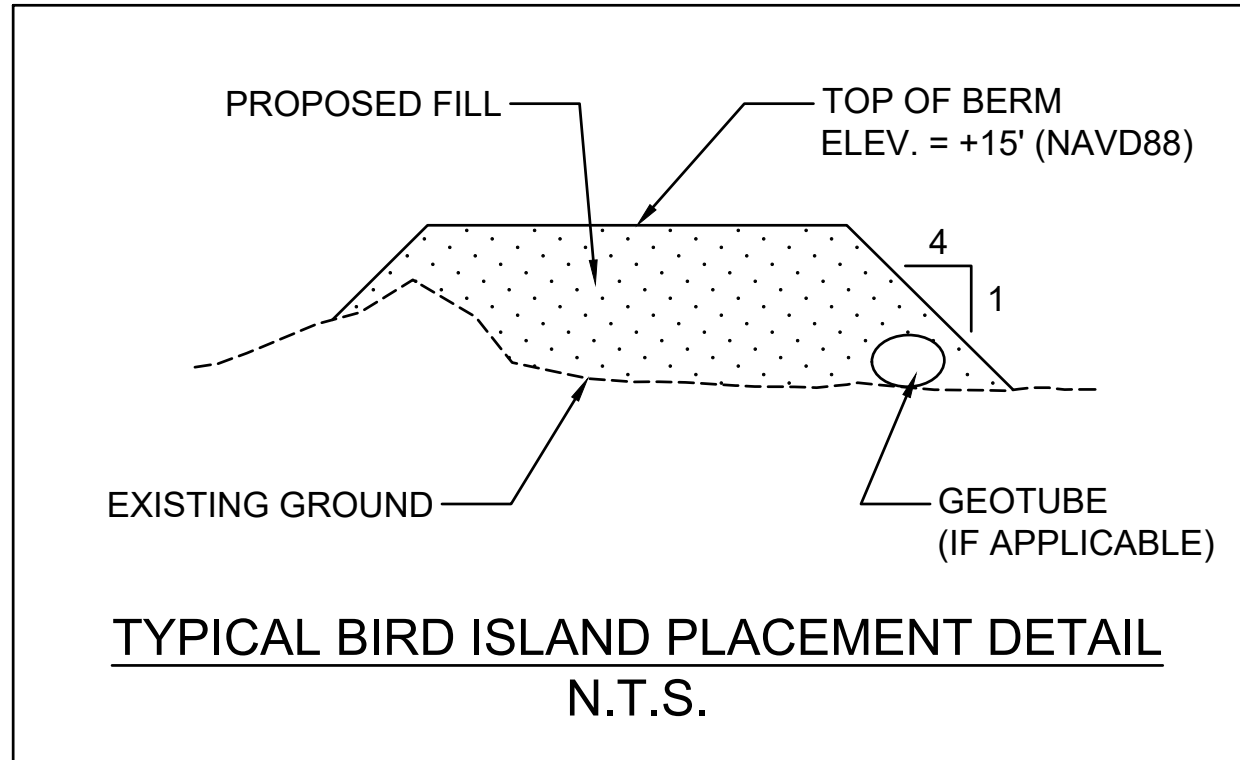
With release of the Draft EA, USACE submitted a Federal consistency determination to the NC Division of Coastal Management (NCDCM) in accordance with Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1456(c)(1)(C)). On June 28, 2023, NCDCM issued a Federal consistency concurrence for the Back Sound to Lookout Bight project with recommendations to utilize biodegradable geo-tubes on Sandbag Island, if possible, and to closely monitor impacts to SAV and report these impacts should they occur.





### GENERAL SHEET NOTES

1. SEE SPECIFICATION SECTION 01 57 19, PARAGRAPH EROSION AND SEDIMENT CONTROL MEASURES FOR "SANDBAG ISLAND" FOR MONITORING REQUIREMENTS DURING PLACEMENT OPERATIONS FOR BIRD ISLAND PLACEMENT.
2. DREDGED MATERIAL IS TO BE DISPOSED ALONG THE NORTH & NORTH EASTERN SIDE OF "SANDBAG ISLAND". SEE SPECIFICATION SECTION 35 20 23, PARAGRAPHS "ISLAND PLACEMENT", "SANDBAG ISLAND PLACEMENT AREA", "DREDGED MATERIAL PLACEMENT PLACEMENT PLAN", AND SHEET CN501 FOR DETAILS ON DISPOSING DREDGED MATERIAL.
3. CROSS SECTIONS CAN BE FOUND ON SHEETS CN301 & CN302.
4. THE SIDE SLOPES SHALL HAVE A NATURAL SLOPE. BUT SHALL NOT EXTEND PAST A SLOPE RATIO OF 4H:1V DUE TO DREDGED MATERIAL CHARACTERISTICS. ANY SLOPE GREATER THAN THIS HAS THE POTENTIAL FOR FAILURE..
5. GROUND TRUTH INVESTIGATION FOR SUBMERGED AQUATIC VEGETATION (SAV) PERFORMED NOV. 2022.
6. INITIAL PLACEMENT TO USE STRUCTURAL CONTAINMENT. FUTURE PLACEMENT TO USE EXISTING MATERIAL TO CONSTRUCT BERMS/DIKES TO EXTEND ISLAND TO FULL EXTENTS.

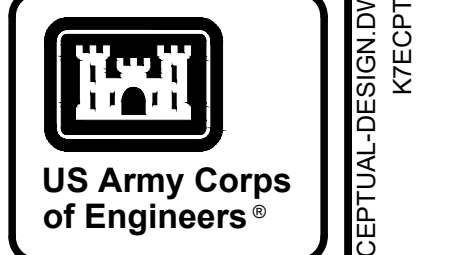


**LEGEND**

	CONSTRUCTION LIMITS
	TOP OF BERM
	TOE OF FILL
	PROPOSED GRADE SLOPE & DIRECTION
	SUB- AQUATIC VEGETATION (SAV)

SCALE IN FEET: 100 0 100 200

North Arrow



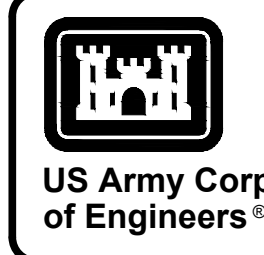
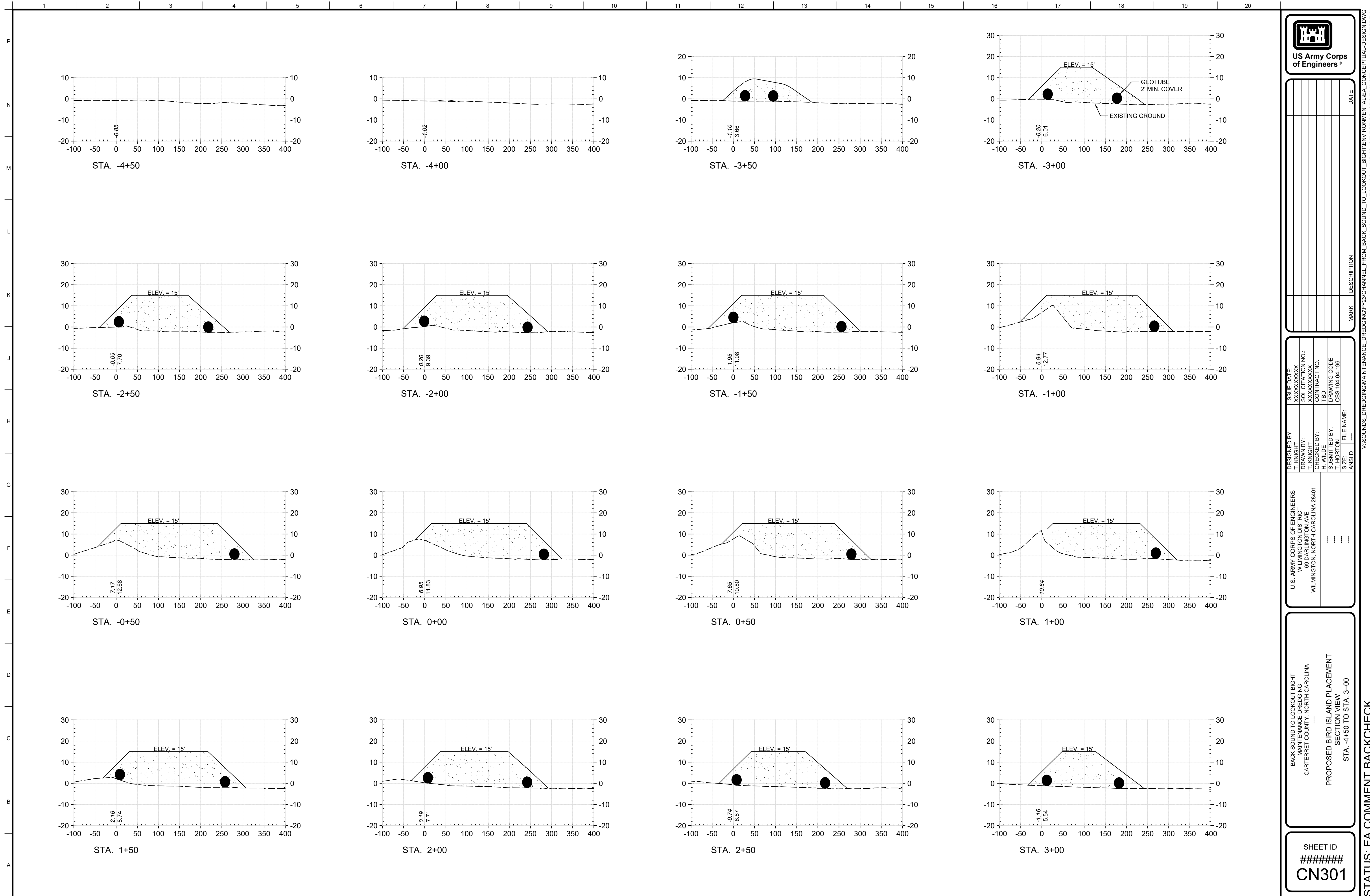
MARK	DESCRIPTION	DATE

DESIGNED BY: T. KNIGHT PLANNED BY: T. KNIGHT CHECKED BY: H. WILDE SUBMITTED BY: T. HORTON	ISSUE DATE: XXXXXX	FILE NAME: ANSID
	WILMINGTON DISTRICT 68 DARLINGTON AVE WILMINGTON, NORTH CAROLINA 28401	
PROJECT NO.: XXXXXX	CONTRACT NO.:	
DRAWING CODE: TBD	FILE NAME: CBS 104-04-198	
U.S. ARMY CORPS OF ENGINEERS		

BACK SOUND TO LOOKOUT BIGHT MAINTENANCE DREDGING CARTERRET COUNTY, NORTH CAROLINA

BIRD ISLAND PLACEMENT AREA "SANDBAG ISLAND" PROPOSED DESIGN

SHEET ID  
#####  
**CN105**



US Army Corps  
of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: T. KNIGHT	ISSUE DATE: XXXXXX
DRAWN BY: X. WILSON	COLLECTION NO.:
CHECKED BY: H. WILDE	CONTRACT NO.:
SUBMITTED BY: T. HORTON	TD
FILE NAME: CBS 104-04-198	DRAWING CODE
ANSID	SIZE

U.S. ARMY CORPS OF ENGINEERS  
WILMINGTON DISTRICT  
68 DARLINGTON AVE  
WILMINGTON, NORTH CAROLINA 28401

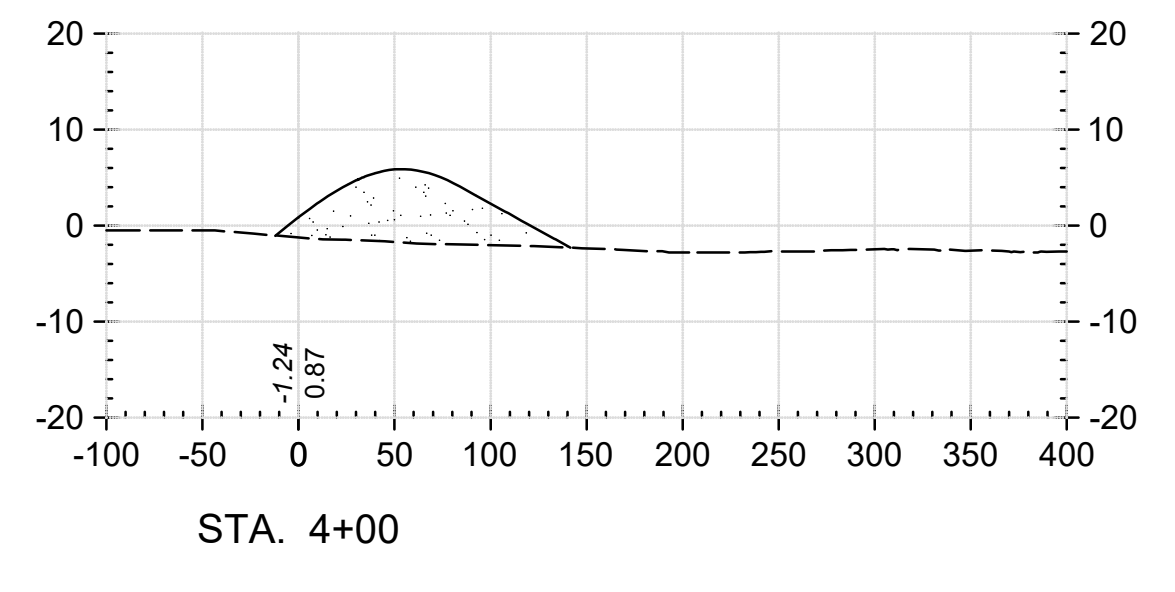
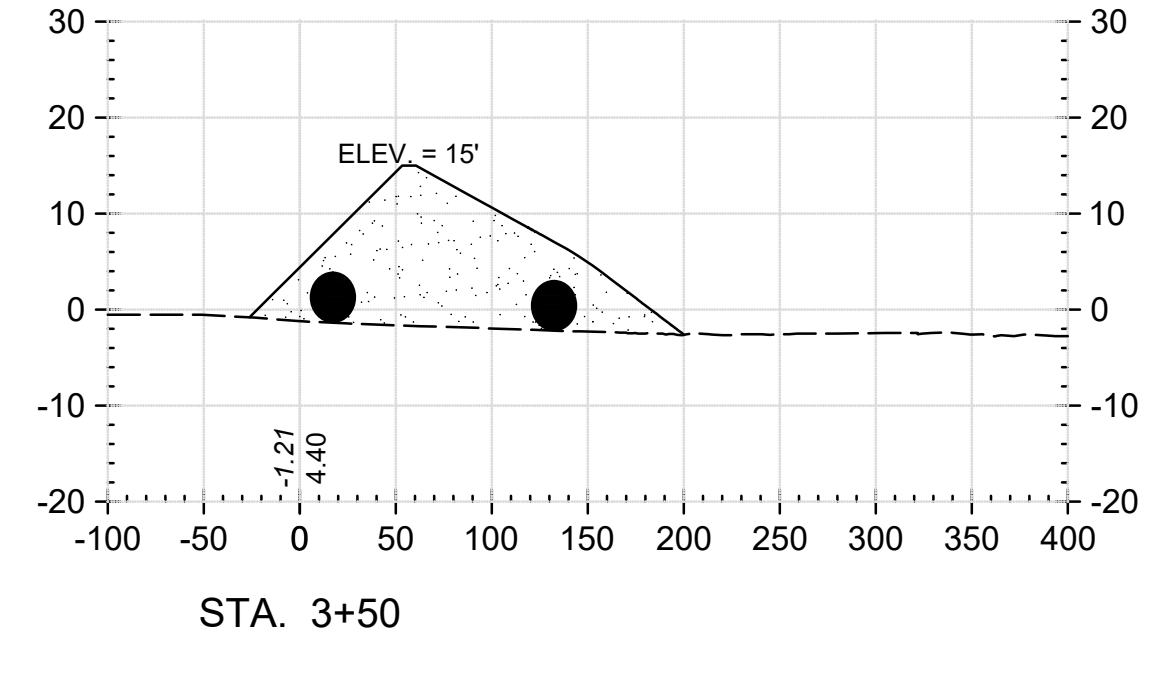
BACK SOUND TO LOOKOUT BIGHT  
MAINTENANCE DREDGING  
CARTERET COUNTY, NORTH CAROLINA

PROPOSED BIRD ISLAND PLACEMENT  
SECTION VIEW  
STA. -4+50 TO STA. 3+00

SHEET ID  
#####  
CN301

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10:57:31 AM 6/7/2023 AEC\_NCS\_1\_MONO\_SELECT-COLORS-T1K2.CTB K7ECPTJK  
STATUS: EA COMMENT BACKCHECK

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**US Army Corps  
of Engineers®**

MARK	DESCRIPTION	DATE

DESIGNED BY: T. KNIGHT	ISSUE DATE: XXXXXX
DRAWN BY: M. KNIGHT	CALCULATION NO.:
CHECKED BY: H. WILDE	CONTRACT NO.:
SUBMITTED BY: T. HORTON	DRAWING CODE: CBS 104-04-198
ANSID:	FILE NAME:

U.S. ARMY CORPS OF ENGINEERS  
WILMINGTON DISTRICT  
68 DARLINGTON AVE  
WILMINGTON, NORTH CAROLINA 28401

BACK SOUND TO LOOKOUT BIGHT  
MAINTENANCE DREDGING  
CARTERET COUNTY, NORTH CAROLINA

PROPOSED BIRD ISLAND PLACEMENT  
SECTION VIEW  
STA. 3+50 TO STA. 4+00

SHEET ID  
#####  
**CN302**

**APPENDIX C**

**SECTION 404(B)(1) GUIDELINES**

**ANALYSIS**

**CHANNEL FROM BACK SOUND**

**TO LOOKOUT BIGHT**

**SEPTEMBER 2023**



Prepared by:

Environmental Resources Section  
U.S. Army Corps of Engineers, Wilmington District

**CHANNEL FROM BACK SOUND TO LOOKOUT BIGHT  
ENVIRONMENTAL ASSESSMENT  
CARTERET COUNTY, NORTH CAROLINA**

Evaluation of Section 404 (b) (1) Guidelines 40 CFR 230

This 404 evaluation covers the placement of all fill material into waters of the United States required for the dredging and maintenance of the Channel from Back Sound to Lookout Bight, Carteret County, North Carolina. The proposed project includes placement of dredged material with Government Plant into open waters by means of sidecast dredging and special purpose hopper, and placement onto either Sandbag or Morgan Island bird islands, and soundside and oceanside beachfronts of Cape Lookout National Seashore by means of contracted pipeline dredge. All required Section 401 Water Quality Certificates from the NC Division of Water Resources will be obtained for the project and all conditions/restrictions will be met.

1. <u>Review of Compliance (230.10(a)-(d))</u> A review of the NEPA Document indicates that:	<b>Preliminary <u>1/</u></b>	<b>Final <u>2/</u></b>
a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem, to fulfill its basic purpose (if no, see section 2 and NEPA document);	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
b. The activity does not: 1) violate applicable State water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of federally listed endangered or threatened species or their habitat; and 3) violate requirements of any federally designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies);	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organism's dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see section 2);	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see section 3.03).	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> *	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>

2. Technical Evaluation Factors (Subparts C-F)

**N/A      Not Significant      Significant**

a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)

- (1) Substrate impacts.
- (2) Suspended particulates/turbidity impacts.
- (3) Water column impacts.
- (4) Alteration of current patterns and water circulation.
- (5) Alteration of normal water fluctuations/hydroperiod.
- (6) Alteration of salinity gradients.

	X	
	X	
	X	
	X	
X		
X		

b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)

- (1) Effect on threatened/endangered species and their habitat.
- (2) Effect on the aquatic food web.
- (3) Effect on other wildlife (mammals birds, reptiles, and amphibians).

	X	
	X	
	X	

c. Special Aquatic Sites (Subpart E)

- (1) Sanctuaries and refuges.
- (2) Wetlands.
- (3) Mud flats.
- (4) Vegetated shallows.
- (5) Coral reefs.
- (6) Riffle and pool complexes.

	X	
X		
X		
X		
X		
X		

d. Human Use Characteristics (Subpart F)

- (1) Effects on municipal and private water supplies.
- (2) Recreational and commercial fisheries impacts.
- (3) Effects on water-related recreation.
- (4) Aesthetic impacts.
- (5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves.

X		
	X	
	X	
	X	
	X	

3. Evaluation of Dredged or Fill Material (Subpart G) 3/

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

- |  |                                     |
|--|-------------------------------------|
| (1) Physical characteristics   | <input checked="" type="checkbox"/> |
| (2) Hydrography in relation to known or anticipated sources of contaminants  | <input checked="" type="checkbox"/> |
| (3) Results from previous testing of the material or similar material in the vicinity of the project   | <input checked="" type="checkbox"/> |
| (4) Known, significant sources of persistent pesticides from land runoff or percolation  | <input type="checkbox"/>            |
| (5) Spill records for petroleum products or designated (Section 311 of CWA) hazardous substances   | <input type="checkbox"/>            |
| (6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources   | <input checked="" type="checkbox"/> |
| (7) Known existence of substantial material deposits of substances, which could be released in harmful quantities to the aquatic environment by man-induced discharge activities | <input type="checkbox"/>            |
| (8) Other sources (specify).   | <input type="checkbox"/>            |

Reference: Appendix A, USACE Sediment Analysis

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to result in degradation of the disposal site.\*

YES  NO \*

4. Disposal Site Determinations (230.11(f)).

a. The following factors as appropriate, have been considered in evaluating the disposal site.

- |  |                                     |
|--|-------------------------------------|
| (1) Depth of water at disposal site  | <input checked="" type="checkbox"/> |
| (2) Current velocity, direction, and variability at disposal site                                      | <input checked="" type="checkbox"/> |
| (3) Degree of turbulence   | <input checked="" type="checkbox"/> |
| (4) Water column stratification  | <input checked="" type="checkbox"/> |
| (5) Discharge vessel speed and direction   | <input checked="" type="checkbox"/> |
| (6) Rate of discharge  | <input checked="" type="checkbox"/> |
| (7) Dredged material characteristics (constituents, amount and type of material, settling velocities). | <input checked="" type="checkbox"/> |
| (8) Number of discharges per unit of time  | <input checked="" type="checkbox"/> |
| (9) Other factors affecting rates and patterns of mixing (specify)                                     | <input type="checkbox"/>            |

Reference: Please refer to EA Section 5.1 and Appendix A for information on sediments and Appendix B for placement onto Sandbag Island.

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site(s) and/or size of mixing zone are acceptable.

YES  NO \*

5. Actions to Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77, to ensure minimal adverse effects of the proposed discharge.

YES  NO \*

Please refer to EA Section 8.0 Environmental Commitments for avoidance and minimization measures.



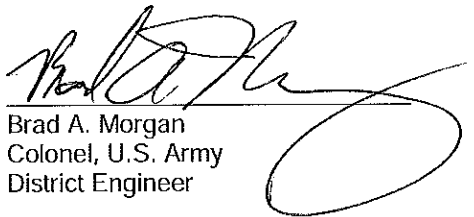
6. Factual Determinations (230.11).

A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:

- |   |   |                               |
|---|---|-------------------------------|
| a. Physical substrate at the disposal site<br>(review sections 2a, 3, 4, and 5).      | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> * |
| b. Water circulation, fluctuation, and salinity<br>(review sections 2a, 3, 4, and 5). | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> * |
| c. Suspended particulates/turbidity<br>(review sections 2a, 3, 4, and 5).             | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> * |
| d. Contaminant availability<br>(review sections 2a, 3, and 4).                        | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> * |
| e. Aquatic ecosystem structure and function<br>(review sections 2b and c, 3, and 5).  | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> * |
| f. Disposal site<br>(review sections 2, 4, and 5).                                    | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> * |
| g. Cumulative impact on the aquatic<br>ecosystem.                                     | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> * |
| h. Secondary impacts on the aquatic<br>ecosystem.                                     | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> * |

7. Findings.

- a. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines
- b. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines with the inclusion of the following conditions:
- c. The proposed disposal site for discharge of dredged or fill material does not comply with the Section 404(b)(1) guidelines for the following reasons(s):
- (1) There is a less damaging practicable alternative.
- (2) The proposed discharge will result in significant degradation of the aquatic ecosystem
- (3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem.

  
Brad A. Morgan  
Colonel, U.S. Army  
District Engineer

Date: 12 SEP 2023

\*A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

1/ Negative responses to three or more of the compliance criteria at this stage indicate that the proposed projects may not be evaluated using this "short form procedure." Care should be used in assessing pertinent portions of the technical information of items 2 a-d, before completing the final review of compliance.

2/ Negative response to one of the compliance criteria at this stage indicates that the proposed project does not comply with the guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form evaluation process is inappropriate."

3/ If the dredged or fill material cannot be excluded from individual testing, the "short-form" evaluation process is inappropriate.

## **APPENDIX D**

### **U.S. Fish and Wildlife Service Endangered Species Act Section 7(c) and Migratory Bird Treaty Act Species and Critical Habitat List**

**Information for Planning and  
Consultation (IPaC, [https://  
ipac.ecosphere.fws.gov/](https://ipac.ecosphere.fws.gov/))**

**SEPTEMBER 2023**



Prepared by:

Environmental Resources Section  
U.S. Army Corps of Engineers, Wilmington District



## United States Department of the Interior



FISH AND WILDLIFE SERVICE  
Raleigh Ecological Services Field Office  
Post Office Box 33726  
Raleigh, NC 27636-3726  
Phone: (919) 856-4520 Fax: (919) 856-4556

In Reply Refer To:

August 08, 2022

Project Code: 2022-0072306

Project Name: Back Sound to Lookout Bight USACE and NPS Channels

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). If your project area contains suitable habitat for any of the federally-listed species on this species list, the proposed action has the potential to adversely affect those species. If suitable habitat is present, surveys should be conducted to determine the species' presence or absence within the project area. The use of this species list and/or North Carolina Natural Heritage program data should not be substituted for actual field surveys.

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered

species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

**Migratory Birds:** In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see <https://www.fws.gov/birds/policies-and-regulations.php>.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see <https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php>.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit <https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php>.

---

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
  - Migratory Birds
  - Marine Mammals
  - Coastal Barriers
-

## **Official Species List**

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

**Raleigh Ecological Services Field Office**

Post Office Box 33726

Raleigh, NC 27636-3726

(919) 856-4520

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## Project Summary

Project Code: 2022-0072306  
Project Name: Back Sound to Lookout Bight USACE and NPS Channels  
Project Type: Navigation Channel Improvement  
Project Description: Project covers dredging and placement of material for fixed navigation channel and proposed corridor area containing USCE and NPS channels. Dredge types include pipeline, special purpose hopper and sidecast. Placement areas include Cape Lookout soundside and oceanside beaches, Sandbag bird island and open water.

### Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@34.640470300000004,-76.5179174080551,14z>



Counties: Carteret County, North Carolina

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## Endangered Species Act Species

There is a total of 15 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries<sup>1</sup>, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

- 
1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

## Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9045">https://ecos.fws.gov/ecp/species/9045</a>	Threatened
West Indian Manatee <i>Trichechus manatus</i> There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available. <b><i>This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.</i></b> Species profile: <a href="https://ecos.fws.gov/ecp/species/4469">https://ecos.fws.gov/ecp/species/4469</a>	Threatened

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## Birds

NAME	STATUS
Eastern Black Rail <i>Laterallus jamaicensis ssp. jamaicensis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/10477">https://ecos.fws.gov/ecp/species/10477</a>	Threatened
Piping Plover <i>Charadrius melodus</i> Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is <b>final</b> critical habitat for this species. Your location overlaps the critical habitat. Species profile: <a href="https://ecos.fws.gov/ecp/species/6039">https://ecos.fws.gov/ecp/species/6039</a>	Threatened
Red Knot <i>Calidris canutus rufa</i> There is <b>proposed</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/1864">https://ecos.fws.gov/ecp/species/1864</a>	Threatened
Red-cockaded Woodpecker <i>Picoides borealis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/7614">https://ecos.fws.gov/ecp/species/7614</a>	Endangered
Roseate Tern <i>Sterna dougallii dougallii</i> Population: Northeast U.S. nesting population No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/2083">https://ecos.fws.gov/ecp/species/2083</a>	Endangered

## Reptiles

NAME	STATUS
American Alligator <i>Alligator mississippiensis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/776">https://ecos.fws.gov/ecp/species/776</a>	Similarity of Appearance (Threatened)
Green Sea Turtle <i>Chelonia mydas</i> Population: North Atlantic DPS There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/6199">https://ecos.fws.gov/ecp/species/6199</a>	Threatened
Kemp's Ridley Sea Turtle <i>Lepidochelys kempii</i> There is <b>proposed</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/5523">https://ecos.fws.gov/ecp/species/5523</a>	Endangered
Leatherback Sea Turtle <i>Dermochelys coriacea</i> There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/1493">https://ecos.fws.gov/ecp/species/1493</a>	Endangered
Loggerhead Sea Turtle <i>Caretta caretta</i> Population: Northwest Atlantic Ocean DPS There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/1110">https://ecos.fws.gov/ecp/species/1110</a>	Threatened

## Insects

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9743">https://ecos.fws.gov/ecp/species/9743</a>	Candidate

## Flowering Plants

NAME	STATUS
Rough-leaved Loosestrife <i>Lysimachia asperulaefolia</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/2747">https://ecos.fws.gov/ecp/species/2747</a>	Endangered
Seabeach Amaranth <i>Amaranthus pumilus</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/8549">https://ecos.fws.gov/ecp/species/8549</a>	Threatened

## Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Piping Plover <i>Charadrius melodus</i> <a href="https://ecos.fws.gov/ecp/species/6039#crithab">https://ecos.fws.gov/ecp/species/6039#crithab</a>	Final

## Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act<sup>1</sup> and the Bald and Golden Eagle Protection Act<sup>2</sup>.

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

- 
1. The [Migratory Birds Treaty Act](#) of 1918.
  2. The [Bald and Golden Eagle Protection Act](#) of 1940.
  3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

**The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern \(BCC\)](#) list or warrant special attention in your project location.** To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Kestrel <i>Falco sparverius paulus</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA <a href="https://ecos.fws.gov/ecp/species/9587">https://ecos.fws.gov/ecp/species/9587</a>	Breeds Apr 1 to Aug 31
American Oystercatcher <i>Haematopus palliatus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. <a href="https://ecos.fws.gov/ecp/species/8935">https://ecos.fws.gov/ecp/species/8935</a>	Breeds Apr 15 to Aug 31

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NAME	BREEDING SEASON
<p><b>Atlantic Puffin</b> <i>Fratercula arctica</i></p> <p>This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p> <p><a href="https://ecos.fws.gov/ecp/species/8943">https://ecos.fws.gov/ecp/species/8943</a></p>	Breeds Apr 15 to Aug 15
<p><b>Bald Eagle</b> <i>Haliaeetus leucocephalus</i></p> <p>This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p>	Breeds Sep 1 to Jul 31
<p><b>Black Scoter</b> <i>Melanitta nigra</i></p> <p>This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p>	Breeds elsewhere
<p><b>Black Skimmer</b> <i>Rynchops niger</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p> <p><a href="https://ecos.fws.gov/ecp/species/5234">https://ecos.fws.gov/ecp/species/5234</a></p>	Breeds May 20 to Sep 15
<p><b>Brown Pelican</b> <i>Pelecanus occidentalis</i></p> <p>This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p> <p><a href="https://ecos.fws.gov/ecp/species/6034">https://ecos.fws.gov/ecp/species/6034</a></p>	Breeds Jan 15 to Sep 30
<p><b>Brown-headed Nuthatch</b> <i>Sitta pusilla</i></p> <p>This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA</p>	Breeds Mar 1 to Jul 15
<p><b>Chimney Swift</b> <i>Chaetura pelagica</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	Breeds Mar 15 to Aug 25
<p><b>Common Loon</b> <i>gavia immer</i></p> <p>This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p> <p><a href="https://ecos.fws.gov/ecp/species/4464">https://ecos.fws.gov/ecp/species/4464</a></p>	Breeds Apr 15 to Oct 31
<p><b>Cory's Shearwater</b> <i>Calonectris diomedea</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	Breeds elsewhere
<p><b>Gull-billed Tern</b> <i>Gelochelidon nilotica</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p> <p><a href="https://ecos.fws.gov/ecp/species/9501">https://ecos.fws.gov/ecp/species/9501</a></p>	Breeds May 1 to Jul 31

NAME	BREEDING SEASON
<p>Lesser Yellowlegs <i>Tringa flavipes</i>            This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.  <a href="https://ecos.fws.gov/ecp/species/9679">https://ecos.fws.gov/ecp/species/9679</a></p>	Breeds elsewhere
<p>Long-tailed Duck <i>Clangula hyemalis</i>            This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.  <a href="https://ecos.fws.gov/ecp/species/7238">https://ecos.fws.gov/ecp/species/7238</a></p>	Breeds elsewhere
<p>Marbled Godwit <i>Limosa fedoa</i>            This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.  <a href="https://ecos.fws.gov/ecp/species/9481">https://ecos.fws.gov/ecp/species/9481</a></p>	Breeds elsewhere
<p>Painted Bunting <i>Passerina ciris</i>            This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA</p>	Breeds Apr 25 to Aug 15
<p>Prairie Warbler <i>Dendroica discolor</i>            This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	Breeds May 1 to Jul 31
<p>Prothonotary Warbler <i>Protonotaria citrea</i>            This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	Breeds Apr 1 to Jul 31
<p>Purple Sandpiper <i>Calidris maritima</i>            This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	Breeds elsewhere
<p>Razorbill <i>Alca torda</i>            This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p>	Breeds Jun 15 to Sep 10
<p>Red-breasted Merganser <i>Mergus serrator</i>            This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p>	Breeds elsewhere
<p>Red-headed Woodpecker <i>Melanerpes erythrocephalus</i>            This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	Breeds May 10 to Sep 10
<p>Red-throated Loon <i>Gavia stellata</i>            This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p>	Breeds elsewhere

NAME	BREEDING SEASON
<b>Ring-billed Gull <i>Larus delawarensis</i></b> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
<b>Royal Tern <i>Thalasseus maximus</i></b> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Apr 15 to Aug 31
<b>Ruddy Turnstone <i>Arenaria interpres morinella</i></b> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
<b>Short-billed Dowitcher <i>Limnodromus griseus</i></b> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. <a href="https://ecos.fws.gov/ecp/species/9480">https://ecos.fws.gov/ecp/species/9480</a>	Breeds elsewhere
<b>Surf Scoter <i>Melanitta perspicillata</i></b> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
<b>White-winged Scoter <i>Melanitta fusca</i></b> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
<b>Willet <i>Tringa semipalmata</i></b> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 5
<b>Wilson's Plover <i>Charadrius wilsonia</i></b> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Aug 20
<b>Wilson's Storm-petrel <i>Oceanites oceanicus</i></b> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere

## Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

### Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is  $0.25/0.25 = 1$ ; at week 20 it is  $0.05/0.25 = 0.2$ .
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

### Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

### Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

### No Data (—)

A week is marked as having no data if there were no survey events for that week.

### Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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■ probability of presence   ■ breeding season   | survey effort   — no data

SPECIES      JAN    FEB    MAR    APR    MAY    JUN    JUL    AUG    SEP    OCT    NOV    DEC

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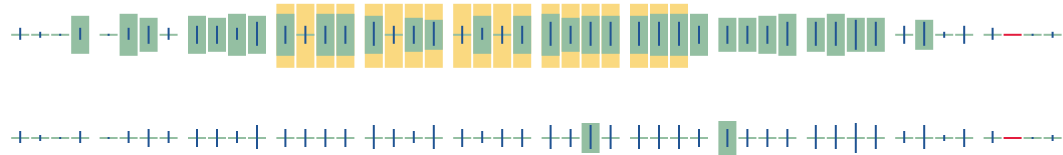




BCC Rangewide  
(CON)

Wilson's Plover  
BCC Rangewide  
(CON)

Wilson's Storm-  
petrel  
Non-BCC  
Vulnerable



Additional information can be found using the following links:

- Birds of Conservation Concern <https://www.fws.gov/program/migratory-birds/species>
- Measures for avoiding and minimizing impacts to birds <https://www.fws.gov/library/collections/avoiding-and-minimizing-incident-take-migratory-birds>
- Nationwide conservation measures for birds <https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf>

## Migratory Birds FAQ

**Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.**

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

**What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?**

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list

of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator \(RAIL\) Tool](#).

### **What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?**

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

### **How do I know if a bird is breeding, wintering or migrating in my area?**

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the [RAIL Tool](#) and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

### **What are the levels of concern for migratory birds?**

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

### **Details about birds that are potentially affected by offshore projects**

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical](#)

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[Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

### **What if I have eagles on my list?**

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

### **Proper Interpretation and Use of Your Migratory Bird Report**

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

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## Coastal Barriers

Projects within the [John H. Chafee Coastal Barrier Resources System](#) (CBRS) may be subject to the restrictions on federal expenditures and financial assistance and the consultation requirements of the Coastal Barrier Resources Act (CBRA) (16 U.S.C. 3501 et seq.). For more information, please contact the local [Ecological Services Field Office](#) or visit the [CBRA Consultations website](#). The CBRA website provides tools such as a flow chart to help determine whether consultation is required and a template to facilitate the consultation process.

## Otherwise Protected Area (OPA)

*OPAs are denoted with a "P" at the end of the unit number. The only prohibition within OPAs is on federal flood insurance. **CBRA consultation is not required for projects within OPAs.** However, agencies providing disaster assistance that is contingent upon a requirement to purchase flood insurance after the fact are advised to disclose the OPA designation and information on the restrictions on Federal flood insurance to the recipient prior to the commitments of funds.*

UNIT	NAME	TYPE	SYSTEM UNIT ESTABLISHMENT DATE	FLOOD INSURANCE PROHIBITION DATE
L03AP	Shackleford Banks	OPA	N/A	10/1/1983
NC-03P	Cape Hatteras	OPA	N/A	10/1/1983
NC-03P	Cape Hatteras	OPA	N/A	11/16/1991

# Marine Mammals

Marine mammals are protected under the [Marine Mammal Protection Act](#). Some are also protected under the Endangered Species Act<sup>1</sup> and the Convention on International Trade in Endangered Species of Wild Fauna and Flora<sup>2</sup>.

The responsibilities for the protection, conservation, and management of marine mammals are shared by the U.S. Fish and Wildlife Service [responsible for otters, walruses, polar bears, manatees, and dugongs] and NOAA Fisheries<sup>3</sup> [responsible for seals, sea lions, whales, dolphins, and porpoises]. Marine mammals under the responsibility of NOAA Fisheries are **not** shown on this list; for additional information on those species please visit the [Marine Mammals](#) page of the NOAA Fisheries website.

The Marine Mammal Protection Act prohibits the take of marine mammals and further coordination may be necessary for project evaluation. Please contact the U.S. Fish and Wildlife Service Field Office shown.

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1. The [Endangered Species Act](#) (ESA) of 1973.
  2. The [Convention on International Trade in Endangered Species of Wild Fauna and Flora](#) (CITES) is a treaty to ensure that international trade in plants and animals does not threaten their survival in the wild.
  3. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

NAME

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West Indian Manatee *Trichechus manatus*

Species profile: <https://ecos.fws.gov/ecp/species/4469>

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## **IPaC User Contact Information**

Agency: Army Corps of Engineers  
Name: Emily Hughes  
Address: 69 Darlington Ave.  
City: Wilmington  
State: NC  
Zip: 28412  
Email: emily.b.hughes@usace.army.mil  
Phone: 9102514635

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# **APPENDIX E**

## **State Historic Preservation Office (SHPO) Correspondence**

### **Channels from Back Sound to Lookout Bight, Carteret County, NC**

**SEPTEMBER 2023**



Prepared by:

Environmental Resources Section  
U.S. Army Corps of Engineers, Wilmington District



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

May 9, 2022

Planning and Environmental Branch

Dear Sir or Madam:

The U.S. Army Corps of Engineers (Corps), Wilmington District is drafting an Environmental Assessment (EA) for the purpose of jointly maintaining existing Corps and National Park Service (NPS) federal channels in the Back Sound to Lookout Bight vicinity, Carteret County, North Carolina. The Corps' authorized channels, which include a fixed portion and a portion that follows deep water, reach from just south of the Island Express Ferry Service dock on Harkers Island to the Barden Inlet gorge (Figure 1). The NPS' channels, Lighthouse Channel, Les and Sally's Channel and the channel to the former U.S. Coast Guard dock, connect three boat docks on Cape Lookout Island to the Corps' channel. Ferries to and from Harkers Island Visitor Center, operated by the NPS Cape Lookout National Seashore (CALO), carry passengers across Barden Inlet to the Lighthouse Dock via Lighthouse Channel. Les and Sally's is currently the NPS' maintenance facility for South Core Banks and is accessed via a channel of the same name. Les and Sally's Channel is the main NPS access for supplies, materials, trash pick-up, fuel, and personnel brought in on a daily basis to support visitor operations, maintenance, construction, and emergency services (e.g., fire, emergency medical services, law enforcement, and search and rescue). The third boat dock, previously associated with a US Coast Guard Station, is now abandoned; however the NPS is planning to utilize this area in the future which will require the associated access channel to be maintained (Figure 1).

The Corps last dredged these channels in April 1997 via a contracted cutterhead suction dredge. In 2006, the NPS borrowed material from within and adjacent to the federal channel to restore the eroding estuarine shoreline adjacent to the CALO Lighthouse. The shoreline protection project also included construction of a 243-foot replacement ferry dock. Over time, shoaling in the fixed portion of the Corps' channel has forced NPS ferries to take alternative routes following deep water. Currently, the northern portion of the fixed channel is heavily shoaled and dangerously shallow as shown in January 2022 bathymetric survey data (Figure 2).

The Corps is proposing to maintain the Back Sound to Lookout Bight route using government-owned sidecast and special purpose hopper dredges and contracted hydraulic suction cutterhead dredges. The extent of the combined Corps/NPS project area under review is shown in Figure 1. It includes the fixed channel and the corridor that applies to the non-fixed channel area. The corridor allows the channel to move, following natural deep water, thus reducing the need to dredge. All channels are authorized at widths of 100 feet and depths of 7 feet + 2 feet allowable overdepth.

Proposed dredged material placement options include: sidecasting (material is typically sidecasted about 80 feet from the dredge); nearshore placement seaward of the east end of Shackleford Banks and the west end of Cape Lookout Island; oceanside and soundside beach placement at Cape Lookout National Seashore for protection and restoration of wildlife habitat and historic structures; and control of effluent placement on an existing bird island located in Back Sound (Figure 1). The majority of material dredged from the fixed channel and from within the corridor is expected to be  $\geq 90\%$  sand, acceptable for placement at all of the proposed locations. The Corps will perform geotechnical surveys throughout the corridor to confirm sediment quality before dredging occurs. If non-beach quality material is identified, the Corps will develop an upland placement plan to address placement of that material.

Submerged Aquatic Vegetation (SAV) exists within the Back Sound complex. Review of historic aerial imagery has shown several patches of SAV beds. Figure 3 shows the most recent (2021, during growing season) locations of SAV in proximity to the project area. As shown in Figure 3, potential impacts to SAV will be thoroughly addressed in the EA.

Regarding the Corps' federal channels within the corridor, including those following natural deep water between Barden Inlet and Lookout Bight, compliance with Section 106 of the National Historic Preservation Act (NHPA) has been previously coordinated and documented in the "Final Environmental Statement, Maintenance Dredging, Channel from Back Sound to Lookout Bight, N.C.", dated November 1975 and filed with the Council on Environmental Quality on March 10, 1976. Similarly, Section 106-related considerations regarding NPS actions in the project area are described in the "Environmental Assessment, National Park Service, Cape Lookout National Seashore, Protection of Lighthouse and Associated Historic Structures", dated December 2005, and in the "Environmental Assessment for National Park Service, Cape Lookout National Seashore, Harkers Island Shore Protection Project", dated August 2006; although, the NPS channels depicted in Figures 1, 3 and 4 are not specifically addressed in these documents. The Corps has identified three submerged sites/shipwrecks in the project area that may be afforded protections under the NHPA and/or the Abandoned Shipwrecks Act (Figure 4) and requests guidance from the North Carolina State Historic Preservation Office (SHPO) to inform dredging methodologies in the immediate vicinities of these sites/shipwrecks. Specifically, within the proposed dredging corridor shown in Figures 1, 3 and 4, the Corps requests the SHPO's guidance regarding any required site/shipwreck buffering to ensure site integrity. Known submerged sites/shipwrecks in the project area are:

Olive Thurlow (shipwreck): 34°37'17.88"N  
76°31'53.82"W

Shell Point: 34°41'1.25"N  
76°31'36.01"W

Wreck Point:                   34°36'55.58"N  
  76°32'23.67"W

The Corps is now requesting comments from stakeholders and agencies, including the SHPO, to identify significant resources and issues of concern regarding the proposed channel maintenance and dredged material placement described above and depicted in Figures 1-4. The Corps proposes to evaluate SAV prior to each dredging event and avoid sidecast dredging in areas within close proximity of SAV. Comments received as a result of this scoping letter will be considered during preparation of the draft EA.

The draft EA is being prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended, and will address the proposed action's relationship to all applicable Federal and State laws and Executive Orders. Resources known to occur in the project area include SAV, fisheries and benthic resources, threatened and endangered species, socioeconomic, recreational and aesthetic resources, and cultural resources. Potential impacts to these resources, as well as water quality and air quality, and potential hazardous and toxic wastes will be fully addressed in the draft EA. Should there be other issues that you believe should be discussed, please take this opportunity to bring them to our attention.

In order to effectively address any concerns that are raised, the Corps requests your input no later than 30 days from the date of this letter. Input may be directed to Ms. Emily Hughes, Environmental Resources Section, by email ([Emily.B.Hughes@usace.army.mil](mailto:Emily.B.Hughes@usace.army.mil)).

Sincerely,

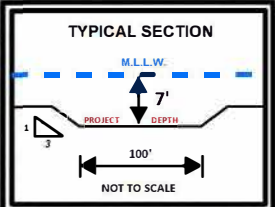
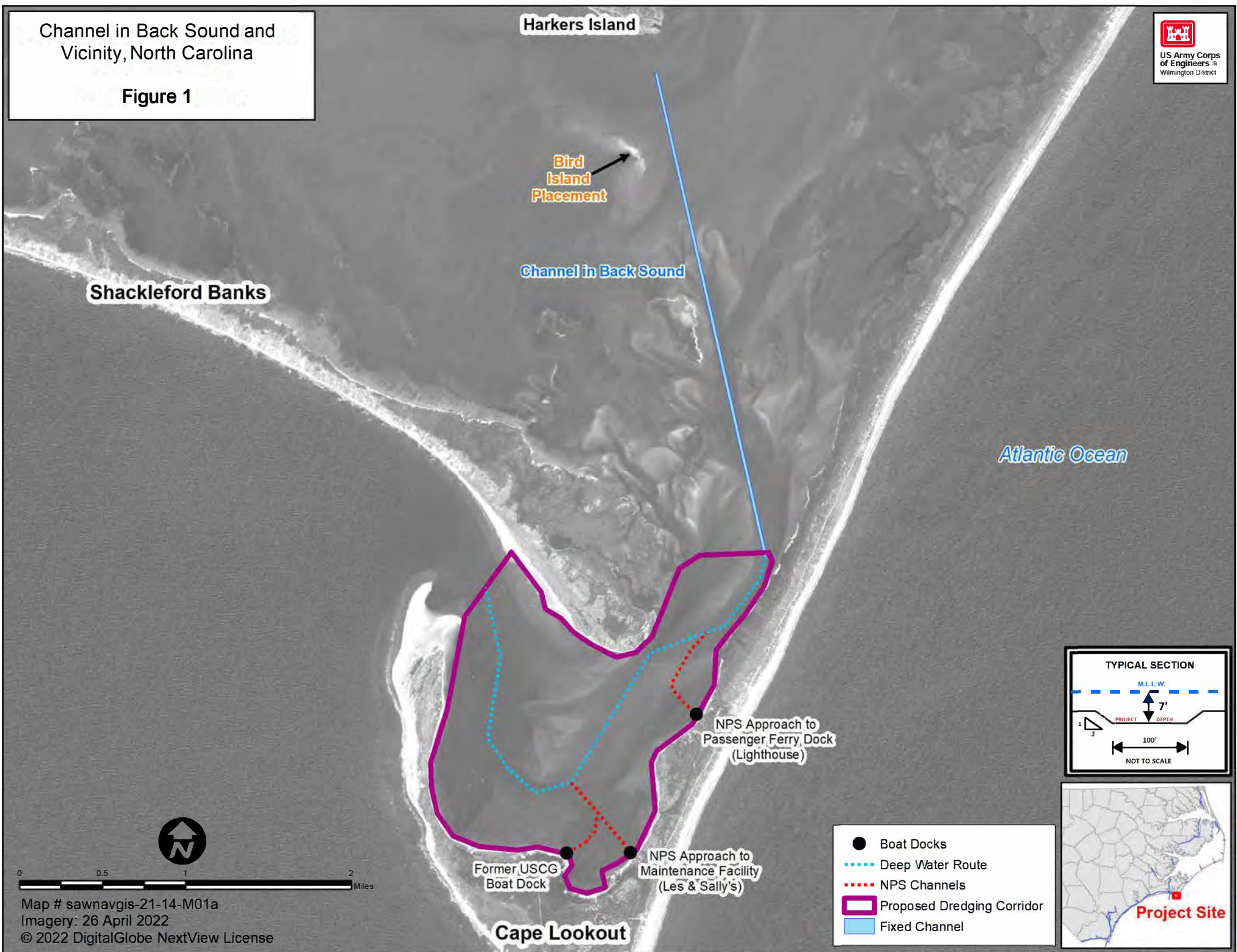
for Elden Gatwood  
Chief, Planning and Environmental  
Branch

Encls

- Figure 1. Back Sound Lookout Bight Project Area
- Figure 2. Project Area with Bathymetry
- Figure 3. Potential SAVs within the Project Area
- Figure 4. Known Submerged Cultural Resources within the Project Area

Channel in Back Sound and Vicinity, North Carolina

Figure 1

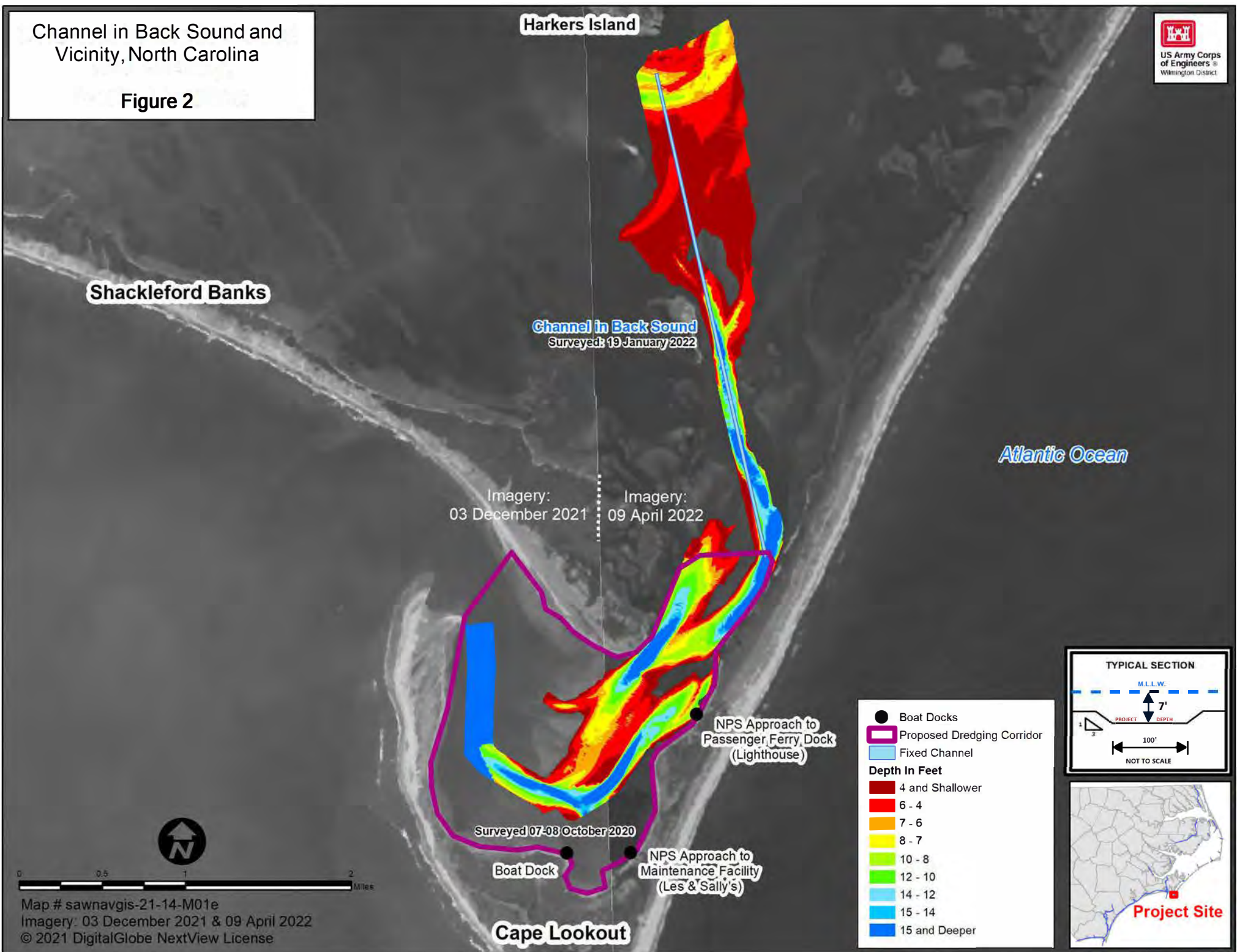


- Boat Docks
- Deep Water Route
- NPS Channels
- █ Proposed Dredging Corridor
- █ Fixed Channel



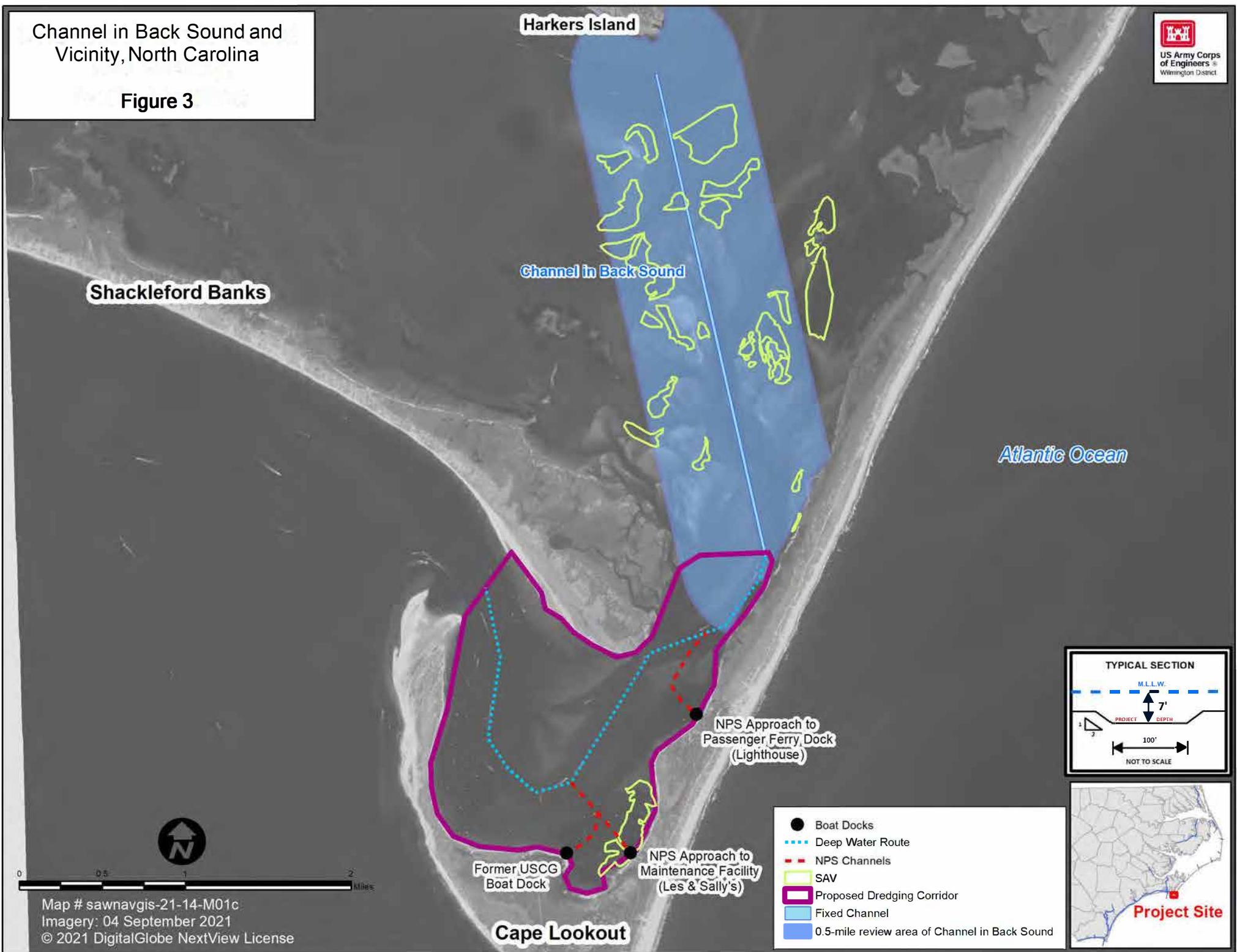
Channel in Back Sound and Vicinity, North Carolina

Figure 2



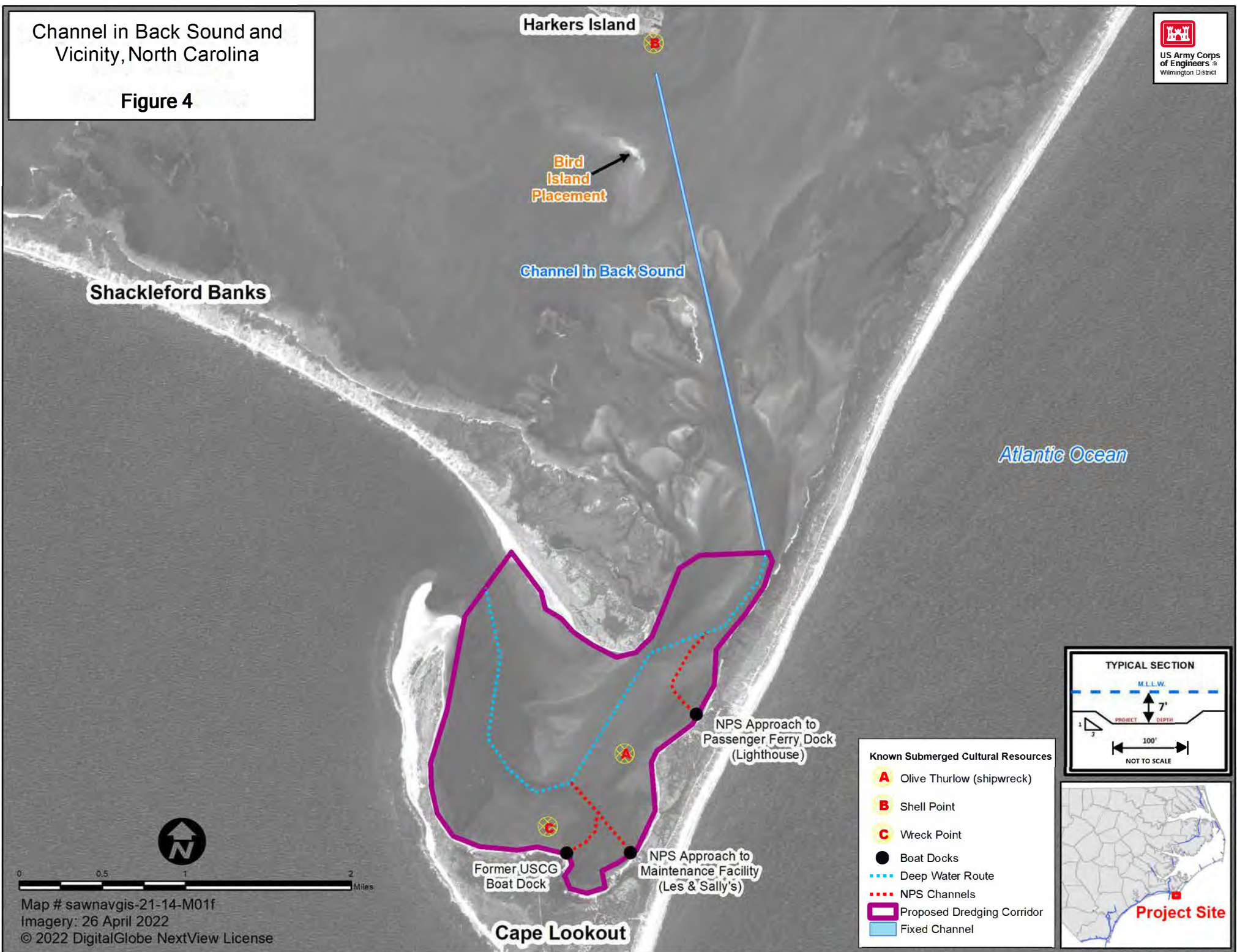
Channel in Back Sound and Vicinity, North Carolina

Figure 3



Channel in Back Sound and Vicinity, North Carolina

Figure 4







**North Carolina Department of Natural and Cultural Resources  
State Historic Preservation Office**

Ramona M. Bartos, Administrator

Governor Roy Cooper  
Secretary D. Reid Wilson

Office of Archives and History  
Deputy Secretary, Darin J. Waters, Ph.D.

June 15, 2022

Justin Bashaw  
Cultural Resources Manager  
U.S. Army Corps of Engineers, South Atlantic Division  
Wilmington District

[justin.p.bashaw@usace.army.mil](mailto:justin.p.bashaw@usace.army.mil)

RE: Maintenance dredging of Back Sound to Lookout Bight environmental assessment, Carteret County,  
ER 22-1393

Dear Mr. Bashaw,

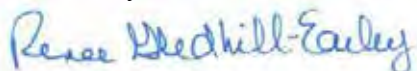
Thank you for your submission on May 12, 2022, concerning the above-referenced project. We have reviewed the materials provided and offer the following comments.

The Cape Lookout Bight and Back Sound areas contain six recorded submerged archaeological sites, most notably the wreck of the Olive Thurlow (CLS0004), that lie adjacent to the channel. While we find that the Area of Potential Effect (APE) of the proposed maintenance dredging will have no adverse effect on the noted archaeological sites, we ask that an adequate buffer area of 150 square meters be provided surrounding the shipwrecks. The purpose of this buffer is to prevent further deterioration and damage of the archaeological resource, as well as to prevent possible damage to dredge machinery.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-814-6579 or [environmental.review@ncdcr.gov](mailto:environmental.review@ncdcr.gov). In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

  
for Ramona Bartos, Deputy  
State Historic Preservation Officer



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

April 14, 2023

Ms. Crystal Best  
North Carolina State Environmental Review Clearinghouse  
Department of Administration  
1301 Mail Service Center  
Raleigh, North Carolina 27699-1301

Dear Ms. Best:

The U.S. Army Corps of Engineers (Corps) Wilmington District has prepared the Channel from Back Sound to Lookout Bight, Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels, Draft Environmental Assessment (Draft EA) dated April 2023. This Draft EA was completed in partnership with the U.S. National Park Service (NPS). Enclosed with this letter is the Public Notice announcing the public release of the Draft EA. The Draft EA is available on the Corps website at:

<https://www.saw.usace.army.mil/Missions/Navigation/Dredging/>

The proposed action includes dredging of Corps and NPS Federal navigation channels located within Back Sound and Lookout Bight using Government-owned shallow draft plant and contracted hydraulic cutterhead pipeline dredges and subsequent dredged material placement in Carteret County, North Carolina.

The Draft EA has been prepared in accordance with the Council on Environmental Quality and Corps and NPS requirements for implementing the National Environmental Policy Act (NEPA) of 1969 (33 CFR 230), as amended.

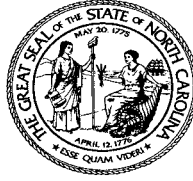
Based on the information in the Draft EA, we expect the proposed Federal action will not significantly affect the quality of the human environment; therefore, an Environmental Impact Statement will not be required. If this opinion is upheld following circulation of this Draft EA, a Finding of No Significant Impact will be signed and circulated.

We would appreciate receiving any comments regarding our determination no later than 30 days from the date of this letter. If we have not received your comments by then, we will assume that you have none. Written comments may be submitted to Mr. John Policarpo at: [John.N.Policarpo@usace.army.mil](mailto:John.N.Policarpo@usace.army.mil).

Sincerely,

Jenny Owens  
Acting Chief  
Planning and Environmental Branch

Enclosure



**North Carolina Department of Natural and Cultural Resources  
State Historic Preservation Office**

Ramona M. Bartos, Administrator

Governor Roy Cooper  
Secretary D. Reid Wilson

Office of Archives and History  
Deputy Secretary, Darin J. Waters, Ph.D.

May 4, 2023

**MEMORANDUM**

**TO:** Crystal Best [crystal.best@doa.nc.gov](mailto:crystal.best@doa.nc.gov)  
North Carolina State Clearinghouse  
Department of Administration

**FROM:** Ramona M. Bartos, Deputy  
State Historic Preservation Officer *RMB for Ramona M. Bartos*

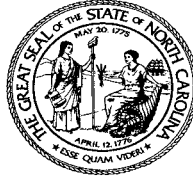
**SUBJECT:** Maintenance dredging of Back Sound to Lookout Bight environmental assessment, Carteret County, 23-E-0000-0220, ER 22-1393

Thank you for your submission of April 19, 2023, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-814-6579 or [environmental.review@ncdcr.gov](mailto:environmental.review@ncdcr.gov). In all future communication concerning this project, please cite the above referenced tracking number.



**North Carolina Department of Natural and Cultural Resources  
State Historic Preservation Office**

Ramona M. Bartos, Administrator

Governor Roy Cooper  
Secretary D. Reid Wilson

Office of Archives and History  
Deputy Secretary, Darin J. Waters, Ph.D.

June 23, 2023

Emily Hughes  
Wilmington Regulatory Field Office  
69 Darlington Avenue  
Wilmington, NC 28403

[Emily.b.hughes@usace.army.mil](mailto:Emily.b.hughes@usace.army.mil)

Re: Maintenance dredging of two channels and place fill material onto Cape Lookout Lighthouse Beach, Cape Lookout National Seashore, Carteret County, SAW-2022-00574, ER 23-1153

Dear Ms. Hughes:

Thank you for your letter of May 9, 2023, regarding the above-referenced undertaking. We have reviewed the submittal and offer the following comments.

We have conducted a review of the project and concur that there is no adverse effect (NAE) to the Cape Lookout Historic District (CR0266).

Based on our knowledge of the area, it is unlikely that any archaeological resources that may be eligible for inclusion in the National Register of Historic Places will be affected by the project. We, therefore, recommend that no archaeological investigation be conducted in connection with this project.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-814-6579 or [environmental.review@ncdcr.gov](mailto:environmental.review@ncdcr.gov). In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

A handwritten signature in blue ink that reads "Renee Gledhill-Earley".

*for* Ramona Bartos, Deputy  
State Historic Preservation Officer



**US Army Corps  
of Engineers**®  
Wilmington District

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## **APPENDIX F**

# **CONSIDERATION OF POTENTIAL IMPACTS OF CLIMATE CHANGE AND SEA LEVEL RISE ON MAINTENANCE DREDGING OF CHANNELS FROM BACKSOUND TO LOOKOUT BIGHT**

**SEPTEMBER 2023**

## ECB 2018-14 Climate Change Assessment

To effectively incorporate climate change adaptation and to increase resilience and decrease vulnerability of the Backsound to Lookout Bight navigation channel dredging and dredged material placement location, the first step was to identify where vulnerability exists. The current USACE Screening-Level Climate Change Vulnerability Assessment (VA) Tool and other tools described in Engineering & Construction Bulletin (ECB) 2018-14 were used in this analysis. This discussion will start with a literature review of climate observations and predictions before moving onto an analysis starting at the broad regional scale and finishing at the project level with the analysis. The project elevation is below 50 feet, so a sea level change assessment will also be conducted in accordance with ECB 2018-14 guidance following Engineering Regulation (ER) 1100-2-8162 and Engineering Technical Letter (ETL) 1100-2-1.

### 1 Literature Review

The Backsound to Lookout Bight navigation channel is in Water Resource Region number 03, the South Atlantic-Gulf Region. A January 2015 report conducted by the USACE Institute for Water Resources summarizes the available climate change literature for this region. The report covers both observed and predicted changes using data published through 2014. Figure 1 shows a summary matrix of the observed and projected trends used in the report.

Multiple studies focused on observed mean temperature, mean seasonal temperature and extreme temperatures. Generally, the studies concurred on increased average annual temperature (Carter et al, 2014, Patterson et al, 2012, Laseter et al, 2012). However, there are conflicting results on observed seasonal changes with some results showing warmer summers and colder winters (Wang et al, 2009) and others showing no observed seasonal changes (Westby et al, 2013). Analysis of global climate model (GCM) projections generally agree that over the next century mean annual temperatures will rise with the largest increases in summer months (Carter et al, 2014; Elguindi and Grundstein, 2013; Qi et al, 2009; Tebaldi, 2006). The 2018 Fourth National Climate Assessment found increasing temperatures and increasing extreme heat events along the Southeast and projects increasing temperatures to continue in the future. The 2022 NOAA State Climate Summary for Virginia show temperatures rising 1.5°F since the beginning of the 20<sup>th</sup> century and projects the increase in temperatures to continue in the future.

Precipitation trend analysis for the South Atlantic-Gulf region showed mixed results with low consensus for increasing trends in annual precipitation totals and precipitation intensity, and moderate consensus for increasing extreme high precipitation events (Wang and Zhang, 2008; McRoberts and Nielsen-Gammon, 2011; Pryor et al., 2009). Wang and Zhang (2008) found an increase in extreme precipitation event frequency and Pryor et al. (2009) found a statistically significant increase in the number of precipitation days per year. Wang, Killick, and Fu (2013) investigated high and low extreme precipitation in the South-Atlantic Gulf region and supported the findings of Wang and Zhang (2008) with an increase in high extreme precipitation events but found no statistically significant change in the low extreme precipitation events. Analysis of GCM

projections are split on future precipitation with some models showing more annual precipitation and others showing less (Bastola et al, 2007; Jayakody et al, 2013; Qi et al, 2009). There is general consensus on more intense and frequent storm events (Gao et al 2012; Tebaldi 2006; Wang and Zhang 2008). The 2018 Fourth National Climate Assessment found increasing extreme rainfall events and projects this trend to continue in the future. The 2022 NOAA State Climate Summary for Virginia found a small upward trend in total annual precipitation and an upward trend in the annual number of extreme precipitation events. The annual precipitation in Virginia is projected to increase.

Studies of stream gages in the regions have shown mixed results but have a moderate consensus on decreasing streamflow. Xu et al (2013) showed no statistically significant trend in stream flows. Kalra et al (2008) found a negative statistically significant trend in annual and seasonal stream flows. Small et al (2006) found a statistically significant negative trend for annual low flows at several gages across the region. GCM projections coupled with macro-scale hydrologic models show no clear consensus on future stream flow trends (Bastola et al, 2007; Carter et al, 2014; Hagemann et al, 2013; Irizarry-Ortiz et al, 2013; Qi et al, 2009; Wang et al 2013a; Wang et al 2013b). The 2018 Fourth National Climate Assessment projects increases in the frequency and severity of droughts in the Southeast US. The 2022 NOAA State Climate Summary for Virginia also projects more intense droughts due to higher projected temperatures and increased rate of loss of soil moisture during dry spells.



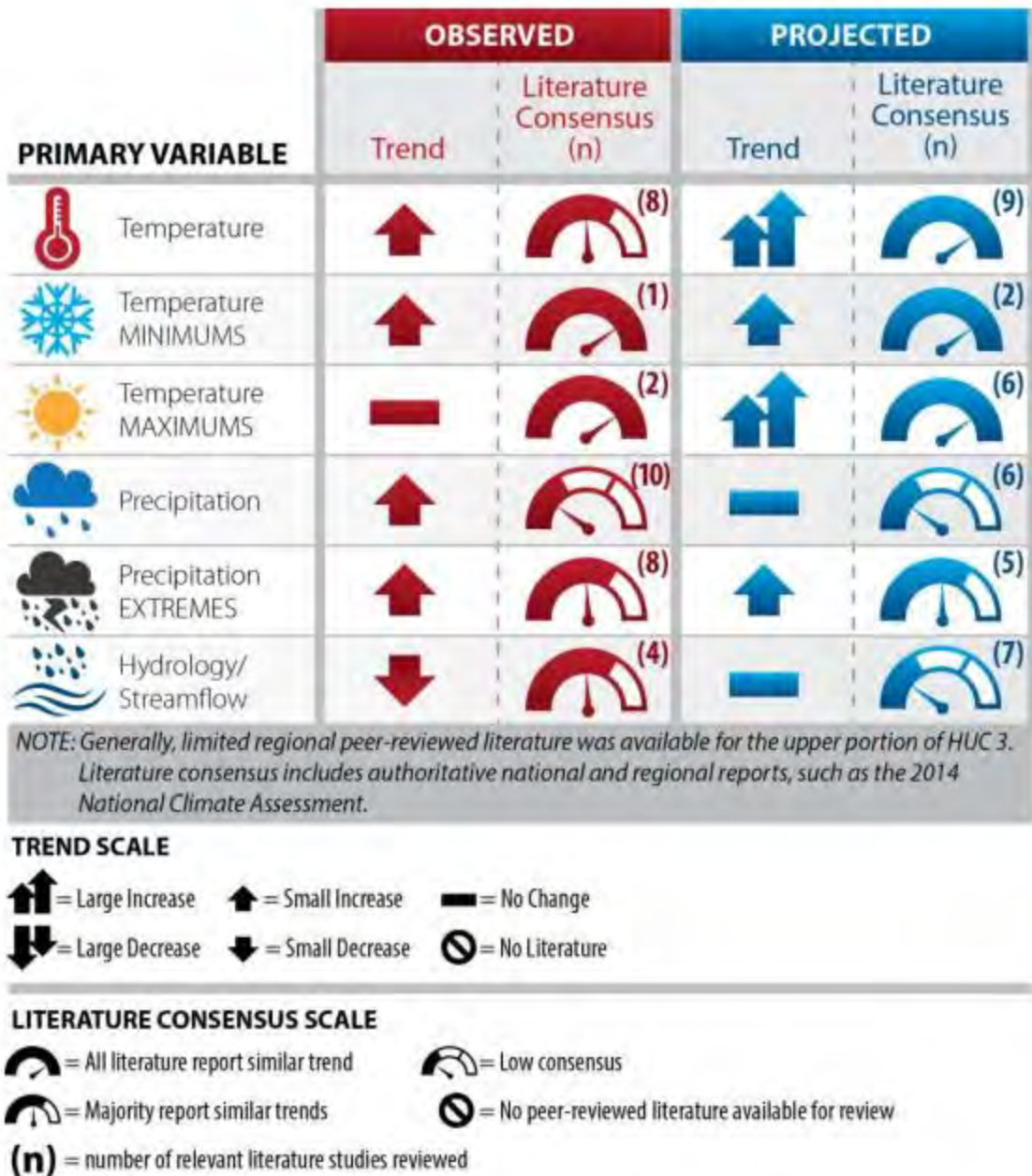


Figure 1. Summary matrix of observed and projected climate trends.

## 2 Vulnerability Assessment

With the knowledge that climate information and understanding is constantly evolving, USACE has developed the USACE Screening-Level Climate Vulnerability Assessment at the Watershed-Scale. The preliminary, screening-level nationwide analysis is built on existing, national-level tools and data that include indicators or processes to identify vulnerabilities in watersheds with respect to climate change. The USACE Watershed Climate Vulnerability Assessment (VA) Tool facilitates screening-level analysis of vulnerabilities of a given business line and HUC-4 watershed to the impacts of climate change, relative to the other continental United States HUC-4 watersheds. It uses the Coupled Model Intercomparison Project (CMIP5) GCM-BCSD-VIC dataset (2014) to

define projected hydrometeorological inputs, combined with other data types, to define a series of indicator variables to define a vulnerability score. Vulnerabilities are represented by a weighted order weighted average (WOWA) score generated for two subsets of simulations (Wet - top 50% of cumulative runoff projections; and Dry - bottom 50% of cumulative runoff projections). Data are available for three epochs, the current epoch (Base), and two future 30-year epochs (centered on 2050 and 2085).

The VA Tool was used to examine the future navigation and flood risk reduction-related vulnerabilities of the project area in the Neuse-Pamlico watershed. For the Neuse-Pamlico watershed (HUC 0302), this tool also shows that the area is projected to be relatively less vulnerable compared to the entirety of the USACE portfolio with respect to navigation and flood risk reduction business lines. While there is an increase in the WOWA scores between year 2050 and year 2085 for both the Dry and Wet scenarios (63.659 to 66.065 for Dry and 63.160 to 66.471 for Wet, respectively), the future increases still do not exceed the threshold for inclusion among the 20% most vulnerable HUC-4 watersheds represented by the navigation business line. For the flood risk reduction business line, which also does not exceed the threshold for inclusion among the 20% most vulnerable HUC-4 watersheds, there is also an increase in the WOWA scores between year 2050 and 2085 for both the Dry and Wet scenarios (45.129 to 47.590 for Dry and 48.158 to 51.991 for Wet, respectively).

The three largest indicators of vulnerability for the navigation business line in the Neuse-Pamlico watershed are low flow reduction, cumulative 90 percent exceedance, and flood magnification, except for the 2085 Wet scenario for the Neuse-Pamlico where sediment contributes more than low flow reduction. Low flow reduction is classified as the change in low flow, or the ratio of the runoff exceeded 90% of the time in the scenario to the base period. Low flow reduction contributes 18.95% of the vulnerability for the 2050 Dry scenario, 19.77% of the vulnerability for the 2085 Dry scenario, 10.18% of the vulnerability for the 2050 Wet scenario, and 7.70% of the vulnerability for the 2085 Wet Scenario. Cumulative 90 percent exceedance is the monthly runoff flow that is exceeded 90% of the time, include upstream freshwater inputs. Cumulative 90 percent exceedance contributes 13.82% of the vulnerability for the 2050 Dry scenario, 13.73% of the vulnerability for the 2085 Dry scenario, 13.17% of the vulnerability for the 2050 Wet scenario, and 10.35% of the vulnerability for the 2085 Wet scenario. Flood magnification is the change in flood runoff, or the ratio of the flow exceeded 10% of the time for the scenario to the base period. Flood magnification contributes 10.74% of the vulnerability for the 2050 Dry scenario, 10.55% of the vulnerability for the 2085 Dry scenario, 18.73% of the vulnerability for the 2050 Wet scenario, and 20.46% of the vulnerability for the 2085 Wet scenario. Sediment is the ratio in the change of sediment load for the scenario to the present load. It contributes 7.84% of the vulnerability for the 2050 Wet scenario and 14.25% of the vulnerability for the 2085 Wet scenario.

The three largest indicators of vulnerability for the flood risk reduction business line for the Neuse-Pamlico watersheds are the cumulative flood magnification, the urban 500 year floodplain, and the local flood magnification. Cumulative flood magnification is the change in flood runoff, or the ratio of the monthly runoff flow exceeded 10% of the time for

the sicario compared to the base period including upstream freshwater flows. Cumulative flood magnification contributes 20.37% of the vulnerability for the 2050 Dry scenario, 13.36% of the vulnerability for the 2085 Dry scenario, 22.60 % of the vulnerability for the 2050 Wet scenario, and 24.53% of the vulnerability for the 2085 Wet scenario. The urban 500 year floodplain is the acreage of urban landcover within the 500 year floodplain. Urban 500 year floodplain contributes 12.64% of the vulnerability for the 2050 Dry scenario, 21.67% of the vulnerability for the 2085 Dry scenario, 12.64% of the vulnerability for the 2050 Wet scenario, and 14.02% of the vulnerability for the 2085 Wet Scenario. Local flood magnification is the change in flood runoff, or the ratio of the monthly runoff flow exceeded 10% of the time for the sicario compared to the base period without upstream freshwater flows. Local flood magnification contributes 6.69% of the vulnerability for the 2050 Dry scenario, 6.75% of the vulnerability for the 2085 Dry scenario, 7.42% of the vulnerability for the 2050 Wet scenario, and 8.05% of the vulnerability for the 2085 Wet scenario.

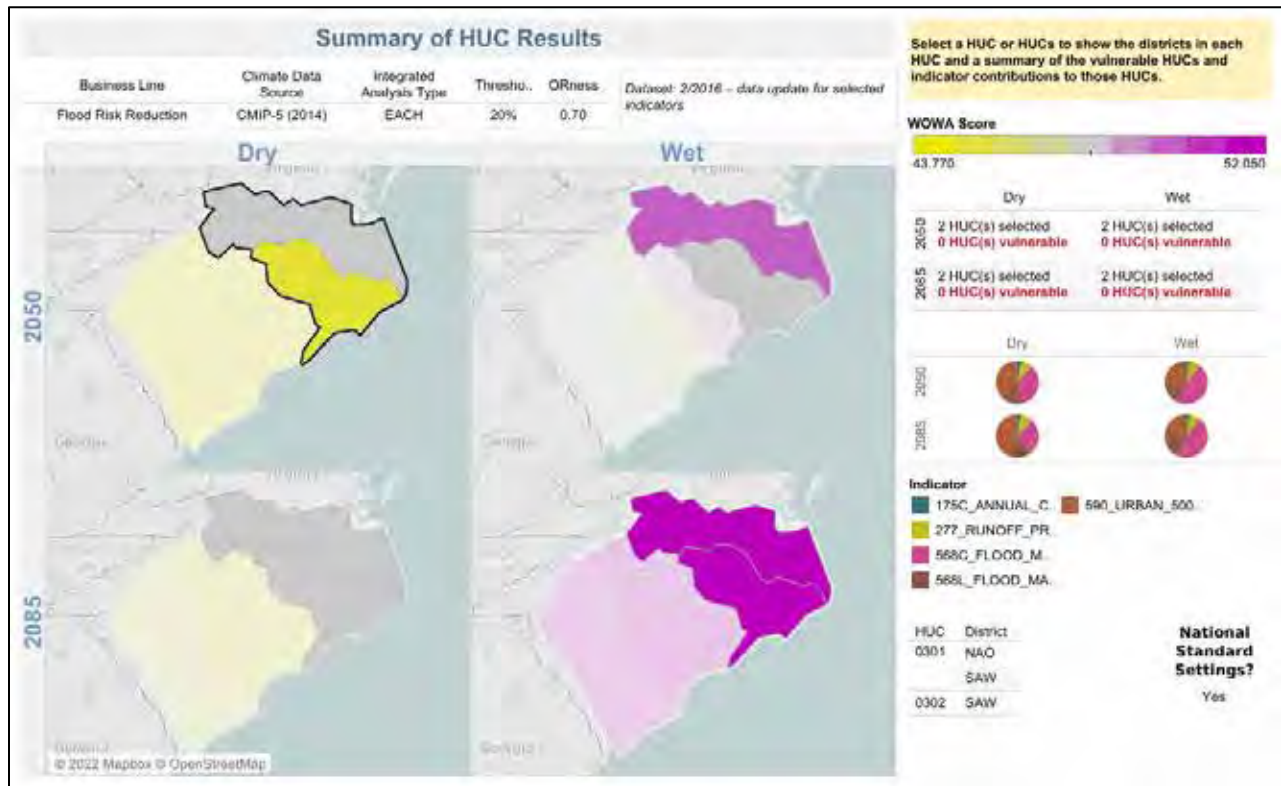


Figure 2. Projected Vulnerability for Chowan-Roanoke and Neuse-Pamlico Watersheds with respect to Flood Risk Reduction.

While the VA tool identifies watersheds that may or may not be relatively vulnerable, it may not be appropriate to cascade those results to the project by default, because projects exist at finer spatial scales than the HUC-4 watersheds. To give a fuller picture of the potential vulnerabilities at this project, additional tools were employed to assess conditions by investigating other data and projections.

### **3 Climate Hydrology Assessment Tool**

The USACE Climate Hydrology Assessment Tool (CHAT) was used to examine modeled, hindcast and projected trends in Upper Roanoke watershed hydrology to support the assessment, based on analysis of 32 general circulation model and 2 future emissions scenarios (representative concentration pathway) through the year 2099. The CHAT uses CMIP5-based simulations of hydrology and climatology, incorporating future projections of greenhouse gas emissions statistically downscaled using the Localized Constructed Analogs (LOCA) method. The CHAT compares a simulated hindcast period (1951-2005) to a simulated future period (2006-2099) of an unregulated basin condition using two different future emission scenarios (RCP 4.5 and RCP 8.5). The hindcast period simulation (1951-2005) assume greenhouse gas emissions to be equivalent to a reconstruction of historically observed greenhouse gas emission levels. The RCP 4.5 scenario represents a rising radiative forcing pathway stabilizing at  $4.5 \text{ W/m}^2$  before 2100 and the RCP 8.5 scenario represents a rising radiative forcing pathway leading to  $8.5 \text{ W/m}^2$  before 2100. Radiative forcing expresses the change in energy in the atmosphere due to greenhouse gas emissions. For projected annual maximum monthly mean streamflows, the CHAT displays the results derived using two future RCP scenarios in one plot. Simulation data is available at the HUC-8 scale. The project area is within HUC 03020106 Bogue-Core Sounds. With the project location on the barrier islands, there is no streamflow, however the project area is still vulnerable to other changing climate variables, such as temperature and precipitation.

Simulated annual accumulated precipitation (Figure 3) has a not statistically significant increasing trend of 0.0208 in/year for the simulated hindcast period for the Bogue-Core Sounds watershed. Under the simulated future period with the RCP 4.5 scenario there is a statistically significant increasing trend of 0.0191 in/year. Under the simulated future period with the RCP 8.5 scenario there is a statically significant increasing trend of 0.0183 in/year.

Simulated historical annual mean temperatures (Figure 4) have a statistically significant trend of 0.0269 degF/year. For the simulated future period under the RCP 4.5 scenario there is a statistically significant increasing trend of 0.0397 degF/year. For the simulated future period under the RCP 8.5 scenario there is a statistically significant increasing trend of 0.0849 degF/year.

Simulated annual maximum temperatures (Figure 5) have a statistically significant trend of 0.0272 degF/year. For the simulated future period under the RCP 4.5 scenario there is a statistically significant trend of 0.0384 degF/year. For the simulated future period under the RCP 8.5 scenario there is a statistically significant increasing trend of 0.0915 degF/year.

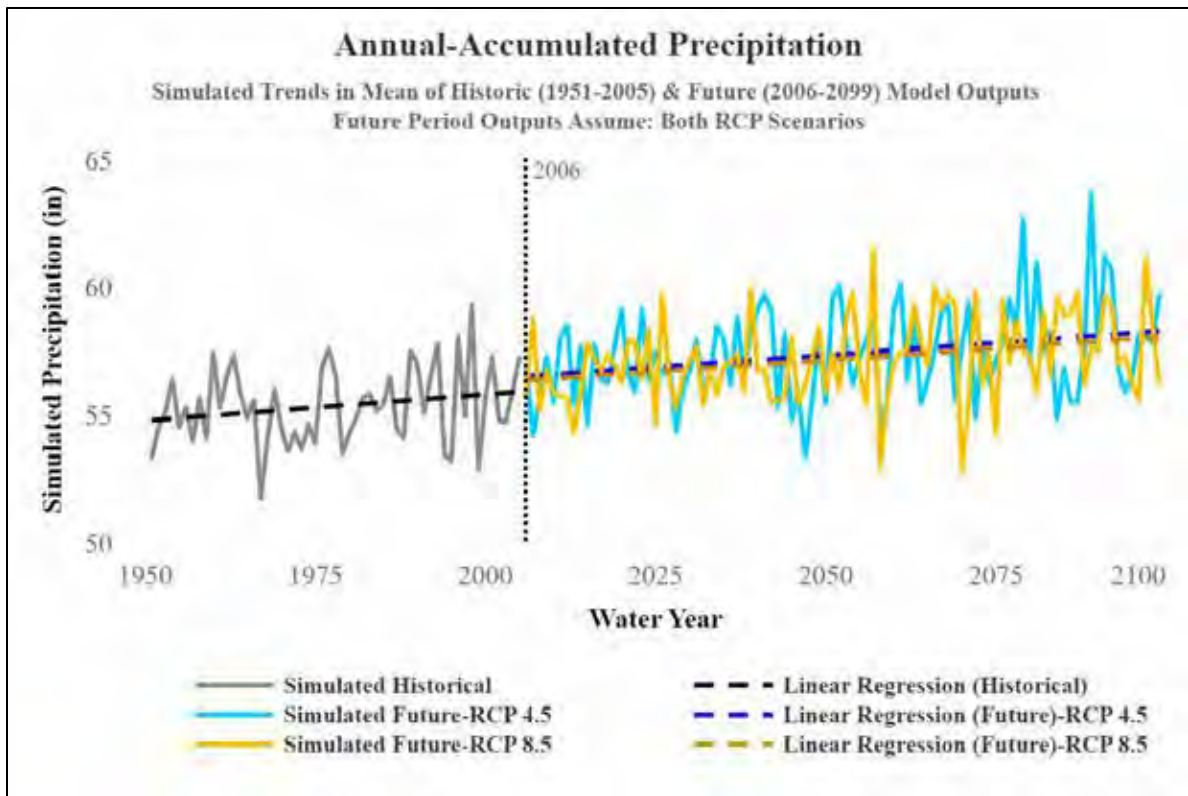


Figure 3. Trends in Projected Annual Accumulated Precipitation for the Bogue-Core Sounds Watershed.

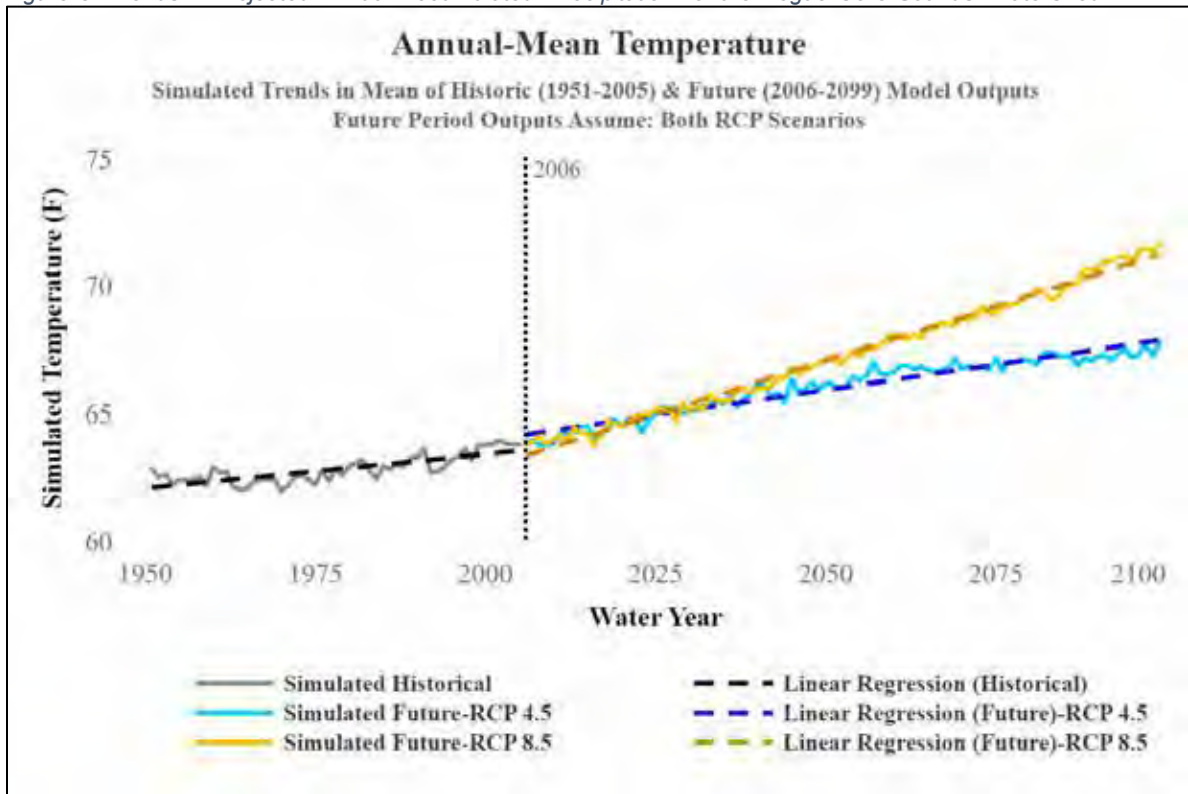


Figure 4. Trends in Projected Annual Mean Temperature for the Bogue-Core Sounds Watershed.

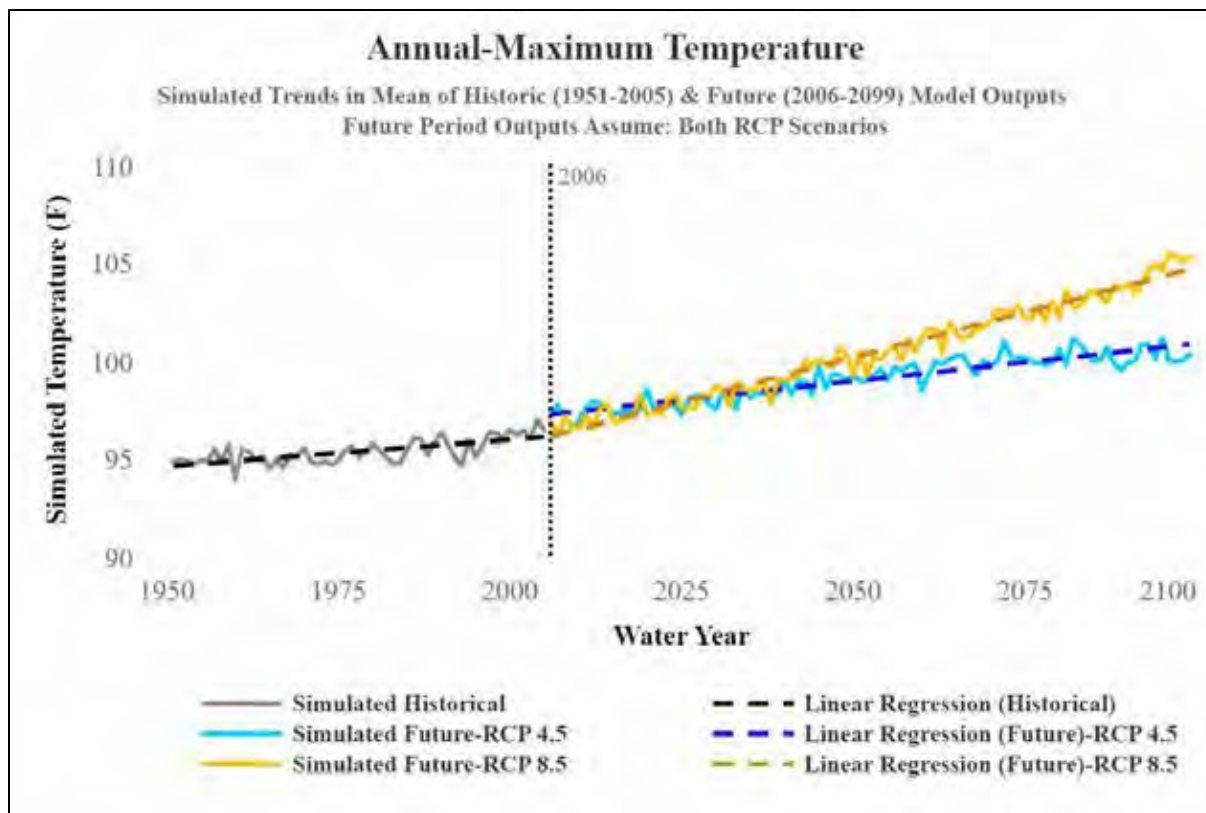


Figure 5. Trends in Projected Annual Maximum Temperature for the Bogue-Core Sounds Watershed.

#### 4 Sea Level Change

ER 1100-2-8162 and ETL 1100-2-1 require that the direct and indirect physical effects of projected future sea level change be considered across the project life cycle in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects. Potential relative sea level change (RSLC) must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence, which is clarified in ECB 2018-14 as projects with elevations less than or equal to 50 ft NAVD88 where sea level rise could affect the river stage by lowering or raising river levels. The Backsound to Lookout Bight navigation channel and the proposed placement sites are lower than 50 ft NAVD88, and within an area that will be affected by future sea level change.

Global (eustatic) sea level change is often caused by the global change in the volume of water in the world's oceans. Global sea level, referred to as global mean sea level, is the overage height of all the world's oceans. Relative sea level change is the local change in the sea level relative to the elevation of the land at a specific point on the coast. RSLC is a combination of global SLC, changes in local estuarine and shelf hydrodynamics, regional oceanographic circulation patterns, river flow, and local vertical land motion (subsidence or uplift).

Within the USACE Sea Level Tracker the closest gauge the Beaufort Duke Marine Lab station which has a complete record from 1977-present. Datum summary for the Beaufort Duke Marine Lab gauges relative to NAVD88 are shown in Figure 7.

At the Beaufort Duke Marine Lab gauge, the most recent RSLC shows an increase of 3.36 mm/year (Figure 8). Figure 9 shows the historical RSLC trends, which have been increasing through time with the 95% confidence limits narrowing.

The USACE Sea Level Tracker allows users to compare RSLC trends with USACE SLC scenarios (low, intermediate, and high). These SLC scenarios are calculated using National Research Council (NRC) curves and equations and are corrected for the local rate of vertical land movement as laid out in ER 1100-2-8162. Figure 10 shows the SLC scenarios for the Beaufort Duke Marine Lab station from 1986-2072. At the end of the 50 year future timeframe the low SLC scenario estimates 0.286 ft of sea level rise, the intermediate SLC scenario estimates 0.86 ft of sea level rise, and the high SLC scenario estimates 2.677 ft of sea level rise.



Figure 6. NOAA tidal station location.

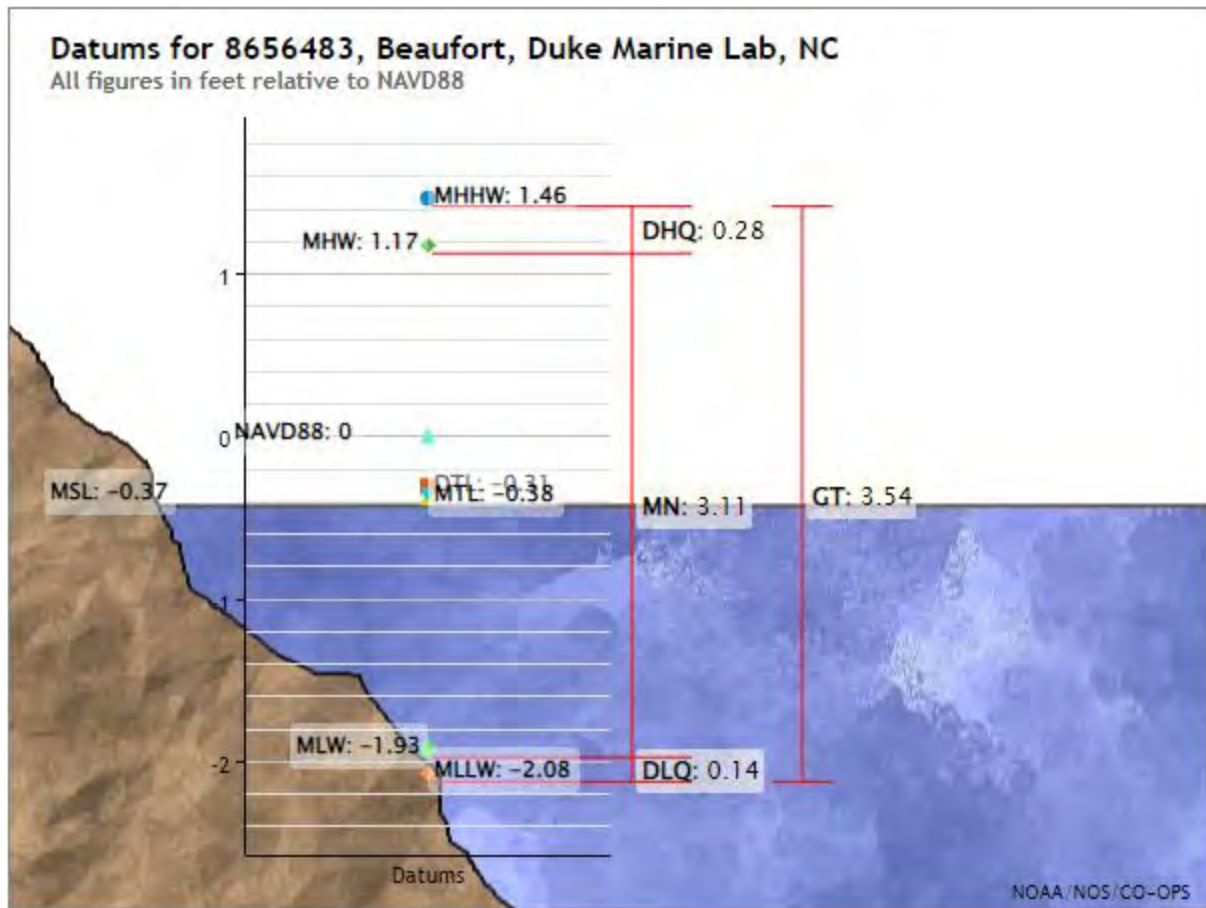


Figure 7. Beaufort Duke Marine lab gauge datum in reference to NAVD88.

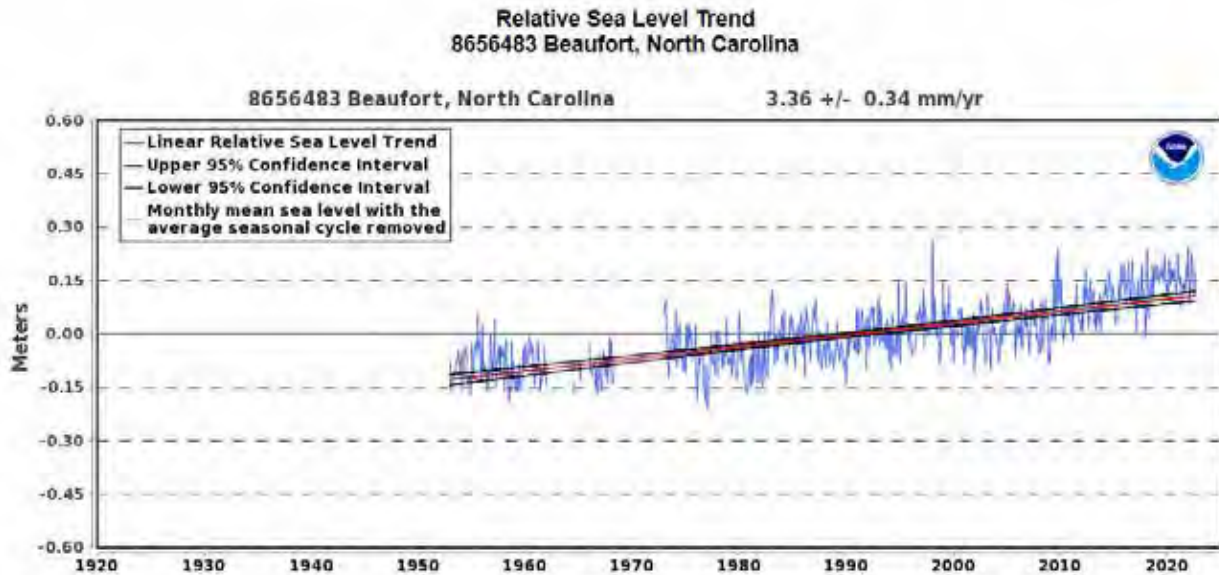


Figure 8. Beaufort Duke Marine Lab gauge RSLC.



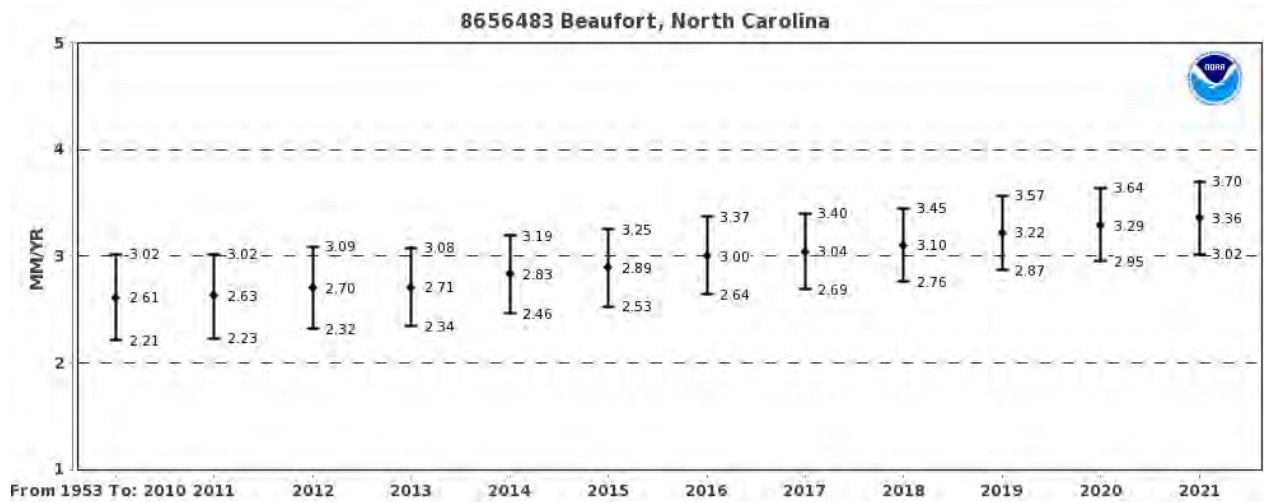


Figure 9. Historical linear SLC rates for the Beaufort Duke Marine Lab gauge.

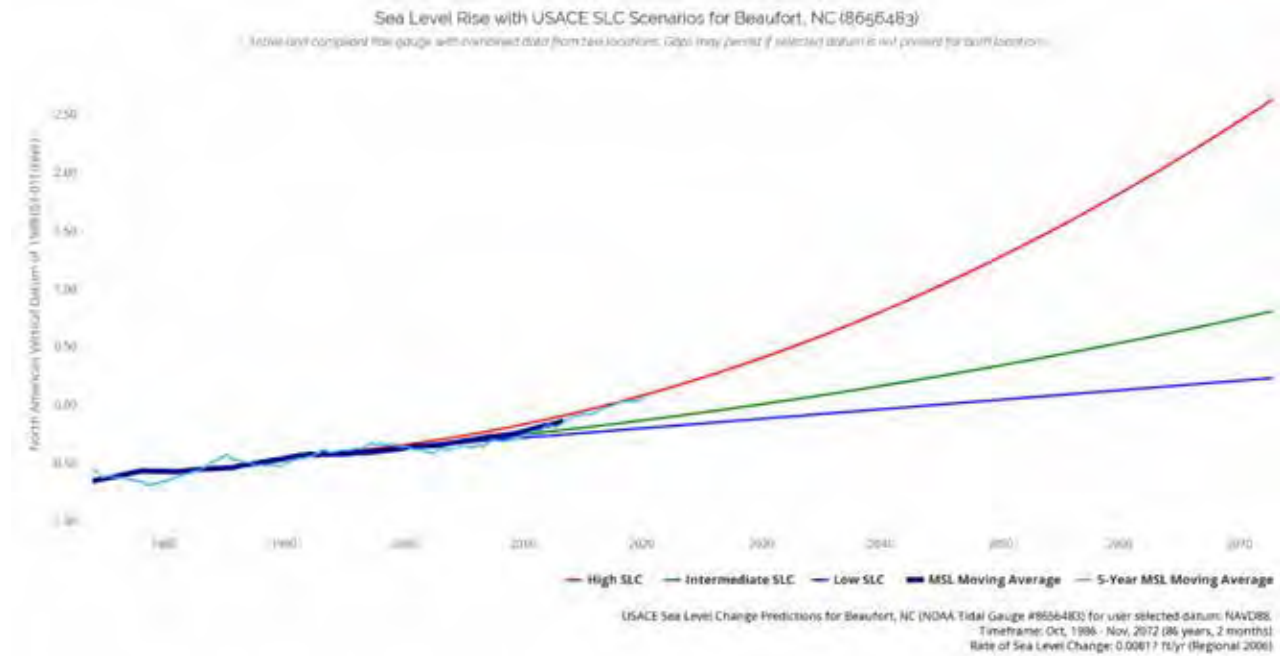


Figure 10. SLC scenarios for the Beaufort Duke Marine Lab gauge.

## 5 Conclusion

Dredging within the Backsound to Lookout Bight channel efforts are needed to restore navigation channels. The dredged material in this area is suitable for beach placement and can be used to restore wildlife habitat islands.

In the literature reviewed, temperatures are forecasted to increase in the future with more extreme rain events; however, there is less consensus on future annual precipitation totals. The changing climate is projected to lead to more extreme drought events.

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

An analysis of watershed climate vulnerability using the USACE VA Tool shows the area to be relatively less vulnerable for the navigation and flood risk reduction business lines compared to the entire USACE portfolio. The variables used to compute the watershed vulnerability score for the navigation business line include increased low flow reduction, decreased cumulative 90% exceedance flows, increased cumulative flood magnification, and increased sedimentation. The variables used to compute the watershed vulnerability for the flood risk reduction business line include increased cumulative flood magnification, changes to percentage of urban area in the 500 year floodplain, and increased local flood magnification.

The potential for an increase in extreme drought events coupled with increased extreme rain events could lead to more sedimentation within the Backsound to Lookout Bight channel, leading to the need for more frequent dredging. The more frequent dredge events could lead to the placement sites reaching capacity sooner than they would at current sedimentation rates.

Increasing sea level trends have been observed at the Beaufort Duke Marine Lab station. Over the next 50 years the sea level is expected to rise up to 2.67 feet.

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# **APPENDIX G**

## **EA MAILING LIST**

### **CHANNELS FROM BACK SOUND TO LOOKOUT BIGHT**

**SEPTEMBER 2023**



Prepared by:

Environmental Resources Section  
U.S. Army Corps of Engineers, Wilmington District

<b>BACK SOUND TO LOOKOUT BIGHT EA EMAIL LISTING</b>		
<b>Line No.</b>	<b>Organization / Title</b>	<b>POC Name</b>
<b>ELECTED OFFICIALS</b>		
01	U.S. Senator	Ted Budd
02	U.S. Senator	Thom Tillis
03	U.S. Representative	Gregory Murphy
04	N.C. Senator (District 1)	Norman Sanderson
05	N.C. Representative (District 13)	Celeste Cairns
<b>NON-PROFIT ORGANIZATIONS</b>		
6	Audubon, North Carolina	Lindsay Addison
7	N.C. Coastal Federation	Kerri Allen
8	N.C. Coastal Federation	Ana Zivanovic-Nenadovic
9	N.C. Wildlife Federation	Manley Fuller
<b>RESOURCE AGENCIES</b>		
10	Atlantic States Marine Fisheries Commission	Toni Kerns
11	Environmental Protection Agency (EPA)	Ntale Kajumba
12	N.C. Division of Coastal Management (NCDCM)	Braxton Davis
13	N.C. Division of Coastal Management (NCDCM)	Daniel Govoni
14	N.C. Division of Marine Fisheries (NCDMF)	Anne Deaton
15	N.C. Division of Marine Fisheries (NCDMF)	Jimmy Harrison
16	N.C. Division of Water Resources (NCDWR)	Stephanie Goss
17	N.C. Wildlife Resources Commission (NCWRC)	Maria Dunn
18	National Marine Fisheries Service (NMFS)	Andy Herndon
19	National Marine Fisheries Service (NMFS)	Pace Wilber
20	National Marine Fisheries Service (NMFS)	Fritz Rohde
21	National Marine Fisheries Service (NMFS)	Twyla Cheatwood
22	National Park Service, CALO	Jeff West
23	N.C. State Clearinghouse	Crystal Best
24	N.C. State Historical Preservation Officer	Renee Gledhill-Earley
25	N.C. State Historical Arch	Chris Southerly
26	N.C. State Historical Arch	Stephen Atkinson
27	U.S. Fish and Wildlife Service (USFWS)	Pete Benjamin
28	U.S. Fish and Wildlife Service (USFWS)	John Ellis
29	U.S. Fish and Wildlife Service (USFWS)	Kathy Matthews
30	USACE, Wilmington Regulatory	Mickey Sugg
31	USACE, Wilmington Regulatory	Emily Hughes
<b>OTHER</b>		
32	U.S. Coast Guard	Greg Kennerley
33	U.S. Coast Guard	Paul Bertram
34	Carteret County	Tommy Burns
35	Carteret County	Nick Wilson
36	Carteret County	Ryan Davenport
37	Crystal Coast Tourism Bureau	Jim Browder
38	Tourism Development Authority	Trace Cooper

## **APPENDIX H**

### **PUBLIC AND AGENCY COMMENTS AND RESPONSES**

**Channel from Back Sound to Lookout Bight  
Maintenance of U.S. Army Corps of Engineers and U.S.  
National Park Service Navigation Channels**

**Carteret County, North Carolina**

**SEPTEMBER 2023**



Prepared by:

Environmental Resources Section

U.S. Army Corps of Engineers, Wilmington District



**APPENDIX H**

**PUBLIC AND AGENCY COMMENTS AND RESPONSES**

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- d. National Park Service, Cape Lookout National Seashore

**2. Comments Received from State Agencies**

- a. NC Wildlife Resources Commission
- b. NC Department of Agriculture & Consumer Services
- c. NC Department of Environmental Quality, Division of Environmental Assistance & Customer Service
- d. NC Department of Transportation
- e. NC Department of Public Safety, Division of Emergency Management
- f. NC Department of Natural and Cultural Resources, State Historic Preservation Office

**3. Comments Received from Individuals, Associations and Organizations**

- a. Carteret County, Shore Protection Office

## 1. FEDERAL AGENCIES

### a. Environmental Protection Agency (EPA), May 12, 2023

Comment #1: The EPA appreciates the opportunity to review and provide comments on the draft Environmental Assessment for the proposed Maintenance Dredging of the Back Sound to Lookout Bight Project, Carteret County, North Carolina. The EPA has not identified any significant environmental impacts from the proposed action that would require substantive changes to the draft EA or require consideration of other alternatives for navigational improvements.

USACE Response: Noted; thank you very much for your review.

### b. U.S. Fish and Wildlife Service (USFWS), May 19, 2023

Comment #1: Page 59, Table 4: *Federally Listed Threatened & Endangered Species (aquatic and terrestrial) located in the vicinity of the project area*. For red knot, recommend adding “*proposed critical habitat*” in the Species column.

USACE Response: Concur; changes were made to Table 4 as applicable.

Comment #2: Page 63, *Environmental Consequences – Threatened and Endangered Species, Alternative 2 – Full Corridor*, 2<sup>nd</sup> paragraph: Recommend changing, “*It may impact the constituent elements for piping plover nesting and wintering habitat.*” to “*It may have impacts on the physical and biological features for piping plover and red knot wintering and migration habitat.*”

USACE Response: Concur; “*It may have impacts on the physical and biological features for piping plover and red knot wintering and migration habitat.*” was added to Alternative 2, 2<sup>nd</sup> paragraph.

Comment #3: Under *Section 6.0 Cumulative Effects, Alternatives 2 and 3 (full and partial project corridors)*, Page 80, first paragraph, starting with the third sentence: Change, “*Minor and temporary disturbance in placement areas during colder months where birds are roosting and foraging will only have minor effects, as these species can vacate the area as needed and find alternate places to roost and forage in the area. Still, the effects determination on piping plover and red knot given by USFWS is may affect, likely to adversely affect, due to alterations of habitat that occur from beach placement activities.*” to “*Minor and temporary disturbance in placement areas during colder months where birds are roosting and foraging will be limited specifically to those discrete locations. This activity may have some impacts on distribution of pre-existing sites that contain the physical and biological features that benefit wintering/migrating piping plover and red knot. In the sand placement areas, piping plovers and red knot individuals may be forced to expend valuable energy reserves to seek available habitat elsewhere. For this reason, we have determined*”

*that the proposed action may affect, and is likely to adversely affect, these species due to alterations of habitat that occur from beach placement activities.”*

USACE Response: Concur; the following information was added to Section 6.0 *Cumulative Effects, Alternatives 2 and 3 (full and partial project corridors)*, third paragraph, starting with the third sentence: *“Minor and temporary disturbance in placement areas during colder months, where birds are roosting and foraging, will be limited specifically to those discrete locations. This activity may have some impacts on distribution of pre-existing sites that contain the physical and biological features that benefit wintering/migrating piping plover and red knot. In the sand placement areas, piping plovers and red knot individuals may be forced to expend valuable energy reserves seeking available habitat elsewhere. For this reason, USACE has determined that the proposed action may affect, and is likely to adversely affect, these species due to alterations of habitat that occur from beach placement activities.”*

Comment #4: Under Section 7.4 *Endangered Species Act*, Page 84, second paragraph: The first sentence states, *“The SPBO lays out the terms and conditions and conservation recommendations for beach placement activities for the protection of sea turtles, manatee, piping plover, red knot and seabeach amaranth.”* The USFWS suggests the use of this sentence, *“The SPBO adopts the Conservation Measures pledged by the USACE for minimizing impacts to federally listed species and lays out the Reasonable and Prudent Measures for beach placement activities for the protection of sea turtles, manatee, piping plover, red knot, and seabeach amaranth.”*

USACE Response: Concur; *“The SPBO adopts the Conservation Measures agreed to by USACE for minimizing impacts to federally listed species and lays out the Reasonable and Prudent Measures for beach placement activities for the protection of sea turtles, manatee, piping plover, red knot, and seabeach amaranth.”* was added to Section 7.4 *Endangered Species Act*, second paragraph, first sentence.

Comment #5: Under Section 7.4 *Endangered Species Act*, Page 84, second paragraph, second sentence: *“This BO is expected to be updated for Red Knot Critical Habitat in the near future.”* The USFWS recommends the following to be more accurate: *“This BO is expected to be updated for Red Knot once a final rule is published that designates Critical Habitat for the species.”*

USACE Response: Concur; *“This BO is expected to be updated for Red Knot once a final rule is published that designates Critical Habitat for the species.”* was added to Section 7.4 *Endangered Species Act*, second paragraph, second sentence.

Comment #6: We appreciate the EAs statements on West Indian manatee and adherence to the Service’s guidance for avoiding impacts to this species.

USACE Response: Noted; thank you very much for your review.

**c. National Marine Fisheries Service – Habitat Conservation Division, June 7, 2023**

Comment #1: Since the Back Sound to Lookout Bight project is not funded by a special source, such as BIL/IIJA, IRA or other special funding sources, NMFS-HCD will not be providing EFH comments on the EA due to insufficient staff. Please continue to include NMFS-HCD in meetings about the project. If we are able to attend, we may comment informally.

USACE Response: Noted; USACE will continue to include NMFS-HCD in any relevant meetings regarding the proposed project in the future. Thank you very much for your comment.

**d. National Park Service, Cape Lookout National Seashore, April 19, 2023**

Comment #1: After initial dredge and spoil placement on Sandbag Island NCWRC, it is important to have the option to place dredge spoil in a similar fashion to the NPS Morgan Island during future dredge operations and/or if there is an over abundance of dredge material in the northwest section of the channel in the initial year. This would help slow the erosion of Morgan Island and maintain bird nesting habitat.

USACE Response: The inclusion of Morgan Island as a possible dredged material placement site has been added to the final EA. During project scoping, the use of Morgan Island as a placement site for dredged material was not supported by the USFWS due to existing bird nesting habitat on the island. However, USACE would consider placing dredged material on Morgan Island in the future should a need arise due to erosion of the island, the amount of material to be dredged, available funding, and the lack of a need to place dredged material on Sandbag Island.

## **2. STATE AGENCIES**

**a. North Carolina Wildlife Resources Commission (NCWRC), May 19, 2023**

Comment #1: Submerged aquatic vegetation (SAV) surveys and ground truthing exercises should be done to determine avoidance, minimization, and/or impacts to SAV resources.

USACE Response: USACE has committed to identifying SAV in the project area utilizing the State's online database and the most up-to-date aerial imagery prior to each dredging event. Ground truth surveys could be conducted on an as needed basis depending on the frequency of maintenance dredging.

Comment #2: The Draft EA details dredging and material management for maintenance, not just a one-time event. While Morgan Island at this time does not need material placement for waterbird management, future placement of material

may benefit the island. Therefore, inclusion of Morgan Island as a potential placement area is requested. Material placement would be done in a manner to enhance habitat benefits and should be coordinated with the NPS and NCWRC to determine need and placement of material. Disturbance to the island would be limited (to) outside the marsh and areas of the island with shrubs and trees that provide heron and egret nesting opportunities.

USACE Response: Morgan Island has been included in the final EA as a potential future dredged material placement option. The use of Morgan Island for dredged material placement was suggested by the NPS as well. While Morgan Island would not be utilized for the initial dredging event, its use would be considered for future dredging events when material is needed on the island to enhance bird nesting habitat, the amount of material to be dredged, and available funds. Any placement of dredged material on Morgan Island would be coordinated with the USFWS, NCWRC, and NPS to identify needed placement areas and to protect those areas utilized as habitat at the time of placement, as well as wetland and SAV habitats. Additionally, placement on Morgan Island would require a federal consistency concurrence, which would be obtained prior to any placement of material on Morgan Island.

Comment #3: The Draft EA is a management plan that presents several dredge and disposal needs and options. One option is material placement on the oceanfront shoreline of South Core Banks. While this is an option to be considered, the NCWRC prefers material be placed on Sandbag or Morgan Islands for waterbird habitat management rather than ocean shoreline placement.

USACE Response: The USACE recognizes NCWRCs recommendation to place as much dredged material on both Sandbag and Morgan Islands to enhance bird nesting habitat. The USACE has committed to placing dredged material from the Back Sound federal navigation channel via pipeline dredging on Sandbag Island for the original dredging event, and on an as needed basis in the future, depending on the amount of material to be dredged and available funding. The inclusion of Morgan Island as a placement option was not considered in the Draft EA as both the USFWS and NCWRC had expressed concerns regarding the use of the island during project scoping. However, both agencies have since stated that the use of Morgan Island for dredged material placement in the future would be beneficial should the island need enhancement, and use of Morgan Island has been added to the final EA. Placement of all dredged material from the Back Sound channel, Lookout Bight, and two NPS channels, is not feasible due to the distance from dredging areas and an agreement with NPS to place material on adjacent park beaches. Beach placement, specifically soundside placement, is necessary to protect park infrastructure and historic structures. Oceanside beach placement would only occur should the soundside beach not be able to accept any further dredged material. Interim dredging using Government plant would not allow for the placement of dredged material on either bird island, due to the type of dredge used, either sidescaper or special purpose hopper.

Comment #4: The NCWRC is concerned with the use of sandbags and geo-tubes on the islands. Sandbags from previous placements are still evident as they are not covered with sand. It is unlikely from the length of time between placement events that sand placed over the bags will remain. The Draft EA also includes instruction that the casing for the geo-tubes may be cut to expose sand, but removal of the casing would be difficult. Therefore, because of the long-term presence of sandbag and geo-tube material, the hardening of the shore, and removal of habitat opportunities from uncovered sandbags, the NCWRC prefers sandbags and geo-tubes not be used on islands managed for waterbirds.

USACE Response: The USACE has determined that a structural solution, either alone or in combination, would be necessary to protect SAV beds to the south-southwest of Sandbag Island. The USACE has coordinated the placement of dredged material on Sandbag Island with several agencies, including NCWRC, NMFS-HCD, and NC Division of Marine Fisheries (NCDMF). A June 7, 2023, meeting between USACE and these agencies noted that the use of geo-tubes was the best way to control the fine-grained sand that would be placed on Sandbag Island. Without use of a structural solution, the dredged material would smother adjacent SAV beds to the south-southwest of the island. The selected option, a synthetic geo-tube perimeter around the restored island, is the least damaging practicable alternative, will provide the needed protection to adjacent resources, and is the most economical.

Comment #5: The Draft EA suggests coastal wetlands, specifically *Spartina spp.* sprigs, be planted along the eastern perimeter of Sandbag Island. While this may be a good habitat enhancement option for aquatic resources, the presence of marsh may remove nesting and foraging habitat for some species of waterbirds that use the island. Therefore, prior to any wetland designs or plantings, we request consultation with our agency and the NPS to determine appropriate wetland grass species, design, and density to not adversely impact waterbird use.

USACE Response: The planting of *Spartina spp.* sprigs along the eastern perimeter of Sandbag Island was a suggestion to reduce future erosion. The USACE has not committed to planting of any vegetation on Sandbag Island as natural vegetation of the island would occur over time. However, should the planting of marsh grass sprigs be needed, USACE would coordinate with both the NCWRC and NPS regarding appropriate species, design, density, and placement areas.

Comment #6: Numerous species of migratory waterbirds present in the area were not listed within Appendix D.

USACE Response: Appendix D includes a list of federally listed and Migratory Bird Treaty Act species generated from the USFWS' Information for Planning and Consultation (IPaC) website. From the IPaC website Frequently Asked Questions, it states that the Migratory Bird Resource List is comprised of USFWS Birds of

Conservation Concern and other species that may warrant special attention in a project location. The migratory bird list generated by IPaC is derived from data provided by the Avian Knowledge Network. This Network data is queried and filtered to develop a list of those birds reported as occurring in a 10-kilometer grid cell that intersects the project area, and which have been identified as warranting special attention because they are a Bird of Conservation Concern species in that area, an eagle, or a species that has a vulnerability to offshore activities or development. The migratory bird list includes only a subset of birds that may occur in any particular project area, it is not representative of all birds that could occur.

Comment #7: Several waterbird breeding season dates listed within the Draft EA may be slightly different than actual within the Cape Lookout National Seashore.

USACE Response: The USACE acknowledges NCWRCs comment regarding differing breeding seasons than what is listed in Appendix D. The breeding season dates listed were generated by USFWS' IPaC website. The list generated by IPaC notes that the breeding season for each species is a "very liberal estimate of the time-frame inside which the bird breeds across its entire range"; therefore, it is not necessarily indicative of any specific species at the exact project location.

Comment #8: The NCWRC is not aware of Atlantic puffins breeding in North Carolina.

USACE Response: The USACE acknowledges that the Atlantic puffin is most likely not found in the project area; however, similar to USACEs response to comment #6, the Atlantic puffin was included in USFWS' IPaC migratory bird species list. It is included in the IPaC list due to potential susceptibilities in offshore areas from certain types of development or activities.

Comment #9: Roseate terns have been reported in the area and should be included as a species that may be found in the project area.

USACE Response: In a conversation with the USFWS on May 31, 2023, the roseate tern is considered transient in the area, and a determination that the project may affect, but is not likely to adversely affect, the species would be appropriate. This determination would be based on the lack of suitable nesting habitat in the project area and adherence to the environmental window for dredged material placement to protect nesting birds. The presence of the roseate tern within the project area has been noted in Table 4, as has the determination of proposed project impacts on the species, in Section 5.8 *Endangered and Threatened Species, Environmental Consequences – Threatened and Endangered Species*.

Comment #10: Overall, the NCWRC appreciates the information and detail presented in the Draft EA for Back Sound and Lookout Bight. We strongly encourage continued communication with our agency and the NPS with regard to material management activities that may affect and improve waterbird habitats. This

may include material composition, placement area, volumes, and seasonal activity restriction.

USACE Response: Noted; USACE will continue to work with NCWRC on bird island placement of dredged material.

**b. NC Department of Agriculture and Consumer Services, May 19, 2023**

Comment #1: No comment.

USACE Response: Noted; thank you for your review.

**c. NCDEQ, Division of Environmental Assistance & Customer Service, May 19, 2023**

Comment #1: No comment.

USACE Response: Noted; thank you very much for your review.

**d. NC Department of Transportation, May 19, 2023**

Comment #1: No comment.

USACE Response: Noted; thank you very much for your review.

**e. NC Department of Public Safety, Division of Emergency Management, May 19, 2023**

Comment #1: No comment.

USACE Response: Noted; thank you very much for your review.

**f. NC Department of Natural and Cultural Resources, State Historic Preservation Office, May 4, 2023**

Comment #1: We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

USACE Response: Noted; thank you very much for your review.

**3. INDIVIDUALS, ASSOCIATIONS, AND ORGANIZATIONS**

**a. Carteret County, Shore Protection Office, April 19, 2023**

Comment #1: Carteret County is in receipt of the Public Notice dated April 14, 2023,



concerning the Draft Environmental Assessment for the maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels. We agree with your opinion that the proposed Federal action will not significantly affect the quality of the human environment. Furthermore, we ask that the Finding of No Significant Impact be signed in a timely manner. This important navigation channel not only serves Cape Lookout National Seashore but also recreational and commercial interests for Carteret County residents and visitors.

USACE Response: Noted; thank you very much for your review.

Comment #2: In closing, Carteret County would like to reiterate our support for the important functions carried out by both the USACE and USCG, and we look forward to maintaining and expanding our partnership with your agency on this and other area projects.

USACE Response: Noted; thank you very much for your review.

# **APPENDIX I**

## **COASTAL ZONE MANAGEMENT ACT FEDERAL CONSISTENCY CORRESPONDENCE**

### **CHANNELS FROM BACK SOUND TO LOOKOUT BIGHT**

**SEPTEMBER 2023**



Prepared by:

Environmental Resources Section  
U.S. Army Corps of Engineers, Wilmington District



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

April 14, 2023

Mr. Daniel Govoni  
North Carolina Department of Environmental Quality  
Division of Coastal Management  
400 Commerce Avenue  
Morehead City, North Carolina 28557

Dear Mr. Govoni:

The United States Army Corps of Engineers (USACE) is seeking Federal Consistency concurrence to maintain the navigation channel within Back Sound to Lookout Bight, including two boat dock channels that provide visitor access to the National Park Service's (NPS) Cape Lookout National Seashore (CALO) and employee access for maintenance of the lighthouse and park grounds.

This determination addresses the proposed dredging of USACE and NPS federal navigation channels located within Back Sound and Lookout Bight, Carteret County, North Carolina. The proposed maintenance dredging is divided into two sections. The northern section includes the fixed USACE federal channel through Back Sound toward Barden Inlet. The southern section includes a corridor encompassing Barden Inlet and Lookout Bight, where the USACE and NPS channels follow natural deep waters and include two NPS channels that provide access to two existing NPS boat docks. The proposed dredging would use Government-owned shallow draft plant and contracted hydraulic cutterhead pipeline dredges. Pipeline dredging would be used for initial dredging, then every 3 to 5 years, depending on shoaling rates and available funding. Pipeline dredged material would be placed on Sandbag Island bird island or on nearby NPS soundside or oceanside beaches. Between pipeline dredging events, Government-owned shallow draft plant (i.e., special purpose hopper dredge or sidecast dredge) would remove any shoals impeding navigation. Special purpose hopper dredged material would be placed in naturally occurring scour holes within the Barden Inlet and Lookout Bight channel. Sidecast dredging is also proposed to be used to maintain the USACE and NPS channels when other dredge plants are not available and would sidecast material 80-feet from the vessel's starboard or port side.

The USACE is committed to balancing safe reliable navigation and environmental stewardship. All Government plant dredging would occur within the recommended October 1 through March 31 environmental window. Placement of dredged material on Sandbag Island would occur from September 1 through March 31, to protect nesting birds. Sandbag Island dredged material placement via control-of-effluent would utilize methodologies to avoid impacts to submerged aquatic vegetation

to the maximum extent practicable. Placement of dredged material on NPS oceanside beach would occur from November 16 through April 30, to protect nesting sea turtles.

In accordance with Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972, as amended, the USACE has determined that the proposed project is consistent, to the maximum extent practicable, with North Carolina's Coastal Management Program. This determination is based on the review of the proposed project against the enforceable policies of the State's coastal management program, which are principally found in Chapter 7 of Title 15A of North Carolina's Administrative Code. We request that the NCDCM concur with this consistency determination and provide a response no later than 60 days from the date of this letter.

Thank you for your time and consideration. Should you have any questions or require additional information, please contact Mr. John Policarpo, Environmental Resources Section, at (910) 251-4700 or by email at [John.N.Policarpo@usace.army.mil](mailto:John.N.Policarpo@usace.army.mil).

Sincerely,

Jenny Owens  
Acting Chief, Planning and  
Environmental Branch  
USACE, Wilmington District

## **Project Name: Channel from Back Sound to Lookout Bight, Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels**

The United States Army Corps of Engineers (USACE) is seeking Federal Consistency concurrence to maintain the navigation channel within Back Sound to Lookout Bight, including two boat dock channels that provide visitor access to the National Park Service's (NPS) Cape Lookout National Seashore (CALO) and employee access for maintenance of the lighthouse and park grounds.

This determination addresses the proposed dredging of USACE and NPS federal navigation channels located within Back Sound and Lookout Bight, Carteret County, North Carolina (Figure 1). The proposed maintenance dredging is divided into two sections. The northern section includes the fixed USACE federal channel through Back Sound toward Barden Inlet. The southern section includes a corridor encompassing Barden Inlet and Lookout Bight, where the USACE and NPS channels follow natural deep waters and include two NPS channels that provide access to two existing NPS boat docks. The proposed dredging would use Government-owned shallow draft plant and contracted hydraulic cutterhead pipeline dredges. Pipeline dredging would be used for initial dredging, then every 3 to 5 years, depending on shoaling rates and available funding. Pipeline dredged material would be placed on Sandbag Island bird island or on nearby NPS soundside or oceanside beaches. Between pipeline dredging events, Government-owned shallow draft plant (i.e., special purpose hopper dredge or sidecast dredge) would remove any shoals impeding navigation. Special purpose hopper dredged material would be placed in naturally occurring scour holes within the Barden Inlet and Lookout Bight channel. Sidecast dredging is also proposed to be used to maintain the USACE and NPS channels when other dredge plants are not available and would sidecast material 80-feet from the vessel's starboard or port side. Figure 2 depicts proposed dredged material placement locations within the project area.

The USACE is committed to balancing safe reliable navigation and environmental stewardship. All Government plant dredging would occur within the recommended October 1 through March 31 environmental window. Placement of dredged material on Sandbag Island would occur from September 1 through March 31, to protect nesting birds. Sandbag Island dredged material placement via control-of-effluent would utilize methodologies to avoid impacts to submerged aquatic vegetation to the maximum extent practicable. Placement of dredged material on NPS oceanside beach would occur from November 16 through April 30, to protect nesting sea turtles.

### **Project Purpose**

The Navigation mission of USACE is to provide safe, reliable, efficient, effective, and environmentally sustainable waterborne transportation systems (i.e., channels, harbors, and waterways). As part of the navigation mission, USACE is responsible for maintenance of the federally authorized Channel from Back Sound to Lookout Bight project, allowing mariners to safely access the open ocean and improving access for the recreational and commercial fishing vessels from Harkers Island. Trawlers and other

larger vessels have not been able to pass through Barden Inlet for several years due to shoaling.

The federal navigation channel through Back Sound has not been maintained in over two decades. Portions of the channel are completely shoaled in, and mariners navigate outside of the north end of the fixed channel, which swings around dangerous shoals. Current depths of the federal channel are 4 feet, allowing only smaller shallow draft boats the ability to navigate. Ferry service from the NPS CALO Headquarters on Harkers Island traverses these waters several times daily during the summer season, navigating by means of homemade buoys that are adjusted as necessary.

The federal navigation channels are divided into two sections, the northern section, which has historically been a fixed channel through Back Sound towards Barden Inlet, and the southern section being the corridor encompassing Barden Inlet and Lookout Bight, where channels follow natural deep water. The northern section includes the USACE channel, which connects Harkers Island and Core Sound to Barden Inlet. The southern section contains both NPS and USACE channels, providing access to the CALO shoreline and the open ocean.

Placement locations vary depending on composition of the material in the channel and the type of dredge plant used for maintenance. The northern section contains material suitable for beneficial use placement onto Sandbag Island bird island via pipeline dredge and open water sidecasting adjacent to the channel via Government plant. Material within Barden Inlet and Lookout Bight is beach quality and suitable for soundside (Lighthouse Beach) and oceanside beach placement.

The USACE explored a reasonable range of alternatives to reestablish safe and navigable channels between Back Sound and Lookout Bight. The No Action alternative of no dredging is compared to the alternatives of restoring the channels to authorized project dimensions. The preferred alternative, which would dredge using Government shallow draft plant and contracted suction cutter hydraulic pipeline dredge, would occur within agency-recommended environmental timeframes, unless emergency actions are needed.

### **Project History and Existing Conditions**

The federal channel from Back Sound to Lookout Bight navigation project was authorized under authority of the Rivers and Harbors Acts of August 26, 1937, and March 2, 1945. The original project provided a channel 5 feet deep and 50 feet wide. A channel 7 feet deep and 100 feet wide was authorized in 1945 by House Document (HD) 746/77/2 and construction was completed in 1956. The channel has been maintained in approximately the same location since it was constructed (1975 FES). The last dredging event via contract occurred in 1997; and the last dredging event via Government plant (using a sidecaster) occurred in 1980.

The federal channel in the project area includes two sections, a northern and southern section. The northern section consists of an approximately 3-mile long, 100-foot-wide fixed channel, with an authorized depth of -7 feet mean lower low water (MLLW), with 2-foot of allowable overdepth, extending from Core Sound, just south of the NPS Visitor Center on Harkers Island, through Back Sound to Barden Inlet. Based on recent and previous sediment analyses, the material within the northern section of the channel contains less than 10% fine-grained sediments, meaning it is acceptable for bird island, sidecasting, and deep-water placement. The southern section consists of a 100-foot-wide channel, with an authorized depth of -7 feet MLLW, with 2-foot of allowable overdepth, that extends from Barden Inlet through Lookout Bight. The southern portion of the project consists of the route through Barden Inlet and Lookout Bight, where, historically, the exact location of the channel was allowed to shift to take advantage of naturally occurring deep water.

There are two NPS boat dock channels proposed to follow deep water to the maximum extent for minimal maintenance. The NPS does not have a specific channel authority for dredging to access their boat docks and there are no records of previous dredging. The dimensions are based on the minimum required to safely accommodate the vessels that typically use the NPS channels.

The two channels are Lighthouse Channel and the Old USCG Station Channel and are described below:

1. Lighthouse Channel: Ferries from the NPS Visitor Center take visitors to the Cape Lookout National Seashore via the lighthouse channel several times daily between the months of April and October. The channel would be maintained at 40 feet wide and -7 feet MLLW, with 1-foot of allowable overdepth.
2. Old U.S. Coast Guard Station Channel: The plan is for NPS to utilize the abandoned USCG Station as a maintenance facility and vehicle storage. The dock is currently in disrepair and would require a complete overhaul; therefore, dredging is not expected to occur here for 3 to 4 years. The channel would be maintained at 40 feet wide by -4 feet MLLW, with 2-foot of allowable overdepth.

Federal funding to maintain the Channel from Back Sound to Lookout Bight project has not been received since the 1990s. The Original EA and Finding of No Significant Impact (FONSI), which was signed in November 1975, assessed impacts associated with pipeline dredging the federal channel, with placement of material onto two bird islands (Morgan Island and Sandbag Island) and on the oceanfront beach of CALO. Sidecasting using the Government owned dredge Merritt was also assessed; however, due to resource agency concerns, sidecasting was limited to only within the Barden Inlet area.

The last navigation contract for maintenance dredging of the Back Sound to Lookout Bight channel was in the winter of 1997 via pipeline dredge, which removed 78,350 cubic yards (CY) of material. The USACE has no records regarding the placement

location for this material; however, 1998 aerial imagery shows a considerable increase in the size of Sandbag Island, which was the placement area identified in the 1975 environmental impact statement (EIS). Prior to that, dredging was completed by pipeline contract in 1992 and, in 1988, USACE removed 47,078 CY of material and placed it on Sandbag Island, which included filling and placing the sandbags.

Currently, at low tide, much of the fixed channel bottom through Back Sound is above mean low water. Boat traffic follows a meandering natural channel that has a controlling depth of 2 feet and runs adjacent to the historic fixed channel alignment.

The NPS boat dock channels (including the former USCG dock channel) provide vital navigational linkage to NPS properties along the southern reach of CALO and to the iconic Cape Lookout Lighthouse area, on which residents, visitors, businesses, and NPS staff depend. These channels were maintained in the past; however, there is no record of the last maintenance dredging event or placement location. The channel to the ferry dock experiences the highest boating activity with ferries accessing it multiple times daily. The channel accessing the old USCG dock has not been dredged since the USCG departed in June 1982; however, it tends to follow a natural deep-water route.

The last NPS project that involved dredging was a shoreline restoration project to protect the important historic structures from erosion. In March 2006, borrow areas within Barden Inlet were dredged and material placed on the soundside beach at Cape Lookout Lighthouse (2005 NPS EA). Only a small portion of the federal channel was dredged, and it was not a project intended to maintain the navigation channel.

## **Proposed Action**

The Proposed Action includes multiple dredging options and placement sites. A small, contracted pipeline dredge would be used for initial dredging, then repeated approximately every 3 to 5 years, depending upon shoaling rates and available funding. Between contracted pipeline maintenance dredging events, Government owned shallow draft plant would remove any shoals impeding navigation. Details of each dredge type and placement are described below.

Pipeline Dredging with Bird Island or Beach Placement: To maintain the USACE and NPS channels, a contracted pipeline dredge would be used for initial dredging, then repeated approximately every 3 to 5 years, for 30 to 45 days per event, depending upon shoaling rates and available funding. Based on recent bathymetry, significant shoaling exists in the current channel alignment, including approximately 170,000 – 180,000 CY of material in the USACE channels and 10,000 CY in the NPS Lighthouse channel. These volumes are proposed for dredging in Fiscal Year (FY) 2023-24. Beneficial use of dredged material may occur in FY23-24 with placement of beach quality sand on Sandbag Island bird nesting island or Lighthouse Beach for the purpose of storm surge protection, habitat restoration for nesting shorebirds and sea turtles, and protection of historic structures. Placement onto the oceanside beach would occur when dredged material from Lookout Bight exceeds the capacity of Lighthouse Beach. Pipeline



dredging has been previously authorized with placement onto bird islands, as well as soundside and oceanside beaches.

Placement of dredged material on Sandbag Island would be via control-of-effluent utilizing bulldozers to create berms, proper slopes, and shape the island. Sandbag Island would not exceed 25 acres in size or 15 feet in height, which are the maximum limitations recommended by the North Carolina Wildlife Resources Commission (NCWRC) for bird island construction. Placement on Sandbag Island would only occur when the Back Sound channel is pipeline dredged every 3 to 5 years, depending on funding and need for placement. Placement of dredged material on Sandbag Island would occur from September 1 through March 31, to protect nesting shore birds.

Placement of dredged material on NPS beaches would only occur during pipeline dredging events. Placement would occur on either Lighthouse Beach (soundside) or Cape Lookout Beach (oceanside); however, oceanside placement would only occur if dredged quantity amounts exceeded the overall placement area of soundside Lighthouse Beach. Placement of dredged material on oceanfront beaches would occur from November 16 through April 30, to protect nesting sea turtles; placement of material on soundside beaches would occur from September 1 through March 31, to protect nesting shore birds.

**Special Purpose Hopper Dredging with Placement in Deep Scour Holes:** The Wilmington District has two shallow-draft special purpose hopper dredges, the Murden and the Currituck. Special purpose hopper dredges have not been previously authorized to work in the entire corridor area; therefore, no approvals for open water placement currently exist. These vessels typically operate during daylight hours approximately 300 out of 365 days per year, 12 hours per day. Both dredges are capable of dredging at a minimum depth of 5.5 feet of water partially loaded and 8 feet of water fully loaded, and both have two dragarms with dragheads (2 feet by 3 feet in size) that pump material into a hopper that can overflow to obtain an economic load. Once full (approximately 300 to 500 CY), the dredged material would be placed by opening the split-hull hopper in naturally occurring scour holes, approximately 14 feet deep or greater below mean low water (MLW), within the channel limits in Lookout Bight. These dredges are used to remove small and/or isolated, regularly occurring shoals when contract dredging is not scheduled. Each hopper dredging event would be expected to last for 1 to 2 weeks.

**Sidecast Dredging:** The Wilmington District presently has one sidecast dredge, the Merritt. The Merritt is capable of dredging in a minimum depth of 4 to 5 feet of water, has two adjustable dragarms with dragheads (2 feet by 3 feet in size), has a 12-inch discharge pipe that is 80 feet long, and has an available 10-foot pipe extension. The Merritt casts material approximately 100 feet from the centerline of the vessel (80 feet from either the starboard or port side) into adjacent open waters where the predominant currents carry sediment away from the channel. As with the special purpose hopper dredge, the sidecaster operates only during daylight hours (12 hours/day). Due to its shallow draft capability, the sidecast dredge is often the only method of dredging available for shoal removal. Sidecast dredging takes less time than special purpose

dredging, since transit time for dredged material placement is not required. When maintenance dredging is required and other dredge types are not available, USACE proposes to sidecast dredge. Sidecast dredges have been previously authorized to work only within the Barden Inlet area; therefore, no approvals for sidecasting currently exist within the remainder of the project area. The USACE proposes to sidecast adjacent to all channels in the project area, only from October 1 through March 31, to minimize impacts to submerged aquatic vegetation (SAV), blue crab spawning, and for egg/larval stages of fish, and only as needed during that period. Sidecast dredging is expected to occur annually for a period of 1 to 2 weeks per event.

## **Alternatives Analysis**

Three alternatives, including the No Action and the Proposed Action, were considered, and are described below.

1. No Action: The No Action alternative would result in no dredging of the Back Sound to Lookout Bight or NPS navigation channels. These channels have not been adequately maintained over the last 20+ years due to lack of federal funding. Neglecting to dredge these channels would continue to result in more detrimental effects on the surrounding communities, including Harkers Island and Cape Lookout.

It is difficult to assess the future specific effects if dredging does not occur; however, the number of boaters running aground due to shoaling is already significant and may increase. Also, in the absence of a safe navigation channel, the USCG would likely pull the remaining navigation aids, leaving it to be marked by only private aids. Some of the aids have already been removed due to the shallow conditions. Ferry service to Cape Lookout could eventually be forced to discontinue operations, and public visitation would dramatically decline. It is USACE's responsibility to maintain the Channel from Back Sound to Lookout Bight navigation project, dependent on funding. As a result, USACE has determined that the No Action alternative is not feasible.

2. Maintenance Dredging of Back Sound to Lookout Bight with a navigation corridor for the full project (no fixed channel portion); NPS channels would follow natural deep water (Full Project Corridor alternative): This alternative includes a large corridor of approximately 2,236 acres that encompasses the entire Back Sound to Lookout Bight project area (Figure 3). The authorized USACE channel dimensions for Back Sound to Lookout Bight (as discussed under Proposed Action) would be dredged following the deepest natural water within the corridor, and the NPS channels would connect to the USACE channel and would follow natural deep water to access the docks. The potential to dredge following deep water could occur anywhere within the corridor limits and all of the aforementioned dredge types and placement options may be used to maintain the channels within the full corridor.

Alternative 2, a full project corridor, was not selected as the proposed action because recent and past surveys show very little natural deep water within the larger overall corridor; therefore, there is no benefit in proposing a full project corridor, which would

only be useful if there were enough deep-water areas to reduce dredging and in turn, save money and decrease the areas of disturbance. As a result, USACE has determined that this alternative is not feasible.

3. Proposed Action – Maintenance Dredging of Back Sound to Lookout Bight along fixed alignment for the northern portion and navigation corridor for the southern portion; NPS channels would follow natural deep water (Partial Project Corridor alternative): Alternative 3 proposes all of the same dredging and placement options as Alternative 2 and as described under the Proposed Action section; however, Alternative 3 differs from Alternative 2 in that it includes a fixed, linear channel through Back Sound to Barden Inlet, (following the historical route of this portion for the USACE federal navigation channel) instead of a navigation corridor (Figure 4). A corridor for only Barden Inlet and Lookout Bight would be established (approximately 1,359 acres, same as Alternative 2) with the USACE channel following the deepest natural water within the corridor, and the NPS channels would connect to the USACE channel, following natural deep water to access the docks.

A fixed channel through Back Sound is the preferred alternative because it meets the project purpose since there is no deep water in the vicinity of the northern portion. It would be more economical to follow a fixed alignment, particularly once the channel is reestablished after the first pipeline dredging and would also decrease areas of disturbance.

Similar to Alternative 2, establishment of a navigation corridor in Lookout Bight would provide flexibility and cost savings in maintaining the USACE and NPS navigation channels. Maintenance dredging would be limited as much as possible and would only be performed in shoaled areas that require dredging to sustain the authorized channel dimensions. Authorized USACE and NPS channel dimensions, dredging methodology, and placement options would remain the same as Alternative 2.

### **Minimization Measures**

The USACE proposes to avoid and minimize impacts to the maximum extent practicable. The USACE is committed to maintaining the project channels within the recommended window of October 1 through March 31, for all Government plant dredging, to avoid impacts to SAV, blue crab spawning, and egg/larval stages of fish. Prior to each dredging event, SAV in the project area would be identified using the State's online SAV database and recent aerial imagery; SAV would be avoided to the maximum extent practicable.

Placement onto Sandbag Island via control-of-effluent would utilize various methodologies designed to avoid impacts to SAV to the maximum extent practicable. Currently, the island is approximately 2-acres in size, and was last used for dredged material placement in 1997. Dredged material from the Back Sound navigation channel contains very fine-grained sand, which makes it challenging to contain and stack up, requiring a suite of methods to build the island with a minimal footprint of 25 acres and a

height of 15 feet. There are SAV beds located behind Sandbag Island to the south-southwest. To protect these SAV beds, USACE proposes a suite of alternatives, including sandbags, geo-tubes, berm construction, and turbidity curtains. These alternatives alone or in combination would be used to keep material from moving towards the SAV beds while constructing the island towards the north and east. Sandbags and geo-tubes are structural solutions that are more able to control effluent but would require removal post-construction; berm construction, while the most environmentally friendly, could not occur based on the insufficient amount of material currently existing; and turbidity curtains require a minimum of 3-feet of water depth to function properly. The USACE would work closely with the contractor to ensure SAV, to the maximum extent practicable, is not affected. The Sandbag Island placement plan is included as Appendix B of the EA and is attached. Placement on Sandbag Island would occur from September 1 through March 31, to protect nesting shore birds.

Placement of dredged material on NPS beaches would occur via pipeline dredging only and would follow the following timelines: oceanfront beach placement would occur from November 16 through April 30, to protect nesting sea turtles; soundside beach placement would occur from September 1 through March 31, if nesting shore birds are present.

To protect historic and archaeological resources, the USACE would establish a 150 square meter buffer around the wreck of the Olive Thurlow (CLS0004) in which no dredging would occur.

It would also be noted in the contract specifications that the contractor must abide by all measures to protect federally listed threatened and endangered species. The USACE has determined that the following species are within the project area: red knot, piping plover, seabeach amaranth, sea turtles (loggerhead, green, Kemp's Ridley, leatherback), Atlantic sturgeon, shortnose sturgeon, West Indian manatee, and giant manta ray. The contractor will be required to adhere to the U.S. Fish and Wildlife Service's (USFWS) *Guidelines for Avoiding Impacts to the West Indian Manatee* (2017) and the *2017 North Carolina Coastal Beach Sand Placement, Statewide Programmatic Beach Placement Biological Opinion* (SPBO), as well as the National Marine Fisheries Service's (NMFS) *2020 South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States* (2020 SARBO). These conservation measures will remain in place until all work is complete, all vessels have left the area, and all equipment has been removed from beaches.

### **Analysis of the Project in Relation to North Carolina's Coastal Management Program**

The project area is within areas of environmental concern (AEC) as defined by Section 113A-113 of the North Carolina Coastal Area Management Act (CAMA), and as discussed below. Specifically, the proposed actions will be occurring in the Estuarine and Ocean System, the Ocean Hazard System (Inlet), Outstanding Resource Waters (ORW), SAV beds, Public Trust, and other AECs as discussed below.

## **Areas of Environmental Concern (AEC)**

**15A NCAC 07H.0205 Coastal Wetlands:** Coastal wetlands are defined as any salt marsh or other marsh subject to regular or occasional flooding by tides, including wind tides, that reach the marshland areas through natural or artificial watercourses, provided this does not include hurricane or tropical storm tides. Alteration of coastal wetlands includes mowing or cutting of coastal wetlands vegetation whether by mechanized equipment or manual means. Coastal wetland alteration not meeting the exemption criteria shall require a CAMA permit.

The proposed action would not have an impact on coastal wetlands as defined in 15A NCAC 07H.0205. Coastal wetlands in the project vicinity include estuarine emergent wetlands located along the shorelines and the island fringes in the overall area. Proposed dredging or placement of dredged material will not affect coastal wetlands as all dredged material will be placed on Sandbag Island and/or adjacent oceanside or soundside NPS beaches. The USACE will coordinate pipeline routes for dredged material placement on NPS beaches to ensure there are no alterations to coastal wetlands.

**15A NCAC 07H.0206 Estuarine Waters:** Estuarine Waters are defined in G.S. 113A-113(b)(2) to include all the waters of the Atlantic Ocean within the boundary of North Carolina and all the waters of the bays, sounds, rivers, and tributaries thereto, seaward of the dividing line between coastal fishing waters and inland fishing waters. The rule establishes management objectives for estuarine waters to conserve and manage the important features of estuarine waters in a manner that safeguards and perpetuates their ecological and economical values and to coordinate and establish a management system capable of conserving and using estuarine waters that maximize their benefits to humans and the estuarine and marine systems. Suitable land and water uses shall be those consistent with the management objectives. Highest priority of use shall be allocated to the conservation of estuarine waters and their vital components, while second priority of estuarine waters use shall be given to those types of development activities that require water access and use that cannot function elsewhere, such as simple access channels, structures to prevent erosion, navigation channels, boat docks, marinas, piers, wharfs, and mooring pilings.

The proposed action is the maintenance dredging of the Channel from Back Sound to Lookout Bight and two NPS boat dock channels, which is considered a water dependent activity. The project would not have long-term adverse effects on the estuarine system, including wetlands, SAV beds, shellfish areas, or nursery areas. The project's design, location, and use have been considered regarding effects to coastal wetlands, estuarine waters, and public trust areas.

**15A NCAC 07H.0207 Public Trust Areas:** Public trust areas are all waters of the Atlantic Ocean and lands thereunder from the mean high-water mark to the seaward limit of state jurisdiction; all natural bodies of water subject to tidal influence and lands

thereunder to the normal high water or normal water level; all navigable natural bodies of water and lands thereunder to the normal high water or normal water level; all water in artificially created bodies of water containing public fishing resources or other public resources that are accessible to the public by navigation from bodies of water in which the public has rights of navigation; and all waters in artificially created bodies of water in which the public has acquired rights by prescription, custom, usage, dedication, or any other means. The rule establishes management objectives to protect public rights for navigation and recreation and to conserve and manage the public trust areas to safeguard and perpetuate their biological, economic, and aesthetic value.

The proposed action will not result in the loss of coastal uses nor impact coastal resources or prohibit access to coastal resources by the public. The proposed dredging will provide safe, reliable navigation in the project area for the NPS, residents, visitors, and commercial and recreational fishermen. The activities that comprise the proposed action are not intended to adversely impact public rights for navigation and recreation and are consistent with conservation of the biological, physical, and aesthetic values of public trust areas.

**15A NCAC 07H.0208 Use Standards:** Uses that are not water dependent, shall not be permitted in coastal wetlands, estuarine waters, and public trust areas. Water dependent uses include, but are not limited to, docks, wharves, boat ramps, dredging, bridges and bridge approaches, revetments, and bulkheads. Use standards require that a project be sited and designed to avoid significant adverse impacts to various resources, such as coastal wetlands, shellfish beds, primary nursery areas, and submerged aquatic vegetation, unless the project has public benefits that outweigh the long-range adverse effects of the project, there is no reasonable alternate available, and all adverse impacts of the project have been mitigated, including avoidance and minimization measures.

The Proposed Action to maintenance dredge the Channel from Back Sound to Lookout Bight is a water dependent, beneficial use to the public. Placement of dredged material on Sandbag Island, into deep scour holes, and adjacent NPS beaches would have a beneficial use to wildlife and the public. Placement of sand on Sandbag Island would minimize effects to adjacent SAV beds located to the south-southwest through several means as noted in the Minimization Measures section above. The project has been designed to avoid and minimize adverse impacts to sensitive resources, such as wetlands, shellfish and SAV beds, and nursery areas, to the maximum extent practicable. The USACE has addressed the applicable General Use Standards at 15A NCAC 07H.208(a) individually below.

**15A NCAC 07H.0208(a)(4) Primary Nursery Areas:** Primary nursery areas are defined as those areas in the estuarine and ocean system where initial post larval development of finfish and crustaceans takes place. They are usually located in the uppermost sections of a system where populations are uniformly early juvenile stages.

The project area, including dredging footprint and placement areas, are not classified as a Primary Nursery Area (PNA).

**15A NCAC 07H.0208(a)(5) Outstanding Resource Waters:** Outstanding Resource Waters (ORW) are defined as those estuarine waters and public trust areas classified by the North Carolina Environmental Management Commission (NCEMC). In those estuarine waters and public trust areas classified as ORW, no permit required by CAMA shall be approved for any project that would be inconsistent with applicable use standards for estuarine waters, public trust areas, or coastal wetlands.

The NCEMC has classified portions of Back Sound and Barden Inlet as ORWs, as defined in 15A NCAC 07H.0208(a)(5). Impacts to ORWs from dredging would be within the existing USACE and NPS navigation channels. Placement of dredged material on adjacent NPS beaches and Sandbag Island would provide beneficial wildlife habitat, as well as a beneficial use to the public for recreational access (beach placement only). The reestablishment of Sandbag Island as bird nesting habitat would place dredged material in approximately 23 acres of estuarine waters and create fast land; however, Sandbag Island would not exceed previously authorized dimensions of 25 acres in size and 15 feet in height. In consideration of impact area versus the entire reach of the affected system, impacts to the ORW are expected to be negligible.

**15A NCAC 07H.0208(a)(6) Submerged Aquatic Vegetation:** Submerged aquatic vegetation is defined as those habitats in public trust and estuarine waters vegetated with one or more species of submergent vegetation. These vegetation beds occur in both subtidal and intertidal zones and may occur in isolated patches or cover extensive areas.

Beds of SAV are prolific in shallow estuaries of Back Sound and Lookout Bight. Areas of SAV were identified using NCDEQs 2019-20 mapping data and aerial imagery in the 2022 growing season (April through October). Currently, there is no SAV present within and immediately adjacent to USACE and NPS channels that would be affected by dredging activity. The nearest SAV bed is a patchy cluster approximately 250 feet west of the Channel in Back Sound, which could be affected by dredging and dredged material placement (sidecasting). Dredging would avoid known areas of SAV to the maximum extent practicable by identifying areas of SAV growth using the State's online database and recent aerial imagery. Government plant dredging and placement activities would occur during a recommended timeframe from October 1 through March 31 to avoid the SAV growing season, thereby making impacts to SAV insignificant.

Effects to SAV beds located south-southwest of Sandbag Island would be minimized, to the maximum extent practicable, during reestablishment of the bird island through a combination of mitigative measures, including use of geo-tubes, sandbags, berms, and turbidity curtains.

**15A NCAC 07H.0208(b)(1) Specific Use Standards:** Navigation channels, canals, and boat basins shall be aligned or located so as to avoid primary nursery areas, shellfish beds, beds of submerged aquatic vegetation as defined by the MFC, or areas of coastal wetlands except as otherwise allowed within this Subchapter.

Only those criteria under 15A NCAC 07H.0208(b)(1) specific to the Proposed Action are addressed below.

**15A NCAC 07H.0208(b)(1)(A):** Navigation channels and canals may be allowed through fringes of regularly and irregularly flooded coastal wetlands if the loss of wetlands will have no significant adverse impacts on fishery resources, water quality or adjacent wetlands, and if there were no reasonable alternative that would avoid the wetland losses.

The Proposed Action would not have an impact on coastal wetlands as defined in 15A NCAC 07H.0205. All dredging work will be conducted within open waters of the USACE and NPS channels. Dredged material would be placed on Sandbag Island bird island, in deep scour holes, or on adjacent oceanside or soundside NPS beaches.

**15A NCAC 07H.0208(b)(1)(B):** All dredged material shall be confined landward of regularly and irregularly flooded coastal wetlands and stabilized to prevent entry of sediments into the adjacent water bodies or coastal wetlands.

The Proposed Action would not have an impact on coastal wetlands as defined in 15A NCAC 07H.0205. All dredging work will be conducted within open waters of the USACE and NPS channels. Dredged material would be placed on Sandbag Island bird island, in deep scour holes, or on adjacent oceanside or soundside NPS beaches.

**15A NCAC 07H.0208(b)(1)(I):** Maintenance excavation in canals, channels, and boat basins, within PNA and areas of SAV, as defined by the MFC shall be avoided. However, when essential to maintain a traditional and established use, maintenance excavation may be approved if the applicant meets the criteria in this section.

By its very nature, dredging is a water dependent use to maintain navigation of waterways. The channel through Back Sound (northern portion of the project area) was previously authorized but has not been maintenance dredged in over 20 years; the southern portion of the project area from Barden Inlet through Lookout Bight will follow naturally occurring deep water channels to maintain navigation, therefore, dredging could occur within the entire southern corridor depending on location and amount of shoaling. Dredged material placement would be used to reestablish Sandbag Island bird island, which would have a beneficial use to wildlife, adjacent NPS oceanside or soundside beaches, which would have beneficial uses to wildlife, the public, and protection of historical resources, and placement into deep scour holes within the southern portion of the project area. Care would be taken to ensure that the reestablishment of Sandbag Island does not adversely affect SAV beds located to the south-southwest of the island (see Mitigation Measures section above for details).

**15A NCAC 07H.0208(b)(2) Hydraulic Dredging:** Hydraulic dredging is permitted under the criteria in 15A NCAC 07H.0208(b)(2)(A-H).



Hydraulic pipeline dredging is proposed for the initial action, and could occur every 3 to 5 years, depending on need and funding; interim dredging would be accomplished using Government plant special purpose dredges. Pipeline dredging will place material on Sandbag Island bird island and adjacent NPS soundside and oceanside beaches. Care shall be taken to ensure dredged material does not go beyond its intended limits. Beds of SAV exist to the south-southwest of Sandbag Island. The reestablishment of Sandbag Island could be accomplished through multiple mitigative measures, including sandbags, geo-tubes, turbidity curtains, and/or berms. These physical structures would be used to protect SAV, to the maximum extent practicable, during dredged material placement. Regardless, the placement of the pipeline would be such that it does not cause erosion to containment dikes or the beaches. No impacts to coastal wetlands would occur due to dredging of the channels, placement of material on the bird island, or placement on adjacent beaches, including the pipeline route.

**15A NCAC 07H.0208(b)(8) Beach Nourishment:** Beach nourishment is permitted under the criteria in 15A NCAC 07H.0208(b)(8)(A-F).

The USACE proposes the placement of dredged material from the southern portion of the project area (USACE and NPS channels) onto adjacent NPS soundside and oceanside beaches. Oceanside beach placement would occur when there is no need for soundside beach placement, and only for pipeline dredging events, which would be every 3 to 5 years after the initial dredging event. Beach placement of dredged material would have multiple benefits. The restored beaches would provide shore bird and sea turtle nesting habitat, as well as recreational benefits to the public, and protect several soundside historic structures in the southern end of the park.

There would be no impacts to PNAs, shellfish or SAV beds, or coastal wetlands through placement of dredged material onto NPS beaches. To protect wildlife, beach placement would only occur during the relevant timeframes for the protection of nesting sea turtles (November 16 to April 30) and birds (September 1 to March 31). The USACE would adhere to the USFWS *Guidelines for Avoiding Impacts to the West Indian Manatee* (2017) and the *2017 North Carolina Coastal Beach Sand Placement SPBO*, as well as NMFS' 2020 SARBO. A Wetlands Statement of Findings and a Special Use Permit will be obtained from the NPS prior to commencement of work on oceanfront beaches.

For information regarding technical standards for beach nourishment, reference the sections addressing 15A NCAC 07H.0308(a)(3) Specific Use Standards for Ocean Hazard Areas, Beach Nourishment and 15A NCAC 07H.0312 Technical Standards for Beach Fill Projects, below.

**15A NCAC 07H.0209 Coastal Shorelines:** The Coastal Shorelines category includes estuarine shorelines and public trust shorelines. Estuarine shorelines AEC are those non-ocean shorelines extending from the normal high-water level or normal water level along the estuarine waters, estuaries, sounds, bays, fresh and brackish waters, and public trust areas for a distance of 75 feet landward. Public trust shorelines AEC are those non-ocean shorelines immediately contiguous to public trust areas located

inland of the dividing line between coastal fishing waters and inland fishing waters as set forth in that agreement and extending 30 feet landward of the normal high-water level or normal water level. Acceptable uses shall be those consistent with the management objectives in this rule. These uses shall be limited to those types of development activities that will not be detrimental to the public trust rights and the biological and physical functions of the estuarine and ocean system. Every effort shall be made to avoid or minimize adverse impacts of development to estuarine and coastal systems through the planning and design of the development project.

The Proposed Action to maintenance dredge the Channel from Back Sound to Lookout Bight is a water dependent, beneficial use to the public; development that would include permanent structures or impervious cover is not proposed as part of the project. Placement of dredged material on Sandbag Island and adjacent NPS beaches would have a beneficial use to wildlife and the public. Placement of sand on NPS beaches would restore sea turtle and shore bird nesting habitat, as well as protect historic structures in the park, and enhance public recreational opportunities. Impacts to wetlands, SAV, shellfish beds, or PNAs are not expected.

**15A NCAC 07H.0308(a)(3) Specific Use Standards for Ocean Hazard Areas, Beach Nourishment:** Sand used for beach nourishment shall be compatible with existing grain size and in accordance with Rule .0312 of this Section.

The USACE proposes the placement of dredged material from the southern portion of the project area (USACE and NPS channels) onto adjacent NPS oceanside beaches. Oceanside beach placement would occur when there is no need for soundside beach placement, and only for pipeline dredging events, which would be every 3 to 5 years after the initial dredging event. Beach placement of dredged material would have multiple benefits, including providing shore bird and sea turtle nesting habitat, protection of historic structures, and recreational benefits to the public.

Placement on Cape Lookout Beach would depend on the quantity of material available, and the area identified would be prior approved by the NPS. The beach template design would mimic the natural beach as much as possible, typically having a berm elevation of 6 feet and berm width of 175 to 200 feet, allowing for successful sea turtle nesting. The pipeline would be laid at the narrowest portion of the island to reduce impacts to sensitive dune or marsh areas.

All dredged material placed would be clean sand, free from pollutants. Grain size would be equal to that found naturally at the site. The 2022 geotechnical investigation confirmed that the subsurface sediments within the study area remain relatively the same as the 2004-2005 vibracore effort. The northern section consists of a very fine to fine grained sand (<0.20 mm mean grain size), while the southern section consists of a fine to medium grained sand (>0.30 mm mean grain size) and higher shell content. Although the northern section meets the suitability criteria of greater than 90 percent sand, the fine-grained nature of the material does not match well with the native beach. In addition, the dredge distance is greater than 3 miles, which is too far for a small

dredge plant to efficiently pump the material from the federal navigation channel to the soundside beach.

**15A NCAC 07H.0312 Technical Standards for Beach Fill Projects:** Beach fill projects including beach nourishment, dredged material disposal, habitat restoration, storm protection, and erosion control may be permitted under the criteria of this section.

The USACE proposes the placement of dredged material from the southern portion of the project area (USACE and NPS channels) onto adjacent NPS soundside and oceanside beaches. Oceanside beach placement would occur when there is no need for soundside beach placement, and only for pipeline dredging events, which would be every 3 to 5 years after the initial dredging event. Beach placement of dredged material would have multiple benefits, including providing shore bird and sea turtle nesting habitat, recreational benefits to the public, and protection of several historic structures in the southern end of the park.

Lighthouse Beach is a sandy estuarine shoreline approximately 2,600 linear feet that experiences high erosion due to currents and storm events. In 2006, 74,000 CY of beach quality material from the Barden Inlet area was placed there but has since eroded. Future placement of dredged material onto Lighthouse Beach would be within the same footprint as the 2006 placement event, in a location that best protects the historic structures landward of the beach. Placement on Cape Lookout Beach would depend on the quantity of material available, and the area identified would be prior approved by the NPS. The beach template design would mimic the natural beach as much as possible, typically having a berm elevation of 6 feet and berm width of 175 to 200 feet, allowing for successful sea turtle nesting. The pipeline would be laid at the narrowest portion of the island to reduce impacts to sensitive dune or marsh areas.

Placement of dredged material on NPS beaches would occur via pipeline dredging only and would follow the following timelines: oceanfront beach placement would occur from November 16 through April 30, to protect nesting sea turtles; soundside beach placement would occur from September 1 through March 31, to protect nesting shore birds.

It would also be noted in the contract specifications that the contractor must abide by all measures to protect federally listed threatened and endangered species. The USACE has determined that dredged material placement activities may affect, and will likely adversely affect, terrestrial habitat for sea turtles, piping plover, red knot, and seabeach amaranth (2017 North Carolina Coastal Beach Sand Placement SPBO). Specifically, placement of beach quality dredged material and the associated construction activities during the November 16 to March 31 timeframe may have minor and temporary impacts on piping plover and red knot foraging, sheltering, and roosting habitat. It may also impact the constituent elements for piping plover nesting and wintering habitat. Adverse effects to federally listed species will be avoided and/or minimized to the maximum extent practicable by implementation of USFWSs *2017 North Carolina Coastal Beach*

*Sand Placement* SPBO. These conservation measures will remain in place until all work is complete and all equipment has been removed from beaches.

**15A NCAC 07H.0505 Coastal Areas that Sustain Remnant Species:** Coastal areas that sustain remnant species are those areas that support native plants or animals determined to be rare or endangered (synonymous with threatened and endangered), within the coastal area. This addresses the need to protect unique habitat conditions that are necessary to the continued survival of threatened and endangered native plants and animals and to minimize land use impacts that might jeopardize these conditions. Permits for development in designated fragile coastal natural or cultural resource areas will be approved upon finding that the project will not cause major or irreversible damage to the resource, no reasonable alternative exists, reasonable mitigative measures are incorporated into the project, and the project will have a public benefit that outweighs the loss.

The USACE has determined that proposed dredging will not likely adversely affect the following federally listed species or their critical habitat: sea turtles (loggerhead, green, Kemp's Ridley, leatherback), Atlantic sturgeon, shortnose sturgeon, West Indian manatee, and giant manta ray. However, dredged material placement activities may affect, and will likely adversely affect, terrestrial habitat for sea turtles, piping plover, red knot, and seabeach amaranth (*2017 North Carolina Coastal Beach Sand Placement* SPBO). Specifically, placement of beach quality dredged material and the associated construction activities during the November 16 to March 31 timeframe may have minor and temporary impacts on piping plover and red knot foraging, sheltering, and roosting habitat. It may also impact the constituent elements for piping plover nesting and wintering habitat. Adverse effects to federally listed species will be avoided and/or minimized to the maximum extent practicable by implementation of USFWS's *Guidelines for Avoiding Impacts to the West Indian Manatee* (2017) and the *2017 North Carolina Coastal Beach Sand Placement* SPBO, as well as NMFS's 2020 SARBO. These conservation measures will remain in place until all work is complete, all vessels have left the area, and all equipment has been removed from beaches.

**15A NCAC 07H.0510 Significant Coastal Historic Architectural Resources:** Significant coastal historic architectural resources are defined as districts, structures, buildings, sites, or objects that have more than local significance to history or architecture. The objective is to conserve coastal historic architectural resources of more than local significance which are valuable educational, scientific, associative, or aesthetic resources.

Most of the archaeological sites identified at CALO are historic structures and ruins located in Portsmouth Village and Cape Lookout Village that date to the late 19<sup>th</sup> and 20<sup>th</sup> centuries. They are associated with the villages and historic districts that have been recorded on Core Banks. The Cape Lookout Light Station, situated near the western bank of Barden Inlet, was listed on the National Register in 1973 and contains prehistoric and historic archaeological remains, as well as supporting historic structures; the Light Station also contributes to the National Register listed Cape

Lookout Village Historic District. Erosion threatens the Light Station due to the progressive eastward encroachment of a large shoal off the east end of Shackelford Banks, whose expansion is forcing the channel against the NPS shoreline.

Archaeological field investigations of the eastern end of Shackelford Banks were not able to successfully identify the location of shore whaling stations or camps associated with the 19<sup>th</sup> century community of Diamond City based solely on surface survey, but fieldwork was able to identify features that appear to be associated with the community itself. However, projected locations for historic whaling camps indicate that these sites may actually be situated underwater within the mouth of Barden Inlet.

Shipwrecks and other submerged cultural resources are considered to have high potential within the proposed project area; however, previous disturbances, including dredging, have already affected such resources to a certain unknown degree. The USACE has identified three submerged sites/shipwrecks in the project area that may be afforded protections under the National Historic Preservation Act (NHPA) and/or the Abandoned Shipwrecks Act. Those sites are the wreck of the Olive Thurlow, Shell Point, and Wreck Point. Shell Point is located close to Harkers Island, while the others are within the southern portion of the project area.

Shell Point was most recently investigated prior to shore stabilization efforts at Harkers Island. Test units in the harbor area of Harkers Island, approximately 0.25 miles north of the proposed dredging area, recorded prehistoric pottery and flake materials at depths of approximately 50cm below modern disturbances.

Regarding USACEs federal channels within the proposed project area, including those following natural deep water between Barden Inlet and Lookout Bight, compliance with Section 106 of the NHPA has been previously coordinated and documented in the *Final Environmental Statement, Maintenance Dredging, Channel from Back Sound to Lookout Bight, N.C.*, dated November 1975. Similarly, Section 106-related considerations regarding NPS actions in the project area are described in the *Environmental Assessment, National Park Service, Cape Lookout National Seashore, Protection of Lighthouse and Associated Historic Structures*, dated December 2005, and in the *Environmental Assessment for National Park Service, Cape Lookout National Seashore, Harkers Island Shore Protection Project*, dated August 2006. Coordination with the North Carolina State Historic Preservation Office (SHPO) has been completed. By letter dated May 9, 2022, USACE informed SHPO of the proposed action and anticipated effects to cultural resources, historic properties, and known shipwrecks. By letter dated June 16, 2022, SHPO provided a response stating, "The Cape Lookout Bight and Back Sound areas contain six recorded submerged archaeological sites, most notably the wreck of the Olive Thurlow (CLS0004), that lie adjacent to the channel. While we find that the Area of Potential Effect (APE) of the proposed maintenance dredging would have no adverse effect on the noted archaeological sites, we ask that an adequate buffer area of 150 square meters be provided surrounding the shipwrecks. The purpose of this buffer is to prevent further deterioration and damage of the archaeological resource, as well as to

prevent possible damage to dredge machinery.” The USACE will implement the requested 150 square meter buffers around known shipwrecks in the proposed project area.

Based on implementation of mitigative measures, USACE has determined that the proposed action would not have an adverse effect on any historic or archaeological resources.

**15A NCAC 07H.0602 Pollution of Waters:** No development shall be allowed in any AEC which would have a substantial likelihood of causing pollution of the waters of the state in which shellfishing is an existing use to the extent that such waters would be officially closed to the taking of shellfish.

The potential water quality impacts of dredging and dredged material placement include minor and short-term suspended sediment plumes and the release of soluble trace constituents from the sediment. Suspended sediments also affect turbidity that affects light penetration into the water column. During dredging, turbidity increases outside the dredging area should be less than 25 nephelometric turbidity units to be considered insignificant. In the case of overflowing Government owned hopper dredges to obtain economic loading, sediment that is  $\geq 90\%$  sand is not likely to produce significant turbidity or other water quality impacts, since material is expected to dissipate from the water column relatively rapidly. Sandy, high-energy areas are not conducive for oyster establishment or growth and are not expected to be present within areas of dredging and placement. There are no NCDMF-listed artificial reefs or oyster sanctuaries within the project area; therefore, USACE has determined that the proposed project would not adversely affect the quality of surrounding waters.

**15A NCAC 07M.1100 Policy on Beneficial Use and Availability of Materials Resulting from Excavation or Maintenance of Navigation Channels:** Certain dredged material disposal practices may result in removal of material important to the sediment budget of ocean and inlet beaches. This may, particularly over time, adversely impact important natural beach functions especially during storm events and may increase long term erosion rates. Therefore, it is the policy of the State of North Carolina that material resulting from the excavation or maintenance of navigation channels be used in a beneficial way wherever practicable. Section 15A NCAC 07M.1102(a) states that clean, beach quality material from navigation channels within the active nearshore, beach, or inlet shoal systems must not be removed permanently from the active nearshore, beach or inlet shoal system unless no practicable alternative exists. Preferably, dredged material will be disposed of on the ocean beach or shallow active nearshore area where environmentally acceptable and compatible with other uses of the beach.

The Proposed Action to maintenance dredge the Channel from Back Sound to Lookout Bight is a water dependent, beneficial use to the public. All proposed dredged material placement will keep sediments in the “system”. For pipeline dredging events, placement of dredged material would be on Sandbag Island bird island and adjacent

NPS beaches, which would have a beneficial use to wildlife and the public. Pipeline dredging would occur every 3 to 5 years, depending on shoaling and availability of funds, after the initial dredge event. Placement of material onto bird islands or beaches via pipeline dredging after the initial event would be dependent on the need of those placement sites, the amount of shoaled material, and available funding. Interim dredging activities would be conducted using Government plant dredges, either sidescaster or special purpose hopper dredges, for minor shoaling events, with placement in adjacent waters.

### **Other Required Approvals**

The USACE has prepared a draft EA for the proposed project, which will be circulated for public and agency comment. All comments received will be addressed and all agency coordination will be satisfactorily concluded prior to the beginning of work associated with this project.

All necessary State and Federal authorizations (Sections 401/404 Clean Water Act permits, etc.) will be obtained prior to work commencing and all conditions will be met. A Wetlands Statement of Findings and a Special Use Permit will be obtained from the NPS prior to commencement of work on oceanfront beaches.

### **Consistency Determination**

Pursuant to North Carolina CAMA regulations for the proposed project, and based on the summary of impacts described above, the proposed action is not expected to have significant adverse effects on water quality, noise levels, shellfish, SAV, or PNAs.

In accordance with Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972, as amended, USACE has determined that the proposed action is consistent, to the maximum extent practicable, with North Carolina's Coastal Management Program. This determination is based on the review of the proposed project against the enforceable policies of the State's coastal management program, which are principally found in Chapter 7 of Title 15A of North Carolina's Administrative Code. We request that the NCDPCM concur with this consistency determination.

### **Conclusion**

Based on the findings described in this consistency determination, it is in the federal interest to implement the proposed action of dredging the Channel from Back Sound to Lookout Bight with contracted pipeline and government owned plant for purposes of maintaining a safe and reliable route for mariners, most notably the NPS, residents, visitors, and recreational and commercial fishermen.

Actions associated with dredging and dredged material placement will result in minor and short-term impacts to water quality, noise, benthic organisms, fisheries resources, and protected species. The overall benefit of the proposed action is to provide a safer,

more navigable channel for mariners. Having the ability to maintain commonly shoaled areas using Government plant dredges, after initial pipeline dredging, will allow USACE to proactively manage the shoaling hazards that often plague vessels utilizing the area. Placement of dredged material will be within areas where material has been previously placed and will be conducted using previously employed and approved methodologies.

The proposed action conforms to the management objectives of all enforceable policies of the North Carolina Coastal Management Program, since it will result in maintenance of important navigation features while minimizing adverse impacts as described herein.





Figure 1. Project Area Overview

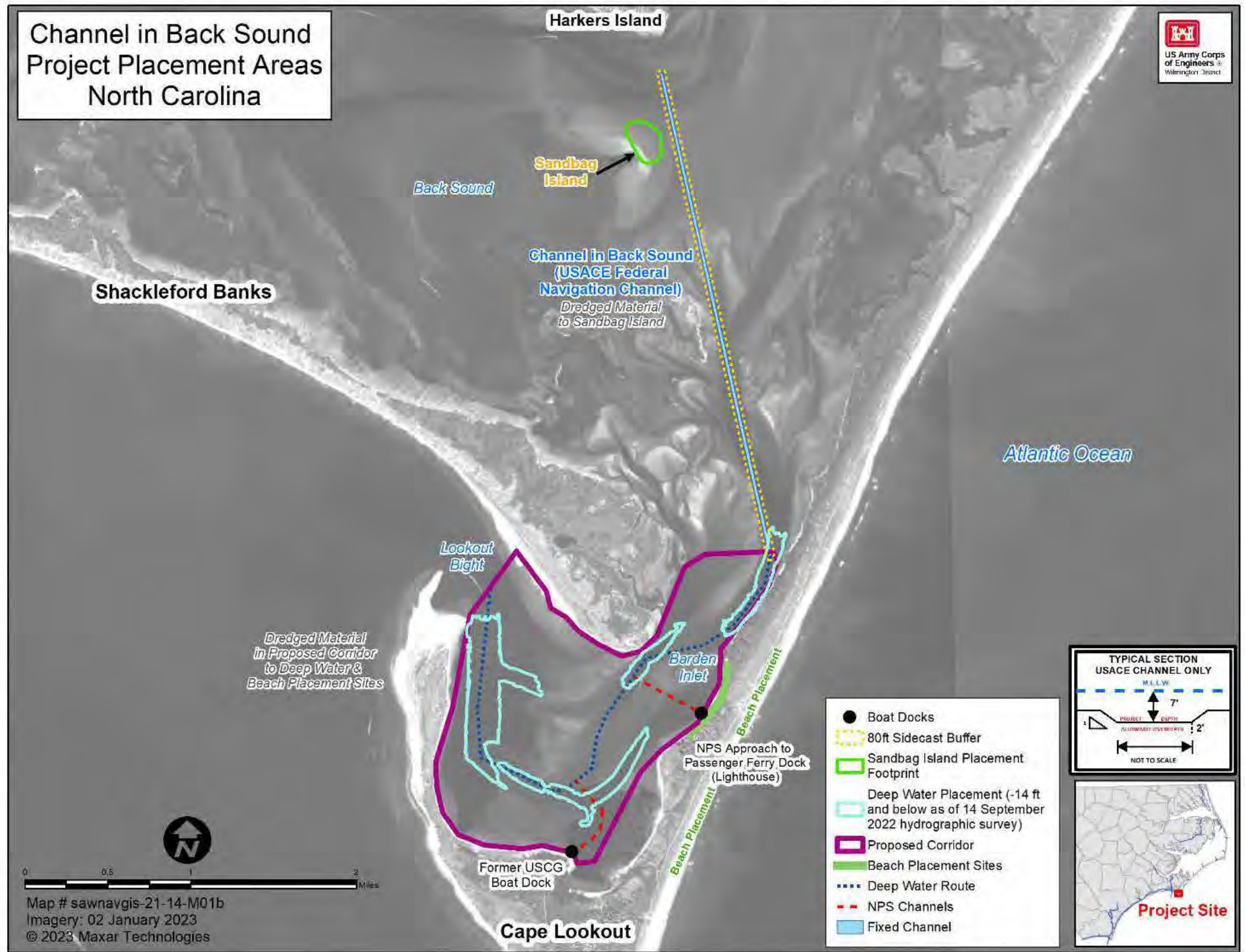


Figure 2. Proposed Dredged Material Placement Areas

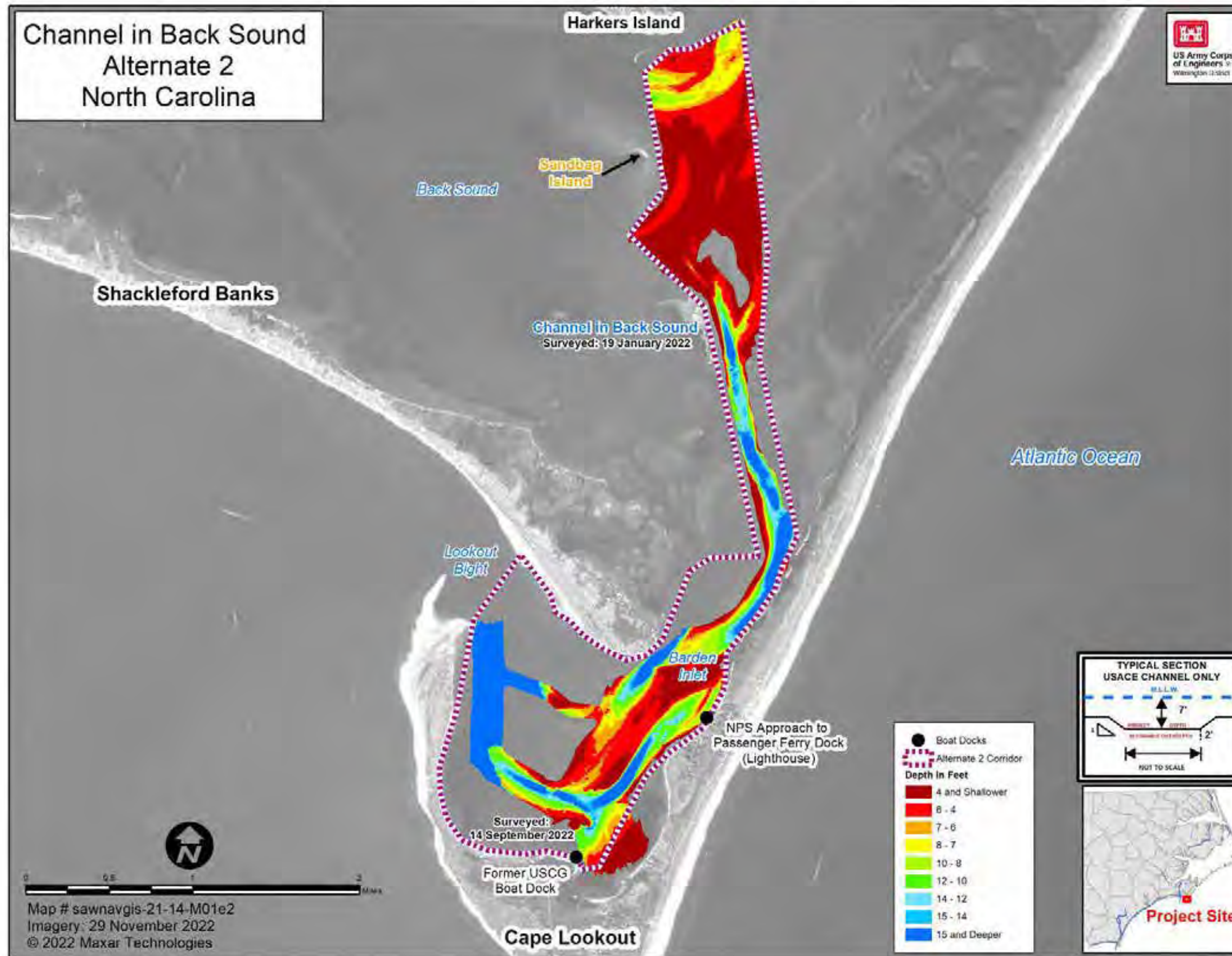


Figure 3. Alternative 2, Full Project Corridor

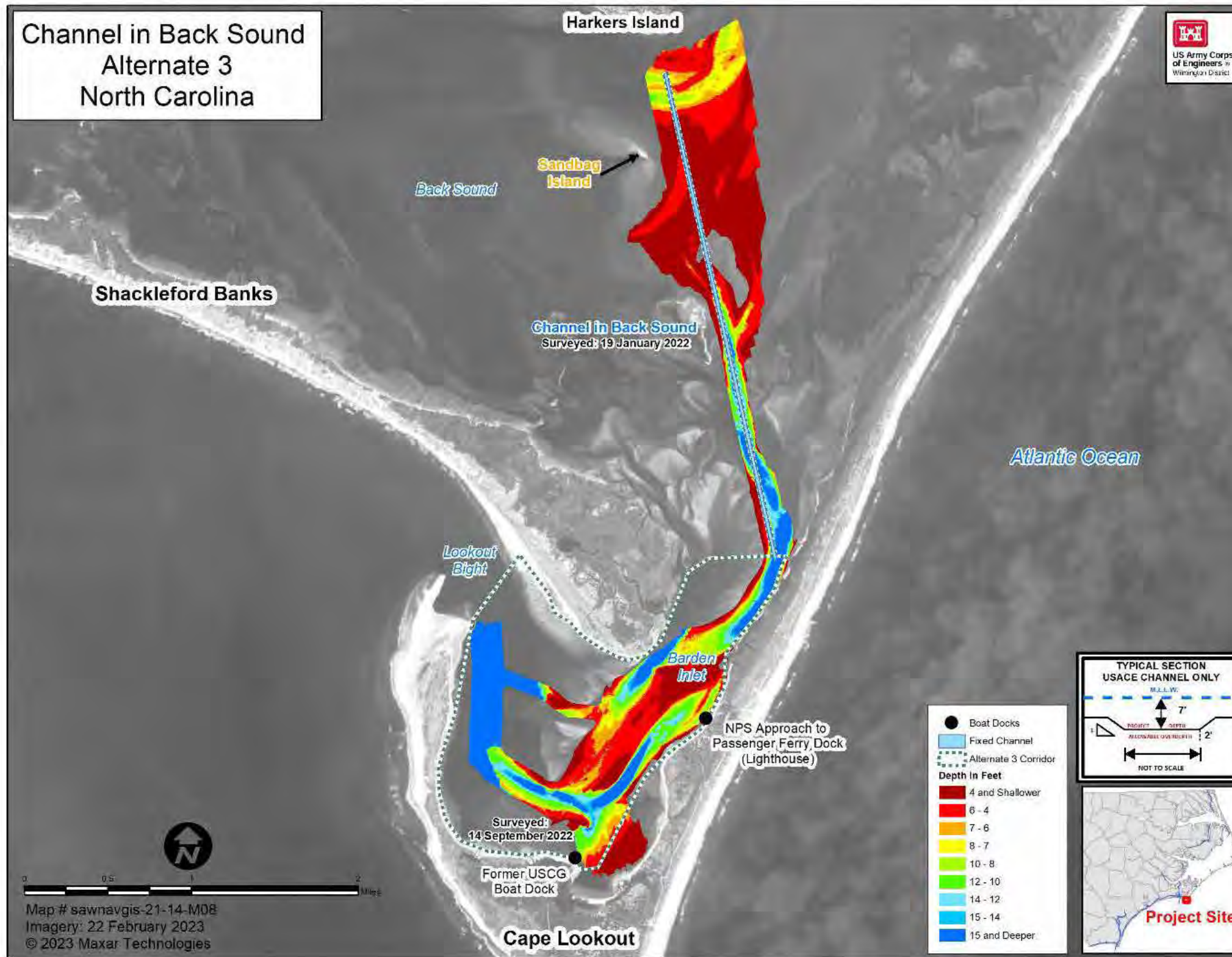


Figure 4. Alternative 3, Partial Project Corridor

# **Channels from Back Sound to Lookout Bight Maintenance Dredging Project Proposed Plan for Sandbag Island Placement Area**

Project Background: The proposed area being considered for dredged material placement from maintenance of the Back Sound federal navigation channel is a previously authorized bird nesting island managed by the State of North Carolina, locally known as Sandbag Island. At present, the island is less than 2 acres in size, and was last used for dredged material placement in 1997 when it was built to its maximum size of 18 acres. The island has eroded considerably over the last 25 years and is subject to seasonal heavy winds from the northeast and boat wakes from the nearby navigation channel.

Dredged material from the Back Sound navigation channel contains very fine-grained sand, with the average grain size ranging from 0.13-0.18 mm (just above the grain size of silt which is 0.075 mm). Behaviors of fine-grained sand make it challenging to contain and stack up, requiring a suite of methods to build the island with a minimal footprint. Past methods of successful placement include control-of effluent measures that used sandbags to contain the material released from the dredge pipe, allowing material to build above mean high water (MHW) level. Once the material stacked high enough for ground moving equipment to safely maneuver, berms were constructed to manipulate material, controlling the direction of flow.

Control-of-effluent measures have been used on various placement areas that serve as bird nesting habitat managed by the State. This proposed plan for reestablishing Sandbag Island is to provide a placement area for the material removed from the navigation channel over the lifetime of the project. The USACE estimates the need for a 25-acre island that would receive material approximately every 3-5 years depending on funding and need. Final elevations of the island would not exceed 15 feet (NAVD).

The backside of Sandbag Island (southwest side, Figure 1) contains a dense bed of submerged aquatic vegetation (SAV). The USACE will attempt to avoid impacts to SAV during island construction to the maximum extent practicable. Efforts using sandbags,

geotubes, berm construction and turbidity curtains will be made to direct effluent away from the direction of SAV and build the island to the north and east.

#### Alternatives Considered:

1. Sandbags – Sandbags are created by filling bags onsite using dredged material and are generally inexpensive to construct. These were previously used during the 1997 construction to assist in controlling the effluent. A sandbag barrier would be constructed to the size needed to contain the quantity of material and built to an elevation to withstand overwash.

Remnant sandbags are visible from two previous construction events (Figure 1). These sandbags are not effective today for island construction and removal would require an extensive effort. Likewise, new sandbags would be difficult to remove once buried with new material. Regular placement activities (every 3 years) could attempt to cover over any exposed sandbags so they do not pose a threat to wildlife.

2. Geotubes – Geotubes are created by filling tubes onsite using dredged material. They are large, single structures as opposed to numerous individual sandbags and thus more effective in controlling effluent and providing a barrier between the placement limits and SAV. They are more resistant to incoming tides and wind-driven waves, requiring less maintenance than sandbags. Costs can range from \$200-\$300 a foot, which could add substantial construction costs overall (\$300k - \$500k).

Following construction, geotubes may be cut open but their casings would be very difficult to remove completely. USACE has limited knowledge and experience using geotubes for coastal projects.

3. Berm Construction — Berm construction is the least expensive containment method and the most environmentally friendly method since they are moveable and do not pose a threat to wildlife. However, existing material on the island is insufficient to construct berms needed to control effluent successfully. Also, due to the fine to very fine-grained nature of the dredge material, using berms alone will be difficult to contain the placement material. Berms can be easily eroded during incoming tides, and can require persistent maintenance during dredging.

4. Turbidity Curtains –Turbidity curtains are effective in trapping sediments suspended in water (clays, silts, and very fine to fine grained sand). Installation and removal are relatively straight forward and costs are generally inexpensive, \$16-\$20 ft. However, use of curtains are constrained by shallow water depths; water depth must be

greater than 3 ft for turbidity curtains to be installed. The project area is very shallow <2 ft. NAVD88, therefore these curtains may not be effective. Until new survey information is obtained placement of turbidity curtains remains unknown

#### Sandbag Island Conceptual Design:

In FY23-24, USACE proposes to place approximately 130,000 CYs onto Sandbag Island using a cutter suction pipeline dredge. The placed material will be managed by means of control-of-effluent using a combination of sandbags, geotubes, berm construction and turbidity curtains. There is no other placement area available for this material that is economically and environmentally feasible.

The conceptual design requires topographic and bathymetric surveys to better conceptualize the proposed design.

Prior to placing material on the island, filling and placement of geotubes and/or sandbags on the west and east side of Sandbag Island would occur to establish a barrier between the placement area and SAV (Figure 1). The total length of geotubes and/or sandbags would be approximately 1400 ft with the west side containing 610 ft. of geotubes and/or sandbags and the east side containing 790 ft. of geotubes and/or sandbags. The height and location of the geotubes and/or sandbags will be determined at later date once a survey of the island is complete. If surrounding waters are 3 feet or greater in depth, turbidity curtains could be installed to prevent the fine-grained dredged material from migrating over the SAV. Using the dredged material in the federal navigation channel, the dredge pipe would be directly connected to the geotubes to fill them to their maximum capacity. Once the geotubes and/or sandbags are filled and placed on the west and east extents of the placement area, the center of the island would then be reworked through earth moving equipment. Material would be pushed away from the center of the island toward the placed geotubes and/or sandbags and to the northern and southern placement extents to create a basin at the center of the island. The dredge pipe would then be oriented toward the north or south (not directed toward SAV) and initial placement would begin in the center of the island. As the dredged material piles up in the center of the island, between the geotubes and/or sandbags, the placed material will be reworked again and pushed away from the center of the island toward the north and south building out berms to further contain the placed material. Placing material in this manner would require around the clock attention to ensure the center of the island does not overflow with material and to ensure berms constructed from placed material do not blow out. Depending on the orientation of the pipe, the effluent would need to be controlled to ensure water velocities are slow enough to allow dredged material to settle out while water continues to flow away from the placed area. After the federal navigation channel is dredged the placed geotubes and/or sandbags will need to be cut and removed from the island. The material trapped

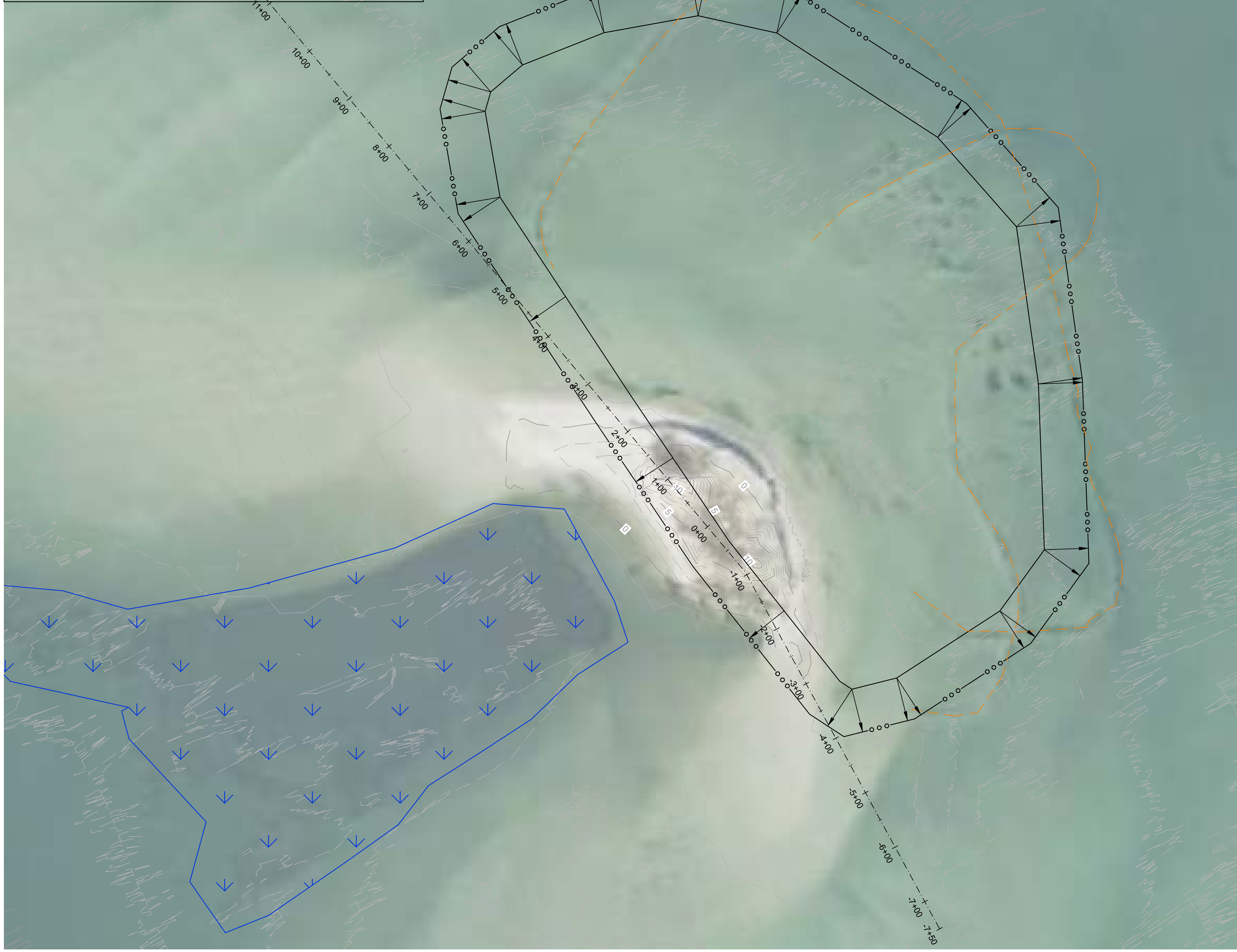
in the geotubes and/or sandbags will then need to be reworked and tie into the existing grade.

Avoidance and Minimization Measures:

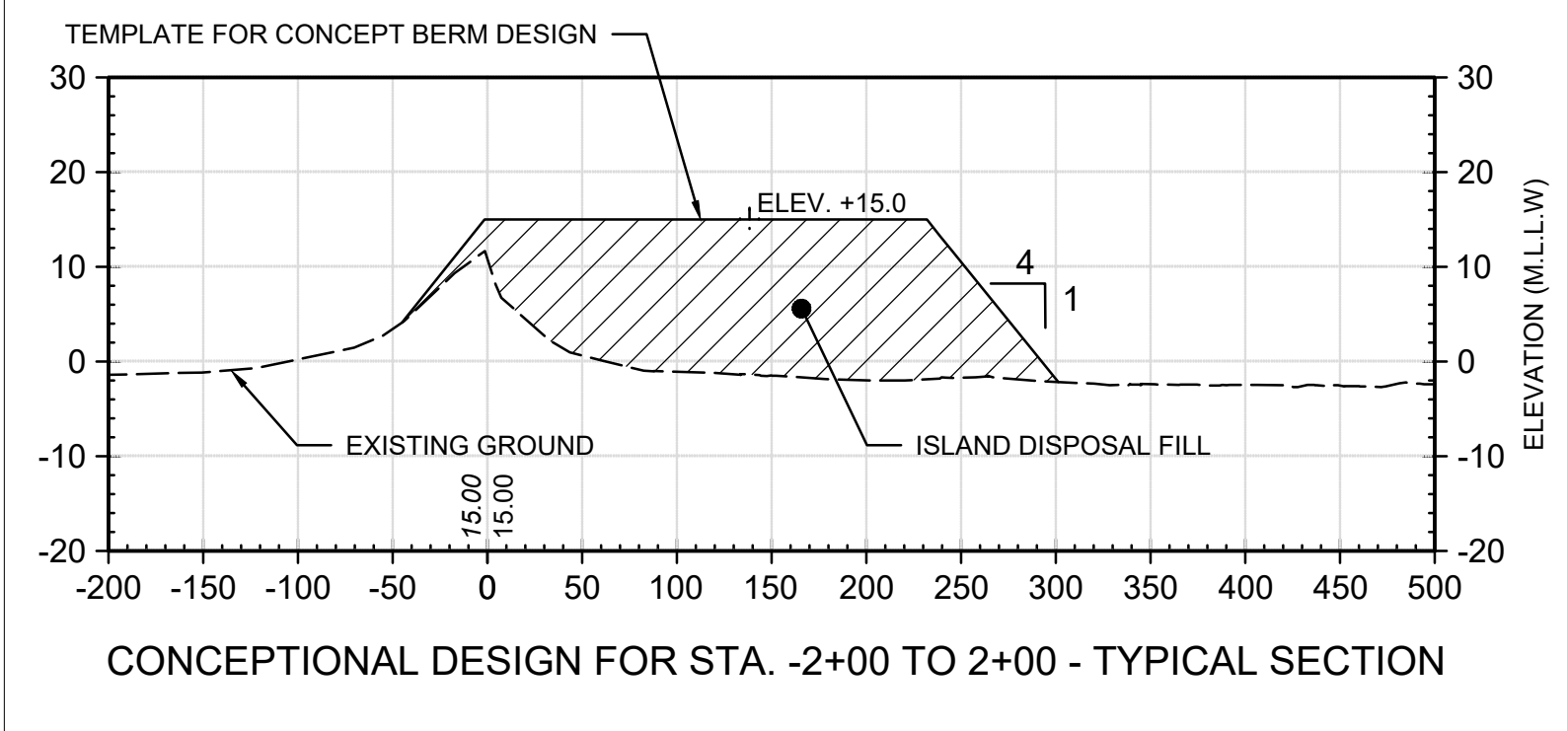
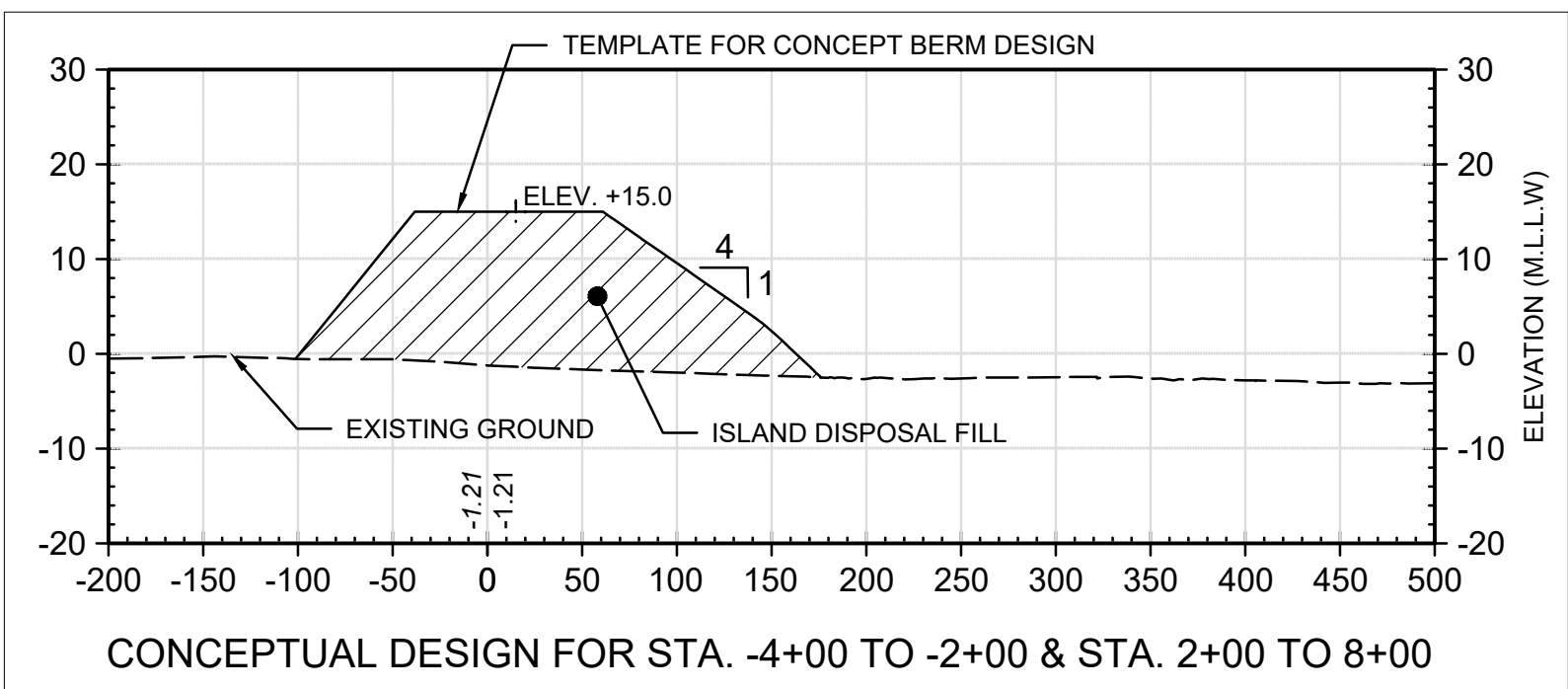
- Survey the existing island and proposed placement area to determine the existing topography and capacity for dredged material. Surrounding waters are very shallow (1-2 feet).
- At early stages of pumping/island construction, geotubes or sandbags will be necessary to contain the dredged material. Once construction is complete geotubes/sandbags should be removed.
- Keeping the discharge end of the pipe below the water level can decrease sediment runoff/suspended sediments and help material to stay within the desired area.
- Once there is enough material on the island, construction of berms will be necessary to help reduce suspended sediments in the surrounding waters and control and direct material away from SAV.
- Turbidity curtains may be useful if water depths are adequate (3ft or greater).
- Continuous bulldozing/manipulation of material will be necessary to construct the island to design. Once placement begins, it is recommended that there should be no planned breaks during pumping until placement of all material is complete (per Erica Janocha, USACE, SAS).
- To reduce future erosion, suggest planting marsh grass (*Spartina* sp) sprigs along the eastern perimeter of the island. This would also qualify for EFH mitigation if required by agencies. Oyster bags and cultch could also be an option for stabilization/mitigation.
- Work will be conducted during fall/winter (September – March) to minimize impacts on nesting birds and their young.

Figure 1. Proposed island footprint adjacent to the ground-truthed SAV bed (in blue). A combination of geotubes and/or sandbags, constructed berms, and turbidity curtains are being considered to assist with the containment of placed dredged material.



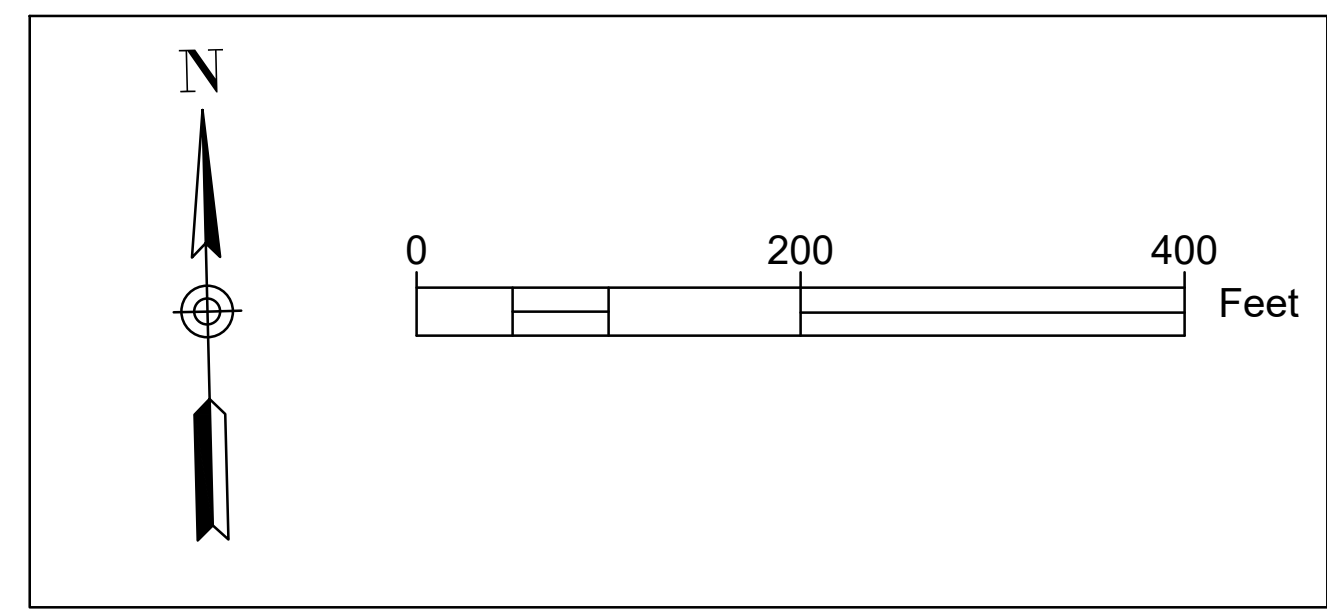


**NOTE:**  
 FIGURE 1. PROPOSED ISLAND FOOTPRINT ADJACENT TO GROUND TRUTHED SAV BED. A COMBINATION OF GEOTUBES AND/OR SANDBAGS, CONSTRUCTION BERMS, AND TURBIDITY CURTAINS ARE BEING CONSIDERED TO ASSIST WITH THE CONTAINMENT OF PLACED DREDGED MATERIAL.  
 DURING CONSTRUCTION THE CONTRACTOR SHALL EVENLY PLACE DREDGED MATERIAL WITH A NATURAL SLOPE. THE NATURAL SLOPE SHALL NOT EXCEED A RATIO OF 4H:1V IN STEEPNESS.



**LEGEND**

	PROPOSED BERM FOOTPRINT
	TOE OF FILL
	SUB AQUATIC VEGETATION (SAV)
	HISTORICAL SANDBAG CONSTRUCTION



MARK	DESCRIPTION	DATE

DESIGNED BY: L. KNIGHT/US. FABIAN	HORIZONTAL DATUM: NC STATE PLANE
CHECKED BY: T. KNIGHT	VERTICAL DATUM: M.L.L.W.
SUBMITTED BY: S. GAGER	DRAWING DATE: 31 MAR 23
FILE NAME: EA_AppendixB_Figure-1.dwg	

U.S. ARMY CORPS OF ENGINEERS  
 WILMINGTON DISTRICT  
 69 DARLINGTON AVENUE  
 WILMINGTON, NORTH CAROLINA 28403

CHANNEL TO BACK SOUND TO LOOKOUT BIGHT  
 MAINTENANCE DREDGING PROJECT  
 TYPICAL AGGREGATE PLACEMENT  
 CARTERET COUNTY, NORTH CAROLINA

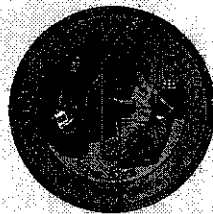
APPENDIX B  
 PROPOSED PLAN FOR SANDBAG ISLAND PLACEMENT AREA  
 FIGURE 1

SHEET ID  
**GI-001**

ROY COOPER  
Governor

ELIZABETH S. BISER  
Secretary

BRAXTON DAVIS  
Director



NORTH CAROLINA  
Environmental Quality

June 28, 2023

Ms. Jenny Owens  
Chief, Environmental Resources Section  
U.S. Army Corps of Engineers  
69 Darlington Ave.  
Wilmington, NC 28403

**SUBJECT:** Consistency Concurrence Concerning U.S. Army Corps of Engineers (Corps) Proposal to Maintain the Navigation Channel within Back Sound to Lookout Bight (DCM#2023025)

Dear Ms. Owens:

We received your consistency submission on April 14, 2023, and revised submission on June 9, 2023, concerning the proposal to maintain the navigation channel within Back Sound to Lookout Bight, including two boat dock channels that provide access to the National Park Service (NPS) Cape Lookout National Seashore and employee access for maintenance of the lighthouse and park grounds. The proposal includes dredging using the Government-owned shallow draft plants and contracted hydraulic cutterhead pipeline dredge. Pipeline dredged material would be placed on Sandbag Island or on nearby Cape Lookout National Seashore soundside or oceanside beaches.

Placement onto Sandbag Island via control-of-effluent would utilize various methodologies including geo-tubes, berm construction, and turbidity curtains. Initially, synthetic geo-tubes are proposed around Sandbag Island to contain dredge material in order to keep dredge material from moving towards the submerged aquatic vegetation (SAV) beds while constructing the island towards the north and east. Between pipeline dredging events, Government-owned shallow draft plants (i.e., special purpose hopper or sidecast dredge) would remove any shoals impeding navigation. Special purpose hopper dredged material would be placed in naturally occurring scour holes within the Barden Inlet and Lookout Bight channel. Sidecast dredging is also proposed to be used to maintain the Corps and NPS channels when other dredge plants are not available and would sidecast material 80-feet from the vessel's starboard or port side.

North Carolina's coastal zone management program consists of, but is not limited to, the Coastal Area Management Act, the State's Dredge and Fill Law, Chapter 7 of Title 15A of North Carolina's Administrative Code, and the land use plan of the County and/or local municipality in which the proposed project is located. It is the objective of the Division of Coastal Management (DCM) to manage the State's coastal resources to ensure that proposed Federal activities would be compatible with safeguarding and perpetuating the biological, social, economic, and aesthetic values of the State's coastal waters.

DCM circulated this proposal to the N.C. Division of Marine Fisheries (DMF) and the N.C. Wildlife Resources Commission (WRC) and both agencies expressed concerns regarding the use of synthetic geo-tubes and proposed spoil disposal options. Both comments are attached for your consideration. DCM has reviewed the submitted information pursuant to the management objectives and enforceable policies of

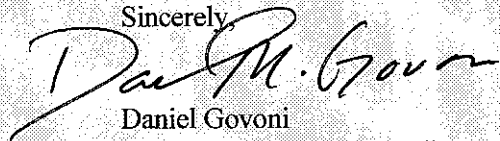


North Carolina Department of Environmental Quality | Division of Coastal Management  
Morehead City Office | 400 Commerce Avenue | Morehead City, North Carolina 28557  
252.808.2808

Subchapters 7H and 7M of Chapter 7 in Title 15A of the North Carolina Administrative Code and concurs that this federal activity is consistent, to the maximum extent practicable, with the relevant enforceable polices of North Carolina's certified coastal management program. However, keeping with recommendations from DMF and WRC, DCM recommends that biodegradable geo-tubes be used if possible and requests the Corps closely monitor SAV impacts and report any impacts to DCM not originally anticipated.

Prior to the initiation of the activities described, the applicant should obtain any additional State approvals or authorizations. Should the proposed action be modified, a revised consistency determination shall be required. This might take the form of either a supplemental consistency determination pursuant to 15 CFR 930.46, or a new consistency determination pursuant to 15 CFR 930.36. Likewise, if further project assessments reveal environmental effects not previously considered by the proposed development, a supplemental consistency certification may be required. If you have any questions, please contact me at (252) 808-2808. Thank you for your consideration of the North Carolina Coastal Management Program.

Sincerely,



Daniel Govoni  
Federal Consistency Coordinator



# **APPENDIX J**

## **USACE REGULATORY PERMIT & WATER QUALITY CERTIFICATE**

### **CHANNELS FROM BACK SOUND TO LOOKOUT BIGHT**

**SEPTEMBER 2023**





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

August 28, 2023

Regulatory Division

Action ID: SAW-2022-00574

Cape Lookout National Seashore  
Attn: Jeff West, Superintendent  
131 Charles Street  
Harkers Island, North Carolina 28531

Dear Mr. West:

In accordance with your written request of April 27, 2023, and the ensuing administrative record, enclosed is a copy of a permit to maintenance dredge two (2) National Parks Service-managed boat docks with placement of dredged material on Lighthouse Beach (soundside) and in surrounding open waters of Lookout Bight, Cape Lookout National Seashore, Carteret County, North Carolina. The request includes maintenance of channels as needed over a ten-year period, using Government-contracted cutter suction dredges (every 3-5 years) and Government-owned special purpose hopper and sidecaster dredges (when needed). Work is proposed to be conducted in accordance with the 2023 Environmental Assessment titled *Channel from Back Sound to Lookout Bight Maintenance of USACE and NPS Navigation Channels* written by the USACE Civil Works Planning Department.

Any deviation in the authorized work will likely require modification of this permit. If any change in the authorized work is necessary, you should promptly submit revised plans to the Corps showing the proposed changes. You may not undertake the proposed changes until the Corps notifies you that your permit has been modified.

Carefully read your permit. The general and special conditions are important. Your failure to comply with these conditions could result in a violation of Federal law. Certain significant general conditions require that:

- a. You must complete construction before **December 31, 2033**.
- b. You must notify this office in advance as to when you intend to commence and complete work.
- c. You must allow representatives from this office to make periodic visits to your worksite as deemed necessary to assure compliance with permit plans and conditions.

You should address all questions regarding this authorization to Ms. Emily Hughes at the Wilmington Regulatory Field Office, at (910) 251-4829 or [emily.b.hughes@usace.army.mil](mailto:emily.b.hughes@usace.army.mil).

Sincerely,

*Mickey Sugg*

FOR Tommy Fennel, Chief  
Regulatory Division  
Wilmington Regulatory Field Office

Enclosures  
Department of the Army Permit  
Special Conditions  
Plans

Copy Furnished via email:

Daniel Govoni, NC Division of Coastal Management  
Heather Coats, NC Division of Coastal Management  
Garcy Ward, NC Division of Transportation  
Holley Snider, NC Division of Water Resources  
Renee Gledhill-Earley, State Historic Preservation Office  
Pace Wilber, National Marine Fisheries Service  
Kathy Matthews, US Fish and Wildlife Service  
Todd Bowers, US EPA

## DEPARTMENT OF THE ARMY PERMIT

Permittee **Cape Lookout National Seashore, Att: Jeff West, Superintendent**

Permit No. **AID SAW-2022-00574**

Issuing Office **CESAW-RG- L**

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: **Maintenance of two NPS boat dock channels (Lighthouse Channel and the Old USCG Channel) using several alternative methods of dredging and disposal to accomplish the work.**

Project Location: **34.6234N, -76.5288W, within waters of Lookout Bight and along the soundside shoreline adjacent to the Cape Lookout Lighthouse (referred to as Lighthouse Beach), near the southern end of Cape Lookout National Seashore, Carteret County, North Carolina.**

### General Conditions:

1. The time limit for completing the work authorized ends on **December 31, 2033**. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.
2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.
3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.
4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.
5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.
6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

**SEE ATTACHED SPECIAL CONDITIONS**

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:
  - ( X ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).
  - ( X ) Section 404 of the Clean Water Act (33 U.S.C. 1344).
  - ( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).
2. Limits of this authorization.
  - a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.
  - b. This permit does not grant any property rights or exclusive privileges.
  - c. This permit does not authorize any injury to the property or rights of others.
  - d. This permit does not authorize interference with any existing or proposed Federal project.
3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:
  - a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.
  - b. 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.
  - c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.
  - d. Design or construction deficiencies associated with the permitted work.

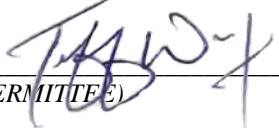


- e. Damage claims associated with any future modification, suspension, or revocation of this permit.
4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.
5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:
- a. You fail to comply with the terms and conditions of this permit.
  - b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).
  - c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

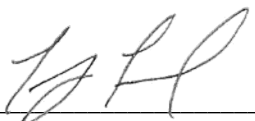
Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit, Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

 CALO Superintendent \_\_\_\_\_ August 28, 2023 \_\_\_\_\_  
 (PERMITTEE) (DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

 \_\_\_\_\_ 28 AUG 2023 \_\_\_\_\_  
 (DISTRICT COMMANDER) (DATE)

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

\_\_\_\_\_  
 (TRANSFEREE) (DATE)

**Individual Permit Special Conditions**  
**National Park Service, Cape Lookout National Seashore**  
**Action ID No SAW-2022-00574**

In accordance with 33 U.S.C. 1341(d), all conditions of the North Carolina Division of Coastal Management Federal Consistency concurrence letter dated June 28, 2023 and the North Carolina Division of Water Resources Individual 401 Water Quality Certification WQC006054 dated August 15, 2023, are incorporated as part of the Department of the Army permit. Therefore, they are not listed as special conditions but are enclosed for your convenience (Attachment E).

**Work Limits**

1. All work authorized by this permit must be performed in strict compliance with the attached Plans and Maps and Cross Sections, dated July 31, 2023, which are a part of this permit (Attachment A). The Permittee shall ensure that the construction design plans for this project do not deviate from the permit plans attached to this authorization. Any modification to these plans must be approved by the U.S. Army Corps of Engineers (USACE) prior to implementation.

2. Beach placement activities under authorization of this permit shall be restricted to September 1 to March 31 of any year during the life of this authorization. All activity, including mobilization efforts, is restricted from the beach prior to September 1. Upon completion of work, all equipment, including pipelines, must be removed by March 31. Dredging activities conducted with Government-owned special purpose hopper or sidecast dredge shall be restricted to October 1 to March 31.

3. Maintenance dredging is limited to the authorized dimensions for each NPS channel listed below and may occur anywhere within Lookout Bight where a connection from the boat dock to the USACE federal navigation channel follows best, natural deep water (with the exception of avoiding the 2 identified underwater shipwreck sites; see Special Condition #26, below for more information).

1. Lighthouse Channel – 40 feet wide by -7 feet MLLW +1 foot allowable overdepth.
2. Old USCG Channel – 40 feet wide by -4 feet MLLW +2 feet allowable overdepth (plans will be provided when the need to dredge occurs).

4. Except as authorized by this permit or any USACE-approved modification to this permit, no excavation, dredging, filling, 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 activities connected with this project.

5. Except as authorized by this permit or any USACE approved modification to this

permit, no excavation, dredging or fill 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.

6. The work authorized herein includes periodic maintenance dredging over the course of 10 years (through 2033). Prior to initiating any maintenance dredging event, a notification request must be submitted to the USACE office for prior verification. This notification must include, but is not limited to, the following: a project description or summary, demonstration of need for the dredging, type of dredge, method and location of placement, projected timeframe of dredging, and estimated amount of material to be dredged. Dredging will not be permitted until approved by our office after review of the information and coordinated with the appropriate agencies.

7. A pre-construction meeting must be held with Wilmington District, Regulatory Division 30 days prior to conducting the work to ensure all parties fully understand the conditions of this permit. Meeting participants may include, but are not limited to, representatives from the USACE Navigation Division, N.C. Division of Coastal Management, N.C. Division of Water Resources, N.C. Wildlife Resource Commission, U.S. Coast Guard, and U.S. Fish and Wildlife Service.

8. 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 and drawings shall be available at the project site during construction and maintenance of this project.

9. This permit does not authorize the interference with any existing or proposed Federal project, including operations of the USACE Civil Works dredging and navigation projects, and the Permittee will not be entitled to compensation for damage or injury to the authorized structure or work which may be caused from existing or future operations undertaken by the United States in the public interest. 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. Use of the permitted activity must not interfere with the public's right to free navigation on all navigable waters of the United States.

10. Prior to each dredging event, submerged aquatic vegetation (SAV) in the project area will be mapped and identified using the State's online SAV database as well as recent aerial imagery (taken during the growing season of May – September) to ensure that SAV are avoided to the maximum extent practicable.

11. The permittee shall coordinate the placement of all dredge pipelines along the beach with the U.S. Fish and Wildlife Service and the N.C. Wildlife Resources Commission prior to any mobilization of equipment to the beach.

12. All notifications, reports, documentation, and correspondence required by the conditions of this permit shall be submitted to the following address: U.S. Army Corps of Engineers, Regulatory Division, Wilmington Regulatory Field Office, Attn: Emily Hughes, 69 Darlington Avenue Wilmington, North Carolina, 28403, and by telephone at: 910-251-4635, and email at [Emily.b.hughes@usace.army.mil](mailto:Emily.b.hughes@usace.army.mil). The Permittee shall reference the following permit number, SAW-2022-00574, on all submittals.

### **Project Maintenance**

13. The permittee shall ensure that an inspector is present during all beach placement activities and immediately report to the USACE in the event any incompatible material is placed on the beach. During operations, material placed on the beach shall be inspected daily to ensure compatibility. At days 2, 4, 6, etc., during dredging, a visual assessment of the material will be conducted, and the results of that assessment will be submitted to the USACE the same day. If during the monitoring process non-beach compatible material (based on grain size, color, silt content, shell percentage, or other sediment issues) is or has been placed on the beach, all work shall stop immediately and the USACE notified by the permittee and/or its contractor to determine the appropriate plan of action or additional monitoring measures. Final results will be coordinated with USFWS and NCWRC to determine compliance with the Endangered Species Act.

14. Buoy Lines (Dredging Operations): In order to minimize potential impacts to federally-listed sea turtle species, in-water lines (rope, chain, and cable, including the lines to secure turbidity curtains) must be stiff, taut, and non-looping. Examples of such lines are heavy metal chains or heavy cables that do not readily loop and tangle. Flexible in-water lines, such as nylon rope or any lines that could loop or tangle, must be enclosed in a plastic or rubber sleeve/tube to add rigidity and prevent the line from looping and tangling. In all instances, no excess line is allowed in the water.

15. 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 Resources at (919) 791-4200, and the North Carolina Emergency Management Office at 1-800-858-0368, and provisions of the North Carolina Oil Pollution and Hazardous Substances Control Act will be followed.

16. The Permittee shall monitor any dredge pipeline utilized during construction activities, in order to check for potential leaks, which may emanate from the pipeline couplings. All dredge activities will cease if leaks are found. Operations may resume upon appropriate repair of affected couplings, or other equipment.

17. 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. 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).

18. As-built surveys of the maintained channel(s) and beach profiles must be provided to the USACE as they are being conducted. Final surveys must be submitted to Emily Hughes at [Emily.b.hughes@usace.army.mil](mailto:Emily.b.hughes@usace.army.mil) within 30 days of the completion of each maintenance event.

### **Threatened and Endangered Species**

19. This Department of the Army permit does not authorize you to take a threatened and/or endangered species and/or to modify designated critical habitat, in particular the Loggerhead sea turtle (marine) (Northwest Atlantic DPS) (*Caretta caretta*); Green sea turtle (marine) (North Atlantic DPS) (*Chelonia mydas*); Hawksbill sea turtle (marine) (*Eretmochelys imbricate*); Leatherback sea turtle (marine) (*Dermochelys coriacea*); Shortnose sturgeon (*Acipenser brevirostrum*); Atlantic sturgeon (Carolina DPS) (*Acipenser oxyrinchus*); West Indian manatee (*Trichechus manatus*); Piping plover (*Charadrius melodus*); Red knot (*Calidris canutus rufa*); Seabeach amaranth *Amaranthus pumilus*); Piping Plover Wintering Critical Habitat; and Red Knot Proposed Wintering Critical Habitat.

In order to legally take a listed species or modify a critical habitat, you shall have separate authorization under the ESA (e.g., an ESA Section 10 permit, or a Biological Opinion (BO) under ESA Section 7, with "incidental take" provisions with which you shall comply). Listed species and designated critical habitats within the action area boundaries are under ESA purview of both the National Marine Fisheries Service Protective Resource Division (NMFS-PRD) and the U.S. Fish and Wildlife Service (USFWS). The NMFS March 26, 2020 South Atlantic Regional Biological Opinion (SARBO) for Dredging and Material Placement Activities in the Southeast United States have mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take". Project Design Criteria (PDCs) that are subject to the specific and general activities associated with the authorized project are included in Attachment B and must be adhered to and implemented. The complete SARBO is available at the following site:

<https://dqm.usace.army.mil/odess/#/technicalInfo>

The August 28, 2017, North Carolina Coastal Beach Sand Placement Statewide Programmatic Biologic Opinion (SPBO) contains mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" specified in the BO. Reasonable and Prudent Measures and Terms and Conditions associated with the SPBO can be found in Attachment C and the complete SPBO is available at <https://www.fws.gov/raleigh/pdfs/spbo.pdf>.

Your authorization under this permit is conditional upon your compliance with all of the mandatory terms and conditions and reasonable and prudent measures associated with the SARBO and the SPBO. Failure to comply with the terms and conditions

associated with incidental take of each BO, where a take of the listed species occurs, would constitute an unauthorized take, and it would also constitute non-compliance with your permit. The NMFS-PRD and USFWS are the appropriate authority to determine compliance with the terms and conditions of their BOs, and with the ESA.

20. In regards to the NMFS SARBO, the Permittee understands and agrees that, even where it is in full compliance with the terms and conditions of the SARBO Incidental Take Statement (ITS) and this permit, incidental take by the Permittee or other dredging operations within the area covered by the SARBO may result in suspension or modification of this permit by the Corps. The amount of incidental take that will trigger suspension, and the need for any such suspension, shall be determined at the discretion of the Corps. The Permittee understands and agrees on behalf of itself, its agents, contractors, and other representatives, no claim, legal action in equity or for damages, adjustment, or other entitlement against the Corps shall arise as a result of such suspension or related action.

Failure to comply with all applicable project design criteria and mandatory conservation measures would constitute non-compliance with your USACE permit. Failure to comply with this permit will be the basis for suspension and revocation of this permit and may be the basis for other enforcement action. NMFS has directed that this SARBO issued to the Corps serve as the formal consultation for all projects in the area covered by the SARBO; however, where the terms and conditions of the SARBO differ from the special conditions of this permit, the special conditions of this permit will take precedence as the more stringent condition. Please reference Section 10.1, Table 53 of the 2020 SARBO for the updated ITS allocations.

21. In the event an incidental take of any of the listed species in Special Condition 19 (above) occurs during construction, the Permittee shall stop all dredging and/or nearshore placement operations and contact the Corps for consultation to determine the appropriate action, including the immediate implementation of additional protective measures. The Permittee shall immediately notify the Wilmington Regulatory Field Office, Attn: Project Manager, Ms. Emily Hughes, by email [Emily.b.hughes@usace.army.mil](mailto:Emily.b.hughes@usace.army.mil) or by telephone at (910) 251-4635 that an incidental take has occurred. In the case of an incidental take of a sea turtle, the Sea Turtle and/or Sturgeon Mortality Report (Attachment D) will be filled out by the Observer immediately (within 6 hours) and e-mailed in pdf format to the Corps contact listed above.

22. Dredging operations involving hydraulic cutter dredge plants must follow the protocols outlined in the Dredge Plant Conditions disclosed in Attachment D.

23. The permittee shall coordinate the placement of all dredge pipelines with the Corps, the US Fish and Wildlife Service, and the North Carolina Wildlife Resources Commission (NCWRC).

24. In order to protect the endangered West Indian manatee (*Trichechus manatus*) the Permittee shall implement the U.S. Fish and Wildlife Service's Manatee Guidelines,

and strictly adhere to all requirements therein. The guidelines can be found in Attachment F or at [https://www.fws.gov/raleigh/pdfs/manatee\\_guidelines.pdf](https://www.fws.gov/raleigh/pdfs/manatee_guidelines.pdf).

### **Cultural Resources**

25. If submerged cultural resources are encountered during the operation, work in the area shall cease immediately. For dredging operations within the 3-nautical mile limit, the USACE Wilmington District, Regulatory Division must be immediately notified so that coordination can be initiated with the Underwater Archeology Unit (UAU) of the Department of Cultural Resources. In emergency situations, the permittee should immediately contact Mr. Nathan Henry at (910-458-9042), Fort Fisher, so that a full assessment of the artifacts can be made.

26. The Cape Lookout Bight and Back Sound areas contain six recorded submerged archaeological sites, most notably the wreck of the Olive Thurlow (CLS0004), that lie adjacent to the channels. As per SHPO letter dated 16 June 2022, a 150 square meter buffer will be established around the 2 identified wrecks in which no dredging will occur.

### **Enforcement**

27. Violations of these permit 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 Emily Hughes, Wilmington District, at [Emily.b.hughes@usace.army.mil](mailto:Emily.b.hughes@usace.army.mil) (910) 251-4635 within 24 hours of the permittee's discovery of the violation.

28. A representative of the USACE, Regulatory Division will periodically and randomly inspect the work for compliance with these conditions. Deviations from the permitted activities and permit conditions may result in cessation of work until the problem is resolved to the satisfaction of the USACE. No claim, legal action in equity or for damages, adjustment, or other entitlement shall be asserted against the United States on account of any such required cessation or related action, by the permittee, its agents, contractors, or other representatives.

29. 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 waters to its pre-project condition.

### **Navigation**

30. 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.

31. The authorized project 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.

### **Miscellaneous**

32. In issuing this permit, the Federal Government does not assume any liability for: a) Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes; b) Damages to the permitted project or uses thereof as a result of current or future Federal activities initiated on behalf of the general public; c) Damages to other permitted or unpermitted activities or structures caused by the authorized activity; d) Design and construction deficiencies associated with the permitted work; e) Damage claims associated with any future modification, suspension, or revocation of this permit.

33. To address concerns from the United States Coast Guard: The following information must be provided 10 days prior to the commencement of dredge operations:

ANY DREDGING OR OTHER OPERATIONAL ACTIVITY THAT IMPACTS THE SAFE NAVIGATION ON FEDERAL WATERWAYS.

1. DATES (INCLUSIVE) OF OPERATION.
2. HOURS OF OPERATION (24 HOURS/DAYLIGHT HOURS ONLY).
3. NAMES OF THE INVOLVED VESSEL(S).
4. WORKING AND STANDBY FREQUENCIES.
5. SPECIFIC LOCATION (MILE MARKER/CHANNEL).
6. ANY SPECIFIC INSTRUCTIONS OR CONCERNS THAT WOULD BE PERTINENT TO THE MARINER. (NOTE: WE CAN ONLY PROVIDE INFORMATION. WE CANNOT DIRECT THE MOVEMENTS OF VESSELS. WE URGE THE MARINER TO ADHERE TO THE REQUESTED ACTIONS.)

Submit the information to:

USCG SECTOR NC WATERWAYS  
DIV 721 MEDICAL CENTER DRIVE  
WILMINGTON, NC 28401

Or email [NCmarineevents@uscg.mil](mailto:NCmarineevents@uscg.mil)

34. Should Federal Aids to Navigation need to be relocated to facilitate this operation, 30 days' notice is required. The request will be sent to the Coast Guard District Five



Office at:  
USCG DISTRICT FIVE (DPW)  
431 CRAWFORD STREET  
PORTSMOUTH, VA 23704

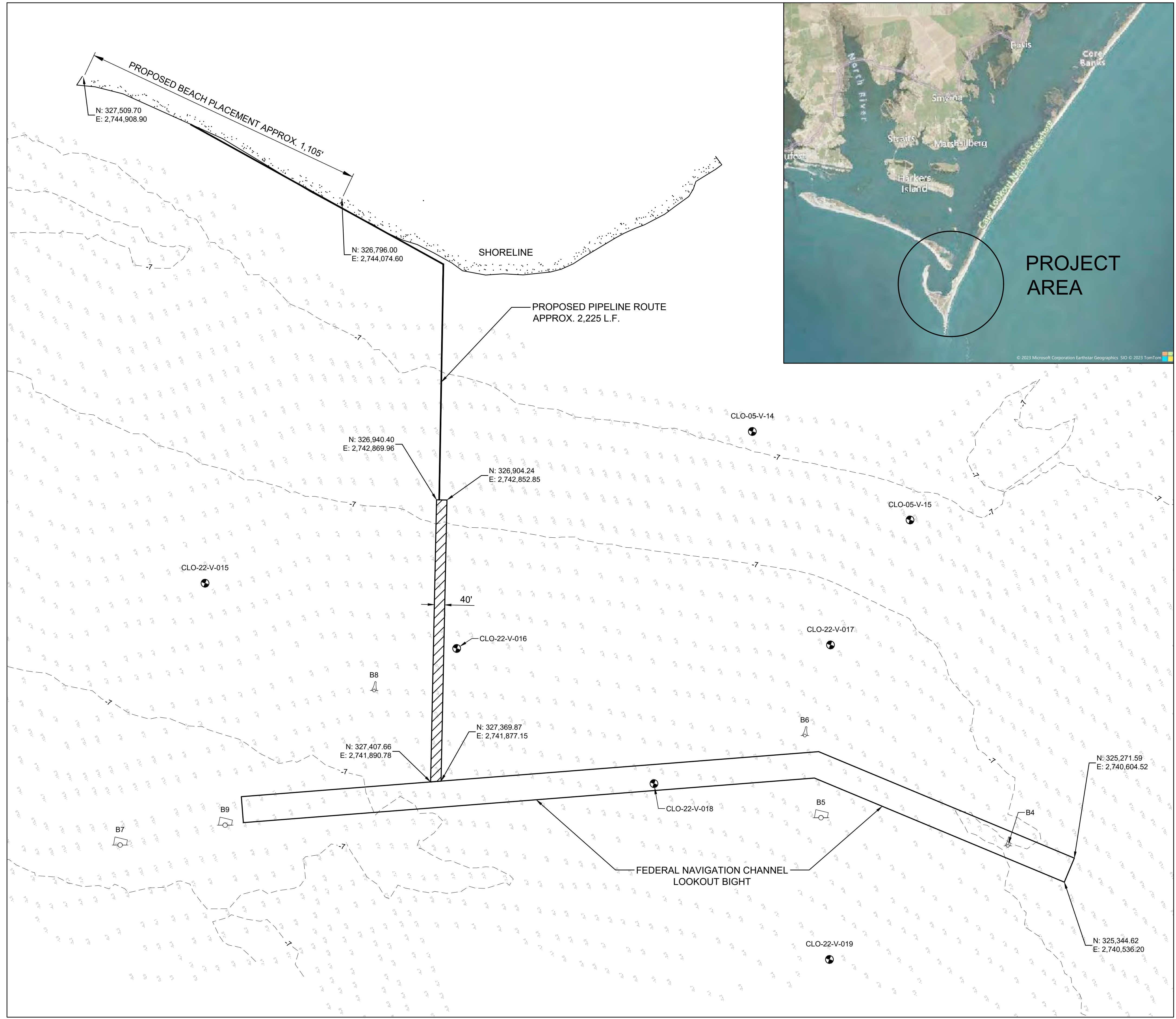
Or email: [CGD5Waterways@uscg.mil](mailto:CGD5Waterways@uscg.mil)

35. The Permittee shall comply with all U.S. Coast Guard regulations for dredging operations. The Permittee shall contact Commander, Fifth Coast Guard District at (757) 398-6220 or [CGD5Waterways@uscg.mil](mailto:CGD5Waterways@uscg.mil) at least 30 days prior to construction to request a notice in the Local Notice to Mariners. The Permittee shall notify the Corps when this coordination with the U.S. Coast Guard has commenced.

36. 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 telephone, (910) 772-2200.

# **ATTACHMENT A**

## **CAPE LOOKOUT DREDGING AND PLACEMENT PLANS**



**GENERAL SHEET NOTES:**

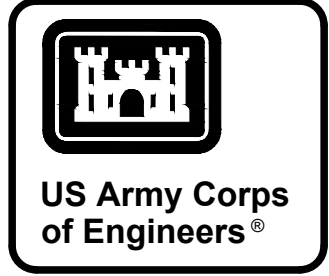
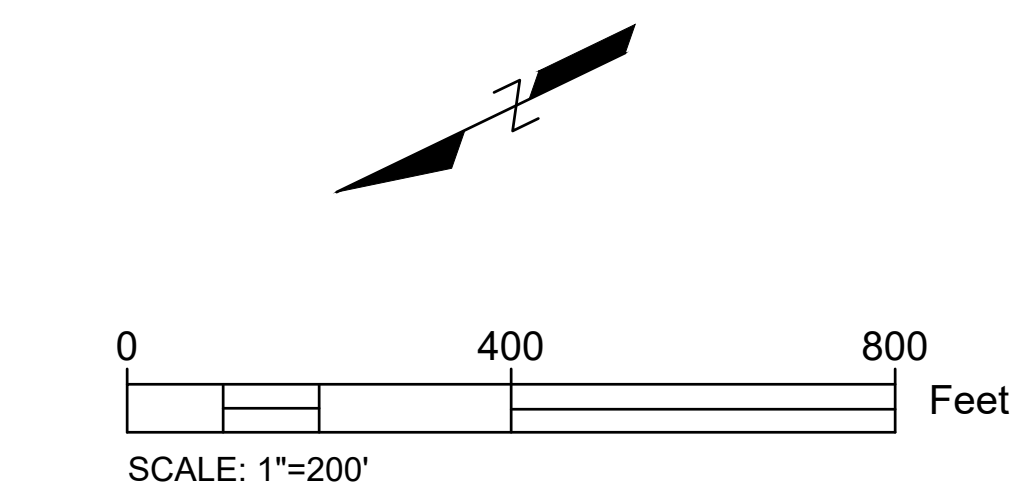
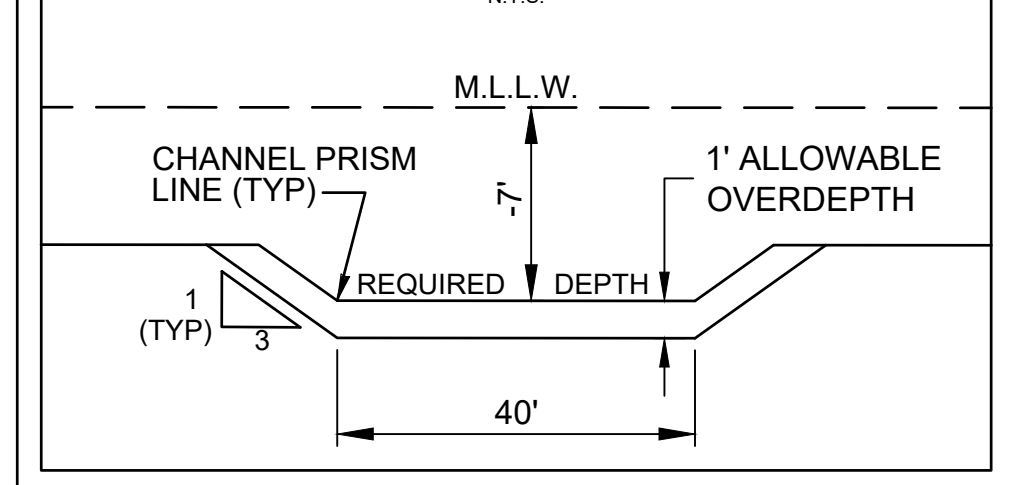
- HORIZONTAL DATUM NAD83. VERTICAL DATUM M.L.L.W.
- SOUNDINGS ARE EXPRESSED IN FEET AND REFER TO NOAA'S REPORTED MEAN LOWER LOW WATER (MLLW) RELATIVE TO THE 1983-2001 TIDAL EPOCH.
- PROJECT SURVEYED 14 SEPTEMBER 2022 WITH DISTRICT SURVEY VESSEL "ROGERS". USING RTK GPS HORIZONTAL GLOBAL POSITIONING EQUIPMENT AND 200 KHZ SOUNDING EQUIPMENT.
- TIDE GAGE LOCATED AT: US PARK SERVICE DOCK.
- THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
- NAVIGATION AIDS LOCATED WITH DISTRICT SURVEY VESSEL. ACCURACY +/- 3 METERS. EASTING AND NORTHING COORDINATES ARE IN FEET.
- THE GOVERNMENT FURNISHED PLACEMENT AREA FOR DREDGED MATERIAL WILL BE ON "LIGHTHOUSE BEACH".

DESCRIPTION	EASTING	NORTHING
B4	2,740,752.97	325,485.31
B6	2,741,460.77	326,022.31
B8	2,742,300.60	327,461.80
B3	2,739,835.28	325,557.10
B5	2,741,147.17	326,095.77
B9	2,742,064.54	328,196.57
B7	2,742,161.26	328,596.03
B2	2,739,277.10	325,266.03

**LEGEND**

- AREA TO BE DREDGED
- SOUNDING
- NAVIGATION AIDS
- ABANDONED NAVIGATION AID SINKER AND CHAIN
- CONTOUR
- BORING LOCATION

**TYPICAL DREDGING DETAIL**  
N.T.S.



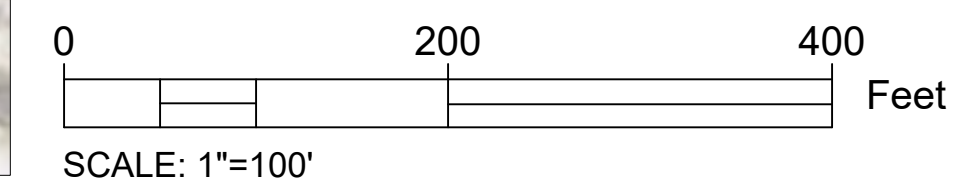
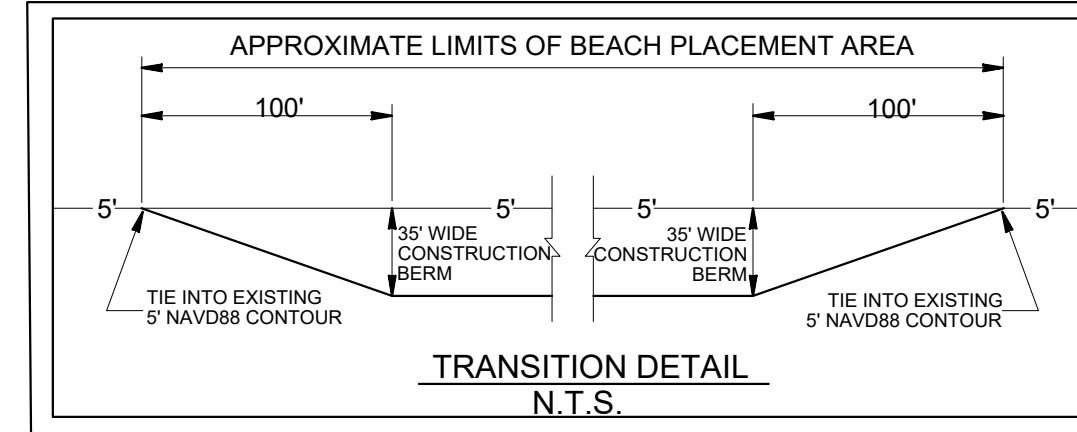
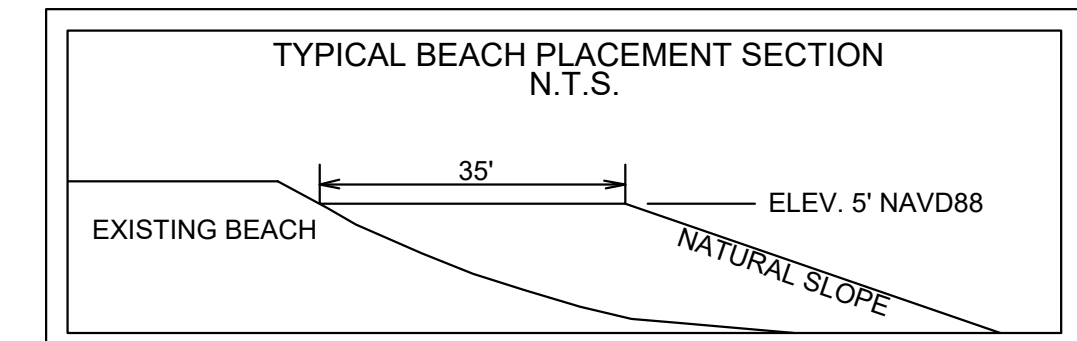
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PROJECT:	NPS Dredging Sheet.dwg
CHECKED BY:	

U.S. ARMY CORPS OF ENGINEERS  
 WILMINGTON DISTRICT  
 69 DARLINGTON AVENUE  
 WILMINGTON, NORTH CAROLINA 28403

MAINTENANCE DREDGING  
 CHANNEL TO BACK SOUND & LOOKOUT BIGHT  
 CARTERET COUNTY, NORTH CAROLINA

NATIONAL PARK SERVICE CHANNEL  
 LIGHTHOUSE  
 DREDGING LAYOUT



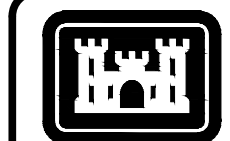
US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

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CHECKED BY: S. GAGER	69 DARLINGTON AVENUE
DATE:	WILMINGTON, NORTH CAROLINA 28403
FILE NAME: ANSI.D	NPS LIGHTHOUSE BEACH Streets.dwg

MANTENANCE DREDGING	PROPOSED BEACH PLACEMENT
CHANNEL TO BACK SOUND & LOOKOUT BIGHT	
CARTERET COUNTY, NORTH CAROLINA	
CAPE LOOKOUT	
PLAN VIEW	

SHEET ID
2 of 4



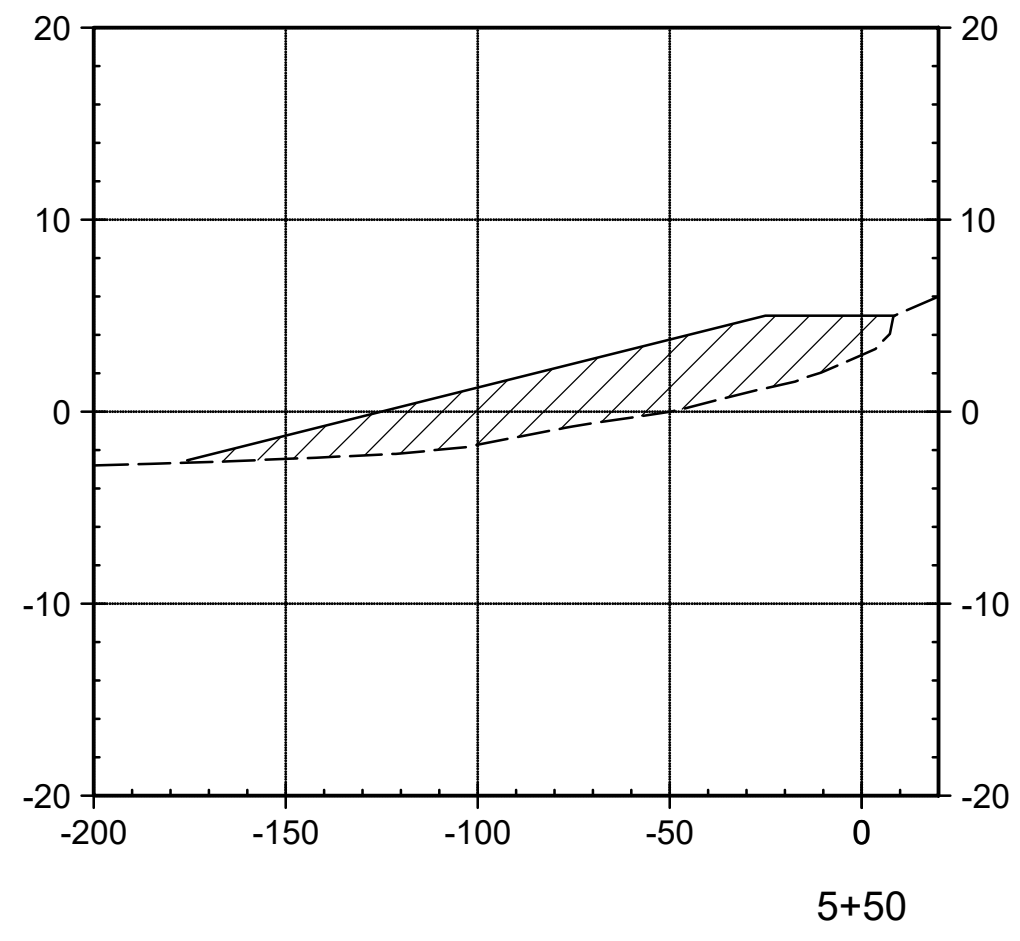
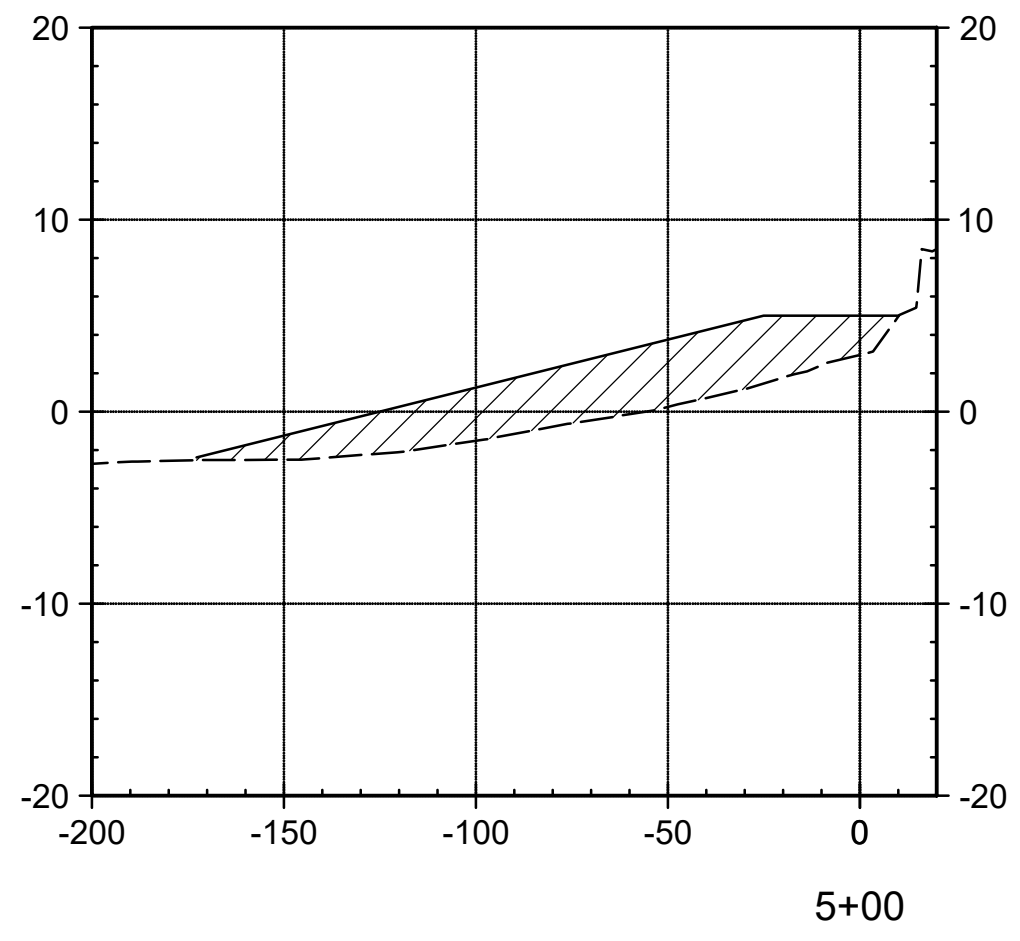
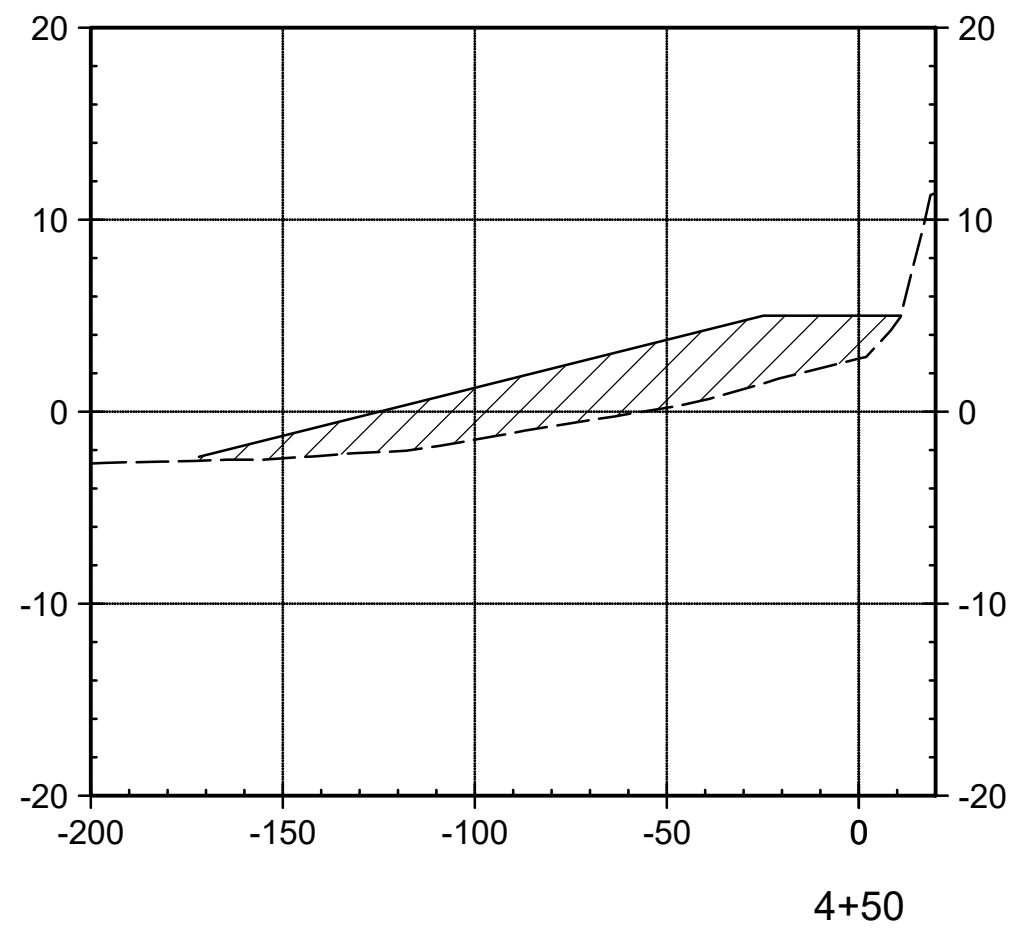
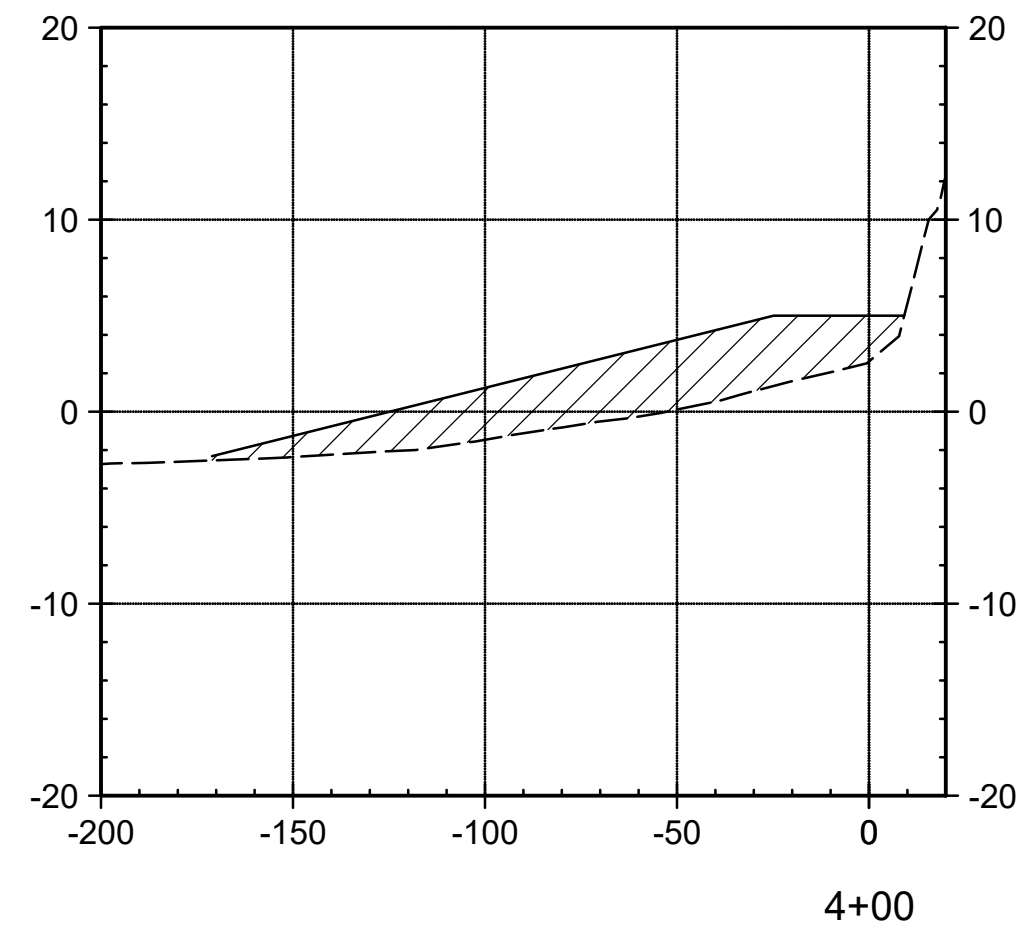
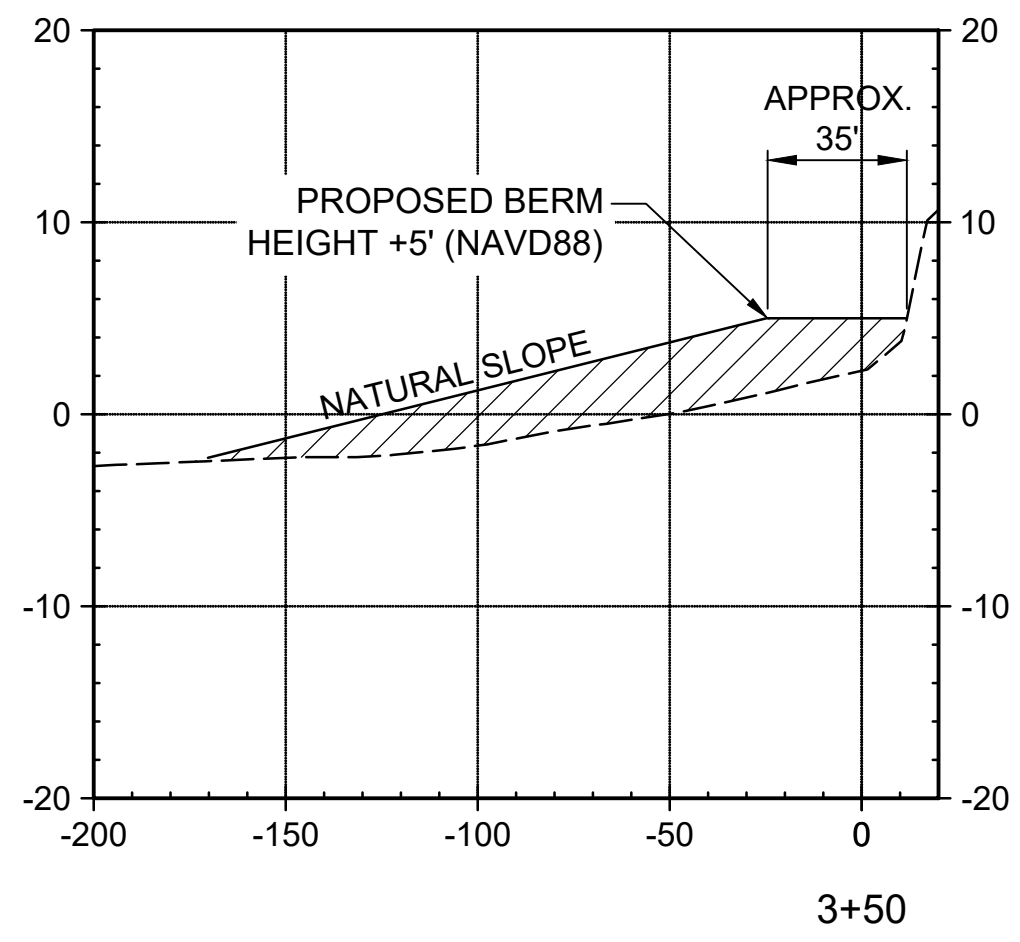
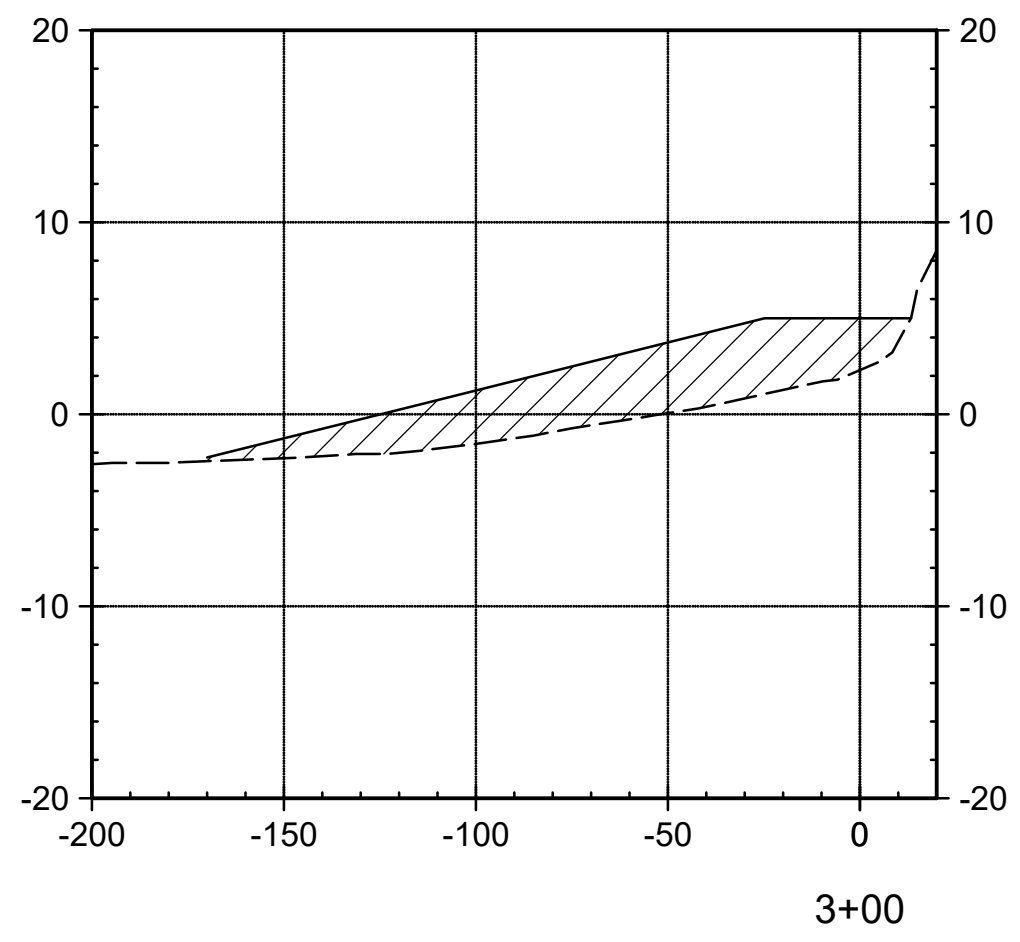
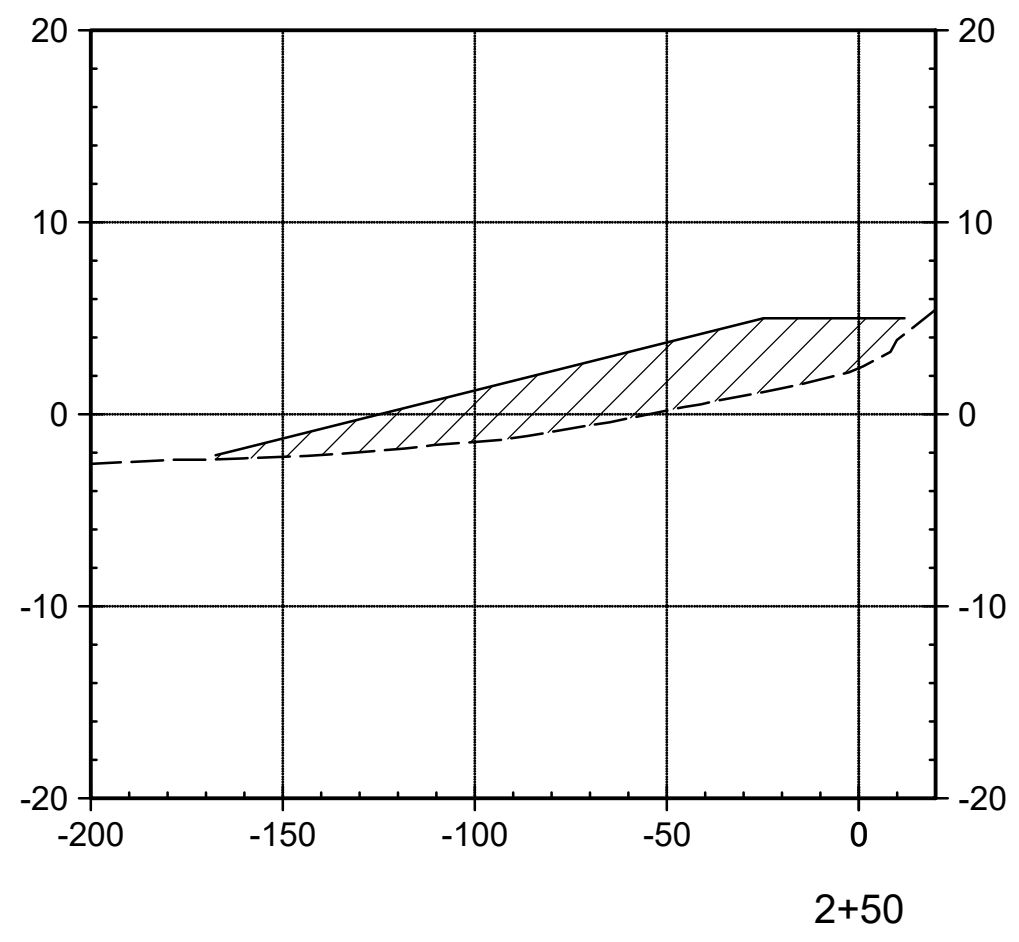
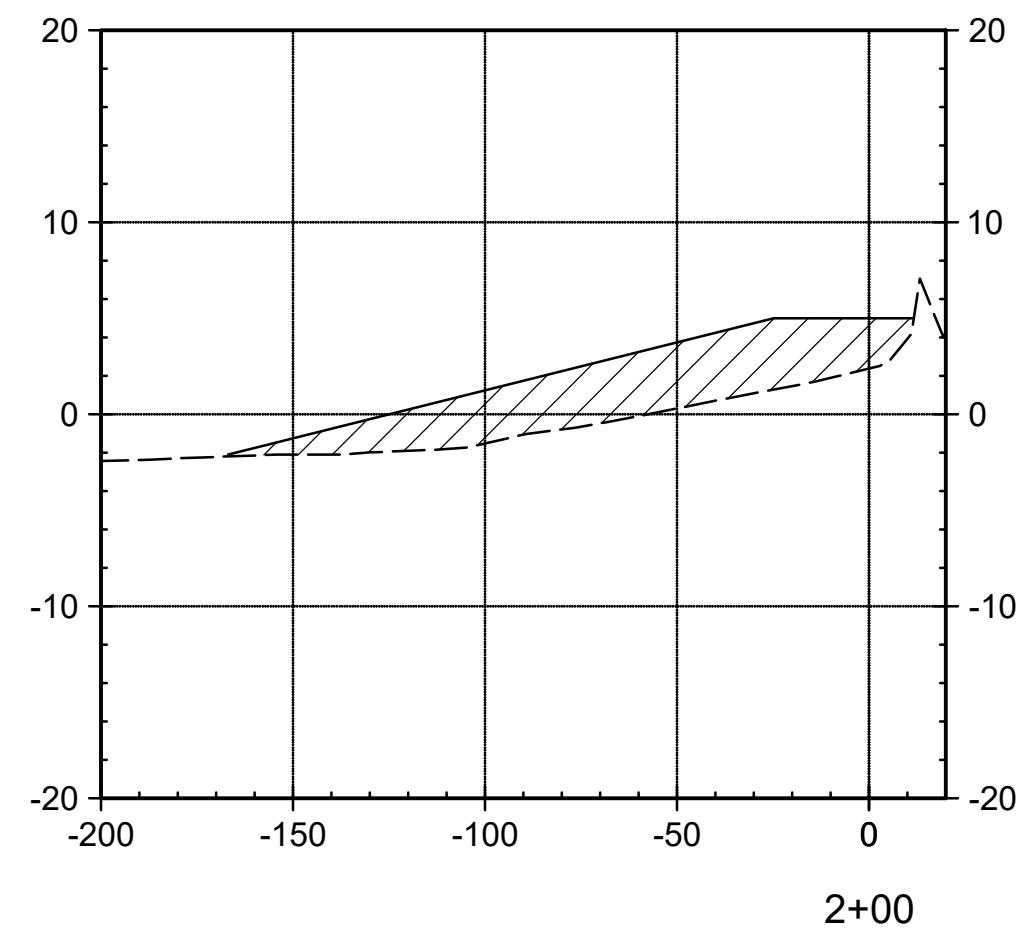
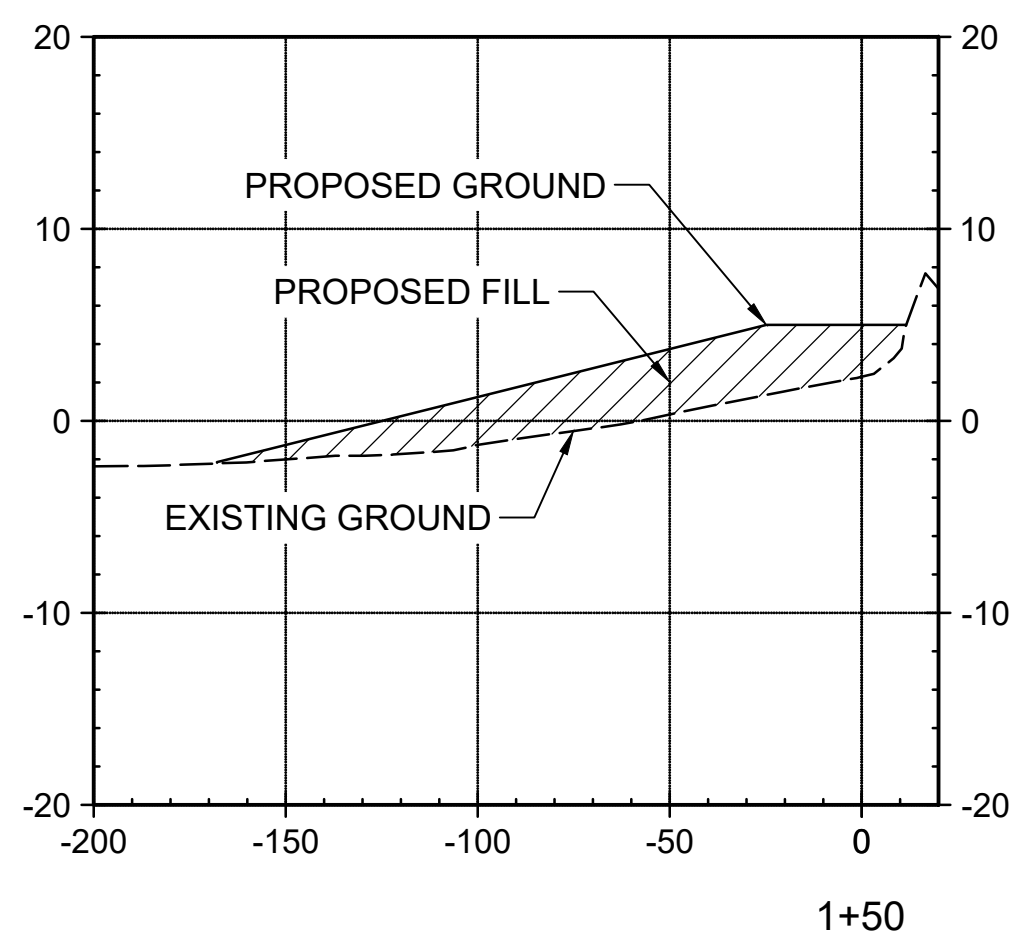
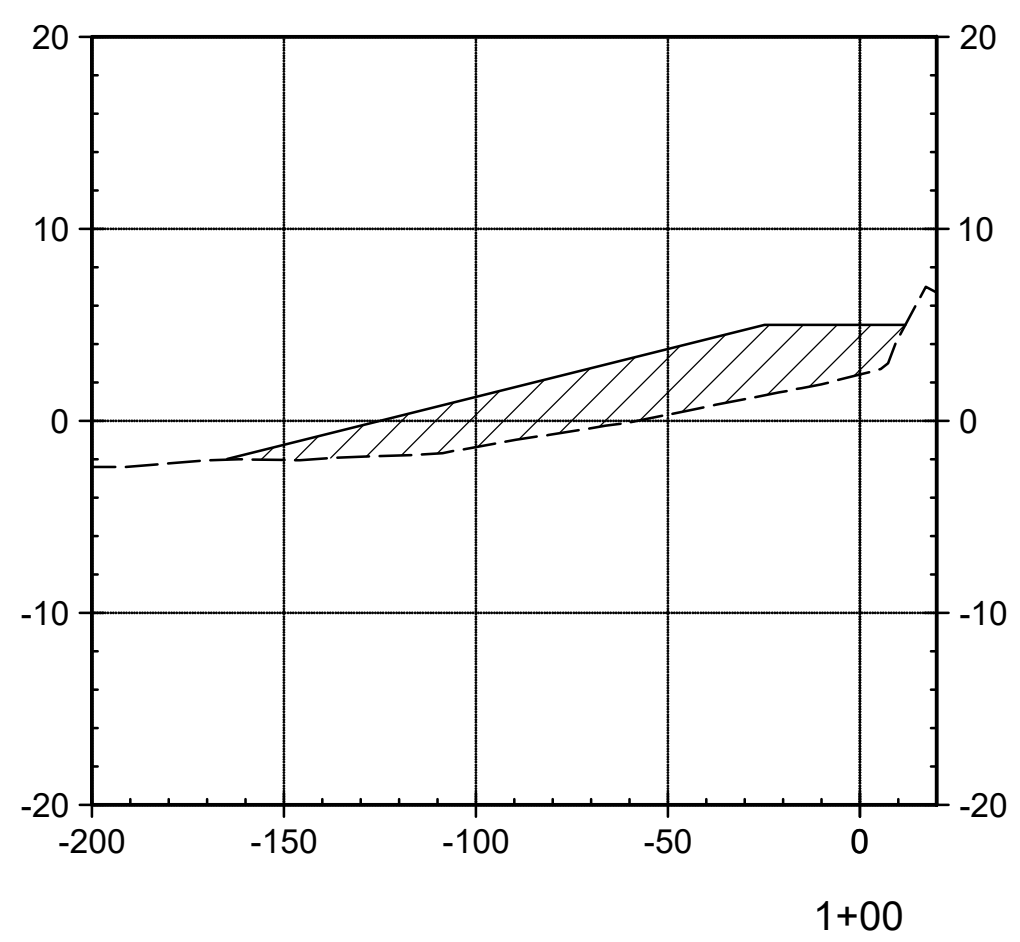
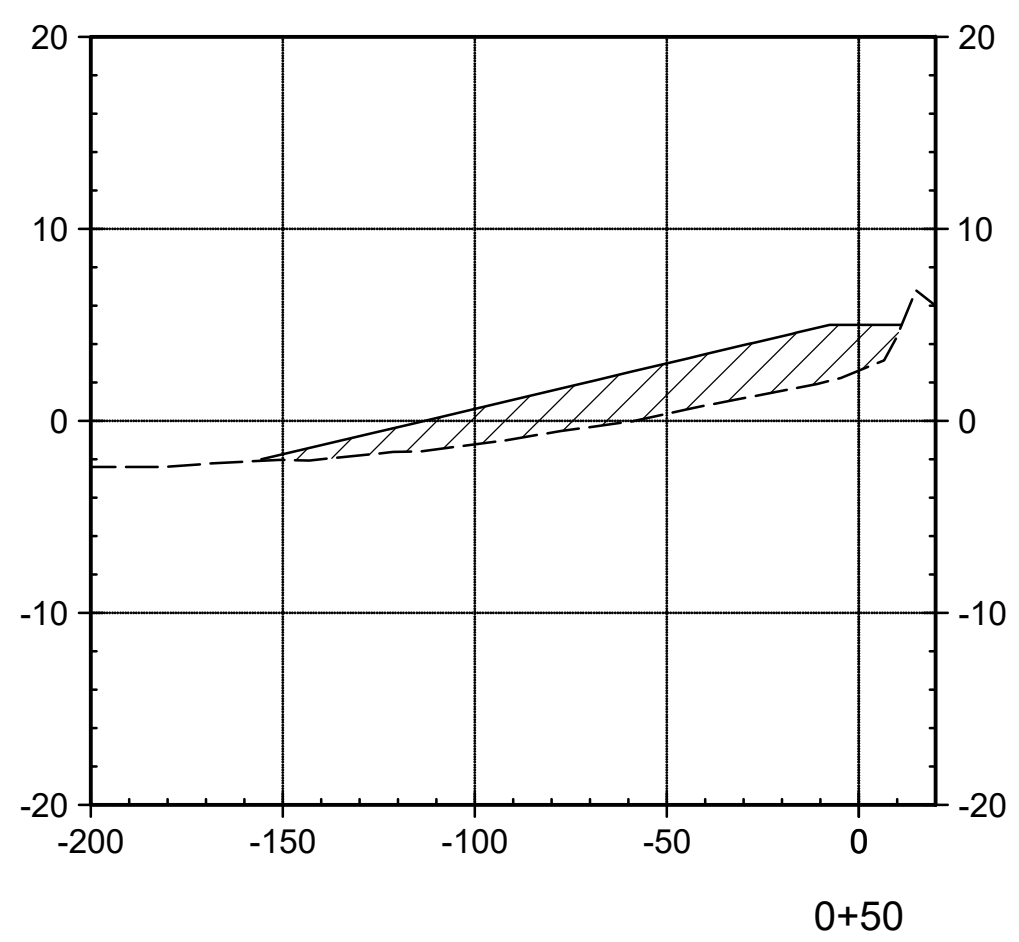
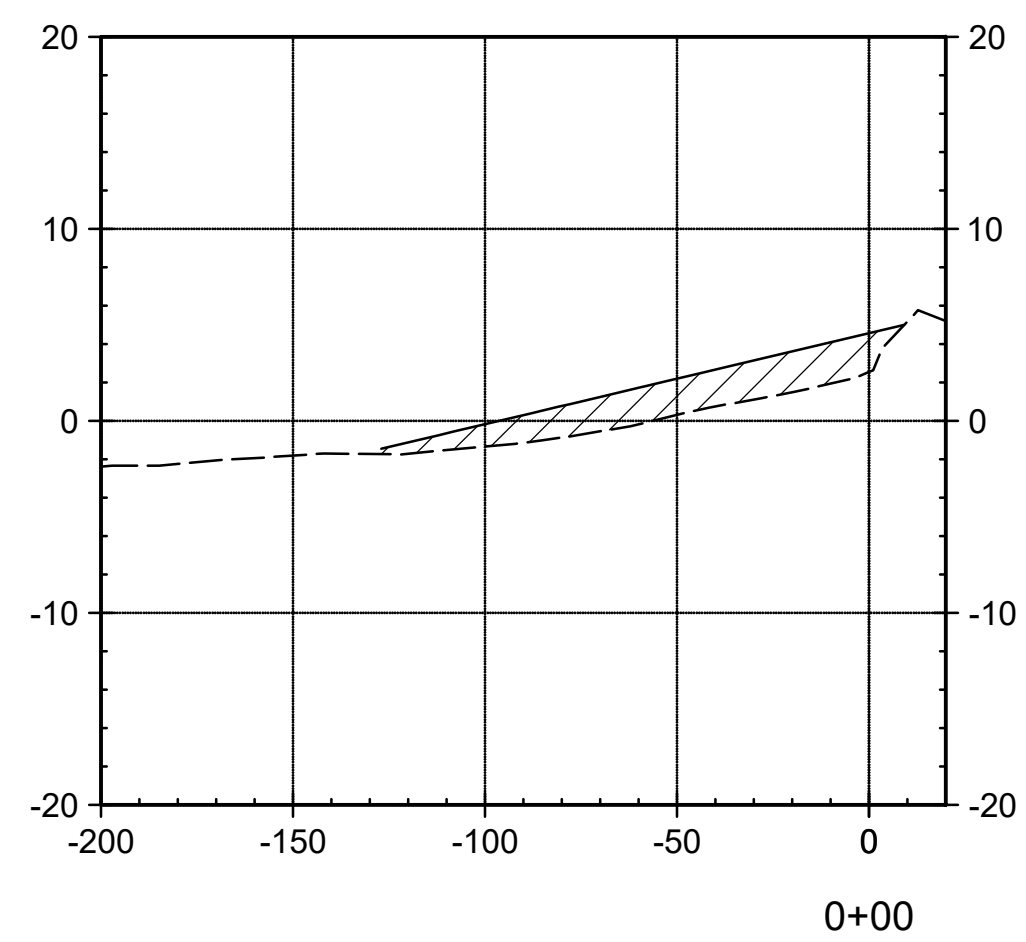
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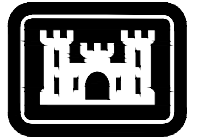
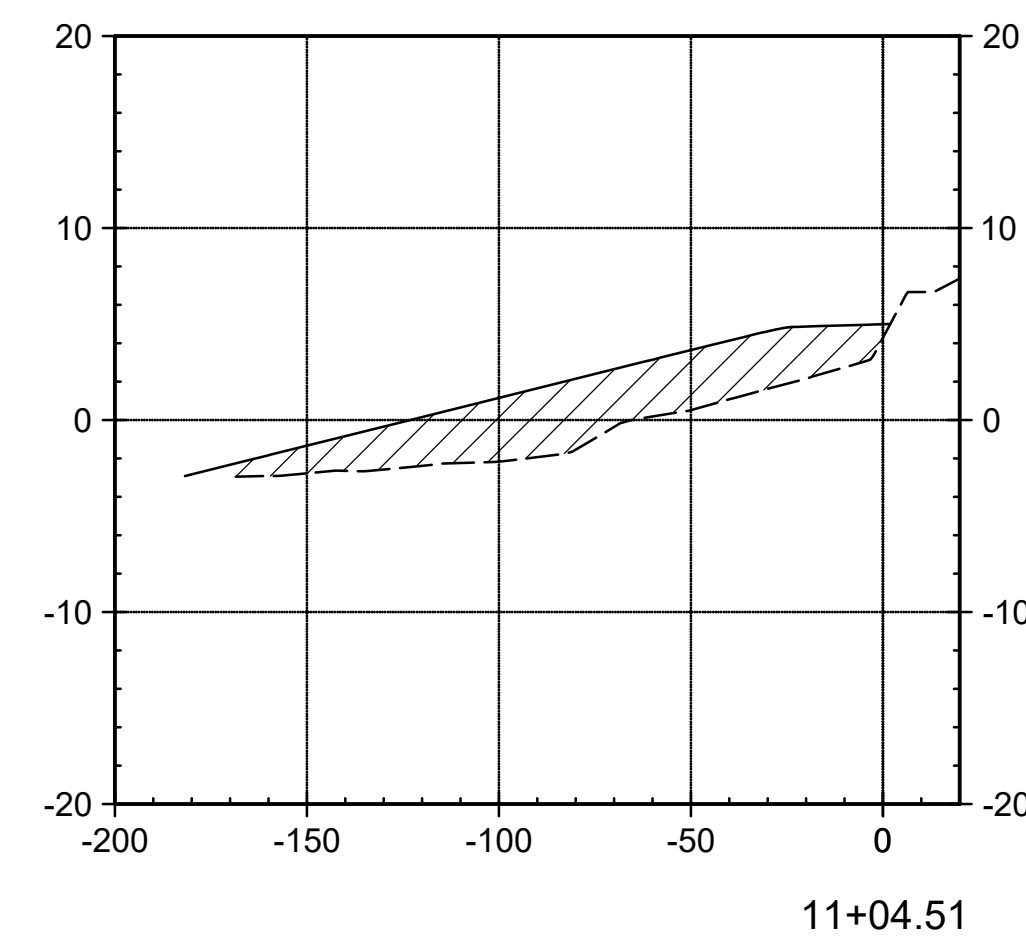
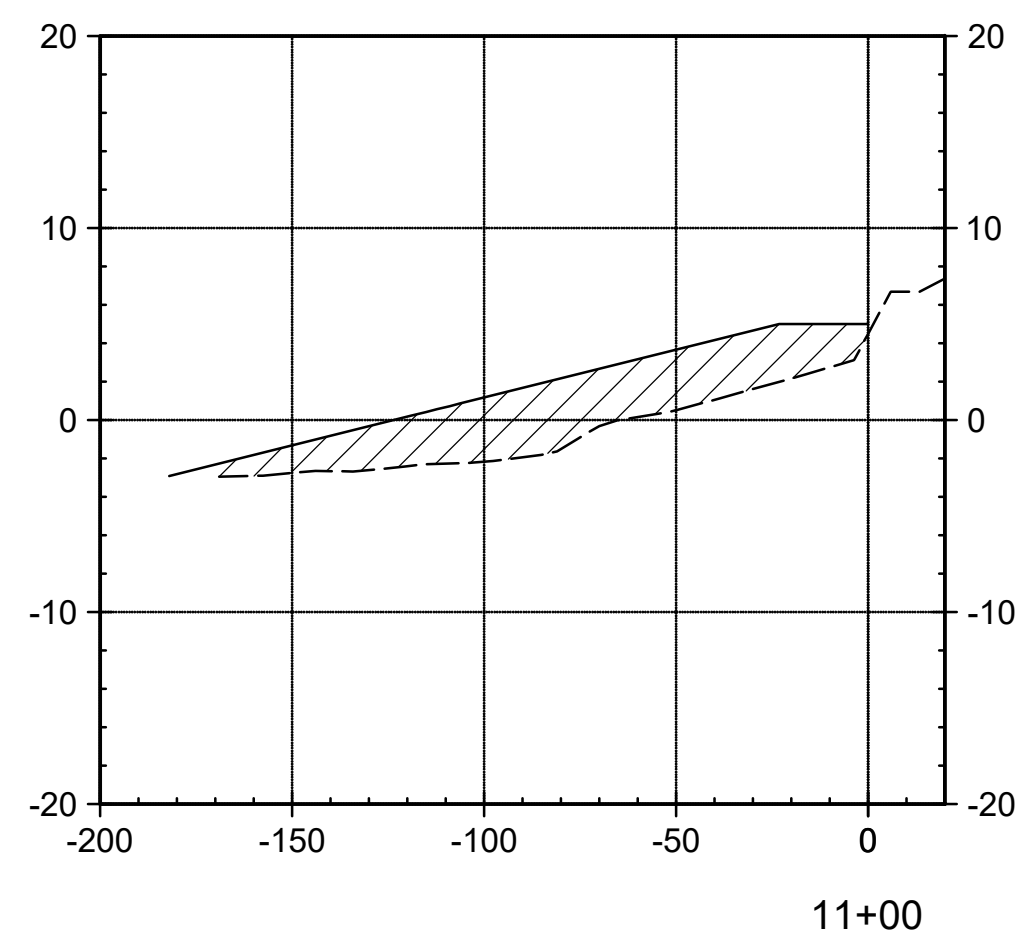
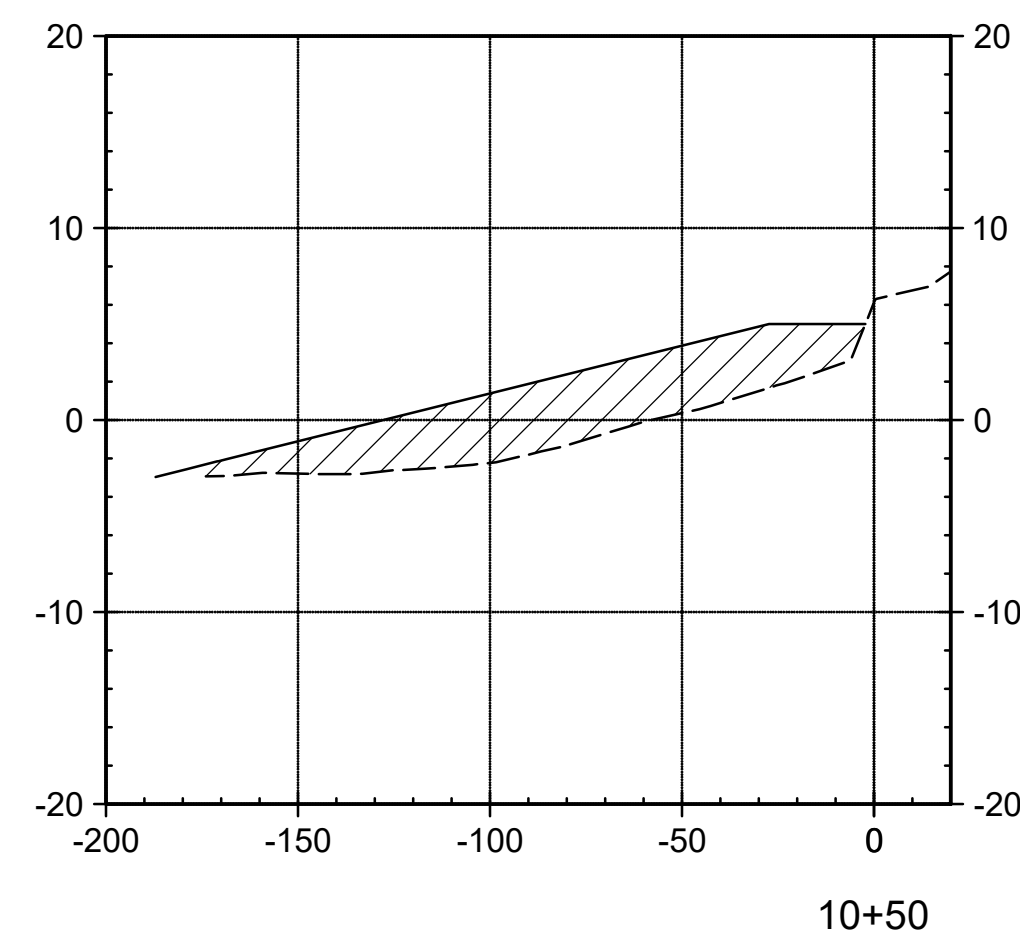
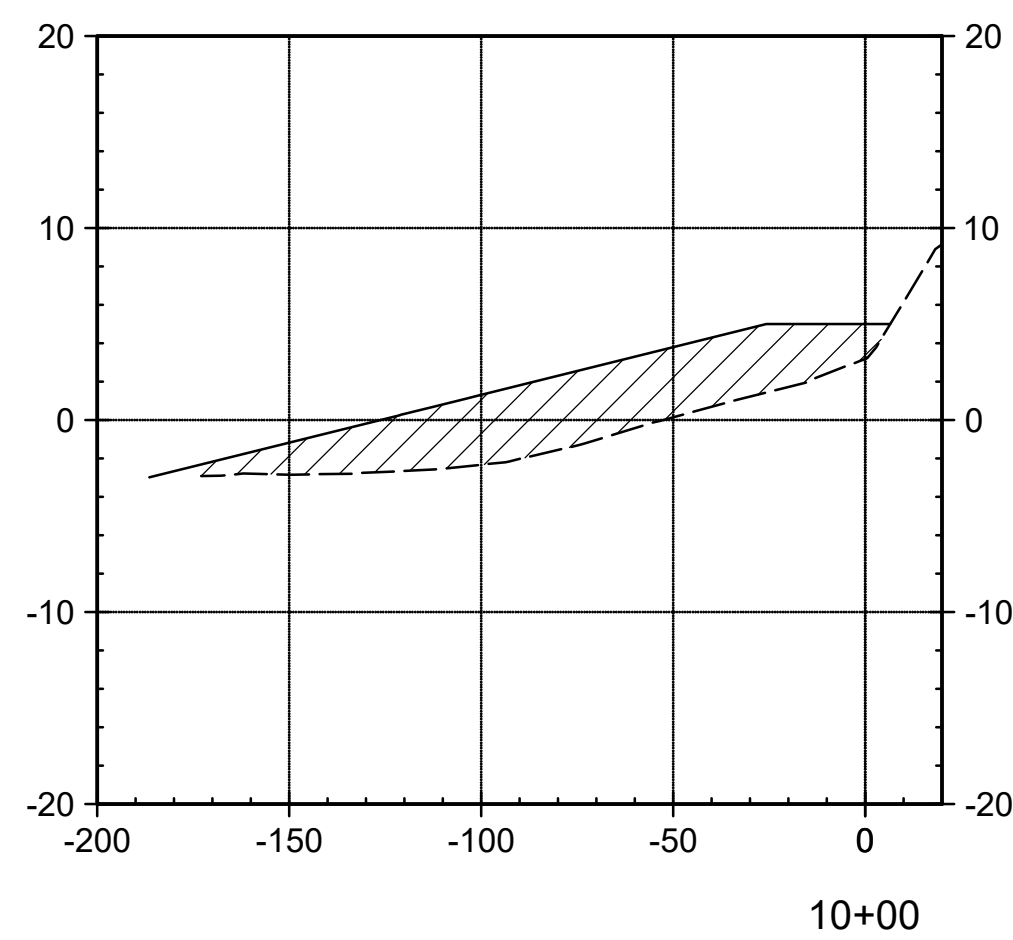
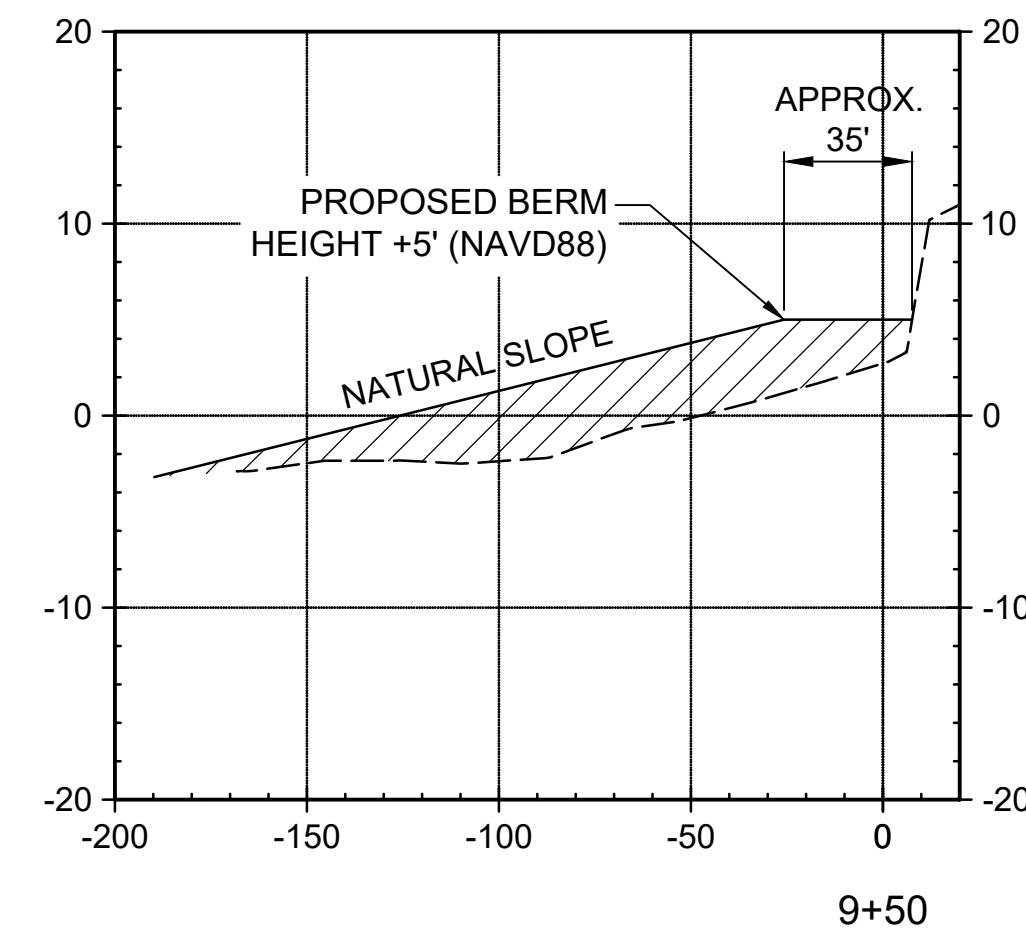
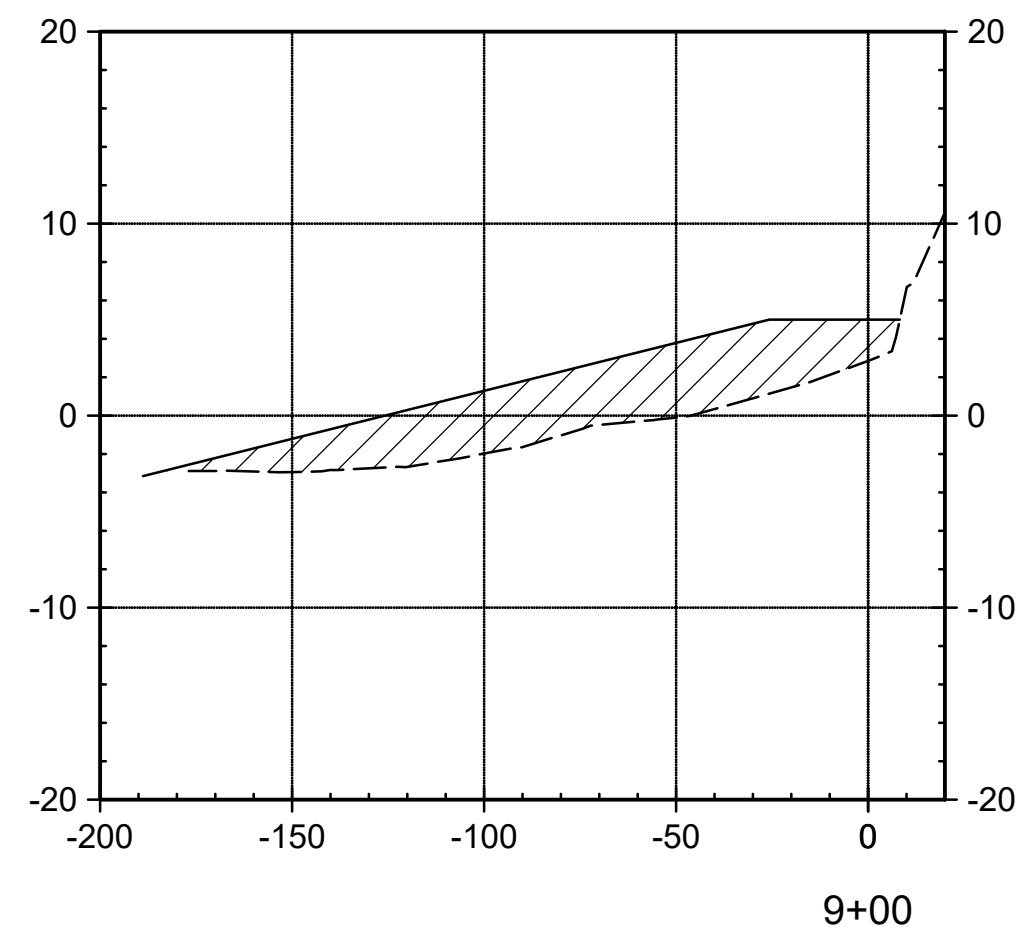
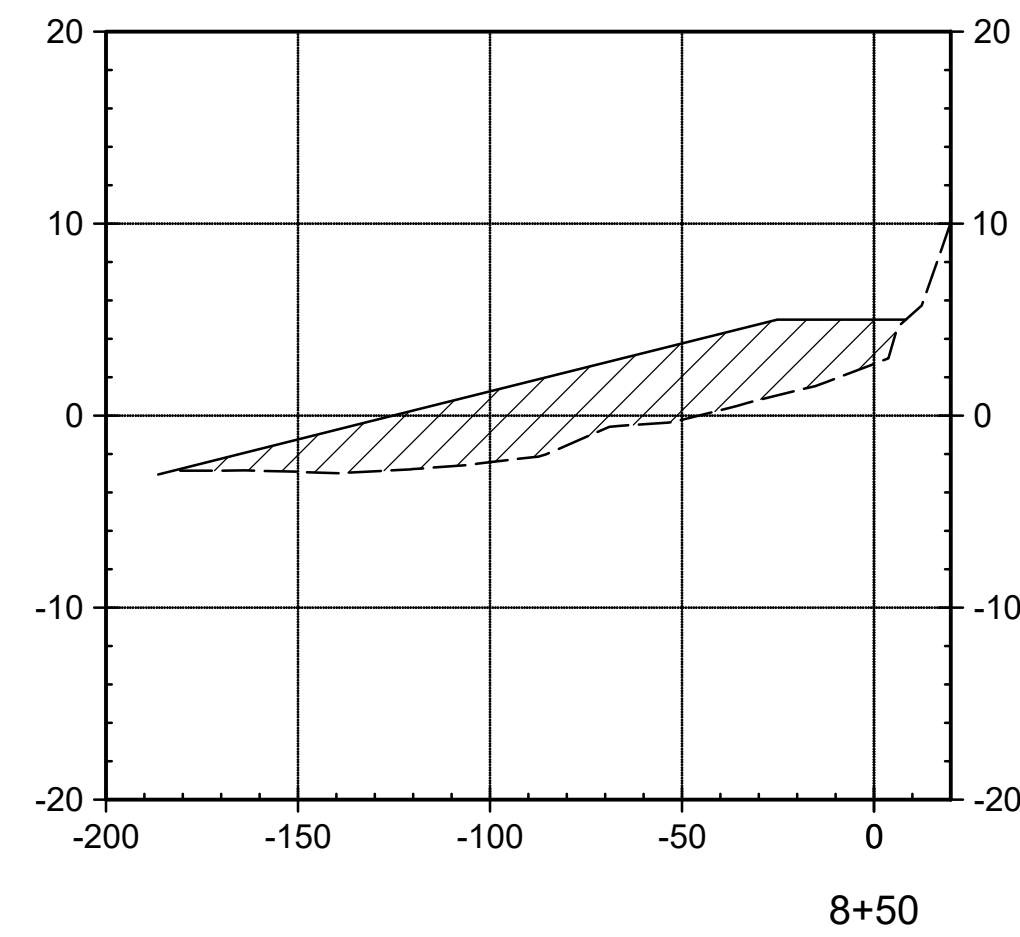
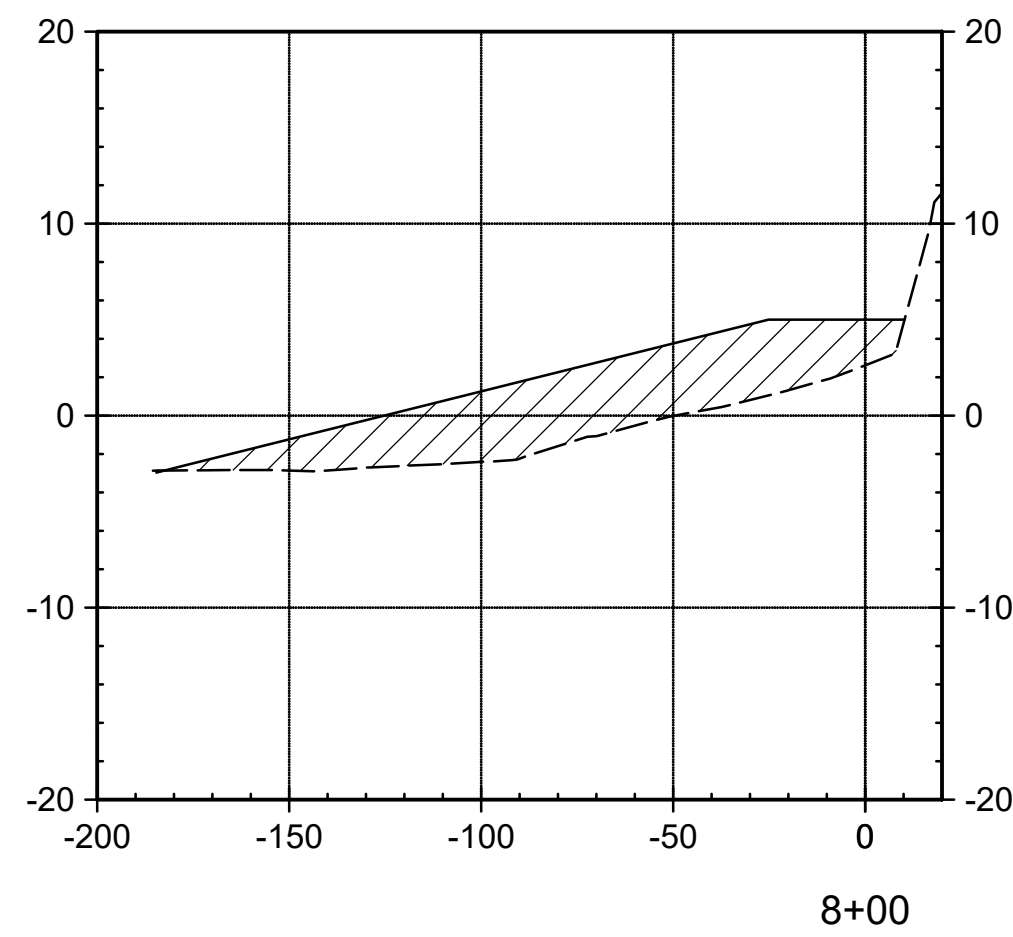
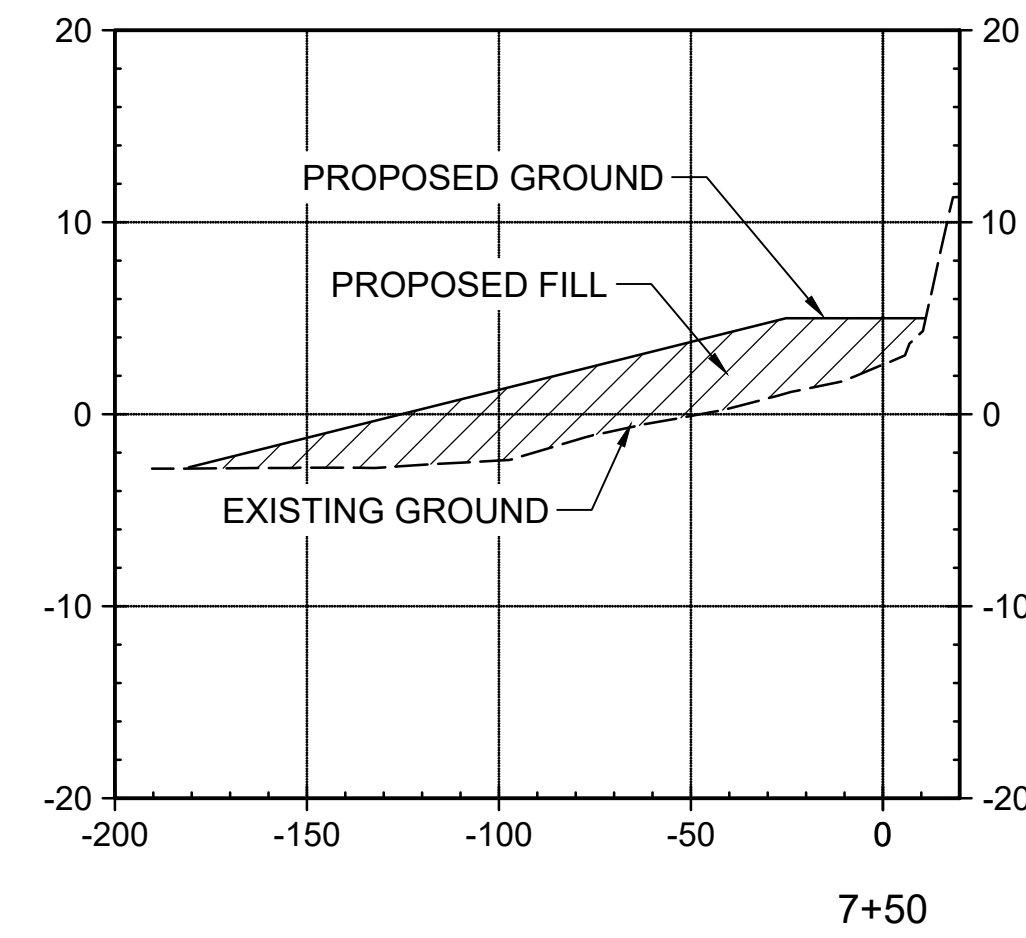
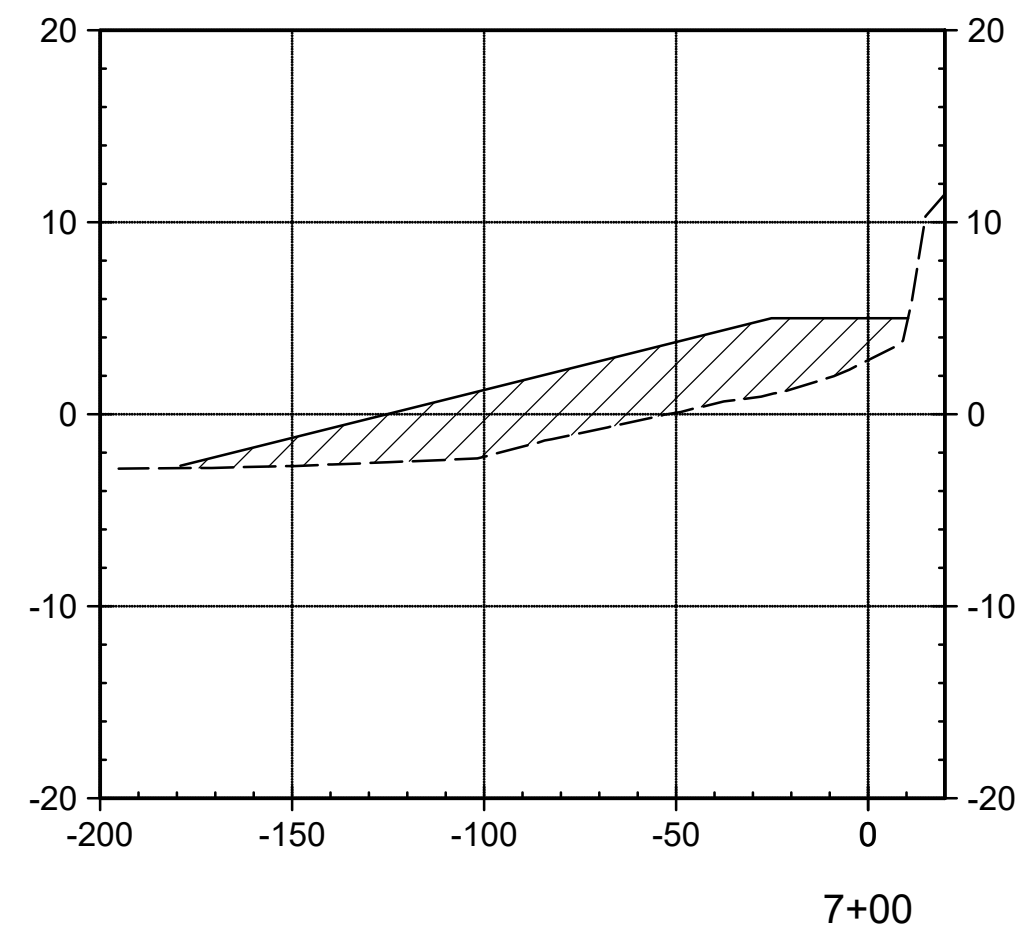
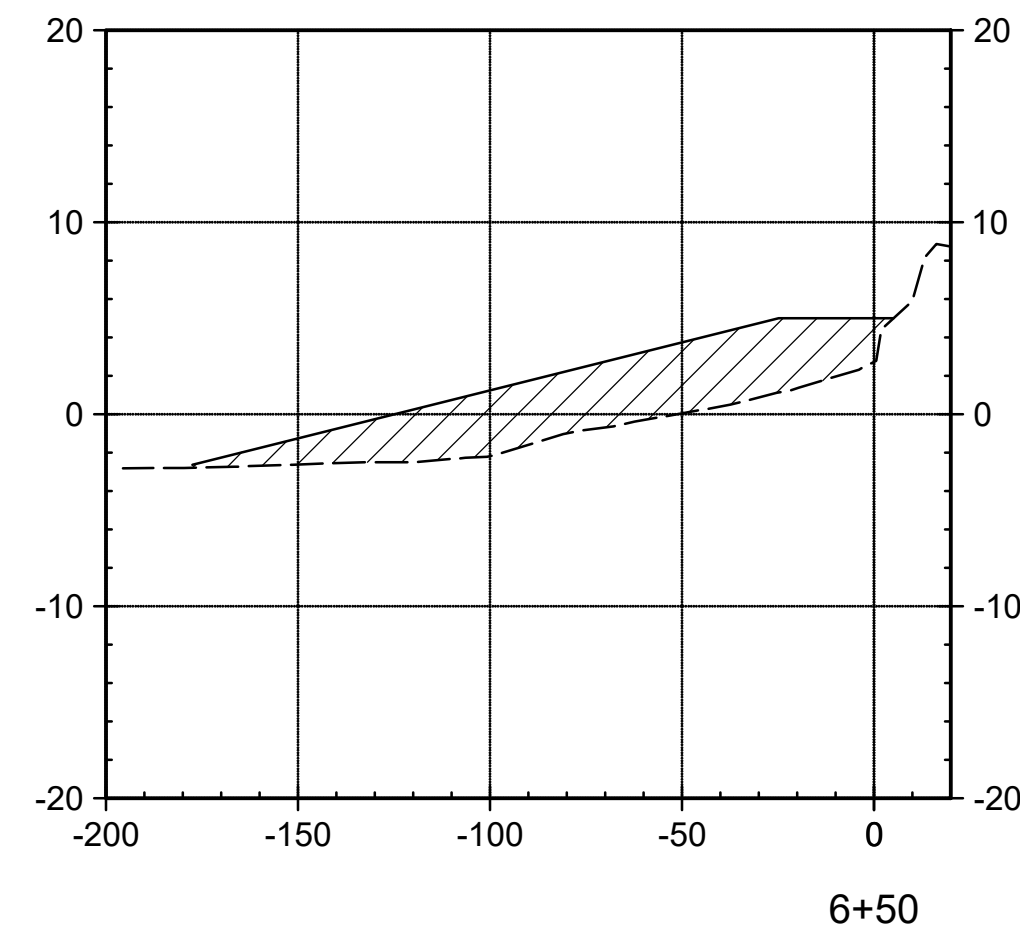
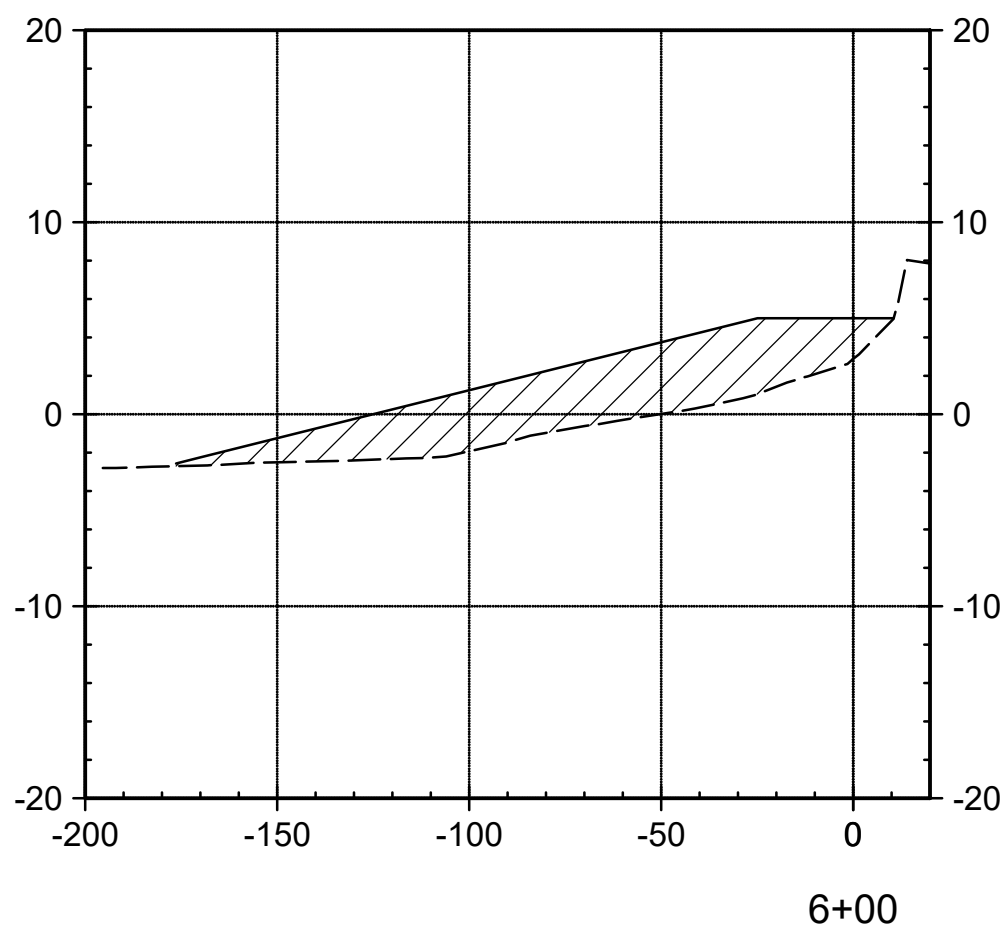
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DRAWN BY: T. WRIGHT	ANSI D
CHECKED BY: S. GAGER	NPS
SUBMITTED BY: NPS	

U.S. ARMY CORPS OF ENGINEERS  
WILMINGTON DISTRICT  
69 DARLINGTON AVENUE  
WILMINGTON, NORTH CAROLINA 28403

MAINTENANCE DREDGING  
CHANNEL TO BACK SOUND & LOOKOUT BIGHT  
CARTERET COUNTY, NORTH CAROLINA

PROPOSED BEACH PLACEMENT  
CAPE LOOKOUT  
CROSS SECTIONS





US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

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CHECKED BY: S. GAGER			
SUBMITTED BY: NPS			

MAINTENANCE DREDGING  
CHANNEL TO BACK SOUND & LOOKOUT BIGHT  
CARTERET COUNTY, NORTH CAROLINA

PROPOSED BEACH PLACEMENT  
CAPE LOOKOUT  
CROSS SECTION

SHEET ID  
4 of 4

STATUS: 100% DQC

# **ATTACHMENT B**

## **NMFS 2020 SARBO PROJECT DESIGN CRITERIA**

**DREDGE.1** Maintenance dredging covered under this Opinion includes the list below, as described in 2.3.1 of the 2020 SARBO.

- Maintenance dredging in navigation waterways and channels required to be maintained under Title 33 (Navigation and navigable waters): Maintenance to the dredge template provided in Title 33 or the deeper or wider template provided in the SARBO Biological Assessment (SARBA) Appendix B (provided on the NMFS dredging website at <https://www.fisheries.noaa.gov/content/southeast-dredging>) or analyzed in an individual Section 7 consultation, including the defined overdepth and advanced maintenance depth.
- Maintenance dredging in navigation channels (not required to be maintained under Title 33): Maintenance to the dredge template provided in SARBA Appendix B or to the dredge template federally authorized or permitted and previously dredged. The dredging template includes the overdepth and advanced maintenance depth analyzed in a consultation during the evaluation of the previous dredging event.
- Maintenance activities should occur at a frequency such that the area is navigable, barring a sudden change from a storm, and that returning the area to the authorized or permitted dredge template does not alter the hydrology of the area. For example, dredging a channel that has not been maintained and gradually returned to the surrounding conditions, is not considered maintenance.
- Maintenance dredging in navigation channels other than the main federal channels, such as the secondary channel sections of a braided river that is not part of the main channel, or a channel/canal that connects the main navigation channel to coastal communities and/or coastal neighborhoods.
- Maintenance dredging areas other than navigation channels: Maintenance dredging of an area to the previously authorized dredge template, as further specified below. Maintenance dredging in areas other than navigation channels may include:
  - Maintenance dredging ports and berths along maintained navigation channels including those not owned and operated by a Port Authority.
  - Maintenance dredging in smaller areas such as public and private marinas, boat ramps, and around docks.
- Maintenance of sediment traps: Maintenance of existing sediment traps to the previous dredge template.
- Minor channel modifications, realignment, or bend easing: Minor channel modifications considered under this Opinion are limited to minor realignments that follow the naturally shifting deep water channel to the same depth and width as the previously maintained channel or realignment of an existing channel that shifted. Intentional minor realignment (e.g. bend easing) is not covered.



**PLACE.1** Beneficial use (e.g., beach nourishment, nearshore placement, or muck dredging considered under 2020 SARBO or marsh creation locations analyzed under a separate ESA Section 7 consultation, but filled with material dredged under 2020 SARBO)

- Beach nourishment described in Section 2.4.1 2020 SARBO and PDC PLACE.2.
- Nearshore placement described in Section 2.4.2 2020 SARBO and PDC PLACE.3.
- Beneficial use placement of material where the dredging of the material is covered under this Opinion and placement of material in a specific location was analyzed under an individual Section 7 consultation (e.g., placement of material used in marsh creation).
- Beneficial use activities not covered include thin-layer placement (e.g., used for marsh creation or other disposal method), filling of holes to improve water quality, filling of holes or minor depressions to restore the appropriate depth for habitat restoration, or other similar placement activities.

**PLACE.2** Beach nourishment projects are covered under this Opinion if they meet the conditions listed below and described in Section 2.4.1 of the 2020 SARBO.

- Beach nourishment in the locations and defined beach sand placement template described in SARBA Appendix B.
- Beach nourishment in areas that has been previously analyzed in a Separate Section 7 consultation, filled, and is being nourished again to the same beach sand placement template.
- Placement on the uplands for activities with no intended equilibrium to occur in water (e.g., dune restoration) is outside of the jurisdiction of NMFS.
- No beach nourishment projects are covered in the U.S. Caribbean.
- New beach nourishment and placement is allowed outside the range of corals (as defined in the Coral PDCs in Appendix C) if it meets the conditions below. For the purposes of this Opinion, new beach placement is defined as placement of sand on an existing beach that has not been previously nourished.
  - o Placement of beach sand outside of Florida will be compatible with the native beach sediment composition to minimize turbidity in the surrounding in-water environment.
  - o New beach placement is allowed if the design profile is similar/consistent to adjacent beaches. This does not include non-traditional beach nourishment designs such as those that protrude and may obstruct species movement along the shore.
  - o All new beach nourishment is limited to placement in areas lacking hardbottom (e.g., worm-rock or other forms of non-coral hardbottom) and seagrasses that may be used as foraging or refuge habitat for ESA-listed species.

**EDUCATE.1** All personnel associated with this project shall be instructed about the potential presence of species protected under the ESA and MMPA and the appropriate protocols if they are encountered including those in the PSO conditions listed below.

**EDUCATE.2** All on-site project personnel are responsible for observing water-related activities for the presence of ESA-listed species.

**EDUCATE.3** All on-site project personnel will be informed of all ESA-listed species that may be present in the area and advised that there are civil and criminal penalties for harming, harassing, or killing ESA-listed species or marine mammals.

**EDUCATE.4** All on-site project personnel will be briefed that the disposal of waste materials into the marine environment is prohibited. All crew will attempt to remove and properly dispose of all marine debris discovered during dredging operations, to the maximum extent possible.

**INWATER.1** All work, including equipment, staging areas, and placement of materials, will be done in a manner that does not block access of ESA-listed species from moving around or past construction.

**INWATER.2** Equipment will be staged, placed, and moved in areas and ways that minimize effects to species and resources in the area, to the maximum extent possible. Specifically:

1. All vessels will preferentially follow deep-water routes (e.g., marked channels) to avoid potential groundings or damaging bottom resources whenever possible and practicable.
2. Barges, scows, and other similar support equipment will be positioned away from areas with sensitive bottom resources such as non-ESA-listed seagrasses, corals, and hardbottom, to the maximum extent possible.
3. Pipelines will be placed in areas away from bottom resources and of sufficient size or weight to prevent movement or anchored to prevent movement or the pipeline will be floated over sensitive areas.

**INWATER.3** All work that may generate turbidity will be completed in a way that minimizes the risk of turbidity and sedimentation to non-ESA-listed non-mobile species (e.g., non-ESA-listed corals, sponges, and other natural resources) to the maximum extent practicable. This may include selecting equipment types that minimize turbidity and positioning equipment away or downstream of non-mobile species.

**INWATER.4** If turbidity curtains are used, barriers will be positioned in a way that does not block species' entry to or exit from designated critical habitat and does not entrap species within the construction area or block access for them to navigate around the construction area. Project personnel must take measures to monitor for entrapped species in areas contained by turbidity curtains and allow access for them to escape if spotted.

**INWATER.5** If lines or cables are used (e.g., to mark floating buoys, lines connecting pickup buoy lines, or for turbidity curtains):

- In-water lines (rope, chain, and cable) will be stiff, taut, non-looping. Examples of such lines are heavy metal chains or heavy cables that do not readily loop and tangle. Flexible in-water lines, such as nylon rope or any lines that could loop or tangle, will be enclosed in a plastic or rubber sleeve/tube to add rigidity and to prevent the line from looping or tangling. In all instances, no excess line is allowed in the water.

- All lines or cables will be immediately removed upon project completion.
- All in-water lines and materials will be monitored regularly to ensure nothing has become entangled.
- Cables or lines with loops used to move pipelines or buoys will not be left in the water unattended.

**CUTTER.1** The cutterhead will not be engaged/turned on when not embedded in the sediment, to the maximum extent possible.

**OBSERVE.1** For generally stationary construction with work contained to a specific project area, such as mechanical dredging equipment:

- All personnel working on the project will report ESA-listed species observed in the area to the on-site crew member in charge of operations.
- Operations of moving equipment will cease if an ESA-listed species is observed within 150 ft of operations by any personnel working on a project covered under this Opinion (e.g., sea turtles, sturgeon, elasmobranchs [giant manta ray, scalloped hammerhead shark, oceanic white tip shark] or ESA-listed marine mammal).
- Activities will not resume until the ESA-listed species has departed the project area of its own volition (e.g., species was observed departing or 20 minutes have passed since the animal was last seen in the area).

**OBSERVE.2** For a vessel underway, such as a hopper dredge or support vessel, traveling within or between operations must follow speed and distance requirements, defined below, while ensuring vessel safety:

- All personnel working onboard will report ESA-listed species observed in the area to the vessel captain.
- If an ESA-listed species is spotted within the vessel's path, initiate evasive maneuvers to avoid collision.

**OBSERVE.4** Any collision(s) with an ESA-listed species must be immediately reported to the USACE according to their internal protocol and to NMFS consistent with the reporting requirements listed below in Take reporting Requirements "Pages 25 & 26 below). A vessel collision with an ESA-listed species is counted as take for the project. In addition, reports of certain species shall also be reported as listed below. A link to the most current contact information will also be available at (SERODredge@noaa.gov).

Sea turtle take will also be reported to the appropriate state species representative (<https://www.fisheries.noaa.gov/state-coordinators-seaturtlestranding-and-salvage-network>).

**OBSERVE.5** Any collision with a marine mammal will be reported immediately to the Southeast Regional Marine Mammal Stranding hotline at 1-877-WHALE-HELP (1-877-942-5343).

All handling, tagging, and/or genetic sampling of ESA-listed species captured will be conducted only by a PSO that meets the qualifications provided by NMFS.

# **ATTACHMENT C**

## **USFWS STATEWIDE PROGRAMMATIC BIOLOGICAL OPINION**

### **REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS**

**NORTH CAROLINA  
STATEWIDE PROGRAMMATIC BIOLOGICAL OPINION (SPBO)  
BEACH SAND PLACEMENT  
August 28, 2017**

**INTRODUCTION**

A biological opinion (BO) is the document that states the opinion of the U.S. Fish and Wildlife Service (Service) as to whether a federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. This BO addresses piping plover (*Charadrius melodus melodus*), red knot (*Calidris canutus rufa*), seabeach amaranth (*Amaranthus pumilus*), and the loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), and Kemp's ridley sea turtles (*Lepidochelys kempii*). Designated critical habitat for wintering piping plovers and terrestrial critical habitat for loggerhead sea turtles is also addressed. The BO evaluates the effects of the Action along with those resulting from interrelated and interdependent actions, and from non-federal actions unrelated to the proposed Action (cumulative effects), relative to the status of the species and the status of the critical habitat to arrive at a Service opinion that the proposed action is or isn't likely to jeopardize species or adversely modify critical habitat. Jeopardize the continued existence of means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02). Destruction or adverse modification of designated critical habitat means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR §402.02). The entire SPBO can be accessed at <http://www.fws.gov/raleigh/pdfs/spbo.pdf>.

Below are following Reasonable and Prudent Measures and Terms *and* Conditions of the SPBO:

**REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS**

The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize take of piping plovers, red knots, seabeach amaranth, and sea turtles in the Action Area for the following sand placement activities:

- A. Sand placement from beach nourishment activities; and**
- B. Sand placement from navigation channel maintenance.**

If unable to comply with the RPMs and Terms and Conditions, the Corps, as the regulatory authority or construction agent may:

1. Inform the Service why the RPM or Term and Condition is not reasonable and prudent for the specific project or activity and request exception under the SPBO; or
2. Initiate consultation with the Service for the specific project or activity.

The Service may respond by either of the following:

1. Allowing an exception to the Terms and Conditions under the SPBO; or
2. Recommending or accepting initiation of consultation (if initiated by the Corps) for the specific project or activity.

**REASONABLE AND PRUDENT MEASURES for:**

**A. Projects that include sand placement from beach nourishment activities, primarily for shore protection (these projects are usually larger scaled) shall include the following measures:**

Post-construction requirements are listed in Reasonable and Prudent Measures A.13, A.16, A.17, A.18, A.19, and A.21. These post-construction requirements may be subject to congressional authorization and the allocation of funds. If the Corps or Permittee cannot fulfill these Reasonable and Prudent Measures, the Corps must reinitiate consultation.

**RPMs – All Species**

- A.1. Conservation Measures included in the Corps' Programmatic Biological Assessment (PBA) that address protection of nesting sea turtles, piping plovers, red knots, and seabeach amaranth shall be implemented in the Corps federally authorized project or regulated activity. If an RPM and Term and Condition address the same requirement, the requirements of the RPM and Term and Condition take precedence over the Conservation Measure.
- A.2. The Corps will notify the Service of the commencement of projects that utilize this SPBO for the purposes of tracking incidental take of all species.
- A.3. For the life of the project, all sand placement activities above MHW must be conducted within the winter work window (November 16 to April 30).
- A.4. Prior to sand placement, all derelict material, large amounts of rock, or other debris must be removed from the beach to the maximum extent possible.
- A.5. During construction, trash and food items shall be disposed of properly either in predator-proof receptacles, or in receptacles that are emptied each night to minimize the potential for attracting predators of piping plovers, red knots, and sea turtles.
- A.6. Pipeline placement must be coordinated with NCDCM, the Corps, the Service, and the NCWRC. Pipeline placement coordination may be accomplished through the permit application or Corps' contract processes utilizing appropriate GIS tools.
- A.7. Access points for construction vehicles should be as close to the project site as possible. Construction vehicle travel down the beach should be limited to the maximum extent possible.
- A.8. A meeting between representatives of the Permittee or Corps, the Service, NCWRC, and NCDCM, must be held prior to the commencement of work on each project.
- A.9. The Corps shall facilitate an annual meeting with the Service to assess the effectiveness of the protection and minimization measures outlined in this SPBO.

## **RPMs - Piping Plovers and Red Knots**

- A.10. All personnel involved in the construction or sand placement process along the beach shall be aware of the potential presence of piping plovers and red knots. Before start of work each morning, a visual survey must be conducted in the area of work for that day, to determine if piping plovers and red knots are present.
- A.11. If project-related activities will potentially adversely affect nesting shorebirds or active nesting habitat, the Corps or Permittee must coordinate with the Service and NCWRC prior to proceeding. If the project is ongoing and shorebirds begin territorial or other nesting behaviors within the project area, then the Corps or Permittee must contact the Service and NCWRC as soon as possible.
- A.12. If project activities will be conducted in Optimal Piping Plover Areas (defined in Terms and Conditions A.13 and A.14), the Corps or the Permittee shall clearly delineate work areas within the Optimal Piping Plover Area such as pipeline corridors, travel corridors, and access points. Disturbance outside those delineated work areas must be limited to the maximum extent possible, thereby minimizing effects to sandy unvegetated habitat within the project footprint.
- A.13. If project activities will be conducted in Optimal Piping Plover Areas (defined in Term and Conditions A.13 and A.14), the Corps, the Permittee, or the local sponsor shall provide the mechanisms necessary to monitor impacts to the piping plovers from the project for two years post-construction.

## **RPMs – Loggerhead, Green, Leatherback, Hawksbill, and Kemp’s Ridley Sea Turtles**

- A.14. Only beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence (defined in Term and Condition A.18) shall be used for sand placement.
- A.15. During dredging operations, material placed on the beach shall be qualitatively inspected daily to ensure compatibility. If the inspection process finds that a significant amount of non-beach compatible material is on or has been placed on the beach, all work shall stop immediately and the NCDCM and the Corps will be notified by the Permittee or Corps to determine the appropriate plan of action.
- A.16. Sea turtle nesting surveys must be conducted within the project area between May 1 and November 15 of each year, for at least two consecutive nesting seasons after completion, if the sand remains on the beach. Acquisition of readily available sea turtle nesting data from qualified sources (volunteer organizations, other agencies, etc.) is acceptable.
- A.17. Visual surveys for escarpments along the Action Area must be made immediately after completion of sand placement, and within 30 days prior to May 1, for two subsequent years after any construction or sand placement event.
- A.18. Sand compaction must be qualitatively evaluated at least twice after each sand placement event. Sand compaction must be inspected in the project area immediately after completion of any sand placement event and one time after project completion between October 1 and May 1.



- A.19. A report describing the fate of observed sea turtle nests and hatchlings and any actions taken, must be submitted to the Service following completion of work for each year when a sand placement activity has occurred.
- A.20. If a dune system is part of the project design, the placement and design of the dune must be coordinated with the Service.

#### **RPMs – Seabeach Amaranth**

- A.21.** The Corps Civil Works Program shall continue its annual seabeach amaranth monitoring program.

#### **TERMS AND CONDITIONS FOR:**

##### **A. Sand placement from beach nourishment activities**

All conservation measures described in the Corps' Programmatic Biological Assessment are hereby incorporated by reference as Terms and Conditions within this document pursuant to 50 CFR §402.14(I) with the addition of the following Terms and Conditions. In order to be exempt from the prohibitions of section 9 of the Act, the Corps shall comply with the following Terms and Conditions, which implement the Reasonable and Prudent Measures, described above and outline reporting/monitoring requirements. These terms and conditions are non-discretionary.

Post-construction requirements are listed in Terms and Conditions A.13, A.14, A.17, A.18, A.19, A.20, A.22, A.23, A.24, A.25, and A.26. These post-construction requirements may be subject to congressional authorization and the allocation of funds. If the Corps or Permittee cannot fulfill these Terms and Conditions, the Corps must reinitiate consultation.

##### **Terms and Conditions – All Species**

- A.1. Conservation Measures included in the Corps' PBA that address protection of nesting sea turtles, piping plover, red knot, and seabeach amaranth listed on pages 10-11 of the SPBO shall be implemented in the Corps federally authorized project or regulated activity.
- A.2. The Corps or the Permittee must provide the following information to the Service at least 10 business days prior to the commencement of work:
- a) Project location (include latitude and longitude coordinates, as well as mile markers, cross streets, or street addresses if available);
  - b) Project description (including linear feet of beach, actual fill template, access points, and borrow areas); and
  - c) Anticipated date of commencement and anticipated duration of construction.
- A.3. For the life of the permit/project, all sand placement activities above MHW must be conducted within the winter work window (November 16 to April 30), unless a variance is approved after additional consultation with the Service.
- A.4. Prior to sand placement, all derelict material, large amounts of rock, or other debris must be removed from the beach to the maximum extent possible. If debris removal activities take place

during shorebird breeding season (April 1– August 31), the work shall be conducted during daylight hours only.

- A.5. During construction, trash and food items shall be disposed of properly either in predator-proof receptacles, or in receptacles that are emptied each night to minimize the potential for attracting predators of piping plovers, red knots, and sea turtles.
- A.6. Pipeline placement must be coordinated with NCDCM, the Corps, the Service, and the NCWRC. This may be accomplished through the permit application or Corps' contract processes utilizing appropriate GIS tools.
- A.7. Access points for construction vehicles should be as close to the project site as possible. Construction vehicle travel down the beach should be limited to the maximum extent possible.
- A.8. A meeting between representatives of the contractor(s), the Corps, the Service, the NCWRC, and NCDCM, must be held prior to the commencement of work. Advance notice (of at least 5 business days) must be provided prior to conducting this meeting. The meeting will provide an opportunity for explanation and/or clarification of the Conservation Measures and Terms and Conditions, and will include the following:
  - a) Staging locations, and storing of equipment, including fuel stations;
  - b) Coordination with the surveyors on required species surveys;
  - c) Pipeline placement;
  - d) Minimization of driving within and around the Action Area;
  - e) Follow up coordination during construction and post construction;
  - f) Direction of the work including progression of sand placement along the beach;
  - g) Plans for compaction monitoring;
  - h) Plans for escarpment surveys and
  - i) Names and qualifications of personnel involved in any required species surveys.
- A.9. Following the preconstruction meeting, the Corps shall provide the Service with specific anticipated shoreline lengths and anticipated duration of the project, using the form on the following web link:  
<<https://www.fws.gov/northflorida/SeaTurtles/Docs/Corp%20of%20Engineers%20Sea%20Turtle%20Permit%20Information.pdf>>. Only the following information should be filled out: Corps permit number, FWS Log Number, Project Location, Construction Activity, Duration of Project, and Actual Take (linear feet of beach). This form shall be emailed to the Service at <[seaturtle@fws.gov](mailto:seaturtle@fws.gov)>. The form should be filled out using information from the permit application or authorization. This form is in addition to the annual report, listed below.
- A.10. The Corps shall meet with the Service, NCDCM, and NCWRC (and cooperating agencies such as BOEM, as appropriate) annually to discuss the effectiveness of the avoidance measures and additional measures to include for future projects. The agencies will also review the projects utilizing this SPBO the previous year to ensure that the reporting requirements for calculating the extent of take are adequate. This meeting will also explore:
  - a) The possibility of using dredged materials to enhance potential or existing piping plover habitat within and adjacent to the project area;
  - b) Methods for funding beneficial use opportunities for dredged materials that are not least-cost disposal to benefit piping plovers and their habitat;
  - c) The development of shore protection design guidelines that can be utilized during future project planning to protect and/or enhance piping plover habitat; and

- d) Incorporating artificial lagoons or ephemeral pools into project designs adjacent to inlets where sand placement is proposed.

### **Terms and Conditions – Piping Plovers and Red Knots**

- A.11. All personnel involved in the construction or sand placement process along the beach shall be aware of the potential presence of piping plovers and red knots. Before start of work each morning, a visual survey must be conducted in the area of work for that day, to determine if piping plovers and red knots are present. If shorebirds are present in the work area, careful movement of equipment in the early morning hours should allow those individuals to move out of the area. Construction operations shall be carried out at all times in a manner as to avoid negatively impacting shorebirds and allowing them to exit the area.
- A.12. If project-related activities will potentially adversely affect nesting shorebirds or active nesting habitat, the Corps or Permittee must coordinate with the Service and NCWRC prior to proceeding. If the project is ongoing and shorebirds begin territorial or other nesting behaviors within the project area, then the Corps or Permittee must contact the Service and NCWRC as soon as possible.
- A.13. If project activities will be conducted in Optimal Piping Plover Areas, piping plover habitat (sandy unvegetated habitat) within the Optimal Piping Plover Area shall be avoided to the maximum extent practicable when staging equipment, establishing travel corridors, and aligning pipeline. The Corps or the Permittee, to the maximum extent practicable, shall clearly delineate work areas within the Optimal Piping Plover Area such as pipeline corridors, travel corridors, and access points. Disturbance outside those delineated work areas must be limited, thereby minimizing effects to sandy unvegetated habitat. Driving on the beach for construction shall be limited to the minimum necessary within the designated travel corridor. The delineation of work corridors and work areas in authorized project plans will be sufficient to meet this term and condition.  
Optimal Piping Plover Areas are defined as having documented use by piping plovers, and they include coastal habitat features that function mostly unimpeded. Optimal Piping Plover Areas include:
  - a) Designated piping plover Critical Habitat Units (see **Appendix B**);
  - b) All Federal, State, and County publicly owned land where coastal processes are allowed to function, mostly unimpeded\*, that have any of the following features in the Action Area:
    - i. Located within 1 mile of an inlet;
    - ii. Emergent nearshore sand bars;
    - iii. Washover fans;
    - iv. Emergent soundside and Ocean shoals and sand bars;
    - v. Soundside mudflats, sand flats, and algal flats; or
    - vi. Soundside shorelines.

[\*Publicly owned land where coastal processes are allowed to function, mostly unimpeded, generally does not include public lands that are solely state-owned water bottoms, street ends, parking lots, piers, beach accesses, heavily-developed or highly-manipulated parks, or shoreline developed for commercial or residential purposes. It generally does include public lands consisting of undeveloped parks, preserves, and other natural undeveloped shoreline and dunes.]

A.14. If project related activities will be conducted in Optimal Piping Plover Areas, then the piping plover and red knot survey protocol in **Appendix D** must be followed. Two full years of post-construction monitoring is required. Optimal Piping Plover Areas include:

- a) Designated piping plover Critical Habitat Units (see **Appendix B**);
- b) All Federal, State, and County publicly owned land where coastal processes are allowed to function, mostly unimpeded\*, that have any of the following features in the Action Area:
  - i. Located within 1 mile of an inlet;
  - ii. Emergent nearshore sand bars;
  - iii. Washover fans;
  - iv. Emergent soundside and Ocean shoals and sand bars;
  - v. Soundside mudflats, sand flats, and algal flats; or
  - vi. Soundside shorelines.

[\*Publicly owned land where coastal processes are allowed to function, mostly unimpeded, generally does not include public lands that are solely state-owned water bottoms, street ends, parking lots, piers, beach accesses, heavily-developed or highly-manipulated parks, or shoreline developed for commercial or residential purposes. It generally does include public lands consisting of undeveloped parks, preserves, and other natural undeveloped shoreline and dunes.]

#### **Terms and Conditions – Sea Turtles**

- A.15. Only beach compatible fill shall be placed on the beach or in any associated dune system. Beach compatible fill must be sand that is similar to a native beach in the vicinity of the site that has not been affected by prior sand placement activity. Beach compatible fill must be sand comprised solely of natural sediment and shell material, containing no construction debris, toxic material, large amounts of rock, or other foreign matter. The beach compatible fill must be similar in both color and grain size distribution (sand grain frequency, mean and median grain size and sorting coefficient) to the native material in the Action Area. Beach compatible fill is material that maintains the general character and functionality of the material occurring on the beach and in the adjacent dune and coastal system. In general, fill material that meets the requirements of the most recent version of the North Carolina Technical Standards for Beach Fill (15A NCAC 07H .0312) is considered compatible.
- A.16. During dredging operations, material placed on the beach shall be qualitatively inspected daily to ensure compatibility. If the inspection process finds that a significant amount of non-beach compatible material is on or has been placed on the beach, all work shall stop immediately, and the NCDCM, Corps, and BOEM (as appropriate) will be notified by the permittee and/or its contractors to determine the appropriate plan of action. Required actions may include immediate removal of material and/or long-term remediation activities.
- A.17. Daily sea turtle nesting surveys must be conducted within the project area between May 1 and November 15 of each year, for at least two consecutive nesting seasons after completion of sand placement (2 years post-construction monitoring). Acquisition of readily available sea turtle nesting data from qualified sources (volunteer organizations, other agencies, etc.) is acceptable. However, in the event that data from other sources cannot be acquired, the Corps or permittee will be responsible to collect the data. Data collected for each nest should include, at a minimum, the information in the table, below. This information will be provided to the Service in the

annual report, and will be used to periodically assess the cumulative effects of these projects on sea turtle nesting and hatchling production and monitor suitability of post construction beaches for nesting. Please see REPORTING REQUIREMENTS, below.

<b>Parameter</b>	<b>Measurement</b>	<b>Variable</b>
Number of False Crawls	Visual Assessment of all false crawls	Number/location of false crawls in nourished areas; any interaction of turtles with obstructions, such as sand bags or scarps, should be noted.
False Crawl Type	Categorization of the stage at which nesting was abandoned	Number in each of the following categories: a) Emergence - no digging; b) Preliminary body pit; c) Abandoned egg chamber.
Nests	Number	The number of sea turtle nests in nourished areas should be noted. If possible, the location of all sea turtle nests should be marked on a project map, and approximate distance to scarps or sandbags measured in meters. Any abnormal cavity morphologies should be reported as well as whether turtle touched sandbags or scarps during nest excavation.
Nests	Lost Nests	The number of nests lost to inundation or erosion or the number with lost markers.
Nests	Relocated nests	The number of nests relocated and a map of the relocation area(s). The number of successfully hatched eggs per relocated nest.
Lighting Impacts	Disoriented sea turtles	The number of disoriented hatchlings and adults.

- A.18. Visual surveys for escarpments along the Action Area must be made immediately after completion of sand placement, and within 30 days prior to May 1, for two subsequent years after any construction or sand placement event. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet must be leveled and the beach profile must be reconfigured to minimize scarp formation by the dates listed above. Any escarpment removal must be reported by location. The Service must be contacted immediately if subsequent reformation of escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet occurs during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the Service or NCWRC will provide a brief written authorization within 30 days that describes methods to be used to reduce the likelihood of impacting existing nests. An annual summary of escarpment surveys and actions taken must be submitted to the Service.

- A.19. Sand compaction must be qualitatively evaluated at least twice after each sand placement event, once in the project area immediately after completion of any sand placement event and once after project completion between October 1 and May 1. Compaction monitoring and remediation are not required if the placed material no longer remains on the beach. Within 14 days of completion of sand placement and prior to any tilling (if needed), a field meeting shall be held with the Service, NCWRC, and the Corps to inspect the project area for compaction and determine whether tilling is needed.
- a) If tilling is needed for sand suitability, the area must be tilled to a depth of 36 inches. All tilling activities shall be completed prior to May 1 of any year.
  - b) Tilling must occur landward of the wrack line and avoid all vegetated areas that are 3 square feet or greater, with a 3-foot buffer around all vegetation.
  - c) If tilling occurs during the shorebird nesting season or seabeach amaranth growing season (after April 1), shorebird surveys and/or seabeach amaranth surveys are required prior to tilling.
  - d) A summary of the compaction assessments and the actions taken shall be included in the annual report to NCDCM, the Corps, and the Service.
  - e) These conditions will be evaluated and may be modified if necessary to address and identify sand compaction problems.
- A.20. A report describing the fate of observed sea turtle nests and hatchlings and any actions taken, must be submitted to the Service following completion of the proposed work for each year when a sand placement activity has occurred. Please see REPORTING REQUIREMENTS, below.
- A.21. If a dune system is part of the project design, the placement and design of the dune must be coordinated with the Service.

#### **Terms and Conditions – Seabeach Amaranth**

- A.22. The Corps Civil Works Program shall continue its annual seabeach amaranth monitoring program in accordance with April 19, 1993 Biological Opinion for various U.S. Army Corps of Engineers' projects and Terms and Conditions A.23 to A.26, below..
- A.23. The Corps should survey beach sand placement areas for at least five years following each placement event, to determine the status of the seabeach amaranth populations in the project areas and the effects that beach disposal has on this species. Surveys should be conducted in August or September so that the number of plants reaching reproductive age can be determined.
- A.24. Suitable habitat along shoreline reaches that have received sand within the previous five years should be surveyed for the occurrence of seabeach amaranth. Documentation for each seabeach amaranth plant should include location (using a handheld GPS unit), unique features, abnormalities, or other relevant information. If multiple plants are observed in an area, a single representative GPS point may be logged with accompanying notes describing total plants associated with that point.
- A.25. A Corps report describing the seabeach amaranth survey and results should be submitted to Service, the North Carolina Natural Heritage Program, and the North Carolina Plant Conservation Program, by December 31 of each year. The report should include a map showing locations of seabeach amaranth populations and the numbers of plants, with separate figures for those in flower or fruit, found in the sand placement areas.

A.26. If tilling of the beach is required due to high compaction levels resulting from beach disposal, surveys should be conducted in advance of the tilling for seabeach amaranth (see sea turtle section - Reasonable and Prudent Measures). No tilling should be conducted in the immediate areas where seabeach amaranth plants are growing.

# **ATTACHMENT D**

**Dredge Plant Conditions, checklist, and  
ODESS forms**



## **Special Conditions for Hydraulic Cutterhead and Hopper Dredge Plants**

### **1. Reporting requirements:**

- a. Pre-Construction Notification:** At least 2 weeks prior to initiating the work authorized by this permit, the Permittee shall submit a completed “SARBO Pre-Construction Notification” form (see form below) to the following emails: [RD.SARBO.GRBO@usace.army.mil](mailto:RD.SARBO.GRBO@usace.army.mil) and [SERODredge@noaa.gov](mailto:SERODredge@noaa.gov). The checklist must be completed using the form function (i.e. do not handwrite or create text boxes). Upon receipt of the notification form, you will receive a list of the Corps primary points of contact for reporting turtle take/incidents. If the permit authorizes multiple work events, the Permittee must submit the SARBO Pre-Construction Notification prior to each event.
- b. Take Reporting:** All lethal and nonlethal take associated with a project covered under SARBO will be reported within 48 hours. Project details related to take that will be reported by completing “SARBO Take Reporting” form (see form below) and sent to the following emails: [RD.SARBO.GRBO@usace.army.mil](mailto:RD.SARBO.GRBO@usace.army.mil) and [SERODredge@noaa.gov](mailto:SERODredge@noaa.gov). The checklist must be completed using the form function (i.e. do not handwrite or create text boxes).
- c. Post-Construction Reporting:** Within 30 days of completing the work authorized by this permit, the Permittee shall submit a completed “SARBO Post-Construction Notification” form (see form below) to the following emails: [RD.SARBO.GRBO@usace.army.mil](mailto:RD.SARBO.GRBO@usace.army.mil) and [SERODredge@noaa.gov](mailto:SERODredge@noaa.gov). The checklist must be completed using the form function (i.e. do not handwrite or create text boxes).

4. **Dredging Quality Management (DQM):** Dredging and dredged material disposal and monitoring of dredging projects using the Dredging Quality Management (DQM) system shall be implemented for this permit. The Permittee shall ensure that each dredge assigned to the work authorized by this permit is equipped with DQM, previously known as 'Silent Inspector', for dredge monitoring. The Permittee's DQM system must have been certified by the DQM Support Team within one calendar year prior to the initiation of the dredging/disposal. Questions regarding certification should be addressed to the DQM Support Center at 877-840-8024. Additional information about the DQM System can be found at <https://dqm.usace.army.mil/>. The Permittee is responsible for insuring that the DQM system is operational throughout the dredging and disposal project and that project data are submitted to the DQM National Support Center in accordance with the specifications provided at the aforementioned website. The data collected by the DQM system shall, upon request, be made available to the Regulatory Division of the U.S. Army Corps of Engineers - Wilmington District.

**South Atlantic Regional Biological Opinion (March 2020)**  
**Pre-Construction Notification Form**

This form is used by the U.S. Army Corps of Engineers to document compliance with Section 2.9.3.5 of the South Atlantic Regional Biological Opinion (SARBO). You are required to complete this form and submit it via email to the email addresses listed in the special condition in the USACE permit **TWO WEEKS** prior to commencing work. The form must be completed electronically using the form feature (i.e. do not handwrite or create text boxes).

1) USACE Project Manager (point of contact and contact information):

2) Protected Species Observer (PSO)

a) Will a PSO be used?      Yes              No

b) Provide the observer company, if a PSO was used, and contact information:

3) List all federal action agency/s associated with project (Select all that apply):

USACE:	SAD	SAC	SAJ	SAS	SAW
FEMA	BOEM	U.S. Air Force	Other:		

4) All federal action agency project tracking numbers associated with the project, if applicable (e.g., USACE Regulatory tracking number, e.g., SAW-2018-xxxxx):

5) Biological Opinion(s) used to authorize the work:

SARBO

JAXBO (SAJ)

6) Estimated project start date:

7) Estimated project complete date:

8) Project name (Typically projects are referred to by the name of the area. If the area has more than one common name, all common names should be provided):

9) Project location:

a) Project location for dredging<sup>1</sup>. For regularly occurring projects with an easily referenced named location, a central location may be sufficient (e.g., latitude and longitude in decimal degree format [xx.xxxx, -xx.xxxx]).

b) Project location for placement. For regularly occurring projects with an easily referenced named location, a central location may be sufficient (e.g., latitude and longitude in decimal degree format [xx.xxxx, -xx.xxxx]).

10) Is the project occurring in an area identified in this Opinion that requires additional protection (select all that apply)?

ESA-listed coral (Appendix C)

Johnson's seagrass (Appendix D)

Sturgeon rivers (Appendix E)

When and where North Atlantic right whales may be present (Appendix F)

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<sup>1</sup> Project spatiolocation (i.e., shapefile/.kmz) to show the complete action area is needed if this information has not been previously provided to NMFS.

11) and 12) Is the project occurring within the geographic limits of a designated critical habitat, even if features are not impacted? Total area of the project that occurs within the geographic area of one or more critical habitat units, if applicable.

Critical habitat	Unit	Additional unit (if applicable)	Total area (Square feet)
Green sea turtle		N/A	
Leatherback sea turtle		N/A	
Loggerhead sea turtle			
Hawksbill sea turtle			
Atlantic sturgeon			
<i>Acropora</i> (Elkhorn and staghorn coral)		N/A	
Johnson's seagrass			
North Atlantic right whale		N/A	

13) Project type/s (Check all that apply):

- |                        |  |
|------------------------|--|
| Maintenance Dredging   | Minor channel modification/realignment |
| Borrow site            | Muck dredging                          |
| Beach nourishment      | Nearshore placement                    |
| ODMDS                  | G&G survey                             |
| New placement location | Other                                  |

14) Pre-project proposed dredge and placement total volume in cubic yards.

Dredge:

Placement:

15) Previous dredge templates:

- a) Does dredging exceed the previously federally-approved or federally-authorized dredge template including previously considered overdepth and/or advanced maintenance?      Yes                      No
- b) If you selected yes to question 16a, provide an explanation (e.g., approved through supersede, unintentional/unusual event and lesson learned).

16) Select all of the vessels and specific equipment used on project. A single project may include more than 1 category of equipment listed below for a portion or all of a project. The equipment types expected to be used and listed with the pre-construction notification will be updated at the end of the project if modifications were necessary.

Hopper dredge

Modified hopper

Non-hopper dredging equipment (e.g., bucket, clamshell, cutterhead, water-injection, bed-leveling to complete project)

Bed-leveling (used as the sole form of material movement or just during clean-up phase of hopper dredging).

Geophysical survey

Relocation trawling

New Equipment or construction method approved through the SARBO Supersede 2 process outlined in Section 2.9.5.2 of this Opinion.

17) The Corps regulatory project manager confirms that all applicable PDCs have been reviewed and will be requirements of the permit, as noted in the decision document?

Yes

No

18) Date Pre-Construction Form completed and emailed:



# Operations & Dredging Endangered Species System (ODESS) Marine Mammal Observation



**US Army Corps  
of Engineers.**

District <input style="width: 95%; height: 30px;" type="text"/>	Project <input style="width: 95%; height: 30px;" type="text"/>	Contract <input style="width: 95%; height: 30px;" type="text"/>
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Dredge <input style="width: 95%; height: 30px;" type="text"/>	Dredging Company <input style="width: 95%; height: 30px;" type="text"/>	Load Number (Required)/Date <input style="width: 95%; height: 30px;" type="text"/>
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Start Date (Required) <input style="width: 95%; height: 30px;" type="text"/>	Start Time (24 hours) (Required) <input style="width: 95%; height: 30px;" type="text"/>	End Date (Required) <input style="width: 95%; height: 30px;" type="text"/>	End Time (24 hours) (Required) <input style="width: 95%; height: 30px;" type="text"/>
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**Beaufort Sea State**

- 0 (0-1 kn, 0-0 ft)
- 1 (1-3 kn, 0-1 ft)
- 2 (4-6 kn, 1-2 ft)
- 3 (6-10 kn, 2-3.5 ft)
- 4 (10-16 kn, 3.5-6 ft)
- 5 (16-21 kn, 6-9 ft)
- 6 (21-27 kn, 9-13 ft)

- 7 (27-33 kn, 13-19 ft)
- 8 (33-40 kn, 19-25 ft)
- 9 (40-47 kn, 25-32 ft)
- 10 (47-55 kn, 32-41 ft)
- 11 (55-63 kn, 41-52 ft)
- 12 (>63 kn, >52 ft)

**Species Observed (Required)**

- |   |  |  |
|---|--|--|
| <input type="checkbox"/> <b>Bryde's/Sei Whale</b><br># ___ Est. Length (ft.) ___<br><input type="checkbox"/> <b>Fin Whale</b><br># ___ Est. Length (ft.) ___<br><input type="checkbox"/> <b>Humpback Whale</b><br># ___ Est. Length (ft.) ___ | <input type="checkbox"/> <b>Manatee</b><br># ___ Est. Length (ft.) ___<br><input type="checkbox"/> <b>Minke Whale</b><br># ___ Est. Length (ft.) ___<br><input type="checkbox"/> <b>Pilot Whale</b><br># ___ Est. Length (ft.) ___ | <input type="checkbox"/> <b>Right Whale</b><br># ___ Est. Length (ft.) ___<br><input type="checkbox"/> <b>Unknown</b><br># ___ Est. Length (ft.) ___ |
|---|--|--|

Air Temp (°C) <input style="width: 95%; height: 30px;" type="text"/>	Water Temp (°C) <input style="width: 95%; height: 30px;" type="text"/>	Winds (K) <input style="width: 95%; height: 30px;" type="text"/>	Seas (ft) <input style="width: 95%; height: 30px;" type="text"/>	Cloud Cover (%) <input style="width: 95%; height: 30px;" type="text"/>
---	---	---	---	---

Magnetic Bearing to Sighting <input style="width: 95%; height: 30px;" type="text"/>	Estimated Distance <input style="width: 95%; height: 30px;" type="text"/>	Vessel's Heading <input style="width: 95%; height: 30px;" type="text"/>	Heading of Animal(s) <input style="width: 95%; height: 30px;" type="text"/>
--	--	--	--

Coloration <input style="width: 95%; height: 30px;" type="text"/>	Fins or Flippers Observed <input style="width: 95%; height: 30px;" type="text"/>
--	---

Behaviors Observed <input style="width: 95%; height: 100px;" type="text"/>	Surfacing Intervals Time <input style="width: 95%; height: 30px;" type="text"/>
	Surfacing Intervals Distance <input style="width: 95%; height: 30px;" type="text"/>

Comments (Was the behavior of the animal(s) affected by the vessel? How far did the animal(s) move? Who was notified?)

Observer(s) Name(s) (Required; Print) <input style="width: 95%; height: 30px;" type="text"/>	Observer(s) Signature(s) <input style="width: 95%; height: 30px;" type="text"/>	Observer(s) Company <input style="width: 95%; height: 30px;" type="text"/>
---	--	---



# Operations & Dredging Endangered Species System (ODESS) Sturgeon Incident



**US Army Corps  
of Engineers®**

District  Project  Contract

Dredge  Dredging Company  **Species (Required)**  
 Atlantic  Gulf  Unknown  
 Green  Shortnose

Load Number (Required)/Date  Recovery Date (Required)  Recovery Time (24 hours) (Required)  Is this a Take? (Required)  
 Yes  No

Incident/Take Description

<b>Location Specimen Recovered</b>	<b>Specimen Condition</b>	<b>Rows of Preanal Shields</b> (SSN = 1/ATL = 2)
<input type="checkbox"/> Deck <input type="checkbox"/> Hopper <input type="checkbox"/> Draghead <input type="checkbox"/> Overflow Screen (Circle one) <input type="checkbox"/> Inflow Cage (Circle one) Starboard/Port/Other <input type="checkbox"/> Starboard/Port/Other <input type="checkbox"/> Pipe	<input type="checkbox"/> Alive <input type="checkbox"/> Severely Decomposed <input type="checkbox"/> Dead <input type="checkbox"/> Skeleton <input type="checkbox"/> Fresh Dead <input type="checkbox"/> Skeleton Old Bone <input type="checkbox"/> Moderately Decomposed <input type="checkbox"/> Undetermined	<input style="width: 100%; height: 30px;" type="text"/>

Location Comment

# Dorsal Scutes (SSN = 8-13/ATL = 7-16)  # Lateral Scutes (SSN = 22-33/ATL = 24-35)  # Ventral Scutes (SSN = 7-11/ATL = 6-9)

Fork Length (cm/in)  Standard Length (cm/in)  Total Length (cm/in)

Mouth Width (cm/in)  Head Width at Eyes (cm/in)  Other (cm/in)

Genetic Samples Taken?  Yes  No Samples Frozen/Preserved?  Yes  No Photo Attached?  
 (If Yes, label the species, date, geographic site, and dredge name on the photo)  
 Yes  No

Comments

Use these diagrams to illustrate the specimen/part that was recovered.



Observer(s) Name(s) (Required; Print)  Observer(s) Signature(s)  Observer(s) Company





# Operations & Dredging Endangered Species System (ODESS)



US Army Corps  
of Engineers.

## Turtle Incident

District  Project  Contract

Dredge  Dredging Company  Species (Required)  
 Green  
 Hawksbill  
 Kemp's Ridley  
 Leatherback  
 Loggerhead  
 Unknown

Load Number (Required)/Date  Is this a Take? (Required)  Yes  No  
 Project Incident # (Required)

Recovery Date (Required)  Recovery Time (24 hours) (Required)  Incident/Take Description

Air Temp (°C)  Surface Water Temperature (°C)

Mid-Depth Water Temperature (°C)  Bottom Water Temperature (°C)

Location Specimen Recovered  
 Deck  
 Draghead  
 Inflow Cage (Circle one) Starboard/Port/Other  
 Hopper  
 Overflow Screen (Circle one) Starboard/Port/Other  
 Pipe  
 Age Class  
 Juvenile (10.1-80 cm)  
 Sub-Adult (80.1-87 cm)  
 Adult (>87 cm)  
 Unknown  
 Gender  
 Female  
 Male  
 Unknown  
 Specimen Condition  
 Alive  
 Dead  
 Fresh Dead  
 Moderately Decomposed  
 Severely Decomposed  
 Skeleton  
 Skeleton Old Bone  
 Undetermined

Location Comment

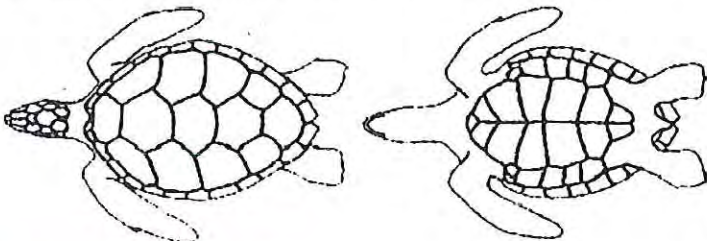
Tag Type  
 Flipper  
 Pit  
 Other (Specify)   
 Head Width (cm/in)

Tag Number  Plastron Length (cm/in)  Carapace Straight Length (cm/in)  Carapace Curved Length (cm/in)

Tag Date  Plastron Width (cm/in)  Carapace Straight Width (cm/in)  Carapace Curved Width (cm/in)

Genetic Samples Taken?  Yes  No  
 Final Disposition of Specimen

Use these diagrams to illustrate the specimen/part that was recovered.



Comments

Observer(s) Name(s) (Required; Print)  Observer(s) Signature(s)  Observer(s) Company

# **ATTACHMENT E**

**NCDWR 401 Water Quality Certification  
and NCDCM Federal Consistency  
Concurrence**



NORTH CAROLINA  
*Environmental Quality*

ROY COOPER

*Governor*

ELIZABETH S. BISER

*Secretary*

RICHARD E. ROGERS, JR.

*Director*

August 15, 2023

Mr. Jeff West  
National Park Service  
Cape Lookout National Seashore  
131 Charles Street  
Harkers Island, NC 28531

Subject: 401 Water Quality Certification Pursuant to Section 401 of the Federal Clean Water Act with ADDITIONAL CONDITIONS for the proposed dredging of NPS navigation channels and beach renourishment at Cape Lookout National Seashore in Carteret County.  
NCDWR Project No. 20230614

Dear Mr. West:

Attached hereto is a copy of Certification No. WQC006054 issued to The National Park Service (NPS) dated August 15, 2023.

This approval is for the purpose and design described in your application. The plans and specifications for this project are incorporated by reference as part of this Water Quality Certification. If you change your project, you must notify the Division and you may be required to submit a new application package with the appropriate fee. If the property is sold, the new owner must be given a copy of this Certification and is responsible for complying with all conditions. [15A NCAC 02H .0507(d)(2)]. This Certification does not relieve the permittee of the responsibility to obtain all other required Federal, State, or Local approvals before proceeding with the project, including those required by, but not limited to, Sediment and Erosion Control, Non-Discharge, Water Supply Watershed, and Trout Buffer regulations.

If we can be of further assistance, do not hesitate to contact us.

Sincerely,

DocuSigned by:

A handwritten signature in black ink, appearing to read "R. Rogers, Jr.", written over a white background.

Richard E. Rogers, Jr., Director  
Division of Water Resources

cc:

Emily Hughes, USACE, Wilmington Regulatory Field Office  
Daniel Govoni, NC Division of Coastal Management  
Jeff West, National Park Service, [Jeff.West@nps.gov](mailto:Jeff.West@nps.gov)  
Maria Dunn, NC Wildlife Resources Commission  
Garcy Ward, NC Division of Water Resources, Washington Regional Office  
File Copy



## 401 Water Quality Certification Pursuant to Section 401 of the Federal Clean Water Act with ADDITIONAL CONDITIONS

**THIS CERTIFICATION** is issued in conformity with the requirements of Section 401 Public Laws 92-500 and 95-217 of the United States and subject to the North Carolina Division of Water Resources (NCDWR) Regulations in 15 NCAC 2H .0500. This certification authorizes the National Park Service (NPS) to impact **7.9 acres** of open water in Carteret County. The project shall be constructed pursuant to the application dated received April 27, 2023. The authorized impacts are as described below:

### Open Water Impacts in the White Oak River Basin

Site	Fill in Open Waters (ac)	Excavation in Open Waters (ac)	Total (ac)
1	4.9	3.0	7.9

**Total Open Water Impact for Project: 7.9 acres.**

The application provides adequate assurance that the discharge of fill material into the waters of Barden Inlet in conjunction with the proposed development will not result in a violation of applicable Water Quality Standards and discharge guidelines. Therefore, the State of North Carolina certifies that this activity will not violate the applicable portions of Sections 301, 302, 303, 306, 307 of PL 92-500 and PL 95-217 if conducted in accordance with the application and conditions hereinafter set forth.

This approval is only valid for the purpose and design that you submitted in your application dated received April 27, 2023. Should your project change, you are required to notify the NCDWR and submit a new application. If the property is sold, the new owner must be given a copy of this Certification and approval letter and is thereby responsible for complying with all the conditions. If any additional wetland impacts, or stream impacts, for this project (now or in the future) exceed one tenth of one acre or 300 linear feet, respectively, additional compensatory mitigation may be required as described in 15A NCAC 2H .0506 (c). For this approval to remain valid, you are required to comply with all the conditions listed below. In addition, you should obtain all other federal, state or local permits before proceeding with your project including (but not limited to) Sediment and Erosion control, Coastal Stormwater, Non-discharge and Water Supply watershed regulations. This Certification shall expire on the same day as the expiration date of the corresponding Corps of Engineers Permit.

This Water Quality Certification neither grants nor affirms any property right, license, or privilege in any lands or waters, or any right of use in any waters. This Water Quality Certification does not authorize any person to interfere with the riparian rights, littoral rights, or water use rights of any other person and does not create any prescriptive right or any right of priority regarding any usage of water. This Water Quality Certification shall not be interposed as a defense in any action respecting the determination of riparian or littoral rights or other rights to water use. No consumptive user is deemed by virtue of this Water Quality Certification to possess any prescriptive or other right of priority with respect to any other consumptive user regardless of the quantity of the withdrawal or the date on which the withdrawal was initiated or expanded. Upon the presentation of proper credentials, the Division may inspect the property.

### Condition(s) of Certification:

1. The issuance of this certification does not exempt the Permittee from complying with any and all statutes, rules, regulations, or ordinances that may be imposed by other government agencies (i.e. local, state, and federal) having jurisdiction, including but not limited to applicable buffer rules, stormwater management rules, soil erosion and sedimentation control requirements, etc.
2. This approval authorizes the excavation of approximately 34,000 cubic yards of bottom material. This material is authorized to be used for beach renourishment at the area shown in your application. Any excess material not needed for beach re-nourishment shall be properly disposed of into an approved upland spoil site. This work shall be done in accordance with your application dated April 27, 2023. [15A NCAC 02H.0506(b)(2)(3)]



3. Additionally, this approval authorizes the National Park Service (NPS) to perform maintenance dredging of the NPS navigation channel as needed for a period of 10 years and shall expire on the same day as the corresponding USACE permit. All dredging is to be confined to the area shown in your application and shall not exceed the specified depths, dimensions, and profile.
4. All sand used for beach renourishment shall be compatible with the native beach material and free of contaminants. [15A NCAC 02H .0506(b)(1)(2)(3)]
5. Prior to each dredging event, the applicant shall submit to NCDWR in writing the necessary information to include but not limited to: the dates of dredging operation, location where dredging will take place, bottom area in acres to be dredged, and volume of bottom material to be excavated. All dredging shall not exceed the depths, dimensions, and profile specified in the modified application dated received April 27, 2021.
6. If activities must occur during periods of high biological activity (e.g. sea turtle nesting, fish spawning, or bird nesting), then biological monitoring may be required at the request of other state or federal agencies and coordinated with these activities. [15A NCAC 02H .0507(c); 15A NCAC 04B .0125]
7. All moratoriums on dredging, beach renourishment and associated activities established by the NC Wildlife Resources Commission (WRC), US Fish and Wildlife Service (USFWS), NC Division of Marine Fisheries (DMF), or National Marine Fisheries Service (NMFS) shall be implemented. Exceptions to this condition require written approval by the resource agency responsible for the given moratorium. A copy of the approval from the resource agency shall be forwarded to DWR. [15A NCAC 02H .0507(c); 15A NCAC 04B .0125]
8. Adherence to *The Guidelines for Avoiding Impacts to the West Indian Manatee: Precautionary Measures for Construction Activities in North Carolina Waters* will be required throughout construction.
9. The issuance of this certification does not exempt the Permittee from complying with any and all statutes, rules, regulations, or ordinances that may be imposed by other government agencies (i.e. local, state, and federal) having jurisdiction, including but not limited to applicable buffer rules, stormwater management rules, soil erosion and sedimentation control requirements, etc.
10. No rock, sand or other materials shall be dredged from the channel except where authorized by this certification. [15A NCAC 02H.0506(b)(3)]
11. There shall be no excavation from, or waste disposal into, jurisdictional wetlands or waters associated with this permit without appropriate modification. Should waste or borrow sites, or access roads to waste or borrow sites, be located in wetlands or streams, compensatory mitigation will be required since that is a direct impact from construction activities.[15A NCAC 02H.0506(b)(3) and (c)(3)]
12. During the construction of the project, no staging of equipment of any kind is permitted in waters of the U.S. or protected riparian buffers. [15A NCAC 02H.0506(b)(2)]
13. All mechanized equipment operated near surface waters must be regularly inspected and maintained to prevent contamination of stream waters from fuels, lubricants, hydraulic fluids, or other toxic materials. [15A NCAC 02H.0506(b)(3)]
14. The permittee and its authorized agents shall conduct its activities in a manner consistent with State water quality standards (including any requirements resulting from compliance with §303(d) of the Clean Water Act) and any other appropriate requirements of State and Federal law. If the NCDWR determines that such standards or laws are not being met (including the failure to sustain a designated or achieved use) or that State or federal law is being violated, or that further conditions are necessary to assure compliance, the NCDWR may reevaluate and modify this certification. [15A NCAC 02B.0200]
15. The Permittee shall report any violations of this certification to the Division of Water Resources within 24 hours of discovery. [15A NCAC 02B.0506(b)(2)]
16. A copy of this Water Quality Certification and all subsequent modifications, if any, shall be maintained on the



construction site at all times. [15A NCAC 02H .0507(c) and 15A NCAC 02H .0506 (b)(2),(c)(2)]

This Certification shall become null and void unless the above conditions are made conditions of the Federal 404 and/or Coastal Area Management Act Permit. This Certification shall expire upon the expiration of the 404 or CAMA permit. Please be aware that impacting waters without first applying for and securing the issuance of a 401 Water Quality Certification violates Title 15A of the North Carolina Administrative Code (NCAC) 2H .0500. Title 15A NCAC 2H .0500 requires certifications pursuant to Section 401 of the Clean Water Act whenever construction or operation of facilities will result in a discharge into navigable waters, including wetlands, as described in 33 Code of Federal Regulations (CFR) Part 323. It also states any person desiring issuance of the State certification or coverage under a general certification required by Section 401 of the Federal Water Pollution Control Act shall file with the Director of the North Carolina Division of Water Quality. Violations of any condition herein set forth may result in revocation of this Certification and may result in criminal and/or civil penalties. Pursuant to G.S. 143-215.6A, these violations and any future violations are subject to a civil penalty assessment of up to a maximum of \$25,000.00 per day for each violation.

This approval and its conditions are final and binding unless contested [G.S. 143-215.5]. Please be aware that impacting waters without first applying for and securing the issuance of a 401 Water Quality Certification violates Title 15A of the North Carolina Administrative Code (NCAC) 2H .0500. Title 15A NCAC 2H .0500 requires certifications pursuant to Section 401 of the Clean Water Act whenever construction or operation of facilities will result in a discharge into navigable waters, including wetlands, as described in 33 Code of Federal Regulations (CFR) Part 323. It also states any person desiring issuance of the State certification or coverage under a general certification required by Section 401 of the Federal Water Pollution Control Act shall file with the Director of the North Carolina Division of Water Quality. Pursuant to G.S. 143-215.6A, these violations and any future violations are subject to a civil penalty assessment of up to a maximum of \$25,000.00 per day for each violation.

This Certification can be contested as provided in Chapter 150B of the North Carolina General Statutes by filing a Petition for a Contested Case Hearing (Petition) with the North Carolina Office of Administrative Hearings (OAH) within sixty (60) calendar days. Requirements for filing a Petition are set forth in Chapter 150B of the North Carolina General Statutes and Title 26 of the North Carolina Administrative Code. Additional information regarding requirements for filing a Petition and Petition forms may be accessed at <http://www.ncoah.com/> or by calling the OAH Clerk's Office at (919) 431-3000.

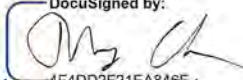
A party filing a Petition must serve a copy of the Petition on:

William F. Lane, General Counsel  
Department of Environmental Quality  
1601 Mail Service Center  
Raleigh, NC 27699-1601

If the party filing the Petition is not the permittee, then the party must also serve the recipient of the Certification in accordance with N.C.G.S 150B-23(a).

This the 15<sup>th</sup> day of August, 2023

DIVISION OF WATER RESOURCES

DocuSigned by:  


Richard E. Rogers, Jr., Director

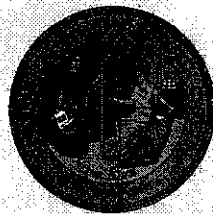
WQC No. 006054



ROY COOPER  
*Governor*

ELIZABETH S. BISER  
*Secretary*

BRAXTON DAVIS  
*Director*



NORTH CAROLINA  
*Environmental Quality*

June 28, 2023

Ms. Jenny Owens  
Chief, Environmental Resources Section  
U.S. Army Corps of Engineers  
69 Darlington Ave.  
Wilmington, NC 28403

**SUBJECT:** Consistency Concurrence Concerning U.S. Army Corps of Engineers (Corps) Proposal to Maintain the Navigation Channel within Back Sound to Lookout Bight (DCM#2023025)

Dear Ms. Owens:

We received your consistency submission on April 14, 2023, and revised submission on June 9, 2023, concerning the proposal to maintain the navigation channel within Back Sound to Lookout Bight, including two boat dock channels that provide access to the National Park Service (NPS) Cape Lookout National Seashore and employee access for maintenance of the lighthouse and park grounds. The proposal includes dredging using the Government-owned shallow draft plants and contracted hydraulic cutterhead pipeline dredge. Pipeline dredged material would be placed on Sandbag Island or on nearby Cape Lookout National Seashore soundside or oceanside beaches.

Placement onto Sandbag Island via control-of-effluent would utilize various methodologies including geo-tubes, berm construction, and turbidity curtains. Initially, synthetic geo-tubes are proposed around Sandbag Island to contain dredge material in order to keep dredge material from moving towards the submerged aquatic vegetation (SAV) beds while constructing the island towards the north and east. Between pipeline dredging events, Government-owned shallow draft plants (i.e., special purpose hopper or sidecast dredge) would remove any shoals impeding navigation. Special purpose hopper dredged material would be placed in naturally occurring scour holes within the Barden Inlet and Lookout Bight channel. Sidecast dredging is also proposed to be used to maintain the Corps and NPS channels when other dredge plants are not available and would sidecast material 80-feet from the vessel's starboard or port side.

North Carolina's coastal zone management program consists of, but is not limited to, the Coastal Area Management Act, the State's Dredge and Fill Law, Chapter 7 of Title 15A of North Carolina's Administrative Code, and the land use plan of the County and/or local municipality in which the proposed project is located. It is the objective of the Division of Coastal Management (DCM) to manage the State's coastal resources to ensure that proposed Federal activities would be compatible with safeguarding and perpetuating the biological, social, economic, and aesthetic values of the State's coastal waters.

DCM circulated this proposal to the N.C. Division of Marine Fisheries (DMF) and the N.C. Wildlife Resources Commission (WRC) and both agencies expressed concerns regarding the use of synthetic geo-tubes and proposed spoil disposal options. Both comments are attached for your consideration. DCM has reviewed the submitted information pursuant to the management objectives and enforceable policies of

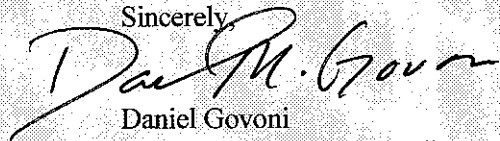


North Carolina Department of Environmental Quality | Division of Coastal Management  
Morehead City Office | 400 Commerce Avenue | Morehead City, North Carolina 28557  
252.808.2808

Subchapters 7H and 7M of Chapter 7 in Title 15A of the North Carolina Administrative Code and concurs that this federal activity is consistent, to the maximum extent practicable, with the relevant enforceable polices of North Carolina's certified coastal management program. However, keeping with recommendations from DMF and WRC, DCM recommends that biodegradable geo-tubes be used if possible and requests the Corps closely monitor SAV impacts and report any impacts to DCM not originally anticipated.

Prior to the initiation of the activities described, the applicant should obtain any additional State approvals or authorizations. Should the proposed action be modified, a revised consistency determination shall be required. This might take the form of either a supplemental consistency determination pursuant to 15 CFR 930.46, or a new consistency determination pursuant to 15 CFR 930.36. Likewise, if further project assessments reveal environmental effects not previously considered by the proposed development, a supplemental consistency certification may be required. If you have any questions, please contact me at (252) 808-2808. Thank you for your consideration of the North Carolina Coastal Management Program.

Sincerely,



Daniel Govoni  
Federal Consistency Coordinator





# **ATTACHMENT F**

**USFWS 2017**

**MANATEE GUIDELINES**



# 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 measures 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), 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), 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. 02/2017):  
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.

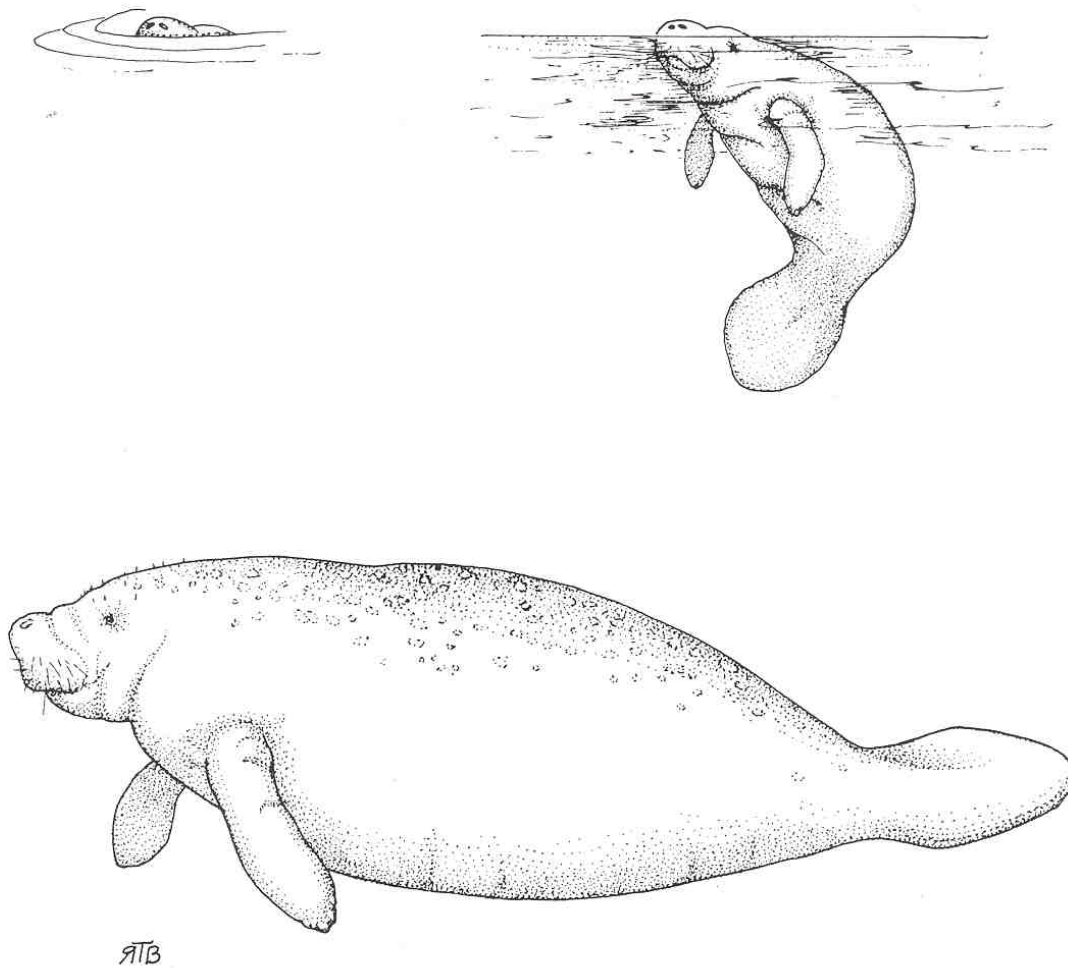


Illustration used with the permission of the North Carolina State Museum of Natural Sciences.

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 L**

## **PUBLIC & AGENCY CORRESPONDENCE**

### **CHANNELS FROM BACK SOUND TO LOOKOUT BIGHT**

**SEPTEMBER 2023**



Shore Protection Manager

James Ryan Davenport

Tel: (252) 222.5835

Fax: (252) 222.5826

Ryan.davenport@carteretcountync.gov



April 19, 2023

U.S. Army Engineer District, Wilmington  
C/O Mr. John Policarpo  
69 Darlington Ave.  
Wilmington, NC 28403

**Subject:** Public Comment on Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channel from Back Sound to Lookout Bight

Dear Mr. Policarpo,

Carteret County is in receipt of the Public Notice dated April 14, 2023 concerning the Draft Environmental Assessment for the maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels. We agree with your opinion that the proposed Federal action will not significantly affect the quality of the human environment. Furthermore, We ask that the Finding of No Significant Impact be signed in a timely manner. This important navigation channel not only serves Cape Lookout National Seashore but also recreational and commercial interests for Carteret County residents and visitors.

In closing, Carteret County would like to reiterate our support for the important functions carried out by both the USACE and USCG, and we look forward to maintaining and expanding our partnership with your agency on this and other area projects. If you should have any questions concerning these comments, please feel free to contact us.

Sincerely,

A handwritten signature in blue ink, appearing to read "J. Ryan Davenport".

Ryan Davenport  
Carteret County Shore Protection Manager

**From:** [Altman, Jon](#)  
**To:** [Policarpo, John N CIV USARMY CESAJ \(USA\)](#)  
**Cc:** [West, Jeffrey B.](#)  
**Subject:** [Non-DoD Source] Barden Inlet Dredge EA Comment  
**Date:** Wednesday, April 19, 2023 11:29:08 AM

---

Hi John,

After the initial dredge year and spoil placement on Sandbag Island NCWRC it is important to have the option to place dredge spoil in a similar fashion to the NPS Morgan Island during future dredge operations and/or if there is an over abundance of dredge materiel in the northwest section of the channel in the initial year. This would help slow the erosion of Morgan Island and maintain bird nesting habitat. Thank you.

Jon Altman  
Supervisory Biologist  
Cape Lookout National Seashore  
131 Charles Street  
Harkers Island, NC 28531  
252 838-8893  
<https://www.nps.gov/calo/index.htm>  
[CALO Beach Access Status \(nps.gov\)](#)  
<https://www.facebook.com/CapeLookoutNPS>

**From:** [Kajumba, Ntale](#)  
**To:** [Policarpo, John N CIV USARMY CESAW \(USA\)](#)  
**Cc:** [Adelsbach, Terrence](#); [Dean, Kenneth](#)  
**Subject:** [Non-DoD Source] FW: EPA Comments on the draft Environmental Assessment for the proposed Maintenance Dredging of the Back Sound to Lookout Bight vicinity, Carteret County, North Carolina.  
**Date:** Thursday, May 18, 2023 10:19:51 AM

---

Hi John,

The letter/email was inadvertently sent to Ms. Emily Hughes. We should have addressed it to you. We can resend this email with your information on it if that helps.

Ntale

Ntale Kajumba  
NEPA Section Chief  
Strategic Programs Office  
U.S. EPA Region 4  
61 Forsyth Street, S.W.  
Atlanta, Georgia 30303  
Tel: (404) 562-9620  
Email: [Kajumba.ntale@epa.gov](mailto:Kajumba.ntale@epa.gov)

---

**From:** Adelsbach, Terrence <[Adelsbach.Terrence@epa.gov](mailto:Adelsbach.Terrence@epa.gov)>  
**Sent:** Friday, May 12, 2023 7:04 AM  
**To:** [Emily.B.Hughes@usace.army.mil](mailto:Emily.B.Hughes@usace.army.mil)  
**Cc:** Kajumba, Ntale <[Kajumba.Ntale@epa.gov](mailto:Kajumba.Ntale@epa.gov)>; Dean, Kenneth <[Dean.William-Kenneth@epa.gov](mailto:Dean.William-Kenneth@epa.gov)>; Buskey, Traci P. <[Buskey.Traci@epa.gov](mailto:Buskey.Traci@epa.gov)>  
**Subject:** EPA Comments on the draft Environmental Assessment for the proposed Maintenance Dredging of the Back Sound to Lookout Bight vicinity, Carteret County, North Carolina.

Ms. Emily Hughes  
Biologist, Environmental Resources Section  
U.S. Army Engineer District, Wilmington  
CESAW-ECP-PE, 69 Darlington Avenue  
Wilmington, NC 28403

([Emily.B.Hughes@usace.army.mil](mailto:Emily.B.Hughes@usace.army.mil))

Re: EPA Comments on the draft Environmental Assessment for the proposed Maintenance Dredging of the Back Sound to Lookout Bight vicinity, Carteret County, North Carolina.

Dear Ms. Hughes:



The United States Environmental Protection Agency (EPA) has reviewed the draft Environmental Assessment (EA) provided for the proposed Maintenance Dredging in the Back Sound to Lookout Bight vicinity, Carteret County, North Carolina (Project). The EPA reviewed the draft EA in accordance with Section 309 of the Clean Air Act and Section 102(2)(C) of the National Environmental Policy Act (NEPA). The United States Army Corps of Engineers (USACE), Wilmington District prepared the draft EA in partnership with the National Park Service (NPS). The purpose of the Project is to provide safe and reliable navigation for residents, visitors, and NPS staff to and from Barden Inlet and Cape Lookout National Seashore, while also protecting valuable historic structures from erosion by beneficially using beach suitable dredged material. A stable and maintainable channel is needed to reduce risks to ferry service operations and mariners. Also, according to the draft EA, many fishing and trawling boats can no longer pass-through Barden Inlet to access the open ocean. The only alternative for them is to travel nearly nine miles west to Beaufort Inlet, which adds an additional two hours round-trip to reach their preferred fishing areas.

The USACE's authorized channels, which include a fixed portion and a portion that follows deep water, reach from just south of the Island Express Ferry Service dock on Harkers Island to the Barden Inlet gorge. The NPS' channel, Lighthouse Channel, and the channel to the former U.S. Coast Guard dock, connect two boat docks on Cape Lookout Island to the USACE's channel. Ferries to and from Harkers Island Visitor Center, operated by the NPS Cape Lookout National Seashore (CALO), carry passengers across Barden Inlet to the Lighthouse Dock via Lighthouse Channel. The second boat dock, previously associated with a US Coast Guard Station, is now abandoned; however, the NPS is planning to utilize this area in the future which will require the associated access channel to be maintained.

The USACE is proposing to maintain the Back Sound to Lookout Bight route using government-owned sidecast and special purpose hopper dredges and contracted hydraulic suction cutterhead dredges. The extent of the combined USACE/NPS project area under review includes the fixed channel and the corridor that applies to the non-fixed channel area. The corridor allows the channel to move, following natural deep water, thus reducing the need to dredge. All channels are authorized at widths of 100 feet and depths of 7 feet + 2 feet allowable overdepth. Dredged material placement options include: sidecasting (material is typically sidecasted about 80 feet from the dredge); nearshore placement seaward of the east end of Shackleford Banks and the west end of Cape Lookout Island; oceanside and soundside beach placement at Cape Lookout National Seashore for protection and restoration of wildlife habitat and historic structures; and control of effluent placement on an existing bird island located in Back Sound. Most of the material dredged from the fixed channel and from within the corridor is expected to be  $\geq 90\%$  sand, acceptable for placement at all the proposed locations. The USACE has performed detailed geotechnical surveys throughout the corridor to confirm sediment quality and will continue geotechnical surveys before and after dredging. If non-beach quality material is identified, the USACE will develop an upland placement plan to address placement of that material.

The draft EA considers three alternatives. Alternative 1, the No Action Alternative, would result in no dredging of the Back Sound to Lookout Bight or NPS navigation channels. Alternative 2 includes a large corridor (approximately 2,236 acres) that encompasses the entire Back Sound to Lookout Bight project area. Alternative 3 proposes all the same dredging and placement options as Alternative 2; however, Alternative 3 differs from Alternative 2 in that it includes a fixed, linear channel through Back Sound to Barden Inlet, (following the historical route of this portion for the USACE federal navigation channel) instead of a navigation corridor. A corridor for only Barden Inlet and Lookout Bight would be established

(approximately 1,359 acres, same as Alternative 2) with the USACE channel following the deepest natural water within the corridor, and the NPS channels would connect to the USACE channel, following natural deep water to access the docks.

The draft EA identifies Alternative 3, which includes a fixed channel through Back Sound, as the preferred alternative because it meets the stated purpose and need since there is no deep water in the vicinity of the northern portion. It would be more economical to follow a fixed alignment, particularly once the channel is reestablished with the first pipeline dredging and would also decrease areas of disturbance. Additionally, according to the draft EA, Alternative 3 is the least environmentally damaging, practicable alternative.

The EPA appreciates the opportunity to review and provide comments on the draft Environmental Assessment for the proposed Maintenance Dredging of the Back Sound to Lookout Bight Project, Carteret County, North Carolina. The EPA has not identified any significant environmental impacts from the proposed action that would require substantive changes to the draft EA or require consideration of other alternatives for navigational improvements. If you have questions regarding our comments, please contact Terry Adelsbach, Project Manager in the NEPA Section at [adelsbach.terrence@epa.gov](mailto:adelsbach.terrence@epa.gov) or at 404-562-9313.

Terry Adelsbach  
NEPA Section  
U.S. EPA Region 4  
404-562-9313  
[adelsbach.terrence@epa.gov](mailto:adelsbach.terrence@epa.gov)  
**Microsoft Teams:** [Call](#) | [Chat](#)

**From:** [Hammond, John](#)  
**To:** [Policarpo, John N CIV USARMY CESAW \(USA\)](#)  
**Cc:** [Matthews, Kathryn H](#); [Benjamin, Pete](#); [Ellis, John](#); [Mann, Leigh](#)  
**Subject:** [Non-DoD Source] Channel from Back Sound to Lookout Bight, Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels, Draft Environmental Assessment (Draft EA)  
**Date:** Friday, May 19, 2023 11:28:10 AM

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Good morning, John -

I apologize for the delay in responding. The Service has the following relatively minor recommendations.

Page 59 - Table 4. *Federally Listed Threatened & Endangered Species (aquatic and terrestrial)*

*located in the vicinity of the project area.* For red knot, recommend adding “; proposed Critical Habitat” in the Species column.

Page 63 – under Alternative 2 – Full Corridor, second paragraph, Recommend changing: “It may impact the constituent elements for piping plover nesting and wintering habitat.” to “It may have impacts on the physical and biological features for piping plover and red knot wintering and migration habitat.”

Page 80 – First paragraph, from the third sentence, Recommend changing:

“Minor and temporary disturbance in placement areas during colder months where birds are roosting and foraging will only have minor effects, as these species can vacate the area as needed and find alternate places to roost and forage in the area. Still, the effects determination on piping plover and red knot given by USFWS is *may affect, likely to adversely affect* due to the alterations of habitat that occur from beach placement activities.”

to:

“Minor and temporary disturbance in placement areas during colder months where birds are roosting and foraging will be limited specifically to those discrete locations. This activity may have some impacts on distribution of pre-

existing sites that contain the physical and biological features that benefit wintering/migrating piping plover and red knot. In the sand placement areas, piping plovers and red knot individuals may be forced to expend valuable energy reserves to seek available habitat elsewhere. For this reason, we have determined that the proposed action *may affect and is likely to adversely affect* these species due to alterations of habitat that occur from beach placement activities.”

Page 84 – Second paragraph Endangered Species Act

First sentence states:

“The SPBO lays out the terms and conditions and conservation recommendations for beach placement activities for the protection of sea turtles, manatee, piping plover, red knot and seabeach amaranth.”

We suggest this sentence instead:

“The SPBO adopts the Conservation Measures pledged by the USACE for minimizing impacts to federally listed species and lays out the Reasonable and Prudent Measures for beach placement activities for the protection of sea turtles, manatee, piping plover, red knot and seabeach amaranth.”

The second sentence in the paragraph appropriately points out that the 2017 U.S. Fish and Wildlife Service State-wide Beach Sand Placement BO “...is expected to be updated for Red Knot Critical Habitat in the near future.”

To be a little more accurate, this could be phrased: “This BO is expected to be updated for Red Knot once a final rule is published that designates Critical Habitat for the species.”

We appreciate the EA's statements on West Indian manatee and adherence to the Service's guidance for avoiding impacts to this species.

Thank you for the opportunity to provide comments for this EA.

Kind regards,  
John Hammond

*Please note that I am teleworking Monday, Thursday and Friday, every week. Email is the best way to reach me.*

John S. Hammond  
U. S. Fish and Wildlife Service  
Fish and Wildlife Biologist  
Raleigh Ecological Services Field Office  
Post Office Box 33726  
Raleigh, North Carolina 27636-3726  
919-856-4520 extension 28 (phone)  
919-856-4556 (fax)  
john\_hammond@fws.gov  
<http://www.fws.gov/raleigh/>



# ⊠ North Carolina Wildlife Resources Commission ⊠

Cameron Ingram, Executive Director

## MEMORANDUM

**TO:** John Policarpo  
Wilmington District  
US Army Corps of Engineers

**FROM:** Maria T. Dunn, Coastal Coordinator  
Habitat Conservation Division

A handwritten signature in black ink that reads "Maria T. D." with a stylized flourish.

**DATE:** May 19, 2023

**SUBJECT:** Public Notice for the Draft Environmental Assessment (Draft EA) Channel from Back Sound to Lookout Bight Maintenance of the US Army Corps of Engineers and US National Park Service, Carteret County, North Carolina.

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) reviewed the April 2023 public notice and Draft EA with regard to impacts on fish and wildlife resources. Our comments are provided in accordance with provisions of the Coastal Area Management Act (G.S. 113A-100 through 113A-128), as amended, Sections 401 and 404 of the Clean Water Act, as amended, the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and the Migratory Bird Treaty Act.

The US Army Corps of Engineers (USACE) and US National Park Service (NPS) have submitted a Draft EA to discuss maintenance dredge and spoil placement activities from Back Sound to Lookout Bight. The proposed maintenance dredging is divided into two sections; the northern section that includes the fixed USACE federal channel through Back Sound toward Barden Inlet and the southern section that includes a corridor encompassing Barden Inlet and Lookout Bight, where the USACE and NPS channels follow natural deep waters and include two NPS channels that provide access to two existing NPS boat docks. The proposed dredging would use Government-owned shallow draft plant and contracted hydraulic cutterhead pipeline dredges. Pipeline dredging would be used for initial dredging, then every 3 to 5 years, depending on shoaling rates and available funding. Pipeline dredged material would be placed on Sandbag Island bird island or on nearby NPS soundside or oceanside beaches. Between pipeline dredging events, Government-owned shallow draft plant (i.e., special purpose hopper dredge or sidecast dredge) would remove any shoals impeding navigation. Special purpose hopper dredged material would be placed in naturally occurring scour holes within the Barden Inlet and Lookout Bight channel. Sidecast dredging is also proposed to be used to maintain the USACE and NPS channels when other dredge plants

are not available and would sidecast material 80-feet from the vessel's starboard or port side. All Government plant dredging would occur within the recommended October 1 through March 31 environmental window. Placement of dredged material on Sandbag Island would occur from September 1 through March 31, to protect nesting birds. Sandbag Island dredged material placement via control-of-effluent would utilize methodologies to avoid impacts to submerged aquatic vegetation to the maximum extent practicable. Placement of dredged material on NPS oceanside beach would occur from November 16 through April 30, to protect nesting sea turtles.

The NCWRC has reviewed the Draft EA and has the following comments:

- SAV surveys and ground truthing exercises should be done to determine avoidance, minimization, and / or impacts to SAV resources.
- The Draft EA details dredging and material management for maintenance, not just a one-time event. While Morgan Island at this time does not need material placement for waterbird management, future placement of material may benefit the island. Therefore, inclusion of Morgan Island as a potential placement area is requested. Material placement would be done in a manner to enhance habitat benefits and should be coordinated with the NPS and NCWRC to determine need and placement of material. Disturbance to the island would be limited outside the marsh and areas of the island with shrubs and trees that provide heron and egret nesting opportunities.
- The Draft EA is a management plan that presents several dredge and disposal needs and options. One option is material placement on the oceanfront shoreline of South Core Banks. While this is an option to be considered, the NCWRC prefers material be placed on Sandbag or Morgan Islands for waterbird habitat management rather than ocean shoreline placement.
- The NCWRC is concerned with the use of sandbags and geotubes on the islands. Sandbags from previous placements are still evident as they are not covered with sand. It is unlikely from the length of time between placement events that sand placed over the bags will remain. The Draft EA also includes instruction that the casing for the geotubes may be cut to expose sand, but removal of the casing would be difficult. Therefore, because of the long-term presence of sandbag and geotube material, the hardening of the shore, and removal of habitat opportunities from uncovered sandbags, the NCWRC prefers sandbags and geotubes not be used on islands managed for waterbirds.
- The Draft EA suggests coastal wetlands, specifically *Spartina* sp. sprigs, be planted along the eastern perimeter of Sandbag Island. While this may be a good habitat enhancement option for aquatic resources, the presence of marsh may remove nesting and forage habitat for some species of waterbirds that use the island. Therefore, prior to any wetland designs or plantings, we request consultation with our agency and the NPS to determine appropriate wetland grass species, design, and density to not adversely impact waterbird use.
- Numerous species of migratory waterbirds present in the area were not listed within Appendix D.
- Several waterbird breeding season dates listed within the Draft EA may be slightly different than actual within the Cape Lookout National Seashore.
- The NCWRC is not aware of Atlantic Puffins breeding in North Carolina.

- Roseate Terns have been reported in the area and should be included as a species that may be found in the project area.

Overall, the NCWRC appreciates the information and detail presented in the Draft EA for Back Sound and Lookout Bight. We strongly encourage continued communication with our agency and the NPS with regard to material management activities that may affect and improve waterbird habitats. This may include material composition, placement area, volumes, and seasonal activity restriction.

Thank you for the opportunity to review and provide comments. We look forward to any forthcoming information and coordination as the Final EA is presented and the project is implemented. If there are any comments, questions, or concerns please do not hesitate to contact me at [maria.dunn@ncwildlife.org](mailto:maria.dunn@ncwildlife.org) or 252-495-5554.



Control No.: 23-E-0000-0220

Date Received: 4/19/2023

County.: CARTERET

Agency Response: 5/19/2023

Review Closed: 5/19/2023

JOSEPH HUDYNCA  
CLEARINGHOUSE COORDINATOR  
DEPT OF AGRICULTURE

Project Information

Type: National Environmental Policy Act Environmental Assessment

Applicant: U.S. Army Corps of Engineers

Project Desc.: Proposed Action is for the dredging of Corps and NPS Federal navigation channels located within Back Sound and Lookout Bight, Carteret County, North Carolina. The proposed maintenance dredging is divided into two sections. The northern section includes the fixed Corps Federal channel through Back Sound toward Barden Inlet. The southern section includes a corridor encompassing Barden Inlet and Lookout Bight, where the Corps and NPS channels follow natural deep waters and include two NPS channels that provide access to two existing NPS boat docks.

As a result of this review the following is submitted:

No Comment

Comments Below

Documents Attached

Reviewed By: JOSEPH HUDYNCA

Date: 4/26/2023

Control No.: 23-E-0000-0220

Date Received: 4/19/2023

County.: CARTERET

Agency Response: 5/19/2023

Review Closed: 5/19/2023

DEVON BORGARDT  
CLEARINGHOUSE COORDINATOR  
DEPT OF NATURAL & CULTURAL  
RESOURCE

Project Information

Type: National Environmental Policy Act Environmental Assessment

Applicant: U.S. Army Corps of Engineers

Project Desc.: Proposed Action is for the dredging of Corps and NPS Federal navigation channels located within Back Sound and Lookout Bight, Carteret County, North Carolina. The proposed maintenance dredging is divided into two sections. The northern section includes the fixed Corps Federal channel through Back Sound toward Barden Inlet. The southern section includes a corridor encompassing Barden Inlet and Lookout Bight, where the Corps and NPS channels follow natural deep waters and include two NPS channels that provide access to two existing NPS boat docks.

As a result of this review the following is submitted:

No Comment

Comments Below

Documents Attached

Reviewed By: DEVON BORGARDT

Date: 5/4/2023

Control No.: 23-E-0000-0220

Date Received: 4/19/2023

County.: CARTERET

Agency Response: 5/19/2023

Review Closed: 5/19/2023

LYN HARDISON  
CLEARINGHOUSE COORDINATOR  
DEPT OF ENVIRONMENTAL QUALITY

Project Information

Type: National Environmental Policy Act Environmental Assessment

Applicant: U.S. Army Corps of Engineers

Project Desc.: Proposed Action is for the dredging of Corps and NPS Federal navigation channels located within Back Sound and Lookout Bight, Carteret County, North Carolina. The proposed maintenance dredging is divided into two sections. The northern section includes the fixed Corps Federal channel through Back Sound toward Barden Inlet. The southern section includes a corridor encompassing Barden Inlet and Lookout Bight, where the Corps and NPS channels follow natural deep waters and include two NPS channels that provide access to two existing NPS boat docks.

As a result of this review the following is submitted:

No Comment

Comments Below

Documents Attached

Reviewed By: LYN HARDISON

Date: 5/19/2023

Control No.: 23-E-0000-0220

Date Received: 4/19/2023

County.: CARTERET

Agency Response: 5/19/2023

Review Closed: 5/19/2023

JESSICA MOSLEY  
CLEARINGHOUSE COORDINATOR  
DEPT OF TRANSPORTATION

Project Information

Type: National Environmental Policy Act Environmental Assessment

Applicant: U.S. Army Corps of Engineers

Project Desc.: Proposed Action is for the dredging of Corps and NPS Federal navigation channels located within Back Sound and Lookout Bight, Carteret County, North Carolina. The proposed maintenance dredging is divided into two sections. The northern section includes the fixed Corps Federal channel through Back Sound toward Barden Inlet. The southern section includes a corridor encompassing Barden Inlet and Lookout Bight, where the Corps and NPS channels follow natural deep waters and include two NPS channels that provide access to two existing NPS boat docks.

As a result of this review the following is submitted:

No Comment

Comments Below

Documents Attached

Reviewed By: JESSICA MOSLEY

Date: 5/18/2023

Control No.: 23-E-0000-0220

Date Received: 4/19/2023

County.: CARTERET

Agency Response: 5/19/2023

Review Closed: 5/19/2023

JINTAO WEN  
CLEARINGHOUSE COORDINATOR  
DPS - DIV OF EMERGENCY MANAGEMENT

Project Information

Type: National Environmental Policy Act Environmental Assessment

Applicant: U.S. Army Corps of Engineers

Project Desc.: Proposed Action is for the dredging of Corps and NPS Federal navigation channels located within Back Sound and Lookout Bight, Carteret County, North Carolina. The proposed maintenance dredging is divided into two sections. The northern section includes the fixed Corps Federal channel through Back Sound toward Barden Inlet. The southern section includes a corridor encompassing Barden Inlet and Lookout Bight, where the Corps and NPS channels follow natural deep waters and include two NPS channels that provide access to two existing NPS boat docks.

As a result of this review the following is submitted:

No Comment

Comments Below

Documents Attached

Reviewed By: JINTAO WEN

Date: 5/15/2023



**Roy Cooper**  
Governor

**Pamela B. Cashwell**  
Secretary

May 23, 2023

John Policarpo  
U.S. Army Corps of Engineers  
Wilmington District  
69 Darlington Avenue  
Wilmington, NC 28403-

**Re: SCH File # 23-E-0000-0220 Proposed Action is for the dredging of Corps and NPS Federal navigation channels located within Back Sound and Lookout Bight, Carteret County, North Carolina. The proposed maintenance dredging is divided into two sections. The northern section includes the fixed Corps Federal channel through Back So**

Dear John Policarpo:

The above referenced environmental impact information has been submitted to the State Clearinghouse under the provisions of the National Environmental Policy Act. According to G.S. 113A-10, when a state agency is required to prepare an environmental document under the provisions of federal law, the environmental document meets the provisions of the State Environmental Policy Act.

Attached to this letter are comments made by the agencies in the review of this document. If any further environmental review documents are prepared for this project, they should be forwarded to this office for intergovernmental review.

If you have any questions, please do not hesitate to contact me at (984) 236-0000.

Sincerely,

CRYSTAL BEST  
State Environmental Review Clearinghouse

Attachments

**Mailing**  
1301 Mail Service Center | Raleigh, NC 27699-1301



[ncadmin.nc.gov](http://ncadmin.nc.gov)

**Location**  
116 West Jones St. | Raleigh NC 27603  
984-236-0000 T

**From:** [Pace Wilber - NOAA Federal](#)  
**To:** [Policarpo, John N CIV USARMY CESAW \(USA\)](#)  
**Subject:** Re: [URL Verdict: Neutral][Non-DoD Source] Re: For Review/Comment - Channel from Back Sound to Lookout Bight, Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels, Draft Environmental Assessment (Draft EA)  
**Date:** Wednesday, June 7, 2023 9:11:04 PM

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Thanks John. I asked about the funding because NMFS is trying very hard to avoid sending "no staff available" responses for projects funded by BIL(IIJA), IRA, and other special sources. Since the Back Sound to Lookout Bight project is not funded by one of these special sources, we will not be providing EFH comments on the EA due to insufficient staff. Please continue to include us in meetings about the project. If we are able to attend, we may comment informally. Pace

On Wed, Jun 7, 2023 at 3:13 PM Policarpo, John N CIV USARMY CESAW (USA) <[John.N.Policarpo@usace.army.mil](mailto:John.N.Policarpo@usace.army.mil)> wrote:

Hi Pace,

To answer your question, currently the project is being funded through NCDEQ and NFS funding for the Federal Channel Portion with National Park Service funding for the connecting channel to the NPS dock. This funding is provided with an MOA with the State of North Carolina.

Is there an issue with the funding source for NMFS or is that something you need for your write-up?

Thanks

John

John N. Policarpo

Physical Scientist

Wilmington District, U.S. Army Corps of Engineers

69 Darlington Avenue

Wilmington, NC 28402

Work: 910-251-4700

---

**From:** Pace Wilber - NOAA Federal <[pace.wilber@noaa.gov](mailto:pace.wilber@noaa.gov)>

**Sent:** Wednesday, June 7, 2023 1:03 PM

**To:** Policarpo, John N CIV USARMY CESAW (USA)

<[John.N.Policarpo@usace.army.mil](mailto:John.N.Policarpo@usace.army.mil)>

**Subject:** [URL Verdict: Neutral][Non-DoD Source] Re: For Review/Comment - Channel from Back Sound to Lookout Bight, Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels, Draft Environmental Assessment (Draft EA)

Hi John. Before I answer, can you tell me how the project is funded? Is it tied to BIL(IIJA) or some other special appropriation? Pace

On Wed, Jun 7, 2023 at 10:33 AM Policarpo, John N CIV USARMY CESAW (USA)

<[John.N.Policarpo@usace.army.mil](mailto:John.N.Policarpo@usace.army.mil)> wrote:

Good Morning Pace,

Thank you again for participating on the call yesterday morning. I meant to ask you if NMFS will be providing their comments on the Draft EA soon. The 45 day was May 31. If you need more time, please let me know.

Thanks

John

John N. Policarpo

Physical Scientist

Wilmington District, U.S. Army Corps of Engineers

69 Darlington Avenue

Wilmington, NC 28402

Work: 910-251-4700



---

**From:** Policarpo, John N CIV USARMY CESAJ (USA)  
**Sent:** Friday, April 14, 2023 4:19 PM  
**To:** Pace Wilber - NOAA Federal <[pace.wilber@noaa.gov](mailto:pace.wilber@noaa.gov)>  
**Cc:** Twyla Cheatwood ([Twyla.Cheatwood@noaa.gov](mailto:Twyla.Cheatwood@noaa.gov)) <[twyla.cheatwood@noaa.gov](mailto:twyla.cheatwood@noaa.gov)>; Fritz Rohde - NOAA Federal <[fritz.rohde@noaa.gov](mailto:fritz.rohde@noaa.gov)>; Owens, Jennifer L CIV USARMY CESAW (USA) <[Jennifer.L.Owens@usace.army.mil](mailto:Jennifer.L.Owens@usace.army.mil)>  
**Subject:** For Review/Comment - Channel from Back Sound to Lookout Bight, Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels, Draft Environmental Assessment (Draft EA)

Good Afternoon Mr. Wilber,

Please see the attached letter, which includes the Public Notice, requesting NMFS-HCD review of the U. S. Army Corps of Engineers, Wilmington District, Channel from Back Sound to Lookout Bight, Maintenance of U.S. Army Corps of Engineers and U.S. National Park Service Navigation Channels, Draft Environmental Assessment (Draft EA), dated April 2023.

The Draft EA is available on the USACE website at:  
<https://www.saw.usace.army.mil/Missions/Navigation/Dredging/>

We would appreciate receiving any comments no later than 45 days from the date of this letter or by May 29, 2023. Please submit written comments to me via email at: [John.N.Policarpo@usace.army.mil](mailto:John.N.Policarpo@usace.army.mil).

Thanks

John

John N. Policarpo

Physical Scientist

Wilmington District, U.S. Army Corps of Engineers

69 Darlington Avenue  
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